Examining Preoperative Risk Factors for Nerve Injury in Pediatric Monteggia Fracture-Dislocations

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Background: The risk factors for fracture-related nerve injury in pediatric Monteggia fracture-dislocations are not well understood. As such, this study aimed to determine the incidence of, and preoperative risk factors for, nerve injury in pediatric Monteggia fracture-dislocations.

Methods: Patients aged ≤18 years with acute Monteggia or Monteggia-equivalent fracture-dislocations that underwent reduction in the operating room, including closed reduction and casting under general anesthesia and internal fixation of the ulnar fracture with or without opening the radiocapitellar joint, from 2011 to 2021 were retrospectively identified. Exclusion criteria included reduction in the emergency department, concomitant ipsilateral upper-extremity fractures, malunions, or patients without preoperative imaging. Nerve function was assessed preoperatively, and nerve injury was defined as persistent motor and/or sensory deficits on postoperative examination. Patients were followed until nerve-related symptoms resolved. Logistic regression controlled for age and fracture pattern to determine preoperative risk factors.

Results: Of 148 patients (mean age, 6.4 ± 2.8 years), 18.2% (27) had preoperative nerve injury. The posterior interosseous nerve (PIN) was injured in 15 patients, the anterior interosseous nerve (AIN) was injured in 7 patients, and other nerves were injured in 6 patients. All the nerve injuries resolved spontaneously, with a mean resolution time of 63.6 days (range, 8 to 150 days). Risk factors for nerve injury included patient age of ≥8 years (odds ratio [OR], 7.7; 95% confidence interval [CI], 2.6 to 22.8; p < 0.001), lateral radial head dislocation (OR, 6.8; 95% CI, 2.0 to 22.4; p = 0.002), an open fracture (OR, 4.5; 95% CI, 1.2 to 16.5; p = 0.025), and a comminuted ulnar fracture (OR, 4.1; 95% CI, 1.4 to 12.2; p = 0.012). PIN injury was associated with lateral radial head dislocation (p < 0.001) and a comminuted ulnar fracture (p < 0.001). AIN injury was associated with an open fracture (p = 0.002) and diaphyseal ulnar fracture (p = 0.004).

Conclusions: The incidence of preoperative nerve-related injury in pediatric Monteggia fracture-dislocations was 18.2%. Risk factors for preoperative nerve injury included patient age of ≥8 years, lateral radial head dislocation, an open fracture, and a comminuted ulnar fracture. All the nerve injuries resolved within 150 days, suggesting that early operative intervention may be unnecessary.

Level of Evidence: Prognostic Level III. See Instructions for Authors for a complete description of levels of evidence.

Monteggia fracture-dislocation, initially described by Giovanni Monteggia in 1814, represents an uncommon pediatric orthopaedic injury involving radial head dislocation and ulnar fracture[1-3]. These fractures, accounting for only 1% of forearm fractures in children[4], have high rates of reduction failure, malunion, and decreased rotational mobility, and an increased potential for nerve injury[5,6]. Due to their complexity and rarity, the specific nerve-related complications associated with Monteggia fracture-dislocations are not well understood.

Nerve injuries are commonly reported in pediatric forearm fractures[7-10], and the literature correlates an elevated risk with open fractures or high-energy trauma[11,12]. A retrospective analysis of 4,868 pediatric forearm fractures revealed that only 0.7% were associated with fracture-related nerve injury, with open and both-bone diaphyseal fractures identified as significant risk factors[13]. In contrast, nerve injury rates in Monteggia fracture-dislocations are higher, with reported incidences ranging from 3.1% to 31.4%[2,6,14-17]. Despite this incidence, specific risk factors for nerve injury in Monteggia fracture-dislocations remain poorly defined.

Given the complexities associated with Monteggia fracture-dislocations and the limited data on risk factors, and outcomes related to preoperative nerve injury, the current study aimed to

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determine the rate of, and preoperative risk factors for, nerve injury in pediatric Monteggia fracture-dislocations. Addressing this gap may enhance early preoperative identification and reduce the risk of missed diagnoses. While a thorough neurological examination should be performed for all patients, identifying specific risk factors can prompt surgeons to exercise heightened vigilance in high-risk cases, ensuring that even subtle signs of nerve injury are not overlooked.

Materials and Methods

Study Design, Setting, and Participants

This study was approved with a waiver of informed consent by our institutional review board. The study design and manuscript preparation complied with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) criteria for observational studies. This retrospective cohort study evaluated patients aged ≤18 years who underwent reduction in the operating room for acute Monteggia fracture-dislocation within 30 days of injury at a single tertiary academic medical center from 2011 to 2021.

Reduction in the operating room included closed reduction and casting under general anesthesia, internal fixation of the ulnar fracture with opening of the radiocapitellar joint, and internal fixation of the ulnar fracture without opening of the radiocapitellar joint. The study included fractures consistent with the 4 types outlined in the Bado classification system[6,18], Monteggia-equivalent injuries involving dislocation of the radiocapitellar joint and olecranon fracture, and Monteggia-equivalent injuries involving dislocation of the radiocapitellar joint with plastic deformation of the ulna. Radial neck fractures were included when accompanied by dislocation of the radiocapitellar joint and a displaced ulnar fracture. Exclusion criteria included reduction in the emergency department, patients without imaging, and patients with concomitant ipsilateral upper-extremity fractures, malunions, chronic fractures (≥30 days post-injury), revision procedures, and isolated radial neck fractures without an accompanying ulnar fracture (Fig. 1).

Data Collection

A comprehensive review of electronic medical records was conducted to collect patient characteristics (age, gender, race, ethnicity, and body mass index [BMI]), treatment histories, imaging studies for fracture patterns, and clinical data, including pre- and postoperative physical examination findings.

Radiographic Assessment

Preoperative radiographs were classified using the Bado classification system[18]. Radiographic parameters included the direction of radial head dislocation (anterior, posterior, or lateral), the location of the ulnar fracture (diaphysis, metaphysis, olecranon, or plastic deformation), the location of the radial fracture (none, diaphysis, or neck), and fracture type (simple or comminuted). Fractures were considered comminuted if imaging showed ≥2 intersecting fracture lines, creating multiple bone fragments. To determine the interobserver reliability of the Bado classification system, the first and second authors independently reviewed a subset of 70 radiographs, providing a Cohen kappa value of 0.77 (95% confidence interval [CI], 0.71 to 0.83; $p < 0.001$), indicating substantial agreement. Subsequent reviews of all the radiographs were then conducted in accordance with established classification protocols.

Preoperative Nerve Injury Assessment

Nerve function was evaluated on the basis of preoperative physical examination findings for sensory and motor function. Patients were considered to have a nerve injury if there were persistent motor and/or sensory deficits on postoperative physical examination, not limited by immobilization. Patients with

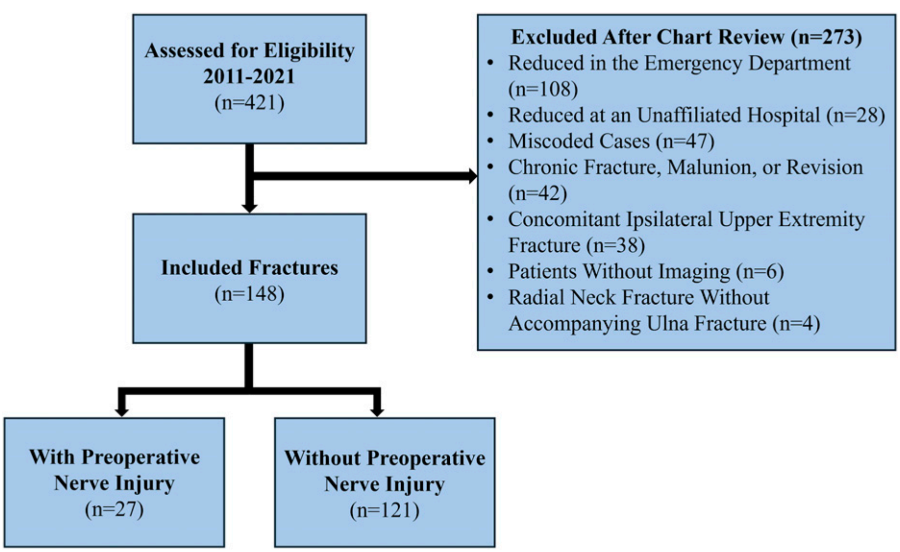

Fig. 1

Flowchart detailing the patient selection process.

suspected nerve injury but inadequate documentation, inconsistent examination findings, or limited patient participation were classified as neurologically intact (n = 3) and remained in the analysis under this designation. Patients were also classified as neurologically intact if preoperative nerve injury findings did not persist postoperatively.

A fellowship-trained pediatric orthopaedic surgeon classified the nerve injury cases on the basis of the examination findings:

- Posterior interosseous nerve (PIN): PIN injuries were purely motor, affecting the finger and thumb extensors and the extensor carpi ulnaris[19]. PIN palsy was distinguished from higher radial nerve lesions by the absence of sensory disturbance[19,20].
- Superficial radial nerve (SRN): SRN injuries were characterized by sensory findings, primarily presenting as pain and sensory disturbances (e.g., hypoesthesia), along the distal lateral forearm and hand[21,22]. SRN neuropathy was differentiated from PIN palsy by the absence of motor involvement[19].
- Anterior interosseous nerve (AIN): AIN injuries were purely motor lesions affecting the flexor pollicis longus and flexor digitorum profundus index without sensory involvement[23,24]. The absence of superficial sensory branch involvement distinguished AIN injuries from median nerve lesions.
- Median nerve (MN): MN injuries involved mixed motor and sensory deficits, typically affecting the thumb, index, and middle fingers. These injuries often included sensory impairments in the thumb and adjacent fingers, distinguishing them from the purely motor involvement seen in AIN palsy[23,25].
- Ulnar nerve (UN): UN injuries involved sensory deficits affecting the ulnar aspect of the hand and motor deficits of the intrinsic muscles of the hand, such as the first dorsal interosseous muscle.

Nerve-Related Outcome Assessment

All patients with preoperative nerve injuries were followed until complete resolution of symptoms. Resolution time was the period from preoperative diagnosis of the nerve injury to the resolution of the nerve-related symptoms at the time of follow-up. Resolution was defined as the return of complete muscle function and/or sensation in the relevant skin distribution on the basis of the documented clinical evaluation and physical examination.

Statistical Analysis

Continuous variables were compared using the Mann-Whitney U test and independent sample t tests, while categorical variables were assessed with Pearson chi-square and Fisher exact tests. Logistic regression assessed predictive factors for nerve injury, including fracture characteristics and age as covariables. The Box-Tidwell procedure confirmed the linearity of continuous variables with respect to the logit of the dependent variable. The area under the receiver operating characteristic (ROC) curve measured the model's discriminatory ability.

TABLE I Demographic Profile of 148 Patients Treated with Operative Reduction for Acute Monteggia Fracture-Dislocations Over a 10-Year Period*

Patient Characteristic	Value
Age *(yr)*	6.4 ± 2.8
BMI percentile	56.2 ± 29.6
Sex	
Male	81 (54.7)
Female	67 (45.3)
Race	
White	70 (47.3)
Hispanic	60 (40.5)
Black	3 (2.0)
Asian	15 (10.1)

*BMI = body mass index. The values for age and BMI are given as the mean ± standard deviation. BMI is based on pediatric growth charts in the electronic medical record and reported as the percentile among individuals of the same age and sex. The values for sex and race are given as the number of patients (percent).

Normality testing revealed a skew in the ages of patients with nerve injury. We addressed this by stratifying patient ages into quartiles, as tertiles, and as above or below the mean or median. Nerve injury was more common in the upper quartile, upper tertile, and above the mean or median. Given the mean age of 6.4 years, we tested the specific age thresholds of 6, 7, and 8 years. Analysis indicated that the threshold of age 8 provided the best fit, evidenced by significantly lower Akaike and Bayesian information criteria values, suggesting a better model fit and mitigating the risk of overfitting. This threshold was adopted for the regression model. Injuries to specific nerve involvements were reported descriptively. Statistical analyses were conducted using SPSS Statistics for Windows (version 29; IBM), with significance set at $p \leq 0.05$.

Results

Study Population

In total, 148 patients with acute Monteggia fracture-dislocations met the inclusion criteria (mean age and standard deviation, 6.4 ± 2.8 years). The demographic characteristics of the study population are outlined in Table I.

Overview of Preoperative Nerve Injuries

Twenty-seven patients (mean age, 8.3 ± 3.4 years) had fracture-related nerve injury, with an incidence rate of 18.2%. Older patients had higher rates of nerve injury ($p = 0.002$). No significant differences were observed with respect to BMI, sex, or race.

The PIN was most frequently involved (10.1%, n = 15), followed by the AIN (4.7%, n = 7), the UN (2.0%, n = 3), the MN (1.4%, n = 2), and the SRN (0.7%, n = 1). In addition,

TABLE II Association of Patient and Fracture Characteristics with Peripheral Nerve Injury in Acute Pediatric Monteggia Fracture-Dislocations*

Characteristic	No. of Cases with Nerve Injury (N = 27)	No. of Cases without Nerve Injury (N = 121)	Total No. of Cases (N = 148)	P Value
Age *(yr)*	8.3 ± 3.4	6.0 ± 2.5	6.4 ± 2.8	**0.002**
Sex				0.34
Male	17 (21.0)	64 (79.0)	81	
Female	10 (14.9)	57 (85.1)	67	
Direction of radial dislocation				**<0.001**
Anterior	9 (9.6)	85 (90.4)	94	
Posterior	2 (16.7)	10 (83.3)	12	
Lateral	16 (38.1)	26 (61.9)	42	
Location of ulnar fracture				0.29
Diaphysis	16 (22.9)	54 (77.1)	70	
Metaphysis	1 (6.3)	15 (93.8)	16	
Olecranon	8 (20.5)	31 (79.5)	39	
Plastic deformation	2 (8.7)	21 (91.3)	23	
Location of radial fracture				0.24
None	26 (20.8)	99 (79.2)	125	
Neck	1 (5.9)	16 (94.1)	17	
Diaphysis	0	6 (100.0)	6	
Fracture status				0.17
Closed	20 (16.3)	103 (83.7)	123	
Open	7 (28.0)	18 (72.0)	25	
Ulnar fracture type				**<0.001**
Simple	12 (11.2)	95 (88.8)	107	
Comminuted	15 (36.6)	26 (63.4)	41	
Bado classification				**<0.001**
Type I	8 (9.9)	73 (90.1)	81	
Type II	2 (33.3)	4 (66.7)	6	
Type III	16 (42.1)	22 (57.9)	38	
Type IV	1 (4.3)	22 (95.7)	23	

*Age is given as the mean ± standard deviation at the time of surgery. Categorical variables are given as the number of cases (percent of total cases per row). P values were calculated by comparing fracture characteristic variables between those with the presence or absence of peripheral nerve injury. Significance was set at p ≤0.05; bold indicates significance.

1 patient exhibited concurrent PIN and UN injuries, totaling 28 distinct nerve involvements in 27 patients.

The univariable analysis demonstrated that nerve injury was significantly more common with lateral radial head dislocation ($p < 0.001$) and with a comminuted ulnar fracture ($p < 0.001$) (Table II). Nerve injury occurred in 7 of the 25 open fractures (28%) and in 20 of the 123 closed fractures (16%), showing no significant association with open fractures ($p = 0.17$). Similarly, nerve injury rates were consistent across different locations of ulnar fracture ($p = 0.29$).

Multivariable logistical regression demonstrated that patients aged ≥8 years (odds ratio [OR], 7.7; 95% CI, 2.6 to 22.8; $p < 0.001$), lateral radial head dislocation (OR, 6.8; 95% CI, 2.0 to 22.4, $p = 0.002$), an open fracture (OR, 4.5; 95% CI, 1.2 to 16.5; $p = 0.025$), and a comminuted ulnar fracture (OR 4.1; 95% CI, 1.4 to 12.2; $p = 0.012$) were significant preoperative risk factors associated with nerve injury (Table III). The area under the ROC curve was 0.86 (95% CI, 0.78 to 0.94), indicating excellent discrimination between event occurrence and non-occurrence (see Appendix).

PIN

There were no significant differences in the rates of PIN injury with respect to sex, race, BMI, or open fractures. Patients with PIN injury tended to be older, although this was not significant (7.8 versus 6.3 years, $p = 0.11$). These injuries were more common with lateral radial head dislocations and less common with anterior radial head dislocations ($p < 0.001$). PIN injury was significantly associated with a comminuted ulnar fracture ($p < 0.001$). Olecranon fractures occurred in 47% of cases, but the location of the ulnar fracture showed no

TABLE III Univariable and Multivariable Models for the Occurrence of Peripheral Nerve Injury in Acute Monteggia Fracture-Dislocations*

	Univariable Model		Multivariable Model	
Characteristic	OR (95% CI)	P Value	OR (95% CI)	P Value
Age group				
<8 yr	Ref.		Ref.	
≥8 yr	5.95 (2.44-14.54)	**<0.001**	7.66 (2.58-22.75)	**<0.001**
Fracture status				
Closed	Ref.		Ref.	
Open	2.00 (0.74-5.42)	0.17	4.47 (1.21-16.47)	**0.025**
Direction of radial dislocation				
Anterior	Ref.		Ref.	
Posterior	1.89 (0.36-10.00)	0.45	4.00 (0.55-29.18)	0.17
Lateral	5.81 (2.30-14.69)	**<0.001**	6.75 (2.04-22.39)	**0.002**
Ulnar fracture type				
Simple	Ref.		Ref.	
Comminuted	4.57 (1.91-10.95)	**<0.001**	4.06 (1.36-12.16)	**0.012**

*Significance was set at p ≤0.05; bold indicates significance.

significant association with the frequency of PIN injuries (p = 0.35) (Table IV).

AIN

Evaluation showed no significant associations with demographics, fracture comminution, or the direction of radial head dislocation. AIN injury was significantly associated with older age (p = 0.015). Additionally, 5 of 7 patients with AIN injury had open fractures (p = 0.002). All AIN injuries involved diaphyseal ulnar fractures (p = 0.004).

UN

Three cases of UN injury occurred after 1 fall and 2 high-energy events. Two involved olecranon fractures with lateral radial head dislocation, and the third featured a diaphyseal ulnar fracture and a radial neck fracture with anterior radial head dislocation, representing 13% of such fractures in this study. All the cases included comminuted ulnar fractures, and none involved open fractures.

MN

Two cases of MN injury were identified. The first involved a 14-year-old girl who sustained an open diaphyseal ulnar fracture with posterolateral radial head dislocation. The second involved an 8-year-old girl with a comminuted diaphyseal ulnar fracture and anterior radial head dislocation.

SRN

A 14-year-old boy sustained an SRN injury from an open diaphyseal ulnar fracture with anterior radial head dislocation after falling and being stepped on by a bull. Preoperative examinations noted decreased sensation in the radial nerve distribution on the dorsum of the hand.

Nerve-Related Outcomes

All 27 patients with preoperative nerve injuries had complete resolution of their neuropathies without intervention, with a mean resolution time of 63.6 ± 39.8 days (range, 8 to 150 days). No patients with a preoperative nerve injury were lost to follow-up before symptom resolution.

Discussion

The current study found that the incidence of preoperative nerve injury in pediatric Monteggia fracture-dislocations was 18.2%, primarily involving the PIN (10.1%) and the AIN (4.7%). This rate is higher than the 1% seen in general pediatric forearm fractures[13], but it falls within the 3.1% to 31.4% range reported for Monteggia-related nerve injuries[2,6,14-17,26]. Risk factors for preoperative nerve injury included patients aged ≥8 years, lateral radial head dislocation, an open fracture, and a comminuted ulnar fracture.

All patients with preoperative nerve injury had spontaneous deficit resolution within 150 days, concurring with the literature that most nerve injuries in Monteggia fracture-dislocations are neurapraxia[26,27]. The complete resolution of symptoms in all the patients suggests that there were no cases of neurotmesis[28]. Longer resolution times may indicate axonotmesis, especially with more severe injury mechanisms, resulting in axonal disruption while preserving connective tissue elements[28]. This finding is relevant as most injuries were in the proximal forearm, where the anatomy may predispose to such patterns. The current study reinforces that surgical intervention is often unnecessary, highlighting the effectiveness of nonoperative treatments for Monteggia-associated nerve injury.

Open fractures demonstrated 4.5-fold higher odds of preoperative nerve injury, supporting previous studies linking open forearm fractures to nerve injury[11-13]. In a study of

TABLE IV Descriptive Characteristics of Patients and Fractures with Peripheral Nerve Injury in Acute Pediatric Monteggia Fracture-Dislocations*

Characteristic	PIN (N = 15)	AIN (N = 7)	UN (N = 3)	MN (N = 2)	SRN (N = 1)	Total No. of Cases (N = 148)
Age *(yr)*	7.8 ± 3.5	8.7 ± 2.2	4.5 ± 1.0	11.4 ± 4.8	14.1	6.4 ± 2.8
Sex						
Male	10 (12.3)	5 (6.2)	2 (2.5)		1 (1.2)	81
Female	5 (7.5)	2 (3.0)	1 (1.5)	2 (3.0)		67
Direction of radial dislocation						
Anterior	1 (1.1)	5 (5.3)	1 (1.1)	1 (1.1)	1 (1.1)	94
Posterior	1 (8.3)			1 (8.3)		12
Lateral	13 (31.0)	2 (4.8)	2 (4.8)			42
Location of ulnar fracture						
Diaphysis	5 (7.1)	7 (10.0)	1 (1.4)	2 (2.9)	1 (1.4)	70
Metaphysis	1 (6.3)					16
Olecranon	7 (17.9)		2 (5.1)			39
Plastic deformation	2 (8.7)					23
Location of radial fracture						
None	15 (12.0)	7 (5.6)	2 (1.6)	2 (1.6)	1 (0.8)	125
Neck			1 (5.9)			17
Diaphysis						6
Fracture status						
Closed	15 (12.2)	2 (1.6)	3 (2.4)	1 (0.8)		123
Open		5 (20.0)		1 (4.0)	1 (4.0)	25
Ulnar fracture type						
Simple	4 (3.7)	6 (5.6)		1 (0.9)	1 (0.9)	107
Comminuted	11 (26.8)	1 (2.4)	3 (7.3)	1 (2.4)		41
Bado classification						
Type I	1 (1.2)	5 (6.2)		1 (1.2)	1 (1.2)	81
Type II	1 (16.7)			1 (16.7)		6
Type III	13 (34.2)	2 (5.3)	2 (5.3)			38
Type IV			1 (4.3)			23
Incidence of nerve injury	10.1%	4.7%	2.0%	1.4%	0.68%	Overall: 18.2%

*PIN = posterior interosseous nerve, AIN = anterior interosseous nerve, UN = ulnar nerve, MN = median nerve, and SRN = superficial radial nerve. The total no. of cases represents the complete study cohort. Age is given as the mean ± standard deviation at the time of surgery. Categorical variables are given as the number of cases (percent of total cases per row).

pediatric forearm fractures, Zilliacus et al. found a 1.1% incidence (53 of 4,868) of open fractures, which increased the odds of nerve injury more than 33-fold compared with closed fractures[13]. Our study, with a higher incidence of open fractures (16.9%, 25 of 148), agrees with those findings but identified a moderate odds increase. This is potentially due to focusing on Monteggia fracture-dislocations that underwent reduction in the operating room, thereby selecting more severe fractures.

Children aged ≥8 years showed 7.7-fold higher odds of nerve injury, which potentially can be attributed to the more severe trauma older children often experience[29]. Our population appears younger than those in broader pediatric fracture studies. However, it is consistent with the typical age range for pediatric Monteggia fracture-dislocations, which peak in incidence between 4 and 10 years[30], suggesting that our results are particularly relevant for these injuries. The lower incidence of nerve injury in children <8 years of age might be related to their limited communication ability, influencing the reliability of clinical examinations[31].

The current study observed the highest incidence of nerve injury in the PIN. The literature suggests that mechanical factors, such as entrapment in the interosseous membrane or stretching over the radial head during injury, substantially contribute to PIN injury[14,32,33]. Our findings demonstrated that lateral radial head dislocation was associated with higher rates of PIN injury, aligning with the existing literature on Bado III fractures[34,35]. The likely mechanism involves posterior displacement of the PIN and potential subluxation within the radiocapitellar joint[14,36,37]. Additionally, comminuted ulnar fractures were significantly associated with PIN injury, possibly reflecting the severity of trauma and the high-energy nature. Surgeons should carefully assess for PIN injury in pediatric Monteggia fracture-dislocations with lateral radial head dislocation or a comminuted ulnar fracture.

AIN injury was predominantly associated with diaphyseal ulnar fractures and open fractures. This pattern may support the hypothesis that displaced ulnar fragments could impinge on the AIN[10,14,38], which traverses between the heads of the pronator teres and along the flexor digitorum profundus, making it susceptible to compression injuries[39,40]. These insights emphasize the need for careful evaluation of open and diaphyseal ulnar fractures for potential AIN involvement, given its less common but clinically important presentation[41].

The combined effects of an open fracture, a comminuted ulnar fracture, and lateral radial head dislocation could explain the high incidence of nerve injury in Monteggia fracture-dislocations. These factors, along with the established association between high-energy trauma and nerve injury in forearm fractures[11,13,42,43], suggest that increased injury severity, as indicated by an open fracture, a comminuted ulnar fracture, and lateral radial head dislocation, could serve as markers of high-energy trauma. A combination of these factors may better estimate the likelihood of nerve injury.

This study focused on patients undergoing reduction in the operating room, potentially skewing the population toward higher-energy mechanisms and a higher incidence of nerve injury. Cases reduced in the emergency department were excluded due to inadequate documentation of neurovascular examinations and loss to follow-up at our Level-I trauma center. By using documentation from fellowship-trained pediatric orthopaedic surgeons, we aimed to more reliably identify nerve deficits and delineate specific nerve involvements. However, the exclusion limited the generalizability of our findings on the incidence of nerve injury.

This study had limitations due to its retrospective design and reliance on historical records, which constrain causal inferences and may introduce information bias. The accuracy in recording physical examination details and the timing and resolution of nerve injuries—which might not be captured between appointments—could have affected our results. Charting reliability issues necessitated the exclusion of ambiguous cases, which may have caused underrepresentation of the incidence of nerve injury.

Furthermore, the limited literature on the reliability of the Bado classification system could have introduced unmeasured bias. To address this, 2 authors independently reviewed a subset of radiographs, achieving substantial agreement. Dependence on cooperative examinations from the young population might have either underrepresented or overrepresented nerve injuries. The modest sample size, especially within the subgroups, heightened the risk of a type-II error. These concerns underscore the need for future studies to validate and expand on our findings.

Conclusions

The incidence of preoperative nerve-related injury in pediatric Monteggia fracture-dislocations was 18.2%. Risk factors associated with preoperative nerve injury included patients aged ≥8 years, lateral radial head dislocation, an open fracture, and a comminuted ulnar fracture. All the patients with preoperative nerve injury had resolution of symptoms within 150 days postoperatively, suggesting that early operative intervention may be unnecessary. Thorough clinical examination is crucial for all patients, and awareness of these risk factors should heighten the suspicion of nerve injury.

Appendix

eA Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJS/I475). ■

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