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Triple modified French osteotomy: a possible answer to cubitus varus deformity. A technical note

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Background: Cubitus varus is the most common delayed complication of pediatric supracondylar humerus fractures. We developed a new technique, the triple modified French osteotomy, that we believe may be the answer to this common but yet unsolved deformity.

Materials and methods: Ten patients aged between 6 and 12 years with post-traumatic cubitus varus deformity were operated on with the triple modified French technique. A varus angle of more than 10° measured on the radiograph was an indication for surgery.

Results: The radiologic union at the osteotomy site took place in a mean period of 5.5 weeks (range, 4.5-7 weeks). The average correction achieved by the osteotomy was 27°. There were no cases with complications of radial or ulnar nerve palsy or joint stiffness.

Conclusion: The triple modified lateral closing wedge French osteotomy is a simple and cosmetically effective method of treating cubitus varus deformity in children. It may obviate the need for more complex procedures; at the same time, it also addresses the potential drawbacks of a simple closing wedge osteotomy.

Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Cubitus varus; supracondylar fracture; French osteotomy

Supracondylar fractures are the most common pediatric elbow fractures, with the peak incidence around 5 to 6 years of age.[4,27] There are numerous complications of supracondylar fractures and its treatment, which are divided into early ones like compartment syndrome and late ones like cubitus varus and myositis ossificans.[2] Cubitus varus along with malunion remains the most common delayed complication, especially of Gartland type III supracondylar humerus fractures.[11] Modern techniques of fixation of supracondylar fractures have significantly reduced the incidence of cubitus varus malunion.[30] However, despite

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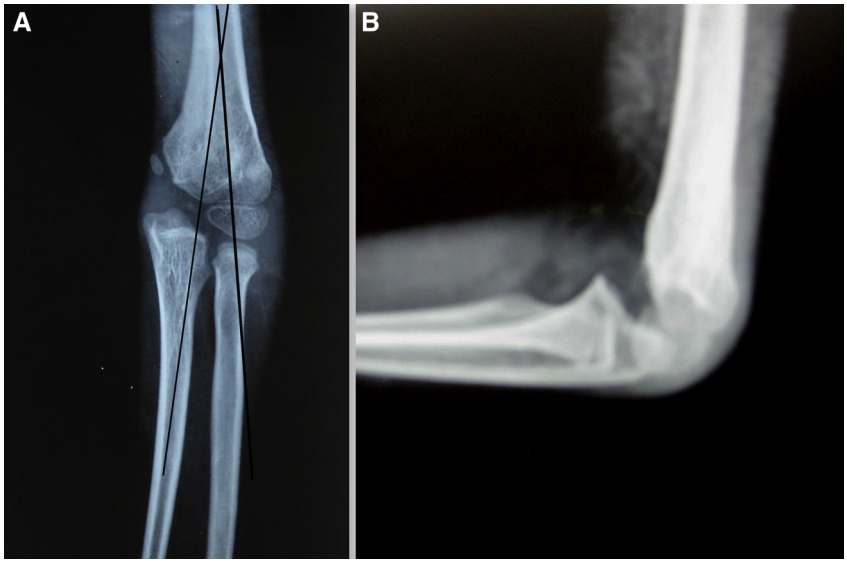

Figure 1 Preoperative anteroposterior (**A**) and lateral (**B**) radiographs showing the varus deformity of 25°.

the low threshold for fixation, malunions continue to occur and are especially a common presentation in developing and underdeveloped countries.

Cubitus varus is either secondary to malunion or less commonly due to trochlear osteonecrosis, in which case the deformity is progressive and is also known as malignant cubitus varus. There are 3 components of the fracture displacement pattern that contribute to the deformity: medial tilt or varus, medial rotation, and to some extent hyperextension. Initially thought to be of only cosmetic significance, the cubitus varus deformity has now been shown to have many pathologically important consequences, some of which are increased risk of lateral condylar fractures,[6] pain, tardy posterolateral rotatory instability,[25] tardy ulnar nerve palsy,[1] posterior shoulder instability with a Bankart lesion,[13] and subluxation of the ulnar nerve and medial head of the triceps over the medial epicondyle that can produce pain, snapping, and paresthesias.[33]

Numerous osteotomy techniques for treatment of this deformity have been described, with variable success and complication rates; the main differences are in the ability to correct the complex deformity and the method of fixation used. The innumerable numbers of osteotomies described are a testament to the fact that none has been found to be ideal; some are too simple and underestimate the various components of the deformity and thus fail to achieve full correction, whereas others are too complex for an apparently benign deformity. French osteotomy, originally described in 1959 by P.R. French, is a lateral closing wedge osteotomy, fixed with 2 screws and a figure-of-8 tension band wire between them on the lateral cortical surface.[10] Bellemore modified French's technique by leaving the medial cortex short of the periosteum and fixing it as in French's technique.[3] In this article, we describe a triple modified French osteotomy for the cubitus varus deformity that aims to correct all the components of the deformity with minimum drawbacks and complications.

Materials and methods

This is a prospective case series of 10 patients, aged between 6 and 12 years, with post-traumatic cubitus varus deformity. All the patients gave informed consent before being included in the study; the study was authorized by the local ethical committee and performed in accordance with the ethical standards of the 1964 Declaration of Helsinki as revised in 2000. Of these patients, 6 were boys and 4 were girls, with the left side involved in 6 cases and the right side in 4. Carrying angle was measured clinically by the angle formed between the long axis of the arm and forearm. Standard anteroposterior and lateral radiographs of the affected extremity were used to assess the deformity. On radiologic examination, the humeroulnar angle was taken into account (Fig. 1). A varus angle of more than 10° measured on the radiograph was an indication for surgery. The cases in the relatively younger age group were observed for a period of 6 months to exclude osteonecrosis or the overgrowth of any condyle. With the patient under anesthesia in the supine position, a tourniquet was applied, and the affected upper extremity was placed over a side-table attachment. The distal humerus was approached through a standard lateral approach, in the interval between the brachioradialis and triceps. The antebrachial cutaneous nerve and its branches were identified and preserved. A predetermined wedge, whose height was already calculated, was marked with an electrocautery on the lateral, anterior, and posterior cortices. On the lateral cortex, the osteotomy mark should be at least 1 cm proximal to the olecranon fossa to accommodate the distal screw that is to be used for fixation. Rather than excision of a simple lateral wedge, an oblique distal osteotomy was made. Making the osteotomy oblique places the apex of the osteotomy closer to the center of rotation of the deformity, which in turn prevents the translation deformity seen after a simple lateral closing wedge. An oblique configuration also