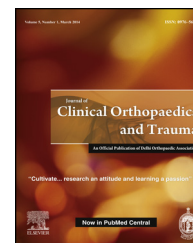




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Technical Note

Closed retrograde multiple intramedullary Kirschner wires fixation for humeral shaft fractures with the limb flexed over an articulated support

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ABSTRACT

Objective: To evaluate the results of multiple closed intramedullary Kirschner wiring via a supracondylar entry point for humeral shaft fractures.

Patients and methods: The charts of 37 patients with humeral shaft fractures treated with the Hackethal's technique between January 2007 and December 2011 were reviewed retrospectively. The operation was performed with the patient lying in supine ($n = 22$) or lateral ($n = 15$) position. The elbow was flexed over an articulated support with the arm kept in a vertical position. Thirty-three patients were available for final evaluation with a mean follow-up delay of 14 (range, 6–24) months. We were concerned about fracture union, range of motion of the shoulder and the elbow, and complications. Final evaluation used the criteria by Qidwai.

Results: Bone union rate was 94%. Restriction of ranges of motion of the shoulder more than 20° was noticed in two patients due to protruding wires. Three patients developed limitation of elbow extension owing to backing out of the wires. The overall results were excellent ($n = 26$; 79%), good ($n = 4$; 12%), and poor ($n = 3$; 9%).

Conclusion: Closed Hackethal's technique using K-wires gives satisfactory results in terms of bone union and elbow and shoulder function in selected humeral shaft fractures. The articulated support precludes the transolecranon traction.

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1. Introduction

Implants used for intramedullary stabilization of humeral shaft fractures range from both flexible nails and K-wires to the current trend of more rigid locking nails.¹ Small flexible diameter implants allow for alignment in the anteroposterior and lateral

planes and function as internal splints.^{1–3} Intramedullary devices such as Ender and Rush nails have fallen out of favor due to inability to obtain rotational or axial control.^{2,3} Related complications have been backed by earliest reports^{4,5} To the contrary, Hackethal's technique (HT) of filling the intramedullary canal sequentially with flexible nails via a supracondylar entry point permits stabilization of humeri with

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Table 1 – Patients demographics and fracture characteristics.

Parameters	Number
Sex	
Male	30
Female	7
Mechanism	
Road Traffic accident	23
Fall	8
Assault	6
Location of fracture	
Proximal third	5
Transition proximal to middle third	7
Middle third	16
Transition middle to distal third	6
Distal third	3
Pattern of fracture	
A1	4
A2	6
A3	12
B1	3
B2	3
B3	2
C1	4
C2	1
C3	2
Closed fractures	32
Open fractures	
Type I	3
Type II	2

varying canal morphology.⁶ This procedure is a minimally invasive technique carrying the advantages of closed reduction of the fracture and limited surgical exposure that does not endanger the radial nerve.⁷ In a prospective study comparing the results achieved using compression plate and the HT to treat transverse fracture of the midshaft of the humerus, no differences have been found between the two methods.⁸ The HT performed with K-wires, instead of flexible nails is the mainstay in the surgical treatment of most displaced proximal and humeral shaft fractures in some trauma centers in Europe.^{9,10} The surgical technique can be performed using transolecranon traction.⁹ The purpose of this study was to evaluate our results employing K-wires to carry out the Hackethal's technique, the limb being flexed over an articulated support.

2. Patients and methods

Thirty-seven adult patients undergoing a multiply closed intramedullary K-wiring via a supracondylar entry portal for humeral shaft fractures at the orthopedic unit of a private hospital from January 2007 to December 2011 were identified and their charts reviewed retrospectively. The fractures were located from 5 cm distal to the surgical neck to 5 cm proximal to the olecranon fossa.¹¹ Impending and completed pathological fractures, fractures as the result of a gunshot injury, grade 3 Gustilo open fractures, and neglected fractures were excluded. Patients treated with other implants or intramedullary K-wires via open reduction of the fracture or an entry point other than the supracondylar site were not included in the series. The average age of patients was 34

(range 16–79) years. Fracture pattern was described according to the AO Müller classification of fractures of long bone. The patient demographics and fracture characteristics are summarized in Table 1. In four patients radial nerve palsy was recorded at the time of admission. None of them had open fracture. Indications for surgery included polyfracture or polytrauma ($n = 26$), open fractures ($n = 5$), and inability to obtain or maintain an adequate closed reduction ($n = 6$). The average time between injury and surgery was 3 (range 1–10) days. A variety of surgeons with varying level of training have performed the procedure. The main steps of the standard technique described in several reports^{7,9,12} are outlined. The operation was performed under general anesthesia with the patient lying in supine ($n = 22$) or lateral position ($n = 15$). The elbow was flexed over a support with the arm kept in a vertical position (Fig. 1). The image intensifier was placed on the side opposite to the injured limb. The C arm was parallel to the floor with its concavity facing the patient (Fig. 2). It was rotated in the same plane to visualize the anteroposterior and lateral views of the arm. The support is articulated. Adjustment of its length by manipulations at the site of the articulation enables traction on the arm and achievement of the fracture reduction. This was checked by image intensifier. The limb was fixed firmly in this position by using an adhesive bandage between the forearm and an iron bar attached to the operating table. Open fracture if present was debrided first, irrigated, and closed on layers. A longitudinal posterior midline incision, about 5 cm in length was started close to the olecranon fossa and continued proximally. A long split incision in the triceps



Fig. 1 – Patient lying in lateral position with the elbow flexed over an articulated support.

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