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Impact of physiotherapy rehabilitation in subject with Monteggia fracture with compartment syndrome- A case report

Aditi Joshi[1], Om Wadhokar[2], Pratik Phansopkar[3*]

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Authors' Affiliation:
[1]Intern, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Wardha, Maharashtra, India; Email:aditiajoshi12@gmail.com, ORCID: https://orcid.org/0000-0003-1761-3877
[2]Resident, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Wardha, Maharashtra, India, Email: wadhokarom@gmail.com, ORCID: https://orcid.org/0000-0002-6336-6400
[3]Associate Professor and HOD, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Wardha, Maharashtra, India; Email: drpratik77@gmail.com, Orcid: https://orcid.org/0000-0003-3635-8840

***Corresponding Author**
Pratik Phansopkar
Associate Professor and HOD, Department of Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences (DU), Wardha, Maharashtra India – 442004
Email: drpratik77@gmail.com, Orcid: https://orcid.org/0000-0003-3635-8840

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ABSTRACT

The Fracture of proximal ulna linked with radial head dislocation is called Monteggia fracture. The cause of injury is traumatic and leads to complications if nerves are damaged with fracture at the forearm. Compartment syndrome is a common cause of trauma that destroys the soft tissues. The compression is due to fracture leads to nerve paralysis, specifically the ulnar and radial nerve. Such complications limit the functional activities as well as slow the healing process. We document a case of 55-year-old farmer, admitted to hospital, with history of twisting injury at forearm due to rotator machine of the tractor, admitted in emergency unit with bleeding wound, pain plus swelling over forearm. On investigations, it was diagnosed as Compound grade I Monteggia fracture and radial head dislocation with Radial plus Ulnar nerve Palsy with Compartment Syndrome. It was managed by open reduction internal fixation and Physiotherapy was started for further rehabilitation.

Keywords: Monteggia fracture, Compartment syndrome, Bado's Classification, ulnar and radial nerve palsy, physiotherapy.

1. INTRODUCTION

The forearm is one of the most important structures of the human skeleton that allows one to carry out activities of daily living. Fractures of this can result in notable short and long-term impairment, especially if fixed improperly (Johnson and Silberman, 2022). One such fracture is the Monteggia fracture. A Monteggia fracture is fracture of the proximal ulna with the ligamentous insufficiency of radius resulting in radial head displacement (Konrad et al., 2007). Amputation and death are both possible outcomes of compartment syndrome. A common cause of compartment syndrome is damaged caused that destroys the muscles and vasculature within an Osseo-fascial compartment, resulting in edema plus swelling. Due to this, the internal compression increases which limits this expansion and decreases

blood supply to nerves & muscles within. As the blood flow is diminished, it can produce ischemia and tissue necrosis (Smith et al., 2015).

Ulnar nerve entrapment emerges when the ulnar nerve compresses or damages. After the median nerve, the ulnar nerve is the second most common neuropathy that occurs after a fracture of the forearm. This also leads to chances of developing complex syndromes (Cloete and Lahri, 2019; Li et al., 2021). In the upper limb fractures, the most affected is the radial nerve. The majority of treatment is non-operative but sometimes surgery becomes necessary to avoid further complications. Radial nerve palsy restricts many functional activities of daily living. Conservative treatment also plays an important role as it helps in maintaining a complete passive range of movement of the injured extremity (Darware and Naqvi, 2020). Physiotherapy plays a vital role in managing cases with complications post-fracture where the nerves are managed that limit the functional activities (Bumbasirevic et al., 2016).

2. PATIENT INFORMATION

This is a case of a 55-year-old male, who is a farmer by occupation and resident of Wardha. He was alright 2 weeks ago when he suddenly had an accident with a twisting injury due to a rotator machine while working on the farm, sustaining the injury to his right forearm, was immediately brought to AVBRH, Wardha and was admitted to the emergency department. On arrival, the patient had complaints of pain and swelling on the right forearm along with bleeding wound over his forearm. The pain was sudden on onset with severe intensity. The patient was asked to rate the pain on NPRS and rated 9/10. It aggravated on movements. He had no history of head injury, no loss of consciousness, no vomiting or ENT bleeding following the accident.

On consultation, necessary investigations were done in which Compound grade I Monteggia fracture-dislocation of the right forearm with Radial and Ulnar nerve palsy with compartment syndrome was diagnosed. The patient was operated with Open Reduction Internal Fixation plus plate osteosynthesis of Ulna and reduction of head of radius and dressing and primary suturing of the wound over the forearm. Followed by the surgery the limb was immobilized with a plaster cast. Post-operation when the patient was stable, he was shifted to the ward for further recovery and was referred for physiotherapy for rehabilitation.

General examination

The patient has a good sense of time, place, & person at the time of examination.

On observation

The patient was in a supine lying when examined with shoulders on equal level. The elbow was flexed in 90 degrees along with the wrist in flexion with fingers partially flexed. The body built was ectomorphic. No scar and swelling were visible. Muscle wasting was observed on the right arm. The forearm was in the above-elbow cast of Plaster of Paris which was supported with a sling.

On palpation

All findings of inspection were confirmed on palpation. The local body warmth was raised. Bony crepitus was present. Active elbow movement was restricted due to plaster cast, Sensory deficit present. Abduction and adduction of fingers were weak and Froment's sign was positive.

On Examination

Manual Muscle testing

Resisted isometric testing was done for the fractured limb and it was weak and painful. While testing the muscle strength, left upper extremity strength was 5/5 and in both legs strength was 4/5 on conventional grading scale.

Range of motion

For bilateral lower limb was full and functional. It was noted that the MCP joint extension was absent. Thumb extension absent. Flexion of IP joints of fingers weak, Loss of ability to cross the 4th and 5th digits of the hand. Wrist dorsiflexion was also absent. The overall grip strength was reduced; Pretreatment Range of Motion of Shoulder Elbow and wrist is mentioned in (Table 1).

Special tests

Froment's sign test was performed to confirm ulnar nerve palsy and it was positive. The upper limb neurodynamic test for radial nerve palsy was positive.

Table 1 Pre- treatment Range of Motion

Joint	Right active (in degrees)	Left active (in degrees)
Shoulder		
Flexion	0-160	0-165
Extension	0-50	0 – 50
Abduction	0-165	0 – 165
Internal rotation	Not tested due to plaster cast	0 – 70
External rotation	Not tested due to plaster cast	0 - 70
Elbow		
Flexion	Not tested due to cast	0 – 110
Extension	Not tested due to cast	0
Wrist		
Flexion	0-65	0 – 67
Extension	0	0 – 20
Radial deviation	Not tested due to cast	0 – 20
Ulnar deviation	Not tested due to cast	0 - 30

Sensory examination

Sensory deficit present, Hypoesthesia is present at the sensory distribution of radial and ulnar nerves.

Diagnostic Assessment

Findings of right elbow x-ray (Figure 1) were taken in anterior and lateral view. The injured area of patient's forearm was within plaster cast and supported in a sling, the X ray shows ulna fracture with radial head dislocation

Figure 1 X – Ray showing ulna fracture and radial head dislocation

Timeline

Timeline of the event is mentioned in the table 2.

Table 2 Time line of the Events

Events	Date
Date of accident	28 September 2021
Open reduction Internal Fixation	1 October 2021
Primary suturing of the wound over the forearm	09 October 2021
Physiotherapy management	10 October 2021

Medical management

The patient was on medications, including pain killers, anti-inflammatory, and antibiotic drugs. After this, the patient was immobilized in an above elbow plaster cast. The patient was further referred to the physiotherapy department for management. Surgical management- through Open reduction and internal fixation was done.

Physical Therapy Management

On first day of management, patient's range of motion, strength and pain were assessed. The patient was informed about the surgical procedure prior to the beginning therapy. The significance of exercise for the patient's health and early return to ADLs was conveyed to him. The short and long term goals are mentioned in the table 3.

Table 3 Short and long term Goals

Short Term Goals:	Long Term Goals:
To reduce pain at the fracture site.	To maintain the range of motion of joints.
Increase the range of motion of elbow, wrist and phalanges	Maintain the grip strength
To increase the grip strength and strength of muscles affected.	Independent ADLs
Enable patient to carry out activities of daily living independently.	Ergonomics

Rehabilitation

Phase 1 (week 1 to 4)

In the initial phase, the main aim was to protect the bone healing and soft tissue structures. An above elbow plaster cast was applied to the patient post-surgery. Exercises to shoulder movement was started to retain the joint's mobility, with 10 repetitions, 2 sets of Flexion, extension, and abduction exercises were taught to the patient. Active range of motion exercises was prescribed to digits, including the interphalangeal and metacarpo-phalangeal joints. Extension of all digits was absent due to radial nerve palsy. Passive extension movements to digits were performed. All rotational movements to the forearm were avoided in the first two weeks. No strengthening exercises to arm and forearm. Isometric exercises to biceps, triceps, and deltoid. At the completion of phase 1, the person had no difficulty in shoulder and digit range of motion. The patient was given a dynamic finger splint to keep the digits in extension as seen in Figure 2, to avoid flexion deformity. Deep breathing exercises were also started from 1st week. The uninvolved extremity was used for functional activities of self-care and personal hygiene.

Phase 2 (Week 6 to 8)

After 4 weeks, the cast was removed and a crepe bandage was applied around the forearm. At 6th week, grip strengthening exercises with ball squeezing were started with 10 repetitions as seen in figure 3. Isometrics to biceps, triceps, and forearm continued. Gentle assisted- active exercises to elbow started. Weight-bearing progressively started 8th week onwards. Active range of motion started with pronation -supination. The gripping ball squeezing exercise continued.

Figure 2 Dynamic Finger Splint

Figure 3 Grip Strengthening Exercises

Phase 3 (Week 8-12)

Full active range of motion exercises was started. Softball squeezing exercises were continued for increasing the grip strength. Progressive resisted exercises were also started. Active-assisted abduction-adduction exercises for digits of the right hand were initiated and continued for the forearm as well as wrist musculature. Weight-bearing exercises were started. The patient was able to hold lightweight now. With the help of a finger splint, a slight extension of the digits also improved. Flexion and extension of the elbow were achieved by strengthening the biceps and triceps. The patient was able to carry out functional activities of daily living with the right hand.

At the end of the rehabilitation, maintaining strength, function increasing range of motion was the ultimate goal and it was achieved by following an exercise therapy program. The exercises ranged from simple to complex patterns along with a range of motion activities.

Outcome Measures

After 12 weeks of physiotherapy, enhancement of range of motions and strength and function the affected upper extremity were noted. Disability of arm, shoulder and hand

Pre-Treatment-40/100

Post-Treatment- 80/100

Post treatment Range of Motion of Shoulder; Elbow and Wrist is mentioned in table 4.

Table 4 Post Treatment Range of Motion of Shoulder, Elbow, Wrist

JOINT	Ranges (active)	Ranges (passive)
Shoulder		
Flexion	0 – 165	0 – 170
Extension	0 – 60	0 – 60
Abduction	0 – 170	0 – 170
Internal rotation	0 – 40	0 – 40
External rotation	0 – 45	0 – 45
Elbow		
Flexion	0 – 120	0 – 125
Extension	0	0
Wrist		
Flexion	0 – 50	0 – 55
Extension	0 – 15	0 – 25
Radial deviation	0 – 15	0 – 20
Ulnar deviation	0 – 20	0 – 25

Manual Muscle Testing

The power of the right extremity of elbow and wrist was grade 4 and that of the shoulder was grade 5, after the rehabilitation program.

3. DISCUSSION

The patient had visited with a history of accidents and had the complaint of pain and swelling on his forearm with an open wound and bleeding. After clinical evaluation and investigations, the diagnosis was of Compound grade I Monteggia fracture with Compartment syndrome and Radial and Ulnar nerve Palsy. A proper treatment protocol was formed to prevent complications. Management of fracture was difficult because of an open wound, therefore after proper wound management (Chen et al., 2018). Dynamic finger splint was prescribed to the patient to help in maintaining the extension of the fingers. Monteggia fractures are scarce and symbolize 0.7% of elbow fractures altogether. In elders, the Bado I classis quite prevalent (Inoue et al., 2018). The arteries supplying to the hand, deep and superficial arches are the ulnar and radial arteries (Phansopkar et al., 2020). After 4 weeks of fracture, check plain radiography was performed this revealed callus formation.

Increased risk of infection due to the wound can be managed by re-surgery or primary suturing of the wound. Active range of motion exercises to shoulder joint maintained the ranges of shoulder and avoided stiffness (Bawiskar et al., 2020). Passive movements to the elbow improved functional activities of daily living. Grip strengthening exercises improved hand functioning (Musa, 2006). No fixed duration was seen, gradual improvement in strength was seen in 12 weeks of rehabilitation (Bhamra et al., 2020). All these exercises were used during the treatment and proved to improve the strength of the muscles and increase stability around the joint and also facilitate mobility (Dadgal, 2021).

4. CONCLUSION

Monteggia fracture in adults is rare and associated with some secondary complications. But it can be treated with a combination of surgical and conservative management with proper protocol and prevent further deformities. Following a 12 week of the treatment program, in this case, the patient had a development in strength and range of the elbow, wrist, and metacarpophalangeal joints; prevent flexion deformities and further complications. This case study establishes a well-structured and thorough rehabilitation program for treating the compound Monteggia fracture in adults with Radial and Ulnar nerve Palsy along with compartment syndrome.

Author's contribution

AJ evaluated the patient, AJ and OW did assessment in documentation and formatting of the manuscript, AJ, OW and PP Approved the final manuscript.

Informed Consent

An oral consent was obtained from the patient.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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