Outcome of Dome Osteotomy for Cubitus Varus Correction in Children

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ABSTRACT

Objective: To analyze the outcomes of dome osteotomy for correction of cubitus varus deformity.

Methods: We managed 14 children of cubitus varus between 7-11 years age, with dome osteotomy correction. Of these patients 9 were boys and 5 were girls. This retrospective study was carried out from Jan 2011 to June 2012. Mean pre-operative angles were 7 degrees varus (5-14 degrees) and post-operative correction was aimed to get an angle of 9 degrees valgus. All patients were followed up for 01 year. The main criterion against which the outcomes were assessed included the range of motion of their elbow joint, degree of correction of carrying angle and lateral condylar prominence index.

Results: In light of the assessment criterion the outcome was found to be excellent in 11 cases and good in 03 patients. Clinical and radiological bone union was achieved in all cases at 10 weeks. Few complications were also seen which included painful scar formation, ulnar neurapraxia and pin tract infection. The mean lateral prominence index did not increase postoperatively.

Conclusion: Dome osteotomy was found to be an exceptional technique to treat cubitus varus with no resultant iatrogenic deformity of lateral condylar prominence.

Key Words: Outcome, Cubitus Varus, Dome Osteotomy.

INTRODUCTION

Cubitus varus deformity occurs in neglected or mal-treated fractures of supracondylar part of humerus. It looks very unpleasant and generates a great deal of anxiety. Most cases therefore report for surgical correction of this deformity. Many corrective osteotomies have evolved over time and have been practiced to deal with this problem. Of these the most commonly practiced is the lateral closing wedge osteotomy. However after performing a corrective lateral closing wedge osteotomy it was noticed that the lateral condyle of the humerus became unduly prominent. Multi-centric studies were done in this context, nearly all concluded that this end-op cosmetic appearance was difficult to avoid with the technique of humeral supracondylar lateral closing wedge osteotomy as the residual distal piece of the humerus inclines laterally in relation to humeral shaft.

Because the presence of an unsightly deformity in cubitus varus was the primary reason of surgery in all the patients hence the lateral closing wedge osteotomy seemed to fail in obtaining the desired cosmetic outcomes. Resultantly a novel surgical technique was introduced by Tachdjian, which successfully produced the desired outcomes as reported in the series by Kanaujia et al and Tien et al. It required a dome osteotomy in the deformed distal humeral metaphysis and then moving the distal fragment in a lateral arc in line with the already calculated angle of correction. This re-established a normal carrying angle without any resultant bump of the lateral condyle of humerus.

METHODS

Supracondylar dome osteotomy of humerus was performed in 14 patients. There were 09 boys and 5 girls between the ages of 07-11 years. This retrospective study was conducted at CMH Abbottabad from Jan 2011 to June 2012. Patients included in the series had cubitus varus deformity (10 Left: 4 Right) due to mal treated supracondylar humeral fractures. Representative radiographs of the effected elbows were taken and the carrying angles were measured. Mean pre-operative angles were 7 degrees varus (5-
14 degrees) and post-operative correction was aimed to get an angle of 9 degrees valgus.

**Fig 1:** The lateral condylar prominence index is the difference between the measured medial and lateral widths of the transepicondylar line from the longitudinal mid-humeral line divided by the total width of their distal humerus transepicondylar line and multiplied with 100. (CB-AB /AC × 100). It is usually in negative percentage in normal elbows. (Range −21% to −3%).

Angles of correction were calculated. Average range of movements was 110 degrees flexion to -5 degrees extension. Campbell exposure of distal humerus was done. Dome supracondylar osteotomy was performed in all cases with cubitus varus deformity according to the technique described by Tachdjian. (Fig 2).

An augmentative above elbow Plaster of Paris posterior slab given in 90 degrees elbow flexion for 3 weeks followed by progressive active movements of the elbow. After 1-1.5 months the wires were removed.

All cases were followed-up to 12 months. Clinical outcomes included measurement of lateral condylar prominence, final cosmetic appearance, and resultant range of motion. All complications encountered were recorded.

**Fig 2:** The midline axis of the elbow and the superior border of the olecranon fossa (point 0) were marked as the dome center. The OA segment was considered the base and a line (OB) was drawn from point 0 to form the calculated angle of correction (a). The segment OB formed the radius of the dome, and the required dome was marked with diathermy. Point B played the starting point of the osteotomy, and a dome was drawn with OB as the radius of the arc. Point A is moved laterally to point B thereby collapsing the angle AOB and osteotomy is fixed.

**Fig 3:** Pre & Post operative Radiographs
RESULTS
The patients were evaluated before operation and their range of motion was analyzed and improvement was detected in range of motion after surgery. We found ROM to be normal in 08 patients with flexion 130 degrees - 0 extension), 05 patients had hyperextension (-07° in three and - 04° in two). One patient revealed no improvement after correction. Mean humero-ulnar angle increased from -15 degrees preoperatively to 8.1° (range, 3.3° to 13.9°) at final follow-up (P: 05). Union was observed at the end of 10 weeks and there was no failure of fixation or loss of angle of correction observed postoperatively. The appearance of elbow after dome osteotomy was excellent in 11 patients and good in 03 patients. The mean postoperative lateral prominence index was found to be −10.1% (range −24% –10%) and the normal side had mean index of −10.2% (range −21%– −3%). The complications encountered were pin tract infection in 02 patients (1 male & 1 female), which was controlled with oral antibiotics. Two patients developed hypertrophic scar (2F). One patient (F) had pain in the scar and one patient (M) developed transient ulnar neurapraxia, which recovered spontaneously in 3 weeks time. The statistical significance of results by SPSS version 20 was observed to have p-value of more than 5% (p > 0.05).

DISCUSSION
Fracture in the supracondylar region of humerus is seen commonly in between the ages of 2 to 13 years. If managed conservatively without any correction of the rotational deformity or when mismanaged by quacks then it ends up in cubitus varus. Worldwide reported incidence of cubitus varus is in between 4% to 21%. Many late sequelae associated with distal humeral fractures are ulnar neuropathy, avascular necrosis of the distal humeral epiphysis, secondary distal humeral or lateral condylar fracture, however most patients present with the complaint of an unsightly cubitus varus rather than any functional disability. In order to correct the cubitus varus various corrective procedures like arc osteotomy lateral closing-wedge osteotomy medial opening wedge osteotomy and dome osteotomy have been performed. The most commonly used procedure to correct the deformity was seen to be the lateral closing-wedge osteotomy of distal humerus. However after this osteotomy it falsely appeared as if the varus deformity still persisted because of the resultant lateral condylar prominence, however when evaluated radiographically for this appearance the measured angle formed by the humeral and ulnar axes (the carrying angle) were same on both sides. Multi-centric studies concluded that this false appearance is because of the radial shift in the distal fragment of the humerus, relative to the proximal humeral shaft, thereby causing a protrusion of the lateral humeral condyle. Excision of the wedge from lateral distal humerus effectively produced two fragments of unequal width and hence closing the osteotomy compromised the final cosmetic outcome. In order to overcome this disappointing outcome Tachdjian devised the dome osteotomy for correction of cubitus varus and the same technique was also reproduced in series of Kanaujia et al and Tien et al. In dome osteotomy the center of rotation of the distal fragment is at the midline of the humerus, therefore the varus forces acting at the osteotomy site are much less and make the osteotomy mechanically more stable. In essence Dome osteotomy uses the center of humeral mechanical axis as the rotation center thereby preventing the para midline shift of lateral condyle and hence it did not become prominent after the surgery.

CONCLUSION
We conclude that dome osteotomy is an excellent procedure for successful correction of cubitus varus and found to be an exceptional technique with no resultant iatrogenic deformity of lateral condylar prominence.

REFERENCES