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# To determine the differences in complications between buried versus unburied-k-wire fixation for pediatric lateral condyle humeral fracture

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**Abstract**
**Introduction:** Operatively treated pediatric lateral humeral condyle fractures require longer period of in-situ k -wire fixation depending upon age, fracture configuration and mode of reduction. After fixation of lateral condyle fracture k-wires can be kept beneath or outside the skin.
**Aim:** To determine the differences in complications between buried versus unburied K-wire fixation in pediatric lateral condyle humeral fractures.
**Patients and Methods:** This prospective study was done in our centre on 50 operatively treated pediatric lateral condyle humeral fractures between January 2017 to Feb 2020.
**Results:** This study included 50 patients among which 35 were males and 15 were females with average age of 7.5 (range 2-15 years). All patients were treated by ORIF and k-wire fixation. In buried group K-wire was kept for 7-12 weeks with average of 8 weeks and in unburied group K-wire was kept 5-9 weeks with average of 7 weeks. Complications like infection, scaring, nonunion, damage of physis due to infection and stiffness was more common in unburied group. Skin erosion, K-wire prominence and requirement of anesthesia was more in buried group.
**Conclusion:** Our study found better results in operatively treated pediatric lateral condyle humerus fractures where k-wires kept beneath skin.

**Keywords:** Unburied-k-wire, ORIF, condyle fracture

## Introduction
Lateral condyle humerus fractures in pediatric age group are common injuries accounting for 17% of distal humerus fractures [1]. In order to achieve anatomical reduction, fractures often require open reduction and internal fixation. After anatomical reduction, fractures are fixed by k-wires which can be left beneath skin or outside skin. These k-wires are usually kept for 6-8 weeks depending upon fracture configuration, anatomical reduction and fixation. Most common complication is pin site infection.
Though, there are few studies comparing the infection rate between buried and unburied K-wires, there is still no consensus on whether the k-wires should be left buried under the skin or left unburied. Those who advocate that K-wires should be buried under the skin beleive that it reduces the chances of pin site infection and those who support leaving wires unburied, find it cost effective and easy for subsequent removal [2-5]. However, these infections could lead to physeal damage, osteomyelitis, septic arthritis, malunion, nonunion and possible sequelae of joint stiffness and deformities, it is necessary to come to a consensus whether K-wires should be buried or unburied to prevent or at least reduce the chances of these infections [6]. The purpose of present study was to determine whether burying k-wires under skin reduce these complications.
**Method:** All cases were initially assessed and admitted in the A&E department of Bone and Joint Hospital, Govt. Medical College, Srinagar. They were provided first aid in the form of analgesia and splintage. All necessary investigations were done besides pre- anaesthetic check up. All cases were operated within 3 days after admission. Mode of trauma, injury mechanism and fracture classification were noted.
**Inclusion criteria:** Age <15 years, fracture < 2 weeks old, fractures fixed by K-wires only, closed fracture, no associated ipsilateral upper limb fractures.

**Exclusion criteria:** Age >15years, duration>2weeks, fractures fixed by screw or treated nonoperatively, associated ipsilateral limb fracture.

**Operative Technique:** All the 50 patients were operated under general anesthesia by open reduction and K-wire fixation. Tourniquet was used in all cases. The wires were buried subcutaneously in 35 cases and unburied in 15 cases. Open reduction was carried out by Kocher approach, the common extensor origin was partially mobilised to adequately visualize the joint surfaces. The articular surfaces werereduced anatomically and fixed with K-wires. In 40 cases only two k-wires were used, in 5 cases divergent wires were used and in 5 cases 3 k-wires were used. An above-elbow backs lab was applied with the elbow flexed to approximately 90º and the forearm in neutral rotation.

**Postoperative care:** Each patient was immediately shifted to recovery ward and distal neurovascular status was assessed. On 1st postoperative day pin site dressing was checked besides a check radiograph. Patients were discharged on 3rd postoperative day with advice about pin site care and finger range of motion exercise. Each patient was asked to report outpatient department weekly for initial 3 weeks. Between 6-8 weeks radiographs were taken to confirm fracture union and plan wire removal.

## Results

50 patients were included in this prospective study among which 35 were males and 15 were females. The age of the patients ranged from 1-15 years with the mean age being 7.5 years. Following results were observed while treating 50 patients with lateral condyle fractures, treated by open reduction and internal fixation with buried or unburied K-wires.

**Table 1:** Distribution of cases by age

| Age in years | No. of cases | Percentage |
|---|---|---|
| 1-5 | 14 | 28% |
| 5- 10 | 26 | 52% |
| 10 -15 | 10 | 20% |

**Table 2:** Distribution of cases by mode of trauma

| Mode of trauma | No. of cases | Percentage |
|---|---|---|
| Fall from height | 22 | 44% |
| RTA | 21 | 42% |
| Direct trauma | 7 | 14% |

**Table 3:** Types of Fracture

| Type of fractures | No. of cases | Percentage |
|---|---|---|
| Milch type I | 10 | 80% |
| Milch type II | 40 | 20% |

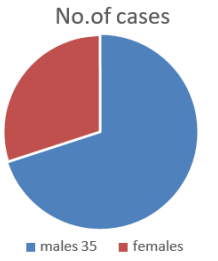


**Fig 1:** Gender distribution of cases

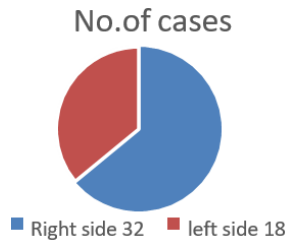


**Fig 2:** Side distribution of cases

**Table 4:** Distribution of cases by method of fixation

| Mode of fixation | No. of cases | Percentage |
|---|---|---|
| Two parallel K-wires | 40 | 80% |
| Two divergent K-wires | 5 | 10% |
| Three parallel K-wires | 5 | 10% |

Of the 15 cases with unburied wires, there was 1Milch type I fracture and 14 Milch type II fracture. In all cases the wires were passed through a separate stab incision from the one used to open reduce the fracture. In unburied group k-wires were kept for 5-9 weeks with average of 7 weeks. All fractures got united except two. These two cases with delayed union because of infection finally got united by ORIF plus bone grafting and post operative culture sensitivity-based antibiotics. Pin-site infection was noted as the most common complication with incidence of 23%. Most often Staphylococcus aureus was cultured from the wound swab and treated with surgical wound washout and antibiotics. In almost all cases infection subsided immediately after wire removal. Other complications noted were two cases of lateral condyle physeal damage, one of osteomyelitis, one case of malunion, two cases of mild cubitus varus deformity. K-wire removal was done without anaesthesia in this group of patients.

Of the 35 cases with buried wires, there were 9 Milch type I fractures and 26 Milch type II. Wires were removed at an average of 8 weeks (range 7-12 weeks).

In buried group most common complication was skin erosion which was noted in 6 cases with incidence of 17%. Of the buried wires that eroded through the skin, three cases had microbiologically confirmed infection. All were treated with oral antibiotics. Other notable complications were 7 cases of skin erosion, 5 cases of k -wire prominence. For wire removal 15 cases required general anesthesia and others were removed under local anesthesia.

**Fig 3:** AP and lateral radiograph showing Milch ty II lateral condyle fracture

**Fig 4:** Post operative AP and lateral radiograph showing K-wire fixation of lateral condyle fracture. Here 3k-wires were used in parallel fashion

## Discussion

The concept of burying K-wires under the skin after fracture fixation versus keeping it unburied has been a topic of debate and still studies are underway to come to a consensus

regarding this matter. In a retrospective study by Ridley TJ et al., in 695 patients over 9 years 16.4% unburied K-wires and 9.2% buried K-wires were infected [7]. Rafique A *et al.* demonstrated a similar rate of infection in his study 18% in unburied K-wires and 4.4% in buried K-wires [3]. Launay F *et al.*, reported higher rate of infection in unburied k-wires (28%) and only 8% infection in buried K-wires [8].

In a retrospective study by Jojin Jose Chitten *et al.*, of the 474 patients, 25% of the total patients had pin site infections. The pin site infection rate was lower in buried K-wires (20%) compared to unburied K-wires (28%). However the difference was not stastically significant. There are several prior studies which reported no significant differences in infection between buried and unburied k-wires on statistical analysis, but the raw data in all these studies demonstrated lower infection rate in the buried k-wire technique [9-11].

Das DS *et al.* conducted a retrospective cohort study of all lateral condyle fractures treated over a 10 year period at a single institution, and found no significant difference in the rate of infection, using buried and unburied wires [12].

Our prospective study, demonstrated a statistically significant lower incidence of infection in buried k-wires compared to unburied k-wires.

The present study is in contrast with few other studies which have compared buried versus unburied k-wire fixation in closed fractures.

Pin site infections are a possible complication with any internal fixation. Supracondylar elbow fractures are often treated with non-buried wires. In these cases, the rate of deep infection is approximately 0.2% while that of superficial infection is 0.8% [13]. The infection rate of lateral condyle fractures has been noted to be higher (8.1%) but in the study by Koh *et al.* it is not clear what proportion of k-wires were buried [14]. Some studies have directly compared buried and non-buried wires in lateral condyle fractures but no significant difference in outcome or complications was shown between the two groups. In our study the most common problem encountered was skin erosin (24%) in the buried wires group. This necessitated early wire removal compared with the buried wires, which did not erode the skin (6.5 weeks vs 8 weeks). This skin breakdown renders wire burial ineffective and also causes damage to the skin. We believe that this complication occurs because the soft tissue swelling evident immediately after the injury and at the time of surgery subsides several days after fixation. This results in the K-wires being more prominent, thereby increasing the risk of skin breakdown. One of the main (anecdotal) arguments for wire burial is to minimise the risk of superficial pin site infection, which, theoretically, may progress to septic arthritis as the wires are intra-articular. This theory is not supported by our data, which indicate that the infectection rate was approximately 10% in each group. There were no cases of septic arthritis in either group. There is a lack of data concerning whether it is preferable to bury k-wire in lateral condyle fractures. There was a low complication rate with one superficial infection and two cases of over granulation, all in exposed wires group. There were no cases of skin erosion in the buried wires group. Thomas *et al* compared 97 exposed and 7 buried wires that were left in situ for 3 weeks [15]. The wire related problems included: one case of wire erosion and septic arthritis in one of the buried wires cases, and one superficial infection in an exposed wires case. However, studies showed that unburied wires are associated with a higher rate of pin site infection when compared with buried wires. The benefit of longer internal fixation afforded with buried wires should be offset against the increased risk of skin breakdown. Skin integrity should be monitored closely if wires are buried.

## Conclusion

The present study shows significantly lower post-operative infection in buried K-wire fixations compared to unburied k-wire fixations in closed fractures. Hence, buried K-wire technique is recommended for fracture fixation in closed fractures.

The idea behind burying K-wires is to reduce infection rates because it is felt that the wires have to stay in for a minimum of six weeks to prevent non-union. In our study there were no cases of non-union in either the buried or unburied wires group but infection rate was higher in unburied group. Hence it is advisable to keep wires buried.

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