Cosmetic Deformity Following Supracondylar Osteotomy for Cubitus Varus

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ABSTRACT: We retrospected twenty-seven patients who had supracondylar closing wedge osteotomy for cubitus varus. There were 10 excellent and 12 good results in terms of restoration of carrying angle and preservation of range of motion in the elbow. However, of these 22 patients, 14 had a significant bony prominence over the lateral condylar region after osteotomy. This prominence was caused by lateral displacement of the elbow as a result of the osteotomy closing around a medial cortical or periosteal hinge. It was less obvious in patients who had their osteotomy at a young age, but could be very prominent in those who had their operations close to or after skeletal maturity. The difference in results was due to remodelling of the osteotomy.

INTRODUCTION

Cubitus varus is the most common complication of supracondylar fracture of the humerus in children. It is generally accepted that the deformity results from unperfect reduction of the displaced fracture rather than from growth unbalance at the distal humeral epiphyses[1,2]. Malunion of the distal fragment in medial tilt is the most significant cause of the reduction of the carrying angle; with internal rotation and posterior tilt of the fragment contributing in part to the typical gunstock deformity[3,4,5]. Although having no functional disability[2,6], correction of the deformity is often requested because of its unacceptable appearance.

Surgical correction usually involves an osteotomy at the supracondylar region of the humerus, the carrying angle being corrected either by excision of a wedge of bone from the lateral side.[2,6,7], opening of the osteotomy and insertion of bone grafts medially[8], or various forms of dome or oblique osteotomies[9,10]. The closing wedge osteotomy is by far the most common procedure. The results of the various techniques of osteotomy and the types of fixation devices are well reviewed. Apart from inadequate correction of the carrying angle, complications arising from neurovascular injuries are well recognised[2,11]. The overall appearance of the elbow after osteotomy has by comparison received little attention.

This paper draws attention to a rather unsightly bony prominence at the lateral condylar region which may compromise an otherwise excellent correction of the carrying angle.

MATERIALS AND METHODS

Thirty-two patients underwent corrective osteotomy for cubitus varus at the Department of Orthopaedic Surgery, National University of Singapore between 1977 and 1986. Twenty-seven patients returned for an interview and the clinical examination. Four patients could not be traced and one declined to attend. These five patients were excluded from the study.

The follow-up period ranged from one to nine years with an average of four and a half years. There were 23 males and 4 females. The average age at operation was 10 years with a range from three to twenty-one years. The average interval between fracture and corrective osteotomy was four years with a range from one to fourteen years. The indication for operation in all cases was the unacceptable appearance of the cubitus varus deformity.

All patients had excision of a laterally based wedge of bone from the supracondylar region of the humerus. The osteotomy was then closed around a medial periosteal or cortical hinge. The size of the bone wedge to be excised was determined from clinical and radiological measurements of the difference in carrying angles between the two elbows. The distal fragment was internally rotated in some patients to correct the torsional alignment of the humerus. The surgical approach was lateral in 18 cases and posterior muscle splitting in 9. The osteotomy was fixed by using Kirschner wires in 23 patients and contoured plates in 3. One patient had osteotomy fixation by using French method[7].

As for the review, the carrying angles and the range of motion in both elbows were measured. The difference in measurements between the operated and normal elbow were then used to clssify the results into excellent, good and poor categories by using the classification of Bellemore et al (1984)[12].

The overall appearance of the elbow after osteotomy was noted. In particular, attention was directed to the presence of a bony prominence over the lateral condylar region at the

site of the osteotomy. Objective assessment of this lateral bony prominence was made by using measurements of standard antero-posterior radiographs of both the operated and normal elbows (Fig 1). The lateral prominence index (LP) measures the relative lateral bony extent away from the longitudinal mid-humeral axis. It is expressed as a ratio of the width of the distal humerus to minimise errors caused by magnification and size of individual humeri. A negative value for LP indicates medial prominence, which is a normal situation. Nineteen sets radiographs were available for these measurements, the normal elbows being used as controls. The observed lateral condylar prominence and the measured lateral prominence index (LP) were then correlated with the age at operation.

RESULTS

There were 10 excellent, 12 good and 5 poor results with respect to restoration of carrying angle and preservation of range of motion in the elbow. Three patients had pin tract infections which were resolved by removal of the Kirschner wires. There were no neurovascular complications.

Nevertheless, the 22 patients who had good or excellent results, 14 patients of them were noted as having significant bony prominence at the lateral condylar region. Six of them,the lateral bulge was very pronounced (Fig 2). The lateral prominence was due to lateral displacement of the elbow on closure of the osteotomy, while hinging on the medial cortex (Fig 3). This can be readily appreciated by drawing a line along the mid-humeral axis. This line normally passes through the olecranon fossa and nearly divides the width of the distal humerus into equal halves. The medial epicondyle normally extends further from this line when it is compared with the lateral side, giving a slight medial prominence.

The lateral prominence was accentuated by wasting of the arm muscles and tethering of the scar from pin-track infection. The worst cosmetic results were presented in patients with significant residual varus of the elbow after osteotomy. The effect of age at operation on the lateral prominence index (LP) is shown in Figure 4. The lateral prominence, although was presented to some extent in nearly all patients after osteotomy, showed a marked increase after the age about 12 years. There was a tendency towards restoration of the normal alignment with longer follow-up radiographs in the younger patients. In comparison, the normal side (control) showed no change with age (Fig 4); and the normal 'medial prominence' was well demonstrated.

Morever,the effect of age at operation on the lateral condylar prominence can be explained by remodelling of the lateral displacement of distal humerus. For example, Figure 5 shows a 5 year old patient who had osteotomy and had excellent remodelling of the distal humerus 6 years later. In contrast, another patient who had osteotomy at the age of 16 had no remodelling when he was reviewed 8 years later (Fig 6).

DISCUSSION

Our closing wedge osteotomy results are comparable with those of other reported series[2,11,12] in terms of restoration of the carrying angle and the preservation of elbow motion. We have noticed the poor cosmetic appearance from a lateral condylar prominence after osteotomy in many of our patients, who otherwise would have excellent or good results by the usual criteria. When the prominence is pronounced, it may appear like a new deformity in the old place. Muscle wasting in the arm, tethered scars from pin-track infection and residual varus accentuate the lateral prominence.

With reference to the lateral prominence that had been made by Smith[5],he suggested that the cosmetic result could be improved by medial displacement of the distal fragment.

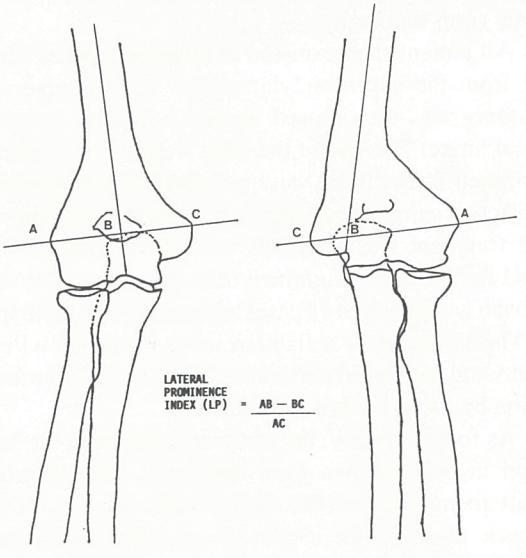

Figure 1: The mid-humeral line passes through the olecranon fossa in the normal humerus. There is normally a slight medial prominence, LP being predominantly negative. With lateral displacement after osteotomy, LP becomes positive.

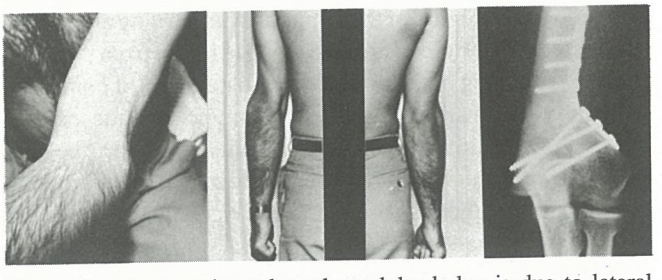

Figure 2 : The prominent lateral condylar bulge is due to lateral displacement of the distal fragment on closure of the osteotomy. Note the well corrected carrying angle.

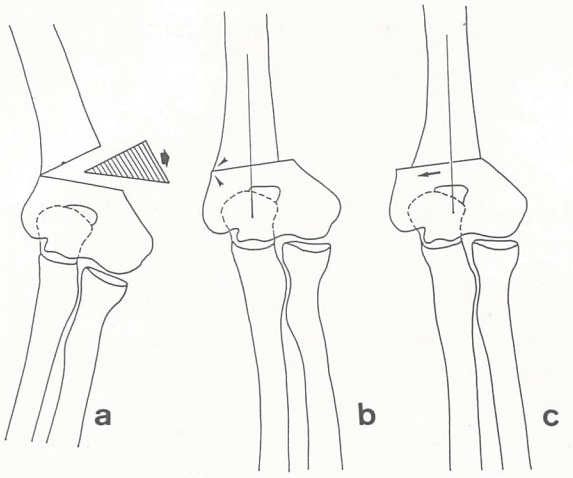

Figure 3 : Lateral shift of the distal fragment occurs during closure of the osteotomy and hinging on the medial cortex (a,b). Medial shift of the fragment realigns the normal axis of the elbow (c).

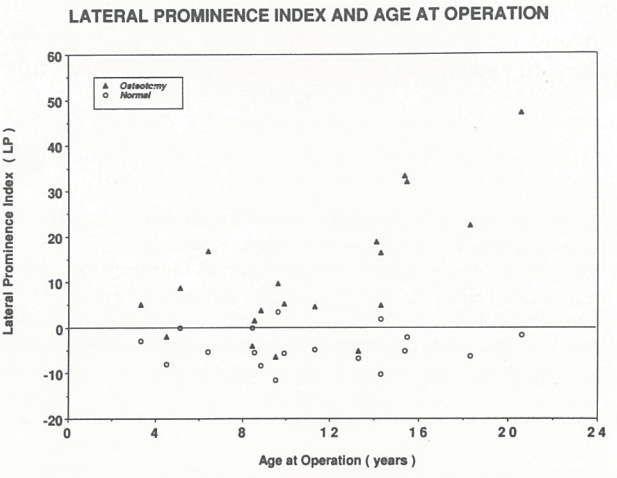

Figure 4 : The lateral prominence increases with the age of the patient at osteotomy. Lack of remodelling following osteotomy after the age about 12 years causes persistence of the lateral prominence. The lateral prominence index on the unoperated humerus shows no change with age.

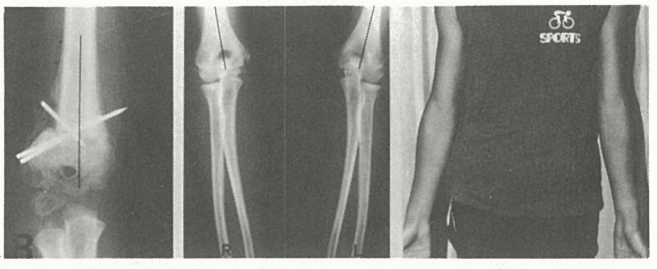

Figure 5 : The lateral displacement of the elbow is clearly seen in the post-operative X-ray. Five years later, there is restoration towards the normal alignment. The opposite normal elbow is shown for comparison.

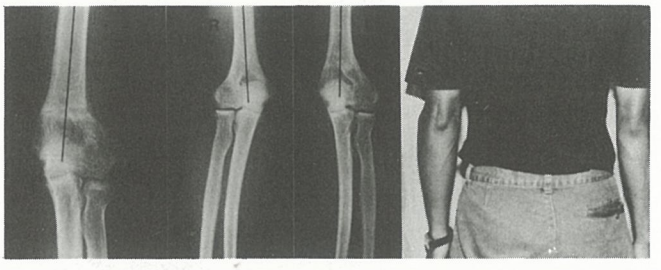

Figure 6 : This patient had osteotomy of the left elbow at the age of 15. There is persistence of the lateral displacement of the elbow 7 years later, compared to the normal side.

Besides, Bellemore[12] et al (1984) note about a bulge on the lateral side of the arm at the level of the osteotomy in 6 of his patients that this blemish was less common after the French osteotomy but gave no explanation. Huurman (1985)[13] commented that the "equal limb" osteotomy of Oppenheim[11] et al (1984) would have a result in a "rather prominent, somewhat cosmetically unappealing" distal humerus. He added that the cosmetic problem could be more significant than the cubitus varus deformity.

The cause of the lateral prominence is inherent in the design of the closing wedge osteotomy. Excision of the wedge leaves two fragments of unequal width and hinging on the medial cortex while closing the osteotomy effectively shifts the distal fragment laterally (Fig 3). The amount of lateral displacement can be appreciated on an AP radiograph of the elbow by reference to a longitudinal mid-humeral axis and a method of measurement of this lateral displacement is introduced.

The normal alignment of the elbow can be restored as a result of remodelling of the distal humerus with growth in younger patients. The degree of remodelling will depend on the amount of growth potential left. Minimal remodelling in patients who had wedge closing osteotomy at an older age results in persistence of the lateral displacement of the elbow, giving rise to the prominent lateral condyle. One possible solution in these older patients is to restore the alignment by shifting the distal fragment medially at the time of osteotomy (Fig 3). A lower level of osteotomy may also cause less lateral displacement. However, an osteotomy at that level is difficult to control as well as being intraarticular and is not recommended.

It would be advantageous to undertake correction of cubitus varus at an early age where remodelling of the distal humerus could be depended upon to give good cosmetic results. Siris[14] (1939), Blount (1955)[15] and Wilson (1982)[16] had recommended surgery to be deferred until skeletal

maturity in case of recurrence of the deformity from growth unbalance. There is; however,little support for growth imbalance to be the cause of cubitus varus except in the rare instance. In view of the potentially poor cosmetic result from surgery after skeletal maturity, operation should be considered early in the young child soon after free range of motion has returned to the elbow following the fracture.

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