

Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirschner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children

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ABSTRACT

Background: One of the most common injuries of the elbow in children is called supracondylar humerus fracture. It makes up around 18% of all fractures in children and 60% of all elbow fractures. The children in which these fractures happen are aged from 5 years to 7 years. This injury happens when a child falls on an outstretched hand and the elbow is bent backwards too far (hyperextension). The side effects of this fracture are pain, swelling, and a limited range of motion in the injured elbow. In more serious fractures where the arm is displaced, it looks like an elbow dislocation in younger children and the arm may look S-shaped. To treat displaced supracondylar humerus fractures, either closed or open reduction is done. After this, Kirschner wires (K-wires) are inserted through the skin to hold the bone in place. Most of the time this method is used because of its cost-effectiveness and it is also less invasive.

Objective: To compare the infection rates between unburied and buried K-wire fixation to treat Gartland Type III fractures in young children

Study design: A prospective, randomised controlled study

Duration and place of study: this study was conducted in Memon Medical Institute Hospital Karachi from April 2024 to April 2025

Methodology: This study is a randomised controlled study which was performed in the Orthopedic and Trauma Department. There were a total of 100 participants included in this research. All of the participants were young children of both genders who were aged between 2 years to 12 years. All the children were having humeral supracondylar fractures of the Gartland Type III which were less than 48 hours old. These fractures were without any signs of neurovascular compromise. Children were admitted and evaluated clinically after the radiological confirmation of a supracondylar fracture. Demographics of the participants along with mechanisms of injury were recorded. SPSS version 25 was used to analyse the data. Continuous variables and age were expressed in terms of mean and standard deviation. The correlation between infection rates were assessed using the chi-square test.

Results: There were a total of 100 participants included in this research. All of the participants were young children of both genders who were aged between 2 years to 12 years. All of the participants were equally divided into 2 groups. One group had fixation with buried K-wires (n=50) while the other had fixation with unburied K-wires (n=50). Males were more likely to receive unburied K-wires (68%). The highest number of children were from the age group of 9 to 12 years (n=37). Most of them received unburied K-wire fixation (56%).

Conclusion: The risk of pin tract infection was lower with buried K-wire fixation in children with humeral supracondylar fractures of the Gartland Type III.

INTRODUCTION

One of the most common injuries of the elbow in children is called supracondylar humerus fracture [1]. It makes up around 18% of all fractures in children and 60% of all elbow fractures [2]. The children in which these fractures happen are aged from 5 years to 7 years. Moreover, these fractures are mostly common in boys [3]. This injury happens when a child falls on an outstretched hand and the elbow is bent backwards too far (hyperextension) [4]. This is the most common way this injury happens which leads to an extension-type fracture. This occurs in over 95% of cases [5].

The side effects of this fracture are pain, swelling, and a limited range of motion in the injured elbow. In more serious fractures where the arm is displaced, it looks like an elbow dislocation in younger children and the arm may look S-shaped [6]. In this injury, there is a risk of nerve and blood vessel injury due to these fractures. Approximately 10% of the displaced fractures involve nerve damage where the median nerve is mostly affected [7]. Brachial artery is often affected in blood vessel injuries which happen in about 7.7% of displaced cases [8]. In order to describe

Noman Khan et al Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirschner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children

these fractures, the Gartland classification system is used by the doctors. The Gartland classification system says that Type III fractures are completely displaced and they are always fixed with surgery [9].

To treat displaced supracondylar humerus fractures, either closed or open reduction is done. After this, Kirschner wires (K-wires) are inserted through the skin to hold the bone in place [10]. Most of the time this method is used because of its cost-effectiveness and it is also less invasive. Generally good outcomes are seen in terms of bone healing and arm function. However, this treatment has its own challenges. Pin tract infection is a common issue caused after the K-wires are inserted in the skin. The occurrence rate of these infections is about 1%-21% of cases [11]. Pin tract infection can be treated with antibiotics and removing of pins because mostly this infection is on the surface. However, if the infection is not managed properly, it can lead to complications such as septic arthritis (joint infection), early closure of the growth plate, osteomyelitis (bone infection), toxic shock syndrome, or nonunion (when bone doesn't heal) [12]. Therefore, this study was conducted to compare the infection rates between unburied and buried K-wire fixation to treat Gartland Type III fractures in young children.

METHODOLOGY

This study is a randomised controlled study which was performed in the Orthopedic and Trauma Department. There were a total of 100 participants included in this research. All of the participants were young children of both genders who were aged between 2 years to 12 years. All the children were having humeral supracondylar fractures of the Gartland Type III which were less than 48 hours old. These fractures were without any signs of neurovascular compromise. To select the participants for this study, a non-probability consecutive sampling method was used. The Ethical Review Committee approved this research. Guardians or parents were informed about this study and their consent was obtained.

Exclusion criteria: Children who had pathological fractures or open fractures were not a part of this study. Moreover, those who had underlying metabolic or neuromuscular bone disorders, and polytrauma were also not included in this study.

Children were admitted and evaluated clinically after the radiological confirmation of a supracondylar fracture. Demographics of the participants along with mechanisms of injury were recorded. To ensure fitness for anesthesia, preoperative assessment was performed. All of the participants were divided into 2 groups. One group had fixation with buried K-wires while the other had fixation with unburied K-wires. General anaesthesia was given to perform all procedures. Lateral-entry K-wire pinning was used to perform all fixations. It reduced the risk of ulnar nerve injury. Follow-ups were scheduled after 1, 2, and 4 weeks after the treatment. Modified Oppenheim Classification was used at each visit to assess pin tract sites.

SPSS version 25 was used to analyse the data. Continuous variables and age were expressed in terms of mean and standard deviation. The other variables such as infection rates and gender were expressed in terms of percentages and frequencies. The correlation between infection rates were assessed using the chi-square test.

RESULTS

There were a total of 100 participants included in this research. All of the participants were young children of both genders who were aged between 2 years to 12 years. All of the participants were equally divided into 2 groups. One group had fixation with buried K-wires (n=50) while the other had fixation with unburied K-wires (n=50). Females were more likely to receive buried K-wires (68%) while males were more likely to receive unburied K-wires (68%). Table number 1 shows the gender wise distribution in both the groups.

Table No. 1:

Gender	K-wires buried (n=50)		K-wires unburied (n=50)	
	N	%	N	%
Male	16	32	34	68
Female	34	68	16	32
Total	50	100	50	100

The highest number of children were from the age group of 9 to 12 years (n=37). Most of them received unburied K-wire fixation (56%). Table number 2 shows the age wise distribution in both the groups.

Table No. 2:

Age (yrs)	K-wires buried (n=50)		K-wires unburied (n=50)		Total (N)
	N	%	N	%	
2 to 4	21	42	4	8	25
4 to 6	19	38	1	2	20
6 to 9	1	2	17	34	18

Noman Khan et al Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirschner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children

9 to 12	9	18	28	56	37
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Table number 3 compares the development of pin tract infection after 4 weeks in both the groups.

Table No. 3:

Pin tract infection after 4 weeks	K-wires buried (n=50)		K-wires unburied (n=50)	
	N	%	N	%
Yes	7	14	14	28
No	43	86	36	72
Total	50	100	50	100

DISCUSSION

This study was conducted to compare the infection rates between unburied and buried K-wire fixation to treat Gartland Type III fractures in young children. There were a total of 100 participants included in this research. Our study revealed that infection rate was lower in the buried K-wire group (14%) as compared to the other group which had a higher infection rate (28%). Similar to our study, there was a study conducted in Peshawar where the infection rate was reported to be 12.9% in the buried group and 29% in the unburied group [13]. Moreover, another study which included a total of 1,854 patients revealed that buried K-wire fixation reduced the chance of developing pin tract infection after the treatment [14].

Kafle et al. conducted a study in Nepal which revealed that the buried group had an infection rate of 4.44% while the unburied group had an infection rate of 13.33% [15]. However, buried K-wires have some side effects as well. Although buried wires reduce infection rates, they have higher skin erosion rates and they require surgical removal under anaesthesia [16]. This increases the number of subsequent procedures.

In our study, lateral entry pinning was used to avoid injuring the ulnar nerve accidentally. According to research, lateral divergent pinning is just as strong as crossed pinning but there is less risk of nerve damage [17,18]. According to Yawar et al., both crossed pin and lateral setup give good results on X-rays [19]. However, cross-pin configurations give better torsional stability. There is a high risk of damaging the ulnar nerve with cross-pinning. Research says that this happens in 3.4% of the cases [20]. The technique that can be used to lower the risk is by using a mini-open technique when placing the medial pin.

Noman Khan et al Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirschner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children

Certain limitations of this study were that the sample size was small and the study design was single centre which limits the generalizability of the results. Moreover, the duration of follow-up was only 4 weeks. This time might not be enough to identify late onset complications.

CONCLUSION

The risk of pin tract infection was lower with buried K-wire fixation in children with humeral supracondylar fractures of the Gartland Type III.

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Conflict in the interest

The authors had no conflict related to the interest in the execution of this study.

Permission

Prior to initiating the study, approval from the ethical committee was obtained to ensure adherence to ethical standards and guidelines.

REFERENCES

1. Inam M, Ullaha T, Rahman W. Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirschner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children. Journal of Pakistan Orthopaedic Association. 2024 Mar 29;36(01):41-7.
2. Qasim M, Wali A, ul Haq S, Waqar M. Comparison of Infection Rate in Buried vs. Exposed Ends of K-wire Used in Fixation of Pediatric Supracondylar Humerus Fracture. Indus Journal of Bioscience Research. 2025 Apr 10;3(4):83-7.
3. Saeed UB, Waseem M, Hassan AR, Khan ZA, Gill D, Ahmad S. COMPARISON OF BURIED VS NON BURIED K WIRES FOR TREATMENT OF SUPRACONDYLAR FRACTURE. Power. 2020 Jun 1;1(2.27):9.
4. Saeed UB, Waseem M, Hassan AR, Khan ZA, Gill D, Ahmad S. Supracondylar fracture, buried vs non buried K wires. The Professional Medical Journal. 2020 Mar 10;27(03):467-71.
5. Suganuma S, Tada K, Takagawa S, Yasutake H, Shimanuki K, Shinmura K, Fujita K, Tsuchiya H. Comparing exposed and buried Kirschner wires in fixation for pediatric supracondylar humerus fractures: a propensity score-matched study. Journal of Orthopaedic Surgery. 2022 Oct 2;30(3):10225536221125949.
6. Hannonen J. Humerus fractures in children: treatment trends and surgical techniques.

7. Ezeokoli EU, Borici N, Serrano E, Inneh I, Shenava V, Smith BG. Early postoperative infections after closed reduction and percutaneous pinning in type II and type III pediatric supracondylar humerus fractures. *Journal of Pediatric Orthopaedics*. 2022 Aug 1;42(7):e732-5.
8. Aubret S, Lecointe T, Mansour M, Rousset M, Andreacchio A, Pereira B, Charles YP, Canavese F. Risk of infection and secondary displacement in pediatric supracondylar or lateral condyle fractures treated with unburied Kirshner-wires removed before complete bone healing. *Journal of Pediatric Orthopaedics B*. 2017 May 1;26(3):222-6.
9. Abul A, Karam M, Al-Shammari S, Giannoudis P, Pandit H, Nisar S. Peri-operative Antibiotic Prophylaxis in K-Wire Fixation: A Systematic Review and Meta-analysis. *Indian Journal of Orthopaedics*. 2023 Jul;57(7):1000-7.
10. Baidoo PK, Kumah-Ametepey R, Segbefia M, Buunaaim ADB-i. Treatment and outcomes of pediatric supracondylar humeral fractures in Korle Bu Teaching Hospital. *OTA International*. 2021;4(2)
11. Tomaszewski R, Wozowicz A, Wysocka-Wojakiewicz P. Analysis of Early Neurovascular Complications of Pediatric Supracondylar Humerus Fractures: A Long-Term Observation. *BioMed Research International*. 2017;2017(1):2803790.doi:<https://doi.org/10.1155/2017/2803790>
12. H. R G, Mahendranath, Malik D, N GP. Supracondylar humerus fracture in children: K wire pinning with minimal sterile technique. *International Journal of Research in Orthopaedics*. 2021;7(4):840-2.doi:10.18203/issn.2455-4510.IntJResOrthop20212433
13. Inam M, Ullaha T, Rahman W. Comparison of Pin Tract Infection Rate in Buried Versus Unburied Kirshner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children. *Journal of Pakistan Orthopaedic Association*. 2024;36(01):41-7
14. Pullan J, Ayeko O, Metcalfe J. Buried or exposed kirschner wires in paediatric upper extremity fracture fixation: A systematic review and meta-analysis of infection rates and complications. *Injury*. 2025;112155
15. Kafle G, Pokhrel A, Gupta MK, Panthee R, Nepal S, Sah RK, et al. Comparison of outcomes in buried versus exposed Kirschner wire for treatment of paediatric supracondylar humerus fracture. *Birat Journal of Health Sciences*. 2023;8(3):2126-32
16. Abdullah S, Soh E, Ngiam C, Sapuan J. A Prospective Study Comparing the Infection Rate Between Buried vs Exposed Kirschner Wires in Hand and Wrist Fixations. *Cureus*. 2023;15.doi:10.7759/cureus.36558
17. Hanim A, Wafiuddin M, Azfar MA, Awang MS, Adel NANA, Razak AHA. Biomechanical Analysis of Crossed Pinning Construct in Supracondylar Fracture of Humerus: Does the Point of Crossing Matter? *Cureus*. 2021;13(3)
18. Parikh SN, Lykissas MG, Roshdy M, Mineo RC, Wall EJ. Pin tract infection of operatively treated supracondylar fractures in children: long-term functional outcomes and anatomical study. *Journal of children's orthopaedics*. 2015;9(4):295-302

Noman Khan et al Comparison of Pin Tract Infection Rate in Buried Versus Unburid Krischner Wires Fixation in the Management of Gartland Type III Supracondylar Fracture of Humerus in Children

19. Yawar B, Khan MN, Asim A, Qureshi A, Yawar A, Faraz A, et al. Comparison of lateral and crossed k-wires for paediatric supracondylar fractures: a retrospective cohort study. *Cureus*. 2022;14(7)
20. Rees AB, Schultz JD, Wollenman LC, Moore-Lotridge SN, Martus JE, Schoenecker JG, et al. A Mini-Open Approach to Medial Pinning in Pediatric Supracondylar Humeral Fractures May Be Safer Than Previously Thought. *JBJS*. 2022;104(1)