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**TITLE: A Multi-Institutional Prospective Observational Study on Nerve Repair and Reconstruction Associated with Major Extremity Trauma**

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**14. ABSTRACT**
This multi-center prospective observational study enrolled and followed 251 patients ages 18-65 undergoing surgical treatment for upper extremity peripheral nerve injury to examine variability in treatment approach and 2-year outcomes. Patients were enrolled at time of surgical treatment and were scheduled to complete follow-up visits at 3, 6, 12, 18 and 24-months following surgery. Outcome assessments included motor and sensory nerve function; range of motion and hand strength; surgical complications; and patient reported pain, upper extremity function, depression, PTSD, quality of life and return to work.

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NONE LISTED

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## 1. INTRODUCTION:

The purpose of this project was to (1) conduct a multi-center prospective observational study to characterize the incidence, type and treatment of peripheral nerve injury resulting from upper extremity trauma admitted to U.S. military and civilian trauma centers, and (2) characterize association between treatment (timing and approach) and outcomes at 3, 6-, 12-, 18-, and 24-months following treatment. This study serves as a first step in better defining the burden of injury and the variation in treatment and outcomes which is critical to the design of future randomized treatment trials. These studies are needed to establish evidence-based treatment algorithms. The long-term potential impact of this study is considerable as nerve injuries lead to significant levels of disability long after bone and soft tissue injuries have healed.

## 2. KEYWORDS:

Peripheral Nerve Injury
Prospective observational study
Primary Repair
Reconstruction
Neurolysis
Sensory and Motor function
Patient reported outcomes

## 3. ACCOMPLISHMENTS:

**What were the major goals of the project?**

The major goals of the project and the status of achieving these goals is summarized in the table below.

| **Goal** | **Percentage of Completion** |
|---|---|
| **Study Initiation** | |
| Local IRB Approval at METRC sites: Month 33 (June 2018) | 100% |
| HRPO approval for all site protocols: Month 41 (February, 2019) | 100% |
| **Train Research Staff** | |
| Research Staff trained and certified to begin enrolling patients: Month 41 (February 2019) | 100% |
| **Conduct Study** | |
| All patients enrolled: Month 45 (June, 2019) | 100% |
| All patients complete follow-up: Month 69 (June, 2021) | 100% |
| **Data Analysis and Report Writing** | |
| Complete analysis: Month 71 (August, 2021) | 100% |
| Report findings: Month 72 (September, 2021) | 50% |

**What was accomplished under these goals?**

*Study Implementation:*

The trial was conducted at 18 U.S trauma centers under the coordination of the Major Extremity Trauma Research Consortium. It is registered in clinical trials.gov (NCT02718768).

Eligible patients were between 18 and 65 years of age with an upper extremity peripheral nerve injury involving motor and sensory dysfunction of the axillary, radial, median, ulnar, or musculocutaneous nerves surgically treated within 6 months of injury. We excluded patients with injuries to the brachial plexus, injuries to the nerves distal to the distal flexion crease of the wrist, injuries that involved a distal extension of the parent nerve that is considered sensory only; motor or sensory deficits resulting from previous trauma, stroke, muscular, neurologic, or neuromuscular disorders; documented psychiatric disorder that precluded consent; and patients who were non-English or Spanish speaking. Patients were enrolled in the hospital at time of surgery.

Demographics including age, gender, and race; education, tobacco use, pre-injury work and health status were collected by interviewing the patient. Pre-existing comorbidity, body mass index and injury characteristics were obtained from the medical record. Injury characteristics included number of eligible nerve injuries, type of nerve injured, mechanism of injury and injury severity defined as percentage of nerve severed. Treatment of the nerve injury followed standard protocols including neurolysis (i.e. operative exploration of the nerve but nerve was not treated), primary repair, reconstruction, and nerve and tendon transfer. Details of the treatment were obtained from operative notes and included use of wraps, tubes, allograft and autograft, and replant and vascular repair procedures. Surgeon specialty and training were also collected. The study team verified injury and treatment characteristics by checking data entered against operative notes for all enrolled patients. Participants were scheduled to return for follow up visits at 3, 6, 12, 18 and 24 months. At each follow-up visit, participants underwent a clinical assessment of motor and sensory function, and completed surveys of upper limb function, pain, depression, PTSD, and return to usual major activities.

*Analysis*

Descriptive statistics (means, standard deviations, and percentages) were used to describe patient, injury, and treatment characteristics. A t-test was used to compare days from injury to treatment in injuries that were primarily repaired versus reconstructed. Chi square tests were used to compare injury mechanism and type of nerve injured among injuries that were primarily repaired versus reconstructed. Descriptive statistics were used to describe patient reported upper limb function and motor function over time, by injury type.

*Study Findings*

We enrolled 242 patients from June 2016 through August 2019 (Figure 1). Most patients were male (n=181, 75%), ages 18-34 (n=134, 55%), nearly half were non-Hispanic White (n=105, 43%), and college educated (n=105, 43%). Most patients were working prior to injury (n=175, 72%) and reported excellent or very good health (n=167, 69%). Most patients had one nerve injury (n=195, 81%). Common causes of injury included cut, pierce or stabbing (n=106, 44%), firearm (n=44, 18%) and motor vehicle accidents (n=31, 13%). (Table 1). There was a total of 292 injured nerves among 242 patients. Most were ulnar (n=124, 42%) or median (n=101, 35%) injuries, over half of all nerve injuries were completely severed (n=182, 62%), and the average time between injury and treatment was 15 days (range: 0-208 days). Most nerve injuries were treated by orthopaedic surgeons with hand fellowship training (n=262, 90%) (Table 2).

Table 3 summarizes treatment by nerve and injury type. Nearly all sharp and laceration injuries were operatively repaired or reconstructed (n=177, 97%) compared with 46% of avulsion, blast, stretch or crush injuries and 62% of gunshot injuries. (Table 3). Most operatively treated sharp/laceration injuries were of ulnar (50%) and median (38%) nerves. Operatively treated avulsion, blast, stretch, or crush injuries were a mix of ulnar (41%), radial (26%), median (22%), and axillary (11%) nerves. Operatively treated gunshot injuries were of the ulnar (34%), radial (22%) and median (44%) nerves.

Table 4 summarizes details of primary repair and reconstruction by injury type. Most sharp or laceration injuries were primarily repaired (direct end-to-end repair, n=109, 62%) while most avulsion, blast, stretch or crush injuries (n=18, 22%) and gunshot injuries (n=25, 81%) were operatively reconstructed. Over half of primary repairs used a wrap or tube to supplement the primary repair (74% of sharp/laceration injuries; 67% of gunshot injuries and 50% of avulsion, blast, stretch or crush injuries). Among nerves that were operatively reconstructed, allograft was used in 74% of sharp/laceration injures, 64% of gunshot injuries and in 83% of avulsion, blast, stretch or crush injuries. (Table 4).

Table 5 summarizes details of repair and reconstruction treatment by injured nerve.  There was variability in treatment approach by nerve. Primary repair was used to treat 49% of median nerves, 38% of radial nerves and 59% of ulnar nerves. Three of 4 axillary nerves were treated with a nerve transfer and the other was primarily repaired. Both musculocutaneous nerves were operatively reconstructed. Most primary repairs used a tube or wrap placed around the primary repair (72% of median nerves, 83% radial nerves, 73% of ulnar nerves). Among nerves that were operatively reconstructed, allograft was used in 69% of median injuries, 85% of radial injuries and 77% of ulnar injuries. (Table 5).

Nerve injuries undergoing reconstruction had a longer duration between injury and treatment compared with injuries that were primary repaired (22 days vs. 3 days, $p<0.001$). Injury mechanism differed among patients getting primary repair versus reconstruction, with nearly all primary repairs conducted for sharp/laceration injuries ($p<0.001$). The use of primary repair versus reconstruction did not vary significantly by injured nerve. (Table 6).

Of the 242 patients enrolled, 213, completed a visit at 3 months, 192 completed a visit at 6 months, 143 completed a visit at 12 months, 119, completed a visit at 18 months and 114 completed a visit at 24 months (Table 7).

We used the Disabilities of the Arm, Shoulder and Hand (DASH) survey, a 30 item validated instrument, to measure upper arm function. Scores range from 0 to 100 with higher scores indicating greater disability. Table 8 summarizes DASH scores overall and by injury type over time. Overall, mean scores improved over time and this trend was similar in magnitude by injury type. Table 9 summarizes DASH scores by treatment. Patients who were operatively explored had worse (higher) scores at each time point compared with patients who were treated with primary repair or reconstruction; and average scores were worse for patients treated with reconstruction versus primary repair.

Of the 292 injured nerves, a motor exam was completed on 205 at 3 months, 179 at 6 months, 125 at 12 months, 91 at 18 months and 66 at 24 months. Table 10 summarizes the number of patients who had a British Research Medical Council (BRMC) motor grade of 4 (Muscle strength is reduced but muscle contraction can still move joint against resistance) or 5 (Muscle contracts normally against full resistance). A higher proportion of nerve injuries had a grade 4 or 5 at later compared with earlier timepoints indicating recover of motor function over time. Notably, there is a high rate of disability at one year with only 75-80% of nerve injuries had a grade 4 or 5. A higher proportion of median nerve injuries had a grade 4 or 5 at all time points compared with other injury types, with variation across motor groups. Analyses examining differences in motor score by treatment type and the impact of timing on motor function as well as correlation with sensory and hand function are underway.

**What opportunities for training and professional development has the project provided?**

None to report.

**How were the results disseminated to communities of interest?**

An abstract of initial findings was submitted to the 2023 Orthopedic Trauma Association meeting. Results will be published in peer-reviewed manuscripts.

**What do you plan to do during the next reporting period to accomplish the goals?**

Nothing to report.

## *4.* IMPACT:

**What was the impact on the development of the principal discipline(s) of the project?**

This is the first prospective multi-center study of major peripheral nerve injury resulting in a high volume of nerve injury recruitment of which the authors are aware. So far, we have been able to report the demographic and baseline characteristic data as the follow up data is still being processed. These data demonstrate the potential morbidity of PNI. Most injuries occurred in employed working age males who are in very productive periods of their working lives. This means that major upper extremity PNI are extremely debilitating not only to patients who experience them during very inopportune times of their work/careers, but also costing society a maximum in productivity loss from individuals at their peak contribution stages of life.

Findings of note that the authors expected include: (1) longer times to treatment result in a higher probability for the need for reconstruction (as opposed to primary repair), and (2) mechanisms of injury other than sharp nerve lacerations also resulted in a much higher percentage of reconstruction instead of primary repair. Unexpected findings included the high frequency of use of a nerve tube or nerve wrap to supplement primary repairs (there is little to no data to support this practice) but no instances of a nerve tube used by itself to bridge a nerve gap. More interestingly, there as a higher percentage of allograft use for nerve reconstruction as compared to autograft-based reconstruction. This was surprising considering the long-standing dogma indicating autograft is the gold standard for nerve reconstruction. There have not been head to head comparisons of autograft and allograft based major (mixed motor/sensory) peripheral nerve injury reconstruction in a prospective manner at multiple institutions. This is the first study of which the authors are aware that has allowed surgeons to choose the treatment modality without any influence or assignment and compare patients. While the outcome data will be even more interesting, the surgical technique chosen by surgeon preference as demonstrated here is by itself is a key finding. Another interesting finding was the primary surgical specialty responsible for treating these injuries was orthopedic hand surgery (as opposed to plastic hand or general plastic surgery), though this may be easily explained by the recruitment bias created by using an orthopedic trauma-based study platform which is the basis of METRC.

Another very interesting finding of this study was the lack of accuracy in reporting the baseline clinical characteristic data for patients by the study coordinators. All baseline characteristic data including injury details, surgical details, and baseline examination results were reviewed by the PI's with METRC staff with operative records submitted from each site for accuracy. The rate of having some element of data mis-reported was 66%. This demonstrates the absolute need for the very labor-intensive practice of reporting verification by the managing study center personnel.

One benefit of this study is the snapshot across geographic areas in the US at major trauma centers of PNI and their treatment in modern times to help realize what the actual "standard of care" is and who these injuries are most effecting. Another benefit of this study is creating a baseline set of data to compare future studies with that has already undergone extensive review to create a set of "standard data" for the modern treatment of major upper extremity PNI.

This study was instrumental in obtaining the AFIRM III consortium award which includes a Phase 2a multicenter randomized controlled trial evaluating the safety and efficacy of polyethylene glycol (PEG) mediated fusion (PEG fusion) compared to standard of care in the repair of mixed motor-sensory acute peripheral nerve injuries (PNI) for rapid and immediate improvement in outcome. The overall objective of this study is to determine the safety of PEG fusion when used with reconstruction in patients with an acute upper extremity peripheral nerve injury (PNI) and to examine the effect of PEG fusion on clinical outcomes including recovery of sensory and motor function. Results will be externally validated using data collected in the prospective NERVE study and will provide preliminary evidence to power a larger phase II efficacy trial. Sites participating in the randomized trial were selected based on volume of patients and performance in the prospective study. Data collection forms and motor and sensory assessment procedures developed in the prospective study will be used in the randomized controlled trial.

**What was the impact on other disciplines?**

None to report.

**What was the impact on technology transfer?**

None to report.

**What was the impact on society beyond science and technology?**

It is too early to determine what the impact of this study, if any, will be on society beyond science and technology. But speaking more generally, it has demonstrated the great difficulty but also great importance of the study of nerve injuries and interventions for nerve injuries. There may be policy decisions by funding sources in the future regarding the targeting of this subject matter for more study funding that are made based upon the completion of this initial study.

## 5. CHANGES/PROBLEMS:

### Changes in approach and reasons for change

Nothing to report.

### Actual or anticipated problems or delays and actions or plans to resolve them

Nothing to report.

### Changes that had a significant impact on expenditures

### Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Not applicable.

### Significant changes in use or care of human subjects

Nothing to report.

### Significant changes in use or care of vertebrate animals

Not applicable.

### Significant changes in use of biohazards and/or select agents

Not applicable.

## 6. PRODUCTS:

### Publications, conference papers, and presentations

#### Journal publications.

Planned papers:

1. Variability in Treatment of Upper Extremity Peripheral Nerve Injuries Across 17 US Trauma Centers (in progress)
2. Recovery of motor and sensory function two years following upper extremity peripheral nerve injury (in progress)
3. Patient reported function following treatment for upper extremity peripheral nerve injury Paper (in progress)

#### Books or other non-periodical, one-time publications.

Nothing to report.

**Other publications, conference papers and presentations**.

Nothing to report.

**Website(s) or other Internet site(s)**

Not applicable.

**Technologies or techniques**

Not applicable.

**Inventions, patent applications, and/or licenses**

Nothing to report.

**Other Products**

This study resulted in a dataset of participant demographics, injury characteristics, treatment characteristics, and outcomes for distribution and secondary data analysis.

We also developed training videos on how to conduct sensory, range of motion and strength assessments which will be used in the recently awarded AFIRM III PEG fusion trial.

## 7. PARTICIPANTS & OTHER COLLABORATING ORGANIZATIONS

**What individuals have worked on the project?**

| | |
|---|---|
| Name: | Jaimie Shores, MD |
| Project Role: | Study PI |
| Researcher ID | NA |
| Nearest person month worked: | 1.2 calendar months |
| Contribution to Project: | Oversees all aspects of study conduct; leads protocol committee meetings and reviews data collected for quality. |
| Name: | Ellen MacKenzie, PhD |
| Project Role: | Co-Investigator |
| Researcher ID | NA |
| Nearest person month worked: | 0.36 calendar months |
| Contribution to Project: | Oversees all aspects of coordinating center activities. |
| Name: | Lisa Reider, PhD |
| Project Role: | Co-Investigator |
| Researcher ID | NA |
| Nearest person month worked: | 2.40 calendar months |
| Contribution to Project: | Oversees all aspects of study management. |
| Name: | Joseph Levy |

| | |
|---|---|
| Project Role:<br>Researcher ID<br>Nearest person month worked:<br>Contribution to Project: | Economist<br>NA<br>2.40 calendar months<br>Dr. Levy is a health care economist with extensive |
| experience working with administrative claims data and large, national survey data. He works closely with METRC in developing methods for cost effectiveness analyses related to orthopaedic trauma interventions. He will be responsible for purchasing and managing data from the Health Care Utilization Project. He works closely with the study PI and the study team in the design and conduct of the analysis. | |
| Name:<br>Project Role:<br>Researcher ID<br>Nearest person month worked:<br>Contribution to Project: | Elizabeth Wysocki<br>Study Manager<br>NA<br>3.60 calendar months<br>Follow up with sites regarding IRB approval for the |
| protocol amendment; scheduling monthly calls with centers, managing paperwork for site certification; distributing study supplies to participating sites; addressing questions from sites about day to day study operations. | |
| Name:<br>Project Role:<br>Researcher ID<br>Nearest person month worked:<br>Contribution to Project: | Elias Weston-Farber<br>Research Assistant<br>NA<br>0.60 calendar months<br>Maintaining REDCap for electronic data capture. |
| Name:<br>Project Role:<br>Researcher ID<br>Nearest person month worked:<br>Contribution to Project: | Jack Dagg *(Replaced Yanjie Huang)*<br>Data Analyst<br>NA<br>2.40 calendar months<br>Generated monthly progress reports |
| Name:<br>Project Role:<br>Researcher ID<br>Nearest person month worked:<br>Contribution to Project: | Yanjie Huang<br>Data Analyst<br>NA<br>0.96 calendar months<br>Generated monthly progress report, conducted |
| preliminary analysis of the data *(Left JHU June 2021)* | |

**Hass there been a change in the active other support of the PD/PI(s) or senior/key personnel since the last reporting period?**

Nothing to report.

**What other organizations were involved as partners?**

The following institutions participated in the study:

Hennepin County Medical Center/Regions Hospital
Vanderbilt Medical Center
Ryder Trauma Center
University of Maryland
MetroHealth Medical Center
OrthoCarolina
University of Oklahoma
Wake Forest
University of Texas Health Science Center at Houston
Denver Health and Hospital Authority
Methodist Hospital
University of New Mexico
Johns Hopkins School of Medicine
San Antonio Military Medical Center
Virginia Commonwealth University
University of Pennsylvania
NYU Langone Health Hospitals and Bellevue Hospital Center
Union Memorial Hospital (The Curtis National Hand Center)

## 8. SPECIAL REPORTING REQUIREMENTS

### COLLABORATIVE AWARDS:

Not applicable.

### QUAD CHARTS:

## 9. APPENDICES:

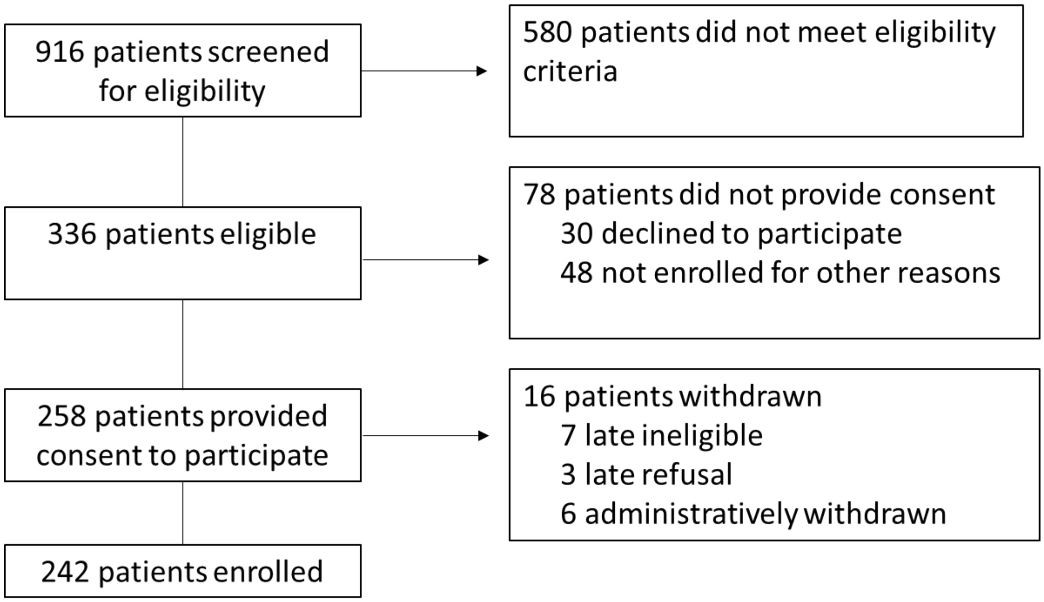


**Figure 1. Patient Enrollment**

**Table 1. Patient Characteristics**

| | **Enrolled Patients (n=242)** |
|---|---|
| Mean age (range), yr | 34 (12) |
| Male sex, No. (%) | 181 (75) |
| Non-Hispanic White, No. (%) | 105 (43) |
| College educated, No. (%) | 105 (43) |
| Working prior to injury, No. (%) | 175 (72) |
| Active Duty Military, No. (%) | 3 (1) |
| No Health Insurance, No. (%) | 54 (22) |
| Current Tobacco Use, No. (%) | 90 (37) |
| Pre-Injury Health, Excellent/Very good, No. (%) | 167 (69) |
| Body Mass Index (BMI), mean (SD) | 28 (SD???) |
| No pre-existing comorbidity, No. (%) | 121 (50) |
| Number of Upper Extremity Peripheral Nerve Injuries, No. (%) | |
| 1 | 195 (81) |
| 2 | 44 (18) |
| 3-4 | 3 (1) |
| Mechanism of Injury | |
| Cut/pierce/stab | 106 (44) |
| Fall | 16 (7) |
| Firearm | 44 (18) |
| Motor Vehicle | 31 (13) |
| Other | 25 (10) |

**Table 2. Nerve Injury and Treatment Characteristics**

| | **Injured Nerves (n=292)** |
|---|---|
| Nerve, No. (%) | |
| Ulnar | 124 (42) |
| Median | 101 (35) |
| Radial | 61 (21) |
| Axillary | 4 (1) |
| Musculocutaneous | 2 (1) |
| Fracture was associated with injury, No. (%) | 73 (25) |
| Percent of Nerve Injured, No. (%) | |
| Intact | 54 (18) |
| 25% | 13 (4) |
| 50% | 17 (6) |
| 75% | 28 (10) |
| Complete | 182 (62) |
| Treatment, No. (%) | |
| Operative exploration | 56 (19) |
| Primary Repair or Reconstruction | 230 (79) |
| Nerve Transfer | 6 (2) |
| Replant, No. (%) | 9 (3) |
| Injuries requiring vascular repair, No. (%) | 113 (39) |
| Mean days, (range) between injury and treatment | 15 (0-208) |
| Nerves treated by orthopaedic surgeon with hand fellowship training, No. (%) | 262 (90%) |

**Table 3. Treatment by Injury and Nerve Type**

| | Sharp/Laceration | | Avulsion/Blast/Stretch/Crush | | Gunshot | |
|---|---|---|---|---|---|---|
| | Neurolysis only (n=4) | Primary Repair or Reconstruction (n=177) | Neurolysis only (n=32) | Primary Repair or Reconstruction (n=27) | Neurolysis only (n=20) | Primary Repair or Reconstruction (n=32) |
| **Axillary** | 0 | 1 (1) | 0 | 3 (11) | 0 | 0 |
| **Median** | 1 (25) | 68 (38) | 3 (9) | 6 (22) | 9 (45) | 14 (44) |
| **Musculocutaneous** | 0 | 2 (1) | 0 | 0 | 0 | 0 |
| **Radial** | 1 (25) | 18 (10) | 23 (72) | 7 (26) | 5 (25) | 7 (22) |
| **Ulnar** | 2 (50) | 88 (50) | 6 (19) | 11 (41) | 6 (3) | 11 (34) |

*3 axillary and 3 ulnar nerve injuries were treated with tendon transfer only; all other injuries were treated with primary repair or reconstruction

**Table 4. Treatment Characteristics by Injury Type**

| | Sharp/Laceration (n=178) | Avulsion/Blast/Stretch/Crush (n=27) | Gunshot (n=32) |
|---|---|---|---|
| Primary Repair, No. (%) | 109 (61) | 4 (15) | 6 (19) |
| Repair Only | *28* | *2* | *2* |
| Repair with Wrap or tube | *58* | *2* | *4* |
| Repair with Nerve Transfer | *0* | *0* | *0* |
| Repair with Tendon Transfer | *1* | *0* | *0* |
| Reconstruction, No. (%) | 69 (39) | 18 (67) | 25 (78) |
| Reconstruction with wrap or tube | *0* | *0* | *0* |
| Reconstruction with Nerve Transfer | *17* | *10* | *7* |
| Reconstruction with Tendon Transfer | *0* | *1* | *0* |
| Reconstruction with Allograft | *51* | *15* | *16* |
| Reconstruction with Autograft | *18* | *3* | *8* |
| Nerve Transfer, No. (%) | 0 | 5 (19) | 1 (3) |
| Tendon Transfer, No. (%) | 0 | 0 | 0 |
| Replant, No. (%) | 5 (3) | 3 (11) | 1 (3) |
| Vascular Repair, No. (%) | 88 (49) | 12 (44) | 13 (41) |

**Table 5. Treatment Characteristics by Nerve Injured**

| | Axillary (n=4) | Median (n=88) | Musculocutaneous (n=2) | Radial (n=32) | Ulnar (n=110) |
|---|---|---|---|---|---|
| Primary Repair, No. (%) | 1 (25) | 43 (49) | 0 | 12 (38) | 63 (57) |
| Repair Only | --- | *12* | --- | *2* | *17* |
| Repair with Wrap or tube | --- | *22* | --- | *6* | *36* |
| Repair with Nerve Transfer | --- | *0* | --- | *0* | *0* |
| Repair with Tendon Transfer | --- | *0* | --- | *0* | *1* |
| Reconstruction, No. (%) | 0 | 45 (51) | 2 (100) | 20 (63) | 44 (40) |
| Reconstruction with wrap or tube | --- | *9* | *0* | *5* | *9* |
| Reconstruction with Nerve Transfer | --- | *0* | *0* | *0* | *11* |
| Reconstruction with Tendon Transfer | --- | *0* | *0* | *0* | *1* |
| Reconstruction with Allograft | --- | *31* | *0* | *17* | *34* |
| Reconstruction with Autograft | --- | *14* | *2* | *4* | *8* |
| Nerve Transfer, No. (%) | 3 (75) | 0 | 0 | 0 | 3 (3) |
| Tendon Transfer, No. (%) | 0 | 0 | 0 | 0 | 0 |
| Replant, No. (%) | 0 | 2 (2) | 0 | 1 (3) | 6 (5) |
| Vascular Repair, No. (%) | 0 | 52 (59) | 2 (100) | 10 (31) | 49 (44) |

**Table 6. Relationship between injury and treatment characteristics**

| | **Repair (n=119)** | **Reconstruction (n=111)** | **p value** |
|---|---|---|---|
| Mean days (SD) between injury and treatment | 3 (7) | 22 (38) | <0.001 |
| Injury Mechanism | | | <0.001 |
| Sharp/Laceration | 109 (92) | 69 (62) | |
| Gunshot | 6 (5) | 25 (23) | |
| Avulsion/Blast/Stretch/Crush | 4 (3) | 18 (16) | |
| Injury Type | | | 0.086 |
| Ulnar | 63 (53) | 44 (40) | |
| Median | 43 (36) | 45 (41) | |
| Radial | 12 (10) | 20 (18) | |
| Axillary | 1 (1) | 0 | |
| Musculocutaneous | 0 | 2 (2) | |

**Table 7. Number (%) of Follow-up Assessments Conducted**

| | n | 3m | 6m | 12m | 18m | 24m |
|---|---|---|---|---|---|---|
| **Patient Reported Function*** | | | | | | |
| DASH | 242 | 213 (88) | 192 (79) | 143 (59) | 119 (49) | 114 (47) |
| **Motor Score**** | | | | | | |
| Overall | 292 | 205 (70) | 179 (61) | 125 (43) | 91 (31) | 66 (23) |
| Axillary | 4 | 2 | 3 | 1 | 1 | 1 |
| Musculocutaneous | 2 | 2 | 0 | 2 | 2 | 0 |
| Radial | 61 | 50 | 43 | 30 | 21 | 14 |
| Median | 101 | 60 | 59 | 38 | 27 | 20 |
| Ulnar | 124 | 91 | 74 | 54 | 40 | 31 |

*Number of patients enrolled; n (%) out of 242

**Number of nerve injuries; n (%) out of 292

**Table 8. DASH Scores by Injury Type Over Time**

| | 3 Month | | 6 month | | 12 Month | | 18 Month | | 24 Month | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Injured Nerve** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** |
| Overall | 213 | 47.237 (22.689) | 192 | 38.109 (24.359) | 143 | 37.776 (27.476) | 119 | 30.292 (23.846) | 114 | 25.527 (23.246) |
| Axillary | 2 | 45.833 (9.428) | 3 | 29.167 (26.194) | 1 | 30.833 (NA) | 1 | 26.667 (NA) | 1 | 31.667 (NA) |
| Median | 66 | 45.791 (20.422) | 63 | 36.575 (22.818) | 44 | 36.563 (27.077) | 37 | 27.883 (20.796) | 34 | 25.294 (23.131) |
| Musculocutaneous | 2 | 49.397 (20.36) | 1 | 72.5 (NA) | 2 | 86.25 (4.125) | 2 | 66.25 (21.802) | 1 | 19.167 (NA) |
| Radial | 50 | 51.394 (23.985) | 47 | 42.802 (26.24) | 35 | 40.857 (28.015) | 27 | 34.743 (27.545) | 31 | 26.375 (23.905) |
| Ulnar | 93 | 46.012 (23.816) | 78 | 36.423 (24.223) | 61 | 35.408 (26.923) | 52 | 28.381 (23.342) | 47 | 25.142 (23.845) |

**Table 9. DASH Scores by Treatment Over Time**

| | 3 Month | | 6 month | | 12 Month | | 18 Month | | 24 Month | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Injured Nerve** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **N** | **Mean (SD)** |
| Overall | 209 | 47.391 (22.556) | 187 | 38.179 (24.146) | 140 | 37.645 (27.396) | 116 | 30.759 (23.913) | 111 | 25.85 (23.378) |
| Explored | 44 | 54.181 (24.271) | 40 | 43.312 (27.715) | 28 | 42.575 (28.508) | 24 | 33.635 (26.618) | 34 | 32.092 (26.92) |
| Repair | 80 | 44.924 (23.663) | 72 | 33.669 (22.208) | 58 | 31.243 (24.978) | 42 | 23.631 (19.394) | 39 | 21.261 (22.436) |
| Reconstruction | 85 | 46.199 (20.008) | 75 | 39.77 (23.47) | 54 | 41.966 (28.402) | 50 | 35.367 (25.009) | 38 | 24.974 (20.069) |

**Table 10. Number (%) of Patients with a BMRC Motor Grade of 4 or 5 over time, by Injury Type**

| | 3m | 6m | 12m | 18m | 24m |
|---|---|---|---|---|---|
| **Axillary** | 0 | 1 (33) | 1 (100) | 1 (100) | 1 (100) |
| **Musculocutaneous** | 0 | 0 | 1 (50) | 1 (50) | 0 |
| **Radial** | | | | | |
| ECRL/ECRB/ECU | 18 (36) | 27 (63) | 22 (73) | 15 (71) | 11 (79) |
| EPL | 8 (16) | 16 (37) | 18 (60) | 13 (62) | 10 (71) |
| APL | 11 (22) | 18 (42) | 22 (73) | 15 (71) | 9 (64) |
| EDC | 10 (20) | 20 (47) | 21 (70) | 15 (71) | 11 (79) |
| EDM/EDQP | 9 (18) | 18 (42) | 20 (67) | 14 (67) | 11 (79) |
| Forearm supination | 30 (60) | 36 (84) | 22 (73) | 17 (80) | 13 (93) |
| Elbow extension | 38 (76) | 37 (86) | 28 (93) | 18 (86) | 13 (93) |
| **Median** | | | | | |
| FDP | 41 (68) | 46 (78) | 32 (84) | 24 (89) | 15 (75) |
| FPL | 41 (68) | 41 (69) | 31 (82) | 22 (81) | 16 (80) |
| APB | 43 (72) | 31 (53) | 23 (61) | 18 (67) | 16 (80) |
| Pronation | 43 (72) | 46 (78) | 34 (89) | 23 (85) | 17 (85) |
| **Ulnar** | | | | | |
| FDP | 51 (56) | 47 (64) | 43 (80) | 29 (73) | 23 (74) |
| ADM | 16 (16) | 19 (26) | 20 (37) | 18 (45) | 21 (68) |
| Finger crossing | 13 (14) | 20 (27) | 20 (37) | 15 (38) | 18 (58) |
| Digit abduction | 14 (15) | 19 (26) | 21 (39) | 16 (40) | 18 (58) |
| Abductor polices | 22 (24) | 29 (39) | 27 (50) | 21 (53) | 19 (61) |