COMBAT SURGERY:

MEDICAL DECISION TREES FOR TREATMENT OF NAVAL COMBAT CASUALTIES

1 February 1991

Naval Health Research Center
P.O. Box 85122
San Diego, CA 92186-5122

Editors:

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To the "thunder and lightning" Coalition Combat Forces participating in Operation Desert Storm 1991, and especially to the Medical Support personnel entrusted to their care. Fair winds and following seas.

PREFACE

This book is intended to aid those involved in the treatment of severe trauma suffered during combat. It is especially intended to provide a quick reference to neurosurgeons, thoracic surgeons, and general surgeons with trauma surgery experience involved in treating combat casualties. We believe it would also be useful to the same individuals when working in more mundane settings such as trauma centers and inner city emergency room settings. It can also be used as a teaching guide for residents training in these fields.

Algorithms are one way of assisting and teaching medical thought processes and procedures. They lead from decision to decision in logical patterns and progression. Trauma care lends itself to this analysis, since only through systematic and timely management of the seriously injured patient can the best chance for survival and successful outcome be assured.

We conceive of the decision trees as guidelines, not gospel, for patient management. Although they are dogmatic in presentation, they are intended to be flexible in interpretation, as it is not possible to allow for all contingencies. The surgeon must always be alert to the dynamic physiology and multi-system involvement confounding severe combat injuries and adjust these guidelines to fit the changing clinical picture as it evolves. Retrospective review of particular cases, using these algorithms, might be useful in self-evaluation.

The contained algorithms are not by any means the only approach to managing acute injury. They have, however, served the various originators and reviewers well in resuscitation, diagnosis, and therapy. An iterative process was used throughout the development of these decision nodes in order to arrive at useful guidelines. A large majority of the decision nodes contained in the clinical algorithms represent unanimous acceptance. The remainder represent "consensus" acceptance. Thus, not every surgeon would concur with all decision nodes.

Logistians, aided by the computer, have checked that the algorithms flow properly. Work is underway in finding ways to improve information transfer time and ease of interpretation. Techniques include the use of computer, sterile keyboards with simplified yes-no keypads to be used in the operating room, and human-factors designed display presentations. All such technology depends on sound underlying algorithms. Since techniques of modern combat surgery are still evolving, the editors welcome all comments, including case reports, with the hope of improving combat care in the future.

Winter, 1991

Jerry Linenger
Bill Long
Bill Sacco

The procedures and treatments contained in this book are the views of the writers and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large. While the editors have made every effort to insure the accuracy of the material presented, all readers are advised to check product information sheets where available, to cross-check information whenever possible with other sources, and to always exercise sound clinical judgement.

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Algorithms were prepared initially by Cyometrics, Inc., 23 Ellendale Street, Suite A, Bel Air, Maryland 21014 to fulfill the terms of Navy contract N66001-85-C-0297 for the acute care of combat casualties who have sustained a penetrating injury, presuming optimal care and resources are available. Cyometrics members included William J. Sacco, Ph.D., Jane K. Melville, William J. Taylor, and John W. Jameson.

We also wish to acknowledge Michelle Haun, RN, CCRN, Trauma Program Coordinator, Joyce Cardinal, RN, CCRN, Nurse Manager, ICU,
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1
INTRODUCTION TO ALGORITHMS

William Sacco
Jerry Linenger

The old order changeth, yielding place to new.
[Tennyson: The Passing of Arthur]

Modern warfare poses a variety of problems for the military surgeon who is faced with the effects of low and high velocity bullet wounds and of the multiple effects of explosive devices on human organs and tissues. Few surgeons would dispute the complexity of the problem of the patient who has sustained multiple traumatic injury exhibiting a multitude of effects. Successful evaluation and resuscitation demand decisive, competent assessment and continual reappraisal of all aspects of the patient's condition.

Video tapes of resuscitations in a civilian trauma center revealed that some surgeons could not handle the stress of coordinating the resuscitation of a severely injured patient.(1) Among the inappropriate responses observed were task fixation (usually on a trivial procedure where other procedures demanded high priority), alternation (changing orders to team members where no evidence suggested the need for a change), perseveration (persisting with a treatment plan when the patient's condition demanded a change in strategy), sensory overload (partial or complete inhibition of thought and action by overwhelming horror or by the magnitude of the problem), and repetition (repeating an action over and over after an adequate initial performance).

The number of surgeons available with combat experience is decreasing with time. Also, recent testing of military physicians revealed a poor understanding of the basic concepts of military injuries and their care.(2) Hence we believe that it is imperative to develop specialized combat casualty clinical management plans which embody current civilian and military trauma management.

Protocols for diagnosis and therapy in a decision-tree or

algorithm format are efficient instruments for such purposes. Such algorithms can be definitive, comprehensive, and explicit models of trauma management and have the following additional advantages:

1. Algorithms concisely detail diagnostic sequences, and therapeutic tasks enabling medics, nurses, and physicians to update their knowledge of sophisticated casualty management rapidly.

2. Algorithms are easily communicated and may permit a few specialists to direct efficiently the care of mass casualties by less experienced personnel.

3. Algorithms provide a format whereby casualty management can be evaluated, both prospectively and retrospectively. Peer review of algorithms by experienced trauma surgeons identifies decision nodes where treatment is critical or controversial. Such nodes can be the focus of research efforts.

We believe that clinical algorithms can improve the competence, confidence, and efficiency of medical personnel in the management of combat casualties. It is conceived that a comprehensive set of penetrating wound treatment algorithms could:

1. Help trauma surgeons lacking combat experience.
2. Serve as a review or guidelines in a combat scenario.

Algorithms for the acute care (resuscitation and emergency surgery) of penetrating-injured naval combat casualties are presented. The algorithms were designed presuming that optimal personnel and resources are available, and are based on the American College of Surgeons Committee on Trauma ATLS Course, COMCINPAC trauma manuals, and the experience of surgeons with combat and civilian experience.

BACKGROUND: Decision trees in medicine

Recent years have witnessed an ever-increasing scientific contribution to the "physician's art": help with biochemical equations and electrolyte problems, modifications to diagnostic and therapeutic techniques, use of prognostic and therapeutic indices, and medical algorithms. Many non-medical professionals have applied algorithms, otherwise known as decision trees or flow charts, to their operations. Such trees can describe many simple tasks and are a help in training personnel to do a job efficiently. Medical problems do not lend themselves readily to such an approach because of rapid changes in the patient's

condition. The unpredictability of physiologic responses, the complexities of intrinsic homeostatic mechanisms, and individual differences of patients or attending physicians complicate the algorithmic approach to the subject. Despite such obstacles, significant progress has been made in the development of algorithms applicable to the treatment of medical problems.

Algorithms are the foundation of the Automated Military Outpatient System (AMOS) Program (3) and have been used in other outpatient settings to direct the activities of physician's assistants (4,5,6), physician extenders (7,8) and nurses (9). Algorithms have been developed for such clinical conditions as cardiac tamponade (10), dysuria (6), diabetes (5), hypertension (5), and for injuries of the duodenum (11) and the heart (12).

Eisman and Wotkyns (13) have edited a book containing algorithms for more than 100 surgical problems. Larson (14) has written on the use of algorithms for triage. Algorithms have been prepared for the diagnosis and management of exotic diseases (15). Champion and Sacco (16) have developed an extensive set of civilian paramedical algorithms.

Shoemaker (17) has prepared detailed algorithms for the resuscitation of injured patients. Long, Sacco, and Gill (18) have written a comprehensive set of 125 algorithms describing early resuscitation and surgery for patients with critical blunt injuries. These algorithms require frequent reappraisal of patient status and often redirect attention to higher priority problems.

Weiner and Barrett (2), in their book on trauma management, use algorithms to summarize the important concepts of injury care.

Margolis discusses many applications to teaching, audit and patient care, and gives an extensive list of references (19). Noteworthy is his statement that students read algorithms faster than prose equivalents and comprehend significantly more.

As far back as 1973 Ingelfinger (20) wrote that "the algorithm is now on every with-it tongue."

Most algorithms in clinical trauma care are simplified flow diagrams that assume a high level of clinical knowledge and experience in trauma care by the user. They presume that the diagnostics and treatment procedures prescribed will be done in a timely fashion, successfully, and without complications. The resulting algorithms do not address contingencies and tend to be simple, global, and terse.

We advocate a radical design philosophy, which calls for algorithms which presume rapidly changing clinical conditions encompassing realistic contingencies precipitated by failures to do timely maneuvers or by complications. Thus, in a patient with rapidly deteriorating vital signs, the entire management team might be suddenly redirected to higher priority problems such as reversion to resuscitation and evaluation steps.

Therefore, we presume that multiple trauma care is a highly dynamic setting and the trauma team needs to perform correctly in a timely manner. These algorithms reflect contingencies like

these:

- What happens if the member of the team cannot perform a procedure requested because of technical difficulties, inexperience, or anatomical variations?

- What happens if a member of the team inordinately "task fixates" on a procedure? Should he or she be doing an alternative procedure?

- What happens if the patient's vital signs deteriorate? Should the priorities of the team be directed toward a new set of procedures?

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2
INTRODUCTION TO CLINICAL TRAUMA CARE DECISION TREES

The deep, dread - bolted thunder.
[Shakespeare: King Lear]

The successful care of acutely injured personnel depends upon accuracy in diagnosis and speed in the implementation of therapy for immediately life threatening injuries. In all cases, survival depends on the restoration and maintenance of Airway, Breathing, and Circulation...the ABC's of primary life support. The destruction to these systems by traumatic injury means major morbidity or death for the victim. All initial trauma care focuses on the ABC's in an effort to maintain life while the clinician surveys injury to these systems first, and then secondarily surveys for less immediately life-threatening problems. A global algorithm illustrative of this principle is shown in Table 1.

In these algorithms, a system of identifying and treating life threatening injury is outlined. Initially, the focus is on those problems relating to the ABC's, branching out subsequently to specific subsets of algorithms concerning areas of the body, head, neck, thorax, abdomen, and genito-urinary tracts.

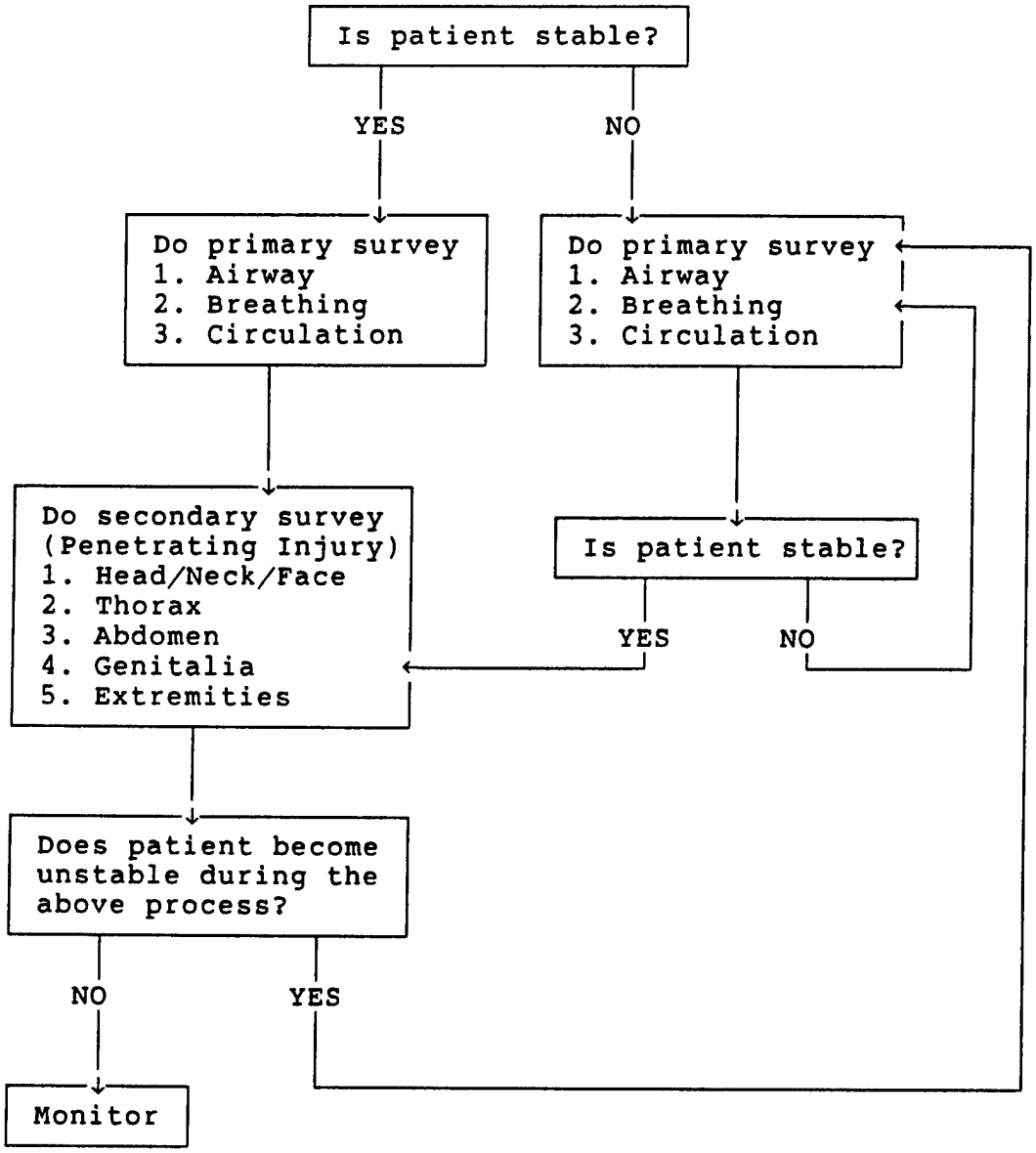
The overall design consists of two blocks of algorithms. The first block consists of recognition and evaluation algorithms which describe the trauma team performing, timely, such tasks as arterial catheterization, endotracheal intubation, thoracotomy, laparotomy, and making such diagnoses as pneumothorax, hypovolemia, and arrhythmias. In some cases, if a time constraint is not met, an alternative procedure is recommended. The algorithms also take into account complications of performing the resuscitative or diagnostic procedures.

The second block of algorithms relate to single body area wounds from fragments or bullets and the surgical management thereof. The body areas are head and neck, face, chest including shoulders, abdomen and pelvis including genitalia, and extremities.

All chapters begin with a general introduction to the materials presented, followed by case histories obtained from surgeons assigned to Operation Desert Storm medical treatment

facilities, and finally, the algorithms themselves. We conceive of the decision trees as guidelines, not gospel, for patient management. Although they are dogmatic in presentation, they are intended to be flexible in interpretation, as it is not possible to allow for all contingencies. The process used in developing these algorithms, along with remaining controversies, are presented in Appendix 2.

GLOBAL ALGORITHM



3
HOSPITAL RESUSCITATION AND EVALUATION

Their using all at once was as the sound of thunder heard remote.
[John Milton: Paradise Lost]

A. Overview

Trauma patients frequently arrive at a definitive care facility with compromised airway and breathing problems, even though field measures have been initiated. This section was designed to handle these extraordinary problems which must be addressed before proceeding to the main body of the algorithms. The modules address creation of an airway through cricothyroidotomy or tracheostomy tube insertion or use of fiberoptic bronchoscopy to remove foreign bodies in the airway.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).
The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
   Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
   He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest.
Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

   CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

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We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

Key to specialty codes: A - Surgeon;
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Remove cricothyroidotomy or tracheostomy tube while assistant presses on wound	3	3	1*	1*	1*	No equipment needed
2. Replace tube with 7.0 or 7.5 tracheostomy tube	3	3	1*	1*	1*	7.0 or 7.5 tracheostomy tube
3. Ventilate patient with bag-valve-tube technique with 100% O_2 @ 20 breaths/min			3	2	1	O_2 source; O_2 tubing; AMBU bag; stethoscope; ventilator
4. Secure tube	3	3	2*	2	1	Tape; Benzoin ointment; gauze
5. Insert bronchoscope through tracheostomy or endotracheal tube	3	3				Fiberoptic bronchoscope; saline lubricant
6. Suction secretions through bronchoscope	3	3				Suction source; suction tubing
7. Remove foreign body	3	3				Oral airway; suction device suction tubing and kit
8. Withdraw tube until tip is above carina	3	3				No equipment needed
9. Withdraw tube over bronchoscope	3	3				No equipment needed
10. Reinsert bronchoscope tip into tracheal lumen and direct tip toward carina	3	3				No equipment needed
11. Reinsert tube over bronchoscope into trachea and place tip 3 cm above cariana	3	3				No equipment needed
12. Do anterior lateral thoracotomy	3	3				Thoracotomy list
13. Start an IV	3	3	2	2	2	#14, #16, #18 gauge; alcohol wipes; 4 X 4's; 2 X 2's; tubing with I.V. solution

********** Explanation of Specialty Codes and Care Descriptors **********

In all cases, the specialty surgeon is a thoracic surgeon.
In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks.
Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

14. Give norcuron 0.1 mg/kg IV	3	3	3	2	1	Norcuron or other agent; syringe alcohol wipes; patent I.V.
15. Insert rigid bronchoscope and remove foreign body	3	3				Rigid bronchoscope; saline; lubricant
16. Reinsert tracheostomy tube	3	3				No equipment needed

CARDIO VASCULAR TRAY

BOTTOM LAYER

#7 KNIFE HANDLE
STRULLY SCISSOR
POTTS SCISSORS - 25, 45, 60 DEG
NARROW TIP SUTURE SCISSOR

SECOND LAYER

30 DEG PERIPHERAL CL (BLACK)
ACUTE ANG MINATURE CLAMPS
STR ATRAGRIP CLAMPS
30 DEG DEBAKEY MINATURE CLAMPS
LONG ALLISES

THIRD LAYER

LONG ATRAGRIP TISSUE FCPS
MED ATRAGRIP TISSUE FCPS
SH ATRAGRIP TISSUE FCPS
LONG FINE TIPPED N.H.
MED N.H.
SH FINE TIPPED N.H.

FOURTH LAYER

TANGENITAL OCCLUSION CL (LG ANG
SATINSKY)
SEMB CLAMP
KIDNEY PEDICLE CLAMP

CHEST SET (THORACIC) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG M.H.
EX LONG FINE M.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
MEDIUM NEEDLE HOLDERS
LONG NEEDLE HOLDER -NOT FINE
SPONGE STICKS
LONG CURVES
LAUERS
TONSILS
KOCKERS - CLAMP
BABCOCK CLAMP
ALLIS CLAMP
CURVED CRILER
CURVED MOSQUITOES CLAMP
SUTURE SCISSORS
MAYO SCISSORS
METZ SCISSORS
LONG METZ SCISSORS

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

LAPAROTOMY EQUIPMENT LIST A

SUTURE
SILK 2-0 STRAND
SILK 3-0 STRAND

STICK TIES
SILK 2-0 SH
SILK 3-0 SH

CLOSURE
VICRYL 0 CT
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM-35W

DRAPES & PACKS
MAJ. BASIN/GRADUATE W/
MED. CUP 60CC
LAPAROTOMY SHEET
BACK TABLE COVER
TOWELS, STERILE (6)
MAYO STAND COVER
GOWN, STERILE XLR. LRG. (3)
SKIN PREP TRAY
MEDIUM SHEET 44 X 60"

SPONGES
LAP. 18 X 18 (3)
4 X 4 X-RAY DETECT
CYLINDRICAL DISECTOR'S

CAUTERY
GROUNDING PAD
ELECTRO-CAUTERY HAND PENCIL
CAUTERY MACHINE
CAUTERY EXTENTION BLADE

CATHETER
CATH. PLUG
FOLEY CATH. TRAY
FOLEY CATH. 16FR. THERMAL
URIMETER DRAINAGE BAG

GLOVES
EXAM, UNSTERILE
SURGEONS, STERILE
SURGEONS HYPO-ALLERG., STERILE

SOLUTIONS
IRRIG. WATER 1500CC
IRRIG. NACL 1000CC

MISCELLANEOUS
BLADE, SURGICAL #10
BLADE, SURGICAL #15
BLADE, SURGICAL #21
CACRON TAPE
HEMOCLIP, SMALL
HEMOCLIP, MED.
HEMOCLIP, LRG.
RAZOR, PROP
MAGNETIC NEEDLE MAT
SUCTION TUBING 20'

INSTRUMENTS & EQUIPMENT
LAPAROTOMY SET
EXTRA LONG INSTR.
RETR. UPPER HAND
BOSEL CLAMPS
HEADLIGHT, FIBEROPTIC
DEEP BALFOR

DRAINS
PENROSE 1" X 36"
JACKSON PRATT, 7MM & 10MM
JACKSON PRATT RESERVOIR
CATH. MALCOTT 22GR.
CATH. RED RUBBER 14FR.

HAVE AVAIL. INTERNAL STAPLES
TA 30,55,90. - 3.5MM & 4.8MM
TA 30,55,90/ - 3.5MM & 4.8MM
GIA MULTI USE UNIT & GUN
POWERED PLDS-15W

DRUGS
CEFADYL 1GM.
THROMBIN 10,000U

SYRINGE
SYRINGE, 30CC LL
SYRINGE, 60CC LL
SYRINGE, 10CC LL
SYRINGE, 60 CC SLIP TIP

COLOSTOMY BAG
COLOST/ILEOST FLNG, 100MM X 4"
COLOST/ILEOST FLNG, 70MM X 4"
LOOP OSTOMY, 100MM
LOOP OSTOMY, 70MM

DRESSINGS
TELFA
GAUZE, 4 X 8"
ABD. STERILE

LAPAROTOMY LIST B EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

2 ARMY/NAVYS
2 SHARP RAKES
1 WIDE MALLEABLE
1 NARROW MALLEABLE
1 WIDE DEAVER
1 NARROW DEAVER
1 LARGE RICHARDSON
1 MEDIUM RICHARDSON
1 SMALL RICHARDSON
1 WIDE HARRINGTON
1 NARROW HARRINGTON
1 BALFOUR
2 TONSIL SUCTIONS
6 BALL CLIPS

PEEL PACK:

---

4 REGULAR TOWEL CLIPS
2 #3 KNIFE HANDLES
1 #4 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
1 LONG THUMBS WITHOUT TEETH
2 LONG RUSSIANS
2 FINE GYNES
2 ADSONS WITH TEETH
2 LONG ATRAGRIPS
1 POOL SUCTION

WRAP IN TOWEL:

---

2 MEDIUM HEMOCLIP APPLIERS - LONG

2 MEDIUM NEEDLE HOLDERS
2 LONG NEEDLE HOLDERS - NOT FINE
2 SPONGE STICKS
4 LONG CURVES
4 LAUERS
4 TONSILS
4 KOCKERS
2 BABCOCKS
4 ALLISES
10 CURVED CRILES
4 CURVED MOSQUITOES
1 SUTURE SCISSOR
1 MAYO SCISSOR
2 METZ SCISSORS
1 LONG METZ SCISSOR

THORACOTOMY LIST

SUTURE

SILK A-306H 0 STRAND
SILK SA-75H 2-0 STRAND
SILK SA-74H 3-0 STRAND

STICK TIES

SILK K-33H 2-0
VICRYL J-833H 2-0 SH
SILK K-832H 3-0
CHROMIC G-122H 3-0 SH

BRONCHUS

VICRYL J-304H 4-0 RB-1 (use with 2-0 silk strand for chest tube skin stitch)
NEEDLE 3/8 CUTTING 2090-14

OR

SILK 737G 2-0 X-0

CLOSURE

VICRYL J-849G 2 TP-1
MAXON 2-0 T-25 OR 628751
MAXON 3-0 T-25 6287-41

SKIN (ASK)

PDS Z-422H 4-0 PS-2
STAPLE, LOADING UNIT SM-35W
STAPLE GUN, SKIN

PACKS AND DRAPES

PACK, BASIC
BASIN, MAJOR
BASIN, STANDARD SINGLE SET
TRAY, SKIN SCRUP SURGERY
COVER, MAYO STAND 8337
SHEET, TRANSVERSE LAP
GOWN, STER BACK XL A9541
GOWN, STER BACK LAG A9511
CLOTH DRAPE (SINGLE)
TOWELS, STERILE (8 PK)

FOLEY CATHETERS --ASK FIRST

TRAY, CATH FOLEY UNIVERSAL
CATHETER, FOLEY W/T SENS 16FR3C
URIMETER, DRAIN BAG

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITC
BOVIE HOLDER
ELECTRODE, BLADE EXTENDED(ARGON BEAM MACHINE AVAILABLE)
ARGON BEAM PAD
ARGON BEAM TIP

SPONGES

SPONGES, CYLINDRICAL DISECTORS
SPONGE, LAP 12 X 12
SPONGE, LAP 18 x 18
SPONGE, GAUZE X-RAY DETECT

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

MISCELLANEOUR SUPPLIES

BLADE, SURGICAL #21
BLADE SURGICAL #10 024760
BLADE, SURGICAL #15
BONE WAX W-31G
DACRON TAPE 8618-00
DRAPE, IOBAN 6648
HEMOCLIP, MED
HEMOCLIP, LRG
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT AVAILABLE
RAZOR, PREP DISP
VESSEL LOOPS MAXI RED
VESSEL LOOPS MINI YELLOW

DRAINS

TUBE, CHEST 28FR THORACIC
TUBE, CHEST 32FR THORACIC
TUBE, CHEST 36FR THORACIC
PLEUREVAC, ADULT

INSTRUMENTS AND EQUIPMENT

CHEST SET
LAPAROTOMY SET
LUNG SPATULA
BEANBAG/"U" SHAPED VAC PAC
CARDIO VASCULAR TRAY
HEADLIGHT
LIGHT HANDLES, BLUE RIGID (2)
CRYO UNIT
SCISSOR, METZ, LONG FINE
APPLIER, HEMOCLIP, LARGE, LONG

(HAVE AVAILABLE)
FCP, ATRAGRIP, LONG
CLAMP, COARCTATION
N H, EX. LONG
RETR, MOORSE, STERNAL
RETR, HIMMELSTEIN
CLAMP, THORACIC ANEURYSM

DRESSINGS

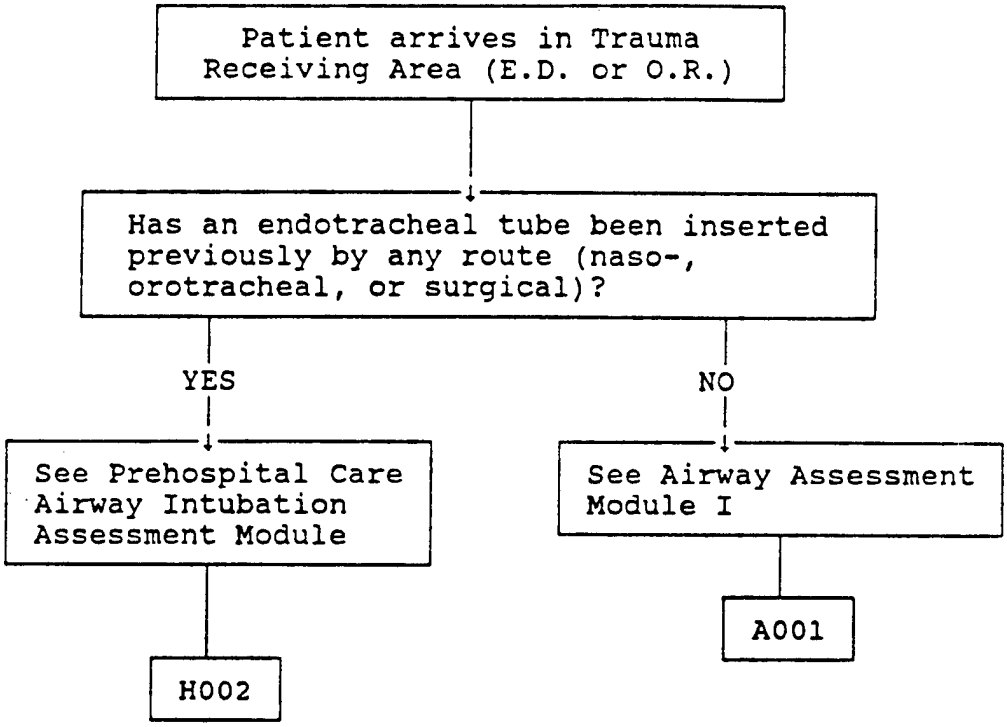
DRESSING, TELFA
DRESSING, GAUZE 4 X 8 12 PLY
PAPER TAPE

TRAUMA CHEST TRAY - Minimal equipment

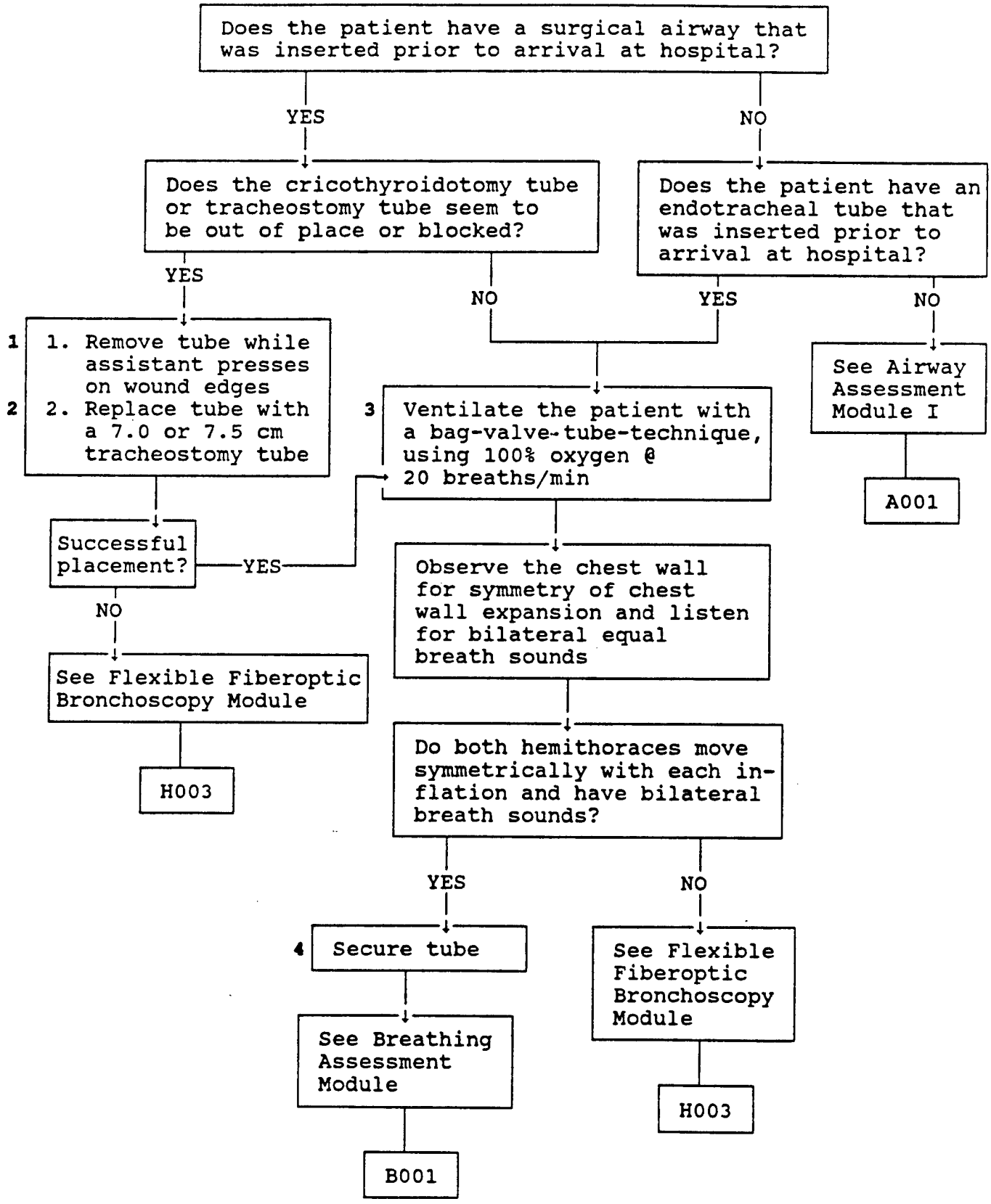
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1 - MEDIMM FINOCHETTI RETRACTOR
1 - EXTRA LONG NEEDLE HOLDER
4 - BABY TOWEL CLIPS
1 - 9" CURVE
1 - LONG MAYO
1 - CURVED CRILE
1 - STRAIGHT CRILE
1 - LAUER
1 - STRAIGHT COARCTATION CLAMP
1 - TANGENTIAL OCCLUSION CLAMP
2 - TONSIL HEMOSTATS
1 - 4# KNIFE HANDLE
4 - TOWELS (FOLDED READY TO SQUARE OFF)
2 - PACKAGES COUNTED 12 BY 12'S
STERNAL SAW/LEBSCHE
BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

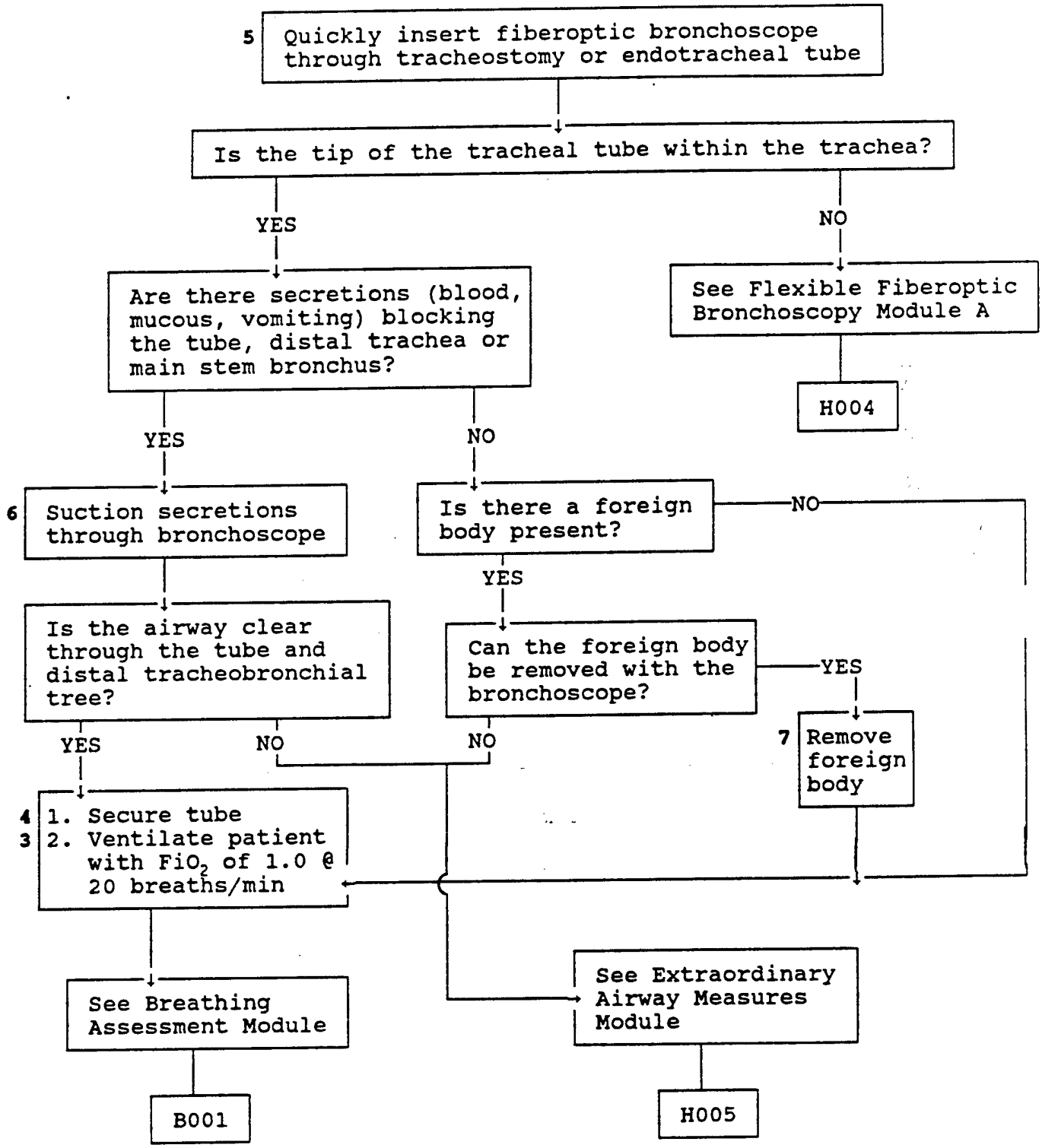
HOSPITAL RESUSCITATION & EVALUATION ALGORITHM SERIES



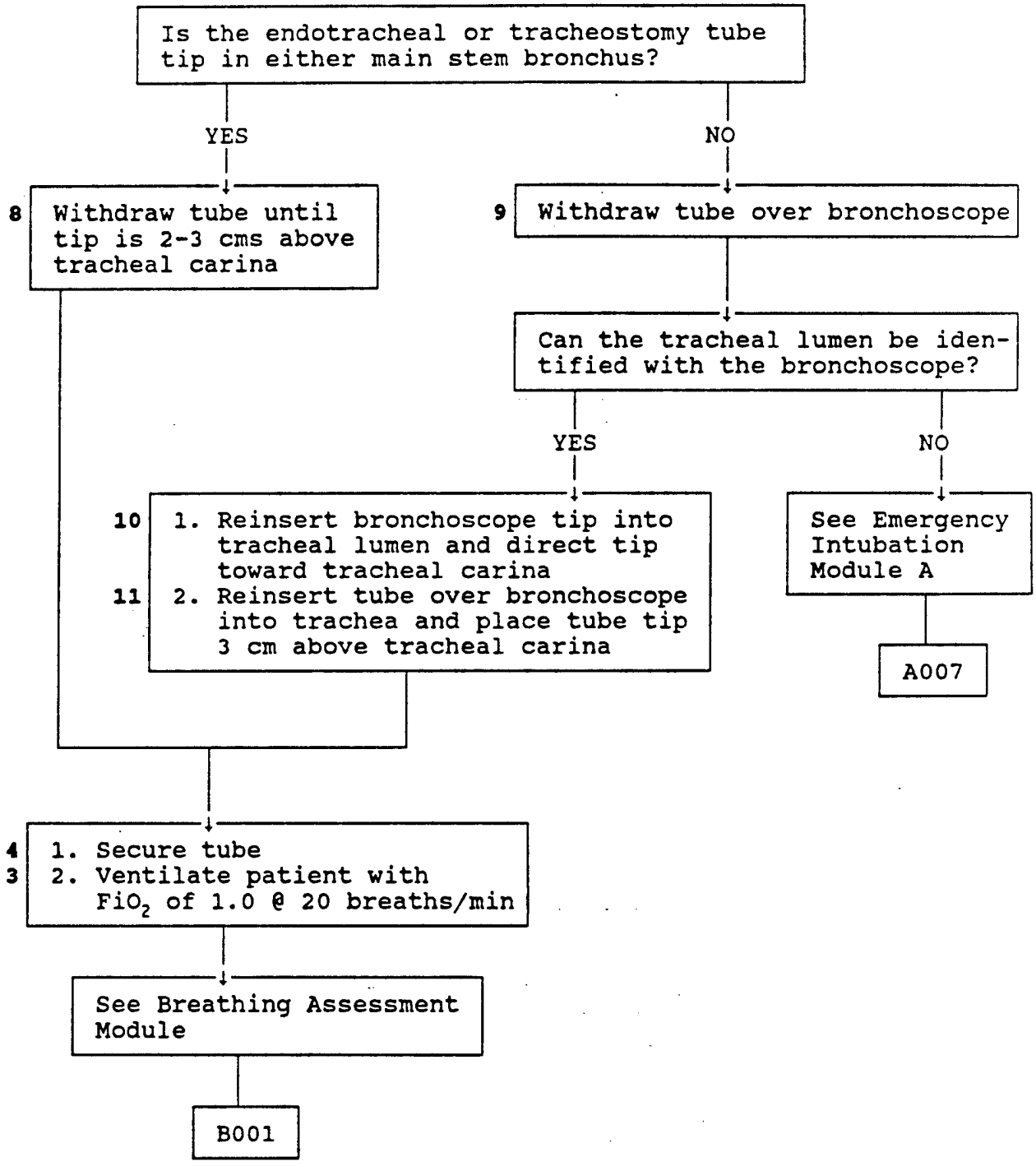
PREHOSPITAL CARE AIRWAY
INTUBATION ASSESSMENT MODULE



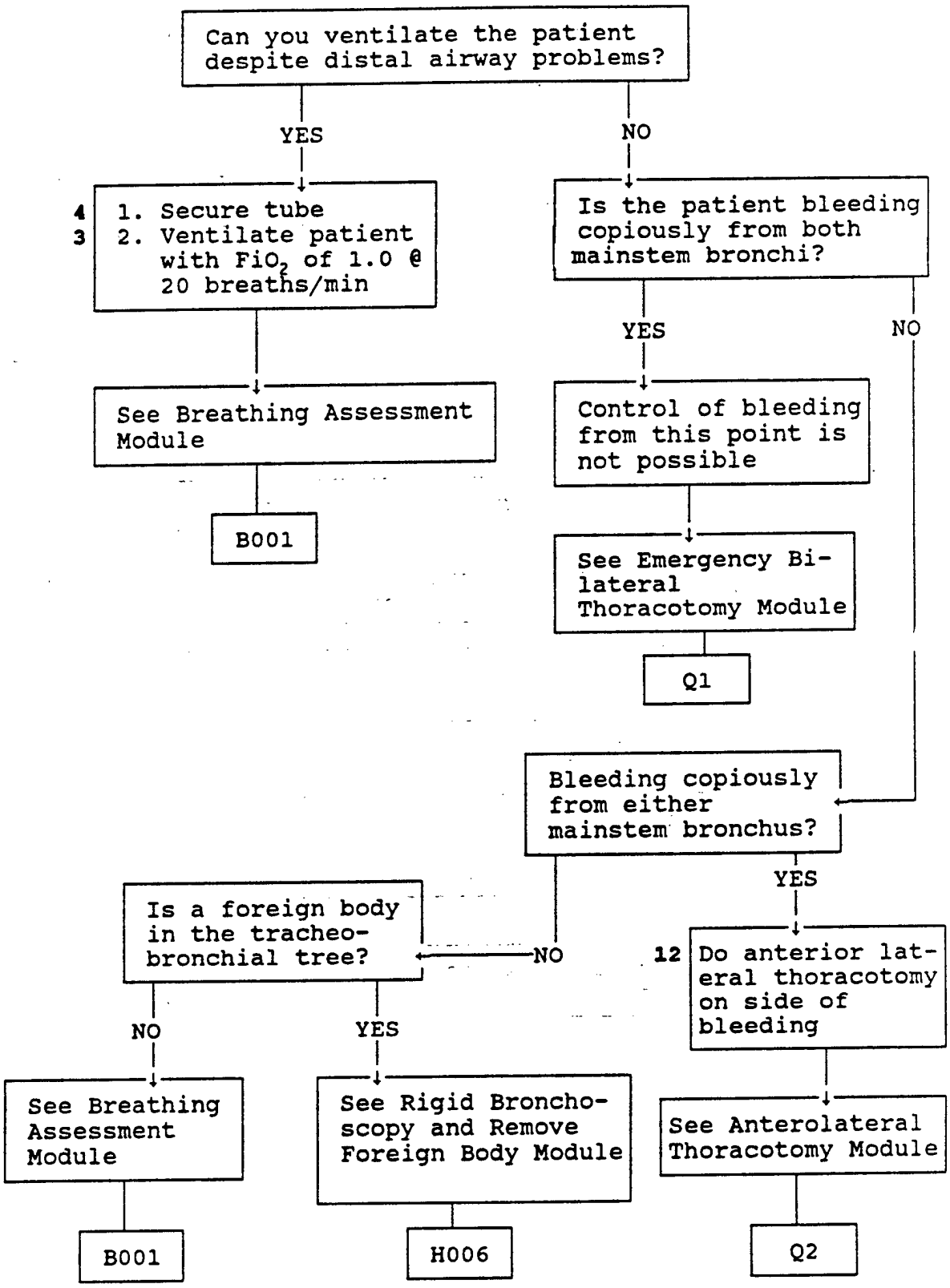
FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE



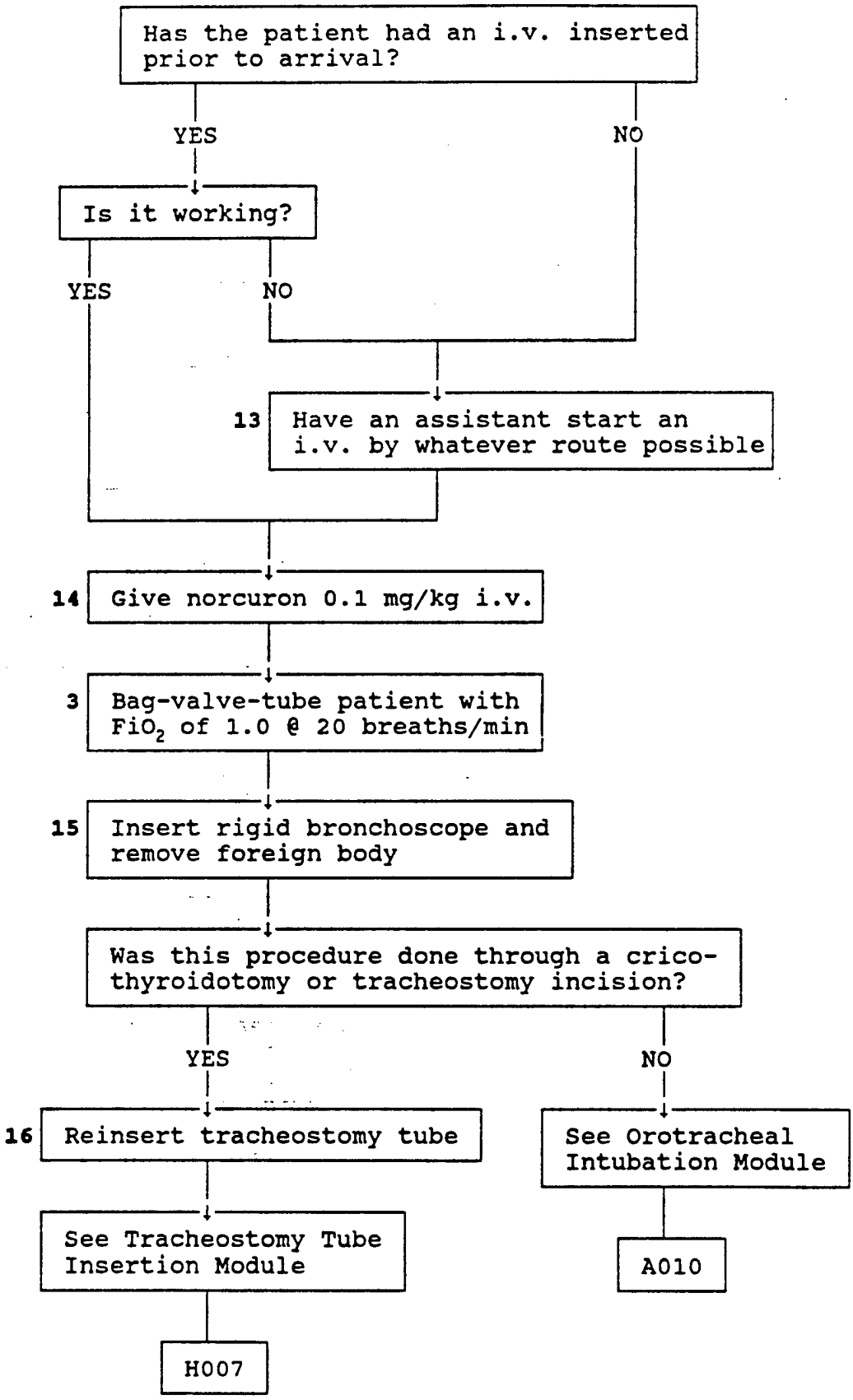
FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE A



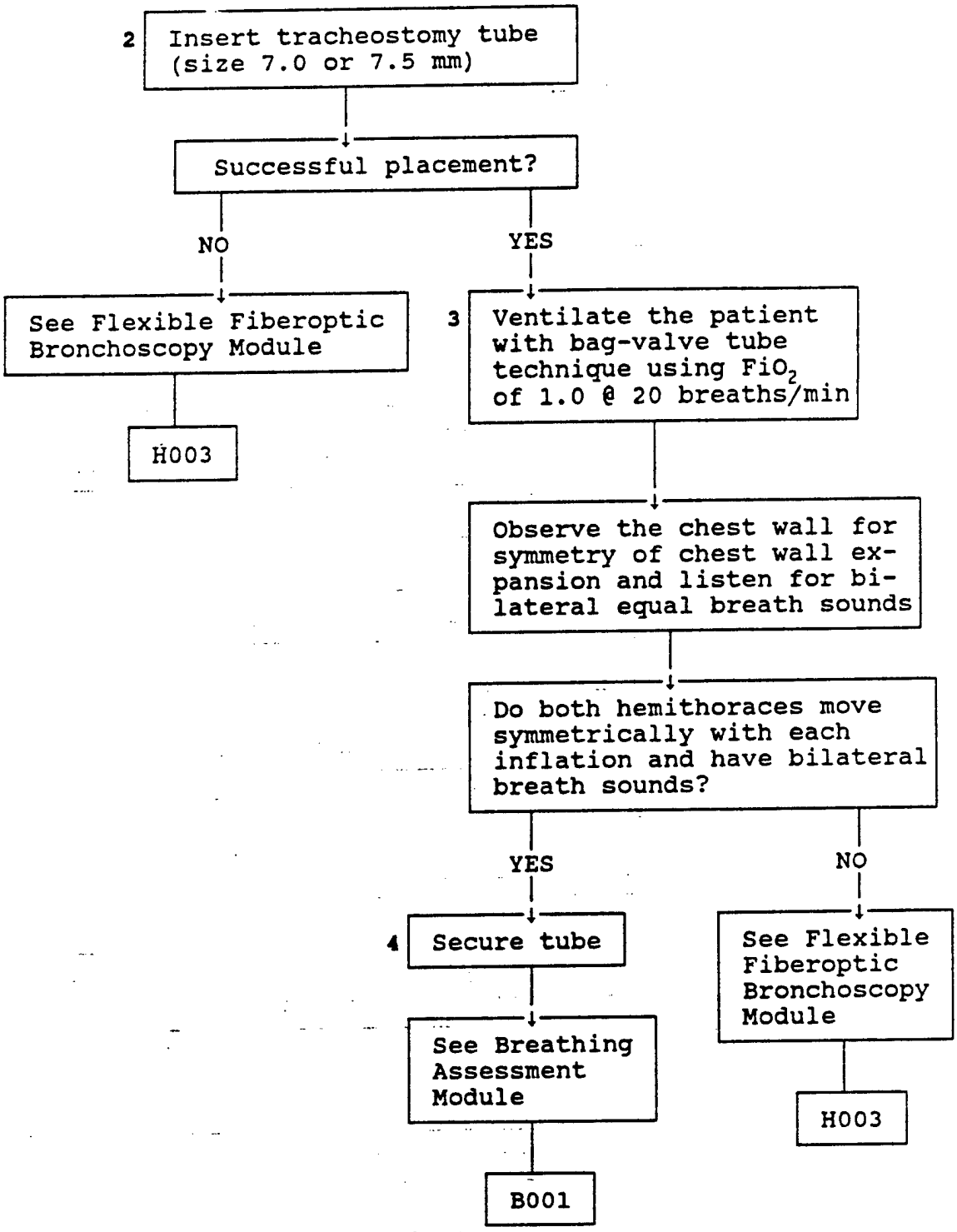
EXTRAORDINARY AIRWAY MEASURES MODULE



RIGID BRONCHOSCOPY AND REMOVE FOREIGN BODY MODULE



TRACHEOSTOMY TUBE INSERTION MODULE



4
AIRWAY

In a good surgeon, a hawk's eye and lions heart:
and a lady's hand.
[Leonard Wright: Display of Duties]

A. Overview

Establishing and maintaining an airway is the first step in trauma resuscitation. Without an adequate oxygen and carbon dioxide exchange, a patient will die. It is the role of the trauma team to rapidly diagnose and manage mechanical obstruction or airway discontinuity first.

Airway problems may be due to injury to the oropharynx, larynx or trachea, or related to head injury with loss of consciousness, foreign body problems, or extrinsic compression. Algorithms in this section focus on the patient's ability to breathe with minimal assistance, and if not, move quickly to establishing appropriate and secured airways by intubation, tracheostomy or cricothyroidotomy. Once the critical airway is established, the resuscitation team can proceed to the next level of primary care, that of breathing.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.

Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest.
Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

Mail to:
CDR J.M. Linenger, MC, USN
Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

AIRWAY - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1 Administer O_2 by mask at 10 L/min	3	3	3	2	1	O_2 mask; O_2 tank
2 Establish I.V.	3	3	3	2	2	#16, #18 gauge I.V. catheters; alcohol wipes; tape; 4X4's; 2X2's; tubing with I.V. solution; prep solution
3 Infuse normal saline			3	2	1	Normal saline; I.V. tubing; established I.V. line
4 Give 0.1 mg/kg I.V. Norcuron			3	2	1	Patient must be ventilated and intubated - syringe; alcohol wipes; Norcuron or other agents; patent I.V.
5 Bag-valve-mask patient with 100% O_2 @ 20 breaths/min			3	2	1	Bag-valve-mask; O_2 source; O_2 tubing
6 Insert oral airway			3	2	1	Appropriate size of oral airway; suction device;suction tubing and kit
7 Remove foreign body in hypopharynx or oropharynx	3	3	3	2	1	Oral airway; suction device; suction tubing and kit
8 Orotracheal intubation	3	3	3			Endotracheal tubes; tape; viscous Lidocaine; drugs for sedation
9 Nasotracheal intubation	3	3	3			Endotracheal tubes/stylet; lubricant; tape; syringe; Laryngoscope; magill forceps; stethoscope; suction/suction source; viscous Lidocaine
10 Secure ET tube	3	3	3	2	1	Tape; Benzoin ointment; gauze
11 Sellick Maneuver	3	3	3	2	1	No equipment needed
12 Inflate endotracheal tube cuff	3	3	3	2	1	Syringe
13 Attach AMBU bag to ET tube and ventilate			3	2	1	AMBU bag; O_2 source; O_2 tubing
14 Cricothyroidotomy	3	3	2*	1*	1*	Curved hemostat; Endotracheal tube/trach tube (5-7mm) O_2 source; AMBU bag
15 Tracheostomy	3	3				#15, #11 knife blade/handle; scalpel; scissors; Bovie with needle tip; tracheostomy tube or wire endotube; See trauma tray. 3-0 silk suture ties; zylocaine with needle; prep solution; trach hook; spreaders

********** Explanation of Specialty Codes and Care Descriptors **********

In all cases, the specialty surgeon is a thoracic surgeon.

In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks.

Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

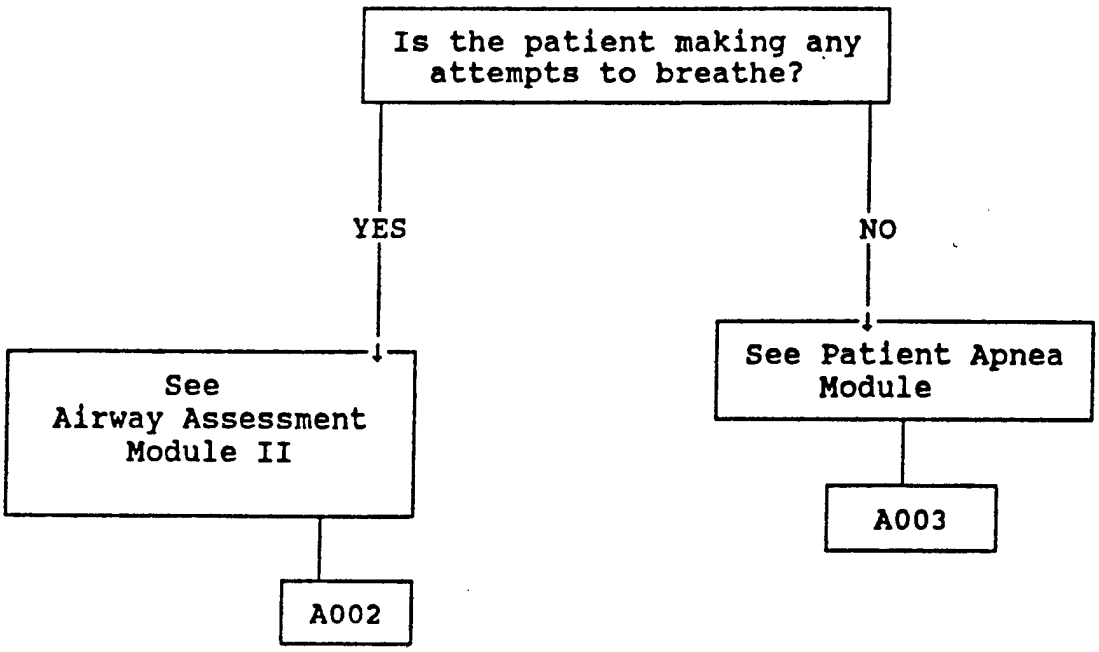
16	Secure tracheostomy tube	3	3	1	1	1	Surgical tape; suture with needle 2.0 silk; surgical tape
17	Suture anterior jugular veins	3	3	2			Suture; 4.0 vicryl; needle holder; scissors
18	Insert bronchoscope into NT tube	3	3	3			Bronchoscope machine; scopes; sterile water or saline
19	Suction trachea tube	3	3	3	3	1	AMBU bag; O_2 source; normal saline for irrigation; gloves; mask

TRAUMA CHEST TRAY - Minimal equipment

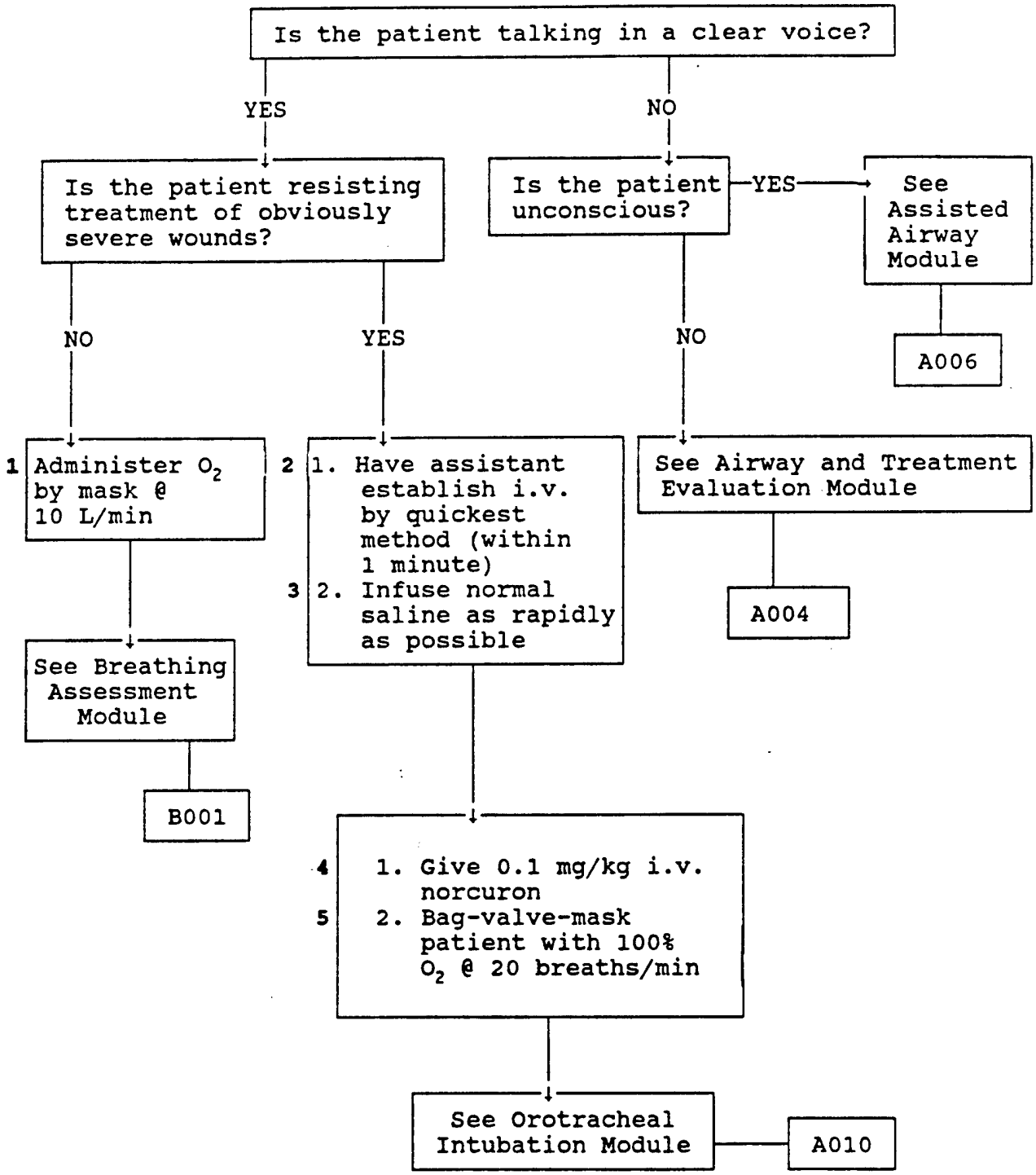
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BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

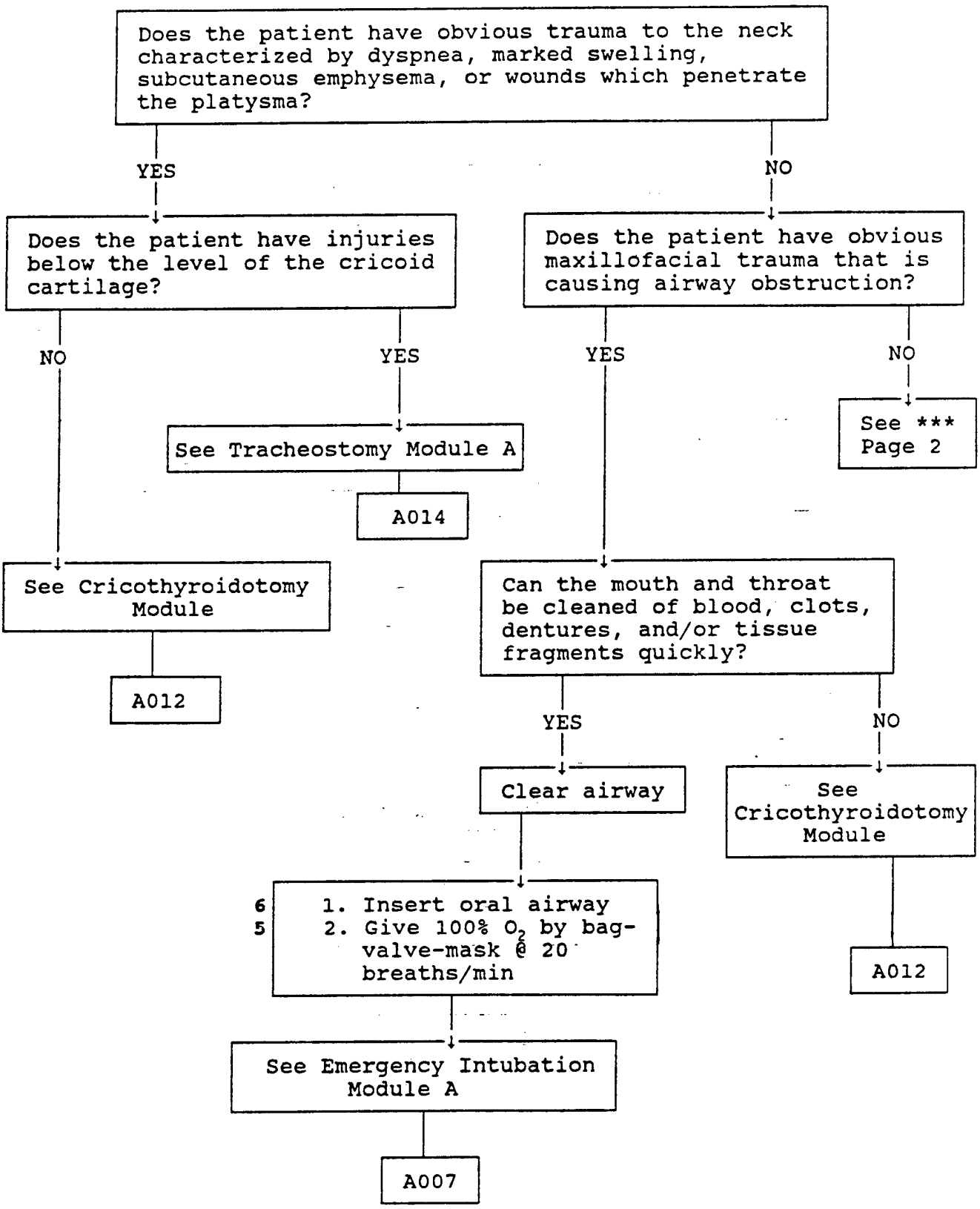
AIRWAY ASSESSMENT MODULE I



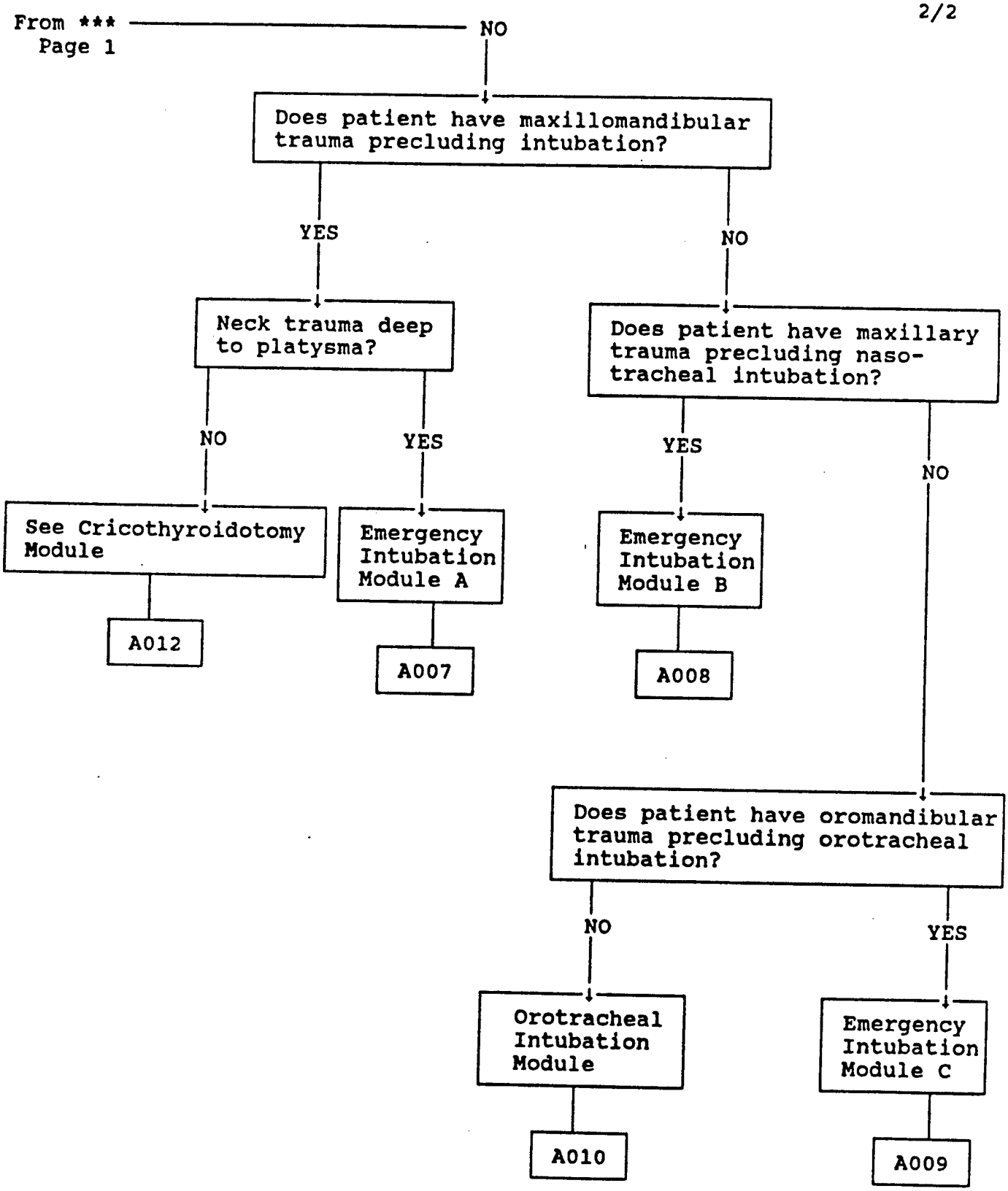
AIRWAY ASSESSMENT MODULE II



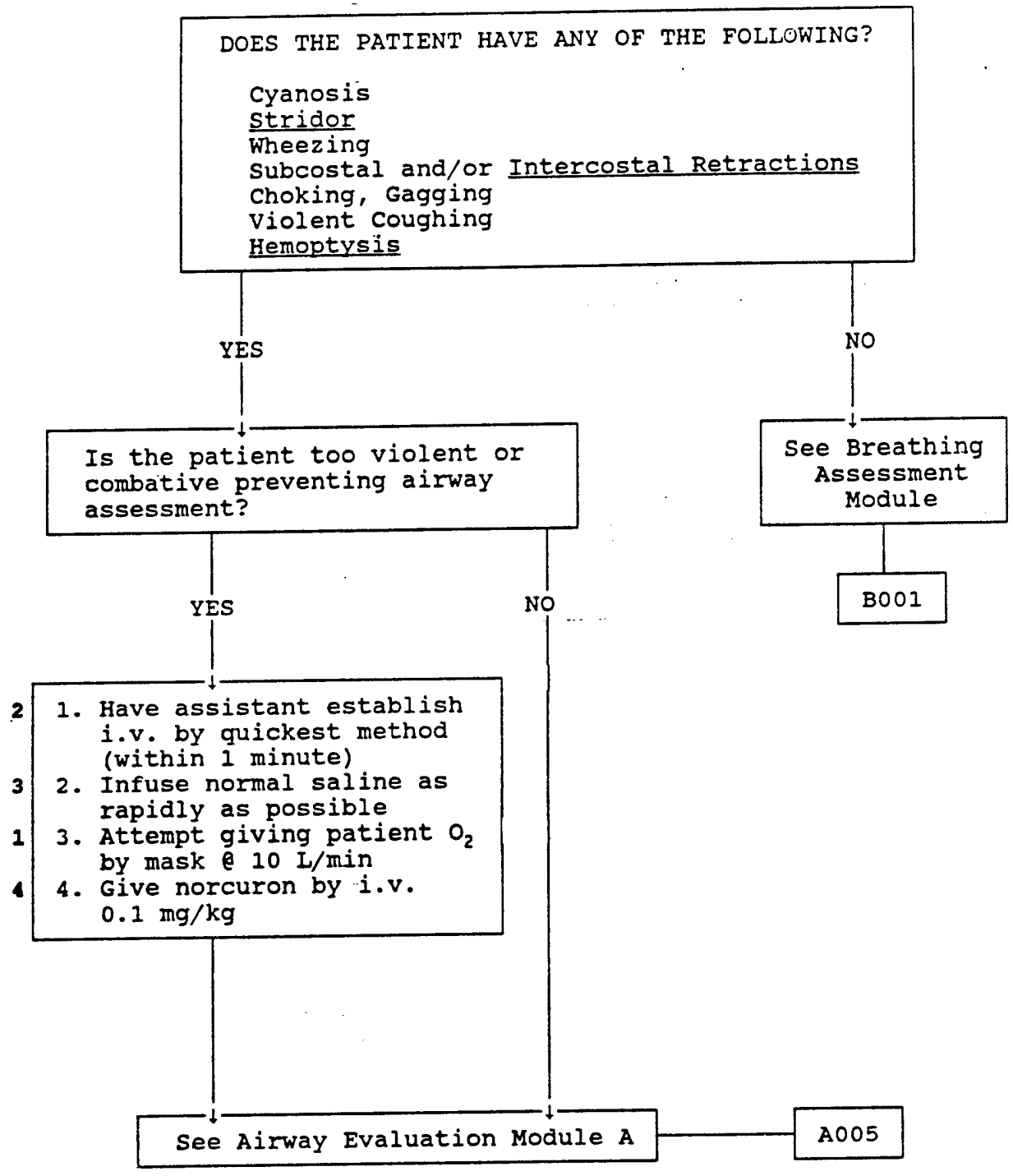
PATIENT APNEA MODULE



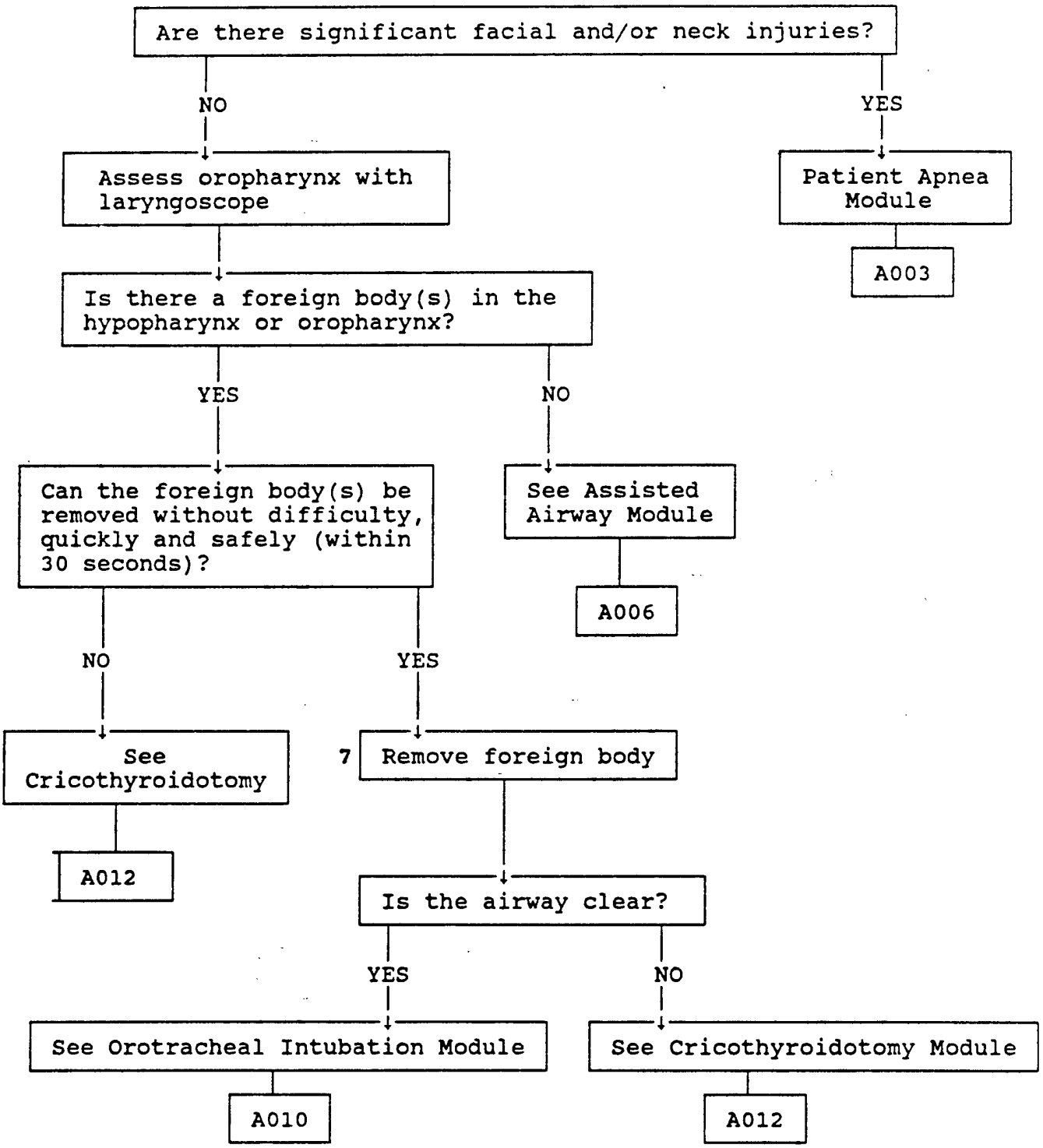
PATIENT APNEA MODULE



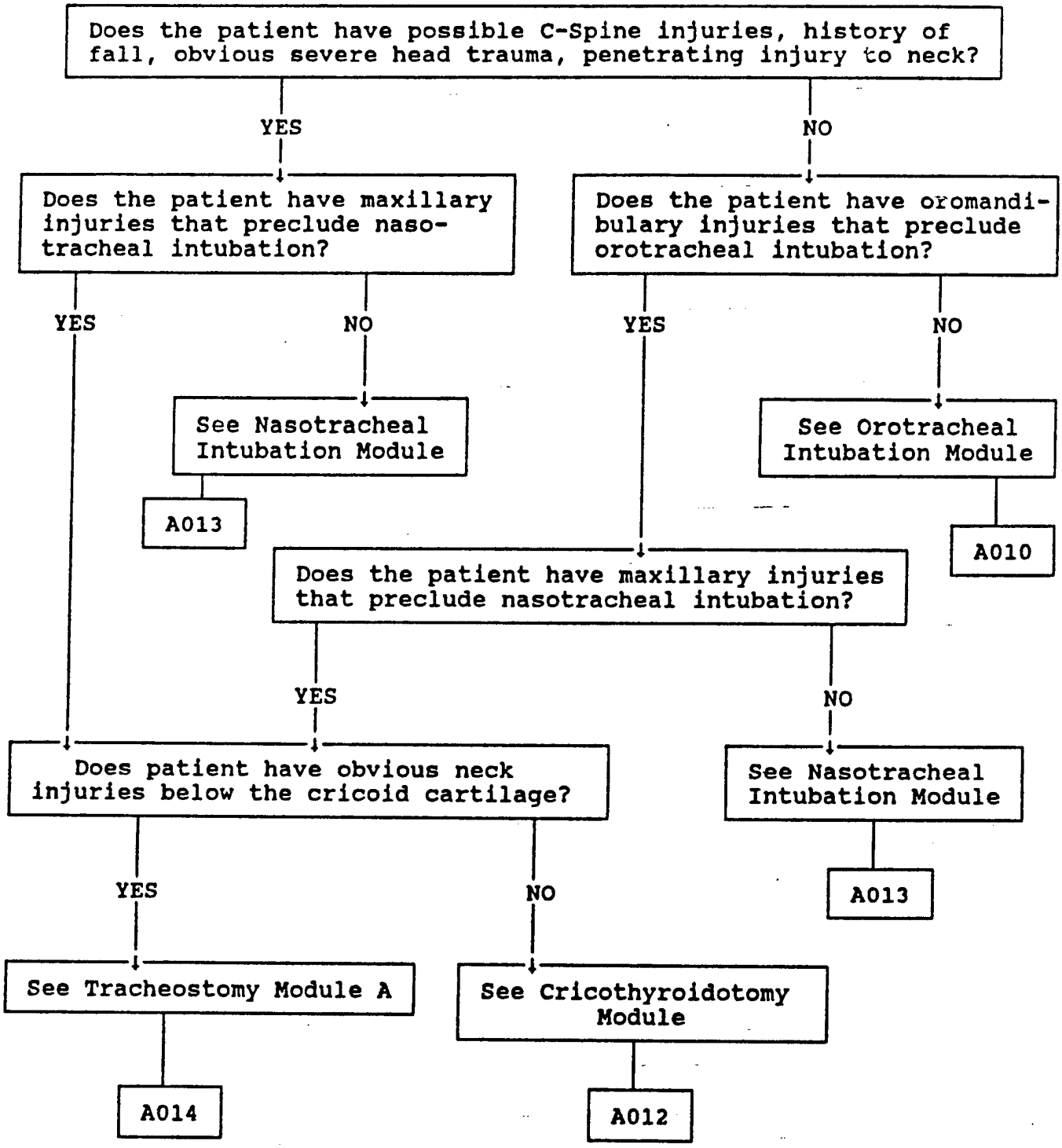
AIRWAY AND TREATMENT EVALUATION MODULE



AIRWAY EVALUATION MODULE A

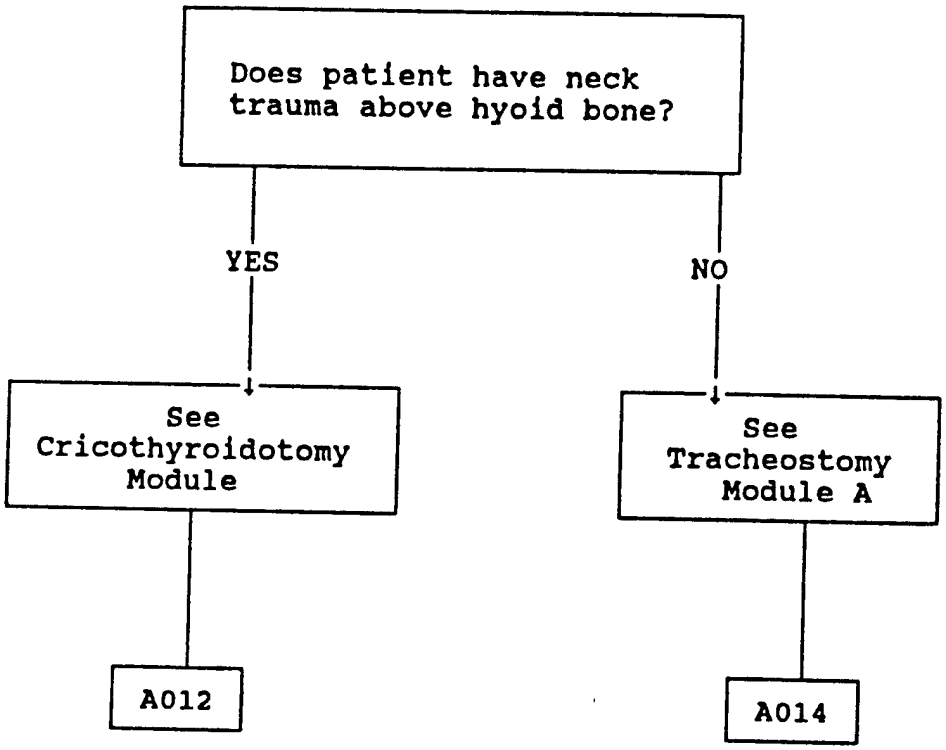


ASSISTED AIRWAY MODULE



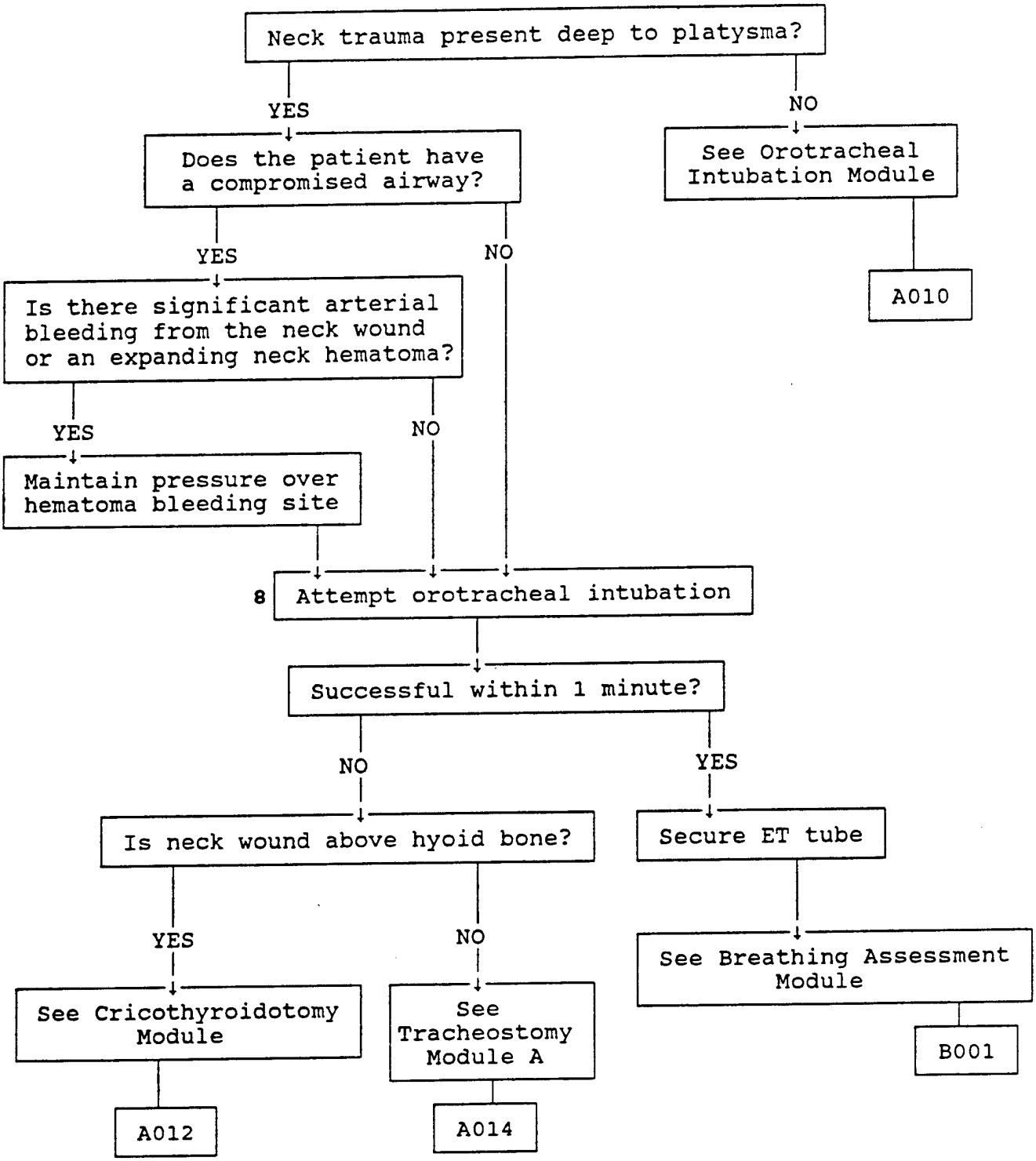
EMERGENCY INTUBATION MODULE

Module A



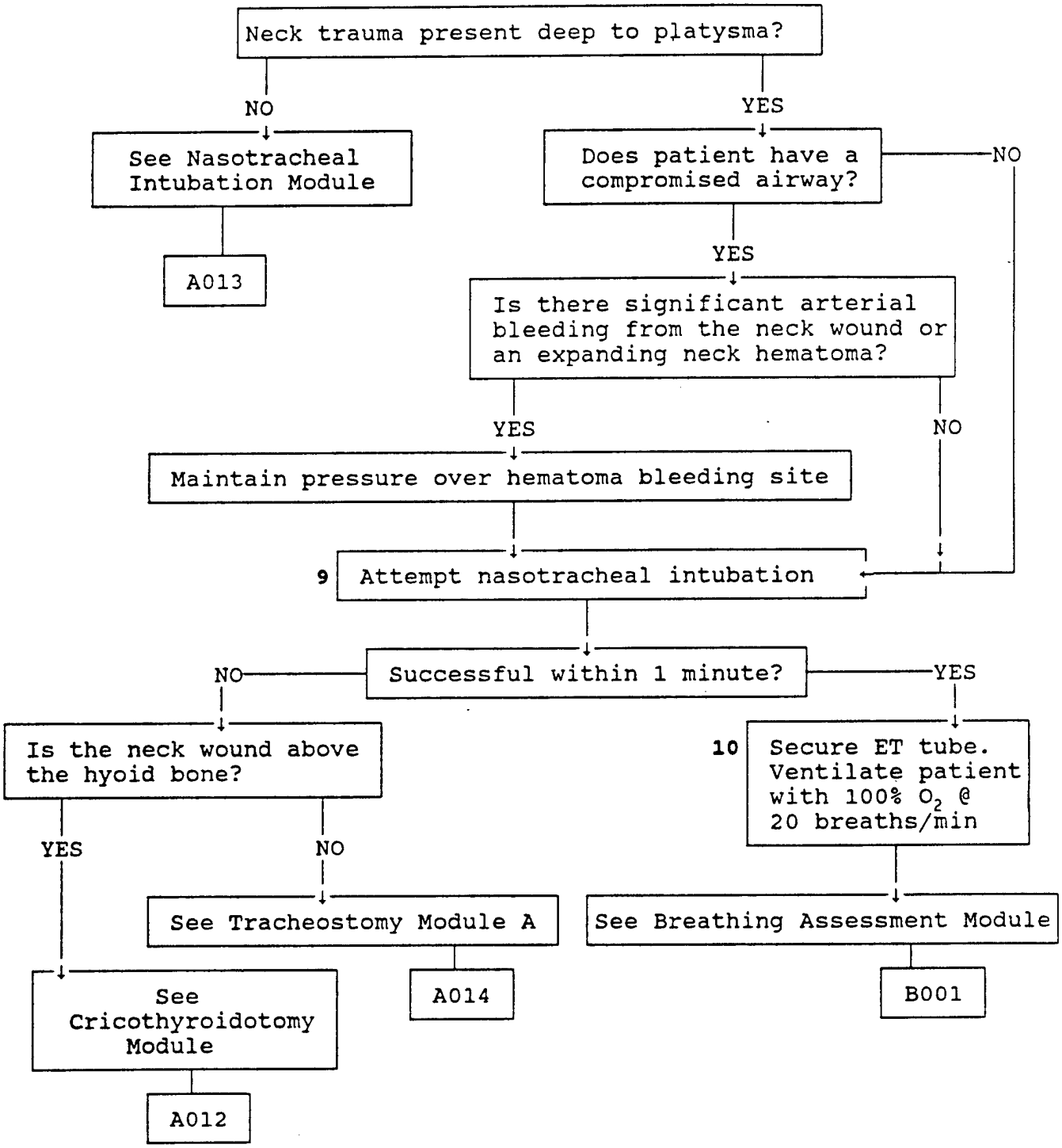
EMERGENCY INTUBATION MODULE

Module B

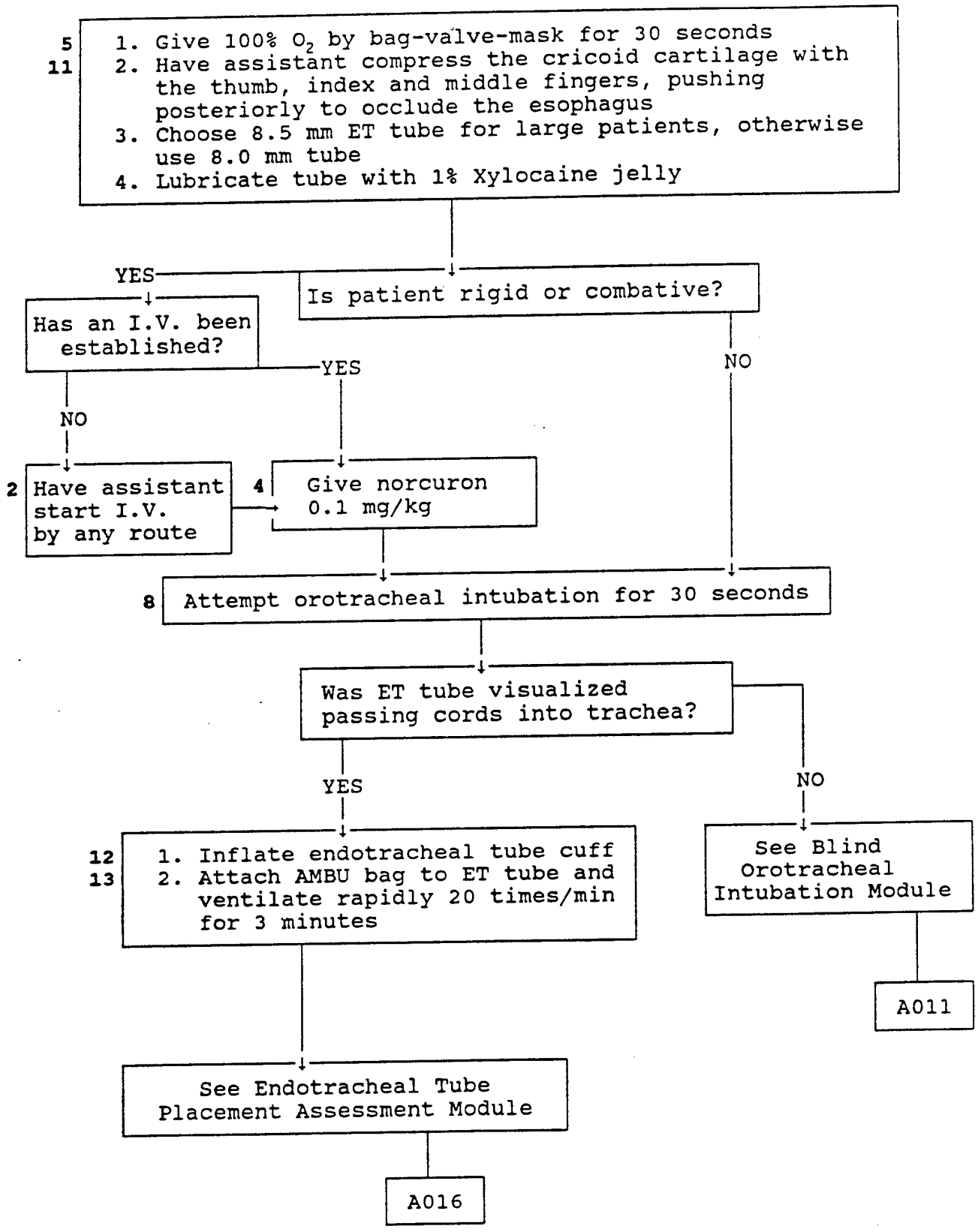


EMERGENCY INTUBATION MODULE

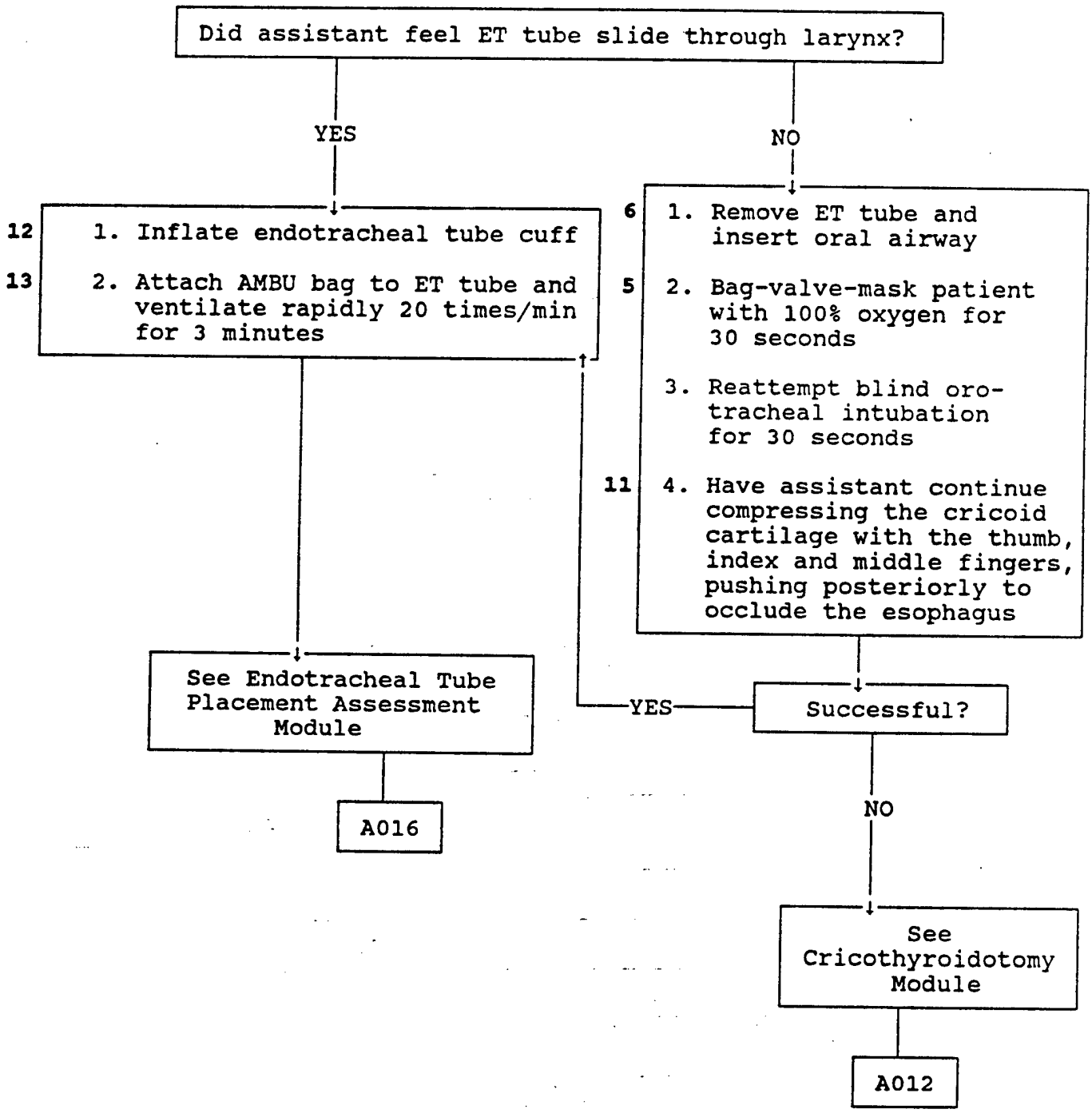
Module C



OROTRACHEAL INTUBATION MODULE



BLIND OROTRACHEAL INTUBATION MODULE



CRICOTHYROIDOTOMY MODULE

11 1. Assistant compresses the cricoid cartilage with the thumb, index and middle fingers of one hand, pushing posteriorly to occlude the esophagus. Assistant compresses thyroid cartilage with the other hand until procedure is completed

14 2. Operator makes a horizontal stab wound in cricothyroid membrane and twists scalpel to allow operator to insert a hemostat to enlarge the opening

15 3. Operator inserts through cricothyroidotomy opening an 8.0 mm ED tracheostomy tube for large patients (7.0 mm ED tracheostomy tube for all other adults)

13 4. Operator inflates tracheostomy tube cuff and ventilates patient with 100% O_2 and ambu bag-valve-tube technique at 20 breaths/min for 1 minute

19 5. Suction tracheostomy tube for 10 seconds

6. Resume positive pressure ventilation

↓

Is tracheostomy cuff ruptured?

YES ↓

Repeat steps 3, 4, 5, 6 with new tracheostomy tube

↓

Does tracheostomy cuff rupture again?

YES ↓

14 1. Enlarge opening of cricothyroidotomy
2. Insert into distal trachea red rubber catheter and slide tracheostomy tube over catheter
3. Remove catheter while suctioning
12 4. Inflate tracheostomy cuff
13 5. Ventilate patient with 100% oxygen using bag-valve-tube technique

NO →

NO ↓

16 1. Secure tracheostomy tube with sutures (2-0 silk) and surgical tape around neck
17 2. If bleeding, suture anterior jugular veins with 4.0 vicryl above and below surgical incision while assistant maintains pressure

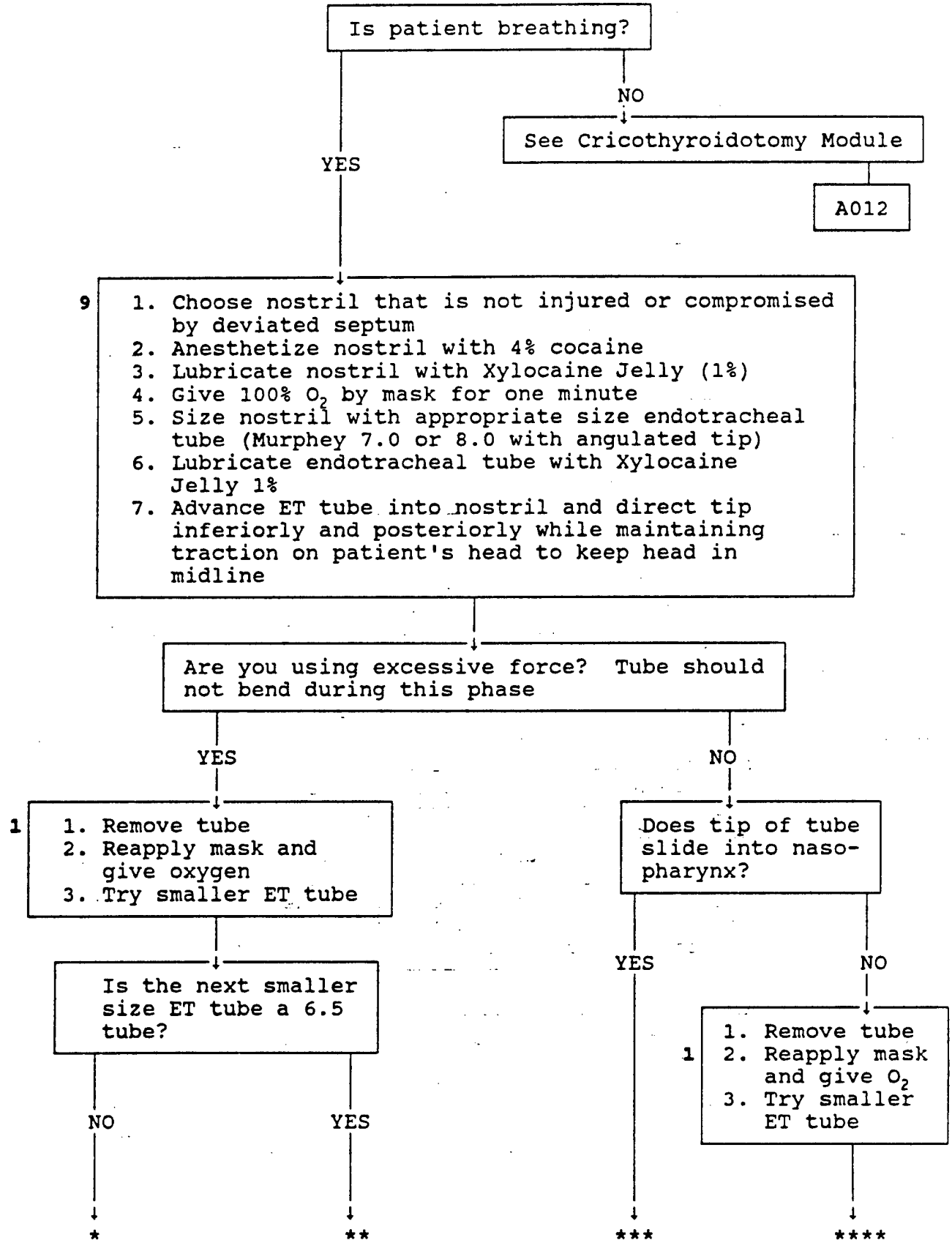
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See Breathing Assessment Module

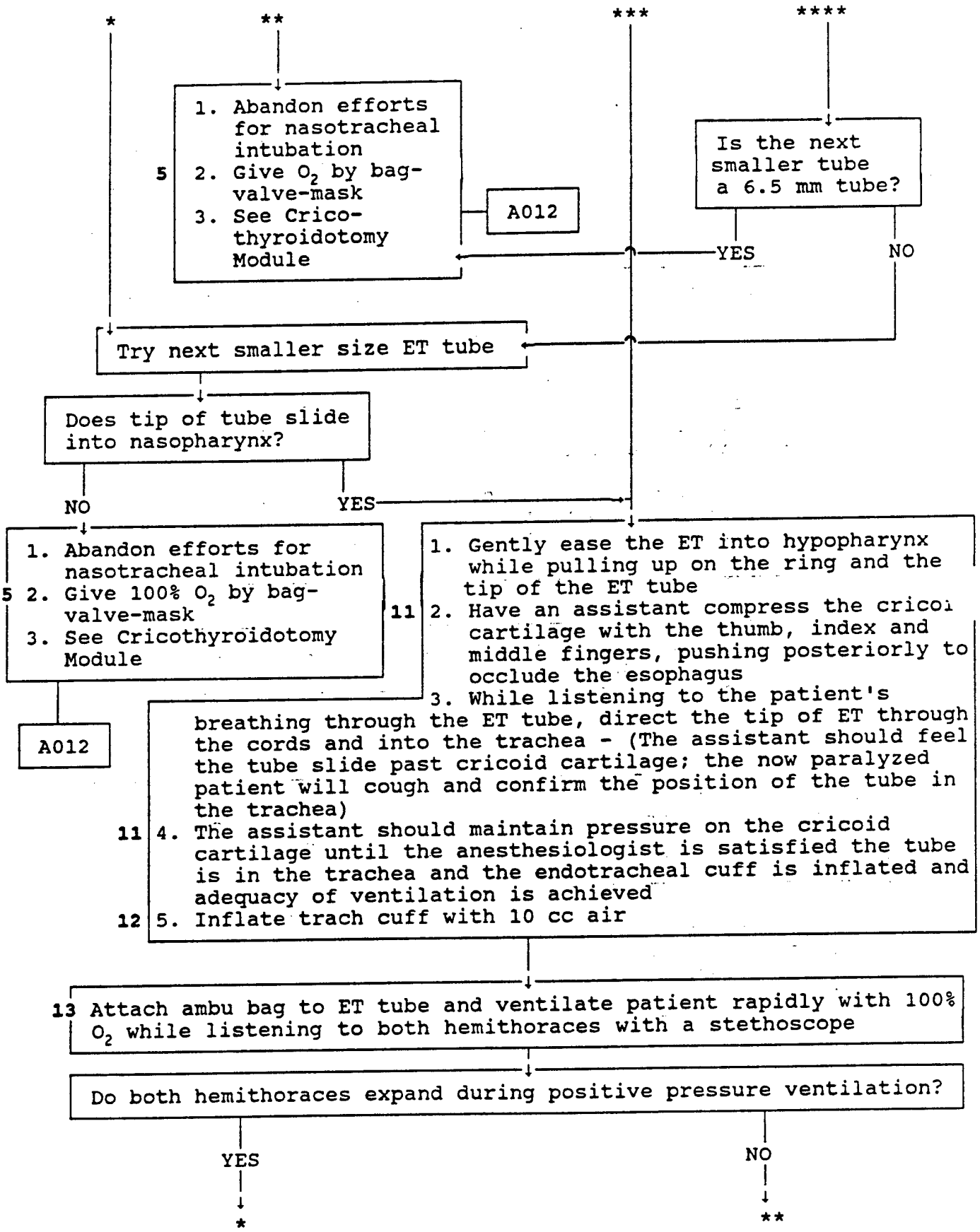
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B001

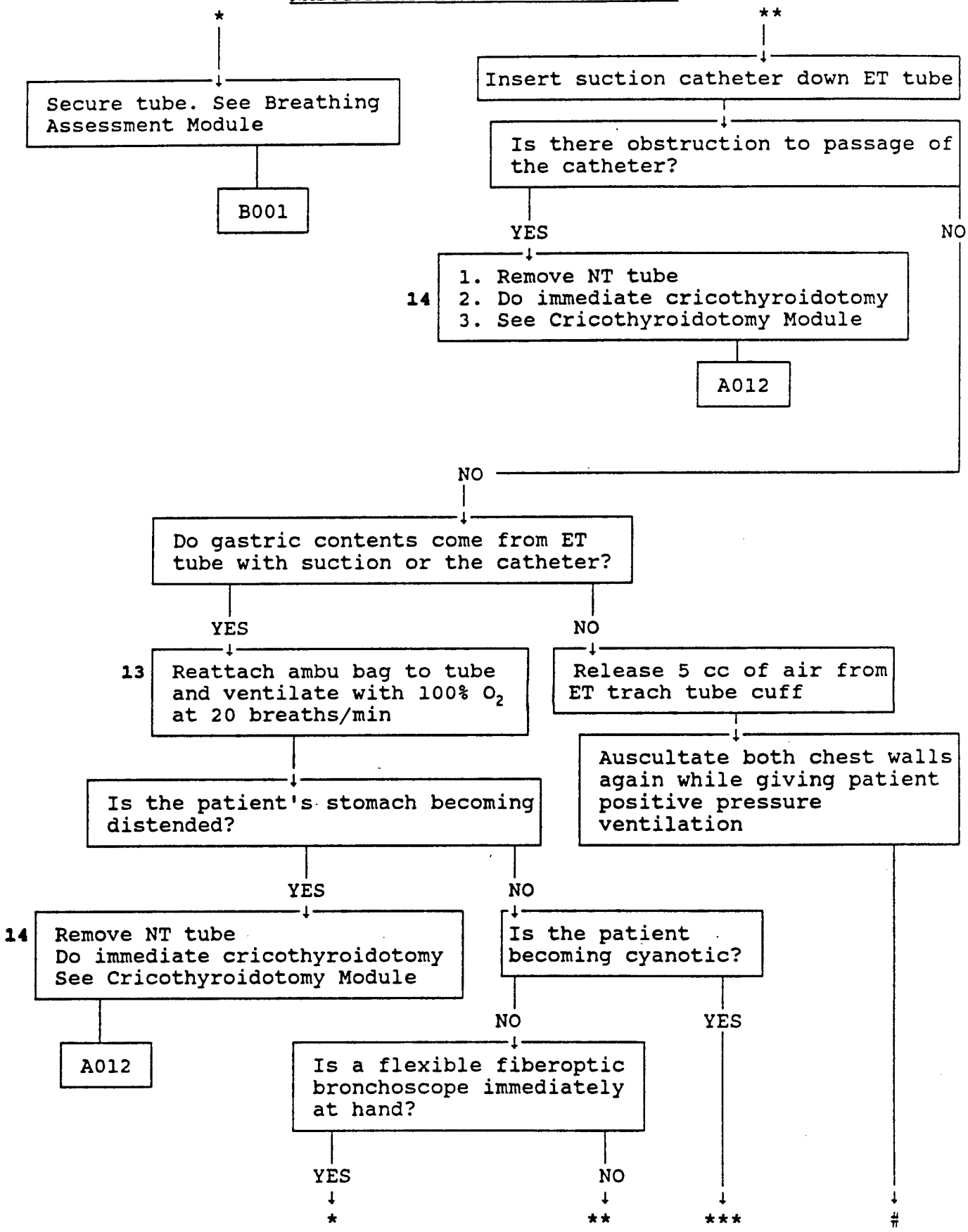
NASOTRACHEAL INTUBATION MODULE



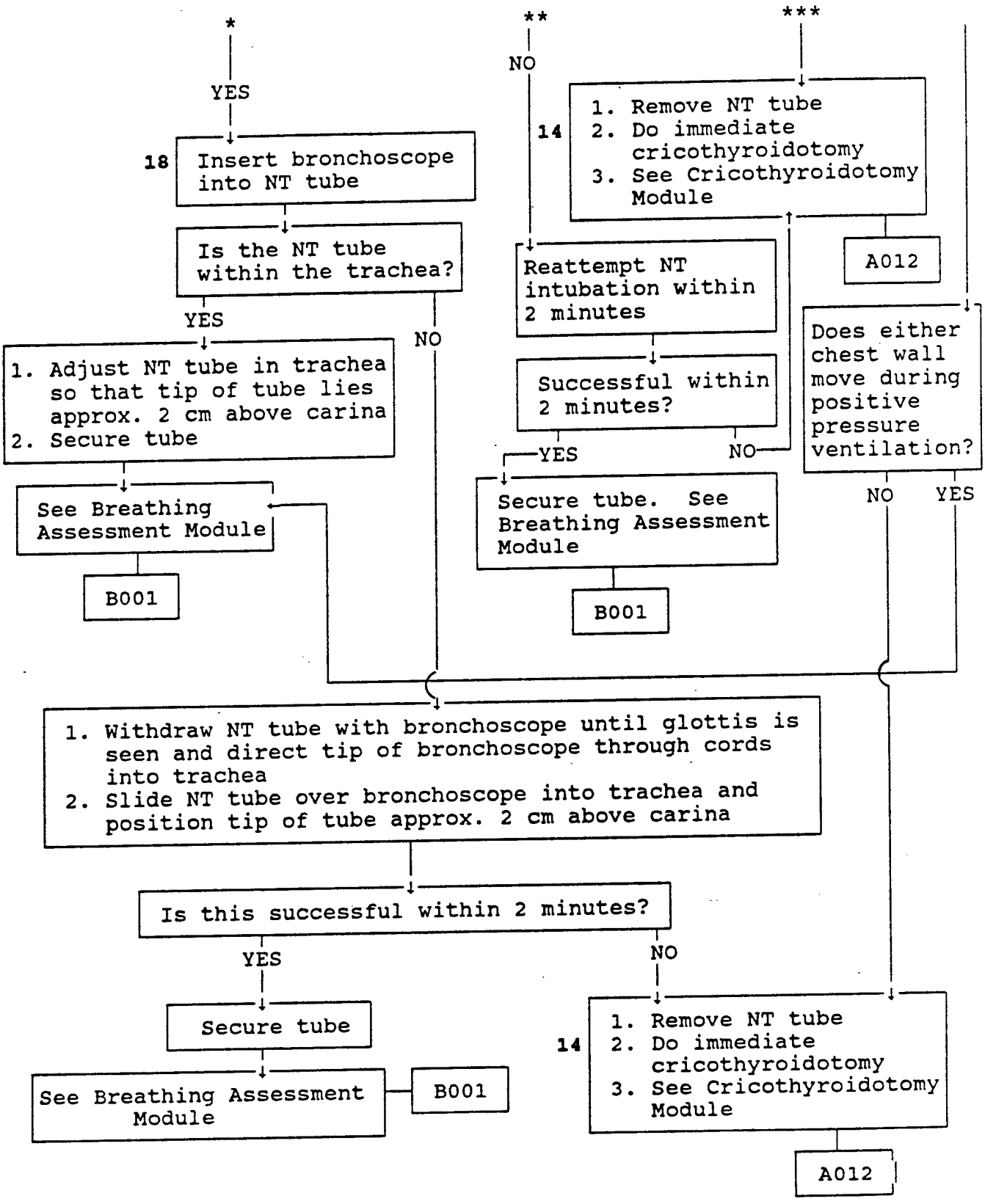
NASOTRACHEAL INTUBATION MODULE



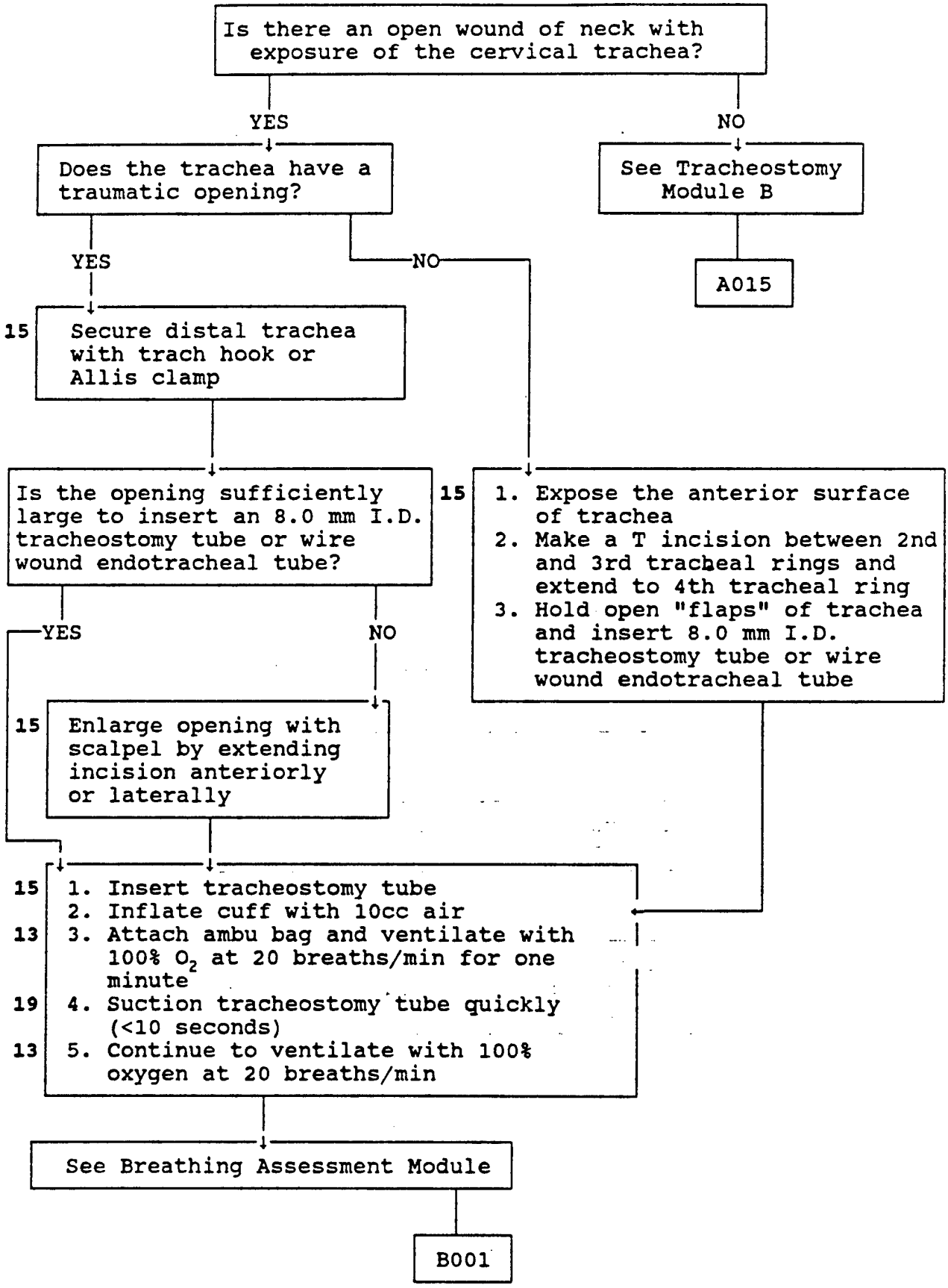
NASOTRACHEAL INTUBATION MODULE



NASOTRACHEAL INTUBATION MODULE



TRACHEOSTOMY MODULE A



TRACHEOSTOMY MODULE B

15

1. Make a vertical incision over trachea from cricoid cartilage to suprasternal notch
2. Have assistant compress both skin edges forcibly while pulling skin and underlying tissue laterally
3. Stab with scalpel directly posteriorly until trachea is entered below cricoid cartilage and continue inferiorly for 2 cm
4. With clamp in superior part of tracheal incision spread trach incision open and insert 8.0 mm I.D. trach tube or wire wound endotracheal tube
5. Inflate cuff with 10 cc air
6. Attach ambu bag and ventilate with 100% O_2 for 20 breaths
7. Suction quickly tracheostomy tube for less than 10 seconds
8. Resume ventilation with 100% oxygen at 20 breaths/min

Control bleeding thyroid isthmus with running sutures

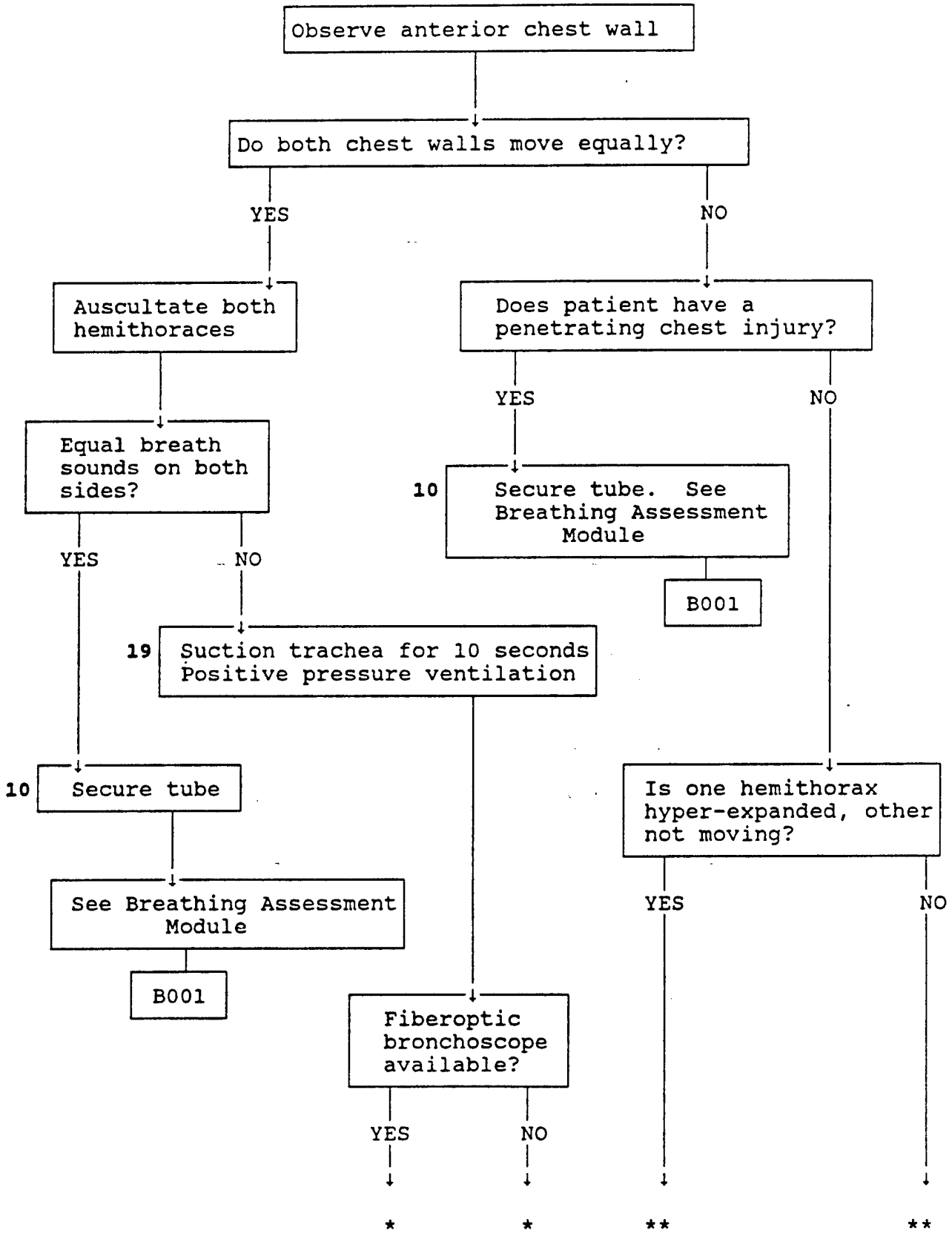
16

Secure tracheostomy tube or wire wound endotracheal tube with 2-0 or 0 silk sutures

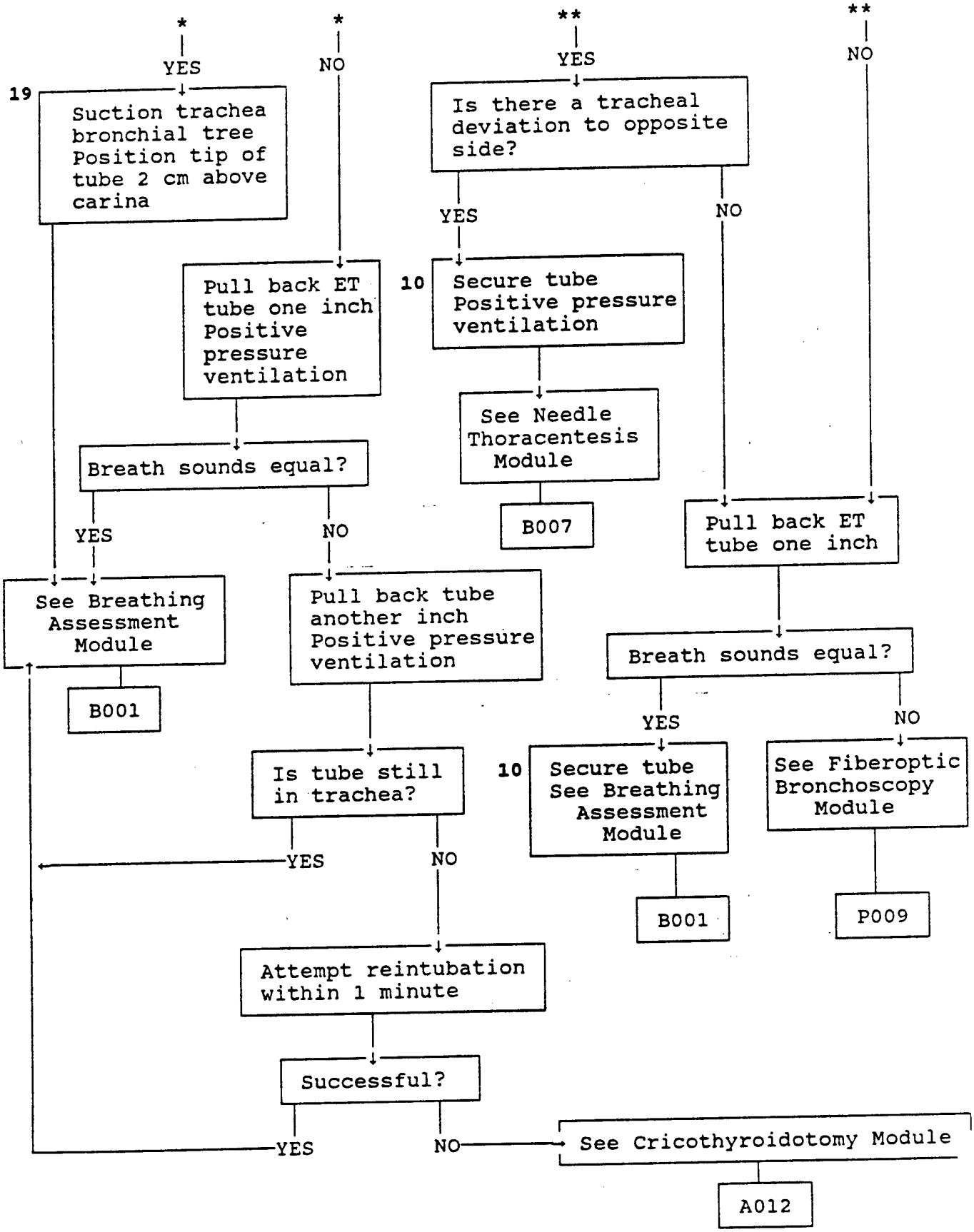
See Breathing Assessment Module

B001

ENDOTRACHEAL TUBE PLACEMENT ASSESSMENT MODULE



ENDOTRACHEAL TUBE PLACEMENT ASSESSMENT MODULE



5
BREATHING

Please do not shoot the pianist. He is doing his best.
[Adjunction to the patrons in a saloon in
Leaderville, Colorado: Oscar Wilde]

A. Overview

After securing the airway, the focus changes to evaluating the patient's ability. Breathing depends on two components: the active expansion and relaxation of the chest wall and diaphragm, and the passive response of the pulmonary tissue and supportive airway to the changes in the intrapleural pressure.

Here, the algorithms begin with the assumption that an appropriate airway has been established. Obviously, there is significant overlap in the airway and breathing modules. The thrust is to rapidly evaluate the patient for significant chest wall injury (flail segment, open thoracic wounds) or more subtle injury that can lead to rapid deterioration (tension pneumothorax, tracheobronchial injury). Once the patient's breathing is secured, then the circulatory system can be addressed.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.

Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest.
Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

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San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

BREATHING - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Provide O_2 by bag-valve-tube for intubated patients			3	2	1	O_2 source; O_2 tubing; Ambu bag; Stethoscope; Ventilator
2. Orotracheal Intubation	3	3	3	1*	1*	Endotracheal tube; tape; viscous lidocaine drugs for sedation
3. Provide O_2 by mask			3	2	2	O_2 source; O_2 mask
4. Cover defects with petrolatum gauze	3	3	2	2		Petrolatum gauze; 4 x 4's/tape
5. Apply local measures i.e. compression with sterile gauze, hemo-clips or ligation of arterial or major venous bleeders of minor chest wall wound(s)	3	3	1*	1*	1*	Sterile gauze; hemoclips; tape; 4 x 4's
5a. Continue efforts at clinician's discretion	3	3				
6. Needle Thoracentesis	3	3	1*	1*	1*	#10, 12, 14 angiocatheter; 1 1/2 finger glove/rubber band tape; Heimlich valve; (flutter valve/stop cock); Betadine; 16 gauge needle
7. Tube Thoracostomy (ies)	3	3				Chest tube (sizes #28, #32, #36) catheters; scalpel; Betadine prep; large curved clamp; chest drainage collector device; zylocaine/syringe; 4 x 4'; suture; needle holder
8. Insert chest tube	3	3				Betadine prep; Stearns saw; Lebshe knife; Cautery 4/0 monofiliment pledgeted sutures; cardiac tape; 4/0 prolene; scalpels; clamps; hemoclips; chest retractors; suctions; chest tube (male #36; female #32; child #28); curved clamp; needle holder; prep solution; xylocaine/syringe; 4 x 4's; tape
9. Secure tube with sutures and attach to chest drainage system	3	3				Suture; needle holder; gauze; gauze; Benzoin; tape; sterile H_2O; suction
10. Autotransfusion	3	3	2	2	1*	Autotransfusion set for chest drainage device; citrate or heparin
11. Clamp chest tube	3	3	2	2	1	Chest tube drainage set; clamps

********** **Explanation of Specialty Codes and Care Descriptors** **********

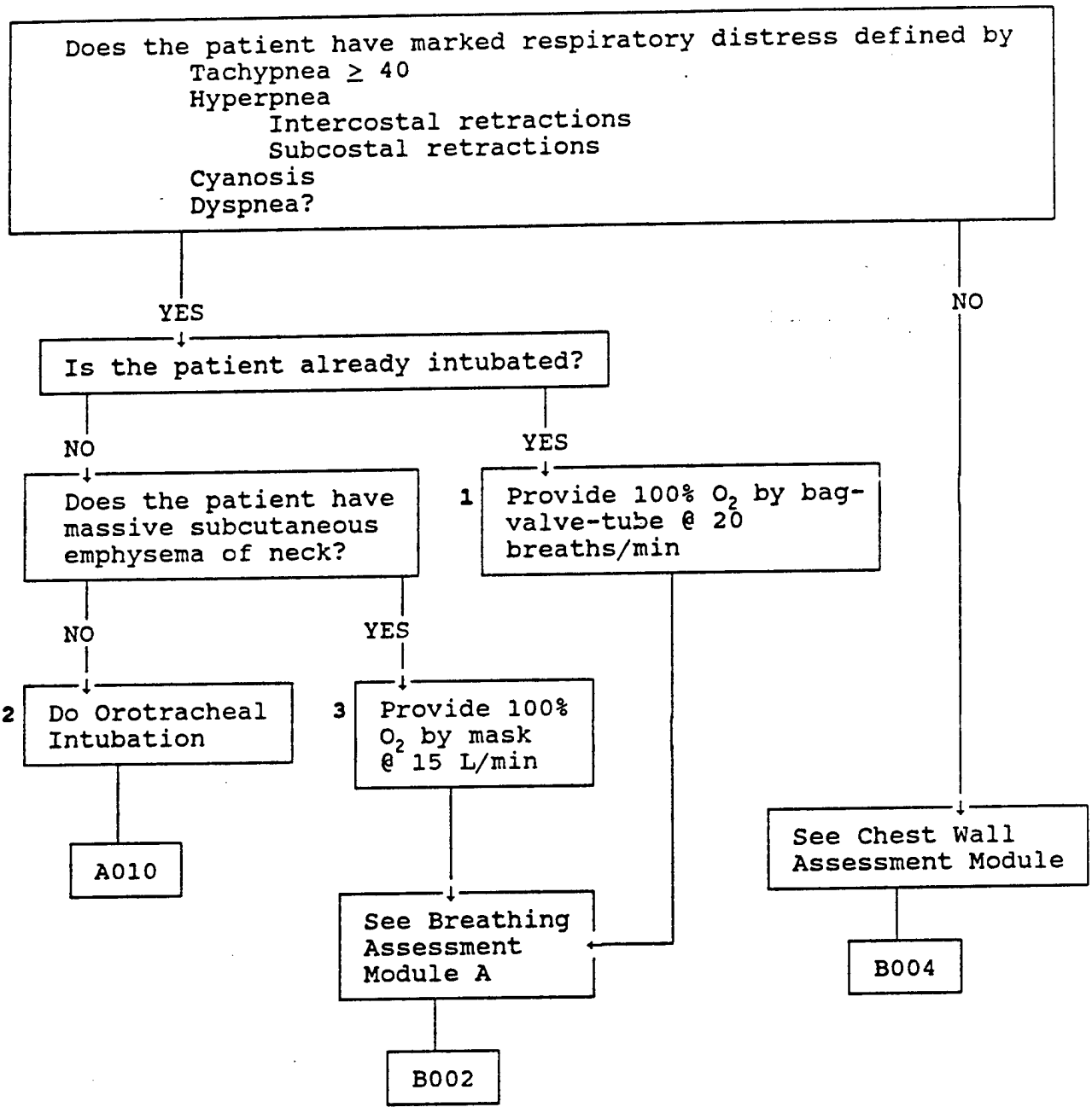
In all cases, the specialty surgeon is a thoracic surgeon.
In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks. Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

12. Chest tube declotting	3	3	1*	1*	1*	Fogarty balloon catheter; Foley balloon catheter; Nasotracheal suction catheter; sterile connections
13. Tighten or reposition chest tube	3	3	1	1	1	No equipment needed

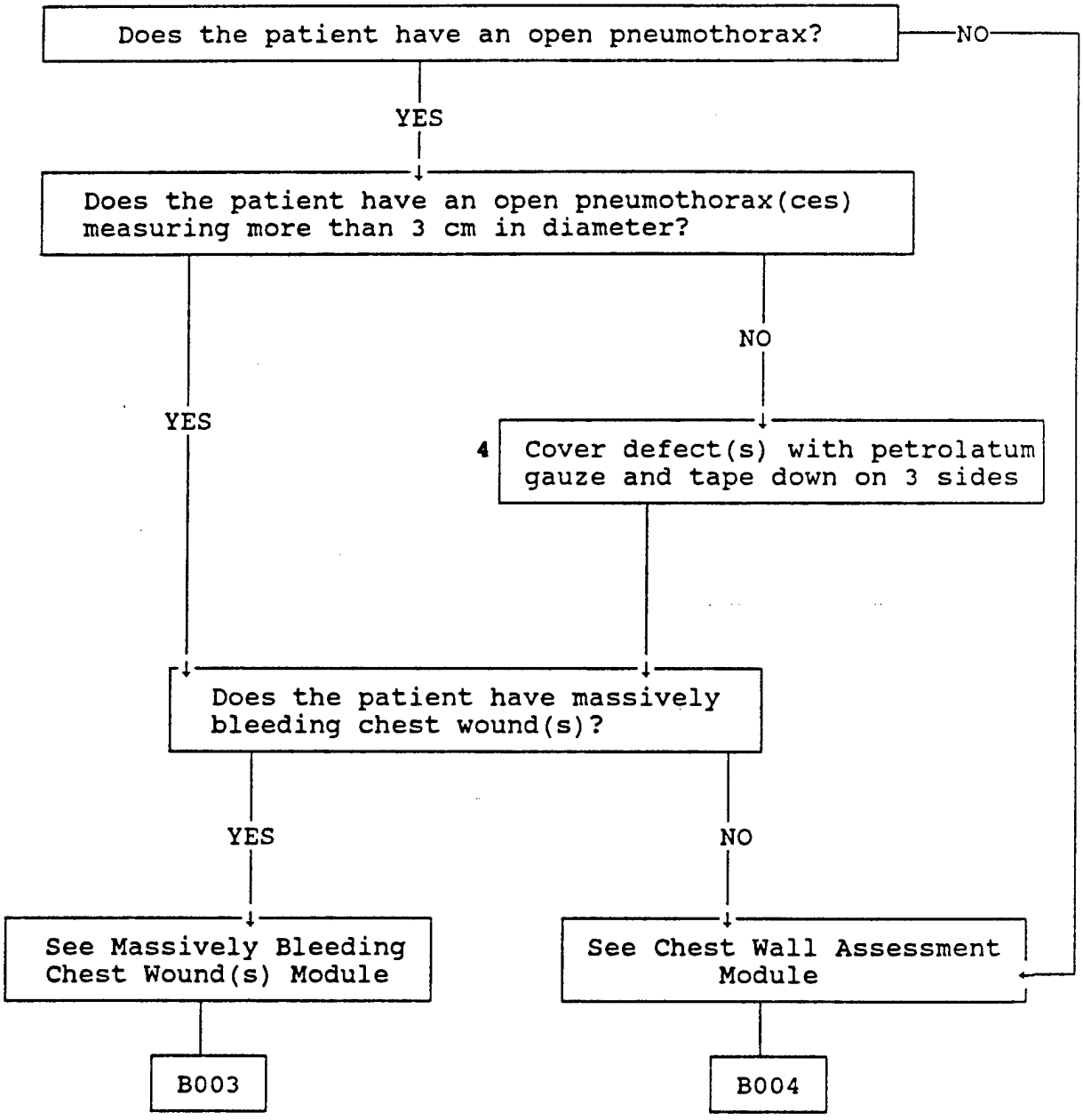
TRAUMA CHEST TRAY - Minimal equipment

1 - MEDIMM FINOCHETTI RETRACTOR
1 - EXTRA LONG NEEDLE HOLDER
4 - BABY TOWEL CLIPS
1 - 9" CURVE
1 - LONG MAYO
1 - CURVED CRILE
1 - STRAIGHT CRILE
1 - LAUER
1 - STRAIGHT COARCTATION CLAMP
1 - TANGENTIAL OCCLUSION CLAMP
2 - TONSIL HEMOSTATS
1 - 4# KNIFE HANDLE
4 - TOWELS (FOLDED READY TO SQUARE OFF)
2 - PACKAGES COUNTED 12 BY 12'S
STERNAL SAW/LEBSCHE
BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

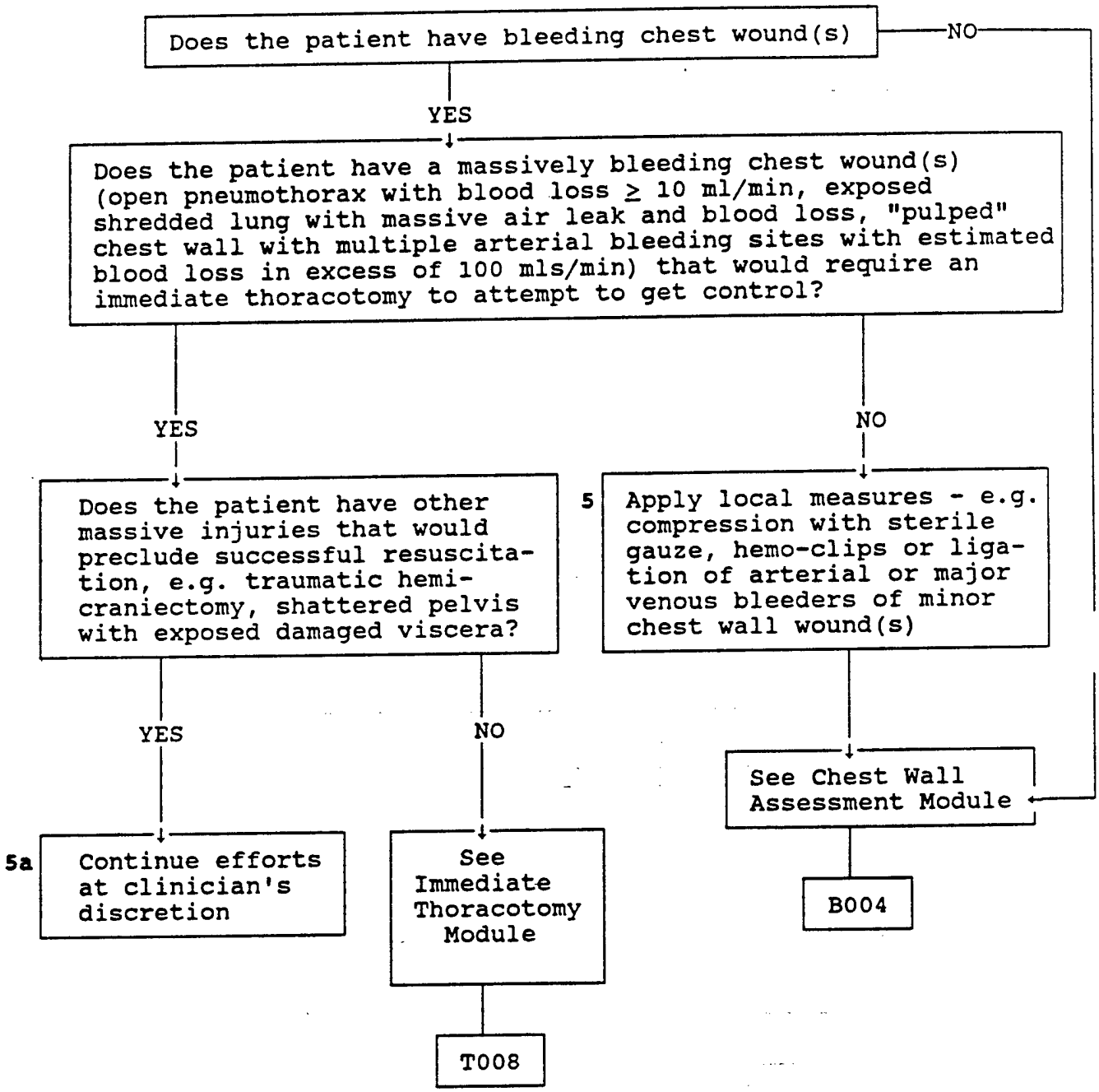
BREATHING ASSESSMENT MODULE



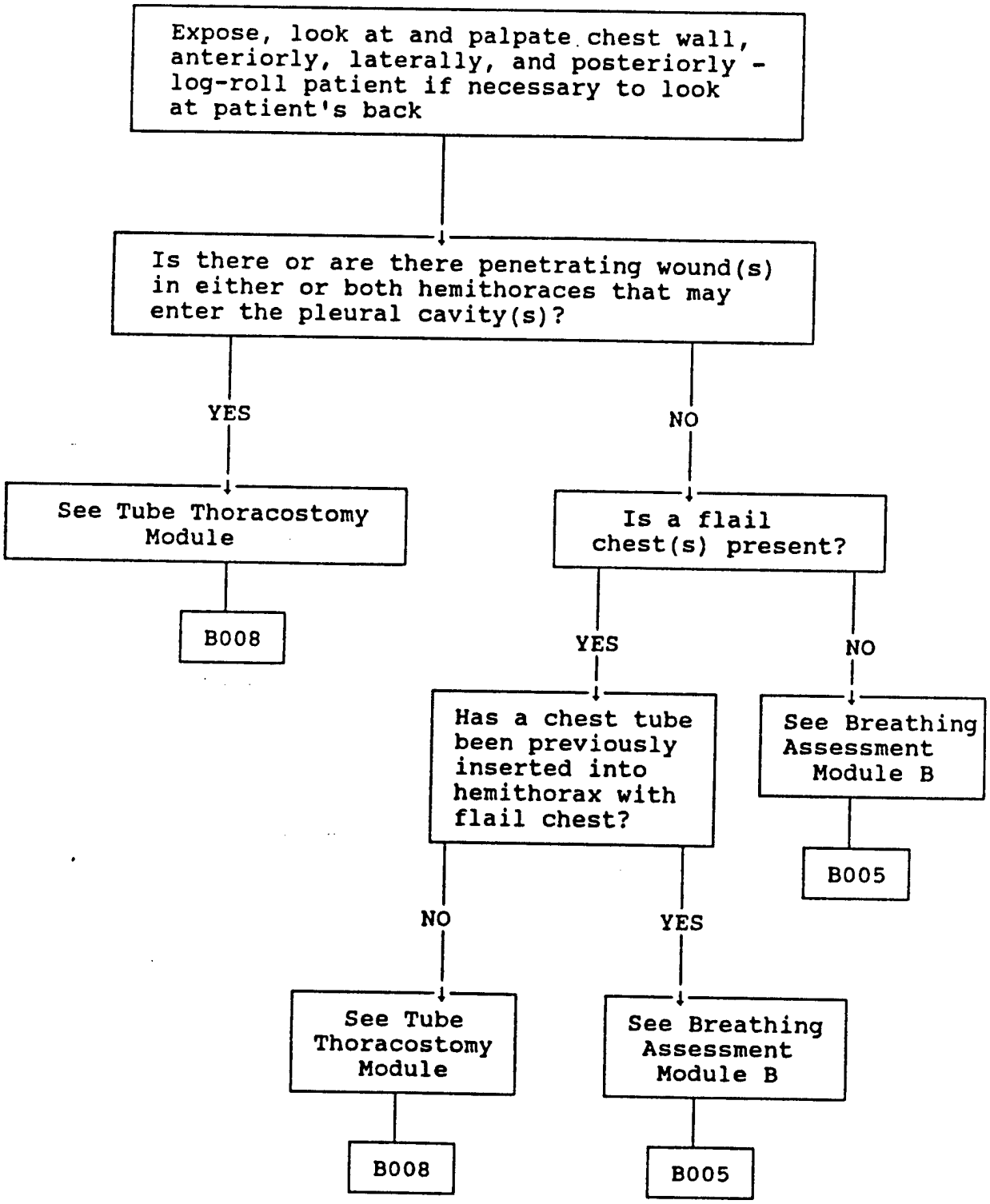
BREATHING ASSESSMENT MODULE A



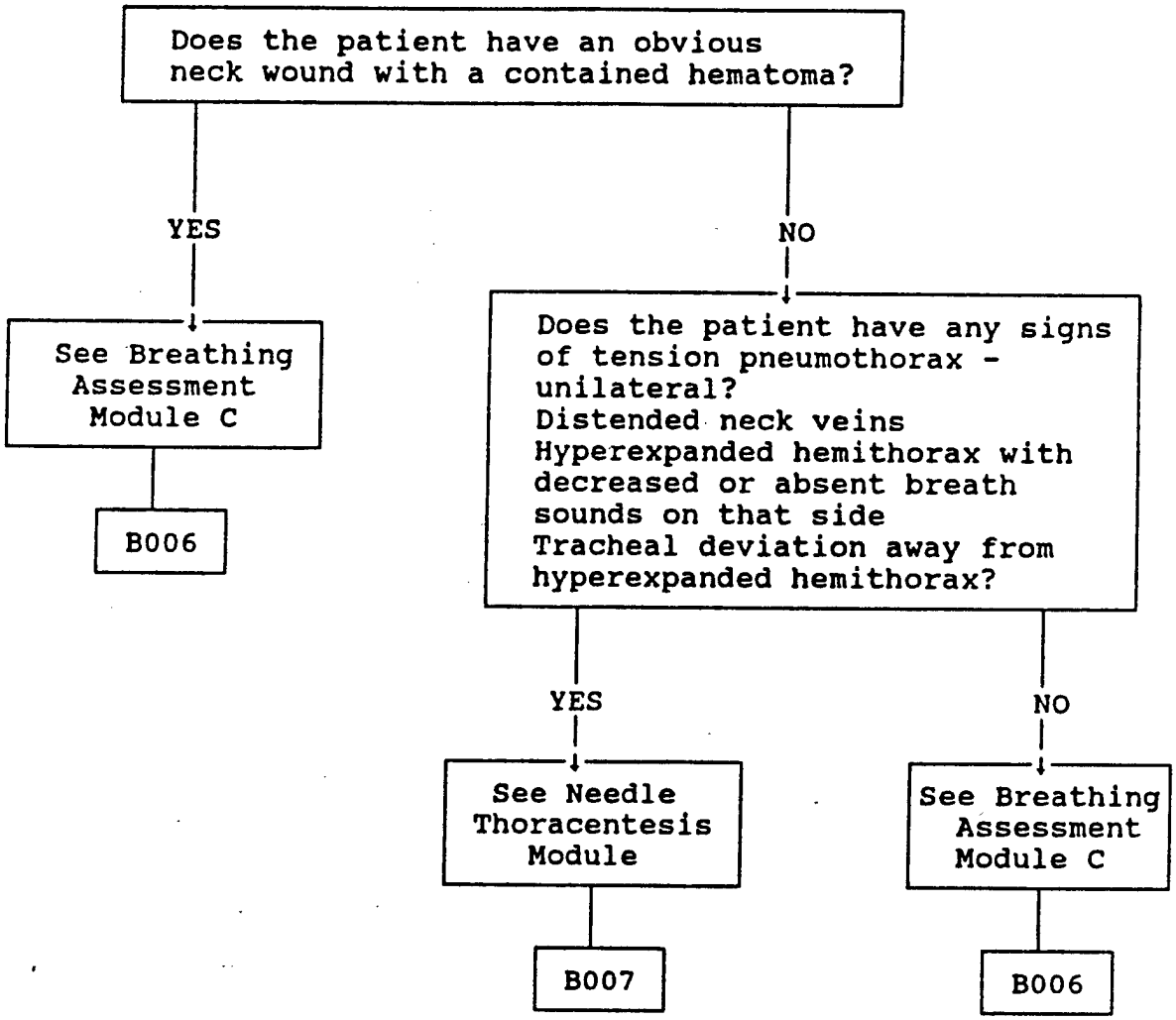
MASSIVELY BLEEDING CHEST WOUND(S) MODULE



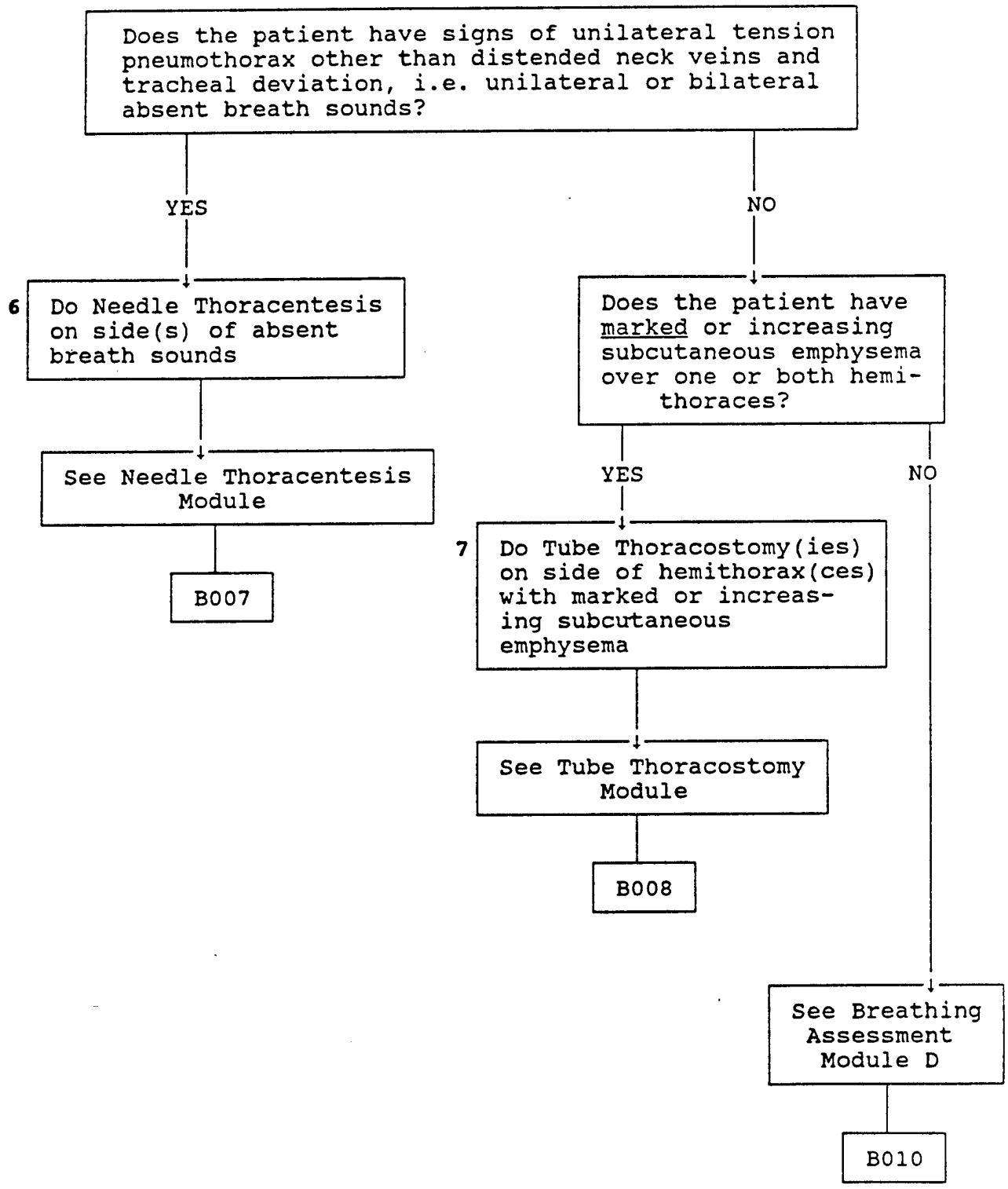
CHEST WALL ASSESSMENT MODULE



BREATHING ASSESSMENT MODULE B



BREATHING ASSESSMENT MODULE C



NEEDLE THORACENTESIS MODULE

6

1. Quickly prep anterior chest wall with Betadine from clavicles to nipples and to both anterior axillary lines.
2. Find angle of Louis and 3rd rib and position fingers over 3rd rib at midclavicular line.
3. Direct 16 gauge needle ≥ 3" long vertically over top of 3rd rib into pleural space(s) of hemithorax with subcutaneous emphysema

Does a great gush of air come out?

YES

Patient had a tension pneumothorax

See Tube Thoracostomy Module

B008

NO

Does a great gush of blood come out?

NO

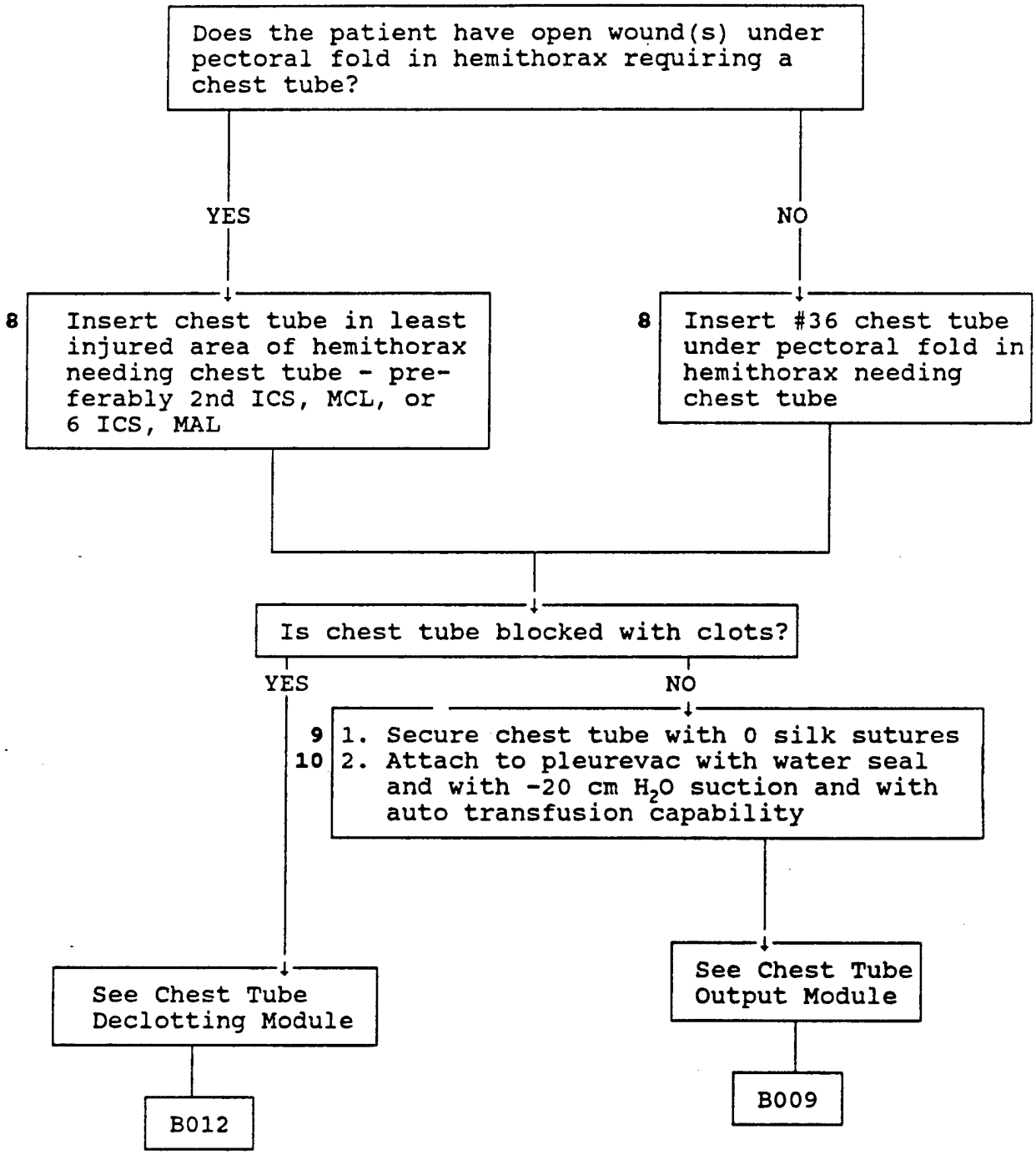
See Tube Thoracostomy Module

YES

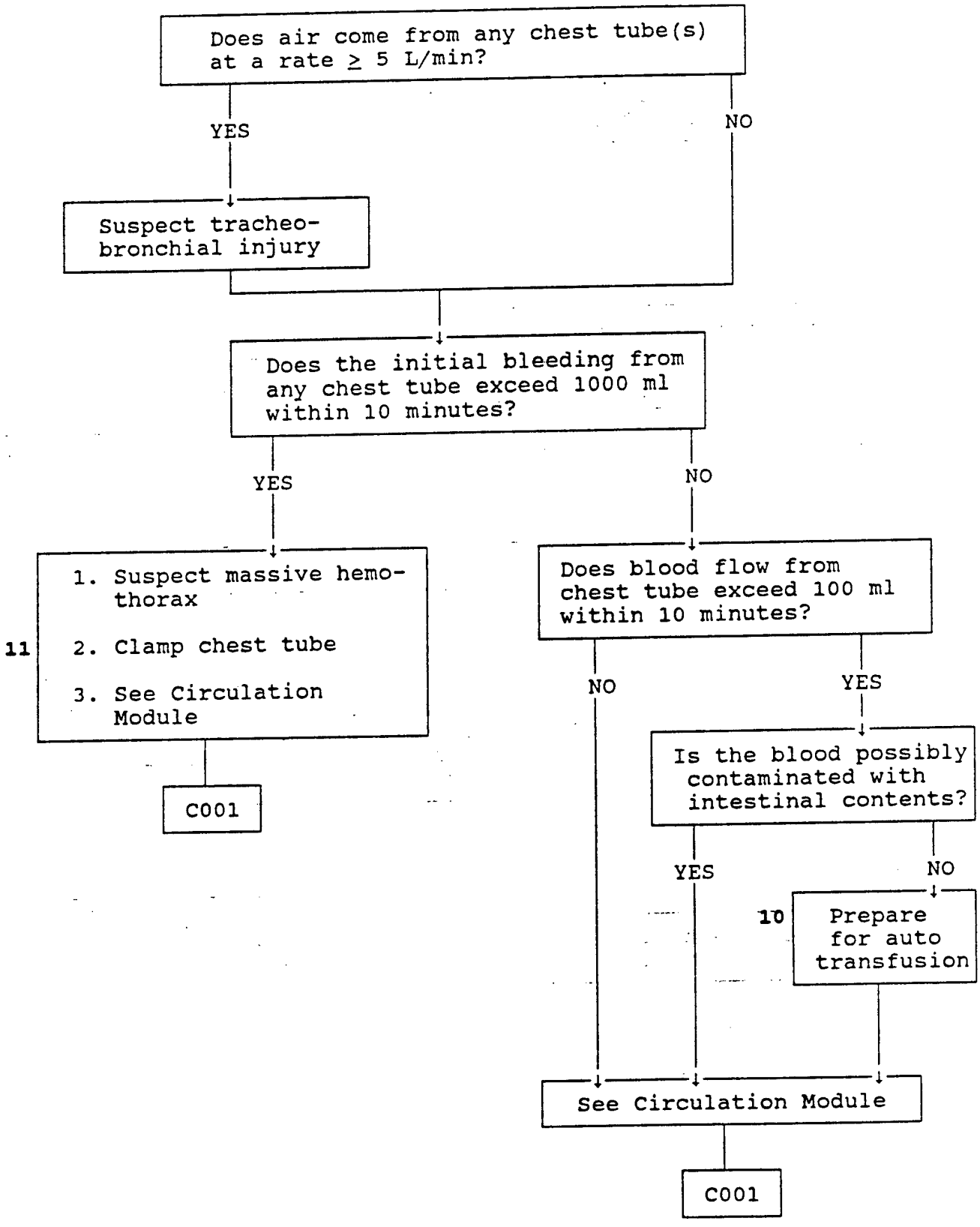
See Immediate Thoracotomy

T008

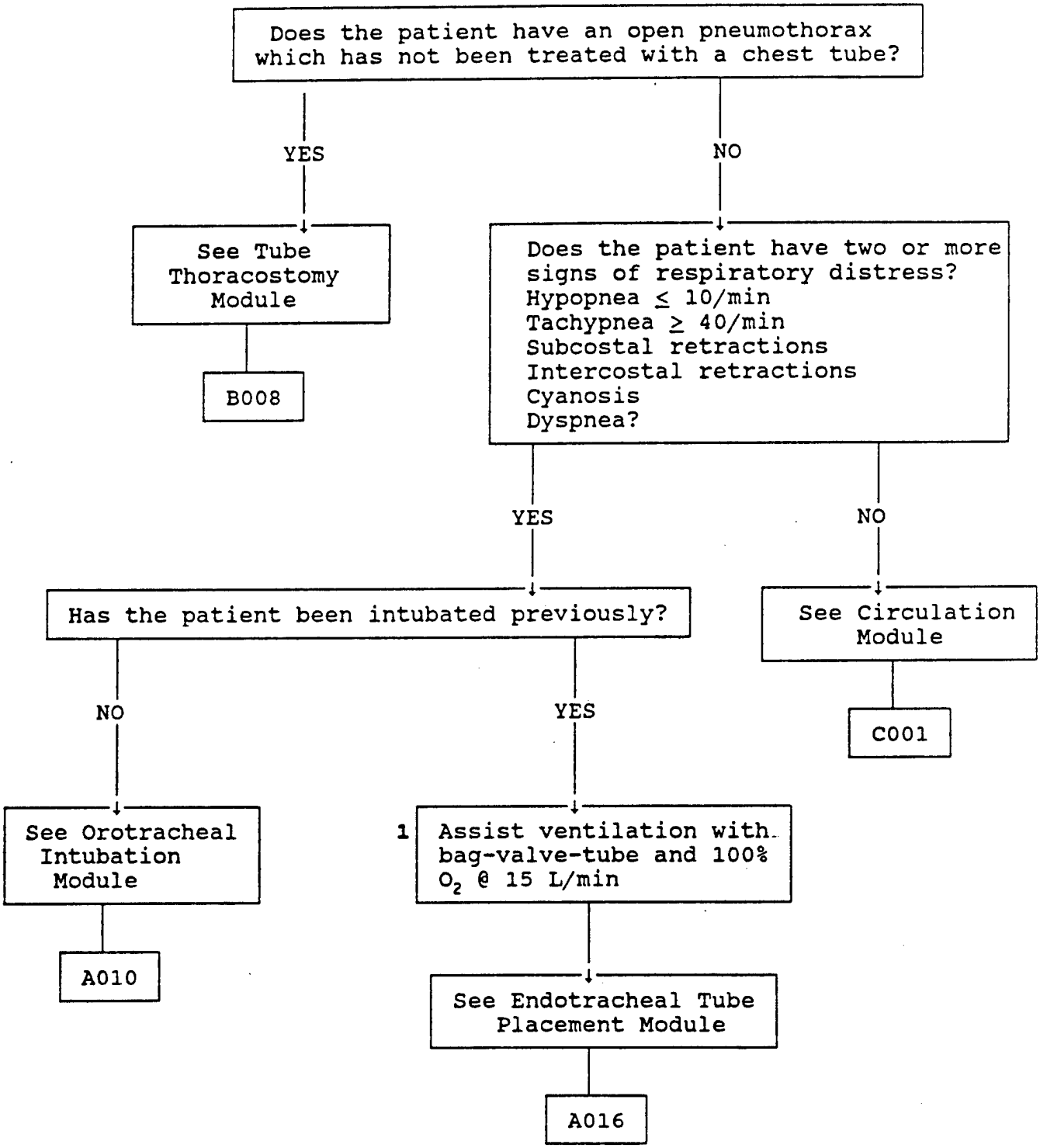
TUBE THORACOSTOMY MODULE



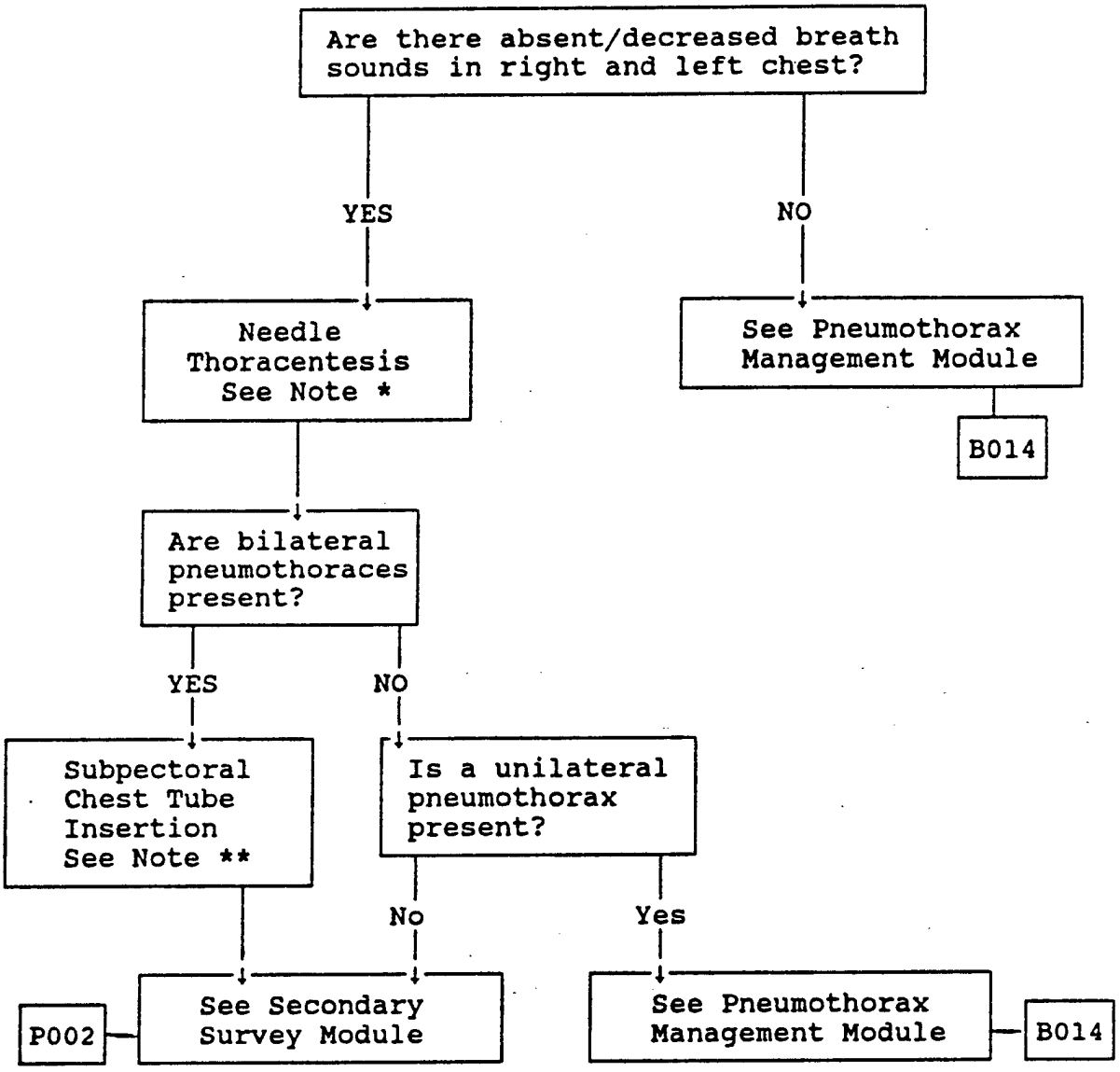
CHEST TUBE OUTPUT MODULE



BREATHING ASSESSMENT MODULE D



BILATERAL TENSION PNEUMOTHORAX MODULE



Note * : See Module B007 for technique
Note ** : See Module P014 for technique

CHEST TUBE DECLOTTING MODULE

12

1.) Sterile prep of chest tube - pleurevac connection.

2.) Separate connection.

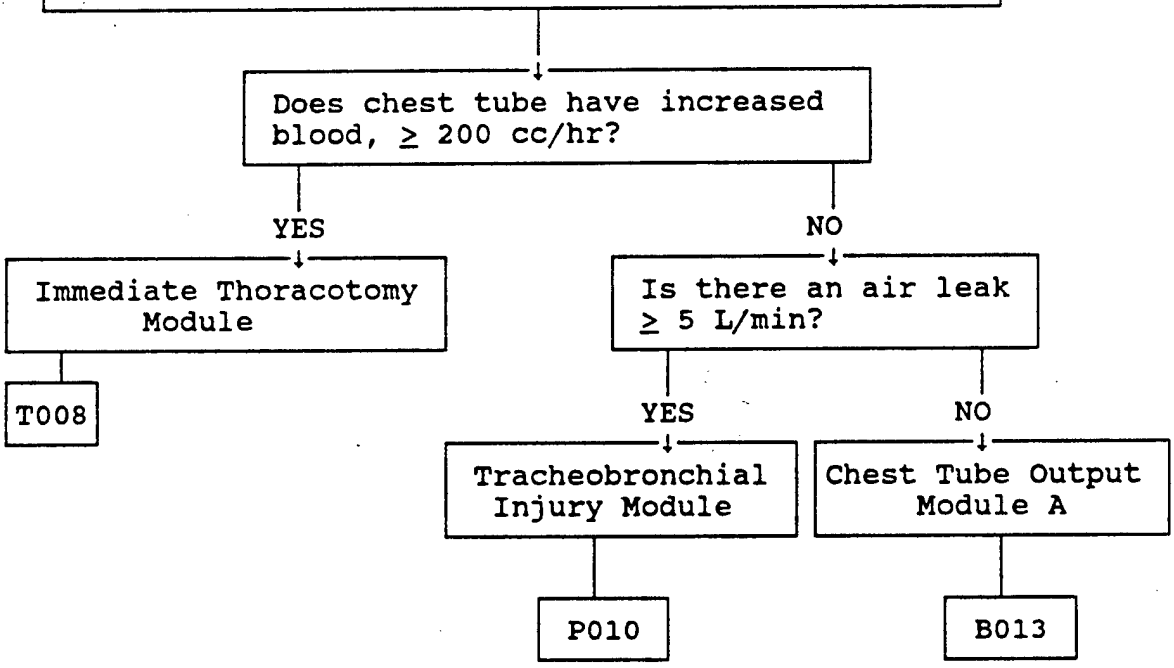
3.) Pass one or more of following to evacuate clots:

a) Fogarty balloon catheter;

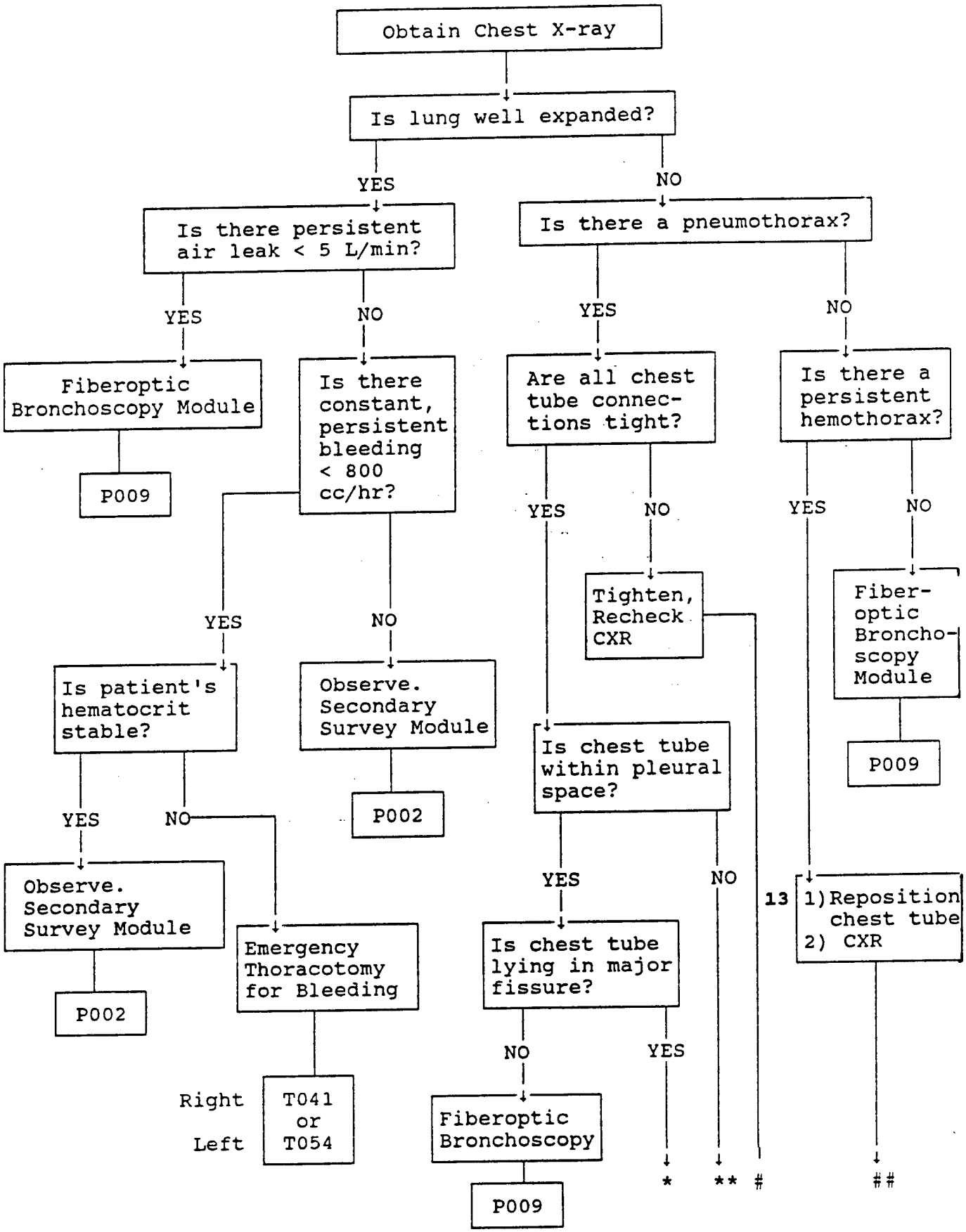
b) Foley balloon catheter;

c) Nasotracheal suction catheter.

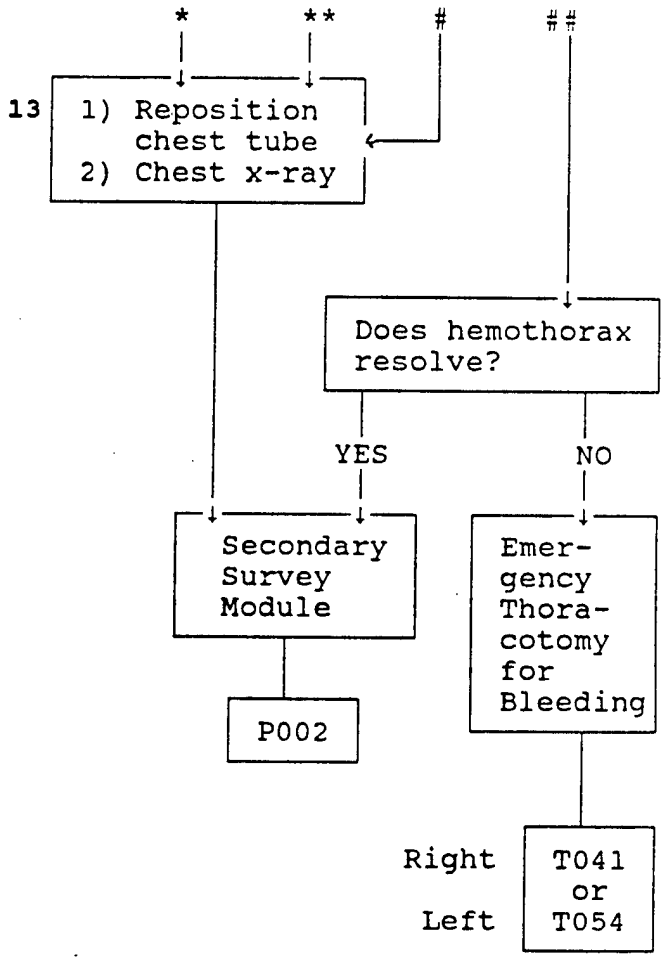
4.) Repeat as needed until chest tube clear. Resume suction via pleurevac.



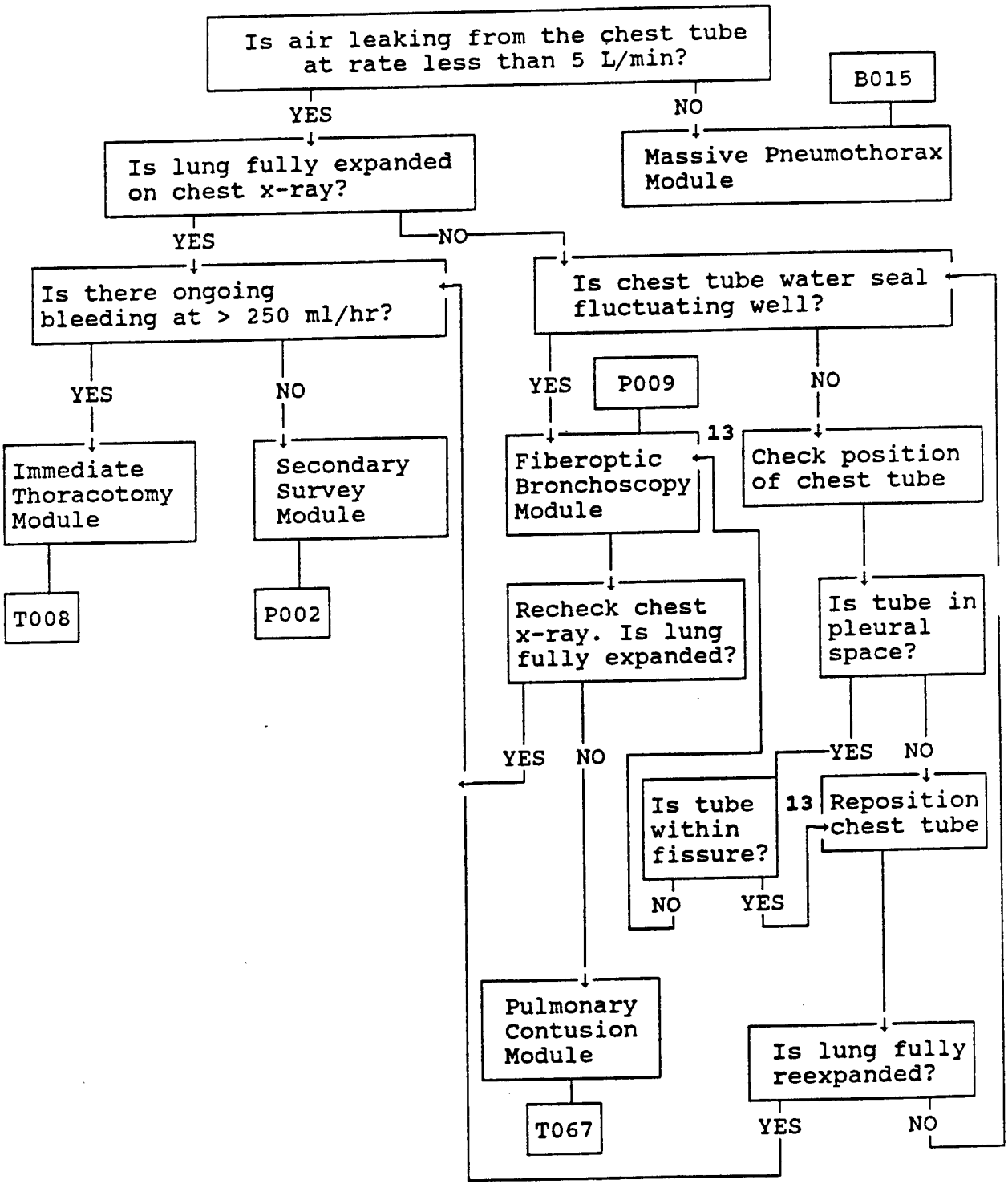
CHEST TUBE OUTPUT MODULE A



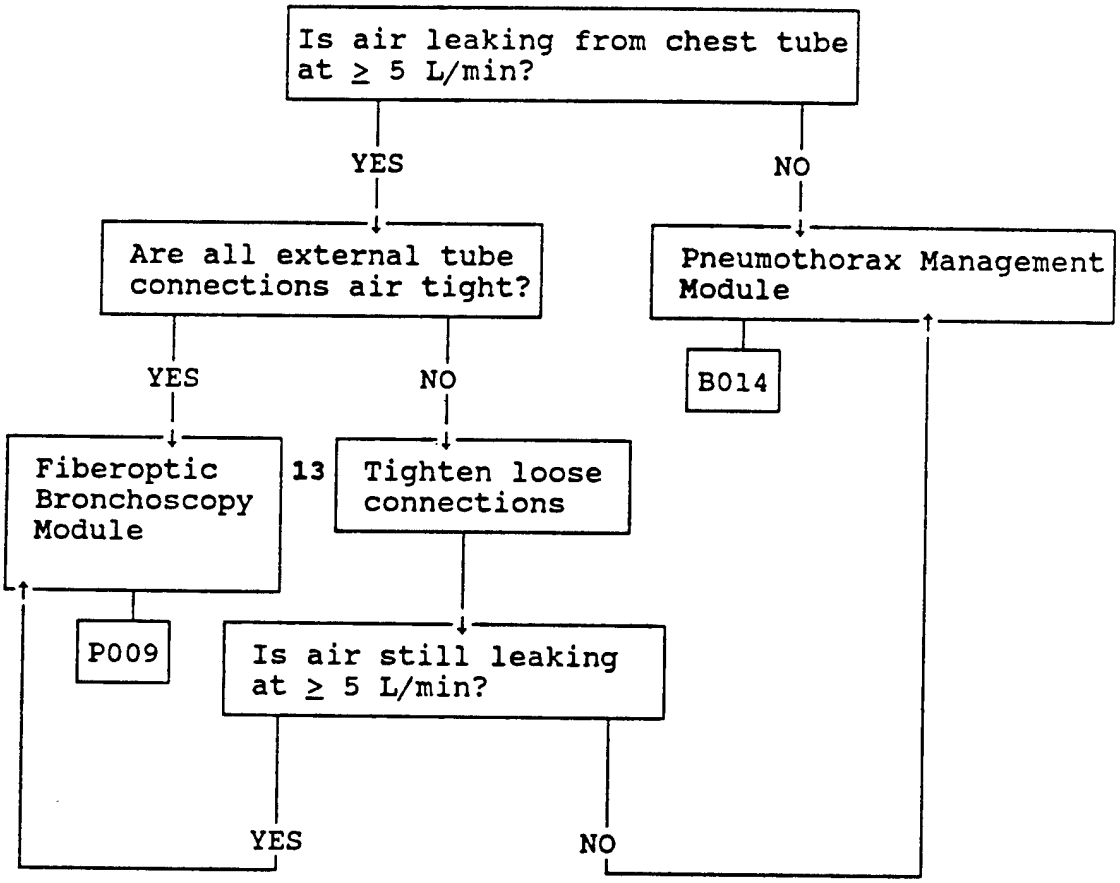
CHEST TUBE OUTPUT MODULE A



PNEUMOTHORAX MANAGEMENT MODULE



MASSIVE PNEUMOTHORAX MODULE



6
CIRCULATION

Thou shalt not covet thy neighbor's house,
thou shalt not covet thy neighbor's wife,
nor his manservant, nor his maidservant,
nor his ox, nor his ass,
nor anything that is thy neighbor's.
[Exodus 20:17]

A. Overview

Disruption of the circulatory system often poses the most dramatic and compelling problems. The physician must stem significant hemorrhage while making sure that the Airway and Breathing modules are satisfactorily addressed. In the initial survey, the team must simultaneously control obvious sources of massive blood loss and provide intravenous access.

The algorithms emphasize adequate intravenous access. Blood loss has to be matched with replacement fluid. Approaches to the venous return system are through large bore peripheral and central venous catheters. Once venous access is satisfactory, the source of rapidly life-threatening hemorrhage can be identified and dealt with appropriately. Hemorrhage that is quickly fatal implies injury to the heart, great vessels in the chest and abdomen, major arterial injuries, pelvic fractures, hepatic, or splenic disruption. Rapid control of these structures in concert with establishing multiple intravenous access sites is the basis for circulation modules.

B. Operation Desert Storm Case Reports

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Striking him in the L groin region . . .

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He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

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6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

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CIRCULATION - PROVIDER & EQUIPMENT LIST

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B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Infuse lactated Ringer's solution			3	2	1	Ringer's lactate; established I.V. line/ tubing
2. Insert percutaneously #14 gauge or #16 gauge 2" catheters into arm veins	3	3	1*	1*	1*	Venous catheters (#14 gauge or #16 gauge 2"); #12 sterile feeding tube; 2-0 silk ligatures; 2" silk suture with Keith needle; scalpel; (see trauma tray)
2a. Insert by cutdown #14 gauge or #16 gauge 2" catheters into arm vein	3	3	1*	1*	1*	Venous catheter; 14 gauge 2" cutdown catheter; 16 gauge 2" cutdown catheter; #12 sterile feeding tube; 2-0 silk ligatures; 2-0 silk suture with Keith needle; scalpel; Betadine; (see trauma tray)
3. Cutdown on greater saphenous vein at groin	3	3	1*	1*	1*	Venous catheter; 14 gauge 8" cutdown catheter; 16 gauge 8" cutdown catheter; # 12 sterile feeding tube; 3-0 silk ligatures; 3-0 silk suture with Keith needle; scalpel; Betadine; syringe; (See trauma tray)
4. Insert percutaneously 14 gauge catheter into right subclavian vein within 2 minutes (may use Seldinger technique)	3	3	1*	1*	1*	14 gauge 8" intracatheter; 30 cc non-luerlok (Regular tip) syringe; 2-0 silk suture with Keith needle; (See trauma tray)
5. Cutdown on greater saphenous vein(s) at ankle(s)	3	3	1*	1*	1*	Venous catheter; 14 gauge 2" cutdown catheter; #12 sterile feeding tube; 2-0 silk ligatures; 2-0 silk suture with Keith needle; scalpel; (see trauma tray)
6. Insert 14 gauge 2" long I.V. catheter	3	3	1*	1*	1*	Venous catheter; 14 gauge 2" cutdown catheter; #12 sterile feeding tube; 2-0 silk ligatures; 2-0 silk suture with Keith needle; scalpel; (See trauma tray)
7. Secure catheter with 2-0 silk ligatures and sutures	3	3	1*	1*		2-0 silk ligatures; suture
8. Establish I.V.			3	3	2	#14, #16, #18 gauge; alcohol wipes; tape; 4 X 4's 2 X 4's; tubing with I.V. solution
9. Insertion of percutaneous 14 gauge catheter 6" long into right internal jugular vein within 2 minutes.	3	3	1*	1*	1*	14 gauge 6" catheter; prep solution; drapes

********** Explanation of Specialty Codes and Care Descriptors **********

In all cases, the surgeon is a general surgeon and the specialty surgeon is a trauma surgeon, except for procedure 41, where a cardiac surgeon would be the optimal care provider.

In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks. Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

10. Draw from common femoral veins 60 cc blood for CBC, platelets, PT, PTT, fibrinogen, FDP, BUN, creatinine, NA^+, K^+, CL^-, CO_2, BS, type and cross match or type and screen			3	3	2*	Syringe with needle; blood tubes; gauze; alcohol wipes; laboratory facilities
11. Draw from artery blood for ABG			3	3	2*	Blood gas syringe with needle; Heparin; 18 gauge arterial catheter; suture 2-0 silk; prep solution; scalpel with blade; bag with ice; (trauma tray)
12. Infuse normal saline			3	2	1	Normal saline; I.V. tubing; established I.V. line
13. Attempt catheterization of unused subclavian, common femoral veins and saphenous veins, and antecubital veins	3	3	1*	1*	1*	16 gauge intracatheter; 30 cc nonluerlok (regular tip) syringe; 2-0 silk ligatures; 2-0 silk suture with Keith needle (See trauma tray)
14. Measure blood pressure in arm			3	2	2	Blood pressure cuff; stethoscope
15. Insert percutaneously 18 gauge arterial catheter within two minutes in femoral artery	3	3	1*	1*	1*	18 gauge arterial catheter; alcohol wipes; gauze; tape
16. Attach arterial pressure monitoring tubing and flush			3	2	1*	Tubing, monitor with pressure capability; pressure bag with Heparin solution
17. Femoral artery cutdown	3	3	1*	1*	1*	Blood gas syringe with needle; Heparin; 18 gauge arterial catheter; suture 2-0 silk; prep solution; scalpel with blade; bag with ice; trauma tray; lidocaine
18. Give 2 units of type specific blood intravenously through blood warmer			2	2	1	Blood; blood tubing; saline solution; blood warmer; established I.V. line
19. Give 2 units of uncross-matched blood intravenously through blood warmer			2	2	1	Blood; blood tubing; saline solution; blood warmer; established I.V. line
20. Complete transfusion as rapidly as possible			2	2	1	Cooler for blood and components; blood pump; syringes; tubing; blood warmers and tubing; lab supplies
21. Insert Foley catheter			3	3	1*	Lubricant; antiseptic cleansing solution; Indwelling Foley catheter; prefilled syringe; collection bag; various Foley catheters; temperature probe foley; Monitherm box
22. Perform percutaneous suprapubic cystostomy	3	3				Prep solution; gauze; cystostomy catheter; scalpel; clamps; drainage device
22a. Monitor urine output			3	3	1*	
23. Central venous pressure measurement	3	3	2	2	1*	Prep solution; razor; sterile gloves; CVP catheter introducer; suture; dressing; tape; chest X-ray; Foley catheter; CVP monitoring system

24. Do needle thoracentesis in hemithorax with untreated pneumothorax	3	3	1*	1*	1*	#10, 12, 14 angiocatheter; 1 1/2 finger glove/rubber band tape; Heimlich valve; (flutter valve/stop cock)
25. Insert chest tube in hemithorax with tension pneumothorax and attach to -20 cm H_2O suction	3	3				Chest tube (sizes #28, #32, #36) catheters; scalpel; Betadine prep; large curved clamp; chest drainage collector device; zylocaine/syringe; 4 x 4's; suture; needle holder
25a. Reposition endotracheal tube if present	3	3	1*	1*	1*	Endotracheal tube; tape; viscous lidocaine; drugs for sedation
26. Manually compress proximal and distal bleeding sites	3	3	2*	2*	2*	Compression dressings
27. Apply tourniquet above amputation site and tighten until bleeding stops	3	3	2*	2*	2*	4 x 4's; sterile gauze; tourniquet Ace wraps
28. Clamp and tie axillary artery and vein	3	3				Vascular clamps; suture; dressings
29. Pack amputation site with sterile gauze and manually compress	3	3	1*	1*	1*	Sterile gauze; dressing; ABD dressings; tourniquet
30. Clamp and tie femoral artery	3	3				Vascular clamp; suture; dressing; tape
31. Apply up to 5 vascular clamps to arterial and venous bleeders	3	3				Vascular clamp; suture; dressing; tape
32. Apply vascular clamps proximal and distal to injured blood vessel	3	3				Vascular clamp; suture; dressing; tape
33. Secure clamps with sutures to prevent dislodgement	3	3				Vascular clamp; suture; dressing; tape
34. Venous blood drawing			3	3	2*	Syringe with needle; blood tubes
35. Insert percutaneously or by cutdown 22 gauge 2" catheter into radial artery	3	3	1*	1*	1*	Percutaneous: 22 gauge 2" catheter Cutdown: Blood gas syringe; Heparin; 18 gauge arterial catheter; suture 2-0 silk; prep solution; scalpel with blade; bag with ice;trauma tray
36. Continue further efforts at clinician's discretion	3	3				
37. Insert bilateral chest tubes	3	3				Chest tube (sizes #28, #32, #36) catheters; scalpel; Betadine prep; large curved clamp; chest drainage collector device; zylocaine; syringe; 4x4's; suture; needle holder
38. Splash Betadine on anterior chest wall. Drape and do median sternotomy; pericardiotomy	3	3				Betadine; sterile drape; sternotomy OR list

39	Put in right atrial purse string and insert 16 French I.V. tubing. Secure with purse string	3	3		16 French I.V. tubing
40.	Clamp sub-diaphragmatic aorta	3	3		Clamp
41.	Put in right atrial and right ventricular pacing wires and attach to A-V sequential pacemaker	3	3		Pacing wires; AV sequencial pacemaker; needle; pacing cable
42	Attempt defibrillation at 30 watts	3	3	Nurse or corpsman must assist	Defibrillator; sterile internal paddles

AMPUTATION - EXTREMITY EQUIPMENT LIST

SUTURE

VICRYL 0 STRAND
VICRYL 2-0 STRAND
VICRYL 2-0 CT
VICRYL 3-0 CT
ETHILON 3-0 CUTTING

SUPPLIES

DRAPE, SPLIT SHEET
DRAPE, MEDIUM 44 X 60"
MAYO STAND COVER
TOWELS, STERILE (6)
GLOVES, SURGEON ASSORT. SIZES
GOWN, SURGICAL XTR. LRG.
BASIN SET W/ GRADUATE & MED.CUP.
SPONGE, LAP 18 X 18 (2)
PAD, GROUNDING
CAUTERY, HANDSWITCH
SUCTION TUBING 20'
IRRIG. WATER 1500 CC
IRRIG. NACL 1000 CC
BLADE, SURGICAL #10 (2)

INSTRUMENTS & EQUIPMENT

AMPUTATION SET
ORTHOPEDIC SET
BLADE, GIGLI
CAUTERY, MACHINE

DRESSING

XEROFOAM 5 X 9"
GAUZE 4 X 9" 12 PLY
ABD, LARGE
ELASTIC 4" X 5'
ELASTIC 6" X 5'

AMPUTATION SET EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

1 AMPUTATION SAW
1 LEWEN BONE HOLDER
3 GIGLI SAW HANDLES
2 DEEP RAKES
1 STAINLESS STEEL RASP
1 STAINLESS STEEL FILE
1 LANGENBECK PERI ELEVATOR

PEEL PACK:

---

1 AMPUTATION KNIFE

ON STRINGER:

---

6 CURVED CRILES

CARDIO VASCULAR TRAY

BOTTOM LAYER

#7 KNIFE HANDLE
STRULLY SCISSOR
POTTS SCISSORS - 25, 45, 60 DEG
NARROW TIP SUTURE SCISSOR

SECOND LAYER

30 DEG PERIPHERAL CL (BLACK)
ACUTE ANG MINATURE CLAMPS
STR ATRAGRIP CLAMPS
30 DEG DEBAKEY MINATURE CLAMPS
LONG ALLISES

THIRD LAYER

LONG ATRAGRIP TISSUE FCPS
MED ATRAGRIP TISSUE FCPS
SH ATRAGRIP TISSUE FCPS
LONG FINE TIPPED N.H.
MED N.H.
SH FINE TIPPED N.H.

FOURTH LAYER

TANGENITAL OCCLUSION CL (LG ANG
SATINSKY)
SEMB CLAMP
KIDNEY PEDICLE CLAMP

CHEST SET (THORACIC) EQUIPMENT LIST

BOTTOM OF PAN

- BETHUNE RIB CUTTER
- GIERTZ RIB CUTTER
- DOYEN ELEVATORS (1 LT & 1 RT)
- ALEXANDER
- MATSON
- RIB APPROXIMATORS (MOVEABLE)
- ADSON RONGEUR
- TONSIL SUCTION
- VEIN RETRACTORS
- DEEP RAKES
- SCAPULA RETRACTOR

WRAP IN TOWEL

- LONG FINE THUMBS W/TEETH
- LONG FINE THUMBS W/OUT TEETH
- EXTRA LONG RUSSIAN
- EXTRA LONG THUMB W/OUT TEETH
- LONG ATRAUGRIPS

ON STRINGER

- CRAFORD CHEST SCISSOR
- EX LONG N.H.
- EX LONG FINE N.H.
- EX LONG CURVES
- EX LONG CARMALT
- REGULAR CARMALTS
- EX LONG RUMEL
- BRONCHUS CLAMPS
- RUMEL THORACIC ARTERY CLAMPS
- DUVAL LUNG CLAMPS SEMB
- SEMB
- LONG ALLISES
- MEDIUM NEEDLE HOLDERS
- LONG NEEDLE HOLDER -NOT FINE
- SPONGE STICKS
- LONG CURVES
- LAUERS
- TONSILS
- KOCKERS - CLAMP
- BABCOCK CLAMP
- ALLIS CLAMP
- CURVED CRILER
- CURVED MOSQUITOES CLAMP
- SUTURE SCISSORS
- MAYO SCISSORS
- METZ SCISSORS
- LONG METZ SCISSORS

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

EXTRA LONG INSTRUMENTS

CONTENTS

EXTRA LONG NEEDLE HOLDER
EXTRA LONG FINE NEEDLE HOLDER
EXTRA LONG CURVES
REGULAR RUMEL
MEEKERS
BRIDGE FORCEPS
EXTRA LONG ALLISES
EXTRA LONG RUSSIAN
EXTRA LONG THUMB WITHOUT TEETH
LONG BABCOCKS
EXTRA LONG METZ

MEDIANSTERNOTOMY EQUIPMENT LIST

SUTURE

MAXON 2-0 T-25
MAXON 3-0 t-25
SILK 3-0 SH
SILK 2-0 SH
SILK 3-0 STRAND
SILK 2-0 STRAND
STAPLE LOADING UNIT SH-35W

SUPPLIES

BASIN, MAJOR SET
GOWN, STER BACK LRG
GOWN, STER BACK XLRG
SHEET, LAB
SHEET, MEDIUM
TABLE COVER
TRAY, SKIN SCRUB

GLOVES

GLOVES, EXAM LRG UNSTERILE
GLOVES, TRIFLEX

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITCH

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #21
BONE WAX W-31G
DACRON TAPE 8618-00
DURA HOOKS, (FISH HOOKS)
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT
NEEDLE, SPINAL 22 GA X 3 1/2
SYRINGE, 30CC LL
SYRINGE, BULB

SPONGES

SPONGE, 18 X 18 LAP
SPONGE, GAUZE X-RAY DETECT
SPONGE, KITTNER DISECTORS

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

INSTRUMENTS & EQUIPMENT

CARDIOVASCULAR TRAY
CHEST SET
EX. LONG INSTRUMENTS
HEADLIGHT
LAP SET
N H, EX LONG
RET, HIMMELSTEIN
RETR, MOARSE
STERNAL SAW
SCISSOR, LONG FINE METZ
TRAUMA CHEST TRAY

DRAINS

CHEST TUBE 32FR THORACIC
CHEST TUBE 36FR THORCIC
PLEUROVAC, ADULT

DRESSINGS

DRESSING, GAUZE 4X8 12 PLY
DRESSING, TELFA

VASCULAR

FELT 3 X 3
SUTURE BOOTS
VESSEL LOOPS, MAXI
VESSEL LOOPS, MINI

ORTHOPEDIC SET EQUIPMENT LIST

CONTENTS

ON STRINGER:

---

2 SHORT N.H.
2 MEDIUM N.H.
1 LEWEN BONE CLAMP
1 LONG CURVE
1 LAUER
4 OCHNERS
2 GYNE ALLISES
2 REGULAR CURVES
4 CURVED CRILES
2 CURVED KELLIES
1 SUTURE SCISSOR
1 BANDAGE SCISSOR
1 MAYO SCISSOR
1 METZ SCISSOR
6 REGULAR TOWEL CLIPS

BOTTOM OF PAN:

---

2 ARMY/NAVYS
2 SHARP RAKES
2 WIDE HIBBS
2 NARROW HIBBS
2 LARGE TAYLOR
1 SMALL TAYLOR
2 BENNETTS
1 ADSON RONGEUR
2 MEDIUM WEITLANERS
1 LANGENBECK
1 PLIER
1 MALLET
1 POINTED RONGEUR
1 SMALL PIN CUTTER
6 BALL CLIPS

PEEL PACK:

---

2 #3 KNIFE HANDLES
1 #4 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
1 TONSIL SUCTION
1 #12 FRAZIER SUCTION
1 LONG THUMB W/TEETH
2 FINE GYNES
2 MEDIUM RUSSIANS
2 ADSONS W/TEETH

PEEL PACK:

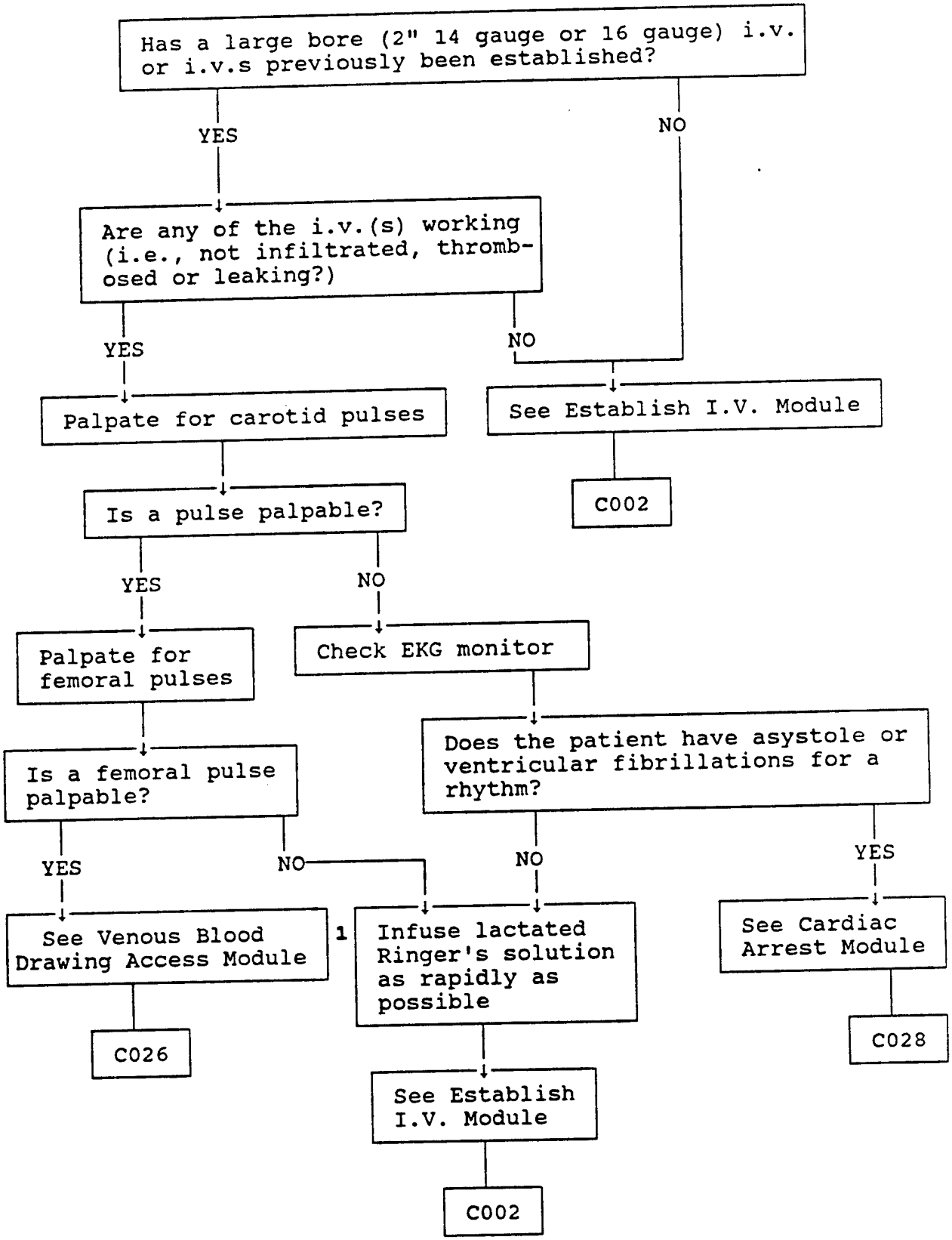
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1 1/4" DRILL BIT
1 7/64" DRILL BIT
1 SMALL METAL RULER

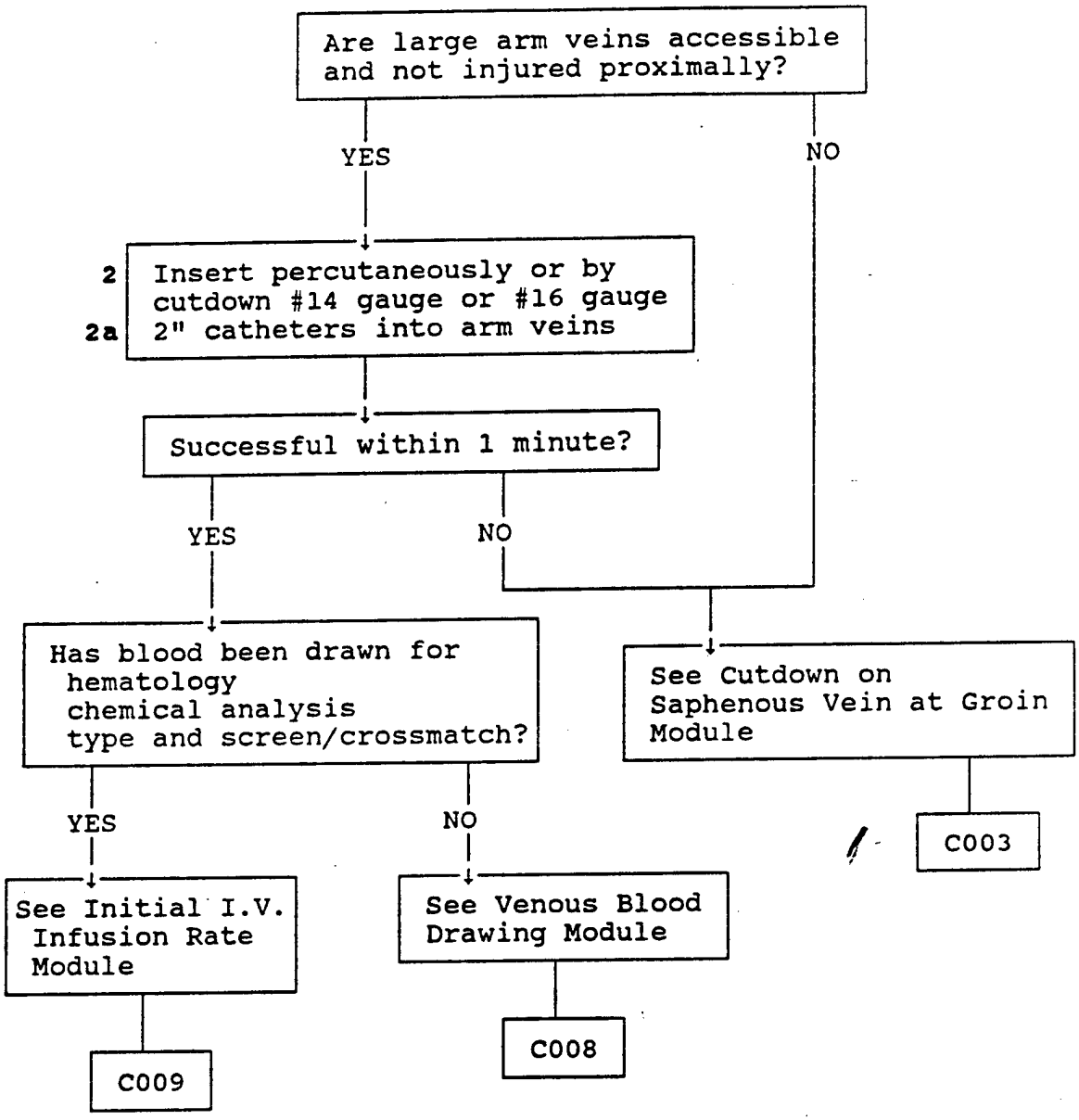
TRAUMA CHEST TRAY - Minimal equipment

1 - MEDIMM FINOCHETTI RETRACTOR
1 - EXTRA LONG NEEDLE HOLDER
4 - BABY TOWEL CLIPS
1 - 9" CURVE
1 - LONG MAYO
1 - CURVED CRILE
1 - STRAIGHT CRILE
1 - LAUER
1 - STRAIGHT COARCTATION CLAMP
1 - TANGENTIAL OCCLUSION CLAMP
2 - TONSIL HEMOSTATS
1 - 4# KNIFE HANDLE
4 - TOWELS (FOLDED READY TO SQUARE OFF)
2 - PACKAGES COUNTED 12 BY 12'S
STERNAL SAW/LEBSCHE
BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

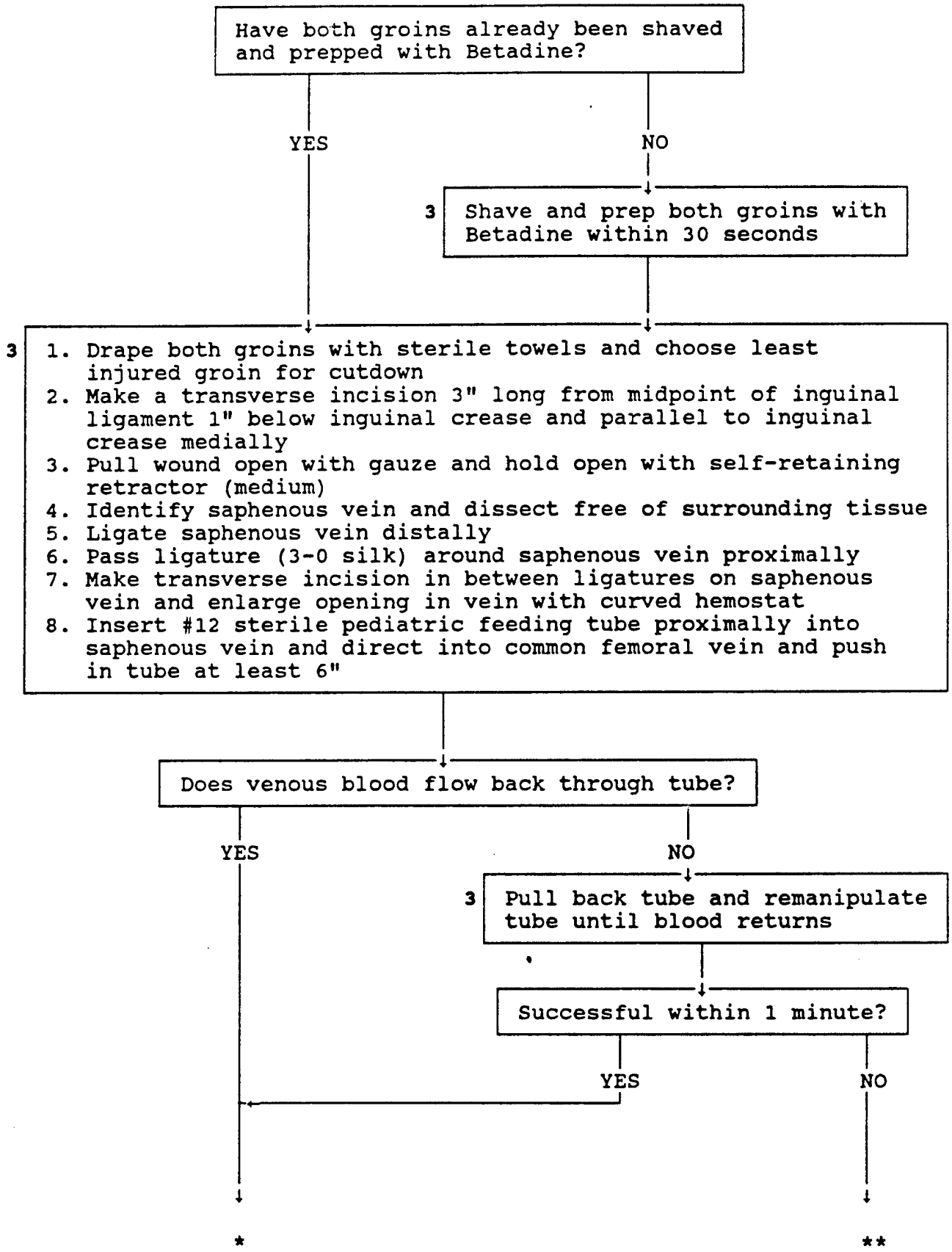
CIRCULATION MODULE



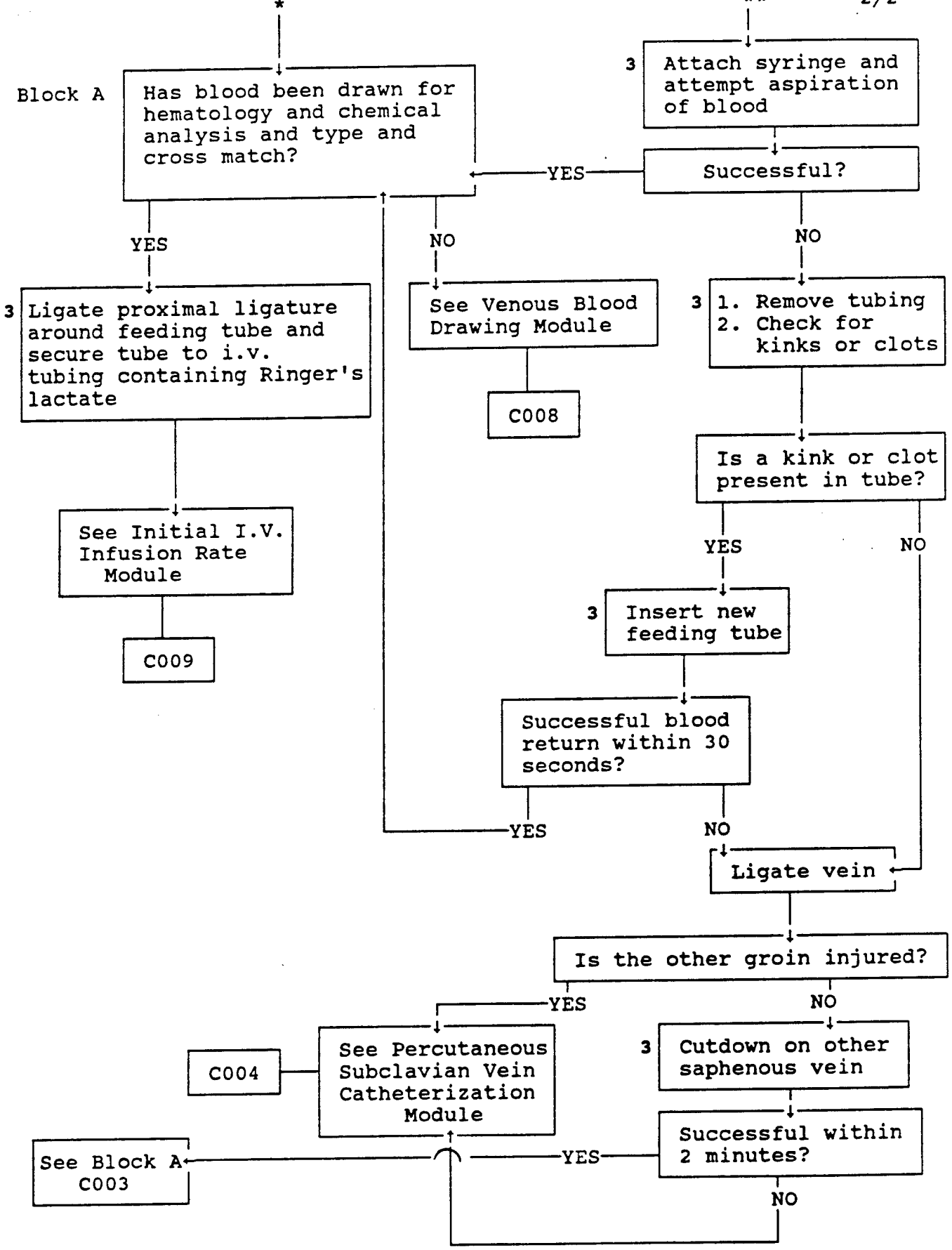
ESTABLISH I.V. MODULE



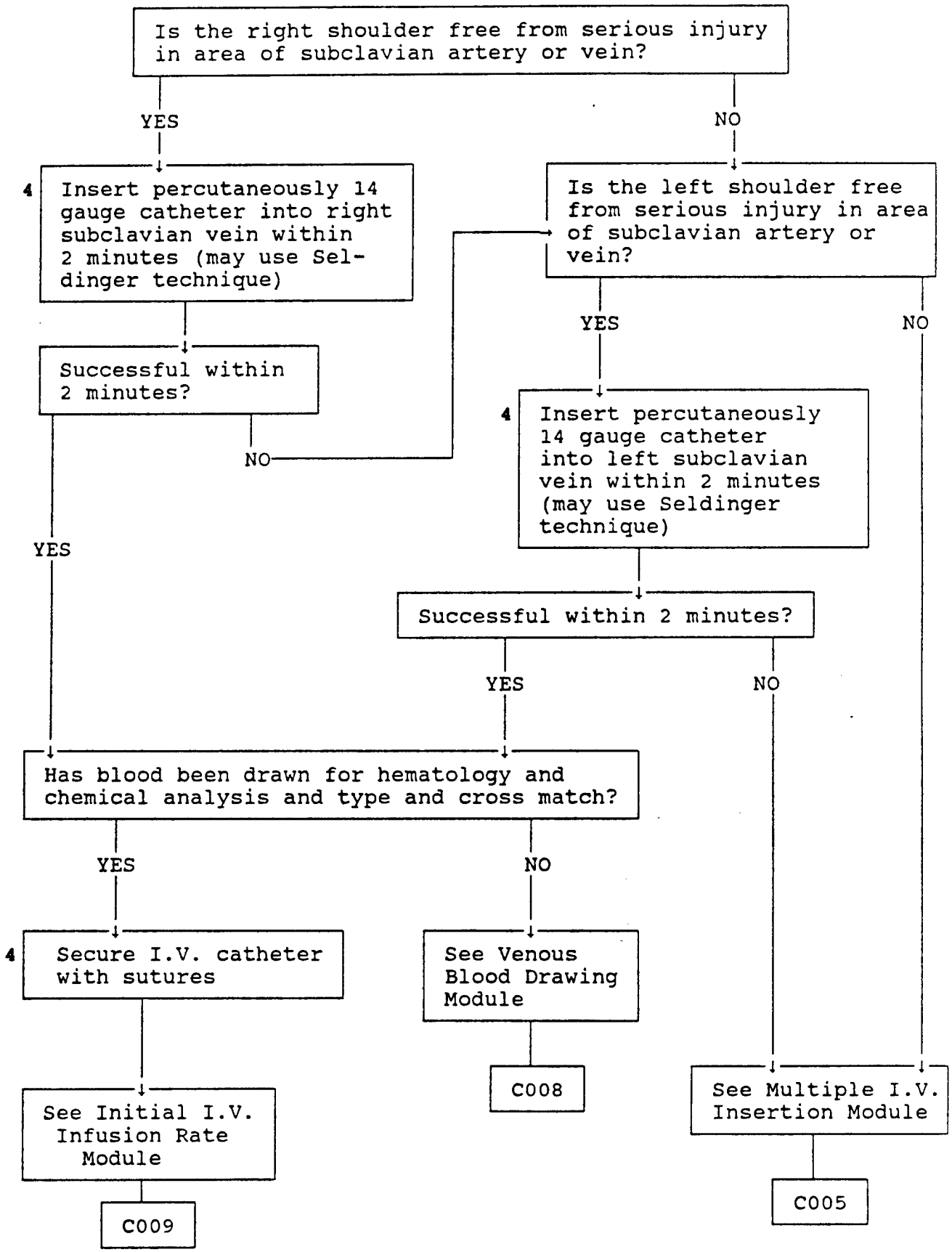
CUTDOWN ON GREATER SAPHENOUS VEIN AT GROIN MODULE



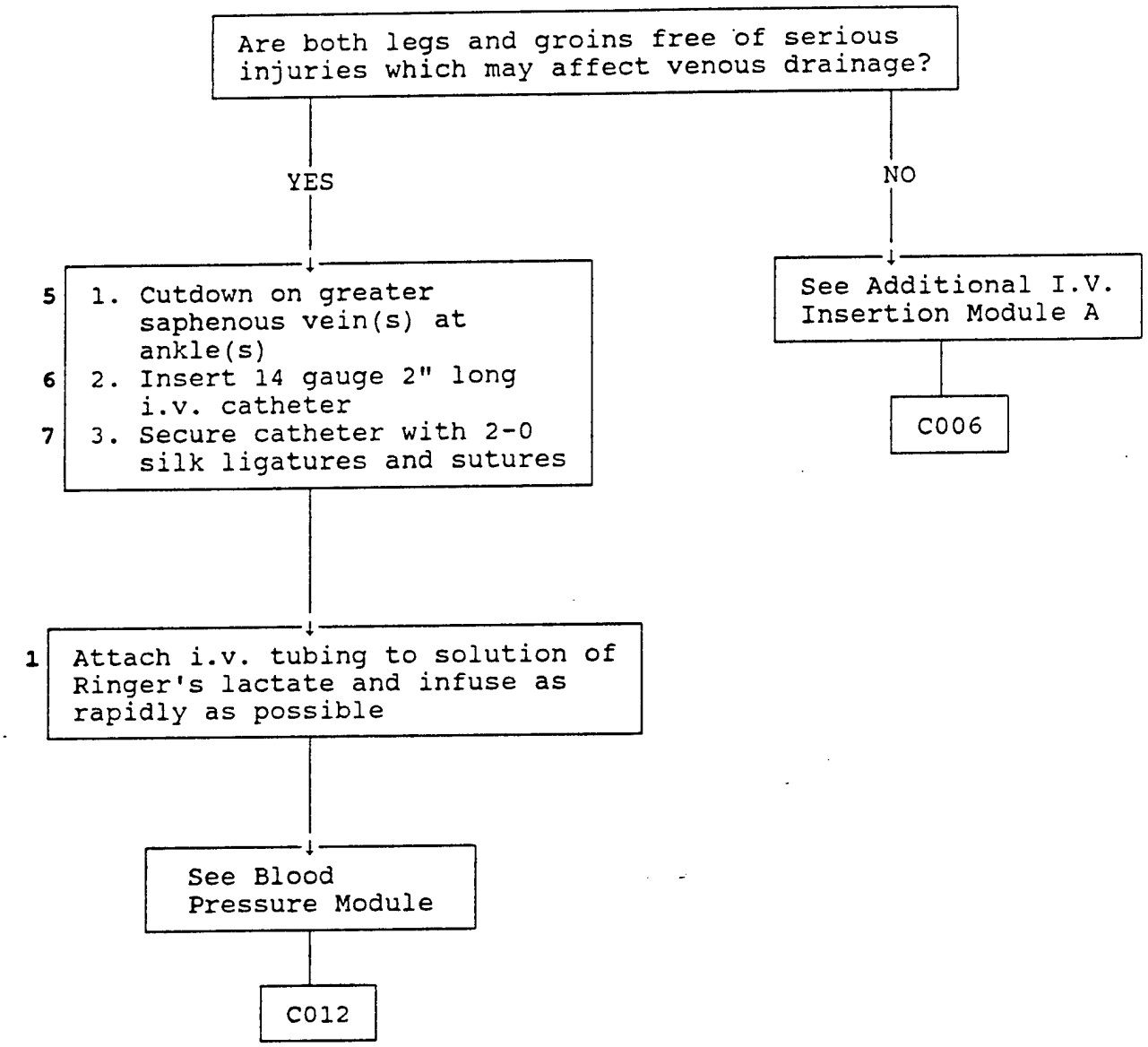
CUTDOWN ON GREATER SAPHENOUS VEIN AT GROIN MODULE



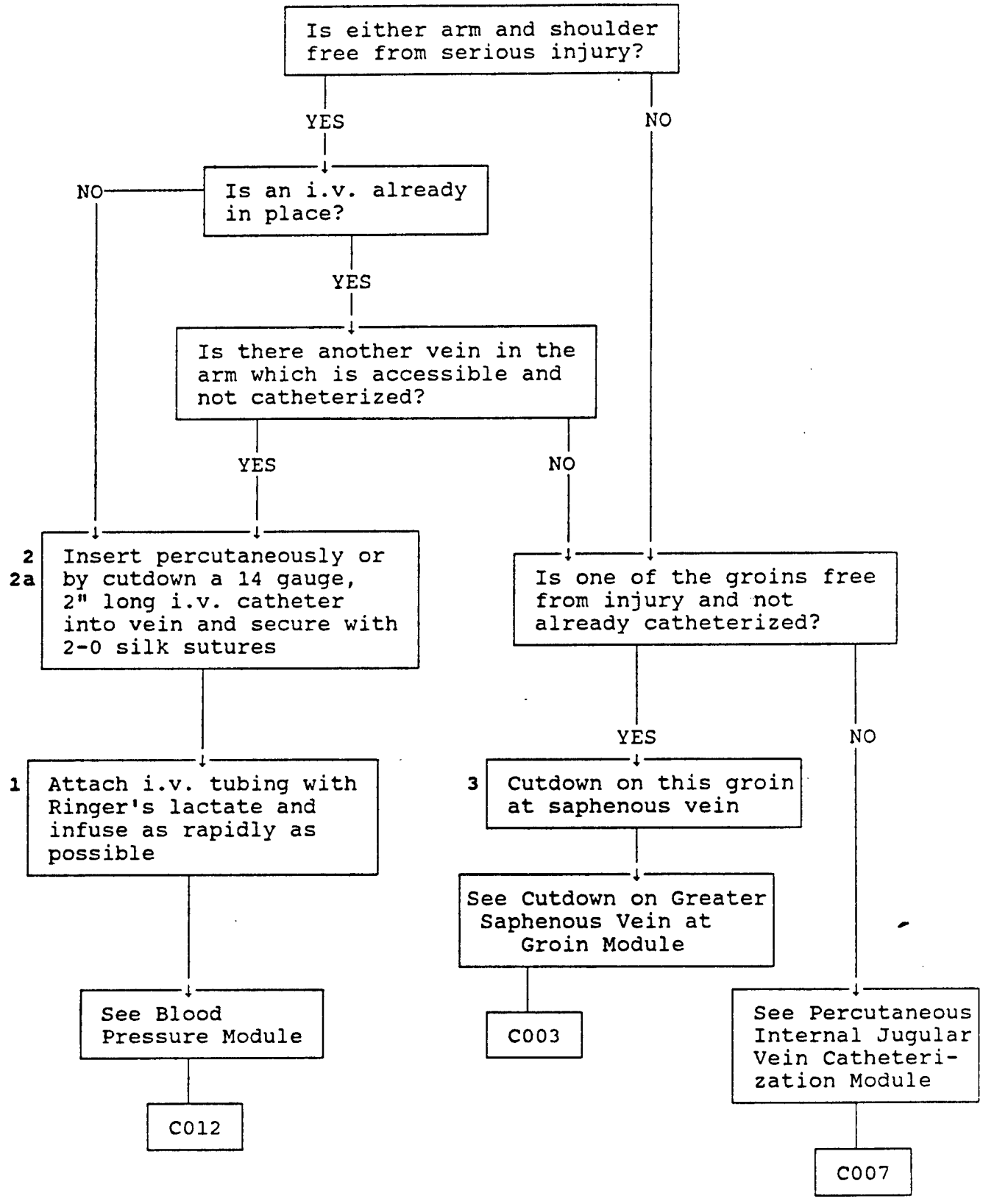
PERCUTANEOUS SUBCLAVIAN VEIN CATHETERIZATION MODULE



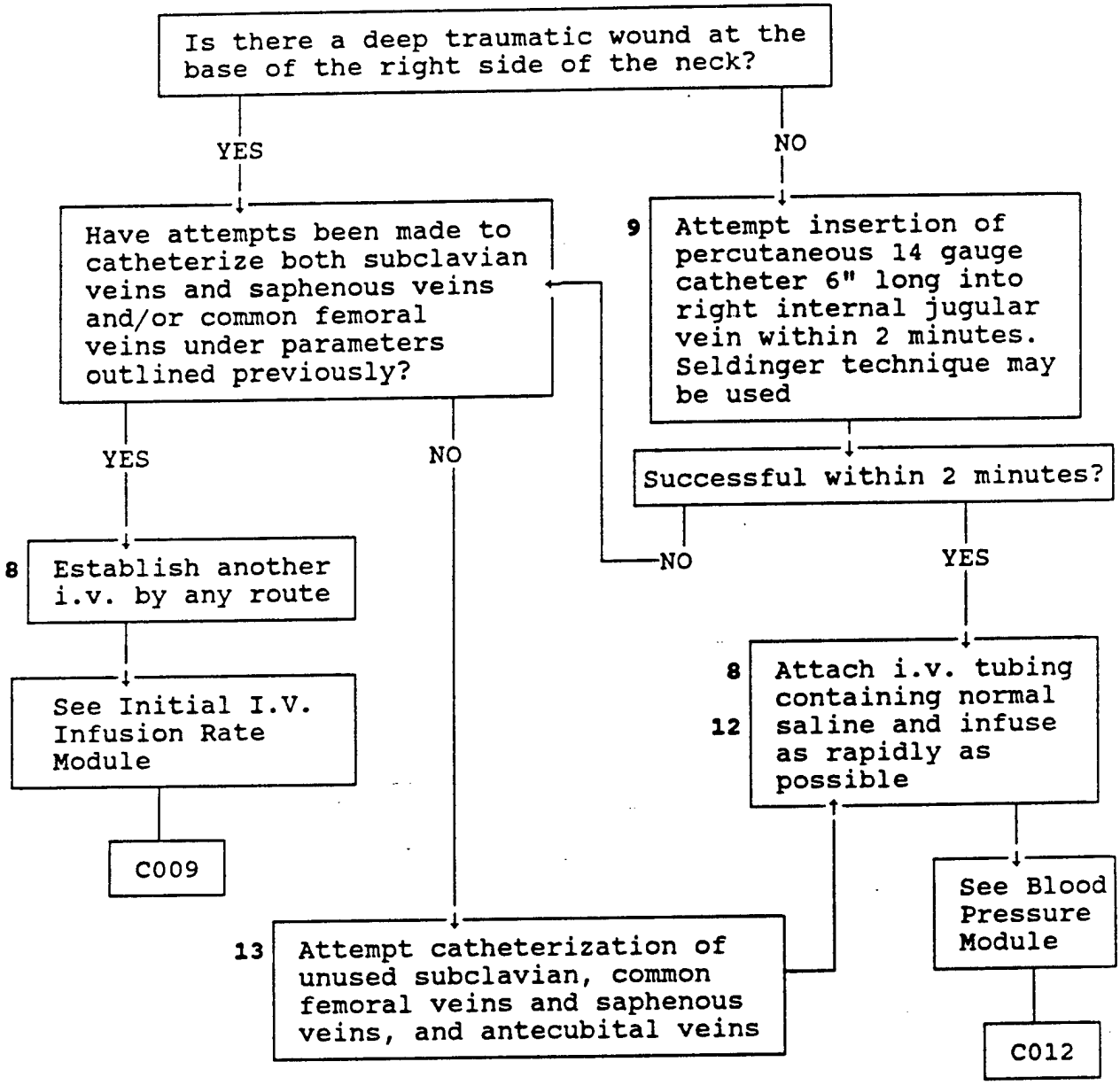
MULTIPLE I.V. INSERTION MODULE



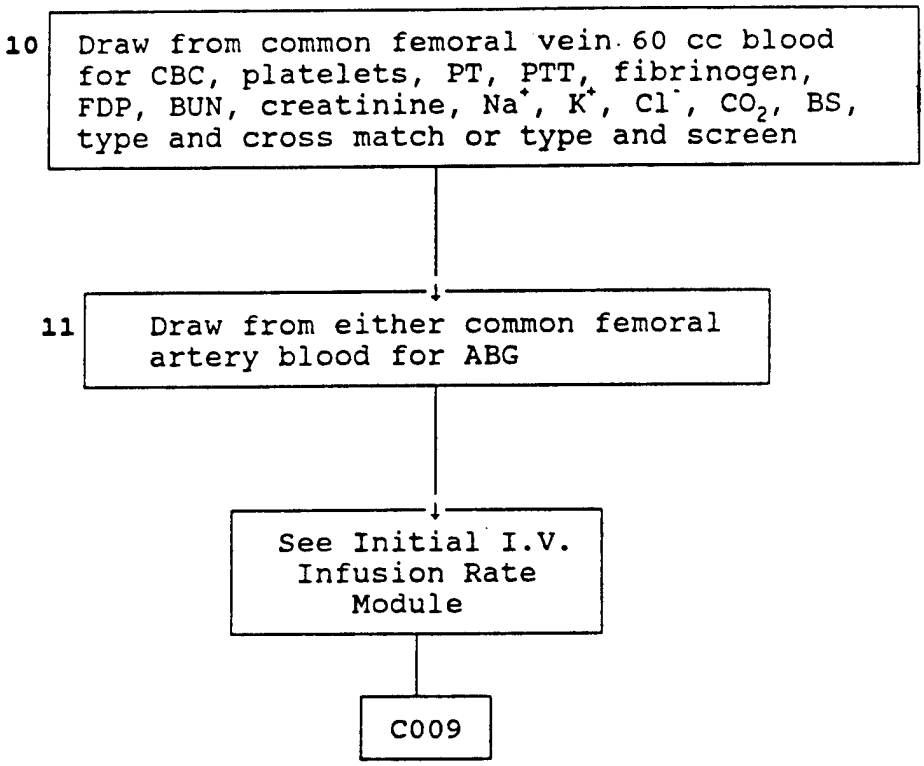
ADDITIONAL I.V. INSERTION MODULE



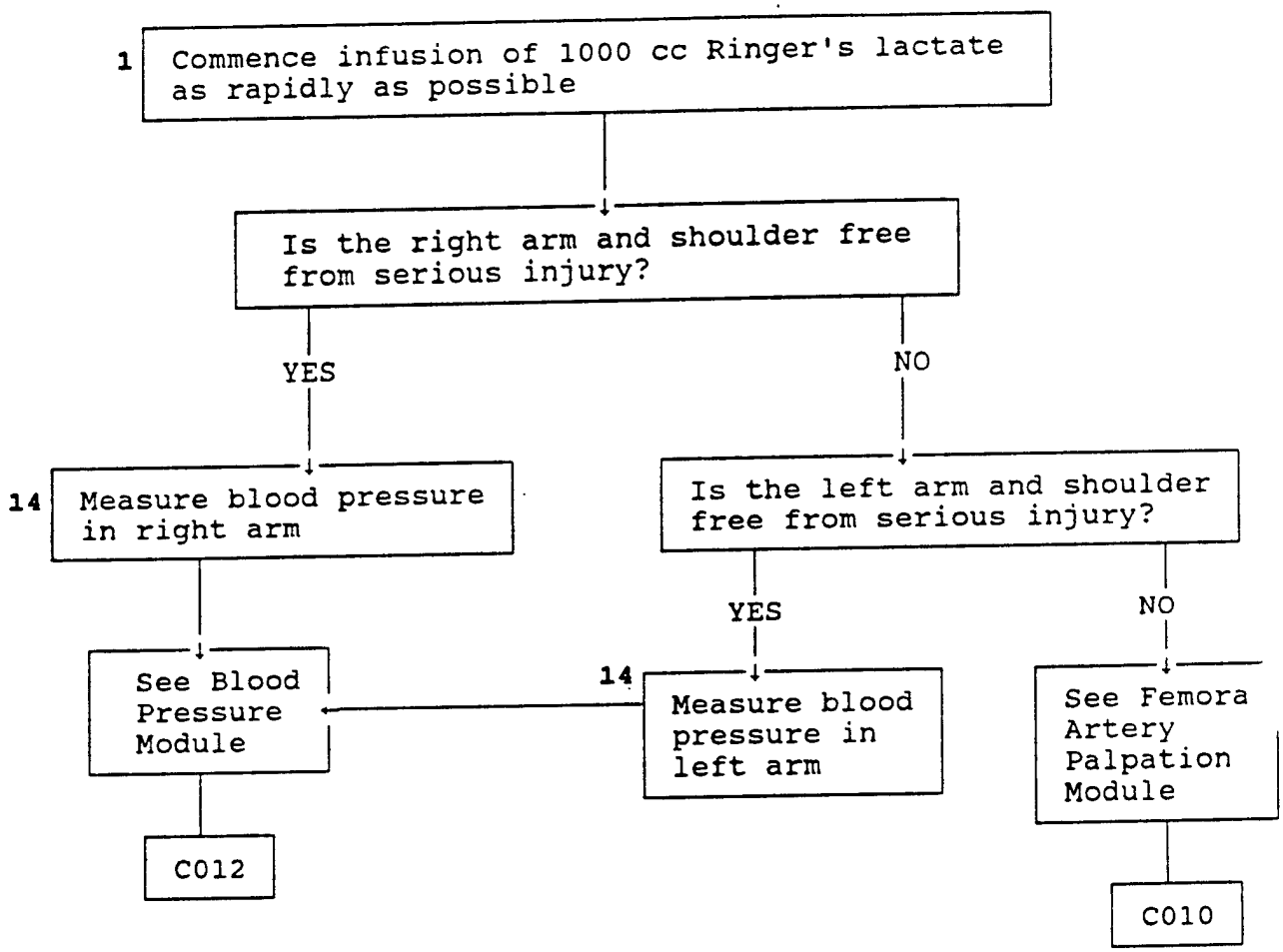
PERCUTANEOUS INTERNAL JUGULAR VEIN CATHETERIZATION MODULE



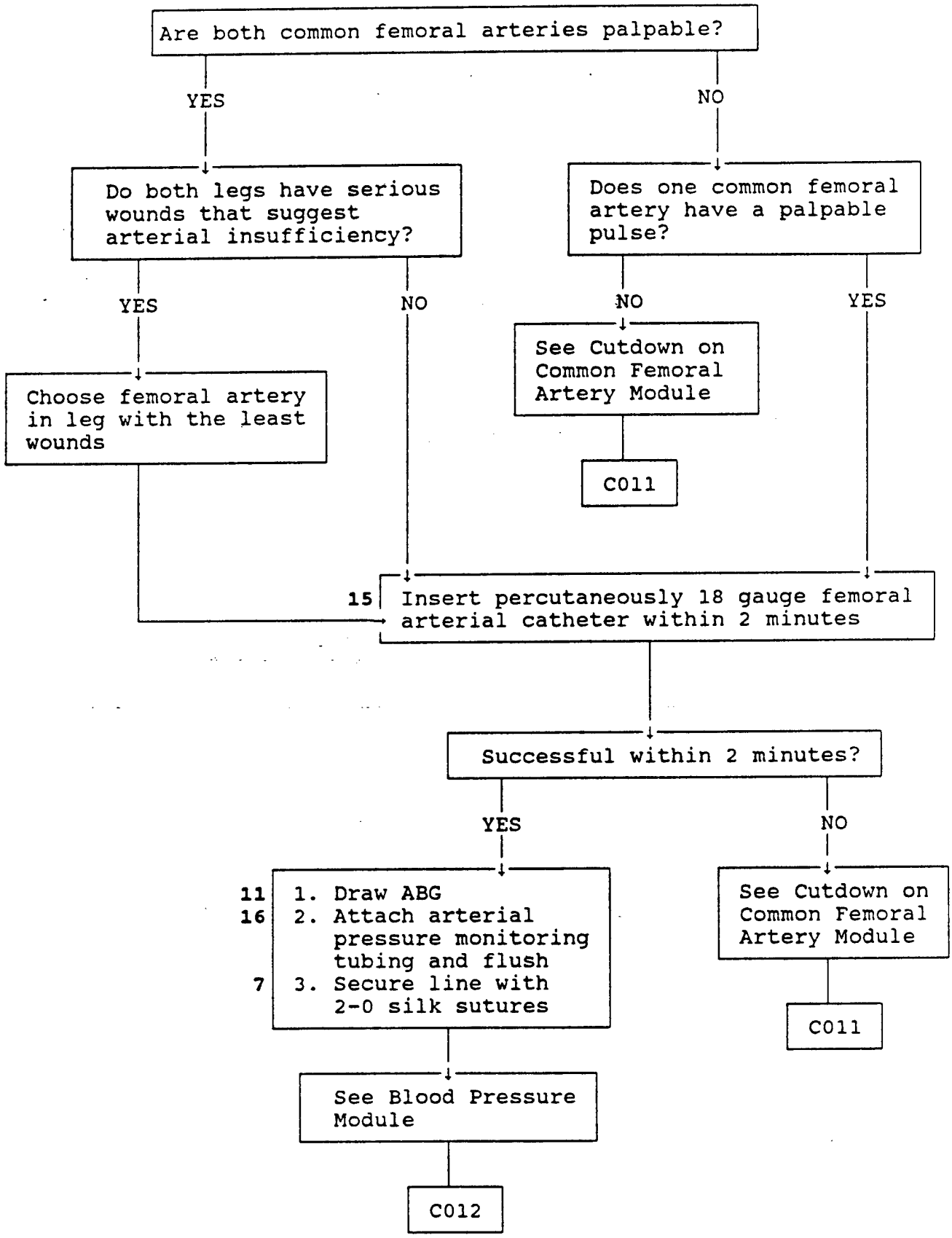
VENOUS BLOOD DRAWING MODULE



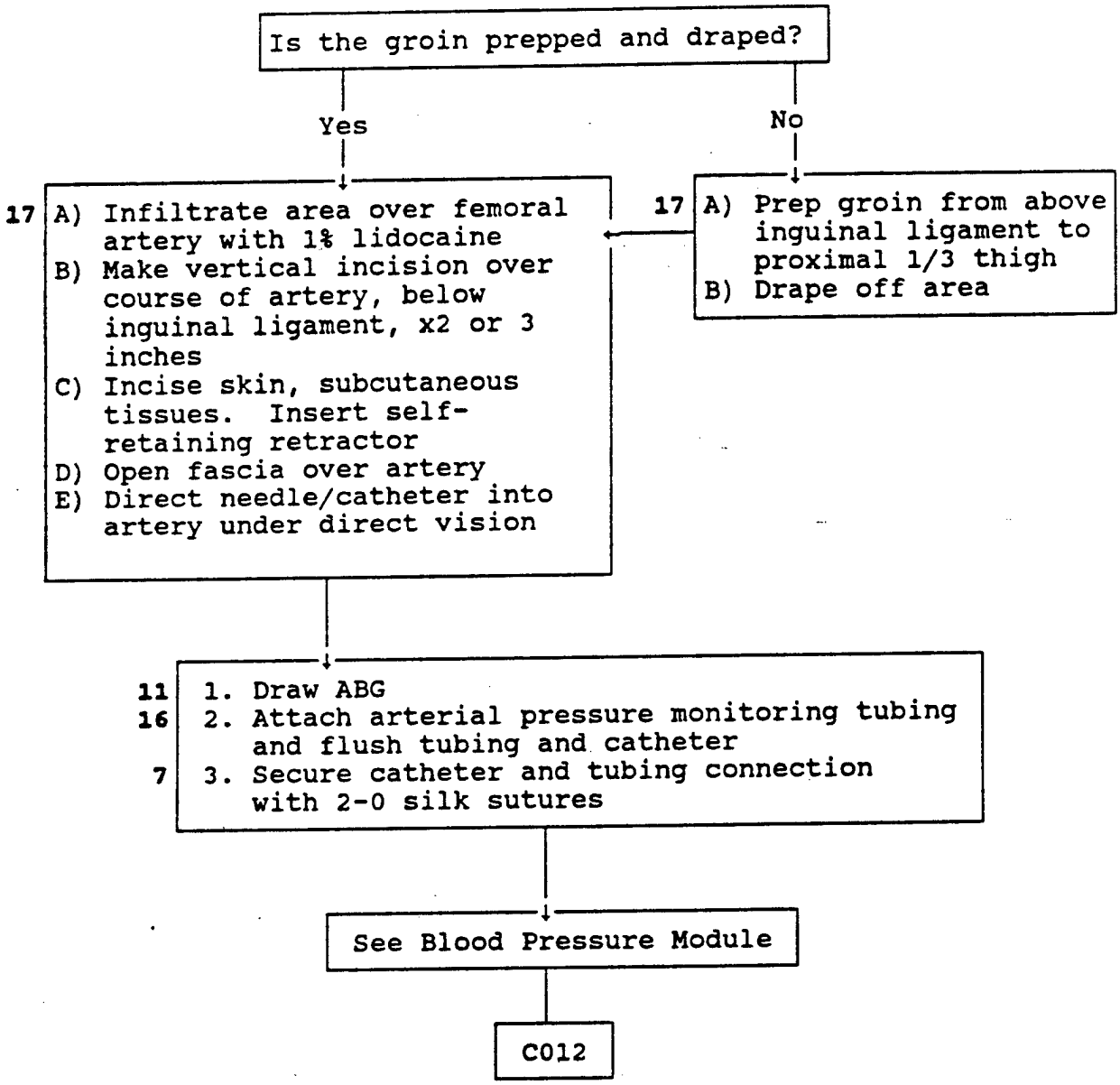
INITIAL I.V. INFUSION RATE



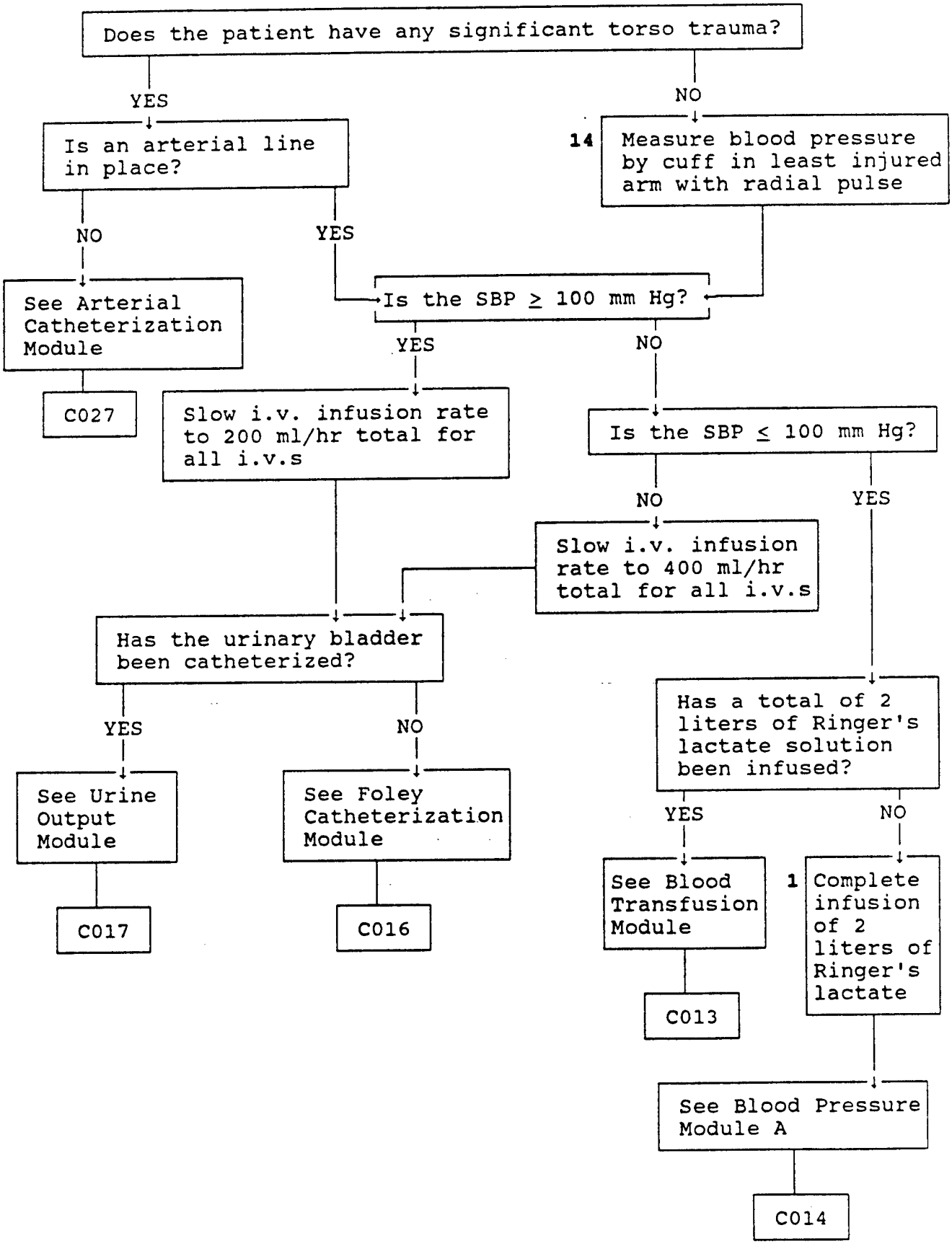
FEMORAL ARTERY PALPATION MODULE



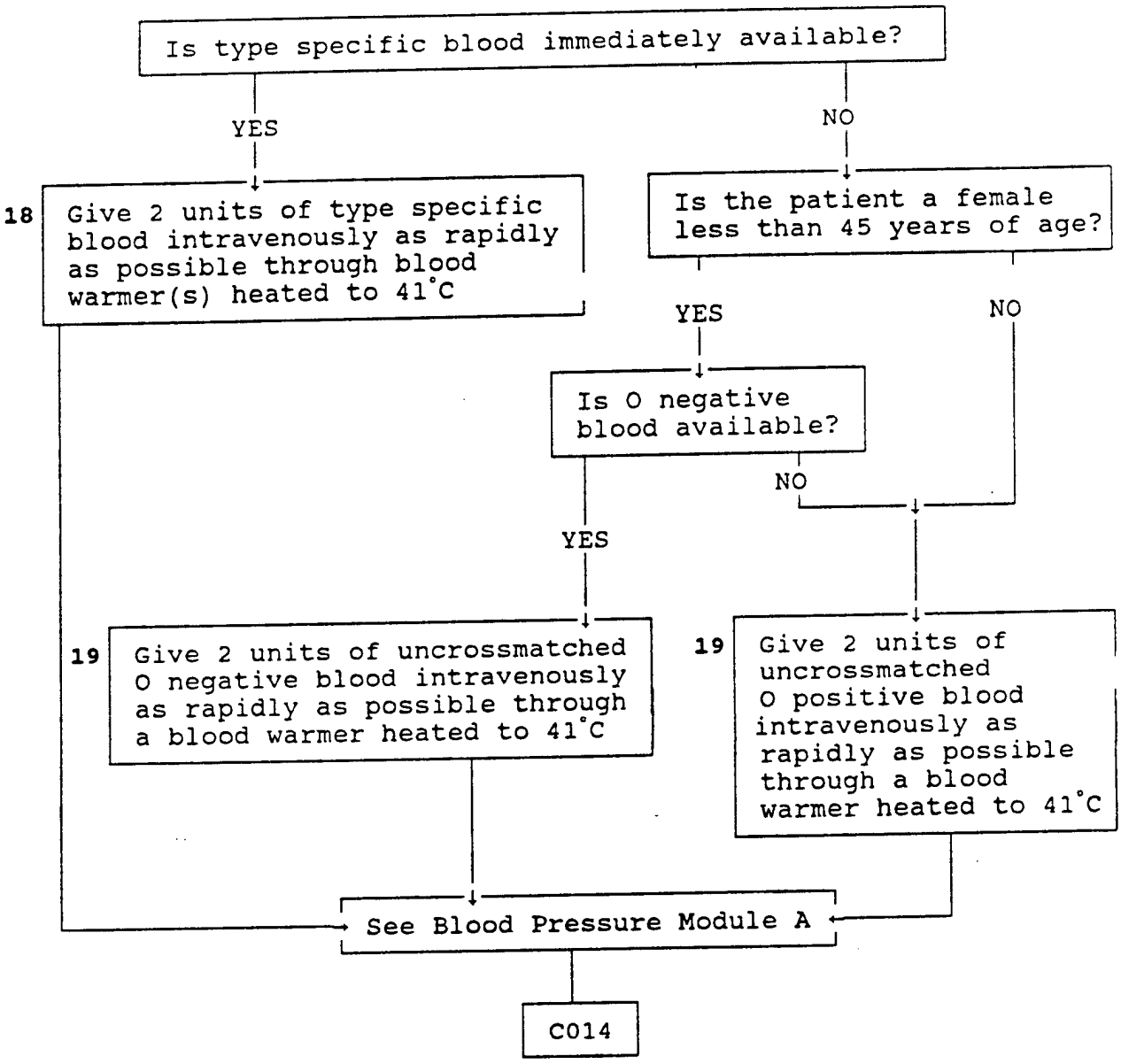
CUTDOWN ON FEMORAL ARTERY



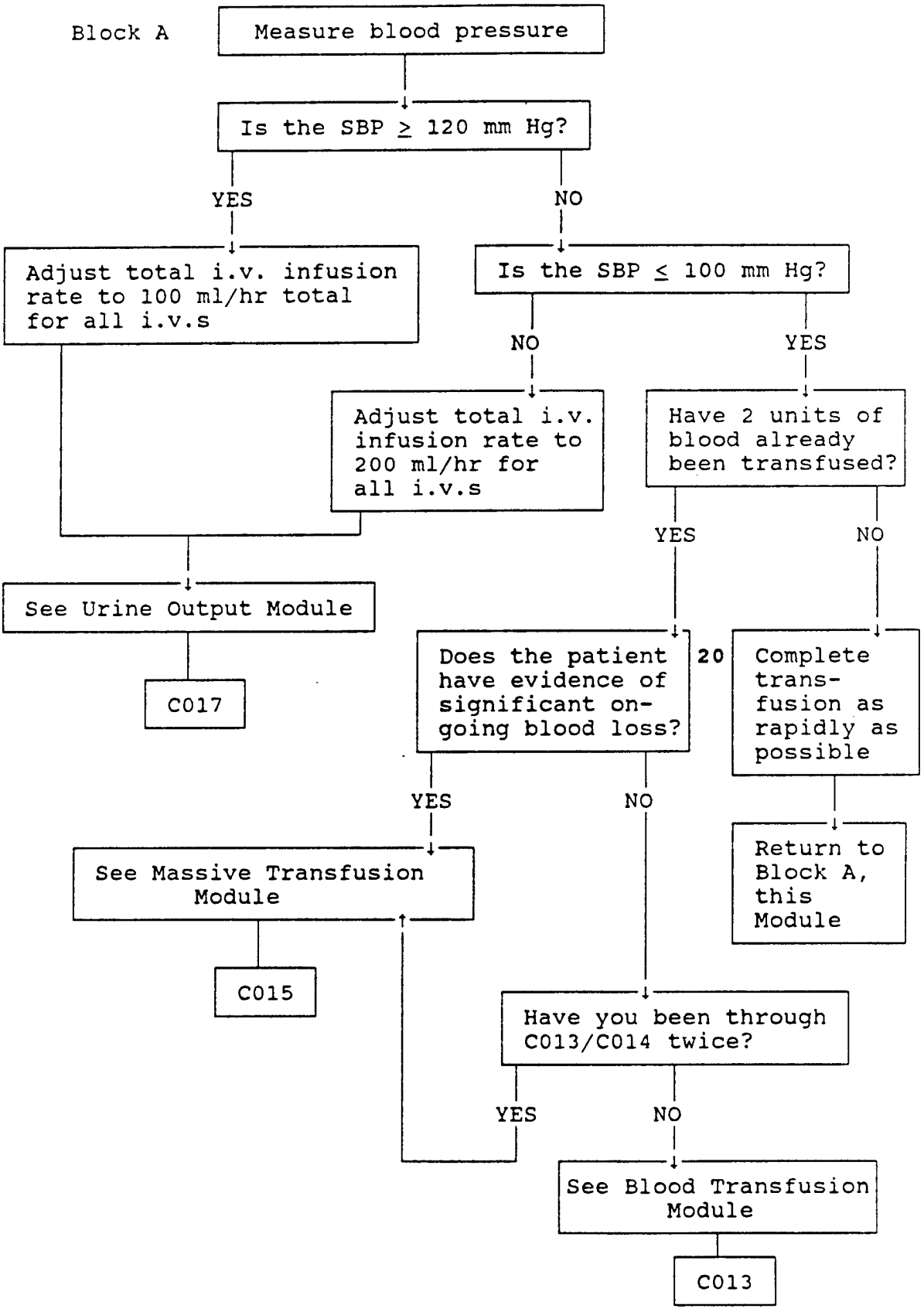
BLOOD PRESSURE MODULE



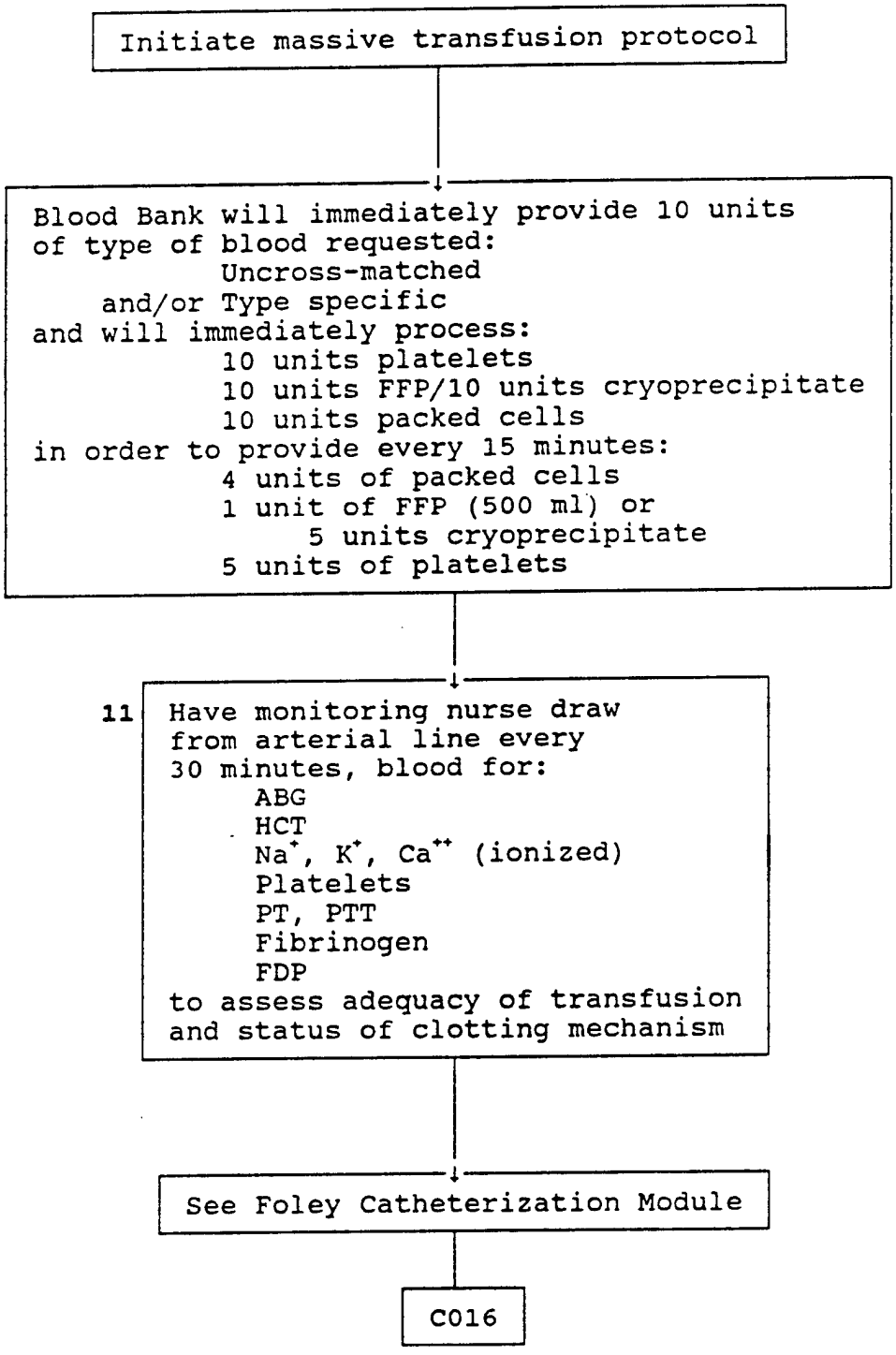
BLOOD TRANSFUSION MODULE



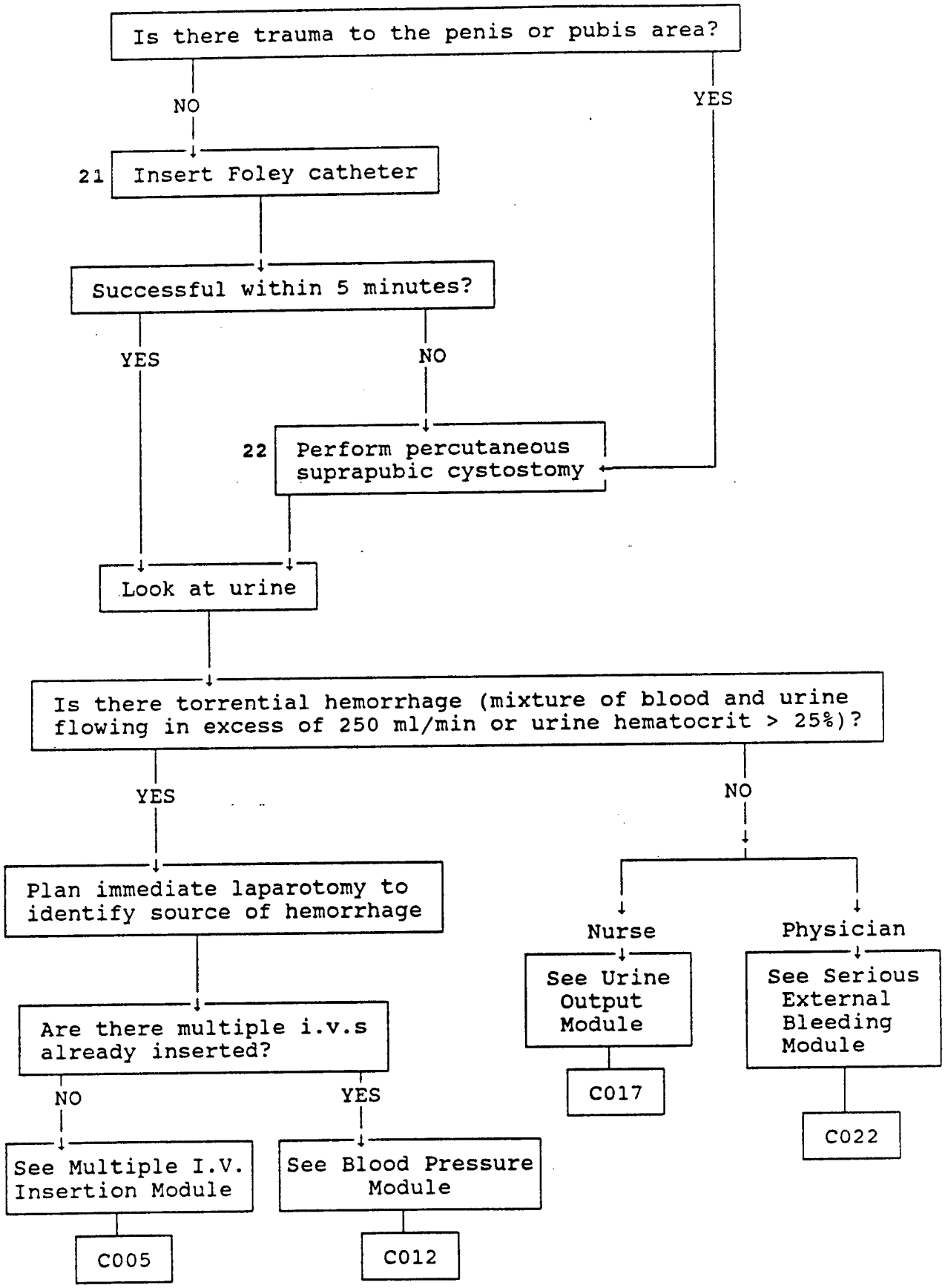
BLOOD PRESSURE MODULE A



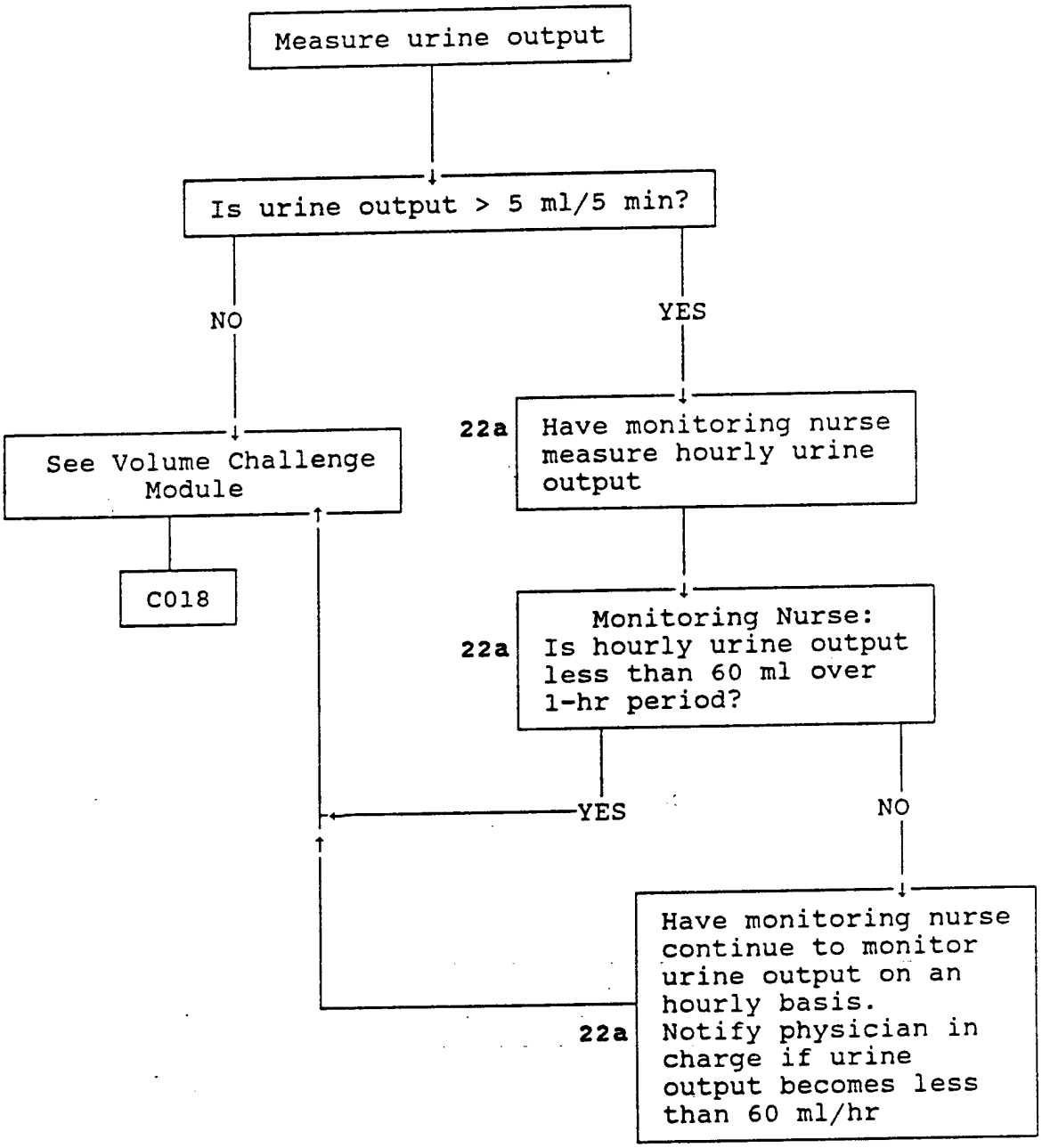
MASSIVE TRANSFUSION MODULE



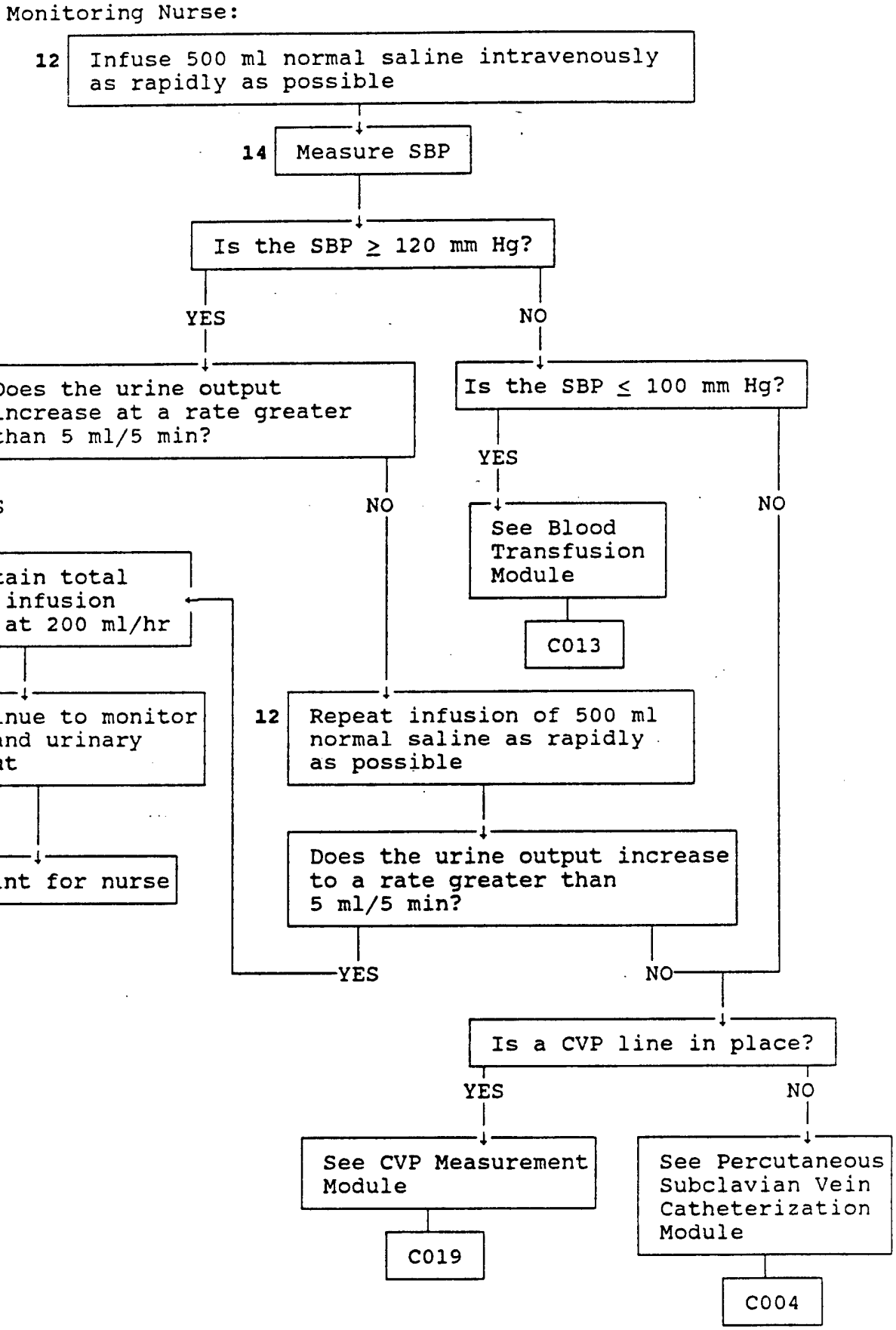
FOLEY CATHETERIZATION MODULE



URINE OUTPUT MODULE

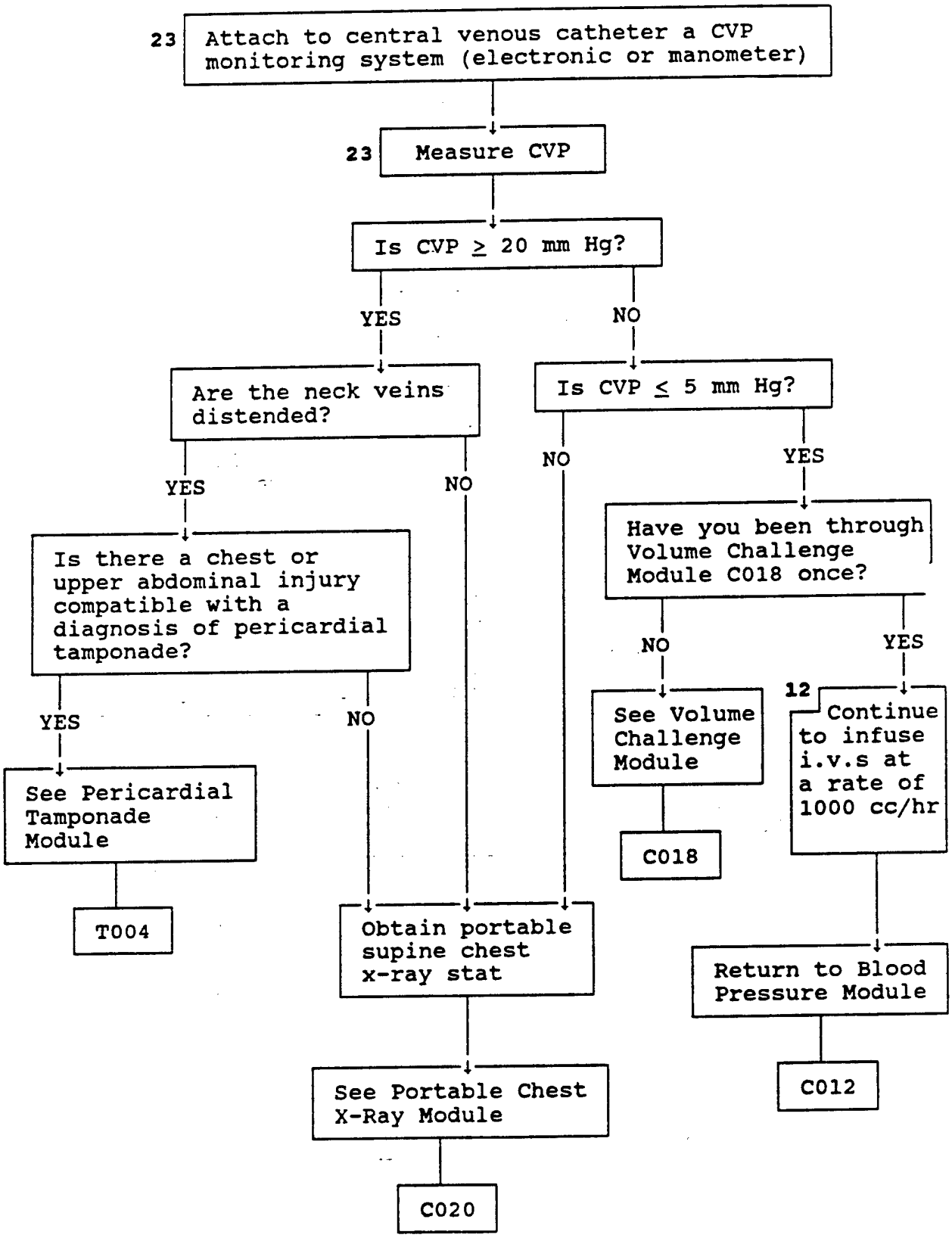


VOLUME CHALLENGE MODULE



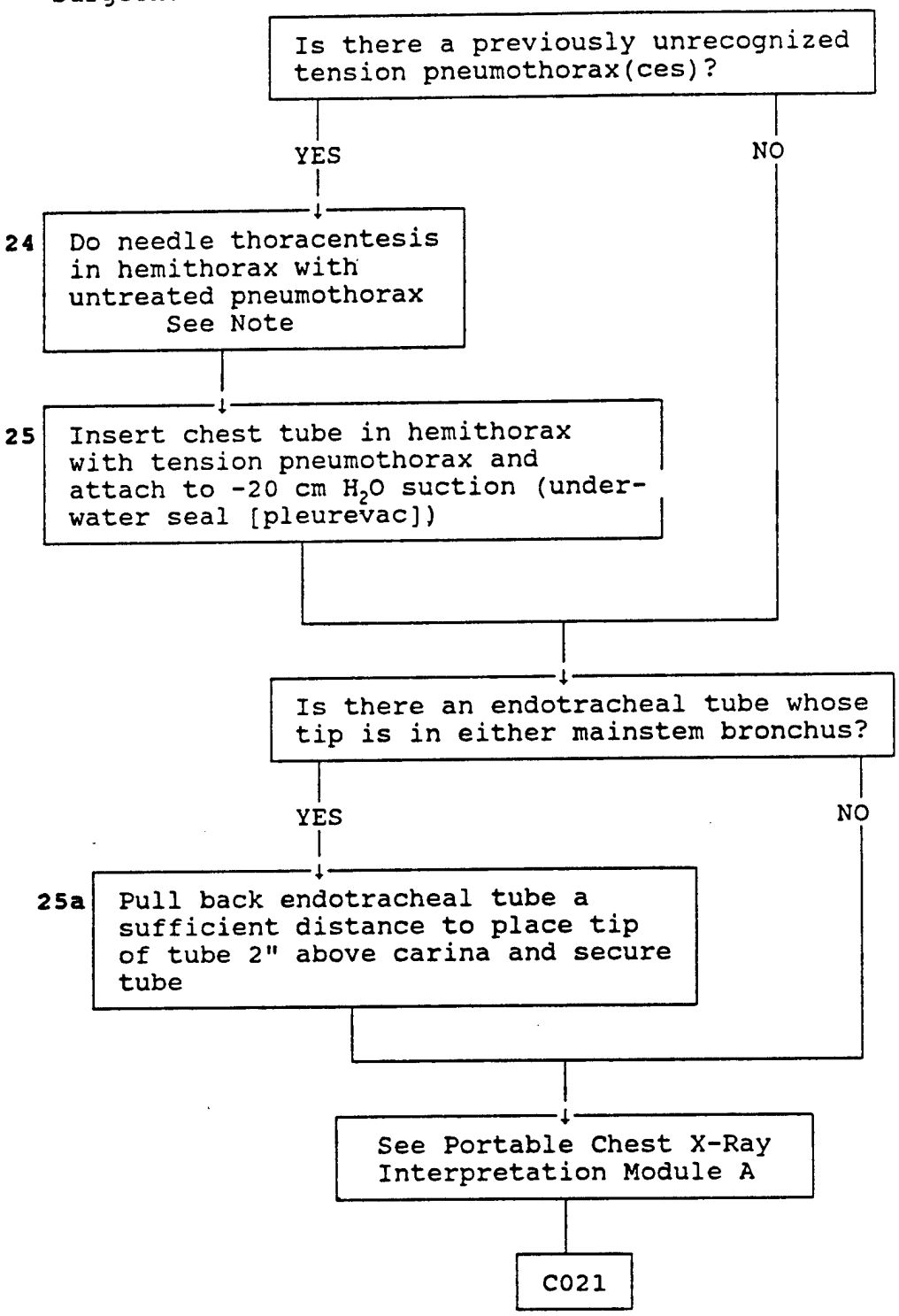
CENTRAL VENOUS PRESSURE MEASUREMENT MODULE

Monitoring Nurse:



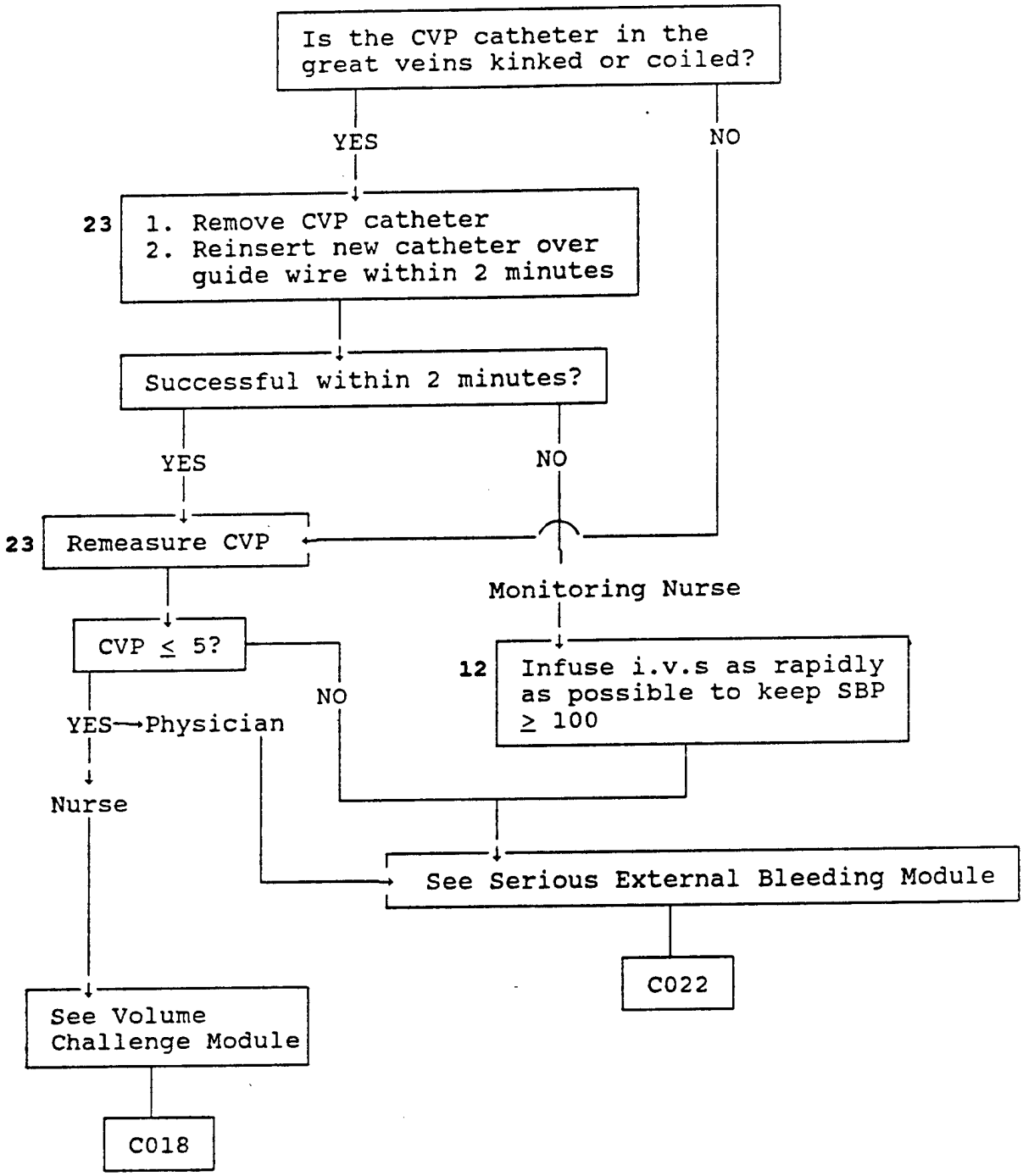
PORTABLE CHEST X-RAY INTERPRETATION MODULE

Surgeon:

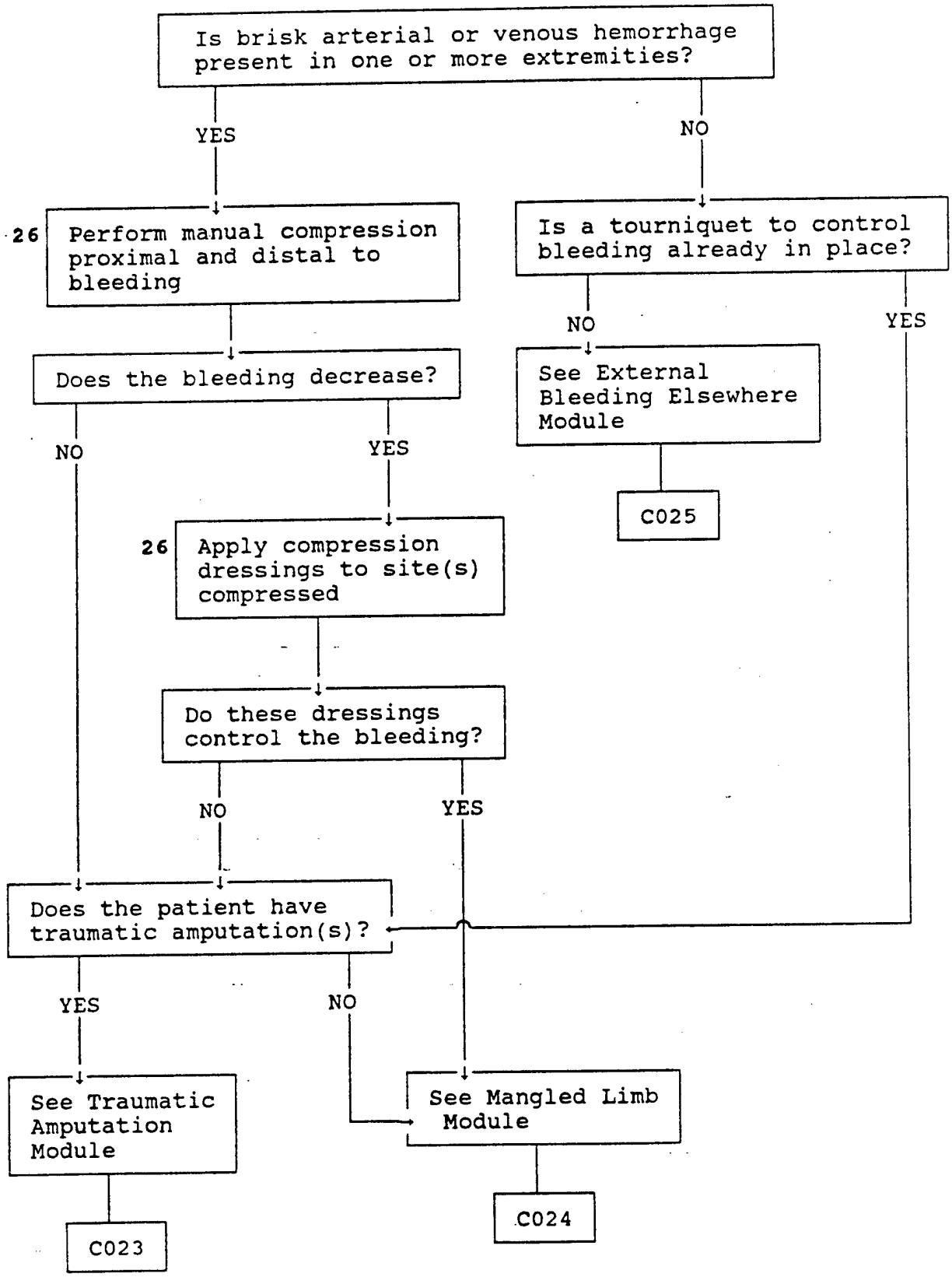


Note: See Needle Thoracentesis Module B007 for technique

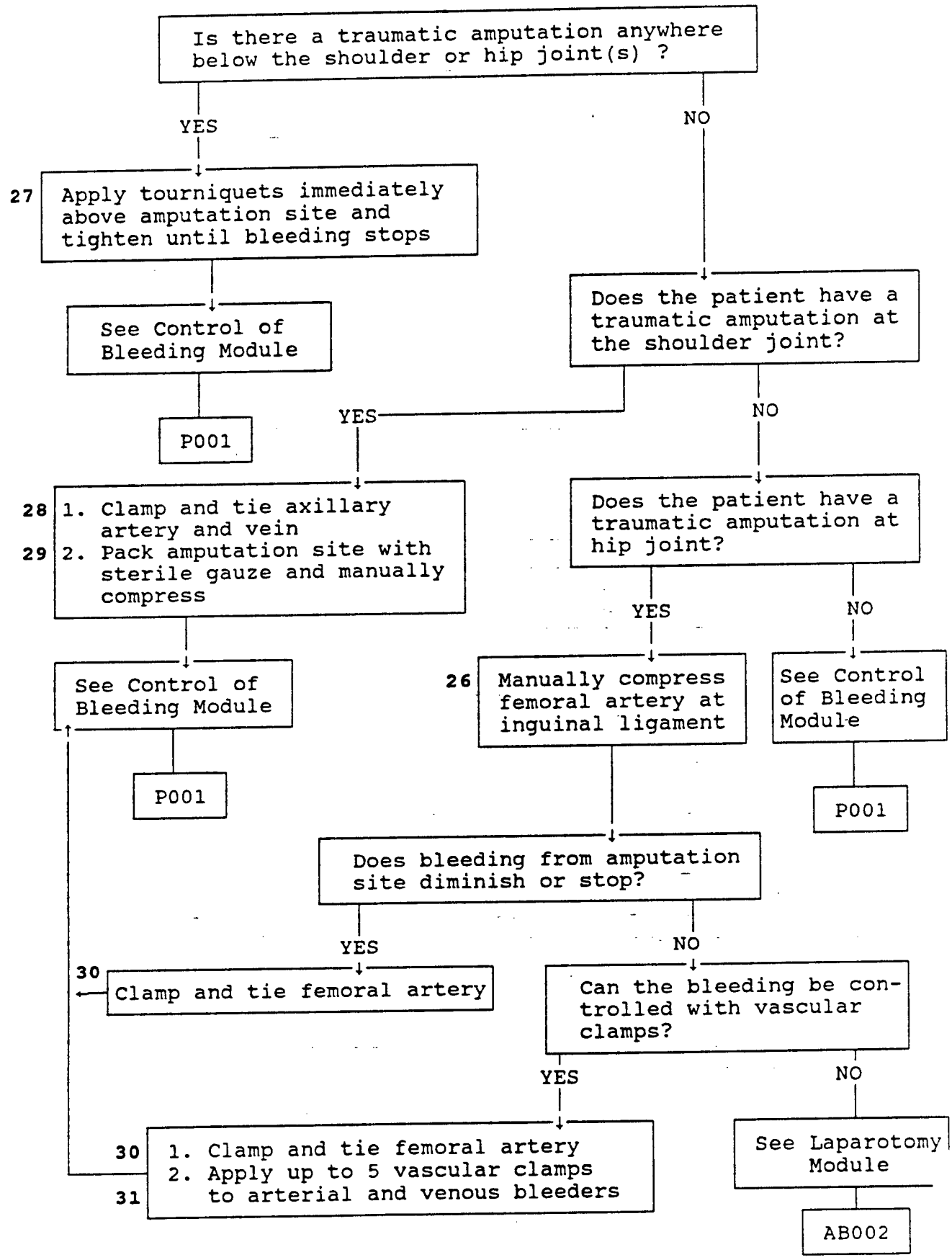
PORTABLE CHEST X-RAY INTERPRETATION MODULE A



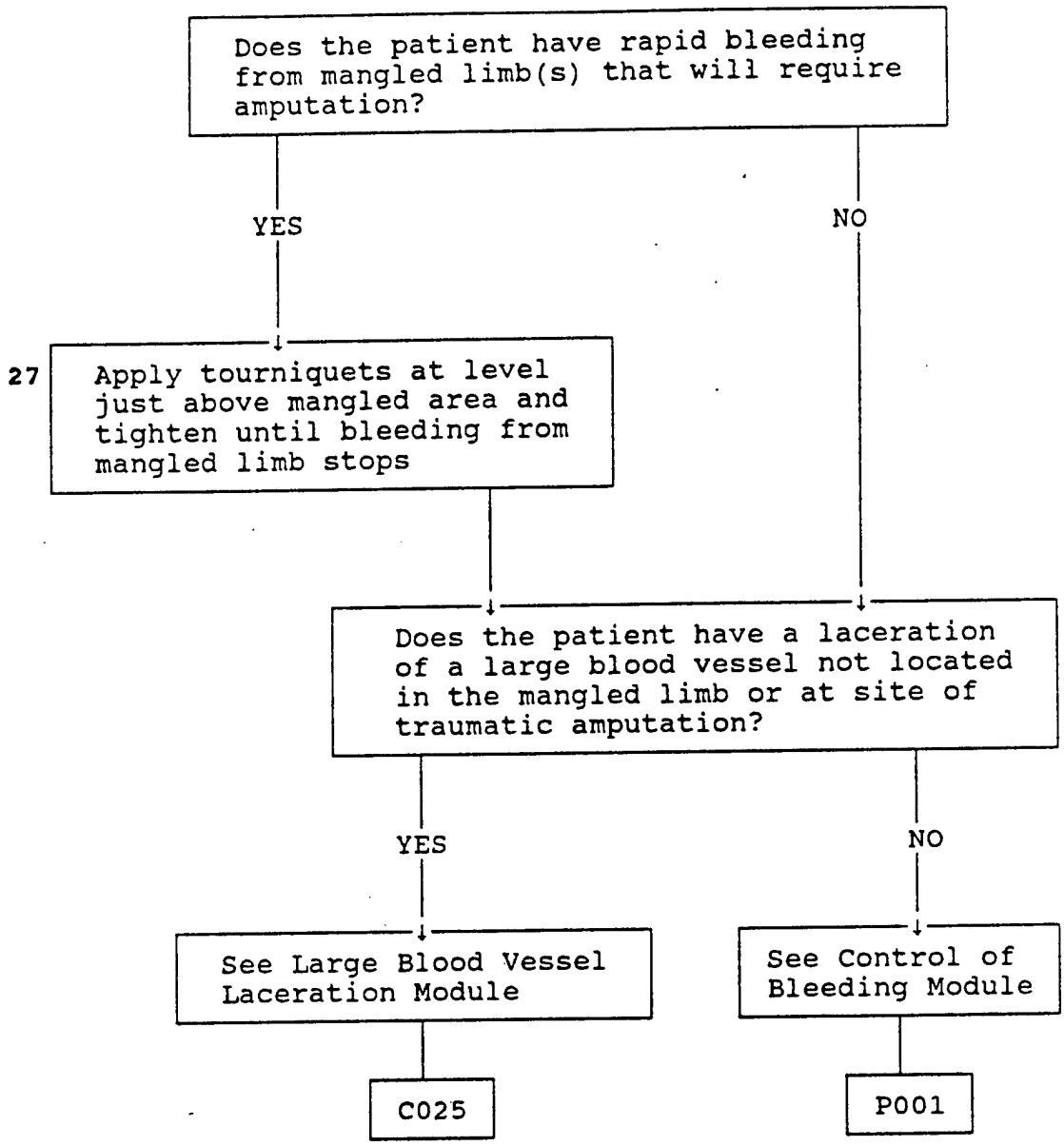
SERIOUS EXTERNAL BLEEDING MODULE



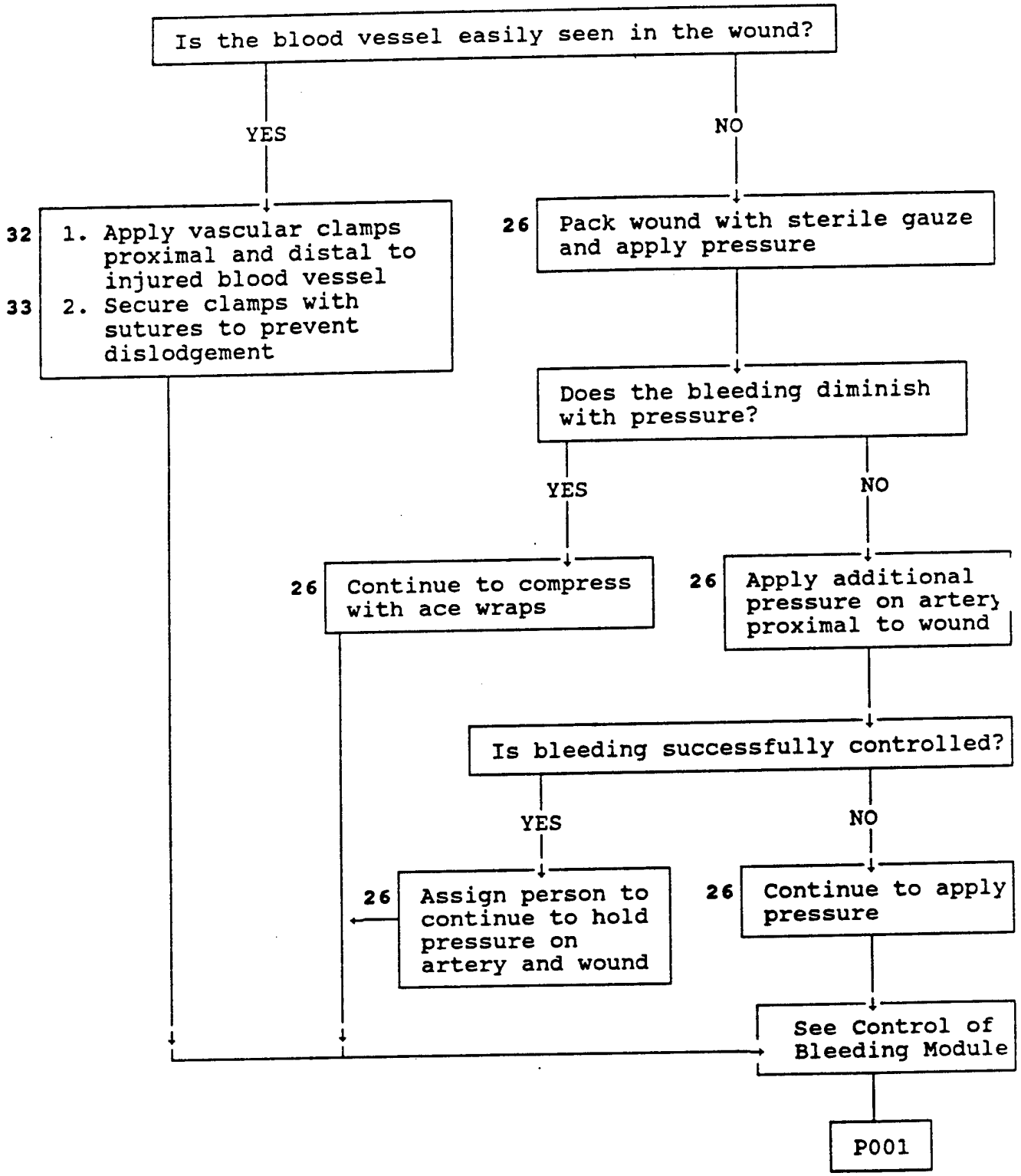
TRAUMATIC AMPUTATION(S) MODULE



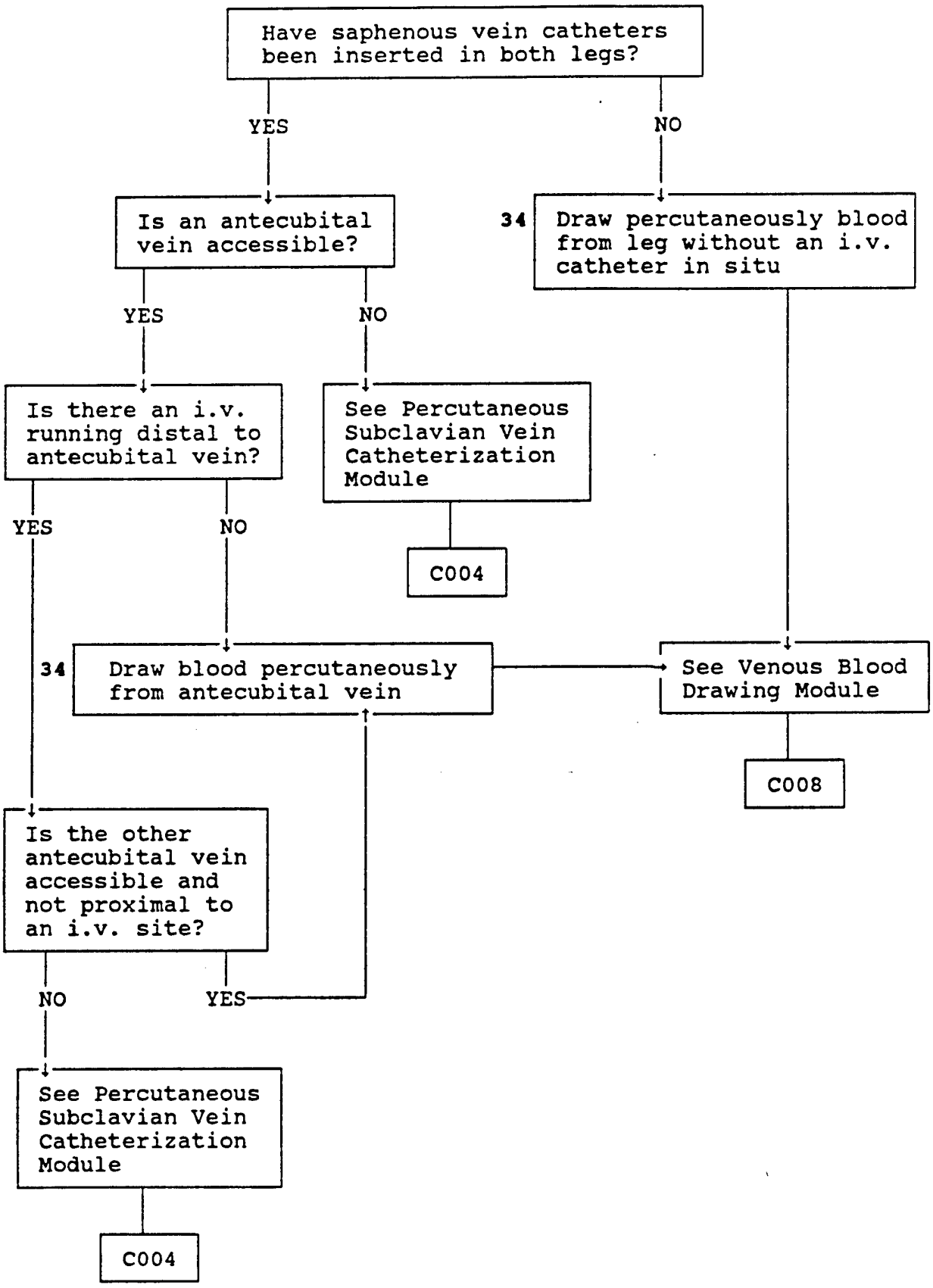
MANGLED LIMB(S) MODULE



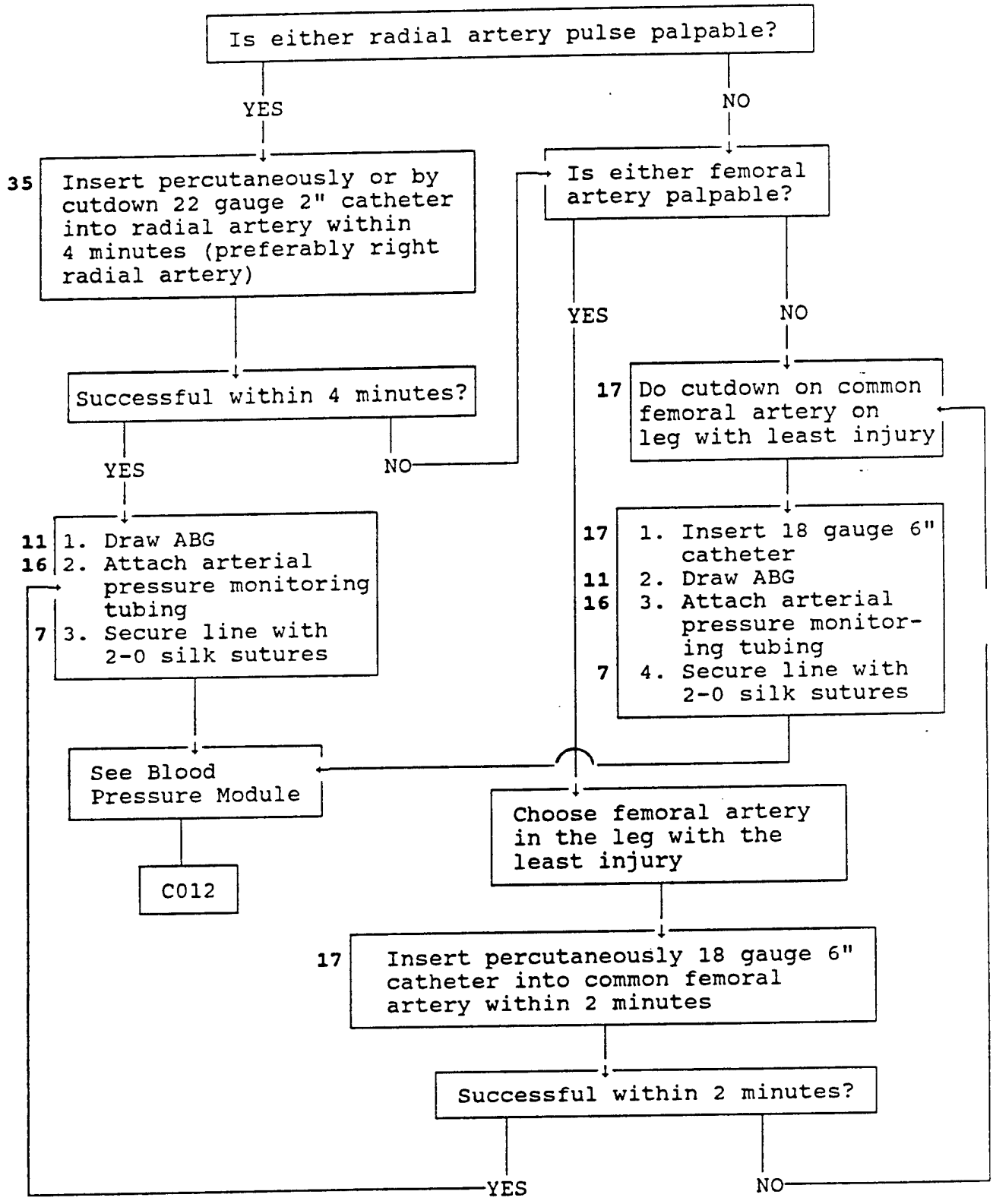
LARGE BLOOD VESSEL LACERATION MODULE



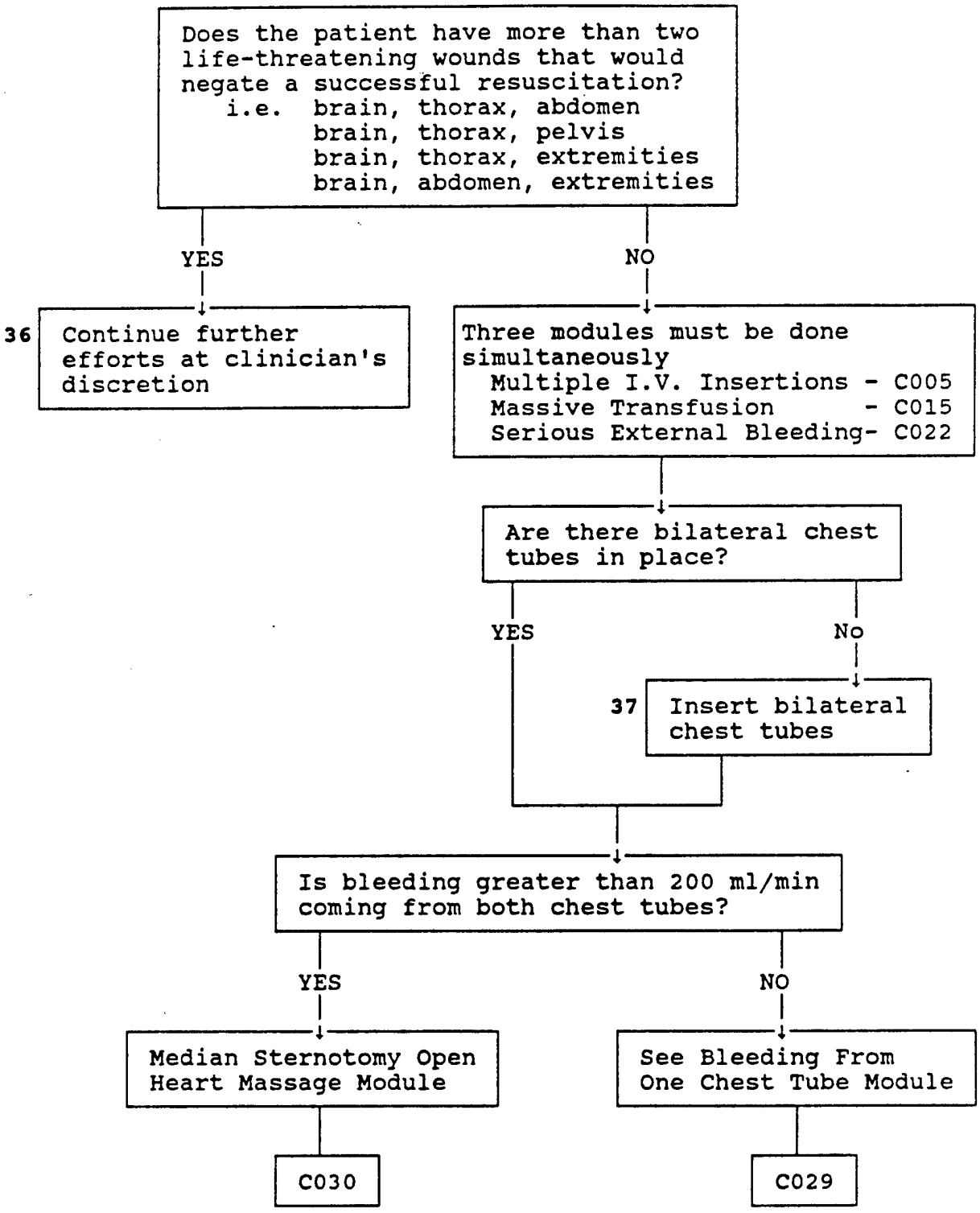
VENOUS BLOOD DRAWING ACCESS MODULE



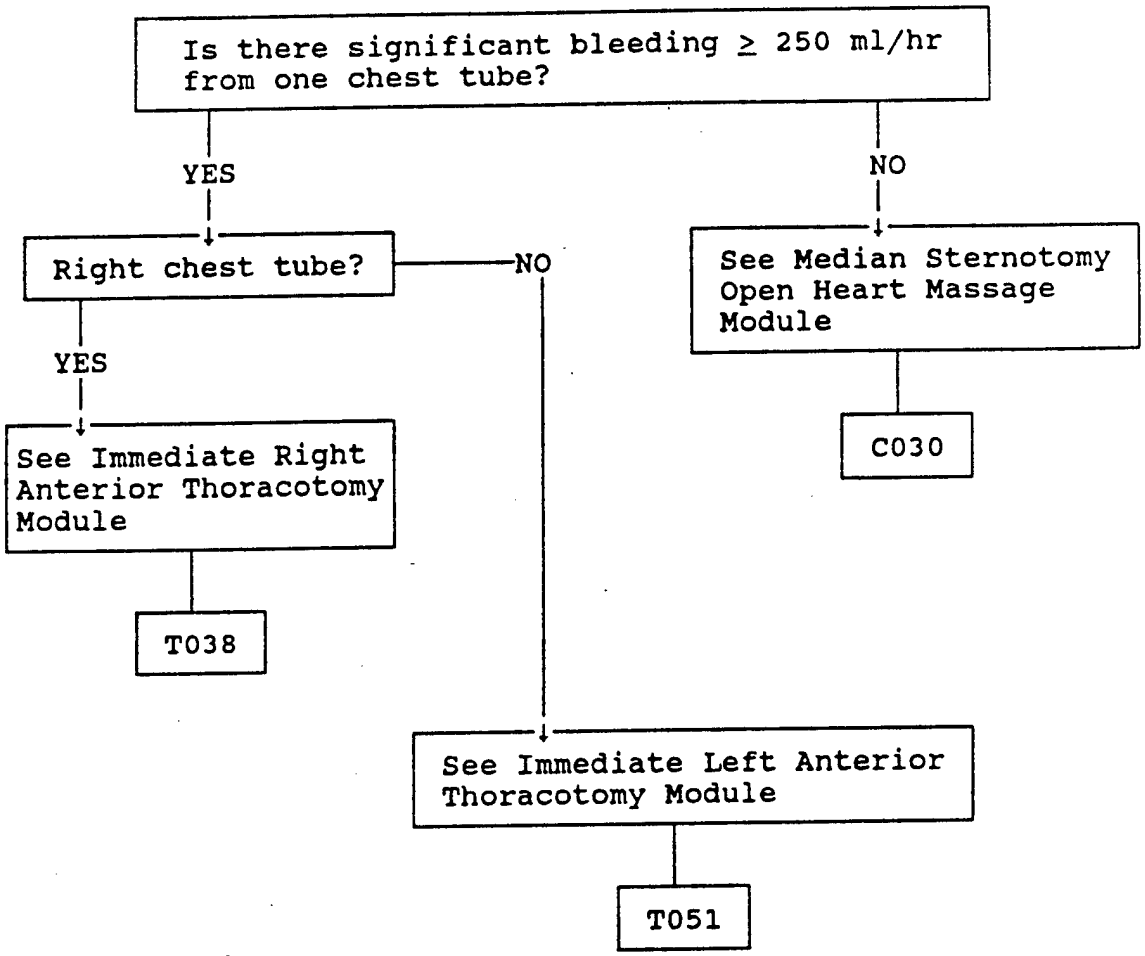
ARTERIAL CATHETERIZATION MODULE



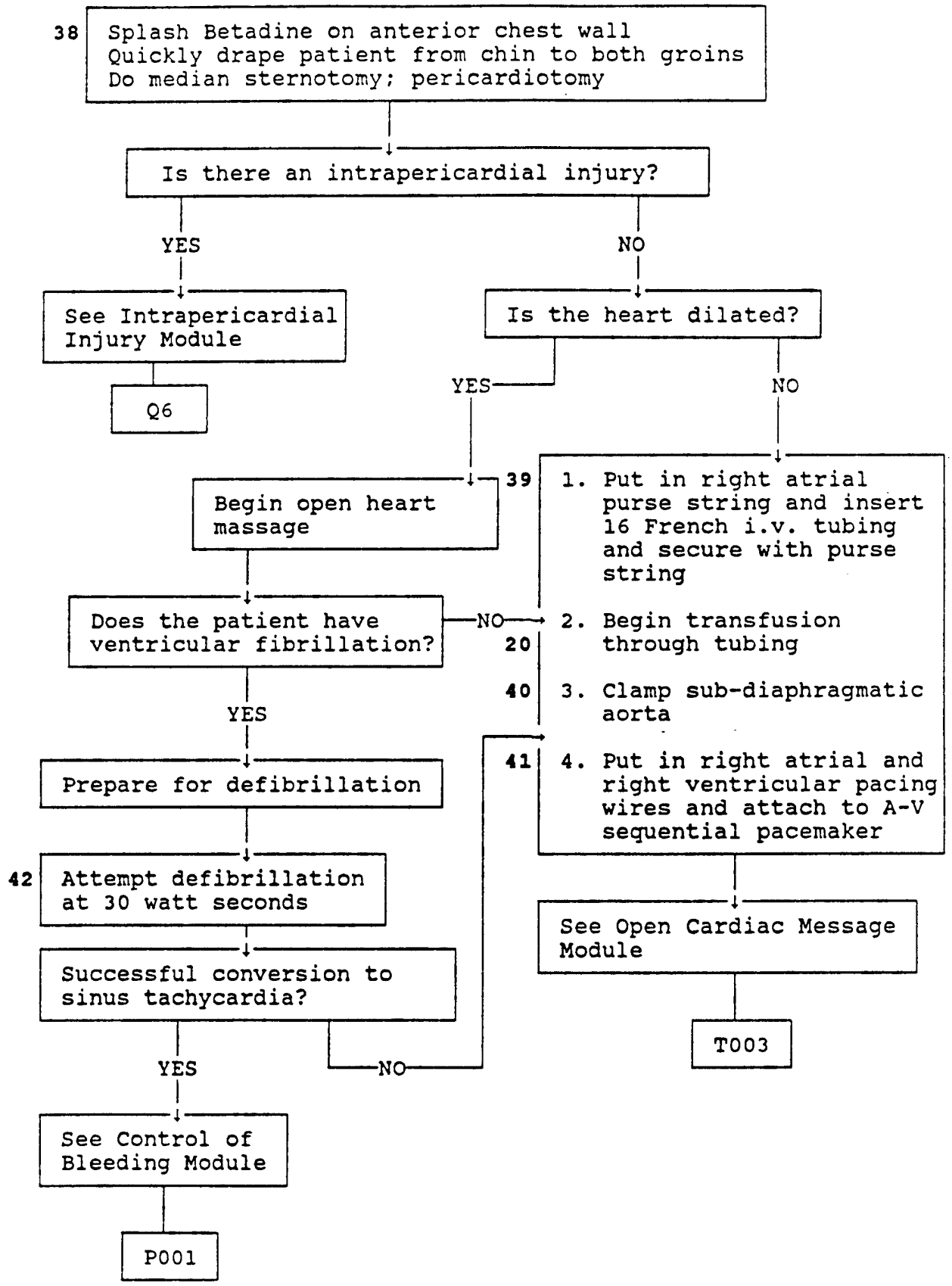
CARDIAC ARREST MODULE



BLEEDING FROM ONE CHEST TUBE MODULE



MEDIAN STERNOTOMY OPEN HEART MASSAGE MODULE



PENETRATING INJURIES - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Place patient on ventilator	3	3	3	2	1*	Ventilator with tubing; O_2 source; O_2 tubing
2. Check arterial blood gas	3	3	3	2	1*	Laboratory capability;Syringe; Heparin; sponge; ice
3. Adjust FiO_2 to maintain $PaO_2 \geq 80$			3	2	1*	Ventilator with tubing; O_2 source; O_2 tubing
4. Adjust tidal volume/rate to maintain $PaCO_2 \leq 30, \geq 25$			3	2	1*	Ventilator with tubing; O_2 source; O_2 tubing
5. Adjust tidal volume/rate to maintain $PaCO_2 \leq 40, \geq 30$			3	2	1*	Ventilator with tubing; O_2 source; O_2 tubing
6. Insert orogastric tube	3	3	1*	1*	1*	Orogastric tube; irrigating syringe; normal saline; suction source; tubing; tape
7. Connect tube to intermittent suction			3	3	1*	Orogastric tube; irrigating syringe; normal saline; suction source; tubing; tape
8. Insert orogastric tube with laryngoscopy if necessary	3	3	1	1	1*	Laryngoscope; orogastric tube; irrigating syringe; normal saline; suction source; tubing; tape
9. Lubricate nasogastric tube			3	3	1*	NG tube; lubricant
10. Insert tube into nostril	3	3	1*	1*	1*	NG tube; irrigating syringe; lubricant; normal saline; suction source; tubing; tape
11. Instill 50 cc air into gastric tube				3	1*	Irrigating syringe
12. Attempt passage via mouth. Laryngoscope may be required	3	3	1*	1*	1*	Laryngoscope; orogastric tube; irrigating syringe; normal saline; suction source; tubing; tape
13. Sterile prep of chest tube - chest drainage system			3	3	1*	Betadine solution; chest drainage system; tubing suction source
14. Pass Fogarty balloon or Foley balloon catheters, or naso-tracheal suction catheter	3	3	1*	1*	1*	Fogarty balloon catheter; Foley balloon; nasotracheal suction catheter; sterile connection

********** Explanation of Specialty Codes and Care Descriptors **********

In most cases the specialty surgeon is a thoracic surgeon. However point 20 could be accomplished by an ear/nose throat specialist. Also points 21, 30, 31, and 32 would require a radiology team, and point 34, an orthopedic or vascular surgeon to be optimal.

In general number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks. Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

15. Suture skin around chest tube tightly	3	3					2-0 silk; needle holder
16. Cover skin/tube interface with vaseline gauze			3	3	1*		Vaseline gauze
17. Pass large channel bronchoscope	3	3					Bronchoscope; bronchoscope machine; suction; lubricant; ET tube
18. Pass small channel scope or switch endotracheal tube	3	3					Bronchoscope; bronchoscope machine; suture; lubricant; small channel scope; ET tube
19. Pass ET tube below injury using bronchoscope for guidance	3	3					Bronchoscope; bronchoscope machine; suture; lubricant; small channel scope; ET tube
19a. Suction blood and mucus and irrigate with saline mucomyst until clear	3	3					Suction capability; saline; mucomyst
20. Cervical approach to tracheal repair	3	3					Thoracic tray
21. Obtain stat chest X-ray		Radiology Team					X-ray machine; plate; light source; stethoscope
22. Pull back the tube an appropriate distance to allow endotracheal tube tip to lie 1" above carina	3	3					AMBU bag; syringe
23. Secure the endotracheal tube	3	3	1*	1*	1*		Tape; Benzoin ointment
24. Manipulate gastric tube until its tip lies within the stomach	3	3					NG tube; syringe
25. Do needle thoracentesis on side of tension pneumothorax	3	3	1*	1*	1*		#10, 12. 14 angiocath; 1 1/2 finger glove with rubber band tape; Heimlich valve (flutter valve with stopcock)
26. Insert chest tube on side of pneumothorax	3	3					Scalpel; chest tube (male #36, female #32, child #28); scissors; clamp (curved) O-silk (Keith) needle holder; prep solution; zylocaine with syringe; 4 x 4's tape; suction set-up; suction tubing
27. Subpectoral Chest Tube Insertion Module	3	3					Scalpel; chest tube (male #36, female #32, child #28; scissors; clamp (curved) O-silk (Keith) needle holder and sutures; prep solution; zylocaine with syringe; 4 x 4's tape; suction set-up; suction tubing; vaseline and sterile gauze dressings
28. Do thoracotomy amd lobectomy	3	3					Thoracotomy list; chest sets (thoracic and vascular)
29. Measure systolic blood pressure	3	3	3	2	1		Blood pressure cuff: stethoscope
30. Get CAT scan of brain		Radiology Team					CT capability; contrast material; syringe;

31. Get CAT scan of face		Radiology Team	CT capability; contrast material; syringe;
32. CAT scan with contrast of abdomen and pelvis		Radiology Team	CT capability; contrast material; syringe;
33. Review patient's status; oxygenation; perfusion; metabolic status; antibiotic/tetanus	3	3	
34. Amputate limb	3	3	Large clamps; tourniquet; retractors; dressings; suction device; extremity amputation list
35. Repair injured extremity	3	3	Orthopedic and Vascular trays

AMPUTATION - EXTREMITY EQUIPMENT LIST

SUTURE

VICRYL 0 STRAND
VICRYL 2-0 STRAND
VICRYL 2-0 CT
VICRYL 3-0 CT
ETHILON 3-0 CUTTING

SUPPLIES

DRAPE, SPLIT SHEET
DRAPE, MEDIUM 44 X 60"
MAYO STAND COVER
TOWELS, STERILE (6)
GLOVES, SURGEON ASSORT. SIZES
GOWN, SURGICAL XTR. LRG.
BASIN SET W/ GRADUATE & MED.CUP.
SPONGE, LAP 18 X 18 (2)
PAD, GROUNDING
CAUTERY, HANDSWITCH
SUCTION TUBING 20'
IRRIG. WATER 1500 CC
IRRIG. NACL 1000 CC
BLADE, SURGICAL #10 (2)

INSTRUMENTS & EQUIPMENT

AMPUTATION SET
ORTHOPEDIC SET
BLADE, GIGLI
CAUTERY, MACHINE

DRESSING

XEROFOAM 5 X 9"
GAUZE 4 X 9" 12 PLY
ABD, LARGE
ELASTIC 4" X 5'
ELASTIC 6" X 5'

AMPUTATION SET EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

1 AMPUTATION SAW
1 LEWEN BONE HOLDER
3 GIGLI SAW HANDLES
2 DEEP RAKES
1 STAINLESS STEEL RASP
1 STAINLESS STEEL FILE
1 LANGENBECK PERI ELEVATOR

PEEL PACK:

---

1 AMPUTATION KNIFE

ON STRINGER:

---

6 CURVED CRILES

CHEST SET (THORACIC) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
MEDIUM NEEDLE HOLDERS
LONG NEEDLE HOLDER -NOT FINE
SPONGE STICKS
LONG CURVES
LAUERS
TONSILS
KOCKERS - CLAMP
BABCOCK CLAMP
ALLIS CLAMP
CURVED CRILER
CURVED MOSQUITOES CLAMP
SUTURE SCISSORS
MAYO SCISSORS
METZ SCISSORS
LONG METZ SCISSORS

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

ORTHOPEDIC SET EQUIPMENT LIST

CONTENTS

ON STRINGER:

---

2 SHORT N.H.
2 MEDIUM N.H.
1 LEWEN BONE CLAMP
1 LONG CURVE
1 LAUER
4 OCHNERS
2 GYNE ALLISES
2 REGULAR CURVES
4 CURVED CRILES
2 CURVED KELLIES
1 SUTURE SCISSOR
1 BANDAGE SCISSOR
1 MAYO SCISSOR
1 METZ SCISSOR
6 REGULAR TOWEL CLIPS

BOTTOM OF PAN:

---

2 ARMY/NAVYS
2 SHARP RAEES
2 WIDE HIBBS
2 NARROW HIBBS
2 LARGE TAYLOR
1 SMALL TAYLOR
2 BENNETTS
1 ADSON RONGEUR
2 MEDIUM WEITLANERS
1 LANGENBECK
1 PLIER
1 MALLET
1 POINTED RONGEUR
1 SMALL PIN CUTTER
6 BALL CLIPS

PEEL PACK:

---

2 #3 KNIFE HANDLES
1 #4 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
1 TONSIL SUCTION
1 #12 FRAZIER SUCTION
1 LONG THUMB W/TEETH
2 FINE GYNES
2 MEDIUM RUSSIANS
2 ADSONS W/TEETH

PEEL PACK:

---

1 1/4" DRILL BIT
1 7/64" DRILL BIT
1 SMALL METAL RULER

THORACOTOMY LIST

SUTURE

SILK A-306H 0 STRAND
SILK SA-75H 2-0 STRAND
SILK SA-74H 3-0 STRAND

STICK TIES

SILK K-33H 2-0
VICRYL J-833H 2-0 SH
SILK K-832H 3-0
CHROMIC G-122H 3-0 SH

BRONCHUS

VICRYL J-304H 4-0 RB-1 (use with 2-0 silk strand for chest tube skin stitch)
NEEDLE 3/8 CUTTING 2090-14

OR

SILK 7370 2-0 X-0

CLOSURE

VICRYL J-849G 2 TP-1
MAXON 2-0 T-25 OR 628751
MAXON 3-0 T-25 6287-41

SKIN (ASK)

PDS Z-422H 4-0 PS-2
STAPLE, LOADING UNIT SM-35W
STAPLE GUN, SKIN

PACKS AND DRAPES

PACK, BASIC
BASIN, MAJOR
BASIN, STANDARD SINGLE SET
TRAY, SKIN SCRUP SURGERY
COVER, MAYO STAND 8337
SHEET, TRANSVERSE LAP
GOWN, STER BACK XL A9541
GOWN, STER BACK LAG A9511
CLOTH DRAPE (SINGLE)
TOWELS, STERILE (8 PK)

FOLEY CATHETERS --ASK FIRST

TRAY, CATH FOLEY UNIVERSAL
CATHETER, FOLEY W/T SENS 16FR3C
URIMETER, DRAIN BAG

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITC
BOVIE HOLDER
ELECTRODE, BLADE EXTENDED(ARGON BEAM MACHINE AVAILABLE)
ARGON BEAM PAD
ARGON BEAM TIP

SPONGES

SPONGES, CYLINDRICAL DISECTORS
SPONGE, LAP 12 X 12
SPONGE, LAP 18 x 18
SPONGE, GAUZE X-RAY DETECT

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

MISCELLANEOUR SUPPLIES

BLADE, SURGICAL #21
BLADE SURGICAL #10 024760
BLADE, SURGICAL #15
BONE WAX W-31G
DACRON TAPE 8618-00
DRAPE, IOBAN 6648
HEMOCLIP, MED
HEMOCLIP, LRG
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT AVAILABLE
RAZOR, PREP DISP
VESSEL LOOPS MAXI RED
VESSEL LOOPS MINI YELLOW

DRAINS

TUBE, CHEST 28FR THORACIC
TUBE, CHEST 32FR THORACIC
TUBE, CHEST 36FR THORACIC
PLEUREVAC, ADULT

INSTRUMENTS AND EQUIPMENT

CHEST SET
LAPAROTOMY SET
LUNG SPATULA
BEANBAG/"U" SHAPED VAC PAC
CARDIO VASCULAR TRAY
HEADLIGHT
LIGHT HANDLES, BLUE RIGID (2)
CRYO UNIT
SCISSOR, METZ, LONG FINE
APPLIER, HEMOCLIP, LARGE, LONG

(HAVE AVAILABLE)
FCP, ATRAGRIP, LONG
CLAMP, COARCTATION
N H, RX. LONG
RETR, MOORSE, STERNAL
RETR, RIMMELSTEIN
CLAMP, THORACIC ANEURISM

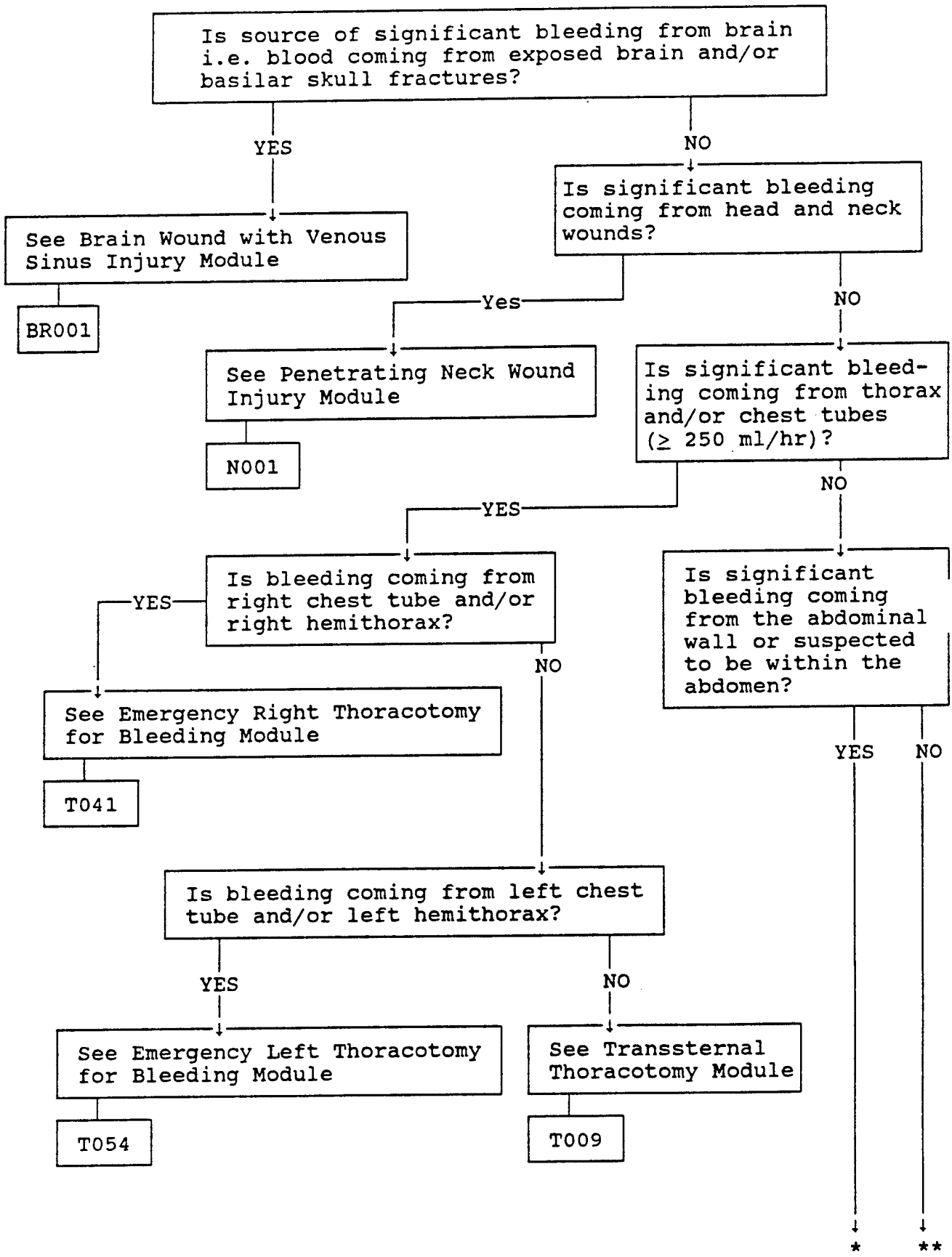
DRESSINGS

DRESSING, TELFA
DRESSING, GAUZE 4 X 8 12 PLY
PAPER TAPE

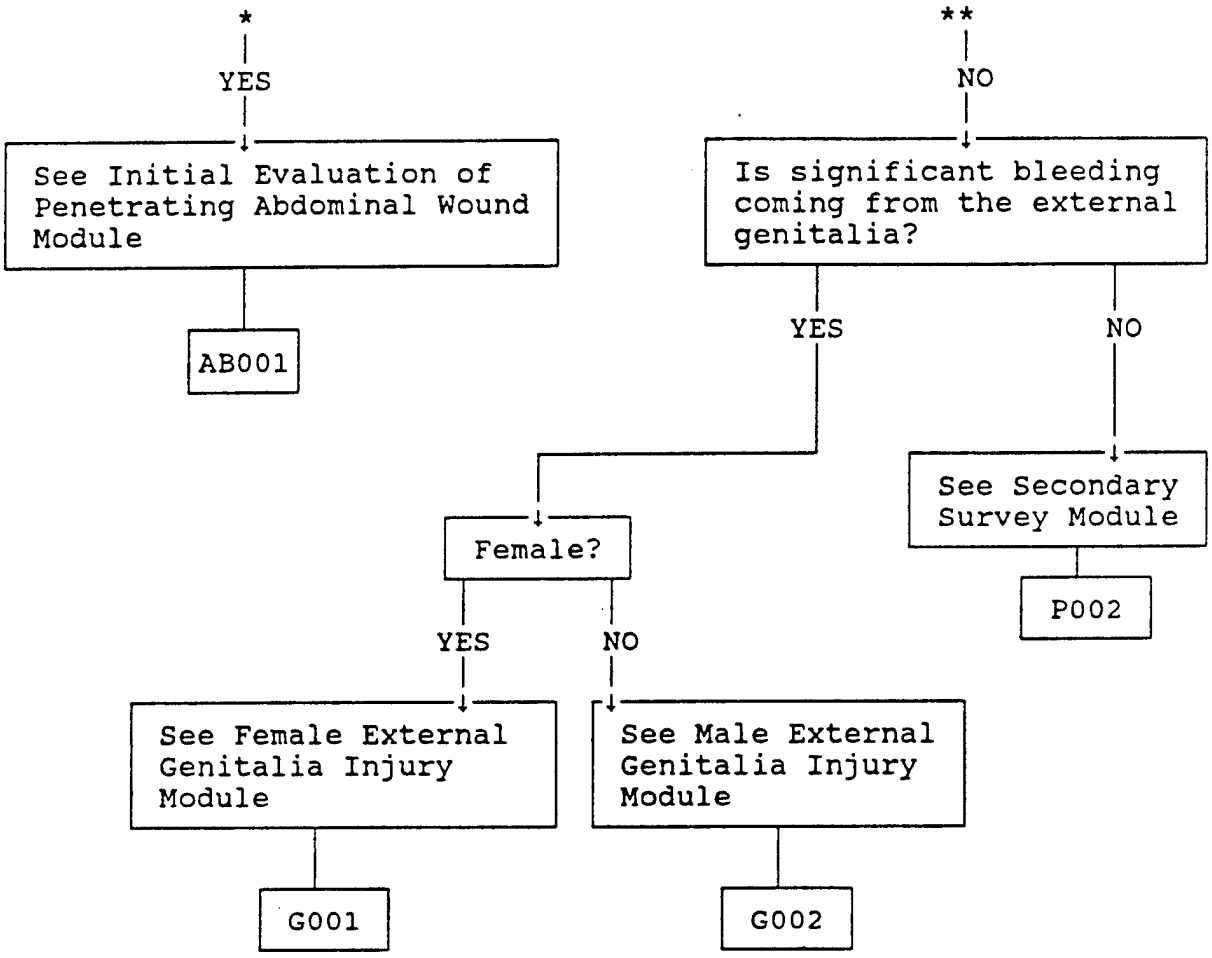
TRAUMA CHEST TRAY - Minimal equipment

1 - MEDIMM FINOCHETTI RETRACTOR
1 - EXTRA LONG NEEDLE HOLDER
4 - BABY TOWEL CLIPS
1 - 9" CURVE
1 - LONG MAYO
1 - CURVED CRILE
1 - STRAIGHT CRILE
1 - LAUER
1 - STRAIGHT COARCTATION CLAMP
1 - TANGENTIAL OCCLUSION CLAMP
2 - TONSIL HEMOSTATS
1 - 4# KNIFE HANDLE
4 - TOWELS (FOLDED READY TO SQUARE OFF)
2 - PACKAGES COUNTED 12 BY 12'S
STERNAL SAW/LEBSCHE
BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

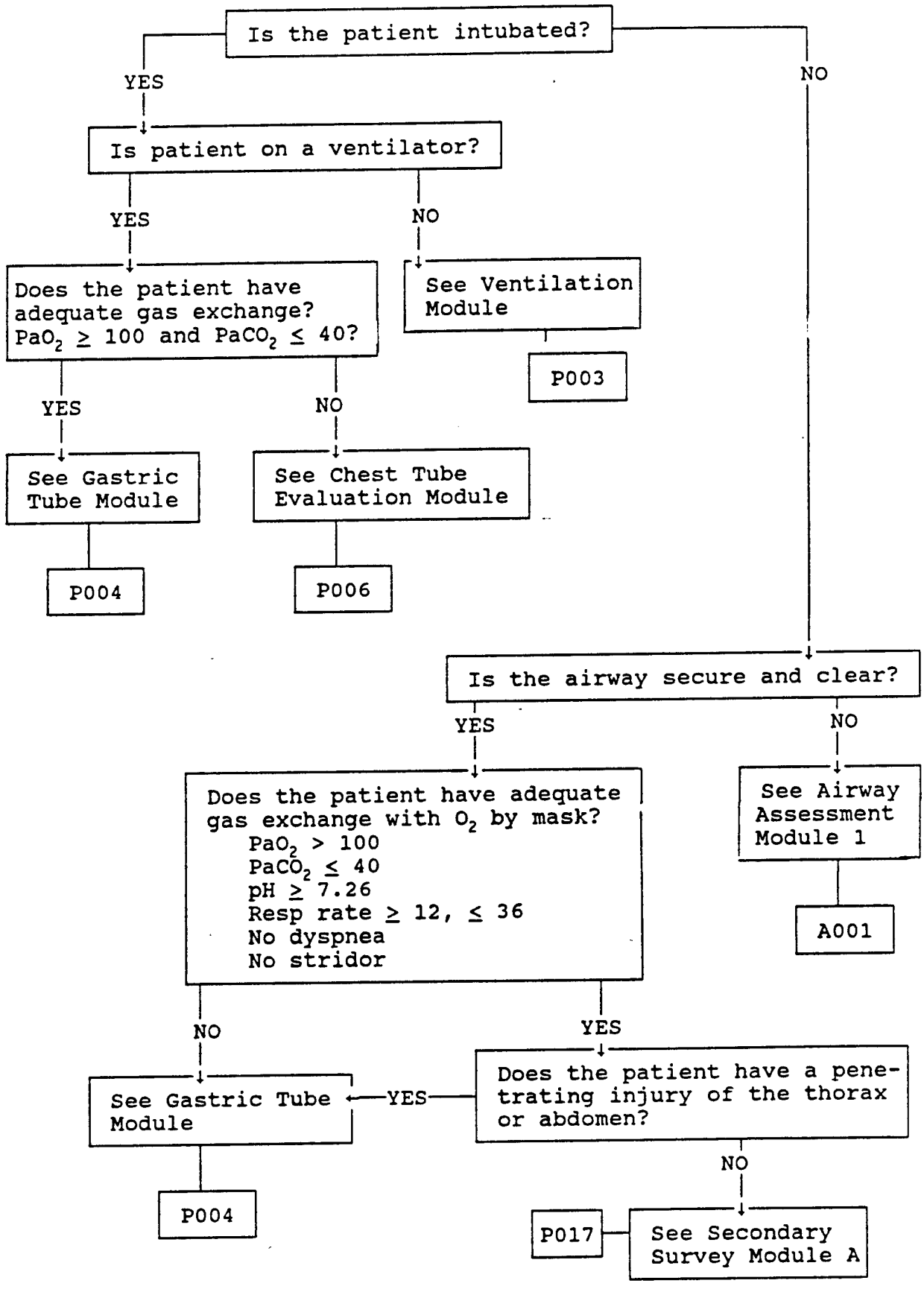
CONTROL OF BLEEDING MODULE



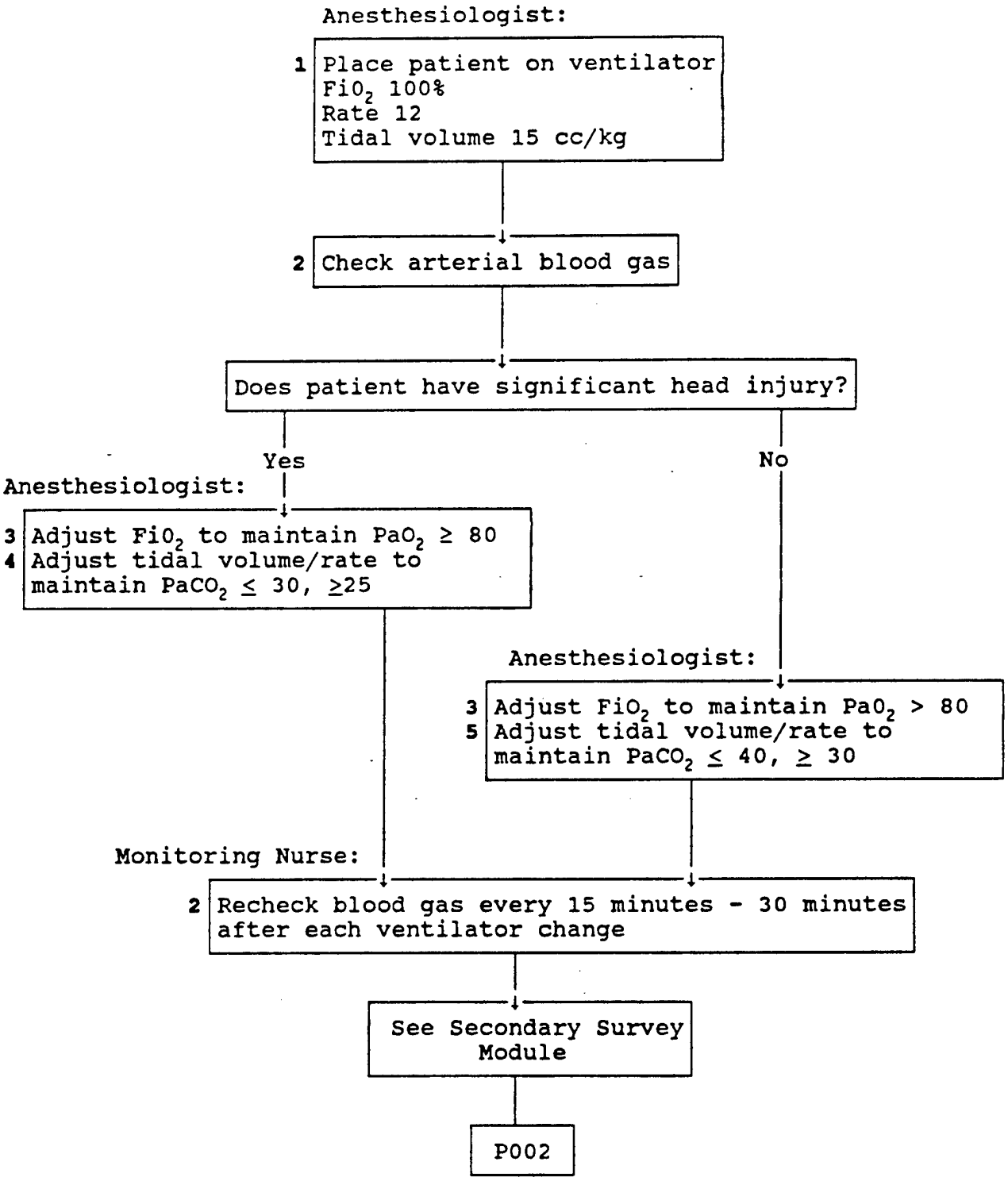
CONTROL OF BLEEDING MODULE



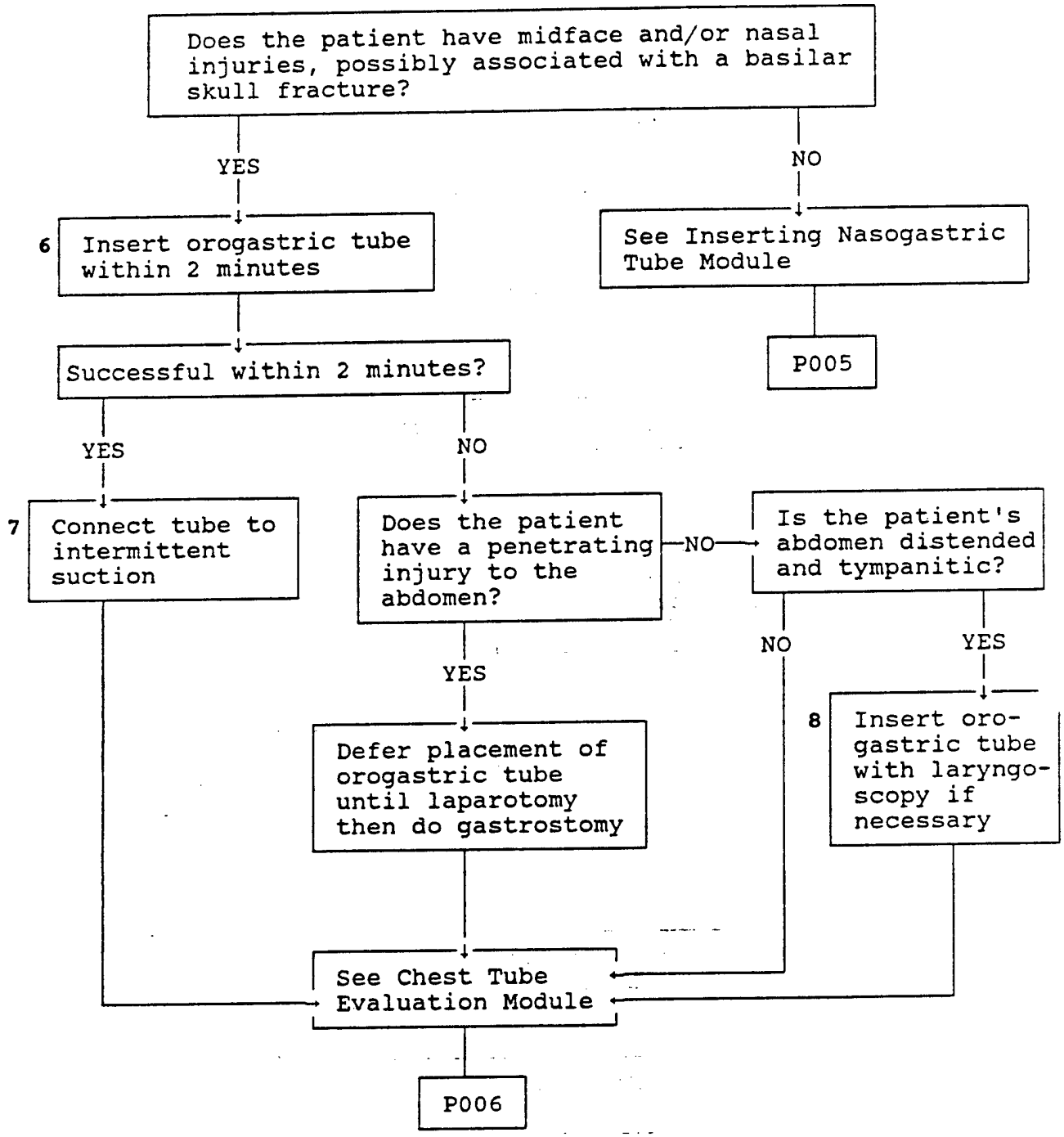
SECONDARY SURVEY MODULE



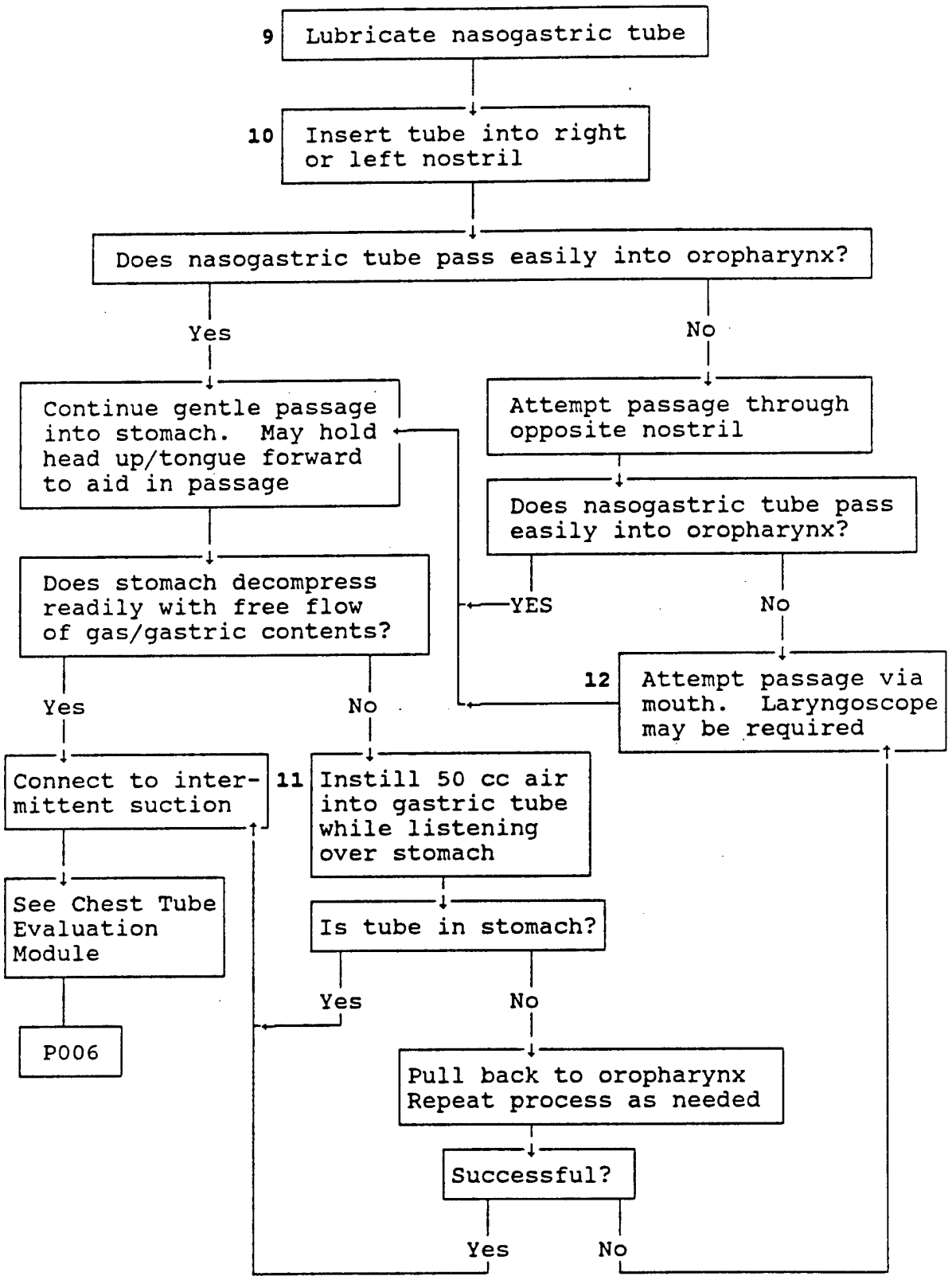
VENTILATION MODULE



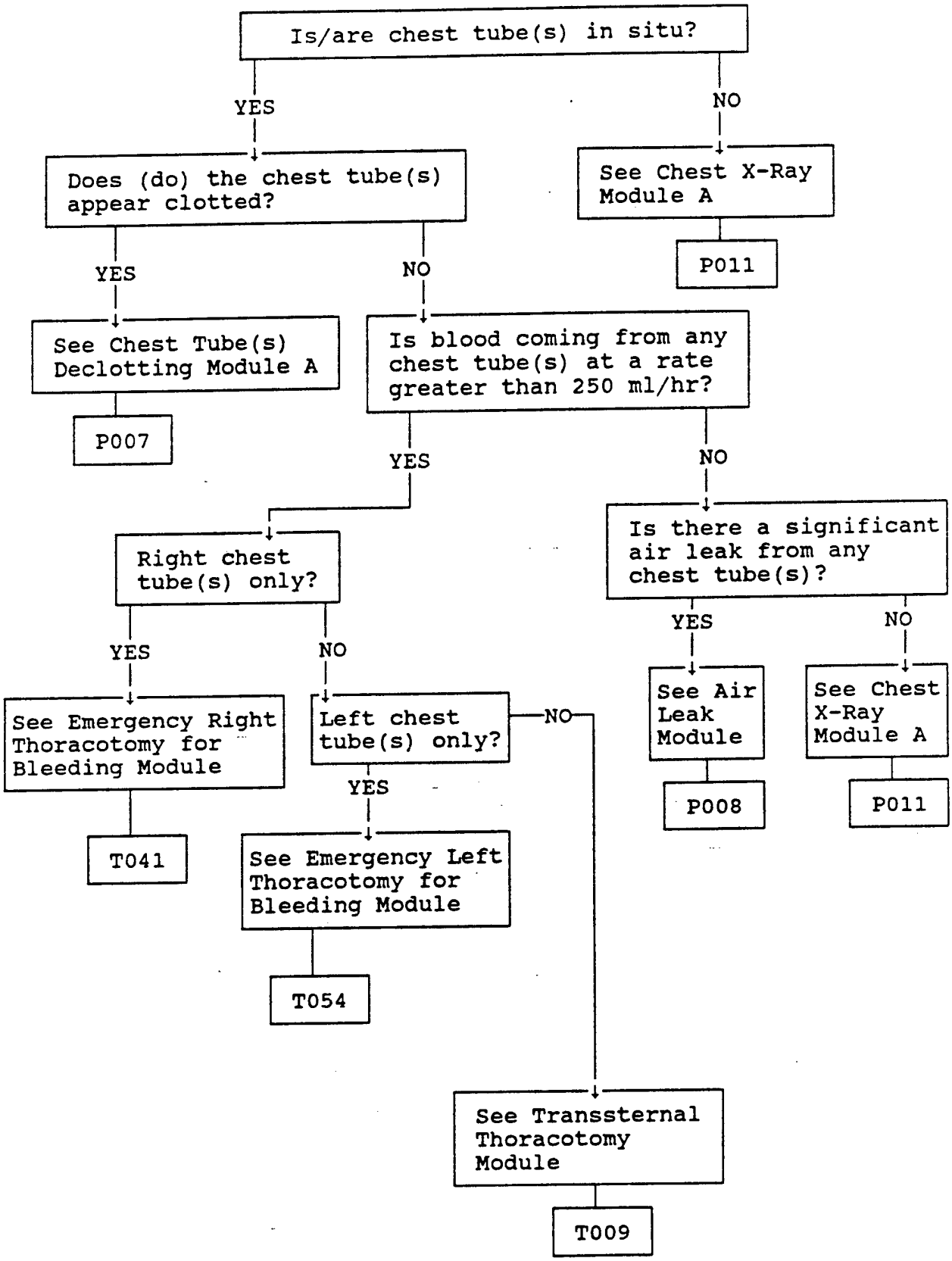
GASTRIC TUBE MODULE



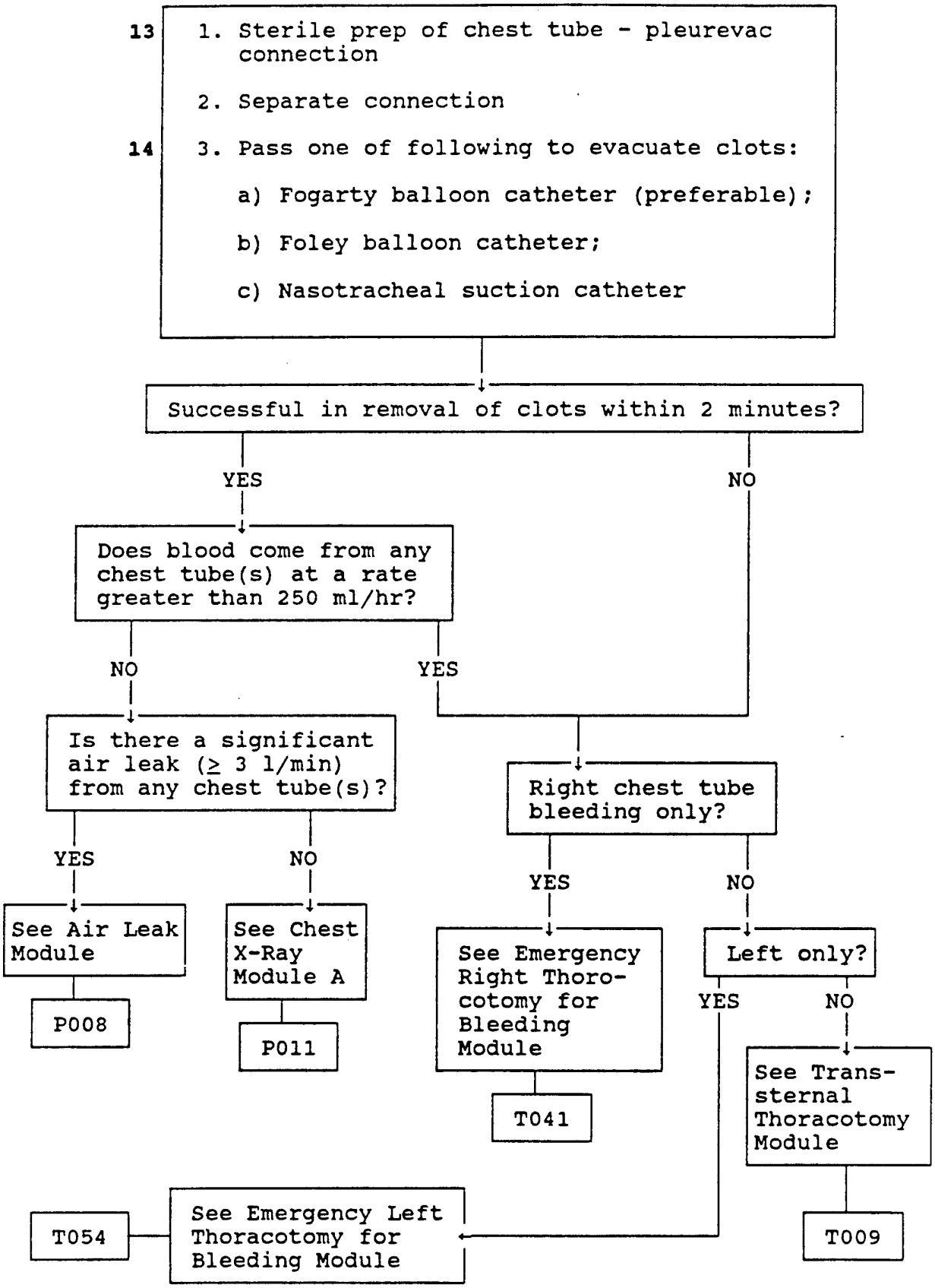
INSERTING NASOGASTRIC TUBE MODULE



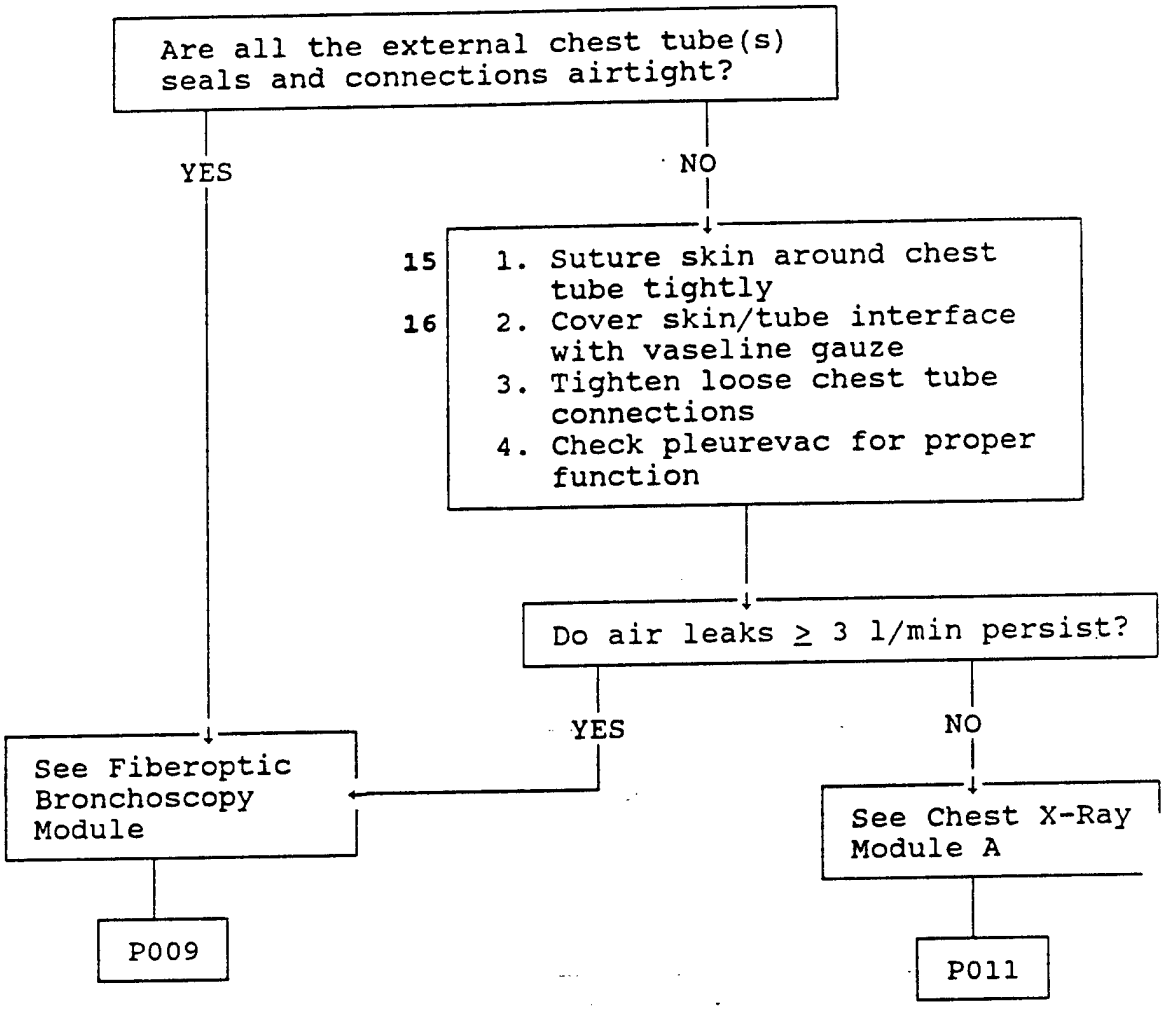
CHEST TUBE EVALUATION MODULE



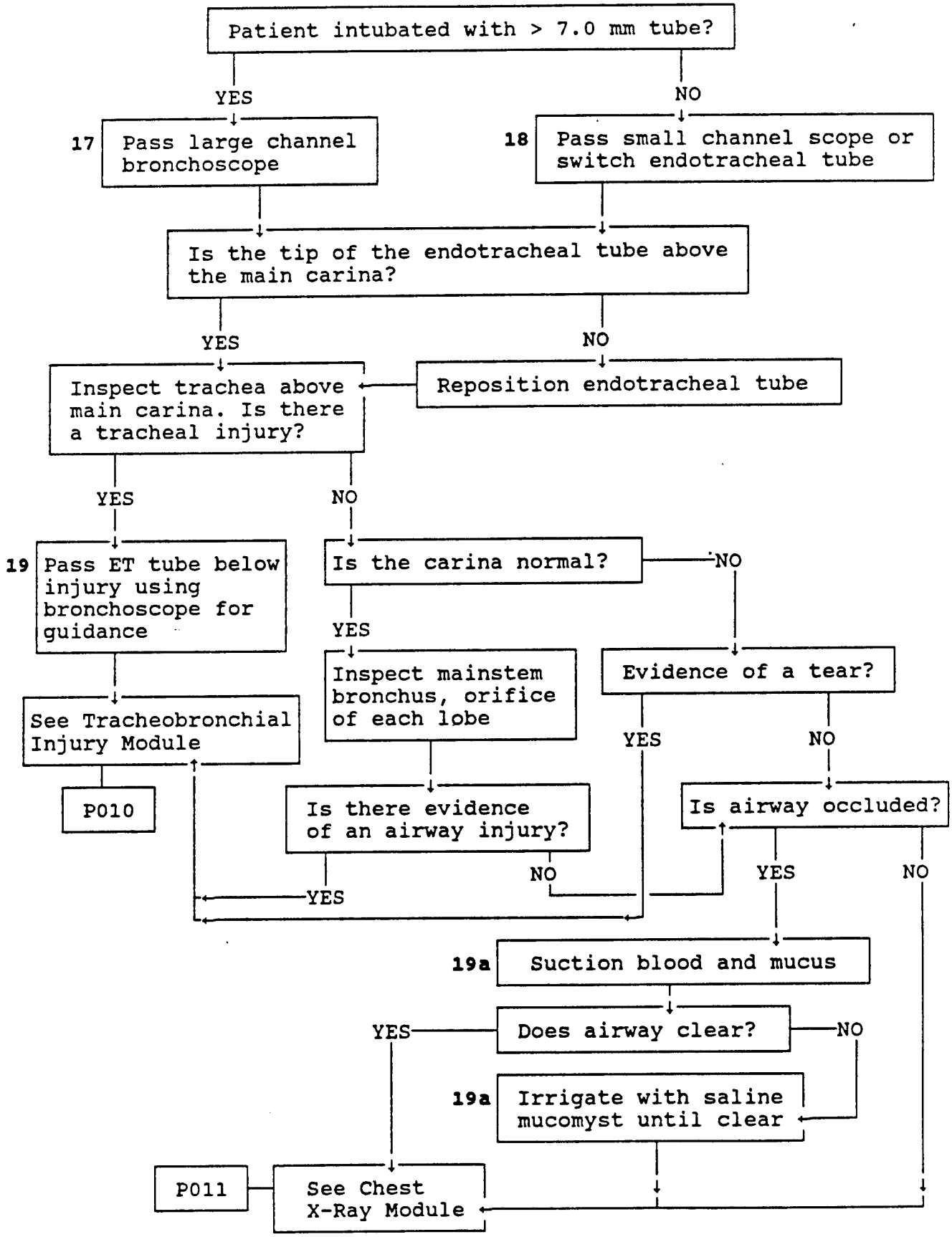
CHEST TUBE DECLOTTING MODULE A



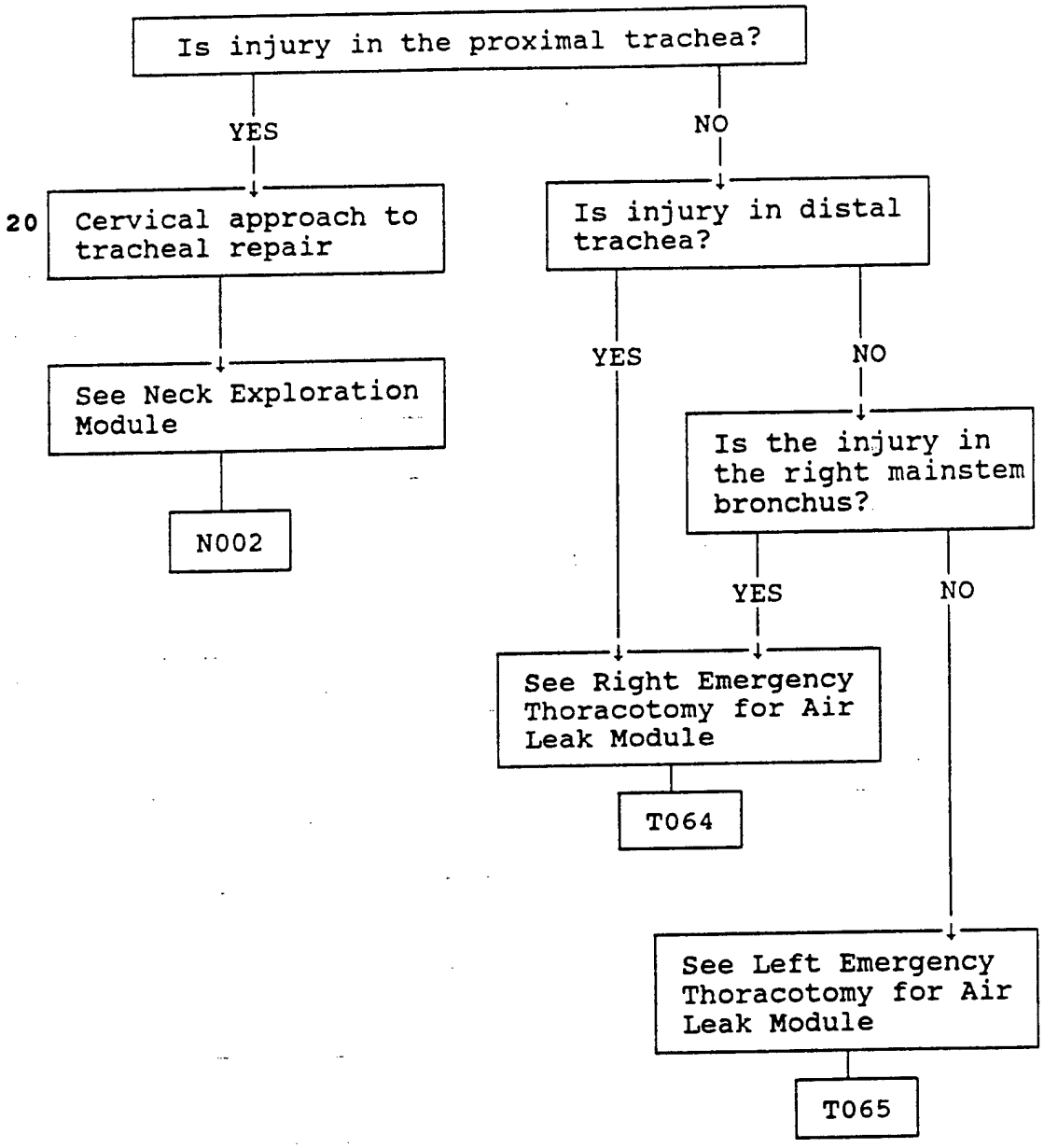
AIR LEAK MODULE



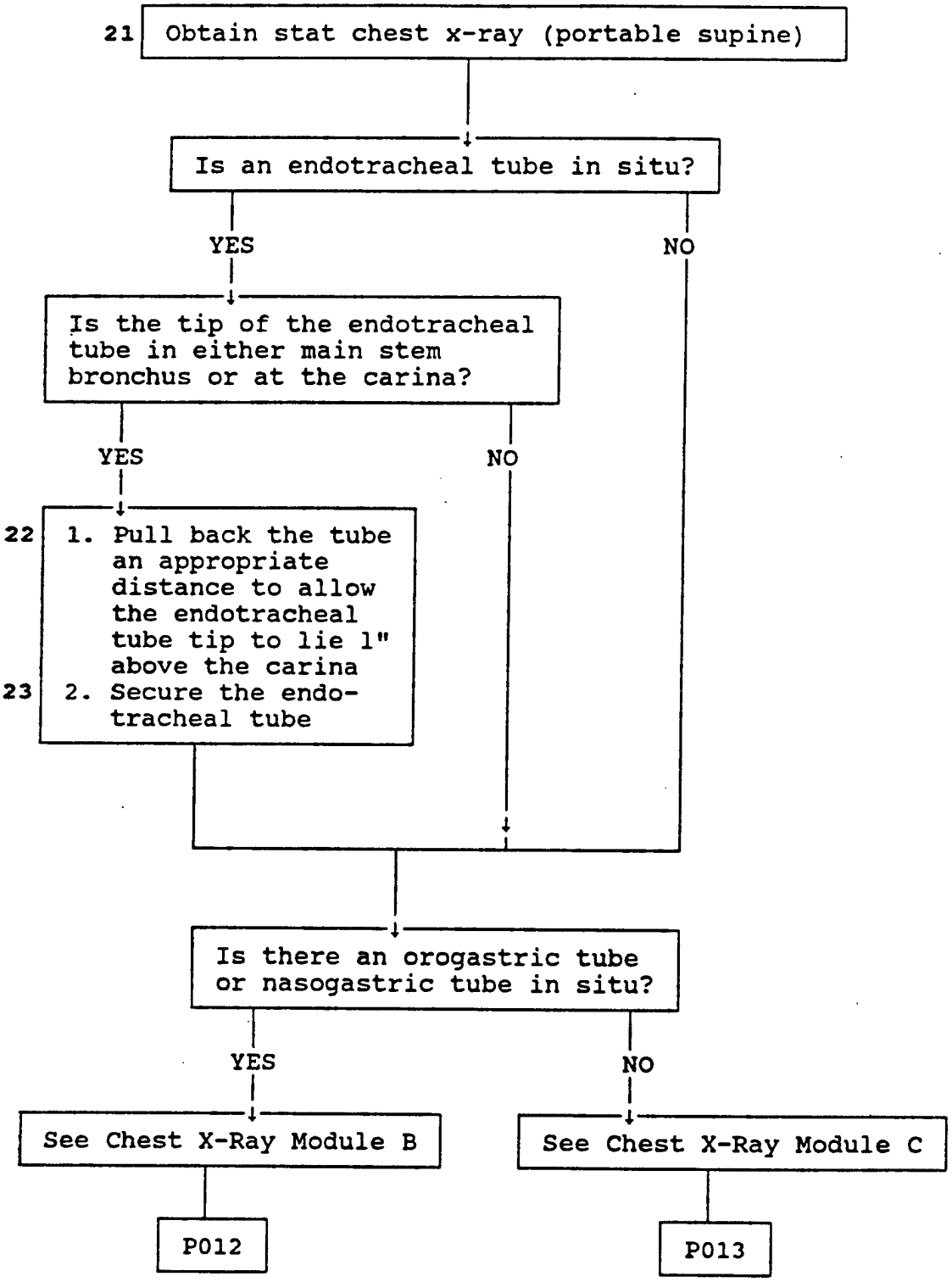
FIBEROPTIC BRONCHOSCOPY MODULE



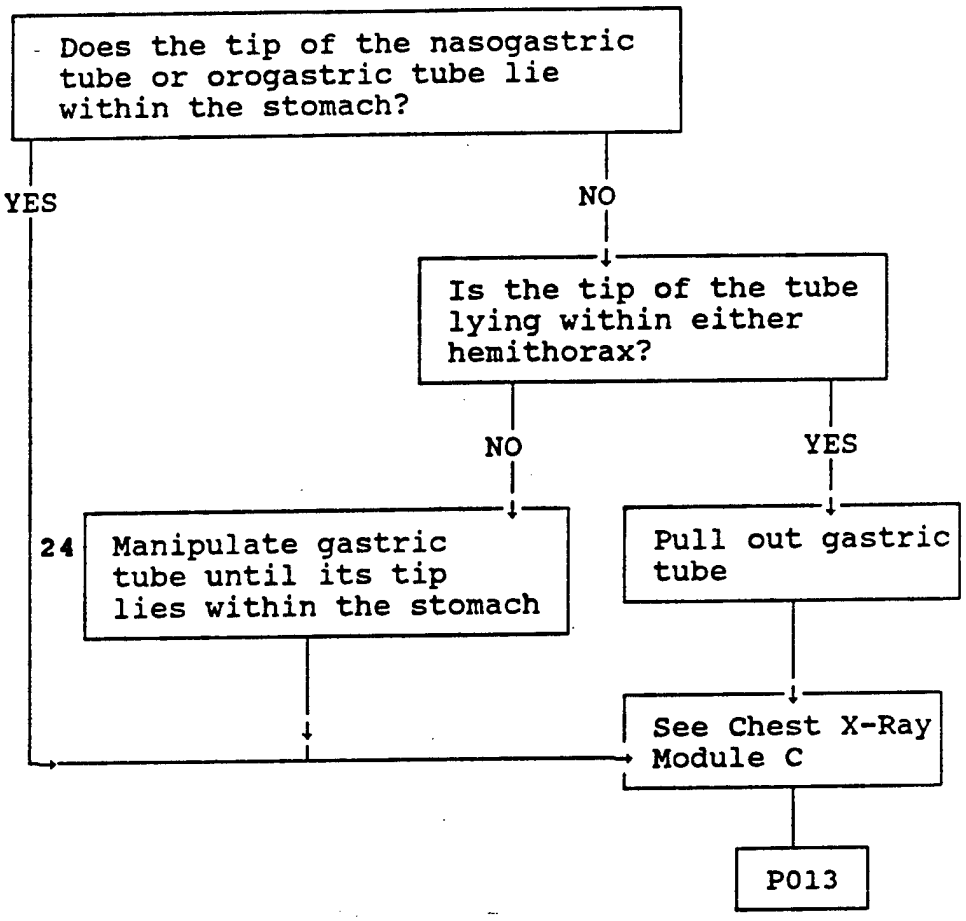
TRACHEOBRONCHIAL INJURY MODULE



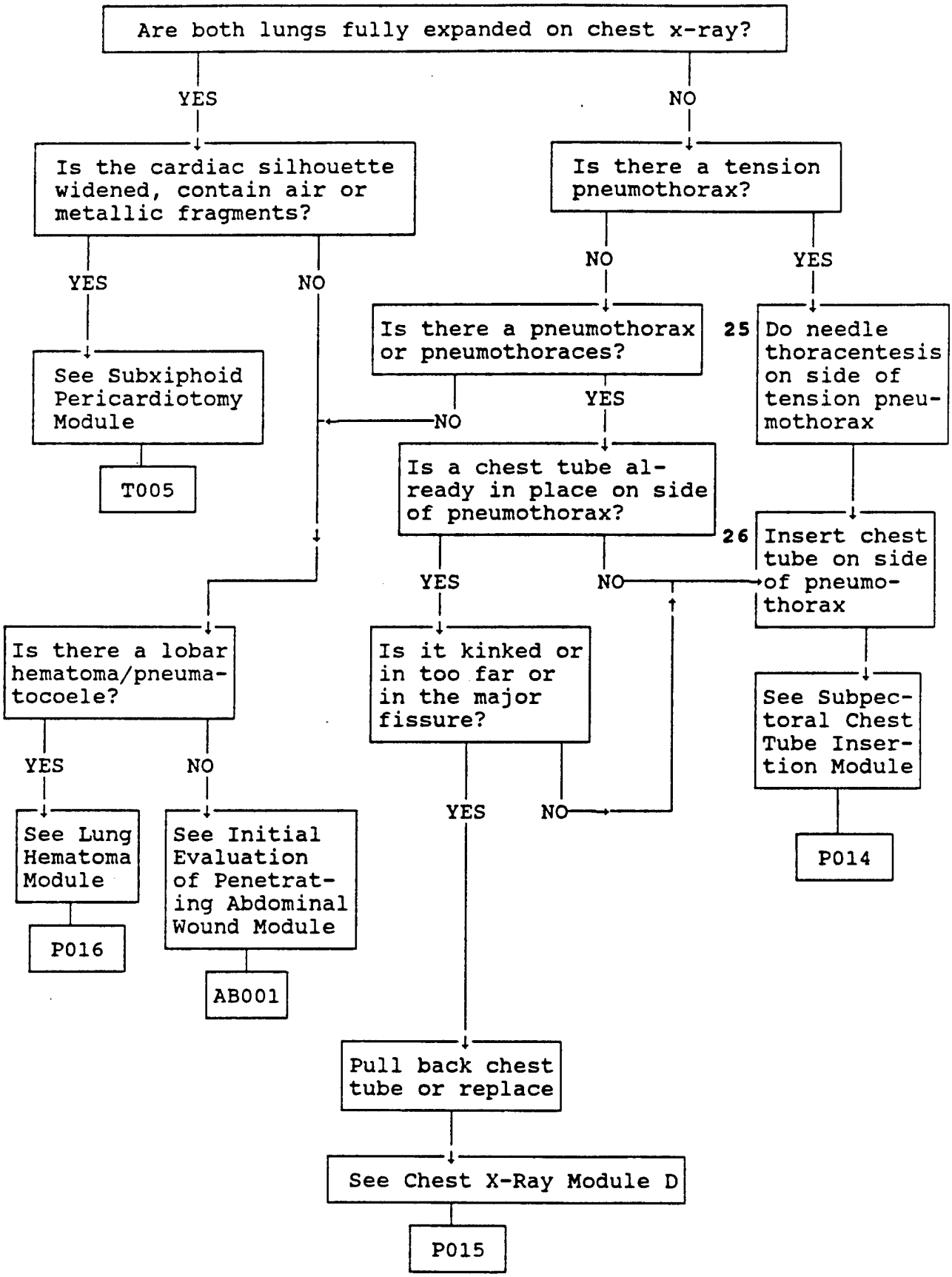
CHEST X-RAY MODULE A



CHEST X-RAY MODULE B



CHEST X-RAY MODULE C



SUBPECTORAL CHEST TUBE INSERTION MODULE

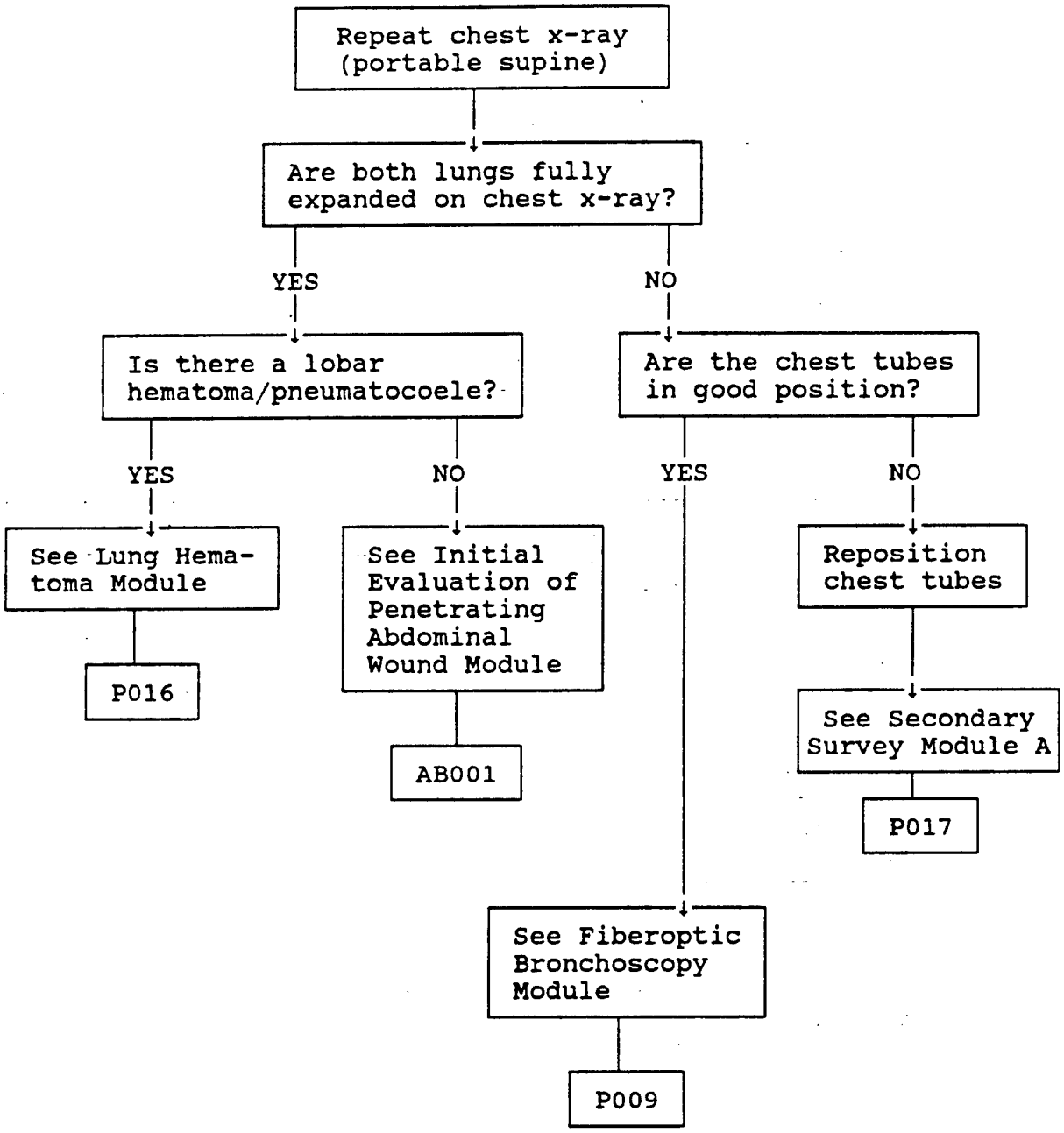
27

1. Sterile prep of chest from nipple line to posterior axillary line
2. Anesthetize skin at anterior-midaxillary line at rib space level with nipple Anesthetize rib space
3. Incise skin for 1 inch
4. Using scissors, cut sharply over the top of rib into the pleural space
5. Insert 36 French chest tube and attach to chest tube drainage system with -20 mm H_2O suction
6. Suture tube in place with 0 silk sutures
7. Apply vaseline and sterile gauze dressing

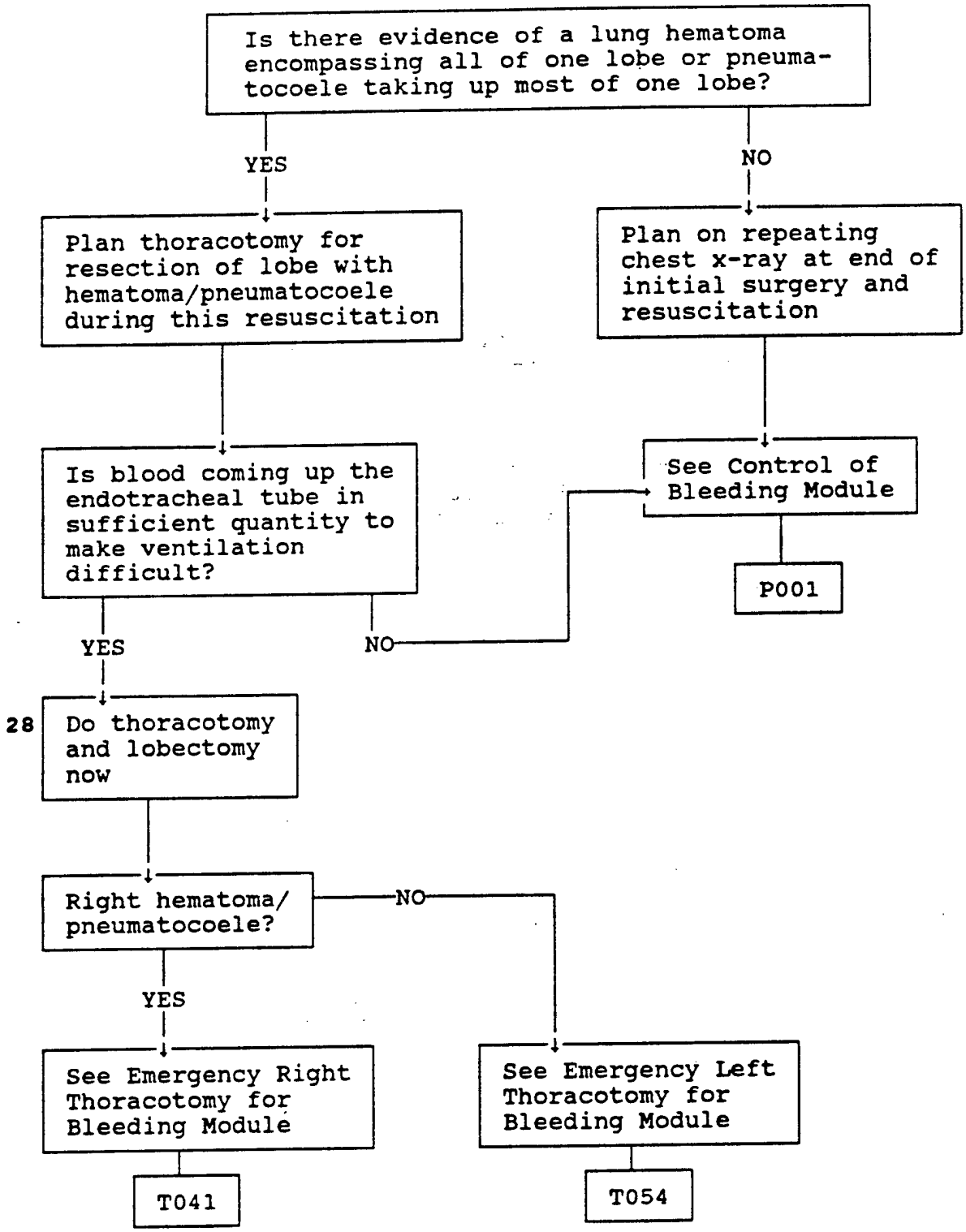
See Chest Tube Evaluation Module

P006

CHEST X-RAY MODULE D



LUNG HEMATOMA MODULE



7
SECONDARY SURVEY MODULES

If all men were just, there would be no need for courage.
[Agesilaus II: In Plutarch's Life of Agesilaus]

A. Overview

One of the major difficulties in dealing with traumatic injuries is becoming focused on specific injuries and overlooking other real or potential problems. After the ABC's have been performed, control of bleeding becomes paramount. At that time, the secondary survey can be performed, which encompasses examining the patient in greater depth, obtaining needed x-rays, and performing other procedures and interventions. In order to have a high level of successful patient outcomes, it is necessary to become quite cyclical in one's approach with a continuous review of the patient's subsystems in order to uncover any injuries that may have been overlooked in the initial evaluation. Only by constant review of the patient's status can excellent results be maintained.

The algorithms here focus initially on major bleeding, then move to the secondary survey with attention paid to stabilization and identification of those problems which are not immediately life-threatening but need to be dealt with expediently and efficiently. From here, many of the algorithms lead to examinations of specific organ subsets as injuries are suspected and/or identified. Ultimately many of those other algorithms lead back again and again to this section in order to help reinforce the cyclical nature of constant patient review. By doing so, it is hoped that all systems will be examined completely, none overlooked, and patient outcomes be assured as best as possible.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
   Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
   He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest.
   Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
   Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

   CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

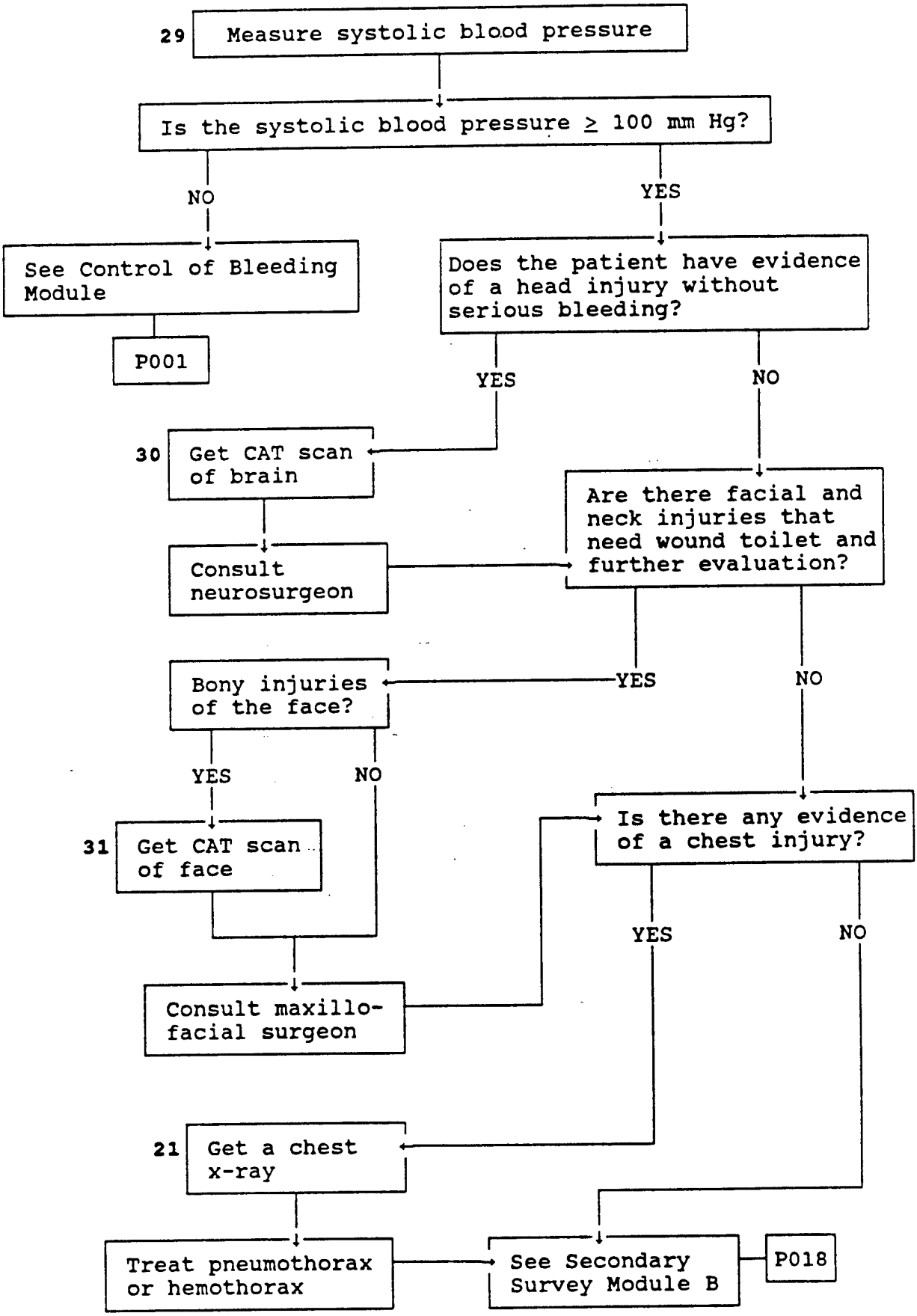
Mail to:
CDR J.M. Linenger, MC, USN
Naval Health Research Center

San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

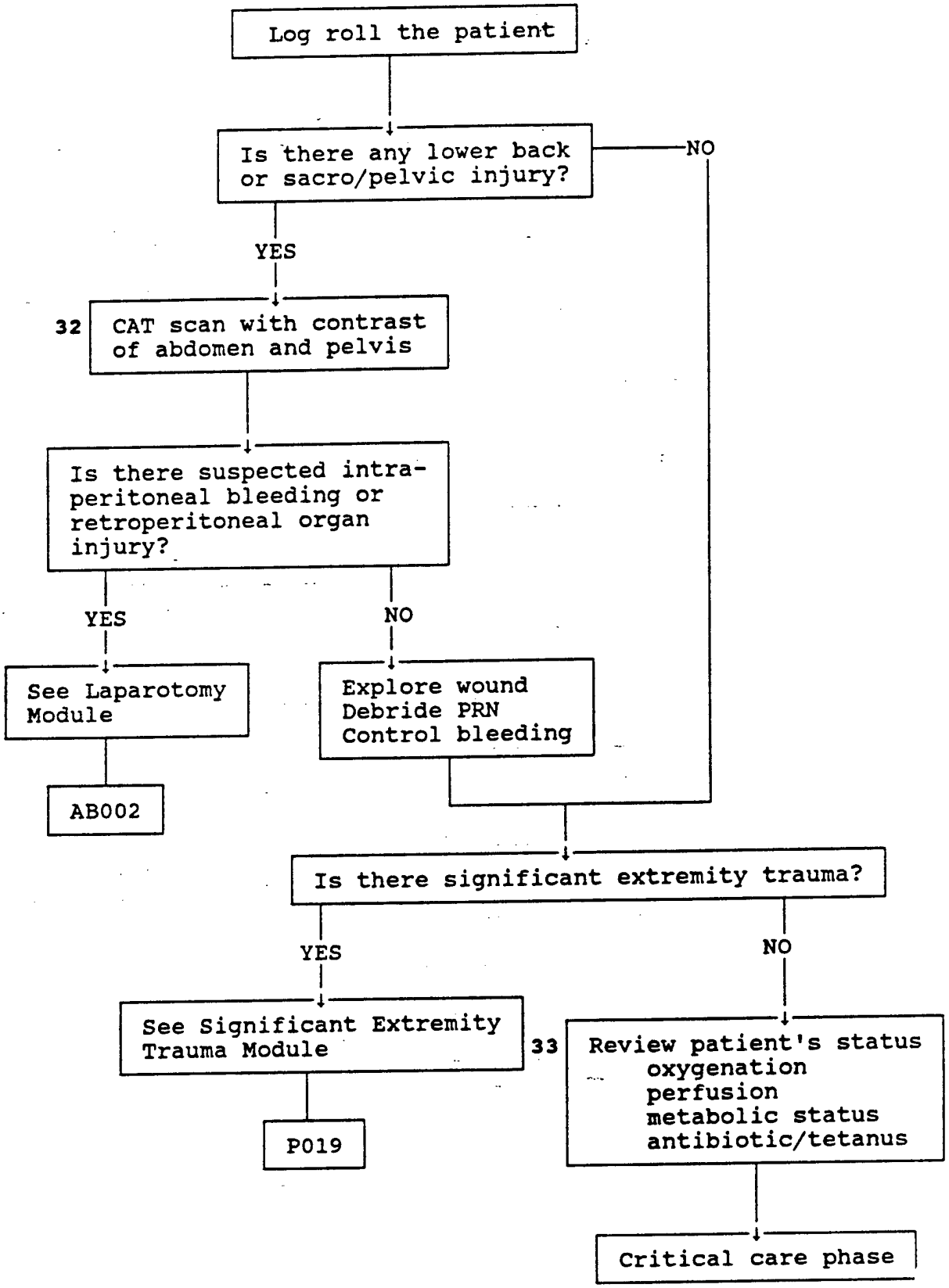
We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

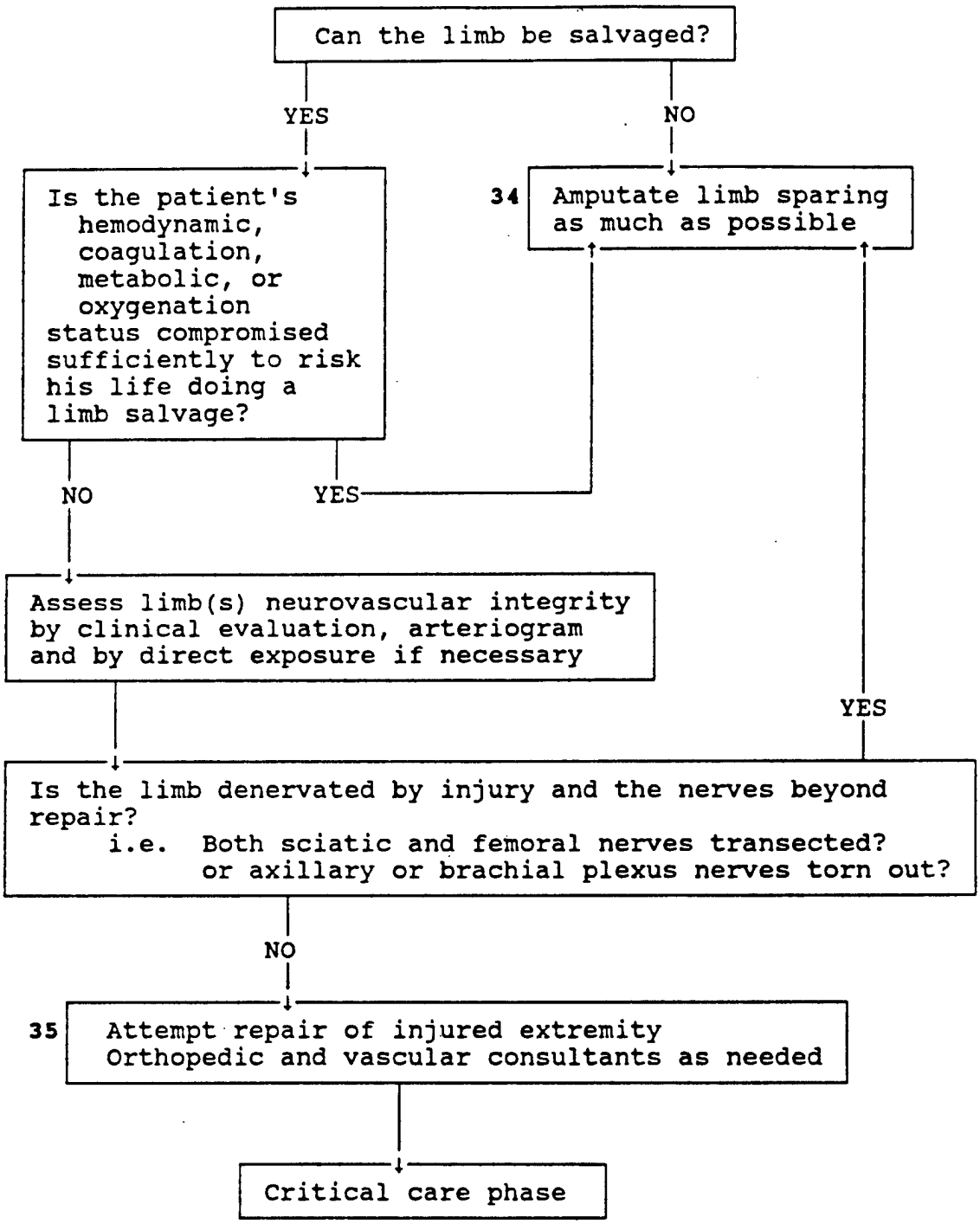
SECONDARY SURVEY MODULE A



SECONDARY SURVEY MODULE B



SIGNIFICANT EXTREMITY TRAUMA MODULE



BRAIN - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES					EQUIPMENT
	A	B	C	D	E	

The staff and equipment listing for brain procedures does not follow the standard pattern since all procedures in modules BR001 - BR008 must be accomplished by a neurosurgeon, except in BR004, where an ophthalmologist might be called upon to enucleate a severely damaged eye. However, the neurosurgeon could perform the procedure in the absence of an ophthalmologist.

BR009 and BR010, which deal with coagulopathy problems, would also involve the neurosurgeon's expertise, even though the procedures of drawing blood and administration of cryoprecipitate, frozen plasma or platelets could be done by other care providers, such as a nurse or corpsman.

Equipment lists are attached.

CRANIOTOMY EQUIPMENT LIST

SUTURE
- CLIP, LIGA MEDIUM - TITANIUM
- CLIP, LIGA SMALL - TITANIUM
- NUROLON 0 MO-7
- PROLENE 3-0 FSL
- VICRYL 4-0 TF

SUPPLIES
- COVER, TABLE
- CUSHION, DONUT 9"
- GOWN, STER BACK LRG
- SHEET, SPLIT
- TOWELS, STERILE (6 PK)
- TRAY, SKIN SCRUB SURGERY

GLOVES
- GLOVES, EXAM LRG UNSTERILE
- GLOVES, TRIFLEX
- GLOVES, ULTRADERM

CAUTERY
- CAUTERY BI POLAR
- CAUTERY MACHINE
- PAD, GROUNDING ADULT
- PENCIL, LECTROSWITCH HANDSWITC

MISCELLANEOUS
- BASIN, MAJOR SET
- BLADE, SURGICAL #10
- BLADE, SURGICAL #15
- CLIP, RANEY
- DURA HOOKS, (FISH HOOKS)
- NEEDLE, SPINAL 22 GA X 3 1/2
- RAZOR, PREP DISP
- SYRINGE, 30CC LL

SPONGES
- PATTIES, SURGICAL 1/2 X 1/2
- PATTIES, SURGICAL 1/2 X 1 1/2
- PATTIES, SURGICAL 1 X 3
- SPONGE, GAUZE X-RAY DETECT

SUCTION
- RECEPTAL LINER 3000CC
- TUBE, CONNECTING 20 FT

SOLUTIONS
- SOLUTION, IRRIG NACL 1000

INSTRUMENTS & EQUIPMENT
- CRANIOTOME
- CURRETTES, NEURO
- MAYFIELD HEADREST
- NEURO INSTRUMENT SET

DRAINS
- DRAIN, FLAT BLAKE 7MM FUL FLUTE
- DRAIN, JVAC BULB RESERVOIR

DRESSINGS
- DRESSING, KLING 3"
- DRESSING, GAUZE 4 X 8 12 PLY
- DRESSING, SOFBAND 4" X 5YD

CRANIUM ACCESS SET

VENTRICULAR NEEDLES W/OBTURATORS
GLASS TIP SYRINGE (PROTECT)
METAL BRAIN SPOON
METAL BRAIN RETR 1-5 VARIBLE 5
TEFLON COATED RETR 1-5 VARI

9
NECK AND FACE

The goal of war is peace; of business, leisure.
[Aristotle: Politics IV

A. Overview

Facial and neck injuries are frequently bloody due to the vascularity of the region. However, not all are immediately life threatening. Airway and esophageal injuries are rarer but serious if not diagnosed and treated.

The modules present a straightforward approach to facial and neck bleeding, and cover neck exploration and the thought process involved in the need for emergency neck surgery. The major emphasis is on bleeding, since this is the most frequent problem with penetrating trauma in these areas. Appropriate attention to face and neck injuries may prevent serious neurologic impairment and morbidity.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
   Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
   He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he

was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest. Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

Mail to:

CDR J.M. Linenger, MC, USN
Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

NECK AND FACE - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Debride wound and close primarily or apply sterile dressing	2*	3				Scalpel; blade; clamps; irrigating normal saline solution; suture; dressing; needle holder; tape
2. Neck exploration	2*	3				Scalpel; blade; clamps; irrigating normal saline solution; suture; dressing; needle holder; tape
3. Metal clip for identification	2*	3				Metal clip
4. Gain proximal arterial control	2*	3				Clamps; suture; needle holder
5. Median sternotomy or trap door incision	2*	3				Median sternotomy list
6. Place arterial shunt	2*	3				Median sternotomy list
7. Harvest sapheneous vein and do interposition graft	2*	3				Median sternotomy list; Saphenous Vein Harvest list
8. Do interposition graft with Gortex	2*	3				Median sternotomy list
9. Primary repair of jugular vein with vascular suture	2*	3				Suture; needle holder; scalpel; blade; clamps
10. Ligate thyroid bleeders and debride nonviable tissue	2*	3				Suture; needle holder; scalpel; blade; clamps
11. Monitor patient for hypocalcemia			3	3	1*	Syringe; laboratory capability
12. Close pharyngeal wound	2*	3				Scalpel; blade; clamps; suture; needle holder
13. Oversew distal esophagus	2*	3				Scalpel; blade; clamps; suture; needle holder
14. Perform wide drainage from esophageal or pharyngeal wound to skin	2*	3				Scalpel; blade; clamps; suture; needle holder; penrose dreain

********** **Explanation of Specialty Codes and Care Descriptors** **********

In all cases, through point 21, a general surgeon with extensive training could be considered optimal but a thoracic surgeon or ear/nose/throat surgeon is preferred. Point 22 and 23 could be handled by a general surgeon or trauma surgeon optimally.

In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks. Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

15. Perform feeding enterostomy	2*	3				Feeding catheter; suture; clamps; scalpel blade; needle holder; irrigating solution
16. Perform esophagostomy or pharyngostomy	2*	3				Sternal saw
17. Tracheostomy	2*	3				#15, #11 knife blade/handle; scalpel; scissors; Bovie/needle tip; tracheostomy tube or wire-wound endotube
18. Repair larynx injury with monofilament suture	2*	3				Scalpel; blade; clamps; needle holder; monofilament suture
19. Repair trachea with monofilament suture	2*	3				Scalpel; blade; clamps; needle holder; monofilament suture
20. Resect. 1-2 rings of trachea as needed	2*	3				Scalpel; blade; clamps; needle holder; monofilament suture
21. Secure airway with tube thru severed end of trachea	2*	3				Suture; airway tube; needle holder; tape
22. All procedures-external bleeding from facial or scalp wounds	3	3	1*	1*	1*	Sterile gauze; hemostats; 4 x 4's; sutures; vaseline gauze
23. All procedures-Initial management of tongue injury	3	3	1*	1*	1*	Lidocaine; epinephrine; 18 gauge & 25 gauge needle; syringe; suture;needle holder; light source

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

EXTRA LONG INSTRUMENTS

CONTENTS

EXTRA LONG NEEDLE HOLDER
EXTRA LONG FINE NEEDLE HOLDER
EXTRA LONG CURVES
REGULAR RUMEL
MEEKERS
BRIDGE FORCEPS
EXTRA LONG ALLISES
EXTRA LONG RUSSIAN
EXTRA LONG THUMB WITHOUT TEETH
LONG BABCOCKS
EXTRA LONG METZ

MEDIANSTERNOTOMY EQUIPMENT LIST

SUTURE

MAXON 2-0 T-25
MAXON 3-0 t-25
SILK 3-0 SH
SILK 2-0 SH
SILK 3-0 STRAND
SILK 2-0 STRAND
STAPLE LOADING UNIT SM-35W

SUPPLIES

BASIN, MAJOR SET
GOWN, STER BACK LRG
GOWN, STER BACK XLRG
SHEET, LAB
SHEET, MEDIUM
TABLE COVER
TRAY, SKIN SCRUB

GLOVES

GLOVES, EXAM LRG UNSTERILE
GLOVES, TRIFLEX

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITCH

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #21
BONE WAX W-31G
DACRON TAPE 8618-00
DURA HOOKS, (FISH HOOKS)
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT
NEEDLE, SPINAL 22 GA X 3 1/2
SYRINGE, 30CC LL
SYRINGE, BULB

SPONGES

SPONGE, 18 X 18 LAP
SPONGE, GAUZE X-RAY DETECT
SPONGE, KITTNER DIECTORS

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

INSTRUMENTS & EQUIPMENT

CARDIOVASCULAR TRAY
CHEST SET
EX. LONG INSTRUMENTS
HEADLIGHT
LAP SET
N H, EX LONG
RET, HIMMELSTEIN
RETR, MOARSE
SARNS SAW
SCISSOR, LONG FINE METZ
TRAUMA CHEST TRAY

DRAINS

CHEST TUBE 32FR THORACIC
CHEST TUBE 36FR THORCIC
PLEUROVAC, ADULT

DRESSINGS

DRESSING, GAUZE 4X8 12 PLY
DRESSING, TELFA

VASCULAR

FELT 3 X 3
SUTURE BOOTS
VESSEL LOOPS, MAXI
VESSEL LOOPS, MINI

NECK AND FACE EQUIPMENT LIST

SUTURE

CHROMIC, 3-0 REEL
SILK 2-0 STRAND
SILK 3-0 SH
SILK 3-0 STRAND
STAPLE, LOADING UNIT SM-35W

SUPPLIES

COVER, MAYO STAND
COVER, TABLE
GOWN, STER BACK LRG
GOWN, STER BACK XLRG
SHEET, THYROID
TOWELS, STERILE (6 PK)
TRAY, SKIN SCRUB

GLOVES

GLOVES, EXAM LRG UNSTERILE
GLOVES TRIPLEX

CAUTERY

PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITC
CAUTERY MACHINE

MISCELLANEOUS

BASIN, MAJOR SET
NERVE STIMULATOR, VARISTIM III
RAZOR, PREP DISP
SYRINGE, 30CC LL
SYRINGE, IRRIGATION-BULB ASEPTO

SPONGES

SPONGE, GAUZE X-RAY DETECT
SPONGE, LAP 12*12
SPONGES, KITTNER DISECTORS

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT
YANKAUER, SUCT. DISP INSTR.

SOLUTION

SOLUTION, IRRIG NACL 1000
SOLUTION, IRRIG WATER 1500ML

INSTRUMENTS & EQUIPMENT

CARDIO VASCULAR TRAY
CAROTID/RADICAL NECK SET
HEADLIGHT
MINOR SET

DRAINS

DRAIN, HEMOVAC MEDIUM KIT

DRESSINGS

DRESSING, TELFA
DRESSING, GAUZE 4x8 12 PLY

SAPHENOUS VEIN HARVEST EQUIPMENT LIST

SUTURE

SILK 4-0 STRAND
SILK 2-0 STRAND
PROLENE 5-0 RB-Z
VICRYL 2-0 CT
VICRYL 3-0 CT
VICRYL 4-0 FS-Z

DRAPES & SUPPLIES

DRAPE, SPLIT SHEET
MEDIUM, SHEET 44 X 60"
MAYO STAND COVER
BASIN SET W/GRADUATE & MED CUP
4 X 4 X-RAY DETECT
SAPHENOUS VEIN CANNULA
GOWN, SURGEON'S XTR. LRG. (2)
GLOVES, SURGEON'S. ASSORT. SIZES
SYRINGE, 30 CC L.L.
CAUTERY, HANDSWITCH PENCIL
PAD, GROUND ADULT
0.9% NACL 500 CC
BAG-O-JET TRANSFER UNIT
BLADE, SURGICAL #10 (2)
SYRINGE, 10 CC W/ 21 GA 1 1/2"
NEEDLE

INSTRUMENTS

TRAUMA TRAY
CAUTERY MACHINE

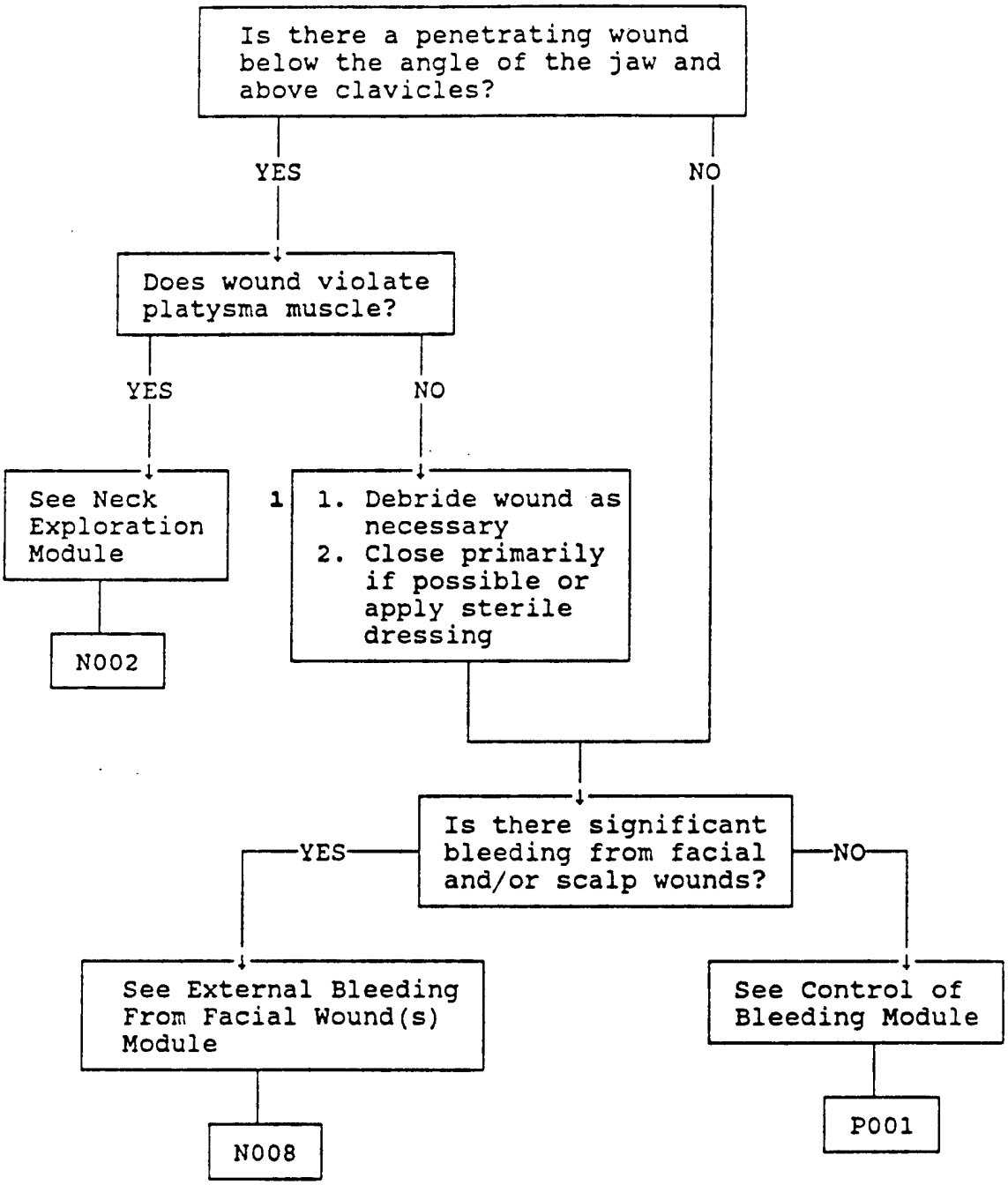
DRUGS

HEPARIN 10,000 U
BACITRACIN 50,000 U

DRESSINGS

TELFA
ELASTIC BANDAGE 4" & 6"

PENETRATING NECK WOUND INJURY MODULE



NECK EXPLORATION MODULE

2
1. Prep entire neck and chest and groins
2. Administer first generation cephalosporin
3. Place NG tube to help identify esophagus
4. Anterior sternocleidomastoid incision
5. Perform careful exploration

BLOCK 1

Is major artery in neck (carotid, subclavian, or vertebral artery) injured?

YES → See Arterial Injury of Neck Module → N003

NO

BLOCK 2

Is jugular or facial vein injured?

YES → See Major Neck Vein Injury Module → N004

NO

BLOCK 3

Are other small or unnamed arteries or veins injured?

YES → Ligate

NO

BLOCK 4

Is thyroid injured?

YES → See Thyroid Injury Module → N005

NO

BLOCK 5

Is pharynx or esophagus injured?

YES → See Pharynx or Esophagus Injury Module → N006

NO

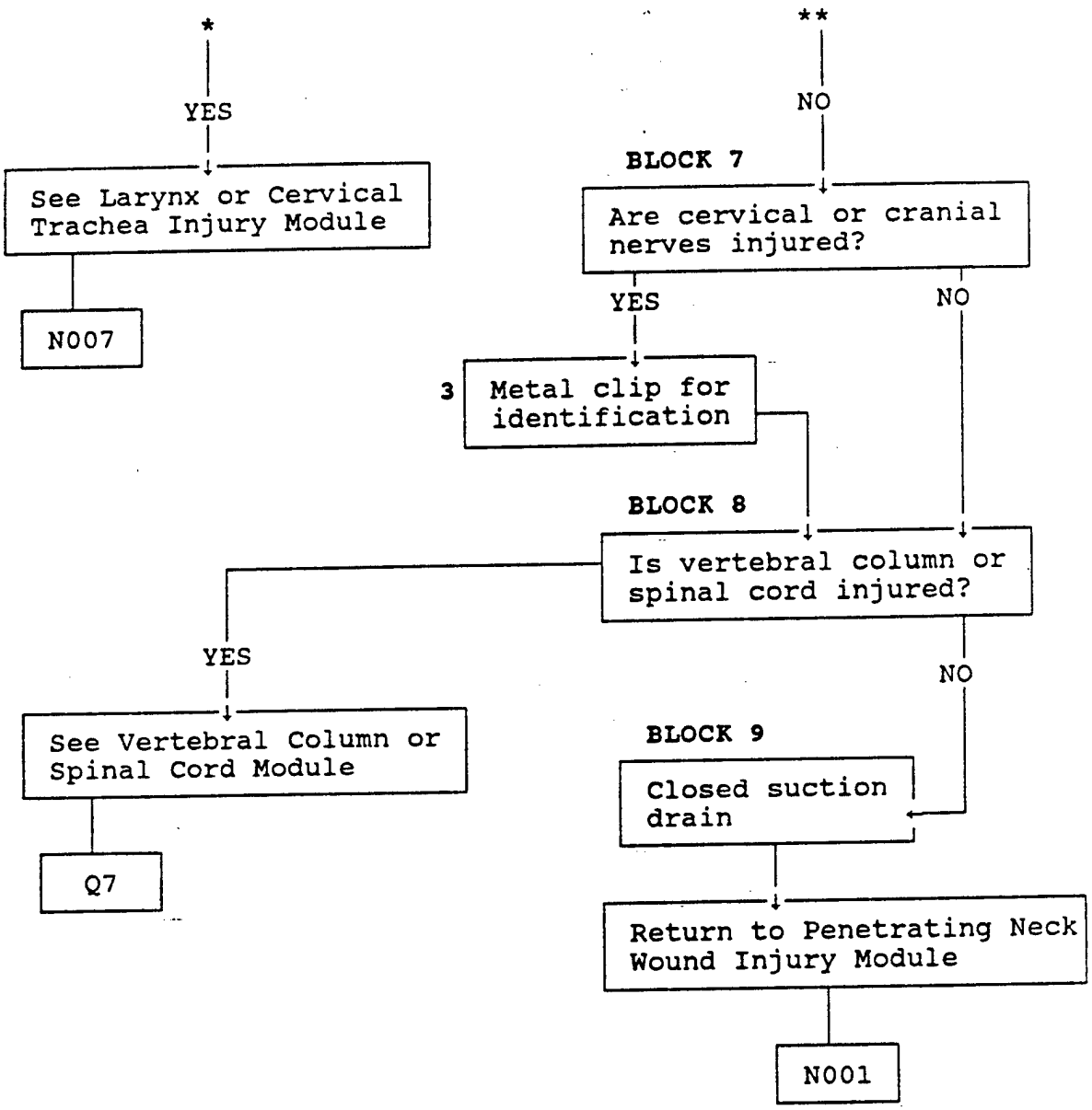
BLOCK 6

Is larynx or trachea injured?

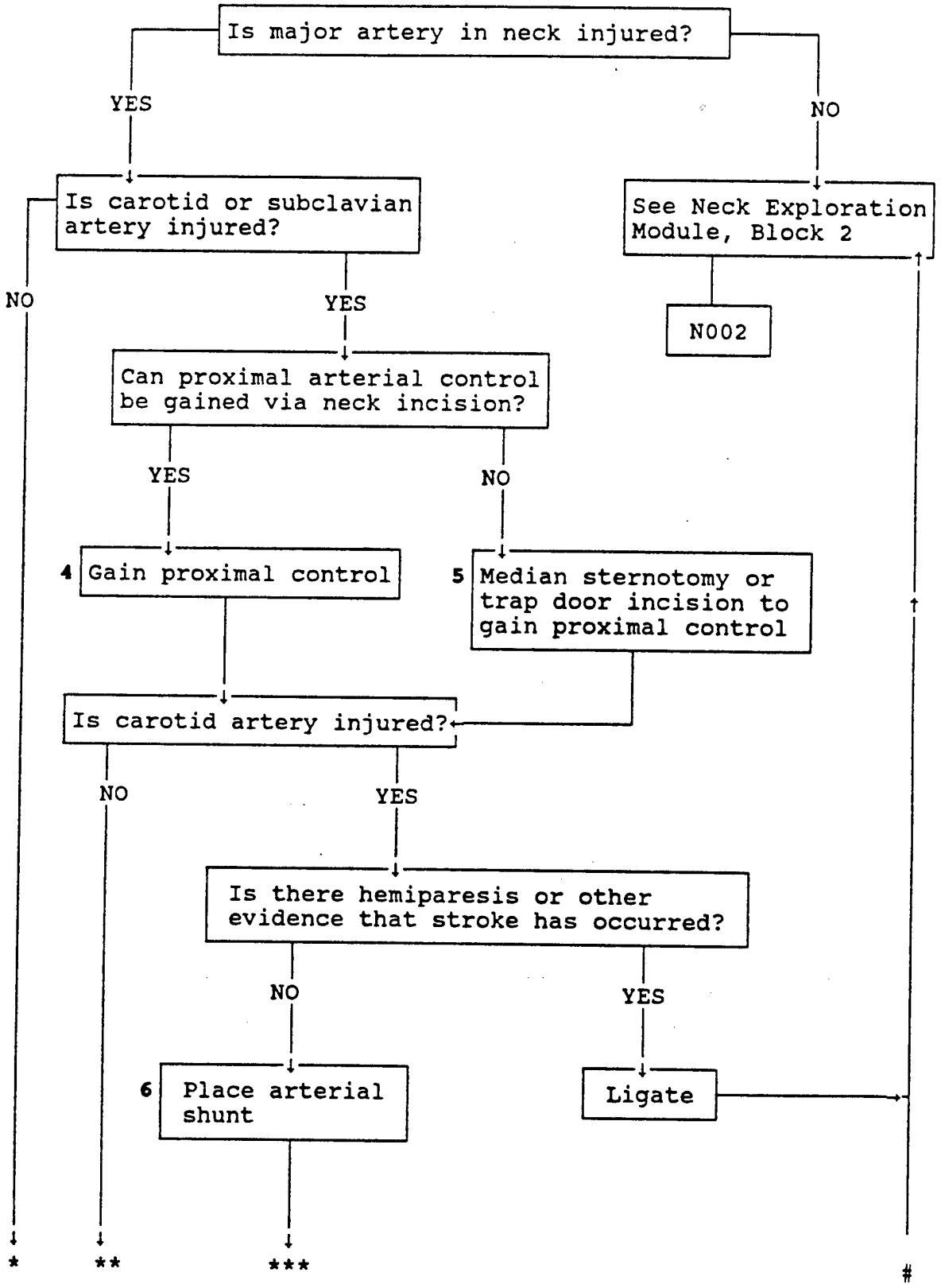
YES → *

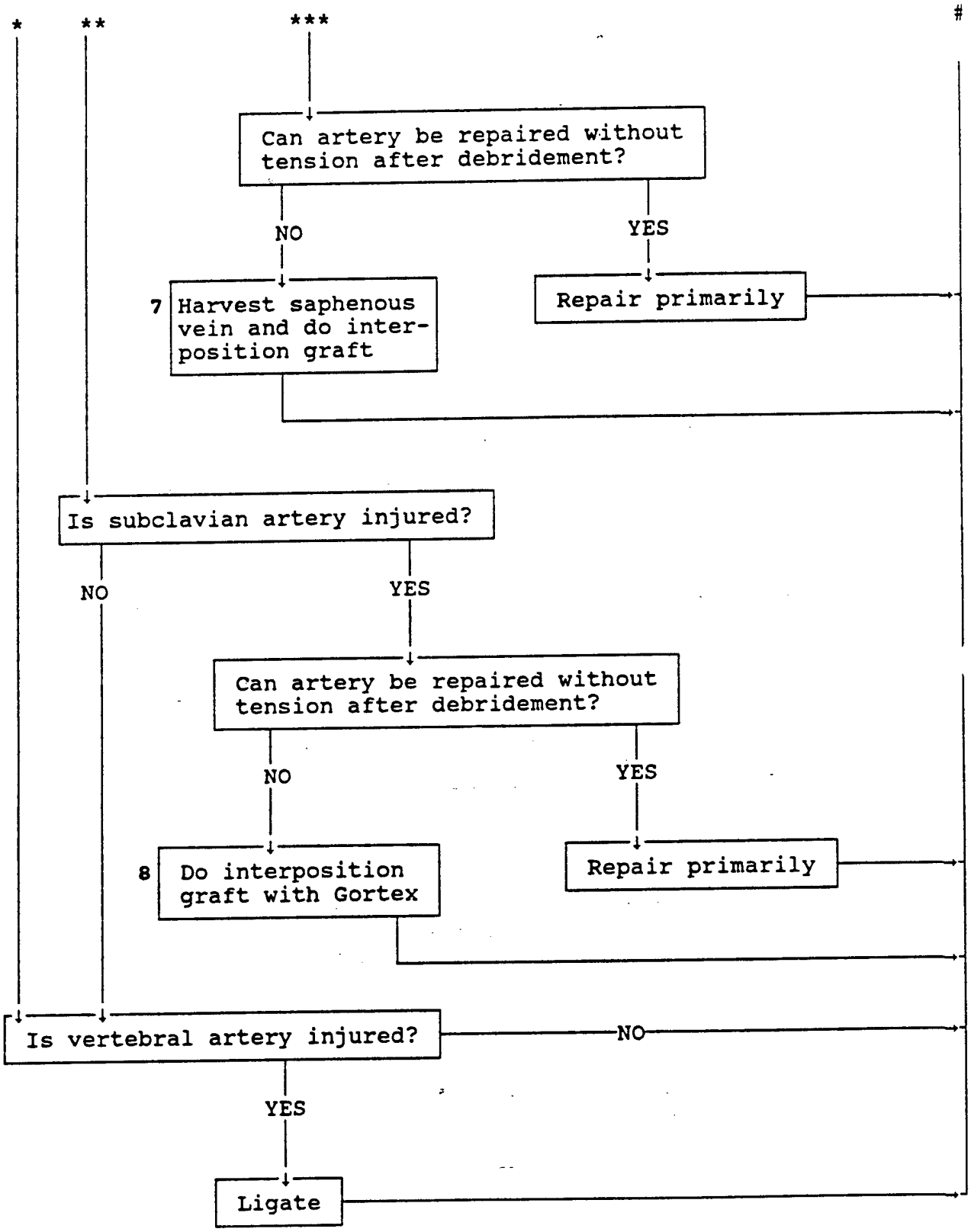
NO → **

NECK EXPLORATION MODULE (cont'd.)

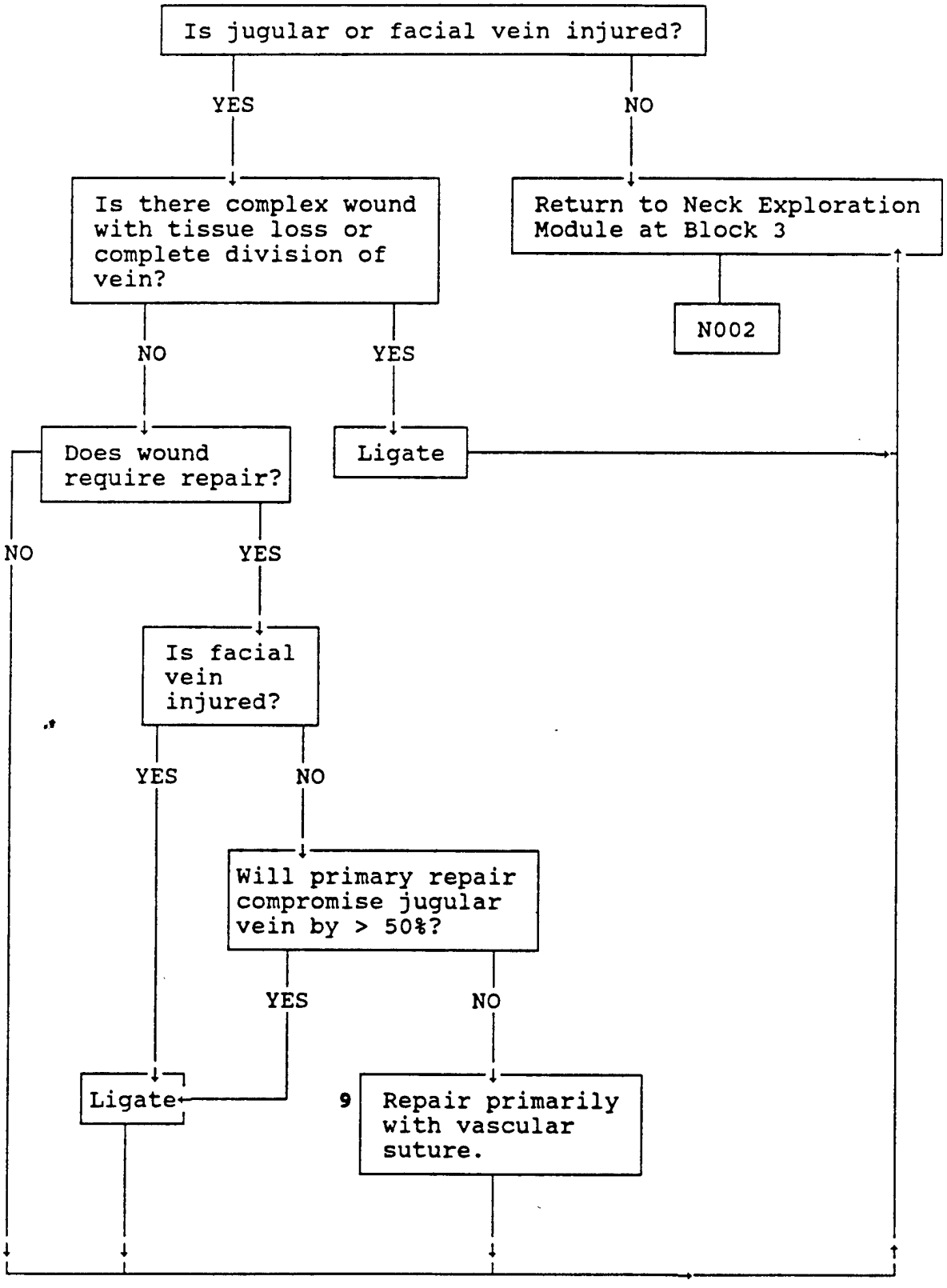


ARTERIAL INJURY OF NECK MODULE

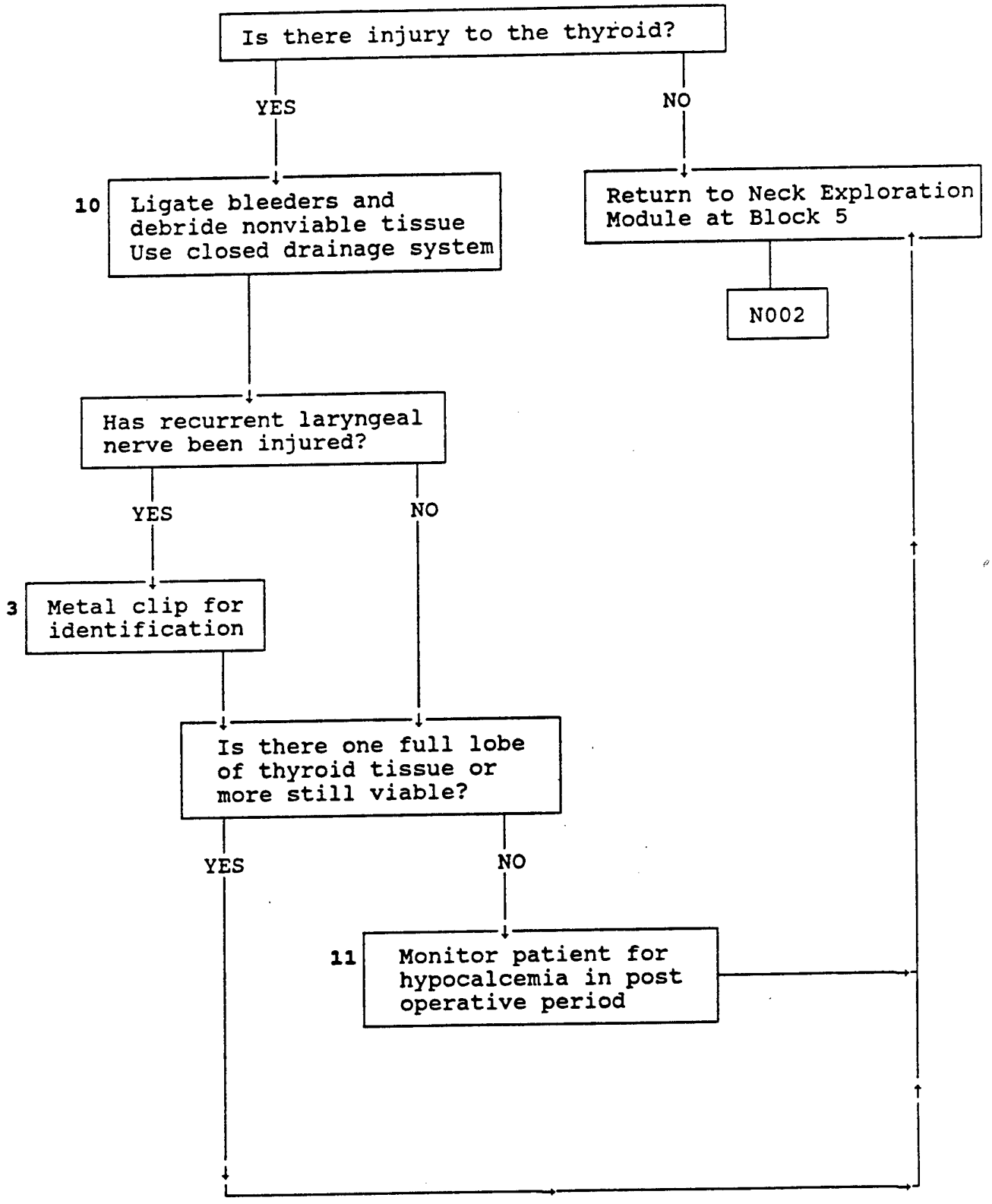



*
**
***
#
Can artery be repaired without tension after debridement?
NO
YES
7 Harvest saphenous vein and do interposition graft
Repair primarily
Is subclavian artery injured?
NO
YES
Can artery be repaired without tension after debridement?
NO
YES
8 Do interposition graft with Gortex
Repair primarily
Is vertebral artery injured?
NO
YES
Ligate

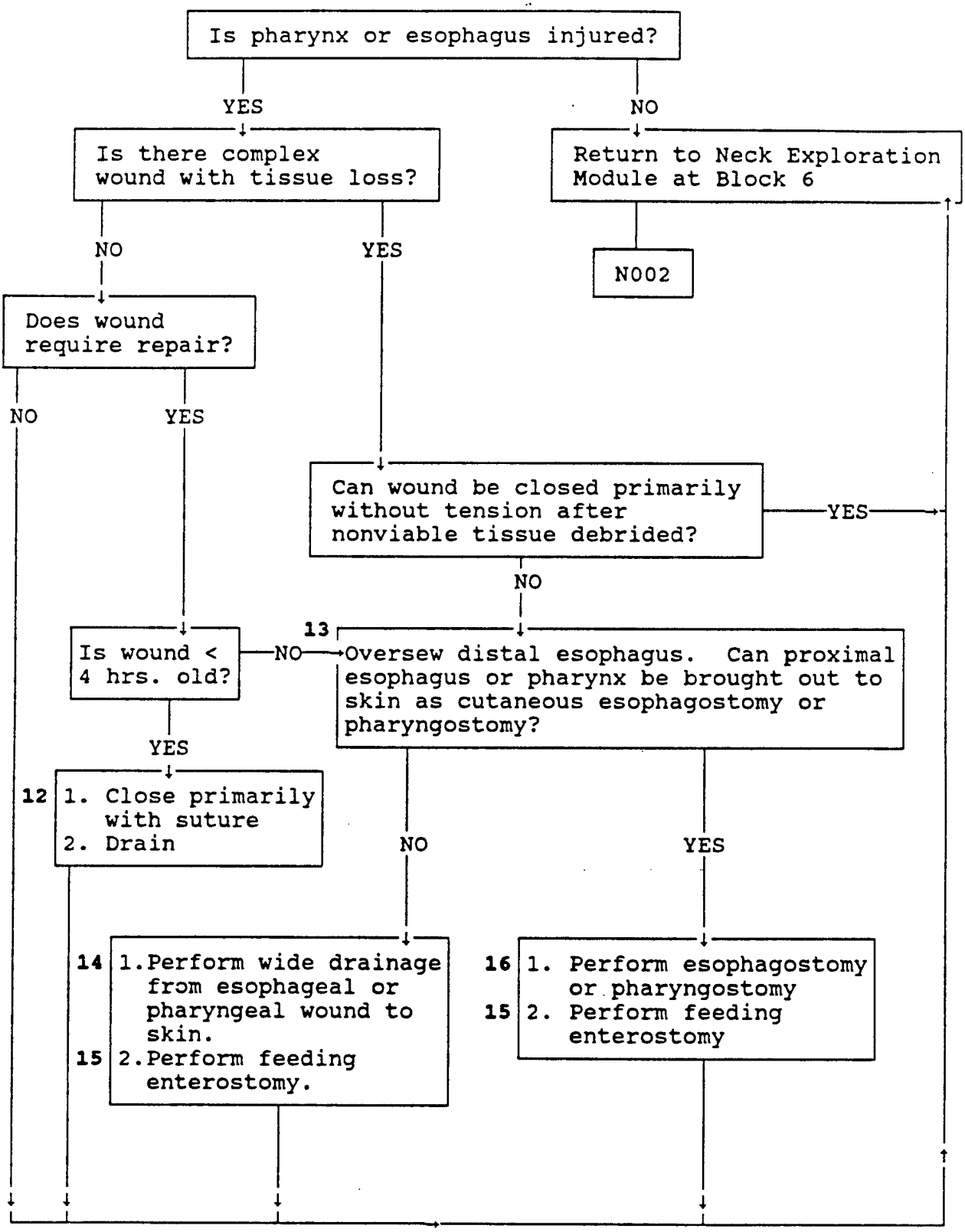
MAJOR NECK VEIN INJURY MODULE



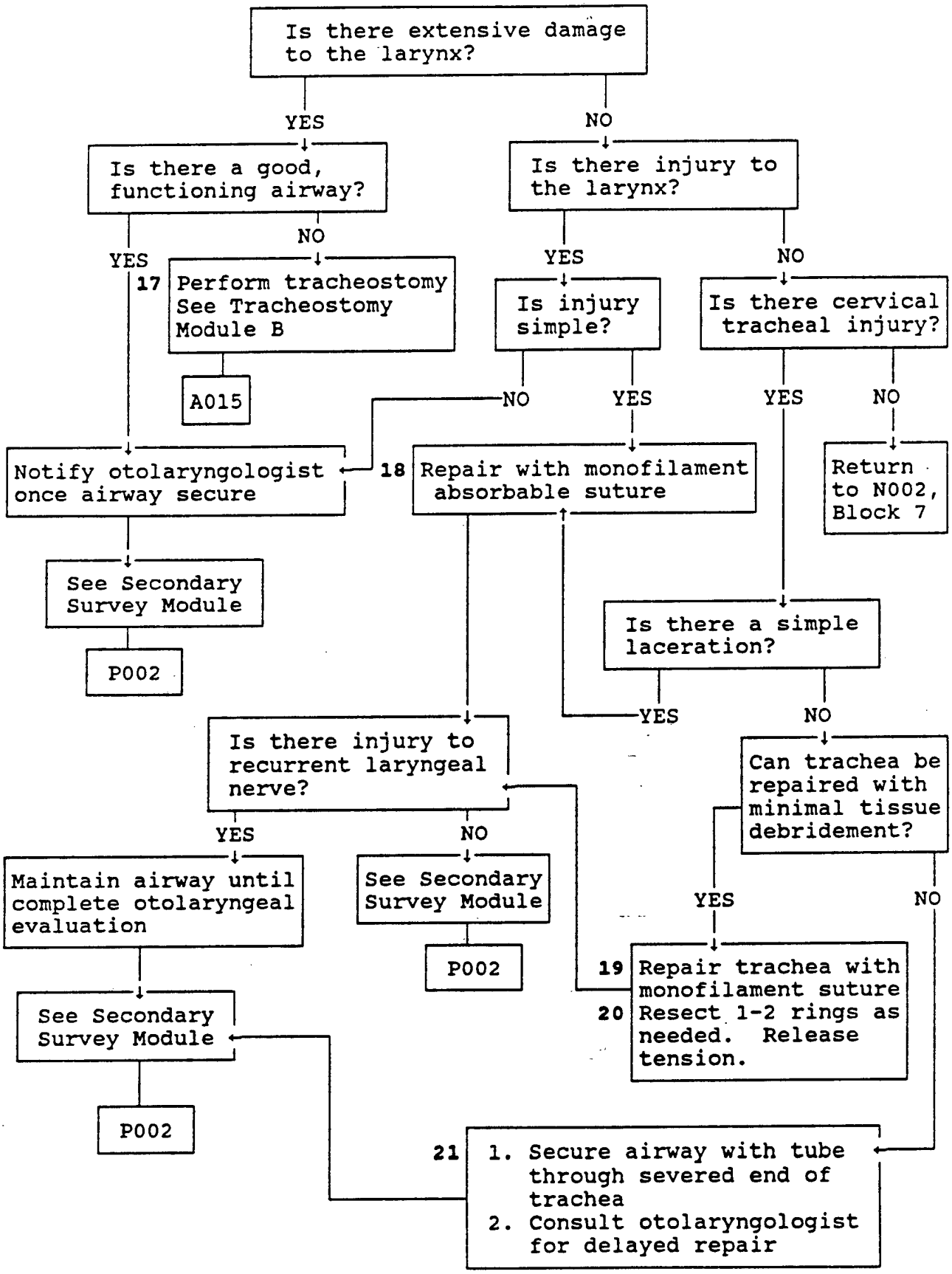
THYROID INJURY MODULE



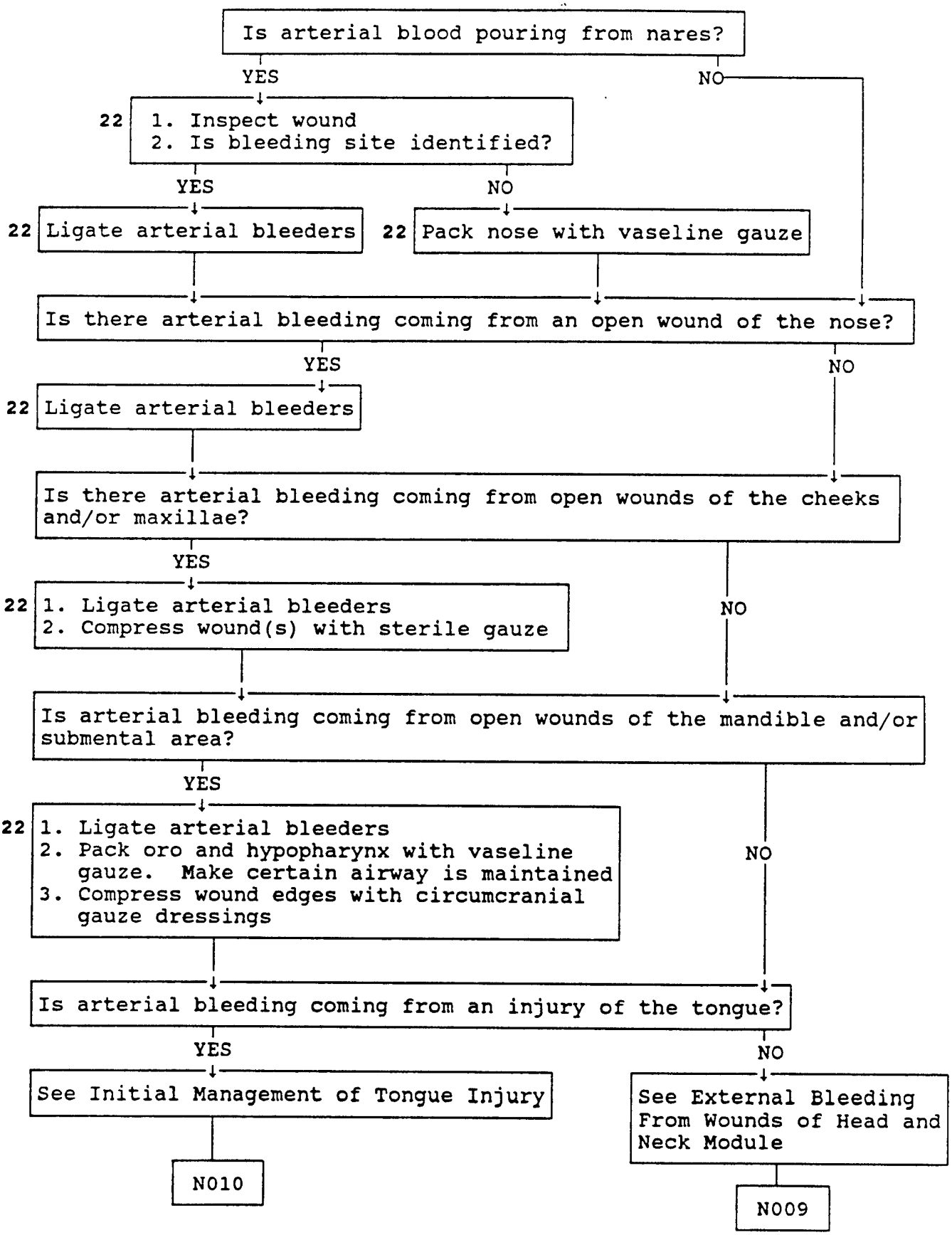
PHARYNX OR ESOPHAGUS INJURY MODULE



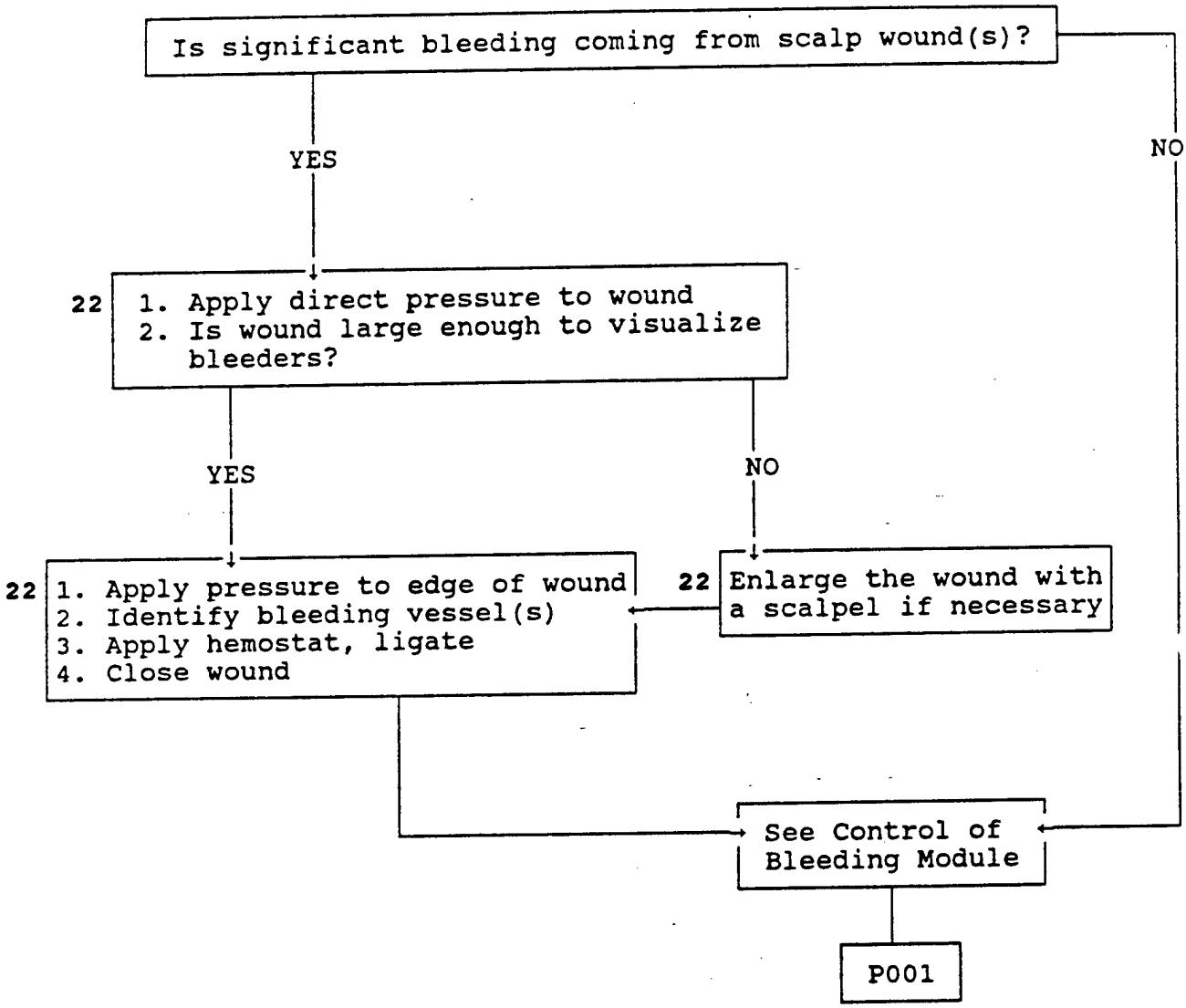
LARYNX OR CERVICAL TRACHEA INJURY MODULE



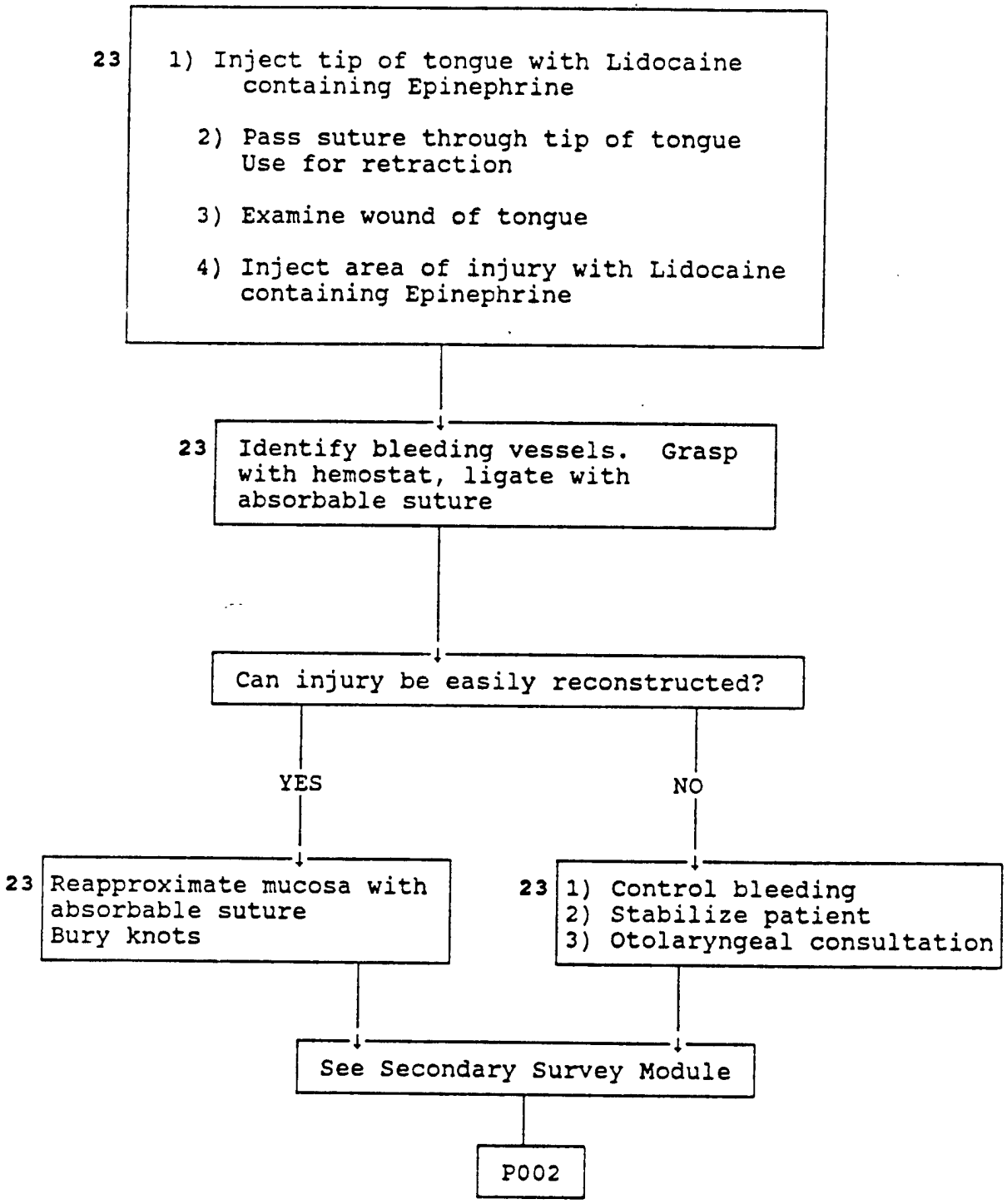
EXTERNAL BLEEDING FROM FACIAL WOUND(S) MODULE



EXTERNAL BLEEDING FROM WOUNDS OF HEAD AND NECK MODULE



INITIAL MANAGEMENT OF TONGUE INJURY MODULE



appreciate your contributions. Thank you.

C. Decision Trees

. . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

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6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

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8. Your name, unit, overseas address, permanent address and phone number (not required).

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We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly

8
BRAIN INJURY

He threatens many who injures one.
[Publilius Syrius: Maxims]

A. Overview

Neurologic injury is potentially the most devastating of major traumatic events. Surgical intervention into traumatic brain injury involves controlling major bleeding and salvaging as much viable neurologic tissue as possible. Since bleeding into the relatively closed cranium can itself lead to compression injury of brain substance, identification of injuries which may result in major intracranial vascular disruption needs to be done quickly and expeditiously.

Knowledge of cranial and brain anatomy is required to appropriately choose the incisions and approaches requested in these modules. Controlling bleeding and debriding bone and devitalized brain constitute the majority of the material here. Closure of the wounds, with particular attention to fluid tight suture lines and allowing for edema formation, is a critical area. Successful treatment of the damaged brain, dura, skull and scalp is the initial step in returning the neurologically impaired individual to a level of useful function.

This set of algorithms presumes that the patient has been stabilized and that the location of the injury(ies) has been identified. Thus the user proceeds to the appropriate module.

B. Operation Desert Storm Case Reports

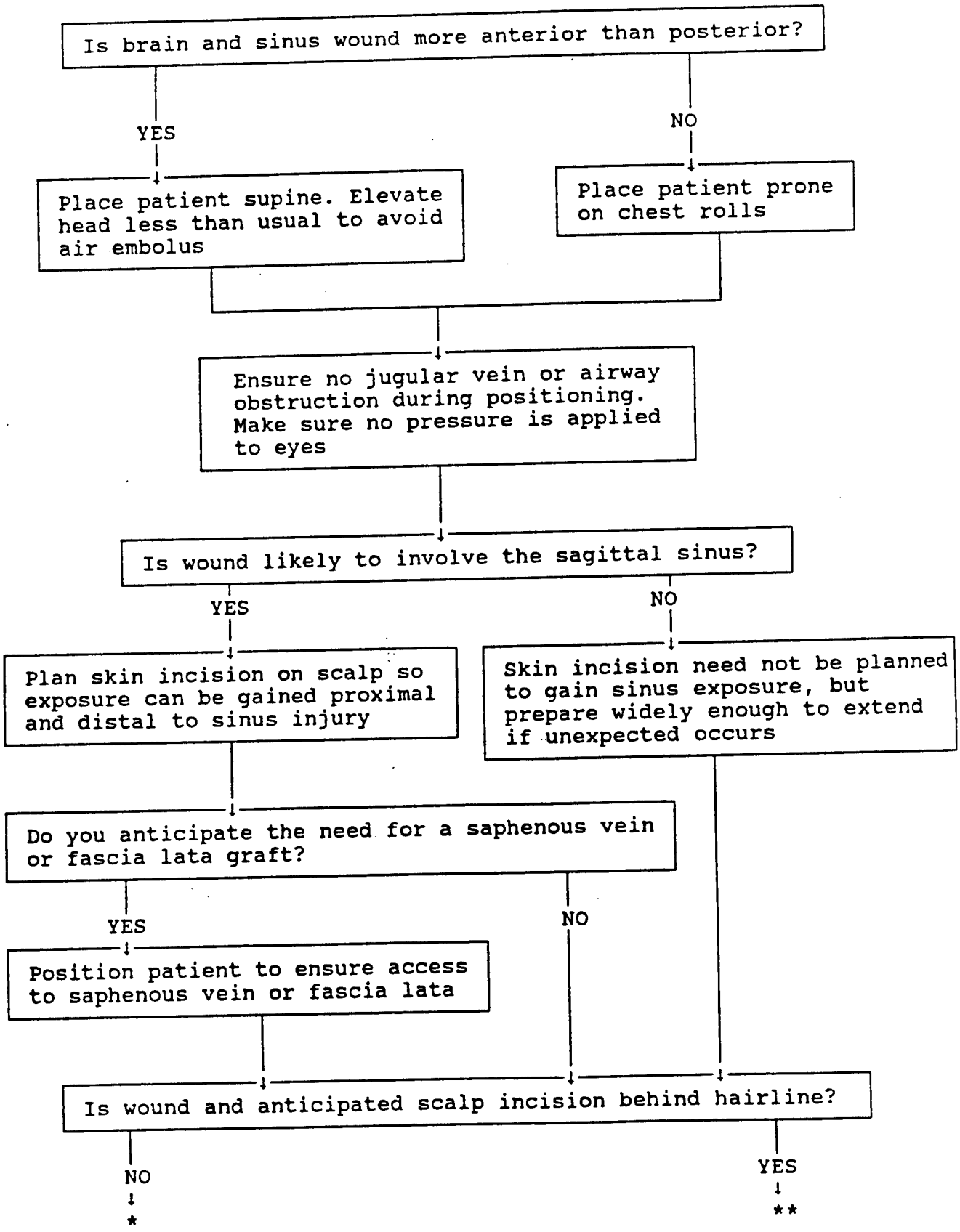
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The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.

BRAIN WOUND WITH VENOUS SINUS INJURY (SAGITTAL SINUS) MODULE



*

NO

Design opening skin incision with an eye to closing it <u>without any tension</u>

a. If a horseshoe skin flap is made around the missile entry site, make sure that base will have adequate blood supply and that height of flap does not exceed 2-3 x base
b. If possible, avoid making a new incision in forehead (cosmetic considerations)
c. 2 layer closing of galea and skin

**

YES

Prepare incision widely enough to extend if unexpected occurs

Can anticipated skin incision be closed without tension?

NO

Create sliding scalp flap or plan relaxing incisions

1. Sliding scalp flap: place debrided scalp wound in one limb of scalp flap. Leave periosteum on skull under distal limb of scalp flap to aid subsequent skin grafting

2. Relaxing incision placed at a distance so "lazy S" incision incorporating debrided wound will close relaxing incision made at end of case during scalp closure

YES

Debride scalp wound and incorporate debrided scalp wound in a "lazy S" incision

With skull visualized do you estimate that missile wound involves sagittal sinus?

YES

1. Leave metal fragment, bone chips or other foreign body in bone wound over the sinus as tamponade

2. Remove circumferential bone plate for immediate and adequate exposure of sagittal sinus, proximal and distal to sinus wound

3. Have scrub nurse prepare a tamponade pad of large rectangle of gelfoam backed by a large pattie

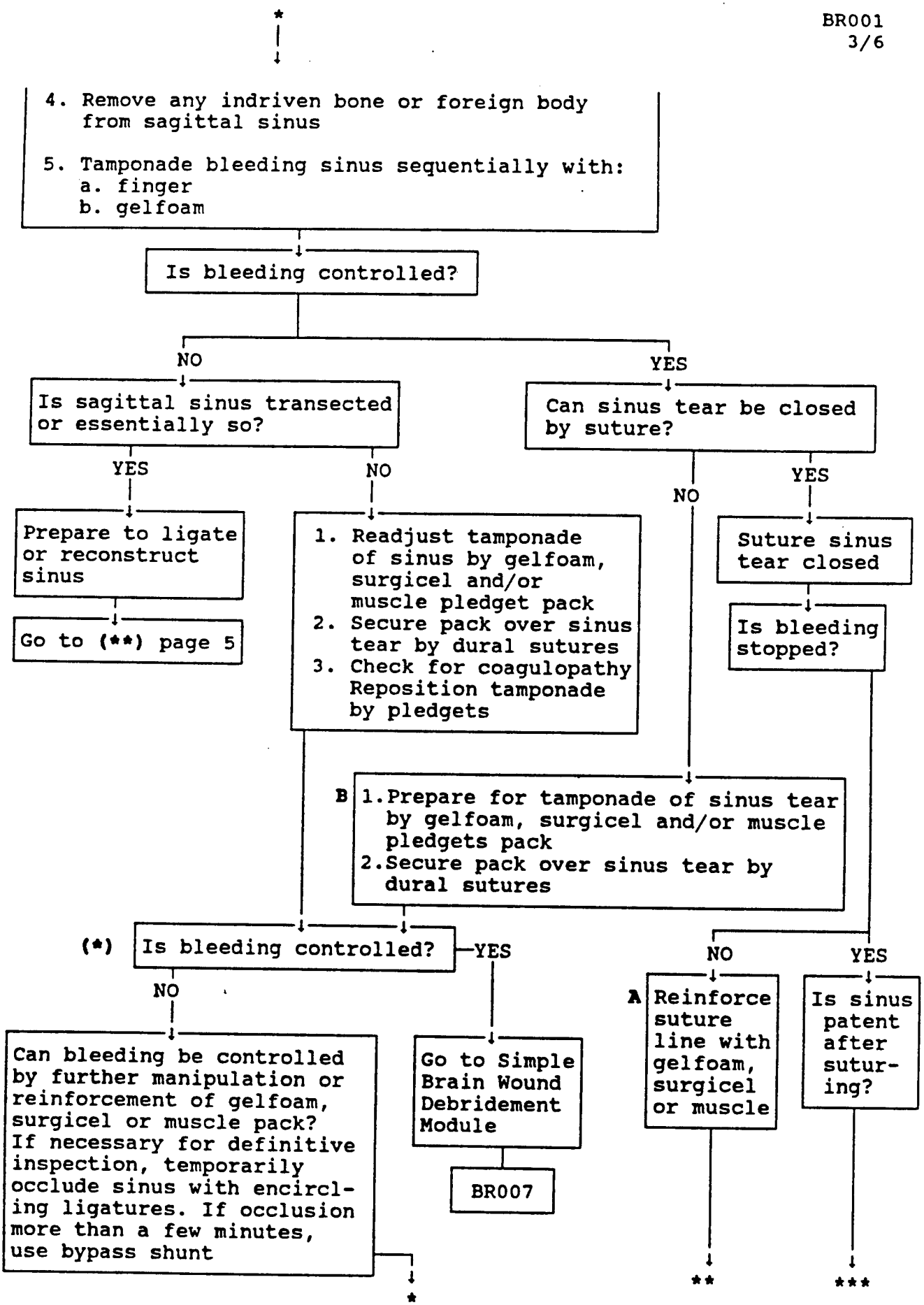
NO

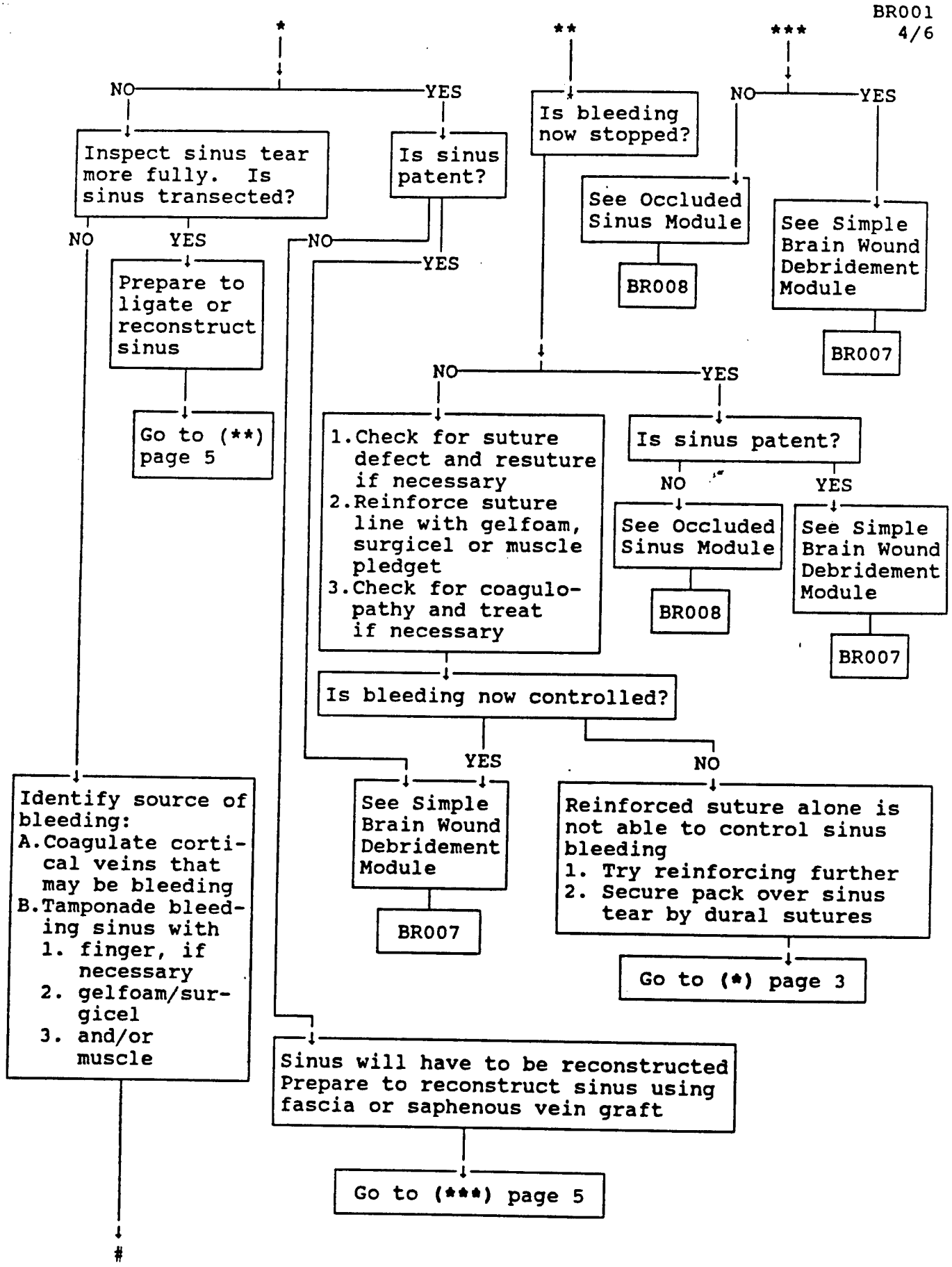
Perform craniectomy keeping away from midline unless there is need to go in this region

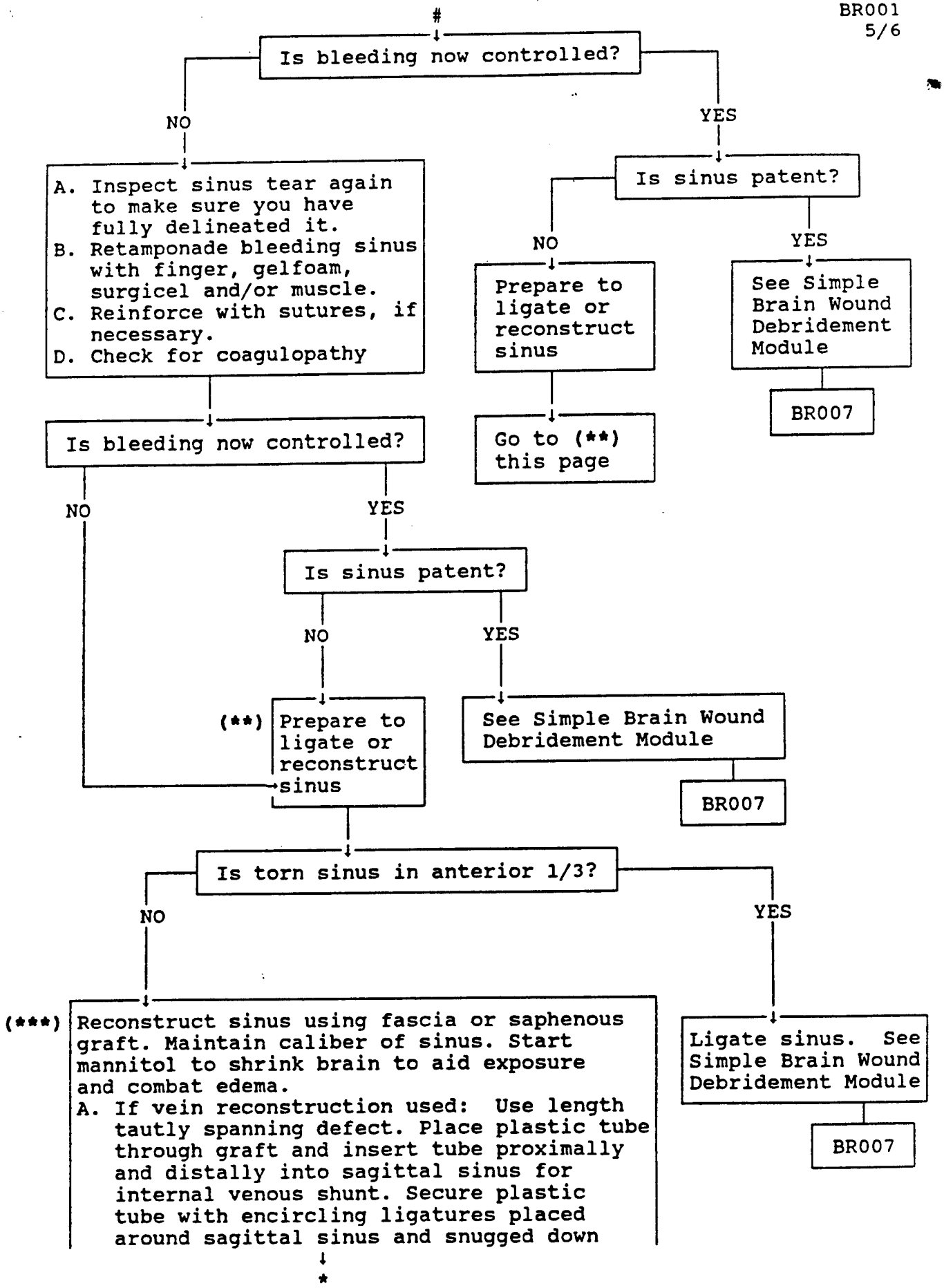
See Simple Brain Wound Debridement Module

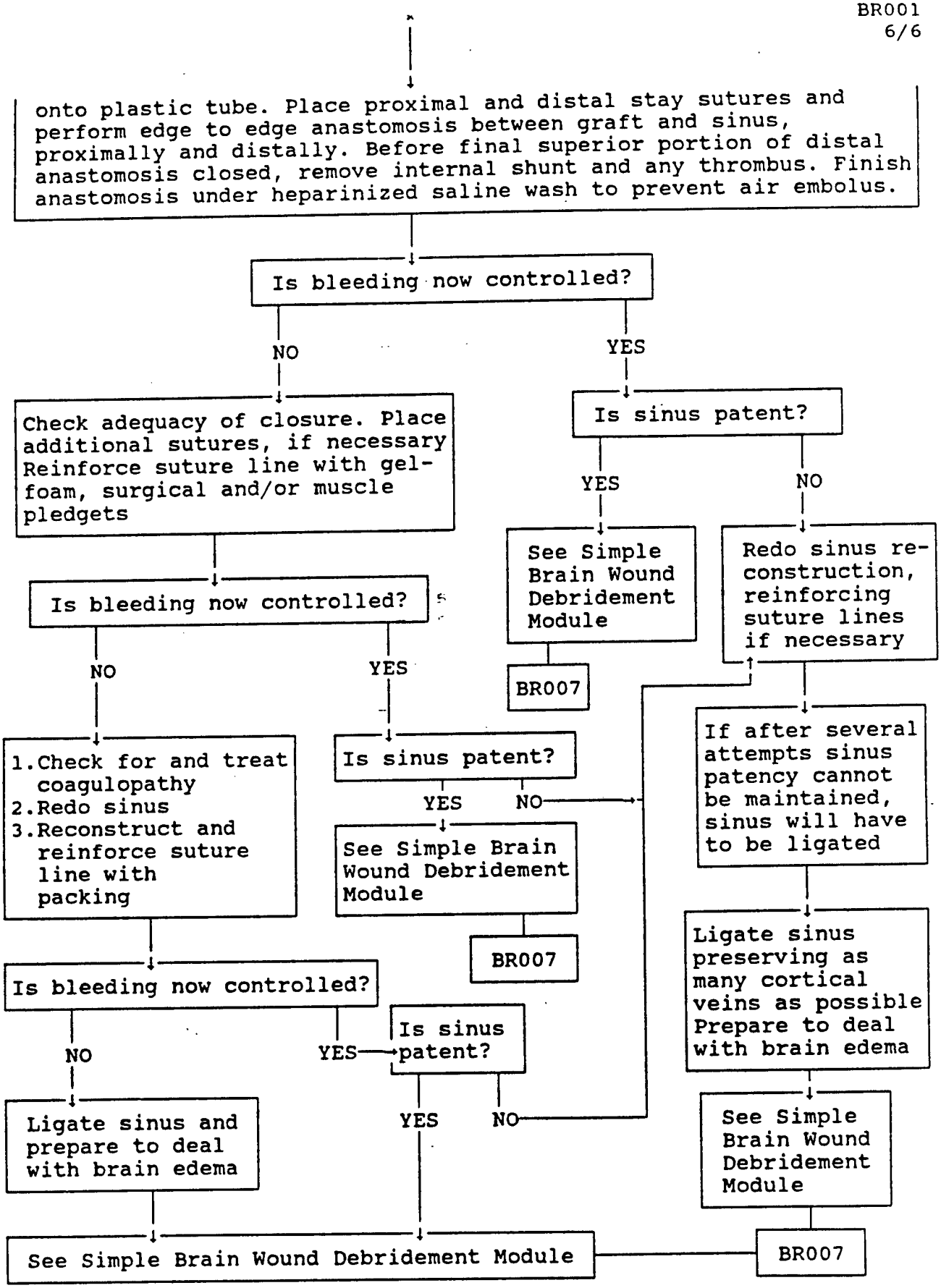
BR007

*


*
4. Remove any indriven bone or foreign body from sagittal sinus
5. Tamponade bleeding sinus sequentially with:
a. finger
b. gelfoam
Is bleeding controlled?
NO
YES
Is sagittal sinus transected or essentially so?
Can sinus tear be closed by suture?
YES
NO
NO
YES
Prepare to ligate or reconstruct sinus
Go to (**) page 5
1. Readjust tamponade of sinus by gelfoam, surgicel and/or muscle pledget pack
2. Secure pack over sinus tear by dural sutures
3. Check for coagulopathy Reposition tamponade by pledgets
Suture sinus tear closed
Is bleeding stopped?
B
1.Prepare for tamponade of sinus tear by gelfoam, surgicel and/or muscle pledgets pack
2.Secure pack over sinus tear by dural sutures
(*)
Is bleeding controlled?
YES
NO
NO
YES
A
Reinforce suture line with gelfoam, surgicel or muscle
Is sinus patent after suturing?
Can bleeding be controlled by further manipulation or reinforcement of gelfoam, surgicel or muscle pack? If necessary for definitive inspection, temporarily occlude sinus with encircling ligatures. If occlusion more than a few minutes, use bypass shunt
Go to Simple Brain Wound Debridement Module
BR007
*
**
***


*
NO
YES
Inspect sinus tear more fully. Is sinus transected?
NO
YES
Prepare to ligate or reconstruct sinus
Go to (**) page 5
Is sinus patent?
NO
YES
**
Is bleeding now stopped?
NO
YES
1.Check for suture defect and resuture if necessary
2.Reinforce suture line with gelfoam, surgicel or muscle pledget
3.Check for coagulo-pathy and treat if necessary
Is bleeding now controlled?
YES
See Simple Brain Wound Debridement Module
BR007
NO
Reinforced suture alone is not able to control sinus bleeding
1. Try reinforcing further
2. Secure pack over sinus tear by dural sutures
Go to (*) page 3
***
NO
YES
See Occluded Sinus Module
BR008
See Simple Brain Wound Debridement Module
BR007
Is sinus patent?
NO
YES
See Occluded Sinus Module
BR008
See Simple Brain Wound Debridement Module
BR007
Identify source of bleeding:
A.Coagulate corti-cal veins that may be bleeding
B.Tamponade bleed-ing sinus with
1. finger, if necessary
2. gelfoam/sur-gicel
3. and/or muscle
Sinus will have to be reconstructed Prepare to reconstruct sinus using fascia or saphenous vein graft
Go to (***) page 5
#


#
Is bleeding now controlled?
NO
YES
A. Inspect sinus tear again to make sure you have fully delineated it.
B. Retamponade bleeding sinus with finger, gelfoam, surgicel and/or muscle.
C. Reinforce with sutures, if necessary.
D. Check for coagulopathy
Is sinus patent?
NO
YES
Prepare to ligate or reconstruct sinus
See Simple Brain Wound Debridement Module
BR007
Go to (**) this page
Is bleeding now controlled?
NO
YES
Is sinus patent?
NO
YES
(**)
Prepare to ligate or reconstruct sinus
See Simple Brain Wound Debridement Module
BR007
Is torn sinus in anterior 1/3?
NO
YES
(***)
Reconstruct sinus using fascia or saphenous graft. Maintain caliber of sinus. Start mannitol to shrink brain to aid exposure and combat edema.
A. If vein reconstruction used: Use length tautly spanning defect. Place plastic tube through graft and insert tube proximally and distally into sagittal sinus for internal venous shunt. Secure plastic tube with encircling ligatures placed around sagittal sinus and snugged down
Ligate sinus. See Simple Brain Wound Debridement Module
BR007
*


onto plastic tube. Place proximal and distal stay sutures and perform edge to edge anastomosis between graft and sinus, proximally and distally. Before final superior portion of distal anastomosis closed, remove internal shunt and any thrombus. Finish anastomosis under heparinized saline wash to prevent air embolus.
Is bleeding now controlled?
NO
YES
Check adequacy of closure. Place additional sutures, if necessary Reinforce suture line with gel-foam, surgical and/or muscle pledgets
Is sinus patent?
YES
NO
See Simple Brain Wound Debridement Module
Redo sinus re-construction, reinforcing suture lines if necessary
BR007
Is bleeding now controlled?
NO
YES
1.Check for and treat coagulopathy
2.Redo sinus
3.Reconstruct and reinforce suture line with packing
Is sinus patent?
YES
NO
See Simple Brain Wound Debridement Module
BR007
If after several attempts sinus patency cannot be maintained, sinus will have to be ligated
Ligate sinus preserving as many cortical veins as possible Prepare to deal with brain edema
Is bleeding now controlled?
NO
YES
Is sinus patent?
YES
NO
Ligate sinus and prepare to deal with brain edema
See Simple Brain Wound Debridement Module
See Simple Brain Wound Debridement Module
BR007

BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS) MODULE

Definitive assessment should be made of the anatomy of patient's transverse sinuses by angiogram, CT scan or X-ray before proceeding with module

↓

Place patient in decubitis position. Turn head, if needed. Make sure there is no jugular vein compression or airway obstruction

↓

Is wound likely to involve transverse sinus?

YES ↓

Make skin incision so exposure can be gained proximal and distal to sinus injury and so bone removal can be made above and below transverse sinus

NO ↓

Skin incision need not be planned to gain sinus exposure, but exposure must be wide enough to deal with the unexpected

↓

Can anticipated skin incision be closed without tension?

NO ↓

Create sliding scalp flap or plan relaxing incisions

1. sliding scalp flap: Place debrided scalp wound in one limb of scalp flap. Leave periosteum on skull under distal limb of scalp flap to aid subsequent skin grafting

2. Relaxing incision placed at a distance so "lazy S" incision incorporating debrided wound will close relaxing incision made at end of case during scalp closure

YES ↓

Debride wound using an incision that will allow exposure above and below involved transverse sinus

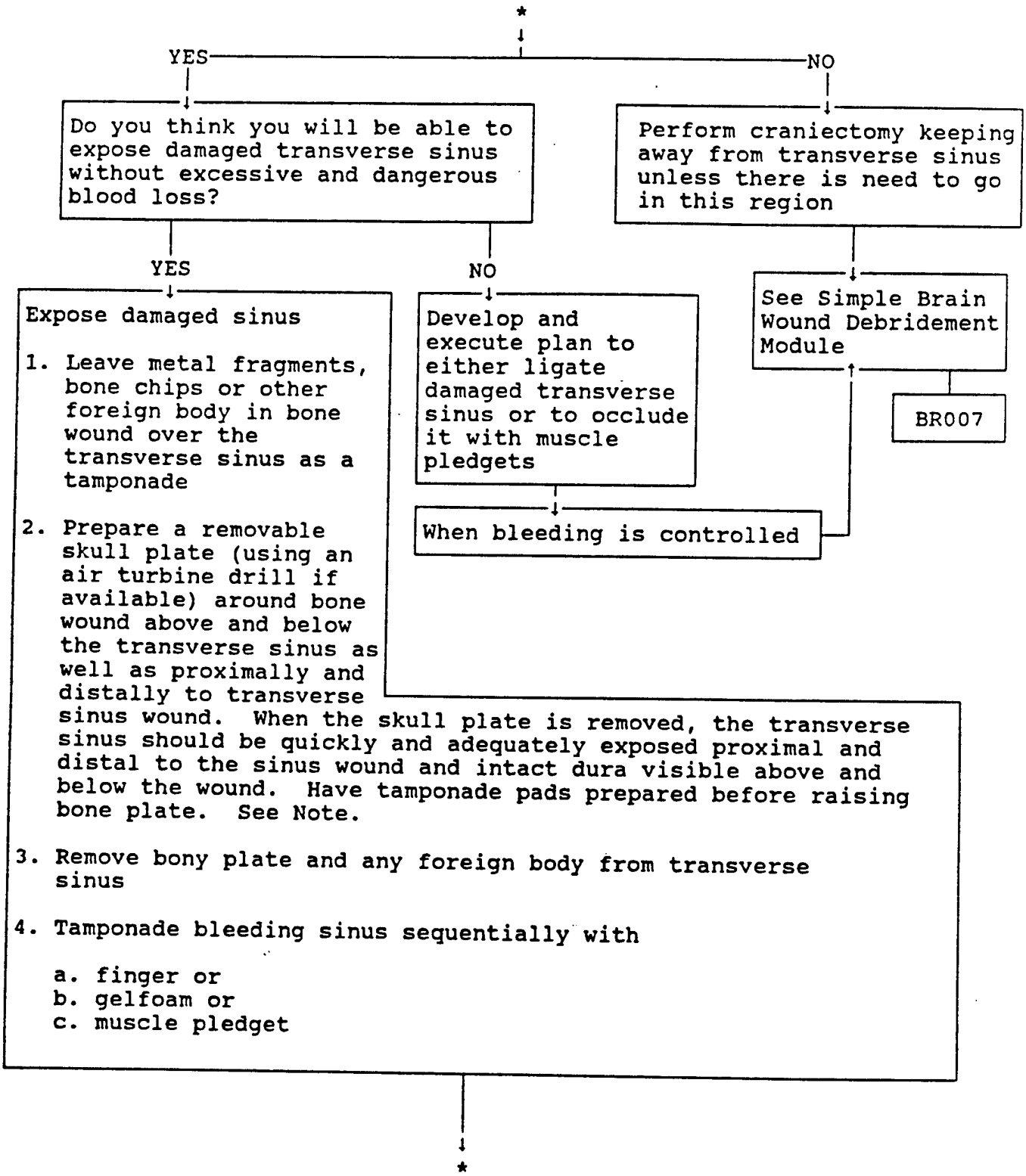
↓

With skull visualized do you still estimate that missile wound involves transverse sinus?

↓

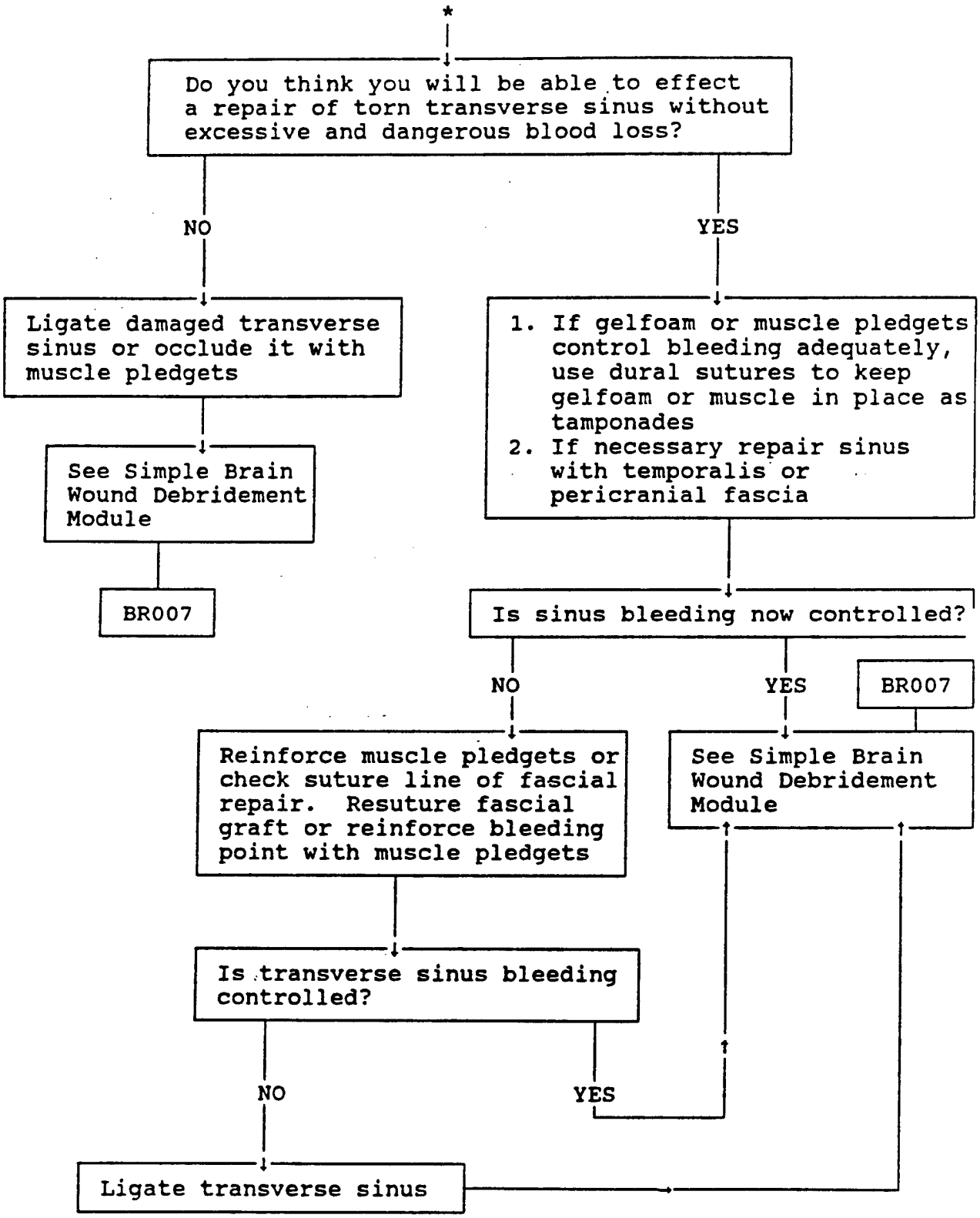
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BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS)

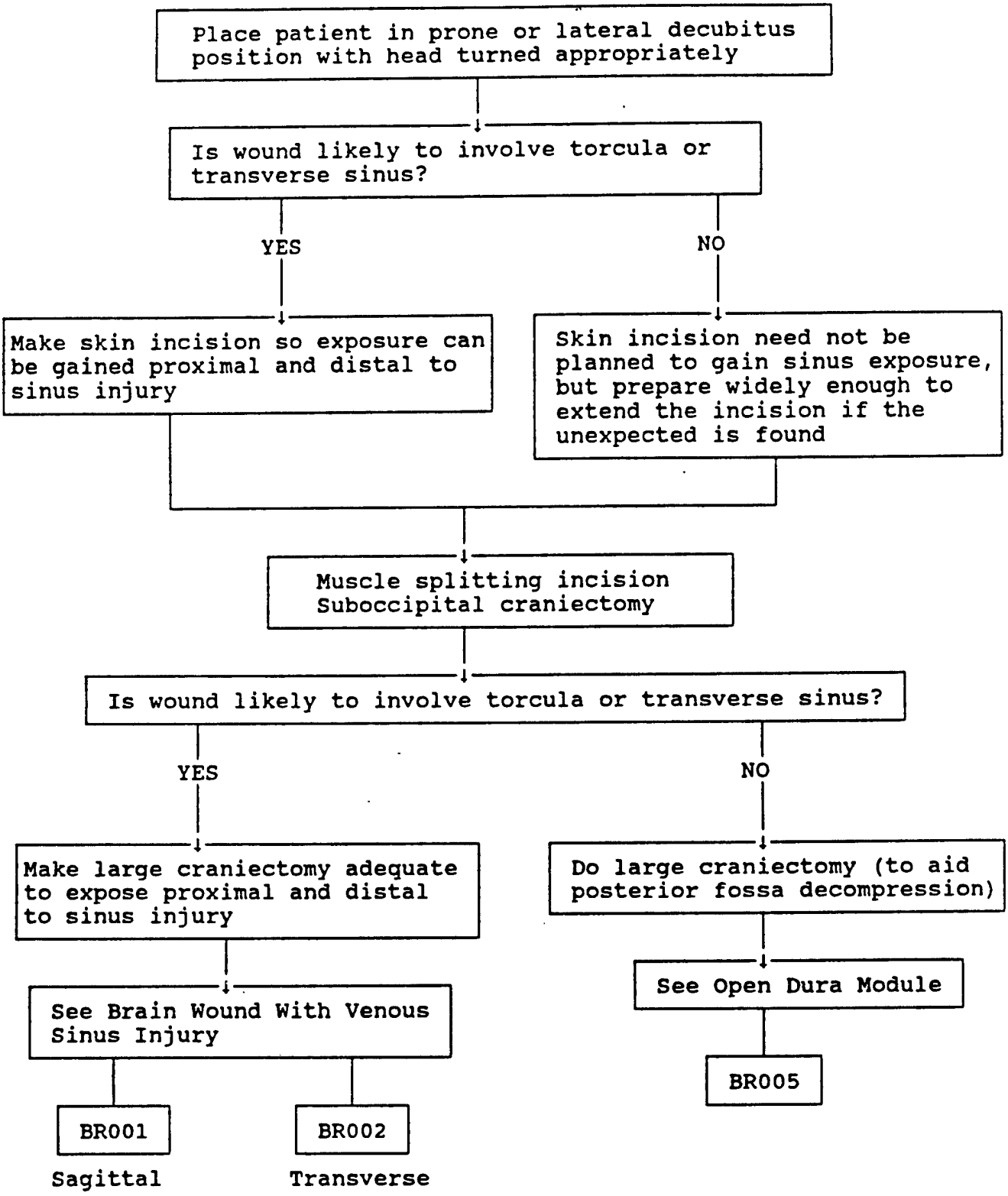


Note: See Brain Wound With Venous Sinus Injury (Sagittal Sinus) Module (BR001) for technique

BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS)



CEREBELLAR WOUND MODULE



FRONTAL SINUS WOUND MODULE

Definitive assessment of frontal sinus wound should be made by angiogram, CT scan or X-ray before proceeding with module

Frontal brain wound with obvious frontal sinus involvement
Place patient supine on operating table and turn head if necessary

Associated severe eye damage?

YES → Enucleate eye by
1. Preferably an ophthalmologist
2. Neurosurgeon if no ophthalmologist available

NO

Is wound likely to involve sagittal sinus?

YES

Ligate sinus if not easily repaired

Monitor

NO

Scalp incision need not be made to gain exposure in region of sagitta sinus but prepare widely enough to extend incision if the unexpected occurs

When forehead wound is debrided could wound edges be approximated without tension?

YES

Expose frontal region either by
1. Enlarging forehead wound
or
2. Soutar incision

Is forehead scalp wound large?

NO → *

YES → **

NO

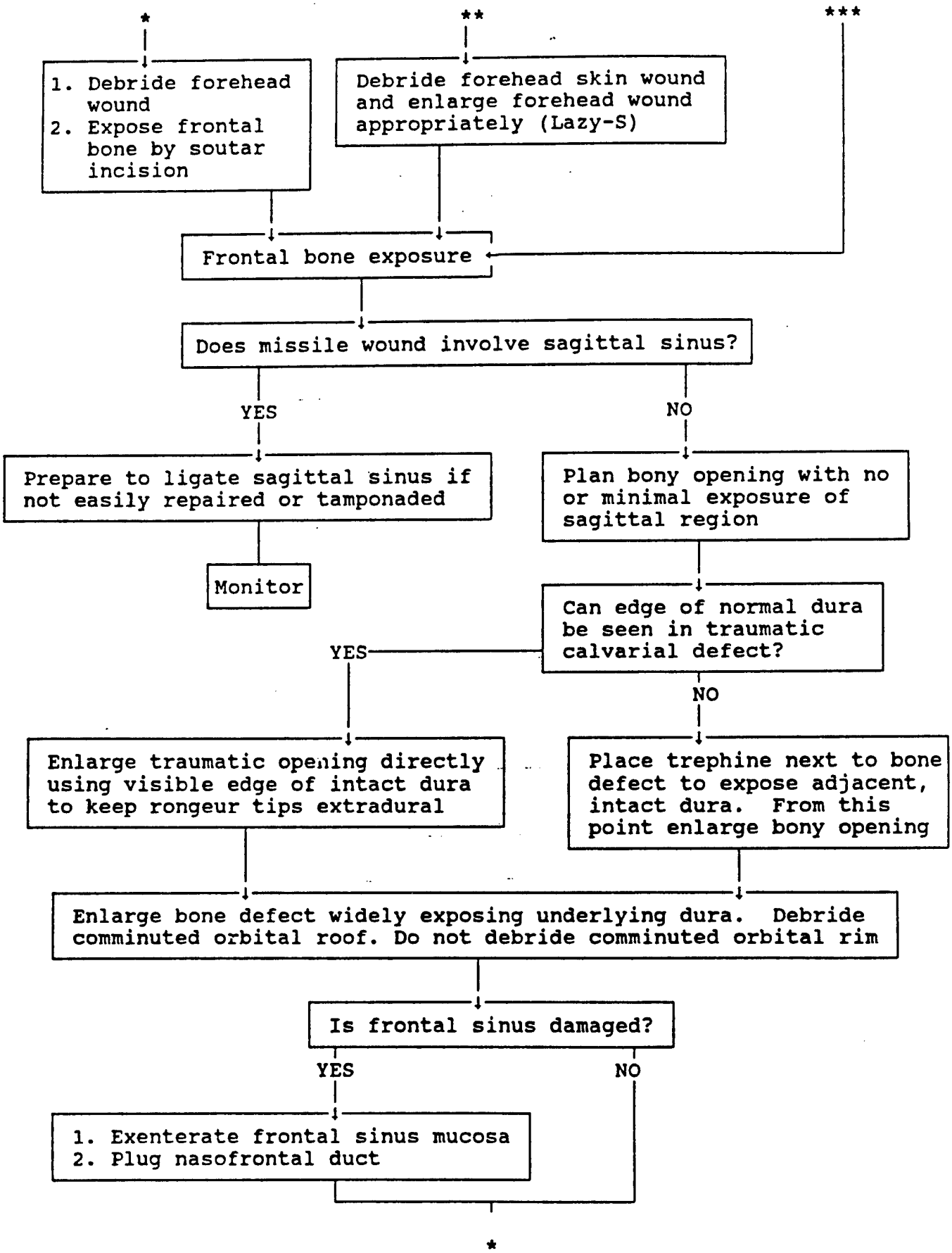
Create sliding scalp flap or plan to close forehead wound with aid of a relaxing incision

1. Sliding scalp flap: place debrided scalp wound in one limb of scalp flap. Leave periosteum on skull under distal limb of scalp flap to aid subsequent skin graft to skull

2. Relaxing incision: place at a distance so debrided forehead scalp wound can be closed without tension

→ ***

FRONTAL SINUS WOUND



FRONTAL SINUS WOUND

1. Open dura
2. Debride brain missile track of blood clot and necrotic brain
3. Remove indriven bone
4. Palpate missile track for bone fragments

Have as many bone fragments been removed as can be counted on preoperative X-ray or CT scan?

YES

NO

Look for additional bone fragments

Additional fragments found with reasonable search regarding "eloquent" vs. "silent" brain; depth of retained bone; proximity of major vessels; and time required?

YES

NO

Prepare to close wound anyway

Is bleeding stopped?

YES

NO

Find bleeders and stop bleeding

Bleeders found and stopped?

YES

NO

Check for coagulopathy

See Coagulation Variables Module

BR009

Is brain loose and without evidence of pressure?

NO

YES

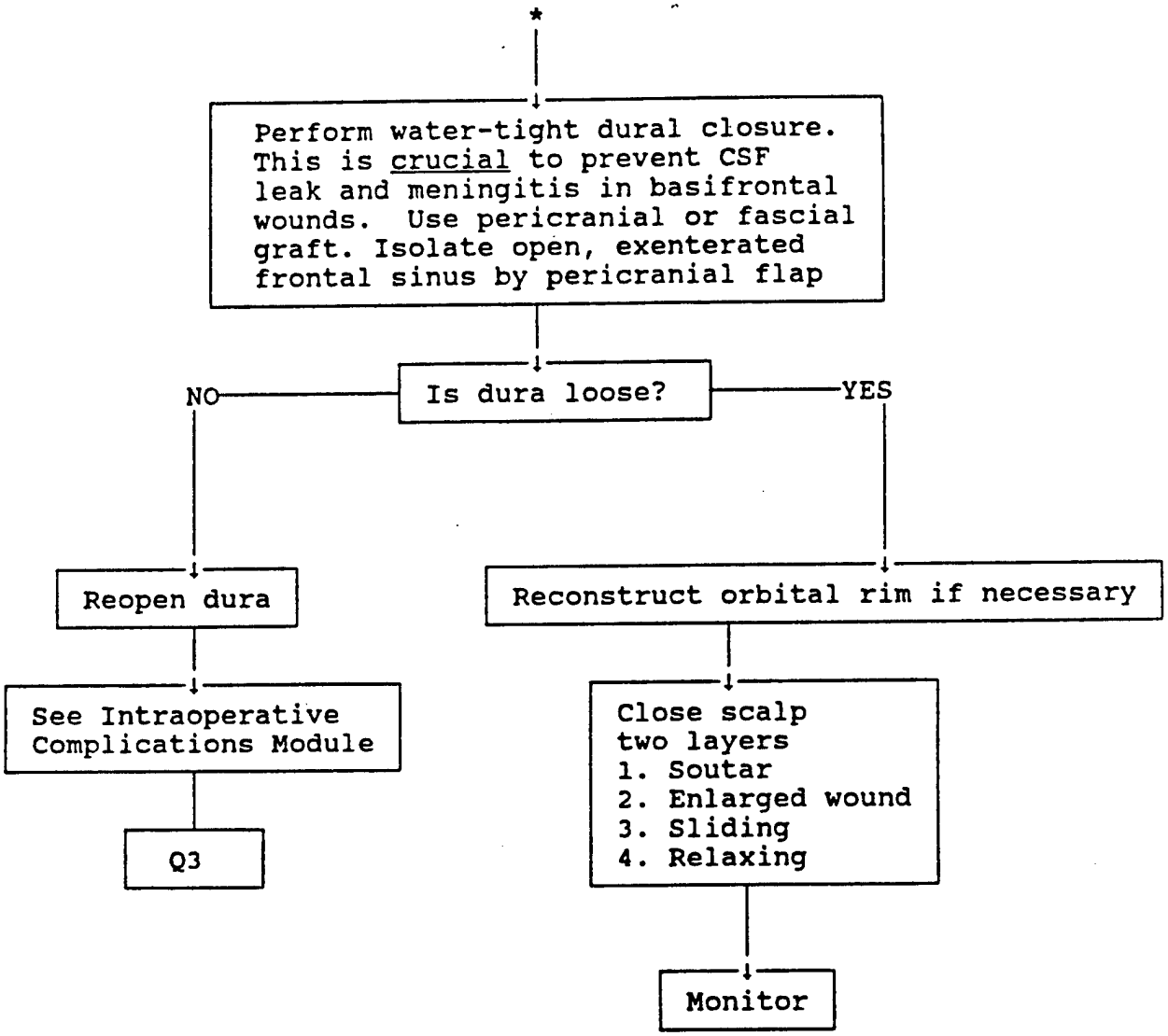
See Intraoperative Complication Module

Q3

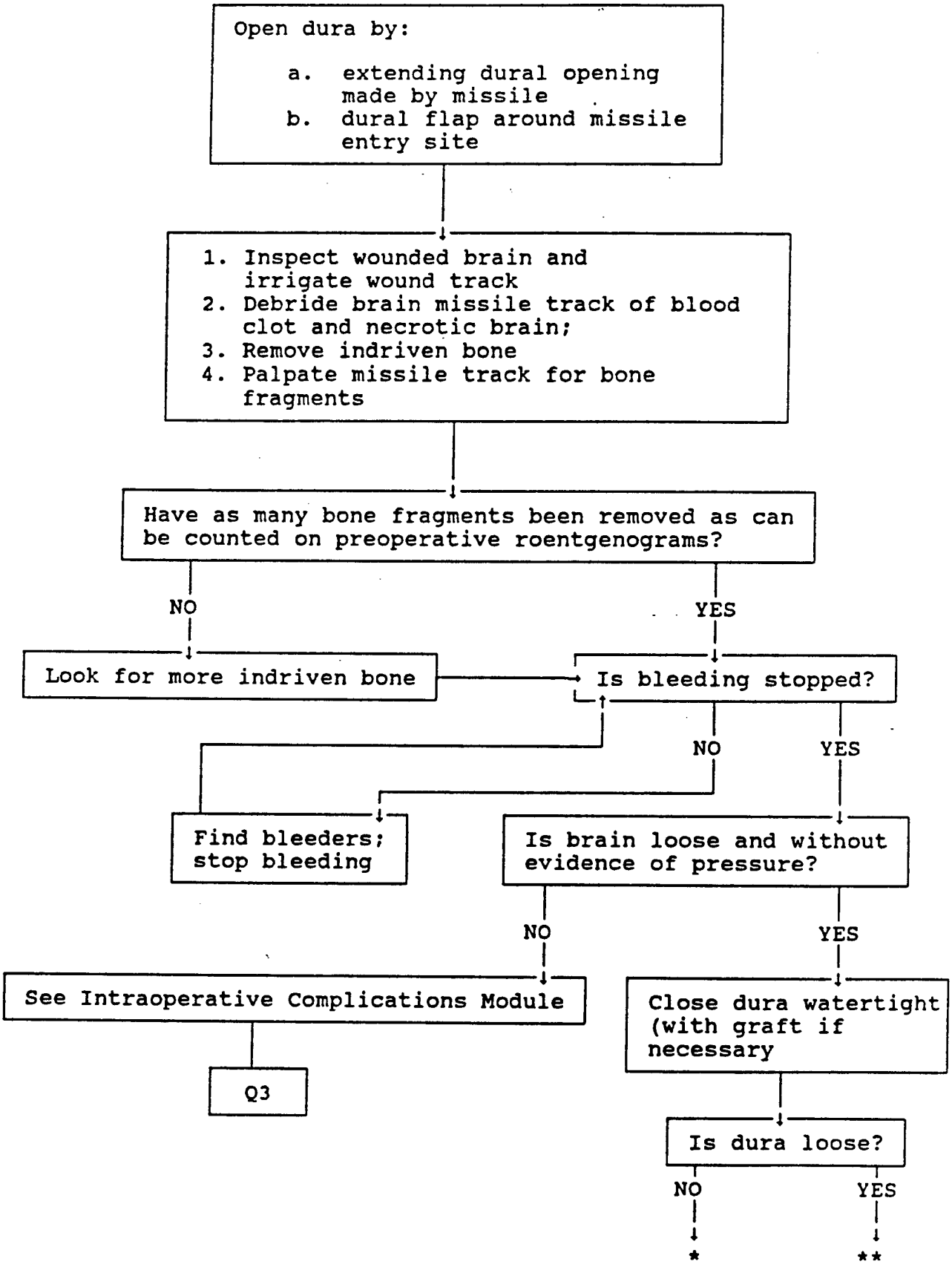
YES

*

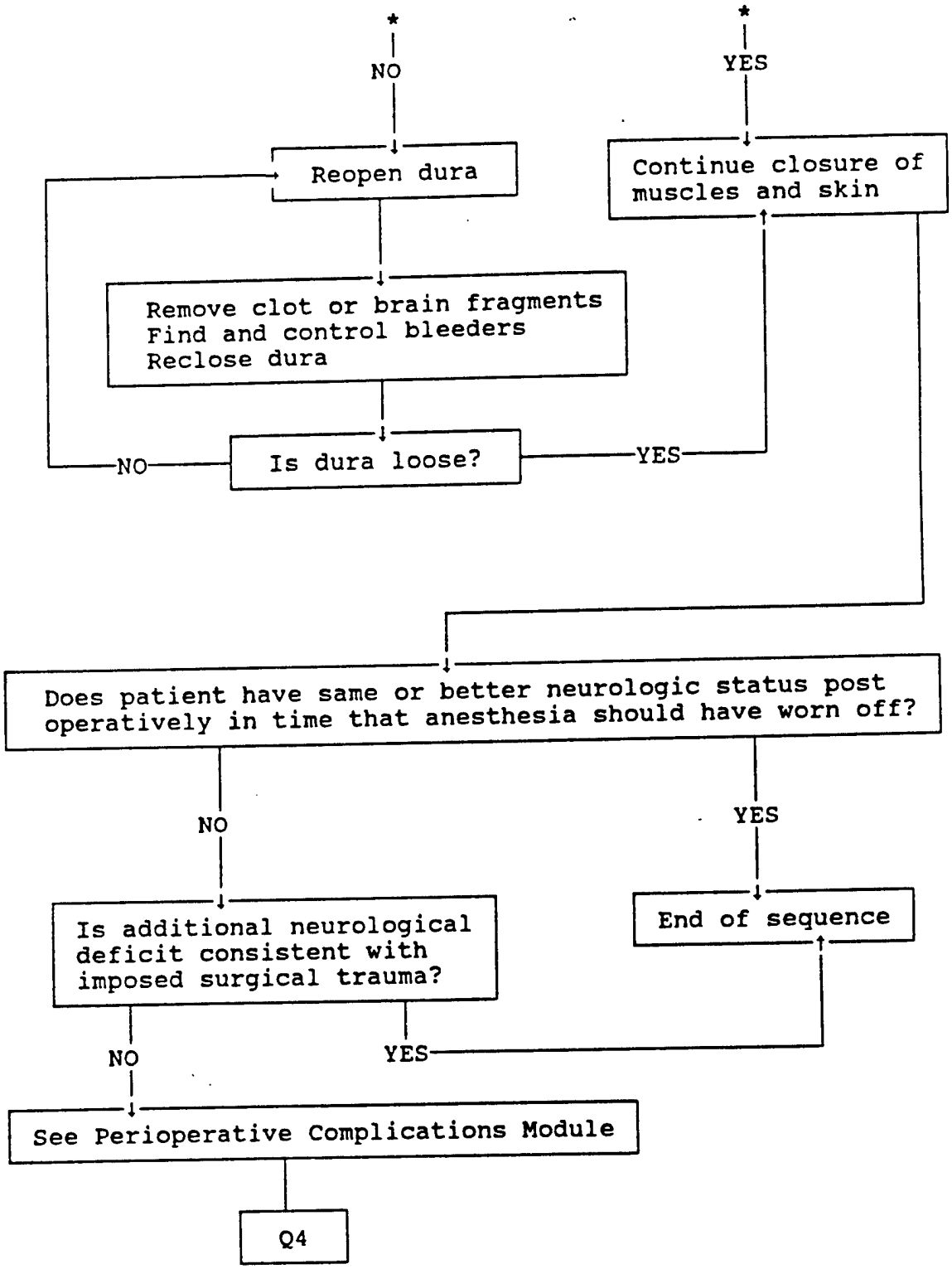
FRONTAL SINUS WOUND



OPEN DURA MODULE



OPEN DURA MODULE



SIMPLE BRAIN WOUND MODULE

1. Place patient in position which gives optimal approach to wound and major intracranial structures which may also be involved (eg. venous sinuses)

   a. supine with head elevated 15° - 30° above heart; turn head if necessary

   b. lateral decubitus or "park bench" with head elevated 15° - 30° above heart

   c. prone

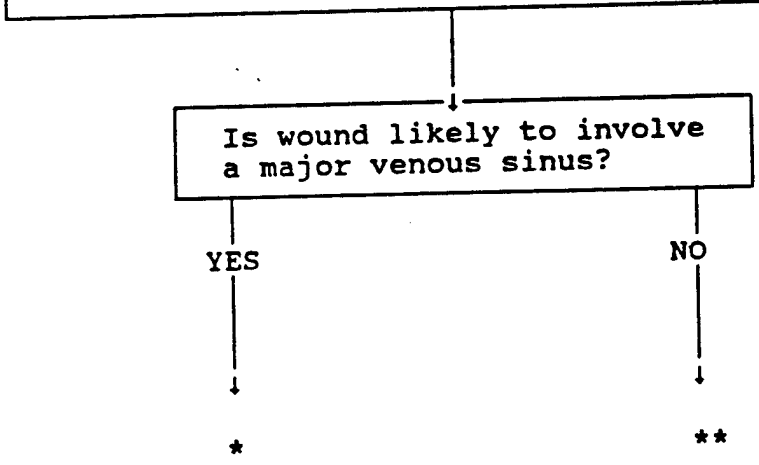
   d. avoid sitting position because of physiological stress it may place on a multiply-wounded patient. Also, anesthetist or anesthesiologist may not be experienced with this position

2. Design opening skin incision with an eye to closing it without any tension

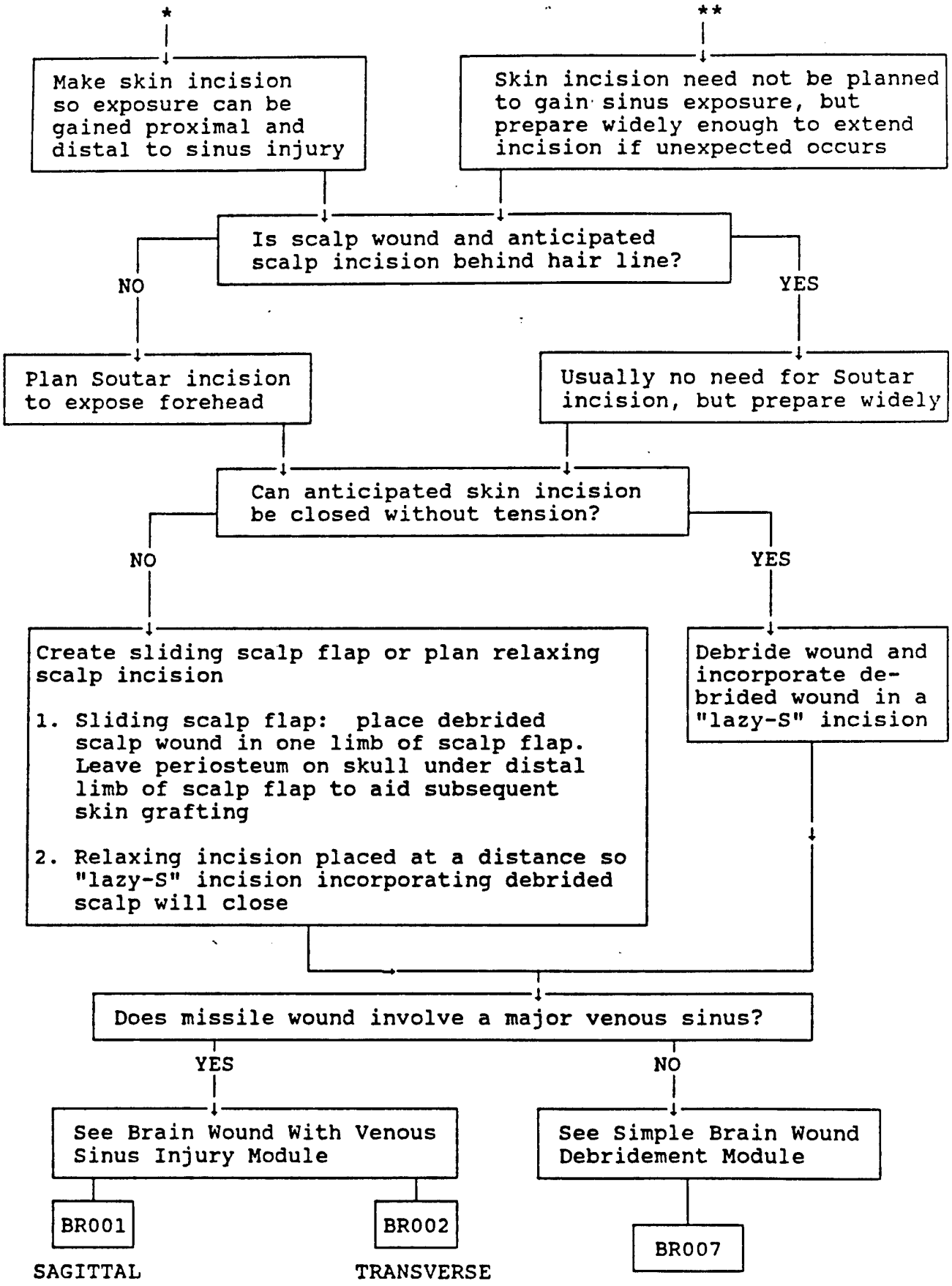
   a. If a horseshoe skin flap is made around the missile entry site, make sure that base will have adequate blood supply and that height of flap does not exceed 2-3 x base

   b. If possible, avoid making a new incision in forehead (cosmetic considerations)

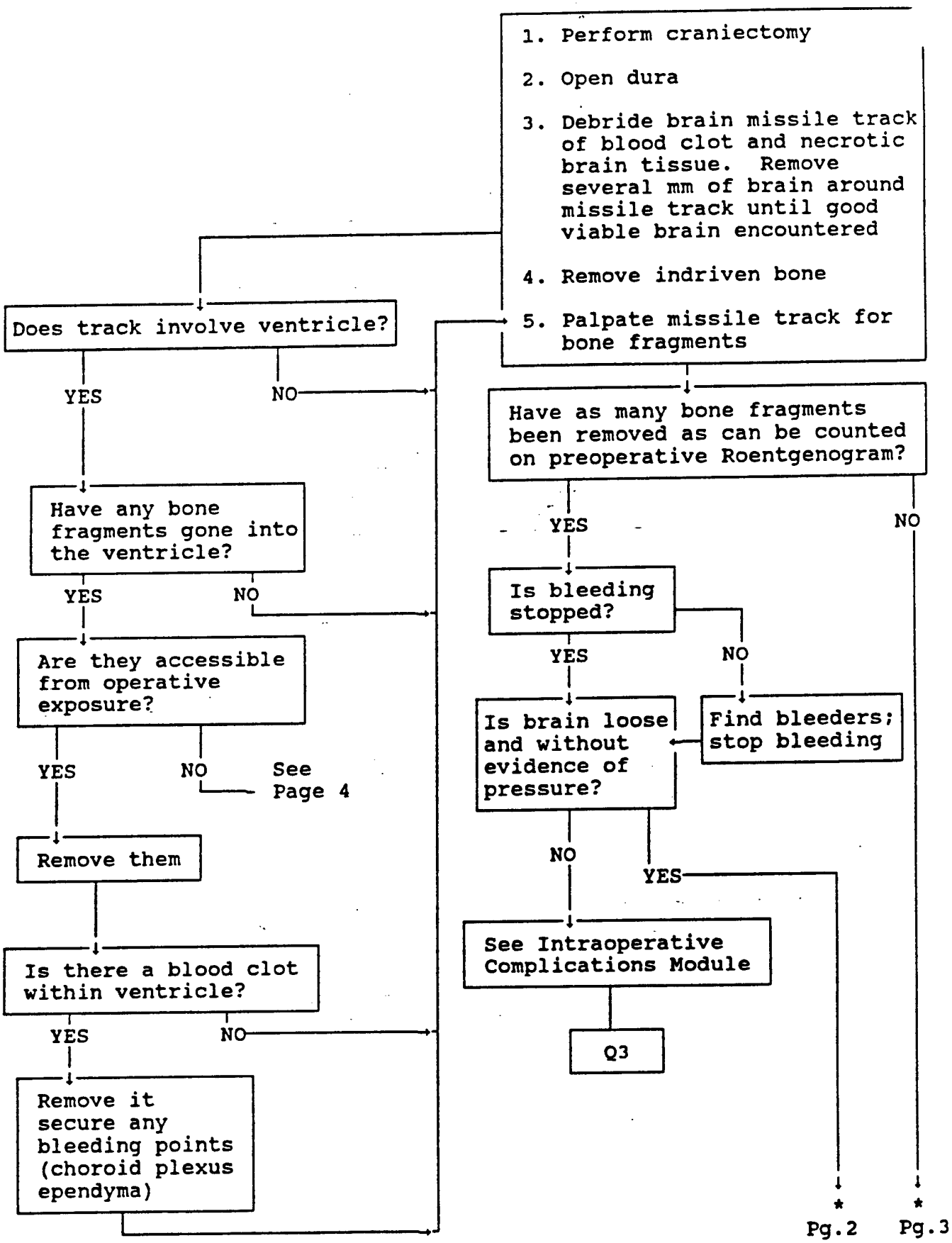
   c. 2 layer closing: galea and skin



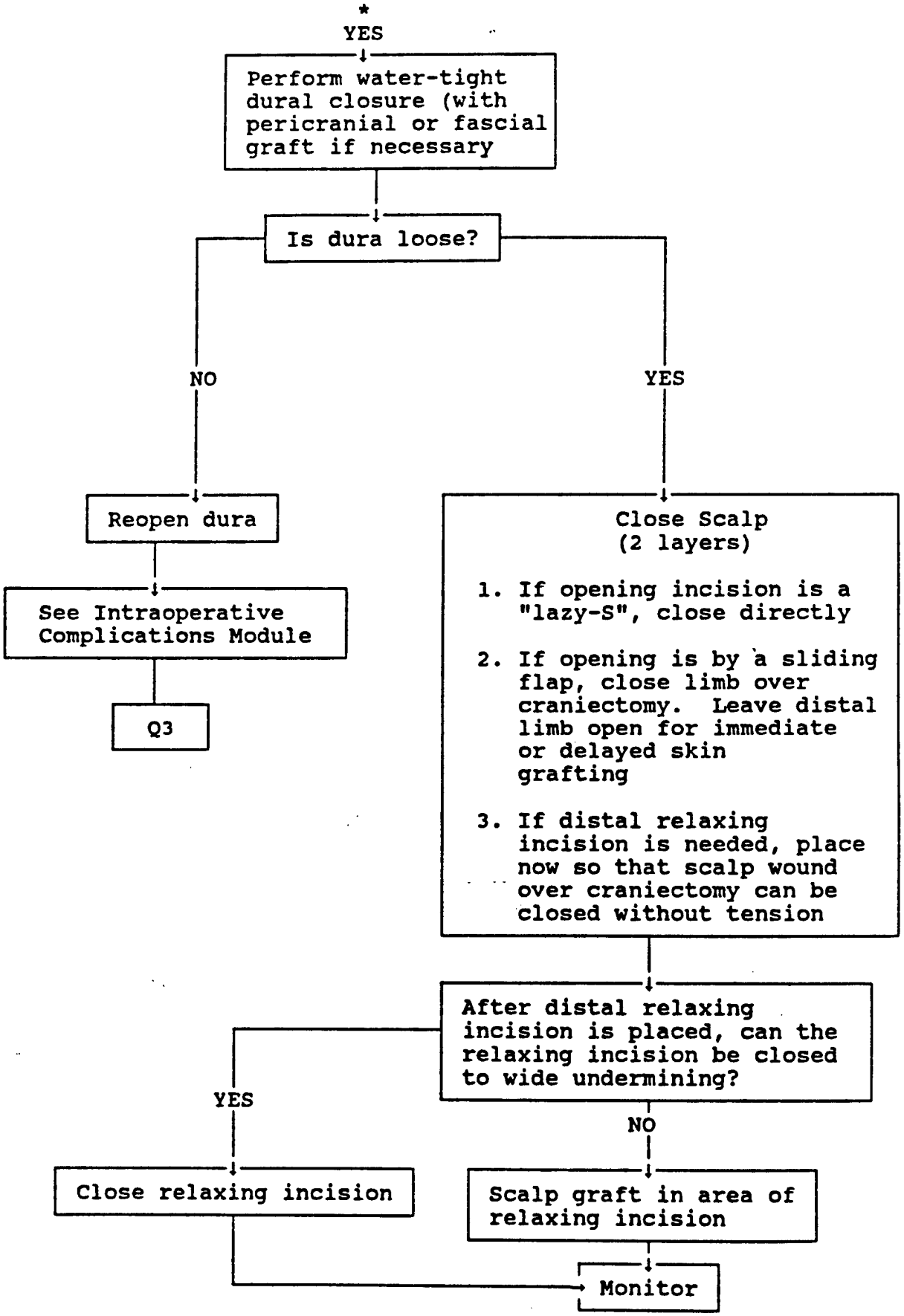
SIMPLE BRAIN WOUND



SIMPLE BRAIN WOUND DEBRIDEMENT MODULE

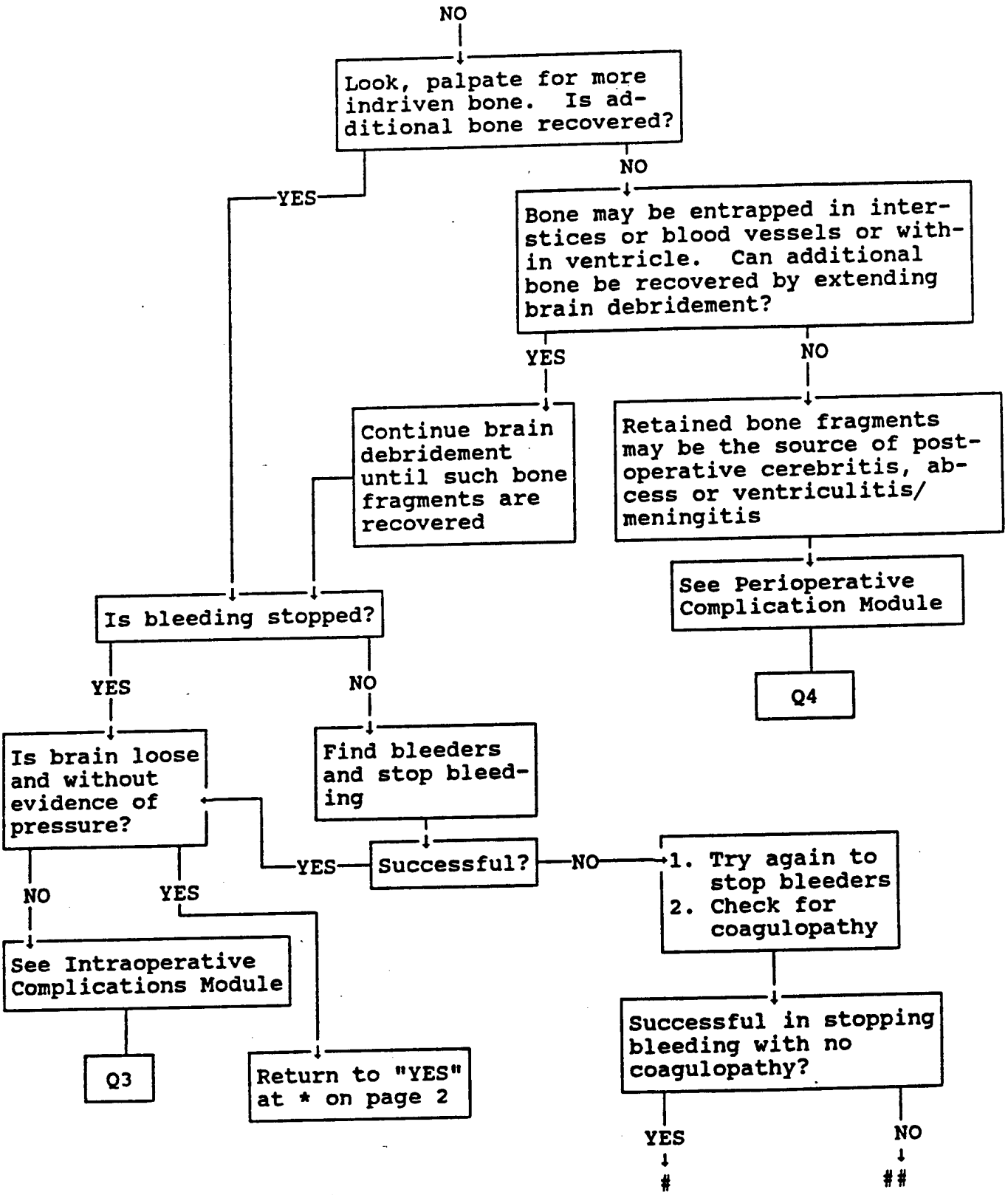


SIMPLE BRAIN WOUND DEBRIDEMENT MODULE

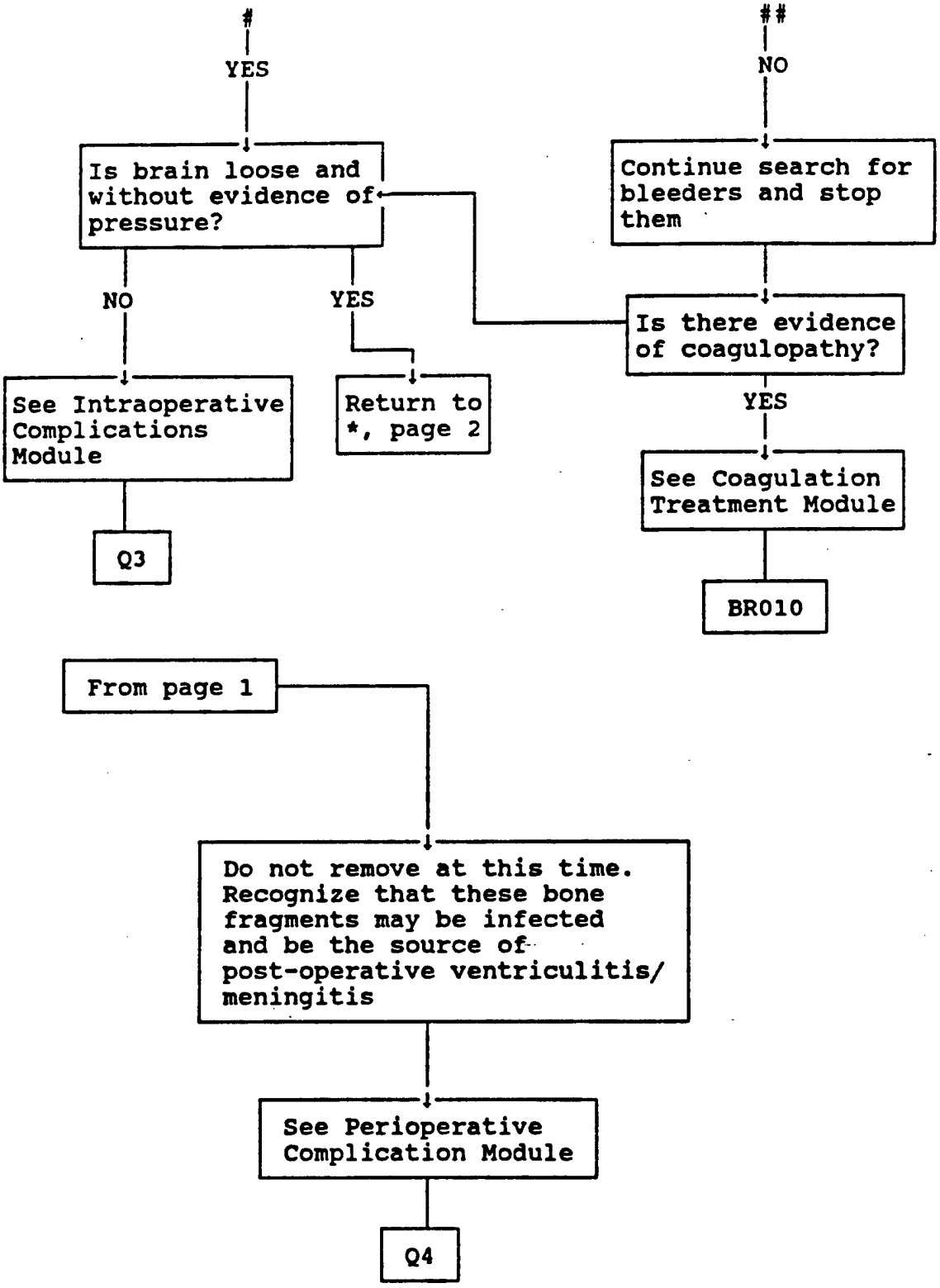


SIMPLE BRAIN WOUND DEBRIDEMENT MODULE

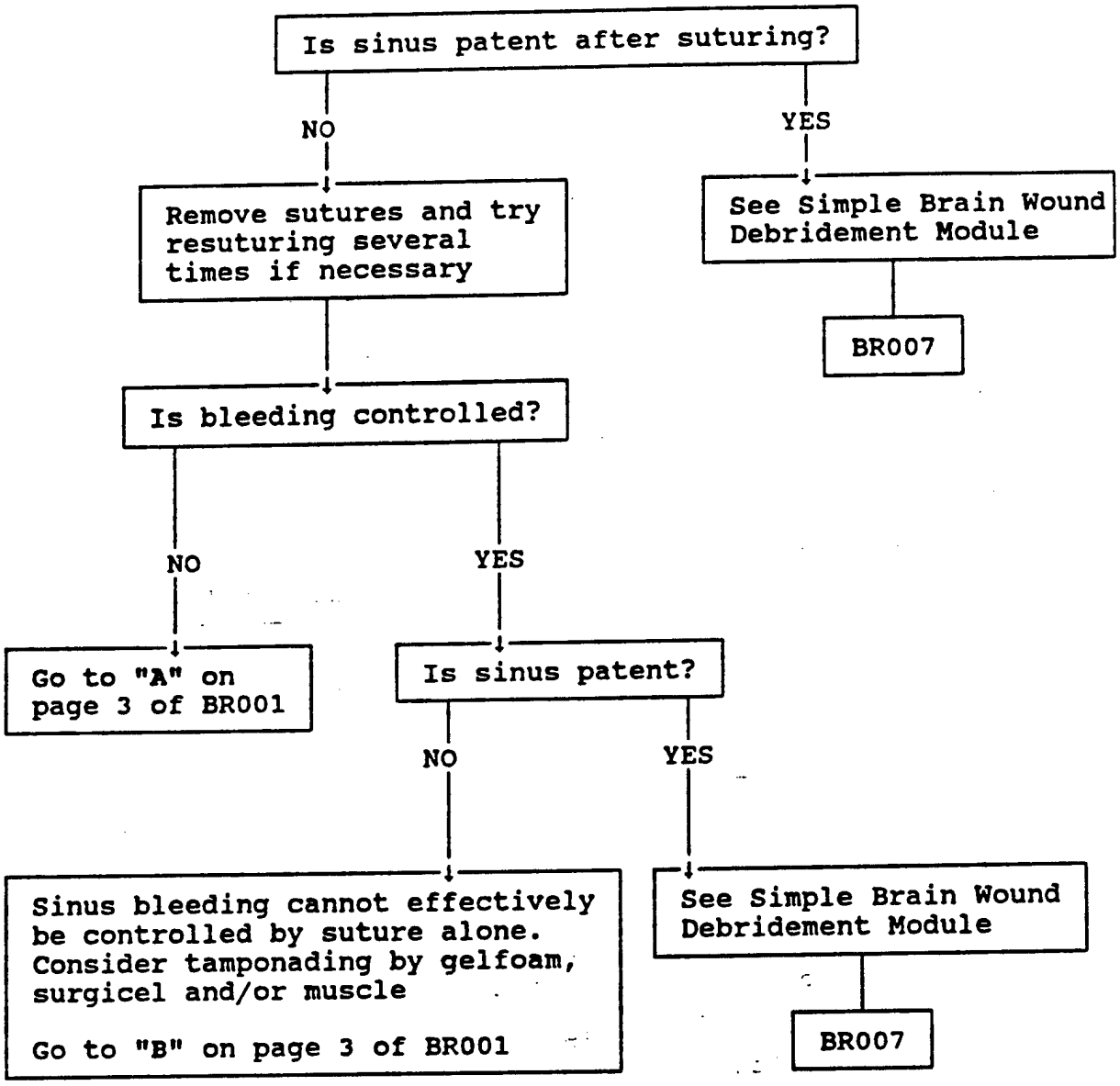
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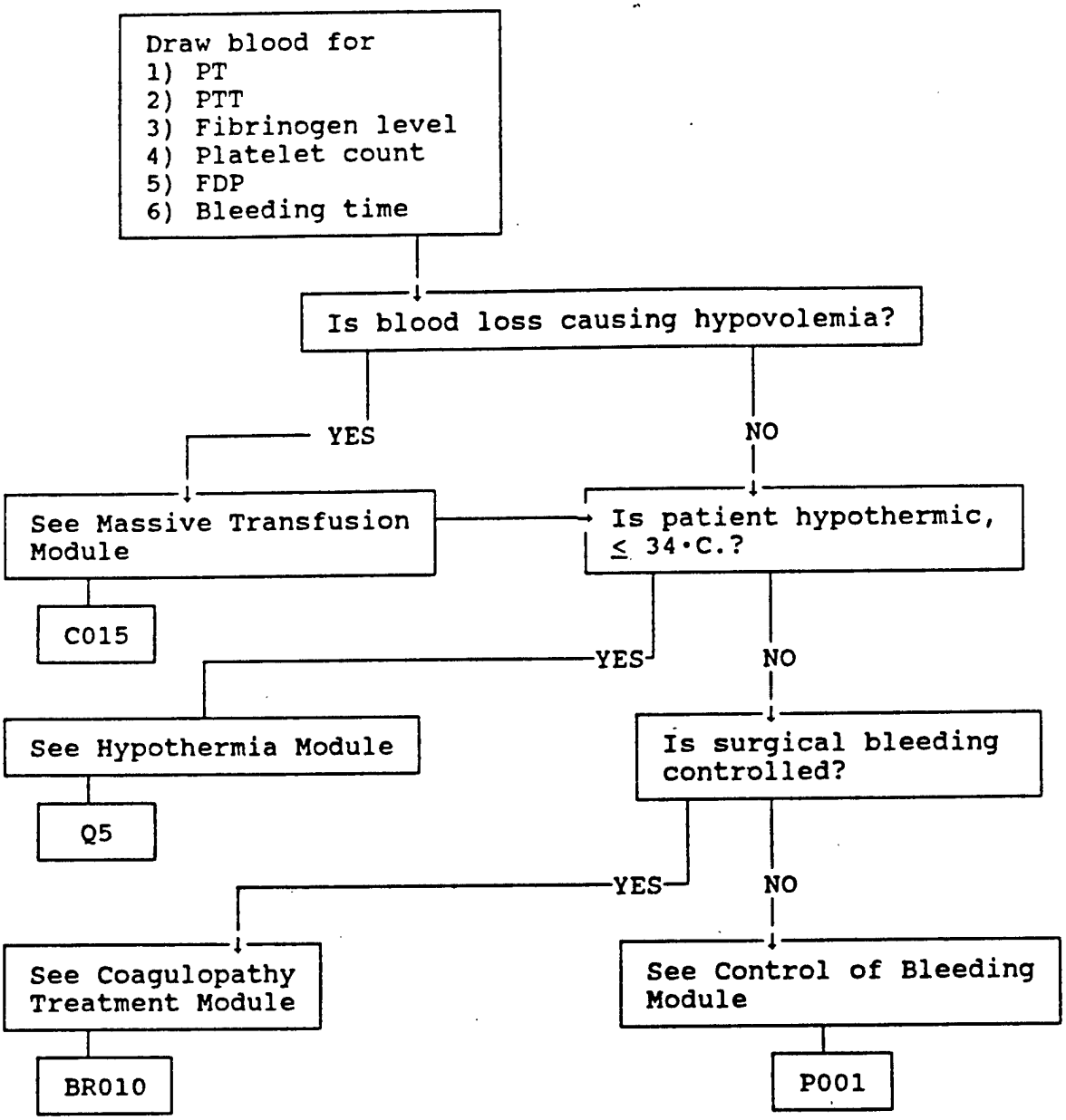
SIMPLE BRAIN WOUND DEBRIDEMENT MODULE



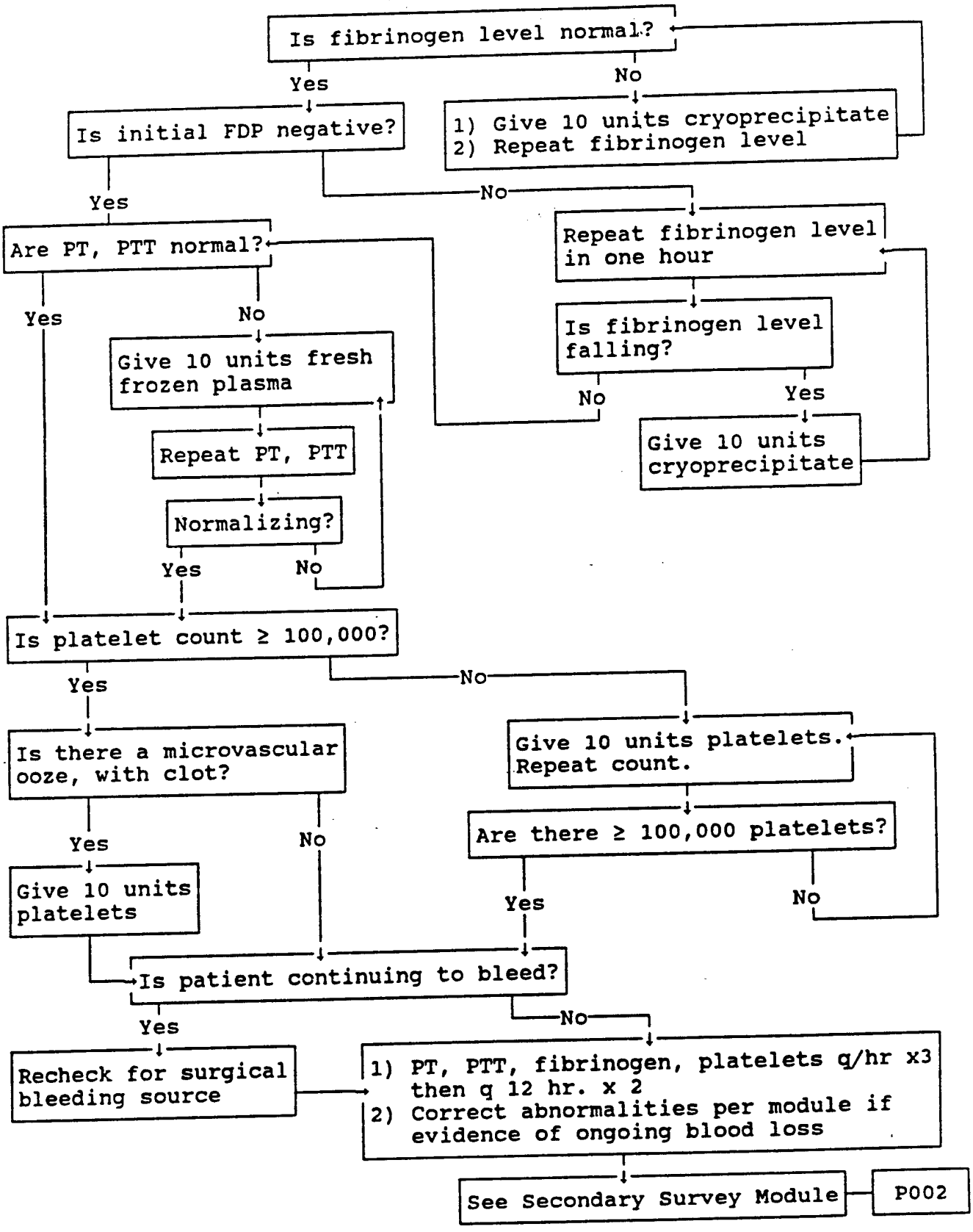
OCCLUDED SINUS MODULE



COAGULATION VARIABLES MODULE



COAGULOPATHY TREATMENT MODULE



10
THORAX

War is nothing more than the continuation of politics
by other means.
[Karl Von Clausewitz: On War]

A. Overview

Chest injuries are responsible for many traumatic fatalities. These result from either disruption of the circulatory system or acute pulmonary compromise, both with a variety of etiologies. The major circulatory problems are hemorrhage and tamponade. Significant hemorrhage usually implies injury to the heart with pericardial disruption, or to the major vessels within the thoracic cage. Massive hemothorax and high volume chest tube bleeding are the hallmarks. Tamponade may present as shock, without the external evidence of hemorrhage and must be considered whenever thoracic or subxiphoid wounds are present.

Acute pulmonary compromise may result from disruption of the chest wall, tracheobronchial or pulmonary tissues, and manifest as pneumothorax or hemorrhage. Again, the chest tube can be both a therapeutic and a diagnostic tool in these cases. Continued bleeding and excessive air leak are the harbingers of potentially rapidly fatal injuries and should be aggressively evaluated.

Algorithms in this section focus on rapidly diagnosing severe cardiothoracic injuries in an effort to salvage these often moribund patients. As the modules progress, diagnosis leads to therapeutic maneuvers, choices and options. By determining and treating serious thoracic injuries, a significant number of fatalities can be avoided.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
   Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
   He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest. Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
   Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

   CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

Mail to:

CDR J.M. Linenger, MC, USN
Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-6896

(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

THORAX - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - General Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Continue further efforts at clinicians's discretion	2*	3				
2. Perform left anterior thoracotomy	2*	3				Trauma chest tray; I.V. tubing; thoracotomy list
3. Open pericardium anterior to phrenic nerve	2*	3				Trauma chest tray; I.V. tubing
4. Open appendage. Insert filled large bore I.V tubing	2*	3				Trauma chest tray; I.V. tubing
5. Place ligature around appendage, I.V.	2*	3				Trauma chest tray; I.V. tubing
6. Run fluid/blood as rapidly as possible			3	3	1*	Trauma chest tray; I.V. tubing
7. Open cardiac massage	2*	3				Standard drugs; syringe
8. Inject epinephrine 1:10,000 10 cc into aortic root	2*	3				Standard drugs; syringe
9. Give sodium bicarbonate into central I.V	2*	3				Standard drugs; syringe
10. Continue massage	2*	3				
11. Counter shock with 10 to 50 watts	2*	3				Internal defibrillator paddles; standard drugs; syringe
12. Resume massage	2*	3				
13. Repeat epinephrine and correct acidosis	2*	3	3	3	1*	Standard drugs
14. Continue CPR	2*	3				
15. Check ABG's			3	3	1*	
16. Check K^+			3	3	1*	

********** Explanation of Specialty Codes and Care Descriptors **********

In all cases, a cardiac-thoracic surgeon represents optimal care. However, a general surgeon with extensive experience (indicated as 2*) could perform many procedures. Also many of the modules call for the mobilization and utilization of a cardio-pulmonary by-pass team but have not been indicated in this listing. Point 176 calls for a cardiologist to administer and interpret an echocardiogram. A radiologist is optimal at point 30.

In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks. Any number followed by an asterisk indicates that, <u>with training,</u> the care provider could do the procedure, but is not the optimal provider.

17. Correct ABG abnormalities and hyperkalemia			3				
18. Begin pressor			3				Standard drugs
19. Check pupils			3				
20. Evaluate pH and K^+	2*	3					Laboratory equipment
21. Evaluate signs of pericardial tamponade	2*	3					
22. Prep anterior chest wall			3	3	1*		Trauma chest tray; betadine
23. Drape area with sterile towel	2*	3	2	2	1*		Sterile towels; laparotomy drape
24. Make incision over xiphoid	2*	3					Trauma chest tray
25. Pull up on xiphoid process and make tunnel to under surface of sternum; wipe anterior surface of pericardium with sterile gauze and hook Army-Navy retractor under sternum to visualize anterior - inferior edge of pericardium	2*	3					Trauma chest tray; Kocher clamp; Army-Navy retractors
26. Do immediate median sternotomy	2*	3					Sternal saw; Lebsche knife; median sternatomy list supply list
27. Grasp edge of diaphragm and pericardium with 2 Allis clamps	2*	3					Trauma chest tray
28. Make a vertical incision over anterior-inferior edge of pericardium	2*	3					Trauma chest tray
29. Subpectoral chest tube insertion	2*	3					Trauma chest tray
30. Esophageal swallow		Radiologist					X-ray capabilities
31. Median sternotomy incision	2*	3					Cardiovascular tray; chest set; median sternotomy supply list
32. Transsternal thoracotomy	2*	3					Trauma chest tray; (open heart pan 1, pan 2; sternal saw, Lebsche knife; Moarse retractor)
33. Extend pericardiotomy across top of diaphragm and proximally to innominate vein and marsupialize pericardium with 2-0 silk	2*	3					Trauma chest tray;
34. Expose pericardium	2*	3					Cardiovascular tray; chest set; median sternotomy supply list
35. Open pleural space and dissect between pleural spaces	2*	3					Cardiovascular tray; chest set; median sternotomy supply list

36. Do vertical pericardiotomy	2*	3	Cardiovascular tray; chest set; median sternotomy supply list
37. Marsupialize pericardial edges	2*	3	Cardiovascular tray; chest set; median sternotomy supply list
38. Apply partial occluding clamp under finger and repair injury	2*	3	Cardiovascular tray; chest set; median sternotomy supply list
39. Repair with pledgeted 4-0 suture	2*	3	Cardiovascular tray; chest set; median sternotomy supply list
40. Clamp aorta above-below injury and close with running suture	2*	3	Cardiovascular tray; chest set; median sternotomy supply list
41. Attempt medical stabilization	2*	3	
42. Perform aorto-innominate bypass		3	Sternal saw; Lebsche knife; trauma chest tray
43. Control proximal innominate artery and and expose subclavian artery		3	Sternal saw; Lebsche knife; trauma chest tray
44. Oversew injury with pledgeted suture		3	Needle; suture
45. Clamp aorta proximal and distal to injury		3	Clamps
46. Mobilize aorta, tape aorta and divide pericardium		3	Sternal saw; Lebsche knife; trauma chest tray
47. Clamp artery distally; clamp origin onto aorta and repair		3	Clamps; 4-0 monofilament suture
48. Perform carotid to carotid or carotid to subclavian bypass		3	Sternal saw; Lebsche knife; trauma chest tray
49. Apply clamp and repair aorta with pledgeted monofilament sutures		3	Clamps; monofilament suture
50. Clamp aorta distal to innominate artery and repair with running suture		3	Clamps; sutures
51. Complete pneumonectomy	2*	3	Cardiovascular tray; chest set; mediansternotomy supply list
52. Perform lobectomy	2*	3	Cardiovascular tray; chest set; mediansternotomy supply list; thoracic list
53. Reevaluate pulmonary venous bleeding	2*	3	
54. Cauterize edge of pericardium	2*	3	Median sternotomy list

55. Suture pericardial edge	2*	3				Median sternotomy list
56. Open pleural space	2*	3				Median sternotomy list
57. Cauterize; suture pericardial surface	2*	3				Suture; cautery
58. Control simple holes or tears in atrium or ventricles	2*	3				Vascular clamp; Foley catheter; 3/0 monofiliment pledgeted sutures
59. Cover holes with fingers and repair with horizontal pledgeted mattress sutures of 2-0 prolene	2*	3				Pledgeted mattress 2-0 prolene sutures
60. Repair with purse string sutures	2*	3				3-0 prolene sutures
61. Defibrillate with pediatric paddles	2*	3	2 to run eqpt.	2	1*	Internal defibrillator paddles; standard drugs; syringe; machine off sterile field
62. Place purse string suture and make stab incision	2*	3				Median sternotomy list
63. Infuse packed cells			3	3	1*	Packed cells
64. Set defibrillator			3 to run eqpt.	3	1*	Internal defibrillator paddles; standard drugs; syringe; machine off sterile field
65. Place paddles and initiate discharge	2*	3				
66. Lidocaine if not already initiated			3	1*	1	Lidocaine
67. Check arterial blood gas			3	3	1*	Laboratory equipment
68. Clamp appropriate structures	2*	3				Cardiovascular tray; chest set; median sternotomy supply list
69. Ligate artery above and below injury		3				Cardiovascular tray; chest set; median sternotomy supply list
70. Attempt repair with inflow occlusion		3				Cardiovascular tray; chest set; median sternotomy supply list
71. Palpate over cardiac injury	2*	3				Monitoring eqpt.; EKG; Arterial pressure; Swan Ganz catheter eqpt.
72. Arrhythmia management	2*	3				Monitoring eqpt.; EKG; Arterial pressure; Swan Ganz catheter eqpt.
73. Compress hole/tear in right atrium	2*	3				Cardiovascular tray; chest set; median sternotomy supply list
74. Control injury with finger pressure	2*	3				
75. Apply occluding clamp to larger hole/tear	2*	3				Cardiovascular tray; chest set; median sternotomy supply list
76. Close hole with purse string suture	2*	3				4-0 purse string suture

77. Close tear with running suture	2*	3	4-0 running prolene suture
78. Place partial occluding clamp to control wound	2*	3	Cardiovascular tray; chest set; median sternotomy supply list; Statinsky clamp
79. Clamp SVC above and below wound, dissect and replace with occluding clamp		3	Cardiovascular tray; chest set; median sternotomy supply list
80. Harvest pericardium for patch and suture		3	Cardiovascular tray; chest set; median sternotomy supply list; 4-0 monofilament suture
81. Suture wound		3	4-0 monofilament permanent suture
82. Suture wound and repeat with pledgeted suture	2*	3	4-0 monofilament suture; 4-0 pledgeted interrupted suture
83. Open right atrial appendage after placing 3-0 purse string		3	Cardiovascular tray; chest set; median sternotomy supply list
84. Insert #40 chest tube		3	Cardiovascular tray; chest set; median sternotomy supply list
85. Place tourniquets		3	Tourniquets
86. Close with 4-0 permanent monofilament sutures		3	4-0 permanent monofilament sutures
87. Cut pericardial patch and close with running 4-0 monofilament sutures		3	Cardiovascular tray; chest set; median sternotomy supply list
88. Open abdomen		3	Cardiovascular tray; chest set; median sternotomy supply list
89. Control IVC below diaphragm		3	Cardiovascular tray; chest set; median sternotomy supply list
90. Apply partial occluding clamp		3	Cardiovascular tray; chest set; median sternotomy supply list; Statinsky clamp
91. Fibrillate heart with DC fibrillation and repair with suture		3	DC fibrillation eqpt; 4-0 suture
92. Clamp vein; split pericardium and repair with 4-0 monofilament		3	Cardiovascular tray; chest set; median sternotomy supply list; 4-0 monofilament
93. Immediate right anterior thoracotomy	2*	3	Thoracotomy list
94. Right pericardiotomy	2*	3	Thoracotomy list
95. Evacuate clot	2*	3	Thoracotomy list
96. Occlude hilum and replace with vascular clamp	2*	3	Thoracotomy list
97. Explore hilum	2*	3	Thoracotomy list

98. Open pericardium anterior to phrenic nerve and isolate pulmonary artery	2*	3	Thoracotomy list
99. Open pericardium anterior to phrenic nerve and control proximal artery	2*	3	Thoracotomy list; Cardiovascular tray
100. Reclamp artery	2*	3	Clamp
101. Repair bronchus	2*	3	Thoracotomy list
102. Control pulmonary artery at hilum	2*	3	Thoracotomy list
103. Control bronchus	2*	3	Thoracotomy list
104. Control pulmonary veins	2*	3	Thoracotomy list
105. Proceed with pneumonectomy	2*	3	Thoracotomy list
106. Open pericardium for proximal control	2*	3	Thoracotomy list
107. Repair bronchus with absorbable suture		3	Thoracotomy list
108. Ligate artery distal to middle lobe	2*	3	Thoracotomy list
109. Perform right lower lobectomy	2*	3	Thoracotomy list
110. Perform right middle lower lobectomy	2*	3	Thoracotomy list
111. Ligate, perform apical anterior segmentectomy or right upper lobectomy		3	Thoracotomy list
112. Repair artery with monofilament suture		3	Thoracotomy list
113. Proceed with right upper lobectomy, segmental or wedge resection of devascularized lung	2*	3	Thoracotomy list
114. Control right middle lobe blood supply	2*	3	Thoracotomy list
115. Control right middle lobe bronchus	2*	3	Thoracotomy list
116. Proceed with right middle lobectomy	2*	3	Thoracotomy list
117. Control arterial supply and bronchus	2*	3	Thoracotomy list

118. Control hilar vessels, oversew venous bleeders and examine arterial supply	2*	3	Thoracic list
119. Isolate area of injury, debride and close wound	2*	3	Thoracic list
120. Place pressure over site with stick sponge	2*	3	Thoracic list; cardiovascular tray
121. Apply side occlusion clamp	2*	3	Thoracic list; cardiovascular tray
122. Repair with non-absorbable monofilament suture	2*	3	Thoracic list; cardiovascular tray
123. Isolate cava with tapes, open pericardium and control azygous vein	2*	3	Thoracic list; cardiovascular tray
124. Close back wall from inside and close outer wall	2*	3	Thoracic list; cardiovascular tray
125. Patch with pericardium or dacron	2*	3	Thoracic list; cardiovascular tray
126. Close with non-absorbable monofilament suture	2*	3	Thoracic list; cardiovascular tray
127. Immediate left anterior thoracotomy	2*	3	Thoracotomy list
128. Make an incision parallel and anterior to the phrenic nerve and suspend pericardium with 3-0 silk	2*	3	Thoracotomy list
129. Evacuate clot	2*	3	Thoracotomy list
130. Control bleeding with finger or pack	2*	3	Thoracotomy list; thoracic aneurysm set; open heart Pan 1-2; cardiovascular tray; chest set
131. Repair artery end - end; heparinized shunt optional	2*	3	Thoracotomy list; thoracic aneurysm set; open heart Pan 1-2; cardiovascular tray; chest set
132. Control bleeding and place clamps above and below injury	2*	3	Thoracotomy list; thoracic aneurysm set; open heart Pan 1-2; cardiovascular tray; chest set
133. Primary repair of injury.	2*	3	Thoracotomy list; thoracic aneurysm set; open heart Pan 1-2; cardiovascular tray; chest set
134. Occlude hilum with manual traction en-bloc and place large vascular clamp across hilum	2*	3	Thoracotomy list
135. Open pericardium and isolate left pulmonary artery	2*	3	Thoracotomy list

136. Control pulmonary artery proximal to injury	2*	3	Thoracotomy list; cardiovascular tray
137. Ligate artery distal to lingular segment	2*	3	Thoracotomy list; cardiovascular tray
138. Perform left lower lobectomy	2*	3	Thoracotomy list; cardiovascular tray
139. Ligate arteries and perform segmentectomy or lobectomy	2*	3	Thoracotomy list; cardiovascular tray
140. Repair bronchus with absorbable sutures	2*	3	Thoracotomy list; cardiovascular tray
141. Control arterial bleeding	2*	3	Thoracotomy list
142. Proceed with wedge or segmental resection or upper left lobectomy	2*	3	Thoracotomy list
143. Perform left upper lobectomy	2*	3	Thoracotomy list
144. Repair bronchus with absorbable monofilament	2*	3	Thoracotomy list
145. Control arterial supply	2*	3	Thoracotomy list
146. Control lower lobe bronchus	2*	3	Thoracotomy list
147. Proceed with left lower lobectomy	3	3	Thoracotomy list
148. Pack the apex of the chest, position patient for median sternotomy, control innominate origin and extend incision	2*	3	Thoracotomy list; mediansternotomy list; cardiovascular tray
149. Control proximal left subclavian artery at aortic arch and distal to injury	2*	3	Thoracotomy list; mediansternotomy list cardiovascular tray
150. Interposition graft for repair of artery	2*	3	Thoracotomy list; mediansternotomy list cardiovascular tray
151. End to end anastomosis for repair of artery	2*	3	Thoracotomy list; mediansternotomy list cardiovascular tray
152. Ligate arterial bleeding proximal and distal to injury	2*	3	Thoracotomy tray
153. Ligate mammary artery proximal and distal to injury	2*	3	Thoracotomy tray

154. Ligate venous bleeding. Azygous vein may be ligated	2*	3			Thoracotomy tray
155. Ligate arterial vessel	2*	3			Thoracotomy tray
156. Oversew area of bleeding	2*	3			Thoracotomy tray
157. Repair diaphragm with permanent suture	2*	3			Thoracotomy tray
158. Repair appropriate chest injury	2*	3			Thoracotomy list
159. Close esophageal injury with layer (single/double) technique	2*	3			Thoracotomy tray
160. Open mediastinal pleura widely	2*	3			Thoracotomy tray
161. Apply chest tube drainage and give antibiotics	2*	3			Thoracotomy tray
162. Ligate esophagus below injury with umbilical tape or heavy stitch	2*	3			Thoracotomy tray
163. Tube pharyngostomy or cervical esophageal diversion	2*	3			Thoracotomy tray
164. Tube gastrostomy, feeding enterostomy	2*	3			Thoracotomy tray
165. TPN or enteral feeding	2*	3			Thoracotomy tray
166. Attempt repair with mobilization of trachea, debridement	2*	3			Thoracotomy tray
167. Trachea ventilated with double lumen, or sterile tube	2*	3			Thoracotomy tray
168. Repair with absorbable monofilament suture	2*	3			Thoracotomy tray
169. Cover suture line with pleural patch, muscle flap or pericardial flap	2*	3			Thoracotomy tray
170. Attempt bronchoplastic repair of upper lobe bronchus	2*	3			Thoracotomy tray
171. Bolus 100 mg lidocaine and begin lidocaine drip 2 mg/min			3	3	1 Lidocaine
172. Measure cardiac enzymes			3	3	1* Monitoring equipment

173. Serial EKG			3	3	1*	Monitoring equipment
174. Swan-Ganz monitor			3			Swan-Ganz catheter and monitor
175. Arterial line			3			Tubing; monitor with pressure capability; pressure bag; heparin
176. Echo cardiogram		Cardiologist				Electrocardiography capability
177. Serial cardiac enzymes			3	3	1*	Monitoring equipment
178. O_2			3	3	1*	O_2 source and monitor
179. Maintain minimal fluid intake to keep urine > 50 cc/M^2/hr	2*	3	2	2	1*	Fluid intake monitor
180. Minimize fluid replacement to keep urine > 50 cc/M^2/hr			2	2	1*	Fluid intake monitor
181. Intraoperative PEEP as tolerated			2	2	1*	Positive end expiratory pressure monitor
182. Ear oximetry			3	3	1*	
183. Hold PEEP until blood pressure stable			2	2	1*	
184. Urine output monitored			2	2	1*	Fluid output monitor
185. Serial blood gases or ear oximetry			3	3	1*	Serial blood gas monitor
186. Respiratory care			3	3	1*	
187. Ventilator			3	3	1*	Ventilator; O_2 source

CARDIO VASCULAR TRAY

BOTTOM LAYER

#7 KNIFE HANDLE
STRULLY SCISSOR
POTTS SCISSORS - 25, 45, 60 DEG
NARROW TIP SUTURE SCISSOR

SECOND LAYER

30 DEG PERIPHERAL CL (BLACK)
ACUTE ANG MINATURE CLAMPS
STR ATRAGRIP CLAMPS
30 DEG DEBAKEY MINATURE CLAMPS
LONG ALLISES

THIRD LAYER

LONG ATRAGRIP TISSUE FCPS
MED ATRAGRIP TISSUE FCPS
SH ATRAGRIP TISSUE FCPS
LONG FINE TIPPED N.H.
MED N.H.
SH FINE TIPPED N.H.

FOURTH LAYER

TANGENITAL OCCLUSION CL (LG ANG
SATINSKY)
SEMB CLAMP
KIDNEY PEDICLE CLAMP

CHEST SET (THORACIC) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
MEDIUM NEEDLE HOLDERS
LONG NEEDLE HOLDER -NOT FINE
SPONGE STICKS
LONG CURVES
LAUERS
TONSILS
KOCKERS - CLAMP
BABCOCK CLAMP
ALLIS CLAMP
CURVED CRILER
CURVED MOSQUITOES CLAMP
SUTURE SCISSORS
MAYO SCISSORS
METZ SCISSORS
LONG METZ SCISSORS

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

EXTRA LONG INSTRUMENTS

CONTENTS

EXTRA LONG NEEDLE HOLDER
EXTRA LONG FINE NEEDLE HOLDER
EXTRA LONG CURVES
REGULAR RUMEL
MEEKERS
BRIDGE FORCEPS
EXTRA LONG ALLISES
EXTRA LONG RUSSIAN
EXTRA LONG THUMB WITHOUT TEETH
LONG BABCOCKS
EXTRA LONG METZ

LAPAROTOMY EQUIPMENT LIST A

SUTURE
SILK 2-0 STRAND
SILK 3-0 STRAND

STICK TIES
SILK 2-0 SH
SILK 3-0 SH

CLOSURE
VICRYL 0 CT
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM-35W

DRAPES & PACKS
MAJ. BASIN/GRADUATE W/
MED. CUP 60CC
LAPAROTOMY SHEET
BACK TABLE COVER
TOWELS, STERILE (6)
MAYO STAND COVER
GOWN, STERILE XLR. LRG. (3)
SKIN PREP TRAY
MEDIUM SHEET 44 X 60"

SPONGES
LAP. 18 X 18 (3)
4 X 4 X-RAY DETECT
CYLINDRICAL DISECTOR'S

CAUTERY
GROUNDING PAD
ELECTRO-CAUTERY HAND PENCIL
CAUTERY MACHINE
CAUTERY EXTENTION BLADE

CATHETER
CATH. PLUG
FOLEY CATH. TRAY
FOLEY CATH. 16FR. THERMAL
URIMETER DRAINAGE BAG

GLOVES
EXAM, UNSTERILE
SURGEONS, STERILE
SURGEONS HYPO-ALLERG., STERILE

SOLUTIONS
IRRIG. WATER 1500CC
IRRIG. NACL 1000CC

MISCELLANEOUS
BLADE, SURGICAL #10
BLADE, SURGICAL #15
BLADE, SURGICAL #21
CACRON TAPE
HEMOCLIP, SMALL
HEMOCLIP, MED.
HEMOCLIP, LRG.
RAZOR, PROP
MAGNETIC NEEDLE MAT
SUCTION TUBING 20'

INSTRUMENTS & EQUIPMENT
LAPAROTOMY SET
EXTRA LONG INSTR.
RETR. UPPER HAND
BOSEL CLAMPS
HEADLIGHT, FIBEROPTIC
DEEP BALFOR

DRAINS
PENROSE 1" X 36"
JACKSON PRATT, 7MM & 10MM
JACKSON PRATT RESERVOIR
CATH. MALCOTT 22GR.
CATH. RED RUBBER 14FR.

HAVE AVAIL. INTERNAL STAPLES
TA 30,55,90. - 3.5MM & 4.8MM
TA 30,55,90/ - 3.5MM & 4.8MM
GIA MULTI USE UNIT & GUN
POWERED PLDS-15W

DRUGS
CEFADYL 1GM.
THROMBIN 10,000U

SYRINGE
SYRINGE, 30CC LL
SYRINGE, 60CC LL
SYRINGE, 10CC LL
SYRINGE, 60 CC SLIP TIP

COLOSTOMY BAG
COLOST/TLEOST FLNG, 100MM X 4"
COLOST/TLEOST FLNG, 70MM X 4"
LOOP OSTOMY, 100MM
LOOP OSTOMY, 70MM

DRESSINGS
TELFA
GAUZE, 4 X 8"
ABD. STERILE

LAPAROTOMY LIST B EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

2 ARMY/NAVYS
2 SHARP RAKES
1 WIDE MALLEABLE
1 NARROW MALLEABLE
1 WIDE DEAVER
1 NARROW DEAVER
1 LARGE RICHARDSON
1 MEDIUM RICHARDSON
1 SMALL RICHARDSON
1 WIDE HARRINGTON
1 NARROW HARRINGTON
1 BALFOUR
2 TONSIL SUCTIONS
6 BALL CLIPS

PEEL PACK:

---

4 REGULAR TOWEL CLIPS
2 #3 KNIFE HANDLES
1 #4 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
1 LONG THUMBS WITHOUT TEETH
2 LONG RUSSIANS
2 FINE GYNES
2 ADSONS WITH TEETH
2 LONG ATRAGRIPS
1 POOL SUCTION

WRAP IN TOWEL:

---

2 MEDIUM HEMOCLIP APPLIERS - LONG

2 MEDIUM NEEDLE HOLDERS
2 LONG NEEDLE HOLDERS - NOT FINE
2 SPONGE STICKS
4 LONG CURVES
4 LAUERS
4 TONSILS
4 KOCKERS
2 BABCOCKS
4 ALLISES
10 CURVED CRILES
4 CURVED MOSQUITOES
1 SUTURE SCISSOR
1 MAYO SCISSOR
2 METZ SCISSORS
1 LONG METZ SCISSOR

MEDIANSTERNOTOMY EQUIPMENT LIST

SUTURE

MAXON 2-0 T-25
MAXON 3-0 t-25
SILK 3-0 SH
SILK 2-0 SH
SILK 3-0 STRAND
SILK 2-0 STRAND
STAPLE LOADING UNIT SM-35W

SUPPLIES

BASIN, MAJOR SET
GOWN, STER BACK LRG
GOWN, STER BACK XLRG
SHEET, LAB
SHEET, MEDIUM
TABLE COVER
TRAY, SKIN SCRUB

GLOVES

GLOVES, EXAM LRG UNSTERILE
GLOVES, TRIPLEX

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, LECTROSWITCH HANDSWITCH

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #21
BONE WAX W-31G
DACRON TAPE 8618-00
DURA HOOKS, (FISH HOOKS)
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT
NEEDLE, SPINAL 22 GA X 3 1/2
SYRINGE, 30CC LL
SYRINGE, BULB

SPONGES

SPONGE, 18 X 18 LAP
SPONGE, GAUZE X-RAY DETECT
SPONGE, KITTNER DISECTORS

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

INSTRUMENTS & EQUIPMENT

CARDIOVASCULAR TRAY
CHEST SET
EX. LONG INSTRUMENTS
HEADLIGHT
LAP SET
N-H, EX LONG
RET, HIMMELSTEIN
RETR, MOARSE
STERNAL SAW
SCISSOR, LONG FINE METZ
TRAUMA CHEST TRAY

DRAINS

CHEST TUBE 32FR THORACIC
CHEST TUBE 36FR THORCIC
PLEUROVAC, ADULT

DRESSINGS

DRESSING, GAUZE 4X8 12 PLY
DRESSING, TELFA

VASCULAR

FELT 3 X 3
SUTURE BOOTS
VESSEL LOOPS, MAXI
VESSEL LOOPS, MINI

OPEN HEART PAN 1 EQUIPMENT LIST

BOTTOM OF PAN

ANGLED PUMP SUCKERS
#9 FRAZIER SUCTION TIP
#11 FRAZIER SUCTION TIP
#7 FRAZIER SUCTION
TONSIL SUCTION TIPS
STERNAL LG ANGLED PUMP SUCTION TIP
TRAUMA SCISSOR

WRAP IN TOWEL

ANGLED DEBAKEY
MEDIUM ATRAGRIPS
LONG ATRAGRIPS
RUMEL STYLETS

WRAP IN TOWEL

ADSON W/TEETH
ADSON W/OUT TEETH
SHORT THUMB W/TEETH
LONG THUMBS W/TEETH
LONG RUSSIANS
DIAMOND JAW ADSON
#3 KNIFE HANDLE
#4 KNIFE HANDLE
#7 KNIFE HANDLES

STRINGER #1

FOGARTY BULLDOG CLAMP
RUMEL CLAMP RIGHT ANGLE
KIDNEY PEDICLE CLAMP
TUBING CLAMPS
LONG NEEDLE HOLDERS
MEDIUM NEEDLE HOLDERS
SHORT FINE NEEDLE HOLDERS
RUGGLES NEEDLE HOLDER
PEDIATRIC MIXTER
ST COARCTATION CLAMP.#7110
ANG COARCTATION CLAMP.#7112
LG SIDE OCCLUSION CL.#4085
SM SIDE OCCLUSION CL.#4084
CROSS CLAMP.....CL.#466
POTTS ANGLED SCISSORS
RUMEL THORACIC ARTERY FORCEPS
KAY-LAMBERT CLAMP ...#3585

STRINGER @2

TONSIL CLAMPS
LAUERS
ST FINE MOSQUITO
CR FINE MOSQUITOES
CR CRILES
SUTURE SCISSORS
MAYO SCISSORS
REGULAR METZ SCISSORS

OPEN HEART PAN 2 EQUIPMENT LIST

PEEL PACK

ASSORTED DILATORS
TRACH HOOK
#3 LONG KNIFE HANDLE
#3 SHORT KNIFE HANDLE
#4 KNIFE HANDLE
NERVE HOOK
PARHAM BANDS
ASSORTED ELEVATORS

RACK

LARGE TOWEL CLIPS
KOCHERS
STRAIGHT CRILES
CURVED CRILES
BABY TOWEL CLIPS
SMALL TUBING CLAMPS
ALLIS
CURVED OSCHNER
STRAIGHT MOSQUITOES
LARGE LONG HEMOCLIP APPLIERS
MED LONG HEMOCLIP APPLIER
HEMOOCLIP APPLIER

LOOSE IN PAN

SHARP RAKE
WIDE RACK
ARMY/NAVY
MEDIUM RIBBON
LONG RULER (1 SET HAS 1)
PARHAM BAND TIGHTNER
FINOCHIETTO RETRACTOR
ADSON RONGUER
BALL CLIPS (PEEL PACK)
MEDIUM WEITLANERS
CT LIGHT HANDLE

SHORT STRINGER

CURVED MOSQUITOES
SHORT NEEDLE HOLDER
RUGGLES NEEDLE HOLDER
MEDIUM LAUER
REGULAR METZ SCISSOR
BABY SUTURE SCISSOR
BABY METZ SCISSOR
REGULAR SUTURE SCISSOR
SM MED HEMOCLIP APPLIERS
SM SHORT HEMOCLIP APPLIERS
BABY WEITLANERS

WRAP IN TOWEL

SHORT ATRAGRIPS
FINE GYNE THUMBS
ADSON THUMBS W/TEETH
#3 SHORT KNIFE HANDLE
SENNS RETRACTORS
ARMY/NAVY
HEMOCLIP HOLDER

CL. THORACIC ANEURYSM EQUIPMENT LIST

DEBAKEY AORTIC ANEURYSM CLAMPS

#FB471
#FB472
#FB473

DEBAKEY NON-TRAUMATIC VESSEL CLAMPS

#FB510
#FB511
#FB512
#FB513

THORACOTOMY LIST

SUTURE

SILK A-306H 0 STRAND
SILK SA-75H 2-0 STRAND
SILK SA-74H 3-0 STRAND

STICK TIES

SILK K-33H 2-0
VICRYL J-833H 2-0 SH
SILK K-832H 3-0
CHROMIC G-122H 3-0 SH

BRONCHUS

VICRYL J-304H 4-0 RB-1 (use with
2-0 silk strand for chest
tube skin stitch)
NEEDLE 3/8 CUTTING 2090-14

OR

SILK 737G 2-0 X-0

CLOSURE

VICRYL J-849G 2 TP-1
MAXON 2-0 T-25 OR 628751
MAXON 3-0 T-25 6287-41

SKIN (ASK)

PDS Z-422H 4-0 PS-2
STAPLE, LOADING UNIT SM-35W
STAPLE GUN, SKIN

PACKS AND DRAPES

PACK, BASIC
BASIN, MAJOR
BASIN, STANDARD SINGLE SET
TRAY, SKIN SCRUP SURGERY
COVER, MAYO STAND 8337
SHEET, TRANSVERSE LAP
GOWN, STER BACK XL A9541
GOWN, STER BACK LAG A9511
CLOTH DRAPE (SINGLE)
TOWELS, STERILE (8 PK)

FOLEY CATHETERS --ASK FIRST

TRAY, CATH FOLEY UNIVERSAL
CATHETER, FOLEY W/T SENS 16FR3C
URIMETER, DRAIN BAG

CAUTERY

CAUTERY MACHINE
PAD, GROUNDING ADULT
PENCIL, ELCTROSWITCH HANDSWITC
BOVIE HOLDER
ELECTRODE, BLADE EXTENDED(ARGON
BEAM MACHINE AVAILABLE)
ARGON BEAM PAD
ARGON BEAM TIP

SPONGES

SPONGES, CYLINDRICAL DISECTORS
SPONGE, LAP 12 X 12
SPONGE, LAP 18 x 18
SPONGE, GAUZE X-RAY DETECT

SUCTION

RECEPTAL LINER 3000CC
TUBE, CONNECTING 20 FT

SOLUTIONS

SOLUTION, IRRIG WATER 1500ML
SOLUTION, IRRIG NACL 1000

MISCELLANEOUR SUPPLIES

BLADE, SURGICAL #21
BLADE SURGICAL #10 024760
BLADE, SURGICAL #15
BONE WAX W-31G
DACRON TAPE 8618-00
DRAPE, IOBAN 6648
HEMOCLIP, MED
HEMOCLIP, LRG
MAGNETIC INSTRUMENT MAT
MAGNETIC NEEDLE MAT AVAILABLE
RAZOR, PREP DISP
VESSEL LOOPS MAXI RED
VESSEL LOOPS MINI YELLOW

DRAINS

TUBE, CHEST 28FR THORACIC
TUBE, CHRST 32FR THORACIC
TUBE, CHEST 36FR THORACIC
PLEUREVAC, ADULT

INSTRUMENTS AND EQUIPMENT

CHEST SET
LAPAROTOMY SET
LUNG SPATULA
BEANBAG/"U" SHAPED VAC PAC
CARDIO VASCULAR TRAY
HEADLIGHT
LIGHT HANDLES, BLUE RIGID (2)
CRYO UNIT
SCISSOR, METZ, LONG FINE
APPLIER, HEMOCLIP, LARGE, LONG

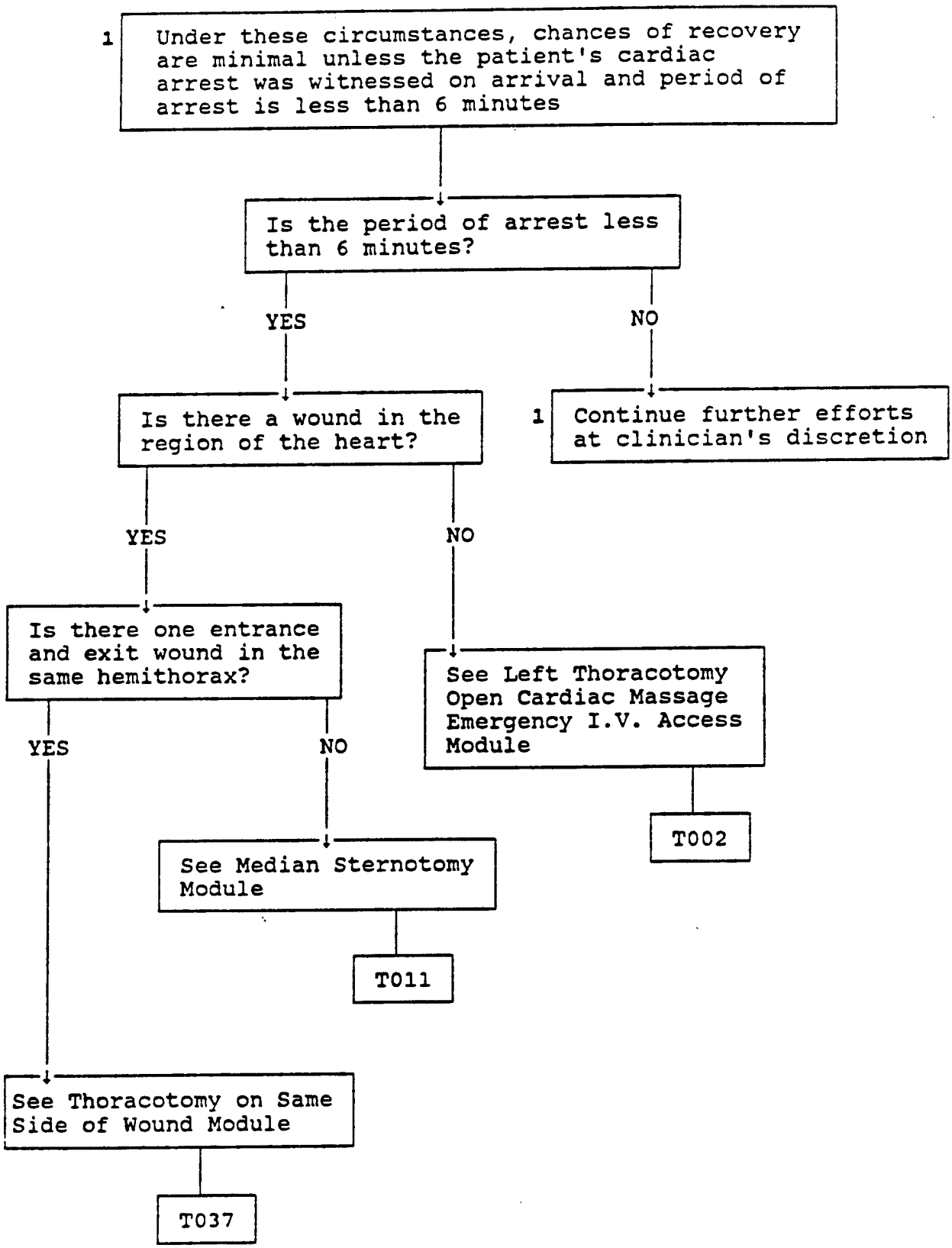
(HAVE AVAILABLE)
FCP, ATRAGRIP, LONG
CLAMP, COARCTATION
B B, EX. LONG
RETR, MOORSE, STERNAL
RETR, HIMMELSTEIN
CLAMP, THORACIC ANEURISM
DRESSINGS

DRESSING, TELFA
DRESSING, GAUZE 4 X 8 12 PLY
PAPER TAPE

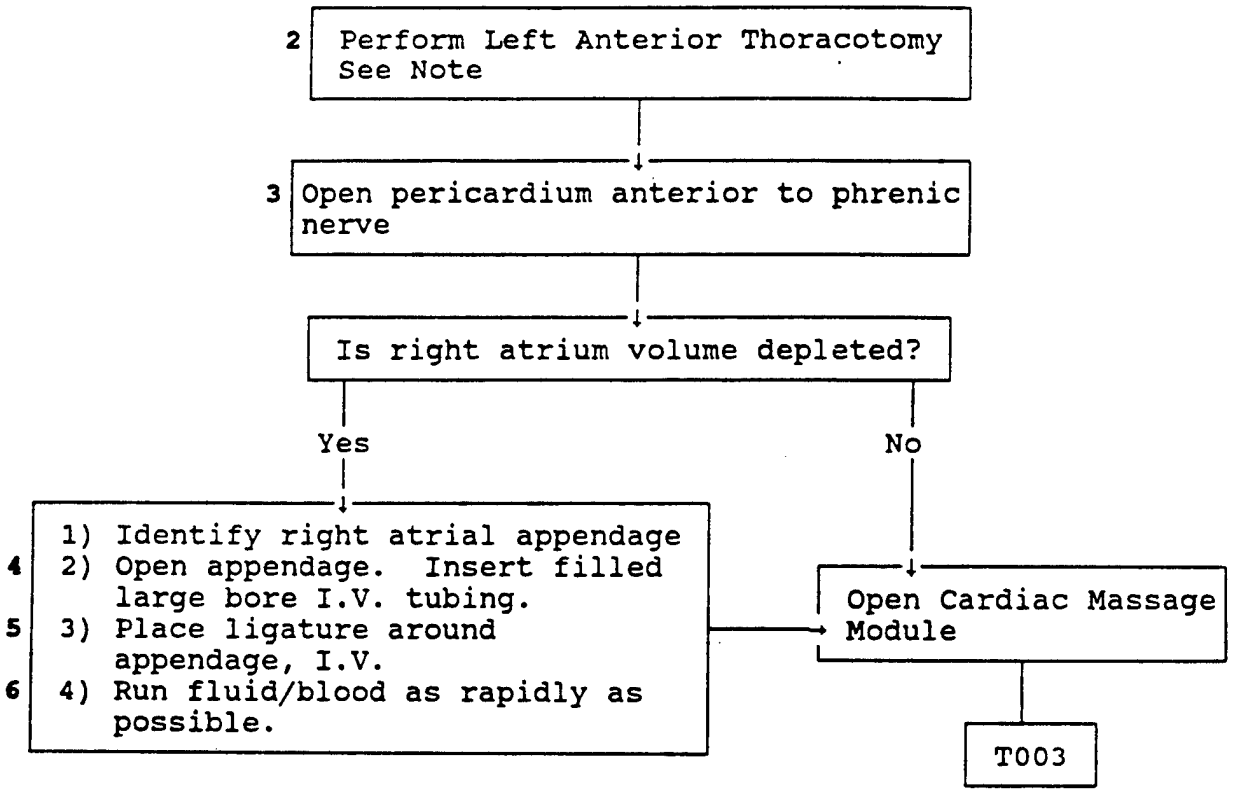
TRAUMA CHEST TRAY - Minimal equipment

1 - MEDIMM FINOCHETTI RETRACTOR
1 - EXTRA LONG NEEDLE HOLDER
4 - BABY TOWEL CLIPS
1 - 9" CURVE
1 - LONG MAYO
1 - CURVED CRILE
1 - STRAIGHT CRILE
1 - LAUER
1 - STRAIGHT COARCTATION CLAMP
1 - TANGENTIAL OCCLUSION CLAMP
2 - TONSIL HEMOSTATS
1 - 4# KNIFE HANDLE
4 - TOWELS (FOLDED READY TO SQUARE OFF)
2 - PACKAGES COUNTED 12 BY 12'S
STERNAL SAW/LEBSCHE
BETADINE PREP
SUTURE FOR REPAIR
SUCTION
CHEST TUBES
DRAINAGE SYSTEM

CARDIAC ARREST MODULE II

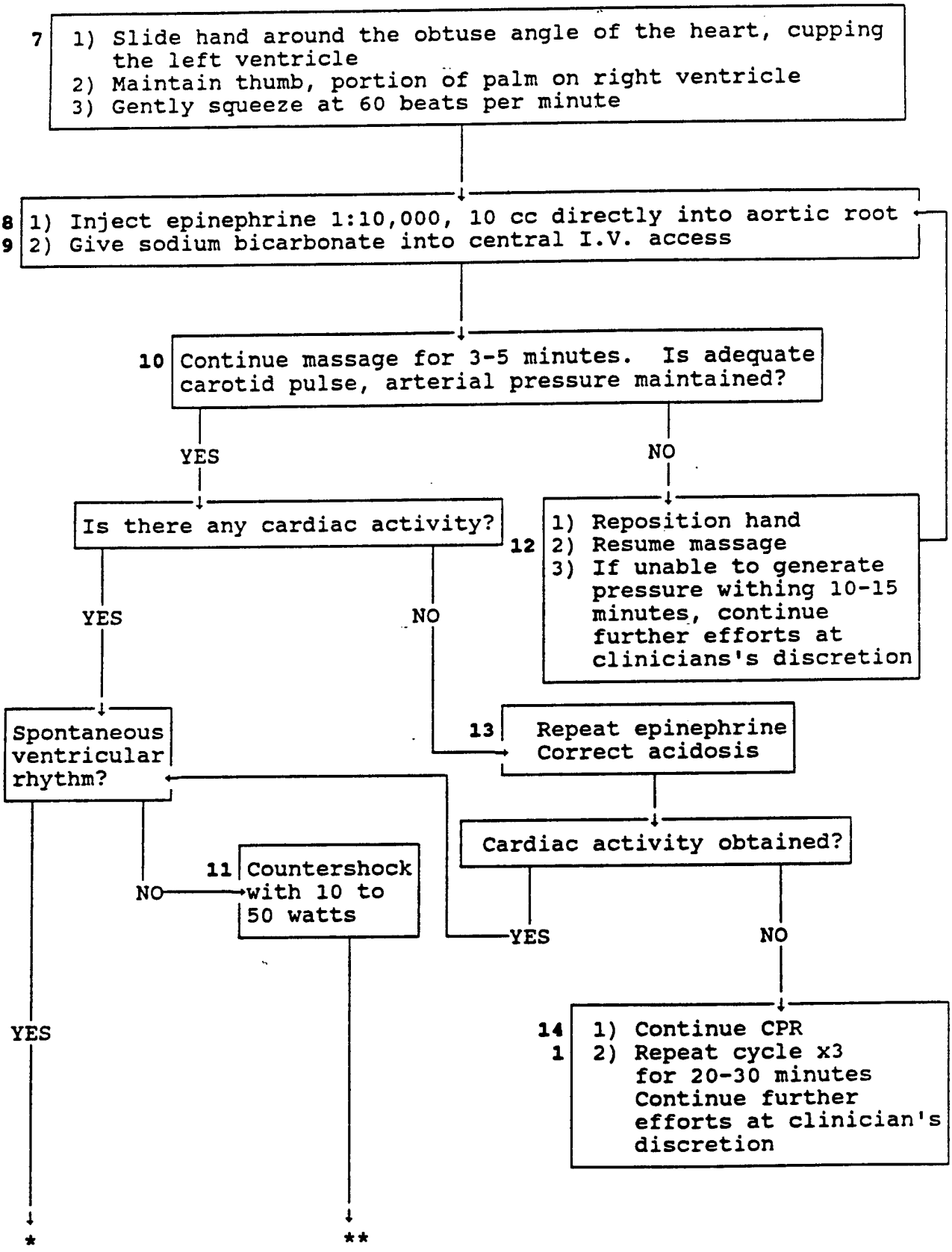


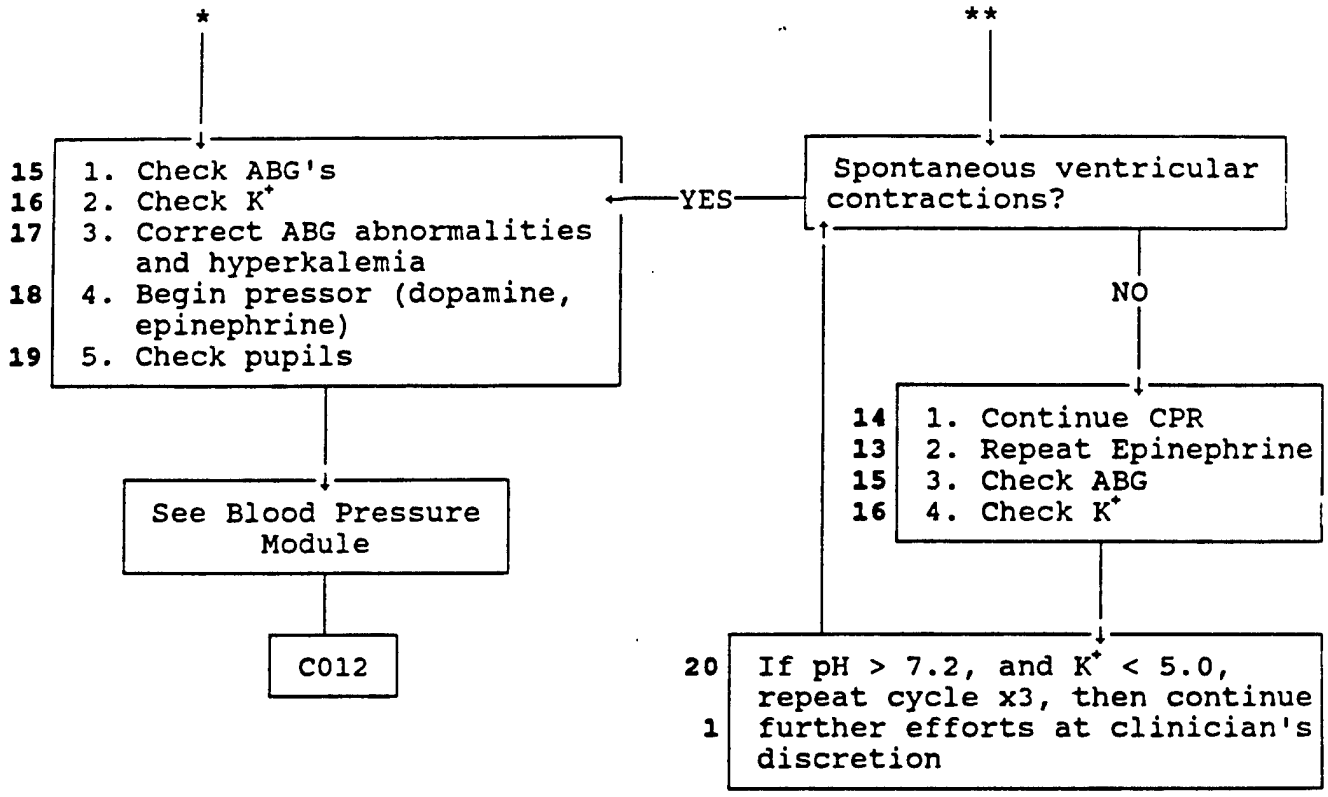
LEFT THORACOTOMY OPEN CARDIAC MASSAGE
EMERGENCY I.V. ACCESS MODULE



Note: See T051 for technique

OPEN CARDIAC MASSAGE MODULE




*
**
15 1. Check ABG's
16 2. Check K+
17 3. Correct ABG abnormalities and hyperkalemia
18 4. Begin pressor (dopamine, epinephrine)
19 5. Check pupils
YES
Spontaneous ventricular contractions?
NO
14 1. Continue CPR
13 2. Repeat Epinephrine
15 3. Check ABG
16 4. Check K+
See Blood Pressure Module
C012
20 If pH > 7.2, and K+ < 5.0, repeat cycle x3, then continue
1 further efforts at clinician's discretion

PERICARDIAL TAMPONADE MODULE

21 Are two or more signs of pericardial tamponade present?
1. Distended neck veins
2. Muffled heart tone
3. Elevated CVP
4. Unexplained shock
5. Agitated patient with unexplained shock

YES

See Subxiphoid Pericardiotomy Module

T005

NO

See Emergency Chest X-Ray Module

T007

SUBXIPHOID PERICARDIOTOMY MODULE

22 1. Prep anterior chest wall from chin to navel and laterally to both midaxillary lines with Betadine solution for 30 seconds

23 2. Drape above area with sterile towels and cover with laparotomy drape

24 3. Make a 2-3" vertical incision over xiphoid process and with the cautery, extend incision down to xiphoid process and around and under xiphoid process, taking care to use cautery as close to xiphoid process as possible

25 4. With a Kocher clamp, pull up on xiphoid process, and with cautery and index finger make a tunnel under xiphoid process to undersurface of sternum

25 5. With sterile gauze, wipe anterior surface of pericardium laterally in both directions

25 6. Hook under sternum two Army-Navy retractors to be held up by assistant (remove Kocher clamp) and visualize anterior-inferior edge of pericardium

Is there obvious blood in the pericardial space?

YES

26 Do immediate median sternotomy

See Median Sternotomy Module

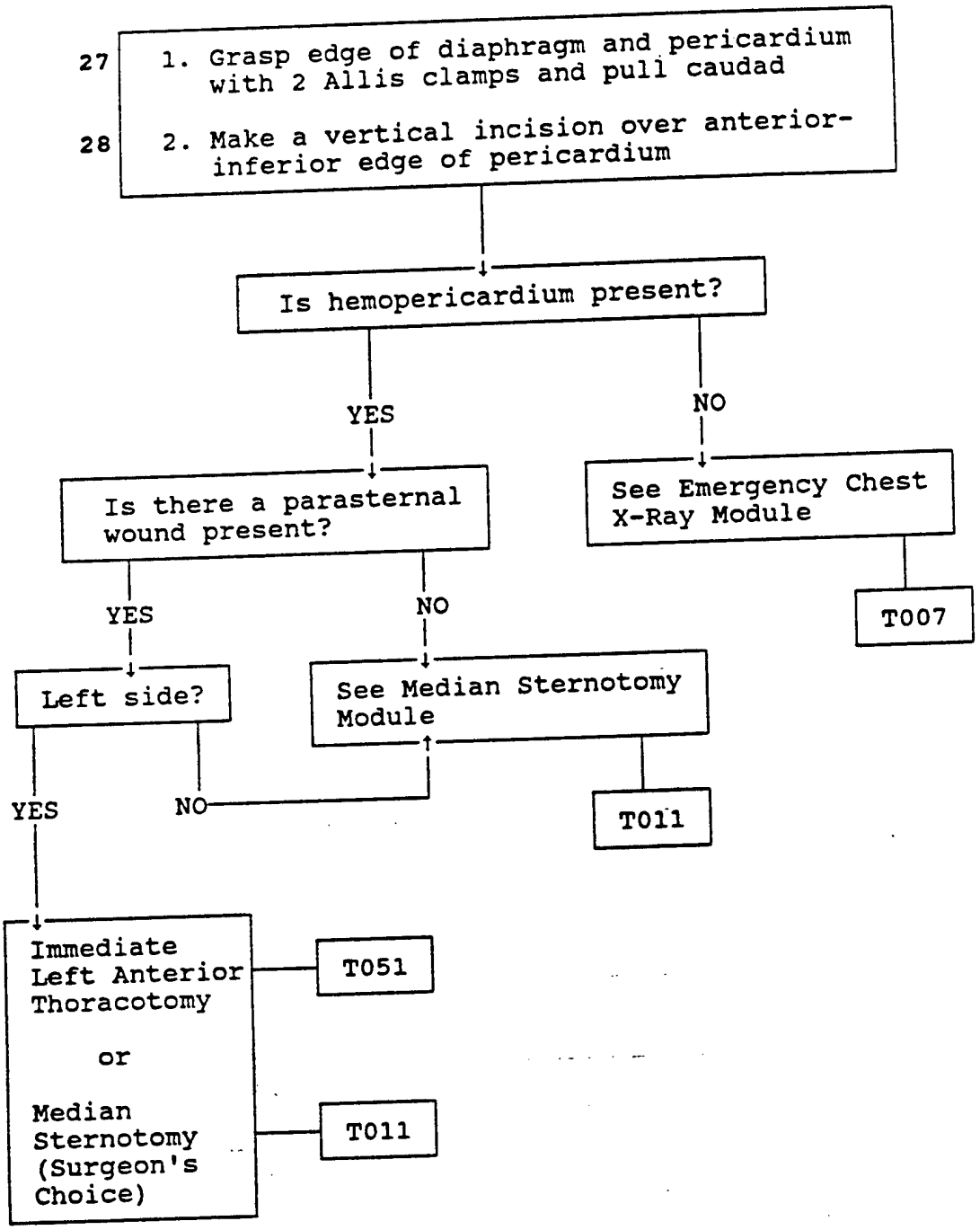
T011

NO

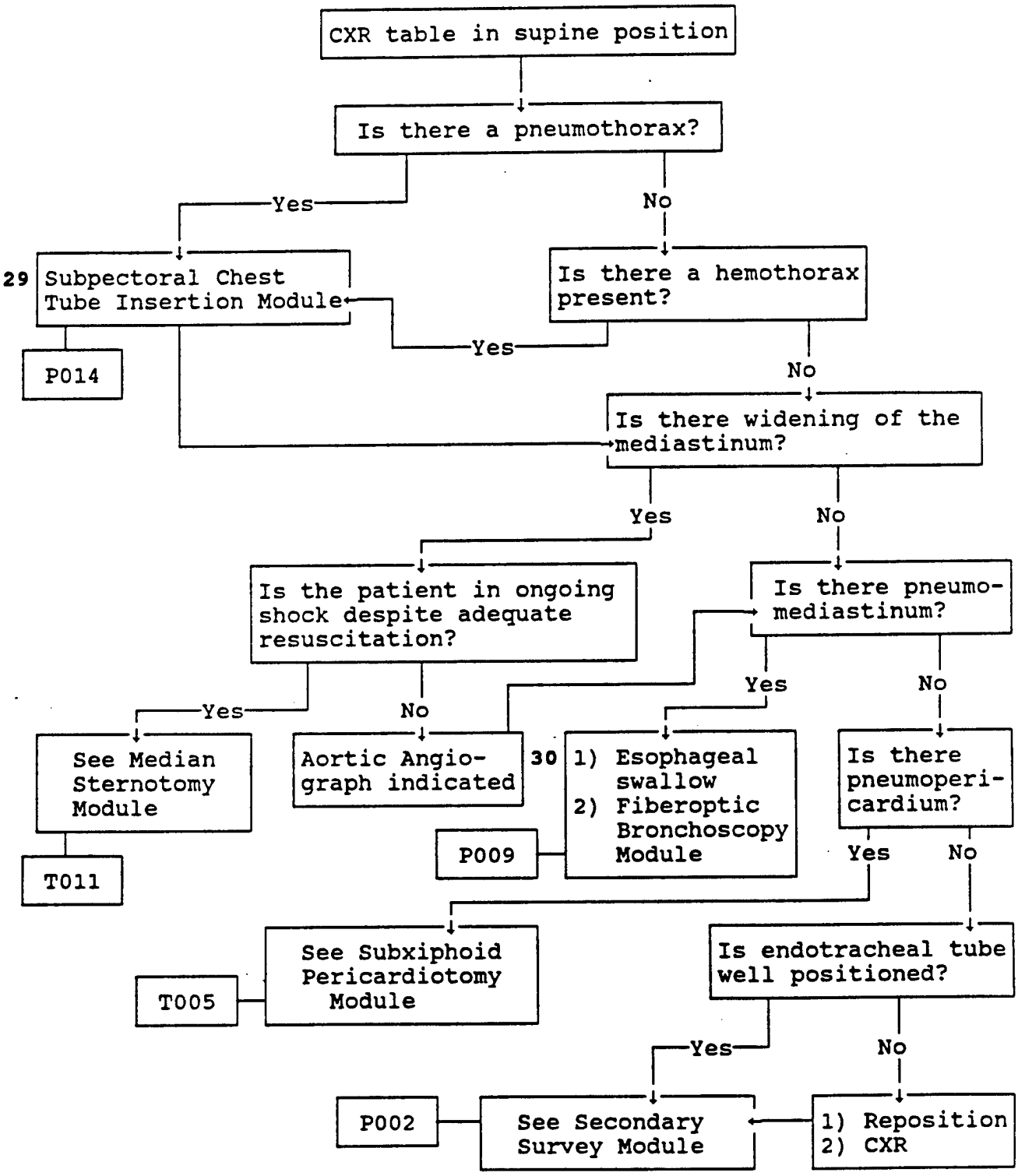
See Subxiphoid Pericardiotomy Module A

T006

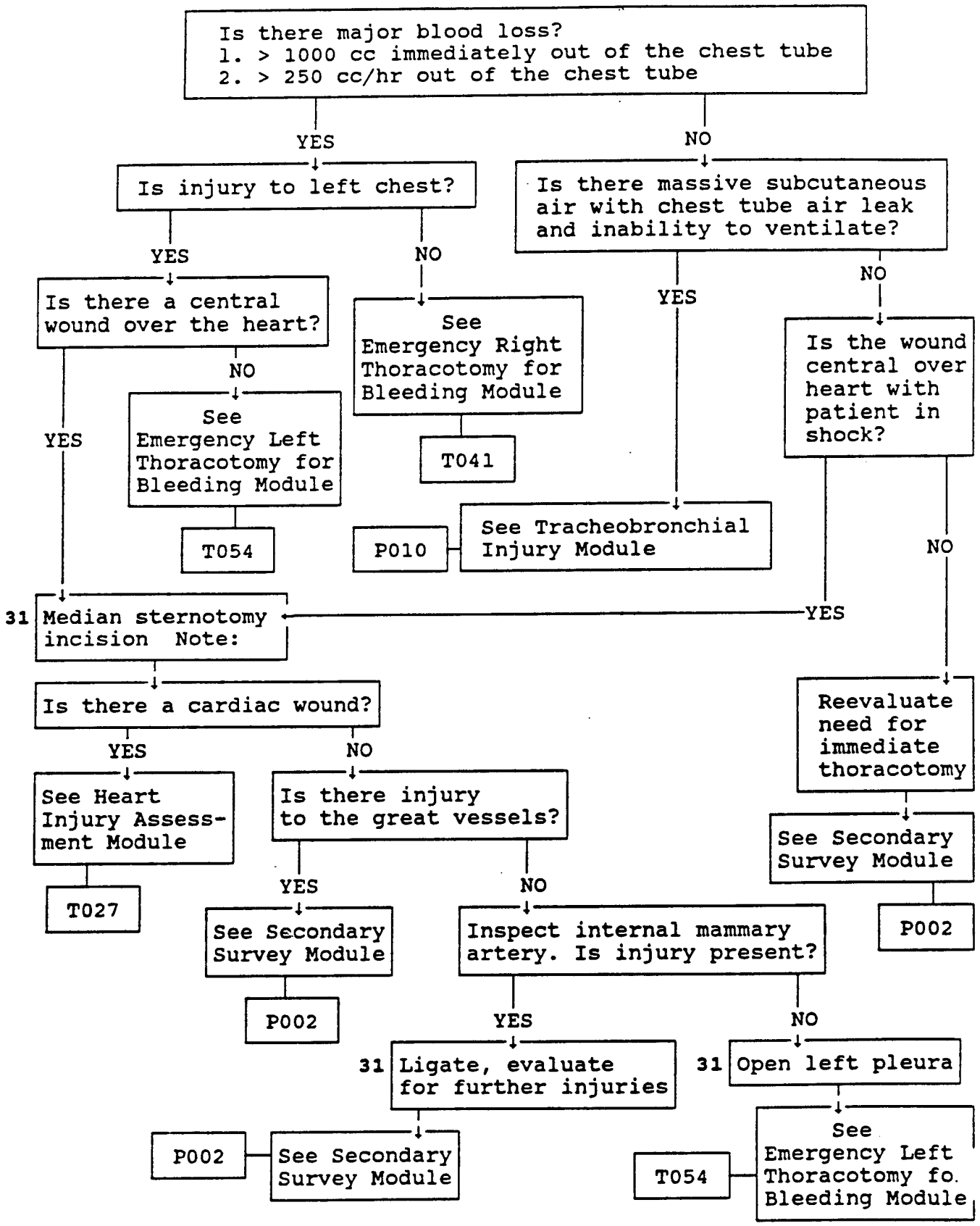
SUBXIPHOID PERICARDIOTOMY MODULE A



EMERGENCY CHEST X-RAY MODULE



IMMEDIATE THORACOTOMY MODULE



Note: See T011 for technique

TRANSSTERNAL THORACOTOMY MODULE

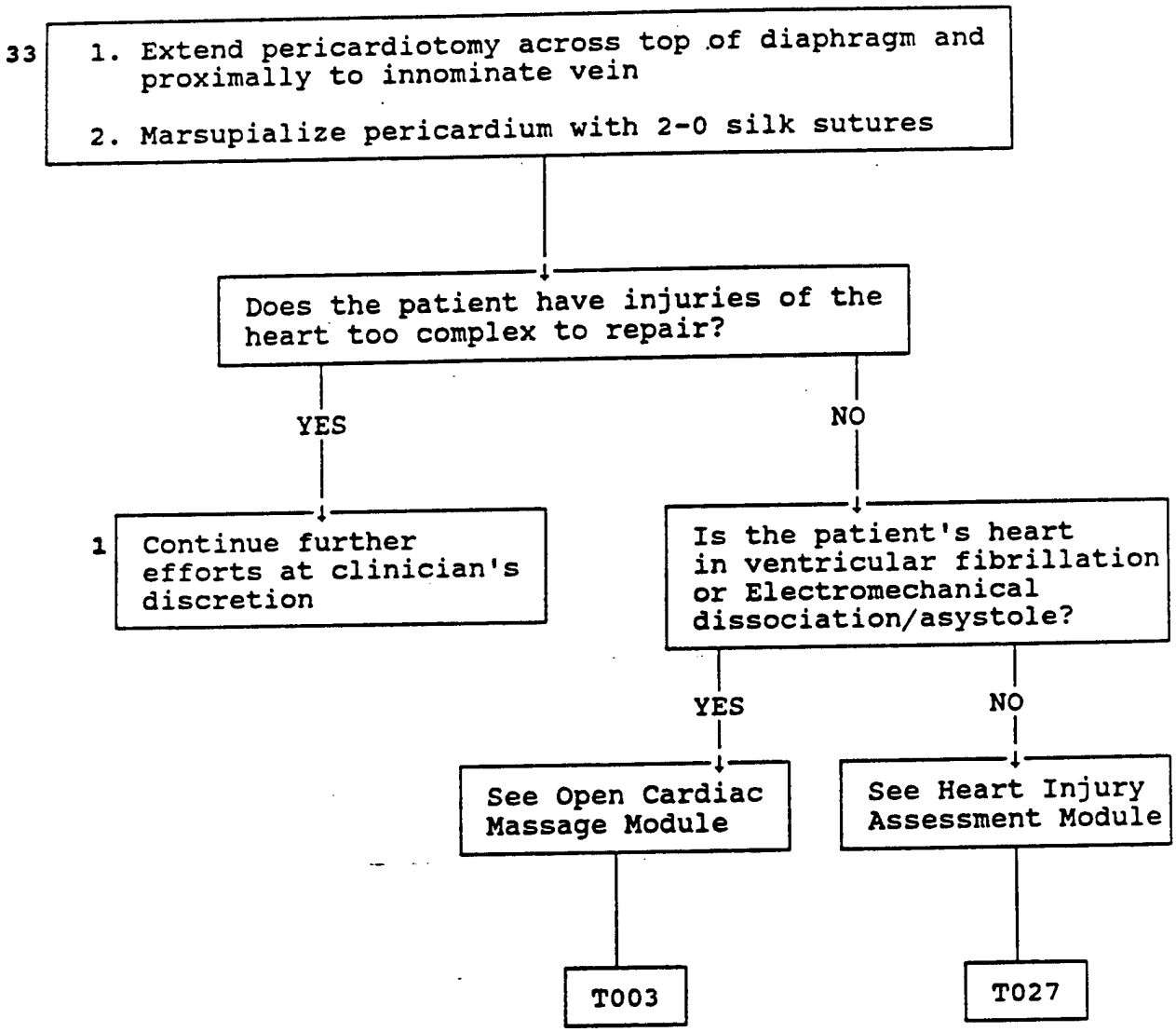
32

1. Extend incision transversely across sternum into opposite 5th intercostal space and extend incision into midaxillary line
2. Use cautery to carry incision down to sternum and intercostal muscles
3. Quickly dissect out opposite internal mammary artery and vein. Ligate or hemoclip in continuity and divide
4. Enter 5th intercostal space by opposite hemithorax by using cautery on top of 6th rib
5. Divide sternum with sternal saw or Lebsche knife or Gigli saw or rib cutter
6. Use another chest retractor to open opposite hemithorax 4-6 inches

See Transsternal Thoracotomy Heart Assessment Module

T010

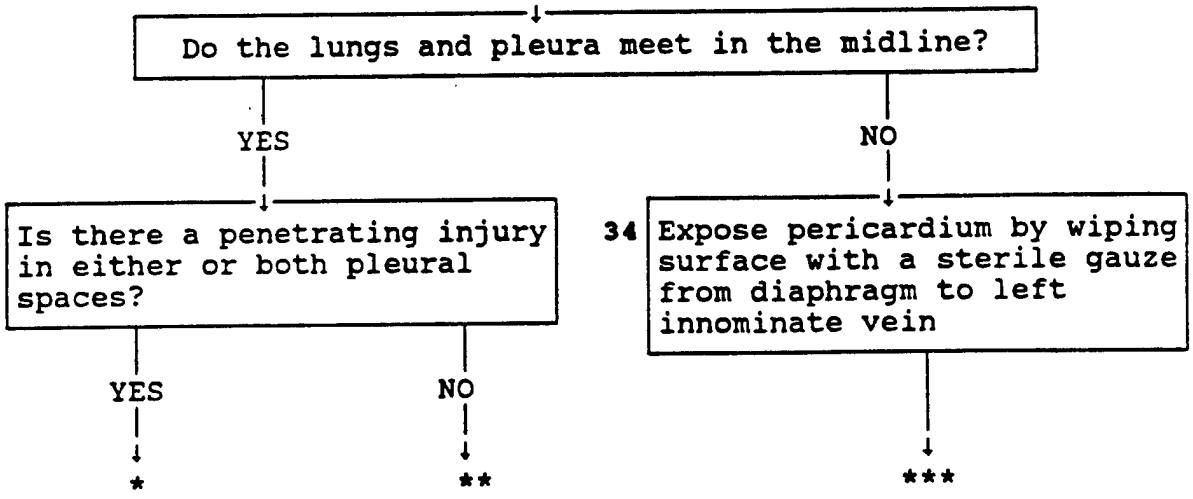
TRANSSTERNAL THORACOTOMY HEART ASSESSMENT MODULE



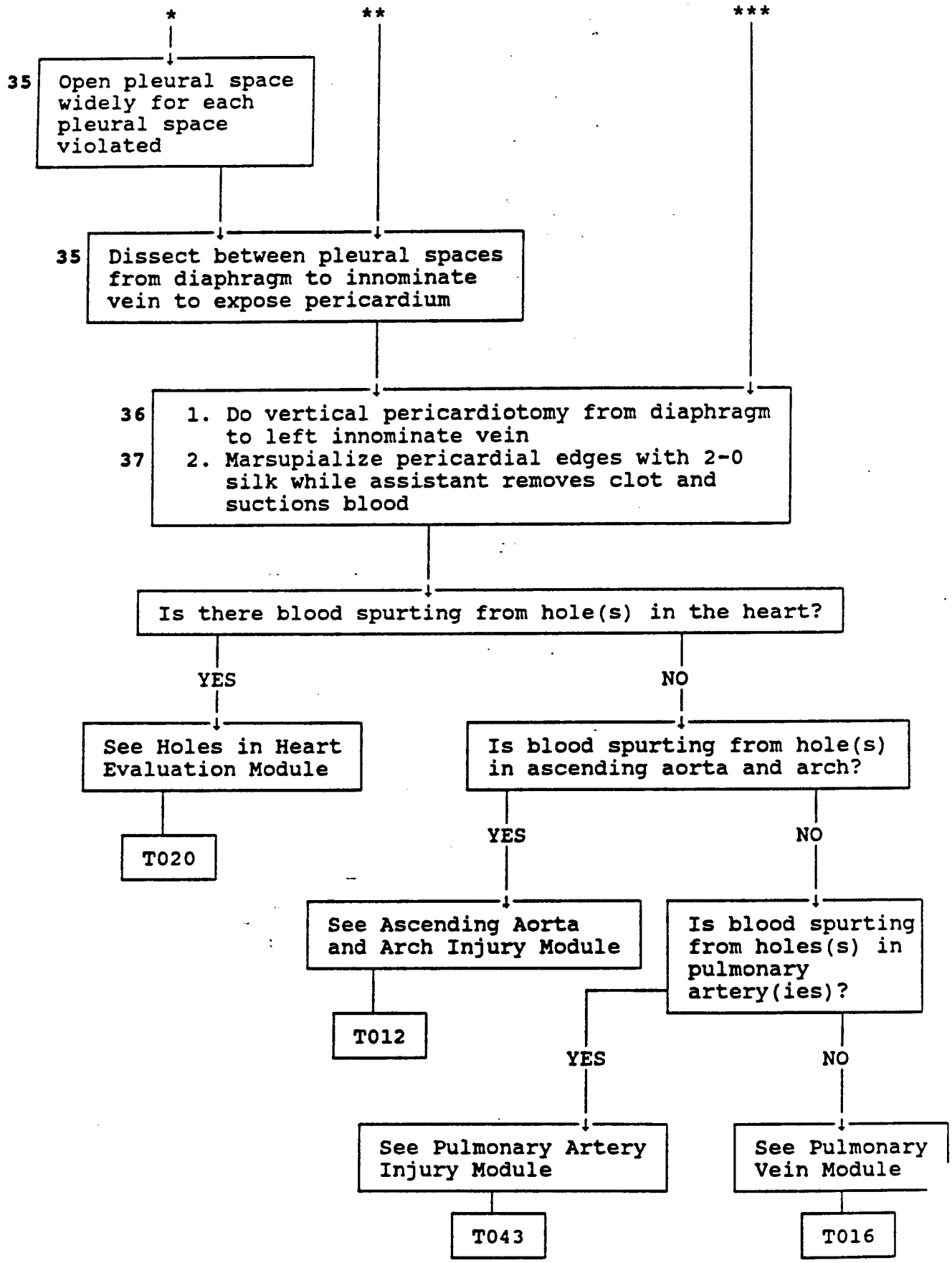
MEDIAN STERNOTOMY MODULE

31

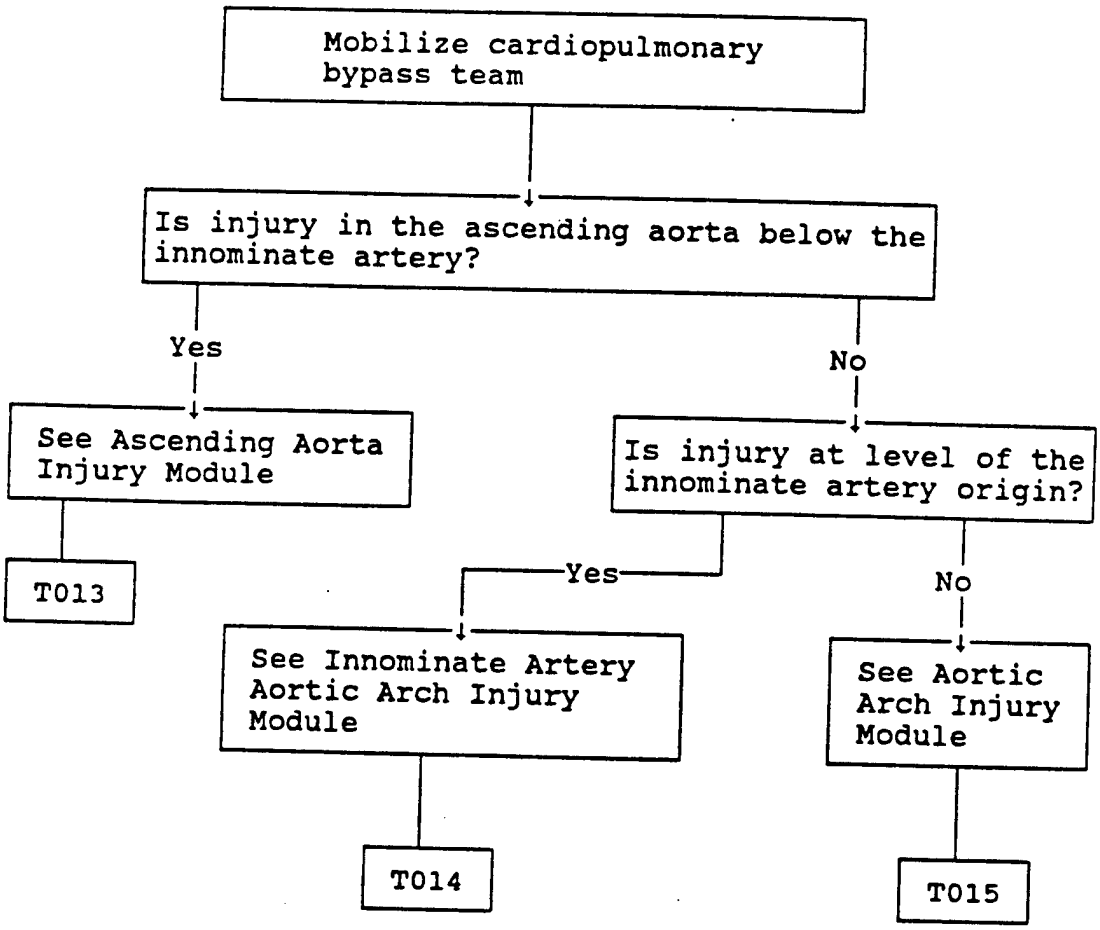
1. Make an incision from suprasternal notch to xiphoid process
2. With the cautery, continue the incision down to the sternum
3. While pushing down with an index finger on the suprasternal fascia, and while an assistant retracts with an Army-Navy retractor the superior border of the incision cephalad, cauterize the fascia immediately under the superior border of the manubrium sterni
4. At the completion of this maneuver, the surgeon should be able to put a finger behind the sternum
4. With a Sarns oscillating saw or with a Lebsche knife, do a median sternotomy from suprasternal notch to xiphoid process after hooking the knife or the saw under the sternum. Always pull up as the saw or knife moves caudad
6. With an assistant, pull the edges of the sternum apart and cover the edges of the sternum with sterile towels
7. Place sternal retractor in between the sternal edge and retract open at least 4 inches



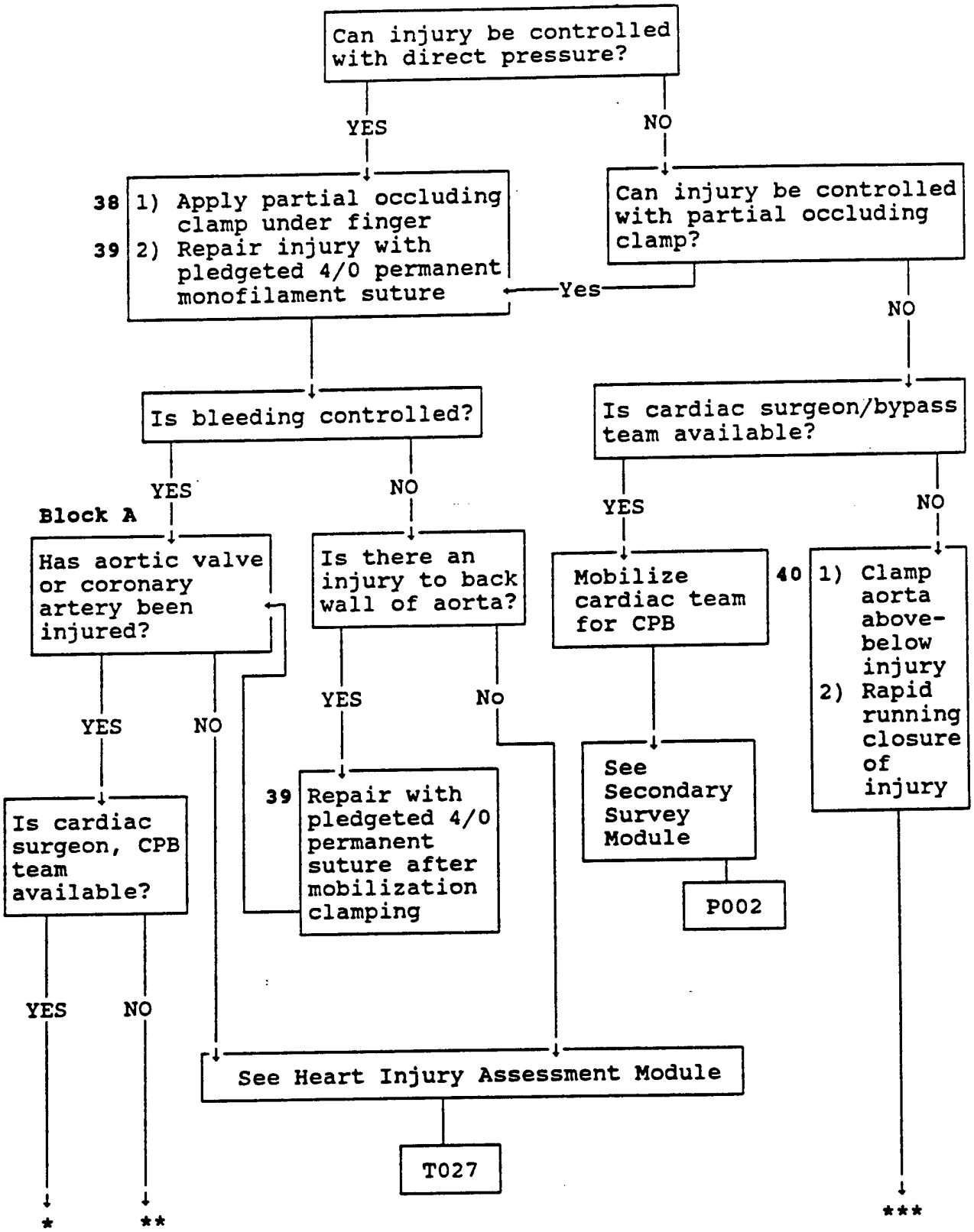
MEDIAN STERNOTOMY MODULE



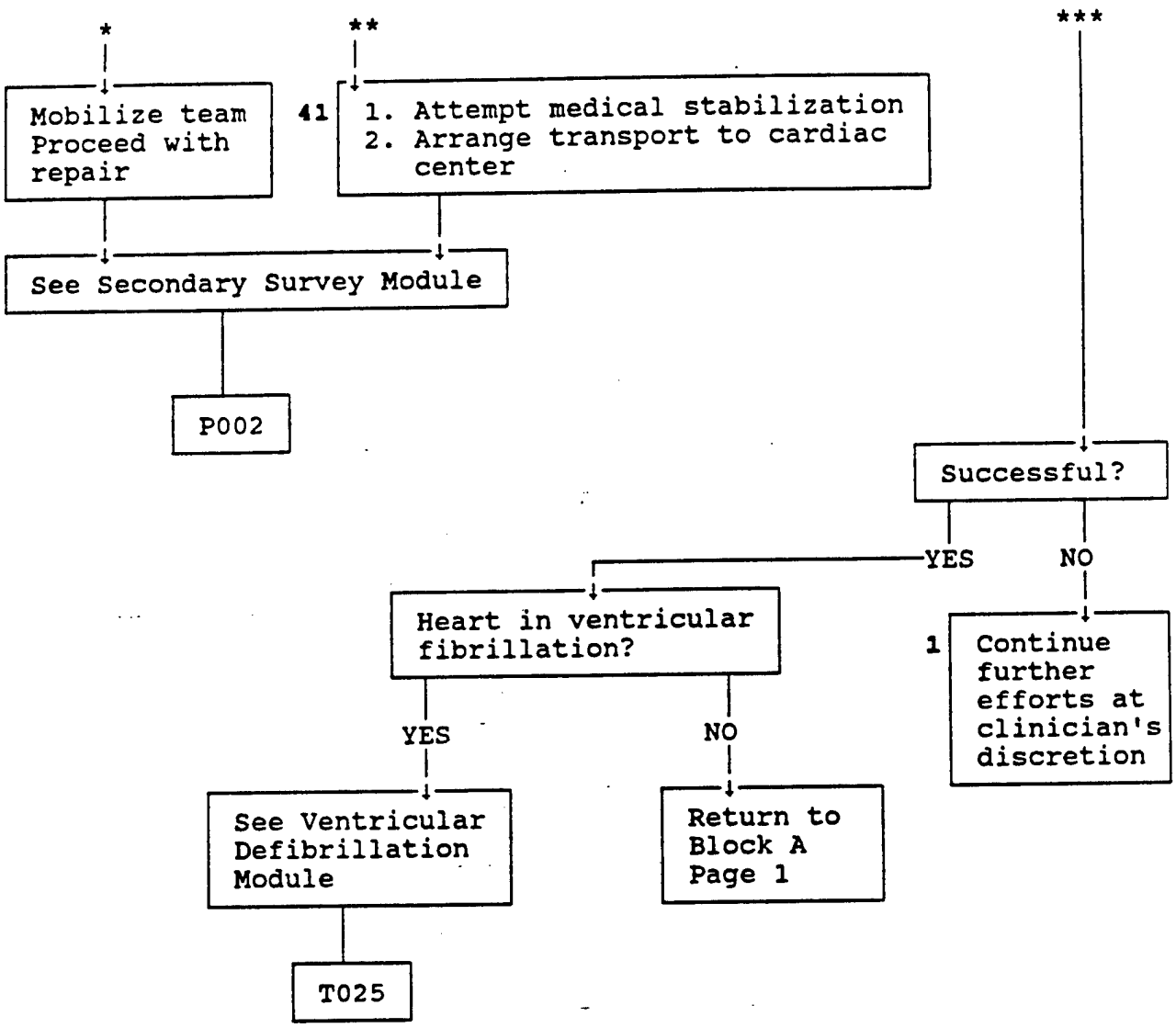
ASCENDING AORTA AND ARCH INJURY MODULE



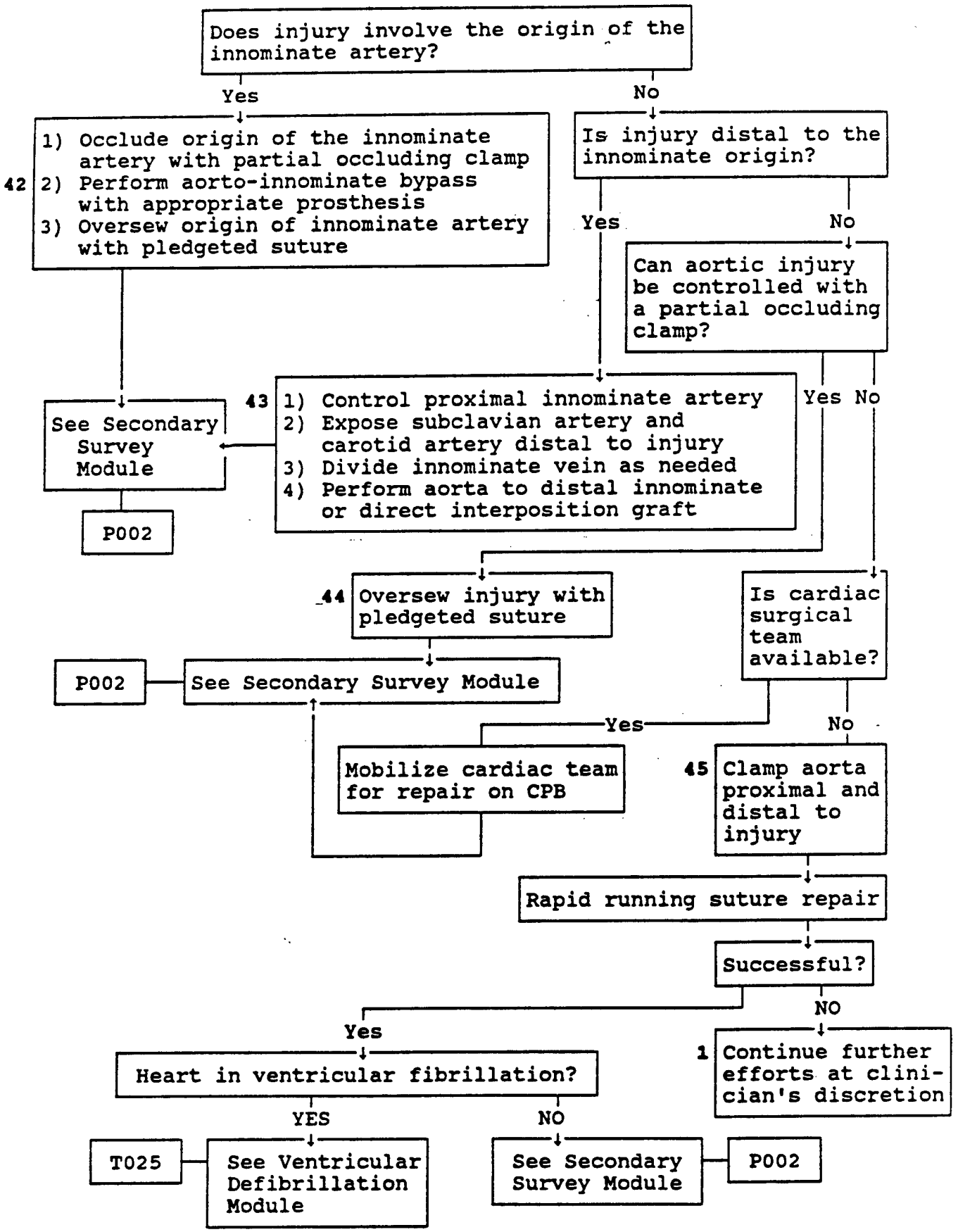
ASCENDING AORTA INJURY MODULE



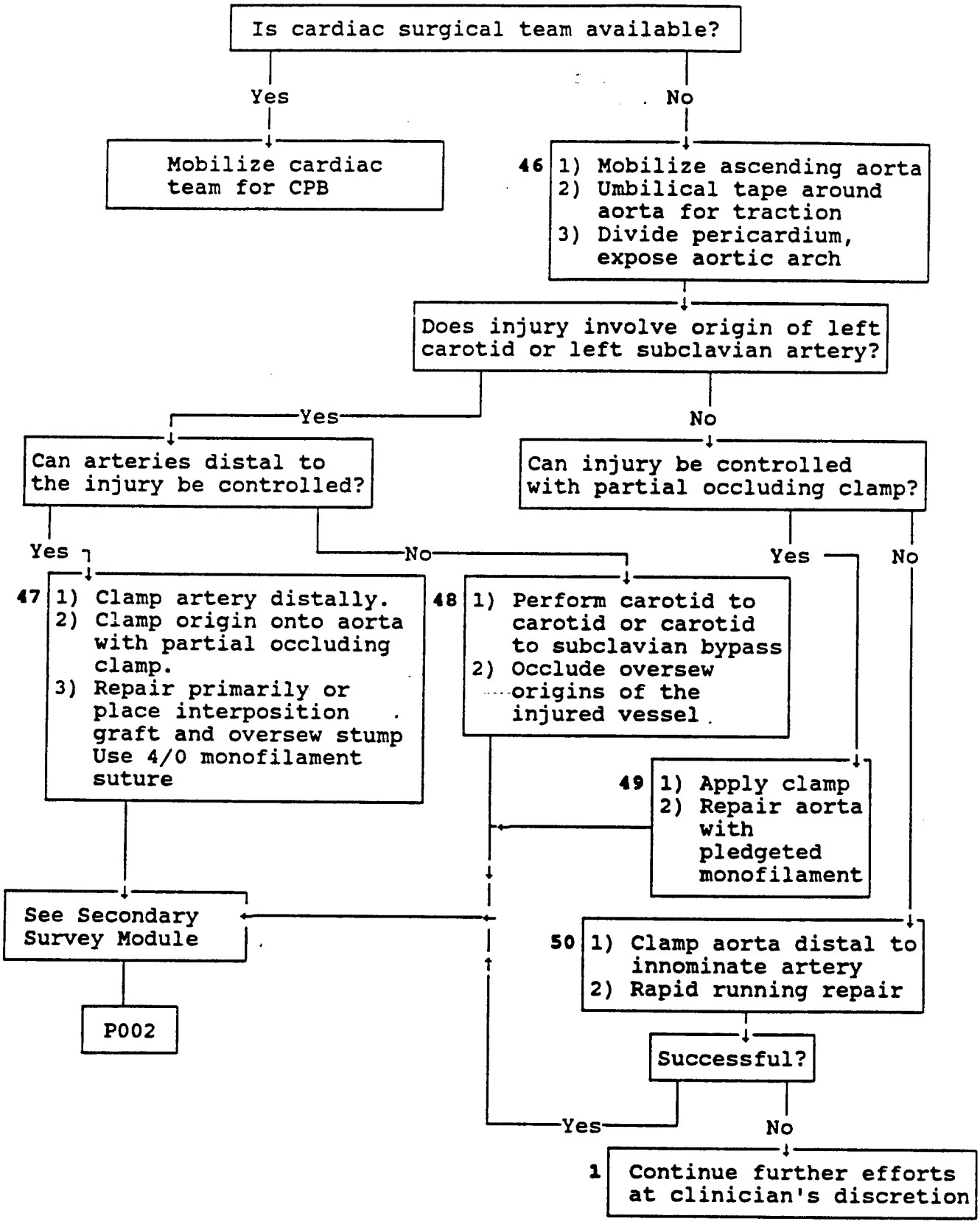
ASCENDING AORTA INJURY MODULE



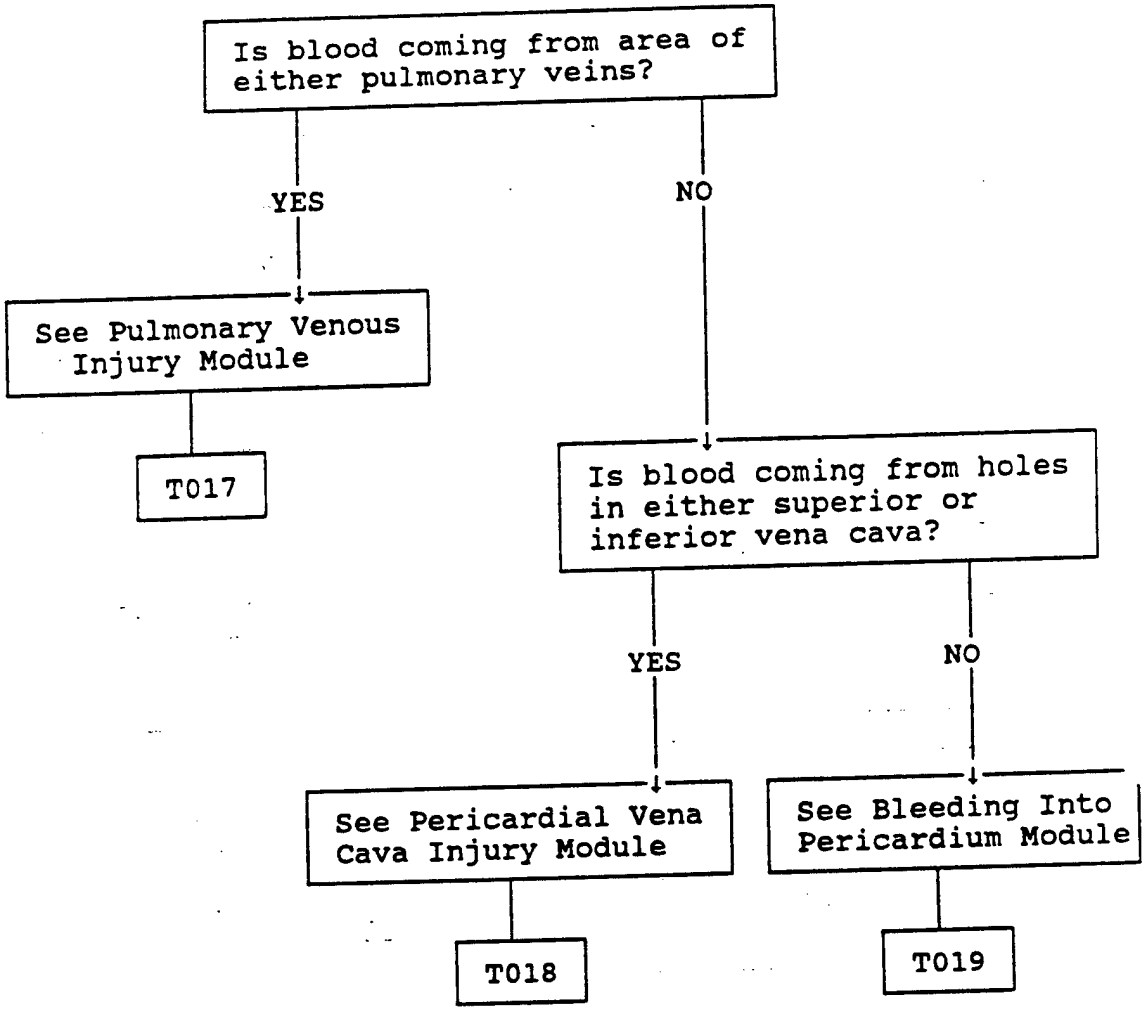
INNOMINATE ARTERY AORTIC ARCH INJURY MODULE



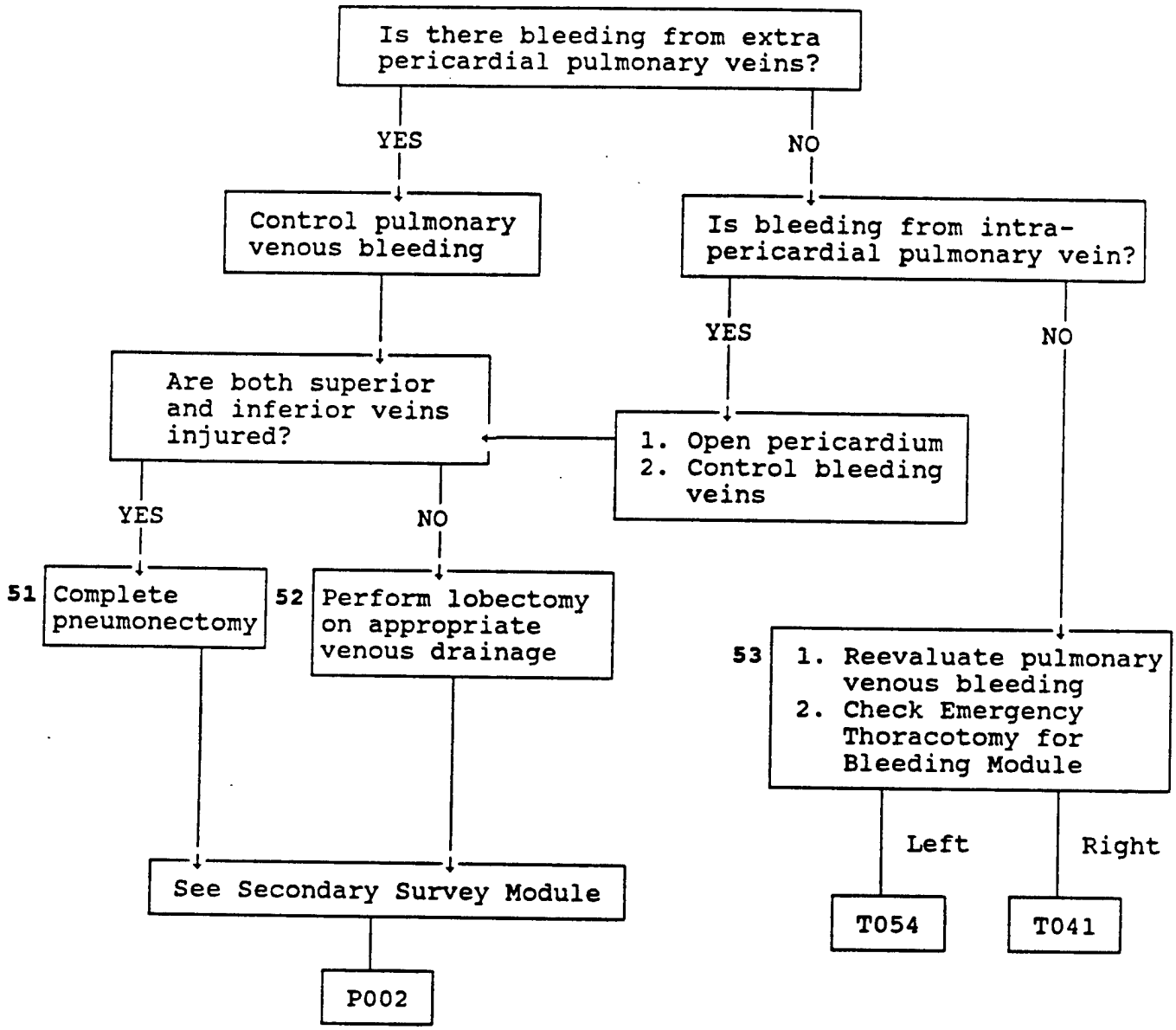
AORTIC ARCH INJURY MODULE



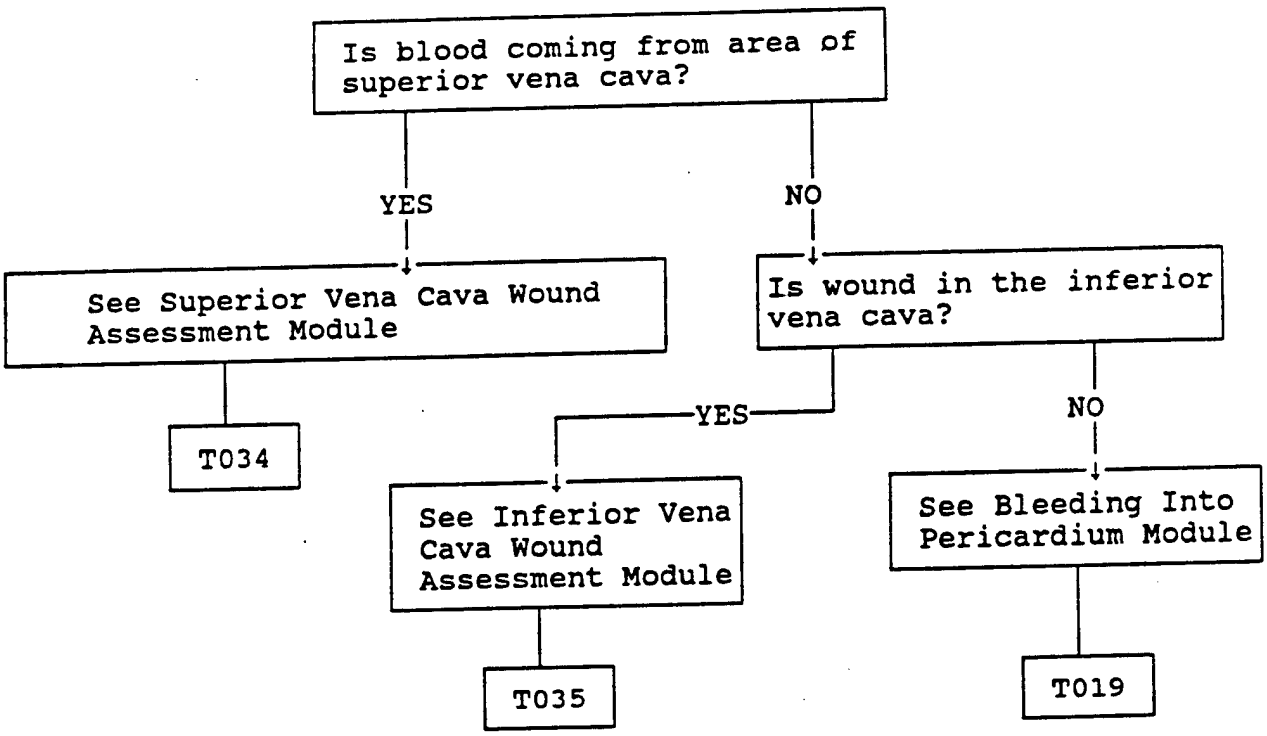
PULMONARY VEIN MODULE



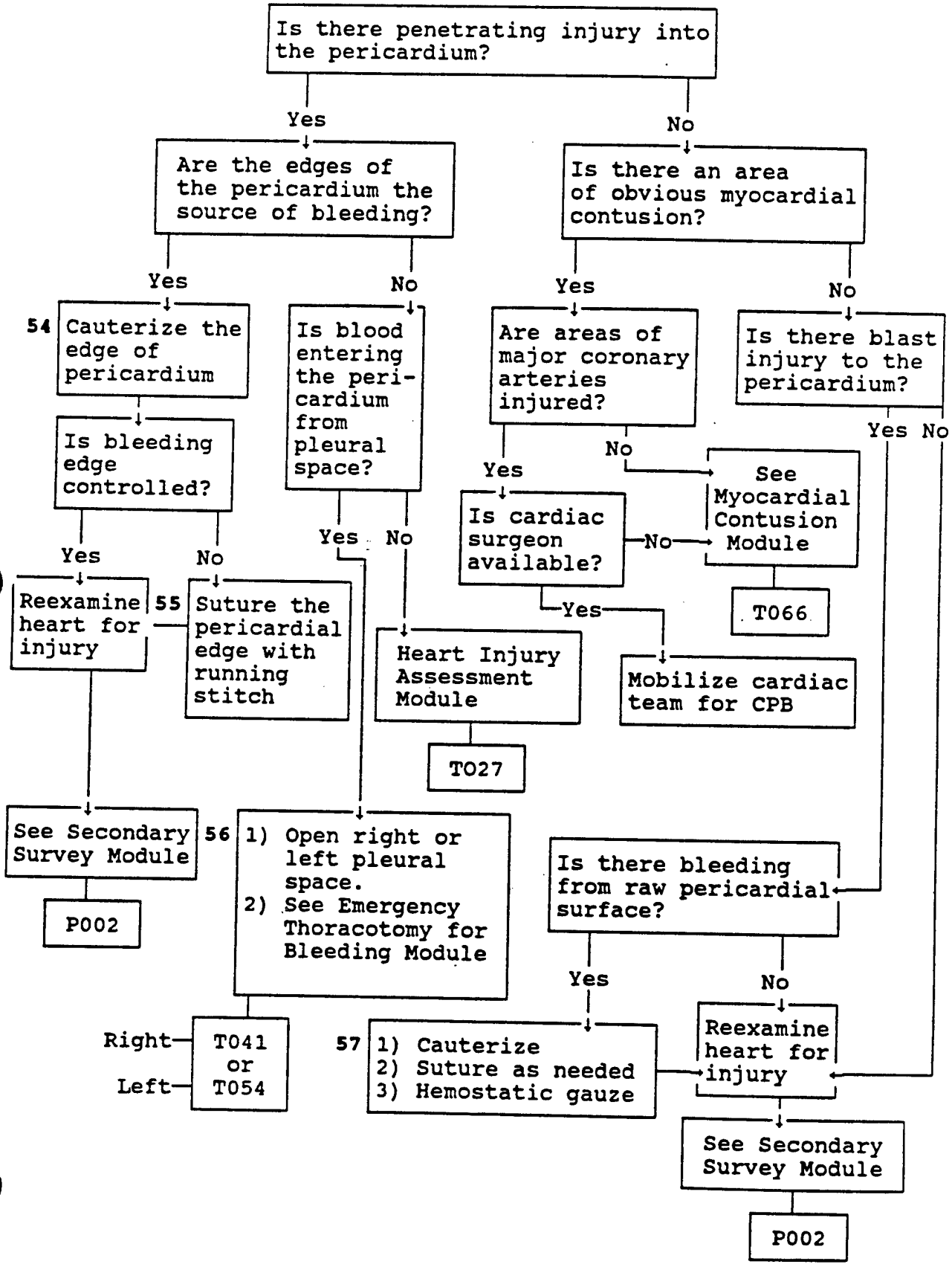
PULMONARY VENOUS INJURY MODULE



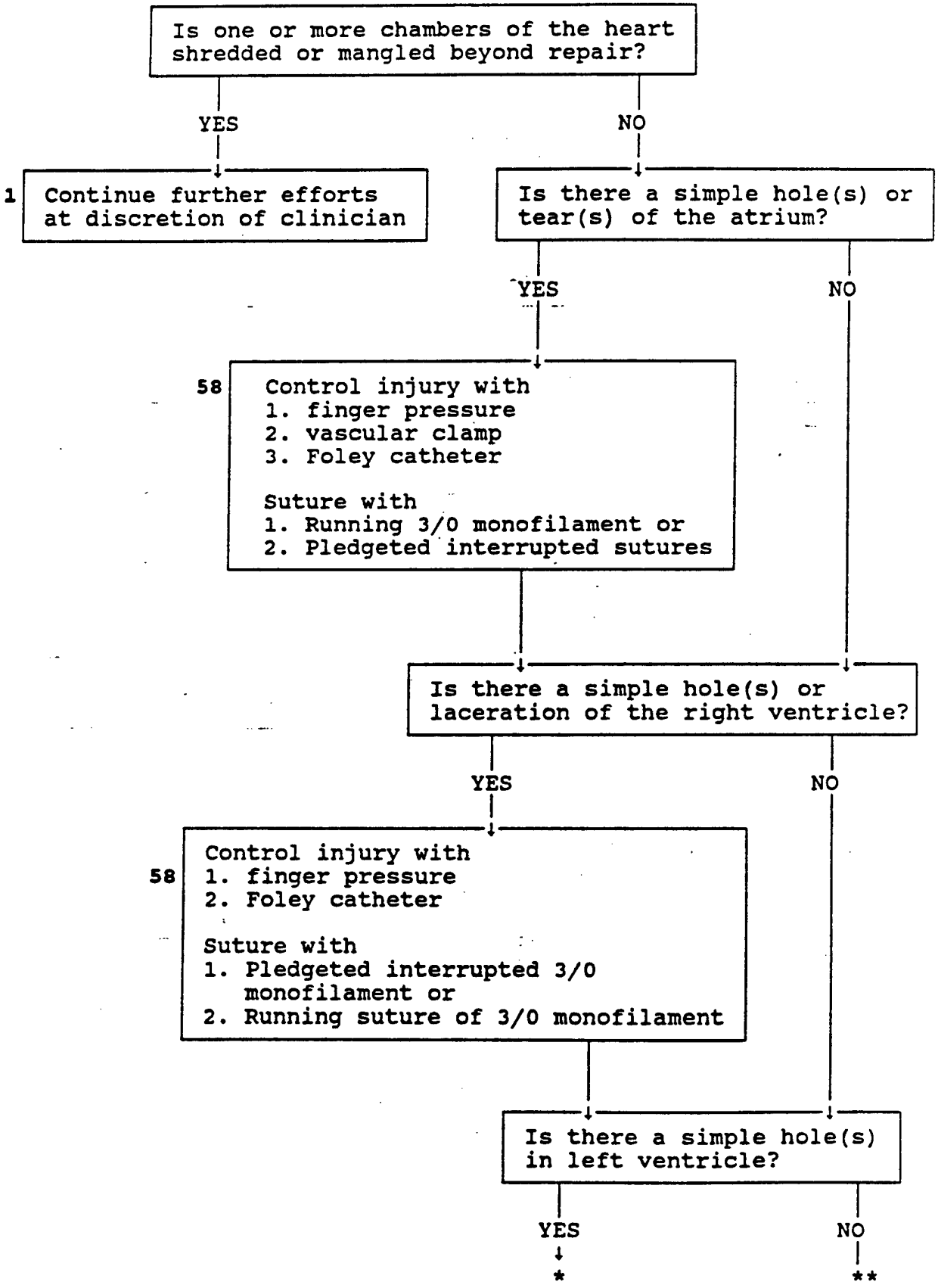
PERICARDIAL VENA CAVAL INJURY MODULE

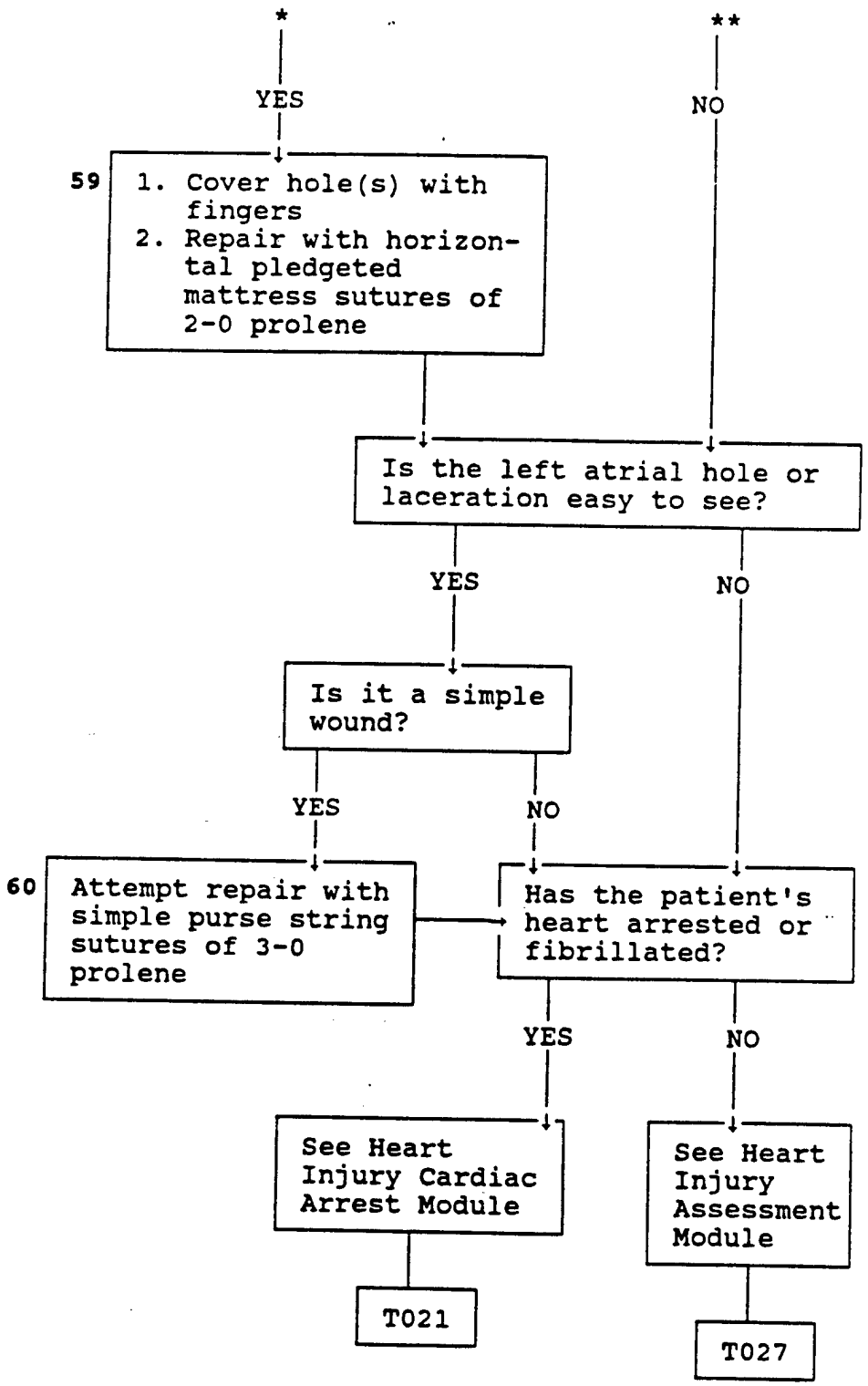


BLEEDING INTO PERICARDIUM

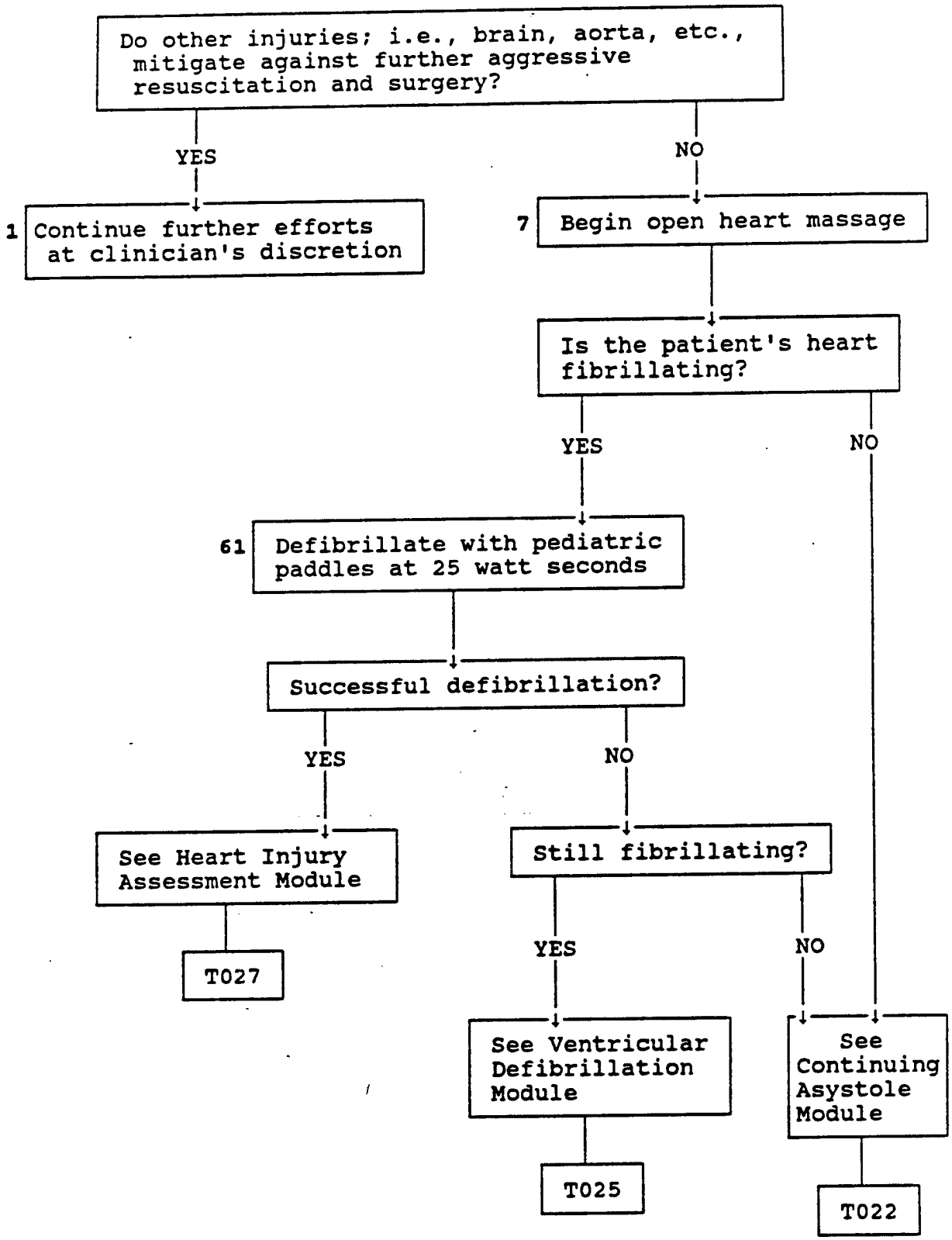


HOLE IN HEART EVALUATION MODULE

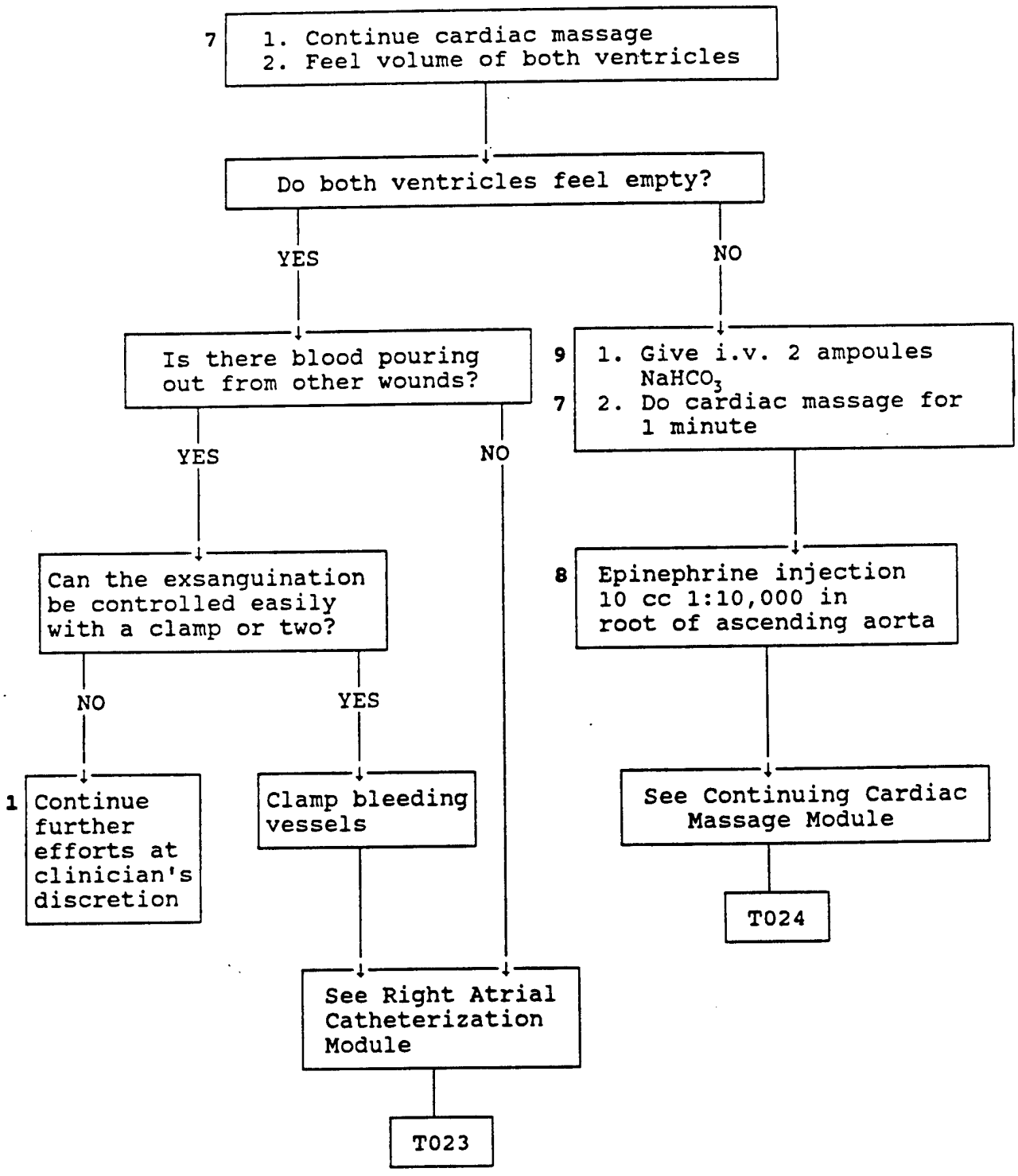



*
**
YES
NO
59
1. Cover hole(s) with fingers
2. Repair with horizontal pledgeted mattress sutures of 2-0 prolene
Is the left atrial hole or laceration easy to see?
YES
NO
Is it a simple wound?
YES
NO
60
Attempt repair with simple purse string sutures of 3-0 prolene
Has the patient's heart arrested or fibrillated?
YES
NO
See Heart Injury Cardiac Arrest Module
See Heart Injury Assessment Module
T021
T027

HEART INJURY CARDIAC ARREST MODULE

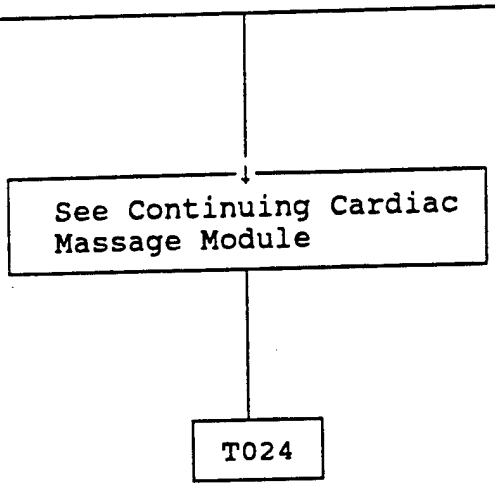


CONTINUING ASYSTOLE MODULE

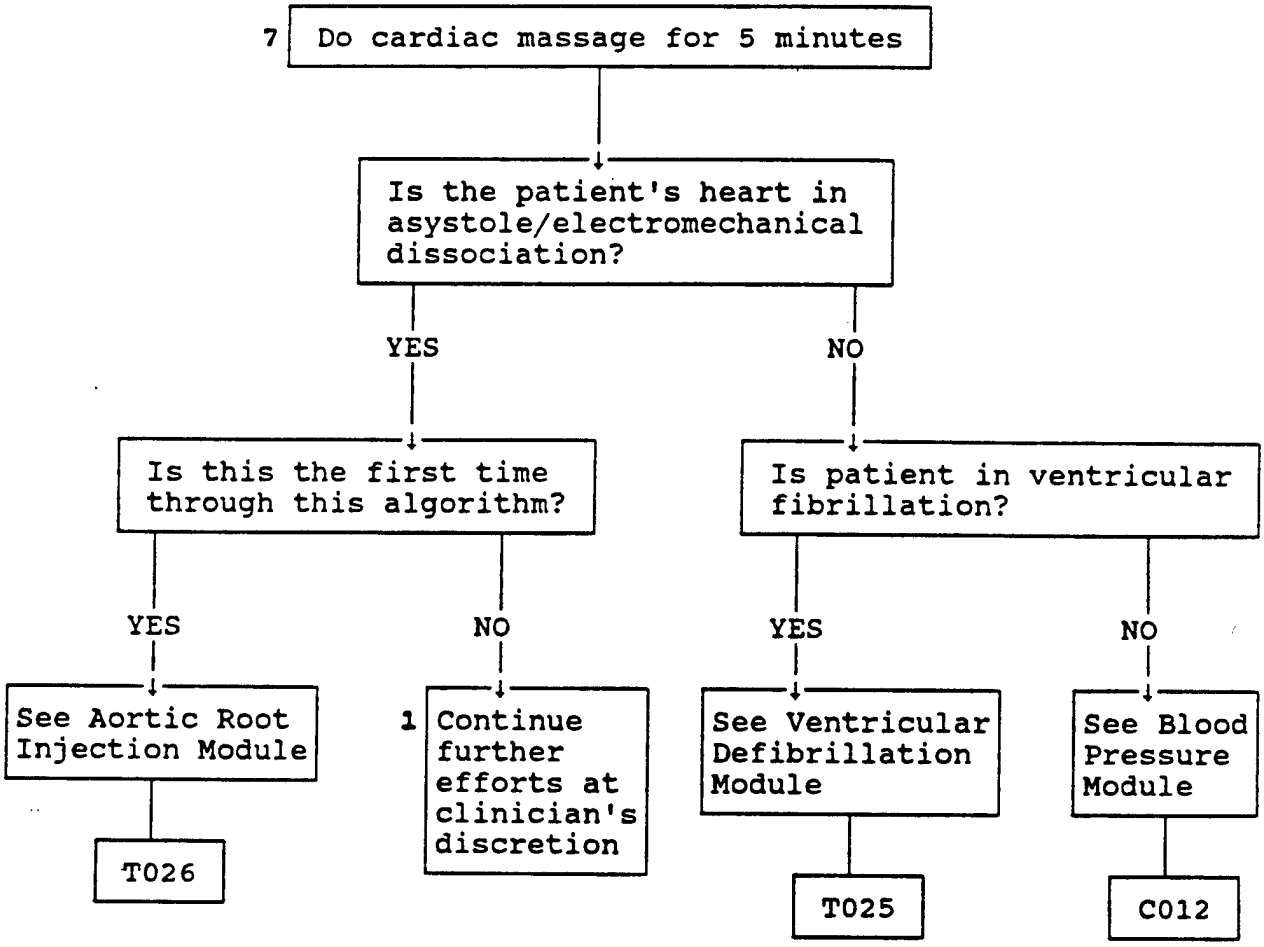


RIGHT ATRIAL CATHETERIZATION MODULE

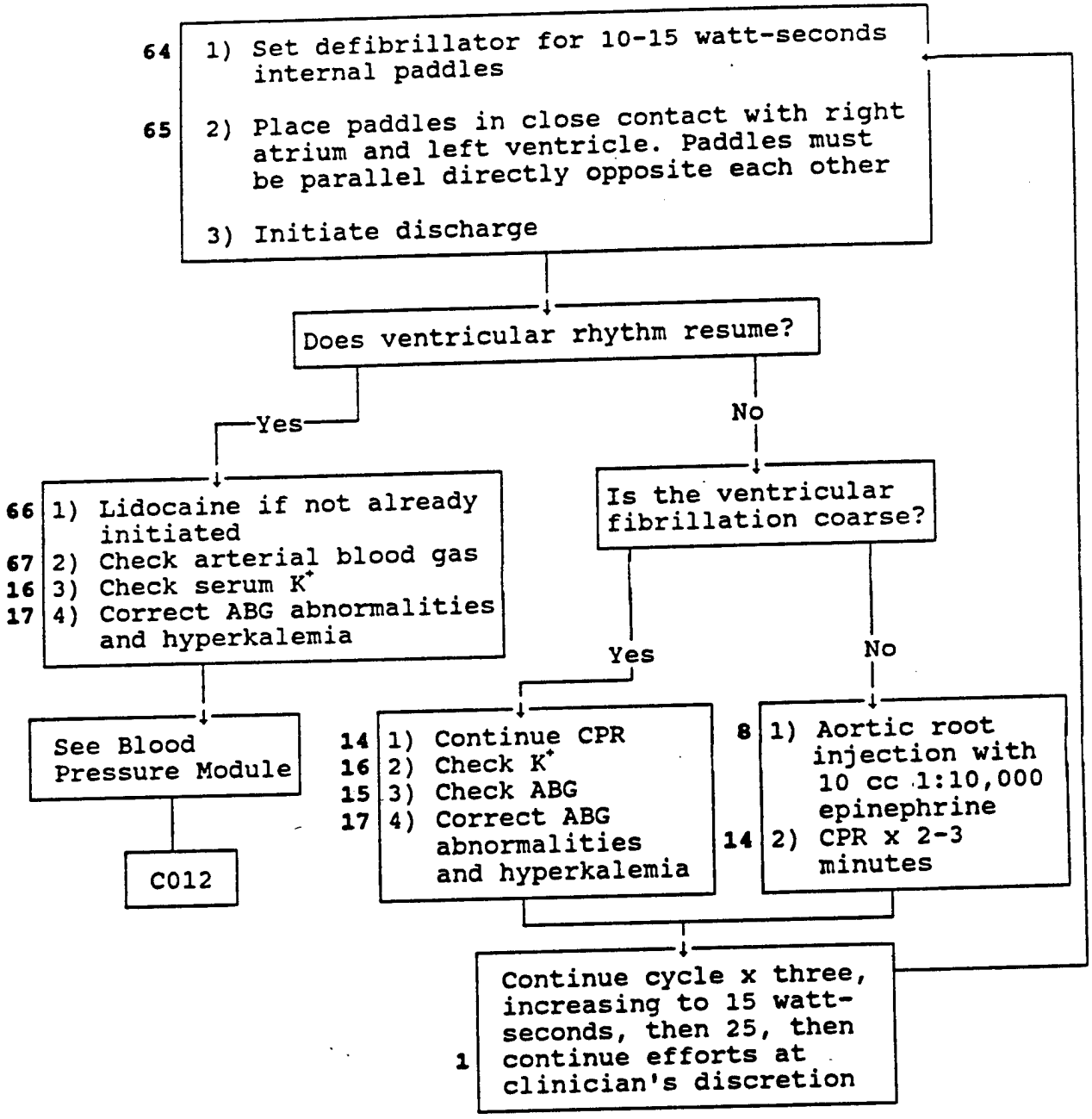
62 1. Put purse string suture (#3-0 Tevdek) in right atrial appendage or atrium
2. Make a stab incision in middle of purse string and insert #18 pediatric feeding tube
63 3. Infuse packed cells as rapidly as possible



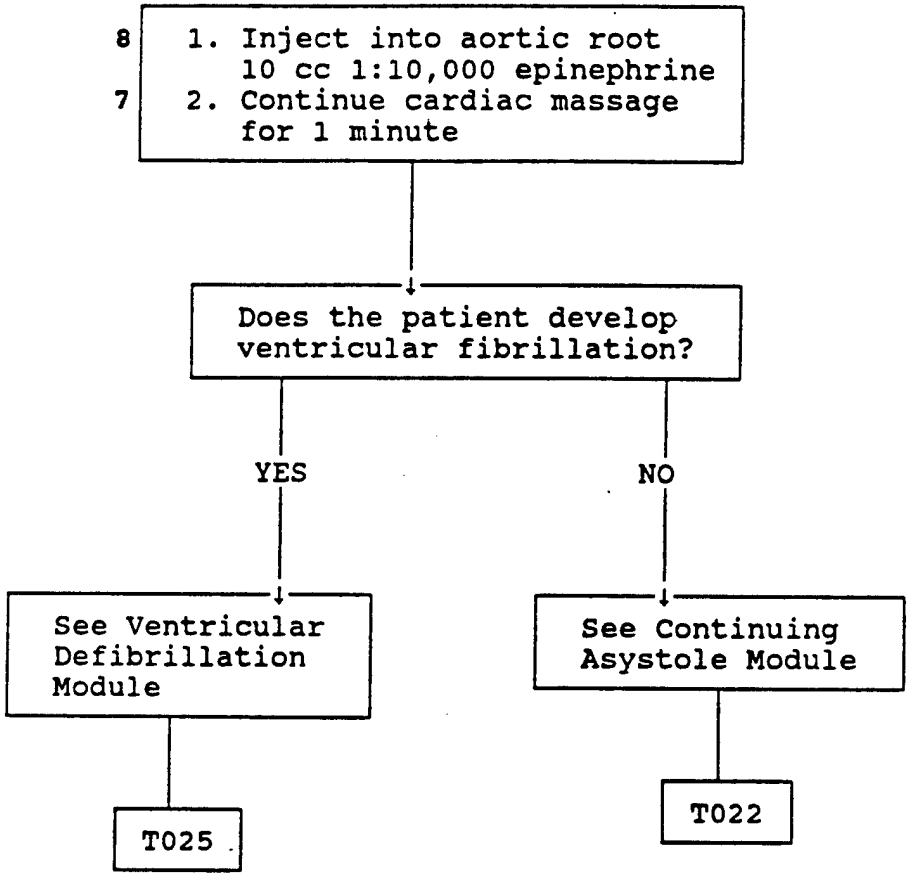
CONTINUING CARDIAC MASSAGE MODULE



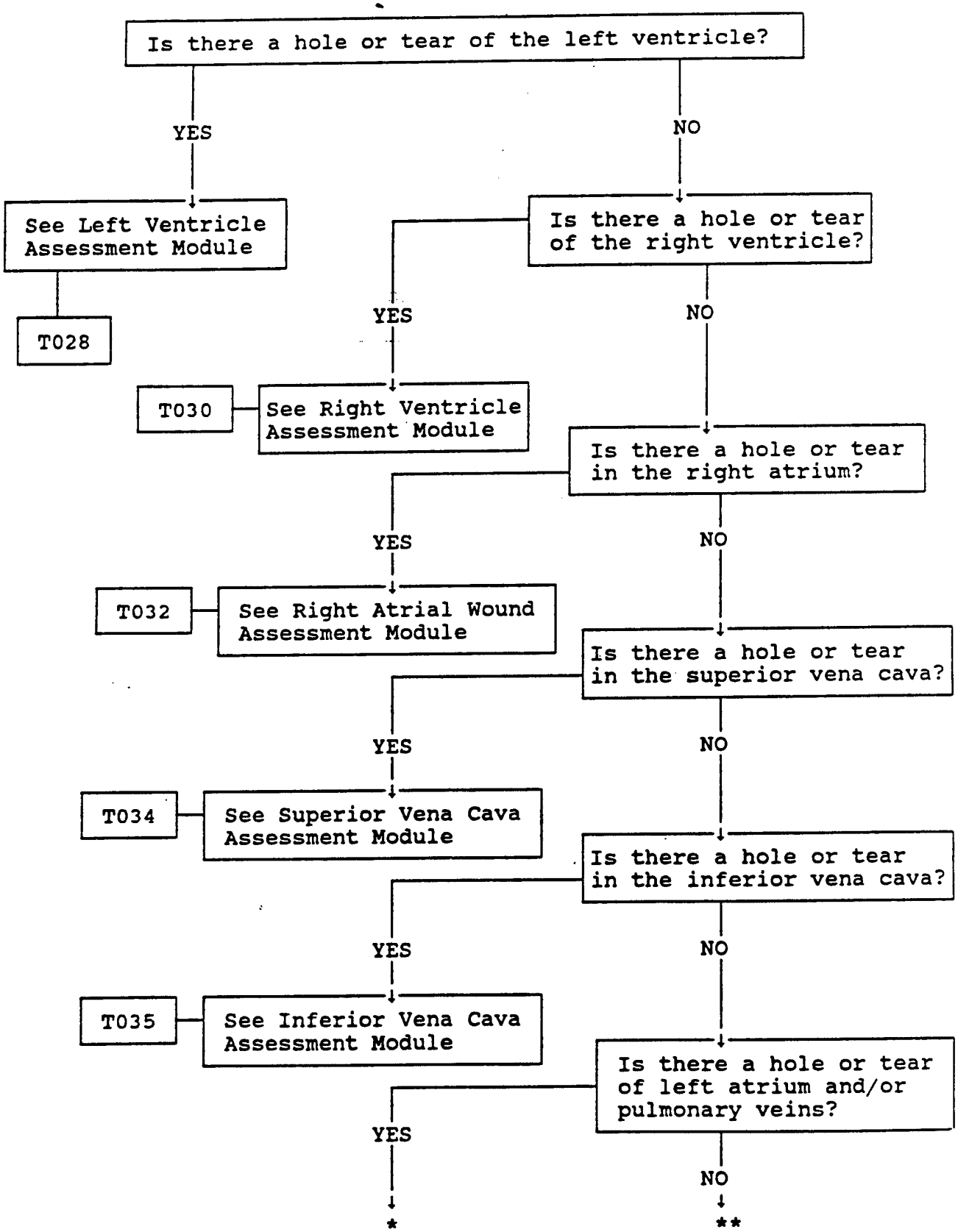
VENTRICULAR DEFIBRILLATION

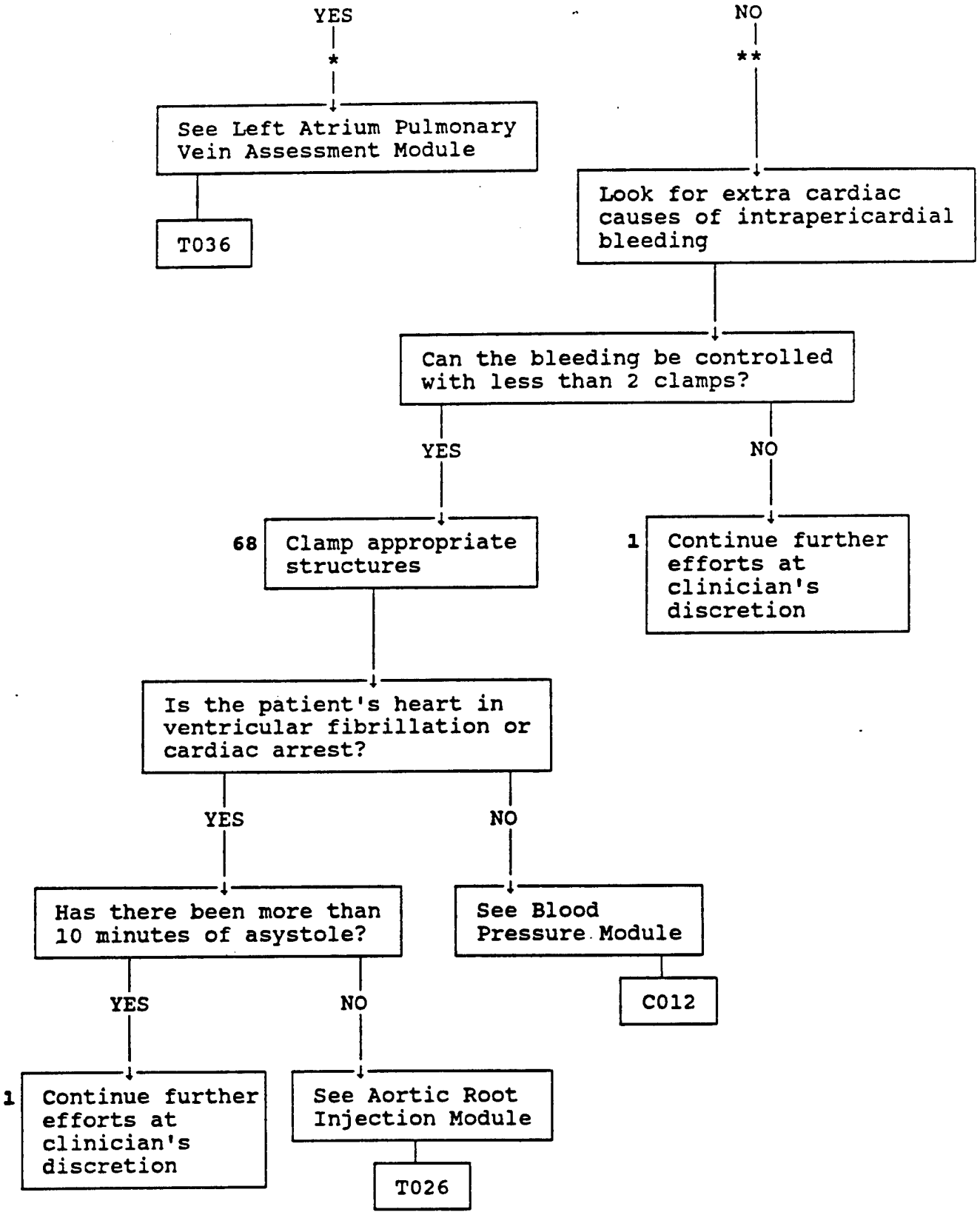


AORTIC ROOT INJECTION MODULE

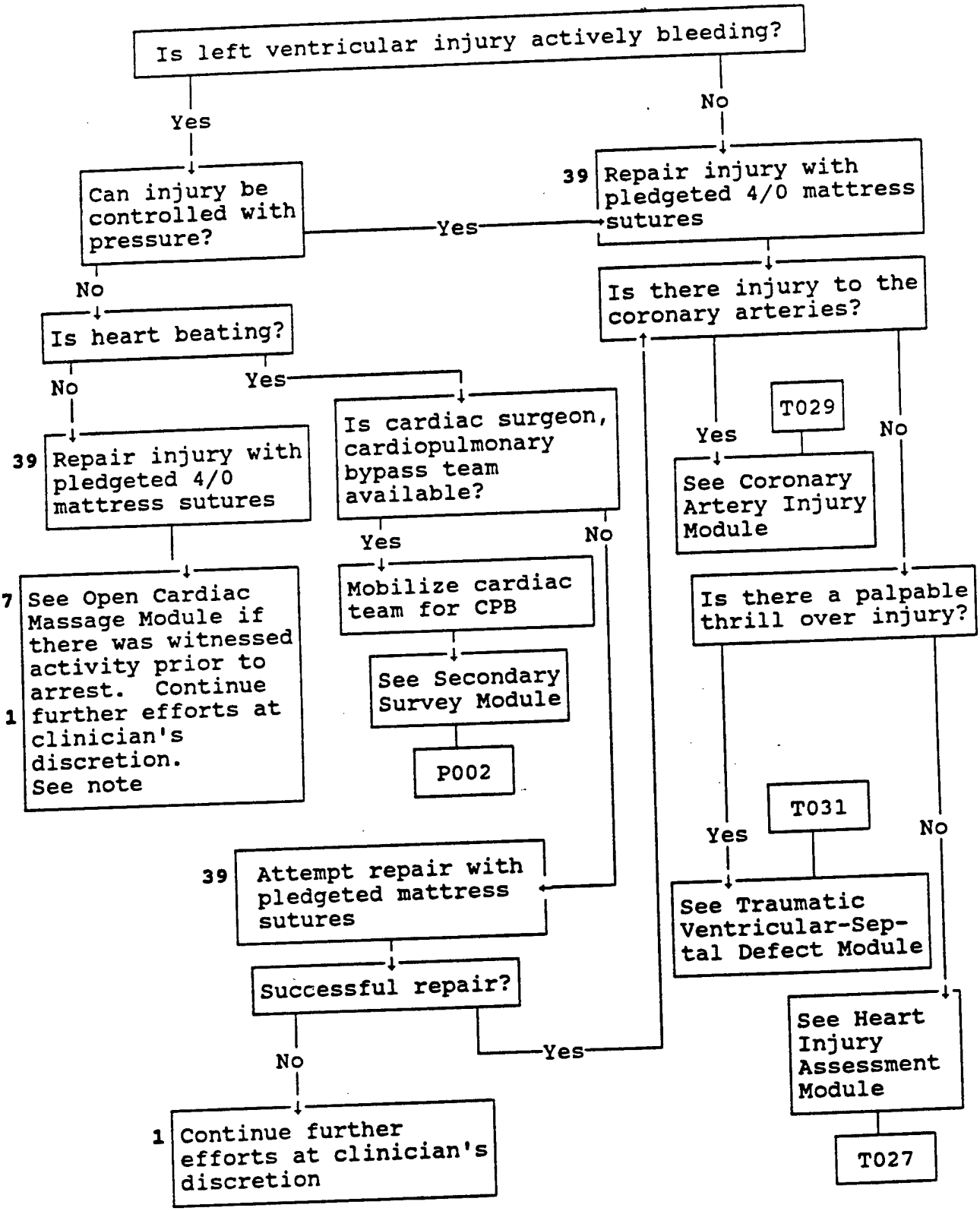


HEART INJURY ASSESSMENT MODULE



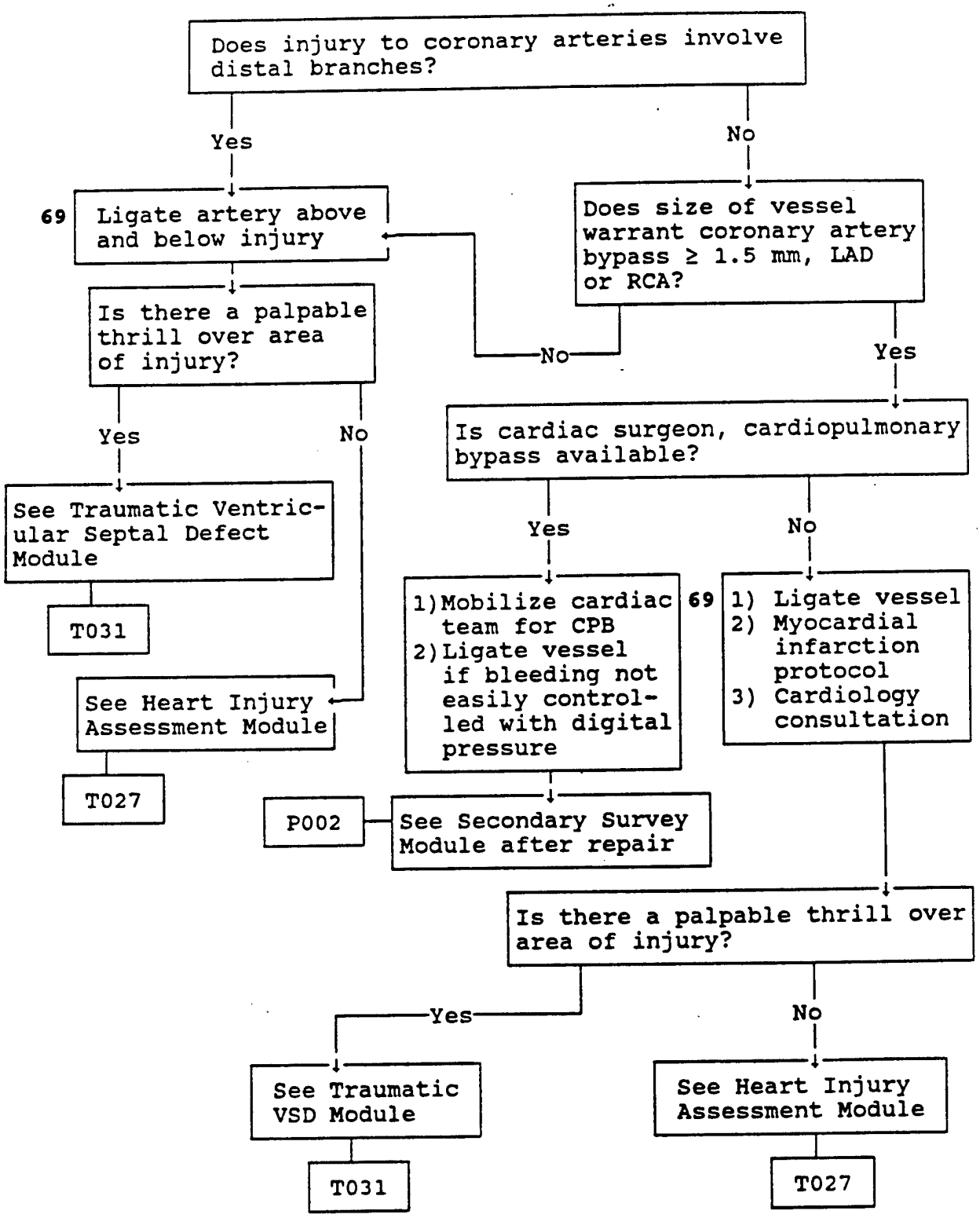

YES
*
See Left Atrium Pulmonary Vein Assessment Module
T036
NO
**
Look for extra cardiac causes of intrapericardial bleeding
Can the bleeding be controlled with less than 2 clamps?
YES
68
Clamp appropriate structures
NO
1
Continue further efforts at clinician's discretion
Is the patient's heart in ventricular fibrillation or cardiac arrest?
YES
Has there been more than 10 minutes of asystole?
YES
1
Continue further efforts at clinician's discretion
NO
See Aortic Root Injection Module
T026
NO
See Blood Pressure Module
C012

LEFT VENTRICLE ASSESSMENT MODULE

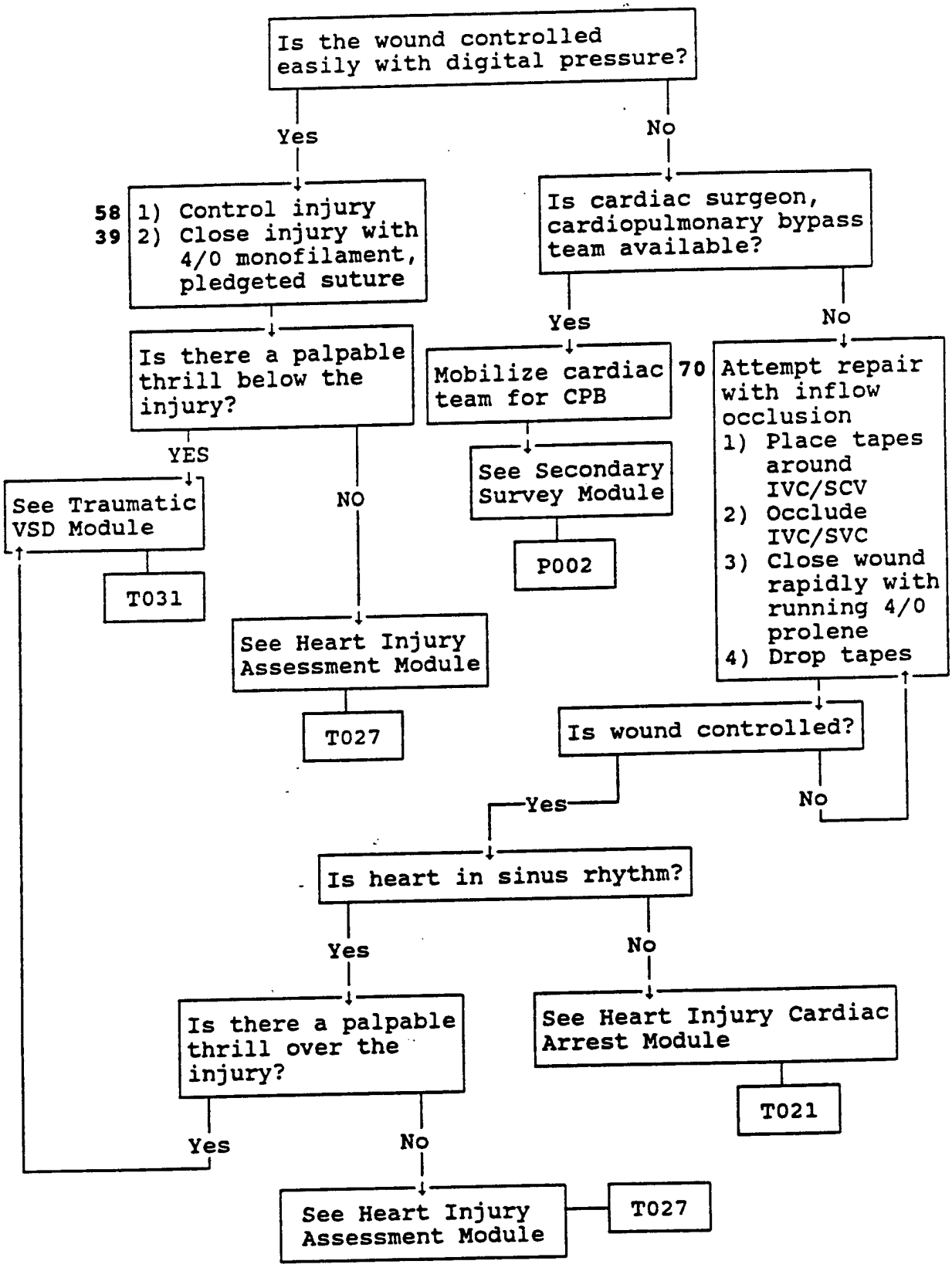


Note: See T003 for Open Cardiac Massage Technique

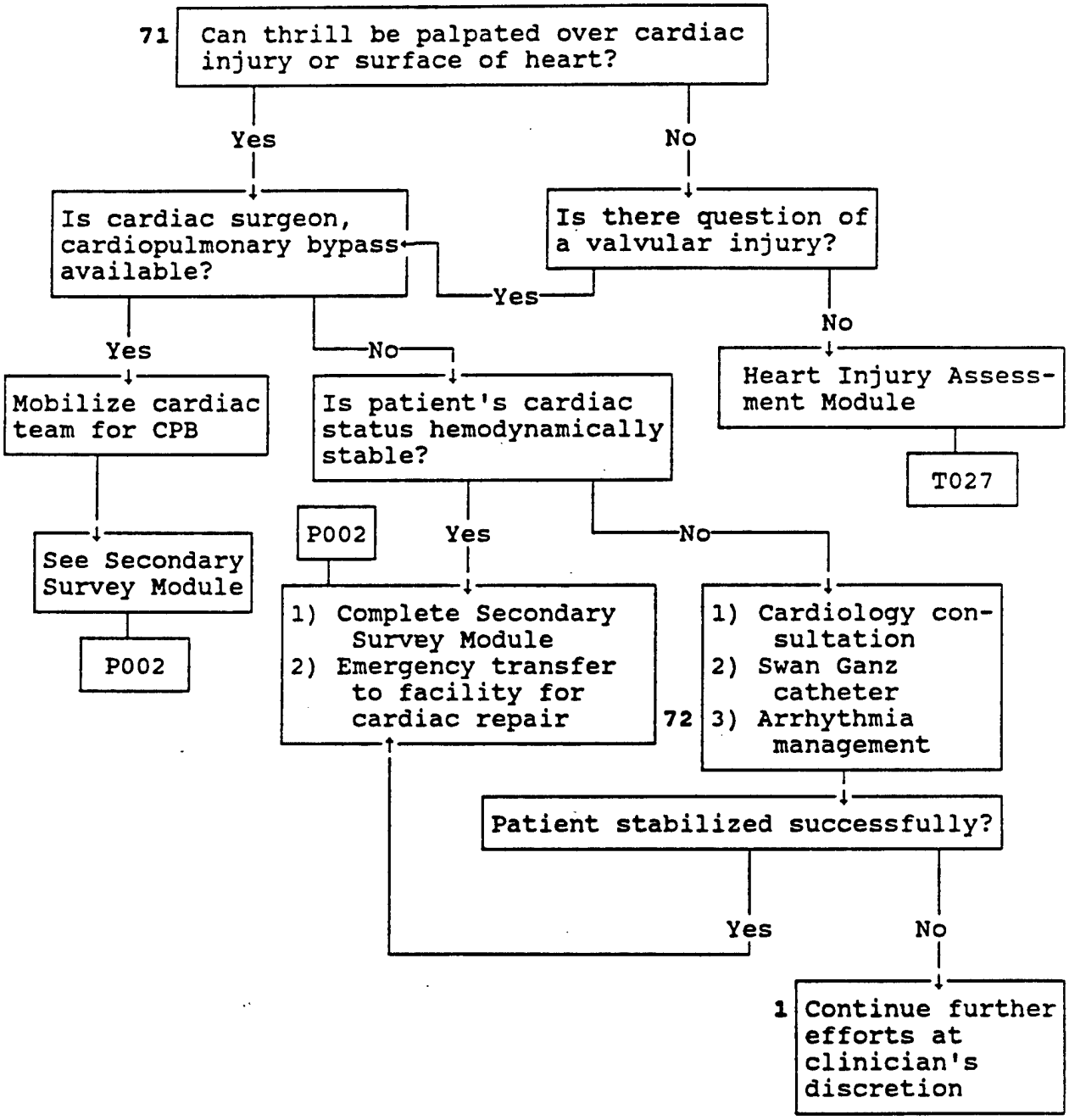
CORONARY ARTERY INJURY MODULE



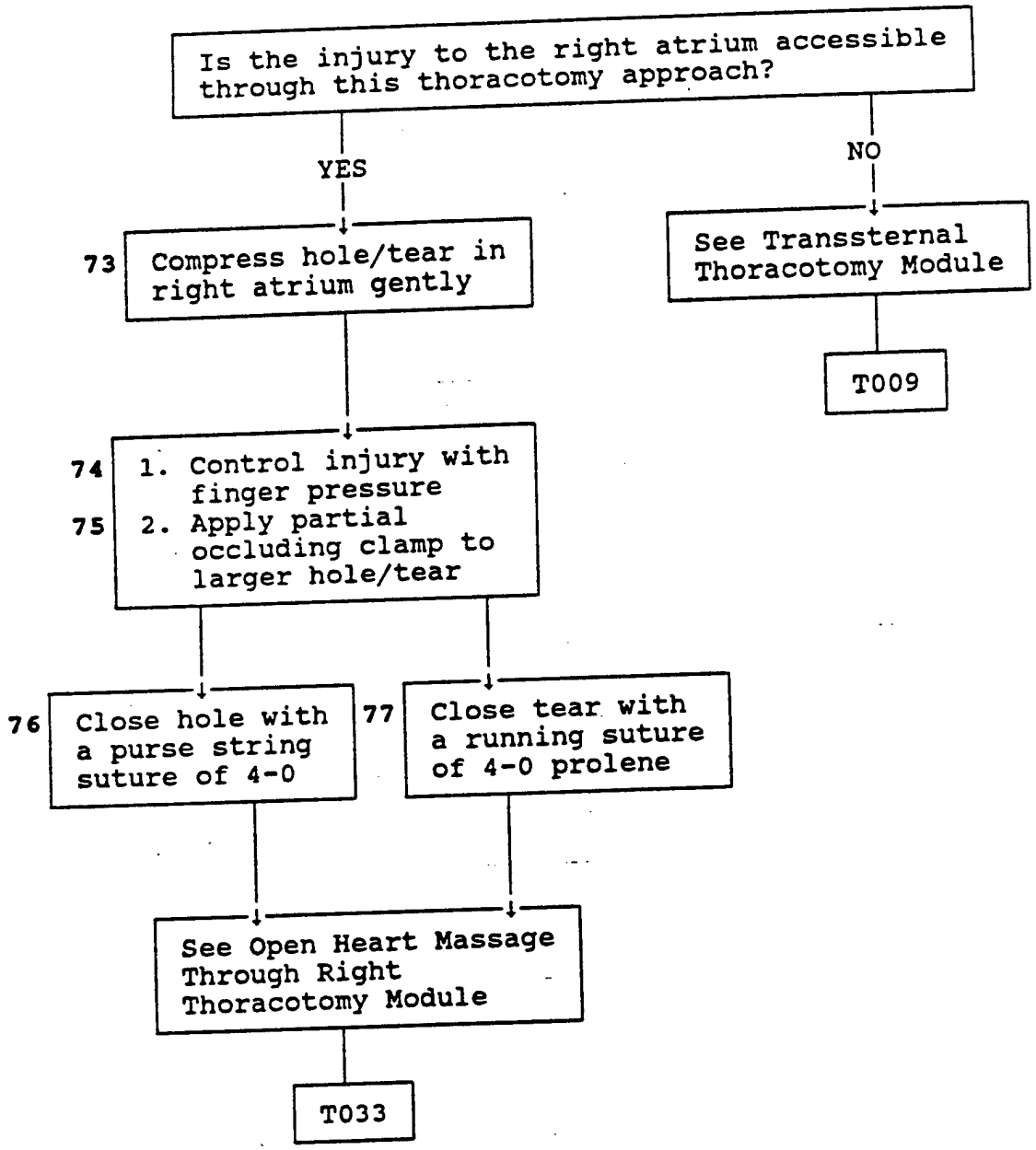
RIGHT VENTRICLE ASSESSMENT MODULE



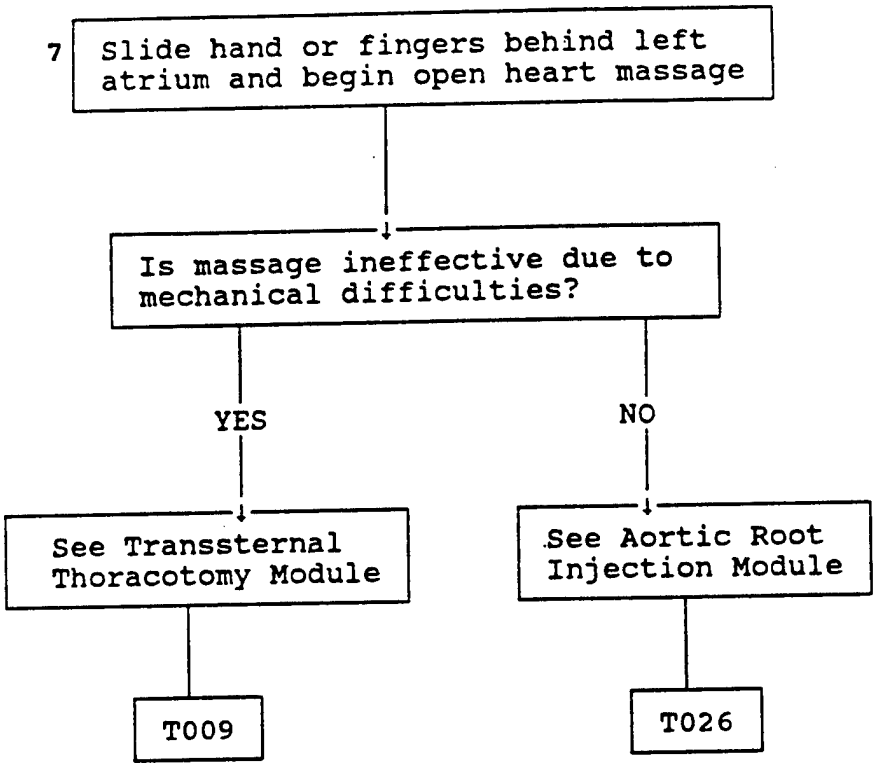
TRAUMATIC VENTRICULAR-SEPTAL DEFECT MODULE



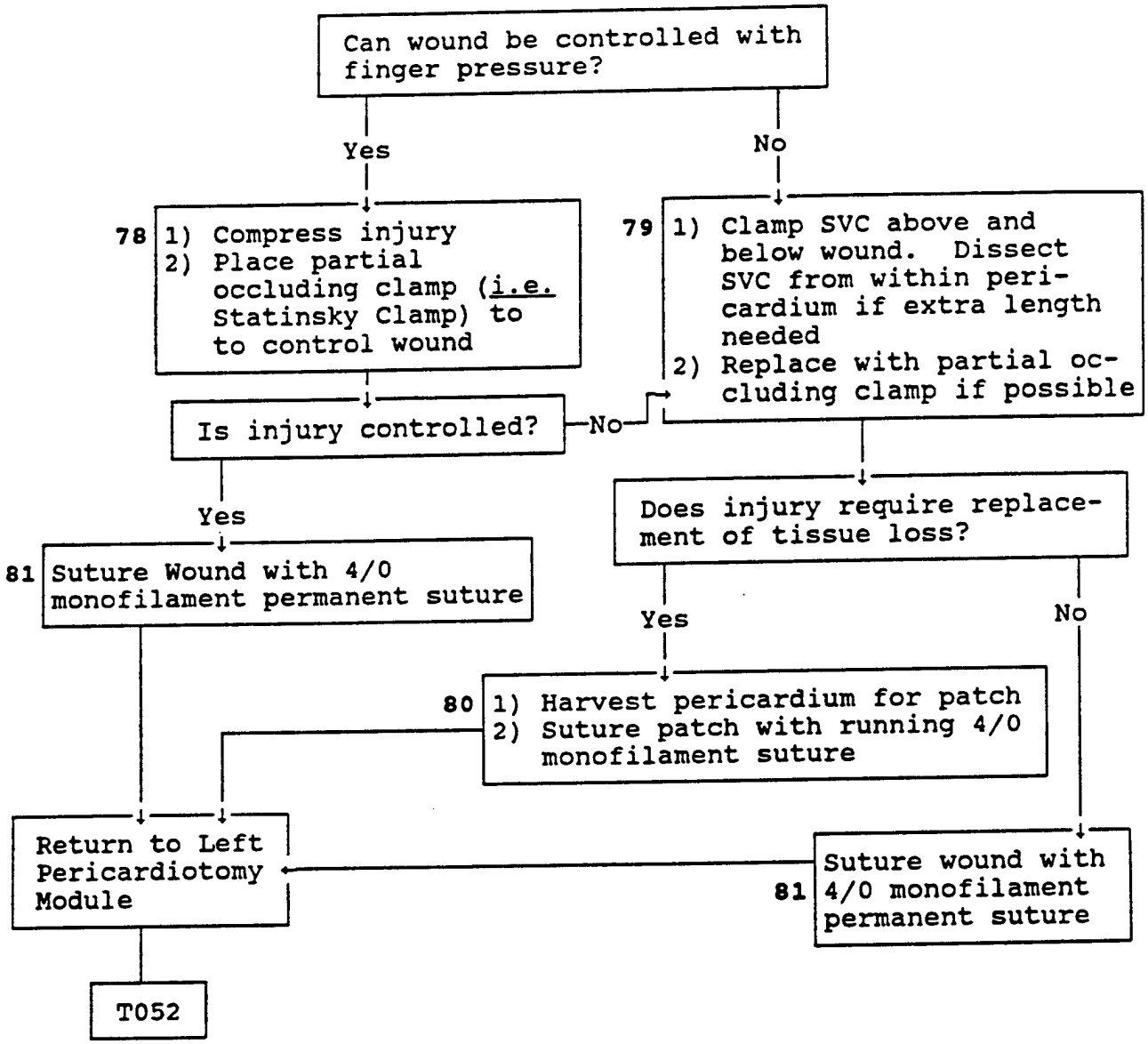
RIGHT ATRIAL WOUND ASSESSMENT MODULE



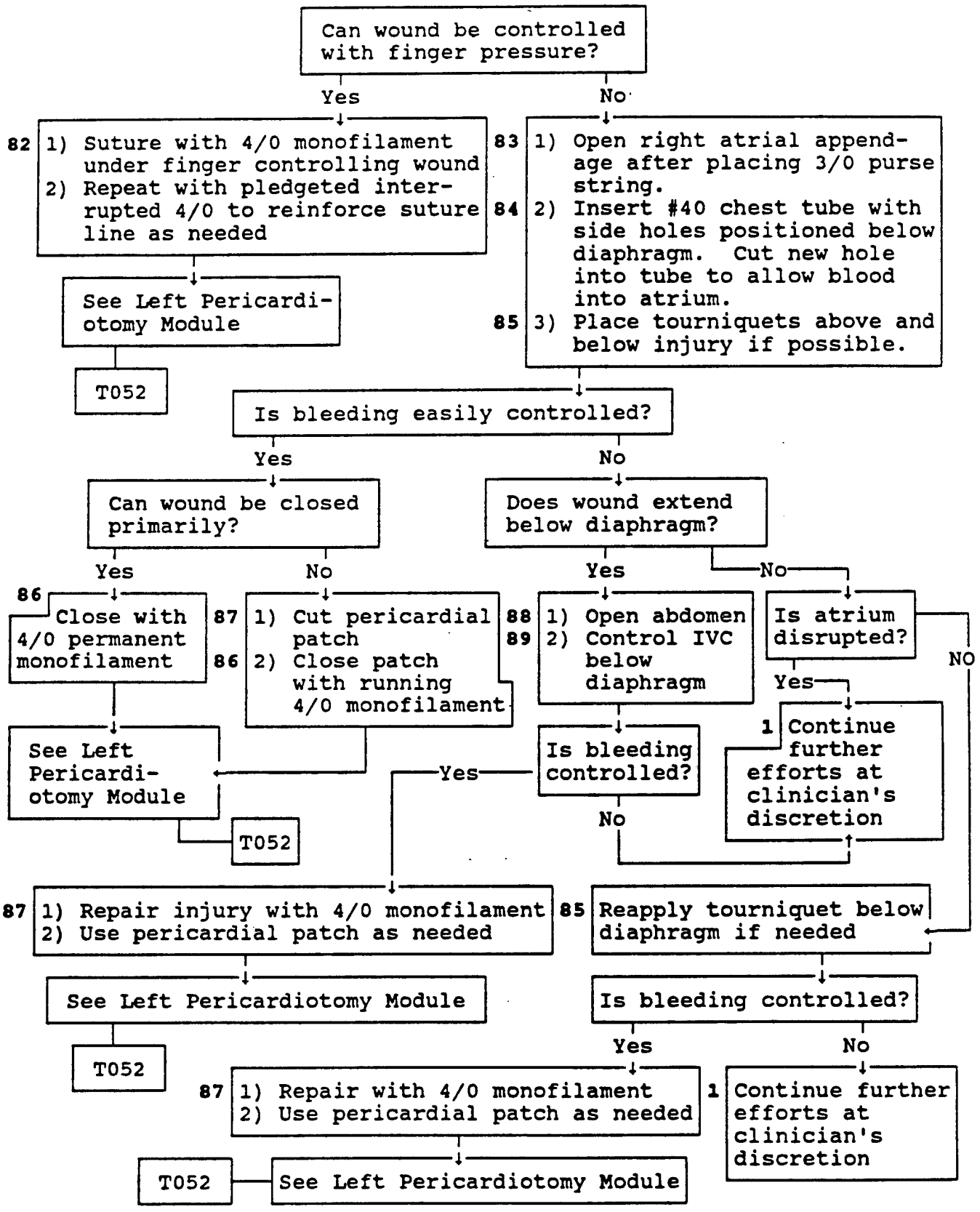
OPEN HEART MASSAGE THROUGH RIGHT THORACOTOMY MODULE



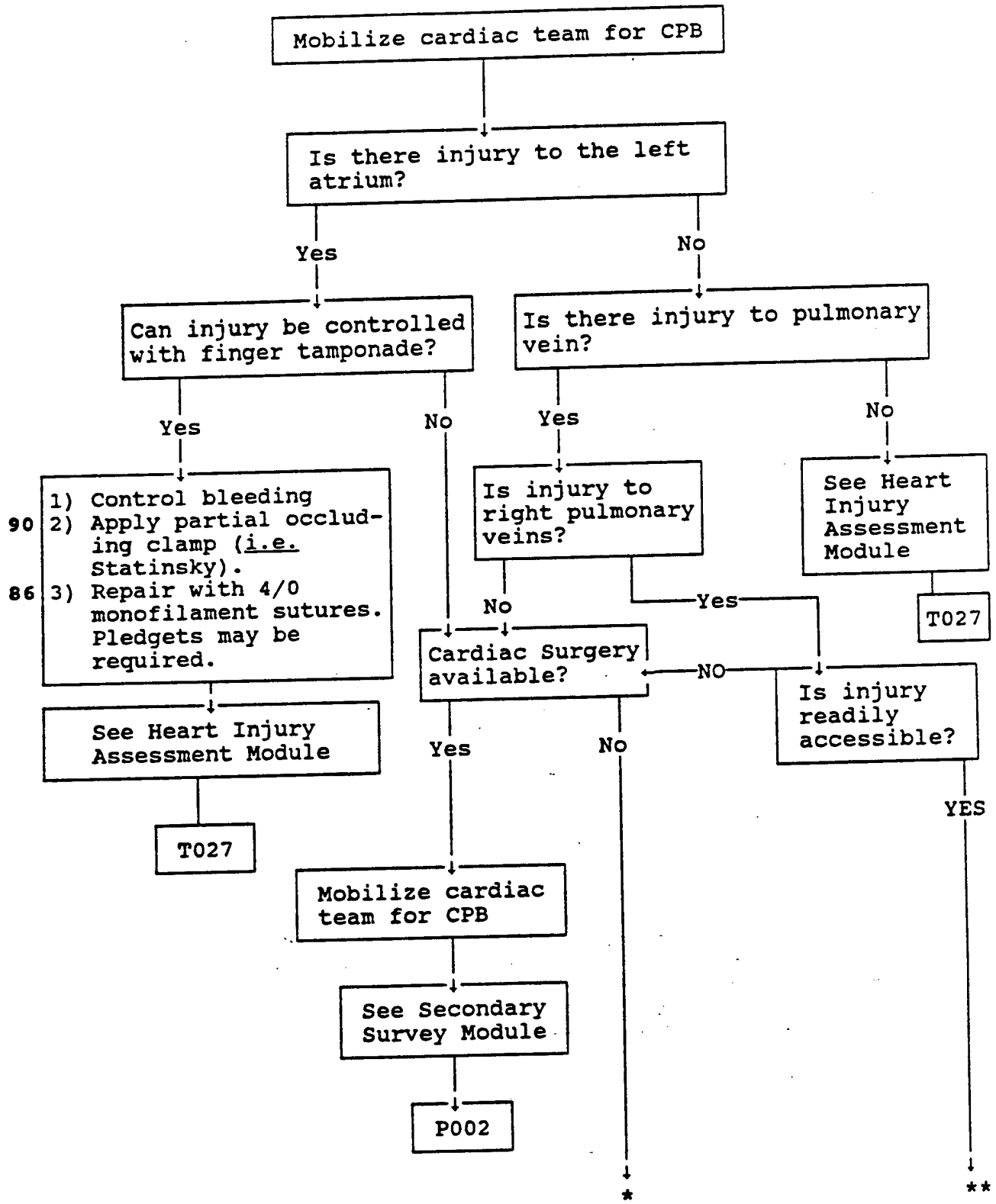
SUPERIOR VENA CAVA WOUND ASSESSMENT MODULE



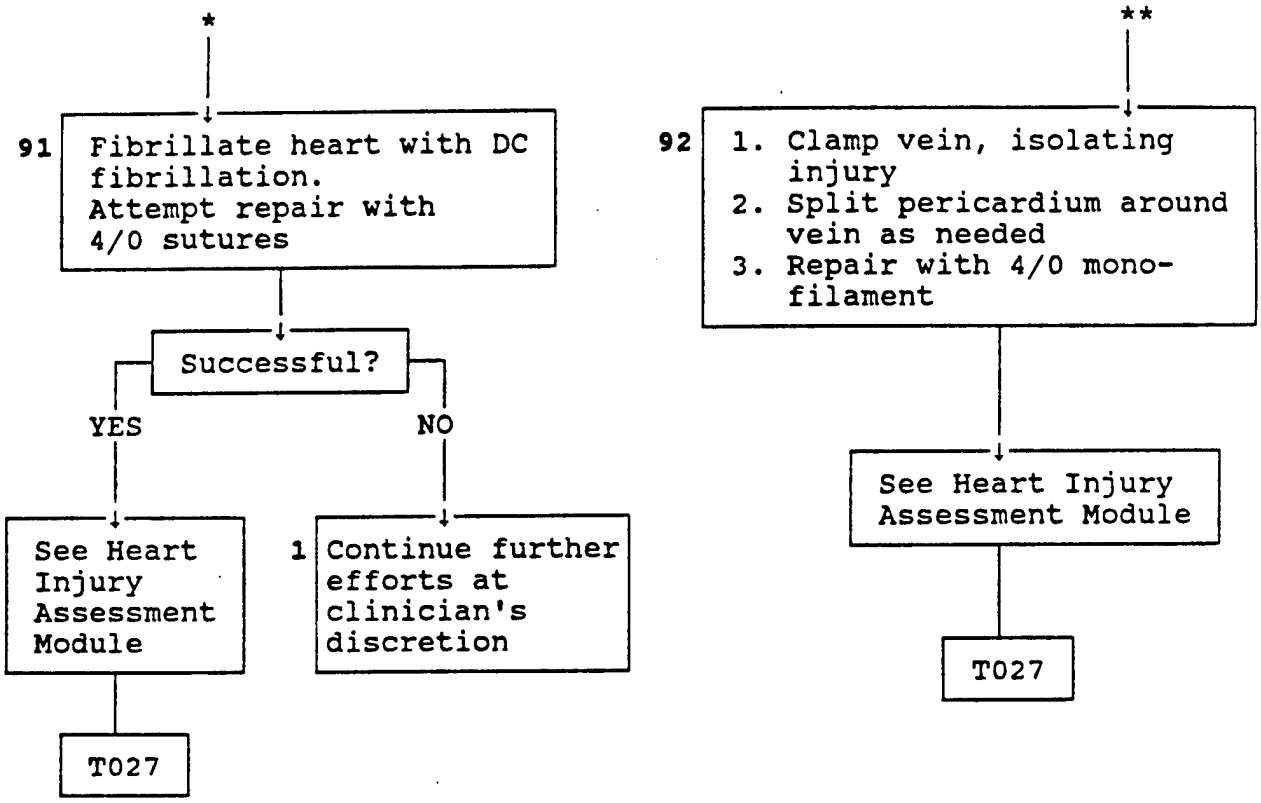
INFERIOR VENA CAVA WOUND ASSESSMENT MODULE



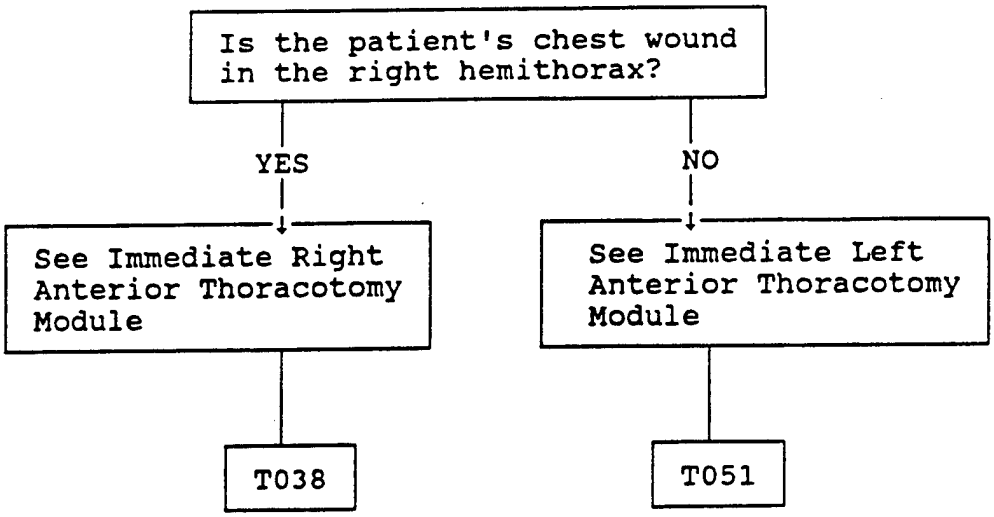
LEFT ATRIUM PULMONARY VEIN ASSESSMENT MODULE



LEFT ATRIUM PULMONARY VEIN ASSESSMENT MODULE



THORACOTOMY ON SAME SIDE OF WOUND MODULE



IMMEDIATE RIGHT ANTERIOR THORACOTOMY MODULE

93

1. Make an incision from right parasternal area 5th intercostal space to midaxillary line
2. With the cautery setting at 50 watts for coagulation and cutting, extend incision down to superior border of 6th rib and enter right pleural space over superior border of right 6th rib. As the right sternal border is approached, cauterize the intercostal muscles between the 5th and 6th costal chondral junctions
3. Hemoclip the right internal mammary artery and vein in continuity and divide
4. Insert a chest retractor into 5th intercostal space and open widely for 5-6 inches

Is there an injury to the pericardium or evidence of cardiac tamponade?

YES

See Right Pericardiotomy Module

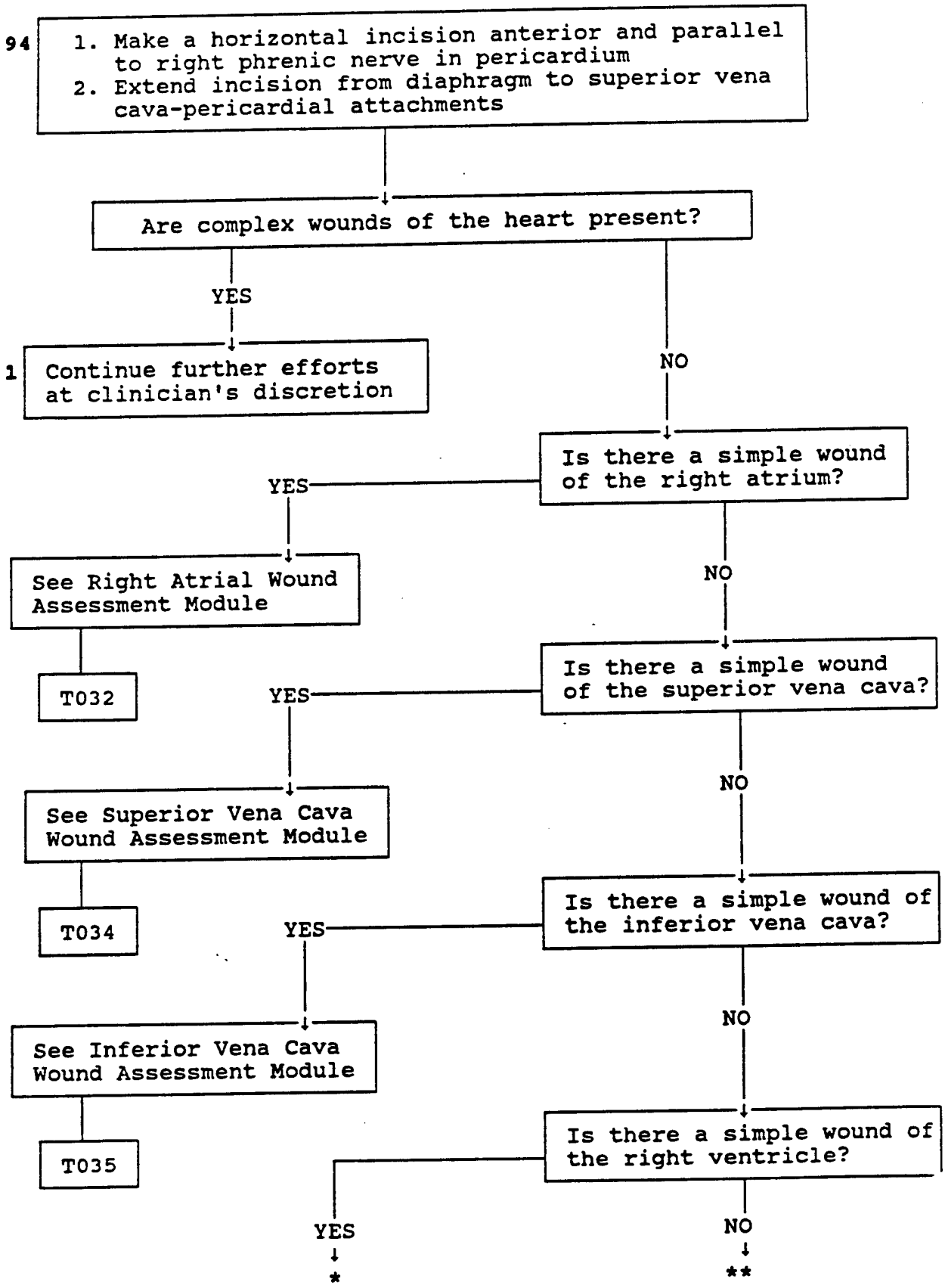
T039

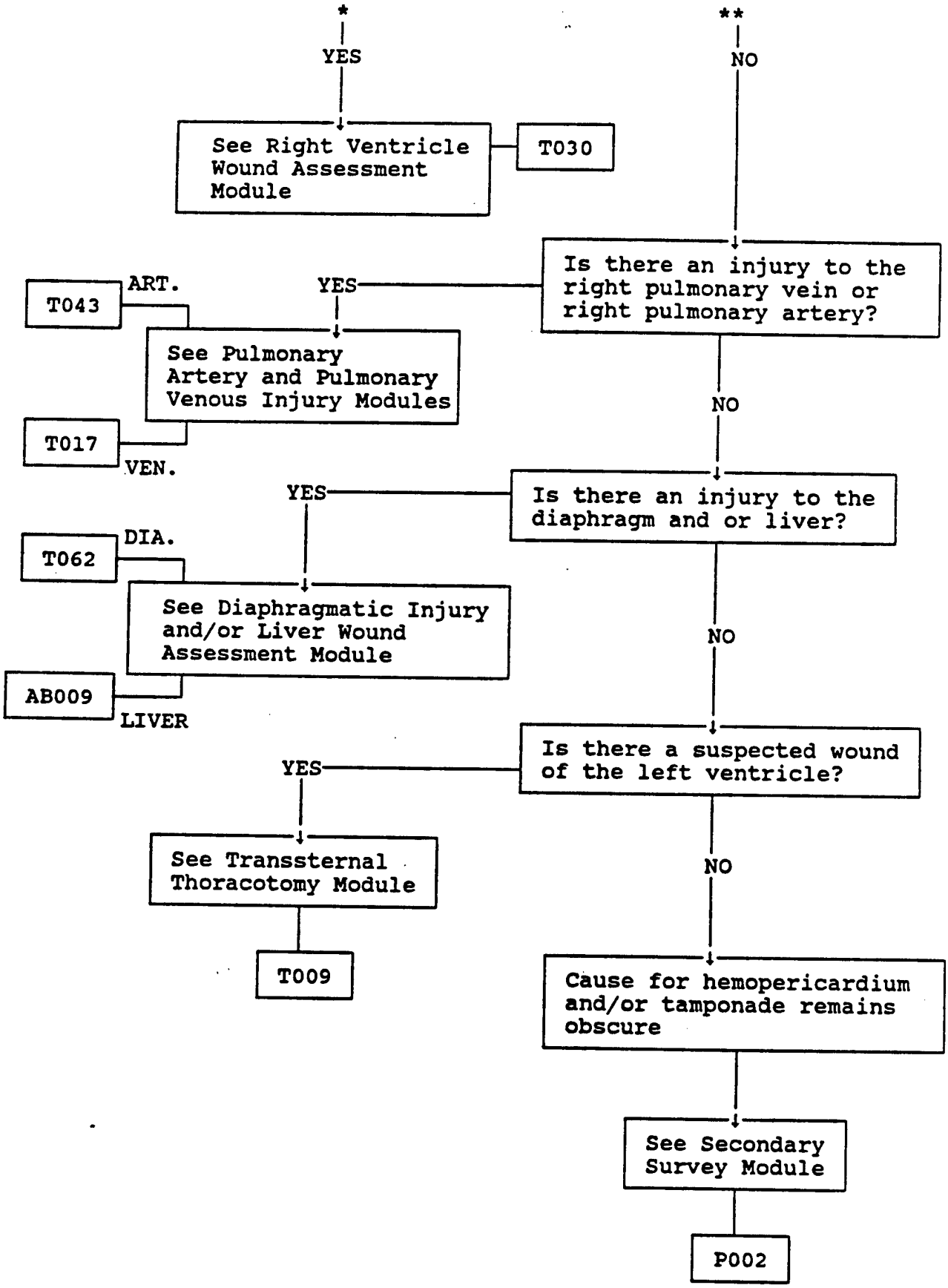
NO

See Right Anterior Thoracotomy Exploration Module

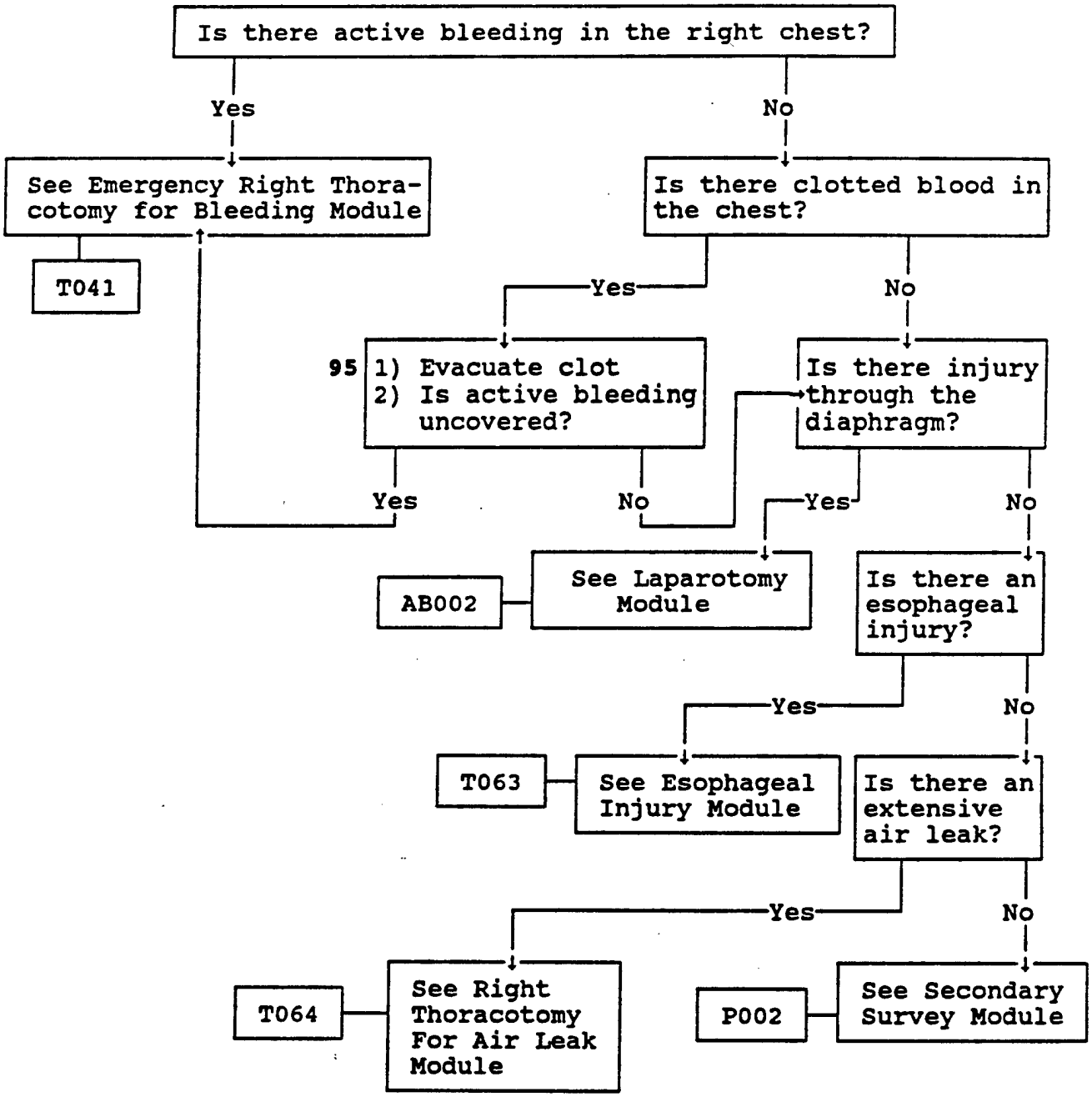
T040

RIGHT PERICARDIOTOMY MODULE

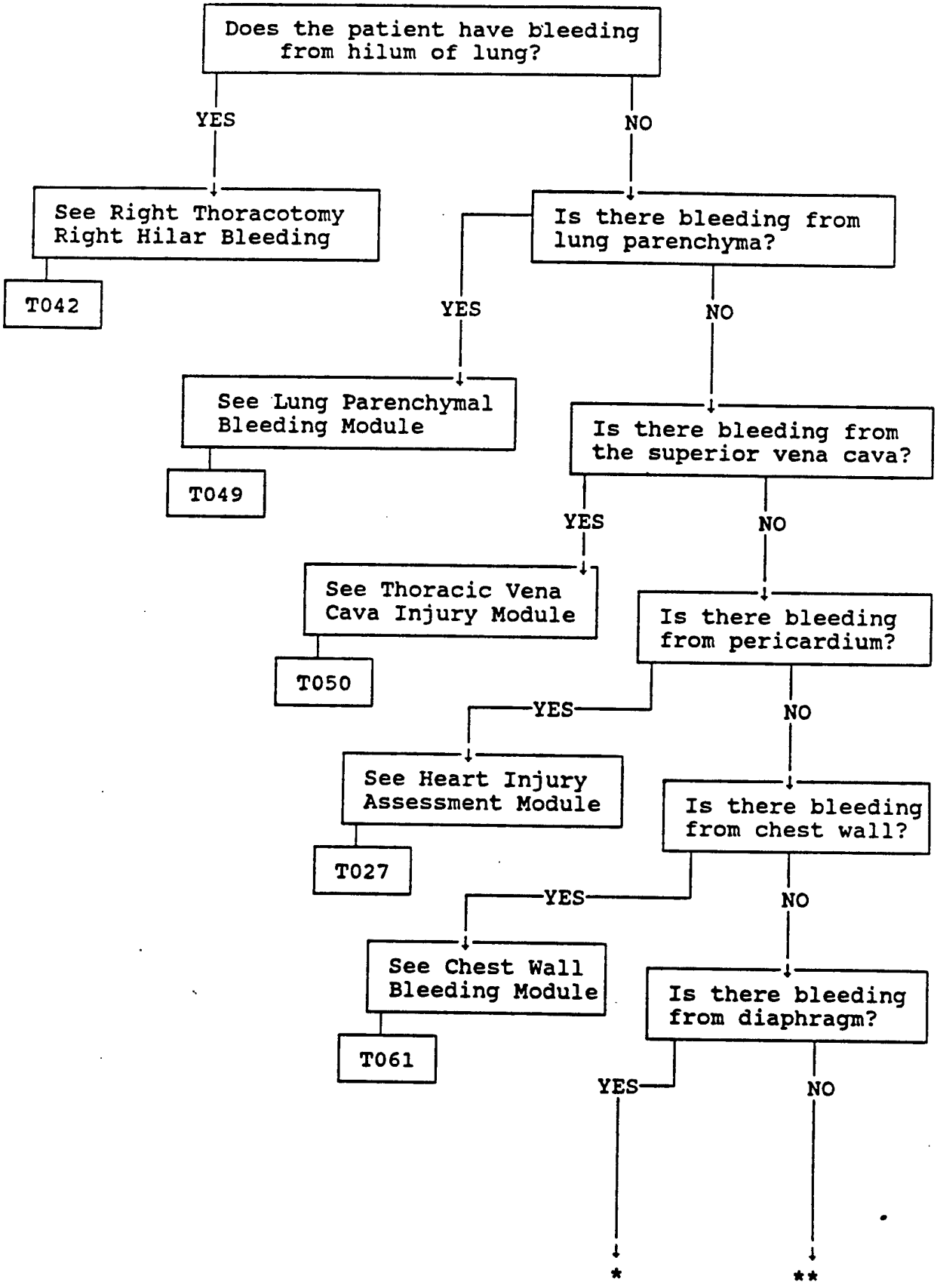


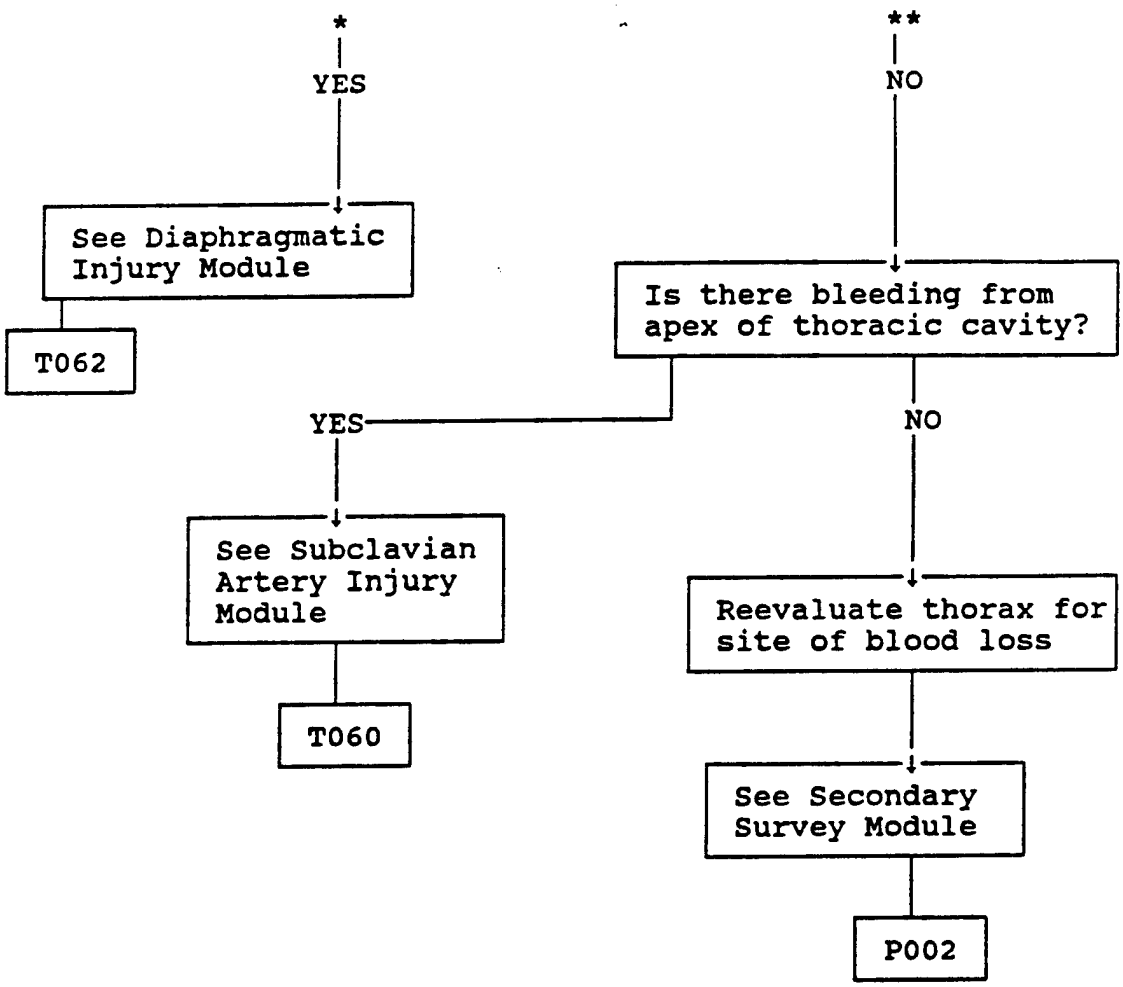

*
YES
See Right Ventricle Wound Assessment Module
T030
**
NO
Is there an injury to the right pulmonary vein or right pulmonary artery?
YES
ART.
T043
See Pulmonary Artery and Pulmonary Venous Injury Modules
T017
VEN.
NO
Is there an injury to the diaphragm and or liver?
YES
DIA.
T062
See Diaphragmatic Injury and/or Liver Wound Assessment Module
AB009
LIVER
NO
Is there a suspected wound of the left ventricle?
YES
See Transsternal Thoracotomy Module
T009
NO
Cause for hemopericardium and/or tamponade remains obscure
See Secondary Survey Module
P002

RIGHT ANTERIOR THORACOTOMY EXPLORATION MODULE

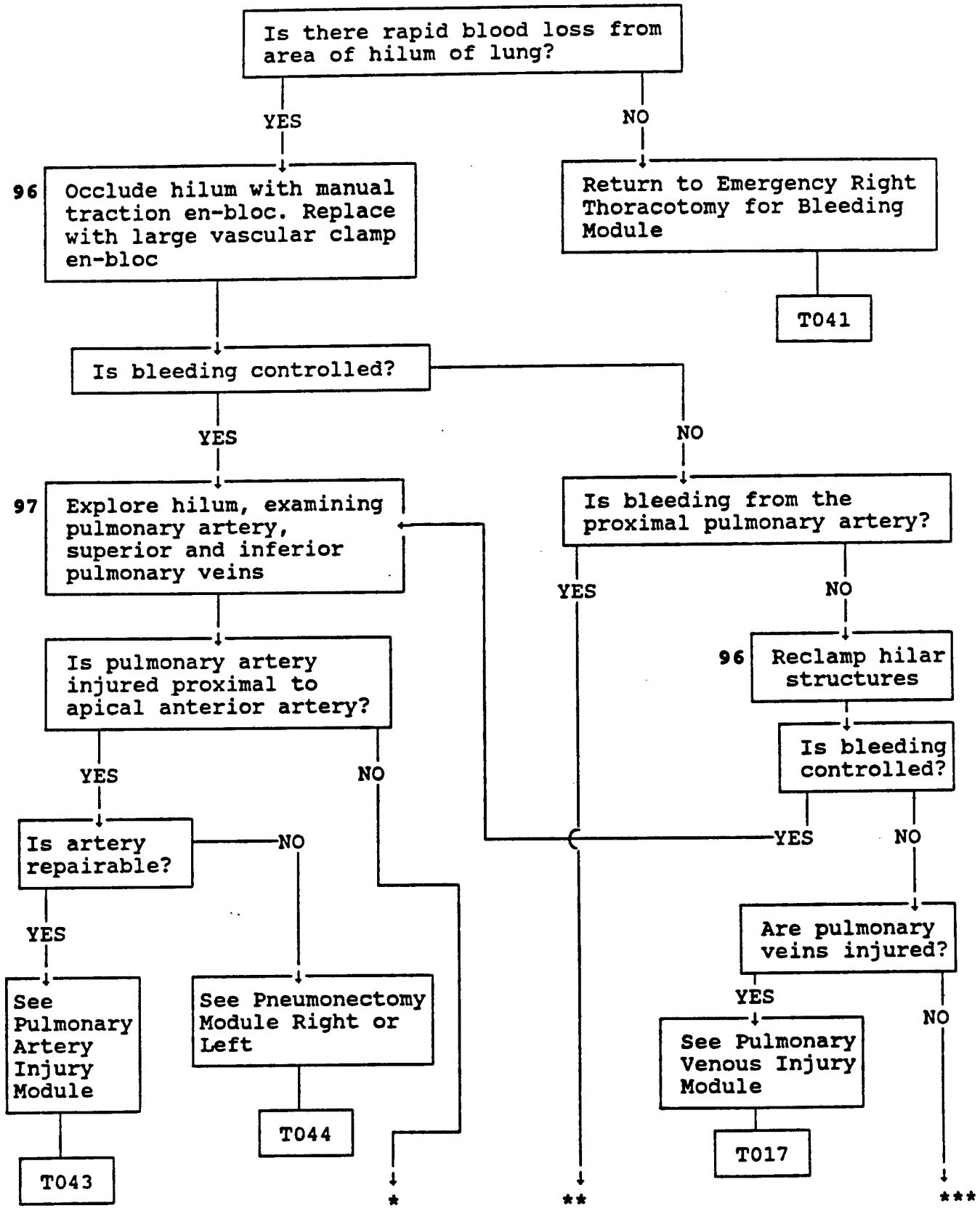


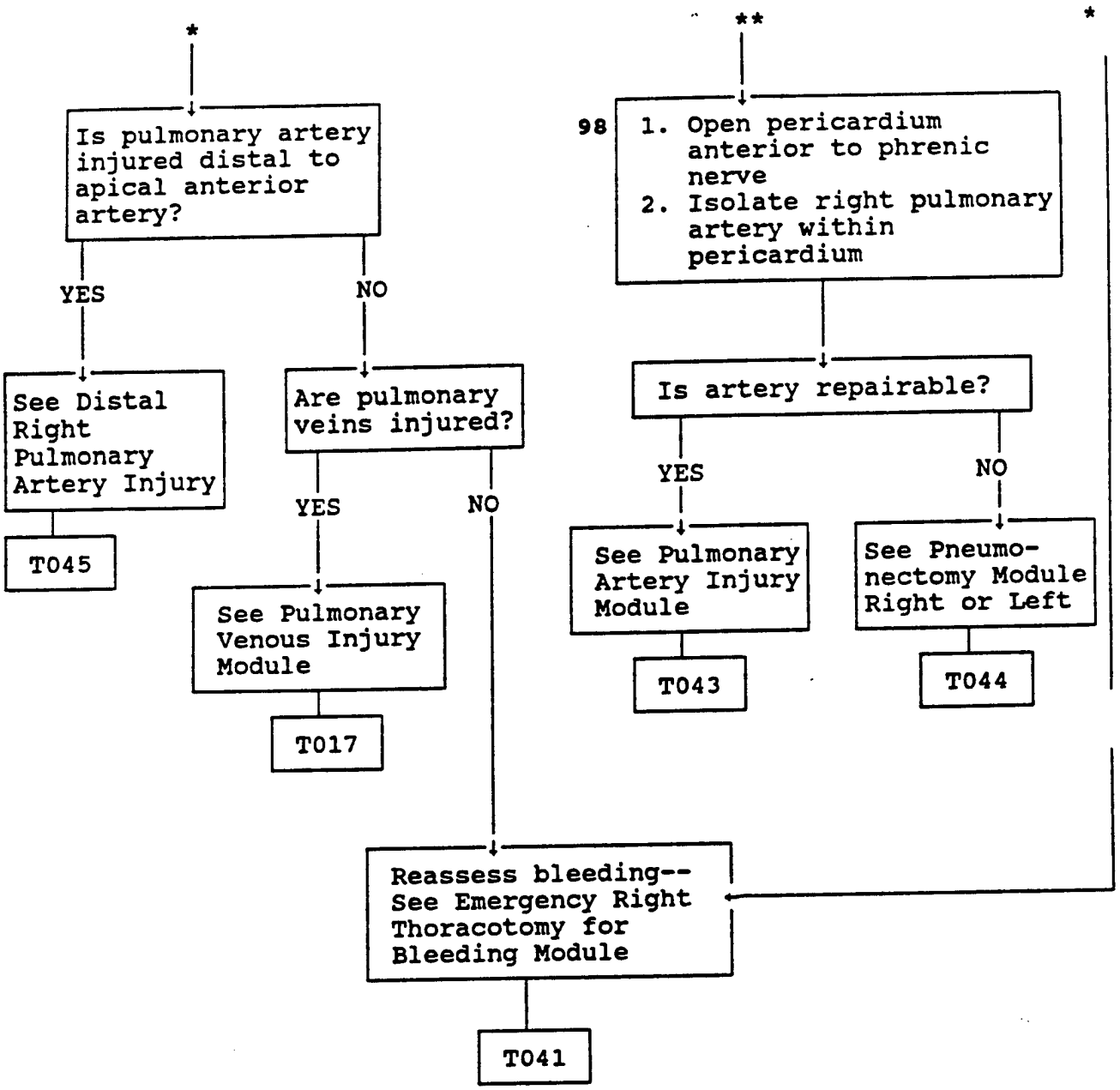
EMERGENCY RIGHT THORACOTOMY FOR BLEEDING MODULE



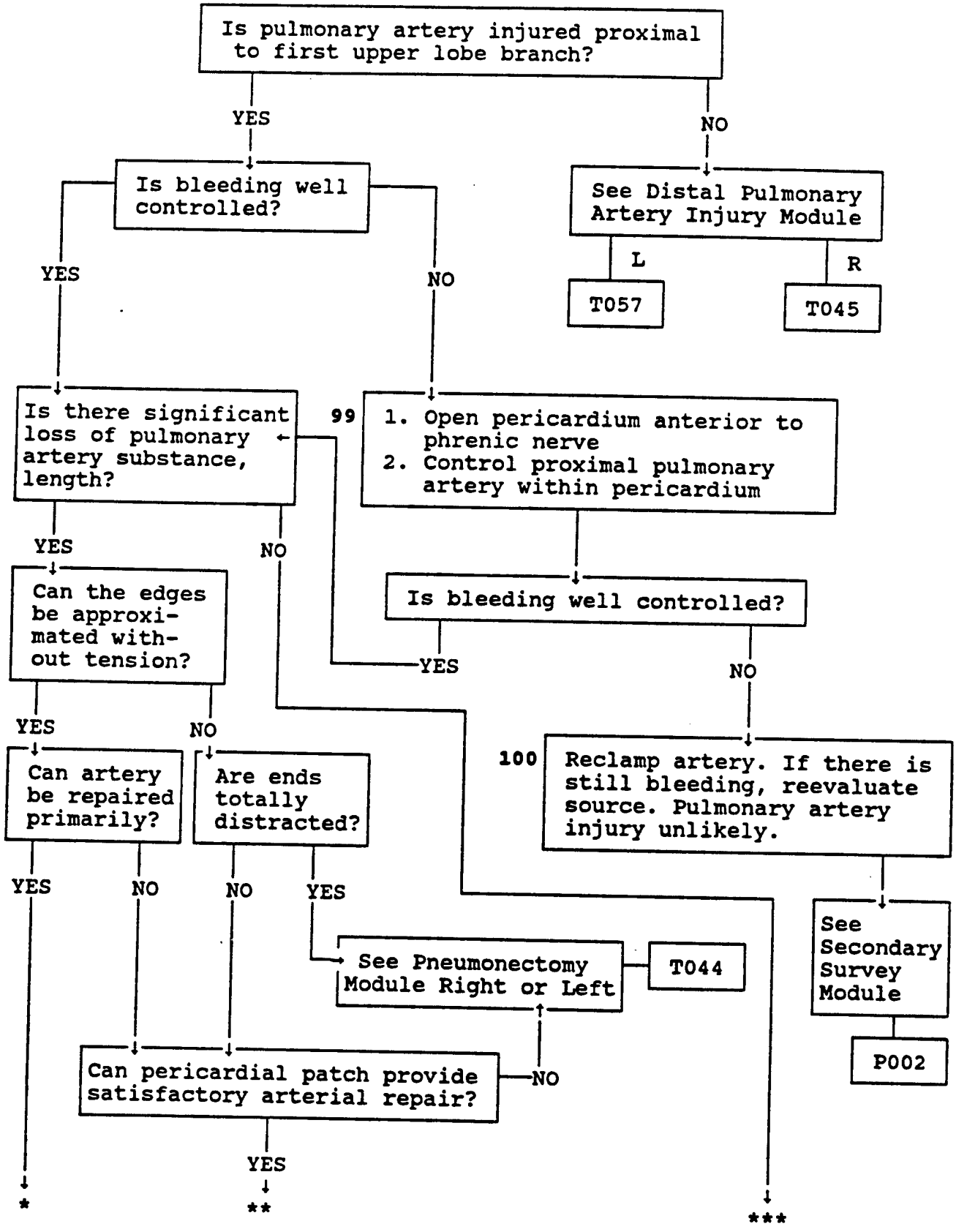

*
YES
See Diaphragmatic Injury Module
T062
**
NO
Is there bleeding from apex of thoracic cavity?
YES
See Subclavian Artery Injury Module
T060
NO
Reevaluate thorax for site of blood loss
See Secondary Survey Module
P002

RIGHT THORACOTOMY RIGHT HILAR BLEEDING MODULE

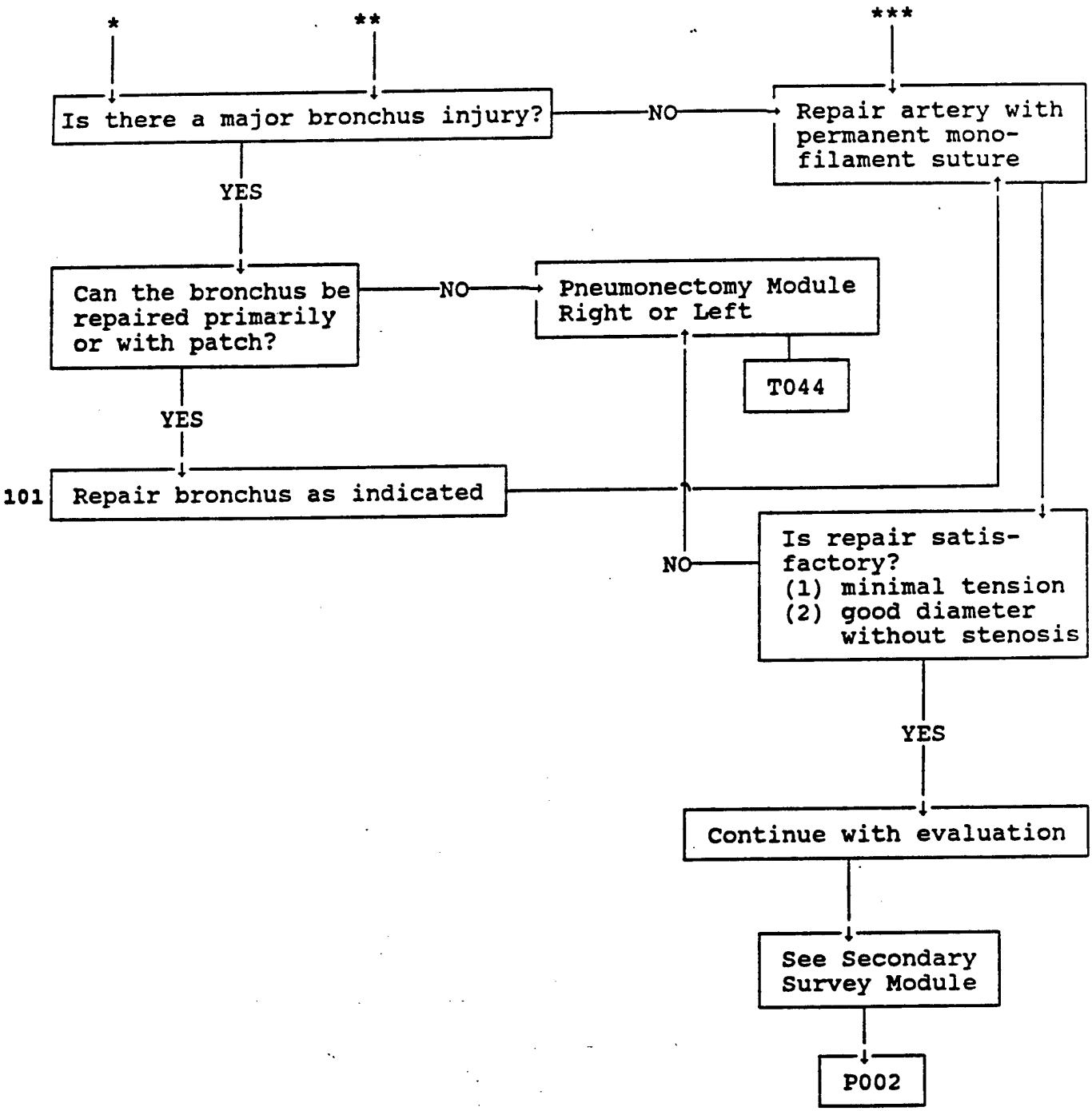



*
Is pulmonary artery injured distal to apical anterior artery?
YES
NO
See Distal Right Pulmonary Artery Injury
T045
Are pulmonary veins injured?
YES
NO
See Pulmonary Venous Injury Module
T017
**
98
1. Open pericardium anterior to phrenic nerve
2. Isolate right pulmonary artery within pericardium
Is artery repairable?
YES
NO
See Pulmonary Artery Injury Module
T043
See Pneumo-nectomy Module Right or Left
T044
*
Reassess bleeding-- See Emergency Right Thoracotomy for Bleeding Module
T041

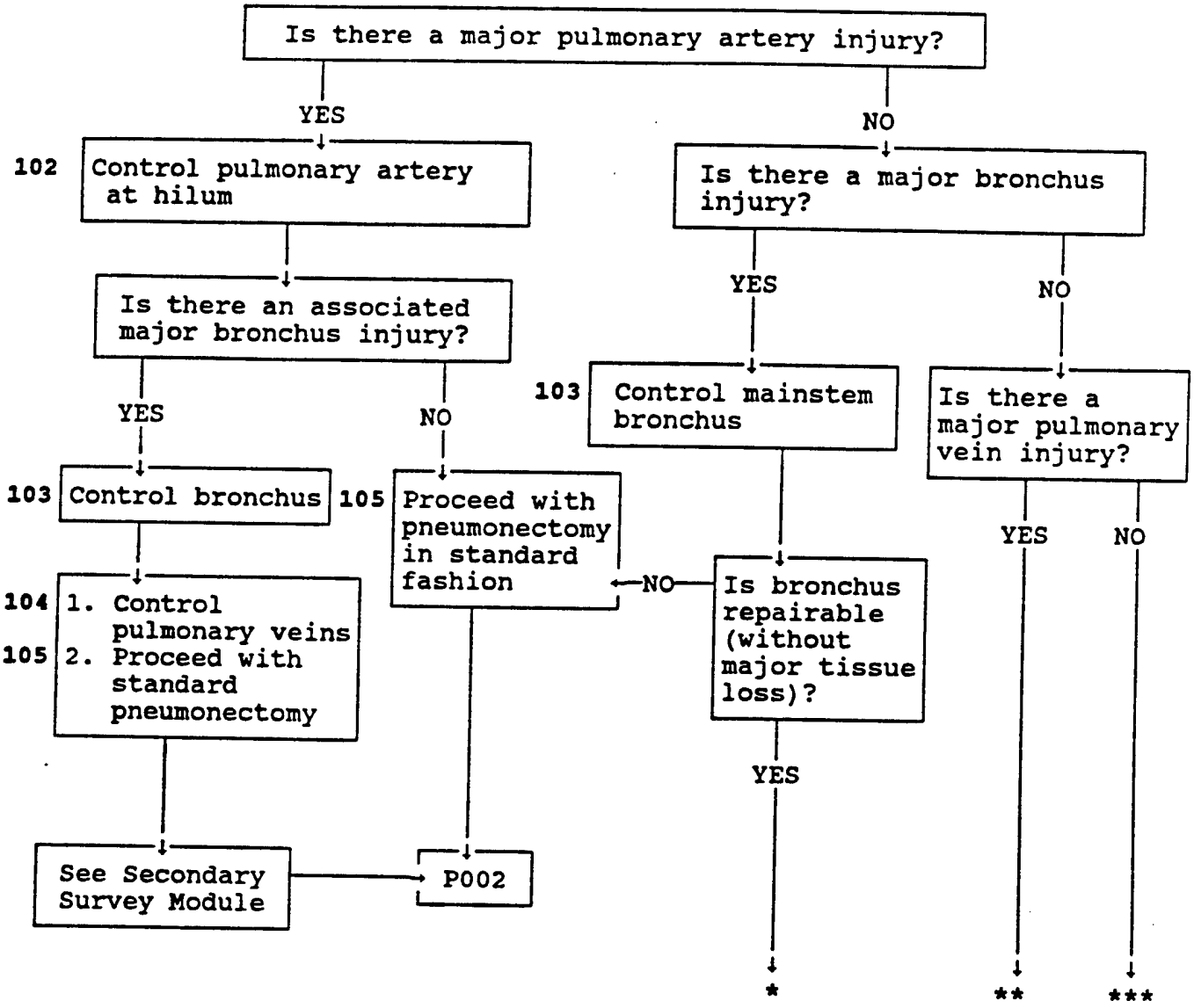
PULMONARY ARTERY INJURY MODULE

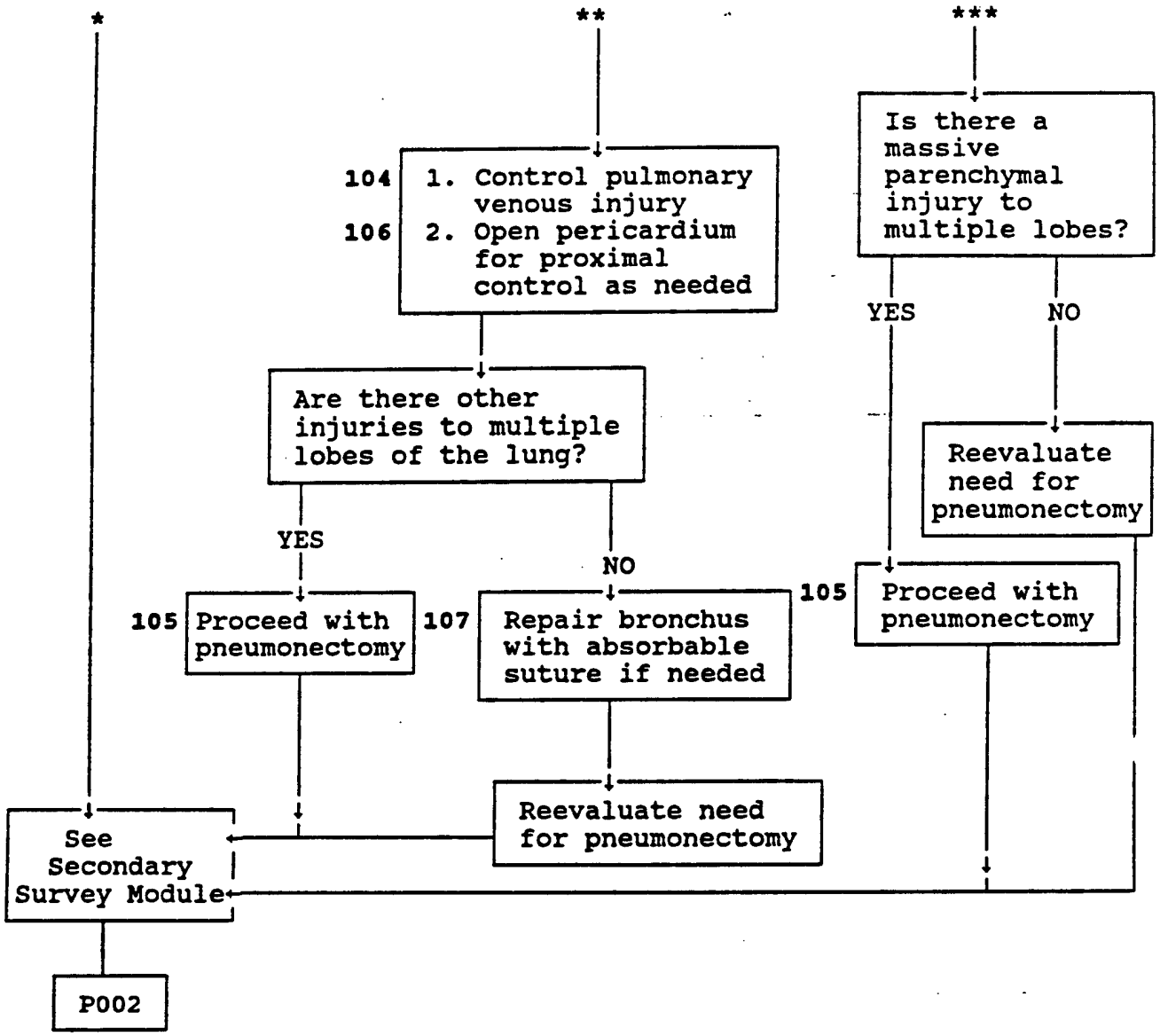


PULMONARY ARTERY INJURY MODULE

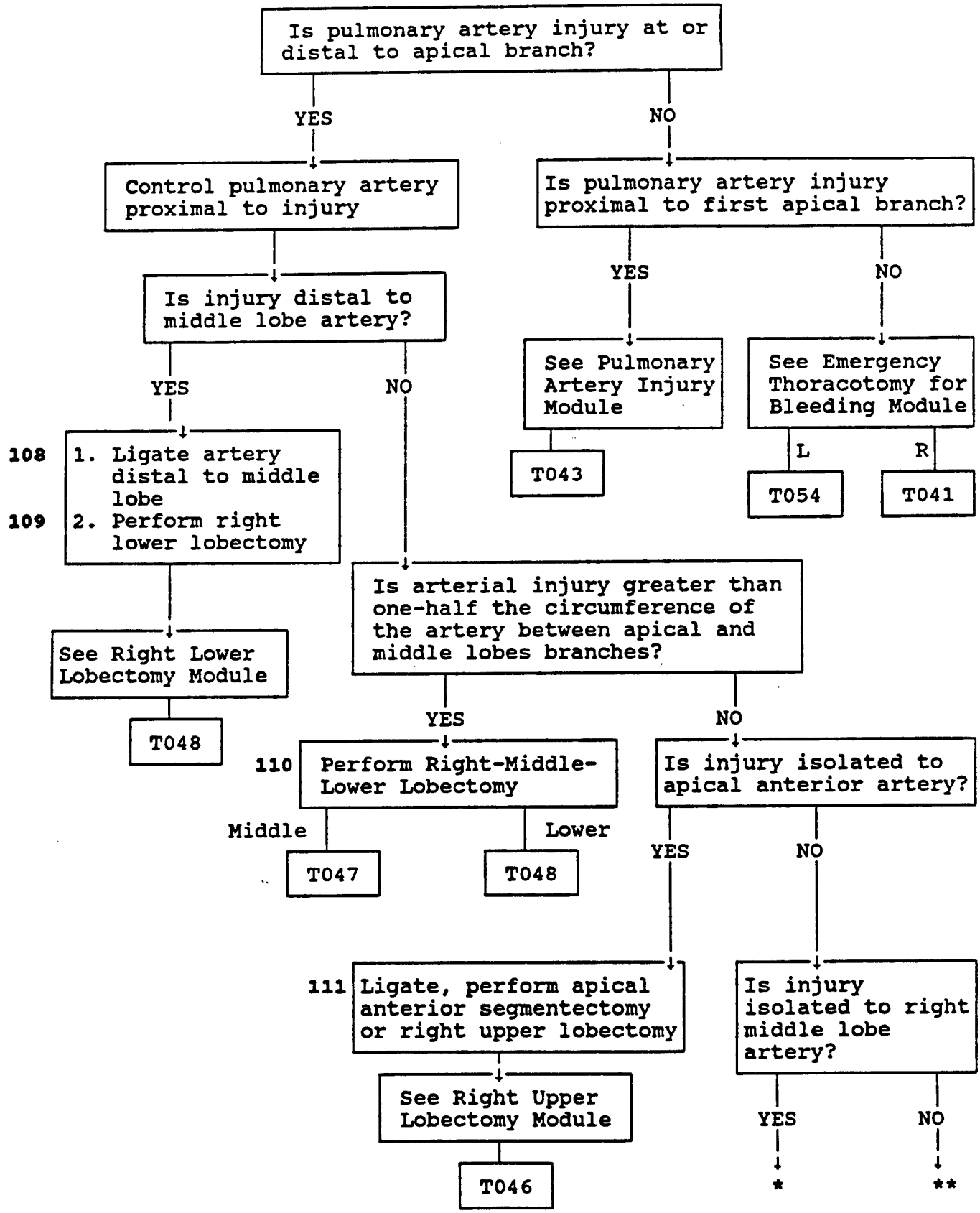


PNEUMONECTOMY MODULE
RIGHT OR LEFT

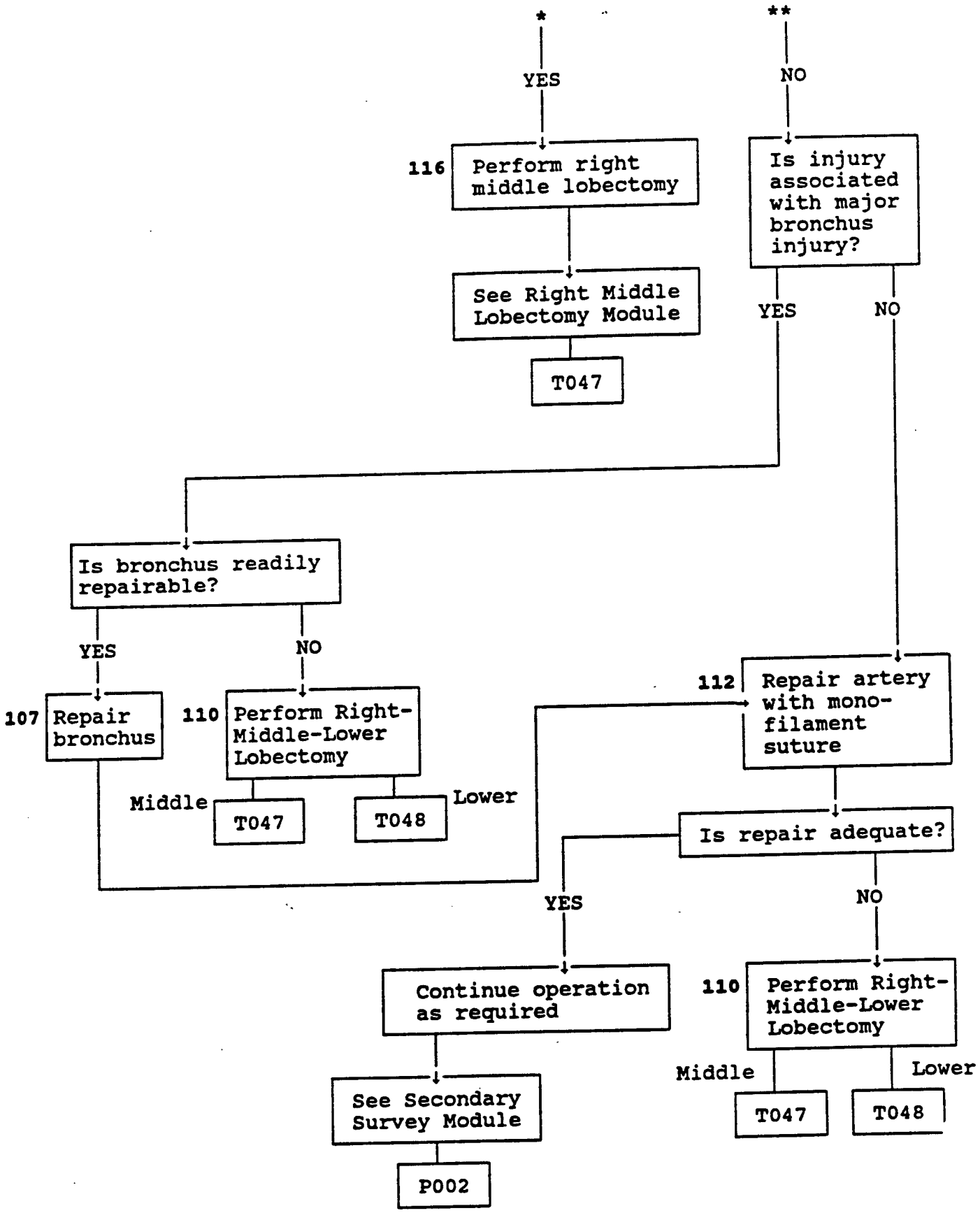



*
**
***
104 1. Control pulmonary venous injury
106 2. Open pericardium for proximal control as needed
Are there other injuries to multiple lobes of the lung?
YES
NO
105 Proceed with pneumonectomy
107 Repair bronchus with absorbable suture if needed
Reevaluate need for pneumonectomy
Is there a massive parenchymal injury to multiple lobes?
YES
NO
Reevaluate need for pneumonectomy
105 Proceed with pneumonectomy
See Secondary Survey Module
P002

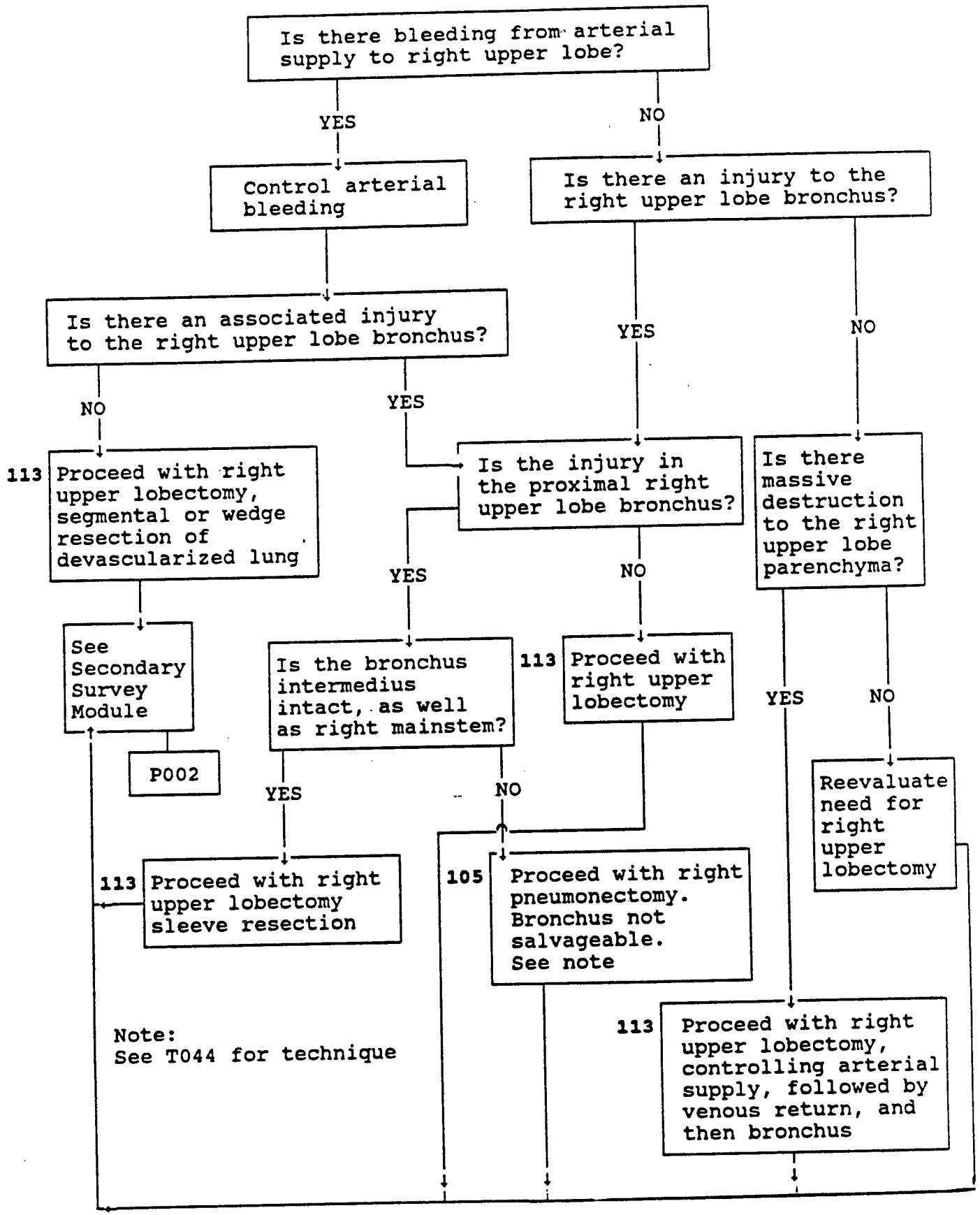
DISTAL RIGHT PULMONARY ARTERY INJURY MODULE



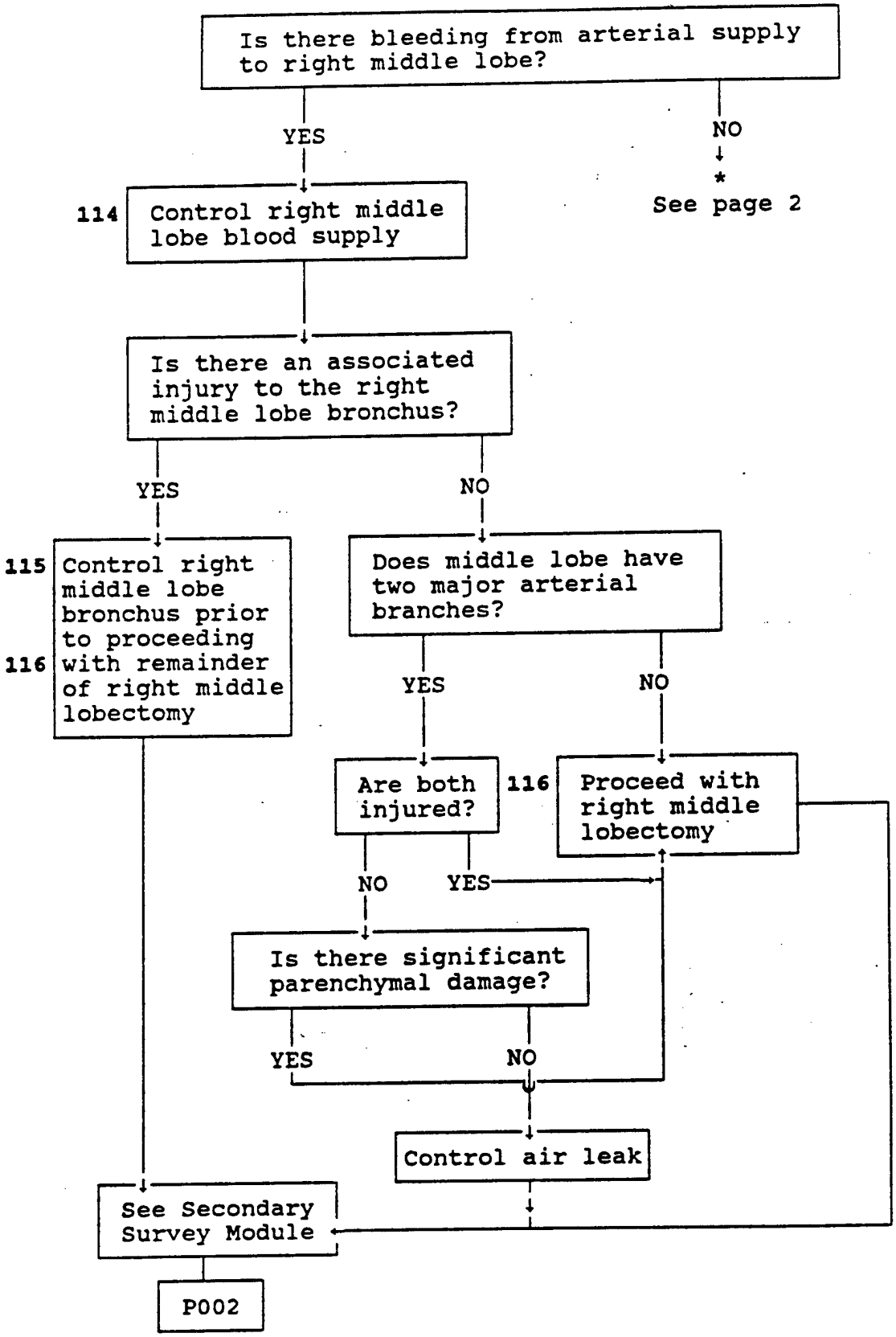
DISTAL RIGHT PULMONARY ARTERY INJURY MODULE

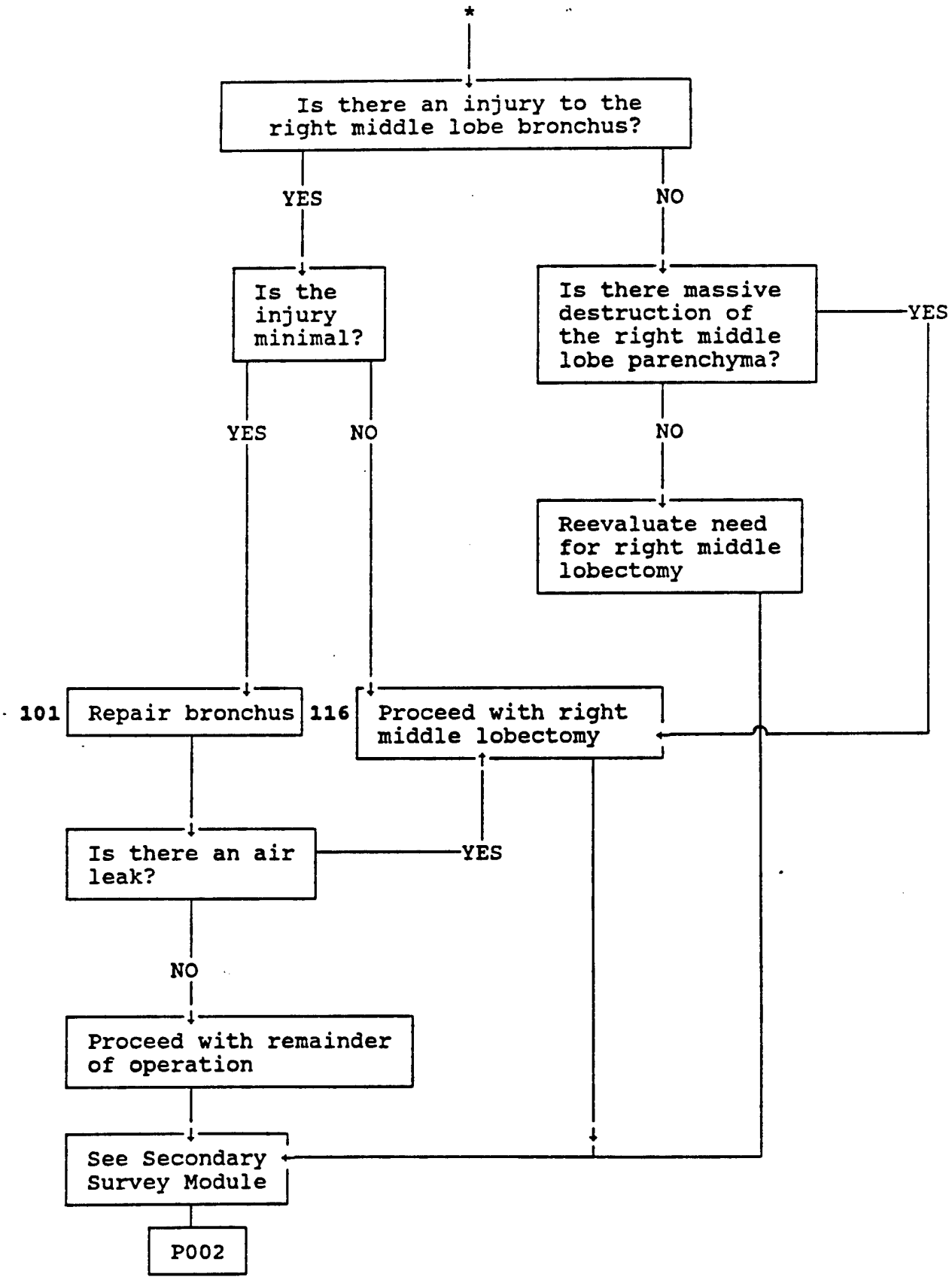


RIGHT UPPER LOBECTOMY MODULE

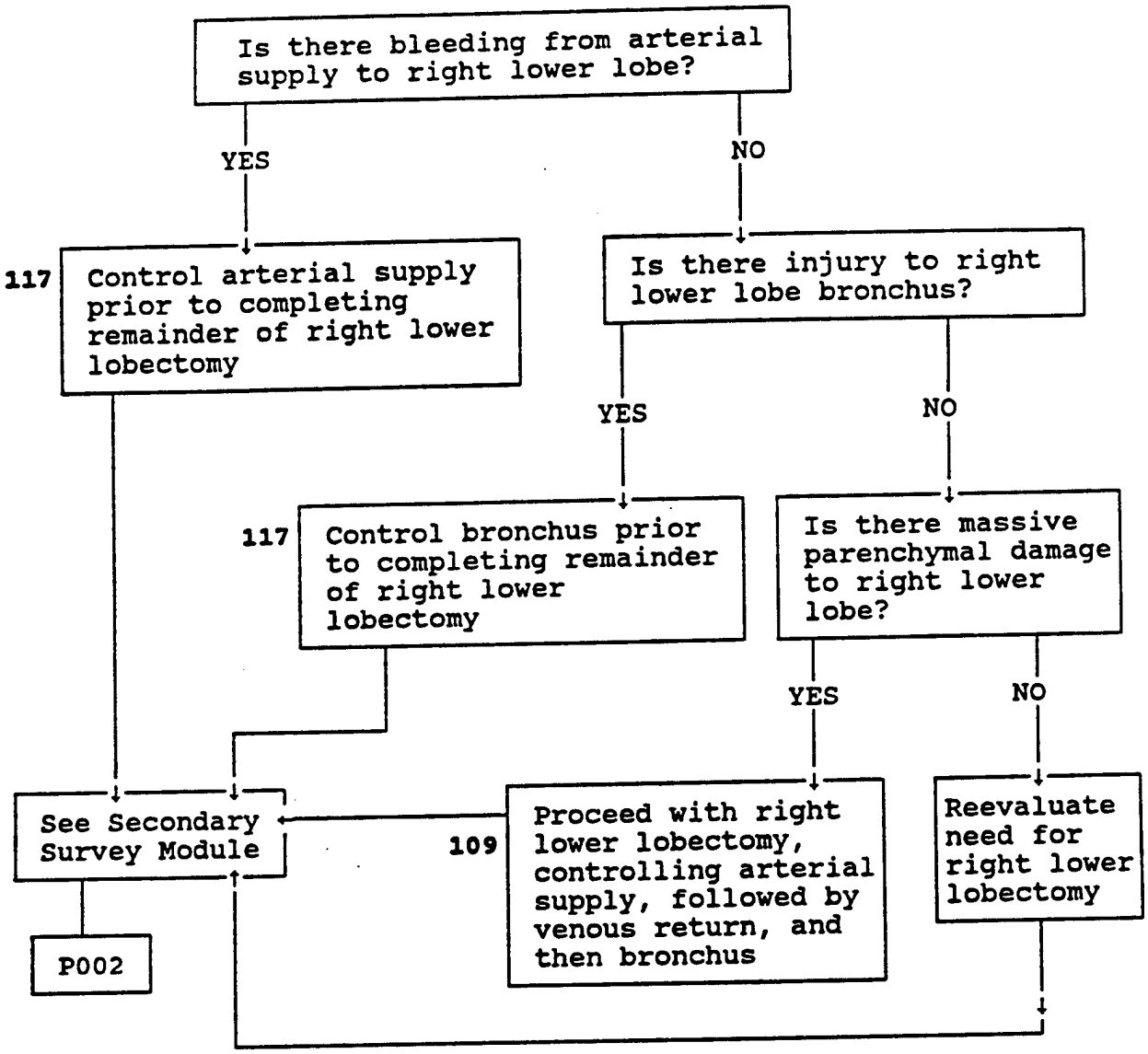


RIGHT MIDDLE LOBECTOMY MODULE

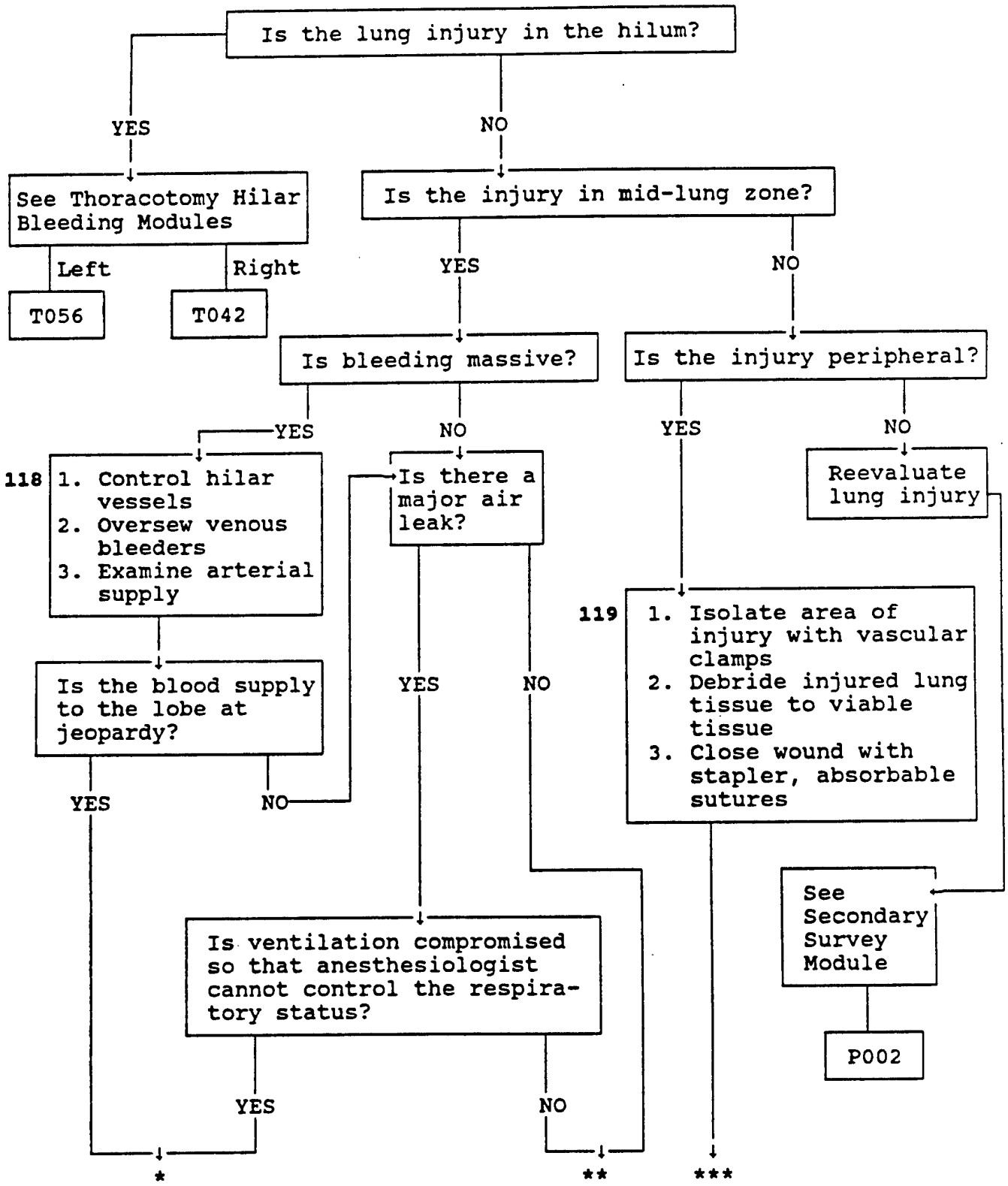



*
Is there an injury to the right middle lobe bronchus?
YES
NO
Is the injury minimal?
Is there massive destruction of the right middle lobe parenchyma?
YES
YES
NO
NO
Reevaluate need for right middle lobectomy
101
Repair bronchus
116
Proceed with right middle lobectomy
Is there an air leak?
YES
NO
Proceed with remainder of operation
See Secondary Survey Module
P002

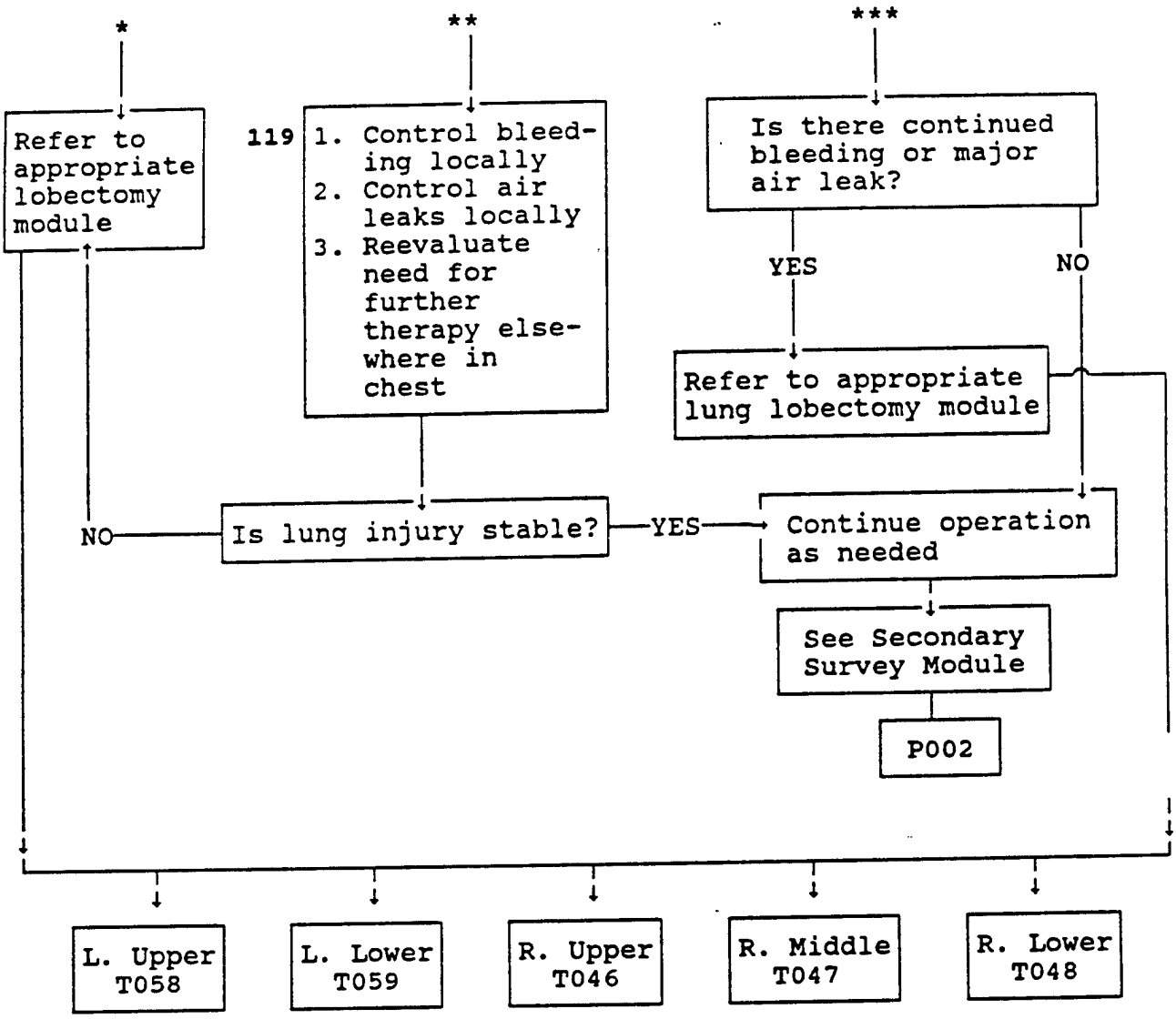
RIGHT LOWER LOBECTOMY MODULE



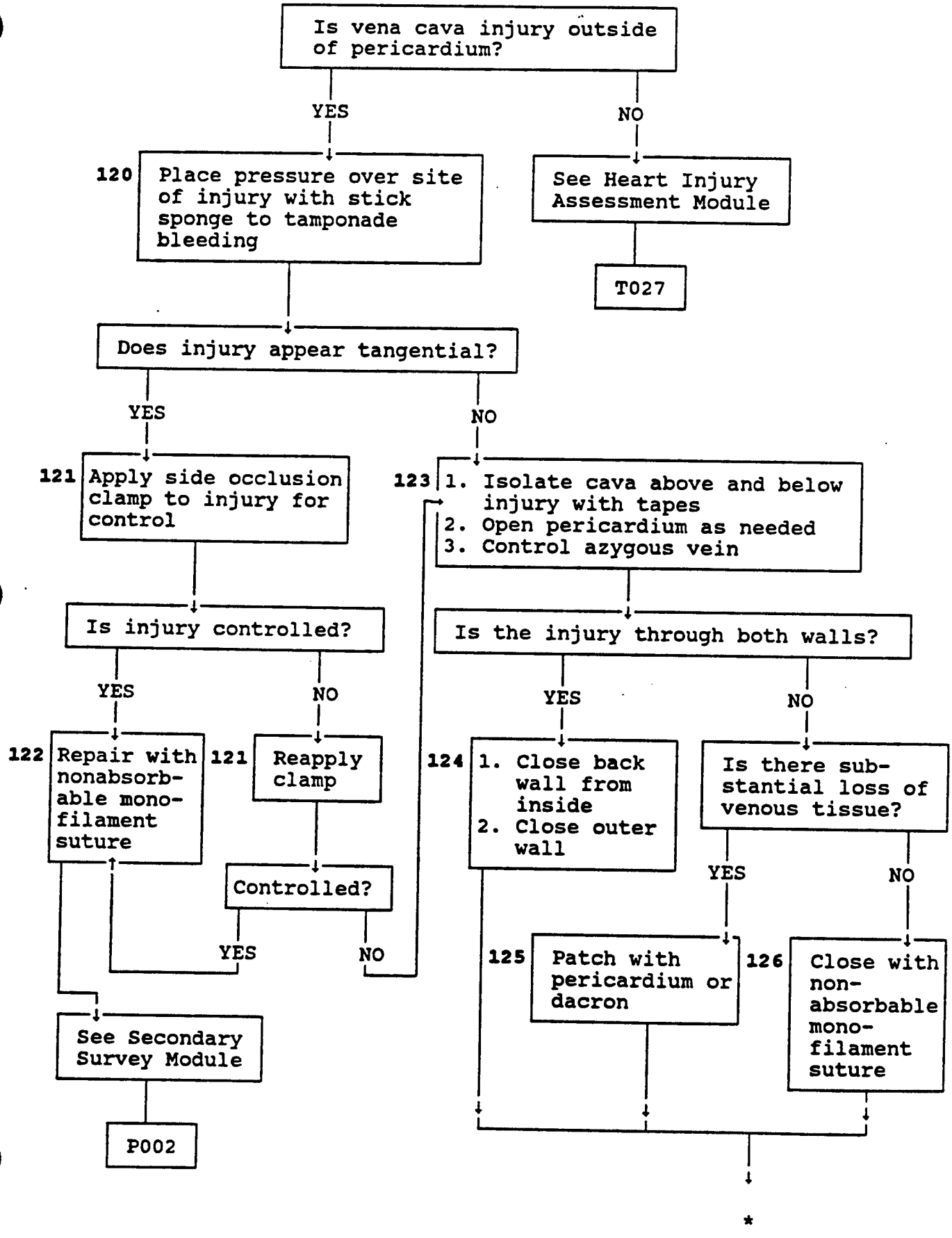
LUNG PARENCHYMAL BLEEDING MODULE

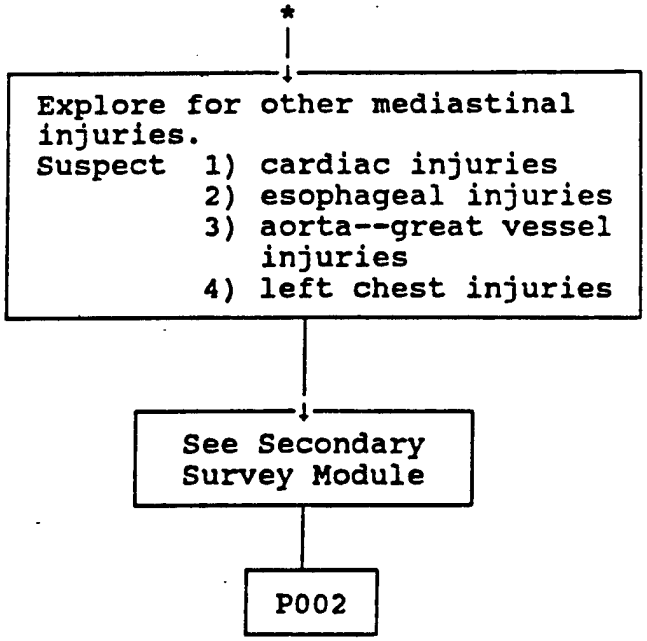


LUNG PARENCHYMAL BLEEDING MODULE



THORACIC VENA CAVA INJURY MODULE




*
Explore for other mediastinal injuries.
Suspect 1) cardiac injuries
2) esophageal injuries
3) aorta--great vessel injuries
4) left chest injuries
See Secondary Survey Module
P002

IMMEDIATE LEFT ANTERIOR THORACOTOMY MODULE

127

1) Make an incision from left parasternal area 4th intercostal space to mid-axillary line.

2) With the cautery setting at 50 watts for coagulation and cutting, extend incision down to superior border of 5th rib and enter pleural space over superior border of left 5th rib. As the left sternal border is approached, cauterize the intercostal muscles between the 4th and 5th costal chondral junctions.

3) Hemoclip the left internal mammary artery and vein in continuity and divide.

4) Insert a chest retractor into 4th intercostal space and open widely for 5-6 inches.

↓

Is there an injury to the pericardium or evidence of cardiac tamponade?

Yes ↓

Left Pericardiotomy Module

↓

T052

No ↓

Left Anterior Thoracotomy Exploration Module

↓

T053

LEFT PERICARDIOTOMY MODULE

128 1) Make an incision parallel and anterior to the left phrenic nerve
2) Suspend edge of pericardium with 3/0 silk

Are complex wounds of the heart present?

YES → 1 Continue further efforts at clinician's discretion

NO → Is there simple wound in right atrium?

YES → See Right Atrial Wound Assessment Module — T032

NO → Is there a simple wound to superior vena cava?

Yes → See Superior Vena Cava Wound Assessment Module — T034

No → Is there a simple wound to inferior vena cava?

Yes → See Inferior Vena Cave Wound Assessment Module — T035

No → Is there a simple wound to right ventricle?

Yes → See Right Ventricular Wound Assessment Module — T030

No → Is there a simple wound to left ventricle?

Yes → See Left Ventricular Wound Assessment Module — T028

No → Is there injury to aortic arch or great vessels?

Yes → See Ascending Aorta and Arch Injury Module — T012

No → Is there injury to pulmonary artery?

Yes → See Pulmonary Artery Injury Module — T043

No → Is there injury to pulmonary veins?

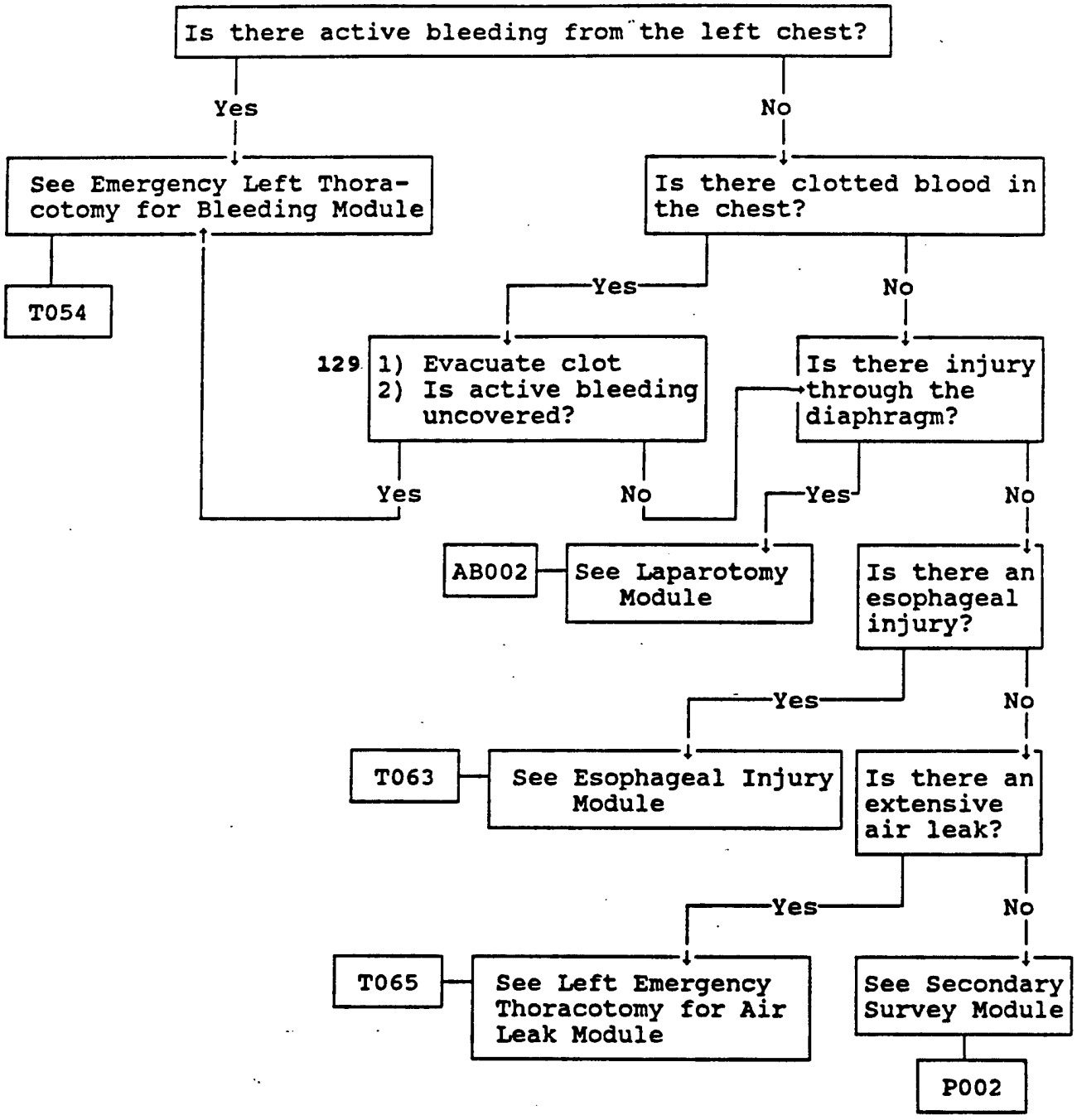
Yes → See Pulmonary Venous Injury Module — T017

No → Is there injury to pericardium?

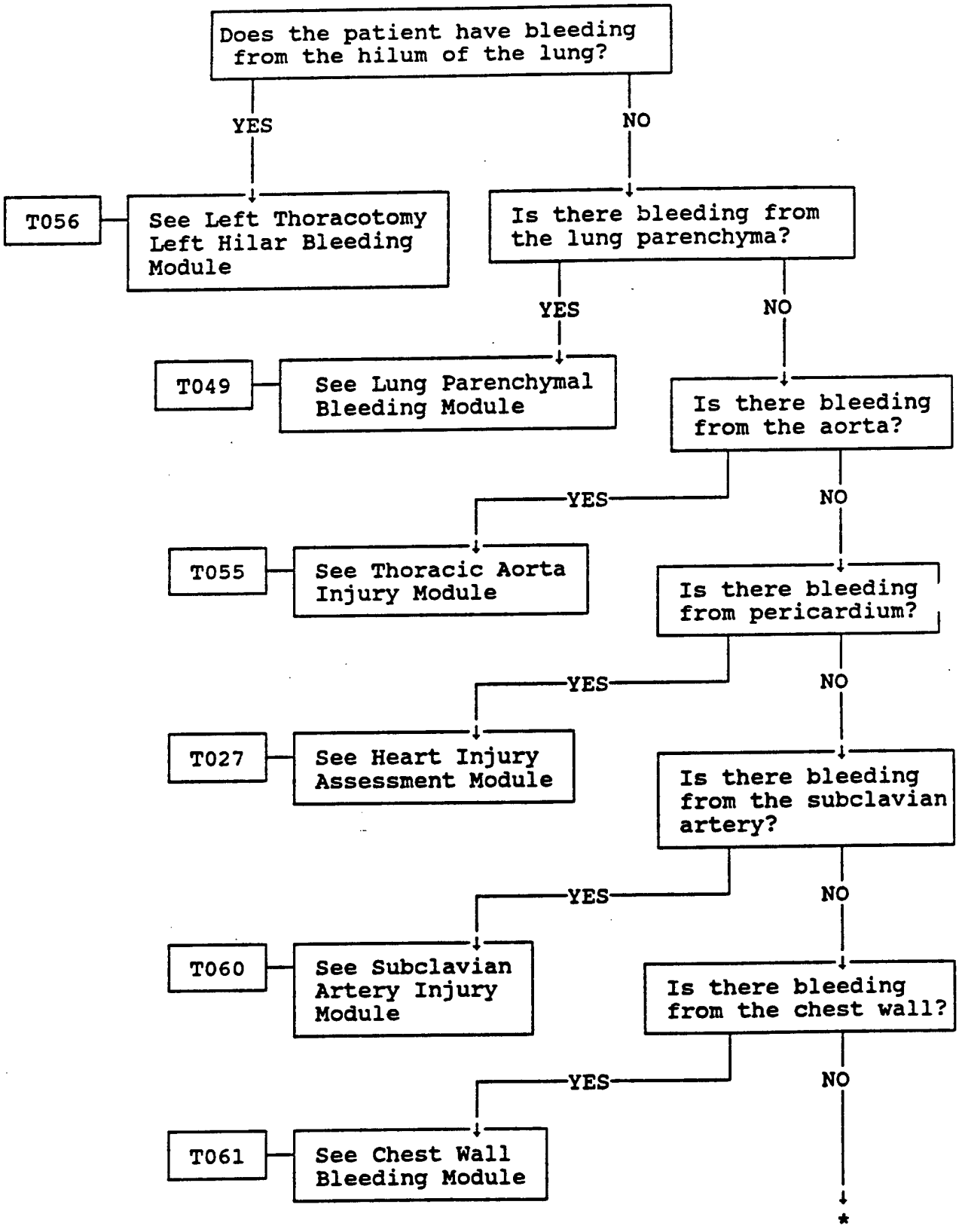
Yes → See Bleeding Into Pericardium Module — T019

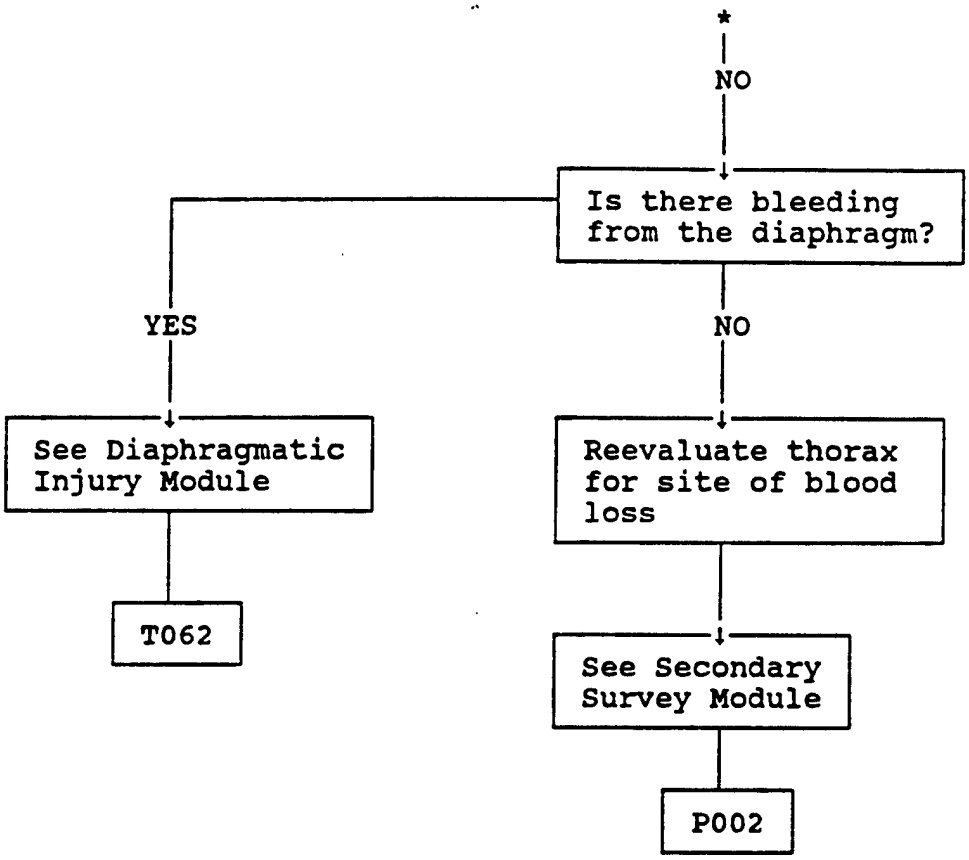
No → T053 — See Left Anterior Thoracotomy Exploration Module

LEFT ANTERIOR THORACOTOMY EXPLORATION MODULE

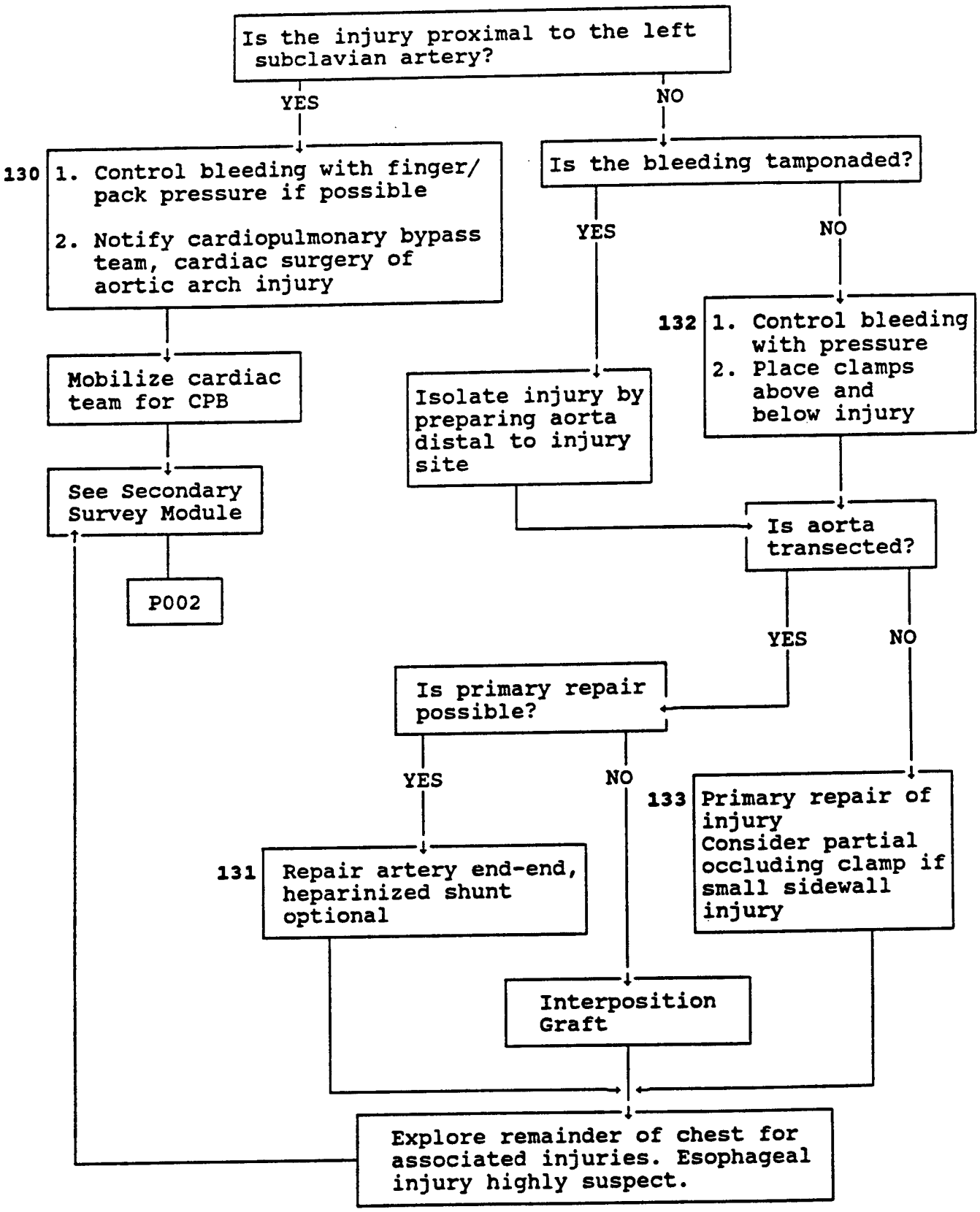


EMERGENCY LEFT THORACOTOMY FOR BLEEDING MODULE

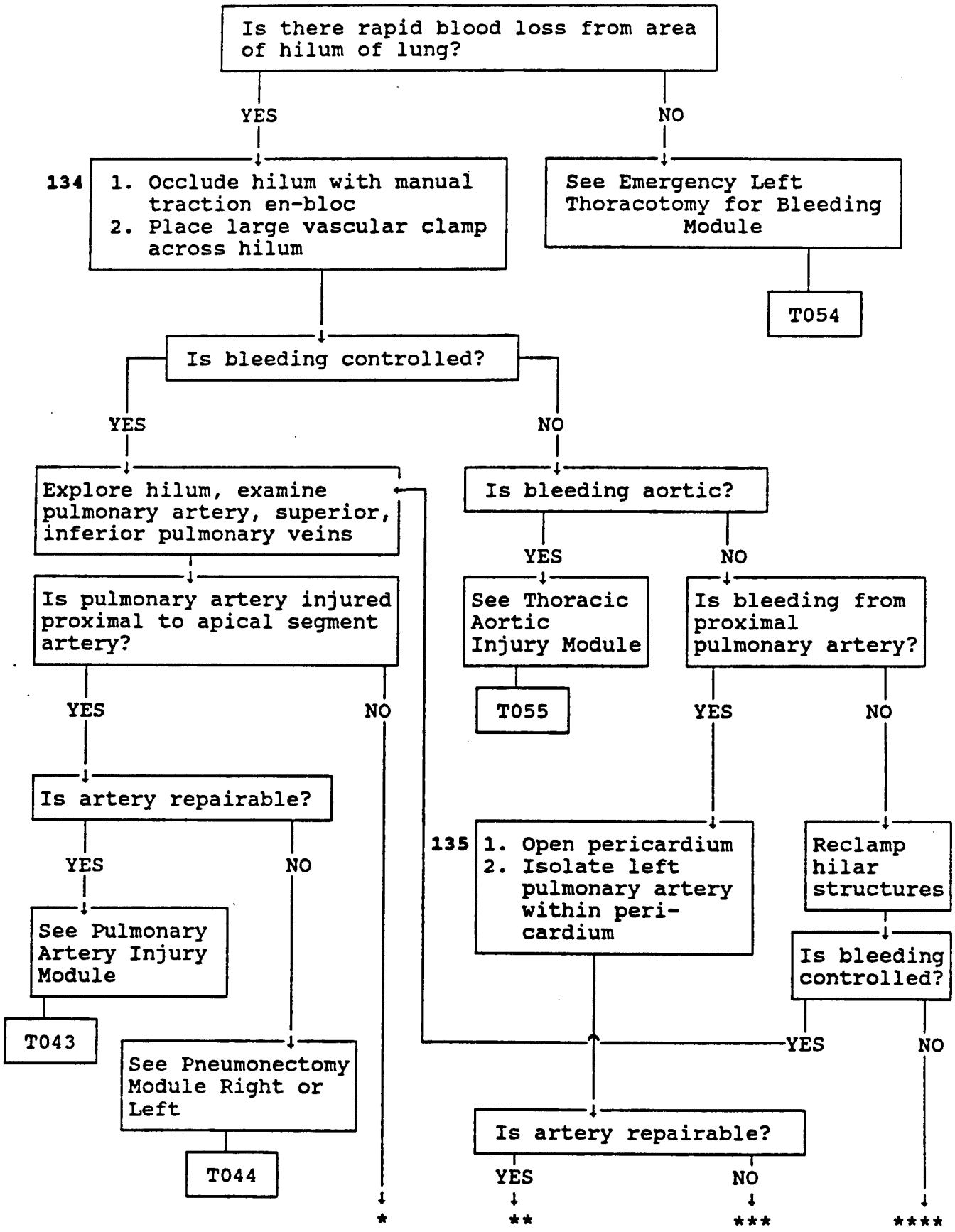



*
NO
Is there bleeding from the diaphragm?
YES
NO
See Diaphragmatic Injury Module
Reevaluate thorax for site of blood loss
T062
See Secondary Survey Module
P002

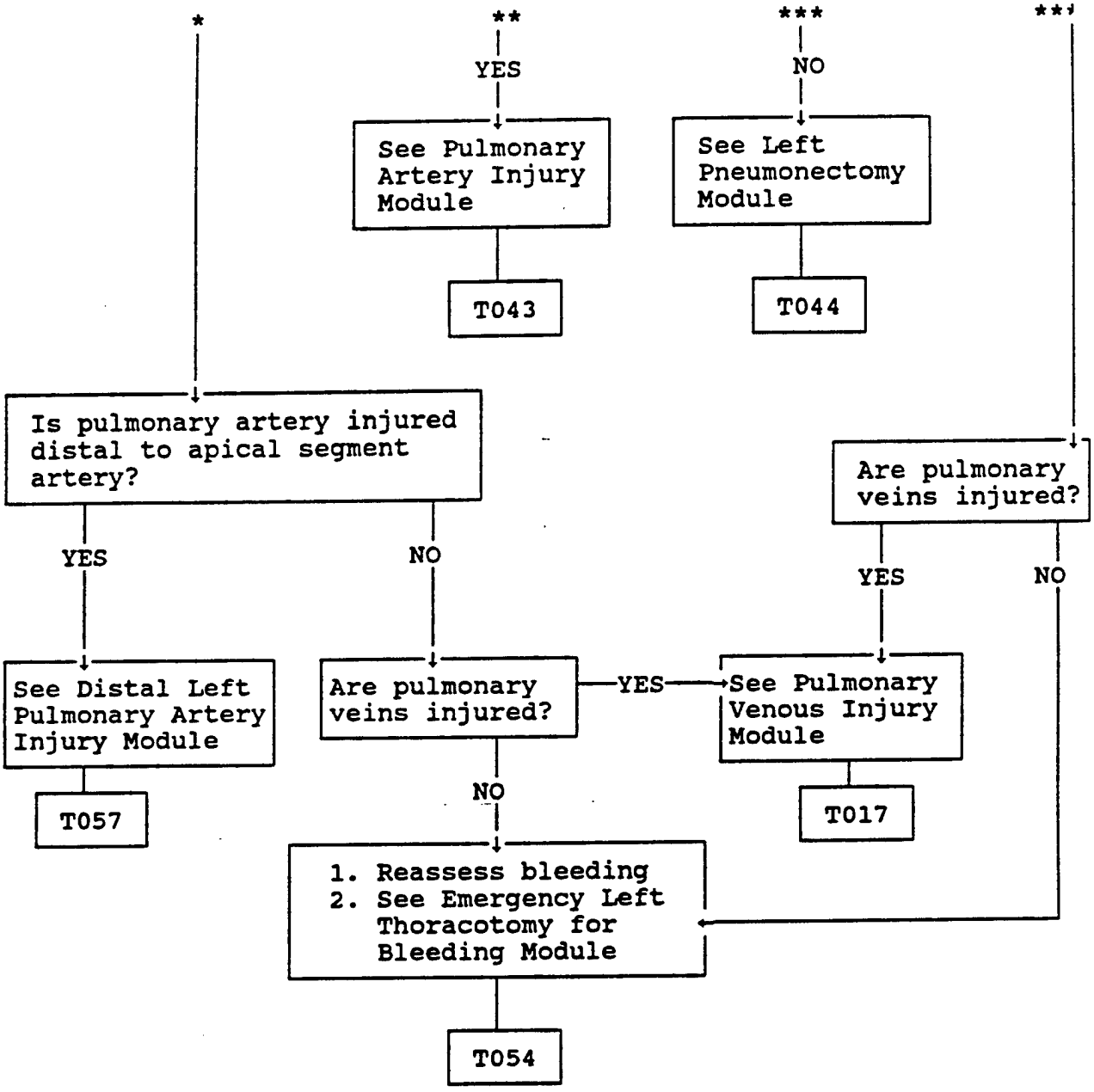
THORACIC AORTIC INJURY MODULE



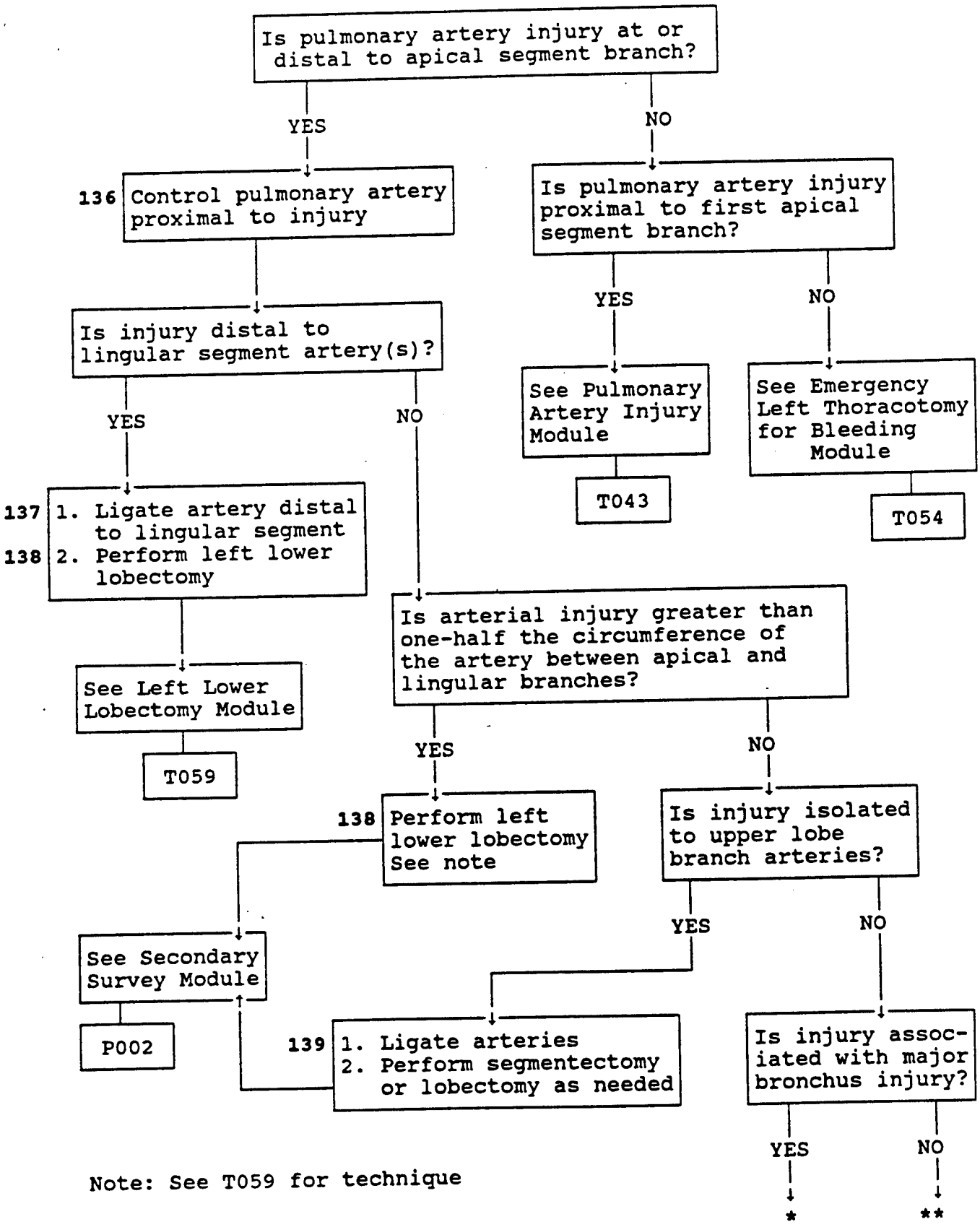
LEFT THORACOTOMY LEFT HILAR BLEEDING MODULE



LEFT THORACOTOMY LEFT HILAR BLEEDING MODULE

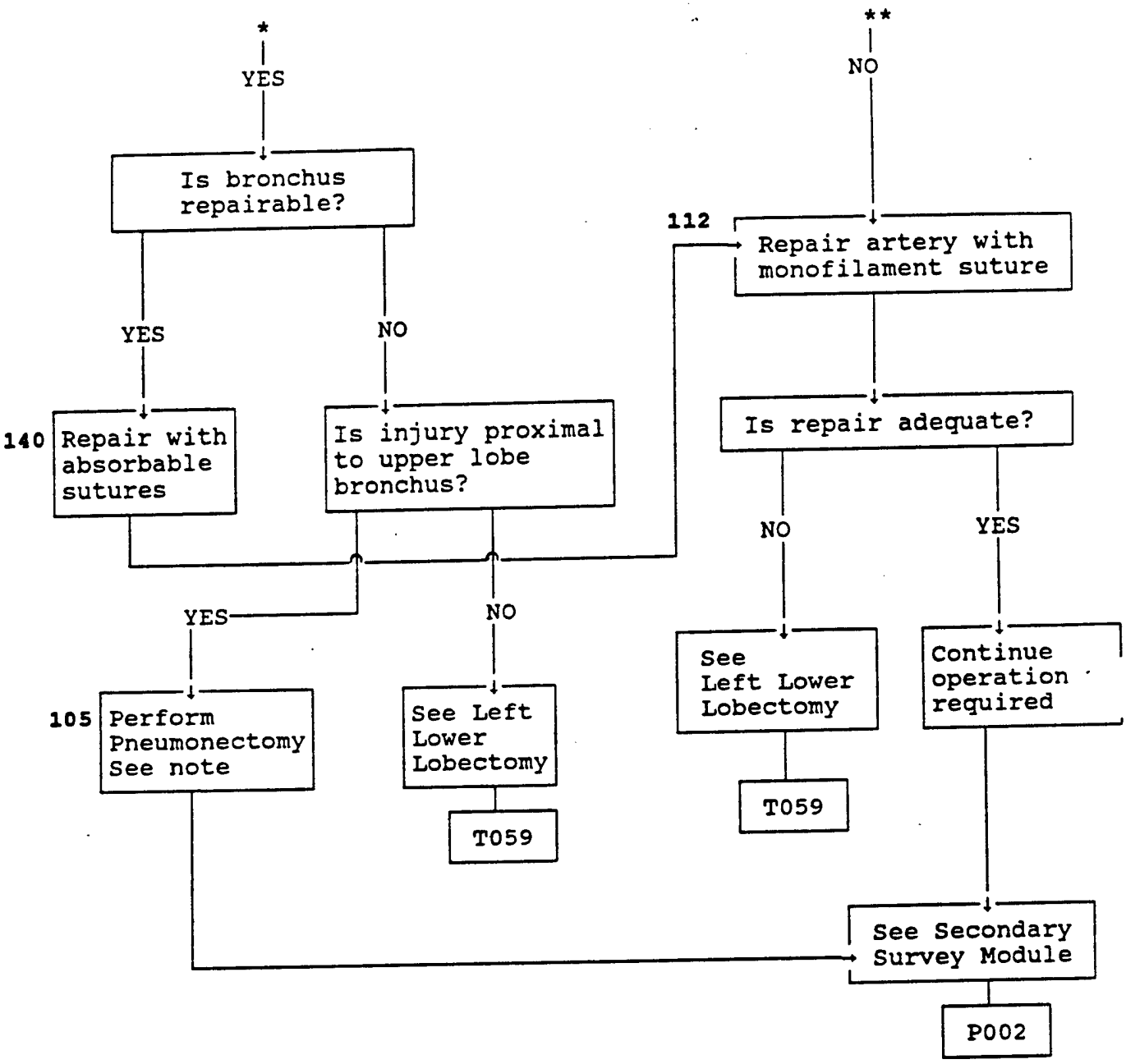


DISTAL LEFT PULMONARY ARTERY INJURY MODULE



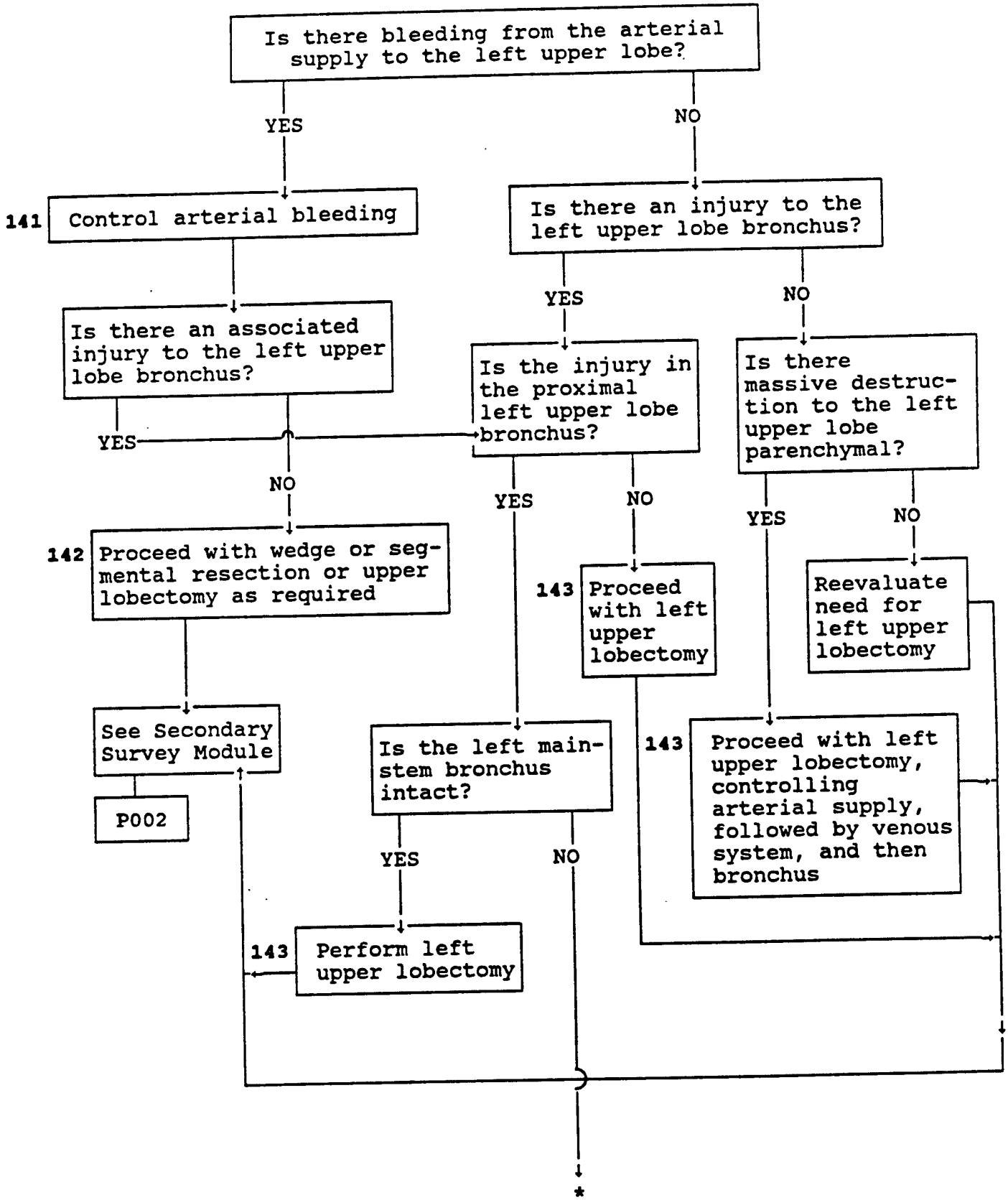
Note: See T059 for technique

DISTAL LEFT PULMONARY ARTERY INJURY MODULE

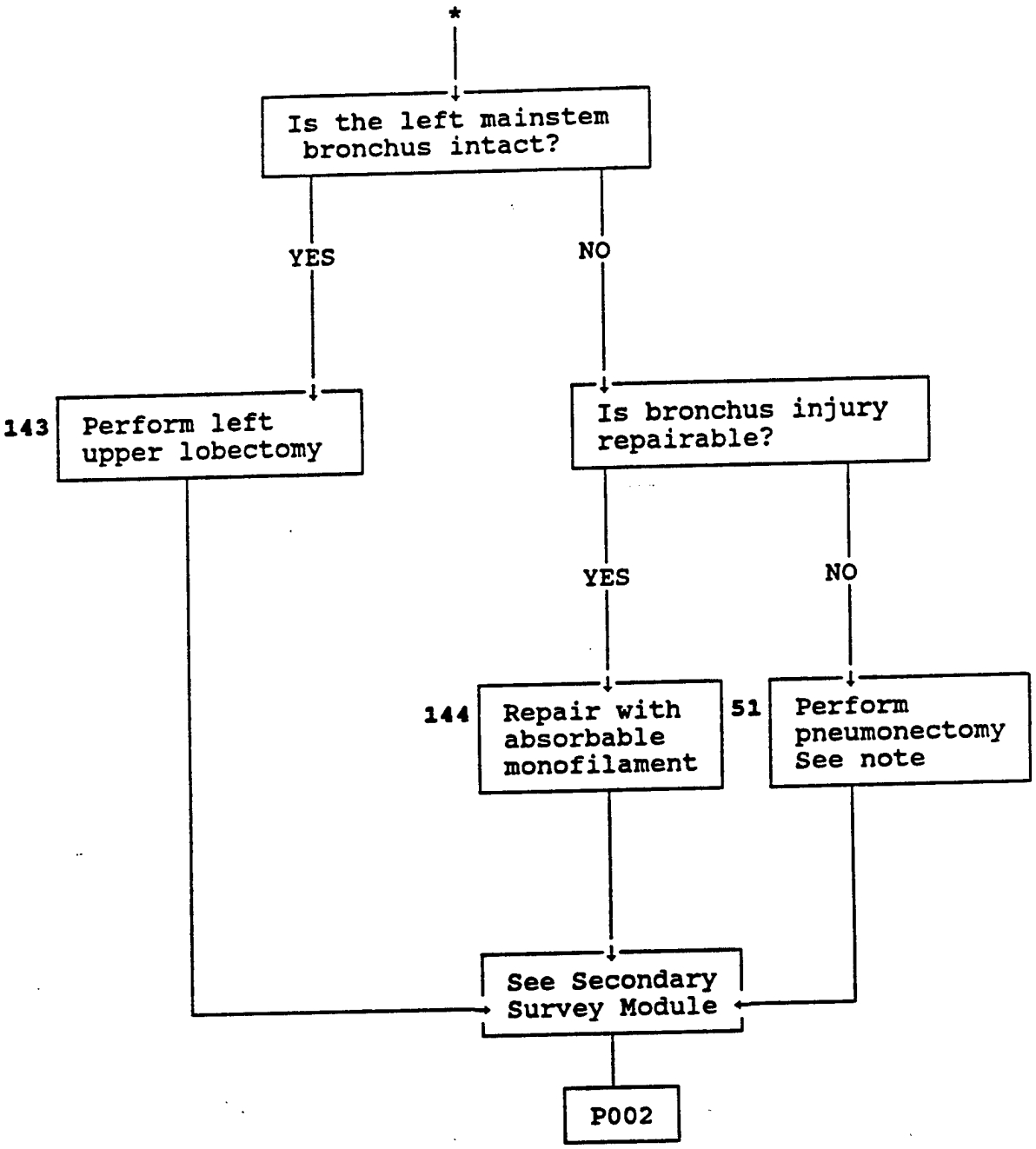


Note: See T044 for technique

LEFT UPPER LOBECTOMY MODULE

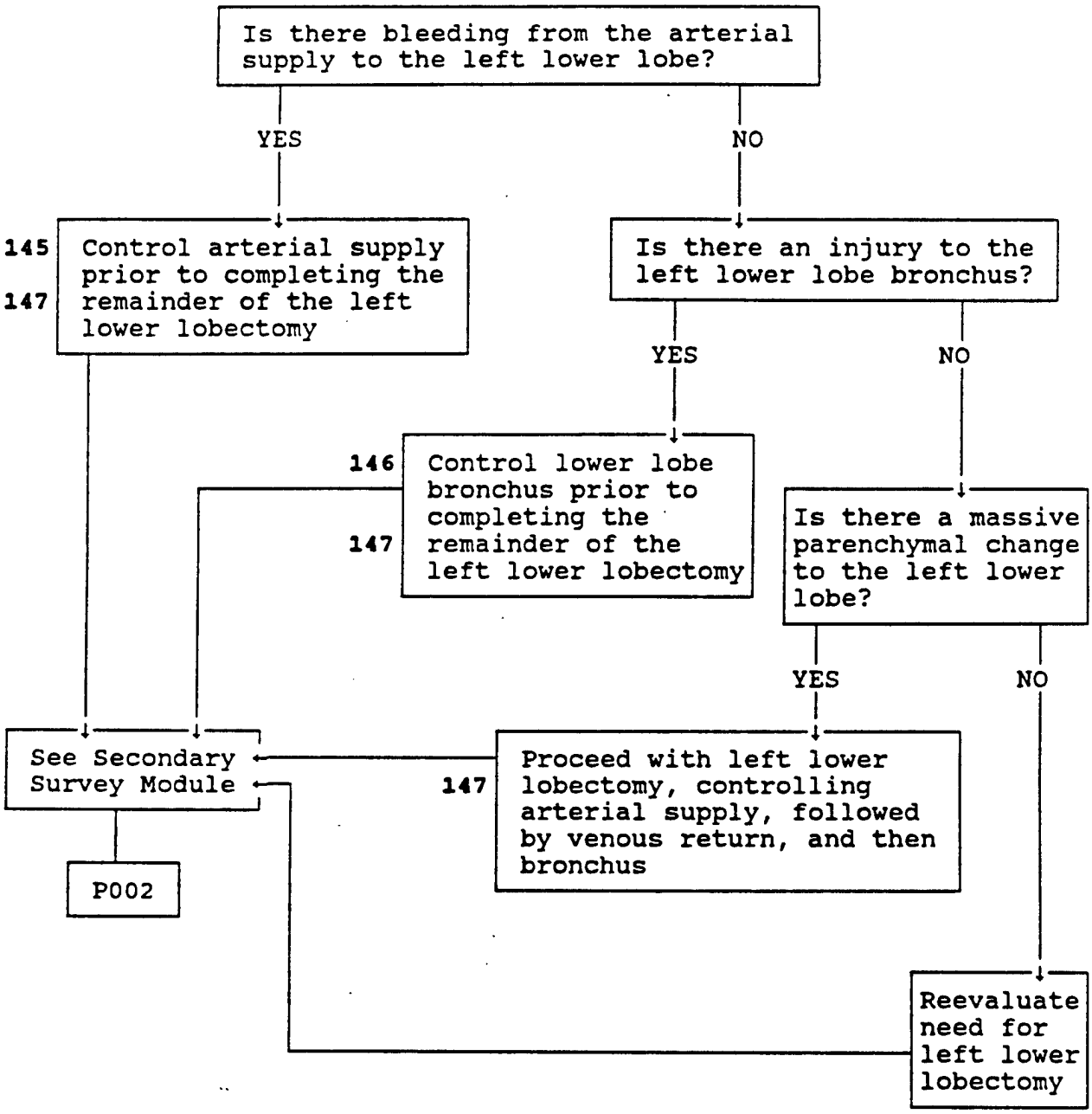


LEFT UPPER LOBECTOMY MODULE

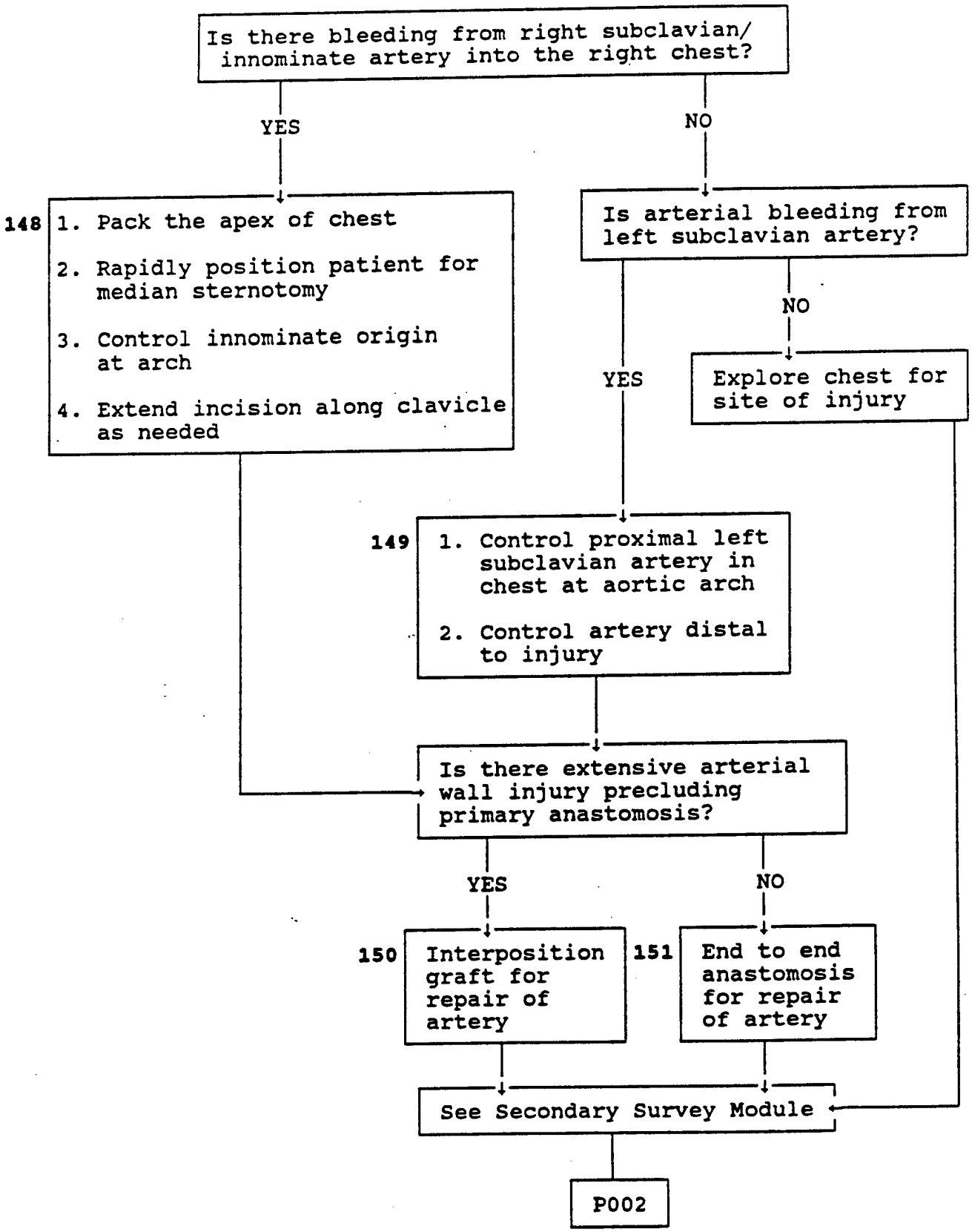


Note: See T044 for technique

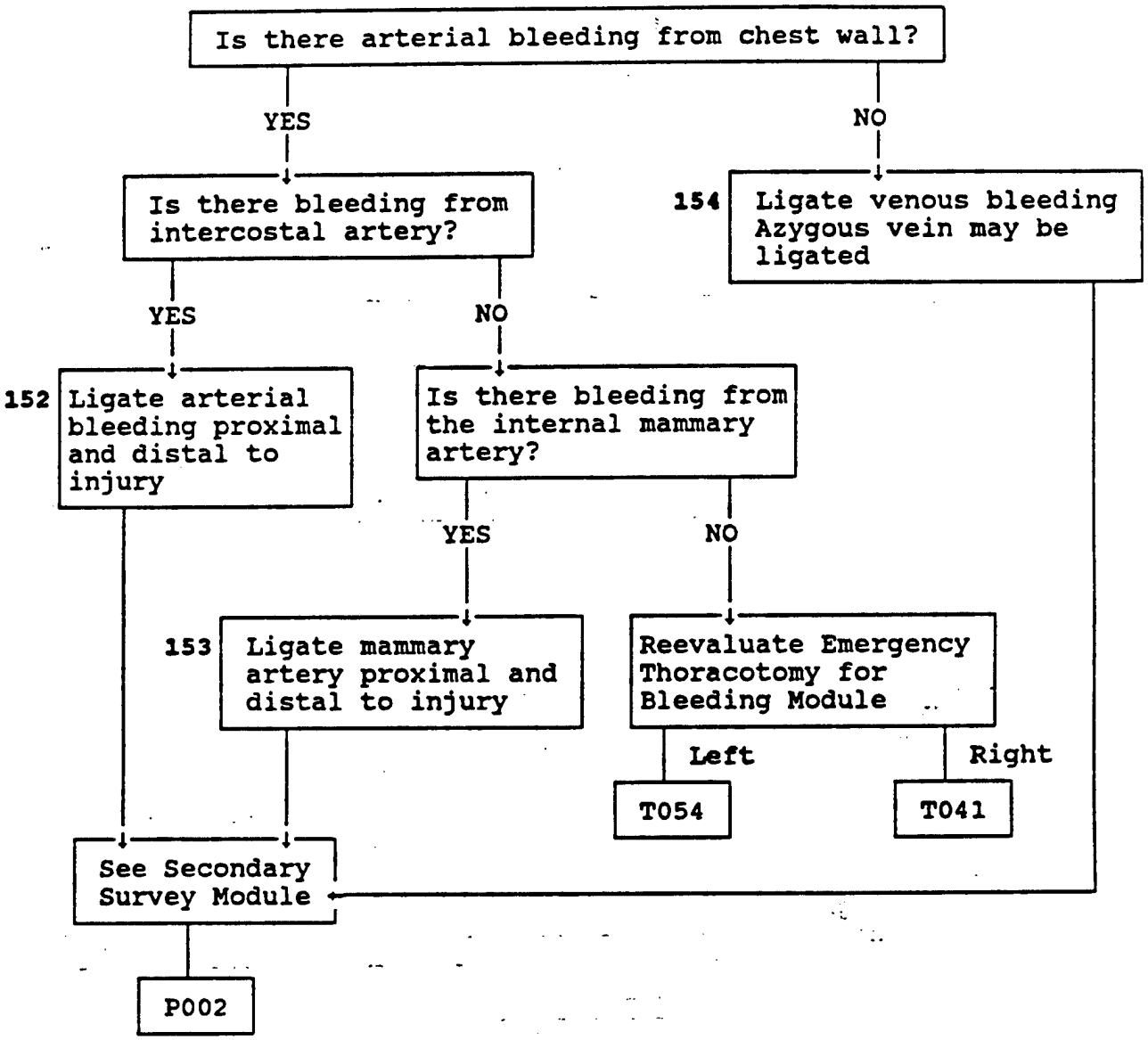
LEFT LOWER LOBECTOMY MODULE



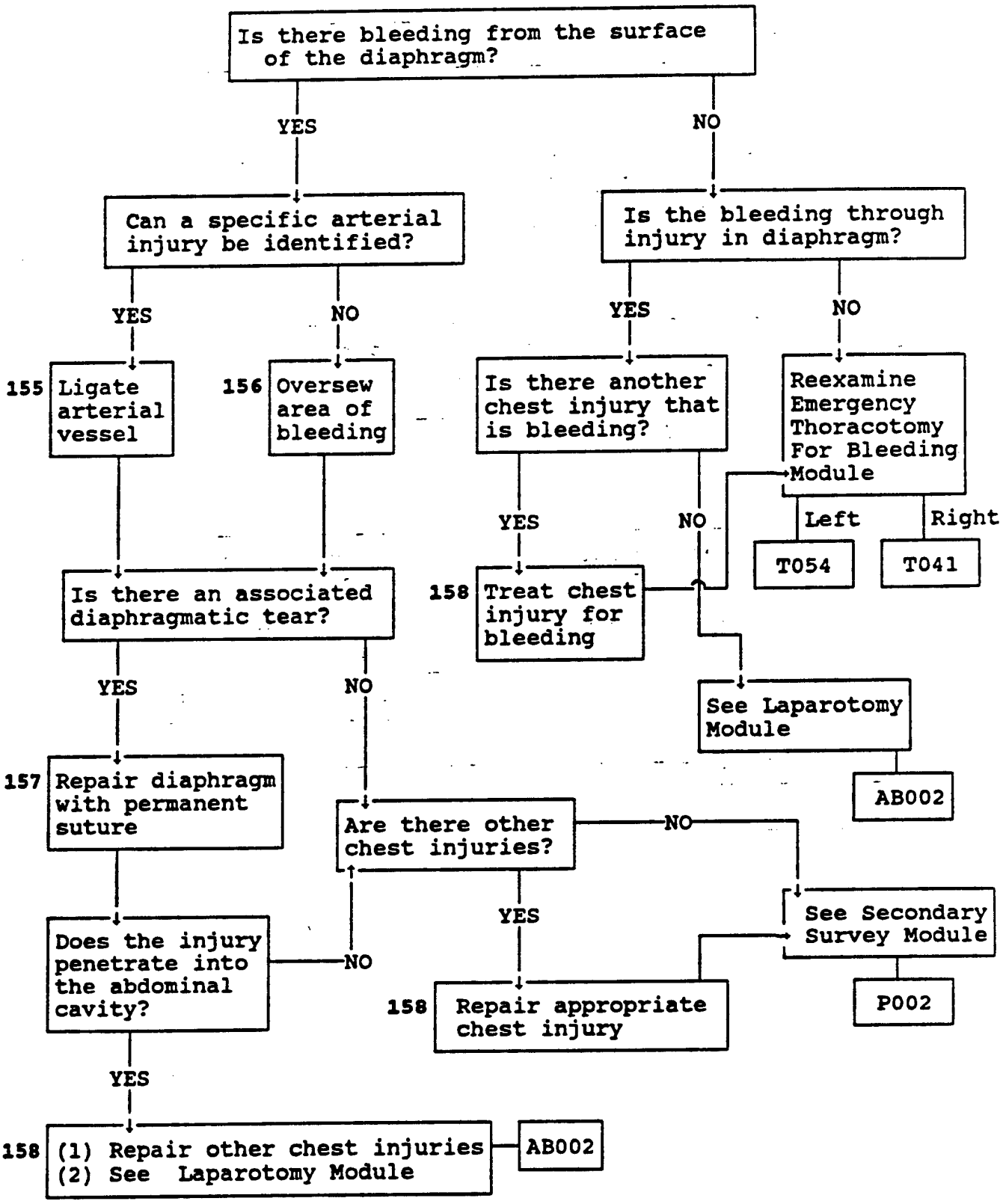
SUBCLAVIAN ARTERY INJURY MODULE



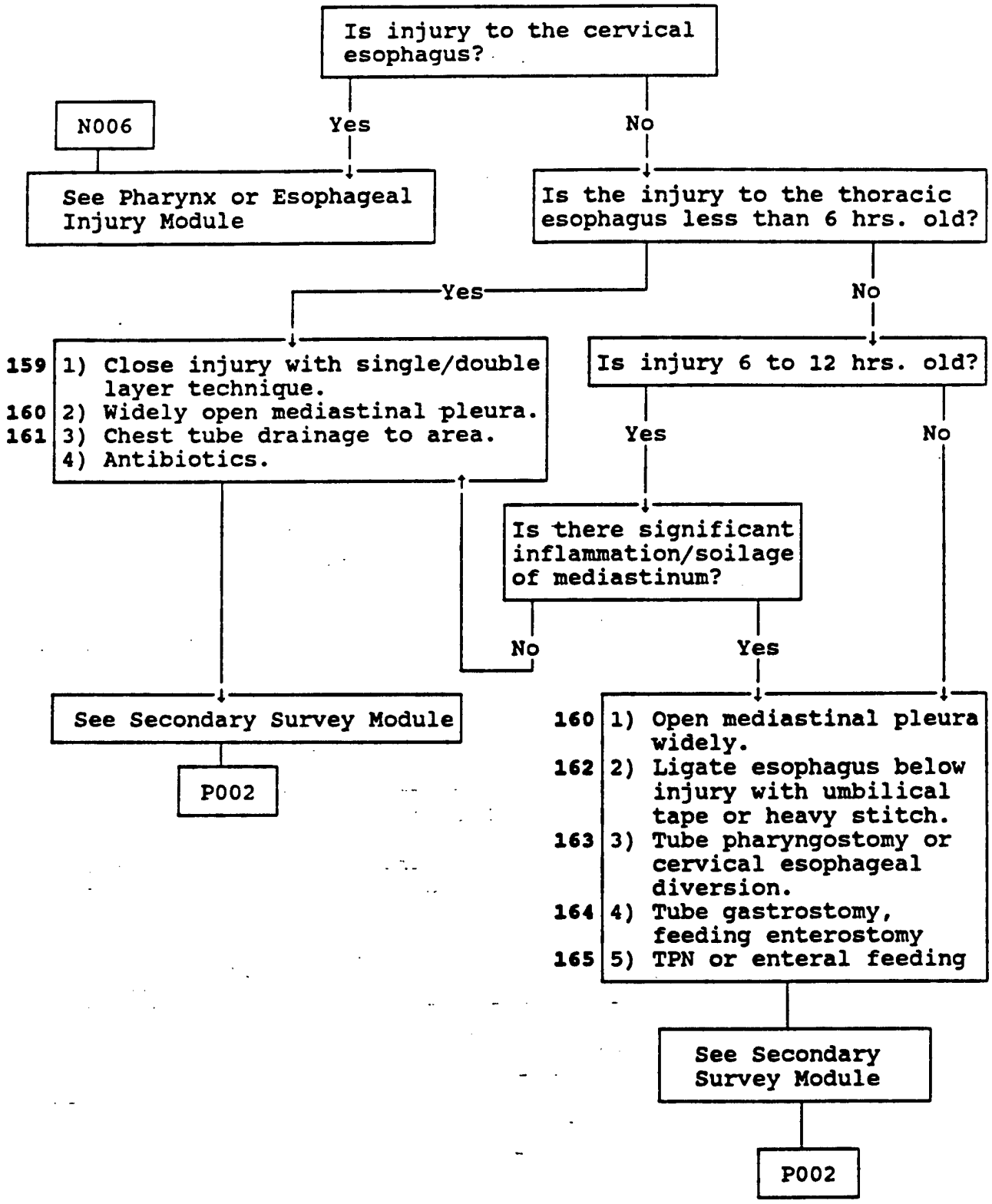
CHEST WALL BLEEDING MODULE



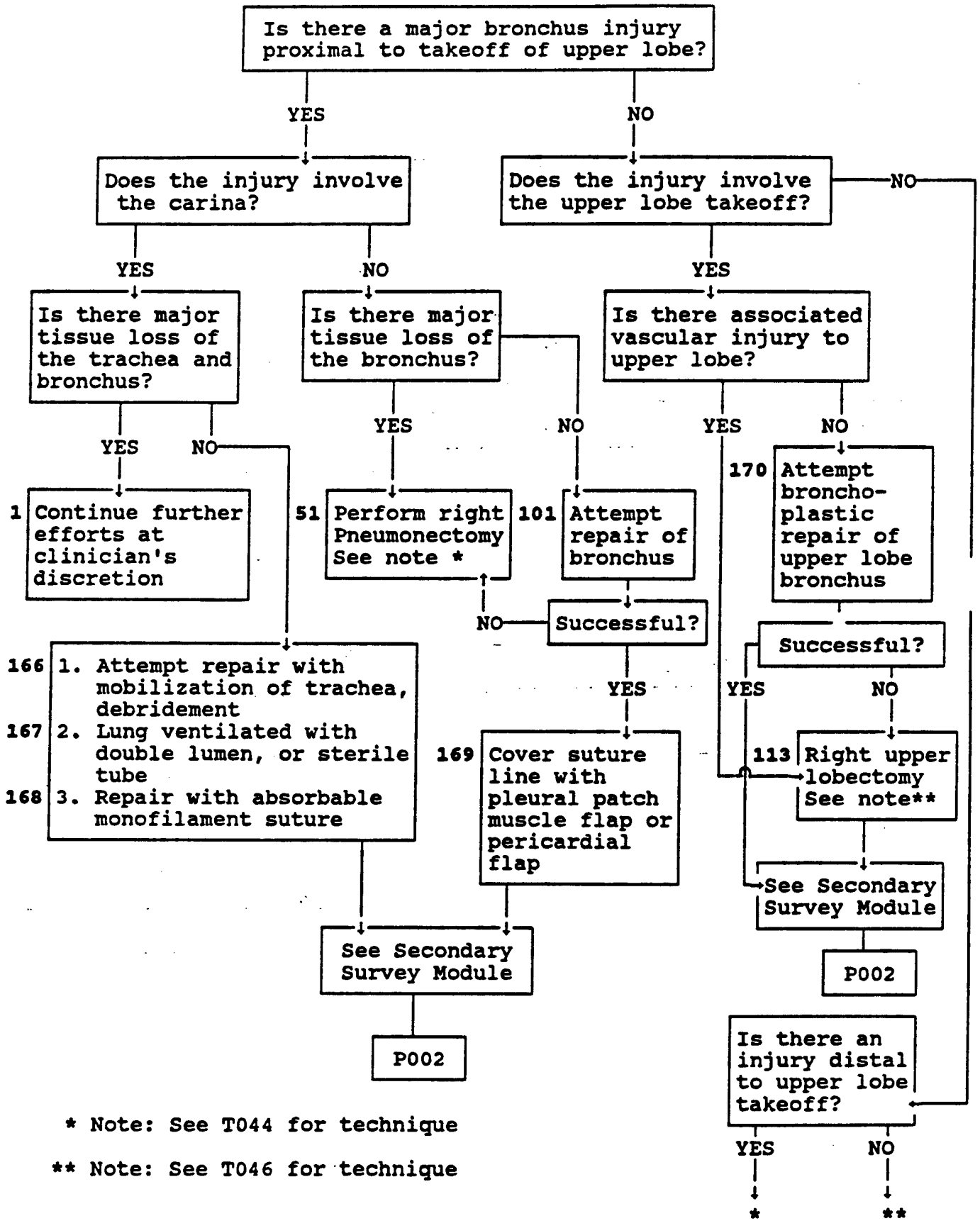
DIAPHRAGMATIC INJURY MODULE



ESOPHAGEAL INJURY MODULE



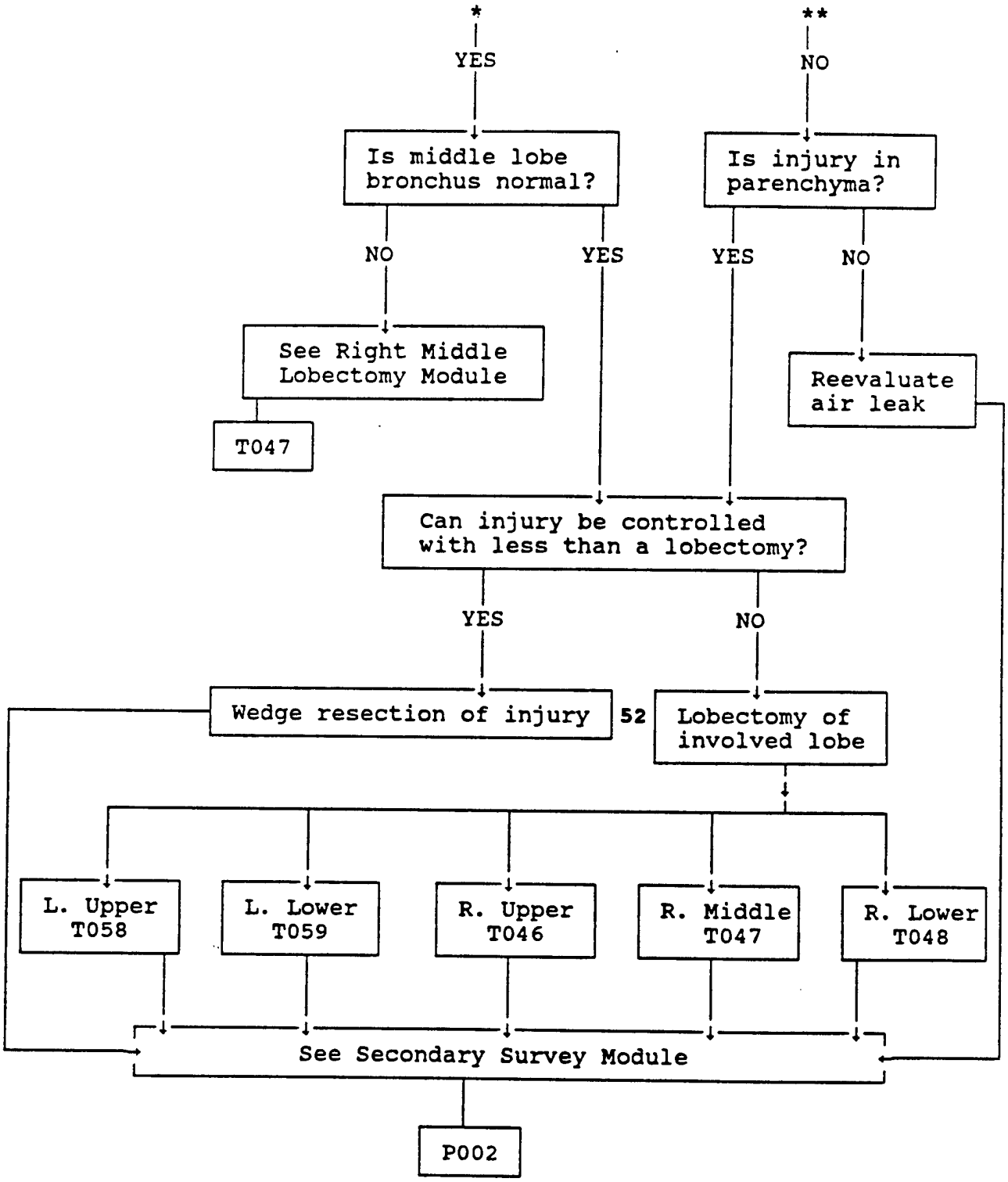
RIGHT EMERGENCY THORACOTOMY FOR AIR LEAK



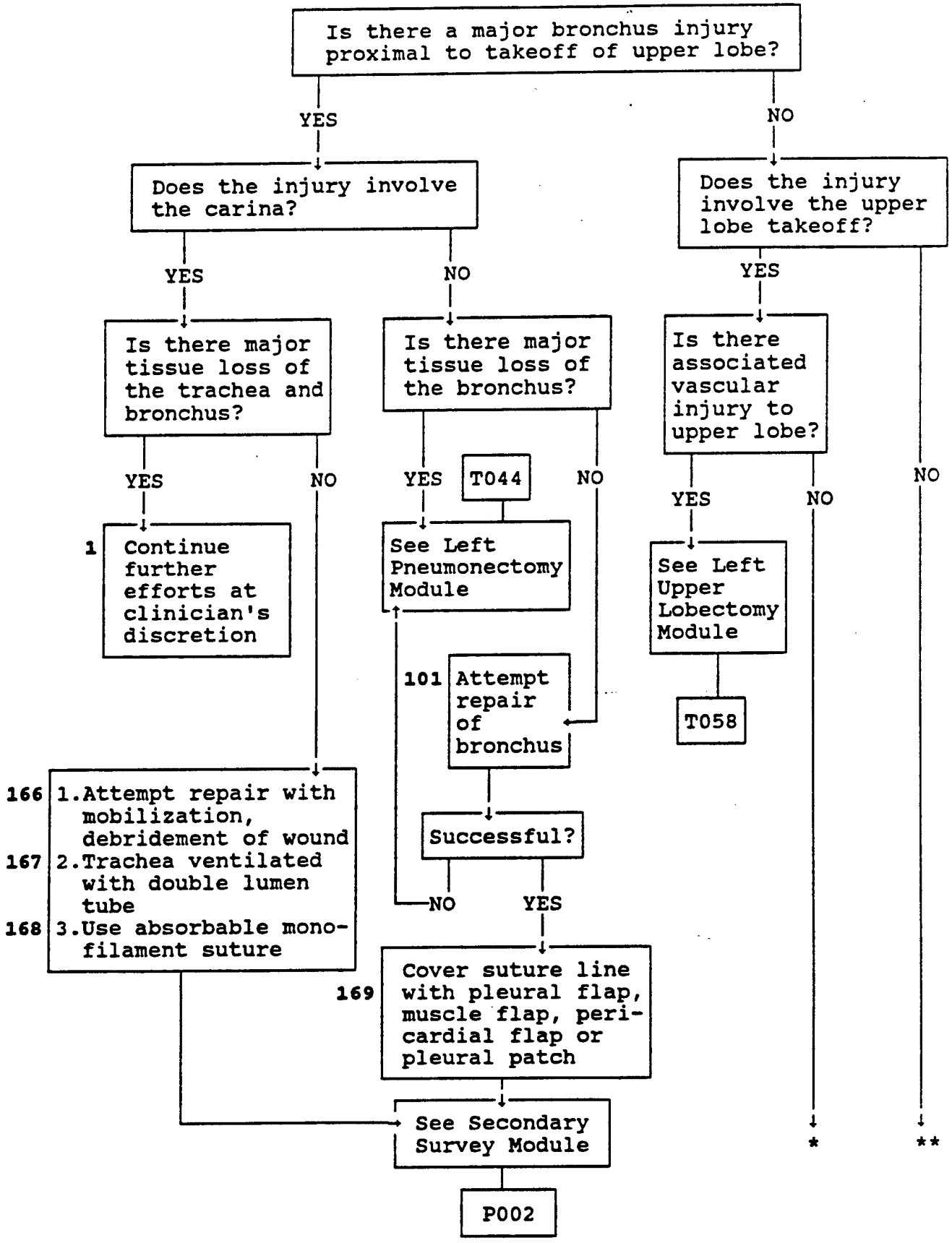
* Note: See T044 for technique

** Note: See T046 for technique

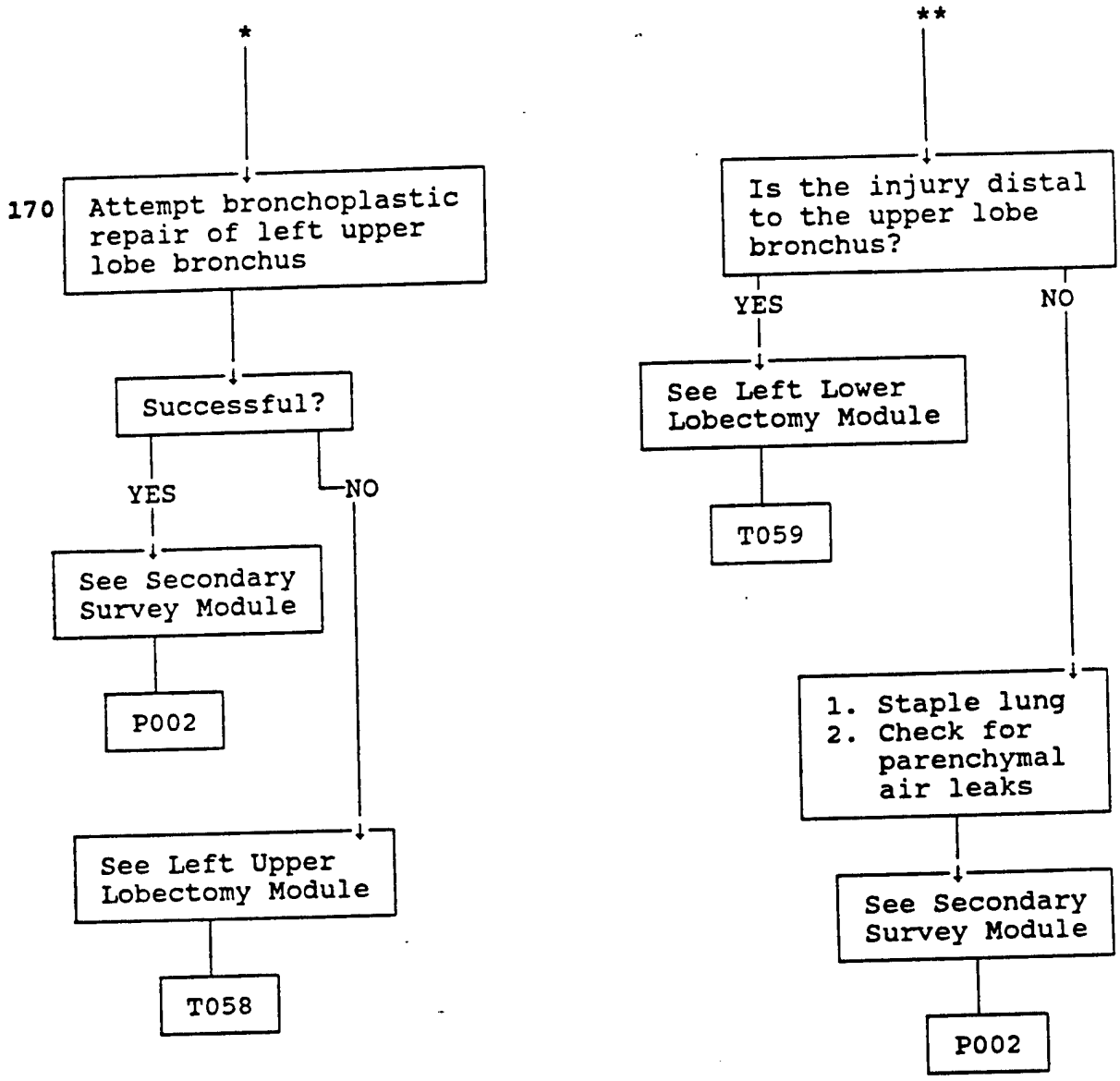
RIGHT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE



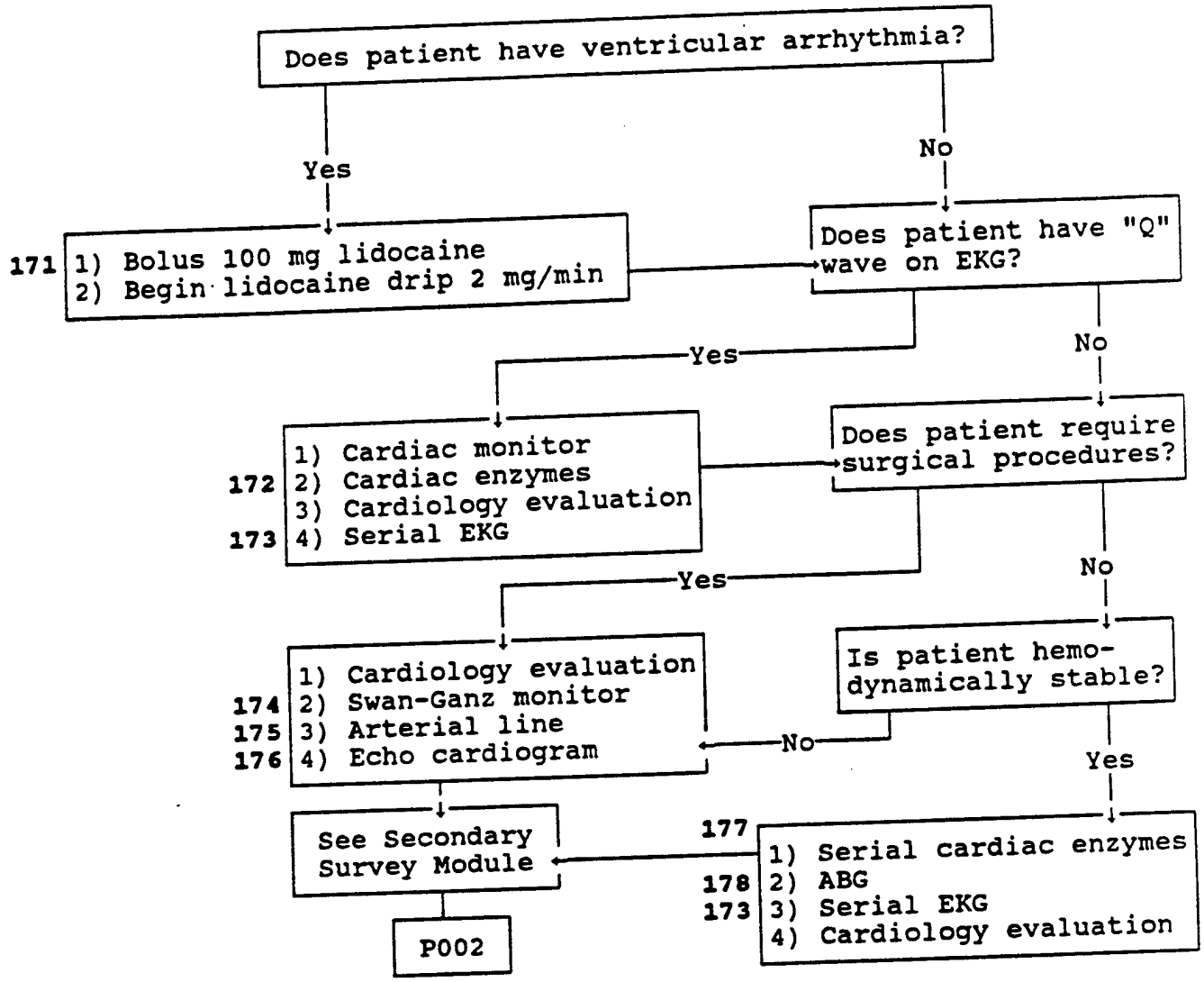
LEFT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE



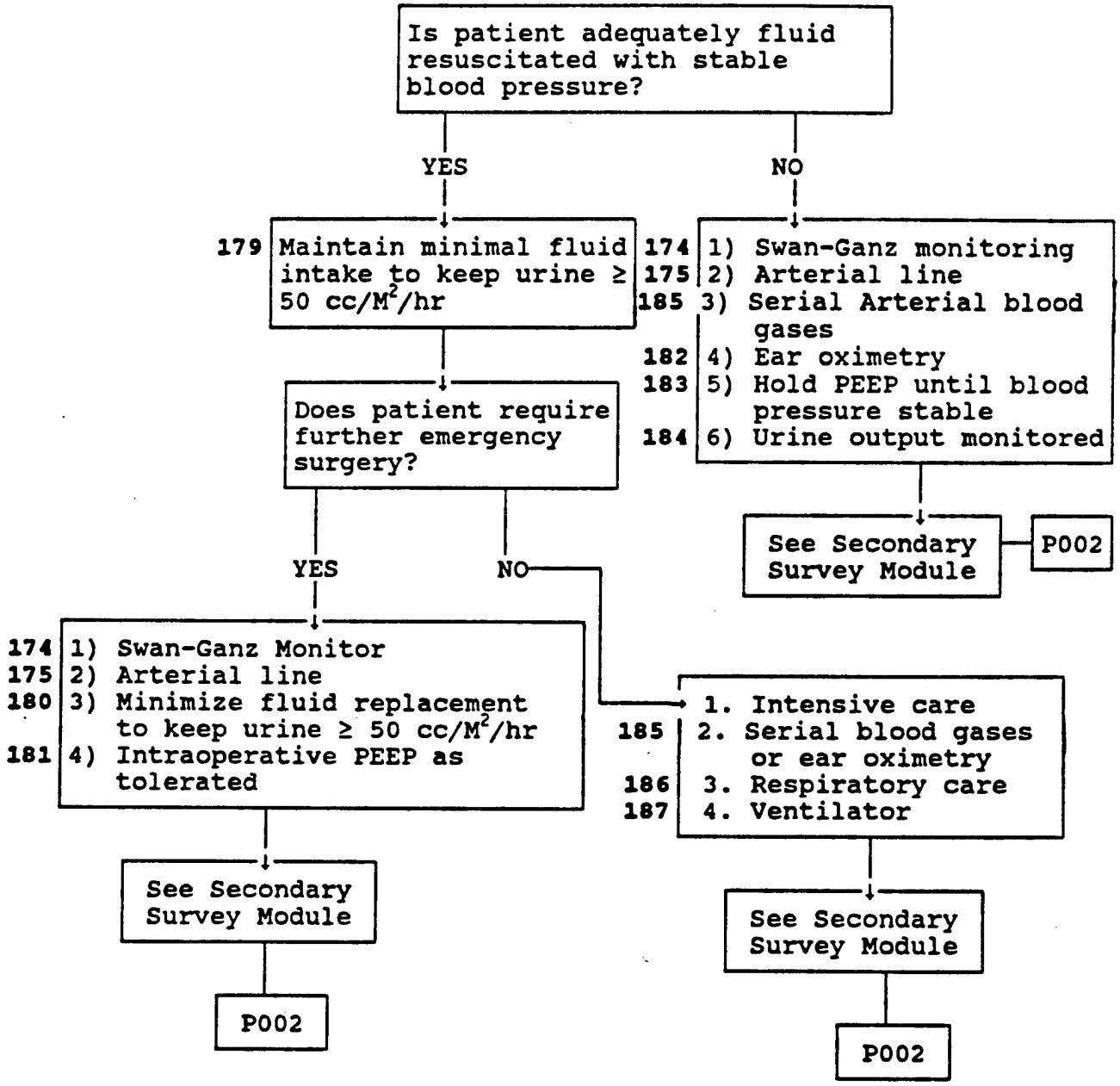
LEFT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE



MYOCARDIAL CONTUSION MODULE



PULMONARY CONTUSION MODULE



11
ABDOMEN

I fall upon you the thorns of life; I bleed.
[Shelley: Ode to The West Wind]

A. Overview

Injuries to the abdomen may occur with penetrating wounds from the nipple line to the inguinal ligament. Hemorrhage from the abdominal great vessels, liver or spleen may be quickly fatal. Though isolated hemorrhage can quickly lead to shock, penetrating abdominal injuries have hemorrhage as a component of multi-organ trauma complicating evaluation and therapy.

Because of the variety of organs within the abdominal cavity, a large number of combinations of problems face the surgeon. The algorithms in this section break down the component injuries into organ systems, survey each system closely and move to the next set of problems. By following a careful systematic approach, the likelihood of missing significant intra-abdominal injury will be lessened. Missed abdominal injuries to the hepaticobiliary, pancreatic, intestinal or urologic systems find a potential common pathway of contamination, sepsis and death. The algorithms should preclude these pitfalls and provide appropriate therapeutic modalities for successful recovery.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).

The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out limitations due to lack of equipment, special circumstances, or any other item of interest. Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

Mail to:
CDR J.M. Linenger, MC, USN
Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

ABDOMEN - PROVIDER & EQUIPMENT LIST

Key to specialty codes: A - General Surgeon
B - Specialty Surgeon
C - Anesthesiologist
D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Explore wound locally	2*	3				Laparotomy lists A and B
2. Diagnostic peritoneal lavage	2*	3				Peritoneal lavage list
3. Prep from clavicle to knee			3	3	1*	Laparotomy lists A and B
4. Midline incision	2*	3				Laparotomy lists A and B
5. Give Cefoxitin 2gm I.V.			3	3	1*	Laparotomy lists A and B
6. Evacuate clots and blood. Eviscerate small bowel and pack all four quadrants	2*	3				Laparotomy lists A and B
7. Gain vascular control with clamps or pressure	2*	3				Laparotomy lists A and B; Abdominal Vascular list
8. Open chest if necessary	2*	3				Abdominal Vascular list; Chest list
9. Control contamination with clamps or sutures	2*	3				Laparotomy lists A and B
10. Perform careful exploration	2*	3				
11. Control thoracic aorta or abdominal aorta at diaphragm	2*	3				Chest list; Abdominal Vascular list
12. Reflect left colon, spleen, stomach, body and tail of pancreas medially to expose aorta	2*	3				Laparotomy lists A and B; Abdominal Vascular list
13. Ligate bleeding vessels	2*	3				Laparotomy lists A and B; Abdominal Vascular list
14. Encircle aorta with umbilical tapes above and below injury. Isolate injury and place clamps proximal and distal to injury	2*	3				Laparotomy lists A and B; Abdominal Vascular list

********** Explanation of Specialty Codes and Care Descriptors **********

Although an experienced general surgeon (as indicated by 2* in position A) is capable of performing the surgical procedures detailed in this section, specialty surgeons must be considered optimal. These specialties include vascular surgeons, urologists, gynecologist, obstetricians, colorectal surgeons and thoracic surgeons.
In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks.
Any number followed by an asterisk indicates that, with training, the care provider could do the procedure, but is not the optimal provider.

15. Create conduit from autologous vein or artery or ligate aorta and perform extra-anatomic bypass	2*	3	Laparotomy lists A and B; Abdominal Vascular list
16. Replace aorta with prosthesis	2*	3	Abdominal Vascular list
17. Use autologous vein or artery (hypogastric) for patch. Gortex may be used if no fecal contamination present	2*	3	Laparotomy lists A and B; Abdominal Vascular list; Saphenous Vein Harvest list
18. Repair anterior aorta primarily	2*	3	Laparotomy lists A and B; Abdominal Vascular list
19. Repair injuries primarily with vascular sutures	2*	3	Laparotomy lists A and B; Abdominal Vascular list
20. Reflect cecum and right colon medially to expose vena cava	2*	3	Laparotomy lists A and B; Abdominal Vascular list
21. Ligate bleeding vessels	2*	3	Laparotomy lists A and B; Abdominal Vascular list
22. Gain proximal and distal control with finger pressure or sponge sticks	2*	3	Laparotomy lists A and B; Abdominal Vascular list
23. Repair injuries primarily with posterior injury sutured from inside through anterior injury. Then repair anterior injury	2*	3	Laparotomy lists A and B; Abdominal Vascular list
24. Repair superior vena cava injury using iliac, gastric, or infrarenal vena cave as patches or conduit	2*	3	Laparotomy lists A and B: Abdominal Vascular list
25. Repair anterior injury primarily	2*	3	Laparotomy lists A and B; Abdominal Vascular list
26. All surgical procedures for bladder injury	2*	3	Laparotomy lists A and B; Abdominal Vascular list Bladder Injury List
27. All surgical procedures for colon injury	2*	3	Bowel Injury list; Laparotomy list A and B
28. All surgical procedures for injuries of duodenum	2*	3	Laparotomy lists A and B; Bowel Injury list
29. All surgical procedures for injuries of extrahepatic biliary tract	2*	3	Laparotomy lists A and B; Extrahepatic Biliary Tract list
30. All surgical procedures for injury to female reproductive tract	2*	3	Laparotomy lists A and B; Female Reproductive Tract list
31. All surgical procedures for injuries to liver	2*	3	Laparotomy lists A and B; Liver Injury List

31a. Set up autotransfuser and use blood as available			3	1*	1*	Autotransfusion capability
31b. Place saphenous vein cutdowns and/or subclavian lines	2*	3	3	1*	1*	I.V. lines
31c. Type and crossmatch blood			3	1*	1*	Blood laboratory capability
31d. Place heater on Ventilator, place patient on heating blanket, warm all fluids to 40°C, lavage chest and abdomen with warm fluid			3	1*	1*	Heater; heated blanket
31e. Correct coagulopathy with component therapy	2*	3	1*	1*	1*	Blood transfusion capability
31f. Correct pH with $NaHCO_3$	2*	3	1*	1*	1*	I.V. lines, sodium bicarbonate
32. All surgical procedures for injury to pancreas	2*	3				Laparotomy lists A and B; Liver Injury list
33. All surgical procedures for penetrating injury to pregnant patient	2*	3				Laparotomy lists A and B; Female Reproductive Tract list
34. All surgical procedures for rectal injury	2*	3				Laparotomy lists A and B; Rectal Injury lists A and B
35. All surgical procedures for injuries to kidney	2*	3				Laparotomy lists A and B; Renal Injury list
36. All surgical procedures for management of retroperitoneal hematoma	2*	3				Laparotomy lists A and B
37. All surgical procedures for injuries to small bowel and mesentery	2*	3				Laparotomy lists A and B; Bowel Injury list
38. All surgical procedures for injuries to spleen	2*	3				Laparotomy lists A and B; Spleen Injury list
38a. Give pneumovax			1*	1*	1*	Polyvalent pneumococcal vaccine (pneumovax)
38b. Blood transfusion			1*	1*	1*	Blood transfusion capability
39. All surgical procedures for injuries to stomach	2*	3				Laparotomy lists A and B; Bowel Injury list
40. All surgical procedures for ureteral injuries	2*	3				Laparotomy lists A and B; Ureteral Injury list
40a. Inject 5cc methylene blue			1*	1*	1*	Ureteral Injury list
41. All surgical procedures for visceral vascular injury	2*	3				Laparotomy list A and B
42. All surgical procedures for superficial injuries	2*	3	1*	1*	1*	Laparotomy lists A and B

ABDOMINAL VASCULAR EQUIPMENT LIST

SUTURE
DACRON TAPE
VICRYL 3-0 REEL
SILK 2-0 STRAND
SILK 3-0 STRAND
SILK 4-0 STRAND
SILK 0 STRAND
SILK 2-0 SH MULTI-PAK
SILK 3-0 SH MULTI-PAC

ABD. CLOSURE
PDS #1 TP-1
VICRYL 0 CT (2)

GROIN CLOSURE
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES

RETENTION
ETHILON 2 LR DA (4)

VASCULAR
PROLENE 4-0 SH DA
PROLENE 5-0 RB-1
PROLENE 6-0 RB-1

DRAPES & PACKS
MAJOR BASIN SET W/ GRADUATE & MED. CUPS
LAPAROTOMY SHEET
BACK TABLE COVER
MAYO STAND COVER
STERI DRAPE 1000
STERI DRAPE IOBAN 6648
STERI DRAPE ISOLATION BAG
GOWN, SURGICAL XLRG.
GLOVES, STERILE SURGICAL
GLOVES, STERILE HYPO-ALL
TOWELS, STERILE, (6)

SPONGES
KITTNER DISECTORS
18 X 18 LAPS. (4)
4 X 4 X-RAY DETECT (2)

SYRINGES & NEEDLES
SYRINGE, TB 1CC
SYRINGE, 10CC LL
SYRINGE, 30CC LL
SYRINGE, 60CC LL
IRRIGATION BULB ASEPTO
NEEDLE, 18GA. 1 1/2"
NEEDLE, 25GA. 5/8

CATHETER
FOLEY CATH. TRAY
FOLEY CATH. 16FR. THERMAL
URIMETER DRAINAGE BAG

SOLUTIONS
IRRG. WATER 1500CC
IRRG. NACL 1000CC
IV NACL 0.9% 500CC
IV PLASMA-LYTE PH7.4 1000CC
ALBUMIN 500CC

MISCELLANEOUS
BLADE, SURGICAL #10
BLADE, SURGICAL $15
BLADE SURGICAL #21
SUTURE BOOTS
VESSEL LOOPS MINI & MAXI
HEMOCLIPS SMALL, MED., LRG.
RAZOR, PREP.
MAGNETIC NEEDLE MAT
PETRIE DISH 6" STERILE
BAG-O-JET TRANSFER SET
STOPCOCK 3-WAY
K-50 TUBING PENCIL, HANDSWITCH CAUTERY
PAD, GROUNDING CAUTERY

DRAINS
HEMOVAC, MED.
SUMP, DUAL LUMEN

INSTRUMENTS & EQUIPMENT
LAPAROTOMY SET
CARDIO VASCULAR TRAY
ABD. ANEURYSM CLAMPS
EXTRA. LONG INST.
PENCIL DOPPLER PROBE
HEADLIGHT, FIBEROPTIC
GRADUATE, 500CC
RETR. DEEP BALFOR
RETR. UPPER HAND
SCISSOR, LONG METZ.
FOGARTY HYDRAGRIPS SM., MED
FOGARTY INSERTS SMALL
FOGARTY INSERTS MED.
CAUTERY MACHINE

FOGARTY CATHETERS
EMB. 3FR,4FR,5FR.
IRR. 3FR,4FR,5FR.

BLADDER INJURY EQUIPMENT LIST

SUTURE

DACRON TAPE
CHROMIC 2-0 REEL
SILK 3-0 STRAND
SILK 3-0 SH MULTI PAK
SILK 4-0 SH MULTI PAK
CHROMIC 2-0 FS-1
CHROMIC 3-0 SH
CHROMIC 4-0 SH
CHROMIC 4-0 RB-1

CLOSING

MAXON #1 T-20
VICRYL 0 CT
VICRYL 2-0 CT
SKIN STAPLES SM-35W

DRAPES AND PACKS

MAJOR BASIN SET WITH GRADUATE 1000CC AND MEDIUM CUPS
LAPAROTOMY SHEET
BACK TABLE COVER
MAYO STAND COVER
MEDIUM SHEET 44" X 60"
GOWN, SURGICAL X-LARGE (3)
GLOVES, UNSTERILE EXAM
GLOVES, SURGEONS, ASSORTED SIZES
TOWELS, STERILE (6 PACK)
SKIN PREP SET

SOLUTIONS

IRRG. WATER 1500CC
IRRG. NACL 1000CC
IRRG. WATER 3000CC

CATHETER

FOLEY CATHETER TRAY
FOLEY CATHETER, 16 FR THERMA
URIMETER DRAINAGE BAG
CATHETER 14 FR 5CC
CATHETER 18 FR 5CC
CATHETER 22 FR 5CC
CATHETER 24 FR 5CC
CATHETER 24 FR 5CC
CATHETER 20 FR 30CC

SPONGES

LAPS, 18 X 8 (3)
X-RAY DETECT 4 X 4 (20
DISSECTORS, KITTNERS

SYRINGES AND NEEDLES

SYRINGE 10CC L.L.
SYRINGE 30CC L.L.
SYRINGE 60CC L.L.
ASEPTO
SYRINGE 60CC IRRIG. TIP
NEEDLE 18 GA 1-1/2"

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #15
BLADE, SURGICAL #21
HEMOCLIP, SMALL
HEMOCLIP, MEDIUM
HEMOCLIP, LARGE
MAGNETIC NEEDLE MAT
RAZOR, PREP
MARLEX MESH
VESSEL LOOPS, MINI, MAXI

DRAINS

JACKSON PRATT 7MM AND 10MM FLAT
JACKSON PRATT RESEVOIR

CAUTERY

PAD, GROUNDING ADULT
PENCIL, HANDSWITCH
EXTENSION BLADE

INSTRUMENTS AND EQUIPMENT

LAPAROTOMY SET
EXTRA LONG INSTR.
SCISSOR, LONG METZ.
SCISSOR, TENOTOMY LONG
CLAMP, RUMEL THORACIC
HEADLIGHT, FIBEROPTIC

HAVE AVAILABLE

CYSTOSCOPE TRAY, ADULT
CYSTO SET
NEPHROSCOPE, FLEXIBLE
NEPHROSCOPE, ACCESSORY PAN

DRESSING

GAUZE 4 X 8" 12 PLY
TELFA

BOWEL INJURY EQUIPMENT LIST

SUTURE

SILK 0 STRAND
SILK 2-0 STRAND
SILK 3-0 STRAND
SILK 2-0 SH
SILK 2-0 SH MULT. PAK
SILK 3-0 SH
SILK 3-0 SH MULTI-PAK
VICRYL 3-0 SH
CHROMIC 3-0 SH
CHROMIC 4-0 SH

CLOSING

VICRYL 0 CT
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM-35W

SUPPLIES & INSTRUMENTS:

SEE LAPAROTOMY LIST

BOWEL CLAMPS EQUIPMENT LIST

CONTENTS

BOWEL CLAMPS:

---

2 ALLEN CLAMPS
2 OCHSNERS
2 LONG BABCOCKS
2 SHORT BABCOCKS
2 STRAIGHT RUBBER SHODS
2 CURVED RUBBER SHODS
2 LONG CURVES

CARDIO VASCULAR TRAY

BOTTOM LAYER

#7 KNIFE HANDLE
STRULLY SCISSOR
POTTS SCISSORS - 25, 45, 60 DEG
NARROW TIP SUTURE SCISSOR

SECOND LAYER
---
30 DEG PERIPHERAL CL (BLACK)
ACUTE ANG MINATURE CLAMPS
STR ATRAGRIP CLAMPS
30 DEG DEBAKEY MINATURE CLAMPS
LONG ALLISES

THIRD LAYER

LONG ATRAGRIP TISSUE FCPS
MED ATRAGRIP TISSUE FCPS
SH ATRAGRIP TISSUE FCPS
LONG FINE TIPPED N.H.
MED N.H.
SH FINE TIPPED N.H.

FOURTH LAYER

TANGENITAL OCCLUSION CL (LG ANG
SATINSKY)
SEMB CLAMP
KIDNEY PEDICLE CLAMP

CHEST SET (THORACIC) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG N.H.
EX LONG FINE N.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
MEDIUM NEEDLE HOLDERS
LONG NEEDLE HOLDER -NOT FINE
SPONGE STICKS
LONG CURVES
LAUERS
TONSILS
KOCKERS - CLAMP
BABCOCK CLAMP
ALLIS CLAMP
CURVED CRILER
CURVED MOSQUITOES CLAMP
SUTURE SCISSORS
MAYO SCISSORS
METZ SCISSORS
LONG METZ SCISSORS

CHEST SET (VASCULAR) EQUIPMENT LIST

BOTTOM OF PAN

BETHUNE RIB CUTTER
GIERTZ RIB CUTTER
DOYEN ELEVATORS (1 LT & 1 RT)
ALEXANDER
MATSON
RIB APROXIMATORS (MOVEABLE)
ADSON RONGEUR
TONSIL SUCTION
VEIN RETRACTORS
DEEP RAKES
SCAPULA RETRACTOR

WRAP IN TOWEL

LONG FINE THUMBS W/TEETH
LONG FINE THUMBS W/OUT TEETH
EXTRA LONG RUSSIAN
EXTRA LONG THUMB W/OUT TEETH
LONG ATRAUGRIPS

ON STRINGER

CRAFORD CHEST SCISSOR
EX LONG M.H.
EX LONG FINE M.H.
EX LONG CURVES
EX LONG CARMALT
REGULAR CARMALTS
EX LONG RUMEL
BRONCHUS CLAMPS
RUMEL THORACIC ARTERY CLAMPS
DUVAL LUNG CLAMPS SEMB
SEMB
LONG ALLISES
TONSILS
MEEKER
KIDNEY PEDICAL CLAMP
REGULAR RUMELS
REGULAR TOWEL CLIPS

PLACE ON TOP OF TRAY

BUFORD RETRACTOR
PEEL PACK

PLACE ON TOP W/RETR

BUFORD BLADES
#3 LONG KNIFE HANDLE

COMMON DUCT SET

CONTENTS

#3 FARR
EXTRA LONG NEEDLE HOLDER
LAHEY GALL DUCT CLAMPS
TROCAR W/SHEATHS: 18FR
DILATORS: #3-#11
LARGE SCOOP
SMALL SCOOPS
SOLID PROBES
METAL RULER
GROOVE DIRECTOR
RANDALL STONE FORCEPS (DIFFERENT ANGLES)

PEEL PACK INDIVIDUALLY

LARGE GALLSTONE SCOOP
FLEXIBLE GALLSTONE PROBE
18 FR TROCAR & SHEATH
20 FR TROCAR & SHEATH
22 FR TROCAR & SHEATH

EXTRAHEPATIC BILIARY TRACT EQUIPMENT LIST

SUTURE

SILK 2-0 STRAND
SILK 3-0 STRAND
SILK 2-0 SH
SILK 3-0 SH
SILK 4-0 RB-1 DA
VICRYL 5-0 RB-1

CLOSING

VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM 35W
PACKS & DRAPES

MAJOR BASIN W/GRADUATE & MED CUPS
LAPAROTOMY SHEET
BACK TABLE COVER
MAYO STAND COVER
GOWN, SURGICAL XTR. LRG. (3)
GLOVES, SURGICAL ASSORT. SIZES
GLOVES, EXAM UNSTERILE
TOWELS, STERILE (6)
SKIN PREP SET

SPONGES

LAP 18 X 18 (4)
X-RAY DETECT 4 X 4
DISSECTORS, KITTNER'S

SOLUTIONS

IRRG. WATER 1500 CC
IRRG. NACL 1000 CC
IRRG. NACL 3000 CC

SYRINGES & NEEDLES

SYRINGE, 10 CC LL.
SYRINGE, 30 CC LL.
NEEDLE 18 GA 1 1/2"
SYRINGE, T.B. 1 CC

CATHETERS

T-TUBE 16 FR.
FOGARTY BILI BAL. PROBE 5 FR.
BAG, BILE
FOLEY 16 FR, THERMAL
FOLEY CATH KIT
URIMETER DRAINAGE BAG

MISCELLANEOUS

BLADE, SURGICAL #10
BALDE, SURGICAL #15
BLADE, SURGICAL #11
BLADE, SURGICAL #21
HEMOCLIPS, SM., MED., LRG.
MAGNETIC NEEDLE MAT.
CYSTO-Y-TUBING
K-50 TUBING
MARX NEEDLE 22 GA
SUCTION TUBING 20'

INSTRUMENTS & EQUIPMENT

LAPAROTOMY SET
EXTRA LONG INSTR.
COMMON DUCT SET
CARDIO VASCULAR SET
RETR. UPPER HAND.
RETR. WEXLER
HEADLIGHT, FIBEROPTIC
CAUTERY MACHINE
HEMOCLIP APPLIERS: SM., MED., LRG.

HAVE AVAILABLE

NEPHROSCOPE, FLEXIBLE
NEPHROSCOPE ACCESSORY PAN

DRAINS

JACKSON PRATT 7 MM & 10 MM FLAT
JACKSON PRATT RESEVOIR

DRUGS

CEPHADYL 2 GM
HYPAQUE 30 CC

CAUTERY

PAD, GROUNDING ADULT
PENCIL, HANDSWITCH
BLADE, EXTENTION

DRESSINGS

TELFA
GAUZE 4 X 8"

EXTRA LONG INSTRUMENTS

CONTENTS

EXTRA LONG NEEDLE HOLDER
EXTRA LONG FINE NEEDLE HOLDER
EXTRA LONG CURVES
REGULAR RUMEL
MEEKERS
BRIDGE FORCEPS
EXTRA LONG ALLISES
EXTRA LONG RUSSIAN
EXTRA LONG THUMB WITHOUT TEETH
LONG BABCOCKS
EXTRA LONG METZ

FEMALE REPRODUCTIVE TRACT INJURY EQUIPMENT LIST

SUTURE

CHROMIC 3-0 REEL
VICRYL 0 CT-2
CHROMIC 2-0 REEL
CHROMIC 2-0 SH

CLOSING

CHROMIC 2-0 CT
VICRYL 0 MO-4
CHROMIC 0 CT
VICRYL 0 CT
VICRYL 2-0 CT
SKIN STAPLES SM-35W

DRAPES & PACKS

BASIN SET W/ GRADUATE & MED.CUP.
LAPAROTOMY SHEET
BACK TABLE COVER
TOWEL'S, STERILE
MAYO STAND COVER
GOWN, SURGICAL (3)
SKIN PREP TRAY
GLOVES, SURGICAL ASSORT. SIZES

SOLUTIONS

IRRIG. WATER 1500 CC
IRRIG. NACL 1000 CC

SPONGES

LAP., 18 X 18 (3)
4 X 4, X-RAY DETECT
CYLINDRICAL, DISSECTOR

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #15
BALDE, SURGICAL #21
HEMOCLIP, MED.
HEMOCLIP, LRG.
MAGNETIC NEEDLE MAT
SUCTION TUBING 20'
FOLEY 16 FR THERMAL
FOLEY CATH KIT
URIMETER DRAINAGE BAG
PAD, GROUNDING ADULT
CAUTERY, PENCIL HANDSWITCH

INSTRUMENTS & EQUIPMENT

LAPAROTOMY SET
GYNE LAP SPECIALS
DEEP BALFOUR
HEMOCLIP APPLIERS: MED., LRG.
EXTRA LONG INSTR.

DRAINS

JACKSON PRATT 7 MM & 10 MM
JACKSON PRATT RESERVOIR

DRESSING

DRESSING, TELFA
GAUZE, 4 X 8 12 PLY
PERI-PAD, LARGE 11"

GYNECOLOGICAL LAPAROTOMY SPECIALS EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN

---

1 #2 FARR
1 #3 FARR
1 NARROW BALFOUR BLADE

ON STRINGER:

---

1 EX LONG NH
2 HEANEY NH
2 ANDERSON CLAMPS
1 DBL TOOTHED TENACULUM
4 HEANEY MUELLERS
6 LONG OCHSNERS
6 CURVED OCHSNERS
2 PEANEUFF CLAMPS
1 EX LONG SUTURE SCISSOR
1 LONG MAYO SCISSOR
1 JORGISON SCISSOR
1 MAYO SCISSOR

PEEL PACK:

---

2 CUSHING VEIN RETR
2 LONG THUMBS W/TEETH
1 BURD DISECTOR
2 MED RUSSIAN FCPS

LAPAROTOMY EQUIPMENT LIST A

SUTURE
SILK 2-0 STRAND
SILK 3-0 STRAND

STICK TIES
SILK 2-0 SH
SILK 3-0 SH

CLOSURE
VICRYL 0 CT
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM-35W

DRAPES & PACKS
MAJ. BASIN/GRADUATE W/
MED. CUP 60CC
LAPAROTOMY SHEET
BACK TABLE COVER
TOWELS, STERILE (6)
MAYO STAND COVER
GOWN, STERILE XLR. LRG. (3)
SKIN PREP TRAY
MEDIUM SHEET 44 X 60"

SPONGES
LAP. 18 X 18 (3)
4 X 4 X-RAY DETECT
CYLINDRICAL DISECTOR'S

CAUTERY
GROUNDING PAD
ELECTRO-CAUTERY HAND PENCIL
CAUTERY MACHINE
CAUTERY EXTENTION BLADE

CATHETER
CATH. PLUG
FOLEY CATH. TRAY
FOLEY CATH. 16FR. THERMAL
URIMETER DRAINAGE BAG

GLOVES
EXAM, UNSTERILE
SURGEONS, STERILE
SURGEONS HYPO-ALLERG., STERILE

SOLUTIONS
IRRIG. WATER 1500CC
IRRIG. NACL 1000CC

MISCELLANEOUS
BLADE, SURGICAL #10
BLADE, SURGICAL #15
BLADE, SURGICAL #21
CACRON TAPE
HEMOCLIP, SMALL
HEMOCLIP, MED.
HEMOCLIP, LRG.
RAZOR, PROP
MAGNETIC NEEDLE MAT
SUCTION TUBING 20'

INSTRUMENTS & EQUIPMENT
LAPAROTOMY SET
EXTRA LONG INSTR.
RETR. UPPER HAND
BOSEL CLAMPS
HEADLIGHT, FIBEROPTIC
DEEP BALFOR

DRAINS
PENROSE 1" X 36"
JACKSON PRATT, 7MM & 10MM
JACKSON PRATT RESERVOIR
CATH. MALCOTT 22GR.
CATH. RED RUBBER 14FR.

HAVE AVAIL. INTERNAL STAPLES
TA 30,55,90. - 3.5MM & 4.8MM
TA 30,55,90/ - 3.5MM & 4.8MM
GIA MULTI USE UNIT & GUN
POWERED PLDS-15W

DRUGS
CEFADYL 1GM.
THROMBIN 10,000U

SYRINGE
SYRINGE, 30CC LL
SYRINGE, 60CC LL
SYRINGE, 10CC LL
SYRINGE, 60 CC SLIP TIP

COLOSTOMY BAG
COLOST/TLEOST FLNG, 100MM X 4"
COLOST/TLEOST FLNG, 70MM X 4"
LOOP OSTOMY, 100MM
LOOP OSTOMY, 70MM

DRESSINGS
TELFA
GAUZE, 4 X 8"
ABD. STERILE

LAPAROTOMY LIST B EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

2 ARMY/NAVYS
2 SHARP RAKES
1 WIDE MALLEABLE
1 NARROW MALLEABLE
1 WIDE DEAVER
1 NARROW DEAVER
1 LARGE RICHARDSON
1 MEDIUM RICHARDSON
1 SMALL RICHARDSON
1 WIDE HARRINGTON
1 NARROW HARRINGTON
1 BALFOUR
2 TONSIL SUCTIONS
6 BALL CLIPS

PEEL PACK:

---

4 REGULAR TOWEL CLIPS
2 #3 KNIFE HANDLES
1 #4 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
1 LONG THUMBS WITHOUT TEETH
2 LONG RUSSIANS
2 FINE GYNES
2 ADSONS WITH TEETH
2 LONG ATRAGRIPS
1 POOL SUCTION

WRAP IN TOWEL:

---

2 MEDIUM HEMOCLIP APPLIERS - LONG

2 MEDIUM NEEDLE HOLDERS
2 LONG NEEDLE HOLDERS - NOT FINE
2 SPONGE STICKS
4 LONG CURVES
4 LAUERS
4 TONSILS
4 KOCKERS
2 BABCOCKS
4 ALLISES
10 CURVED CRILES
4 CURVED MOSQUITOES
1 SUTURE SCISSOR
1 MAYO SCISSOR
2 METZ SCISSORS
1 LONG METZ SCISSOR

LIVER INJURY EQUIPMENT LIST

SUTURE

DACRON TAPE
SILK 0 STRAND
SILK 2-0 STRAND
SILK 3-0 STRAND
SILK 4-0 STRAND
SILK 2-0 SH MULTI-PAK
SILK 3-0 SH MULTI-PAK
CHROMIC #1 BP LIVER

CLOSING

VICRYL 2-0 CT
VICRYL 3-0 CT
PDS #1 TP-1
SKIN STAPLES SM-35W

DRAPES & PACKS

MAJOR BASIN SET W/ GRADUATE & MED. CUPS
LAPAROTOMY SHEET
BACK TABLE COVER
MAYO STAND COVER
MEDIUM SHEET 44 X 60"
GOWN, SURGICAL XTR LRG. (3)
GLOVES, SURGICAL ASS. SIZES
GLOVES, EXAM UNSTERILE
TOWELS, STERILE (6)
PREP SET

SPONGES

LAP. 18 X 18 (4)
4 X 4 X-RAY DETECT
PEANUT DISSECTORS

SYRINGES & NEEDLES

SYRINGE, 10 CC W/ 21 ga. 1 1/2"
SYRINGE, 30 CC LL
SYRINGE, 60 CC LL
NEEDLE, 18 ga. 1 1/2"
NEEDLE, 25 ga. 5/8"

CATHETER

FOLEY CATH. TRAY
FOLEY CATH. 16FR. THERMAL
URIMETER DRAINAGE BAG

SOLUTIONS

IRRG. WATER 1500 CC
IRR. NACL 1000 CC

MISCELLANEOUS

BLADE, SURGICAL #10
BLADE, SURGICAL #15
BLADE, SURGICAL #21
SUTURE BOOTS
VESSEL LOOPS, MINI & MAXI
HEMOCLIPS, SM., MED., & LRG.
RAZOR, PREP
MAGNETIC NEEDLE MAT
PENCIL, HANDSWITCH CAUTERY
PAD, GROUNDING CAUTERY
AUTO-TRANSFUSION SUPPLIES

DRUGS

THROMBIN 10,000 U
HEPARIN 10,000 U
SURGICEL GAUZE
GELFOAM #100

INSTRUMENTS & EQUIPMENT

LAPAROTOMY SET
CARDIOVASCULAR TRAY
EXTRA LONG INSTR.
HEADLIGHT FIBEROPTIC
SARNS SAW (HOLD)
RETR. UPPER HAND
SCISSOR, LONG METZ.
LIVER CLAMP
THORACIC ANEURYSM CLAMPS
CAUTERY MACHINE
ARGON BEAM COAGULATOR (IF POSS.)
HEMOCLIP APPLIERS, SM., MED., LRG.
CHEST SET

ADD. SUPPLIES

MARLEX MESH
HYPOTHERMIA WARMING BLANKET
BLOOD WARMER (3)
RAPID INFUSION WARMER I.V.

DRAINS

HEMO-VAC, MED.
SUMP, DUAL LUMEN
MEDIASTINAL TUBE (HOLD)
CHEST DRAINAGE SYSTEM (HOLD)

DRESSINGS

TELFA
4 X 8 GAUZE
ABO, STERILE
RETENTION STRAPS

PERINEAL SET EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

2 SMALL RIGHT ANGLE RETRACTORS
2 LARGE RIGHT ANGLE RETRACTORS
2 SHARP RAKES
2 DEEP RAKES
1 TURNER WARWICK RETROGRADE BOUGIE
(BLACK) DOWNS SURG.
EH 040 010

ON STRINGER:

---

2 LONG NEEDLE HOLDERS
2 SPONGE STICKS
4 LONG CURVES
8 ALLISES
6 CURVED CRILES
1 LONG MAYO SCISSOR
1 REGULAR MAYO SCISSOR
1 SUTURE SCISSOR

PEEL PACK:

---

1 #3 KNIFE HANDLE
1 #3 LONG KNIFE HANDLE
2 LONG ATRAGRIP FORCEPS
2 LONG THUMBS WITHOUT TEETH
2 FINE GYNE FORCEPS

PERITONEAL LAVAGE EQUIPMENT LIST

SUTURE

VICRYL 2-0 SH
ETHILON 4-0 FS-Z

DRAPES & SUPPLIES

TOWELS, STERILE
DRAPE, FENESTRATED
MAYO STAND COVER
SKIN PREP TRAY
4 X 4 X-RAY DETECT
GOWN, SURGICAL XR. LRG. (2)
GLOVES, SURGICAL ASSORT. SIZES
CAUTERY PENCIL, HANDSWITCH
PAD, GROUNDING ADULT
BLADE, SURGICAL #10 & #15
TUBING, I.V.
IMPERSOL LAVAGE CATH 11 FR.
0.9% NACL IV 1000 CC
O.P. SITE

INSTRUMENTS & EQUIPMENT

TRAUMA TRAY
CAUTERY MACHINE

RECTAL SET A EQUIPMENT LIST

SUTURE

CHROMIC 2-0 SH
CHROMIC 2-0 REEL
VICRYL 3-0 SH
VICRYL 2-0 CT
ETHILON 5-0 PS-Z

DRAPES & PACKS

BASIN SET W/ GRADUATE & MED.CUP.
PERI-GYN SHEET
BACK TABLE COVER
MAYO STAND COVER
TOWELS, STERILE (6)
GOWN, SURGICAL XTR. LRG.
GLOVES, SURGEON ASSORT. SIZES

SPONGES

LAP, 12 X 12 (3)
4 X 4, X-RAY DETECT

SOLUTIONS

IRRIG. WATER 1500 CC
IRRIG. NACL 1000 CC
BETADINE PAINT 30 OZ.

CAUTERY

PAD, GROUNDING
PENCIL, HANDSWITCH
BLADE, EXTENTION

MISCELLANEOUS

BLADE, SURGICAL #15 (2)
SUCTION TUBING 20'
HEMOCLIP, MED.
HEMOCLIP, LRG.
MAGNETIC NEEDLE MAT
HEADLIGHT, FIBEROPTIC

INSTRUMENT & EQUIPMENT

LAPAROTOMY SET
RETR., RECTAL
HEMOCLIP APPLIERS, MED., LRG.

INTERNAL STAPLES HAVE AVAIL:

TA 30, 55, 90 - 3.5 MM & 4.8 MM
GIA MULTI USE UNIT & GUN

COLOSTOMY BAG

COLOST / ILEOST FLANGE KIT
100 MM X 4" / 70 MM X 4"

DRESSINGS

XEROFOAM 7 X 4"
PACKING GAUZE, IODOPHORM 1"
FLUFF 36" X 36"

RECTAL SET B EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

1 BOUIE-SMITH RETRACTOR
2 SAWYER RETRACTORS
1 RECTAL SPECULUM
1 EATON ANALSCOPE
4 BALL CLIPS

PEEL PACK:

---

1 REGULAR PROBE
1 LONG PROBE (TAPED)
1 #3 LONG KNIFE HANDLE
2 LONG THUMBS WITHOUT TEETH
2 ADSONS WITH TEETH
1 CRYPT HOOK (TAPED)
1 FISTULOTOMY HOOK
1 POOLE SUCTION
2 SENNS RETRACTORS
1 #7 KNIFE HANDLE
1 GROOVE DIRECTOR
1 #3 KNIFE HANDLE

ON STRINGER:

---

1 LONG NEEDLE HOLDER
2 MEDIUM NEEDLE HOLDERS
1 METZ SCISSOR
1 MAYO SCISSOR
1 SUTURE SCISSOR
1 HEMORRHOID CLAMP
2 SHORT PENNINGTONS
2 LONG PENNINGTONS
6 RECTAL ALLISES

CONTENTS

---

4 REGULAR ALLISES
4 CURVED CRILES
4 BABY TOWEL CLIPS
1 SMALL SCISSOR (DR. SMILEY'S)

RENAL INJURY EQUIPMENT LIST

SUTURE

18" TIES

_____ 1 EACH SILK 2-0 STRAND
_____ 1 EACH SILK 3-0 STRAND
_____ 1 EACH SILK 4-0 STRAND

30" TIES

_____ 1 EACH SILK 0 STRND
_____ 1 EACH SILK 2-0 STRAND
_____ 1 EACH SILK 1 STRAND
_____ 1 EACH CHROMIC 2 STRAND
_____ 1 EACH CHROMIC 3-0 SH
_____ 1 EACH DACRON TAPE

FOR DRAIN

_____ 1 EACH SILK 3-0 X-1

CLOSURE

_____ 1 EACH VICRYL 1 CT
_____ 4 EACH VICRYL 0 CT
_____ 1 EACH VICRYL 3-0 CT

GLOVES

GLOVES, EXAM LRG UNSTERILE
GLOVES, SURGICAL, ASSORTED SIZES
GLOVES, ULTRADERM

CAUTERY

1 EACH CAUTERY MACHINE
1 EACH PAD, GROUNDING ADULT
1 EACH TIP CLEANER, ELECTRO SURG
1 EACH ELECTRODE, BLADE EXTENDED

SPONGES AVAILABLE

2 EACH SPONGES, GAUZE X-RAY DETECT
3 EACH SPONGES, LAP 18*18
1 EACH SPONGES, PEANUT DISECTORS

HEMOCLIPS

1 PK HEMOCLIP, SM
1 PK HEMOCLIP, MED
1 PK HEMOCLIP, LRG

SOLUTIONS

1 EACH SOLUTION, IRRIG WATER 1500 ML
1 EACH SOLUTION, IRRIG NACL 1000

FOLEY CATHETER

1 EACH TRAY, CATH FOLEY UNIVERSAL
1 EACH CATHETER, FOLEY W/T SENS 16FR3C
1 EACH URIMETER, DRAIN BAG

DRAINS

1 EACH DRAIN, PEN STER 3/4 X 12"

INSTRUMENTS AND EQUIPMENT

1 EACH LAPAROTOMY SET
1 EACH CARDIOVASCULAR TRAY
1 ST INSTRUMENT SET, EXTRA LONG
1 EACH APPLIER, HEMOCLIP, LARGE, LONG
1 EACH SLUSH MACHINE AND PAN

HAVE AVAILABLE

NEPHROSCOPE, FLEXIBLE
CHEST SET

DRESSINGS

2 EACH DRESSING, GAUZE 4*8 12 PLY
1 EACH DRESSING, FLUFF 36*36 (STERILE)
1 EACH DRESSING, SURGIPAD 8*10

SPECIALS

SLUSH MAY BE NEEDED FOR PARTIAL NEPHRECTOMY
HAVE AUTO-TRANSFUSION SUPPLIES AVAILABLE

SAPHENOUS VEIN HARVEST EQUIPMENT LIST

SUTURE

SILK 4-0 STRAND
SILK 2-0 STRAND
PROLENE 5-0 RB-Z
VICRYL 2-0 CT
VICRYL 3-0 CT
VICRYL 4-0 FS-Z

DRAPES & SUPPLIES

DRAPE, SPLIT SHEET
MEDIUM, SHEET 44 X 60"
MAYO STAND COVER
BASIN SET W/GRADUATE & MED CUP
4 X 4 X-RAY DETECT
SAPHENOUS VEIN CANNULA
GOWN, SURGEON'S XTR. LRG. (2)
GLOVES, SURGEON'S. ASSORT. SIZES
SYRINGE, 30 CC L.L.
CAUTERY, HANDSWITCH PENCIL
PAD, GROUND ADULT
0.9% NACL 500 CC
BAG-O-JET TRANSFER UNIT
BLADE, SURGICAL #10 (2)
SYRINGE, 10 CC W/ 21 GA 1 1/2"
NEEDLE

INSTRUMENTS

TRAUMA TRAY
CAUTERY MACHINE

DRUGS

HEPARIN 10,000 U
BACITRACIN 50,000 U

DRESSINGS

TELFA
ELASTIC BANDAGE 4" & 6"

SPLEEN INJURY EQUIPMENT LIST

SUTURE

SILK 2-0 STRAND
SILK 3-0 STRAND
SILK 2-0 SH MULTI-PAK
SILK 3-0 SH MULTI-PAK
SILK 0 STRAND
VICRYL 3-0 SH

CLOSING

VICRYL 0 CT
VICRYL 2-0 CT
VICRYL 3-0 CT
SKIN STAPLES SM - 35 W

SUPPLIES & INSTRUMENT

SEE LAPAROTOMY LIST

URETERAL INJURY EQUIPMENT LIST

IF DOING CYSTOSCOPY

CYSTO SET
CYSTOSCOPE TRAY, ADULT
URETHROSCOPE DIRECT VISION
SET, IRRIG TUR Y-TYPE
SOLUTION, IRRIG WATER 3000ML

SUTURE

1 PLAIN L-102G 3-0 REEL
2 CHROMIC 817H 0 CP-1
1 CHROMIC S-115H 1 STRAND
2 VICRYL J- 359H 1 CT
1 STAPLE GUN, SKIN SM-35W
2 CHROMIC U-255H 2-0 UR-4
2 CHROMIC U 203 H 4-0 RB-1

SUPPLIES

1 DRAPE, PERI/GYN
1 BASIN, SET WITH GRADUATE AND MED. CUPS
1 SHEET, TRANSVERSE LAP
1 COVER, MAYO STAND
1 TRAY, SKIN SCRUB
1 TOWELS, STERILE (6 PACK)
3 GOWNS, STERILE BACK XL
1 SYRINGE, IRRIGATION-BULB ASEPTO
1 RAZOR, PREP DISP
1 SUCTION TUBING 20'
1 SYRINGE, 10CC LL
1 SYRINGE, 30CC LL
1 NEEDLE, 18 GA. 1-1/2
1 DRAIN, PEN STER 1/4*12
1 BLADE, SURGICAL #15
1 SYRINGE, CONTROL 10CC
1 HEMOCLIP, MED
1 HEMOCLIP, LRG
1 APPLIER, HEMOCLIP, LARGE, LONG
1 APPLIER, HEMOCLIP, MEDIUM, LONG
1 SPONGE, GAUZE X-RAY DETECT
1 SPONGE, KITTNER DISECTORS
3 SPONGES, 18 X 18

GLOVES

1 GLOVES, EXAM LRG UNSTERILE
1 GLOVES, SURGEONS, ASSORTED SIZES

CAUTERY

1 CAUTERY MACHINE
1 PAD, GROUNDING ADULT
1 PENCIL, HANDSWITCH

SOLUTIONS

1 SOLUTION IRRIG WATER 1500ML
1 SOLUTION IRRIG NACL 1000

CATHETERS

1 CATHETER, 18FR 5CC
1 CATHETER, 20FR 5CC
1 CATHETER, 22FR 5CC
1 CATHETER, 22FR 30CC
1 CATH, PLUG (STERILE)
1 URIMETER, DRAIN BAG
1 BAG, URINARY DRAIN

INSTRUMENTS

1 UROLOGICAL LAPAROTOMY SPECIALS
1 LAPAROTOMY SET
1 PERINEAL SET

DRESSINGS

1 DRESSING, TELFA
1 DRESSING, GAUZE 4*8 12 PLY
1 DRESSING, FLUFF 36 X 36 (STERILE)
1 DRESSING, SURGIPAD 8*10

DRUGS

METHYLENE BLUE

UROLOGICAL LAPAROTOMY SPECIALS EQUIPMENT LIST

CONTENTS

BOTTOM OF PAN:

---

2 WIDE RAKES
2 GREEN GOITER RETRACTORS

WRAP IN TOWEL

---

2 VEIN RETRACTORS
1 DULL NERVE HOOK
1 #12 FRAZIER SUCTION
1 METAL RULER
1 STR NERVE ROOT RETR
1 ANG NERVE ROOT RETR
2 SHORT THUMBS W/OUT TEETH
2 MARTIN THUMBS
2 SINGLE SKIN HOOKS

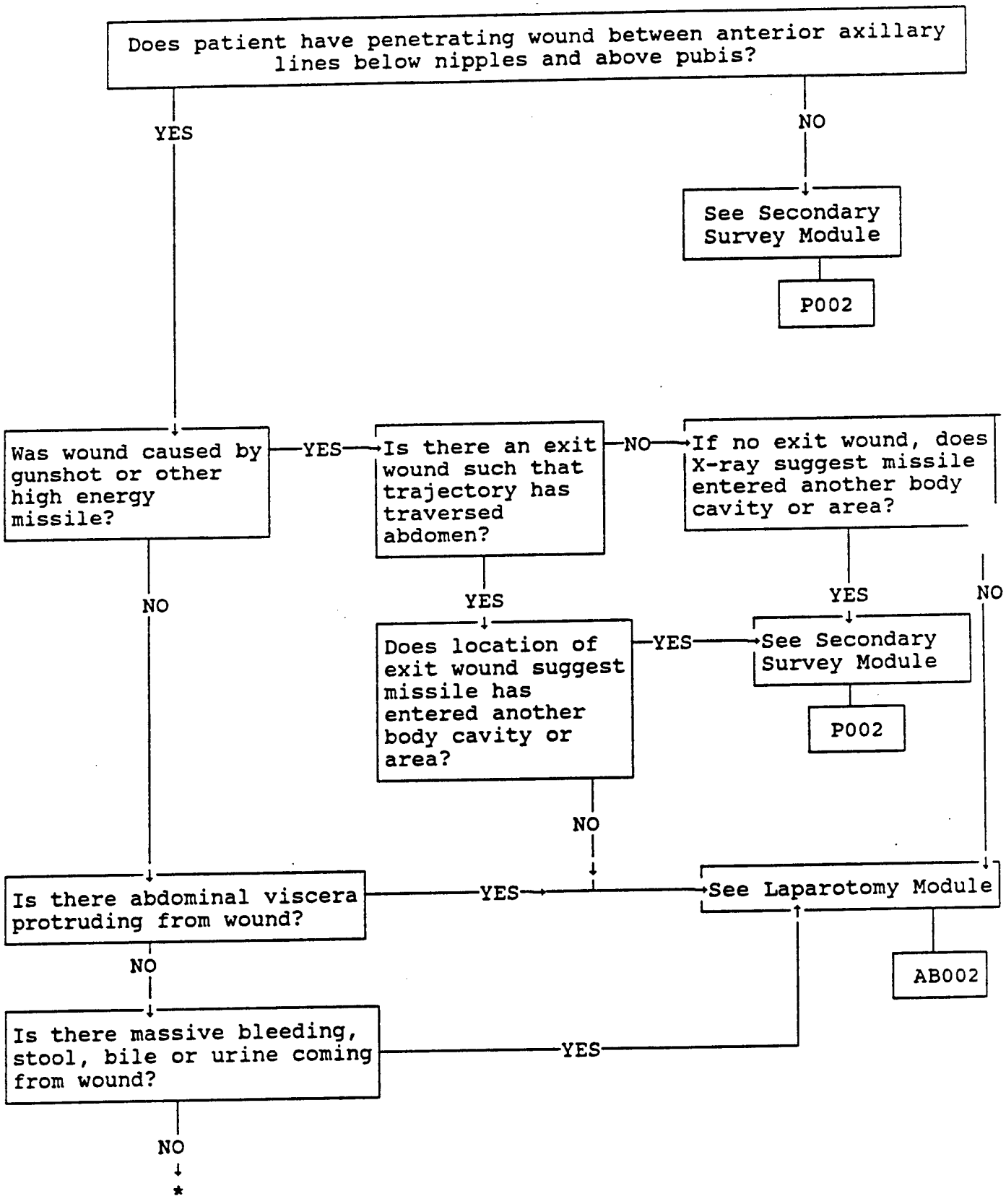
ON STRINGER:

---

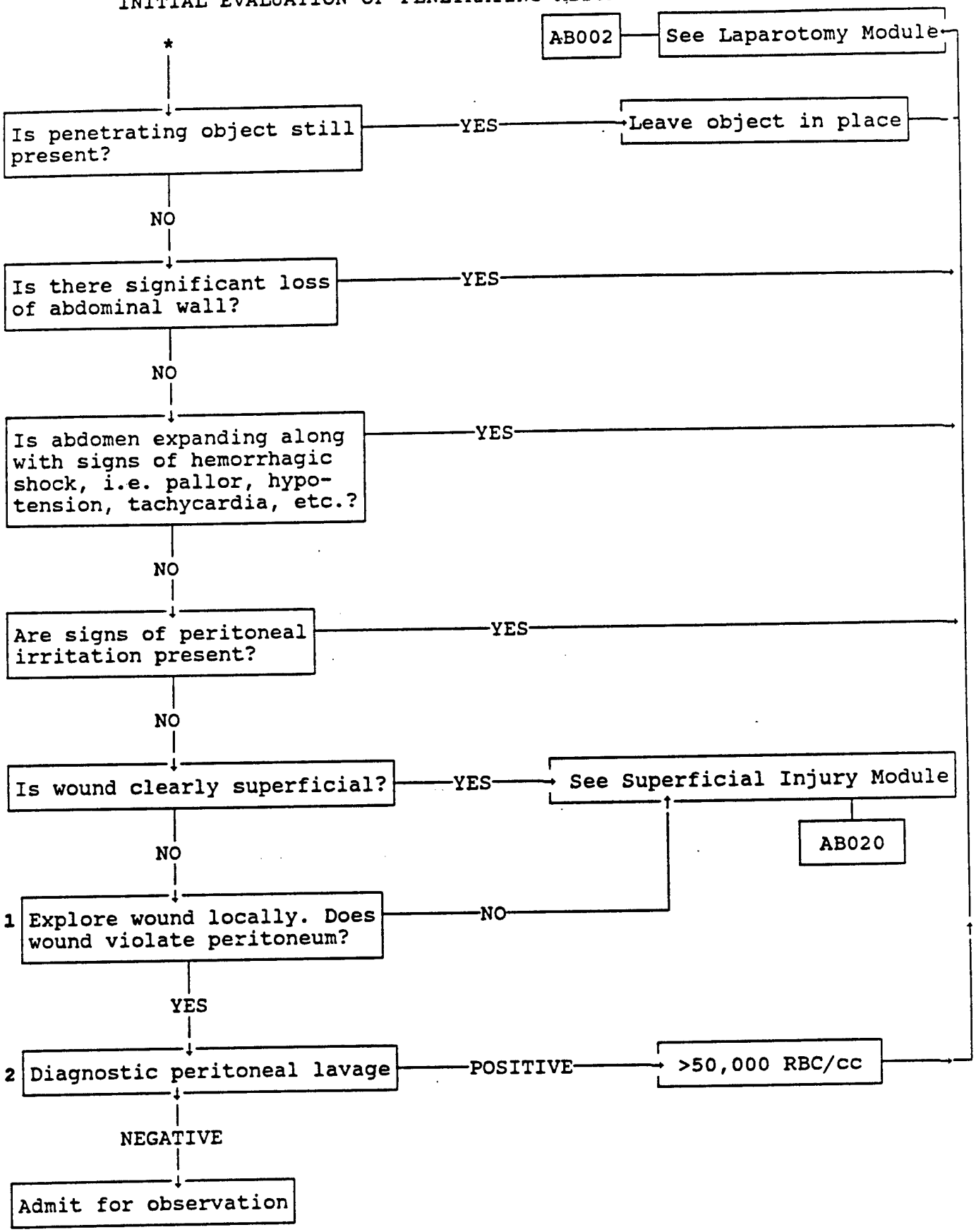
1 SINGLE TOOTHED TENACULUM
1 DOUBLE TOOTHED TENACULUM
2 KIDNEY PEDICLE CLAMPS
3 RANDALL STONE FCP-DIFF ANG
2 TONSIL HEMOSTATS
2 HEANEY CLAMPS
6 REGULAR ALLISES
6 CURVED CRILES
4 LONG ALLISES

INITIAL EVALUATION OF PENETRATING ABDOMINAL WOUND MODULE

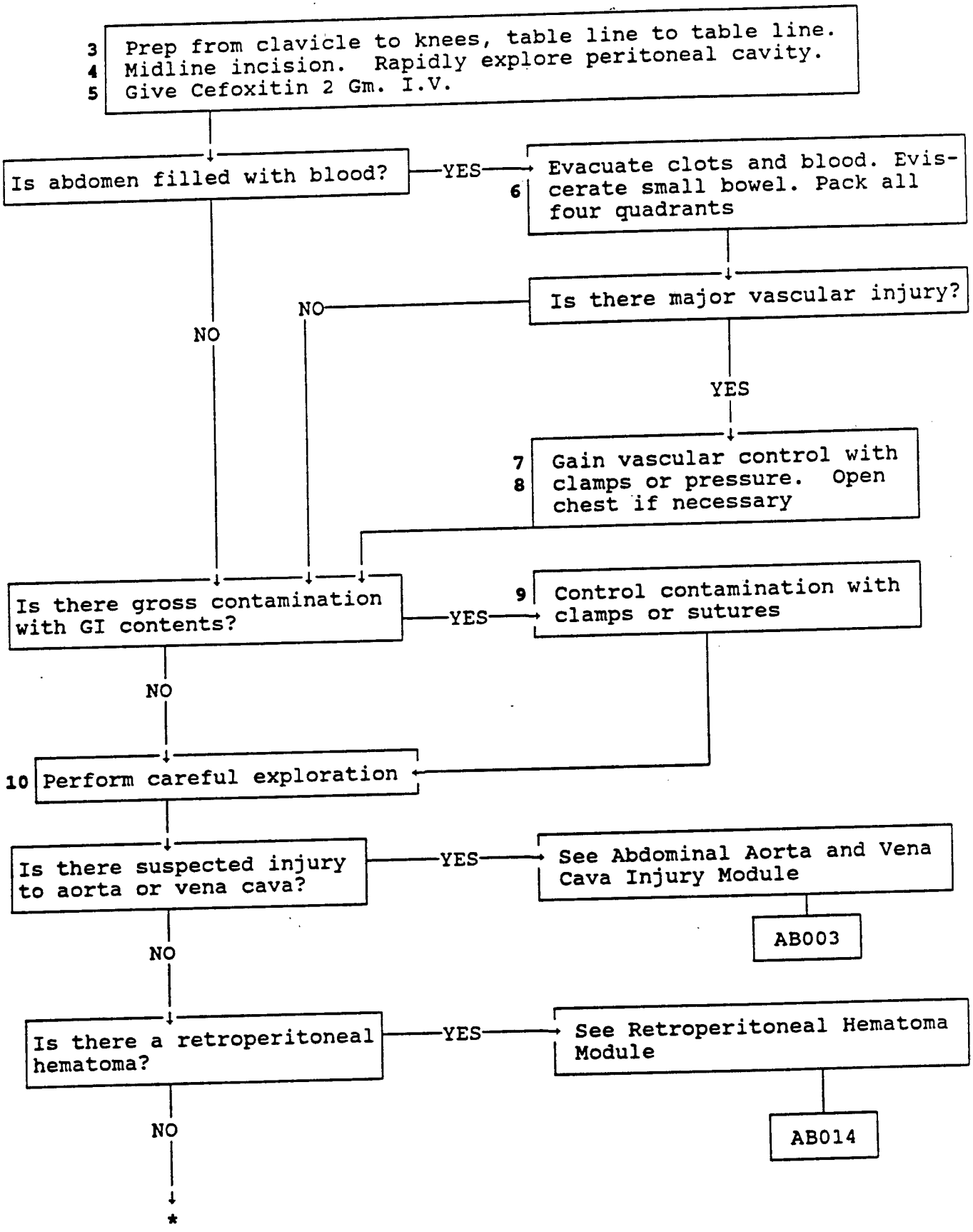
Assume patient is naked and lying supine. Assume ABC's of trauma care have been done.



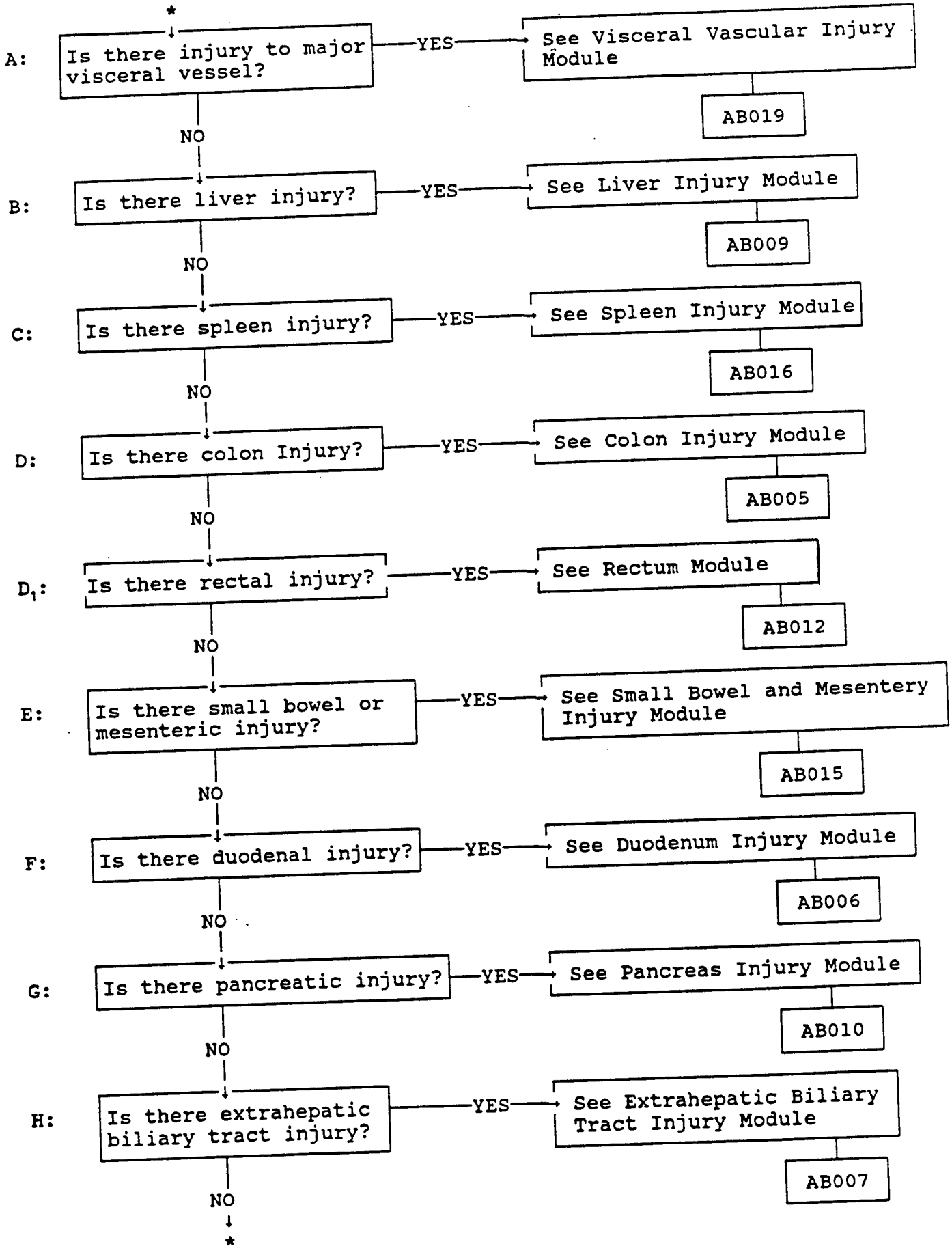
INITIAL EVALUATION OF PENETRATING ABDOMINAL WOUND MODULE



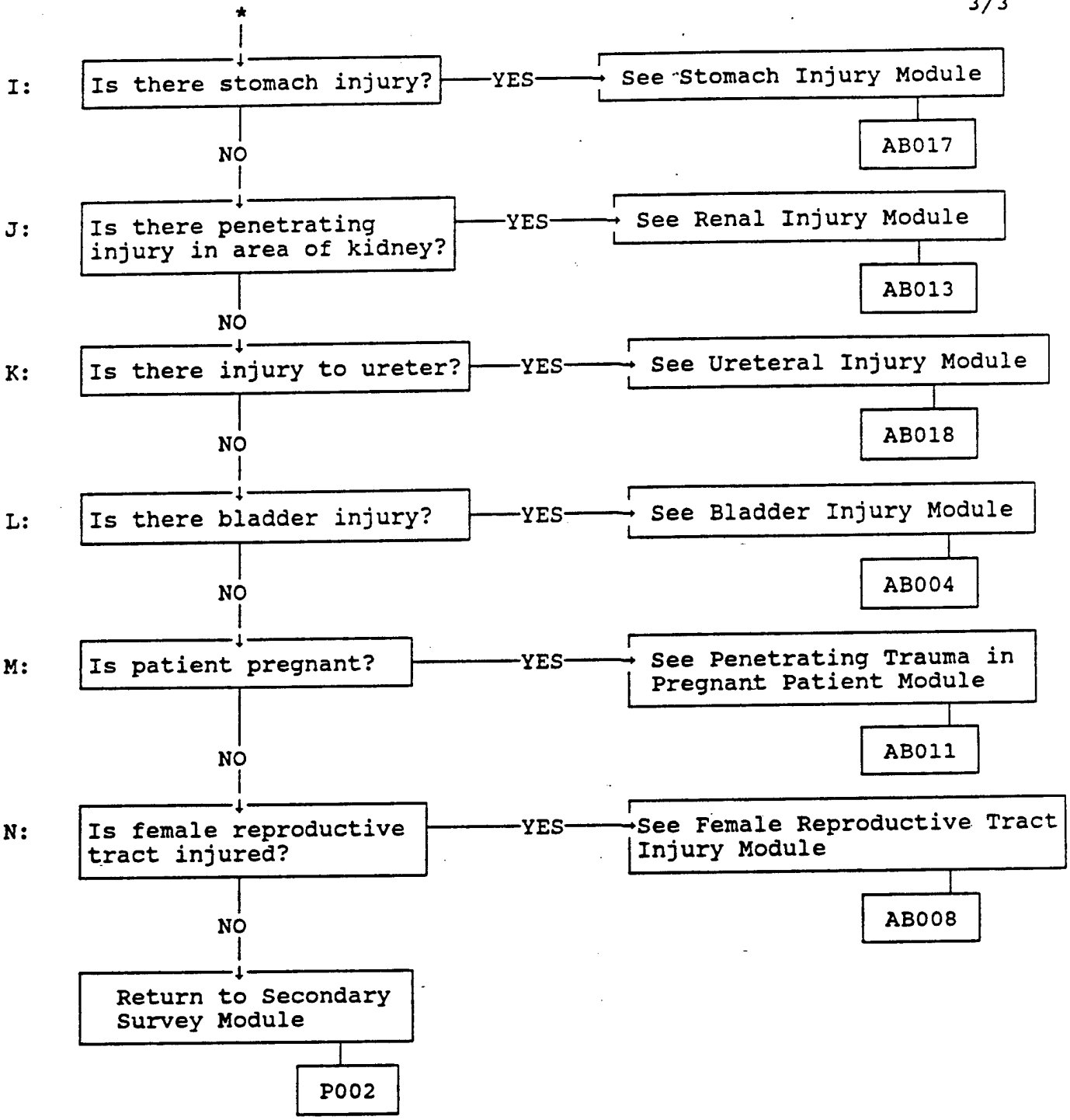
LAPAROTOMY MODULE



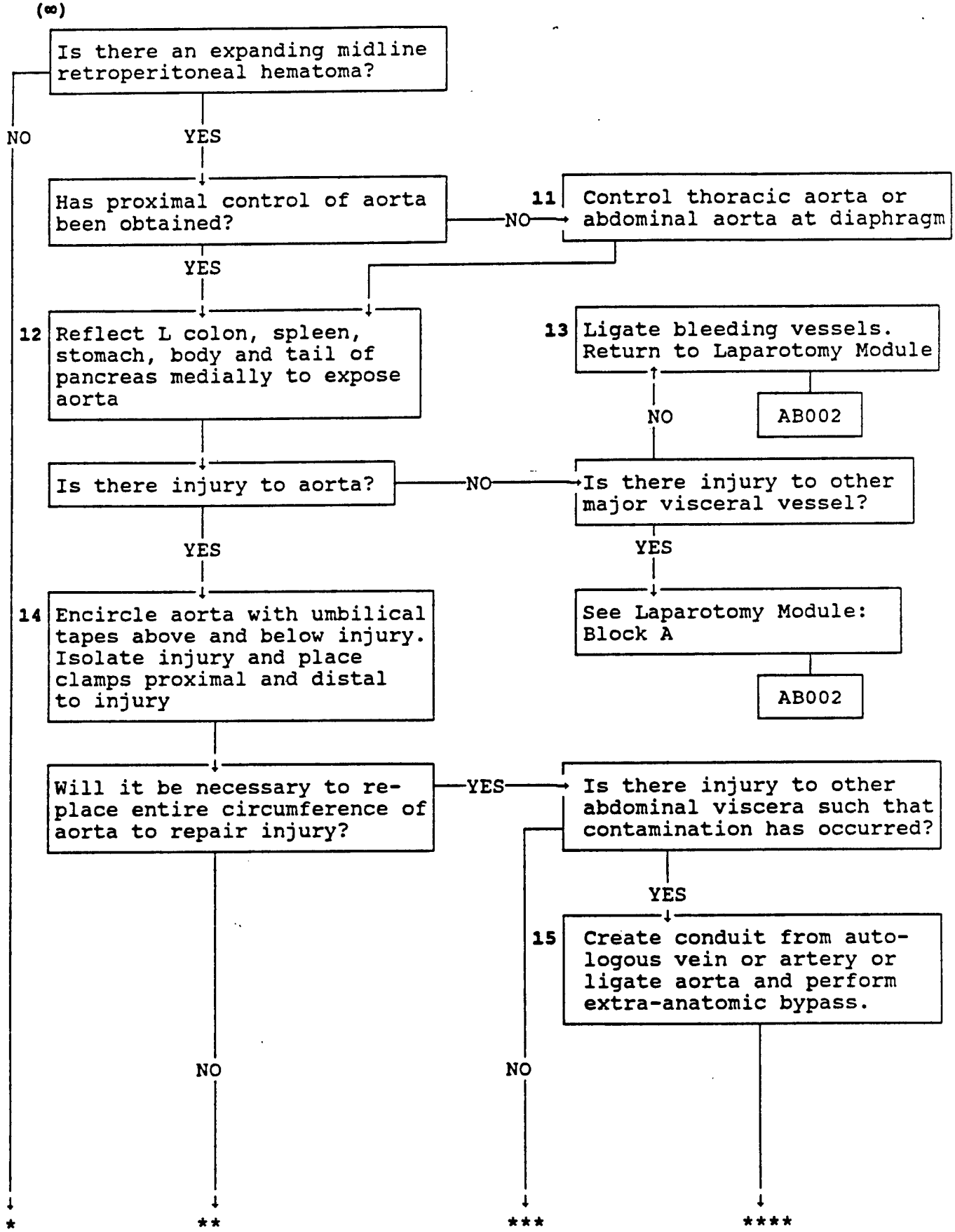
LAPAROTOMY MODULE



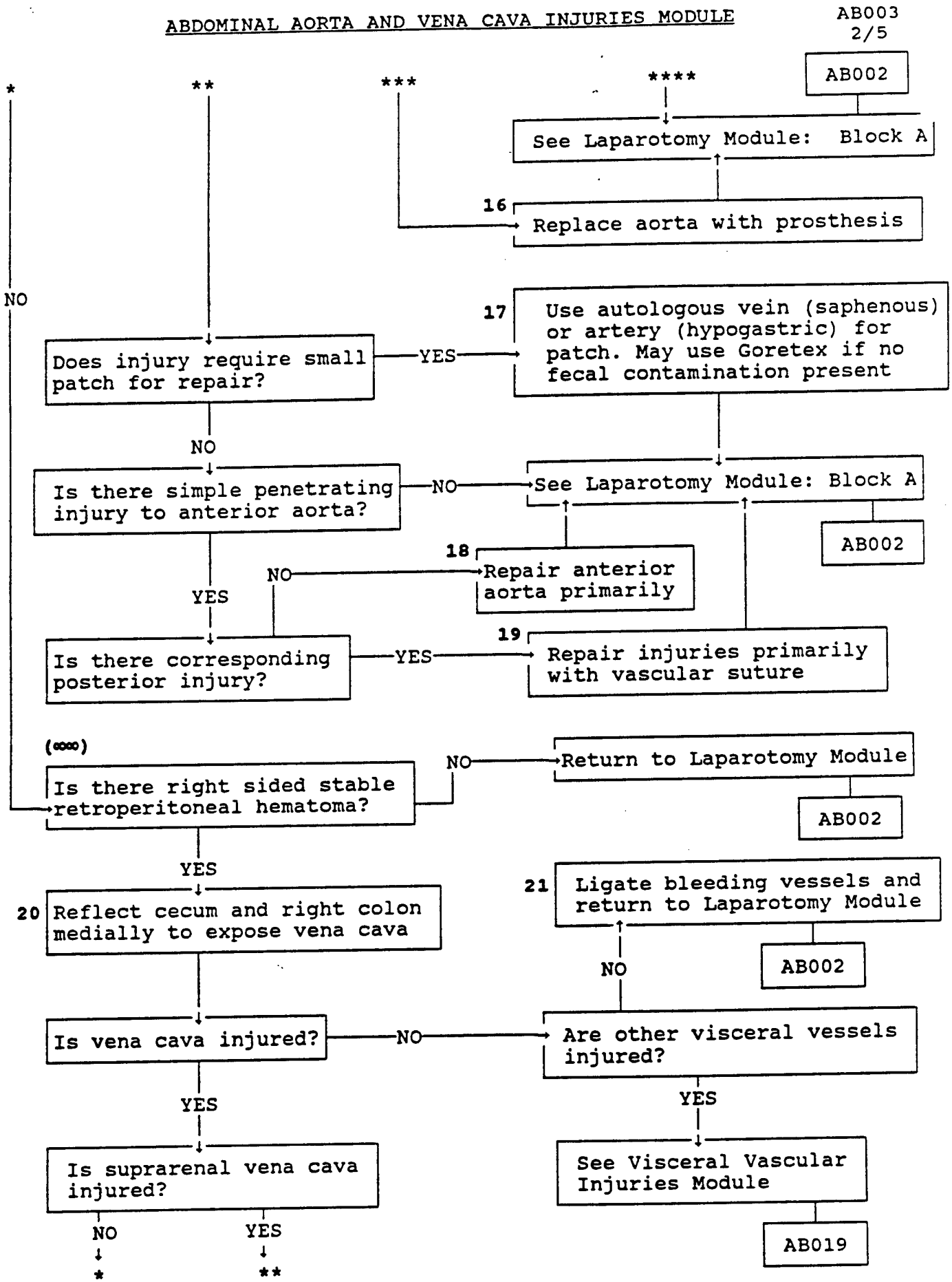
LAPAROTOMY MODULE



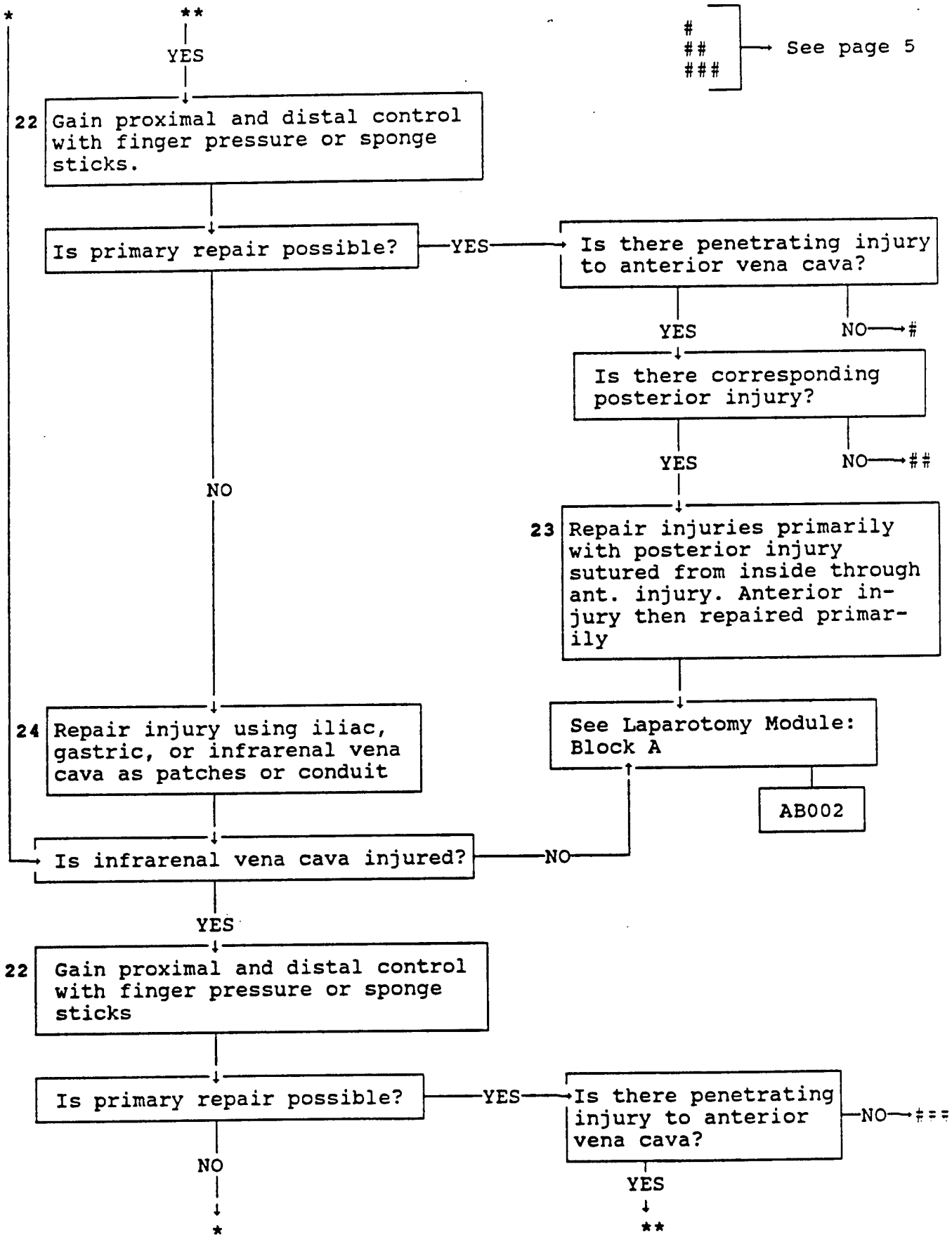
ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE



ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE

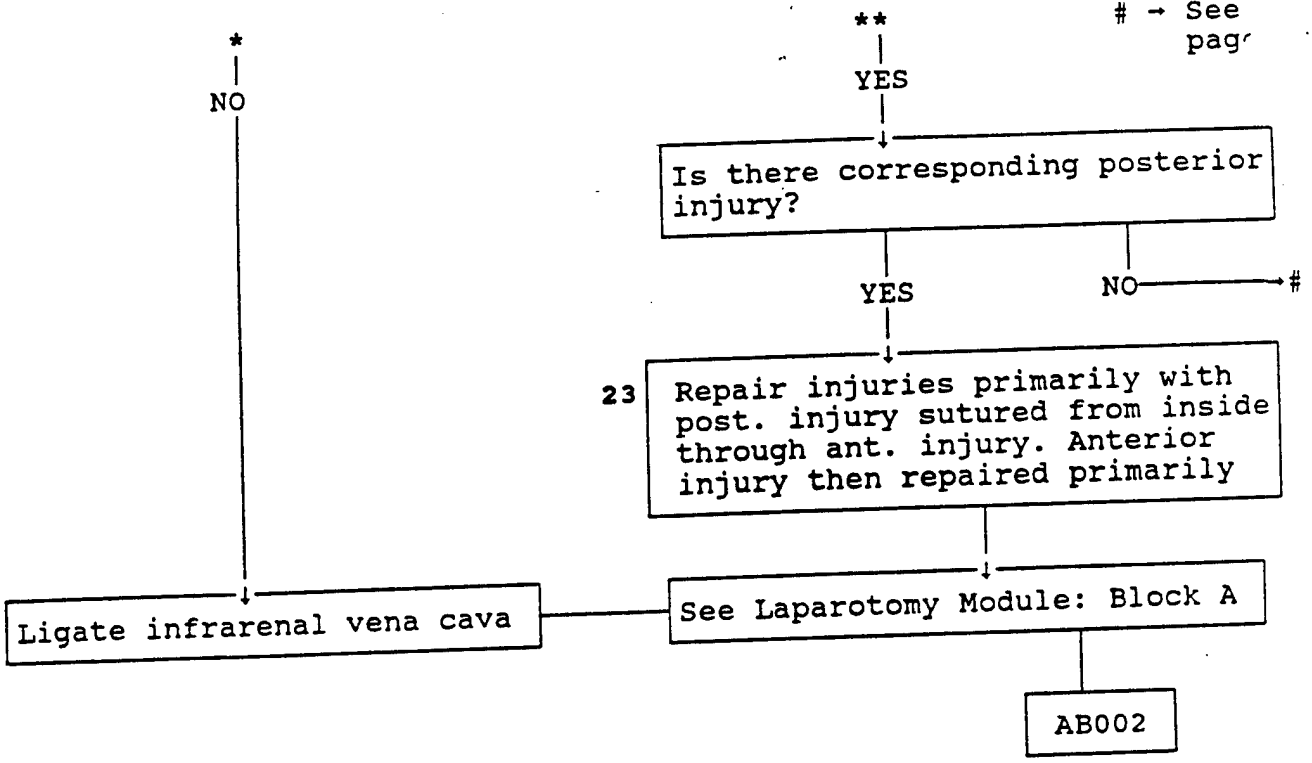


ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE

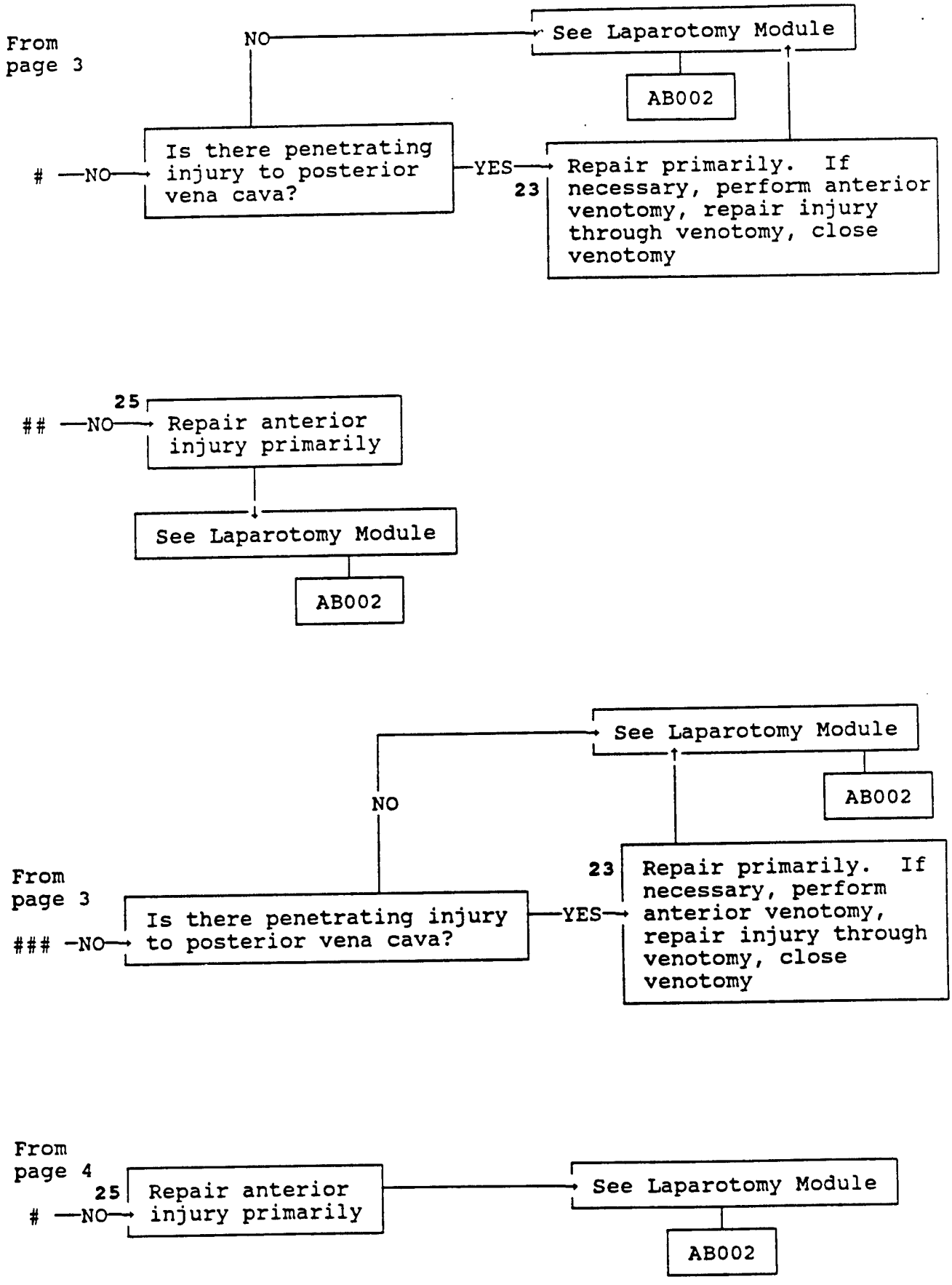


ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE

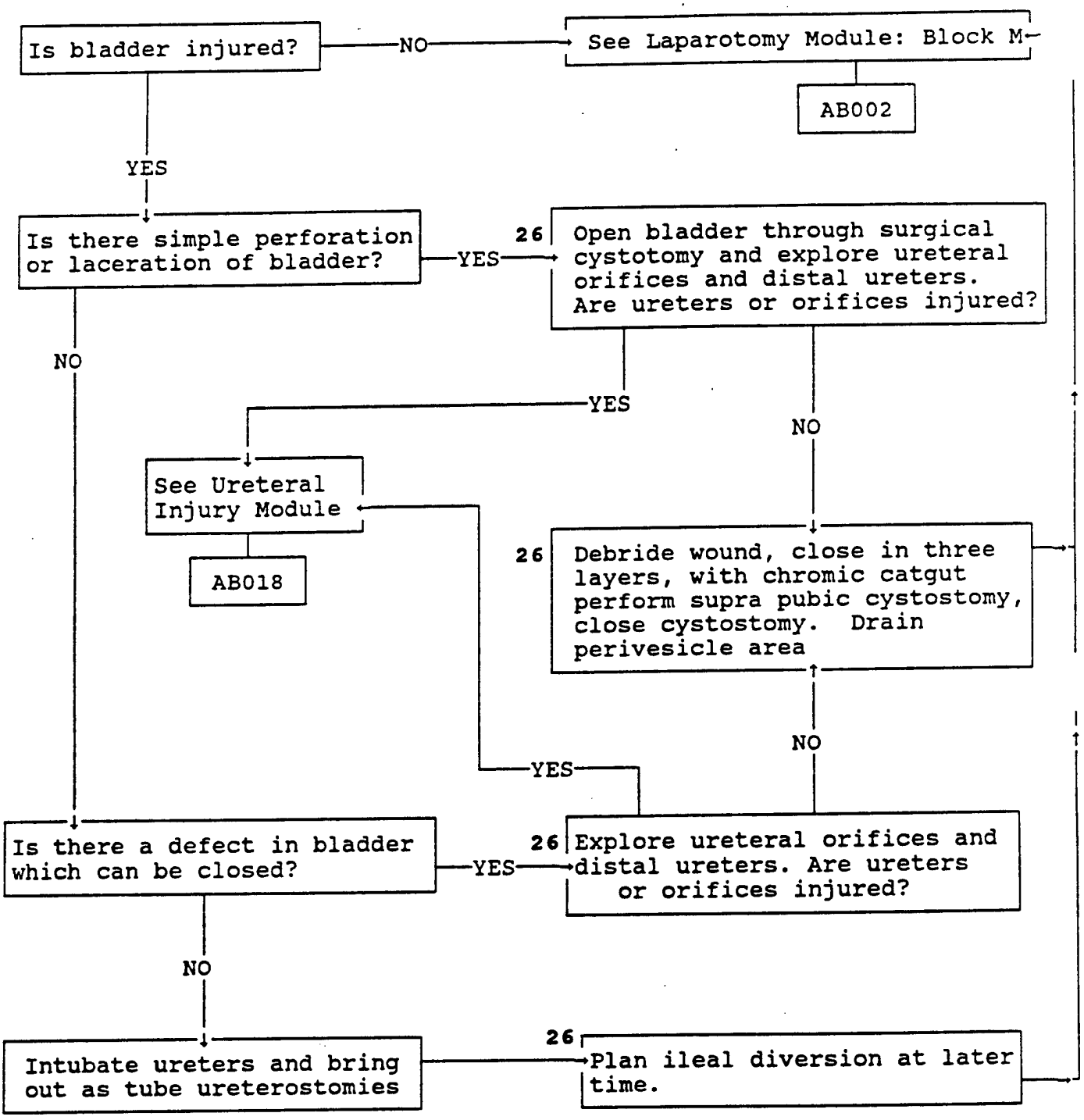
→ See page



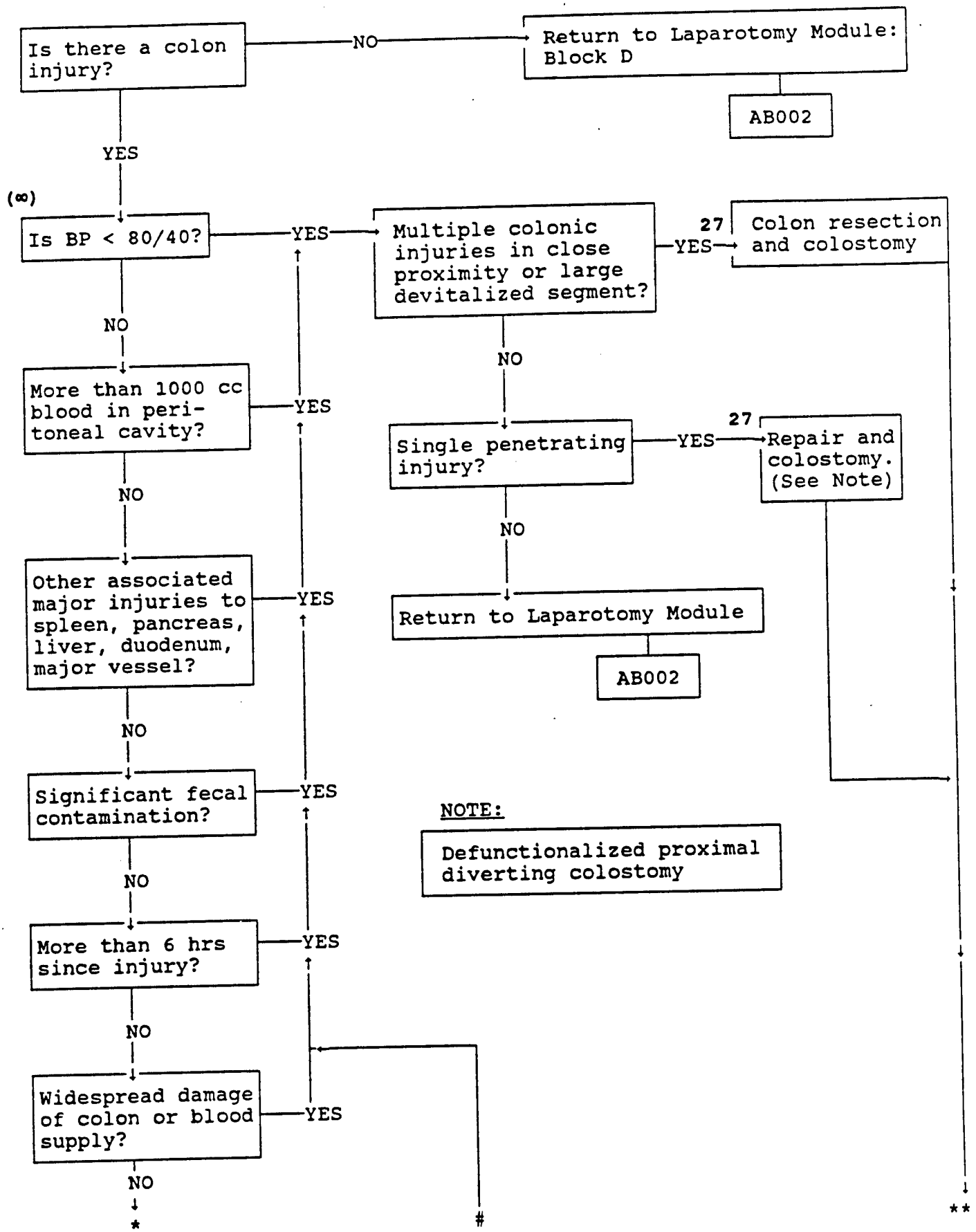
ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE



BLADDER INJURY MODULE



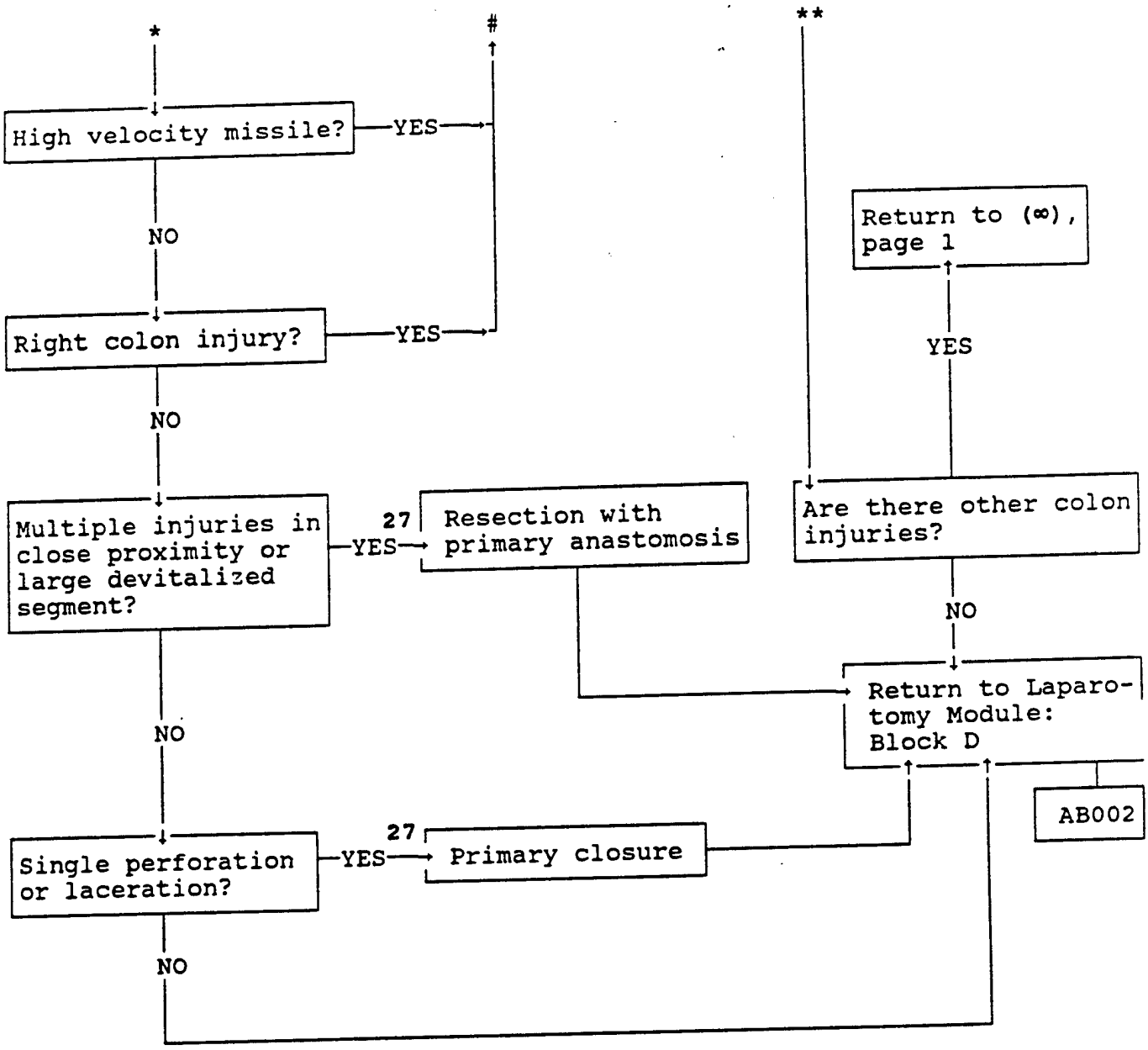
COLON INJURY MODULE



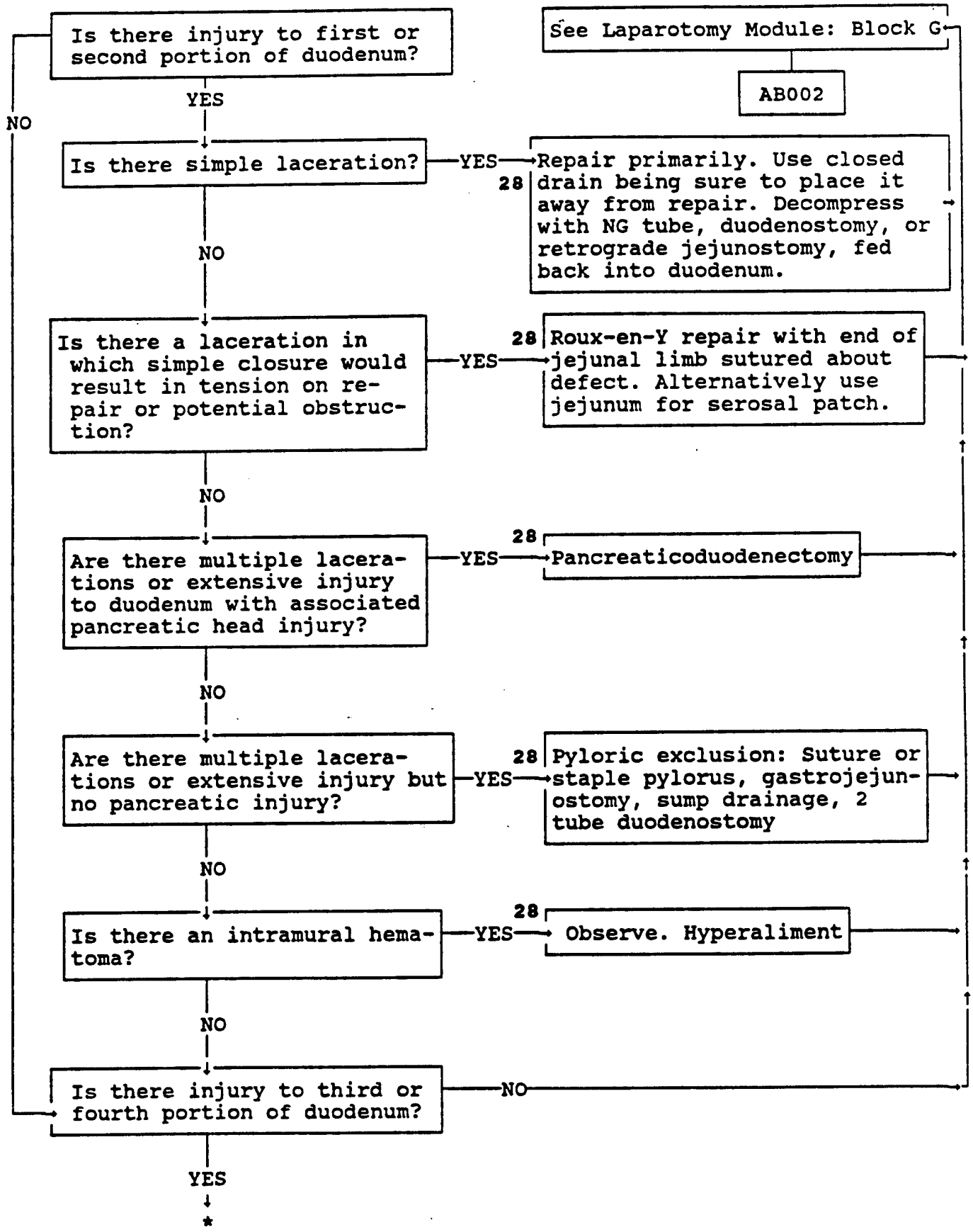
NOTE:

Defunctionalized proximal diverting colostomy

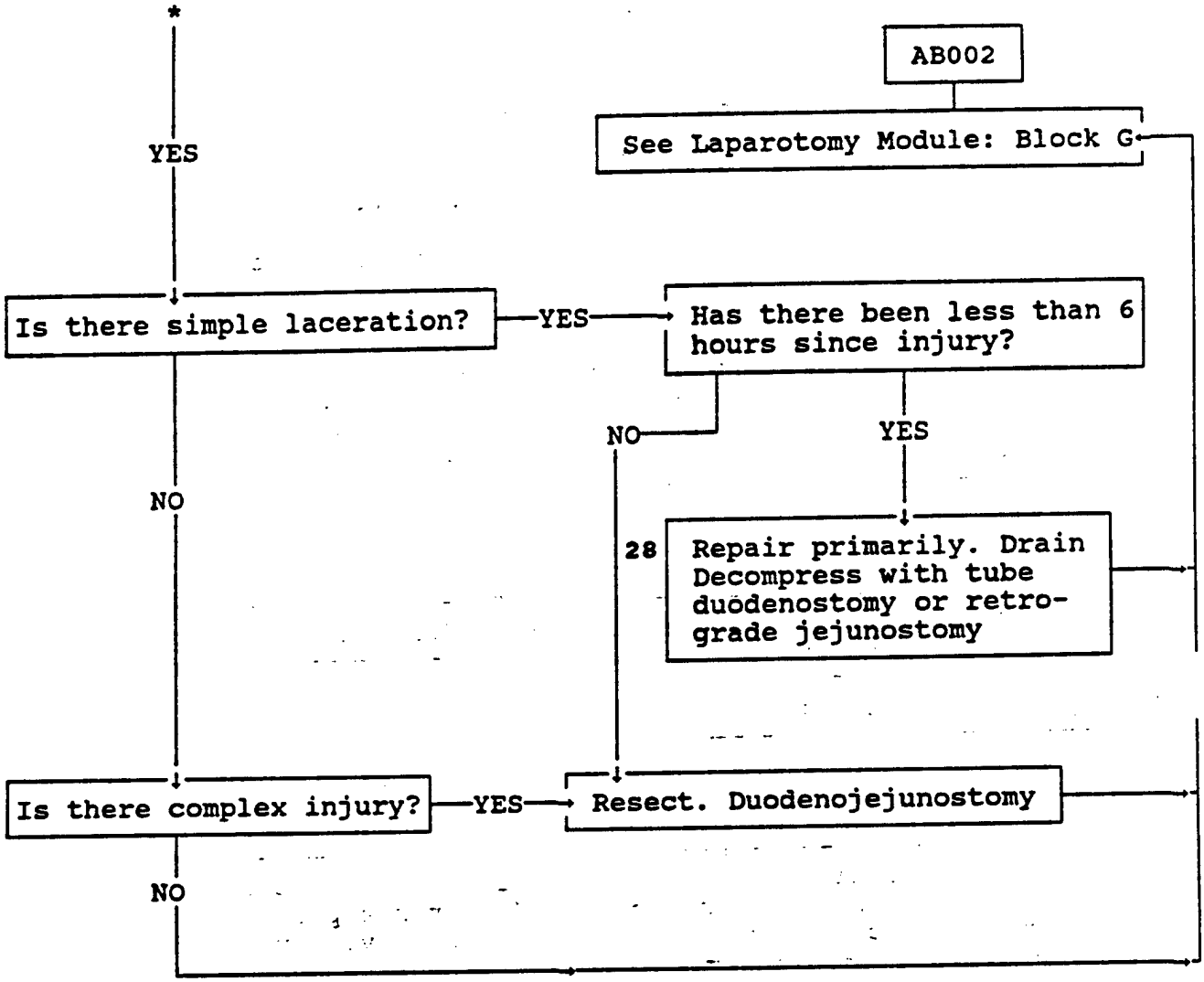
COLON INJURY MODULE



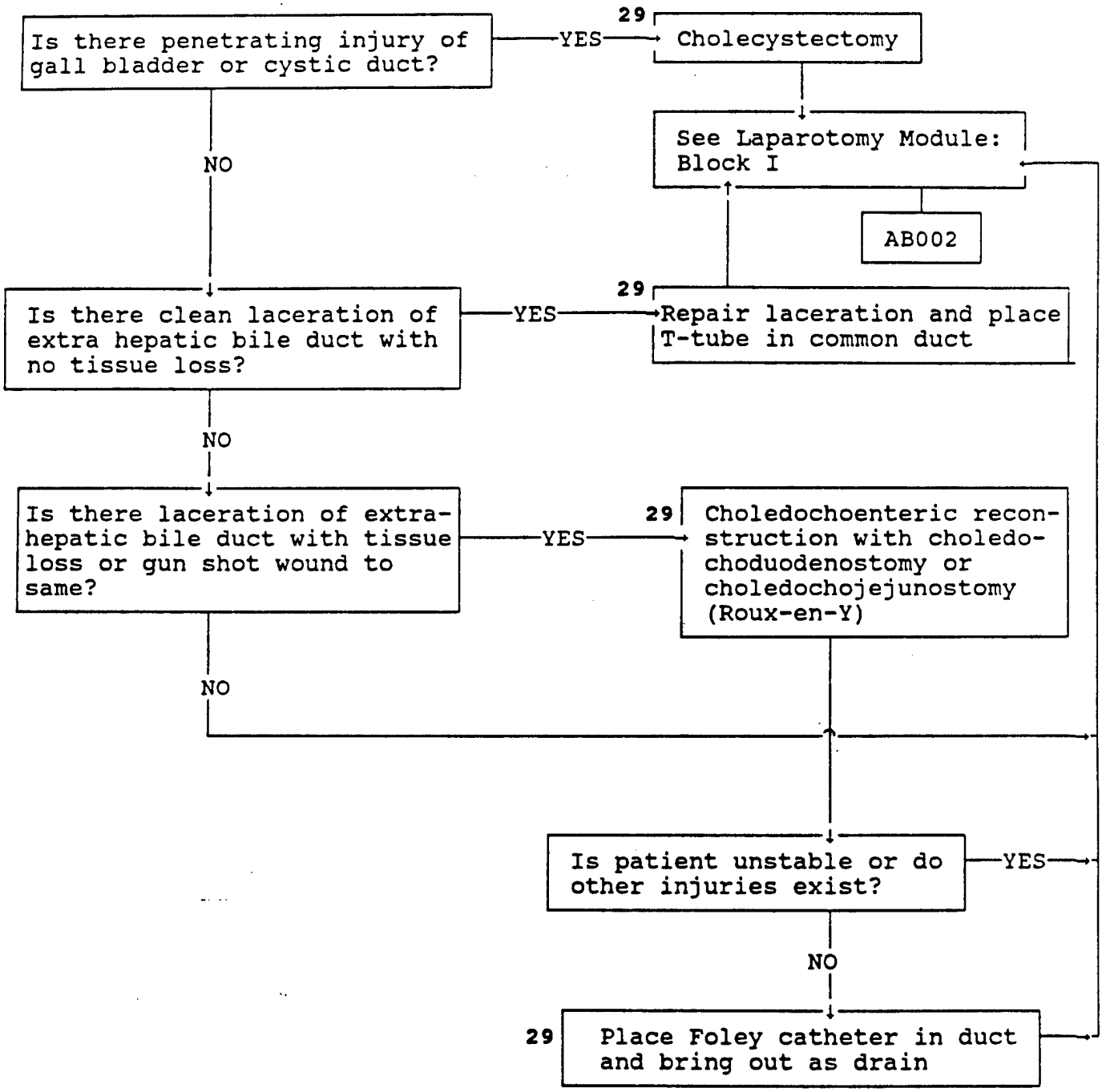
DUODENUM INJURY MODULE



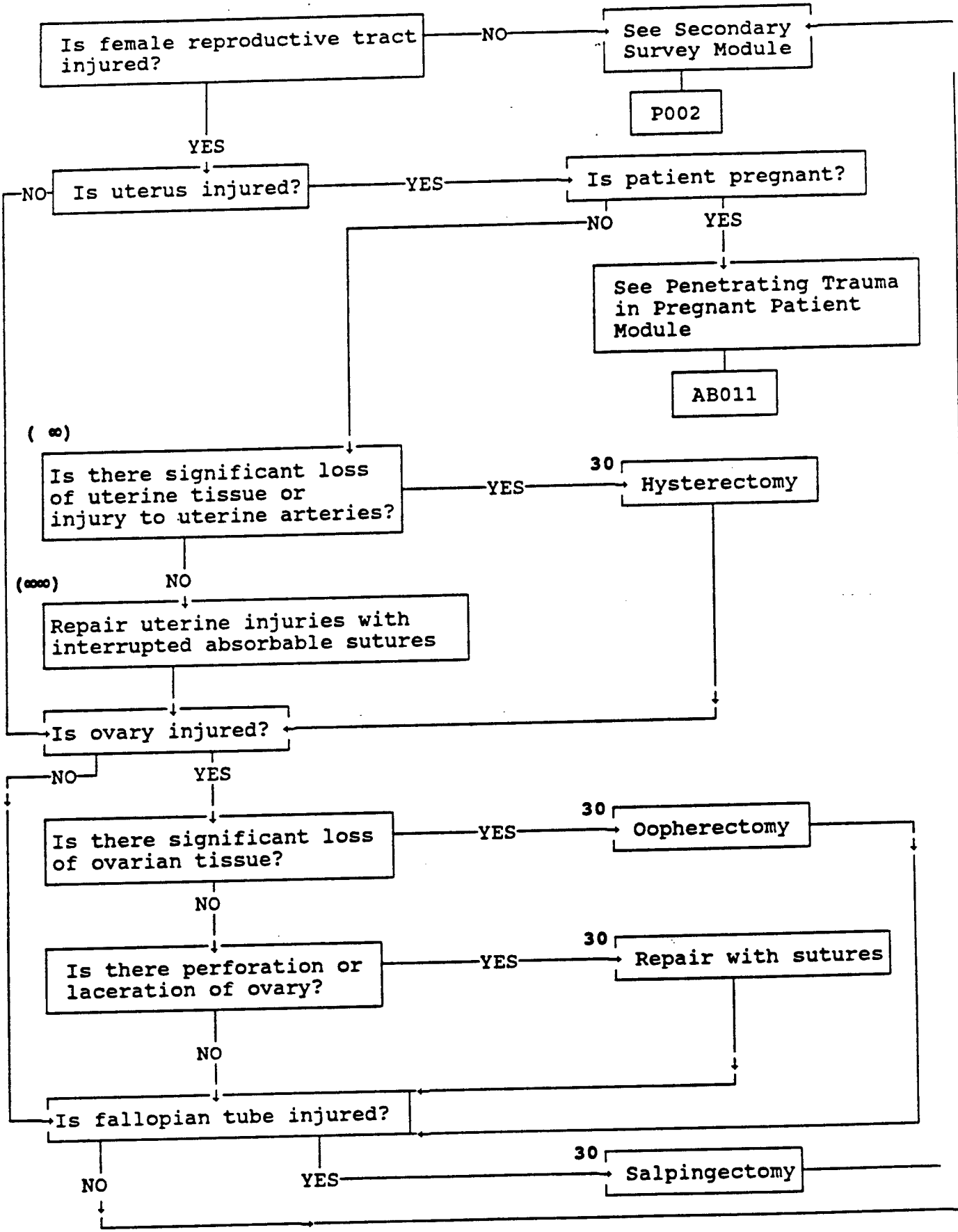
DUODENUM INJURY MODULE



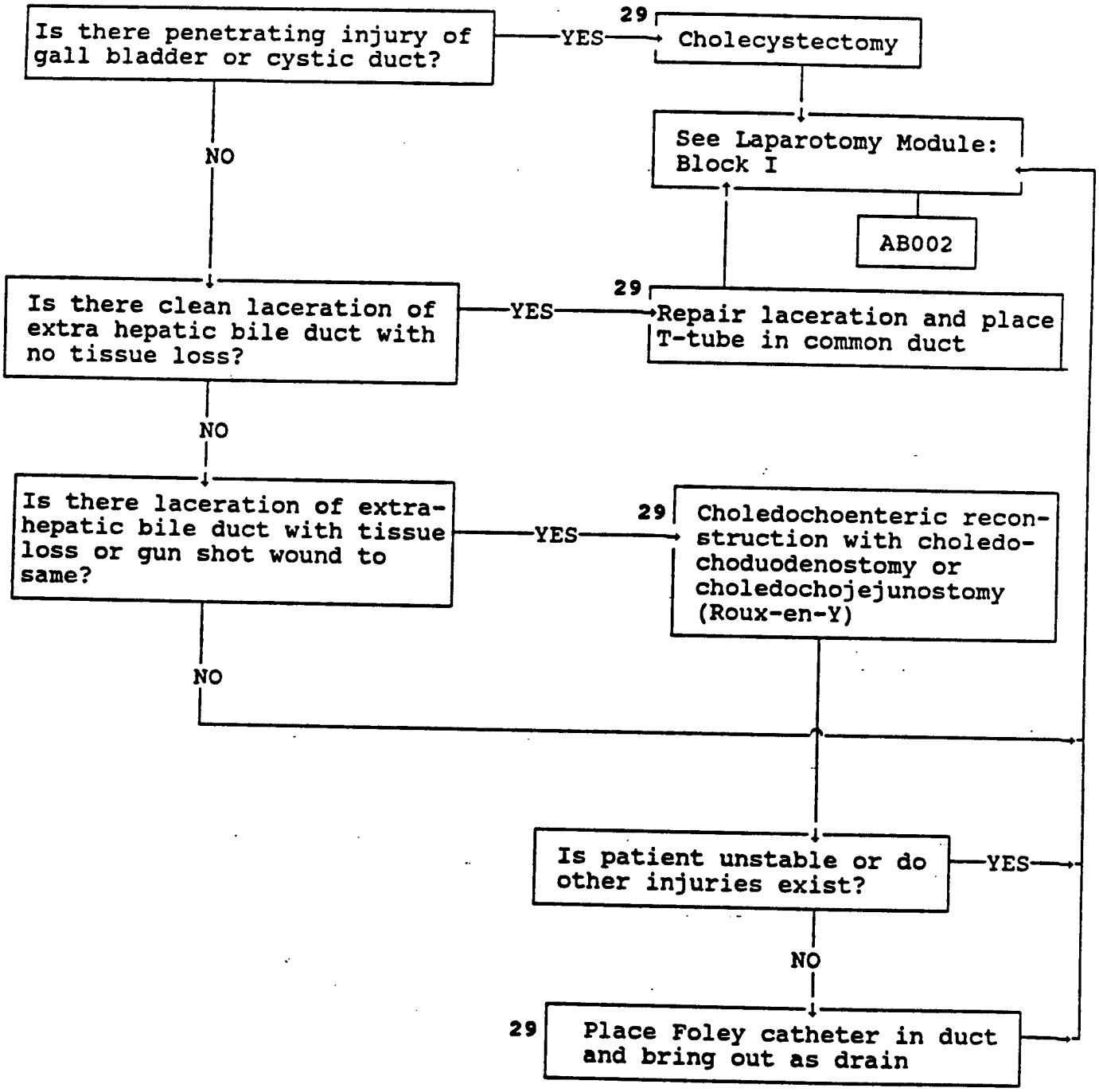
EXTRAHEPATIC BILIARY TRACT INJURY MODULE



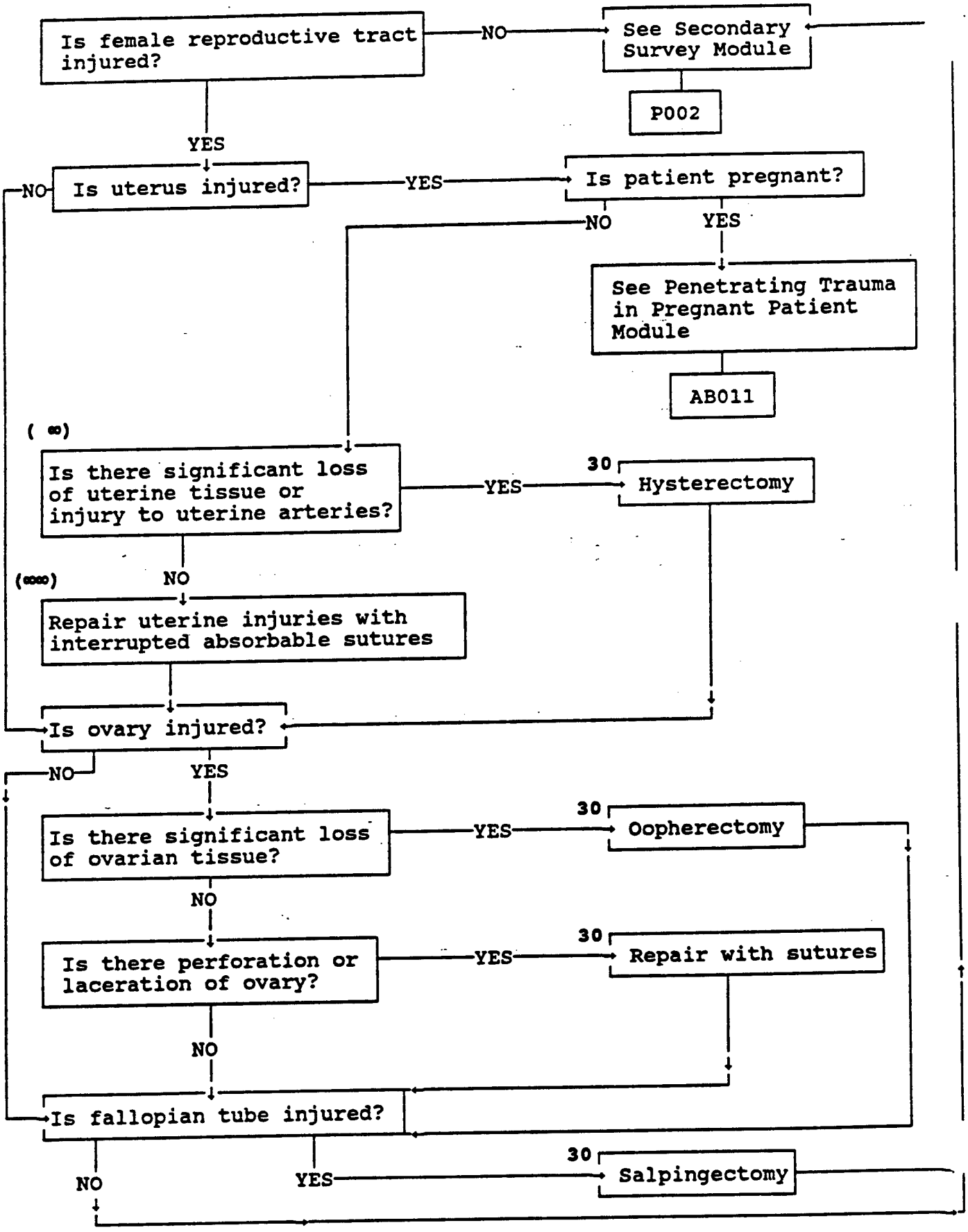
FEMALE REPRODUCTIVE TRACT INJURY MODULE



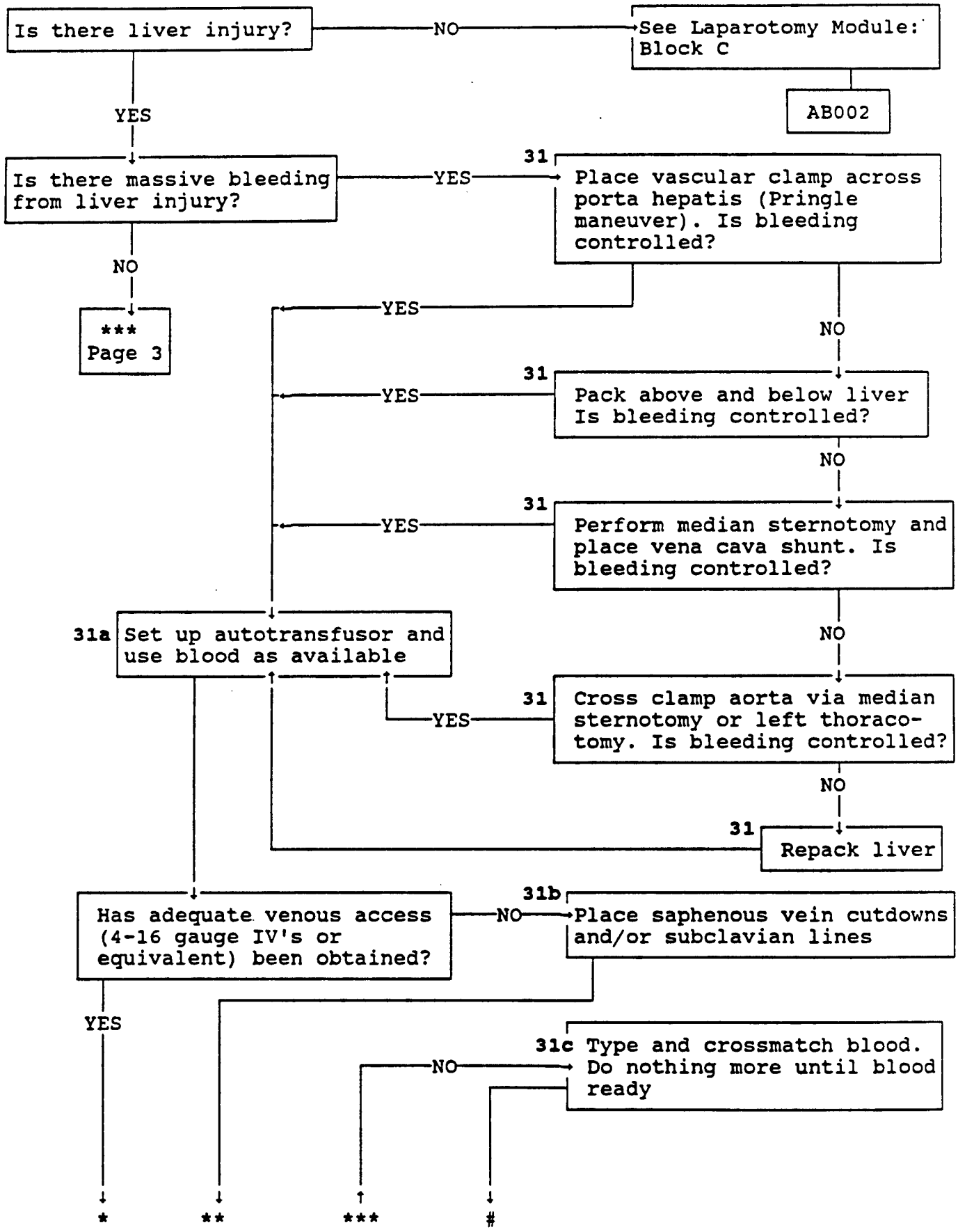
EXTRAHEPATIC BILIARY TRACT INJURY MODULE



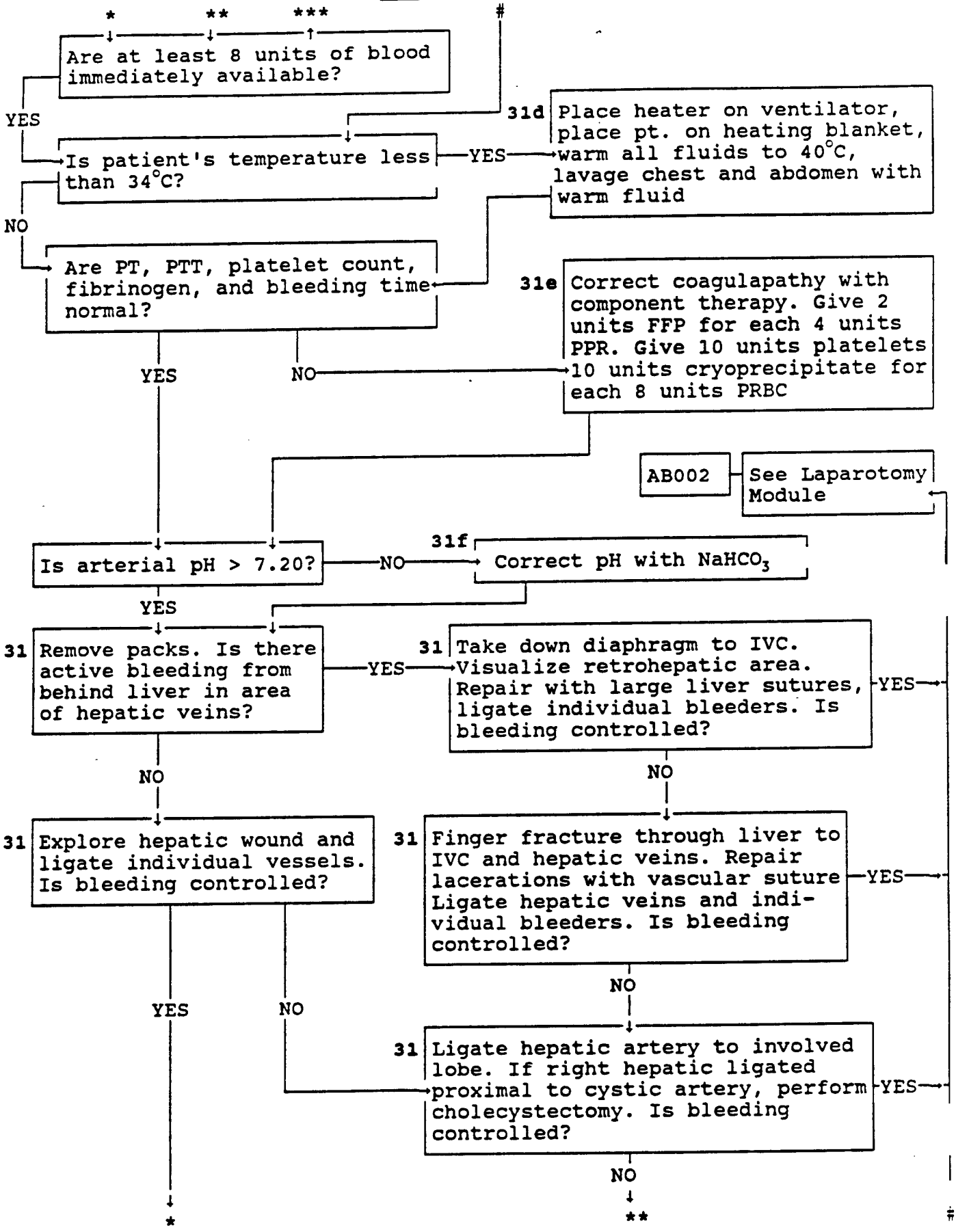
FEMALE REPRODUCTIVE TRACT INJURY MODULE

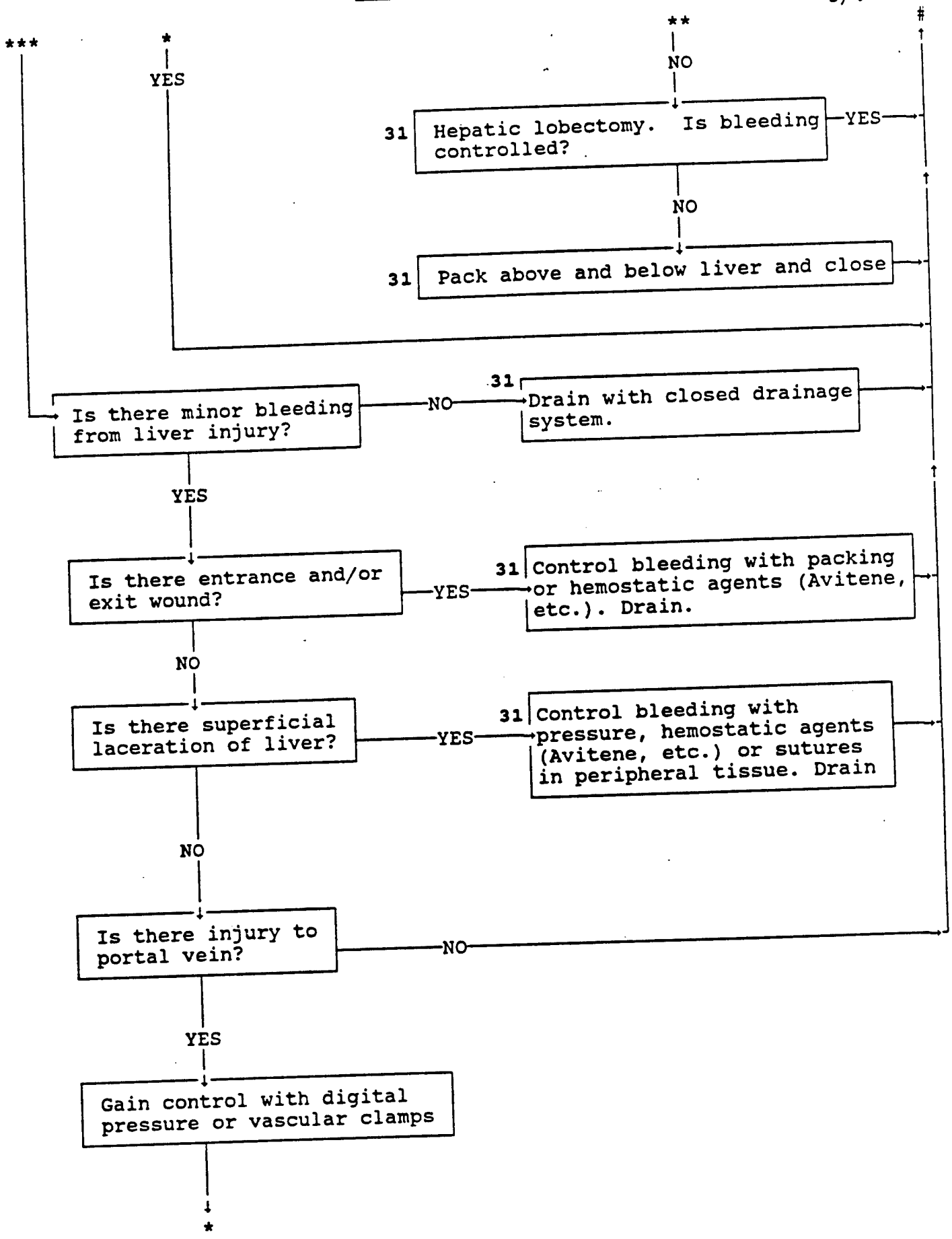


LIVER INJURY MODULE

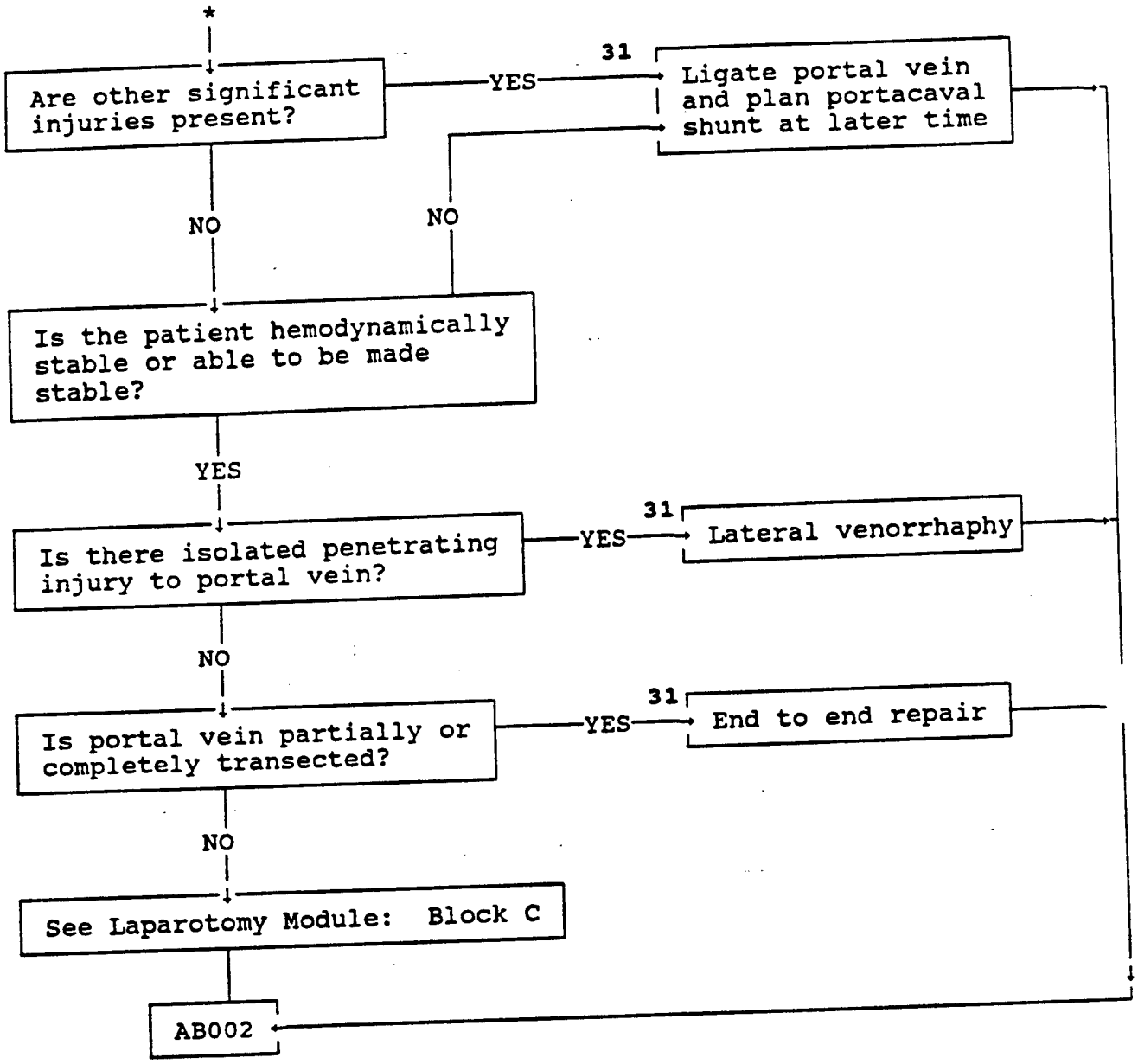


LIVER INJURY MODULE

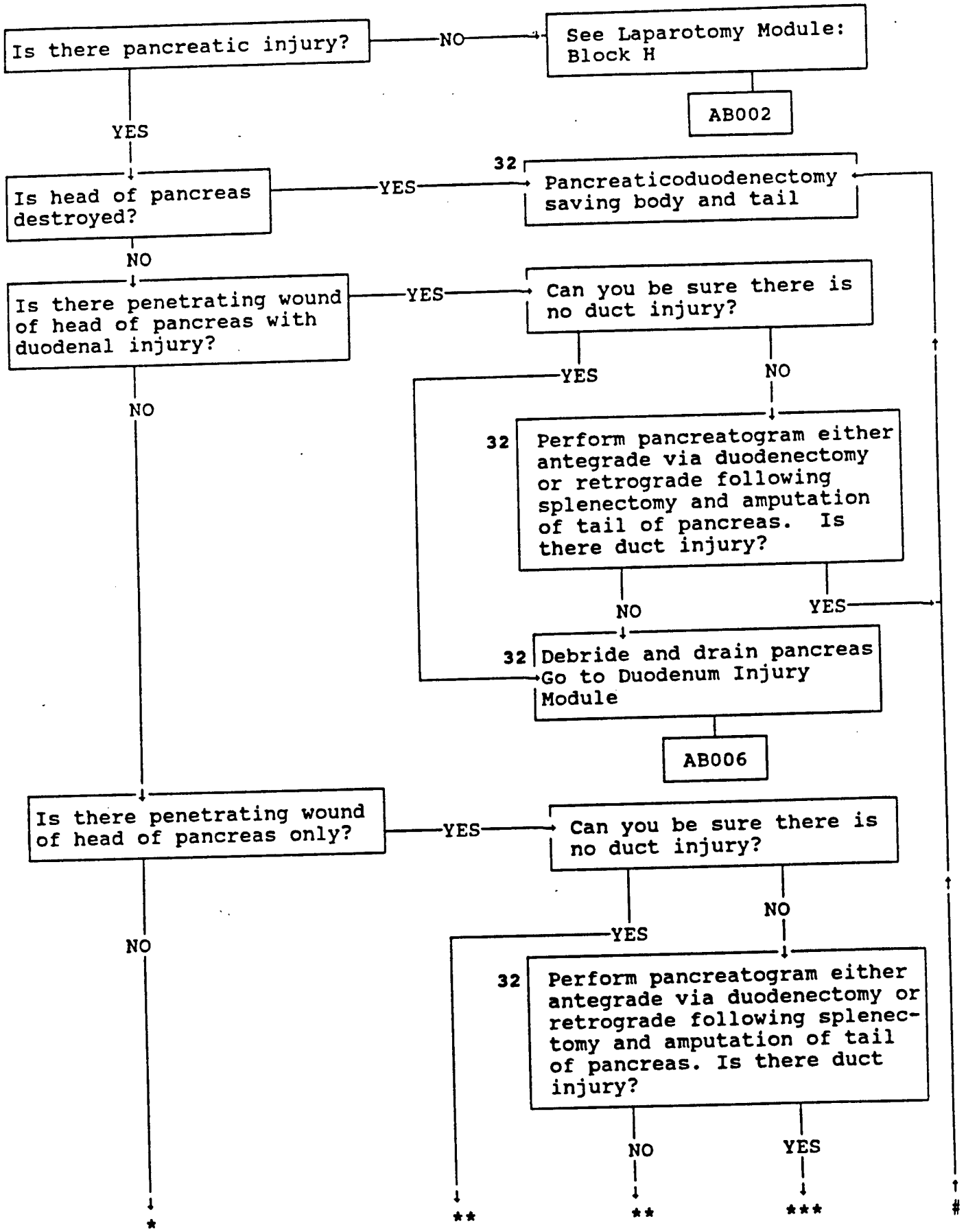



***
*
YES
**
NO
31 Hepatic lobectomy. Is bleeding controlled?
YES
NO
31 Pack above and below liver and close
#
Is there minor bleeding from liver injury?
NO
31 Drain with closed drainage system.
YES
Is there entrance and/or exit wound?
YES
31 Control bleeding with packing or hemostatic agents (Avitene, etc.). Drain.
NO
Is there superficial laceration of liver?
YES
31 Control bleeding with pressure, hemostatic agents (Avitene, etc.) or sutures in peripheral tissue. Drain
NO
Is there injury to portal vein?
NO
YES
Gain control with digital pressure or vascular clamps
*

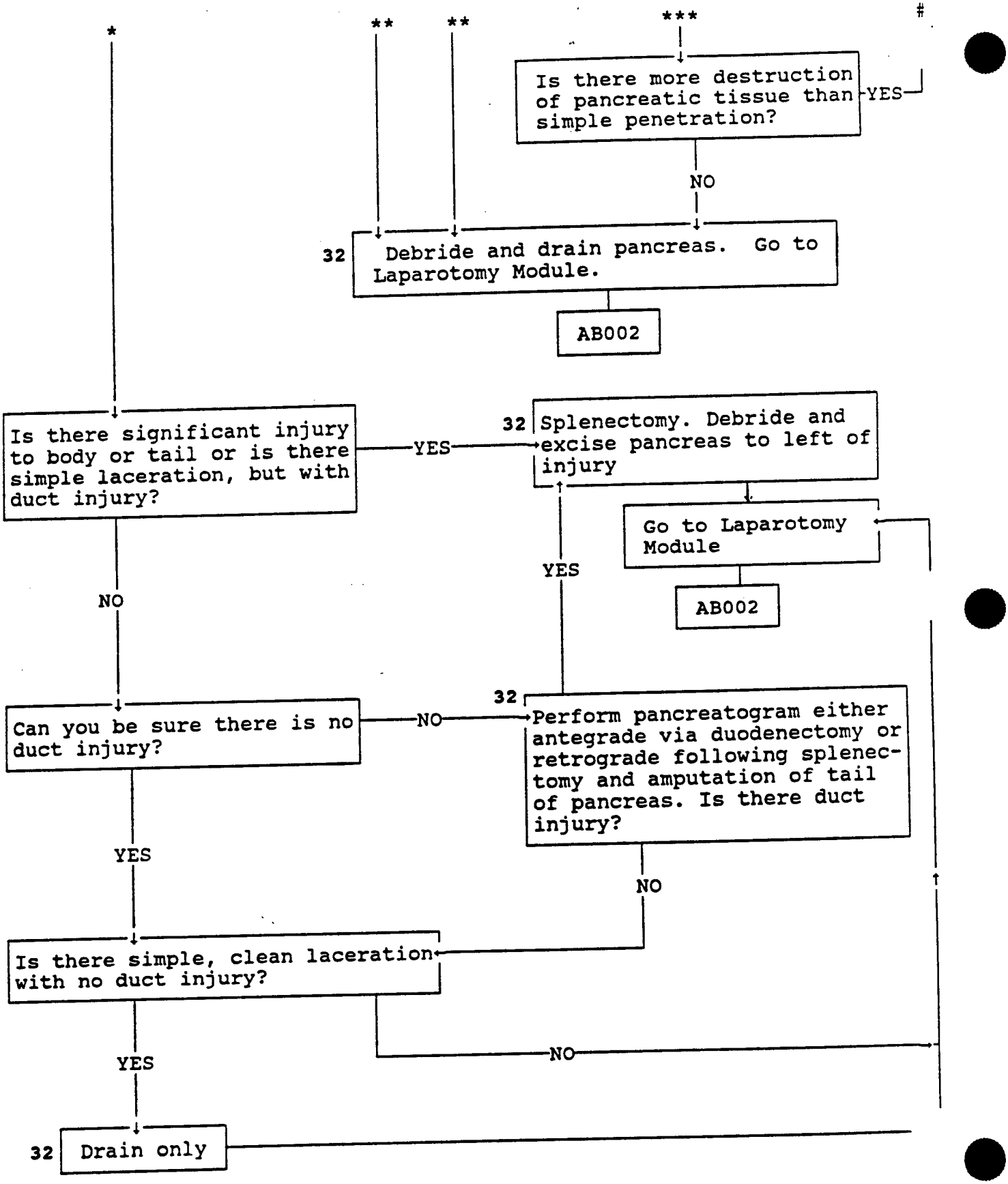
LIVER INJURY MODULE



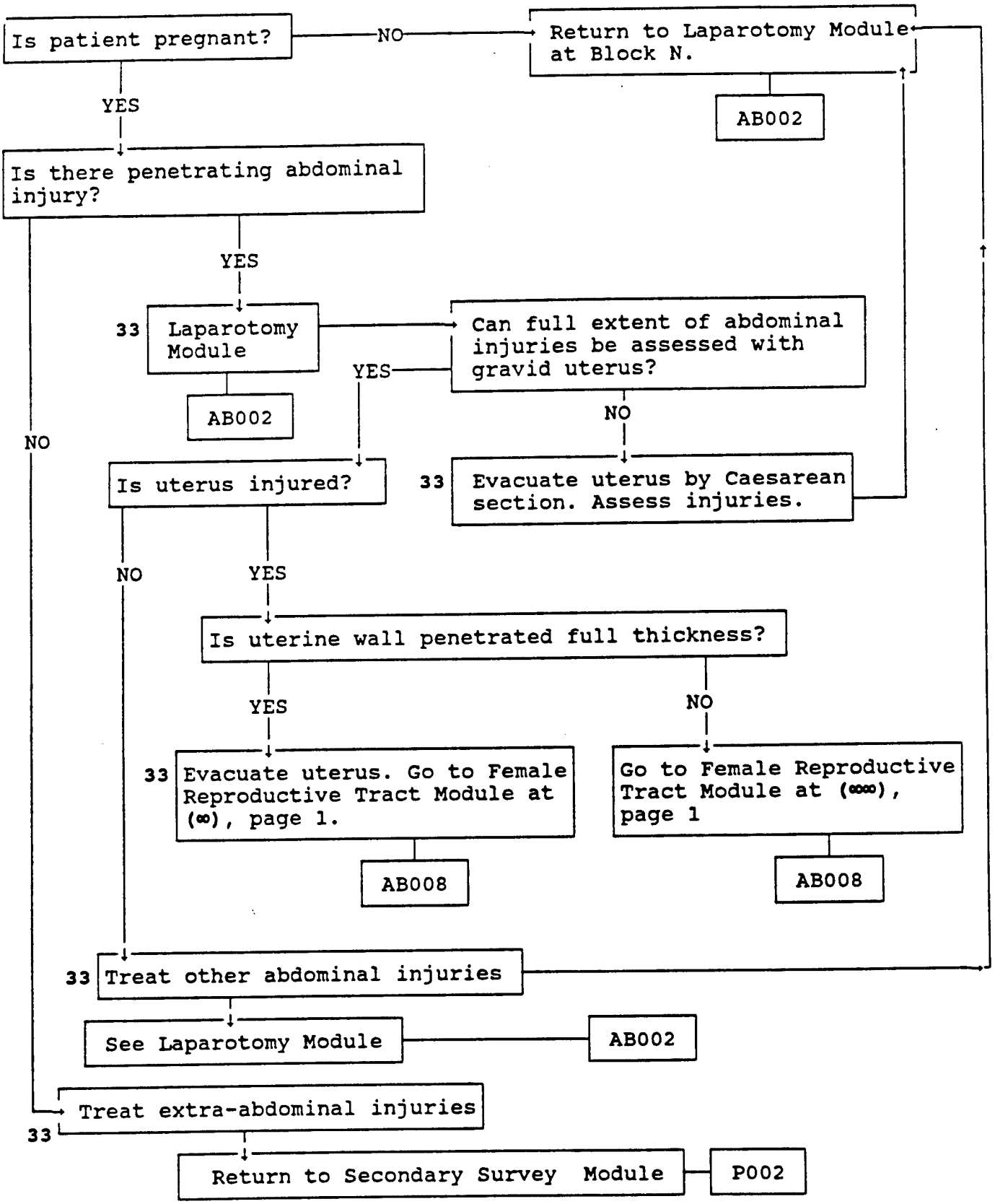
PANCREAS INJURY MODULE



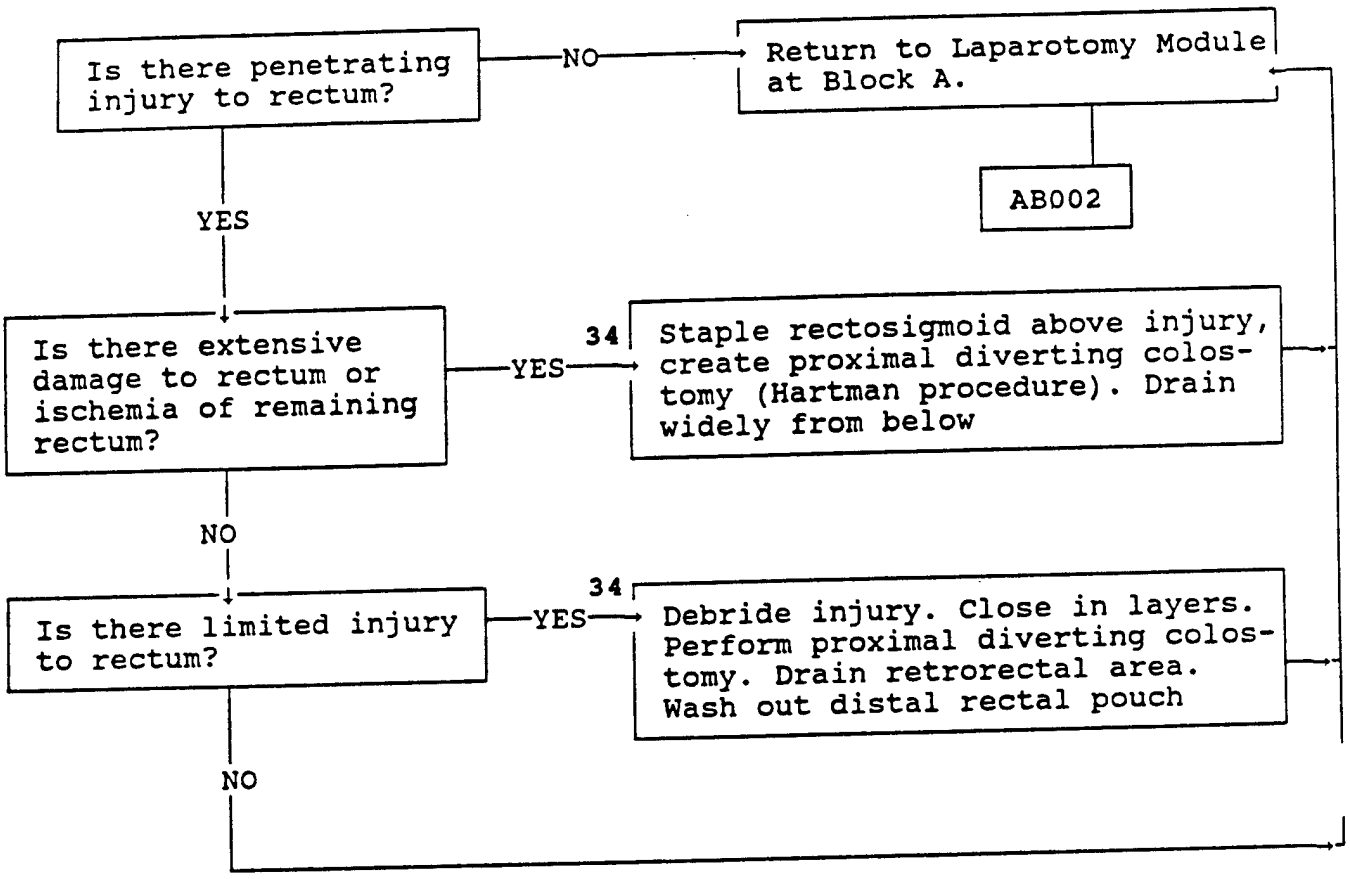
PANCREAS INJURY MODULE



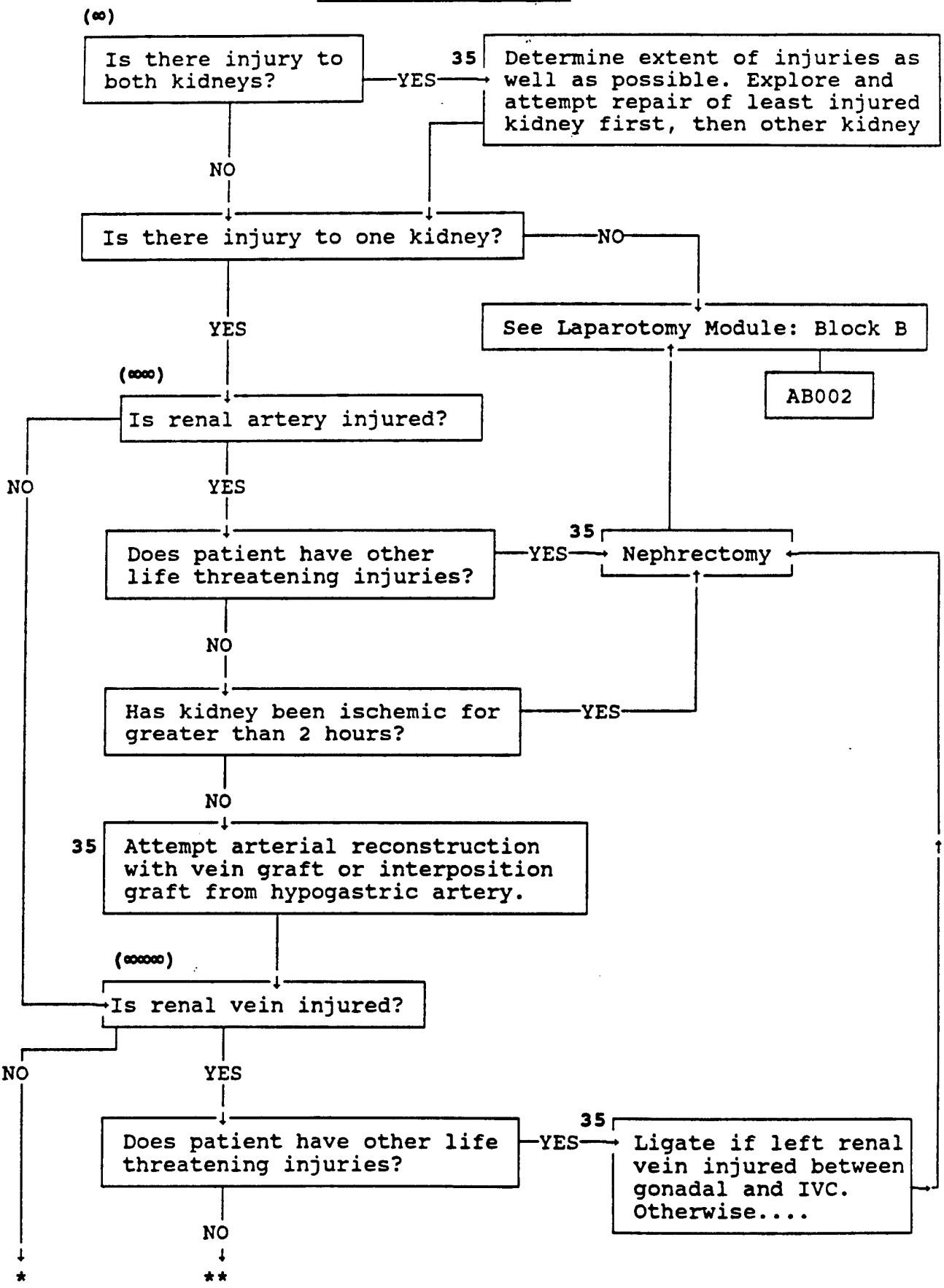
PENETRATING TRAUMA IN PREGNANT PATIENT MODULE



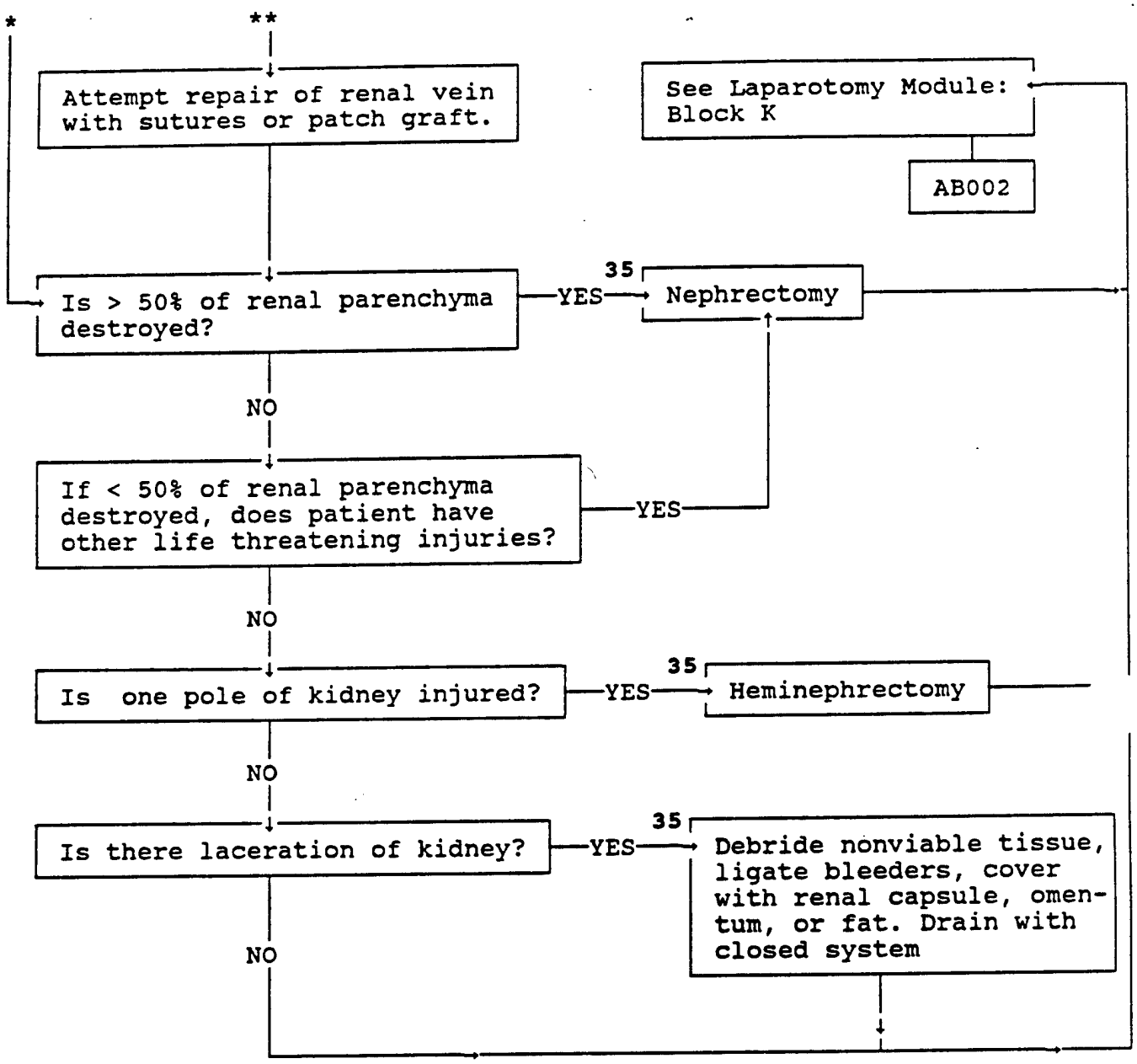
RECTUM INJURY MODULE



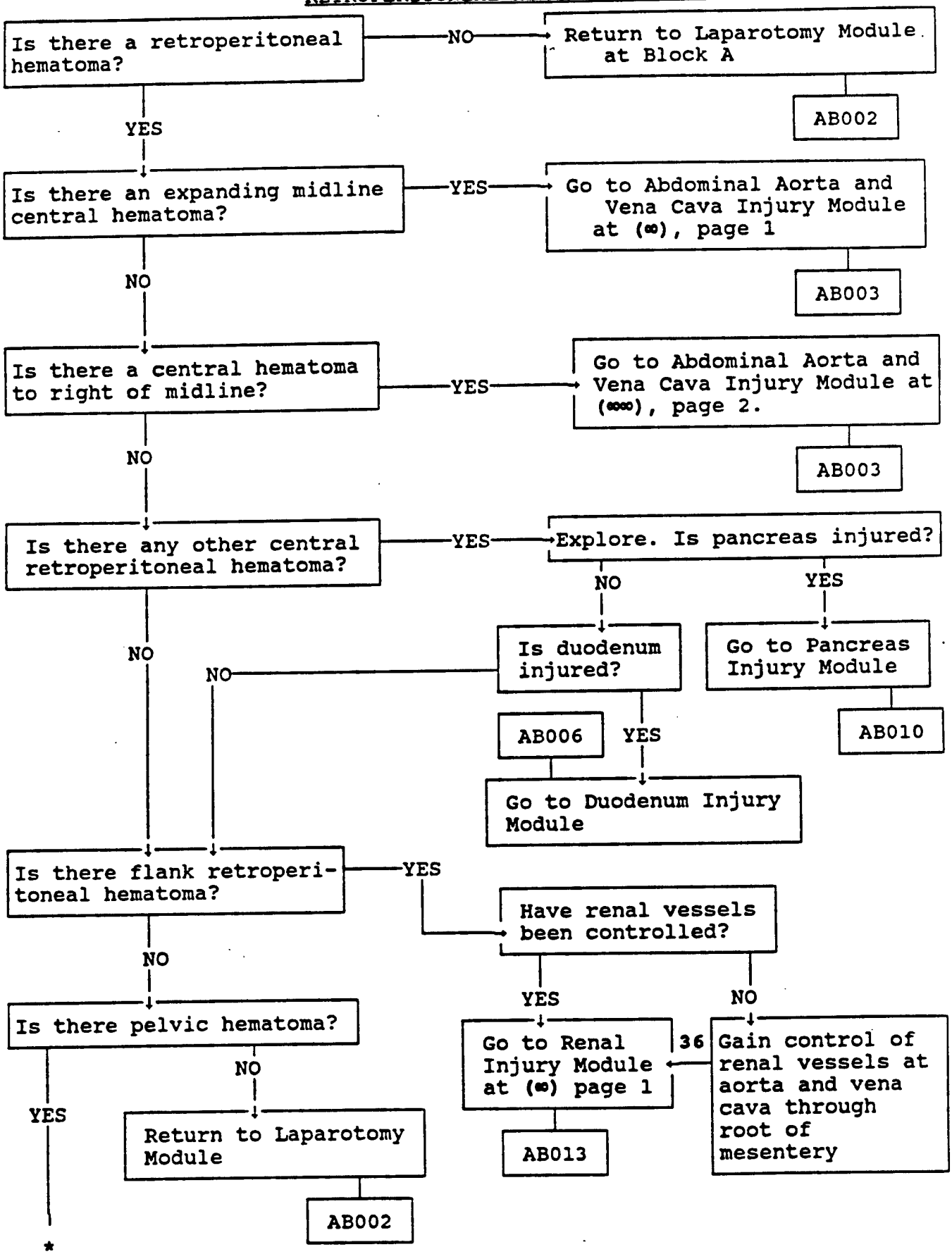
RENAL INJURY MODULE



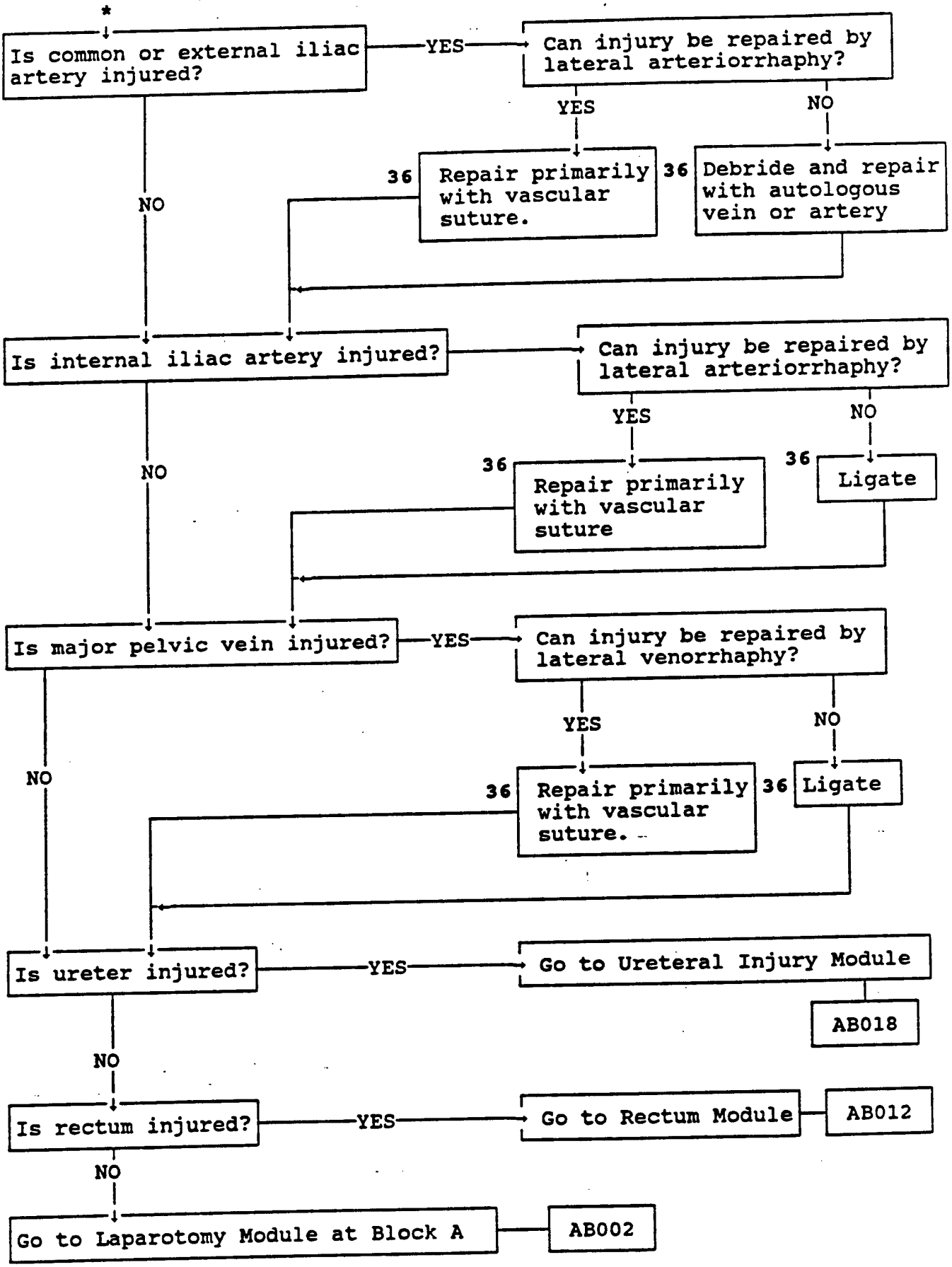
RENAL INJURY MODULE



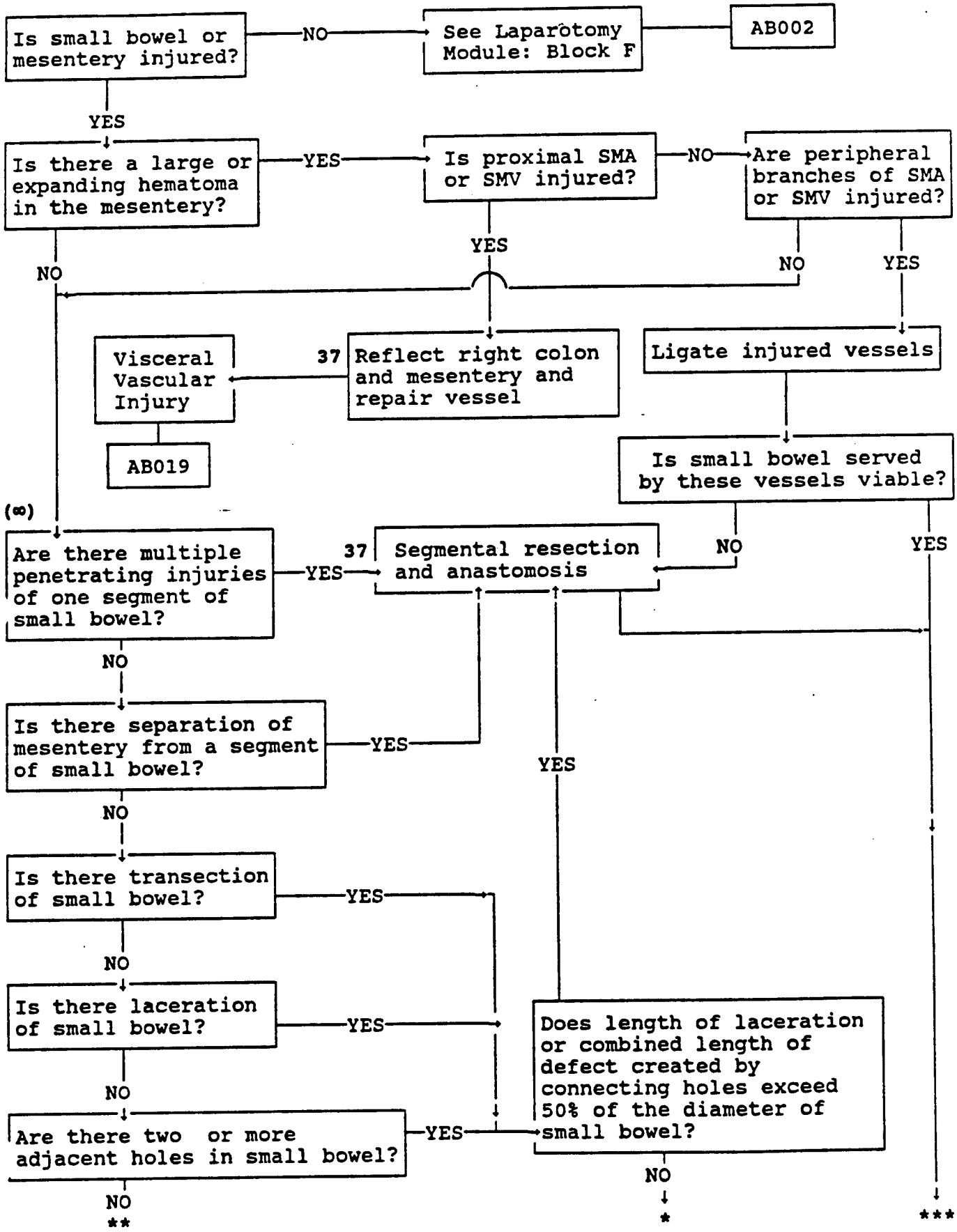
RETROPERITONEAL HEMATOMA MODULE



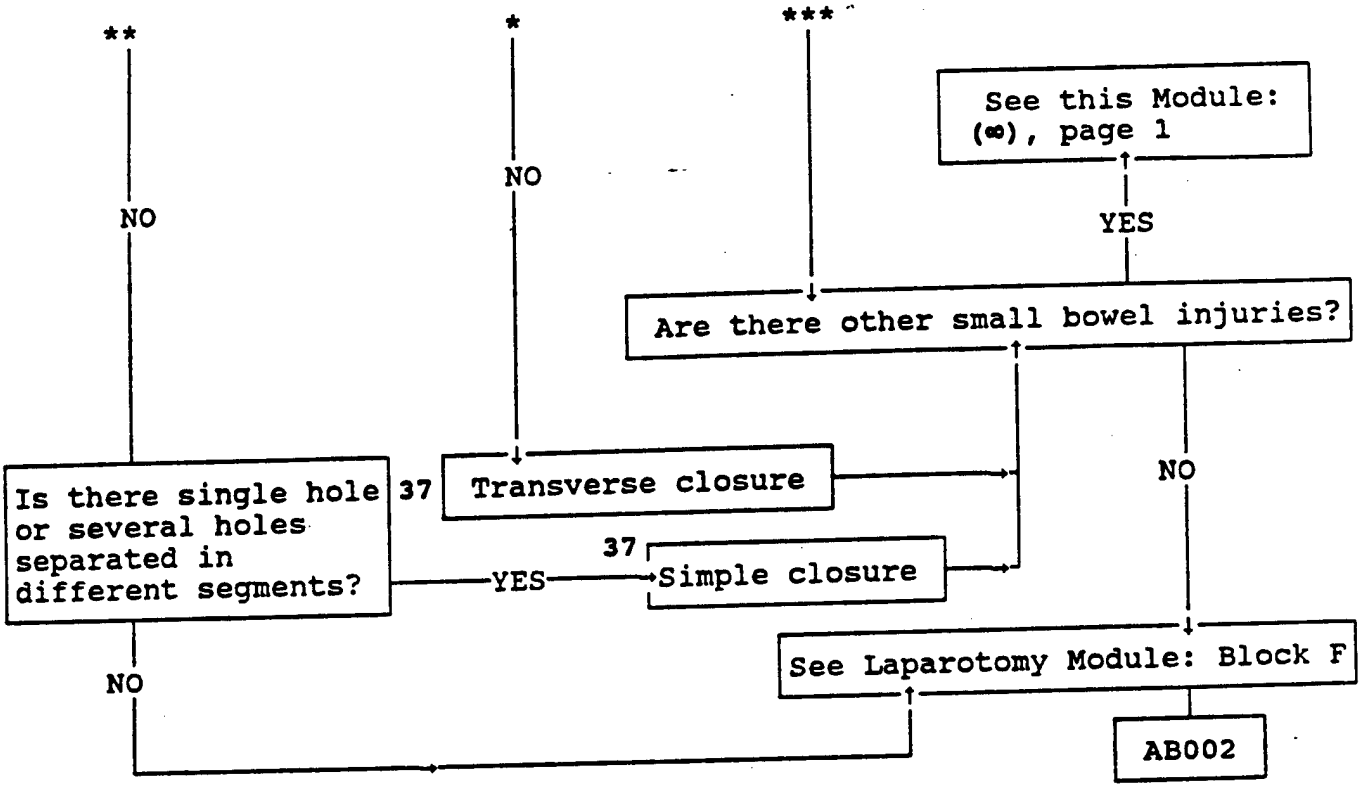
RETROPERITONEAL HEMATOMA MODULE



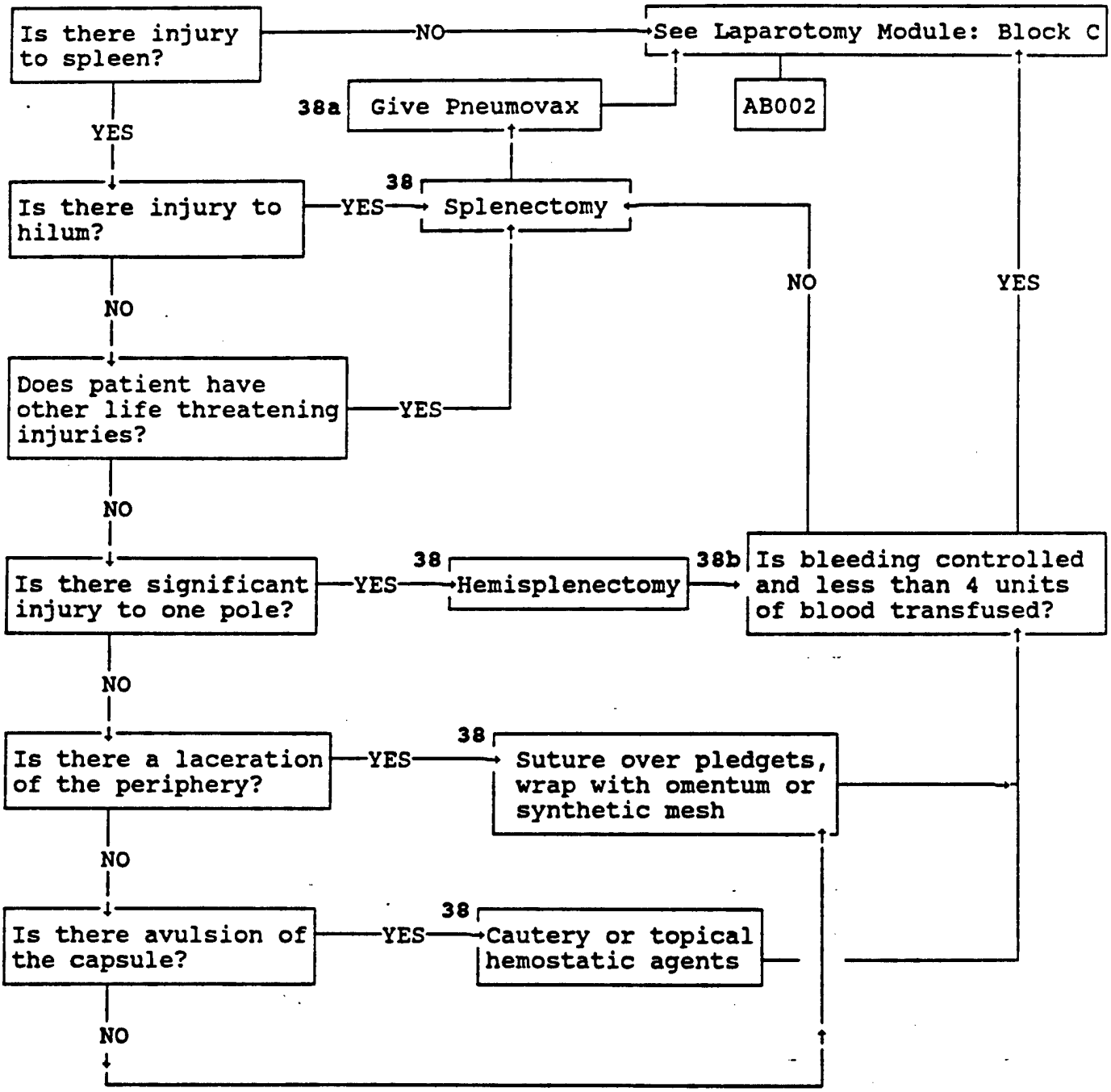
SMALL BOWEL AND MESENTERY INJURY MODULE



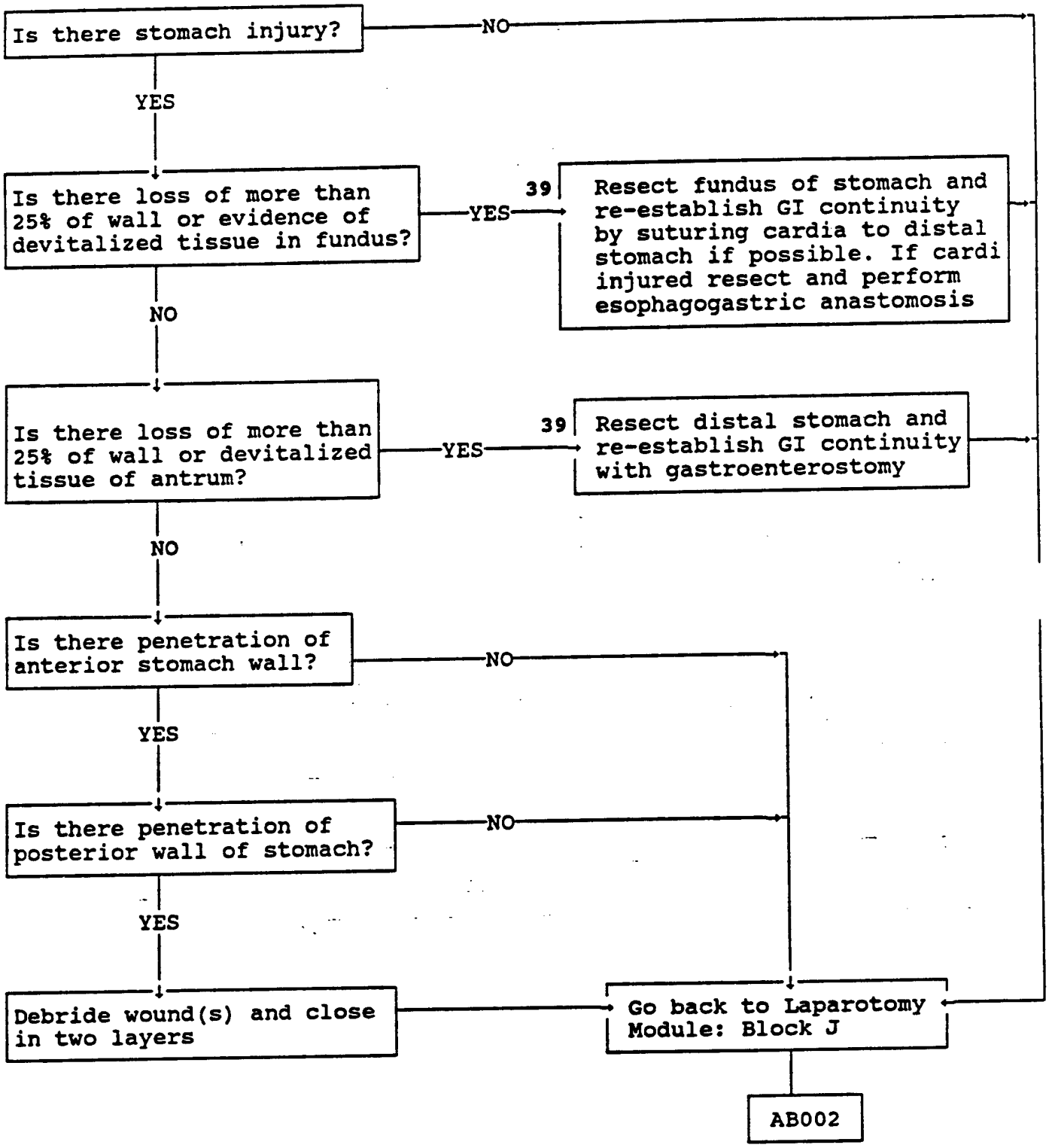
SMALL BOWEL AND MESENTERY INJURY MODULE



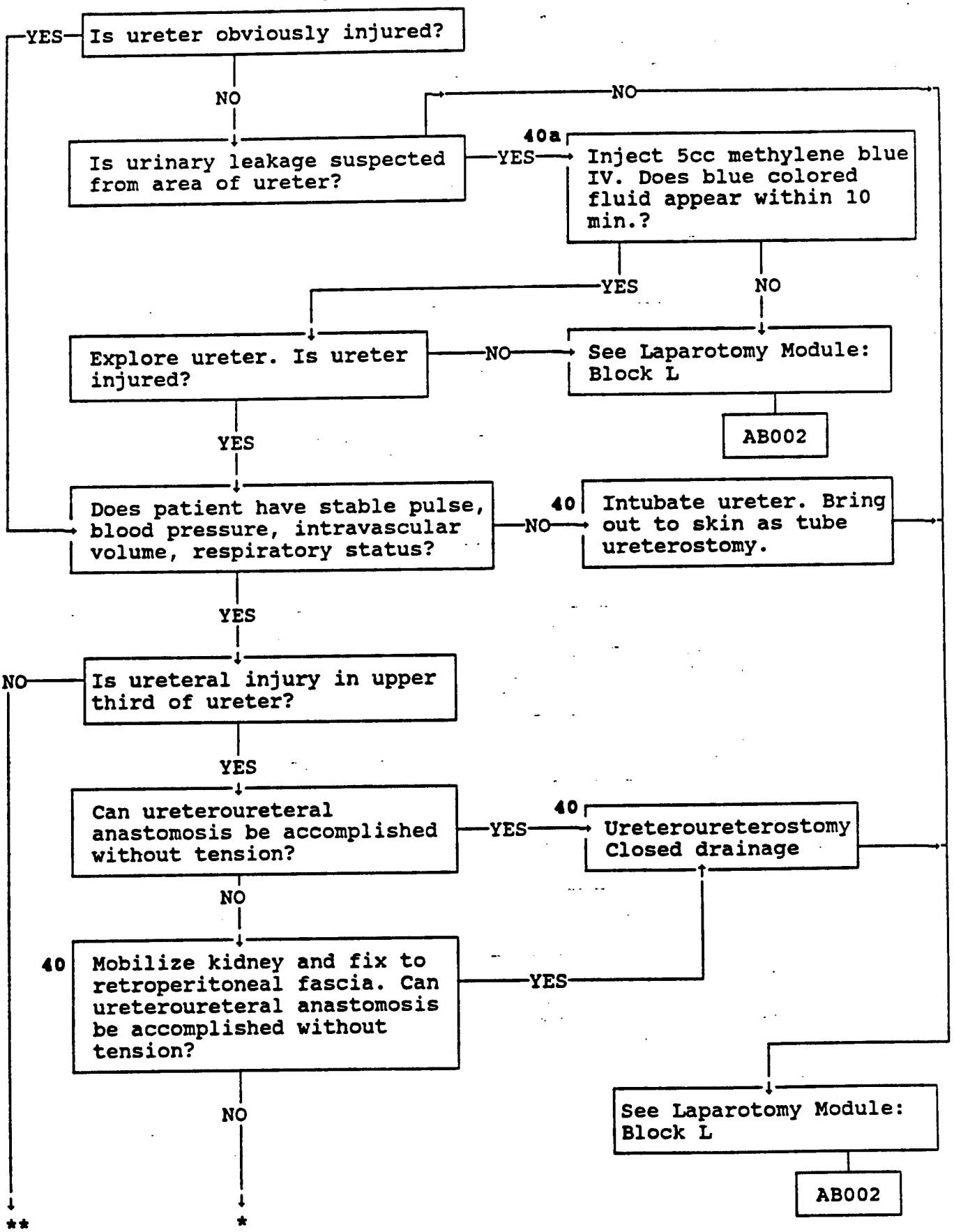
SPLEEN INJURY MODULE



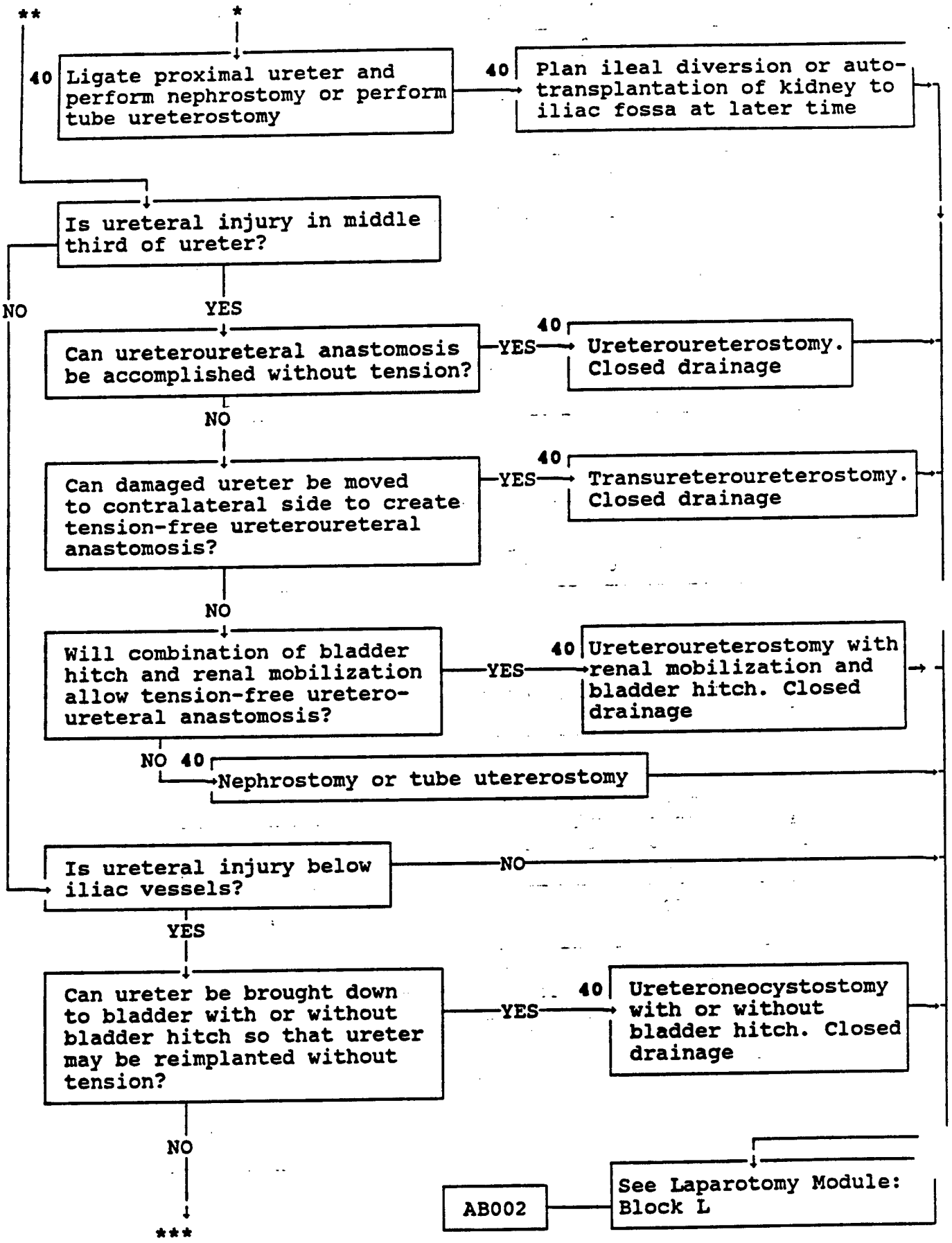
STOMACH INJURY MODULE



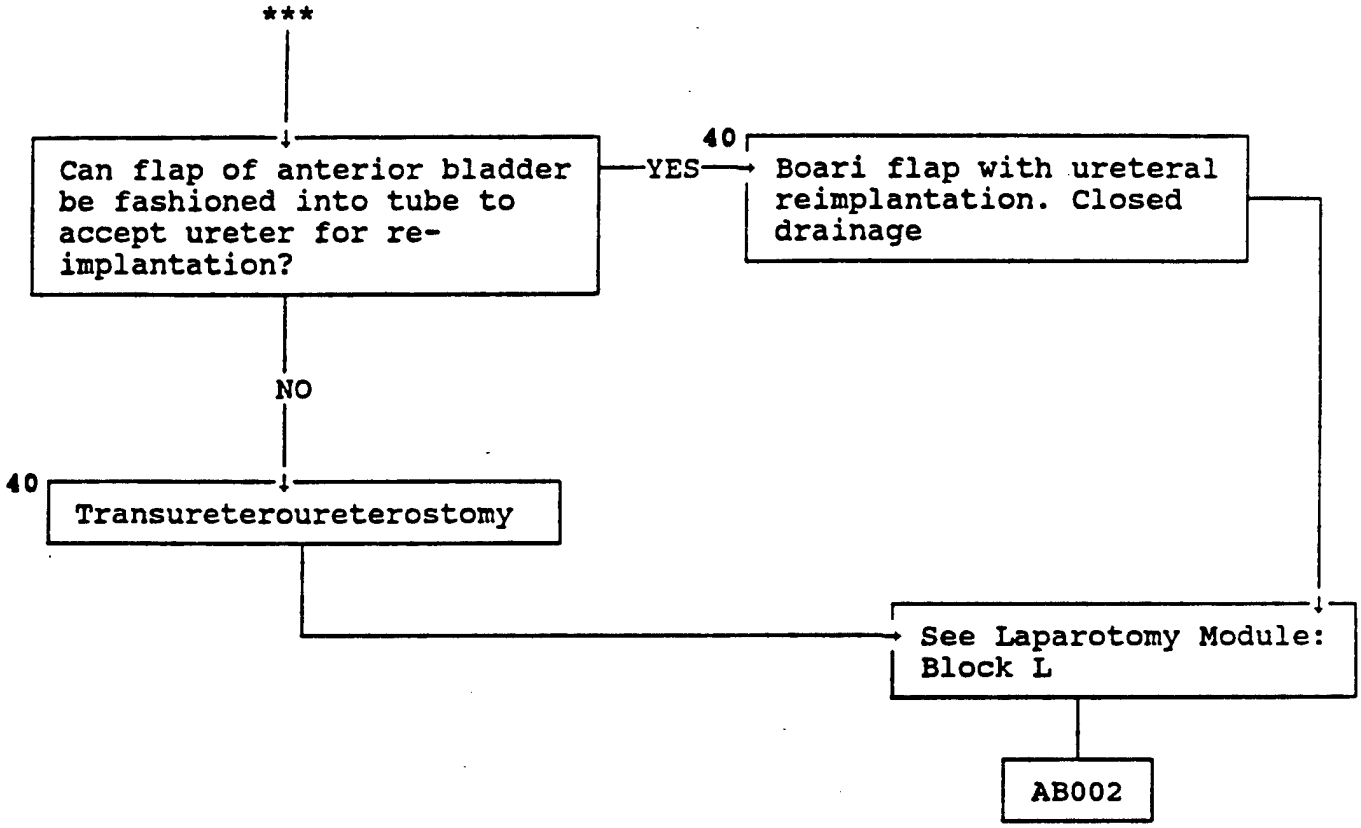
URETERAL INJURY MODULE



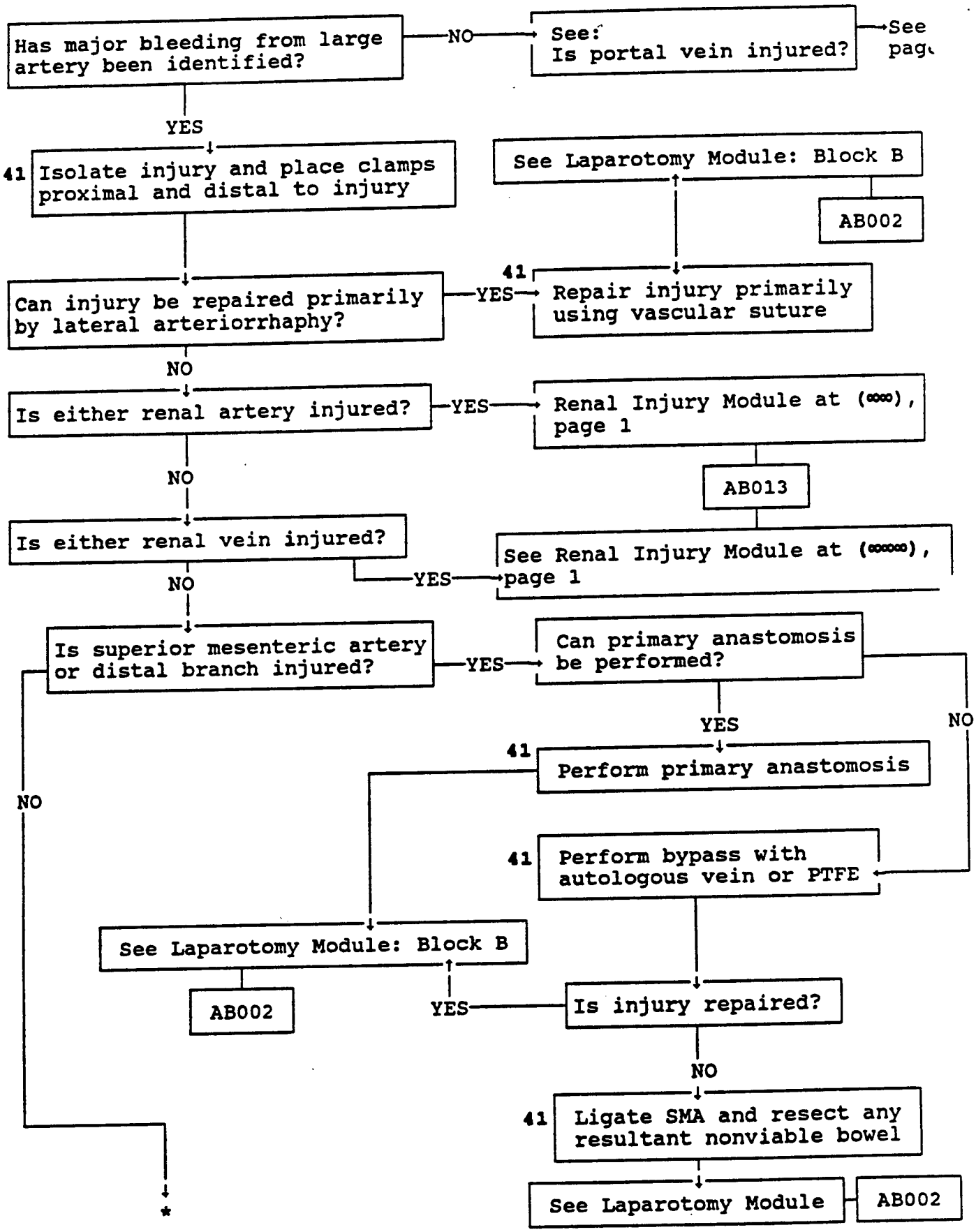
URETERAL INJURY MODULE



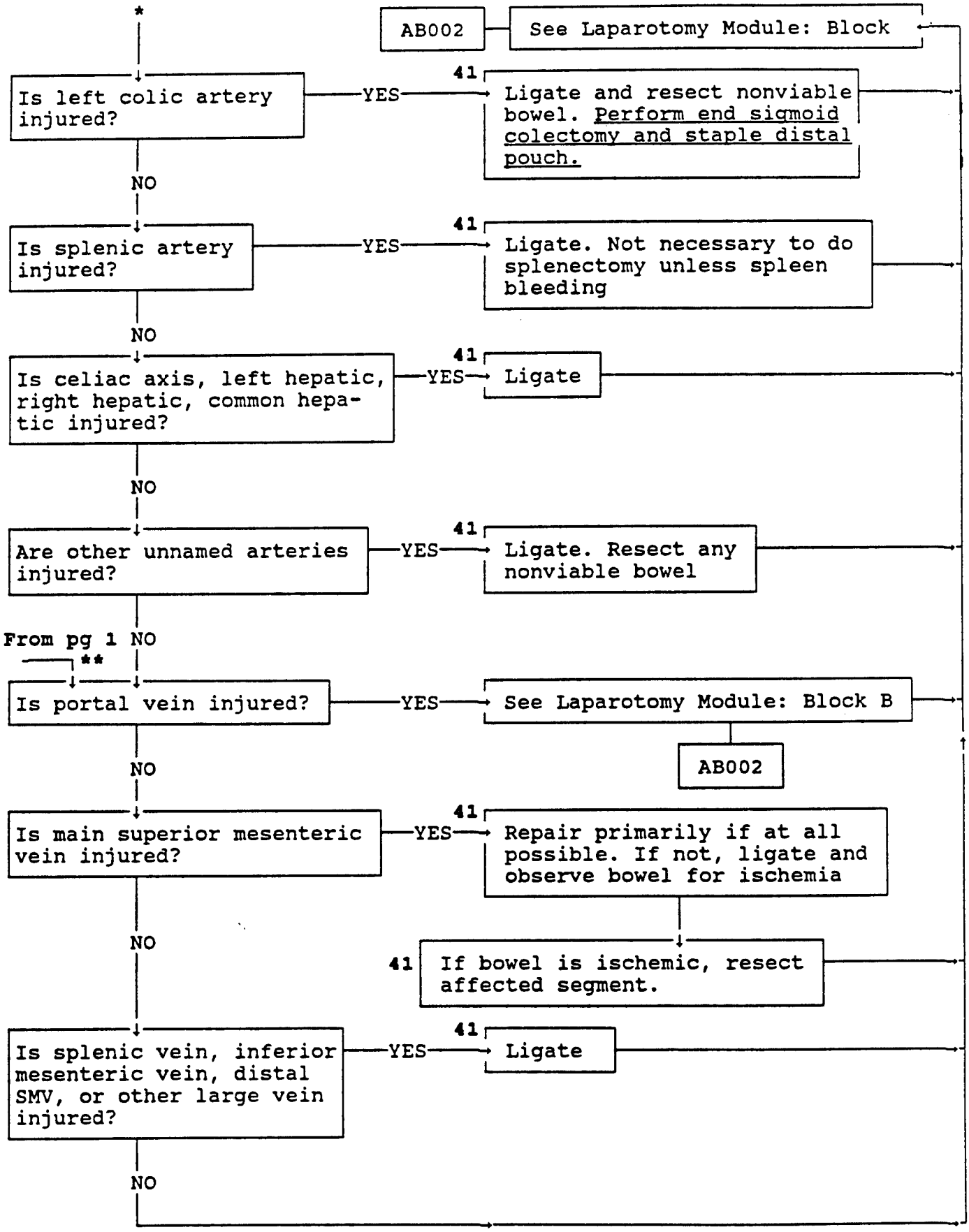
URETERAL INJURY MODULE



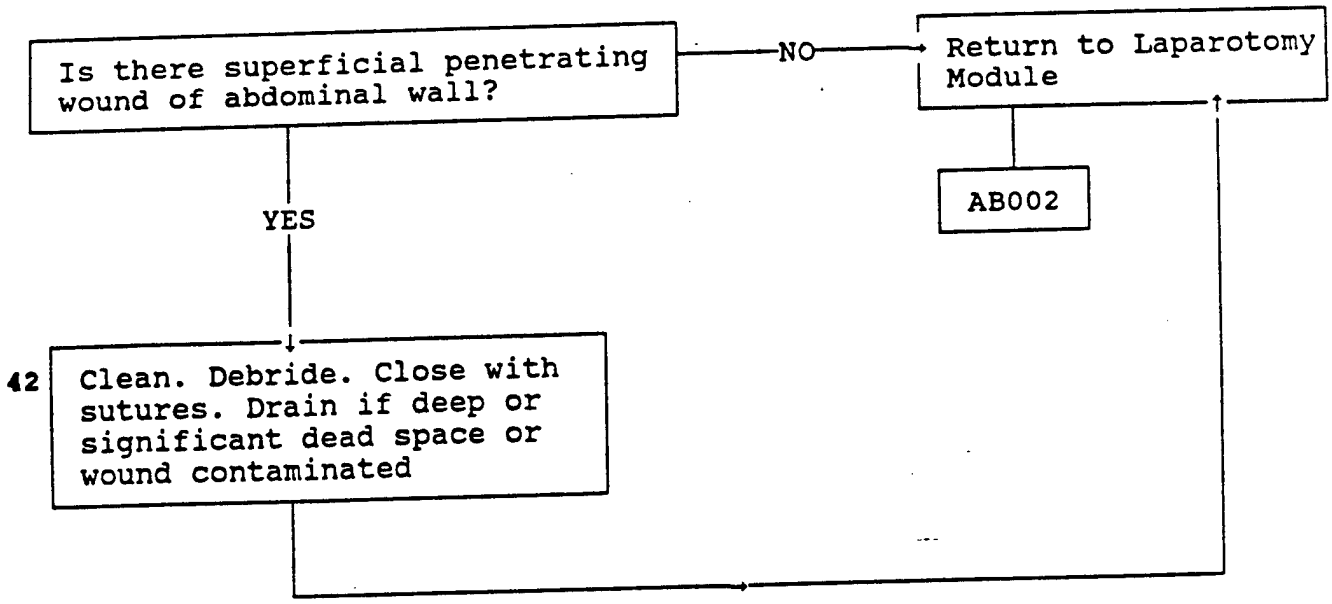
VISCERAL VASCULAR INJURIES MODULE



VISCERAL VASCULAR INJURIES MODULE



SUPERFICIAL INJURY MODULE



12
EXTERNAL GENITALIA

Piss when you can.
[Attributed to the Duke of Wellington,
When asked by a young subaltern for some
piece of permanent military wisdom]

A. Overview

This section deals with the treatment of traumatic injuries to both male and female eternal genitalia.

B. Operation Desert Storm Case Reports

[The authors are in the process of compiling case scenarios drawn from Desert Storm experience. We would greatly appreciate your help in this task. All case reports will acknowledge the surgeon who reported the case (given that the surgeon would like this information printed).
The report should be (roughly)in the following format:

1. Patient identifying information.
   A 24 yo B Marine corporal . . .

2. Combat situation. True "war stories" are encouraged.
   . . . was involve in an amphibious assault exercise on friendly shores in Saudi Arabia when an M-16 accidentally fired . . .

3. Injury description.
   Striking him in the L groin region . . .

4. Presentation to the hospital ship/field hospital.
   He was immediately evacuated by SH-3 helicopter to the hospital ship USS Mercy. Initial vital signs were . . . he was sent to the OR approximately 45 minutes after the initial injury.

5. Describe OR procedures used. Where possible, refer to appropriate algorithm. Be sure to point out why deviation from the algorithm (if any) occurred. Be sure to point out

limitations due to lack of equipment, special circumstances, or any other item of interest.
Area was quickly prepped . . . scrotal injury with major bleeding obscured the field. The spermatic cord was compressed against the pubic tubercle to control hemorrhage (Node G002, 1/2). . .

6. Post op course.
Recovery was uneventful. After two days he was transferred via Air Force C-9 to . . .

7. Any other "pearls" or difficulties you'd like to discuss.

8. Your name, unit, overseas address, permanent address and phone number (not required).

CAPT Joe Jones (USN(R), General Surgeon assigned to U.S.S. Mercy, FPO . . ., 111 Main St, Topeka, KS 50000. (555)222-1212.

9. Be sure that all information sent is unclassified and does not disclose information that might be harmful to the forces presently involved.

We understand the circumstances under which many of you are operating. Ideally, submit on word perfect disc. Typewritten next best option. Scribbled on the back of a piece of MRE wrapping--just fine. We are looking for <u>common cases</u> as well as the more esoteric.

Mail to:
CDR J.M. Linenger, MC, USN
Naval Health Research Center
San Diego, CA 92186-5122
(619) 553-6896
(619) 553-6890 (FAX)

We feel that these case scenarios will be useful to future combat surgeons with less experience than your own, and we greatly appreciate your contributions. Thank you.]

C. Decision Trees

EXTERNAL GENITALIA

Key to specialty codes: A - Surgeon; B - Specialty Surgeon
C - Anesthesiologist; D - Nurse
E - Corpsman

Key to care descriptors: 1 - Minimal
2 - Adequate
3 - Optimal
* - With training

TREATMENT	SPECIALTY CODES A	B	C	D	E	EQUIPMENT
1. Repair injury to vulva	2*	3				Basic Instrument List; Secondary List
2. Pack or repair vaginal injury	2*	3				Basic Instrument List; Secondary List
3. Place urethral catheter	2*	3				Secondary List
4. Repair urethral injury, stent, place supra-pubic cystostomy	2*	3				Basic Instrument List; Cysto Instrument List; Secondary List
5. Compress spermatic cord against pubic tubercle	2*	3				Basic Instrument List; Secondary List
6. Explore scrotum and control bleeding	2*	3				Basic Instrument List; Secondary List
7. Orchiectomy	2*	3				Basic Instrument List; Secondary List
8. Suture wound	2*	3				Basic Instrument List; Secondary List
9. Place testis in thigh pouch	2*	3				Basic Instrument List; Plastics Instrument List; Secondary List
10. Apply full thickness skin graft	2*	3				Basic Instrument List; Plastics Instrument List; Secondary List
11. Amputate penis and place urethral catheter	2*	3				Basic Instrument List; Secondary List
12. Place urethral catheter, debride necrotic penile tissue, close Buck's fascia and skin	2*	3				Basic Instrument List; Secondary List
13. Suprapubic cystostomy, delayed repair. Debride necrotic penile tissue, close fascia and skin	2*	3				Basic Instrument List; Secondary List
14. Remove fascia sutures, and pack wound	2*	3				Basic Instrument List; Secondary List

********** Explanation of Specialty Codes and Care Descriptors **********

In all cases, procedures are optimally performed by a gynecology surgeon for female patients, a genito-urinary surgeon for males, and a urologist for injuries involving the urinary tract. At point 10, a plastic surgeon would be an optimal alternate to the urologist. A general surgeon could handle some procedures as indicated at points 8, 12, 13, and 14.

In general, number codes have been assigned to the anesthesiologist, nurse or corpsman who would handle the designated procedure at the same time that the general surgeon or specialist would be involved in other tasks.

Any number followed by an asterisk indicates that, <u>with training</u>, the care provider could do the procedure, but is not the optimal provider.

EXTERNAL GENITALIA

BASIC INSTRUMENT LIST

HEANEY RETRACTORS
BABY DEAVERS
RT. ANGLE RETRACTORS
WEIGHTED SPECULUM
SHARP RAKES
MED. WEITLANER
MED. BABY RICHARDSON
ARMY/NAVY RETR.
MEDIUM NEEDLE HOLDER
LONG NEEDLE HOLDER
HEANEY NEEDLE HOLDER
VAGINAL PACKING FORCEP
SPONGE STICK
LONG BABCOCKS
SINGLE TOOTHED TENACULUMS
LONG OCHSNERS
KOCKER'S
HEANEY MUELLERS
TONSIL CLAMPS
ALLISES GYNE AILSES - WIDE
STRAIGHT CRILES
CURVED CRILES
LONG METZENBAUM SCISSOR
MAYO SCISSOR
SUTURE SCISSAR
REG. TOWEL CLIPS
CURVED MOSQUITOES
STRAIGHT MOSQUITOES
#3 KNIFE HANDLE
LONG THUMB FORCEP W/TEETH
LONG RUSSIAN FORCEP
SHORT RUSSIAN FORCEPO
GYNE FORCEPS
ADSON FORCEP W/TEETH
METAL CATHETER
#12 FRAIZER SUCTION TIP

EXTERNAL GENITALIA

SECONDARY LIST

PERI/GYNE DRAPE
44" X 60" DRAPE
DRAPE TOWEL
MAYO STAND COVER
BACK TABLE COVER
SURGICAL GOWN
LARGE STERILE BASIN
CAUTERY HAND PIECE
CAUTERY MACHINE
CAUTERY GROUNDING PAD
SPONGE, LAP 12" X 12"
SPONGE, RAYTEX 4" X 4"
SUCTION TUBING 20'
SURGICAL GLOVES
IRRIGATION TUBING Y-TYPE
CATHETER, 16 FR. 5CC
CATHETER, 14 FR. 5CC
CATHETER, 22 FR. 5CC
CATHETER, 24 FR. 5CC
CATHETER, 26 FR. 5CC
STENTS, DOUBLE J
- 6 FR. 24CM
- 6 FR. 26CM
- 7 FR. 24CM
- 7 FR. 26CM
- 8 FR. 26CM
- 8 FR. 28CM

URINARY DRAINAGE BAG
SYRINGE, 30CC LUER LOK
KNIFE BLADE'S #11, #16, #10
PREP SET
MICROSCOPE
DERMATOME
DERMAMESHER
SUTURE
- SILK 2-0 STRAND 18"
- SILK 3-0 STRAND 18"
- SILK 3-0 STRAND SH NEEDLE
- NYLON 3-0 CUTTING
- NYLON 4-0 CUTTING
- VICRYL 3-0 SH CR/8

GAUZE DRESSING, 4" X 8"

EXTERNAL GENITALIA

CYSTO INSTRUMENT LIST

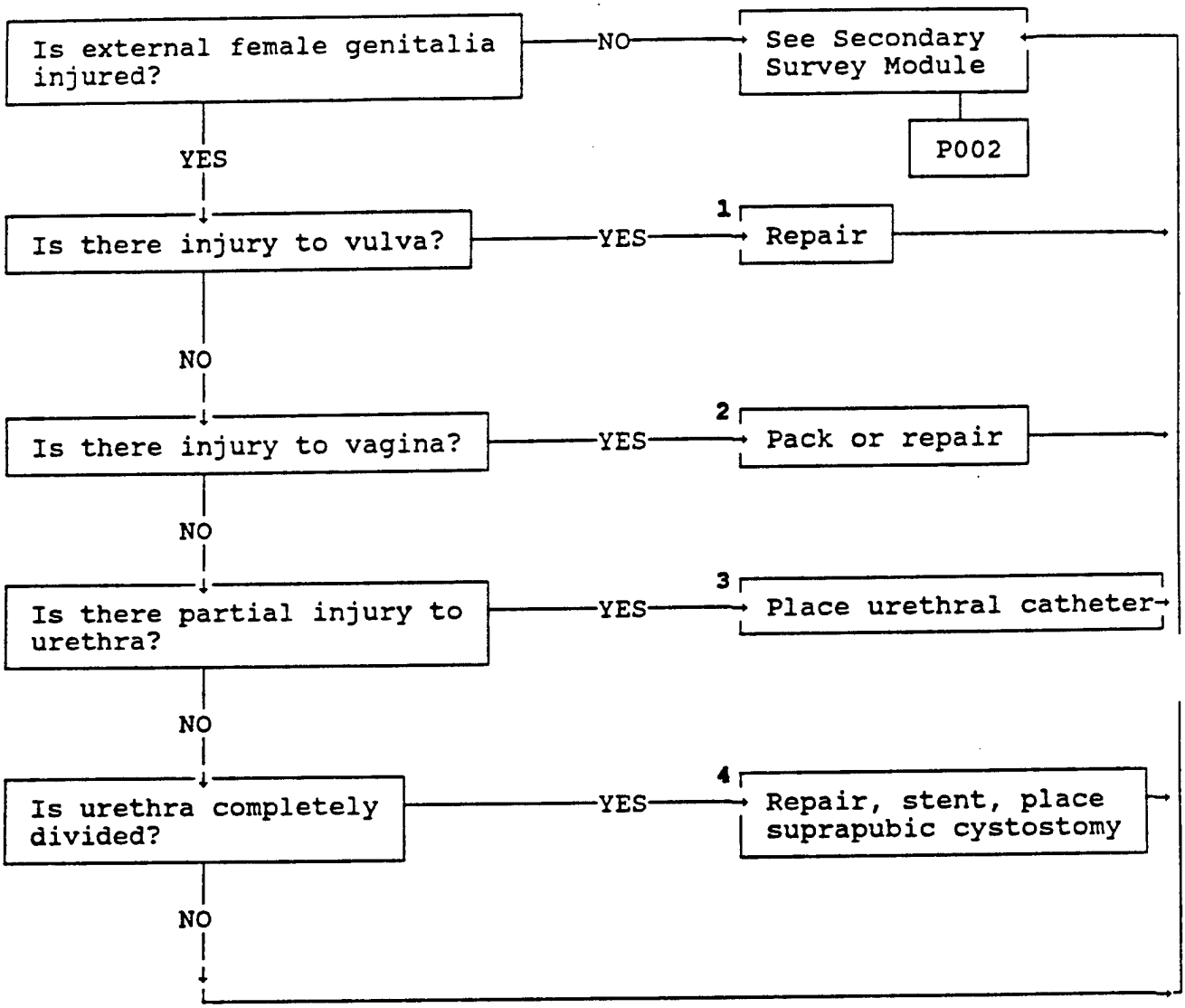
VAN BUREN DIALATORS (SIZES #16 THRU 34)
23.5 SCOPE & OBTURATOR
19.0 SCOPE & OBTURATOR
15.5 SCOPE & OBTURATOR
CATHETER SCOPE & OBTURATOR
ANGLED BRIDGE
A.C.M.I. FIBEROPTIC CORD (LIGHT)
STOP COCK
70 DEGREE SCOPE LENSE
30 DEGREE SCOPE LENSE
GREY NIPPLES
STRAIGHT BRIDGES
FIBEROPTIC LIGHT SOURCE

EXTERNAL GENITALIA

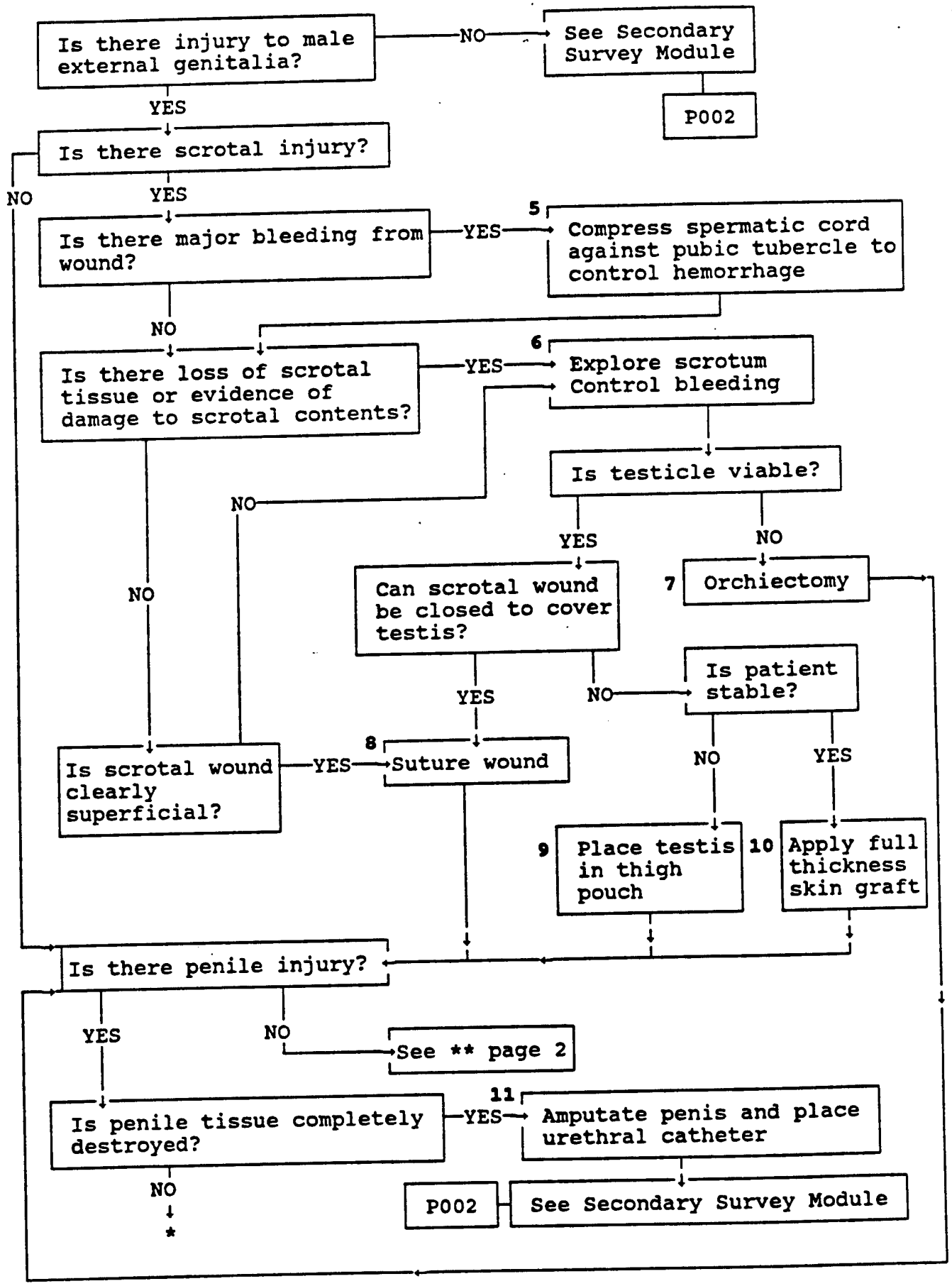
PLASTICS INSTRUMENT LIST

ARMY/NAVY RETRACTORS
SENN RETRACTOR
LONG SINGLE SKIN HOOKS
DOUBLE SKIN HOOKS
#3 KNIFE HANDLE
#7 KNIFE HANDLE
SENKIN THUMBS
ADSONS W/TEETH
ADSON BROWNS
ADSON W/O TEETH
MEDIUM FRAIZER SUCTION
FREER ELEVATOR
PLASTIC NEEDLE HOLDER
WEBSTER NEEDLE HOLDER
SHORT NEEDLE HOLDER
IRIS SCISSORS
TENOTOMY SCISSOR
BABY METZ. SCISSOR
RHINOPLASTY SCISSOR
JOSEPH SCISSOR
PLASTIC SUTURE SCISSOR
REGULAR METZ. SCISSOR
STRAIGHT MOSQUITOES
CURVED MOSQUITOES
CURVED CRILES
ALLIS CLAMPS
TONSIL HEMOSTAT
SMALL TOWEL CLIPS
27 GA. MICRO IRRIGATION TIP
30 GA. MICRO IRRIGATION TIP
.5MM CASTROVIEJO FORCEP
.12MM CASTROVIEJO FORCEP
JEWELER'S FORCEP, CURVED
JEWELER'S FORCEP, STRAIGHT
MICRO CLIP APPLICATOR
CASTROVIEJO NEEDLE HOLDER
WESCOTT SCISSOR
STEVENS SCISSOR
STRAIGHT GNATS

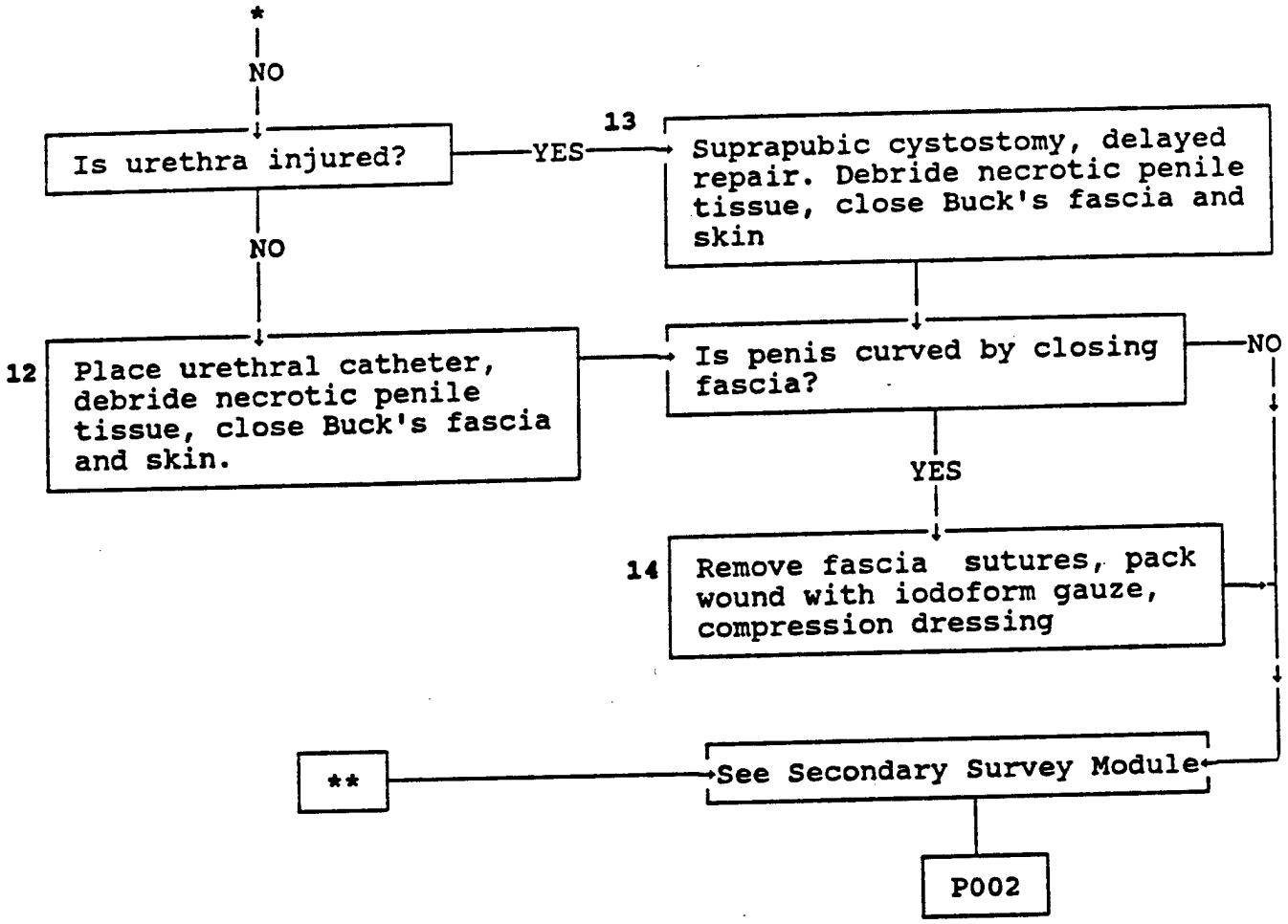
FEMALE EXTERNAL GENITALIA INJURY MODULE



MALE EXTERNAL GENITALIA INJURY MODULE



MALE EXTERNAL GENITALIA INJURY MODULE



APPENDIX 1
NUMERICAL AND ALPHABETICAL LISTING OF MODULE NAMES

The following is a numerical listing of the module numbers and their names. They are ordered as they appear in the volume.

MODULE NUMBERS	MODULE NAMES
H001	HOSPITAL RESUSCITATION & EVALUATION ALGORITHM SERIES
H002	PREHOSPITAL CARE AIRWAY INTUBATION ASSESSMENT MODULE
HOO3	FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE
HOO4	FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE A
H005	EXTRAORDINARY AIRWAY MEASURES MODULE
H006	RIGID BRONCHOSCOPY AND REMOVE FOREIGN BODY MODULE
H007	TRACHEOSTOMY TUBE INSERTION MODULE
A001	AIRWAY ASSESSMENT MODULE I
A002	AIRWAY ASSESSMENT MODULE II
A003	PATIENT APNEA MODULE
A004	AIRWAY TREATMENT AND EVALUATION MODULE
A005	AIRWAY EVALUATION MODULE A
A006	ASSISTED AIRWAY MODULE
A007	EMERGENCY INTUBATION MODULE A
A008	EMERGENCY INTUBATION MODULE B
A009	EMERGENCY INTUBATION MODULE C
A010	OROTRACHEAL INTUBATION MODULE
A011	BLIND OROTRACHEAL INTUBATION MODULE
A012	CRICOTHYROIDOTOMY MODULE
A013	NASOTRACHEAL INTUBATION MODULE
A014	TRACHEOSTOMY MODULE A
A015	TRACHEOSTOMY MODULE B
A016	ENDOTRACHEAL TUBE PLACEMENT ASSESSMENT MODULE
B001	BREATHING ASSESSMENT MODULE
B002	BREATHING ASSESSMENT MODULE A
B003	MASSIVELY BLEEDING CHEST WOUND(S) MODULE
B004	CHEST WALL ASSESSMENT MODULE
B005	BREATHING ASSESSMENT MODULE B
B006	BREATHING ASSESSMENT MODULE C
B007	NEEDLE THORACENTESIS MODULE
B008	TUBE THORACOSTOMY MODULE
B009	CHEST TUBE OUTPUT MODULE
B010	BREATHING ASSESSMENT MODULE D
B011	BILATERAL TENSION PNEUMOTHORAX MODULE
B012	CHEST TUBE DECLOTTING MODULE
B013	CHEST TUBE OUTPUT MODULE A
B014	PNEUMOTHORAX MANAGEMENT MODULE

B015	MASSIVE PNEUMOTHORAX MODULE
C001	CIRCULATION MODULE
C002	ESTABLISH I.V. MODULE

MODULE NUMBERS	MODULE NAMES
C003	CUTDOWN ON GREATER SAPHENOUS VEIN AT GROIN MODULE
C004	PERCUTANEOUS SUBCLAVIAN VEIN CATHETERIZATION MODULE
C005	MULTIPLE I.V. INSERTION MODULE
C006	ADDITIONAL I.V. INSERTION MODULE
C007	PERCUTANEOUS INTERNAL JUGULAR VEIN CATHETERIZATION MODULE
C008	VENOUS BLOOD DRAWING MODULE
C009	INITIAL I.V. INFUSION RATE MODULE
C010	FEMORAL ARTERY PALPATION MODULE
C011	CUTDOWN ON FEMORAL ARTERY MODULE
C012	BLOOD PRESSURE MODULE
C013	BLOOD TRANSFUSION MODULE
C014	BLOOD PRESSURE MODULE A
C015	MASSIVE TRANSFUSION MODULE
C016	FOLEY CATHETERIZATION MODULE
C017	URINE OUTPUT MODULE
C018	VOLUME CHALLENGE MODULE
C019	CENTRAL VENOUS PRESSURE MEASUREMENT MODULE
C020	PORTABLE CHEST X-RAY INTERPRETATION MODULE
C021	PORTABLE CHEST X-RAY INTERPRETATION MODULE A
C022	SERIOUS EXTERNAL BLEEDING MODULE
C023	TRAUMATIC AMPUTATION(S) MODULE
C024	MANGLED LIMB(S) MODULE
C025	LARGE BLOOD VESSEL LACERATION MODULE
C026	VENOUS BLOOD DRAWING ACCESS MODULE
C027	ARTERIAL CATHETERIZATION MODULE
C028	CARDIAC ARREST MODULE
C029	BLEEDING FROM ONE CHEST TUBE MODULE
C030	MEDIAN STERNOTOMY OPEN HEART MASSAGE MODULE
P001	CONTROL OF BLEEDING MODULE
P002	SECONDARY SURVEY MODULE
P003	VENTILATION MODULE
P004	GASTRIC TUBE MODULE
P005	INSERTING NASOGASTRIC TUBE MODULE
P006	CHEST TUBE EVALUATION MODULE
P007	CHEST TUBE DECLOTTING MODULE A
P008	AIR LEAK MODULE
P009	FIBEROPTIC BRONCHOSCOPY MODULE
P010	TRACHEOBRONCHIAL INJURY MODULE
P011	CHEST X-RAY MODULE A
P012	CHEST X-RAY MODULE B
P013	CHEST X-RAY MODULE C
P014	SUBPECTORAL CHEST TUBE INSERTION MODULE
P015	CHEST X-RAY MODULE D
P016	LUNG HEMATOMA MODULE
P017	SECONDARY SURVEY MODULE A

P018	SECONDARY SURVEY MODULE B
P019	SIGNIFICANT EXTREMITY TRAUMA MODULE

MODULE NUMBERS	MODULE NAMES
N001	PENETRATING NECK WOUND INJURY MODULE
N002	NECK EXPLORATION MODULE
N003	ARTERIAL INJURY OF NECK MODULE
N004	MAJOR NECK VEIN INJURY MODULE
N005	THYROID INJURY MODULE
N006	PHARYNX OR ESOPHAGUS INJURY MODULE
N007	LARYNX OR CERVICAL THRACHEA INJURY MODULE
N008	EXTERNAL BLEEDING FROM FACIAL WOUND(S) MODULE
N009	EXTERNAL BLEEDING FROM WOUNDS OF HEAD AND NECK MODULE
N010	INITIAL MANAGEMENT OF TONGUE INJURY MODULE
BR001	BRAIN WOUND WITH VENOUS SINUS INJURY (SAGITTAL SINUS) MODULE
BR002	BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS) MODULE
BR003	CEREBELLAR WOUND MODULE
BR004	FRONTAL SINUS WOUND MODULE
BR005	OPEN DURA MODULE
BR006	SIMPLE BRAIN WOUND MODULE
BR007	SIMPLE BRAIN WOUND DEBRIDEMENT MODULE
BR008	OCCLUDED SINUS MODULE
BR009	COAGULATION VARIABLES MODULE
BR010	COAGULOPATHY TREATMENT MODULE
T001	CARDIAC ARREST MODULE II
T002	LEFT THORACOTOMY OPEN CARDIAC MASSAGE EMERGENCY I.V. ACCESS MODULE
T003	OPEN CARDIAC MASSAGE MODULE
T004	PERICARDIAL TAMPONADE MODULE
T005	SUBXIPHOID PERICARDIOTOMY MODULE
T006	SUBXIPHOID PERICARDIOTOMY MODULE A
T007	EMERGENCY CHEST X-RAY MODULE
T008	IMMEDIATE THORACOTOMY MODULE
T009	TRANSSTERNAL THORACOTOMY MODULE
T010	TRANSSTERNAL THORACOTOMY HEART ASSESSMENT MODULE
T011	MEDIAN STERNOTOMY MODULE
T012	ASCENDING AORTA AND ARCH INJURY MODULE
T013	ASCENDING AORTA INJURY MODULE
T014	INNOMINATE ARTERY AORTIC ARCH INJURY MODULE
T015	AORTIC ARCH INJURY MODULE
T016	PULMONARY VEIN MODULE
T017	PULMONARY VENOUS INJURY MODULE
T018	PERICARDIAL VENA CAVAL INJURY MODULE
T019	BLEEDING INTO PERICARDIUM MODULE
T020	HOLE IN HEART EVALUATION MODULE
T021	HEART INJURY CARDIAC ARREST MODULE
T022	CONTINUING ASYSTOLE MODULE
T023	RIGHT ATRIAL CATHETERIZATION MODULE
T024	CONTINUING CARDIAC MASSAGE MODULE

MODULE NUMBERS	MODULE NAMES
T025	VENTRICULAR DEFIBRILLATION MODULE
T026	AORTIC ROOT INJECTION MODULE
T027	HEART INJURY ASSESSMENT MODULE
T028	LEFT VENTRICLE ASSESSMENT MODULE
T029	CORONARY ARTERY INJURY MODULE
T030	RIGHT VENTRICLE ASSESSMENT MODULE
T031	TRAUMATIC VENTRICULAR-SEPTAL DEFECT MODULE
T032	RIGHT ATRIAL WOUND ASSESSMENT MODULE
T033	OPEN HEART MASSAGE THROUGH RIGHT THORACOTOMY MODULE
T034	SUPERIOR VENA CAVA WOUND ASSESSMENT MODULE
T035	INFERIOR VENA CAVA WOUND ASSESSMENT MODULE
T036	LEFT ATRIUM PULMONARY VEIN ASSESSMENT MODULE
T037	THORACOTOMY ON SAME SIDE OF WOUND MODULE
T038	IMMEDIATE RIGHT ANTERIOR THORACOTOMY MODULE
T039	RIGHT PERICARDIOTOMY MODULE
T040	RIGHT ANTERIOR THORACOTOMY EXPLORATION MODULE
T041	EMERGENCY RIGHT THORACOTOMY FOR BLEEDING MODULE
T042	RIGHT THORACOTOMY RIGHT HILAR BLEEDING MODULE
T043	PULMONARY ARTERY INJURY MODULE
T044	PNEUMONECTOMY MODULE RIGHT OR LEFT
T045	DISTAL RIGHT PULMONARY ARTERY INJURY MODULE
T046	RIGHT UPPER LOBECTOMY MODULE
T047	RIGHT MIDDLE LOBECTOMY MODULE
T048	RIGHT LOWER LOBECTOMY MODULE
T049	LUNG PARENCHYMAL BLEEDING MODULE
T050	THORACIC VENA CAVA INJURY MODULE
T051	IMMEDIATE LEFT ANTERIOR THORACOTOMY MODULE
T052	LEFT PERICARDIOTOMY MODULE
T053	LEFT ANTERIOR THORACOTOMY EXPLORATION MODULE
T054	EMERGENCY LEFT THORACOTOMY FOR BLEEDING MODULE
T055	THORACIC AORTIC INJURY MODULE
T056	LEFT THORACOTOMY LEFT HILAR BLEEDING MODULE
T057	DISTAL LEFT PULMONARY ARTERY INJURY MODULE
T058	LEFT UPPER LOBECTOMY MODULE
T059	LEFT LOWER LOBECTOMY MODULE
T060	SUBCLAVIAN ARTERY INJURY MODULE
T061	CHEST WALL BLEEDING MODULE
T062	DIAPHRAGMATIC INJURY MODULE
T063	ESOPHAGEAL INJURY MODULE
T064	RIGHT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE
T065	LEFT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE
T066	MYOCARDIAL CONTUSION MODULE
T067	PULMONARY CONTUSION MODULE
AB001	INITIAL EVALUATION OF PENETRATING ABDOMINAL WOUND MODULE
AB002	LAPAROTOMY MODULE
AB003	ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE
AB004	BLADDER INJURY MODULE
AB005	COLON INJURY MODULE
AB006	DUODENUM INJURY MODULE

MODULE

NUMBERS	MODULE NAMES
AB007	EXTRAHEPATIC BILIARY TRACT INJURY MODULE
AB008	FEMALE REPRODUCTIVE TRACT INJURY MODULE
AB009	LIVER INJURY MODULE
AB010	PANCREAS INJURY MODULE
AB011	PENETRATING TRAUMA IN PREGNANT PATIENT MODULE
AB012	RECTUM INJURY MODULE
AB013	RENAL INJURY MODULE
AB014	RETROPERITONEAL HEMATOMA MODULE
AB015	SMALL BOWEL AND MESENTERY INJURY MODULE
AB016	SPLEEN INJURY MODULE
AB017	STOMACH INJURY MODULE
AB018	URETERAL INJURY MODULE
AB019	VISCERAL VASCULAR INJURIES MODULE
AB020	SUPERFICIAL INJURY MODULE
G001	FEMALE EXTERNAL GENITALIA INJURY MODULE
G002	MALE EXTERNAL GENITALIA INJURY MODULE

ALPHABETICAL LISTING OF MODULE NAMES

The following is an alphabetical listing of the module names and their identifying number.

MODULE NUMBERS	MODULE NAMES
AB003	ABDOMINAL AORTA AND VENA CAVA INJURIES MODULE
C006	ADDITIONAL I.V. INSERTION MODULE
P008	AIR LEAK MODULE
A001	AIRWAY ASSESSMENT MODULE I
A002	AIRWAY ASSESSMENT MODULE II
A005	AIRWAY EVALUATION MODULE A
A004	AIRWAY TREATMENT AND EVALUATION MODULE
T015	AORTIC ARCH INJURY MODULE
T026	AORTIC ROOT INJECTION MODULE
C027	ARTERIAL CATHETERIZATION MODULE
N003	ARTERIAL INJURY OF NECK MODULE
T012	ASCENDING AORTA AND ARCH INJURY MODULE
T013	ASCENDING AORTA INJURY MODULE
A006	ASSISTED AIRWAY MODULE
B011	BILATERAL TENSION PNEUMOTHORAX MODULE
AB004	BLADDER INJURY MODULE
C029	BLEEDING FROM ONE CHEST TUBE MODULE
T019	BLEEDING INTO PERICARDIUM MODULE
A011	BLIND OROTRACHEAL INTUBATION MODULE
C012	BLOOD PRESSURE MODULE
C014	BLOOD PRESSURE MODULE A
C013	BLOOD TRANSFUSION MODULE

MODULE NUMBERS	MODULE NAMES
BR001	BRAIN WOUND WITH VENOUS SINUS INJURY (SAGITTAL SINUS)
BR002	BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS)
B001	BREATHING ASSESSMENT MODULE
B002	BREATHING ASSESSMENT MODULE A
B005	BREATHING ASSESSMENT MODULE B
B006	BREATHING ASSESSMENT MODULE C
B010	BREATHING ASSESSMENT MODULE D
C028	CARDIAC ARREST MODULE
T001	CARDIAC ARREST MODULE II
BR003	CEREBELLAR WOUND MODULE
B012	CHEST TUBE DECLOTTING MODULE
P007	CHEST TUBE DECLOTTING MODULE A
P006	CHEST TUBE EVALUATION MODULE
B009	CHEST TUBE OUTPUT MODULE
B013	CHEST TUBE OUTPUT MODULE A
B004	CHEST WALL ASSESSMENT MODULE
T061	CHEST WALL BLEEDING MODULE
P011	CHEST X-RAY MODULE A
P012	CHEST X-RAY MODULE B
P013	CHEST X-RAY MODULE C
P015	CHEST X-RAY MODULE D
C001	CIRCULATION MODULE
BR009	COAGULATION VARIABLES MODULE
BR010	COAGULOPATHY TREATMENT MODULE
AB005	COLON INJURY MODULE
T022	CONTINUING ASYSTOLE MODULE
T024	CONTINUING CARDIAC MASSAGE MODULE
P001	CONTROL OF BLEEDING MODULE
T029	CORONARY ARTERY INJURY MODULE
A012	CRICOTHYROIDOTOMY MODULE
C011	CUTDOWN ON FEMORAL ARTERY MODULE
C003	CUTDOWN ON GREATER SAPHENOUS VEIN AT GROIN MODULE
T062	DIAPHRAGMATIC INJURY MODULE
T057	DISTAL LEFT PULMONARY ARTERY INJURY MODULE
T045	DISTAL RIGHT PULMONARY ARTERY INJURY MODULE
AB006	DUODENUM INJURY MODULE
T007	EMERGENCY CHEST X-RAY MODULE
A007	EMERGENCY INTUBATION MODULE A
A008	EMERGENCY INTUBATION MODULE B
A009	EMERGENCY INTUBATION MODULE C
T054	EMERGENCY LEFT THORACOTOMY FOR BLEEDING MODULE
T041	EMERGENCY RIGHT THORACOTOMY FOR BLEEDING MODULE
A016	ENDOTRACHEAL TUBE PLACEMENT ASSESSMENT MODULE
T063	ESOPHAGEAL INJURY MODULE
C002	ESTABLISH I.V. MODULE
N008	EXTERNAL BLEEDING FROM FACIAL WOUND(S) MODULE
N009	EXTERNAL BLEEDING FROM WOUNDS OF HEAD AND NECK MODULE
AB007	EXTRAHEPATIC BILIARY TRACT INJURY MODULE

H005	EXTRAORDINARY AIRWAY MEASURES MODULE
G001	FEMALE EXTERNAL GENITALIA INJURY MODULE
AB008	FEMALE REPRODUCTIVE TRACT INJURY MODULE
C010	FEMORAL ARTERY PALPATION MODULE
P009	FIBEROPTIC BRONCHOSCOPY MODULE
HOO3	FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE
HOO4	FLEXIBLE FIBEROPTIC BRONCHOSCOPY MODULE A
C016	FOLEY CATHETERIZATION MODULE
BR004	FRONTAL SINUS WOUND MODULE
P004	GASTRIC TUBE MODULE
T027	HEART INJURY ASSESSMENT MODULE
T021	HEART INJURY CARDIAC ARREST MODULE
T020	HOLE IN HEART EVALUATION MODULE
H001	HOSPITAL RESUSCITATION & EVALUATION ALGORITHM SERIES
T051	IMMEDIATE LEFT ANTERIOR THORACOTOMY MODULE
T038	IMMEDIATE RIGHT ANTERIOR THORACOTOMY MODULE
MODULE NUMBERS	**MODULE NAMES**
T008	IMMEDIATE THORACOTOMY MODULE
T035	INFERIOR VENA CAVA WOUND ASSESSMENT MODULE
AB001	INITIAL EVALUATION OF PENETRATING ABDOMINAL WOUND MODULE
C009	INITIAL I.V. INFUSION RATE MODULE
N010	INITIAL MANAGEMENT OF TONGUE INJURY MODULE
T014	INNOMINATE ARTERY AORTIC ARCH INJURY MODULE
P005	INSERTING NASOGASTRIC TUBE MODULE
AB002	LAPAROTOMY MODULE
C025	LARGE BLOOD VESSEL LACERATION MODULE
N007	LARYNX OR CERVICAL THRACHEA INJURY MODULE
T053	LEFT ANTERIOR THORACOTOMY EXPLORATION MODULE
T036	LEFT ATRIUM PULMONARY VEIN ASSESSMENT MODULE
T065	LEFT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE
T059	LEFT LOWER LOBECTOMY MODULE
T052	LEFT PERICARDIOTOMY MODULE
T056	LEFT THORACOTOMY LEFT HILAR BLEEDING MODULE
T002	LEFT THORACOTOMY OPEN CARDIAC MASSAGE EMERGENCY I.V. ACCESS MODULE
T058	LEFT UPPER LOBECTOMY MODULE
T028	LEFT VENTRICLE ASSESSMENT MODULE
AB009	LIVER INJURY MODULE
P016	LUNG HEMATOMA MODULE
T049	LUNG PARENCHYMAL BLEEDING MODULE
N004	MAJOR NECK VEIN INJURY MODULE
G002	MALE EXTERNAL GENITALIA INJURY MODULE
C024	MANGLED LIMB(S) MODULE
B015	MASSIVE PNEUMOTHORAX MODULE
C015	MASSIVE TRANSFUSION MODULE
B003	MASSIVELY BLEEDING CHEST WOUND(S) MODULE
T011	MEDIAN STERNOTOMY MODULE

C030	MEDIAN STERNOTOMY OPEN HEART MASSAGE MODULE
C005	MULTIPLE I.V. INSERTION MODULE
T066	MYOCARDIAL CONTUSION MODULE
A013	NASOTRACHEAL INTUBATION MODULE
N002	NECK EXPLORATION MODULE
B007	NEEDLE THORACENTESIS MODULE
BR008	OCCLUDED SINUS MODULE
T003	OPEN CARDIAC MASSAGE MODULE
BR005	OPEN DURA MODULE
T033	OPEN HEART MASSAGE THROUGH RIGHT THORACOTOMY MODULE
A010	OROTRACHEAL INTUBATION MODULE
AB010	PANCREAS INJURY MODULE
A003	PATIENT APNEA MODULE
N001	PENETRATING NECK WOUND INJURY MODULE

MODULE NUMBERS	**MODULE NAMES**
AB011	PENETRATING TRAUMA IN PREGNANT PATIENT MODULE
C007	PERCUTANEOUS INTERNAL JUGULAR VEIN CATHETERIZATION MODULE
C004	PERCUTANEOUS SUBCLAVIAN VEIN CATHETERIZATION MODULE
T004	PERICARDIAL TAMPONADE MODULE
T018	PERICARDIAL VENA CAVAL INJURY MODULE
N006	PHARYNX OR ESOPHAGUS INJURY MODULE
T044	PNEUMONECTOMY MODULE RIGHT OR LEFT
B014	PNEUMOTHORAX MANAGEMENT MODULE
C020	PORTABLE CHEST X-RAY INTERPRETATION MODULE
C021	PORTABLE CHEST X-RAY INTERPRETATION MODULE A
H002	PREHOSPITAL CARE AIRWAY INTUBATION ASSESSMENT MODULE
T043	PULMONARY ARTERY INJURY MODULE
T067	PULMONARY CONTUSION MODULE
T016	PULMONARY VEIN MODULE
T017	PULMONARY VENOUS INJURY MODULE
AB012	RECTUM INJURY MODULE
AB013	RENAL INJURY MODULE
AB014	RETROPERITONEAL HEMATOMA MODULE
T040	RIGHT ANTERIOR THORACOTOMY EXPLORATION MODULE
T023	RIGHT ATRIAL CATHETERIZATION MODULE
T032	RIGHT ATRIAL WOUND ASSESSMENT MODULE
T064	RIGHT EMERGENCY THORACOTOMY FOR AIR LEAK MODULE
T048	RIGHT LOWER LOBECTOMY MODULE
T047	RIGHT MIDDLE LOBECTOMY MODULE
T039	RIGHT PERICARDIOTOMY MODULE
T042	RIGHT THORACOTOMY RIGHT HILAR BLEEDING MODULE
T046	RIGHT UPPER LOBECTOMY MODULE
T030	RIGHT VENTRICLE ASSESSMENT MODULE
H006	RIGID BRONCHOSCOPY AND REMOVE FOREIGN BODY MODULE
P002	SECONDARY SURVEY MODULE
P017	SECONDARY SURVEY MODULE A
P018	SECONDARY SURVEY MODULE B

MODULE NUMBERS	MODULE NAMES
C022	SERIOUS EXTERNAL BLEEDING MODULE
P019	SIGNIFICANT EXTREMITY TRAUMA MODULE
BR007	SIMPLE BRAIN WOUND DEBRIDEMENT MODULE
BR006	SIMPLE BRAIN WOUND MODULE
AB015	SMALL BOWEL AND MESENTERY INJURY MODULE
AB016	SPLEEN INJURY MODULE
AB017	STOMACH INJURY MODULE
T060	SUBCLAVIAN ARTERY INJURY MODULE
P014	SUBPECTORAL CHEST TUBE INSERTION MODULE
T005	SUBXIPHOID PERICARDIOTOMY MODULE
T006	SUBXIPHOID PERICARDIOTOMY MODULE A
AB020	SUPERFICIAL INJURY MODULE
T034	SUPERIOR VENA CAVA WOUND ASSESSMENT MODULE
T055	THORACIC AORTIC INJURY MODULE
T050	THORACIC VENA CAVA INJURY MODULE
T037	THORACOTOMY ON SAME SIDE OF WOUND MODULE
N005	THYROID INJURY MODULE
P010	TRACHEOBRONCHIAL INJURY MODULE
A014	TRACHEOSTOMY MODULE A
A015	TRACHEOSTOMY MODULE B
H007	TRACHEOSTOMY TUBE INSERTION MODULE
T010	TRANSSTERNAL THORACOTOMY HEART ASSESSMENT MODULE
T009	TRANSSTERNAL THORACOTOMY MODULE
C023	TRAUMATIC AMPUTATION(S) MODULE
T031	TRAUMATIC VENTRICULAR-SEPTAL DEFECT MODULE
B008	TUBE THORACOSTOMY MODULE
AB018	URETERAL INJURY MODULE
C017	URINE OUTPUT MODULE
C026	VENOUS BLOOD DRAWING ACCESS MODULE
C008	VENOUS BLOOD DRAWING MODULE
P003	VENTILATION MODULE
T025	VENTRICULAR DEFIBRILLATION MODULE
AB019	VISCERAL VASCULAR INJURIES MODULE
C018	VOLUME CHALLENGE MODULE

APPENDIX 2

PROCESS FOR THE DEVELOPMENT OF THE ALGORITHMS AND REMAINING CONTROVERSIES

The algorithms were developed to address the acute care needs of combat casualties who have sustained a penetrating injury, presuming optimal care and resources are available. Initially, several surgeons (called originators here) designed and prepared two blocks of algorithms, 149 algorithms (modules) in all. The first block deals with the ABC's of trauma (Airway, Breathing, Circulation) reflecting medical stabilization of an injured patient. The second block addresses the surgical management of wounds in the head, neck, brain, face, thorax, abdomen, genitalia and extremities.

Each algorithm was reviewed by at least two appropriate surgeons, among a panel of general surgeons, thoracic surgeons, and neurosurgeons, all but one of whom had combat clinical experience. The reviewers were encouraged to provide critical comments on the algorithms and to assign each algorithm a level of acceptability: 1. acceptable as is, 2. acceptable with minor revisions, 3. requires major revisions, and 4. completely unacceptable. To promote objectivity, the designers and reviewers were kept anonymous.

For perspective on the first round of reviews, the (aggregate) percentages for each acceptability level are shown (Table 1).

TABLE 1

Aggregated Percentages For Each Acceptability Level

Acceptability Level	Percentage
1. Acceptable as is	68
2. Acceptable with minor revisions	16
3. Requires major revisions	13
4. Completely unacceptable	3

Most reviewers also proposed detailed modifications, and, in some cases, references justifying their proposals. These proposals ranged from seemingly minor issues, such as choice of suture material and antibiotic, to blatantly important issues, such as choice of surgical procedure associated with a "major laceration in the body or tail of the pancreas", and preference for craniotomy over craniectomy.

The reviews were returned to the originators, who revised the algorithms to account for most (about 75%) of the proposed changes. The originators provided counter-arguments to reviewer comments with which they did not concur. Also the originators were asked to develop 51 additional (mostly thoracic) modules, referred to,

but not developed, in the revised set of 149 modules.

The revised 149 modules were subjected to a second round of reviews, and the 51 new modules were subjected to independent reviews by two thoracic surgeons. The reviewers were requested to provide the information requested in the initial review plus 1) comments on the "controversial issues" remaining from the first round of "review and originator responses" and 2) assignments of each module to level of care categories (optimal, nearly optimal, average, below average, poor).

With regard to the 51 new modules, Tables 2 and 3 give the (aggregate) percentages for acceptability levels and level of care categories assigned by the two reviewers.

TABLE 2

Aggregated Percentages for each Acceptability Level for the 51 New Modules: Assigned by two Reviewers

Acceptability Level	Percentage
1. Acceptable as is	46
2. Acceptable with minor revisions	29
3. Requires major revisions	21
4. Completely unacceptable	4

TABLE 3

Aggregated Percentages for each Level of Care Category for the 51 New Modules: Assigned by two Reviewers

Level of Care Category	Percentage
1. Optimal	54
2. Nearly optimal	19
3. Average	19
4. Below Average	7
5. Poor	1

Tables 4 and 5 give the (aggregate) percentages for acceptability levels and level of care categories from reviewer responses (second review) for the 149 modules. Most of the modules with acceptability levels 3 and 4 were rated by 1) one reviewer who reacted strongly to usage of the phrase "Cease further efforts" by the originators for patient status situations which they deemed hopeless, and 2) one (of three) neurosurgical reviewer who strongly opposed the use of craniectomy rather than craniotomy.

TABLE 4

Aggregated Percentages for each Acceptability Level for the 149 Modules: Second Review

Acceptability Level	Percentage
1. Acceptable as is	70
2. Acceptable with minor revisions	24
3. Requires major revisions	4
4. Completely unacceptable	2

TABLE 5

Aggregated Percentages for each Level of Care Category for the 149 Modules: Second Review

Level of Care Category	Percentage
1. Optimal	68
2. Nearly Optimal	18
3. Average	7
4. Below Average	5
5. Poor	2

In July, 1989, an in-depth conference was held with the principal originators to address all remaining comments and criticisms of the reviewers. Some modules were modified, some rewritten, some eliminated, some new ones written, and some were re-ordered. This effort resulted in 196 revised modules. We believe that these modules represent consensus optimal modules for acute management of combat casualties with the exceptions noted in the section on "remaining controversies".

To give a sense of the activity of the July 1989 conference the next several paragraphs detail the originators' deliberations and responses to the concerns of the reviewers.

AIRWAY

Several general criticisms of the AIRWAY and BREATHING sections were made by the reviewers. They included concerns about precautions for handling C-spine injuries, the use of terms such as "Sellick maneuver", which may not be familiar to surgeons by that name, a need to standardize dosages and measurements of blood loss and oxygen administration, and that the AIRWAY and BREATHING modules should be re-classified, combined, or modified to present a more consistent flow.

In the first instance, the originators responded by pointing out that penetrating injuries only were considered in the design of the algorithms and most C-spine precautions would normally be unnecessary under such circumstances. However, the originators have taken note of potential problems in the opening box of the amended A006 - ASSISTED AIRWAY.

Expressions such as "Sellick maneuver" have been replaced with text which details the required procedure, as in #2 of box 1 of A010 - OROTRACHEAL INTUBATION.

A standardized measure of 20 breaths/min was adopted for ventilation rates. Also, standardized doses of paralytic agents such as norcuron were adopted throughout the modules.

BREATHING

The BREATHING modules move through a progression of visual observation for indications of respiratory distress, open pneumothorax and/or copious bleeding to diagnosis and treatment of obvious injuries. In doing this, modules were expanded, combined, simplified, and in some cases changed materially from the previous version. The question of standardized chest tube output was raised by the reviewers and addressed, as in B009 - CHEST TUBE OUTPUT.

Other points raised include the timing of obtaining a chest x-ray in the diagnostic flow of the modules. The criticism has been addressed in the new B013 - CHEST TUBE OUTPUT MODULE A and is done after a chest tube has been inserted. The originators have followed ATLS procedures here.

Also the designers feel that the use of optimal equipment answers the reviewers' concerns about accurately measuring air leaks. The latest equipment has this capability.

CIRCULATION

The modules of the CIRCULATION section were re-written to address concerns expressed by reviewers, and some modules which were redundant have been eliminated. Most suggestions advanced by reviewers were adopted. Several proposed changes (related to C015 - MASSIVE TRANSFUSION and C016 - FOLEY CATHETERIZATION), however, reflect the optimal versus field hospital care situations. Since only optimal conditions of personnel and equipment were considered in the design of the algorithms these proposals were not adopted.

C015 - MASSIVE TRANSFUSION has generated a difference of opinion as to the necessity of drawing blood from the arterial line every 30 minutes to measure blood products. The originators stand by their contention that prolonged coagulopathy leads to liver injury, hypothermia, and brain & muscle injury. Monitoring and adjusting for falling fibrinogen and platelets can assist in modifying blood product replacement. Frequent monitoring of serum potassium helps to avoid hypo- and hyperkalemia in cardiac arrest during resuscitation with large volume infusions.

For C010 - FEMORAL ARTERY PALPATION, a reviewer questioned why the catheters used in the femoral artery are not more precisely defined as to length and gauge. The originator responded by stating that a variety of catheters would be available under optimal conditions and need not be specified in each module.

A suggestion was made regarding C016 - FOLEY CATHETERIZATION at the node which reads

Perform percutaneous suprapubic cystostomy

A reviewer suggested that fluid resuscitation be performed first to allow the bladder time to distend prior to placement of a cystostomy. The originators responded by indicating that if the penis or pubic area is injured to the point where a catheter cannot be inserted, a cystostomy is indicated.

Also at the node which reads

Is there torrential hemorrhage (mixture of blood and urine flowing in excess of 250 ml/min or urine hematocrit > 25%)?

a reviewer indicated that he had never encountered such a degree of hematuria even in the most severe injuries to the bladder, ureter or kidney and suggested the node be removed.

The originators responded that they had seen such cases and that the node should be retained.

THORAX

T042 - RIGHT THORACOTOMY RIGHT HILAR BLEEDING MODULE provoked the strongest controversy regarding whether a pneumonectomy or lobectomy was the proper surgical procedure in severe lung injuries. The originators were adamant in that they feel strongly that a pneumonectomy is not "optimal" if the lesser procedure of a lobectomy will address the problem and would certainly be in the patient's best interest. T049 - LUNG PARENCHYMAL BLEEDING MODULE stimulated a reviewer suggestion regarding the manner in which an air leak problem is addressed. The originators modified the module by inserting new boxes to handle "major air leaks" which proceed to indications for a lobectomy in the event ventilation is severely compromised.

All other differences of opinion were considered minor and were addressed by the originators by refinements throughout the new thoracic section, with the exception of the new T060 - SUBCLAVIAN ARTERY INJURY. In this case, a reviewer questioned the use of an interposition graft to repair the arterial wall, citing the difficulty of grafting and suggested ligation instead. The

originators maintain that arterial repair is ideal to maintain function, particularly since all casualties may not be young men and injury could be sustained by an officer or others with pre-existing vascular problems.

BRAIN

Minor amendments have been made throughout the BRAIN modules to address such issues as the use of angiograms, CT scans and x-rays in diagnosing the extent of brain injuries as in BR002 - BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS) & BR004 -FRONTAL SINUS WOUND; definition of the method by which the dura is opened (BR005 - OPEN DURA); positioning of the patient to give optimal access to the wound and major intracranial structures (BR006 - SIMPLE BRAIN WOUND); and the use of the latest equipment, such as an air turbine drill in the preparation of a removable skull plate, BR002 - BRAIN WOUND WITH VENOUS SINUS INJURY (TRANSVERSE SINUS)). These and other minor amendments reflect the reaction of the originator to the comments of the reviewers.

Also, EXTERNAL BLEEDING FROM FACIAL WOUNDS and EXTERNAL BLEEDING FROM WOUNDS OF HEAD AND NECK have been moved from the BRAIN section to the NECK AND FACE section.

Another suggestion concerned the necessity for a module(s) covering coagulopathy. Although the originator indicated that he did not feel that checking for coagulopathy was necessary for the majority of brain wounds, modules BR009 and BR010 were designed and added to the BRAIN sequence and referenced in BR004.

The fourth point arose from the optimal versus combat situation where calling on specialists, such as plastic surgeons or ophthalmologists was in question. The originator agreed to the insertion of nodes calling upon specialists in the appropriate areas.

ABDOMEN

This section has been revised to eliminate the SOFT TISSUE module and to incorporate a new module AB001 - INITIAL EVALUATION OF PENETRATING ABDOMINAL WOUND which serves as an overview of abdominal injuries.

There were five major suggestions by the reviewers.

1. In AB003 - ABDOMINAL AORTA AND VENA CAVA INJURIES, the block which reads

> Create conduit from autologous vein or artery or ligate aorta and perform extra-anatomic bypass

was questioned by a reviewer who felt that an extra-anatomical bypass was time-consuming and beyond the scope of many surgeons. He felt that it would be best to recommend aortic replacement using Gore-Tex, and worry about the suture line disruptions and mycotic

aneurysms at a later time. A second reviewer stated that the decision as to which course to pursue should depend upon the degree of contamination and status of the patient. Yet another reviewer indicated that an extra-anatomic bypass is easier than creating a conduit from the autologous vein and a tough aortic replacement. The originators responded that the treatment is optimal, and that placement of prosthetic material, even in a contaminated field, is an alternative, but not ideal.

2. In AB005 - COLON INJURY, a reviewer commented on the entire sequence down the left side of the algorithm. He felt that as written, shock and loss of blood play no role in determining the choice between repair and resection. The originator responded that the sequence is valid. Several other reviewers agreed with the originator's stand and no changes were made.

3. AB006 - DUODENUM INJURY was amended to read:

> Repair primarily. <u>Use closed drain being sure to place it away from repair.</u> Decompress with NG tube, duodenostomy, or retrograde jejunostomy, fed back into duodenum.

in response to reviewers' comment about the necessity of placing the drain <u>away</u> from the area of repair.

One reviewer also suggested that, when faced with major pancreatic or duodenal injuries, surgeons should insert a needle feeding jejunostomy since prolonged duodenal ileus and/or intra-abdominal sepsis with accompanying ileus occur in approximately half of such patients. However, the originator and most reviewers agreed that hyperalimentation should be left to the surgeon's discretion.

4. An early version of AB009 - LIVER INJURY, was amended to read

> Control bleeding with sutures or hemostatic agents. Drain with closed drainage system.

in response to a reviewer's comment that liver injuries should be drained routinely. Most reviewers agreed with his stand.

5. The review of AB013 - RENAL INJURY provoked a question as to whether to attempt revascularization of an injured kidney or perform a nephrectomy using length of time of renal ischemia as the determinant. A reviewer stated that the average ischemic time of successful revascularization exceeds four hours, and that the decision to revascularize depends on such factors as patient stability and whether the patient has a functioning second kidney.

Both the originators and most reviewers agree that the module should stand as written, although the presence of multiple injuries may dictate a nephrectomy.

EXTERNAL GENITALIA

One reviewer felt that there was no advantage, and indeed disadvantages in placing the testis in a subcutaneous thigh pouch as indicated in G002 - MALE EXTERNAL GENITALIA INJURY.

However, both the originator and most reviewers agree that the procedure was sound, especially in an unstable patient, where deferred treatment is planned.

REMAINING CONTROVERSIES

A large majority of the so-called "remaining" controversial issues between the originators and reviewers are attributable to perceived differences between optimal care (the presumption of unlimited resources) and field hospital care (which often involves multiple casualties and clinical compromises for the presumed good of all patients). Such (field versus optimal) issues arose throughout the entire review and revision process, although the goal of "optimal" decision trees was stated and emphasized in all communications with originators and reviewers. Despite these goal-focus efforts, reviewers would often and originators would occasionally argue for the "field hospital case". Nonetheless the Cyometrics staff has striven to redirect the focus to "optimal" care and we believe that the algorithms presented reflect current optimal care. In this section we first delineate the controversial points that are not "field versus optimal" issues. We follow this by a discussion of the "potential" for differences between field hospital and optimal care.

CONTROVERSIAL POINTS IN VOLUME I THAT ARE NOT "FIELD HOSPITAL VERSUS OPTIMAL CARE" ISSUES

There are four major controversial points, which are discussed here.

1. Placement of the needle in needle thoracentesis.

A reviewer suggested the axillary insertion route as opposed to a more anterior placement of the needle. The cardiothoracic surgeons who designed the module feel that the anterior approach is standard and preferred, in that it avoids potential kinking of the line by movement of the patient's arm when the axillary approach is used.

2. The question of craniectomy versus craniotomy as indicated in **BR004 - FRONTAL SINUS WOUND** and **BR007 - SIMPLE BRAIN WOUND DEBRIDEMENT.**

The reviewer states

"We are probably not going to be able to

> resolve the difference of opinion between the originator and the reviewer relative to craniectomy versus craniotomy. I have previously enclosed the monograph relative to the usefulness and safety of a craniotomy in combat conditions. The originator does not totally appreciate the fact that a complete debridement of potentially infected skull is accomplished as part of the craniotomy technique. He also disregards the secondary risk factors of a cranioplasty."

In a paraphrased rebuttal, the originator indicated

> No amount of talking would convince him that a craniotomy is acceptable in dealing with contaminated and potentially infected skull bone. He maintained that a craniectomy is more physiologically sound.

3. Necessity of dural closure.

Several reviewers expressed concern regarding the necessity of dural closure as in **BR005 - OPEN DURA.** One reviewer commented

> "Again, we have a point of difference between the reviewer and the originator relative to the necessity of a dural closure. The point to be made here is that the "cerebral envelope" should be restored anatomically and water-tight in a mode that insures a full decompression of the underlying cerebral tissue. This can be accomplished by excellent closure of other anatomical layers external to the dura or by the use of expanding grafts in the dural layer. The latter technique, of course, carries an added morbidity risk of infection in a graft. The plea here is for common sense that cerebral tissue needs to remain decompressed and that an anatomical barrier be re-created to preclude bacterial contamination associated with a spinal fluid fistula."

The originator responded that, in his opinion, the dura should virtually, always be closed. If decompression were needed, he would favor a loose dural graft.

A second reviewer commented

> "I do not agree that <u>tight</u> dual closure is necessary <u>anywhere</u> except over air-filled sinuses or in fistula-prone areas, <u>or</u>, except

where scalp closure is not secure. Most closures can be reinforced with only patches, even gelfoam, without CSF fistulae developing or brain coming through, if brain is loose at closure."

To this comment, the originator replied

"I strongly disagree here. In my opinion the dura should have a water-tight dural graft to prevent CSF leakage which is a preventable complication which can lead to meningitis and death. I am not willing to compromise here."

4. Uterus Evacuation.

AB011 - PENETRATING TRAUMA IN PREGNANT PATIENT occasioned a comment about the evacuation of the uterus in the penetration of the full thickness of the uterine wall. The reviewer stated

"Penetration of the uterus in a pregnant woman is not an indication for evacuation of the uterus unless the size of the gravid uterus prevents visualization and repair of other maternal injuries. In the absence of this circumstance, the uterus should be closed primarily with double layers of interrupted chromic sutures. More than 95% of intrauterine fetal injuries are fatal, but more than 90% of these women will spontaneously abort their dead fetus without difficulty within three weeks."

An originator disagreed and commented

"If you don't get the fetus out, you have no way to assess injuries to the fetus. Even if you have only a 5% chance of saving the fetus, I think you should take it. A C-section is a well-tolerated procedure and a small price to pay for a live baby."

Another reviewer agreed with the first review and indicated that penetrating injuries to the uterus are almost always fatal to the fetus, and that no attempt to salvage a child through a C-section should be undertaken.

Yet another reviewer felt that, if at term (>28 weeks), a C-section and repair of the infant/fetus should be attempted. In other circumstances, he felt that it represents better management to evacuate the uterus and make repairs. He does raise the problem of the frequent incidence of disseminated intravascular coagulation (DIC) from retained fetal products in injured mothers.

The originator rejects the first two reviewers' comments and

feels that the third reviewer's concern about DIC lends credence to his stand that the module should remain unchanged.

POTENTIAL FOR DIFFERENCES BETWEEN FIELD HOSPITAL CARE AND OPTIMAL CARE

The decision trees were designed presuming that unlimited and state-of-art resources are available for each casualty. In most combat scenarios involving many casualties, this presumption is extremely optimistic. Cases that require much time and resources are often, necessarily, managed at a suboptimal level taking into account the needs of all wounded patients.

The decision tree originators and reviewers agree that, generally, these cases are apparent, that clinicians are capable of improvisation reflecting available resources and needs of other patients, and that it would not be possible to explicitly define all circumstances for which one should use an optimal procedure.

Potential for significant differences between optimal care and field care (when there are limited resources for the multiple casualties) mentioned by reviewers were the following:

OPTIMAL PROTOCOL	POSSIBLE FIELD ALTERNATIVES IN COMPROMISED CIRCUMSTANCES
Management incorporating blood chemistries	Management without benefit of blood chemistries
Management incorporating CT scans	Management without benefit of CT scans
Management incorporating X-rays	Management without benefit of X-rays
Management incorporating fiberoptic bronchoscope	Management without benefit of fiberoptic bronchoscope
Pulmonary artery repair	Ligation or pneumonectomy
Isolated apical anterior artery repair	Lobectomy or pneumonectomy
Major bronchus repair	Right middle-lower lobectomy or pneumonectomy
Upper lobe bronchi repair	Lobectomy
Cardiopulmonary bypass surgery	Transfer
Treat pulmonary contusion	Transfer (only if absolutely necessary)

Treat myocardial contusion	Transfer (only if absolutely necessary)
Manage massive liver injury	Pack and transfer (only if absolutely necessary)
Manage major pancreatic-duodenum injury	Pack and transfer
Flail chest fixation	Intubate, ventilate and transfer