



International Journal of Multidisciplinary Research and Growth Evaluation.

Esmarch Bandage as a Reduction Tool for Closed Reduction Pinning In Pediatric Supracondylar Humerus Fractures

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Article Info

ISSN (online): 2582-7138

Impact Factor: 5.307 (SJIF)

Volume: 04

Issue: 04

July-August 2023

Received: 04-07-2023;

Accepted: 26-07-2023

Page No: 1035-1038

Abstract

In the pediatric population, distal humerus fractures account for nearly 12% of all elbow fractures often presents as emergency with vascular and neurological complications. Our technique in the operative management of supracondylar fractures uses the external application of an Esmarch bandage as a reduction tool followed by K-wire fixation under fluroscopy. This technique decreases the need for soft-tissue release and, therefore maintains soft-tissue vascularity of the small fracture fragments. This relatively simple operative technique makes for a more seamless operative process, improved reduction, and key preservation of soft-tissue vascularity.

Keywords: Supracondylar humerus, Esmarch bandage, reduction tool

Introduction

Closed reduction and percutaneous pin fixation is the recommended treatment of displaced (Gartland types II and III) supracondylar humerus fractures. The surgical treatment for supracondylar fractures of the humerus in children has dramatically lowered the rate of complications from this injury. Medial comminution is a subtle finding that, if treated nonoperatively, is likely to lead to unacceptable varus malunion. The incidence rates of malunion (cubitus varus) and compartment syndrome have both decreased. Nerve injury accompanying this type of fracture (prevalence, 5% to 19%) is usually a neurapraxia, which should be managed conservatively. Vascular insufficiency at presentation (prevalence, 5% to 17%) should be managed initially by rapid closed reduction and pinning without arteriography. Persistent vascular insufficiency necessitates exploration and vascular reconstruction. The purpose of this study was to develop a model of supracondylar humerus fractures fixation using esmarch bandage intraoperatively as a reduction tool.

Materials and Methods

Our technique involves the use of a bandage that is universally available in September 2021 to November 2022 in the department of Orthopaedic Surgery, Delta Medical College & Hospital, Bangladesh. After anesthesia, the fracture is reduced under fluoroscopy guidance and esmarch bandage is applied to withhold the reduction. It is easy to apply by the principal surgeon. Thus eliminating the need for an assisting surgeon/ technical scrub person during the surgery. Followed which the reduction is stabilized with two or three 'K' wires randomly. 25 closed pediatric distal humerus fractures that had undergone surgery between August 2016 and June 2018 with the above mentioned technique were included in the study. Observational tools were recorded such as operating time, number of surgical scrub staff involved, radiation exposure under fluoroscopy and post-op monitoring of compartment syndrome.

The need for a medial pin for maximal stability remains controversial. Here, we have randomly used unilateral and bilateral pins for fixation. This suggested technique decreases the need for soft tissue release and, therefore maintains soft-tissue vascularity of the small fracture fragments and reduces the need for assisting surgeon.

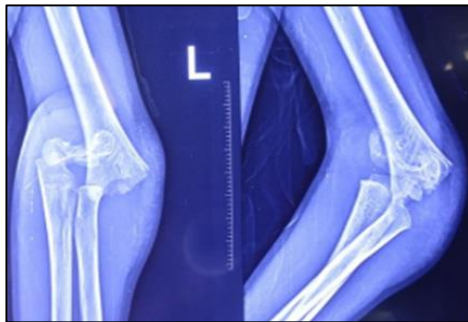


Fig 1: Pre-operative radiograph



Fig 2: Closed reduction under fluoroscopy

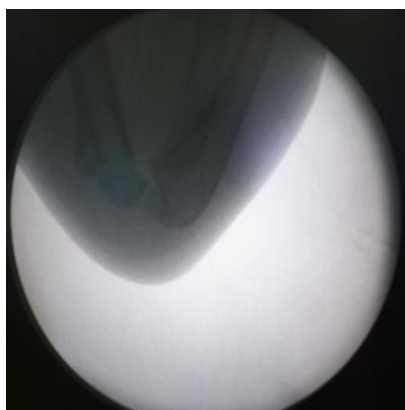


Fig 3: Intra-operative reduction of fracture



Fig 4: Esmarch bandage as a reduction tool



Fig 5: Stabilization with K wires

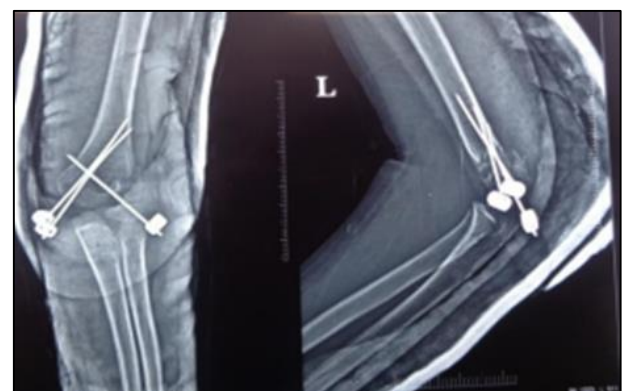


Fig 6: Post-operative radiograph

Results

The study population n = 20 consists of 14 boys and 6 girls. The mean age distribution was 7.36 years. The side of elbow fractures was predominantly left – 14 and right – 6. The fractures were classified according to Gartland classification. Type II fracture constitutes for 16 children and Type III constitutes for 4 children. The choice on unilateral versus bilateral pinning was random as the surgeon decides intra-operatively. Two pins lateral versus bilateral was used to fix 16 fractures and rest 4 was three pins fixation. Most of the type III unstable fractures required bilateral pinning with 3 pins intra-operatively. On follow up, there was no difference observed between bilateral and unilateral pinning in supracondylar humerus fractures in terms of stability. The mean operating time was less than 15 minutes with a mean of 13.26. There was no immediate post-operative complication observed in the above cases.

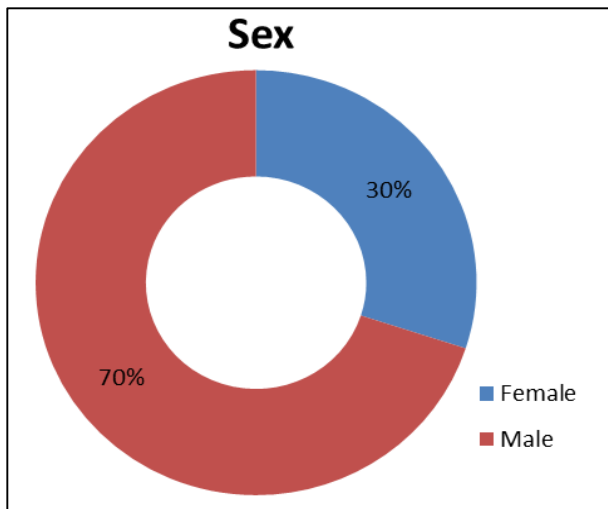


Fig 7

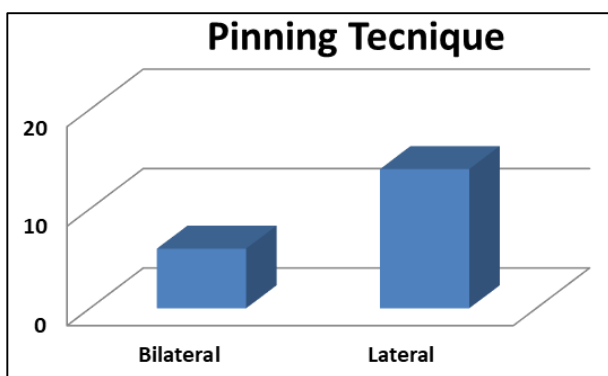


Fig 8

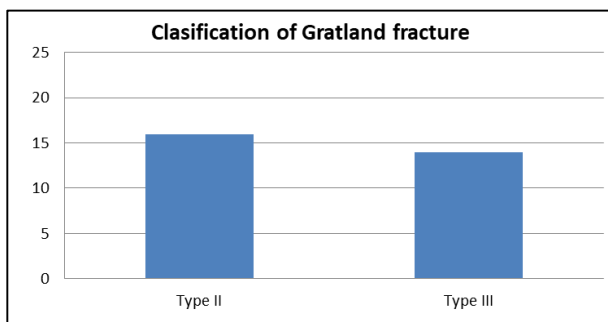


Fig 9

Discussion

Supracondylar fracture of the humerus is one of the most common encountered injury after clavicle and both bone forearm fracture in pediatric age group with a male predominance (as compared to our study) accounting for 15% of all pediatric fractures and 60% of all pediatric elbow fractures, classically occurring as a result of fall on an outstretched hand. The non-dominant arm was more often injured. Falls from a height accounted for 70% of the fractures. Children ≤ 3 years old tended to fall off of household objects (beds, couches, other objects 3-6 feet high), and children 4 years and older tended to fall from playground equipment such as monkey bars, slides, and swings. Safety precautions should be implemented in homes of young children and at playgrounds to avoid these fractures. Percutaneous fixation is popular, and was described by Judet and Swenson as an osteosynthesis technique based on the

work by Miller (1939) which recommends this method for the surgical treatment; its widespread use is due to a series of advantages, including low cost, safety, efficiency and minimal hospitalization times. External application of the Esmarch bandage decreases the need for soft-tissue release and, therefore, theoretically, maintains soft tissue vascularity of the small fracture fragments. The use of the bandage, which can be tied to itself after each turn of compression, minimizes the effort on the surgical assistant or resident, the assistant no longer needs to hold the wrist, forearm, and elbow position while attempting to retract in the surgical wound during reduction. In this manner, a more controlled and constant soft tissue tension can be applied, with focus turned to the fracture reduction and protection of vital neurovascular structures. It minimizes the risk of redisplacement of fracture fragments with repeated manipulations when holding the reduction manually by assistant. It has been suggested that the ratio of elbow growth to width has the same biomechanical importance as longitudinal growth in terms of muscle balance and stability. We agree with the concept that Kwire fixation should be used in the very young. However, the type of fixation should be modified depending on age. In our own experience, more than 75% of these injuries have occurred in pediatrics. In younger patients, K-wire fixation may be used due to decreased physiologic stresses than implants. Sibinski et al., confirmed that uncomplicated, displaced supracondylar fractures do not have to be treated at emergency. A delay to operation of more than 12 hours did not increase the hospital stay, the length of the operation or the incidence of open reduction. The number of peri-operative complications was low and the final outcome unaffected by the timing of treatment. Woratanara et al. stated that lateral pinning is preferable to cross pinning for fixation of pediatric supracondylar humerus fractures as a result of decreased risk of ulnar nerve injury. Though, in our cases with random bilateral pinning we had no nerve injuries. The operating scrub personnel were only two in our study; less theater trafficking and we had no post op infection.

Conclusion

Our technique involves the use of a bandage that is available in orthopedic operating rooms. It is easy to apply by either the principal or assisting surgeon. With practice, it cuts down operative time and can help substitute for an assistant. This relatively simple operative technique makes a more feasible operative process, improved reduction and key preservation of soft-tissue vascularity.

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