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# Adult Male Status Post Chronic Traumatic Brachial Plexus Injury: A Case Report

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# ADULT MALE STATUS POST CHRONIC TRAUMATIC BRACHIAL PLEXUS INJURY: A CASE REPORT

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# ADULT MALE S/P CHRONIC TRAUMATIC BRACHIAL PLEXUS INJURY: A CASE REPORT


## ABSTRACT

**Background and Purpose:** There is a lack of research using conservative treatment to treat chronic traumatic brachial plexus injuries. The purpose of this study was to examine the impact of a physical therapy treatment plan and home exercise plan (HEP) for a 47 year old male referred for shoulder pain following a traumatic compression injury 11 months ago.

**Case Description:** This study contained interventions focused on increasing joint mobility, resistance training, massage, and modalities to decrease patient symptoms and improve quality of life. To measure outcomes, the following examinations were used: numeric pain rating scale, gross shoulder manual muscle testing, AROM of the glenohumeral joint, DASH, and pectoralis minor MLT to evaluate muscle tightness versus guarded posture.

**Outcomes:** The patient showed limited to no improvement in each of the measures used to take from baseline to discharge. Slight improvements in AROM of the shoulder noted from 92$^{o}$ to 99$^{o}$ shoulder flexion and 84$^{o}$ to 104$^{o}$ shoulder abduction, no change in gross strength, and no change in DASH score. The patient was able to relax in the supine position over a period of 25 minutes to allow his right upper extremity to rest on the table for an accurate pectoralis minor MLT, the right shoulder measures 18 cm and left measured 15 cm.

**Discussion:** The results of this study emphasize early conservative treatment with brachial plexus injuries as well as the complexity involved when treating patients with chronic traumatic injuries. This case report adds a chronic component to the brachial plexus literature that is currently lacking. Additional research could include a study focused on specific interventions related to improving joint mobility, preventing muscle atrophy, and decreasing pain would be beneficial to the small population of traumatic brachial plexus injuries as well as the chronic BPI.

## BACKGROUND AND PURPOSE

The brachial plexus is comprised of cervical and thoracic nerves that network together to innervate the upper extremity. The nerves of the lower four cervical and first thoracic vertebra come together to form a single nerve root that lies between the anterior and middle scalene muscles; it then divides into three nerve cords that form the radial, median, and ulnar nerves.[1] The brachial plexus injury (BPI) is a rare condition that only affects 1.2% of patients worldwide, with 89% of BPI patients being males between the ages of 14 and 63 years.[1] "Literature classifies adult lesions on the basis of lesion site, distinguishing supraclavicular, retroclavicular or infraclavicular plexus lesions."[2] BPI are also commonly categorized as traumatic or obstetric injuries.[3] The traumatic injury can be further broken down as a closed or open injury depending on the mechanism. Closed injuries are typically associated with a stretching or traction force where the head and neck are forced away from the shoulder; whereas open injuries are typically seen in gunshot and stab wounds.[3] BPI are commonly associated with a lack in sensory and motor function, neurologic degeneration, atrophy of the related muscle groups, and neurogenic pain in the upper extremity.[2] Physical therapists need to be aware of the mechanism and location of the injury to effectively create a plan of care. Surgical intervention is often seen in cases of a closed BPI and is recommended within 3 weeks of the initial injury according to Limthongthang *et al*.[3] Few studies have looked at creating a

specific treatment protocol for patients with chronic traumatic BPI. The purpose of this study was to examine the impact of a physical therapy treatment plan and home exercise plan (HEP) for a 47 year old male referred for shoulder pain following a traumatic compression injury 11 months ago. The treatments used in this study focused on patient education, increasing joint mobility, resistance training, massage, and modalities to decrease the patient's symptoms and improve his quality of life.

## SUBJECT DESCRIPTION

The patient was a 47 year old Caucasian male who presented to physical therapy with severe upper extremity pain and radicular symptoms into his right forearm and hand that occurred from a traumatic accident 11 months ago. The patient is a correctional officer and while on the job, a metal hatch fell on his outstretched right arm proximal to the acromion process. Imaging two months post injury showed no fractures or nerve damage at the neck or shoulder. The patient consulted an orthopedic physician but was quickly referred to a neurologist for consultation concerning the patient's severe and persistent radicular symptoms. The neurologist cleared the patient to return to full-duty at work. The patient returned to work 6 months post injury with no change in symptoms since the incident. The patient felt he was unable to safely perform his work duties and revisited the orthopedic physician, who then referred him to physical

therapy for evaluation and treatment. The patient was evaluated by a physical therapist nearly 11 months from the initial injury. The patient had not yet seen a physical therapist for this condition.

The patient had a non-remarkable medical history other than type II diabetes mellitus that was regulated with diet and exercise. The patient presented with a height of 6’2” and weighed 240 pounds. Prior to the incident, the patient was fully independent and had no difficulty with activities of daily living or job duties. The patient reported taking prescription Tramadol 50 mg as needed for pain the first few months post injury, but had since stopped as he felt no effect of the drug. The patient was currently on disability and expressed being anxious to return to work as he was nearing retirement. His goals included: experiencing less pain, returned use of his right arm to feed himself, don and doff clothes, and return to coaching his daughter’s softball team.

**Clinical Impressions**

The patient’s primary complaint was the extreme constant pain he experienced in his right upper trapezius, anterior right shoulder, right lateral forearm, and first and second digits of his right hand. Due to the nature of the injury and radicular symptom distribution, diagnoses of cervical strain, shoulder strain, or brachial plexus injury were each a matter of consideration. The physical therapy examination focused on assessing

patient range of motion, gross upper extremity strength, sensation, and quantitatively measuring pain and functional disability. This patient was appropriate for a case report due to the lack of research on adult closed brachial plexus injuries, chronic brachial plexus injuries, and non-athletic traumatic brachial plexus injuries.

**Systems Review**

The cardiopulmonary and integumentary portions of the systems review were unremarkable. During the musculoskeletal assessment, the patient was found to have substantial limitations in right upper extremity range of motion and significant guarding during active movements. We were unable to properly assess upper extremity strength given the patients limited range of motion, but were able to gain an understanding of his current strength with modified strength tests. The neuromuscular portion of the exam found that upper extremity dermatomes were intact and found that the radicular symptoms traveled along C6-C7 distributions.[2, 4] Spurling's Test was utilized to rule out cervical involvement, and was found to be negative. We chose to not perform special tests related to BPI on this patient given his limited range of motion, noted pain with palpation, and increased pain with all activities. Joint mobilizations were not assessed at the initial examination, but were evaluated at the second session and found to be limited in all directions. The patient's learning style preference was verbal

with written instructions provided as well. He was alert and able to communicate, spoke English clearly, and was able to follow instructions.

## EXAMINATION

### Manual Muscle Testing

In order to test right upper extremity strength, we used a modified version of manual muscle testing as it provided us baseline measurements of the patient's gross right shoulder strength. The patient was tested in the sitting position in a supportive chair and measurements were taken with the patient's right arm at his side with his elbow bent. The physical therapist applied pressure to the lateral aspect of the elbow and asked the patient to "push out" to assess shoulder abduction. The same position was used to assess shoulder flexion, extension, internal rotation and external rotation. Measurement grades were consistent with normative manual muscle testing, for example, since the patient was unable to perform full range of motion, strength could not be assessed any higher than a 3/5.[5] We also tested the patient's left upper extremity strength in accordance to the technique as indicated in Hislop and Montgomery's *Daniels & Worthingham's Muscle Testing: Techniques of Manual Examination.*[5] Bilateral strength test results can be found in Table 1.

### Muscle Length Testing

Due to the patient presenting with significant guarding of the right upper extremity, it was important to measure muscle length of the pectoralis minor bilaterally to determine muscle tightness versus patient guarding. To assess pectoralis minor muscle length, the patient was asked to lie in the supine position with arms resting by his side. A tape measure was used to measure from the acromion process to the table and the measurement was recorded in centimeters.[6] At the initial examination, the patient was unable to allow his right upper extremity to lie on the table secondary to anterior shoulder pain. Pectoralis minor MLT provided a good measure in which to set goals noting improvement in the length of the muscle.

**DASH**

Due to the patient having significant functional limitations, it was important to quantify his difficulty with normal daily tasks. The Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH) is designed to evaluate disorders of the upper extremities and monitor change in function over time. The DASH consists of a 30-item self-report questionnaire designed to assess musculoskeletal disorders of the upper extremities.[7] Each item asks the patient to rate their disability/symptom from 1 (no difficulty or strongly disagree) to 5 (unable to perform or strongly agree). The DASH is scored with the following equation: [(sum of n /n) -1] x 25; where n = number of completed responses.[7] It is also noted that the DASH should not be scored if more than three of the items are missing. A higher score on the

questionnaire equates to increased disability. The minimally clinically important difference (MCID) for the DASH is 10,[8] whereas test-retest reliability is 0.928.[9]

**Active Range of Motion**

The patient showed significant limitations in right upper extremity active range of motion (AROM) and also stated that his limited range is one of the most debilitating factors of his current condition. Standard goniometry measurements were used to measure the patient's right shoulder flexion and abduction.[6] Active shoulder flexion and abduction have an intra-rater reliability of .53 and .58, respectively.[6] We chose to focus on these two specific ranges as they are primary movements of the glenohumeral joint and were limiting the patient most with his daily activities. The patient's shoulder AROM measurements can be found in Table 1. Passive ROM was not assessed at the initial examination with this patient given the significant amount of pain with movement and palpation.

**Numeric Pain Rating Scale**

The Numeric Pain Rating Scale (NPRS) was used to objectively quantify the patient's pain at the current moment, as well as the best and worst it had been in the past 24 hours. The NPRS is an 11 point scale ranging from numbers 0 to 10. "0" correlates to "no pain" and "10" to the most intense pain imaginable.[10] The NPRS is a quick way to gain an

understanding of the patient's pain and requires no equipment or training. The NPRS has a minimally clinically important difference (MCID) of 2.17 points for patients with shoulder pain,[11] a test-retest reliability of 0.95 for patients with chronic pain,[12] and criterion validity of r=0.88.[13]

| **Table 1: Results of Initial Physical Examination/Tests and Measures** | | |
|---|---|---|
| NPRS (0-10) | Present at 1st Visit: 3/10<br>Worst pain in last 24 hrs: 8/10, with pain radiation along C6-C7 distribution | |
| AROM | Flexion: 92°<br>Abduction: 84° | |
| MMT | R Glenohumeral Jt:<br>Flx: 2+/5<br>Abd: 2+/5<br>ER: 2+/5<br>IR: 2+/5 | L Glenohumeral Jt:<br>Flx: 5/5<br>Abd: 5/5<br>ER: 5/5<br>IR: 5/5 |
| DASH | 69.2/100 | |
| MLT | Unable to test | |

## Clinical Impressions

Following the patient's examination, we were unable to determine a true diagnosis due to the patient's pain level with movement and palpation. Our professional opinion given the mechanism of injury and patient's specific nerve pattern suggested a brachial plexus injury rather than a cervical or shoulder strain. Our next step was to develop a plan of care to decrease the patient's guarded behavior, decrease pain with therapeutic modality use and massage, and increase range of motion. The patient was also given a home

exercise program designed to increase mobility of the glenohumeral joint and to prevent further muscle atrophy and joint capsule tightness.

## PROGNOSIS AND GOALS

The patient was a healthy, active 47 year old man that sustained a traumatic injury to his right shoulder 11 months ago. The amount of time from injury to initial examination indicated its chronic nature, which may significantly affect the prognosis. Musculoskeletal conditions generally take 4-6 weeks to heal with proper treatment and rest;[14] however, minor nerve injuries could take up to 4-12 weeks to heal,[3] as research has shown nerves regenerate at a rate of 1-3 mm/day.[15] Research has also shown that brachial plexus injuries are often treated surgically;[3, 16, 17] since our patient had not had surgery we were unable to determine the degree of damage to the axon of the nerve(s). We were not able to be aggressive with our treatment with this patient due to his guarded position and heightened state of pain. We wanted to be cautious in our approach since this patient had not actively moved his right upper extremity for several months and could have developed capsular and muscular adhesions limiting any available ROM. Positive factors included the patient's age, and willingness to return to normal activity at work and in the community. Given the previously stated factors, the patient had a fair prognosis for recovery. Over the course of the

4 weeks, the patient was asked to attend 12 visits (3 visits per week) for 60 minute treatments sessions to achieve the following mutually established goals/outcomes:

The short term goals concentrated on decreasing his current pain to 0/10, increasing his right shoulder flexion AROM to 110 degrees and abduction AROM to 105 degrees, and decreasing his guarded behavior enough to properly assess pectoralis minor muscle length. The short term goals were set to be accomplished in 2 weeks. Long term goals included decreasing his worst pain to 5/10, improving his score on the DASH to 59.2 to make a clinically significant change, increasing gross shoulder flexion, abduction, internal and external rotation strength to 4/5, increasing his flexion AROM to 150 degrees and abduction AROM to 140 degrees, and normal pectoralis minor muscle length compared to the uninvolved side. The long term goals were set to be accomplished in 4 weeks. In summary, our goal was to improve the patient's mobility and decrease pain in order to improve his daily activities and quality of life. Any other improvement noted would be secondary gains to these goals.

## INTERVENTIONS

The patient attended physical therapy treatment sessions 3 times per week for 4 weeks, for a total of 12 visits. Each session lasted approximately 60 minutes. Interventions focused on decreasing the patient's pain using

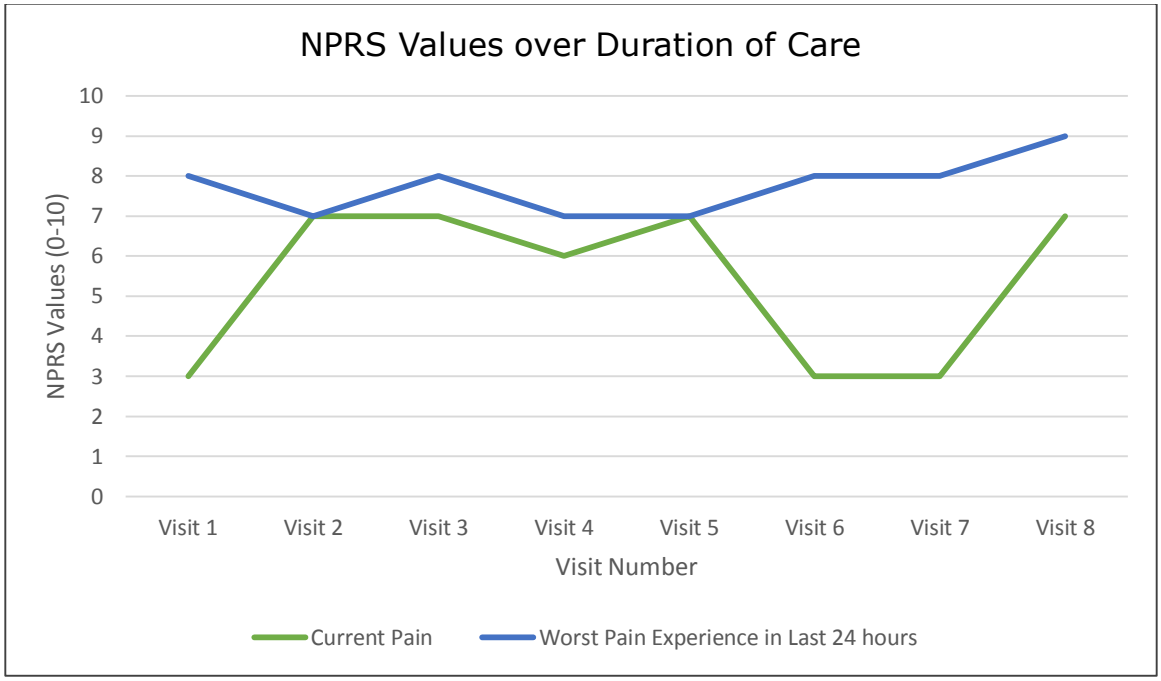
electrical stimulation and ultrasound, active assisted and passive range of motion exercises, myofascial release, stretching exercises, joint mobilization, and postural education.[2] Interventions were selected based on patient's level of function, current pain rating on the NPRS, radicular symptoms, and support in the research.[2] Specific exercises and progressions for the 4 week treatment are listed in Appendix A. The patient was provided a home exercise program in addition to the treatment sessions in order to maintain gains in treatment and to promote rehabilitation and return to function as quickly and effectively as possible. A reassessment was scheduled to be performed at 2 weeks to gauge treatment effectiveness, but was rescheduled due to patient cancellation. The patient attended 8 of the 12 sessions. He missed 2 sessions during the third week due to a brief illness unrelated to his current condition. The remaining 2 sessions were put on hold as the patient was referred back to his orthopedic physician. He reported compliance to the best of his ability with his home exercise program. At the end of the last treatment session, the patient was instructed to continue with the home exercise program provided to him initially to maintain the mobility achieved throughout treatment and manage his current level of pain. The patient was provided written as well as verbal/ physical demonstration of these exercises and was discharged after.

## OUTCOMES

At the rescheduled progress report on the 8th visit, the patient had not achieved any of the short term goals. This data comparison from the initial evaluation to the progress note is represented in Table 2. The patient only showed slight improvements in AROM of the shoulder, no change in gross strength, and no change in DASH score. However, the patient was able to relax in the supine position over a period of 25 minutes to allow his right upper extremity to rest on the table for an accurate pectoralis minor MLT (Table 2). Our professional opinion was that physical therapy was not benefitting this patient's condition and that further follow up with the physician was necessary. A referral back to the orthopedic physician was made.

**Table 2: Comparison of Initial Examination and Progress Note Data**

| **Test/Measure** | **Initial Exam** | **Progress Note (8th visit)** |
|---|---|---|
| NPRS (0-10) | Present at 1st Visit: 3/10<br>Worst in Past 24 hrs: 8/10, with pain radiation along C6-C7 distribution | Present at 8th Visit: 3/10<br>Worst in Past 24 hrs: 9/10, with pain radiation along C6-C7 distribution |
| AROM | Flx: 92°<br>Abd: 84° | Flx: 84°<br>Abd: 104° |
| MMT | R GH Jt<br>Flx: 2+/5<br>Abd: 2+/5<br>ER: 2+/5<br>IR: 2+/5 | R GH Jt:<br>Flx: 2+/5<br>Abd: 2+/5<br>ER: 2+/5<br>IR: 2+/5 |
| DASH | 69.2 | 69.2 |
| MLT | Unable to test | R: 18 cm L: 15 cm |




## DISCUSSION/CONCLUSION

The purpose of this study was to examine the impact of a physical therapy treatment plan and home exercise plan for a 47 year old male referred for shoulder pain following a traumatic compression injury 11 months previous. The treatments used in this study focused on patient education, increasing joint mobility, resistance training, massage, and modalities to decrease patient symptoms and improve patient quality of life. This study was significant because of the lack of research devoted to adult brachial plexus injuries, particularly the chronic case. "These traumatic injuries are increasing with the popularity of extreme sports and with the improvement in survival rates of motor vehicle accidents."[18, 19] No studies

came to our attention demonstrating specific conservative treatments for patients with chronic traumatic brachial plexus injuries. Many studies focus on surgical procedures and post-operative care, but did not address the physical therapy treatment pre-operatively. With the higher prevalence of high impact injuries associated with sporting events, as well as motorcycle accident survivors,[19] this study is very much needed.

Factors other than physical therapy interventions may have influenced this patient's outcome. Treatment sessions began when the patient was 11 months post-injury and had been experiencing extreme symptoms for the entirety of that time. The chronic condition of the injury may have already limited the effectiveness of physical therapy. Also, this patient had good adherence to his HEP but did not log outside activities which could have aggravated his condition.

Limitations of this case report may be seen in some of the data collection and techniques used to assess the patient. Although dermatomes were assessed, myotomal integrity and reflexes were not examined and thus we cannot determine the degree of nerve injury. The assessment of gross strength is also a limitation as proper technique and protocol was not followed due to the patient's level of pain and guarded nature. However, the same positioning was used at the initial examination and at the reassessment. We also chose to not perform special tests related to BPI on this patient given his heightened state of pain and lack of range of motion,

as the outcome of the tests would be unreliable. Another limitation of this study is that the patient did not receive physical therapy treatment immediately post-injury, and research shows that immediate conservative treatment can improve the outcome of closed BPI.[2, 18-20] Alternate forms of pain management could have also assisted this patient, such as a referral to a chronic pain center.

Suggestions for future research may include physical therapy intervention beginning immediately post trauma with strict adherence to treatment and a HEP with a patient log that illustrates compliance. It is also important to note that educating patients on the nature of their injury and early examination can play a vital role in a patient's outcomes. Lastly, a study focused on specific interventions related to improving joint mobility, preventing muscle atrophy, and decreasing pain would be beneficial to the small population of traumatic brachial plexus injuries as well as the chronic BPI.

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| Appendix A: Comprehensive Plan of Care | | | | | | |
|---|---|---|---|---|---|---|
| | **Stretching** | **ROM Exercises** | **Massage** | **Joint Mobilizations** | **Postural Education** | **Modalities** |
| **Week 1** | | Over-the-door pulley AAROM: 5 min.<br><br>Table AAROM to improve shoulder flexion and abduction: 4 min each direction<br><br>Supine shoulder flexion, abduction, internal and external rotation PROM, 5 min each direction | | Long axis distraction of GH joint, Grade 2; 4 min<br><br>Glenohumeral mobilizations, Grade 2: lateral distraction, posterior glides, inferior glides, 3 min each direction | Demonstrated understanding of proper posture to enhance facilitate increased glenohumeral mobility and decrease guarded posture. | Ultrasound: 20% pulsed, 1 MHz, 1 W/cm$^2$ for 8 minutes applied to anterior shoulder |
| **Week 2** | Supine position over halved foam roll to stretch pec wall; 5 min | Over-the-door pulley AAROM: 5 min.<br><br>Table AAROM to improve shoulder flexion and abduction: 4 min each direction<br><br>Supine shoulder flexion, abduction, internal and external | Myofascial Release Technique over right upper and middle trap and right pec minor; 8 min | | | Ultrasound: 50% pulsed, 1 MHz, 1 W/cm$^2$ for 8 minutes applied to anterior shoulder<br><br>EStim: Interferential Current 80-120 mA, 15 min, applied to right upper trap and right pec minor |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | rotation PROM, 5 min each direction | | | | |
| **Week 3** | Supine position over halved foam roll to stretch pec wall, with pillows under right UE – pillows gradually removed over time; 25 min | Over-the-door pulley AAROM: 5 min.<br><br>Table AAROM to improve shoulder flexion and abduction: 4 min each direction | | Long axis distraction of GH joint, Grade 2; 4 min<br><br>Right 1st Rib mobilizations, Grade 2; 4 min. | | Ultrasound: 50% pulsed, 1 MHz, 1 $W/cm^2$ for 8 minutes applied, to right pec minor insertion<br><br>EStim: Interferential Current 80-120 mA, 15 min, applied to right upper trap and right pec minor |