

Original Research Article

Surgical treatment in children missed Monteggia lesions at Bhuj, Kutch, Gujarat: a retrospective study

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Received: 12 November 2016

Revised: 27 November 2016

Accepted: 30 November 2016

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ABSTRACT

Background: The treatment of an unrecognized Monteggia lesion continues to pose a therapeutic challenge, as evidenced by the variety of surgical techniques described. Moreover, there are high complication and redislocation rates following surgery. This report concerns a surgical technique to reduce a chronic dislocation of the radial head utilizing an ulnar osteotomy and internal fixation.

Methods: Present study was performed at department of orthopedics, Gujarat Adani institute of medical science, Bhuj, Kutch, Gujarat. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. Between July 2015 and September 2016 six children presented in a traumatic context with chronic dislocation of the radial head and malunion of the ulna. Patient mean age was 6.5 (range 4–8) years, and the mean interval between injury and surgical procedure was 17 (range 1–49) months. Surgery consisted of an ulnar osteotomy with angulation and lengthening, bone grafting at the osteotomy site, and internal fixation. Open reduction of the radial head, repair or reconstruction of the annular ligament or temporary fixation of the radial head with a transarticular wire was not undertaken. Cast immobilization with the forearm in neutral rotation was maintained for 4-6 weeks.

Results: There was one case of nonunion. At an average follow-up of 3 (range 1.5–4.4) years, all patients had regained painless function of the forearm, good range of elbow and forearm motion, and maintenance of the radial head reduction.

Conclusions: Both angulation and elongation of the ulna are required to allow for reduction of the radial head. We do not see any indication for procedures directed at the radio-capitellar joint.

Keywords: Angulation, Kutch, Monteggia, Ulna

INTRODUCTION

Radial head dislocation is an uncommon injury in children. In most of the cases it is associated with an ulnar fracture or deformation as a part of the spectrum of Monteggia lesions. The classification of Bado remains the most commonly used for these types of injuries. It divides four types true Monteggia lesions and some “equivalent lesions” based on the direction of ulna angulation and radial head displacement.¹ Letts et al proposed a pediatric classification, subdividing the Bado

type 1 based on the ulnar fracture pattern (plastic deformation, greenstick, and complete).² Monteggia fractures in the pediatric population can result in excellent outcomes if recognized early and treated promptly. Restoration and maintaining the length and alignment of the ulna by closed reduction or surgery usually results in stable reduction of the radiocapitellar joint. However, missing or delayed recognition of radial head dislocation is the most common (16% - 50%) and serious complication of pediatric Monteggia lesions, especially with plastic deformation of the ulna, resulting

in a far more complex injury with often unpredictable surgical outcome.

Unreduced dislocation of the radiocapitellar joint that is still present more than four weeks after the injury is considered chronic.³ Although in the short term persistent dislocations do well, the natural history of chronic Monteggia lesions is not benign and is associated with restricted forearm rotation and elbow flexion, radial head overgrowth, progressive valgus deformity, pain, instability, tardy nerve palsies and potential degenerative arthritis.⁴⁻⁸ Treatment of chronic radial head dislocation is much more complicated and challenging than the management of an acute Monteggia lesion.

Delayed recognition of a Monteggia fracture continues to pose a treatment challenge, as evidenced by the variety of surgical techniques that have been described. Procedures include ulnar and radial osteotomies, open or closed reduction of the radial head, repair or reconstruction of the annular ligament, temporary fixation of the radial head with a transarticular wire, or some combination of these techniques.⁹⁻¹³ In addition, the outcome of the surgical treatment of chronic radial head dislocation is uncertain, with reports of subluxation and re-dislocation, as well as complications including stiffness, elbow instability, nonunion of the osteotomies, avascular necrosis of the radial head, nerve injury, and infection.¹⁴ Secondary degenerative arthritis may also be late sequelae. Although many authors recommend a procedure directed at the radio-capitellar joint in order to reduce the radial head, other studies support the opposite approach, focusing on correction or over-correction of the ulnar deformity.¹⁵ The objective of present study was to review the clinical outcome of patients who were treated with a specific technique of ulnar osteotomy.

METHODS

Present study was performed at department of orthopedics, Gujarat Adani Institute of Medical Science, Bhuj, Kutch, Gujarat. Ethical clearance was taken from the institutional ethics board and informed consent was obtained from all the participants. The study was conducted between July 2015 and September 2016. Six children presented in a traumatic context with chronic dislocation of the radial head and malunion of the ulna were involved in the study. None of the patients had a history of previous elbow pathology or surgery non patients had congenital dislocations, and none had been treated initially at our hospital.

The right elbow was involved in three patients and the left in three. The mean interval between the initial injury and the corrective surgery was 17.2 (range 2–49) months, and the mean age of the patients at the time of surgery was 6.5 (range 4.7–8.1) years. All patients had limited elbow and forearm motion and pain. No child presented with nerve palsy. On the preoperative radiographs, we noted the direction of dislocation, carrying angle, head–

neck ratio and any abnormal bony architecture. Bado divided Monteggia lesions into four types with the classification depending on the direction of the radial head. In type I the head is anterior, in type II posterior and in type III lateral. In type IV there is a dislocation of the radial head associated with a fracture of both the radius and ulna.¹⁶ There were five children with a Bado type I, and one with a Bado type II injury. Patient Two patients underwent preoperative elbow arthrography in order to evaluate joint morphology and the possibility of radial head reduction. The ulna shaft was approached directly, and an osteotomy was performed either at the proximal metaphysis or at the center of rotation of angulation. The osteotomy site was distracted and angulated to overcorrect the ulnar deformity.



Figure 1 (a & b): Pre operative radiograph.



Figure 2 (a & b): Post operative radiograph.

The mean angulation was 18.8, and the mean distraction was 8.5 mm. The degree of angulation was determined by evaluation of the reduction of the radial head under image-intensification, in all combinations of full flexion, extension, pronation and supination in both lateral and anteroposterior projections. In one case, however, the incision was extended proximally via a Kocher approach to observe the position of the radial head in the radio-capitellar joint under direct vision. In five patients the ulna was fixed with a plate and screws, and in one patient with an elastic nail. It was not necessary to perform ligament reconstruction, radial osteotomy, temporary transarticular radio-capitellar wire stabilization, or

neurolysis in any of the patients. A long arm plaster splint was applied for 4-6 weeks with the elbow in 90° of flexion and the forearm in neutral rotation. At that point the children were encouraged to use the elbow as tolerated, and no formal physiotherapy was advised. At final follow-up, patients were questioned about pain, stability, and disturbance of daily and sporting activities. Physical examination included evaluation of elbow and forearm range of motion. Function was assessed using the elbow performance score, which takes account of four parameters, namely deformity, pain, range of motion, and function, which are weighted equally with a scale of 0 (worst) to 100 (best).¹⁷ Anteroposterior and lateral radiographs were made to determine the congruency of the radio-capitellar joint and the presence of any deformity or arthritic changes.

RESULTS

All wounds healed primarily with no infection. There were no neurovascular complications, compartment syndrome, or implant breakage. One patient who underwent a diaphyseal osteotomy at the center of

rotation of angulation developed a nonunion, requiring bone grafting with demineralized bone matrix 1 year postoperatively with rapid consolidation. One patient underwent arthrography at 1 month postoperatively for a suspicion of subluxation that was in fact due to a radial head deformity. All patients were pain-free with no deformity as compared with the opposite side.

Elbow, wrist and forearm motion was without pain, with mean elbow flexion of 132.5 and mean extension of 4.2. Mean forearm pronation was 85, and all patients had full supination of 90. There was no sign of distal radio-ulnar joint instability. No patients had functional deficits or limitations of activity, with the elbow performance score of 100 for all patients, corresponding to an excellent result. Preoperatively three cases that had more than 2 months between the trauma and the operation had larger head-neck ratios compared to the normal side. Radiographs at the latest review showed that the radial head was successfully reduced in all cases. In addition, no patient had any degenerative changes in the elbow joint.

Table 1: Clinical, demographic data and interpretation.

Case	Gender	Side	Age	Delay between injury and operation (months)	ROM before surgery in PS (°)	ROM before surgery in FE (°)	Ulnar angulation at osteotomy site (°)	Ulnar lengthening at osteotomy site (cm)
1	F	R	4.6	2	20-0-40	100-0-0	11	0.4
2	M	L	8.2	48	70-0-70	100-0-0	15	1.8
3	M	L	5.4	3	10-0-50	90-15-0	26	1
4	F	L	7.2	31	90-0-90	130-0-0	18	0.6
5	F	R	6.2	3	80-0-10	90-30-0	20	0.7
6	M	R	7.6	18	50-0-70	110-10-0	25	0.6
Mean			6.5	18			18.9	0.84

DISCUSSION

In cases of missed Monteggia fracture, the radio-capitellar articulation will progressively undergo dysplastic changes due to the lack of joint restraint, leading to well-documented long-term consequences that are unacceptable for the patient.¹⁸⁻²⁰ Thus, reduction of the radial head is necessary. Our results seem to indicate that restoration of the congruency of the joint can be achieved by a proximal ulnar osteotomy, even when the condition exists for several years duration. The interval between the traumatic dislocation and reconstructive procedure could affect outcome since the dysplastic changes are not immediately correctable. However, since this dislocation occurs mainly in young patients who have a large amount of growth remaining, there is a high potential for remodeling.

The treatment we propose has been previously described and is based upon the hypothesis that the primary problem is malunion of the ulna preventing reduction of

the radial head. Consequently, the surgical technique consists of an ulnar osteotomy with lengthening and angulation. Lengthening permits reduction, providing sufficient space for the dysplastic head while avoiding excessive pressure on the radial head. The angulation creates an overcorrection, which firmly maintains the head in place for the time necessary for its stabilization. If a satisfactory reduction cannot be achieved by closed means we recommend proceeding directly to arthrography to exclude the possibility that the reduction is being prevented by a pseudocapsule around the new radio-humeral joint, or perhaps a remnant of annular ligament interposed within the radio-capitellar joint. In either situation this would pose the indication for a simple removal of this fibrous tissue. According to our experience, the reconstruction of the annular ligament was unnecessary, as all the radial heads were stable without such reconstruction.

The additional dissection required to reconstruct the annular ligament might result in elbow stiffness,

avascular necrosis of the radial head, heterotopic ossification, or radio-ular synostosis.²¹ It seems of no value to reconstruct or repair a ligament around a neck altered by a dysplastic head, since the latter will be progressively remodelled after reduction leading to an attenuation of the graft and predisposing to subsequent re-dislocation. On the other hand, a short graft results in a tight constriction of the radial neck and functional limitation, as demonstrated by the postoperative thinning of the neck previously reported after the Bell Tawse procedure.¹⁸ While lamination of the neck by the annular ligament temporarily maintains the head in place, it does not seem to us physiological. If re-dislocation occurs we are of the opinion that it not related to the absence of annular ligament reconstruction, but rather to a lack of angulation of the ulnar osteotomy. In our study one patient underwent arthrography at 1 month post-operatively for suspicion of subluxation that was in fact due to a radial head deformity. Such a pseudosubluxation has been previously described.²²

Dysplastic changes were present in three patients with long-standing radial head dislocation. Findings consisted of radial head overgrowth and thinning of the radial neck, thus disturbing the head-neck ratio. Overgrowth of the radial head is due to the loss of its symbiotic relationship with the ulna and humerus. We explain thinning of the neck due to lamination by structures such as remnants of annular ligament, capsule, or fibrous scar formation. In our cases we observed that the neck regained a normal diameter after reduction of the head

There is no consensus in the literature as to the type of fixation necessary to stabilize the osteotomy. Recommendations include internal or external fixation, or even no fixation.²³ All our osteotomies were internally fixed to decrease the risk of secondary displacement and to allow early mobilization. In our opinion, external fixation and progressive correction, as previously described, remains of little use in view of the fact that it is possible to achieve correction in one step. One patient developed a nonunion, which we attribute to several factors, among them the degree of lengthening, the level of osteotomy, and the location of the plate. While the lengthening was 7 mm such lengthening has been advocated by others despite the risk of delayed union.

Another factor could be the level of the osteotomy. In a recent case of Monteggia fracture, we performed an osteotomy at the center of rotation of angulation, similar to what was done with this patient. In retrospect we feel this was not a good option for a chronic Monteggia fracture. The reorganization of the ulna over time in such a chronic case makes it difficult to determine the center of rotation of angulation. Additionally, an osteotomy at the proximal ulna allows for greater likelihood of healing, and while angulation at the metaphyseal level has less effect on reduction, it permits a finer adjustment. Finally, an additional factor predisposing to delay union may have been the lateral location of the plate. According to the

tension band principle a posterior plate might have been a better choice.

CONCLUSION

According to our experience it seems that this procedure for the treatment of chronic Monteggia fracture results in excellent pain-free function and good motion of elbow, forearm, and wrist, with no pain or instability at the distal radioulnar joint in the short term. The long-term benefit of such treatment requires further observation.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Chauhan P. Surgical treatment in children missed Monteggia lesions at Bhuj, Kutch, Gujarat: a retrospective study. *Int J Res Orthop* 2017;3:30-4.