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CASE STUDY

INCIDENCE OF TRAUMATIC AND IATROGENIC NERVE INJURIES IN DISPLACED SUPRACONDYLAR HUMERUS FRACTURE IN CHILDREN

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ABSTRACT

Objective: To estimate the frequency of trauma and treatment induced nerve injuries in cases of displaced supracondylar humerus fractures in children.

Materials & Methods: This retrospective observational study was conducted in department of orthopedics, Liaquat National Hospital from January 2011 to December 2015. All the cases of displaced supracondylar humerus fractures in the above mentioned period treated at our institute were analyzed. On a predesigned proforma the age, gender, variety & gartland type of fracture, nerve injuries whether iatrogenic or trauma induced were recorded and data analyzed.

Result: 437 patients of displaced supracondylar humerus fractures were identified. Out of which 90 (20.5%) patients had nerve injuries. 54 (60%) patients had trauma induced nerve injury and 36 (40%) had iatrogenic nerve injury. 54.6% were male. Mean age $\pm$ SD was 7 years. Most common fracture variey was extension 91.1% and most common fracture type was gartland type III 66.7%.

Conclusion: Supracondylar fractures have a low to moderate association with nerve injuries. Iatrogenic nerve injury is less common and dependent on method of fixation. Diligent care must be taken for the prevention, early identification and management of these cases.

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INTRODUCTION

Extremes of age bring about in the shape of physiology and anatomy distinctive patterns of diseases that are unique in their own entity and have to be studied separately from normal adult ages. The unique development of the human body in the early stages of life leads to a different response to trauma and hence the varied and distinct pediatric fracture patterns. The most common and well recognized of them being the supracondylar fractures (Della-Giustina and Della-Giustina, 1999). The frequency with which an orthopedic physician is expected to encounter the pathology can be determined by the fact that 60% of all observed trauma in children is reported to belong to this category (Lins *et al*., 1999). Its frequent and recognized association with the occurrence of nerve injuries makes it even more sinister. The most common age group identified to be affected is the 5-10 years old and the most common mechanism implicated is a fall on the outstretched hand (Kasser and Beaty, 2001; Farnsworth *et al*., 1998). Two major types of fractures exist. The majority are the extension type and the flexion type only account for around 5% of the cases (Fowles and Kassab, 1974). The particular anatomy of the elbow region makes all three major nerves of the upper limb susceptible to injuries. Although potentially these injuries carry the risk of long term morbidity but fortunately majority of the observed are neuropraxias and not nerve disruptions (Villarin *et al*., 1999). A recently published meta analysis raised the debate about the treatment of the fracture causing iatrogenic nerve injury and implicated lateral pinning and medial pinning methods for risking median and ulnar nerves respectively (Babal *et al*., 2010).

Background

Liaquat National Hospital is one of the leading hospitals in trauma care provision in the largest city of Pakistan. We want to retrospectively review the supracondylar fractures cases treated at this hospital with respect to trauma induced and treatment induced nerve injuries. Carrying out this study will enable us to evaluate and compare our institutions performance and help identify factors for improved patient outcomes.

MATERIALS AND METHODS

A retrospective observational study was conducted in orthopedic department of Liaquat National Hospital, Karachi

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from January 2011 to December 2015. All the displaced supracondylar humerus fractures in children between 3-13 years of age with their presentation in OPD or emergency within 7 days of injury were included in this study. The patients with open fractures and non-displaced supracondylar humerus fracture were excluded. All the cases of supracondylar fractures in the above mentioned period treated at our institute were analyzed. On a predesigned proforma the age, gender, gartland type of the fracture, nerve involvement and name of nerve involved, whether iatrogenic or trauma induced were recorded and data analyzed. The study is focused on nerve injury either caused by trauma or treatment induced during close reduction and internal fixation of displaced supracondylar humerus fracture through cross pinning or lateral pinning. The nerve injury is identified and confirmed through clinical examination by performing specific test for each of the median, ulnar and radial nerve. Variety (Extension and Flexion) & Type (Gartland) of supracondylar humerus fracture is identified on X-rays of concerned Elbow in both AP and Lateral views.

RESULTS

In this study total 437 patients with displaced supracondylar humerus fracture were observed. Out of these, 90 patients were selected as they suffered from nerve injury either traumatic or treatment induced. The results showed there were 54 (60%) boys and 36 (40%) girls. Mean age ± SD was 7 years.. Overall 82 (91.1%) patients had Extension variety and 8 (8.9%) patients had Flexion variety of supracondylar humerus fracture. In terms of Gartland type 60 (66.7%) patients had type III and 30 (33.3%) patients had type II fracture. Most commonly injured nerve from both Trauma and Treatment induce aspect was Median nerve in 36 (40%) followed by Ulnar nerve 33 (36.7%), Radial nerve 17 (18.9%), Multiple nerve injury in 4 (4.4%) patients. Results also showed that 54 (60%) children got traumatic nerve injury while 36 (40%) got Iatrogenic nerve injury Most commonly traumatic injured nerve in displaced supracondylar humerus fracture was found to be Median nerve 28 (51.8%) followed by Radial 17 (31.4%) and ulnar nerve 5 (9.2%). Multiple nerve injury also found in 4 (7.4 %) cases. In iatrogenic nerve injury, out of 36 patients, cross pinning was performed on 31 (86.1%) patients and Lateral pinning on 5 (13.8%) patients.

Table 1. Frequency of nerve injury with variety, nerve and gender

			Gender				
			Male		Female		Total
Nerve Injury	Variety	Nerve	(n)	%	(n)	%	
Trauma		Median	19	67.9	9	32.1	28
Injury		Radial	7	43.8	9	56.3	16
	Extension	Multiple	4	100	0	0	4
		Ulnar	0	0	0	0	0
		Median	0	0	0	0	0
		Radial	1	100	0	0	1
	Flexion	Multiple	0	0	0	0	0
		Ulnar	4	80	1	20	5
Iatrogenic		Median	2	28.6	5	71.4	7
Injury		Radial	0	0	0	0	0
	Extension	Multiple	0	0	0	0	0
		Ulnar	17	63	10	37	27
		Median	0	0	1	100	1
		Radial	0	0	0	0	0
	Flexion	Multiple	0	0	0	0	0
		Ulnar	0	0	1	100	1

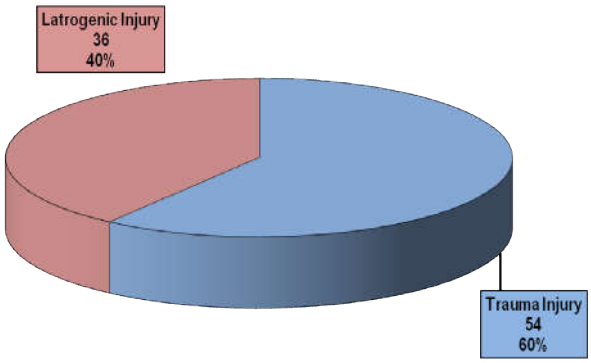


Figure 1. Frequency of patients according to nerve injury (n=90)

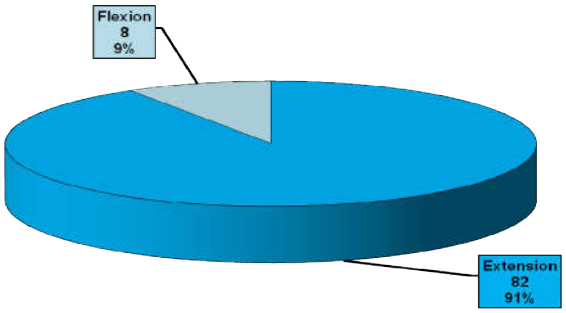
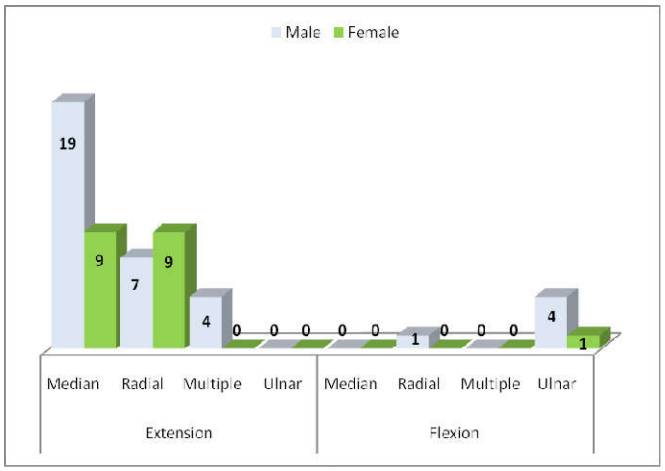


Figure 2. Frequency of patients according to variety

Traumatic nerve injury



Iatrogenic nerve injury

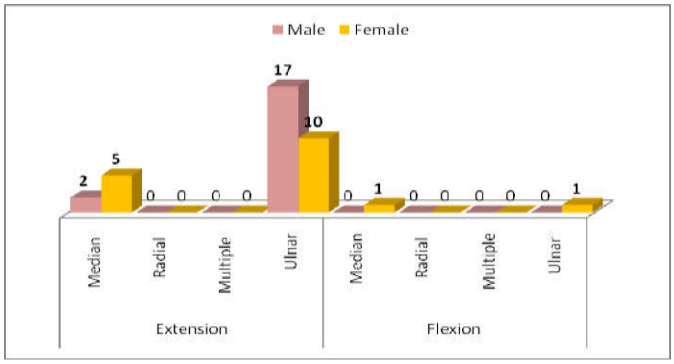


Table 2. Frequency of nerve injury with variety and fracture

			Gender				
			Male		Female		Total
Nerve Injury	Variety	Fracture	(n)	%	(n)	%	
Trauma Injury	Extension	II	8	100	0	0	8
		III	22	55	18	45	40
	Flexion	II	0	0	0	0	0
		III	5	83.3	1	16.7	6
Iatrogenic Injury	Extension	II	19	86.4	3	13.6	22
		III	0	0	12	100	12
	Flexion	II	0	0	0	0	0
		III	0	0	2	100	2

Table 3. Frequency and association of nerve injury with gender

		Nerve injury				Total	P-value
		Trauma Injury		Iatrogenic Injury			
		(n)	%	(n)	%		
Gender	Male	35	64.8	19	35.2	54	0.253*
	Female	19	52.8	17	47.2	36	

Table 4. Frequency and association of nerve injury with variety and gender

		Gender					
		Male		Female		Total	P-value
Nerve Injury	Variety	(n)	%	(n)	%		
Trauma Injury	Extension	30	62.5	18	37.5	48	0.408*
	Flexion	5	83.3	1	16.7	6	
Iatrogenic Injury	Extension	19	55.9	15	44.1	34	0.216*
	Flexion	0	0	2	100	2	

Most common nerve injured in cross pinning was found to be Ulnar nerve 27 (87.1%), second by Median nerve 4 (12.9%) & in terms of lateral pinning Median nerve 4 (80%) was the commonest nerve to be damaged followed by ulnar nerve 1 (20%).

DISCUSSION

The overall frequency of nerve injuries associated with cases of supra-condylar humerus fractures at our institute was 20.5%. Traumatic nerve injuries were the culprit in 12.3% and the rest that is 8.2% were iatrogenic. The pathophysiology of the traumatic nerve injuries has been attributed to the entrapment of the nerves against the sharp proximal fracture fragment of humerus (Brown and Zinar, 1995). Those identified as iatrogenic can trace back the occurrence to the time when the fractures are either being manipulated for reduction or when surgical pinning is being carried out. The pathophysiology of the fracture itself is age dependent, with the peak of fractures being seen in the ages between six and seven years (Brubacher and Dodds, 2008). It has been theorized that the thinness of the bone in this region predisposes it to the fracture in case of any trauma. The only methodology to control the occurrence of the traumatic nerve injuries is prevention. Only by minimizing the occurrence of the injury to the bones can the nerve be safeguarded. In the pediatric population this may be difficult but the obvious measures include wearing of protective gears and making play areas 'accident proof'. On the other hand continuous appraisal is required to ensure that the standards of care being imparted are meeting the internationally accepted levels. The incidence of iatrogenic nerve injuries in literature range from 2 to 6% (Rasool, 1998; Birch and Achan, 2000). In our review of the cases managed in our institute we did not identify any nerve injuries reductions and all of the iatrogenic nerve injury cases were in those patients who had been primarily treated with surgery. In this context the iatrogenic injury frequency is slightly on the higher side than that reported in the literature usually. A possible likelihood for this discrepancy may be the increased number of patients in our study.

Conclusion

Supracondylar fractures have a low to moderate association with nerve injuries. Iatrogenic nerve injury is less common and dependent on method of fixation. Diligent care must be taken for the prevention, early identification and management of these cases.

Limitation

Single centre retrospective study.

Recommendation

Need multicentre randomized control trials to formulate the accurate incidence of traumatic and iatrogenic nerve injuries in displaced supracondylar humerus fracture in pediatric age group.

Compliance with Ethical Standards: **YES**

Funding: The Authors declare that **no funding** was involved in this study.

Conflict of Interest

Osama Bin Zia declares that he has no conflict of interest. Muhammad Asif Peracha declares that he has no conflict of interest. S.M.Khalid Karim declares that he has no conflict of interest.Faizan Iqbal declares that he has no conflict of interest. Naveed Khan declares that he has no conflict of interest.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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