

FUNCTIONAL OUTCOME OF SUPRACONDYLAR FRACTURE OF HUMERUS IN CHILDREN UNDERGOING DORGAN'S SURGICAL TECHNIQUE

Original Research

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ABSTRACT

Background: Supracondylar fractures of the humerus are among the most common pediatric elbow injuries, typically occurring in children aged 5 to 7 years. Prompt and effective management is crucial to prevent long-term functional impairment. Dorgan's lateral cross pinning technique, introduced to avoid ulnar nerve injury associated with traditional medial-lateral pinning, offers a potentially safer and biomechanically stable alternative. Despite its clinical utility, local evidence on its outcomes remains limited, warranting further evaluation in institutional settings.

Objective: To determine the functional outcome of supracondylar fractures of the humerus in children treated with Dorgan's surgical technique at a tertiary care center.

Methods: A descriptive study was conducted from 01 November 2024 to 01 May 2025 at the Department of Orthopedic Surgery, Combined Military Hospital, Peshawar. Ninety children aged 5 to 15 years with radiographically confirmed supracondylar humerus fractures were enrolled through consecutive non-probability sampling. All patients underwent closed reduction followed by percutaneous fixation using Dorgan's technique. Postoperative immobilization was provided with an above-elbow cast. Functional outcomes were assessed at 60 days using the Mayo Elbow Performance Score (MEPS), categorized as excellent (90–100), good (75–89), fair (60–74), or poor (<60). Data were analyzed using SPSS v21.

Results: The mean age was 9.12 ± 3.05 years, and the mean weight was 31.96 ± 11.69 kg. Males comprised 61.1% (n=55) and females 38.9% (n=35). Functional outcomes were excellent in 76.7% (n=69), good in 16.7% (n=15), and fair in 6.7% (n=6). No poor outcomes were reported. Complications included infection in 12.2% (n=11) and malunion in 3.3% (n=3).

Conclusion: Dorgan's lateral-entry technique demonstrated high efficacy with excellent functional outcomes and low complication rates, supporting its use as a safe and effective approach for pediatric supracondylar humerus fractures.

Keywords: Dorgan's technique, Mayo Elbow Performance Score, pediatric orthopedics, percutaneous pinning, supracondylar humerus fracture, surgical fixation, treatment outcome.

INTRODUCTION

Supracondylar fractures of the humerus represent the most common type of elbow fractures in the pediatric population, accounting for a significant proportion of upper limb injuries in children. These injuries predominantly occur between the ages of five and seven years, with a median age of approximately six years, and their incidence tends to decrease with advancing age (1). Although earlier literature presents conflicting evidence regarding gender distribution—with some studies suggesting a male predominance and others indicating a higher prevalence among females—recent epidemiological data show no significant difference between genders (2,3). Extension-type supracondylar fractures are markedly more common than flexion-type fractures and are typically sustained from a fall onto an outstretched hand (4). The annual incidence rate of these fractures has been estimated at 177.3 per 100,000 children, making them not only the most common elbow fractures but also a considerable portion—approximately 16%—of all pediatric fractures (5). Most frequently, the non-dominant arm is involved, with 90% of cases occurring within the vulnerable 5 to 7-year age group (6). These fractures can lead to serious complications, including functional impairments, if not managed appropriately. While the gold standard for treatment has long involved closed reduction followed by percutaneous cross pinning using medial and lateral Kirschner (K) wires, this approach carries a risk of iatrogenic ulnar nerve injury (7,8).

In an effort to minimize such complications, Dorgan's lateral cross K-wire fixation technique, introduced in 1994, has emerged as a promising alternative. This method avoids medial wire insertion, thereby significantly reducing the risk of ulnar nerve damage, while offering improved biomechanical stability through reduced rotational torque compared to traditional medial-lateral pinning (9,10). Previous studies have reported favorable functional outcomes with Dorgan's technique, with approximately 73.3% of patients achieving excellent results, 16.6% good, and 10% fair (11-13). Despite its potential, limited data are available from local healthcare settings, creating a gap in context-specific evidence for this technique. Therefore, this study aims to determine the functional outcomes of pediatric supracondylar humerus fractures treated with Dorgan's lateral cross pinning technique at our tertiary care facility. By evaluating the efficacy and safety of this method in a local clinical context, the study seeks to contribute to the body of knowledge in pediatric orthopedic surgery and inform future practice for improved patient outcomes.

METHODS

This descriptive study was conducted in the Department of Orthopedic Surgery at Combined Military Hospital (CMH) Peshawar from November 2024 to May 2025 after obtaining ethical clearance from the institutional review board (IRB). A total of 90 pediatric patients were enrolled using consecutive non-probability sampling. The sample size was calculated assuming a 10% expected proportion of fair outcomes, with a 6.2% absolute precision at a 95% confidence interval (14). The inclusion criteria comprised children aged 5 to 15 years who presented with supracondylar humerus fractures confirmed through radiographic evidence, including fracture angulation and posterior fat pad signs. Patients with polytrauma, open fractures, or associated vascular injuries were excluded from the study to avoid confounding variables that could affect surgical outcomes. Informed consent was obtained from parents or legal guardians prior to enrollment. Baseline demographic data including age, gender, weight, area of residence, and socioeconomic status were recorded for each patient using a structured proforma. All surgical interventions were performed under general anesthesia in a sterile environment. Fracture reduction was achieved through standard traction and counter-traction methods, with alignment verified intraoperatively using a fluoroscopic image intensifier. Dorgan's lateral cross K-wire fixation technique was applied uniformly in all cases. This technique involved the insertion of two K-wires: the first passed laterally through the condyle into the medial cortex, and the second introduced from the lateral cortex directed proximally into the medial condyle without breaching the medial cortex. After wire placement, both were bent and buried subcutaneously. An above-elbow cast was applied to ensure immobilization during the healing period.

Postoperative follow-up evaluations were performed on the 60th postoperative day using the Mayo Elbow Performance Score (MEPS), a validated instrument that assesses elbow function based on pain, range of motion, stability, and ability to perform daily tasks. The MEPS scoring system ranges from 0 to 100, and outcomes were categorized as excellent (90–100), good (75–89), fair (60–74), or poor (<60), if any. Data collection was carried out by the principal investigator and reviewed under the supervision of a senior consultant orthopedic surgeon. All collected data were entered and analyzed using SPSS version 21. Quantitative variables such as age and weight

were presented as mean and standard deviation, whereas qualitative variables including gender, socioeconomic status, area of residence, postoperative complications, and functional outcomes were expressed as frequencies and percentages. To examine associations between functional outcomes and categorical variables, the Chi-square test was applied. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

The study enrolled 90 pediatric patients with supracondylar humerus fractures, presenting a mean age of 9.12 ± 3.05 years and a mean weight of 31.96 ± 11.69 kg. Males comprised 61.1% (n=55) of the cohort, while females accounted for 38.9% (n=35). A slight majority of the patients were residents of urban areas (54.4%, n=49), whereas 45.6% (n=41) came from rural settings. Socioeconomic distribution indicated that most participants belonged to the middle class (67.8%, n=61), followed by upper class (16.7%, n=15) and lower class (15.6%, n=14). Postoperative complications were observed in a small subset of patients. Infections were reported in 12.2% (n=11), while the remaining 87.8% (n=79) had no postoperative infections. Malunion was noted in 3.3% (n=3) of cases, whereas 96.7% (n=87) had no evidence of malunion on follow-up radiographs. Functional outcomes assessed using the Mayo Elbow Performance Score (MEPS) revealed that 76.7% (n=69) of the patients achieved excellent results. Good outcomes were noted in 16.7% (n=15), and fair results were seen in 6.7% (n=6). No poor outcomes were recorded among the study participants.

Stratification of outcomes revealed notable associations. Among the patients with infections, only 2 achieved excellent results, while 5 had good and 4 had fair outcomes. In contrast, those without infections predominantly achieved excellent outcomes (n=67), with 10 showing good and only 2 having fair results. Similarly, malunion was associated with poorer functional outcomes, with 2 out of 3 cases categorized as fair. Urban residence was positively associated with better outcomes, with 86.7% of those in the good category and 49.3% in the excellent category being urban dwellers. Rural residence was more common among patients with fair outcomes (66.7%). Age and weight stratification did not demonstrate statistically significant differences in outcome categories. Children aged 5–10 years accounted for the majority of excellent (68.1%) and fair (83.3%) outcomes. Weight distribution followed a similar trend, with children weighing 20–35 kg more likely to achieve excellent (68.1%) and fair (83.3%) outcomes compared to those over 35 kg.

Table 1: Demographics

Demographics		N	%
Gender	Male	55	61.1%
	Female	35	38.9%
Area of residence	Urban	49	54.4%
	Rural	41	45.6%
Socioeconomic status	Low class	14	15.6%
	Middle class	61	67.8%
	Upper class	15	16.7%

Table 2: Complications

Complications		N	%
Infection	Yes	11	12.2%
	No	79	87.8%
Malunion	Yes	3	3.3%
	No	87	96.7%

Table 3: Functional outcome

Functional outcome	N	%
Excellent	69	76.7%
Good	15	16.7%
Fair	6	6.7%

Table 4: Stratification of functional outcome with demographics and complications

		Functional outcome						P value
		Excellent		Good		Fair		
		N	%	N	%	N	%	
Age distribution (Years)	5 to 10	47	68.1%	8	53.3%	5	83.3%	0.36
	11 to 15	22	31.9%	7	46.7%	1	16.7%	
Gender	Male	42	60.9%	10	66.7%	3	50%	0.77
	Female	27	39.1%	5	33.3%	3	50%	
Area of residence	Urban	34	49.3%	13	86.7%	2	33.3%	0.01
	Rural	35	50.7%	2	13.3%	4	66.7%	
Socioeconomic status	Low class	11	15.9%	3	20.0%	0	0.0%	0.08
	Middle class	46	66.7%	12	80.0%	3	50.0%	
	Upper class	12	17.4%	0	0.0%	3	50.0%	
Infection	Yes	2	2.9%	5	33.3%	4	66.7%	0.0001
	No	67	97.1%	10	66.7%	2	33.3%	
Malunion	Yes	1	1.4%	0	0.0%	2	33.3%	0.0001
	No	68	98.6%	15	100.0%	4	66.7%	
Weight (Kg)	20 to 35	47	68.1%	8	53.3%	5	83.3%	0.36
	> 35	22	31.9%	7	46.7%	1	16.7%	

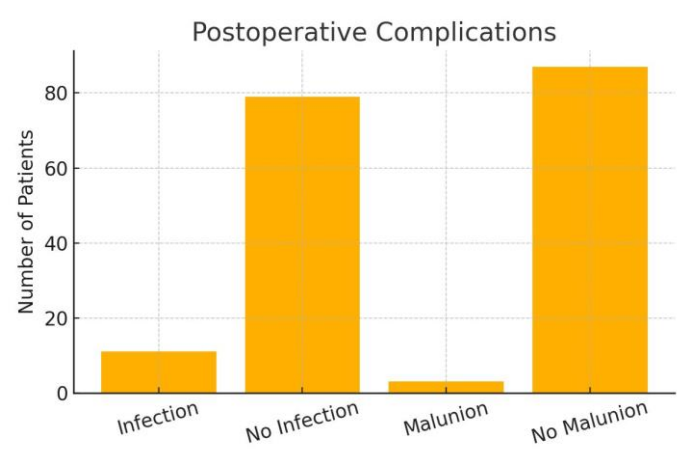


Figure 1 Postoperative Complications

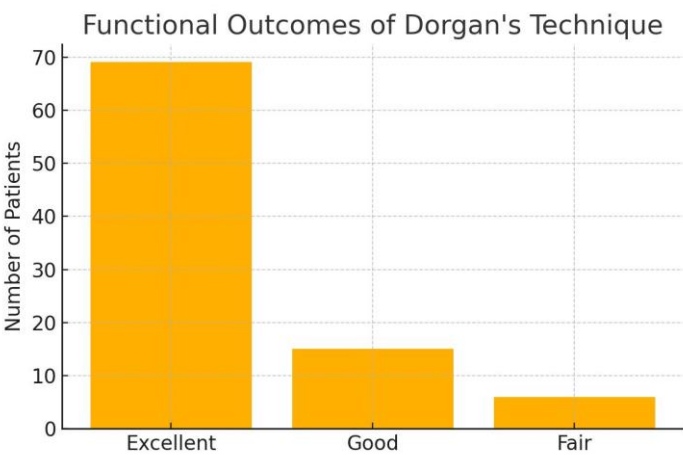


Figure 2 Functional Outcomes of Dorgan's Technique

DISCUSSION

With a cohort of 90 pediatric patients, the present study demonstrated a mean age of 9.12 ± 3.05 years, which is comparatively higher than the age ranges reported in several earlier studies where the mean age typically ranged between 5 and 6 years (14,15). This age variation may be clinically relevant, as older children tend to have more mature skeletal structures, improved bone remodeling capacity, and greater compliance with postoperative care protocols, potentially influencing both healing trajectories and final outcomes. The observed gender distribution with a predominance of males (61.1%) is consistent with previously published literature where male representation ranged from 70% to 75% (16). Although the male predominance remained evident, the current findings did not reveal any significant association between gender and functional outcomes, suggesting that surgical success may be independent of sex-related biomechanical differences in this age group. The overall complication rate in this study was relatively low. A superficial infection rate of 12.2% was recorded, falling within the acceptable range reported in existing literature. Previous studies reported varying infection

rates, from 8.6% for minor pin tract infections to a combined rate exceeding 30% when both superficial and deep infections were considered (17). The absence of deep infections in the present study highlights a potential improvement in intraoperative asepsis, postoperative wound care, and the standardized application of antibiotic prophylaxis. These observations reflect the strength of current perioperative protocols but also underscore the importance of vigilance in maintaining sterile technique, especially in resource-limited settings.

Malunion was observed in only 3.3% of cases, which is significantly lower compared to previous reports that documented rates up to 10% (18). This difference could plausibly be attributed to a combination of meticulous surgical technique, the use of intraoperative image intensification for alignment verification, and a larger study sample that allowed more robust statistical inference. The incorporation of Dorgan’s lateral-entry fixation technique likely contributed to this favorable outcome by minimizing soft tissue disruption and preserving alignment stability, particularly in the coronal and sagittal planes. Functional outcomes based on the Mayo Elbow Performance Score (MEPS) revealed that 76.7% of patients achieved excellent results, which is comparable to earlier studies that reported excellent outcomes ranging from 73% to 85% when using either MEPS or Flynn’s criteria (19). The present study’s use of MEPS provided a comprehensive assessment by integrating pain, stability, range of motion, and ability to perform daily activities. While Flynn’s criteria remain widely used in pediatric orthopedic literature, they primarily emphasize cosmetic and angular parameters, potentially underestimating the broader functional recovery achieved through advanced surgical techniques such as Dorgan’s. Despite methodological differences in scoring, the absence of poor outcomes in this study reinforces the reliability of Dorgan’s technique in avoiding major postoperative complications, mirroring similar findings in earlier reports (20).

Strengths of this study include the use of a uniform surgical technique across all cases, a clearly defined inclusion/exclusion framework, structured follow-up at 60 days, and the utilization of a validated functional scoring system. Furthermore, complications were rigorously tracked and stratified, offering valuable insight into potential risk modifiers. However, the study also presented several limitations. It lacked granular reporting of MEPS subcomponents, such as pain severity or degree of range of motion recovery, which could have strengthened the functional outcome assessment. Additionally, the absence of long-term follow-up restricts the interpretation of complications like growth disturbances or late-onset deformities. The use of non-probability sampling also introduces a degree of selection bias, which may affect generalizability. Future investigations should consider comparing MEPS and Flynn’s criteria within the same population to assess their relative sensitivity in capturing clinically meaningful outcomes. Moreover, evaluating socioeconomic determinants—such as parental education levels, access to physical therapy, and rural versus urban disparities—may offer insight into modifiable barriers to optimal recovery. Expanding the follow-up duration and incorporating radiographic union timelines, along with detailed motion analysis, would further refine the understanding of the long-term efficacy of Dorgan’s technique in pediatric supracondylar fractures.

CONCLUSION

In conclusion, this study affirms the clinical utility of Dorgan’s lateral cross pinning technique as a reliable and safe method for managing pediatric supracondylar humerus fractures. The technique demonstrated consistent functional recovery with minimal complications, underscoring its value as a preferred approach in surgical practice. These findings support its broader adoption in orthopedic settings, especially where minimizing nerve injury risk and achieving stable fixation are primary goals.

AUTHOR CONTRIBUTION

Author	Contribution
Muhammad Bilal Khan*	Data Collection, Data entry & Analysis, Manuscript Writing, Conception of Study Design
Muhammad Ejaz Ashraf	Critical Input, Conception of Study Design, Final Approval of Draft

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