ORIGINAL RESEARCH PAPER
Volume-9 | Issue-4 | April-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

EVALUATION OF RESULTS OF REVERSE DOME OSTEOTOMY IN CUBITUS VARUS DEFORMITY

Orthopaedic

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ABSTRACT

Our study was conducted at the orthopaedics department of Institute of Post Graduate Medical Education and Research & S.S.K.M. Hospital, Kolkata-20, from December 2016 to October 2018.In this prospective longitudinal study 22 patients of 5-15 years age group with cubitusvarus deformity underwent Corrective osteotomy by Reverse dome osteotomy technique.All patients are followed up post up for avg 1 year 5 months (ranges from 4 months to 24 months) .

Pre-operatively carrying angle, lateral condylar prominent index, range of motion were recorded.

The patients were treated with dome osteotomy.A posterior longitudinal midline incision was used for the osteotomy. After osteotomy, fixation of the osteotomy site was done by giving 2/3 lateral K- wires and if required 1 medil k-wire. There were no intraoperative complications.

Post–operatively, Two patient developed superficial skin infection. Other complications in our study wereone patient had pin-tract infection; one patient had ulnar nerve neurapraxia; one patient had cosmetically unacceptable scar. But no elbow stiffness, pin loosening , nonunion of osteotomy site was there.

Pendulum exercises of the shoulder and active finger movements were started from the immediate post operative period. Wound checking was done at the 4th post operative day and suture removal at the 12th post operative date. Post operative check radiograph was taken for documentation. Plaster of Paris back slab was removed at the 3rd week and k-wire at the 4th week. Active assisted range of motion exercises was started by the 3rd week. Vigorous active range of motion exercises of the elbow was encouraged during every follow up.

Clinicoradiological assessment was done initially at the interval of 4 weeks for the first 6 months and every 8 weeks for next one year, followed by every three months till final follow up.

The results were graded according to the pre-operative and post- operative carrying angle, movement of flexion and extension, lateral condylar prominence index and they were statistically evaluated.Pre-operative and post-operative extension, carrying angle and lateral condylar prominence index has got statistical significance.

KEYWORDS

Reverse Dome Osteotomy , Cubitus , Deformity

INTRODUCTION

Cubitusvarus(gunstock deformity) is the most common long term complication of childhood supracondylar fracture of humerus , irrespective of the method of treatment.[1,2] Various corrective osteotomy procedures have been proposed for treatment of cubitusvarus .The goals of osteotomy are correction of the coronal, sagittal and rotational deformity. Prevention of elbow stiffness, through firm fixation of the osteotomy site and early use of the joint, is also desirable. Surgical treatment of such deformities is performed mainly to correct the varus deformity and in most cases lateral closing wedge osteotomy of distal humerus is carried out. But the clinical results of the lateral closing wedge osteotomy have been disappointing in some series.[3,4,5] The lateral closing wedge osteotomy is the simplest method of correction but it has many technical problems and that too with a post operative lateral condylar prominence[6]. after the angulations is corrected often compromises the cosmetic outcome.

In 1972, a dome osteotomy was initially mentioned by Tachdjian without giving details to overcome several reported complications of lateral closing-wedge osteotomy.ThenHigaki and Ikuta (1982) reported the same kind of osteotomy in Japanese.After that several authors have reported the usefulness of dome osteotomy for cubitusvarusdeformity.This problem was well taken care of in Dome osteotomy. The main limitation of Dome osteotomy is the difficulty in accommodating the smaller distal fragment into a larger proximal fragment. Freedom of rotation is hindered at the lateral and medial edges[7]. So, the cut was modified in the reverse direction. The proximal surface thus was made convex and the distal concave, greater freedom of rotation was achieved during reorientation of the distal fragment following osteotomy. This is a new operative technique not practised commonly.

AIM AND OBJECTIVES

The aim of our study was to evaluate the results of Reverse dome osteotomy in respect of pre and post-operative carrying angle, range of motion and lateral condylar prominence index to avoid cosmetic complication and achieve a better functional outcome.

The main objectives were:

1. To describe a new technique for correction of cubitusvarus deformity
2. To study the anatomical deformity before and after the operation.
3. To study the cosmetic deformity before and after the operation.
4. To study any association between the different variable like carrying angle, lateral condylar prominence index before and after the reverse dome osteotomy

MATERIALS AND METHODS

1. STUDY AREA: The proposed study was institution based, conducted at the Orthopaedics department of I.P.G.M.E.R.& S.S.K.M. Hospital, Kolkata, a tertiary health care center catering to people of West Bengal and adjacent states of Eastern India.

2. STUDY POPULATION: The patients coming to orthopaedics-OPD with cubitus varus deformity was screened and recruited based on fulfillment of inclusion and exclusion criteria.

3. STUDY PERIOD: From December 2016 to October 2018 (23 months duration).

4. SAMPLE SIZE: 22 patients of cubitusvarus deformity age between 5-15 years were subjected to reverse dome osteotomy of which 14 males and 8 females based on fulfillment of inclusion and exclusion criteria.

5. SAMPLE DESIGN: Consecutive patients coming to Orthopedics-OPD of S.S.K.M. Hospital with cubitusvarus deformity was included.

There were some inclusion and exclusion criteria. Inclusion criteria:

1.Age of patient 5 to15 years.

2. Appearance of deformity more than 6 months Exclusion criteria: 1.Patient younger than 5 and older than 15 years 2.Occurrence of

deformity less than 6months.
3. Anesthetically unfit patient
4. Associated with other serious injuries or co-morbid medical illness

6.STUDY DESIGN: This is an institution based, prospective longitudinal study

7.PARAMETERS TO BE STUDIED:
The result of management of cubitusvarus deformity using reverse dome osteotomy was evaluated by: All patients and their parents responded to a questionnaire similar to that used by Barrett et al [8] to assess true clinical outcome in a one to one confrontation.

The questions were as follows:
1. Does your child's arm look crooked? 2. Do you or your child notice a bump?
3. Does the bump bother you or your child?
4. Do you or your child the operation scar?
5. Does the scar bother you or your child?
6. Are you or your child pleased with the result?
7. Would you repeat the operation if given the same circumstance?

Clinical assessment included the subjective evaluation of the lateral condylar prominence, cosmesis and scar by one of the authors. The range of motion and the complications were also noted. Radiographic assessment included post operative evaluation of the carrying angle and the lateral condylar prominence index [LCPI]. The operative time, blood loss, neurologic complications, wound healing and pin tract condition all were noted. Post operative carrying angle, range of motion and LCPI were used as strict criteria to categorise results. Results were accordingly categorised as excellent, good and poor as in Table below- Criteria Excellent Good Poor Carrying Angle Difference in the angle from the unaffected side was 5 degrees or less Difference in the angle from the unaffected side was 6 to 10 degrees Difference in the angle from the unaffected side was more than 10 degrees Range Of Motion Loss of flexion and extension was 10 degrees or less Loss of flexion and extension was 20 degrees or less Loss of flexion and extension was more than 20 degrees Lateral Condylar Prominence Index No increase in the lateral condylar prominence index The increase in the lateral condylar prominence index was2.5% or less The increase in the lateral condylar prominence index was more than 2.5%

9. STUDYTECHNIQUES:
Pre operative assessment
Antero posterior (with elbow in full extension and forearm in full supination) and lateral radiographs of both upper limbs from shoulder to wrist joint were taken. The humerus-elbow-wrist angle was measured as per Oppenheim[3] on both the sides and the angle of correction was measured. The lateral condoler prominence index (LCPI) was calculated on the affected side as described by H.K.Wong[8] .Range of motion of the elbow and the shoulder on the affected side was assessed.

Lateral condylar prominence index=(AB-BC)100/AC
A-point at lateral epicondyle physics
B-point where mid humeral line cut olecrenonefosse
C-point at medial eicondyle

Statistical Analysis
For statistical analysis data were entered into Microsoft excel spread sheet and then analysed by SPSS 10.0.1 and Graph Pad Prism version 5. Data have been summarized as mean and standard deviation for numerical variables and count and percentage for categorical variables. The median and the inter-quartile range have been stated for numerical variables that are normally distributed.

Student's independent samples t-test was not applied to compare normally distributed numerical variables between groups;unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

Once the t value is determined, a p-value can be found using a table of values from Students t distribution. If the calculated p value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level) , then the null hypothesis is rejected in favor of alternate hypothesis.

RESULTS &ANALYSIS
Our study was conducted at the orthopedics department of Institute of Post Graduate Medical Education and Research & S.S.K.M. Hospital, Kolkata-20, from December 2016 to October 2018.In this prospective longitudinal study 22 patients of 5-15 years age group with cubitusvarus deformity underwent Corrective osteotomy by Reverse dome osteotomy technique. All patients are followed up post up for age 1 year 5 months (ranges from 4 months to 24 months).
It was Operated all 22 patients were evaluated using Barrett et al[9]questioner and clinic-radiological with strict criteria of Oppenheim criteria [10] Post operative carrying angle, range of motion and LCPI to categories results as excellent, good and poor.

Range of motion(Flexion)
Before operation the range of motion was normal in 16 patients and 6 had hyperextension at the elbow. The average range of motion was 129.54^0(Ranges from 120^0-135^0) before surgery and post operatively 126.59^0 (Ranges from 115^0-135^0) . Post operatively all patient had normal ROM with correction of all hyperextension except one in whom ROM is decreased (ROM 0^0-110^0) .

Cosmetic outcome
In terms of appearance of the elbow only one patient reported about unsightly scar. None of them complained of lateral bony hump and medial fullness of the elbow.

Complication
Two of our patients had superficial wound infection and one had pin-tract infection in the immediate post operative period and another one had lunar nerve neuropraxia. Infection was treated with regular dressing and oral antibiotics. Lunarneuropraxia recovered spontaneously over the next 6 weeks.

Radiographic assessment
The average pre operative hummers-elbow-wrist angle(Carrying angle) was 13.818^0varus(ranges from -6^0 to -21^0) and the post operative value angle was average 8.636^0(ranges from 4^0 to 15^0) . In 15 pa ents the carrying angle was Within of the contra lateral unaffected side post operatively. The pre operative LCPI ranged -45.95 to 15.56. The post operative LCPI ranged from - 16.28 to 26.08. Compared with the pre operative value, the LCPI actually decreased following surgery.

As per criteria 14 childrens(63.64%) had excellent final results and 7 childrens (31.82%) had good final results as compared to only one (4.54%) had poor final result.

We found that majority of our study population were MALE(64%).Majority (64%) of Children were between 5-10 years ofage.The mean carrying angle on the affected side pre operatively was -13.818^0 (Range: -6 to -21; SD: 4.932).

Our study should that the mean carrying angle on the normal side was 11.045^0(Range:8 to 15 ; SD: 1.608).The mean carrying angle on the affected side post-operatively was 8.636^0(Range:4 to 15; SD:3.282). The mean corrected carrying angles of affected side after surgery was within 4^0 of the normal side in all children.

It was found that the mean discrepancy of carrying angle between the affected side and normal side pre-operatively was 24.86^0 (Range:19 to 32; SD:4.115) and postoperatively it was 3.23^0(Range:0 to 8 ; SD: 2.391).All children had a correction of carrying angle from 13 to 30 degrees with SD:4.314.

We found thatbefore operation, the range of motion was normal in all 22 patients and 6 had hyperextension (10 degrees in one & 5 degrees in five). Post operatively all patient had normal ROM with correction of all hyperextension except one in whom ROM is decreased (ROM 0^0-110^0) .The mean range of flexion at the affected elbow pre-operatively was 129.54^o(Range:120^0 to 135^o;SD:3.34) which becomes post-operatively 126.59^o(Range:115^o to 135^o;SD:4.85).

Our study should that Post-operatively all patient was corrected normal hyperextension.The pre operative LCPI ranged -45.95 to 15.56. The post operative LCPI ranged from -16.28 to 26.08. Compared with the pre operative value, the LCPI actually decreased following surgery.

It was should that 9.09% of our patients had superficial wound

infectionand 4.54% had pin-tract infection in the immediate post operative period and another 4.54% had ulnar nerve neuropraxia which very lesssignificant.As per above criteria 63.64% had excellent final results and 31.82% had good final results as compared to only 4.54% (negligible)had poor final result.

DISCUSSION

Cubitusvarus is one of the most common complications of supracondylar fracture of humerus in children managed conservatively. Incidence varies from 4% to 58% [1, 2]. Numerous corrective procedures have been described for correction of cubitusvarus deformity. These include medial opening wedge osteotomy [11], lateral closing wedge oosteotomy[3,12,13,14] arc osteotomy [15],domeosteotomy [7,16,17] and pentalateral osteotomy [18] .Lateral closing wedge osteotomy is the most commonly used procedure to correct the deformity. Wong et al [8] reported an incidence of 64% incidence of lateral condylar prominence following this procedure in a series of 22 patients.Ballemore et al [19] noted this complication in 22% of patients. The cause of this lateral condylar prominence is the inherent design of the osteotomy.

Excision of the wedge leaves two fragments unequal and further hinging on the medial cortex produces the lateral condylar prominence and thus compromising the cosmetic outcome. Tien et al [17] and Kanaujia et al [7] reported in their series of dome osteotomy that none of the patients had lateral condylar prominence after correction of the deformity. In case of dome osteotomy the centre of rotational angulation [CORA] is in the midline and this osteotomy is concentric to this CORA. The main limitation of dome osteotomy is the difficulty in accommodating the larger distal convex surface into a smaller proximal proximal concave surface. This produces significanthindrance during reorientation of the distal fragment following osteotomy. This is the reason that we modified the cut in a reverse direction and thereby greater degree of freedom of rotation was achieved during reorientation of the distal fragment. Posterior scar in our series was cosmetically more acceptable. The results of reverse dome osteotomy for the correction of cubitusvarus in our series were comparable to those of the lateral closing wedge[3,13,19] and dome osteotomy [7,16,17] in terms of restoration of carrying angle, preservation of elbow movements and the incidence of complication (infection ,neuropraxia ,loss of correction) and were superior to lateral closing wedge osteotomy in terms of lateral condylar prominence of humerus, acceptability of the scar and superior to dome osteotomy as far as technical details are concerned. It is a simple surgery with minimal implants and can be performed in any averageinfrastructure.

Operated all 22 patients were evaluated using Barett et al[9]questionure and clinico-radiologicaly with strict criteria of Oppenheims criteria [10]Post operative carrying angle, range of motion and LCPI to categorise results as excellent,good andpoor.

CONCLUSION

I conclude that Reverse dome osteotomy for the correction of the cubitusvarus deformity is associated with an excellent cosmetic outcome and low complication rates.Reverse Dome osteotomy was found to have the following advantages for correction of cubitusvarus deformity: the osteotomy site is more stable than a lateral closing wedge osteotomy for maintaining the correction, it avoids the lateral condyle becoming prominent and theposterior scar is more cosmetically acceptable than the lateral scar in the lateral closing wedge osteotomy.It overcomes the main limitation of Dome osteotomy. The main limitation of dome osteotomy is the difficulty in accommodating the larger distal convex surface into a smaller proximal proximal concave surface. This produces significant hindrance during reorientation of the distal fragment following osteotomy. This is the reason that we modified the cut in a reverse direction and thereby greater degree of freedom of rotation was achieved during reorientation of the distal fragment.

All the procedures have their advantages and pitfalls as with any other surgical intervention. Ours is a completely new operative technique. It is technically sound and safe. Results in our study are at par with that of the international standard. Our longest follow up is of 3 years but as of today we can conclude that conclude that reverse dome osteotomy can be taken as one of the procedures to address the age old problem with some advantages from technical point of view.

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