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Relocation of the radial head with minimal invasive approach using the Ilizarov technique in neglected Monteggia fracture

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Abstract

Introduction: Missed or Neglected Monteggia fracture dislocation classically implies a duration of more than 4 weeks. Two factors of significant deformity and delayed presentation constitute the problem of management of old Monteggia fracture-dislocation in paediatric age group. Restoration of radiocapitellar joint and biomechanics of the elbow joint is of paramount importance for favourable long term functional outcome. Long-term follow-up of untreated Monteggia fracture dislocations reveals development of premature arthritis, pain, instability, loss of pronation and supination, valgus deformity and a prominence on the anterior aspect of the elbow. Tardy nerve palsies have been reported subsequent to long-standing unrecognized Monteggia lesions. Thus, it is imperative to treat the neglected fracture as soon as it is diagnosed. We used the Ilizarov method using ulnar osteotomy with distraction osteogenesis to produce controlled lengthening to restore the radiocapitellar articulation

Aims and Objectives: To evaluate the outcome of relocation of the radial head with minimal invasive approach using the Ilizarov technique in neglected Monteggia fracture in respect to mean increase in Mayo Elbow Performance Index (MEPI).

Conclusion: Neglected Monteggia fracture dislocation in children can produce significant orthopaedic complications with gross restriction of activities of daily living. Early diagnosis and prompt management results in favourable long term outcome. Restoration of ulnar length and reduction of the radial head with minimal invasive approach using the Ilizarov technique and transcapitellar pinning is a more biological option for the restoration of the elbow biomechanics and increase in the Mayo Elbow Performance Index.

Keywords: Neglected Monteggia, ilizarov, Distraction osteogenesis.

Introduction

Giovanni Battista Monteggia first described in 1814 the fracture dislocation now named after him. It represents a link between injuries of the forearm and the elbow. However, these injuries are often missed at the time of initial trauma. ^[1]

Missed or Neglected Monteggia fracture dislocation classically implies a duration of more than 4 weeks. ^[2, 3] The patients also have significant disability in less severe injury with minimum angulations of ulnar fracture, where radial head dislocation may be missed. Therefore, this emphasises the importance of such injury to a competent orthopaedic surgeon in reviewing all elbow injuries at an early stage. Often patients attend hospital, weeks or months after the injury or mistreated by bonesetters. These two factors of significant deformity and delayed presentation constitute the problem of management of old Monteggia fracture-dislocation in paediatric age group. Restoration of radiocapitellar joint and biomechanics of the elbow joint is of paramount importance for favourable long term functional outcome.

Long-term follow-up of untreated Monteggia fracture dislocations reveals development of premature arthritis, pain, instability, loss of pronation and supination, valgus deformity and a prominence on the anterior aspect of the elbow. Tardy nerve palsies have been reported subsequent to long-standing unrecognized Monteggia lesions. ^[4, 5] Thus, it is imperative to treat the neglected fracture as soon as it is diagnosed. Fowles *et al* reported successful relocations up to 3 years after injury, Freedman *et al.* performed reconstructive procedures up to six years after injury. ^[6]

Previously, many authors have described various operative procedures regarding its management, such as reconstruction of annular ligament ^[4], osteotomy of ulna ^[7], or a combination of annular ligament reconstruction and osteotomy ^[8] or a combination of open

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reduction of radial head with a repair of annular ligament and osteotomy of ulna. [5]

Currently, chronic dislocations are treated by ulnar osteotomy, open reduction of the radial head and reconstruction of the annular ligament. [8] The literature reports excellent results but with restricted movement, [2] and development of complications⁹ associated with methods involving open reduction of the radial head, and ulnar osteotomy with or without annular ligament reconstruction. [7] Relocation of the radial head has been successfully achieved by using distraction lengthening and hyperangulation over a uniplanar lengthening device. [10] We used the Ilizarov method using ulnar osteotomy with distraction osteogenesis.

Aims and Objectives

The aim was to evaluate the outcome of relocation of the radial head with minimal invasive approach using the Ilizarov technique in neglected Monteggia fracture.

The objective was to analyse the results in respect to mean increase in the Mayo Elbow Performance Index (MEPI).

Material and Methods

We have treated 15 patients of post traumatic symptomatic old neglected Monteggia fracture dislocation from the year 2010 to 2014 in the department of orthopaedics at Surat Municipal Institute of Medical Education and Research (SMIMER). The age of patients at the time of reconstruction ranged from 4-12 years.

The inclusion criteria included time interval between injury and surgical repair at least more than four weeks as per definition of missed or neglected Monteggia fracture dislocation and this varied in our study between 8 to 36 weeks.

We chose a procedure (the Ilizarov technique) that would produce controlled lengthening to restore the radiocapitellar articulation. The procedure was explained to the parents and written informed consent obtained from them. Radiographs in both antero-posterior and lateral view were studied to assess the dislocation of the radial head. An osteotomy in the proximal ulna and lengthening was planned to place the radial head in the appropriate radiocapitellar orientation.

The surgery was undertaken under general anaesthesia. A two and half ring construct was used. The proximal half ring was fixed to ulna with an Ilizarov wire and one threaded pin. The middle ring is fixed to radius and ulna both with Ilizarov wire. The distal ring was fixed with ilizarov wire in supine position of distal radioulnar joint. Through an incision 15 mm long, a low-energy corticotomy of the ulna was performed at the proposed site. Distraction was started on the third day after surgery by moving middle ring downward towards the distal one to create lengthening as planned. We followed up the progress of our patients every week with both clinical and radiologic examinations to assess the lengthening, angulation and relocation of the radial head. Patients were encouraged to perform range of motion exercises of the elbow, and when we able to bring the radial head down to the level of radial notch the apparatus was finally removed and transcapsular pinning was done either in open or close reduction and above elbow cast was applied for 3 weeks to maintain the reduction then cast is removed and elbow mobilisation exercise was started. And regular patients follow up were taken until 2 years after surgery.

Results and Analysis

Results were evaluated on the basis of 100 point Mayo Elbow Performance Index.

No. of subjects	15
Subluxation of radial head	3(20%)
Average increase in ROM in degree	30
Average increase in MEPI	30
Average duration of union	8 weeks
Superficial infection	3(20%)
Loosening of pin	1(6.66%)
Osteotomy related problem	1(6.66%)

All patients of ulnar osteotomy united in good position and the length of ulna was maintained except one in which apparatus removed and rushpin was done. Three patients also had superficial wound infection which subsided by antibiotics.

Based on the Mayo Elbow Performance Index, at the final follow-up the mean increase in MEPI was 30. The mean range of motion increased by 30. The mean supination-pronation arc was 140°. Although no significant correlation was noted between the range of movements achieved and the duration of treatment, patients treated earlier had a greater range of movements than those treated later. At the final follow-up, no patient had any sign of instability

Discussion

The treatment of neglected Monteggia fracture-dislocation in children is still open to controversy. The first question often raised is for how long a neglected dislocation may be accepted as being reversible before the secondary adaptive changes disrupt the end result. This interval ranges – depending on the author – from 6 months to 6 years. [5] Another important point with respect to achieving a good functional outcome is the maximum age of the patient undergoing potential bone remodelling. Three of the patients reported here were over 10 years at the time of surgery, with the oldest being 12 years of age. [6]

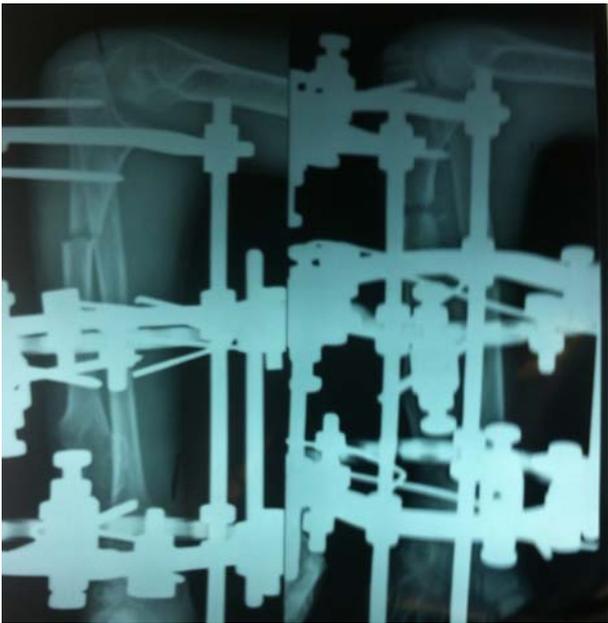
Owing to the potential complications of conservative methods in cases of neglected Monteggia injuries, it is important that the radial head be replaced in appropriate relation to the capitellum. This is especially true in children who are less than 12 years of age.

Another point that is often raised is the choice of surgical technique used in the treatment of these lesions.

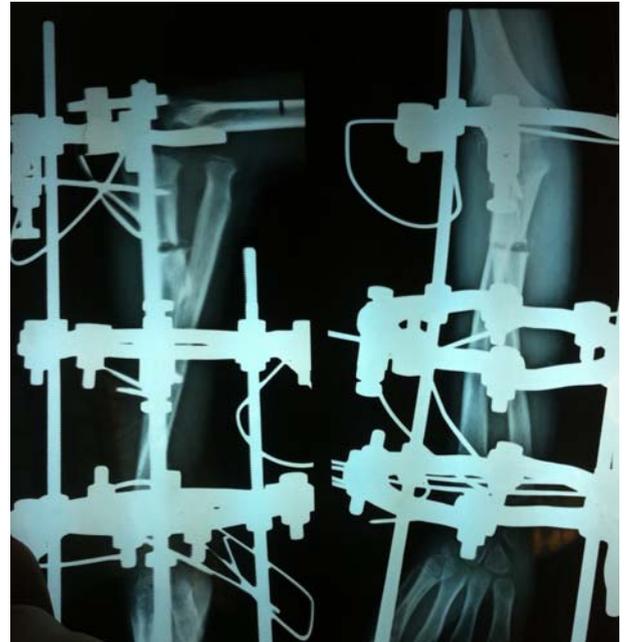
Controversy exists regarding reconstruction of the annular ligament. Nakamura *et al.*, [11] and David-West *et al.*, [21] advocate it in all cases while others like Devnani [2] and Bhojraj *et al.*, [13] disregard it completely. Others like Bhaskar *et al.*, [3] prefer an intra-operative decision based on the stability of reduction. Garg *et al.*, [14] reported better results with annular ligament reconstruction using Palmaris longus graft. Freedman *et al.* used a technique in which the annular ligament was not reconstructed but the radial notch was deepened to achieve stability. [6]

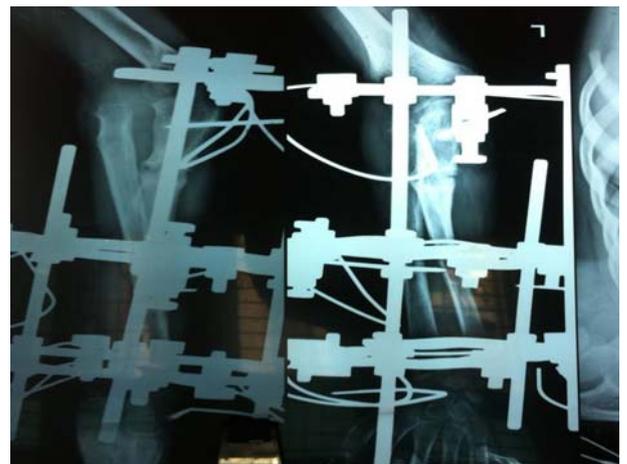
We found that chronic dislocations may be associated with significant discrepancy in the radioulnar length, the radius having overgrown as a result of lack of support between the capitellum and the radial head. The optimum treatment in these patients is lengthening of the osteotomy in addition to angulation. By doing gradual lengthening of ulna by ilizarov apparatus and bringing the radial head down at radial notch and reduction of radiocapitellar joint with pinning by minimal invasive approach restores biomechanics of elbow without ligamentous reconstruction. The advantages of distraction treatment can be summarized as: minimally invasive surgery, controlled lengthening, no need for bone grafting, and early resumption of functional exercises.

Resection of the radial head should be reserved only for symptomatic cases in patients more advanced in years as an absolute exception, following skeletal maturation.













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Conclusion

Neglected Monteggia fracture dislocation in children can produce significant orthopaedic complications with gross restriction of activities of daily living. Early diagnosis and prompt management results in favourable long term outcome. Restoration of ulnar length and reduction of the radial head with minimal invasive approach using the Ilizarov technique and transcapsular pinning is a more biological option for the restoration of the elbow biomechanics and increase in the Mayo Elbow Performance Index.

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