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COMBINED EFFECTS OF BALLISTICS

INJURY AND BLOOD LOSS

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19. ABSTRACT (Maximum 200 words) To study the combined effects of a ballistic injury and hemorrhage, we have used 5 experimental groups : anesthetized (A), anesthetized and ballistic injury (AI), anesthetized and bled (AB), anesthetized, ballistic injury, and bled (AIB), and conscious bled (CB). The model is the splenectomized, 90kg Large White Pig. The hemorrhage volume was 15ml/kg removed over a one hour period. The ballistic injury was given just before the hemorrhage, and only involves the soft tissue of the posterior thigh. The animals were chronically instrumented for the measurement of physiological parameters (heart rate, arterial and central venous pressures, and renal artery and aortic flows), hematology, and biochemistries. The ballistic injury only provoked a significant and lasting drop in CVP in the anesthetized animals. The combination injury and hemorrhage modified the cardiac responses to hemorrhage by favoring the inotropic responses more			
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than chronotropic response that was seen.
classic hemorrhage model does not therefore exactly represent the
hemorrhage received in combat which is generally associated with a
ballistic injury.

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For the protection of human subjects, the investigator(s) have adhered to policies of applicable Federal Law 45CFR46.

In conducting research utilizing recombinant DNA technology, the investigator(s) adhered to current guidelines promulgated by the National Institutes of Health.

Signature

Date

23 / 04 / 93

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COMBINED EFFECTS OF BALLISTICS INJURY AND BLOOD LOSS

I- INTRODUCTION

Recent studies suggest that a variety of factors may impact on the physiological and biochemical responses to and survival following a major hemorrhage. For example, in response to removal of a fixed volume of blood, animals bled in a holding cage had a higher survival rate than those bled in a Pavlov sling (6). This simple change in handling procedure drastically changed the outcome. In addition, it has been found that the hemodynamic and biochemical responses during recovery from blood loss are altered by the addition of sciatic nerve stimulation as a nociceptive input, showing that possible nervous system involvement from injury can modify the homeostatic reflexes to hemorrhage (18).

A high velocity shot in the thigh of an anesthetized pig induces a high frequency, high amplitude pressure wave. This wave is not restricted to the injury area, but can be recorded throughout the body and induces structural changes in the sciatic nerve and even in the central nervous system (22, 9).

These findings raise questions of the applicability of information obtained from pure hemorrhage animal models to the understanding of what happens to the military trauma victim, who would likely have ballistic injury plus hemorrhage. Almoskog (1) studied the effects of hypovolemia on local missile injury, but he did not study the opposite question, how does local missile injury affect the responses to hypovolemia? Therefore, our study was designed to characterize the physiological responses involved in the combination of a realistic battlefield ballistic injury with a fixed-volume hemorrhage. This information should help us more fully understand the applicability of animal models to combat casualty care.

Hemorrhage model:

Previous studies demonstrated that the domestic pig is superior to the dog or sheep as a large animal model of hemorrhagic hypotension

(23, 7, 12). Functional characteristics of the porcine cardiovascular system and the pig's hemodynamic responses to hemorrhage more closely resemble those of the human than do other animal models (14, 28). Moreover, an animal with sufficiently large-sized muscle mass is required in order to perform the type of ballistic, soft tissue injury utilized in this study. The Large-white pig, weighing approximately 90 kg meets this muscle mass requirement.

It is necessary to splenectomize the pig, because the pig has a large contractile spleen which Hannon and al (11) showed is capable of storing a large volume of red blood cells which can be released in response to hemorrhage. The splenectomized pig has responses to hemorrhage that are remarkably similar to those reported for adult humans (13).

The fixed-volume hemorrhage model seems to simulate the hemorrhage seen in combat casualties better than the Wiggers fixed-pressure hemorrhage model (10). Also, recent experiments have demonstrated that blood loss produced by aortotomy results in a more hypotensive response than that expected by the loss of a similar volume of blood in the fixed-volume phlebotomy model (3). This is another indication that injury plus blood loss alters the responses in the combat casualty.

II- METHODS

Surgical preparation:

Thirty-eight female Large-white pigs (obtained from a commercial swine farm) were used in this study. They underwent three operations. The animals were fasted 24 hours before each surgery with water available ad libitum. On the morning of surgery, they were pre-medicated with ketamine (30 mg/kg), acepromazine (2 mg/kg) and atropine (0,05 mg/kg). An intravenous infusion of saline (0,9 % NaCl) was begun and the animals were intubated. For major surgery, 0,5% - 1,0% halothane was administered with 20% O₂ and 80% N₂O, with a Minerve respirator. All surgery was performed using aseptic techniques.

The three surgeries were as follows : 1) Six weeks before the experiment, the spleen was removed via a left posterior lateral hypochondral laparotomy.

2) Two weeks before the experiment, we chronically implanted a renal flow probe, catheters and EKG electrodes. The electromagnetic flow probe (4 mm, Spectramed) was placed around the left renal artery via a retroperitoneal incision. Two silicon catheters (Silastic N°602 25; Dow Corning) were inserted non-occlusively; one was inserted into the left carotid artery to be used for taking blood samples, and the other into the left external jugular vein and advanced to the right atrium to be used for measuring central venous pressure (Statham transducer - Spectramed). Three EKG leads (spiral of steel wire on silastic patch) were placed subcutaneously in the middle of the right and left chest and on the back and attached to the musculature. 3) One week before the experiment, we performed a left thoracotomy and an electromagnetic blood flow transducer (20 mm - Spectramed) was placed around the aortic root. A pressure transducer (Koenigberg Instrument) was also placed into the aortic root. A strain gauge embedded in silastic (Medical Adhesive Silicon - Dow Corning) was sutured onto the left ventricular myocardium. Finally, a large-bore silastic catheter (n° 602 405, Dow Corning), through which the hemorrhage was performed, was sutured non-occlusively into the aortic wall.

The catheters and the flow probe, pressure transducer and EKG connectors were tunneled subcutaneously and exteriorized out the left side and sutured at an interscapular position. A specially designed protective box with connectors was placed on the pig's back: it enabled us to record from the unanesthetized animal (photo 1).

Catheters were flushed daily with a normal saline solution and filled with a saline solution containing heparin (50 U/ml). Oxytetracyclin (50 mg/10 kg) was administered daily to prevent infection. The entire post-operative recovery was monitored and appropriate treatment administered if needed.

Experimental protocol:

There were 5 experimental groups with 5 animals per group and the animals were randomly assigned to each group :



a- Protective box and special turning connector
 The protective box have three partitions (on left: for catheters, on right: for acquiring physiological datas, on middle: for hemorrhage catheter)
 The special turning connector have 50 connections.



b- The physiologicals parameters are recorded on conscious animals thanks to a special turning connectors placed on the back of the pig.

PHOTO n°1

group 1: anesthetized pigs (A)
group 2: anesthetized and injured pigs (AI)
group 3: anesthetized and bled pigs (AB)
group 4: anesthetized, injured and bled pigs (AIB)
group 5: conscious bled pigs. (CB)

To achieve the ballistic injury, we used unfragmentable high velocity bullets (simulating AK 74 round). These bullets were reconstituted according Fackler's technique (8). The target area for the shot was in the thigh muscle. The target area was determined by radiography in order to avoid any fracture, large vessel or nerve damage. This standardized shot procedure also resulted in a standardized missile trauma (4).

We removed 15 ml/kg blood continuously over 60 min, in a logarithmic fashion to mimic a hemorrhage from a severed artery: the blood was removed uniformly in equal parts over successive intervals of 9, 10, 12, 13 and 16 minutes (10, 11).

The pigs were fasted 12 h prior to experiment with water available ad lib. On the morning of the experiment, the pigs were brought to a holding cage to which they had previously been trained to become familiarized with the surroundings and used to the experimental procedure. The aortic and renal flow transducers were connected to the blood flowmeter (2202 Spectramed). The aortic pressure transducer and venous pressure transducer were connected to amplifiers (Signal Conditioning Amplifier 2310, Vishay Measurements). The EKG electrodes were connected to the amplifier (Universal Amplifier, Gould). All physiological parameters were recorded on a Dash IV recorder (Astro-Med).

A period of 30 min was allowed for the animal to become accustomed to the surroundings before performing the initial measurements and taking any samples. After this 30 min period, baseline control measurements and a blood sample was taken (t-30). After the recording and samples were taken, the anesthetized groups received ketamine (10 mg/kg bolus iv and 0,5 mg/kg/min infusion). Then, they were rapidly taken to the ballistic laboratory. The post-anesthetic

measurements and sample were then obtained (t-15). From that moment, the physiological parameters were continuously recorded until the end of the hemorrhage. In the groups receiving the ballistic injury, it preceded the third sample (t-5) and the start of hemorrhage (t-0). Samples were taken at 5, 9, 19, 31, 44 and 60 min; and physiological recordings were taken at 120, 180 and 360 min after the beginning of the hemorrhage. The anesthetic infusion was stopped at 60 min. These recording and sampling procedures were the same for each group. After the injury was induced, local treatment consisting of antiseptics and sticking plaster was carried out. Samples and recordings were made daily for four days in order to study the recovery. After the experiment, the animals were euthanized with an intravenous overdose of barbiturate.

Sample analyses :

Each sample requires 40 ml of blood. Hematology was studied with a Coulter Counter T540. Coagulation tests were performed with a fibrometer (Merieux). Blood gases were measured with an ABL 500 Blood Gas Analyzer (Radiometer). Biochemical analyses were made with a semi-automatic analyzer FP 900 (Labsystem), and ionograms with an automatic analyzer M644 (Ciba-Corning). Finally, catecholamines were measured by high-pressure liquid chromatography (Varian 500 LC-Chromatofield Eldec 103).

Physiological parameters :

Heart rate, cardiac output, renal blood flow, and arterial and venous pressure were directly recorded (see above). Systemic vascular resistance was calculated by dividing the mean arterial pressure by the cardiac output. Renal vascular resistance was estimated as the ratio of mean arterial pressure to renal blood flow. Stroke volume was calculated with the fraction: cardiac output/heart rate.

Statistical analysis :

The homogeneity of the baseline values was tested with a Friedman pseudo two-way ANOVA (21,17). To ascertain whether there were changes within a group with time, we performed a Wilcoxon signed rank test comparing post-hemorrhage values to the control values.

Next, we determined whether there were differences between groups using the Mann-Whitney U test. In order to elucidate how ballistic injury modified the effects of hemorrhage, we made the following comparisons :

1) To determine the effect of hemorrhage alone in anesthetized animals, we compared the non-injured, non-bled group (A) with the non-injured, bled group (AB).

2) To determine the effect of injury alone in anesthetized animals, we compared the non-injured, non-bled group (A) with the injured, non-bled group (AI).

3) To determine the effect of the combined injury and hemorrhage in anesthetized animals, we compared the non-injured, non-bled group (A) with the injured, bled group (AIB).

4) To determine the effect of hemorrhage on the injured animal, we compared the injured, non-bled group (AI) with the injured, bled group (AIB).

Lastly, we analyzed the effects of anesthesia on the hemorrhage response by comparing the anesthetized, bled group (AB) to the conscious, bled group (CB).

Statistical significance was accepted at $p < 0.05$. The data is expressed as mean $\pm$ SEM.

III- RESULTS

Six pigs died before the experiment : 2 from aortic ruptures because of the flowmeter, and 4 from cardiac fibrillation during surgery which occurred at the time of suturing the strain gauge to the left ventricle in spite of prophylactic xylocaine treatment. We were thus compelled to omit the strain gauge technique. Two pigs were excluded because they developed a perforated ulcer with uncontrolled blood loss.

We originally planned to remove 24 ml/kg blood volume, but all the anesthetized pigs (three) died. So we used a smaller hemorrhage

study all the pigs throughout the recovery period, we decided to perform a 15 ml/Kg hemorrhage.

Controls values :

Control levels were similar to those reported in previous published studies, except parameters which were changed because of the operations (enzymology). Depending on whether comparisons were made on the acute or recovery phases of the study, two control values were used. For the acute (0-360 min) phase, the first point before the experiment but after anesthesia administration was used. For the recovery (24 to 96 hours) phase, the point before anesthetic administration was used. To allow comparisons, the control data point for each variable was assigned a normalized value of 0 and all other values were corrected to reflect relative changes. All the values (mean and SEM) are submitted in the appendix. The interesting changes are shown in curve form (figures 1 to 5).

Hemodynamics responses :

Baseline values of all physical parameters did not change during the time-control, pre-injury and/or pre-hemorrhage periods.

Figure 1 shows the changes in heart rate (HR), mean aortic pressure (MAP), central venous pressure (CVP) and cardiac output (CO).

Hemorrhage caused a significant ($p < 0.05$) 20% increase in HR between initial and post-hemorrhage values only in the anesthetized, non-injured bled group (AB). There were no time-related changes in HR in any of the other four groups (A, AI, AIB and CB). For the between group comparisons, the AB group had a significantly higher HR when compared to the control group (A vs AB, $p < 0.05$) as well as the conscious bled group (AB vs CB, $p < 0.01$). Ballistic injury had no effect on HR, either by itself or in combination with hemorrhage.

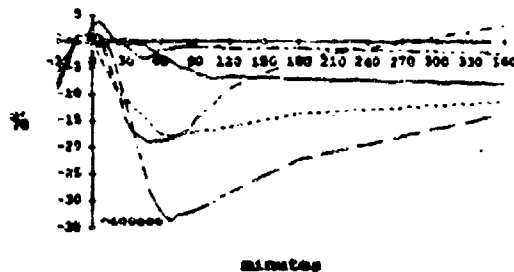
This level of hemorrhage caused MAP to fall significantly, both with respect to time and when compared to the time control group, by 20% in the conscious group ($p < 0.05$) and by 30% in the anesthetized group ($p < 0.01$), and MAP did not return to control levels even after 240 min. There was a heterogenous response (initial decrease and then

FIGURE N°1

HEART RATE



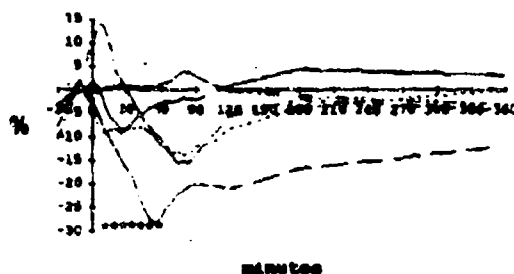
MEAN ARTERIAL PRESSURE



CENTRAL VENOUS PRESSURE



CARDIAC OUTPUT



Hemodynamic changes in the five groups: Anesthetized (---),
Anesthetized and injured (—), anesthetized and bled (- -),
anesthetized, injured and bled (-.-), conscious bled (....)
(time of hemorrhage:)

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which did not permit us to detect a significant difference. As with HR, ballistic injury had no effect on MAP, either by itself (A vs AI) or in combination with hemorrhage (A vs AIB). This suggests that ballistic injury attenuates the fall in MAP induced by this level of hemorrhage in anesthetized animals.

Central venous pressure (CVP) decreased significantly ($p < 0.05$) between pre and post-treatment values in all treated groups : by 45% in the AB group, 40% in AIB, 35% in CB, and 25% in the AE group ($0.05 < p < 0.10$). The CVP recovered toward control values at 2 h after hemorrhage in the anesthetized bled group (AE) but not in the injury alone group (AI) or the combination group (AIB). Between-group comparisons showed significant differences between A vs AI ($p < 0.01$), A vs AIB ($p < 0.05$), and AB vs CB ($p < 0.05$).

Cardiac output (CO) was significantly ($p < 0.05$) reduced from pre-hemorrhage values by 25% in the anesthetized bled group (AE). Although there was a tendency for CO to fall in the order groups (by 12% in the combination AIB group and by 10% in the conscious bled (CB) group), the responses were heterogeneous and did not permit us to find statistical significance. The anesthetized hemorrhage group (A vs AB) had a significantly ($p < 0.01$) greater response than the combination of ballistic injury and hemorrhage group (A vs AIB), again indicating that the ballistic injury attenuated the fall in CO in response to the hemorrhage. There was also a significant ($p < 0.01$) difference between the anesthetized and conscious bled groups (AE vs CB).

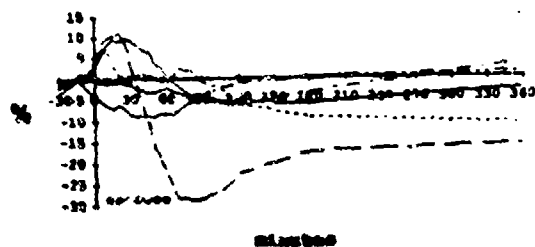
Figure 2 shows the changes in stroke volume (SV), systemic vascular resistance (SVR), renal blood flow (RBF) and renal vascular resistance (RVR).

Stroke volume (SV) was significantly ($p < 0.05$) reduced between pre and post-hemorrhage values in both the anesthetized (35%, AB) and the conscious (20%, CB) hemorrhaged groups. SV remained lower than baseline for the entire 5 hour experimental period in the AB group.

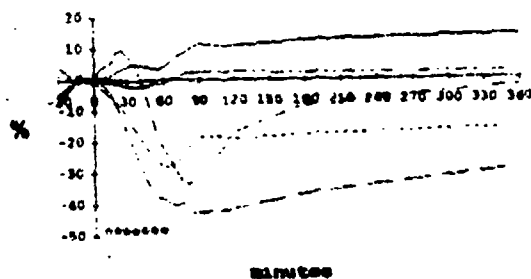
STROKE VOLUME



SYSTEMIC VASCULAR RESISTANCE



RENAL BLOOD FLOW



RENAL VASCULAR RESISTANCE



Hemodynamic changes in the five groups: Anesthetized (---),
Anesthetized and injured (—), anesthetized and bled (— —),
anesthetized, injured and bled (— · —), conscious bled (·····)
(time of hemorrhage: ·····)

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Hemorrhage reduced SV significantly ($p < 0.01$) in the anesthetized bled group when compared to the time control group (A vs AB). Only the anesthetized bled (AB) group and the combination injury and hemorrhage (AIB) group decreased SVR significantly ($p < 0.05$) by 25% and 10%, respectively, between initial and post-hemorrhage values. There were no significant differences between any of the groups at the end of hemorrhage (AI vs AIB, AB vs AIB, AB vs CB).

There was a significant ($p < 0.05$) decrease in renal blood flow (RBF) by 40% in the anesthetized bled group (AB) and by 30% in the conscious bled group (CB) between the initial and post-hemorrhage values. Hemorrhage group had a significant ($p < 0.01$) decrease in RBF.

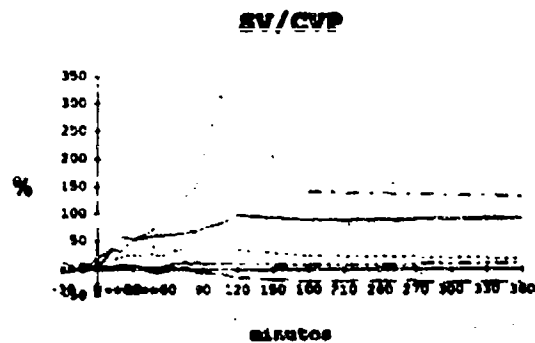
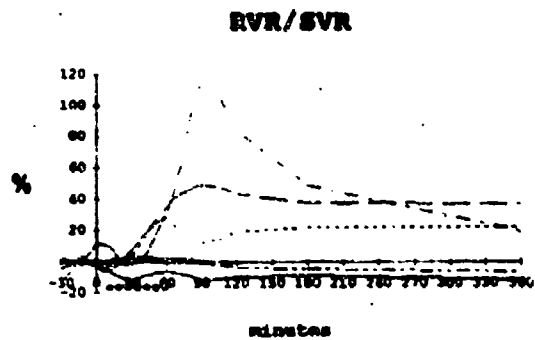
There was no change in renal vascular resistance (RVR) in any group between control and post-hemorrhage values. The increase in RVR in the combination (AIB) group was caused by heterogeneous values during the period (after 60min) when the animals were recovering from anesthesia. There were also no significant differences between groups.

Figure 3 shows the ratios of RVR/SVR and SV/CVP.

There was a significant ($p < 0.05$) increase in the RVR/SVR ratio of 35% in the AB group between the control and post-hemorrhage values. The RVR/SVR ratio was significantly ($p < 0.05$) greater in the A vs AB group but not in the A vs AIB group. The RVR/SVR ratio was also significantly greater in the AB group compared to the CB group. There were no other significant differences between any of the other groups.

There was a significant ($p < 0.05$) increase in the SV/CVP ratio, by 60% in the AI group and by 100% in the AIB group between the pre and post-hemorrhage values. The increase by 320% in the AIB group was caused by a heterogeneous response during the period when the animals were recovering from anesthesia. Ballistic injury increased significantly ratio SV/CVP, either by itself ($p < 0.01$) or in combination with hemorrhage ($p < 0.05$). There were no other significant differences between any other groups.

FIGURE N°3



Hemodynamic changes in the five groups: Anesthetized (---),
 Anesthetized and injured (—), anesthetized and bled (— —),
 anesthetized, injured and bled (— · —), conscious bled (....)
 (time of hemorrhage: ----)

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Only the parameters with significant variations are shown in the figures 4 and 5.

Hemorrhage produced an increased release of epinephrine with significant ($p < 0.05$) differences at +60 min in all three hemorrhage groups (AB, CB, and AIB) when compared to the pre-hemorrhage value. The comparisons between the AI vs AIB, the A vs AB, and AB vs CB groups were significant ($p < 0.05$).

Glucose was increased by 35%, 25 % and 10%, respectively in the three groups: AB ($p < 0.01$), AIB ($p < 0.01$), and CB ($p < 0.05$) groups when compared to pre-hemorrhage values. There was a late 20% increase in glucose in the anesthetized and trauma alone (AI) group at 360 min ($p < 0.01$). There were no significant differences between groups.

Plasma creatinine increased ($p < 0.01$) by 38% in AIB group and by 18% in AB group at 180 min. At this time, there were significant ($p < 0.01$) differences between the AI vs AIB, A vs AB, AB vs CB, and A vs AIB groups.

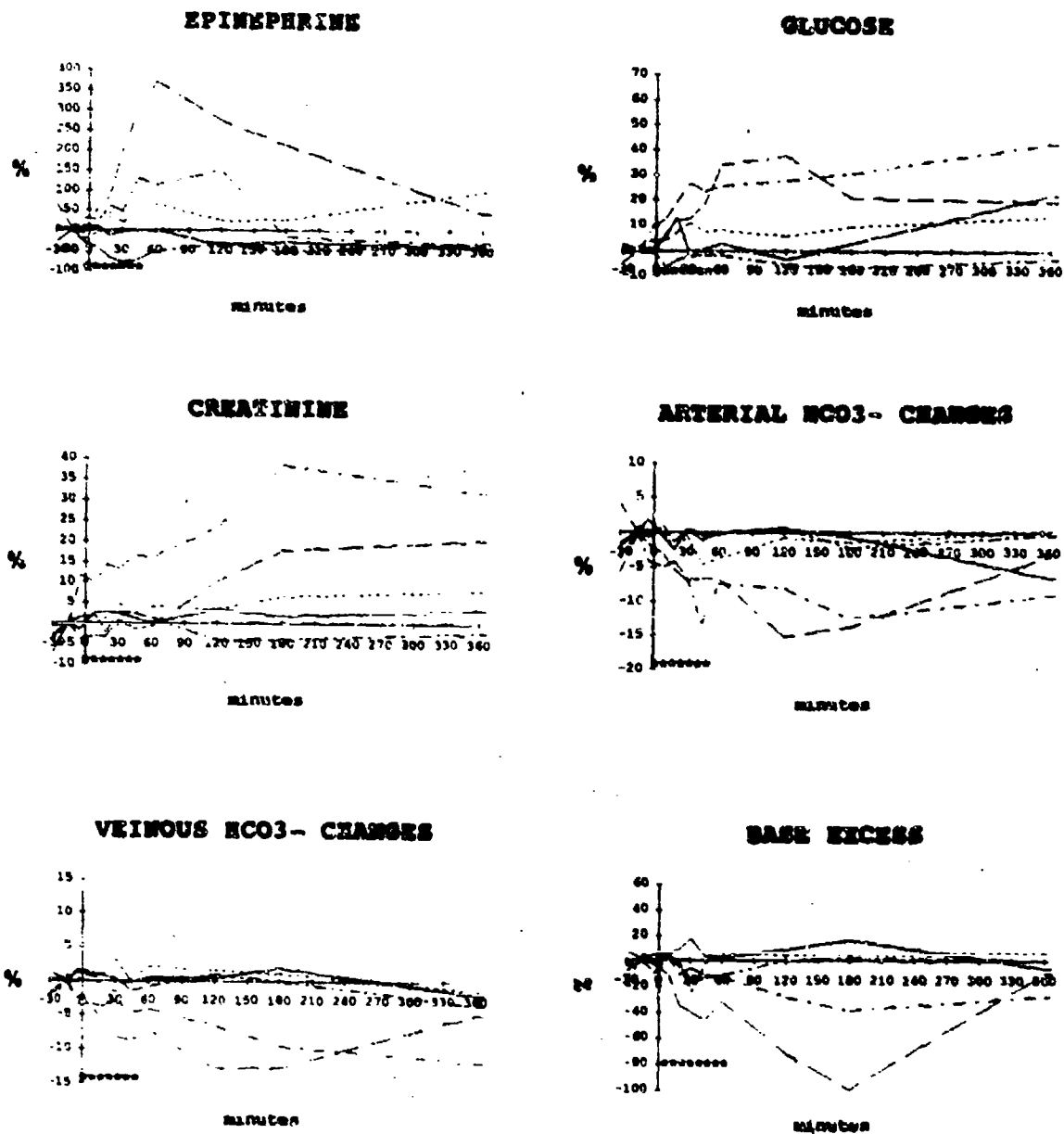
Blood pH and blood gases didn't shown significant variations between pre and post-hemorrhage values. However, plasma bicarbonate was decreased significantly ($p < 0.05$ at + 180 min) in both the AB and AIB groups. Six hours after hemorrhage, arterial bicarbonate tended to return toward its control value but only in the AB group. At this time, arterial bicarbonate was decreasing in the AI group. There were no significant differences between groups.

Figure 5 shows some biological parameters which presented some significant long-term changes, to 96 hours after the experiment.

Hematocrit and hemoglobin levels fell rapidly until 6 hours ($p < 0.01$) and more moderately until 24 hours in the 3 bled groups (AB, CB, and AIB). At this time, there were no statistically significant differences between those groups.

The number of leukocytes presented a moderate increase (10 to 25%) at 6 hours, and a second larger increase (+45 %) at 72 hours in the AIB group. These changes were significant. There were no significant changes between the groups.

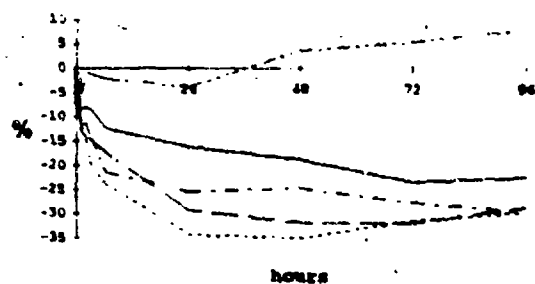
FIGURE N°4



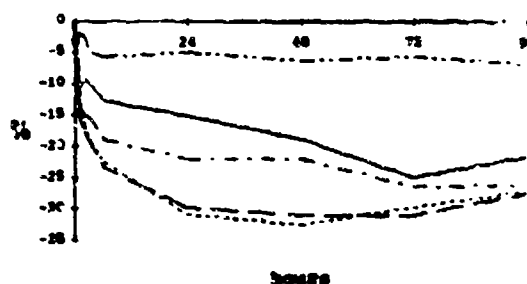
Biological changes in the five groups: Anesthetized (---).
 Anesthetized and injured (---), anesthetized and bled (---).
 anesthetized, injured and bled (---), conscious bled (....)
 (time of hemorrhage: #####)

COPY AVAILABLE TO DTIC DOES NOT PERMIT FULLY LEGIBLE REPRODUCTION

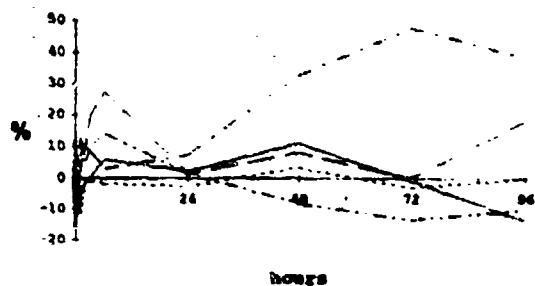
HEMATOCRIT CHANGES



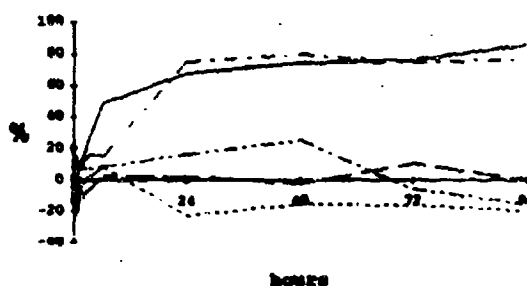
HEMOGLOBIN CHANGES



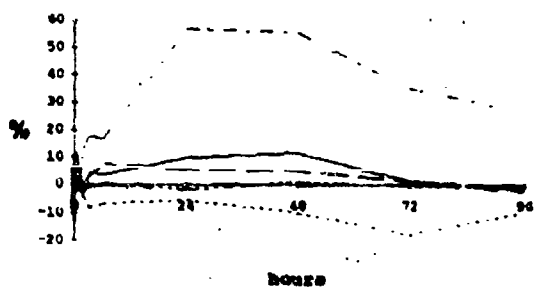
LEUKOCYTES CELLS



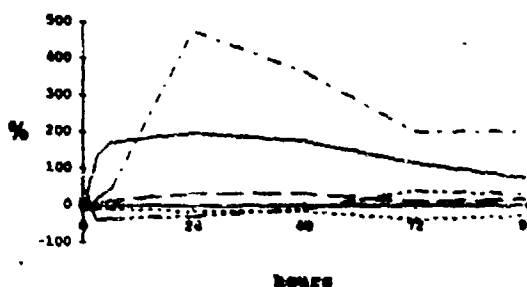
SGOT



LDH



CPK



Biological changes in the five groups: Anesthetized (---),
Anesthetized and injured (—), anesthetized and bled (— —),
anesthetized, injured and bled (— · —), conscious bled (....)
(time of hemorrhage: -----)

COPY AVAILABLE TO DTIC DOES NOT PERMIT FULLY LEGIBLE REPRODUCTION

Reflecting cellular destruction, the enzymes SGOT, LDH and CPK were increasing to a peak at 24 hours in both trauma groups (AI and AIB). The increase in the AI group was similar to the AIB group for SGOT, but somewhat less for LDH and CPK.

IV- DISCUSSION

For this study, we used the splenectomized pig model. This model is considered as one of the best with respect to hypovolemia, and also the best with respect to studying projectile injury (20). In fact, the muscular thickness of the thigh (about 14cm), allows one to obtain a significant cavitation effect (4) and therefore the resulting tissue lesions are more representative of those which are observed in humans (1). Furthermore, we have chosen the site of impact so that there will neither be a diaphyseal fracture (distance between diaphysis and projectile trajectory > 7cm), nor damage to a major blood vessel. Under these conditions, the hemorrhage due to the damage from the projectile is minimal. The ballistic injury is administered just before the hemorrhage, thus making these conditions more realistic to those seen in combat. In creating a ballistic injury, the rules of good laboratory practice require the experimenter to anesthetize the animals. We have chosen to use Ketamine as the anesthetic because it modifies the function of the cardiovascular system minimally during hypovolemia (25, 26, 27). After administration of the anesthetic, we have found a slight increase in heart rate, mean arterial pressure, and aortic flow. These results, in agreement with those given in references, are consequence of central stimulation of the sympathetic system (24, 26, 25). In preliminary measurements of the plasma volume using the Evan's Blue method, we showed that the total blood volume of the splenectomized, 90 kg, Large White Pig, varies between 60 to 66ml/kg. A hemorrhage of 15 ml/kg therefore corresponds to a moderate hemorrhage of 25% of the total blood volume. Such a blood loss does not provoke a maximal sympathetic stimulation ; this allows us to compare the amount of stimulation evoked by different treatments.

In the conscious animal, a hemorrhage of 25% provokes a very mild response. Because of an insufficient number of animals in this study, the changes observed in the conscious animals were frequently statistically insignificant. Likewise, in the anesthetized animals, we have found some physiological responses of variable intensities. Nevertheless, in either conscious or anesthetized animals, the physiological responses to the hemorrhage were generally in accord with those given in the literature (10, 13, 2, 16). The response corresponds to the classic scheme of a moderate sympathetic reaction: the reduction of blood volume and arterial pressure stimulates the sympathetic system via the volume and baroreceptors, which immediately causes an increase in heart rate and vasoconstriction of certain peripheral vascular beds like the kidneys. As found in many other animal studies, the decrease in renal flow was independent of the decrease in aortic flow. The variable, RVR/SVR, gives a good idea of this differential vasoconstriction. In contrast, we observed that the systemic vascular resistance decreased in this study. Hannon has reported similar results in the literature of porcine hypovolemia. The variability of the physiological parameters found in the conscious and anesthetized hemorrhaged groups generally agree in some ways but are of different intensity: they are more marked when the animal is anesthetized. In fact, the administration of anesthetic, general, is a factor which aggravates the response to hypovolemia. There exist many hypotheses concerning the mechanisms of action of ketamine: it can diminish the vasomotor responses, in spite of its effects on stimulating sympathetic discharge centrally, and it has a depressant effect on the myocardium (24). Our study shows effectively a large drop in the stroke volume (the increase in heart rate wasn't sufficient to be the cause) in animals anesthetized with ketamine.

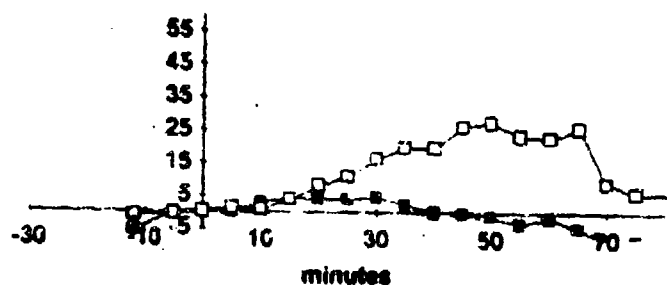
The projectile used in this study has a speed between 900 and 950m/sec at impact. The injury caused to the soft tissue of the thigh shows those local hemodynamic modifications as described by Rybeck, Holmström and Almskog: a large zone of hyperemia surrounds the ischemic area adjacent to the projectile trajectory. Thus, in the animals of the AI and AIB groups, we saw a cutaneous vasomotor reaction (RVMC of Breteau) appearing some minutes after the injury,

giving evidence of the existence of this phenomenon in the present study. Rybeck has shown that the local lesions are accompanied by an increase in the loss of blood in each of 2 limbs, with a slight reduction of arterial pressure and heart rate. It suggests the possible action of vasodilatory or neurogenic substances, but does not explain the non-cardiac response.

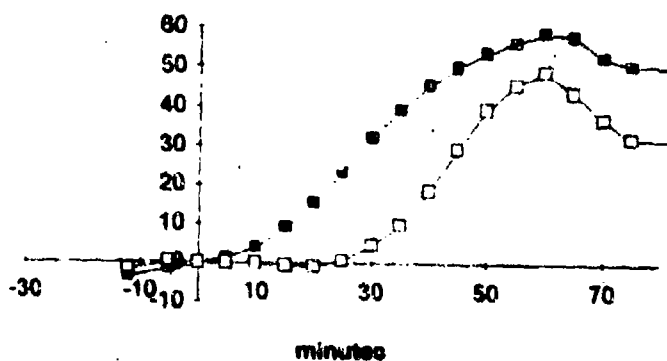
In the anesthetized and ballistically wounded animals, we have found a consistent decrease of the CVP, the other parameters do not present significant variations. The CVP decreased rapidly until 30min after the injury and it was maintained at this low level. This drop indicates an increase in the venous capacitance which could be due to the slow liberation of vasoactive substances by the injured tissue.

The animals in the injury and hemorrhage group presented rather heterogenous responses, which explains their occasional lack of statistical significance and makes it difficult to interpret. Nevertheless, all show a drop in CVP like those observed in the anesthetized, injured without hemorrhage. One would therefore hypothesize, as we have noted with the 18 ml/kg hemorrhage experiment, that the injury would aggravate the effects of hemorrhage. But this study has shown that for the hemorrhage of 15ml/kg, the arterial pressure subsides less when there is trauma associated with it. Two hypotheses can be advanced : either (1) peripheral vasoconstriction, or (2) the inotropy of the heart appears more effective in this case. Evidence against the first hypothesis, only 1 of 5 animals reacted with an intense vasoconstriction (the reason for the large response observed in the AIB group on the RVR and RVR/SVR curves. The other subjects appear to have maintained their arterial pressure with an increase in inotropy. Thus, in spite of a low preload, the stroke volume does not drop significantly, contrary to that observed in the anesthetized hemorrhaged group. The results which we have obtained of the animals instrumented with the myocardial strain gauge appears to confirm this hypothesis. Figure N° 6 shows the time course of the change in heart rate on the bottom panel and the relative change in the ratio of cardiac strain gauge over stroke volume on the top panel, for one animal in the AB group and one animal from the AIB group. This figure gives evidence for the inotropic hypothesis: one sees that

RATIO STRAIN GAUGE/SV CHANGES (%)



HEART RATE CHANGES (%)



Comparison of the strain gauge/stroke volume (reflection of myocardial inotropy) and the heart rate changes in the same animal from 2 groups: anesthetized with hemorrhage (■) and anesthetized, wounded with hemorrhage (□).

The stroke volume/SV ratio increased when there was an injury, preceded by hemorrhage alone while the heart rate increased later. In the hemorrhaged animal without injury, the heart responds almost exclusively with an early increase in the heart rate. The ratio SV/CVP has been calculated to evaluate the inotropy for the group of animals of each of the groups: this ratio increased significantly with the injury confirming the previous hypothesis.

It appears therefore, that in the case of a hemorrhage preceded by a ballistic injury, the heart used the mechanism of its increased inotropy, rather than its rate, to compensate for the hypovolemia. This reaction, which is effective for a hemorrhage of low volume, can become insufficient or result in cardiac fatigue for a larger hemorrhage, as we have observed in the animals injured and hemorrhaged at 12ml/kg, which died at the end of hemorrhage. However, to confirm this hypothesis, additional experiments will be necessary.

Inotropy and heart rate are modulated by the vagal and sympathetic activity. A modification of the responses of these parameters can come from the modulation of the balance between the two system's central control nuclei. Also, it will be particularly interesting to study the precise role of the vagus, by vagotomy, injection of atropine, or a dose of pancreatic polypeptide.

The modifications of hematologic and biochemical parameters reflect the physiological responses which resulted from the injury and/or the hemorrhage: the drop in hematocrit and the rate of hemoglobin are evidence of transcappillary refill. The epinephrine concentration reached its maximum at the end of hemorrhage reflecting increased sympathetic activity. The increase of the creatinine is a consequence of renal disfunction. The blood gases and pH, the hydroelectric equilibrium did not vary in a significant fashion. In contrast, the bicarbonate and the base excess dropped moderately, which corresponds to a well compensated hypovolemia. With the animals injured and hemorrhaged, the enzymes, evidence of cellular lysis, are liberated in a slower fashion but more intensely than in the wounded but not hemorrhaged group, reflecting the differences of local perfusion.

In conclusion, an injury of soft tissue by a projectile under anesthesia, modifies the physiological responses of the organism to

with hemorrhage, the heart utilizes the mechanism of increased inotropy rather than increased chronotropy, for contending against the hypovolemia. This compensatory reaction, effective for the small loss of blood (25%) became insufficient with a larger hemorrhage. The model of simple hemorrhage is therefore not quite representative of that which one would observe on the battlefield where hemorrhage is frequently the consequence of a bullet wound. There may be some limit in extrapolating the conclusion gained from this anesthetized, combination wound-hemorrhage model to that expected in the conscious animal, because the anesthesia itself modifies appreciably the responses to hemorrhage.

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ANEX

AI anesth+injured, AB anesth+bled, CB concious bled, AIB anesth+injured+bled, A anesth

Time (min)	30	-15	5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
H.R. (beats/min)																			
Mean AI	105	106	110	113	115	115	114	113	113	113	112	111	112	112	112	113	113	113	112
SEM	4.98	5.80	6.72	8.16	9.02	8.35	8.32	8.18	8.55	8.44	8.56	8.89	8.92	9.08	10.02	9.93	9.77	8.95	8.16
Mean AB	102	108	108	108	110	113	115	116	118	121	121	125	125	127	128	131	132	134	134
SEM	8.49	9.31	9.31	9.12	8.32	8.00	7.56	8.74	10.86	14.66	17.99	21.10	23.05	24.70	24.89	24.71	23.42	22.93	21.97
Mean CB	102	102	102	102	104	105	107	110	111	111	112	113	114	114	114	114	114	113	111
SEM	3.54	3.92	4.39	5.13	7.27	7.71	9.71	11.60	14.53	15.59	17.11	20.08	21.41	19.61	18.11	16.09	14.69	13.71	13.41
Mean AIB	99	108	110	114	117	119	115	113	110	108	108	106	106	105	105	105	105	107	107
SEM	3.75	9.81	12.85	18.15	23.23	25.20	18.60	15.22	11.81	8.85	9.44	10.67	12.54	14.08	14.67	14.34	14.19	13.79	13.89
Mean A	104	112	112	113	112	111	111	111	111	111	111	112	111	111	112	112	112	112	113
SEM	6.02	3.36	3.97	2.15	1.90	2.38	3.02	2.94	3.35	3.37	3.26	2.77	2.99	2.61	3.06	3.36	4.06	4.39	4.50
MAP (mmHg)																			
Mean AI	95	104	105	107	107	107	105	103	103	103	103	103	103	102	101	101	100	100	99
SEM	8.98	13.67	15.10	18.93	20.42	17.99	17.01	15.96	14.90	14.43	14.15	14.47	15.15	16.26	17.53	17.87	17.85	17.06	16.24
Mean AB	95	101	101	102	102	101	100	97	94	90	85	81	78	74	72	71	69	69	70
SEM	3.59	5.64	6.74	9.17	12.07	13.58	15.03	16.74	17.96	18.38	16.35	19.00	16.68	18.54	18.87	18.36	17.79	16.98	15.47
Mean CB	96	94	94	94	93	90	88	86	84	83	82	81	80	78	78	77	77	77	77
SEM	2.85	2.99	2.83	2.43	2.94	5.10	6.34	7.18	8.97	10.91	12.81	14.20	15.14	14.54	14.87	15.08	15.20	15.75	16.37
Mean AIB	91	98	99	100	100	98	95	92	88	84	82	81	81	80	80	80	80	81	81
SEM	1.94	4.06	5.01	5.38	4.97	5.74	7.93	9.46	12.67	16.11	18.02	19.03	20.07	20.96	21.65	22.36	22.36	21.94	21.42
Mean A	95	104	105	103	103	103	104	104	104	104	102	101	101	101	101	102	102	103	103
SEM	10.37	12.28	14.05	13.01	12.77	11.99	11.75	11.40	11.25	11.12	10.74	10.80	10.81	10.61	10.94	10.99	10.66	10.78	10.77
C.V. P. (mmHg)																			
Mean AI	5.4	5.5	5.3	5.1	4.7	4.1	3.6	3.4	3.3	3.3	3.4	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.1
SEM	0.43	0.50	0.84	1.18	1.29	1.23	1.26	1.06	0.91	0.94	0.96	0.91	0.88	0.83	0.81	0.78	0.79	0.77	0.76
Mean AB	4.8	4.7	4.7	4.1	4.5	4.2	4.1	3.8	3.7	3.7	3.7	3.7	3.7	3.6	3.6	3.4	3.4	3.4	3.3
SEM	0.34	0.33	0.34	0.48	0.45	0.60	0.70	0.76	0.88	0.90	1.13	1.24	1.32	1.29	1.32	1.33	1.27	1.24	1.27
Mean CB	4.8	4.8	4.8	4.0	4.4	4.1	3.8	3.6	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	2.9	2.9	2.8
SEM	0.23	0.34	0.44	0.55	0.68	0.75	0.78	0.67	0.82	0.44	0.34	0.32	0.36	0.38	0.44	0.40	0.53	0.56	0.58
Mean AIB	4.7	4.5	4.4	4.1	4.3	4.1	3.9	3.9	3.7	3.5	3.4	3.2	3.1	2.9	2.7	2.4	2.3	2.2	2.1
SEM	0.51	0.54	0.53	0.70	0.75	0.76	0.73	0.75	0.72	0.73	0.73	0.75	0.80	0.82	0.85	0.88	0.90	0.91	0.98
Mean A	5.2	5.0	5.8	6.0	6.0	6.0	5.8	5.7	5.7	5.7	5.7	5.9	5.9	5.9	5.8	5.5	5.4	5.3	5.3
SEM	0.91	0.84	0.88	1.38	1.14	0.92	1.02	0.94	0.91	0.91	0.81	0.86	0.59	0.56	0.59	0.46	0.49	0.48	0.57
C. Q. (Mean)																			
Mean AI	14.4	15.1	15.2	15.3	15.2	14.8	14.3	14.1	13.9	13.9	14.1	14.3	14.4	14.6	14.6	14.7	14.7	14.8	14.8
SEM	1.74	1.82	2.00	2.38	2.63	2.44	2.28	2.19	2.36	2.33	2.47	2.78	2.83	2.77	2.81	2.78	2.63	2.63	2.72
Mean AB	12.8	13.2	13.2	12.8	12.5	12.1	11.8	11.4	11.1	10.8	10.5	9.9	9.8	9.3	9.1	9.3	9.6	9.6	10.0
SEM	0.61	0.52	0.52	0.62	1.34	1.05	1.13	1.23	1.24	1.25	1.25	1.25	1.25	1.24	1.23	1.22	1.19	1.17	1.18
Mean CB	14.1	13.7	13.5	13.2	12.8	12.4	12.5	12.5	12.4	12.5	12.5	12.5	12.5	12.4	12.3	12.2	11.9	11.7	11.8
SEM	0.71	0.70	0.60	0.76	1.28	1.41	1.55	1.68	2.38	2.88	3.48	3.61	3.62	3.38	3.54	3.59	3.25	3.17	3.26
Mean AIB	14.4	16.0	16.8	17.5	18.0	17.9	17.4	16.5	16.3	15.9	15.6	15.3	15.0	14.8	14.5	14.2	14.2	13.9	13.7
SEM	2.92	3.90	5.12	6.03	6.84	6.62	6.50	5.90	5.42	6.70	6.59	6.19	5.81	5.51	4.89	4.43	4.31	3.99	3.69
Mean A	13.5	14.6	14.7	14.6	14.6	14.7	14.7	14.7	14.8	14.7	14.8	14.7	14.7	14.7	14.7	14.7	14.9	15.0	15.1
SEM	1.12	1.15	1.17	1.06	1.00	1.12	1.22	1.35	1.45	1.51	1.66	1.76	1.73	1.72	1.65	1.46	1.11	0.94	0.81

Time (min)	80	85	90	105	120	180	340	1440	2680	4320	5760
H.R. (beats/min)											
Mean AI	113	112	112	113	114	114	112	111	109	105	104
SEM	7.18	6.28	5.48	5.03	3.80	5.82	9.04	13.12	17.54	21.59	24.25
Mean AB	130	140	141	136	135	128	120	112	108	101	100
SEM	21.88	22.38	22.41	18.92	12.89	10.50	8.31	8.89	10.12	10.06	10.87
Mean CB	112	112	112	113	115	114	111	109	106	102	102
SEM	13.11	13.08	14.05	16.86	20.05	21.98	21.74	21.44	19.26	18.00	18.05
Mean AIB	108	108	110	115	115	115	106	104	95	90	85
SEM	14.02	14.18	14.28	15.99	16.62	16.03	18.45	24.31	31.47	41.32	51.05
Mean A	114	115	115	114	113	111	106	107	107	109	106
SEM	5.08	5.12	4.56	4.39	4.64	4.00	5.40	6.42	6.05	6.59	5.35
M.A.P. (mmHg)											
Mean AI	99	98	98	97	97	97	98	98	94	94	95
SEM	15.88	15.28	15.07	14.85	14.83	14.59	14.82	15.35	17.46	15.58	15.99
Mean AB	70	71	71	73	75	81	88	98	102	107	108
SEM	14.71	13.17	12.08	11.08	10.67	10.33	11.20	14.74	17.82	20.08	21.27
Mean CB	77	77	77	78	78	81	83	88	90	93	95
SEM	16.41	16.74	16.79	17.00	16.14	14.13	12.88	11.80	10.96	11.09	11.54
Mean AIB	82	83	84	87	91	96	102	102	100	97	87
SEM	20.47	20.75	20.45	20.04	21.30	21.21	18.08	15.53	19.23	27.47	40.29
Mean A	103	103	103	103	103	103	101	99	97	93	93
SEM	10.49	10.23	9.88	10.22	10.47	11.52	12.52	12.73	13.36	12.51	14.89
C.V. P. (mmHg)											
Mean AI	3.1	3.1	3.0	2.9	2.8	2.8	2.8	3.1	3.3	3.5	3.6
SEM	0.83	0.80	0.87	0.94	1.04	0.91	0.92	0.90	0.84	0.82	1.01
Mean AB	3.4	3.5	3.6	3.7	4.0	4.5	4.6	5.5	6.3	6.5	6.8
SEM	1.22	1.21	1.23	1.24	1.22	1.30	0.73	0.48	0.41	0.51	0.70
Mean CB	2.8	2.8	2.9	3.0	3.3	3.7	4.0	4.2	4.8	4.8	4.5
SEM	0.68	0.65	1.07	1.12	0.98	0.88	0.72	0.63	0.71	0.81	0.82
Mean AIB	2.2	2.1	2.1	1.9	1.8	2.1	2.3	2.6	2.8	3.2	3.3
SEM	1.02	1.11	1.20	1.23	1.13	0.91	0.83	1.08	1.46	1.79	2.09
Mean A	5.3	5.2	5.3	5.3	5.3	5.4	5.1	6.0	5.1	5.4	5.6
SEM	0.88	0.74	0.85	0.88	1.05	1.08	1.22	1.22	1.19	1.08	0.86
C. Q. (mmHg)											
Mean AI	14.9	14.8	14.8	15.0	15.3	15.8	15.8	15.8	16.3	15.0	14.6
SEM	2.70	2.74	2.85	3.15	3.48	4.41	4.59	4.44	4.18	4.12	3.31
Mean AB	10.1	10.3	10.3	10.3	10.3	10.3	11.5	12.1	12.8	13.6	13.8
SEM	4.78	4.87	5.08	5.02	4.81	3.86	3.08	2.30	1.89	1.12	1.43
Mean CB	11.7	11.7	12.0	12.1	12.5	13.1	13.7	14.0	14.5	15.0	15.1
SEM	2.84	2.85	2.78	2.65	2.34	2.04	1.57	1.67	2.03	2.11	2.07
Mean AIB	13.7	13.7	14.0	14.6	15.2	15.6	15.3	14.7	13.9	12.9	12.1
SEM	3.71	3.75	3.84	3.92	4.14	4.30	2.64	1.36	2.49	4.55	6.85
Mean A	15.2	15.2	15.1	14.8	14.6	14.4	14.2	13.8	12.7	12.8	13.6
SEM	0.78	0.74	0.74	0.99	1.28	1.40	1.62	1.48	2.22	1.48	0.74

AI anesth+injured, AB anesth+bled, CB concious bled, CB concious bled, AB anesth+injured+bled, A anesth.

Time (min)	-30	-15	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
S. V. R. (beats/min)																				
Mean AI	134	135	132	131	127	126	123	124	123	123	125	127	126	127	126	127	126	127	127	
SEM	12.41	12.32	14.73	16.73	20.24	21.33	20.23	19.00	20.46	18.74	20.70	22.63	21.94	20.81	20.82	19.16	18.67	19.60	21.33	
Mean AB	125	123	123	119	115	109	104	99	95	91	87	82	76	75	73	73	74	74	73	
SEM	6.91	9.02	11.64	14.30	17.66	21.66	21.65	21.52	21.28	24.06	25.89	30.47	33.73	36.12	36.71	36.85	35.46	35.01	34.11	
Mean CB	139	134	132	129	122	116	117	114	112	112	111	111	110	108	107	105	104	103	103	
SEM	5.72	7.21	8.30	11.28	17.78	19.02	18.75	19.18	19.12	20.70	23.10	23.10	22.46	20.23	20.29	20.09	17.87	17.71	18.11	
Mean AIB	146	140	154	157	156	155	154	149	149	148	140	147	146	144	142	138	137	134	134	
SEM	31.74	36.68	50.99	60.54	67.84	64.74	62.83	57.47	61.96	64.21	67.26	67.26	65.61	63.93	59.82	54.12	51.81	47.92	45.13	
Mean A	131	131	131	130	131	133	133	132	133	132	132	131	132	132	132	133	133	133	134	
SEM	13.16	10.56	11.46	6.02	8.36	9.77	10.04	10.73	11.41	11.78	12.74	13.94	13.93	14.00	13.45	12.15	9.92	8.50	8.33	
S. V. R. (beats/min)																				
Mean AI	6.78	7.03	7.15	7.24	7.46	7.59	7.72	7.65	7.74	7.67	7.60	7.50	7.48	7.28	7.21	7.05	6.98	6.91	6.84	
SEM	1.04	1.22	1.32	1.54	1.73	1.58	1.64	1.62	1.77	1.73	1.78	1.90	1.97	1.99	2.06	2.09	2.04	1.99	1.83	
Mean AB	7.00	7.74	7.72	8.03	8.32	8.43	8.48	8.51	8.36	7.95	7.64	7.32	7.00	6.61	6.40	6.14	5.88	5.75	5.75	
SEM	0.32	0.50	0.60	0.92	1.47	1.76	1.94	2.17	2.27	2.10	2.01	1.94	1.84	1.67	1.66	1.52	1.43	1.37	1.35	
Mean CB	6.80	6.90	7.00	7.17	7.42	7.35	7.14	7.01	6.96	6.93	6.97	6.96	6.97	6.91	6.86	6.90	6.95	7.09	7.04	
SEM	0.24	0.21	0.23	0.39	0.73	0.82	0.69	0.71	0.80	0.80	0.82	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	
Mean AIB	6.49	6.48	6.29	6.18	6.12	6.04	5.99	6.06	5.99	5.86	5.85	5.88	5.85	5.85	5.88	5.89	5.89	5.97	6.04	
SEM	1.10	1.36	1.62	1.78	1.90	1.91	1.96	1.90	2.00	2.03	2.06	2.03	1.92	1.83	1.69	1.51	1.36	1.25	1.11	
Mean A	7.05	7.13	7.18	7.10	7.06	7.05	7.07	7.09	7.06	7.03	6.96	6.94	6.91	6.91	6.96	6.96	6.94	6.90	6.85	
SEM	1.09	1.13	1.23	1.15	1.05	1.02	0.96	1.02	1.03	1.05	1.11	1.15	1.16	1.14	1.15	1.12	1.05	1.02	1.00	
R. B. P. (mmHg)																				
Mean AI	766	824	825	824	830	832	836	844	853	861	866	881	869	854	854	859	872	881	889	
SEM	55.80	74.79	73.23	65.32	64.20	62.07	61.42	57.36	51.93	50.03	44.47	40.34	37.13	36.72	42.49	46.64	50.13	50.66	49.08	
Mean AB	795	834	836	826	831	817	797	766	732	694	662	619	587	561	537	533	518	515	522	
SEM	32.35	45.82	54.40	76.25	97.78	104.65	119.70	134.17	140.81	139.40	132.16	137.80	130.41	121.60	131.66	129.80	116.40	114.04	113.53	
Mean CB	740	778	773	772	780	748	735	718	702	681	662	628	605	582	566	557	557	565	581	
SEM	23.51	17.66	19.97	32.10	42.86	51.82	50.65	43.13	37.56	32.04	27.80	27.80	26.81	26.86	31.57	36.44	38.83	39.44	43.95	
Mean AIB	710	791	791	785	820	830	835	850	858	853	828	798	745	680	641	611	585	567	534	
SEM	31.55	58.14	67.37	90.59	103.30	120.31	149.54	172.83	194.02	222.48	222.90	212.79	202.38	186.27	207.09	224.44	234.28	240.54	266.41	
Mean A	761	726	717	720	720	722	719	718	716	712	711	711	712	715	720	723	727	732	738	
SEM	26.66	18.51	25.86	22.36	21.29	19.70	20.39	19.93	20.52	20.52	19.36	18.95	19.31	19.62	21.50	22.25	23.68	24.80	24.80	
R. V. R. (beats/min)																				
Mean AI	124	125	127	129	129	128	125	122	120	119	119	120	120	119	118	117	115	113	111	
SEM	3.33	5.48	7.40	10.20	11.96	12.93	12.68	11.94	11.36	11.24	11.59	12.33	13.32	14.50	15.65	16.15	16.04	15.37	14.39	
Mean AB	119	120	121	121	123	124	125	127	126	128	131	131	131	131	131	131	131	132	132	
SEM	2.10	1.82	1.74	2.66	3.73	5.97	6.93	12.65	15.66	16.02	19.14	20.03	20.13	20.90	22.37	24.30	24.65	24.78	23.30	
Mean CB	121	122	122	123	122	121	120	120	120	122	126	130	130	131	140	141	140	138	134	
SEM	2.63	4.14	5.71	6.37	10.44	12.10	13.00	13.22	13.34	14.18	16.60	19.66	23.93	28.65	32.37	34.33	32.71	37.86	38.27	
Mean AIB	121	124	124	124	121	118	113	107	102	99	100	103	110	120	134	147	160	179	200	
SEM	5.90	7.11	10.07	15.67	19.83	23.13	24.30	24.07	22.94	22.26	21.33	22.16	25.08	31.60	44.52	57.27	68.74	84.35	105.24	
Mean A	124	123	124	123	123	123	124	124	124	124	124	124	124	124	124	124	124	124	124	
SEM	1.52	1.55	1.91	1.73	1.67	1.66	1.56	1.47	1.40	1.40	1.38	1.37	1.26	1.19	1.06	1.16	1.29	1.51	1.47	

Time (min)	80	85	90	105	120	180	360	1440	2160	4320	5760
S. V. (prebled)											
Mean AI	130	131	131	132	132	135	136	136	140	145	147
SEM	22.04	24.37	26.51	29.09	30.03	34.50	33.57	27.82	19.26	13.61	2.79
Mean AB	73	74	75	75	76	83	83	105	117	130	132
SEM	34.79	35.14	35.94	36.35	36.11	29.46	23.44	16.35	7.50	3.42	8.37
Mean CB	101	104	106	107	109	117	125	131	141	149	150
SEM	14.65	11.68	13.72	15.42	15.31	16.47	17.30	19.36	21.49	22.11	21.24
Mean AIB	131	130	131	133	136	140	146	150	155	157	142
SEM	48.53	47.86	48.73	49.04	48.53	49.10	48.60	46.53	45.80	44.40	40.43
Mean A	134	132	131	130	129	130	130	128	118	117	128
SEM	7.55	5.87	3.79	4.79	7.08	10.59	10.71	7.85	17.86	10.16	.51
S. V. R. (injured+bled)											
Mean AI	6.75	6.75	6.73	6.68	6.62	6.02	6.85	6.80	6.80	6.88	6.93
SEM	1.75	1.57	1.43	1.28	1.20	1.46	1.34	1.41	1.20	1.31	1.05
Mean AB	5.72	5.71	5.74	5.87	6.15	6.50	6.62	7.34	7.67	7.91	7.94
SEM	1.29	1.28	1.27	1.22	1.31	1.28	1.25	1.59	1.56	1.24	1.45
Mean CB	7.04	6.85	6.85	6.75	6.47	6.25	6.13	6.16	6.25	6.28	6.37
SEM	2.86	2.66	2.61	2.43	2.01	1.43	1.08	0.74	0.75	0.74	0.83
Mean AIB	6.08	6.13	6.14	6.08	6.04	6.35	6.71	6.98	7.25	7.94	7.20
SEM	1.04	0.93	0.85	0.79	0.68	1.08	0.90	0.85	0.99	1.56	1.90
Mean A	6.79	6.82	6.85	6.98	7.06	7.16	7.21	7.20	7.78	7.31	6.72
SEM	0.98	0.94	0.90	0.84	0.98	1.00	1.04	1.04	1.61	0.96	1.03
R. B. F. (injured)											
Mean AI	48.68	52.95	58.18	57.47	50.37	127.50	151.20	162.81	181.94	204.84	182.26
SEM	509	469	497	501	503	544	605	645	681	731	745
Mean AB	100.65	96.23	95.33	96.47	85.19	56.62	38.29	73.64	110.32	159.95	169.83
SEM	603	621	631	631	624	637	761	682	739	790	839
Mean CB	69.89	69.23	105.17	110.12	107.41	105.30	24.95	58.08	36.36	57.25	112.85
SEM	522	534	598	591	657	728	773	607	823	888	919
Mean AIB	207.03	312.01	312.70	319.42	308.73	323.97	300.40	171.04	26.55	80.08	50.45
SEM	742	753	747	747	746	746	746	745	741	740	741
Mean A	25.14	23.73	21.85	19.97	19.24	17.89	11.51	15.81	13.42	26.22	13.42
SEM	108	108	108	108	107	105	134	103	101	96	98
Mean AI	13.17	12.19	11.29	12.14	19.24	20.71	23.29	23.82	28.03	22.33	22.75
SEM	134	136	137	139	142	146	147	153	153	158	159
Mean AB	20.37	18.04	13.14	12.16	14.09	19.07	25.80	35.59	44.17	50.36	54.15
SEM	130	128	128	129	131	132	136	127	122	119	115
Mean CB	38.39	41.82	44.52	45.70	44.76	40.33	31.95	22.08	16.76	17.07	20.51
SEM	224	242	251	205	211	177	153	131	130	125	122
Mean AIB	143.97	180.87	205.85	202.89	177.93	122.46	67.08	23.20	6.55	2.79	4.47
SEM	136	136	137	137	137	137	136	133	131	128	124
Mean A	19.95	10.50	10.34	10.87	11.08	12.62	15.21	16.78	19.60	19.95	21.94
SEM	108	108	108	108	107	105	134	103	101	96	98

AI: anesth+injured; AB: anesth+bled; CB: concious blec; AIB: anesth+injured+bled; A: anesth.

Time (min)	30	15	5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	
Ratio RV/SHR																				
Mean AI	18.43	16.29	16.25	16.46	16.06	17.36	16.77	16.51	16.12	16.10	16.30	16.06	16.73	17.09	17.13	17.24	17.06	16.94	16.93	
SEM	3.26	3.47	3.62	4.34	1.60	3.62	3.67	3.54	3.64	3.55	3.31	3.92	3.68	3.77	3.76	3.66	3.27	3.26	3.21	
Mean AB	15.64	15.62	15.73	15.30	15.12	15.24	15.36	15.68	16.22	17.08	17.92	18.73	19.51	20.65	21.40	22.02	22.98	23.59	23.77	
SEM	0.85	1.16	1.39	1.65	2.87	3.32	3.46	3.52	4.17	4.16	4.31	4.67	4.92	4.98	5.73	5.84	5.61	5.72	6.07	
Mean CB	17.86	17.64	17.44	17.09	16.54	16.57	16.95	17.36	17.62	18.45	19.46	20.43	21.41	22.10	22.71	22.77	22.21	21.40	20.34	
SEM	0.96	0.73	0.71	1.08	1.39	1.46	1.69	2.29	3.76	4.55	6.20	7.09	7.97	8.09	8.80	8.96	8.39	8.03	8.25	
Mean AIB	19.23	20.02	21.23	22.03	22.15	21.95	21.47	19.87	19.60	19.93	20.40	20.59	21.65	23.12	24.63	26.06	27.76	30.12	32.35	
SEM	3.76	5.42	7.52	8.97	9.73	10.08	10.47	9.41	10.00	11.46	12.36	11.66	11.49	11.12	10.17	9.84	10.21	11.79	14.30	
Mean A	17.91	20.21	20.27	20.36	20.26	20.35	20.52	20.56	20.71	20.77	20.81	20.73	20.72	20.84	20.49	20.51	20.48	20.48	20.48	
SEM	2.17	2.10	2.34	2.10	1.83	2.02	2.17	2.36	2.54	2.94	2.82	2.91	2.83	2.73	2.61	2.36	2.08	1.94	1.80	
Ratio SV/SHR																				
Mean AI	24.65	24.84	25.30	26.86	28.42	33.00	37.46	39.95	40.28	39.84	35.88	40.37	40.79	41.08	41.24	41.58	41.60	42.51	42.59	
SEM	2.67	2.82	4.66	6.63	8.75	11.34	14.36	14.44	14.36	13.72	13.60	13.60	13.14	12.45	12.10	10.30	9.80	9.03	8.42	
Mean AB	26.04	26.11	26.15	26.18	25.16	26.52	26.84	26.97	27.55	27.35	26.73	25.61	24.93	24.34	24.66	25.73	26.22	26.17	26.81	
SEM	2.91	3.41	4.03	5.21	6.37	6.73	9.08	11.04	12.33	13.53	14.35	14.67	15.28	15.38	15.96	16.75	16.61	16.32	17.03	
Mean CB	28.79	28.28	28.14	28.72	28.92	30.57	33.14	34.02	35.05	35.08	35.02	33.81	35.61	35.13	35.12	35.43	37.53	37.55	39.20	
SEM	1.63	3.45	4.30	6.01	6.45	10.34	12.50	12.14	12.20	11.34	10.86	9.12	10.94	10.07	9.85	10.37	11.15	11.94	13.54	
Mean AIB	31.95	33.88	36.56	39.57	41.02	42.13	43.57	42.52	43.67	47.01	49.46	50.50	52.57	54.27	57.66	60.92	63.53	65.34	70.15	
SEM	10.43	13.71	18.14	25.40	29.39	30.27	30.75	29.27	31.82	34.79	37.05	37.09	37.17	36.20	34.53	29.25	27.04	24.95	30.27	
Mean A	25.84	22.67	23.14	23.06	22.80	22.67	23.67	23.98	24.11	24.08	23.78	22.84	22.79	22.92	23.34	24.26	25.03	25.31	25.70	
SEM	6.50	4.87	5.00	7.24	5.84	4.89	5.68	5.91	5.93	5.90	5.72	5.10	4.65	4.72	4.91	4.28	3.74	3.26	3.36	

A1 anesth+injured; AB anesth+bled; CB concious bled; AIB anesth+injured+bled; A anesth

Time (min)	80	85	90	105	120	180	360	1440	2880	4320	5760
Ratio RYR:SVR											
Mean A1	16.74	18.41	16.71	16.31	16.61	16.74	16.13	15.82	15.51	15.03	14.95
SEM	3.10	2.98	2.95	3.21	4.01	5.32	5.99	5.98	5.30	6.02	5.14
Mean AB	24.10	24.65	24.76	24.36	23.60	22.57	22.30	20.84	20.24	19.65	19.69
SEM	5.37	5.42	5.32	4.54	3.89	2.52	2.18	2.35	2.91	3.96	4.36
Mean CB	19.38	19.05	20.00	20.42	21.22	21.72	21.67	20.65	19.93	18.93	18.02
SEM	7.46	7.43	8.67	9.23	9.02	8.39	6.83	3.25	2.36	1.72	1.76
Mean A1	36.77	39.53	41.34	39.35	36.51	29.05	23.58	19.14	18.24	16.22	16.08
SEM	21.55	28.53	34.90	34.54	30.96	20.96	12.20	4.98	3.34	3.13	2.74
Mean A	20.51	20.39	20.19	19.82	19.83	19.36	19.05	18.56	17.18	17.37	18.78
SEM	1.76	1.85	1.55	1.65	1.83	1.97	2.23	2.40	3.31	2.86	1.32
Ratio SVR:VP											
Mean A1	43.70	43.72	45.21	47.57	51.57	48.01	50.07	47.91	45.17	43.69	43.44
SEM	9.09	8.51	10.06	13.26	17.93	14.84	16.45	16.24	14.60	14.73	13.56
Mean AB	25.64	24.64	24.17	23.69	21.81	20.02	19.58	19.36	18.73	19.98	19.63
SEM	15.83	15.03	14.95	14.80	12.97	9.41	6.54	3.90	1.51	1.48	2.46
Mean CB	40.72	42.18	42.73	42.78	37.72	35.11	33.33	32.17	32.72	33.71	34.66
SEM	16.69	19.46	21.43	23.34	17.06	14.01	10.36	9.74	8.73	9.25	9.73
Mean A1S	69.90	76.20	88.94	119.80	107.42	71.97	68.88	75.76	92.02	123.38	43.12
SEM	33.11	45.82	60.87	124.50	85.10	21.14	31.25	62.58	110.85	186.78	20.85
Mean A	25.51	25.75	25.56	25.36	25.25	24.94	25.35	22.82	24.58	22.70	23.22
SEM	3.53	3.72	4.32	5.28	6.05	6.46	7.42	5.38	8.64	6.25	4.51

Time (h)	0	15	5	9	15	31	44	60	120	180	300	1440	2880	4320
Mean length (mm)														
Mean AI	4.62	6.35	7.14	6.26	5.68	6.28	6.46	6.42	4.10	4.52	3.90	2.70	3.12	1.64
SEM	3.46	4.32	4.06	3.25	2.86	2.84	4.27	4.11	2.11	1.27	1.80	1.52	1.64	0.45
Mean AB	2.55	1.50	1.43	2.36	2.78	4.46	6.03	7.08	5.58	4.68	2.70	3.88	5.40	3.10
SEM	1.05	1.06	1.05	1.70	2.21	4.36	5.86	5.32	3.80	3.88	0.98	2.98	4.58	1.57
Mean CB	2.36	2.14	1.66	2.04	2.84	2.62	2.90	3.58	2.68	2.72	4.26	2.46	1.68	2.34
SEM	0.86	0.54	0.70	0.57	1.86	2.17	1.34	2.48	1.37	0.90	4.24	0.31	1.40	1.40
Mean AIB	3.92	3.64	4.78	4.80	6.03	5.46	6.34	7.80	9.10	3.08	2.45	3.74	2.40	1.64
SEM	1.77	2.04	4.78	4.80	6.03	5.46	6.34	7.80	9.10	3.08	2.45	3.74	2.40	1.64
Mean A	3.12	4.41	5.21	2.45	1.41	0.92	1.28	2.12	3.01	2.15	3.23	4.10	1.21	0.95
SEM	1.24	1.36	2.14	1.05	0.98	1.01	1.21	1.74	1.85	1.53	1.24	2.13	1.07	0.87
Mean length (mm)														
Mean AI	4.80	4.94	4.32	5.46	5.62	4.68	3.82	4.02	5.90	4.86	6.76	2.78	4.42	2.88
SEM	2.62	2.62	3.25	3.47	4.98	3.62	1.85	2.35	4.65	2.63	4.85	1.76	3.04	2.31
Mean AB	6.80	5.54	5.76	5.62	5.30	6.80	6.92	6.90	7.46	11.02	4.30	3.39	3.68	4.52
SEM	2.70	3.18	5.50	4.47	4.30	3.58	2.40	3.18	5.09	8.30	1.13	2.00	1.70	2.18
Mean CB	4.28	4.16	3.84	3.28	3.66	4.44	5.06	4.78	4.76	6.04	5.24	5.47	4.35	6.09
SEM	2.20	2.68	2.20	1.79	2.41	3.01	3.15	2.16	2.21	2.53	3.01	3.69	2.26	3.05
Mean AIB	6.36	7.38	6.78	6.34	6.34	5.80	7.50	6.74	6.56	8.42	7.46	5.34	4.90	9.82
SEM	6.90	5.95	4.50	3.83	5.29	2.44	5.81	4.92	4.68	5.44	5.10	4.15	2.81	4.38
Mean A	5.12	5.23	4.52	4.58	4.38	6.01	5.27	4.83	3.73	4.26	3.24	3.78	4.19	3.12
SEM	2.40	2.34	1.95	1.98	2.21	3.01	2.74	2.32	1.98	2.38	1.97	1.6	2.01	2.37
Mean length (mm)														
Mean AI	0.91	0.91	0.90	0.96	1.03	0.90	0.91	0.94	0.88	0.84	1.11	1.08	1.07	0.97
SEM	0.12	0.09	0.08	0.07	0.23	0.09	0.13	0.14	0.12	0.10	0.27	0.19	0.15	0.15
Mean AB	0.98	0.96	0.95	1.03	1.07	1.06	1.14	1.29	1.32	1.16	1.15	1.07	0.97	0.95
SEM	0.19	0.17	0.13	0.19	0.27	0.26	0.38	0.42	0.43	0.16	0.13	0.19	0.08	0.06
Mean CB	0.84	0.83	0.85	0.88	0.88	0.92	0.89	0.89	0.88	0.81	0.94	0.96	0.89	0.96
SEM	0.20	0.17	0.16	0.17	0.18	0.19	0.19	0.16	0.21	0.21	0.19	0.20	0.16	0.10
Mean AIB	0.73	0.74	0.80	0.83	0.88	0.93	0.91	0.93	0.94	0.98	1.05	1.20	1.10	1.00
SEM	0.13	0.14	0.21	0.23	0.28	0.27	0.23	0.25	0.22	0.30	0.23	0.10	0.22	0.09
Mean A	0.89	0.92	0.93	0.86	0.88	0.90	0.80	0.80	0.87	0.85	0.89	0.84	0.84	0.91
SEM	0.13	0.10	0.09	0.09	0.10	0.06	0.11	0.15	1.01	0.06	0.10	0.06	0.06	0.14
Mean length (mm)														
Mean AI	52.22	14.44	57.02	59.80	58.60	57.90	56.34	56.06	61.74	58.80	58.98	57.16	57.80	57.31
SEM	15.11	4.10	16.20	11.46	14.05	12.42	16.16	14.04	14.58	17.56	18.44	10.82	19.65	17.87
Mean AB	59.13	45.55	54.33	61.55	58.03	54.45	53.23	53.60	52.90	55.13	49.85	53.10	51.80	52.78
SEM	20.27	3.79	25.51	16.88	15.08	14.34	11.78	14.10	15.28	11.02	8.96	6.37	7.31	6.57
Mean CB	56.54	33.88	55.84	58.28	55.64	54.08	61.90	63.50	57.86	53.00	53.60	59.00	58.92	57.32
SEM	17.38	16.70	16.10	13.88	11.88	14.14	11.53	15.05	12.17	16.55	15.25	13.73	11.90	10.48
Mean AIB	49.53	40.18	70.80	69.00	75.86	77.80	80.33	78.30	88.63	100.80	95.04	88.44	81.44	76.52
SEM	2.06	23.07	27.02	20.02	25.58	28.41	37.17	35.07	53.03	74.42	83.10	56.28	51.74	60.70
Mean A	57.00	57.20	60.10	57.85	59.25	57.10	58.56	58.06	56.30	58.50	58.50	58.50	59.30	54.7
SEM	13.32	14.25	10.52	11.20	17.52	16.34	12.78	14.20	10.48	11.78	12.85	13.47	15.23	12.63

Time (min)	-30	-15	-5	9	19	31	44	60	120	180	360	1440	2880	4320	5760
AI: anesth+injured															
Mean AI	0.33	0.26	0.29	0.29	0.30	0.29	0.27	0.24	0.31	0.26	0.26	0.30	0.30	0.35	0.3
SEM	0.09	0.05	0.12	0.09	0.16	0.11	0.06	0.09	0.10	0.08	0.09	0.06	0.06	0.08	0.07
Mean AB	0.36	0.37	0.36	0.38	0.37	0.37	0.36	0.38	0.37	0.39	0.40	0.42	0.39	0.36	0.35
SEM	0.09	0.11	0.10	0.10	0.09	0.08	0.08	0.10	0.12	0.14	0.14	0.15	0.11	0.08	0.07
Mean CB	0.30	0.32	0.32	0.31	0.34	0.32	0.33	0.33	0.33	0.31	0.35	0.37	0.36	0.43	0.41
SEM	0.12	0.13	0.13	0.13	0.13	0.12	0.13	0.13	0.18	0.14	0.16	0.21	0.21	0.20	0.16
Mean AIB	0.30	0.30	0.31	0.30	0.32	0.31	0.32	0.31	0.33	0.34	0.33	0.39	0.41	0.44	0.45
SEM	0.09	0.11	0.13	0.12	0.11	0.11	0.10	0.12	0.15	0.15	0.15	0.11	0.14	0.16	0.16
Mean A	0.25	0.22	0.22	0.24	0.22	0.23	0.22	0.23	0.22	0.23	0.25	0.26	0.24	0.22	0.20
SEM	0.12	0.09	0.09	0.10	0.11	0.09	0.09	0.09	0.07	0.06	0.09	0.08	0.07	0.09	0.10
AB: anesth+bled															
Mean AI	13.14	14.12	13.92	14.50	14.53	14.45	14.34	14.13	14.61	14.41	14.03	14.93	14.87	14.59	14.70
SEM	3.95	4.36	3.56	3.93	4.08	3.95	3.94	3.49	3.37	3.36	3.39	3.68	3.94	2.46	1.77
Mean AB	13.99	14.52	13.97	14.08	14.09	14.62	14.38	14.42	16.01	17.09	17.49	14.07	13.94	13.47	13.72
SEM	3.97	3.74	3.30	3.50	3.42	3.32	3.72	3.33	4.28	2.95	2.89	1.58	2.80	3.26	2.35
Mean CB	14.19	14.78	14.78	14.78	15.00	15.50	15.13	15.40	15.30	15.78	18.00	18.26	15.61	15.81	14.70
SEM	2.02	2.29	1.65	1.52	2.23	1.94	1.91	2.01	2.10	2.22	2.91	1.90	2.10	1.67	1.96
Mean AIB	13.72	14.12	15.90	15.54	16.16	16.02	16.49	16.36	17.43	19.53	18.95	16.70	18.06	17.06	17.45
SEM	2.06	2.39	3.13	2.73	3.60	3.29	4.03	3.97	4.36	7.80	7.27	6.31	7.07	6.07	6.40
Mean A	14.00	14.80	15.10	15.20	14.80	15.36	15.28	15.11	14.31	14.32	14.80	13.93	14.40	14.21	13.84
SEM	2.80	3.21	2.38	2.50	1.58	2.45	2.63	3.01	3.58	2.47	1.96	3.12	3.03	2.41	3.04
CB: conscious+bled															
Mean AI	48.70	47.56	47.12	49.64	47.62	49.39	49.58	47.48	47.90	50.28	49.78	50.18	50.46	53.11	58.24
SEM	4.30	4.10	4.01	2.96	3.12	3.65	2.95	2.59	4.49	6.82	6.48	5.60	5.97	6.17	4.59
Mean AB	55.60	54.63	55.18	53.88	50.76	51.48	52.41	51.48	51.94	59.22	59.88	58.54	57.03	59.84	57.86
SEM	10.51	10.47	8.98	10.19	11.23	11.53	10.58	11.15	13.36	9.16	11.54	9.95	10.01	8.18	6.90
Mean CB	68.25	65.80	67.16	65.15	64.36	63.64	63.62	61.61	61.61	61.48	62.1	63.22	58.24	57.24	55.78
SEM	12.67	12.18	9.86	9.62	8.78	7.37	8.58	9.91	10.97	10.87	10.507	9.93	9.15	7.41	8.78
Mean AIB	58.59	58.08	58.62	54.40	50.19	58.79	58.63	55.89	58.51	58.63	55.48	59.54	58.42	60.74	61.70
SEM	14.63	13.40	13.53	10.90	9.91	10.21	10.46	11.07	12.12	11.45	11.788	13.92	13.98	20.48	23.55
Mean A	65.25	66.90	67.56	65.25	67.66	67.25	68.75	65.05	67.05	67.90	62.41	65.78	63.12	66.23	65.10
SEM	12.20	10.41	9.71	5.32	5.56	9.23	3.74	8.63	4.68	8.52	6.47	8.98	10.41	9.64	8.52
A: anesth															
Mean AI	628	626	624	637	600	651	639	657	605	669	668	608	919	835	813
SEM	329	383	339	390	324	315	327	310	253	324	374	300	325	347	341
Mean AB	1027	953	956	1028	1012	983	946	898	931	982	1005	1015	1013	977	942
SEM	368	473	468	479	461	442	454	494	495	424	450	468	467	470	483
Mean CB	915	783	787	740	785	785	772	775	749	715	731	741	703	844	708
SEM	248	184	178	129	117	135	166	180	168	168	187	167	185	153	133
Mean AIB	563	639	701	633	714	684	654	654	726	749	749	1000	991	863	808
SEM	242	210	177	219	211	241	347	373	246	250	239	84	75	188	196
Mean A	801	857	880	860	858	851	854	852	849	851	861	843	864	854	846
SEM	310	341	311	421	305	365	345	381	371	413	423	345	321	332	352

Time (min)	-30	-15	5	19	31	44	57	72	180	300	1440	2880	4320	5760
Mean AS	72.10	74.14	75.06	75.94	76.06	76.66	77.38	78.62	79.62	79.94	81.12	78.68	70.78	70.91
SEM	17.72	11.33	12.13	14.13	15.53	14.13	13.19	14.58	14.46	12.78	10.73	6.88	15.15	17.63
Mean AB	70.77	71.32	73.32	76.30	78.56	78.66	79.92	74.63	83.86	88.32	88.12	86.74	86.82	87.04
SEM	25.47	35.32	28.70	30.06	31.15	31.08	30.83	27.97	29.10	33.85	37.83	31.24	33.22	37.24
Mean CB	75.62	79.56	83.20	83.50	83.06	84.73	84.04	88.57	85.61	83.04	88.90	74.36	74.52	79.98
SEM	16.40	18.80	16.46	16.25	15.15	15.97	17.46	19.78	21.12	30.30	14.82	12.38	18.85	
Mean ASB	55.83	51.43	52.73	50.99	52.49	53.38	53.81	56.97	42.36	48.53	50.78	65.85	59.08	57.05
SEM	11.83	16.14	14.30	15.75	12.84	10.02	8.90	9.88	22.89	16.09	20.99	36.78	23.77	24.88
Mean A	72.70	72.40	78.33	70.94	75.87	74.80	73.13	74.13	72.67	72.08	74.63	78.31	74.14	71.22
SEM	8.81	10.62	13.12	17.32	16.79	12.46	14.44	13.48	20.32	13.11	15.24	19.83	17.68	19.77
Mean ASB	16.08	15.78	17.94	17.08	18.10	17.19	17.00	17.10	18.16	19.06	23.46	28.50	27.60	29.27
SEM	1.82	4.23	6.10	4.67	5.20	6.30	4.77	6.03	5.67	5.70	8.59	13.07	9.62	14.45
Mean AB	24.14	25.38	25.36	25.30	25.30	24.95	23.76	23.97	22.58	23.94	26.06	24.86	26.06	25.40
SEM	23.43	24.14	24.33	25.17	22.53	20.48	20.88	20.46	19.19	18.99	18.84	21.22	20.39	20.32
Mean CB	19.16	19.44	18.86	18.25	18.49	18.04	19.87	19.52	19.80	19.79	20.01	14.22	15.66	14.75
SEM	4.17	3.83	5.43	4.93	4.11	3.77	4.44	5.31	7.88	10.20	4.04	3.37	2.78	4.82
Mean ASB	15.94	18.09	13.73	14.20	14.02	14.63	14.82	16.00	20.15	21.11	20.74	31.78	32.52	31.64
SEM	7.39	12.46	4.50	6.23	4.91	4.41	5.78	6.73	10.47	12.00	11.88	17.88	19.76	21.93
Mean A	16.18	13.1	11.7	12.01	12.43	11.82	11.88	12.3	12.8	13.4	14.21	15.23	16.44	11.06
SEM	4.63	4.79	5.36	6.01	6.32	5.24	5.06	4.83	5.73	5.27	6.01	6.86	7.01	5.66
Mean AS	25.14	21.21	25.62	27.00	28.88	29.38	31.88	32.22	32.84	33.16	32.46	32.88	31.80	29.80
SEM	9.61	7.83	6.83	11.02	11.81	18.47	17.51	18.86	19.40	19.71	15.77	19.20	14.53	12.42
Mean AB	59.47	61.17	53.31	57.30	59.40	58.84	58.09	58.16	58.43	59.25	61.70	58.98	57.56	56.18
SEM	32.88	31.28	32.02	31.36	30.98	28.74	28.12	28.81	27.88	25.86	27.89	27.81	27.28	27.27
Mean CB	48.05	41.80	47.88	48.21	48.41	48.77	48.86	45.66	44.72	43.11	41.91	41.17	30.86	27.88
SEM	18.07	19.16	17.45	19.15	18.82	19.38	18.83	18.08	17.68	18.31	17.32	17.66	19.28	10.27
Mean ASB	24.40	21.23	28.75	30.25	32.41	34.08	38.31	33.30	34.28	28.09	25.81	32.80	35.90	34.23
SEM	6.73	3.09	9.85	12.88	15.70	23.01	28.44	3.28	4.16	3.88	2.86	6.71	11.63	12.71
Mean A	32.81	31.35	36.05	31.17	34.70	37.00	38.10	33.50	32.86	38.40	33.08	29.79	28.34	31.29
SEM	5.60	4.63	7.83	7.21	9.37	5.31	8.48	10.79	10.32	12.44	6.78	16.32	17.46	7.83
Mean AS	486	509	462	497	541	570	682	728	832	1180	1389	1506	1300	1078
SEM	134	148	155	136	153	96	379	420	487	774	808	850	893	610
Mean AB	822	813	786	782	812	780	748	738	704	763	913	1070	1080	977
SEM	679	683	689	682	637	616	571	547	512	537	619	1101	1219	1112
Mean CB	580	514	484	484	436	489	480	478	460	468	481	426	422	339
SEM	464	378	333	375	439	320	388	385	343	328	402	308	382	101
Mean ASB	575	482	446	451	455	440	421	442	482	571	713	2816	2276	1467
SEM	570	467	421	315	414	319	272	281	188	207	185	1883	1737	975
Mean A	309	357	422	337	471	470	488	365	273	194	221	306	465	432
SEM	188	299	397	273	471	483	467	382	180	58	166	134	107	203

AI: anesth+injured; AB: anesth+bled; CB: conscous+bled; AB: anesth+injured+bled; A: anesth.

Time (min)	30	15	5	9	19	31	44	60	120	180	300	1440	2880	4320	5760
Mean AI	136	138	138	138	138	138	136	138	138	137	137	138	138	138	138
SEM	3.24	3.13	3.70	3.54	3.54	3.54	4.12	3.70	3.71	4.27	4.81	4.44	6.61	3.70	3.91
Mean AB	138	138	138	137	138	138	138	138	137	137	137	138	137	137	138
SEM	2.00	1.22	1.30	1.34	1.22	1.31	1.52	1.53	1.64	1.30	2.30	2.60	2.92	2.19	1.64
Mean CB	137	137	137	136	136	136	136	137	136	136	136	137	137	136	135
SEM	2.97	2.38	2.96	2.07	2.00	2.07	1.86	2.07	2.17	2.30	1.80	2.41	2.30	3.08	3.11
Mean AB	134	133	134	133	132	132	134	134	134	138	132	133	135	137	140
SEM	4.04	4.63	4.36	5.54	5.90	4.22	3.64	3.68	4.22	6.20	7.13	4.97	6.03	3.39	6.89
Mean A	138	138	140	138	140	140	138	138	138	138	140	140	138	138	138
SEM	3.54	2.63	2.12	2.78	2.71	2.71	2.89	3.64	2.63	2.88	3.51	2.58	3.11	2.78	3.25
Mean AI	101	102	102	102	112	102	102	102	102	102	101	102	102	102	103
SEM	5.41	5.22	4.83	4.83	4.83	4.83	5.72	5.22	5.24	5.78	5.28	5.83	7.84	4.34	5.77
Mean AB	102	103	103	103	104	104	102	103	102	102	101	101	100	100	102
SEM	2.70	2.38	2.88	2.98	3.08	3.31	4.34	3.38	3.53	3.44	2.88	3.49	3.66	2.17	1.64
Mean CB	100	101	100	100	100	101	100	100	100	101	100	100	100	97	98
SEM	3.28	3.65	3.44	3.44	3.27	3.03	3.66	2.86	3.51	3.70	3.40	2.58	2.56	5.08	6.14
Mean AB	99	100	100	100	100	101	101	101	100	97	100	100	100	101	103
SEM	2.30	1.30	1.56	2.36	2.89	2.07	1.48	1.58	1.52	6.03	3.27	2.87	3.03	4.04	6.91
Mean A	97	97	97	97	99	100	96	99	99	98	99	100	101	98	98
SEM	2.41	2.51	1.91	2.12	2.31	1.41	2.83	2.06	3.41	1.41	2.21	2.48	1.83	3.11	2.73
Mean AI	4.08	3.73	3.80	3.72	3.73	3.71	3.78	3.78	3.84	3.82	4.11	3.78	3.75	3.82	3.78
SEM	0.98	0.88	0.82	0.82	0.88	0.81	0.96	0.82	0.84	0.78	0.88	0.83	0.88	0.22	0.28
Mean AB	4.01	3.66	3.61	3.73	3.70	3.61	3.64	3.69	3.71	3.61	4.04	3.68	3.68	3.76	3.73
SEM	0.57	0.63	0.64	0.60	0.67	0.72	0.77	0.76	0.72	0.68	0.72	0.64	0.62	0.80	0.65
Mean CB	3.89	3.46	3.44	3.36	3.64	3.62	3.63	3.68	3.61	3.73	4.01	3.68	3.68	3.67	3.65
SEM	0.34	0.27	0.27	0.34	0.38	0.31	0.28	0.15	0.30	0.37	0.44	0.38	0.42	0.40	0.48
Mean AB	3.79	3.43	3.46	3.41	3.48	3.47	3.48	3.48	3.47	3.62	4.08	3.48	3.75	3.63	3.65
SEM	0.48	0.44	0.34	0.38	0.33	0.33	0.21	0.26	0.31	0.44	0.63	0.63	0.58	0.21	0.62
Mean A	3.37	3.27	3.12	3.08	3.04	3.31	3.33	3.12	3.38	3.48	3.42	3.48	3.44	3.21	3.03
SEM	6.34	6.17	6.22	6.17	6.13	6.21	1.44	0.87	0.18	0.21	0.72	0.68	0.22	0.32	0.32
Mean AI	22.7	22.3	22.2	21.4	21.8	21.8	21.5	22.0	22.8	22.1	22.2	23.2	23.7	21.5	22.3
SEM	3.08	0.42	0.94	1.04	0.92	0.91	0.96	1.14	1.14	0.73	0.41	1.00	0.83	1.36	0.50
Mean AB	20.8	19.3	20.1	19.3	19.8	19.1	20.3	19.8	19.8	20.6	20.7	20.6	20.6	20.0	20.0
SEM	1.44	0.66	0.79	0.86	0.88	0.81	0.89	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Mean CB	14.8	15.1	14.9	15.0	15.6	15.1	15.9	15.0	15.0	15.3	15.3	15.1	15.7	15.3	15.9
SEM	1.83	1.04	1.34	1.36	1.34	1.34	1.40	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
Mean AB	20.8	22.4	22.3	19.1	20.0	20.0	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
SEM	2.15	4.58	1.56	0.91	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Mean A	19.8	19.2	19.3	19.8	19.8	19.8	20.3	20.4	21.9	21.9	21.9	20.3	21.2	21.5	22.0
SEM	3.16	5.60	5.23	1.70	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78

AI anesth+injured; AB anesth+bled; CB conscious+bled; AIB anesth+injured+bled; A anesth

Time (min)	-30	-15	5	9	19	31	44	62	120	180	300	1440	2860	4320	5760
Core (mmHg)															
Mean AI	10	94	98	98	97	99	99	99	101	101	102	102	102	104	103
SEM	12.34	14.1	13.28	12.78	15.17	16.91	15.78	18.12	14.90	12.85	15.11	11.50	11.44	13.07	16.63
Mean AB	61	80	89	87	87	91	89	84	85	93	91	91	91	90	94
SEM	14.78	18.14	13.30	12.77	14.44	13.28	12.84	11.94	12.12	14.52	12.97	12.31	14.52	18.08	17.96
Mean CB	88	87	90	91	90	93	93	92	90	91	92	94	95	91	94
SEM	9.17	8.12	4.63	7.31	5.31	7.73	11.21	5.38	9.11	6.74	8.28	8.71	10.51	10.21	9.97
Mean AIB	87	87	88	88	88	88	87	88	88	88	88	87	80	85	96
SEM	11.18	12.10	12.24	9.37	10.28	8.33	7.27	8.23	9.19	8.48	8.92	11.63	10.26	17.26	18.27
Mean A	94	94	91	95	90	90	90	92	89	96	93	94	92	89	87
SEM	12.404	10.081	8.383	9.2631	8.8294	6.3538	8.7778	8.7378	10.233	13.98	12.11	13.76	9.85	8.75	7.55
Core (mmHg)															
Mean AI	284	281	282	282	282	284	283	283	284	285	288	286	288	288	285
SEM	11.58	10.80	10.80	9.87	11.31	11.69	11.84	10.88	11.83	11.34	11.87	11.82	11.12	11.80	10.79
Mean AB	289	281	288	287	285	289	281	280	289	289	287	287	289	300	302
SEM	31.91	34.18	32.36	30.23	31.67	30.74	31.84	31.38	33.19	30.15	30.88	31.85	32.88	33.11	31.46
Mean CB	280	281	282	280	283	280	281	281	289	281	281	280	282	280	281
SEM	11.80	10.72	11.43	12.48	10.88	10.88	11.28	9.55	9.59	10.46	7.42	9.82	7.88	8.76	9.10
Mean AIB	283	282	283	284	283	284	283	284	288	287	287	286	288	282	288
SEM	2.63	2.81	4.12	3.10	2.82	2.83	2.88	1.73	1.88	2.22	3.11	4.24	4.85	10.71	17.58
Mean A	284	281	286	288	288	284	285	286	285	287	288	282	288	287	285
SEM	10.71	11.41	8.97	12.12	14.28	13.54	19.31	12.12	14.14	18.88	15.13	17.28	12.54	12.58	14.20

AI: anesth+injured; AB: anesth+bled; CB: conscious bled; AIB: anesth+injured+bled; A: anesth

Time point	-30	-15	-5	0	5	15	31	44	60	125	180	360	1440	2880	4320	5760
AI: anesth+injured																
Mean AS	6.40	5.04	4.81	4.74	4.82	4.82	4.12	4.81	4.76	4.86	4.50	4.58	4.40	4.25	3.90	3.90
SEM	1.08	1.07	1.09	1.08	1.14	1.14	0.13	0.84	0.87	1.01	0.94	0.78	0.77	0.47	0.58	0.84
Mean AB	4.76	4.40	4.34	4.42	4.42	4.42	4.12	4.07	4.21	3.89	3.84	3.76	3.39	3.27	3.21	3.35
SEM	1.11	1.14	1.04	0.88	1.00	1.00	1.18	1.02	1.10	1.00	0.89	0.67	0.84	0.61	0.40	0.40
Mean CB	5.83	5.16	5.23	5.26	5.23	5.12	5.12	5.02	5.22	4.84	4.49	4.21	3.63	3.54	3.08	3.60
SEM	0.82	0.83	0.83	0.87	0.79	0.79	0.12	0.73	0.83	0.88	0.86	0.62	0.30	0.35	0.30	0.32
Mean AIB	4.83	4.36	4.34	4.17	4.13	4.13	3.19	3.84	3.91	3.28	3.48	3.69	3.30	3.48	3.22	3.28
SEM	1.08	0.70	0.76	0.77	0.76	0.76	0.19	0.77	0.76	0.81	0.86	0.65	0.63	0.41	0.52	0.75
Mean A	5.24	5.22	5.11	5.09	5.13	5.13	5.17	5.13	5.02	5.10	5.37	5.35	5.23	5.34	5.24	5.15
SEM	0.50	0.81	0.93	0.47	0.46	0.46	0.17	0.57	0.55	0.69	0.25	0.51	0.46	0.56	0.63	0.41
AB: anesth+bled																
Mean AS	17.7	14.6	1.4	15.8	16.1	16.1	10.6	17.1	18.8	17.5	17.8	16.8	18.1	19.7	17.6	15.3
SEM	3.63	3.46	3.21	3.31	3.23	3.23	2.7	2.22	2.7	2.4	2.4	2.7	2.2	2.7	2.19	2.58
Mean AB	21.9	19.4	18.7	21.7	22.2	21.7	7.8	22.2	22.7	24.0	24.2	27.9	22.2	23.7	21.9	20.8
SEM	6.08	4.91	3.70	7.14	7.72	7.72	7.08	8.88	8.66	8.84	11.12	13.28	8.83	8.46	6.15	10.46
Mean CB	20.8	20.2	19.8	19.8	19.8	19.8	10.2	19.3	19.2	20.4	20.4	20.2	20.1	21.3	20.0	20.6
SEM	6.58	5.75	5.00	4.85	4.80	4.80	4.54	4.83	4.87	7.56	6.20	3.85	3.00	1.82	1.70	5.88
Mean AIB	14.7	14.1	14.3	13.5	14.2	14.2	11.9	14.8	15.8	16.2	15.8	15.2	15.8	19.6	21.7	20.4
SEM	2.28	2.67	2.30	2.01	1.93	2.25	1.67	2.89	2.89	5.23	4.49	3.08	2.85	1.78	0.88	6.63
Mean A	20.3	22.7	22.0	21.7	19.5	19.1	18.8	21.0	21.5	21.5	22.3	23.2	20.6	18.6	17.6	18.3
SEM	1.58	4.31	2.28	1.83	0.97	0.83	1.83	4.88	3.04	3.04	1.88	3.48	0.74	3.85	0.41	4.95
CB: conscious bled																
Mean AS	9.64	8.84	8.52	8.28	8.18	8.18	8.18	8.20	8.08	8.20	8.12	7.88	7.88	7.34	6.78	7.08
SEM	1.38	1.41	1.41	1.48	1.38	1.38	1.38	1.38	1.43	1.53	1.38	1.42	1.38	1.03	1.00	1.16
Mean AB	8.44	8.08	7.74	7.72	7.78	7.80	7.28	7.12	7.12	6.94	6.78	6.46	6.82	6.82	5.82	6.12
SEM	1.88	1.80	1.81	1.78	1.82	1.82	1.80	1.80	1.82	1.78	1.84	1.67	1.67	1.61	0.67	0.98
Mean CB	8.82	8.40	8.30	8.22	8.08	7.88	7.84	7.82	7.82	7.18	6.88	6.88	6.88	5.82	6.06	6.28
SEM	0.58	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.82	0.82	0.47	0.36	0.76
Mean AIB	7.24	6.94	6.88	6.88	6.78	6.48	6.48	6.34	6.26	6.14	6.12	5.88	5.84	5.84	5.32	5.34
SEM	1.58	1.20	1.20	1.40	1.20	1.28	1.20	1.21	1.20	1.20	1.18	0.80	0.91	0.64	0.72	1.14
Mean A	8.16	8.08	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.48	8.15	8.06
SEM	0.82	1.13	0.86	0.82	0.82	0.82	0.82	1.29	1.29	1.13	2.12	1.00	1.25	1.18	0.84	0.58
A: anesth																
Mean AS	26.1	27.8	28.3	27.2	28.3	28.3	27.8	28.3	28.3	28.3	28.3	28.3	28.3	28.3	22.1	22.4
SEM	4.31	6.07	5.17	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	2.88	3.19
Mean AB	27.1	28.4	28.1	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	19.0	19.9
SEM	6.01	4.20	3.80	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	4.34	1.83	1.83
Mean CB	26.1	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	18.4	20.0
SEM	4.21	2.88	2.11	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.88	1.32	2.00
Mean AIB	23.1	22.6	22.6	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	17.3	18.8
SEM	4.31	3.88	4.08	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	2.00	2.98
Mean A	24.1	26.1	25.6	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	24.9	26.0
SEM	4.51	3.11	4.53	3.40	3.82	3.82	3.82	3.11	4.83	4.82	4.05	4.82	3.88	5.21	4.83	5.78

AI: anesth. +injured; AB: anesth. +bled; CB: conscious bled; AIB: anesth. +injured +bled; A: anesth.

Time (min)	-30	-15	-5	9	19	31	44	60	120	180	300	1440	2880	4320	5760
TP: anesth.															
Mean AS	542	525	515	540	510	545	512	535	537	542	544	540	585	501	532
SEM	80	100	122	148	122	142	117	144	128	128	124	73	121	183	157
Mean AB	362	365	357	371	375	365	340	365	363	368	365	319	365	389	445
SEM	48	53	77	100	104	132	89	100	55	124	87	77	128	120	112
Mean CB	485	484	483	473	485	478	485	448	438	441	423	401	425	477	490
SEM	121	126	130	111	151	126	110	114	104	139	94	98	122	169	54
Mean AIB	546	515	473	490	483	474	485	490	485	475	482	455	457	458	470
SEM	65	78	101	80	81	100	87	95	138	108	111	125	134	145	147
Mean A	555	538	515	555	565	580	514	579	553	528	512	521	533	542	562
SEM	90	95	135	130	121	98	130	90	91	120	85	92	86	99	110
TP: anesth.															
Mean AS	136	144	141	142	142	144	146	147	142	138	138	147	145	141	146
SEM	116	124	120	187	255	159	201	180	128	083	147	114	100	076	136
Mean AB	140	143	129	133	136	134	134	129	132	137	148	156	152	137	137
SEM	140	141	080	071	118	148	176	153	213	162	138	100	130	208	197
Mean CB	134	138	133	133	130	131	128	147	138	140	145	147	152	149	152
SEM	143	125	128	138	111	107	188	284	136	168	152	177	082	139	220
Mean AIB	135	148	142	148	141	141	140	140	142	143	143	148	148	148	156
SEM	244	168	177	284	204	214	200	221	181	148	137	204	154	226	187
Mean A	143	138	133	143	143	132	138	134	138	148	146	144	145	148	151
SEM	112	086	071	081	107	127	108	185	183	164	180	145	173	090	123
TP: anesth.															
Mean AS	172	184	170	183	183	183	177	178	176	179	175	172	188	171	177
SEM	408	490	317	187	309	271	304	278	288	324	364	473	239	205	302
Mean AB	156	151	158	154	163	164	158	163	163	163	162	184	191	191	186
SEM	239	181	140	141	171	181	209	230	379	281	180	277	284	382	402
Mean CB	181	181	181	171	182	187	183	175	174	182	178	171	172	169	175
SEM	238	230	149	218	232	211	240	284	321	347	315	311	261	268	308
Mean AIB	170	181	183	178	178	189	188	184	177	180	188	182	188	173	178
SEM	308	281	327	404	822	819	872	860	402	402	620	380	228	308	220
Mean A	170	174	169	173	168	185	181	174	172	182	178	173	178	181	179
SEM	339	421	263	274	278	257	258	280	281	357	320	285	218	310	278
TP: anesth.															
Mean AS	580	581	512	609	508	508	519	534	517	518	523	588	611	616	611
SEM	123	121	080	082	085	113	132	122	128	148	139	185	232	233	218
Mean AB	528	581	588	573	598	551	528	548	537	582	588	584	628	588	687
SEM	088	081	087	088	074	084	048	064	038	077	048	088	074	070	143
Mean CB	488	471	463	478	480	486	480	501	519	517	588	530	478	454	575
SEM	136	111	110	111	120	121	120	138	122	123	142	897	878	881	818
Mean AIB	473	421	408	429	423	428	420	452	460	412	428	875	631	613	840
SEM	087	071	083	110	114	088	083	085	087	088	088	219	187	172	194
Mean A	548	581	521	511	528	528	526	522	538	552	548	542	536	534	541
SEM	110	081	081	089	089	101	108	133	128	133	081	112	088	178	114

AI: anesth. +injured; A: anesth. +bled; CB: conscious bled; AB: anesth.+injured+bled; A: anesth.

Time (min)	-30	-15	-5	0	5	10	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375	390	405	420	435	450	465	480	495	510	525	540	555	570	585	600	615	630	645	660	675	690	705	720	735	750	765	780	795	810	825	840	855	870	885	900	915	930	945	960	975	990	1005	1020	1035	1050	1065	1080	1095	1110	1125	1140	1155	1170	1185	1200	1215	1230	1245	1260	1275	1290	1305	1320	1335	1350	1365	1380	1395	1410	1425	1440	1455	1470	1485	1500	1515	1530	1545	1560	1575	1590	1605	1620	1635	1650	1665	1680	1695	1710	1725	1740	1755	1770	1785	1800	1815	1830	1845	1860	1875	1890	1905	1920	1935	1950	1965	1980	1995	2010	2025	2040	2055	2070	2085	2100	2115	2130	2145	2160	2175	2190	2205	2220	2235	2250	2265	2280	2295	2310	2325	2340	2355	2370	2385	2400	2415	2430	2445	2460	2475	2490	2505	2520	2535	2550	2565	2580	2595	2610	2625	2640	2655	2670	2685	2700	2715	2730	2745	2760	2775	2790	2805	2820	2835	2850	2865	2880	2895	2910	2925	2940	2955	2970	2985	3000	3015	3030	3045	3060	3075	3090	3105	3120	3135	3150	3165	3180	3195	3210	3225	3240	3255	3270	3285	3300	3315	3330	3345	3360	3375	3390	3405	3420	3435	3450	3465	3480	3495	3510	3525	3540	3555	3570	3585	3600	3615	3630	3645	3660	3675	3690	3705	3720	3735	3750	3765	3780	3795	3810	3825	3840	3855	3870	3885	3900	3915	3930	3945	3960	3975	3990	4005	4020	4035	4050	4065	4080	4095	4110	4125	4140	4155	4170	4185	4200	4215	4230	4245	4260	4275	4290	4305	4320	4335	4350	4365	4380	4395	4410	4425	4440	4455	4470	4485	4500	4515	4530	4545	4560	4575	4590	4605	4620	4635	4650	4665	4680	4695	4710	4725	4740	4755	4770	4785	4800	4815	4830	4845	4860	4875	4890	4905	4920	4935	4950	4965	4980	4995	5010	5025	5040	5055	5070	5085	5100	5115	5130	5145	5160	5175	5190	5205	5220	5235	5250	5265	5280	5295	5310	5325	5340	5355	5370	5385	5400	5415	5430	5445	5460	5475	5490	5505	5520	5535	5550	5565	5580	5595	5610	5625	5640	5655	5670	5685	5700	5715	5730	5745	5760	5775	5790	5805	5820	5835	5850	5865	5880	5895	5910	5925	5940	5955	5970	5985	6000	6015	6030	6045	6060	6075	6090	6105	6120	6135	6150	6165	6180	6195	6210	6225	6240	6255	6270	6285	6300	6315	6330	6345	6360	6375	6390	6405	6420	6435	6450	6465	6480	6495	6510	6525	6540	6555	6570	6585	6600	6615	6630	6645	6660	6675	6690	6705	6720	6735	6750	6765	6780	6795	6810	6825	6840	6855	6870	6885	6900	6915	6930	6945	6960	6975	6990	7005	7020	7035	7050	7065	7080	7095	7110	7125	7140	7155	7170	7185	7200	7215	7230	7245	7260	7275	7290	7305	7320	7335	7350	7365	7380	7395	7410	7425	7440	7455	7470	7485	7500	7515	7530	7545	7560	7575	7590	7605	7620	7635	7650	7665	7680	7695	7710	7725	7740	7755	7770	7785	7800	7815	7830	7845	7860	7875	7890	7905	7920	7935	7950	7965	7980	7995	8010	8025	8040	8055	8070	8085	8100	8115	8130	8145	8160	8175	8190	8205	8220	8235	8250	8265	8280	8295	8310	8325	8340	8355	8370	8385	8400	8415	8430	8445	8460	8475	8490	8505	8520	8535	8550	8565	8580	8595	8610	8625	8640	8655	8670	8685	8700	8715	8730	8745	8760	8775	8790	8805	8820	8835	8850	8865	8880	8895	8910	8925	8940	8955	8970	8985	9000	9015	9030	9045	9060	9075	9090	9105	9120	9135	9150	9165	9180	9195	9210	9225	9240	9255	9270	9285	9300	9315	9330	9345	9360	9375	9390	9405	9420	9435	9450	9465	9480	9495	9510	9525	9540	9555	9570	9585	9600	9615	9630	9645	9660	9675	9690	9705	9720	9735	9750	9765	9780	9795	9810	9825	9840	9855	9870	9885	9900	9915	9930	9945	9960	9975	9990	10005	10020	10035	10050	10065	10080	10095	10110	10125	10140	10155	10170	10185	10200	10215	10230	10245	10260	10275	10290	10305	10320	10335	10350	10365	10380	10395	10410	10425	10440	10455	10470	10485	10500	10515	10530	10545	10560	10575	10590	10605	10620	10635	10650	10665	10680	10695	10710	10725	10740	10755	10770	10785	10800	10815	10830	10845	10860	10875	10890	10905	10920	10935	10950	10965	10980	10995	11010	11025	11040	11055	11070	11085	11100	11115	11130	11145	11160	11175	11190	11205	11220	11235	11250	11265	11280	11295	11310	11325	11340	11355	11370	11385	11400	11415	11430	11445	11460	11475	11490	11505	11520	11535	11550	11565	11580	11595	11610	11625	11640	11655	11670	11685	11700	11715	11730	11745	11760	11775	11790	11805	11820	11835	11850	11865	11880	11895	11910	11925	11940	11955	11970	11985	12000	12015	12030	12045	12060	12075	12090	12105	12120	12135	12150	12165	12180	12195	12210	12225	12240	12255	12270	12285	12300	12315	12330	12345	12360	12375	12390	12405	12420	12435	12450	12465	12480	12495	12510	12525	12540	12555	12570	12585	12600	12615	12630	12645	12660	12675	12690	12705	12720	12735	12750	12765	12780	12795	12810	12825	12840	12855	12870	12885	12900	12915	12930	12945	12960	12975	12990	13005	13020	13035	13050	13065	13080	13095	13110	13125	13140	13155	13170	13185	13200	13215	13230	13245	13260	13275	13290	13305	13320	13335	13350	13365	13380	13395	13410	13425	13440	13455	13470	13485	13500	13515	13530	13545	13560	13575	13590	13605	13620	13635	13650	13665	13680	13695	13710	13725	13740	13755	13770	13785	13800	13815	13830	13845	13860	13875	13890	13905	13920	13935	13950	13965	13980	13995	14010	14025	14040	14055	14070	14085	14100	14115	14130	14145	14160	14175	14190	14205	14220	14235	14250	14265	14280	14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AI: anesth +injured; A: anesth +bled; CB: conscious bled; AIB: anesth+injured+bled; A: anesth.

Time (min)	-30	-15	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	365	370	375	380	385	390	395	400	405	410	415	420	425	430	435	440	445	450	455	460	465	470	475	480	485	490	495	500	505	510	515	520	525	530	535	540	545	550	555	560	565	570	575	580	585	590	595	600	605	610	615	620	625	630	635	640	645	650	655	660	665	670	675	680	685	690	695	700	705	710	715	720	725	730	735	740	745	750	755	760	765	770	775	780	785	790	795	800	805	810	815	820	825	830	835	840	845	850	855	860	865	870	875	880	885	890	895	900	905	910	915	920	925	930	935	940	945	950	955	960	965	970	975	980	985	990	995	1000																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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AS	40.16	46.48	46.7	46.3	42.9	41.48	42.48	42.36	41.08	40.14	39.05	38.05	36.05	34.05	32.05	30.05	28.05	26.05	24.05	22.05	20.05	18.05	16.05	14.05	12.05	10.05	8.05	6.05	4.05	2.05	0.05	-1.95	-3.95	-5.95	-7.95	-9.95	-11.95	-13.95	-15.95	-17.95	-19.95	-21.95	-23.95	-25.95	-27.95	-29.95	-31.95	-33.95	-35.95	-37.95	-39.95	-41.95	-43.95	-45.95	-47.95	-49.95	-51.95	-53.95	-55.95	-57.95	-59.95	-61.95	-63.95	-65.95	-67.95	-69.95	-71.95	-73.95	-75.95	-77.95	-79.95	-81.95	-83.95	-85.95	-87.95	-89.95	-91.95	-93.95	-95.95	-97.95	-99.95	-101.95	-103.95	-105.95	-107.95	-109.95	-111.95	-113.95	-115.95	-117.95	-119.95	-121.95	-123.95	-125.95	-127.95	-129.95	-131.95	-133.95	-135.95	-137.95	-139.95	-141.95	-143.95	-145.95	-147.95	-149.95	-151.95	-153.95	-155.95	-157.95	-159.95	-161.95	-163.95	-165.95	-167.95	-169.95	-171.95	-173.95	-175.95	-177.95	-179.95	-181.95	-183.95	-185.95	-187.95	-189.95	-191.95	-193.95	-195.95	-197.95	-199.95	-201.95	-203.95	-205.95	-207.95	-209.95	-211.95	-213.95	-215.95	-217.95	-219.95	-221.95	-223.95	-225.95	-227.95	-229.95	-231.95	-233.95	-235.95	-237.95	-239.95	-241.95	-243.95	-245.95	-247.95	-249.95	-251.95	-253.95	-255.95	-257.95	-259.95	-261.95	-263.95	-265.95	-267.95	-269.95	-271.95	-273.95	-275.95	-277.95	-279.95	-281.95	-283.95	-285.95	-287.95	-289.95	-291.95	-293.95	-295.95	-297.95	-299.95	-301.95	-303.95	-305.95	-307.95	-309.95	-311.95	-313.95	-315.95	-317.95	-319.95	-321.95	-323.95	-325.95	-327.95	-329.95	-331.95	-333.95	-335.95	-337.95	-339.95	-341.95	-343.95	-345.95	-347.95	-349.95	-351.95	-353.95	-355.95	-357.95	-359.95	-361.95	-363.95	-365.95	-367.95	-369.95	-371.95	-373.95	-375.95	-377.95	-379.95	-381.95	-383.95	-385.95	-387.95	-389.95	-391.95	-393.95	-395.95	-397.95	-399.95	-401.95	-403.95	-405.95	-407.95	-409.95	-411.95	-413.95	-415.95	-417.95	-419.95	-421.95	-423.95	-425.95	-427.95	-429.95	-431.95	-433.95	-435.95	-437.95	-439.95	-441.95	-443.95	-445.95	-447.95	-449.95	-451.95	-453.95	-455.95	-457.95	-459.95	-461.95	-463.95	-465.95	-467.95	-469.95	-471.95	-473.95	-475.95	-477.95	-479.95	-481.95	-483.95	-485.95	-487.95	-489.95	-491.95	-493.95	-495.95	-497.95	-499.95	-501.95	-503.95	-505.95	-507.95	-509.95	-511.95	-513.95	-515.95	-517.95	-519.95	-521.95	-523.95	-525.95	-527.95	-529.95	-531.95	-533.95	-535.95	-537.95	-539.95	-541.95	-543.95	-545.95	-547.95	-549.95	-551.95	-553.95	-555.95	-557.95	-559.95	-561.95	-563.95	-565.95	-567.95	-569.95	-571.95	-573.95	-575.95	-577.95	-579.95	-581.95	-583.95	-585.95	-587.95	-589.95	-591.95	-593.95	-595.95	-597.95	-599.95	-601.95	-603.95	-605.95	-607.95	-609.95	-611.95	-613.95	-615.95	-617.95	-619.95	-621.95	-623.95	-625.95	-627.95	-629.95	-631.95	-633.95	-635.95	-637.95	-639.95	-641.95	-643.95	-645.95	-647.95	-649.95	-651.95	-653.95	-655.95	-657.95	-659.95	-661.95	-663.95	-665.95	-667.95	-669.95	-671.95	-673.95	-675.95	-677.95	-679.95	-681.95	-683.95	-685.95	-687.95	-689.95	-691.95	-693.95	-695.95	-697.95	-699.95	-701.95	-703.95	-705.95	-707.95	-709.95	-711.95	-713.95	-715.95	-717.95	-719.95	-721.95	-723.95	-725.95	-727.95	-729.95	-731.95	-733.95	-735.95	-737.95	-739.95	-741.95	-743.95	-745.95	-747.95	-749.95	-751.95	-753.95	-755.95	-757.95	-759.95	-761.95	-763.95	-765.95	-767.95	-769.95	-771.95	-773.95	-775.95	-777.95	-779.95	-781.95	-783.95	-785.95	-787.95	-789.95	-791.95	-793.95	-795.95	-797.95	-799.95	-801.95	-803.95	-805.95	-807.95	-809.95	-811.95	-813.95	-815.95	-817.95	-819.95	-821.95	-823.95	-825.95	-827.95	-829.95	-831.95	-833.95	-835.95	-837.95	-839.95	-841.95	-843.95	-845.95	-847.95	-849.95	-851.95	-853.95	-855.95	-857.95	-859.95	-861.95	-863.95	-865.95	-867.95	-869.95	-871.95	-873.95	-875.95	-877.95	-879.95	-881.95	-883.95	-885.95	-887.95	-889.95	-891.95	-893.95	-895.95	-897.95	-899.95	-901.95	-903.95	-905.95	-907.95	-909.95	-911.95	-913.95	-915.95	-917.95	-919.95	-921.95	-923.95	-925.95	-927.95	-929.95	-931.95	-933.95	-935.95	-937.95	-939.95	-941.95	-943.95	-945.95	-947.95	-949.95	-951.95	-953.95	-955.95	-957.95	-959.95	-961.95	-963.95	-965.95	-967.95	-969.95	-971.95	-973.95	-975.95	-977.95	-979.95	-981.95	-983.95	-985.95	-987.95	-989.95	-991.95	-993.95	-995.95	-997.95	-999.95	-1001.95	-1003.95	-1005.95	-1007.95	-1009.95	-1011.95	-1013.95	-1015.95	-1017.95	-1019.95	-1021.95	-1023.95	-1025.95	-1027.95	-1029.95	-1031.95	-1033.95	-1035.95	-1037.95	-1039.95	-1041.95	-1043.95	-1045.95	-1047.95	-1049.95	-1051.95	-1053.95	-1055.95	-1057.95	-1059.95	-1061.95	-1063.95	-1065.95	-1067.95	-1069.95	-1071.95	-1073.95	-1075.95	-1077.95	-1079.95	-1081.95	-1083.95	-1085.95	-1087.95	-1089.95	-1091.95	-1093.95	-1095.95	-1097.95	-1099.95	-1101.95	-1103.95	-1105.95	-1107.95	-1109.95	-1111.95	-1113.95	-1115.95	-1117.95	-1119.95	-1121.95	-1123.95	-1125.95	-1127.95	-1129.95	-1131.95	-1133.95	-1135.95	-1137.95	-1139.95	-1141.95	-1143.95	-1145.95	-1147.95	-1149.95	-1151.95	-1153.95	-1155.95	-1157.95	-1159.95	-1161.95	-1163.95	-1165.95	-1167.95	-1169.95	-1171.95	-1173.95	-1175.95	-1177.95	-1179.95	-1181.95	-1183.95	-1185.95	-1187.95	-1189.95	-1191.95	-1193.95	-1195.95	-1197.95	-1199.95	-1201.95	-1203.95	-1205.95	-1207.95	-1209.95	-1211.95	-1213.95	-1215.95	-1217.95	-1219.95	-1221.95	-1223.95	-1225.95	-1227.95	-1229.95	-1231.95	-1233.95	-1235.95	-1237.95	-1239.95	-1241.95	-1243.95	-1245.95	-1247.95	-1249.95	-1251.95	-1253.95	-1255.95	-1257.95	-1259.95	-1261.95	-1263.95	-1265.95	-1267.95	-1269.95	-1271.95	-1273.95	-1275.95	-1277.95	-1279.95	-1281.95	-1283.95	-1285.95	-1287.95	-1289.95	-1291.95	-1293.95	-1295.95	-1297.95	-1299.95	-1301.95	-1303.95	-1305.95	-1307.95	-1309.95	-1311.95	-1313.95	-1315.95	-1317.95	-1319.95	-1321.95	-1323.95	-1325.95	-1327.95	-1329.95	-1331.95	-1333.95	-1335.95	-1337.95	-1339.95	-1341.95	-1343.95	-1345.95	-1347.95	-1349.95	-1351.95	-1353.95	-1355.95	-1357.95	-1359.95	-1361.95	-1363.95	-1365.95	-1367.95	-1369.95	-1371.95	-1373.95	-1375.95	-1377.95	-1379.95	-1381.95	-1383.95	-1385.95	-1387.95	-1389.95	-1391.95	-1393.95	-1395.95	-1397.95	-1399.95	-1401.95	-1403.95	-1405.95	-1407.95	-1409.95	-1411.95	-1413.95	-1415.95	-1417.95	-1419.95	-1421.95	-1423.95	-1425.95	-1427.95	-1429.95	-1431.95	-1433.95	-1435.95	-1437.95	-1439.95	-1441.95	-1443.95	-1445.95	-1447.95	-1449.95	-1451.95	-1453.95	-1455.95	-1457.95	-1459.95	-1461.95	-1463.95	-1465.95	-1467.95	-1469.95	-1471.95	-1473.95	-1475.95	-1477.95	-1479.95	-1481.95	-1483.95	-1485.95	-1487.95	-1489.95	-1491.95	-1493.95	-1495.95	-1497.95	-1499.95	-1501.95	-1503.95	-1505.95	-1507.95	-1509.95	-1511.95	-1513.95	-1515.95	-1517.95	-1519.95	-1521.95	-1523.95	-1525.95	-1527.95	-1529.95	-1531.95	-1533.95	-1535.95	-1537.95	-1539.95	-1541.95	-1543.95	-1545.95	-1547.95	-1549.95	-1551.95	-1553.95	-1555.95	-1557.95	-1559.95	-1561.95	-1563.95	-1565.95	-1567.95	-1569.95	-1571.95	-1573.95	-1575.95	-1577.95	-1579.95	-1581.95	-1583.95	-1585.95	-1587.95	-1589.95	-1591.95	-1593.95	-1595.95	-1597.95	-1599.95	-1601.95	-1603.95	-1605.95	-1607.95	-1609.95	-1611.95	-1613.95	-1615.95	-1617.95	-1619.95	-1621.95	-1623.95	-1625.95	-1627.95	-1629.95	-1631.95	-1633.95	-1635.95	-1637.95	-1639.95	-1641.95	-1643.95	-1645.95	-1647.95	-1649.95	-1651.95	-1653.95	-1655.95	-1657.95	-1659.95	-1661.95	-1663.95	-1665.95	-1667.95	-1669.95	-1671.95	-1673.95	-1675.95	-1677.95	-1679.95	-1681.95	-1683.95	-1685.95	-1687.95	-1689.95	-1691.95	-1693.95	-1695.95	-1697.95	-1699.95	-1701.95	-1703.95	-1705.95	-1707.95	-1709.95	-1711.95	-1713.95	-1715.95	-1717.95	-1719.95	-1721.95	-1723.95	-1725.95	-1727.95	-1729.95	-1731.95	-1733.95	-1735.95	-1737.95	-1739.95	-1741.95	-1743.95	-1745.95	-1747.95	-1749.95	-1751.95	-1753.95	-1755.95	-1757.95	-1759.95	-1761.95	-1763.95	-1765.95	-1767.95	-1769.95	-1771.95	-1773.95	-1775.95	-1777.95	-1779.95	-1781.95	-1783.95	-1785.95	-1787.95	-1789.95	-1791.95	-1793.95	-1795.95	-1797.95	-1799.95	-1801.95	-1803.95	-1805.95	-1807.95	-1809.95	-1811.95	-1813.95	-1815.95	-1817.95	-1

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