ORIGINAL RESEARCH PAPER

Orthopaedics

Annular ligament reconstruction using triceps fascia for management of chronic radial head dislocation

KEY WORDS: radioulnar joint, annular ligaments, monteggia fracture

Dr Pabitra kumar Sahoo DNB (PMR), DNB(Ortho), Assistant professor, SVNIRTAR, Olatpur, Cuttack, Odisha

Mamata Manjari Sahu MPT(Musculo skeletal), Senior Physiotherapist, SVNIRTAR, Olatpur, Cuttack, Odisha.

ABSTRACT

Background: Radial head dislocation is frequently encountered in old neglected monteggia fracture treated traditionally or misdiagnosed. . It is often associated with annular ligament injury. In case of chronic radial head dislocation, the annular ligament must be reconstructed after surgical reduction

Objectives: Clinical evaluation of annular ligament reconstruction using triceps fascia for stabilization of radial head.

Material and methods: 6 cases of chronic radial head dislocation were managed by open reduction of radiocapitular joint with reconstruction of annular ligament using autologous tricep fascia. Clinical parameters are recorded at 12th & 36th week postoperatively and compared with Pre-op data.

Results: Results were evaluated using Mayo elbow performance Index (MEPI). There is significant improvement between pre op and post operative follow up parameters

Conclusion: The clinical evaluation confirms the use of triceps fascia for effective reconstruction of annular ligament in stabilizing radial head.

Introduction:

Annular ligament stabilizes the elbow joint and is a strong band of fibers that encircles the head of the radius and holds it in contact with the radial notch of the ulna [1]. Annular ligament prevents dislocation of radial head and limits its forward, backward and lateral displacement [2,3]. As the radial capitellum distal articular surface is slightly to the rear and not entirely vertical with the long axis of the radius, the annular ligament can easily slide to anterolateral of the radial head when the radial head is in supination position, which may predispose to a transverse tear in the annular ligament and result in radial head dislocation. [4,5]. Radial head dislocation (RHD) is categorized into isolated RHD, chronic RHD, congenital RHD and traumatic RHD [6-8]. Traumatic radial head dislocation involving proximal ulna fracture present as monteggia fracture dislocation in pediatric population. it is often associated with significant damage to soft tissues, including annular ligament injury [9]. Dislocation of radial head without concomitant ulnar fracture or humeroulnar subluxation is an isolated radial head dislocation, which is a rare injury [10]. Approximately, 5-10 % of paediatric patients experience traumatic elbow injury, but despite these substantial numbers, treatment guidelines and prognosis varies widely. To treat isolated radial head dislocation, some medical professionals suggest taking no surgical measures, while others recommend using splints after manual reduction. However, if the manipulative reduction fails, re-dislocation occurs or, in case of chronic radial head dislocation, the annular ligament must be reconstructed after surgical reduction [11,12]. Chronic radial head dislocation in children is caused by progressive deformity and an unacceptable loss of motion, requiring timely intervention (fixation and reduction), as symptoms rapidly deteriorate [13]. Radial head resection is some time inevitable for correcting the dysfunction, therefore early diagnosis and timely intervention is critical for effective treatment of chronic radial head dislocation [14,15]. Annular ligament reconstruction has received significant attention as a viable treatment for radial head dislocation [16,17] . Open reduction and corrective ulnar osteotomy is required when associated with ulnar bowing or malunion of fracture ulna.

Objective of the Study:

Evaluation of elbow function in Annular ligament reconstruction for the management of chronic radial head dislocation using triceps fascia

Material and Methods:

This study includes 6 patients. 2 were male and 4 were female. Age ranging from 11 to 18years. All the patients had history of injury to elbow and fore arm All the six patients diagnosed radiologically as chronic radial head dislocation are recruited for the study. All injuries of the patients were unilateral, including 4 right elbow and 2 left elbow.5 patients were malunited monteggia Bado's type I fracture dislocation and one had Bado's type III monteggia fracture . None of them had any features of radial nerve injury. The average time from injury to surgery was 9.2 weeks (1–16 months). All patients were followed up for a median of 11 months (range, 9 to 23 months)

Table: 1, Patient Profile

Sl No	Age	sex	side	BADO'S Type
1	12	F	R	I
2	11	F	R	III
3	13.5	M	L	I
4	11.5	F	R	I
5	18	F	L	I
6	13	M	R	I

Surgical procedure:

Patients were placed in supine position under intravenous anaesthesia or brachial plexus anaesthesia. Antibiotics were administered prophylactic ally 30 min before tourniquet was applied to the arm. The affected limb was positioned on the surgery table with elbow flexion ranging from 30° to 60° and forearm pronated to expose radial head, humeroradial joint and proximal radioulnar joint. The incision begins 5 to 7 cm proximal to tip of olecranon process curving slightly lateral to elbow joint towards radial neck for a distance of 5 cm. The average incision length was 10 cm and reached the joint directly. Dense fibrous tissue were found in the elbow joint. Scar tissues and cartilaginous metaplastic fibrous tissue were marked around dislocated radial head. All those tissues were resected for easier reduction of radial head. Once trial reduction was successful, a strip of triceps fascia, 1cm x 6cm from lateral side of triceps tendon is harvested. Care was taken to preserve the attachment of triceps fascia to ulna. The proximal end of the fascia was pass around the neck radial head and reattached to the base of the triceps fascia. (fig. 1)Radio capitular joint was stabilized by trans articular K wire. The tip of the K wire was bend to prevent migration. One patient had significant ulnar bowing and was managed by ulnar osteotomy, fixed with plate and screw.(fig. 2)All the patients were immobilized in plaster at 90° flexion and neutral forearm rotation for 3weeks . After that stitches removed and transarticular radiocapitular wire was removed and limb was replastered for 3 weeks more. Once

the plasters were removed, assisted exercises were performed, with the supervision of a professional therapist, to improve the elbow function. Shoulder abduction was avoided to reduce elbow stress when the patients were treated with active flexion. All patients were followed up once a month after the surgery for the first six months and then once every six months. In follow up, the elbow function was assessed using the Mayo elbow Performance index. The range of motion was measured by a therapist with a goniometer and plain radiograph was performed to assess joint congruency

Figure-1

Figure-2

Evaluation: Mayo elbow performance Index (MEPI) was used to evaluate the elbow function in patients after surgery .It is most commonly used physician based elbow rating system. This index consists of four parts : Pain (with a maximum score of 45 points, ulnohumeral motion(20 points), stability (10 points), and the ability to perform five functional task(25 points). Pain is recorded on VAS scale. Pain is rated as none, mild, moderate and severe. Motion is recorded with goniometric measurement of flexion, extension, supination, pronation. Regarding stability, clinical examination assess varus/valgus instability. This instability is graded as none; mild,if a perception of instability is observed by the Physician; moderate, if definite instability is observed; severe, if perceptible varus/valgus laxicity is detected by the physician and perceived by the patient.

Table:2, Mayo elbow performance Index Table

Variable	Definition	No of points
PAIN (max.45 points)	None Mild Moderate severe	45 30 15 0
ROM (max 20 points)	Arc > 100 degree Arc 50-100 degree Arc <50 degree	20 15 05
Stability (max 10 points)	Stable Moderately unstable Grossly unstable	10 05 0
Function (max 25 points)	Able to comb hair Able to feed oneself Able to perform personal hygiene task Able to put on shoes Able to on shirt	5 5 5 5 5

The total score ranges from 5 to 100 points with higher score indicating better function. Score between 90-100 considered as excellent, 75-89 as good, 60-74 as fair and less than 60 were considered as poor result. The excellent or good outcome was considered as satisfactory, while fair or poor outcome was unsatisfactory.

Results:

All patients underwent post-operative clinical and radiographic evaluation. They were evaluated at 6weeks of surgery after plaster removal and removal of radiocapitular K wire .All the surgical wounds were healed by first intention. None of the patient showed posterior interosseus nerve palsy. All the patients were subjected to a course of physiotherapy under the supervision of a senior physiotherapist. Subsequent evaluations were done at 12 weeks and 36 weeks . Range of motion was measured with flexion, extension, pronation, and supination. The result of the procedure were evaluated using Mayo elbow performance Index (MEPI) with respect to pain, range of motion, stability in the form of varus and valgus and ability of performing task on activities of daily living.

Data Analysis:

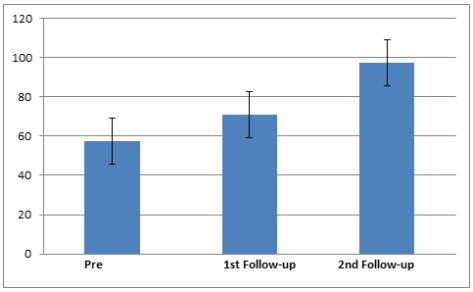
Data collected at Pre op, at 12 weeks and 36th week post operatively were analysed using SPSS software . The level of significant difference was defined as $P < 0.05$. The data analysis in this study shows a significant improvement in Mayo Elbow performance index when compared between preop and 2nd follow up parameters. $P < 05$ indicates that the improvements are not by chance

Table:3, Mean and Standard Deviation values of MEPI at all points of measurement:

Pre (Mean & SD)	Post 1st follow up at 12th week	Post 2nd follow up at 36th week
57.5 (15.0)	70.8 (8.0)	97.5 (4.1)

Table: 4, Changes in mean MEPI values between points of Measurement

Mean values between points of measurement	95% CI (Confidence Interval)	P (paired T test)
Pre – 1st Post follow up	21.9 , 4.7	0.01
Pre – 2nd post follow up	52.4, 27.5	0.00
1st – 2nd post follow up	32 , 21.2	0.00



Discussion:

Chronic RHD treatment is controversial. Conservative treatment of chronic RHD is prone to failure and radial head resection is inevitable for correcting the dysfunction, therefore early diagnosis and timely intervention is critical for effective treatment of chronic RHD [14,15]. Open reduction and annular ligament reconstruction has received significant attention as a viable treatment of chronic RHD [16,17]. Annular ligament stabilizes the elbow joint and is a strong band of fibers that encircles the head of the radius and holds it in contact with the radial notch of the ulna[1]. Annular ligament prevents dislocation of radial head and limits its forward, backward and lateral displacement[2,3]. Corrective ulnar osteotomy have been considered as an alternative methods of treatment especially when associated with significant ulnar bowing due to malunited monteggia fracture dislocation.

Reconstruction of annular ligament can also be achieved by

palmaris longus tendon autograft, which is passed around the radial neck first and then through a bony tunnel to be sutured to itself [17]. However, this surgical method is too complicated and requires ensuring that the longer graft can pass through the narrow ulnar tunnel, which could lead to ulna fracture [18]

In this study, all the children with chronic RHD are because of untreated or traditional maltreated cases of monteggia fracture dislocation Annular ligament reconstruction using Triceps fascia is a cost effective method based on sound mechanical principle. Earlier studies show, use of bone anchors or by making drill holes for stabilization of reconstructed annular ligament. Bone anchors are costly. Making drill holes for passing of Palmaris longus may lead to pathological fracture of ulna [17,18,19]. In the current study normal attachment of triceps fascia to olecranon is used and the fascia is suture to itself after encircling through radial head by that above problems can be avoided.

Limitation of the study- small sample size may limit statistical accuracy and universal application. Short term follow up is the second limiting factor. Thus, prospective studies and long-term follow-up with large sample size is needed to further confirm the efficacy of the procedure

Conclusion :

This study presents effectiveness of use of triceps fascia in reconstructing annular ligament and promote functional recovery in chronic radial head dislocation patients. The procedure has the advantage of being a simple operation and is a cost effective method based on sound mechanical principle. Use of expensive bone anchors or bone tunnelling for fixation of graft which may lead to pathological fracture are not required. Thus, this method is an effective and reliable approach for the treatment of children with chronic radial head dislocation.

Acknowledgement:

We extend our sincere thanks to Dr S P Das for allowing us for conducting the study. Our special thanks to those who participated in our study

Financial support : Nil

Conflict of interest: There is no conflict of interest

References:

1. Nwoko OE, Patel PP, Richard MJ, Leversedge FJ. Annular ligament reconstruction using the distal tendon of the superficial head of the brachialis muscle: an anatomical feasibility study. J Hand Surg Am. 2013;38(7):1315–9.
2. Zhang X, Gan RZ: Dynamic properties of human stapedial annular ligament measured with frequency-temperature superposition. J Biomech Eng 2014, 136(8)
3. Paraskevas GK. Human ligaments classification: a new proposal. Folia Morphol (Warsz). 2011;70(2):61–7.
4. Hartzler RU, Morrey BF, Steinmann SP, Llusa-Perez M, Sanchez-Sotelo J. Radial head reconstruction in elbow fracture-dislocation: monopolar or bipolar prosthesis? Clin Orthop Relat Res. 2014;472(7):2144–50.
5. Rosenbaum AJ, Leonard GR, Uhl RL, Mulligan M, Bagchi K. Radiologic case study. Diagnosis: congenital posterior dislocation of the radial head. Orthopedics. 2014;37(1):11.
6. Li Z, He Y, Zhong G, Huang F. [Research progress in repair and reconstruction of isolated traumatic radial head dislocation with annular ligament injury in children] Chin J Reparative Reconstructive Surg. 2011;25(10):1266–8.
7. Takase K, Mizuochi J. Irreducible dislocation of the radial head with undisplaced olecranon fracture in a child: a case report. J Pediatr Orthop B. 2011;20(5):345–8.
8. El Ibrahimi A, Shimi M, Daoudi A, Elmrini A. Isolated, traumatic posterior dislocation of the radial head in an adult: A new case treated conservatively. J Emerg Trauma Shock. 2010;3(4):422–4.
9. Wang MN, Chang WN. Chronic posttraumatic anterior dislocation of the radial head in children: Thirteen cases treated by open reduction, ulnar osteotomy, and annular ligament reconstruction through a boyd incision. J Orthop Trauma. 2006;20(1):1–5.
10. Pike JM, Athwal GS, Faber KJ, King GJ. Radial head fractures--an update. J Hand Surg Am. 2009;34(3):557–565.
11. Sturm PF, Levine J, Sedlin ED, Ulin RI. Isolated dislocation of the radial head. Mt Sinai J Med. 1989;56(4):304–8.
12. Krul M, van der Wouden JC, van Suijlekom-Smit LW, Koes BW. Manipulative interventions for reducing pulled elbow in young children. Cochrane Database Syst Rev. 2012;1
13. Kim HT, Park BG, Suh JT, Yoo CI. Chronic radial head dislocation in children, part 2: Results of open treatment and factors affecting final outcome. J Pediatr Orthop. 2002;22(5):591–597.
14. Illingworth KD, Thompson K, Lovell M, McGinty J. Spontaneous reduction of a chronic radial head subluxation after open reduction and percutaneous pin fixation of a radial neck fracture: a case report and review of the literature. Iowa Orthop J. 2013;33:221–4.
15. Xiao SW, Xiao HL, Yan JH, Qin SH. [Surgical treatment for chronic radial head dislocation] China J Orthopaedics Traumatol. 2013;26(6):530–2.
16. Eamsobhana P, Kaewpornsawan K. Chronic Monteggia lesions treatment with open reduction and Z-lengthening technique with annular ligament reconstruction. J Med Assoc Thai. 2012;95(Suppl 9):S47–53.
17. Itadera E, Ueno K. Recurrent anterior instability of the radial head: case report. J Hand Surg Am. 2014;39(2):206–8.
18. Lee MC, Lee DW, Rah DK, Lee WJ. Reconstruction of a total soft palatal defect using a folded radial forearm free flap and palmaris longus tendon sling. Arch Plast Surg. 2012;39(1):25–30.
19. Miyake J, Oka K, Moritomo H, Sugamoto K, Yoshikawa H, Murase T. Open reduction and 3-dimensional ulnar osteotomy for chronic radial head dislocation using a computer-generated template: case report. J Hand Surg Am. 2012;37(3):517–22.