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Effectiveness of stimulation along with conventional therapy in rehabilitation of brachial plexus injury in multiple trauma patient – A case study

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Abstract
Background: Brachial plexus syndrome Injury causes chronic impairments that require long-term management. Injuries to the brachial plexus frequently result in decreased upper limb sensation and muscle strength was involved in two-wheeler versus lorry Road Traffic Accident (RTA). It results in decreased upper limb sensation and muscle strength.
Aim: The aim Is to find out the effectiveness of neuromuscular electrical stimulation along with conventional therapy in rehabilitation of post traumatic damage of brachial plexus in brachial plexus in multiple trauma patient.
Case Study: A 21-year-old man was involved in two-wheeler versus lorry Road Traffic Accident (RTA). Which leads to brachial plexus injury due to penetrating injury and multiple traumas in various parts the body. The patient received neuromuscular electrical stimulation along with conventional therapy, which includes suspension therapy, stretching and strengthening exercise along with massage therapy.
Outcome Measures: The oxford grading scale used to measure the strength of the muscle involved. The disability of arm, shoulder and hand [DASH] questionnaire assess the functional disability.
Result: The patient is now functionally independent shown by DASH Score.
Conclusion: Neuromuscular electrical stimulation along with conventional therapy is effective in rehabilitation of post traumatic damage of brachial plexus in brachial plexus in multiple trauma patient.
Effectiveness of neuromuscular electrical stimulation along with conventional therapy in rehabilitation of post traumatic damage of brachial plexus in multiple trauma patient – a case study.

Keywords: Electrical stimulation, physiotherapy, weight-bearing

Introduction

Traumatic peripheral nerve injuries can occur following road traffic accidents and lead to severe disability and loss of function in the upper and lower limbs. Injuries to the brachial plexus frequently result in decreased upper limb sensation and muscle strength. According to research, these types of injuries are more common in young males. The upper limb, specifically the brachial plexus, is affected by a large percentage of traumatic peripheral nerve injuries. Traumatic brachial plexus injury is estimated to account for 44% to 70% of all motorcycle accidents, sporting events, and workplace accidents. Brachial plexus damage was found in 4.2% of motorcycle injuries (22%). The upper brachial plexus lesion (C5, C6) causes paralysis of the shoulder muscles and biceps. If elbow flexion and wrist extension is reduced or winging of the scapula is detected, C6 involvement should be considered. When the wrist and forearm muscles are affected, C7 is affected and the forearm flexor and the intrinsic muscles of the hand involved indicates C8, T1.

Brachial plexus syndrome Injury causes chronic impairments that require long-term management. The establishment of trauma centres and major advances in emergency care have resulted in the accurate diagnosis and surgical treatment of brachial plexus injuries. However, there has been little research into the rehabilitation of these complex patients. Injuries to the brachial plexus frequently result in decreased upper limb sensation and muscle strength. The focus of this study was on early physiotherapy for traumatic brachial plexus injury.

Physiotherapy aims to improve range of motion, strengthen afflicted muscles, increase sensitivity, manage pain, and prevent secondary effects by using conventional therapy such as suspension therapy, Stretching and strengthening exercise along with massage therapy.

Neuromuscular electrical stimulation (NMES) is a rehabilitation method that has previously been studied with a specific focus on nerve regeneration after traumatic injury. Conventional therapy includes stretching, strengthening exercise and massage therapy.

The disabilities of the Arm, Shoulder and Hand (DASH) questionnaire is a validated outcome measure for the upper limb. It is a 30-item questionnaire looking at the ability for patients to perform certain upper limb activities and can be used as a measurement of functional recovery of the upper limb.

However, little research has been conducted on acute traumatic brachial plexus injuries in the multiple trauma group. Younger boys with multiple-site trauma that require considerable multifaceted therapy. Patients with multiple trauma and brachial plexus injuries require therapy in a specialized facility.

Case Study

This patient is a 21-year-old man. Prior to his accident, he had no significant personal or family medical history; he was completely self-sufficient. His interests included motorcycle riding. He was involved in two-wheeler versus lorry Road Traffic Accident (RTA) on 18th March 2022 which resulted in:

- Penetrating injury left side of neck

- Brachial plexus injury
- Left femur shaft fracture
- Left forearm both bone fracture
- Left mandible fracture with left infraorbital rim
- Left first rib fracture
- Left neck soft tissue injury.

Patient undergone emergency wound exploration + hemostasis + 1st rib excision and left femur ORIF with broad large fragment DCP were done. followed by ORIF left mandible, left infraorbital rim and left forearm both bone fracture- ORIF with small fragment DCP were also done. and then he undergone trapezius muscle transfer with deltoid insertion. Later patient was discharged in hemodynamically stable status with following medications and advice. He sustained a brachial plexus injury on his left side.

Investigation

The patient was admitted to a major trauma centre due to his complex life-threatening injuries. He had multiple chest, arm, wrist, pelvis and hip X-rays. He has also had CT scans for neck, arm and hip.

The Seddon classification was used to diagnose the nerve injury -- 'Neuropraxia' was identified (a pre-ganglionic lesion with evidence of conduction block, no degenerative injury seen in operation)

Treatment

The patient received neuromuscular electrical stimulation along with conventional therapy. Conventional therapy includes suspension therapy, stretching and strengthening exercise along with massage therapy.

His neck, shoulder, elbow, hip, and knee injuries were referred to physiotherapy for musculoskeletal management. His lower limb rehabilitation went well, with range of motion and strength returning quickly. As a result, a significant portion of his physiotherapy was given over to his brachial plexus injury, for which he received Neuromuscular Electrical Stimulation (NMES) training.

Home exercises and an NMES program for both his elbow and shoulder joints were also part of his rehabilitation. He was also given active-assisted exercises to help him maintain and improve range of motion in his elbow and shoulder joints.

Early stage

As a result of his brachial plexus injuries, his early stage rehab focused on active-assisted ranges of motion around his shoulder and elbow joints in order to maintain range. We also started muscle stimulation on his left upper limb at this stage, focusing on his elbow flexion. Suspension therapy was given to improve range of motion and muscle power. At this point in time, manual therapy on his elbow was also attempted to increase his passive range of motion.

Later stage

With the muscle stimulation sessions, the patient was performing active assisted exercises. The patient's muscle activation in the upper limb muscles improved further. Maintain with manual shoulder therapy to increase range of motion.

Outcome and Follow Up

The patient presents with the following symptoms following physiotherapy intervention using specific strengthening and stretching exercises and daily NMES:

- Biceps activity has advanced to 4/5 on the Oxford grading scale in terms of available range of motion.
- When his dermatome is tested, the patient reports full 100% sensation on his left side, as well as increased sensitivity and pins and needles.

The Disability of the Arm, Shoulder, and Hand (DASH) questionnaire is a 30-item questionnaire that assesses patients' ability to perform certain upper limb activities and can be used to assess functional recovery of the upper limb; lower DASH scores indicate greater functional independence. The patient was evaluated at the start of the physiotherapy intervention and six months later.

Table 1: Disability of Arm, Shoulder and Hand (DASH) score

Pre test	Post test
86/100	65/100

Result

The patient's DASH measurements differed by 21 points before and after the physiotherapy intervention. The patient is now self-sufficient in terms of his personal care.

Discussion

Traumatic brachial plexus injuries can occur as a result of an automobile accident, and they are frequently part of a complex multiple traumatic injuries presentation. The most common associated injuries are glenohumeral joint fractures and dislocations, and many patients will require surgical intervention. Brachial plexus injuries are complicated and necessitate intensive, long-term rehabilitation. Patients frequently struggle with daily activities and returning to work.

The rehabilitation of a traumatic brachial plexus injury in a young multi-trauma patient following a road traffic accident was the focus of this case review. Rehabilitating an isolated brachial plexus injury is widely considered a difficult procedure. However, when combined with additional multiple traumas damage, the current case study included a level of complexity that is rarely seen beyond Major Trauma centres. This is reflected in the lack of rehabilitation guidelines to guide the recovery of combined brachial plexus and multiple trauma patients.

The post-operative instructions included wearing a sling for comfort, mobilizing the arm as much as possible, and considering rehabilitation six weeks after surgery. Unexpectedly, active physiotherapy rehabilitation was not recommended by the medical team after the exploratory surgery. It is possible that an earlier chance for rehabilitation was lost now that it is recognized that the nerve injury was a neuropraxia. This is one potential disadvantage of delaying surgery until beginning rehabilitation rather than based solely on the MRI diagnosis. However, the patient was not even considered for rehabilitation until 10 weeks after his injury, which may have limited his overall recovery.

When compared to the current study's excellent functional recovery, these values may be considered rather low. As a result, the suggestion is made that with access to NMES and

full gym-based rehabilitation, functional recovery may be improved.

There were a number of limitations throughout the rehabilitation program that had an impact on the overall recovery times observed. These included neuropathic pain, upper limb weight-bearing limitations, and additional, complex surgeries.

In conclusion, this case study provides encouraging evidence for the use of NMES following brachial plexus injury in a complex multiple trauma patient. It is a rare example of a successful rehabilitation process that included the management of orthopaedic and neurological pathologies in the absence of current national guidelines. Muscle stimulation appeared to be especially beneficial, with no reported negative side effects. These suggest that more research into the use of NMES in patients with combined brachial plexus injury and multiple traumas is required.

Conclusion

Early physiotherapy is effective in improving the physical condition of an individual who is recovering from a traumatic brachial plexus injury.

Conflicts of Interest

We have no conflict of interest to declare.

Source of Fundings

We did not receive support from any organization for the submitted work.

Ethical Clearance

Approval was obtained from local ethics committee.

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