

Buried vs. Exposed K-wire Fixation in Lateral Condyle Distal Humerus Fractures in Children

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Abstract

Introduction: Distal humerus lateral condyle fractures are common injuries in childhood and need effective treatment to prevent complications. Open reduction and internal fixation with Kirschner (K) wires is a proven, cost-effective and convenient technique for treating pediatric lateral condyle distal humeral fractures. K-wires may be buried beneath the skin or inserted through the skin with the wire ends exposed. There is no clear consensus as to whether K-wires should be buried or left exposed outside the skin. The aim of this study to compare the results and complications of divergent buried and non-buried K-wires in the treatment of lateral condyle fractures of the distal humerus.

Methods: A study was conducted between March 2019 to August 2020 in 32 pediatric patients with lateral condyle fractures of distal humerus who were treated with open reduction with divergent k-wire fixation in our hospital. All patients under the age of 14 years presenting with lateral condyle humerus fractures with more than 2 mm displacement were included in the study. The exclusion criteria were open fractures, undisplaced fractures treated conservatively, and pathological fractures.

Results: 32 patients under the age of 14 years were included in this study and were divided into two groups (Buried K-wire group and Exposed K-wire group) based on the treatment they received. Out of the 16 cases with exposed wires, 2 cases had superficial pin tract infection. And out of 16 cases with buried wires, 3 cases developed an infection, and 5 cases had skin erosion. However, no case of severe infection was seen. No cases of non-union were seen and all patients returned to preinjury function.

Keywords: Lateral Condyle, Distal Humerus, K-wire, Open Reduction and Internal Fixation, ORIF

Introduction

Lateral condyle fractures of the humerus are common injuries in childhood typically caused by a fall onto an extended arm with a varus force accounting for 10% to 15% of all pediatric fractures of the elbow with a high incidence between 4 and 10 years of age [1, 2, 3]. Conservative approach with casting can be applied in Undisplaced fractures, but displaced fractures have a high incidence of nonunion, and fractures with more than 2 mm of displacement require operative fixation [4, 5, 6]. Various fixation

methods have been described [7, 8, 9, 10]; the most widely utilized method is open reduction and fixation with smooth Kirschner (K) wires [11]. K-wires may be buried beneath the skin or inserted through the skin with the wire ends exposed [5, 12]. There is no clear consensus as to whether K-wires should be buried or left exposed outside the skin. Unburied wires can be removed in an outpatient setting, avoiding a secondary operation for wire removal. Therefore, unburied wires offer logistical and cost-saving benefits. However, unburied wires might likely be more prone to pin site infection and after deep infection [5]. The duration of unburied fixation for reducing the probability of infection is about 4 weeks; however, it may provide inadequate time for secure union [13]. Conversely, buried K-wires can be left in place until surgeons have explicit radiographic evidence of fracture union. However, a second general anesthetic is necessary for wire removal. Several studies comparing the outcome between buried and unburied K-wires have been published in past years [5, 14, 15, 16]. However, there is no clear consensus as to whether K-wires should be buried or left unburied outside the skin.

We have taken up this study intending to compare the results and complications of divergent buried and non-buried K-wires in the treatment of lateral condyle fractures of the humerus.

Materials and Methods

This was a prospective comparative study conducted between March 2019 to August 2020 in 32 pediatric patients (20 boys and 12 girls) with lateral condyle fractures of humerus who were treated with open reduction with divergent k-wire fixation. Before starting the study Institutional ethical clearance and informed patient consent were obtained. Patients were divided into two groups; Group-1 (Exposed K-wires) and Group-2 (Buried K-wires) having 16 patients in each group. All patients between the ages of 2-14 years (average 4.6 years) presenting with lateral condyle humerus fractures with more than 2 mm displacement were included in the study. The exclusion criteria were open fractures, undisplaced fractures treated conservatively, and pathological fractures.

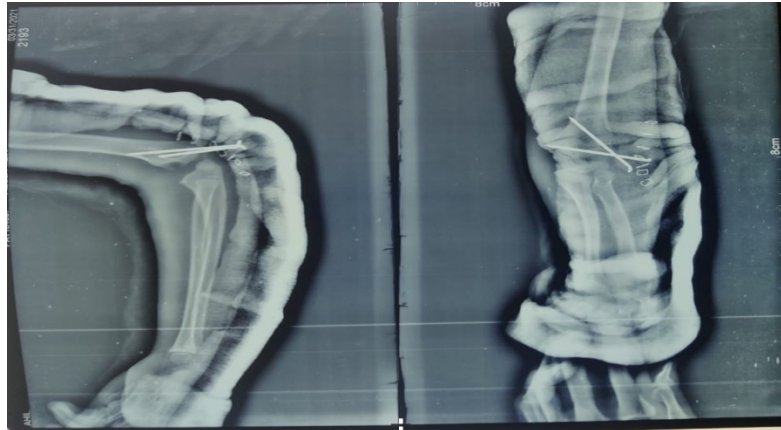
Pre-op Work Up

All patients had undergone a routine blood workup, chest x-ray, x-ray of an injured elbow in two planes (anteroposterior and lateral). Preoperative intravenous injection of 3rd-generation cephalosporin was given to all patients 30 minutes before the surgery.

Operative Technique

Open reduction was carried out under general anesthesia with fluoroscopic guidance and the use of a high tourniquet. The plane between the brachioradialis and the triceps was identified. The common extensor origin was partially mobilized to adequately visualize the joint surfaces. The articular surfaces were reduced anatomically and fixed with 2 divergent K-wires (Figure 1). Postoperative above elbow slab was applied in all cases with an elbow in approximately 90 degrees flexion and was continued for 6 weeks. Post-operative i/v 2nd generation cephalosporins for 5 days and aminoglycosides for 3 days were given in all cases followed by oral antibiotics 2nd generation cephalosporins till suture removal. X-ray was done on postoperative day-1 to assess the fracture reduction, wire placement, and configuration. The patients were discharged on the 3rd postoperative day.

Figure 1: Post-op X-ray with 2 Divergent K-wire Configuration



Follow Up

All patients were followed on the 7th day, 14th day, 6 weeks, and 3 months or later. At the 7th day follow-up, patients were reviewed for wound inspection. Suture removal and repeat wound inspection were done at 2 weeks. At 6 weeks follow-up, the slab was removed, range of movements was started and a radiograph was done to assess fracture reduction, union, and/or radiological signs of osteomyelitis if any. Superficial infection was managed by a short course of oral antibiotics. Deep infection was managed by antibiotics along with wound lavage or surgical debridement along with wire removal if necessary.

In Group-1, wires were removed at 6-8 weeks. In Group-2, wires were removed electively after the radiographic union.

Results

In our study of 32 cases, 20 boys (62.5%) and 12 girls (37.5%) were included between the age group of 2-14 years (average 4.6 years).

Group-1 (Exposed Wires)

Out of the 16 cases with exposed wires, there were 6 (37.5%) Milch type I fractures and 10 (62.5%) Milch type II fractures. In all cases, wires were inserted in a divergent fashion after open reduction, and the wires were removed after 6 weeks. Two (12.5%) patients had superficial pin tract infection at 2 weeks which was treated with oral antibiotics one case had deep wound infection which was noted after six weeks when the wires were removed. Staphylococcus aureus was cultured from the wound swab and treated with k-wire removal, wound debridement and antibiotics.

Group-2 (Buried Wires)

Out of the 16 cases with buried wires, 4 (25%) were Milch type I fractures and 12 (75%) Milch type II fractures. The wires were inserted in a divergent fashion in all cases. Wires were removed at 12 weeks. Erosion through the skin was the most common problem and occurred in 5 (31.25%) cases. Of the buried wires that eroded through the skin, 3 (18.75%) cases had microbiologically confirmed infection. All were treated with antibiotics, which was sufficient in two cases. The third patient required two surgical debridements.

- No serious infections (septic arthritis) were seen in many cases.
- No fracture in either group went on to non-union and backing out of wires was not seen in either of the groups.
- All patients achieved pre-injury function at the end of follow-up.

Discussion

Infection is one of the most common complications in the treatment of pediatric lateral condyle humerus fractures with K-wire fixation. Some studies have shown no significant difference in infection rates between the patients treated with buried and exposed K-wires [5, 15]. However other studies showed significantly higher infection rates in the exposed K-wire group [4].

In our study we have not found any significant difference in infection rates between the two groups and our results are consistent with other studies.

Skin erosion is associated with buried wires and was the most common complication in our study. Ormsby et al. [16] reported 14 (23.3%) cases out of 60 cases in the buried wire group developed skin erosion and wire protrusion. In our study 5 (31.25%) cases out of 16 in the buried group developed skin erosions which were comparable to other studies. This complication may be because of subsidence of soft tissue swelling after fracture fixation. Theoretically pin tract infection may lead to septic arthritis as wires are intra-articular. But this theory isn't supported by our study as there was no case of septic arthritis in either group.

We have found that leaving wires exposed for the fixation of lateral condyle humerus fractures in children has logistical and cost advantages over buried wires. The patient requires only one general anesthetic for fixation, and the removal can be quickly and easily performed in the outpatient department. But patients treated with buried wires have the burden of undergoing a second surgery hardware removal.

Conclusion

The study shows good outcomes for both exposed and buried k-wires for lateral condyle fractures of the humerus in children. Keeping wires outside following the open reduction of lateral condyle fractures of the humerus in children is a safe and effective alternative to burying wires, and eliminates the need for a second surgery for hardware removal. The divergent wire configuration provides adequate stability in lateral condyle fracture of humerus in children. Weighing all the facts and considering the financial conditions of the majority of the population of our country, we recommend keeping wires outside.

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