

# Incidence of traumatic axillary nerve injury after glenohumeral dislocation and fractures of the proximal humerus in Mansoura Emergency Hospital

\*Roshdy M. ElSllab (MD) and \*\*Naser M. Selim (MD)

\* Professor of orthopedic surgery  
\*\* Assistant prof. of orthopedic surgery,  
Orthopedic department,  
Knee surgery - arthroscopy and sports injuries unit,  
Mansoura university hospital,  
Faculty of medicine  
Corresponding author  
Naser M. SELIM (MD)  
Assistant prof. of orthopedic surgery  
Mansoura university Hospital, Egypt  
E-mail: [dr.nasserselim728@yahoo.com](mailto:dr.nasserselim728@yahoo.com)  
Telephone no: 01224214290

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## Abstract

### Aim of the study

Is to report the incidence of axillary nerve injury associated with anterior shoulder dislocation and proximal humeral fractures. Early detection of nerve injury allows early management and save the patient from salvage treatment as tendon transfer or shoulder arthrodesis.

### Patients and Methods

The study carried out on 135 patients, in the period between April 2015 and April 2016. Patients presented by shoulder trauma led to anterior shoulder dislocation or proximal humeral fracture. Follow up for one year after trauma was done in outpatient clinic.

### Results

Of 135 patients; partial axillary nerve injury was reported in 18 patients (13.3 %). There was a significant relation between incidence of axillary nerve injury and age, sex, type of injury and Type of fracture ( $p < 0.05$ ).

### Conclusion

The incidence of traumatic axillary nerve injury after glenohumeral dislocation and fractures of the proximal humerus was 13.3%. It is associated with anterior shoulder dislocation in 2.2% and it is associated with proximal humeral fractures in 11.1%.

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## Introduction

Traumatic axillary nerve injury represents less than 1% of all nerve injuries [1]. Up to 55% of all anterior shoulder dislocations [2, 3, 4] and in up to 58% of all proximal humeral fractures [5, 6] were reported to be associated with axillary nerve injury.

Five patients with deltoid paralysis were encountered in the period between March 2008 and May 2009[7]. Deltoid paralysis was due to complete traumatic axillary nerve injury. Patients initially presented by proximal humeral fracture and axillary nerve treatment was missed and neglected for one to two years. All patients were treated by trapezius tendon transfer.

This group of clinical cases pushed us to do prospective study of incidence of axillary nerve injury in our locality. Early detection of nerve injury allows early management and save the patient from salvage treatment as tendon transfer or shoulder arthrodesis.

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## Patients and Methods

The study carried out on 135 patients, in the period between April 2015 and April 2016. Patients presented by shoulder trauma led to anterior shoulder dislocation or proximal humeral fracture.

The ethical committee had accepted the performance of such a study. Patients' consent was mandatory for inclusion in the study after detailed explanation of the procedure and its aim.

All patients were subjected to thorough history taking. Patients were examined generally to exclude any other injury. Local examination of the shoulder included inspection, palpation and allowed range of motion especially abduction. Examination of muscle power (however difficult in acute situations) especially deltoid muscle was done. Neurovascular assessment of the affected limb was done for all cases including deltoid power and pin brick sensation at the regimental badge area. Plain x-ray shoulder (AP view) was done for all cases at time of presentation. Electromyography and nerve conduction studies were

ordered six weeks post injury for suspected cases. Diagnosis and treatment were done individually.

Statistical analysis was done using the SPSS (Statistical package for social science) program, version 20.0. The p-value (Probability of error) was calculated and the threshold of significance was fixed at 5% level. Research was accepted by the IRB (institutional research board).

The study included 78 male (57.8%) and 57 female (42.2%). the age of the patients ranged from 18 to 80 years, 68 patients (50.8%) below the age of 50, 67 patients (49.2%) above the age of 50, with a mean age of 45.4 years. The right side was affected in 71 patients (52.6%), while the left side was affected in 64 patients (47.4%). Low-energy trauma as fall on the ground was the mechanism of injury in 103 patients (76.3%), while high-energy trauma as motor vehicle accident reported in 32 patients (23.7 %).

The study included 53 patients (39.3%) presented with anterior shoulder dislocation. While 82 patients (60.7 %) presented with fractures of the proximal humerus. 4 patients had non-displaced Neer type I fracture, 47 patients had Neer type II fracture, 26 patients had Neer type III fracture and 5 patients had fracture-dislocation.

All patients (53 patients) presented with anterior shoulder dislocation were treated by conservative treatment (Fig.1, 2), in the form of closed reduction under anesthesia and immobilization in a sling for 3 weeks followed by exercise and physiotherapy.



**(Fig.1):** A 44-year-old, female was involved in a high speed car accident, presented by anterior dislocation of the right shoulder

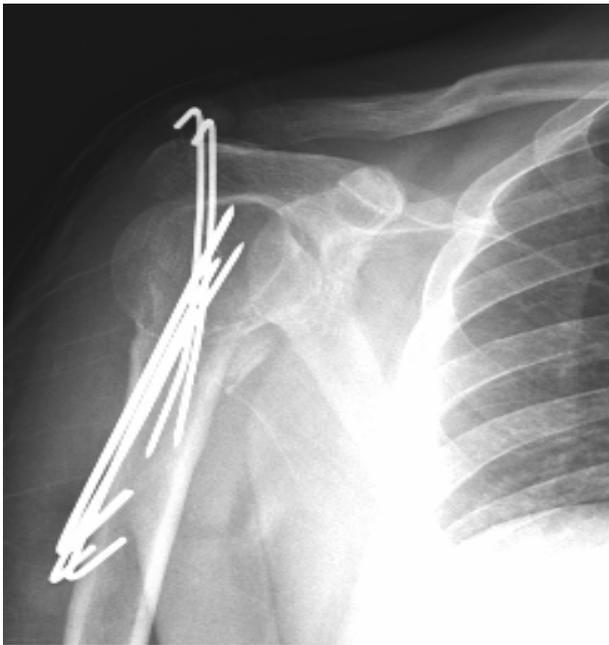


**(Fig.2):** The patient was treated by closed reduction under anesthesia. The patient had partial axillary nerve palsy with a mild denervation of the right deltoid.

57 patients presented with fractures of the proximal humerus were treated conservatively. 13 patients presented with fractures of the proximal humerus were treated by closed reduction under image intensifier and percutaneous pinning (Fig. 3, 4).



**(Fig.3):** A 52-year old, male fall down the stairs on his right shoulder, presented by proximal humeral fracture



**(Fig.4):** Closed reduction and percutaneous pinning was done for fracture fixation. The patient had partial axillary nerve injury with partial axonal degeneration

12 presented with fractures of the proximal humerus were treated by open reduction and internal fixation using locked proximal humeral plate (Fig. 5, 6).

The patient demographic data are shown in table.1



**(Fig.5):** A 59-year old, female slid down the street on her left shoulder, was presented by proximal humeral fracture (Neer III)



**(Fig.6):** The treatment consisted of open reduction and internal fixation by locked plate. The patient had partial axillary nerve injury with partial axonal degeneration

## Results

Of 135 patients; **partial axillary nerve injury** was reported in 18 patients (13.3 %). 14 patients (10.4 %) with injured axillary nerve were older than 50 years, while only 4 patients (3 %) are younger. Axillary nerve injury was found in 12 women (8.9 %) and 6 men (4.4 %). Right side included in 11 patients (8.1 %), left side in 7 patients (5.2 %). High energy trauma was the mechanism of injury in 10 patients (7.4 %), low energy in 8 patients (5.9 %). 3 patients (2.2 %) presented by anterior shoulder dislocation and 15 patients (11.1 %) presented by proximal humeral fractures.

In this study, 3 of 53 patients (5.7 %) presented with anterior shoulder dislocation had axillary nerve injury, while axillary nerve injury detected in 15 of 82 patients (18.3 %) presented with fractures of the proximal humerus. For patients presented with fracture of proximal humerus, axillary nerve injury was found in 6 of 57 patients (10.5 %) treated conservatively, 3 of 13 patients (23 %) treated by pinning and 5 of 12 patients (41.6 %) treated by open reduction and internal fixation using locking proximal humeral plate.

For patients presented with fractures, 3 of 47 patients (6.4 %) with two-part fracture pattern had axillary nerve injury, 10 of 26 patients (38.5 %) with three-part fracture pattern had axillary nerve injury and 2 of 5 patients (40 %) presented with fracture-dislocation had axillary nerve injury.

There was a significant relation between incidence of axillary nerve injury and age, sex, type of injury (anterior shoulder dislocation or proximal humeral fracture) and Type of fracture ( $p < 0.05$ ).

**Table 1:** patient demographic data

The variables		Patients (135)	
		No.	% (no. /135)
Age	below 50	68	50.8
	above 50	67	49.2
Sex	male	78	57.8
	female	57	42.2
Side	right	71	52.6
	left	64	47.4
Trauma	high energy	32	23.7
	low energy	103	76.3
Injury type	anterior shoulder dislocation	53	39.3
	proximal humeral fracture	82	60.7
Type of fracture	one- part fracture	4	2.9
	two-part fracture	47	34.8
	three-part fracture	26	19.2
	fracture-dislocation	5	3.7
Type of treatment	conservative	110	81.5
	operative	25	18.5
Type of operative treatment	pc pinning	13	9.6
	plate fixation	12	8.9

**Table 2:** data analysis

The variables		Axillary nerve injury (18)			Chi square	P-value
		No.	% (no. /18)	% (no. / 135)		
Age	below 50	4	5.9	3	-	<b>0.002*</b>
	above 50	14	20.9	10.3		
sex	male	6	7.7	4.4	<b>4.00</b>	<b>0.046*</b>
	female	12	21.1	8.9		
side	right	11	15.5	8.1	<b>1.77</b>	<b>0.18</b>
	left	7	10.9	5.2		
trauma	high energy	10	31.3	7.4	<b>0.44</b>	<b>0.5</b>
	low energy	8	7.8	5.9		
Injury type	anterior shoulder dislocation	3	5.7	2.2	-	<b>&lt;0.001*</b>
	proximal humeral fracture	15	18.3	11.1		
Type of fracture	one- part fracture	0		0	<b>19.11</b>	<b>&lt;0.001*</b>
	two-part fracture	3	6.4	2.2		
	three-part fracture	10	38.5	7.4		
	fracture-dislocation	2	40	1.5		
Type of treatment	conservative	10	9,1	7.4	<b>0.44</b>	<b>0.5</b>
	operative	8	32	5.9		
Type of operative treatment	pc pinning	3	23	2.2	-	<b>0.69</b>
	plate fixation	5	41.6	3.7		

From above results, **high risk factors** for axillary nerve injury due to anterior shoulder dislocation and proximal humeral fractures are:

1. Patients above 50
2. Females Patients
3. Fractures of the proximal humerus
4. Three part fractures

## Discussion

The shoulder joint is vital in performing activities of daily living, which often require a great range of motion. This joint sustains large amounts of strain during repeated motion in aggressive activities, such as professional sports [4].

Traumatic axillary nerve injury may be partial or complete, isolated or combined, iatrogenic or because of direct contusion, fracture or dislocation. It is vulnerable to damage after acute trauma to the shoulder leading to anterior dislocation, proximal humeral fractures, or direct impact to the anterolateral part of the shoulder. It is also may be injured by surgical trauma to the shoulder such as open or arthroscopic procedures [1, 8, 9].

Many axillary nerve injuries may be missed and neglected because it is subclinical and masked by the pain due to shoulder trauma [9, 11]. Early recognition of axillary nerve injury is important to inform patients about their anticipated delayed recovery and to ensure appropriate treatment<sup>(12, 13)</sup>. Neglected axillary nerve injury leads to deltoid weakness, or paralysis and so severe disability in daily living activities and employment<sup>(14)</sup>. If no spontaneous recovery occurs or when nerve repair and physiotherapy are unsuccessful, shoulder arthrodesis or tendon transfers have been advocated [15].

The aim of this study is to report the incidence of axillary nerve injury after anterior shoulder dislocation and fractures of the proximal humerus in patients who were managed Emergency Hospital between April 2015 and April 2016.

Clinical examination was valuable in detection of nerve lesions due to anterior shoulder dislocation but it is proved to be less valuable in detection of nerve lesions due to proximal humeral fractures because it was difficult to distinguish between muscle weakness due to a nerve lesion and that due to pain or the fracture.

This study shows that axillary nerve injuries are more frequent in females than males, old than young patients, proximal humeral fractures than anterior shoulder dislocations and in displaced fractures than in non-displaced fractures [16].

A greater force during the trauma can result in a more severe bony injury and more severe nerve injury. The high trauma energy harms females than males, old than young patients, and causes fractures than dislocation and leads to more displacement of fractures [16].

Several studies evaluated the incidence of axillary nerve injury after anterior shoulder dislocation and

proximal humeral fractures. The incidence of axillary nerve injury varied widely in the reported studies. Some studies evaluated the incidence of axillary nerve palsy in selected series or only in the elderly population; others depended on electromyography study after three weeks post trauma.

Visser et al. (2001) studied the severity, the pattern, and the recovery of nerve lesions by electrophysiological investigation in 142 patients presented with proximal humeral fractures, he found that axillary nerve injury was in 83 patients (58 %) and almost all patients were elderly [16].

Robison et al. (2012) studied the prevalence of and risk factors for rotator cuff tears, tuberosity fractures, and neurological deficits associated with shoulder dislocation in 3633 patients, 2861 presented with dislocation and 772 associated with fracture of the greater tuberosity. Neurological deficits were in 492 patients (13.5 %), axillary nerve injury with dislocation was in 200 patients (6.7 %), and EMG was done after six weeks [13].

Atef et al. (2015) studied the prevalence of osseous, soft tissue and neurological lesions around the shoulder after traumatic anterior glenohumeral dislocations in 240 patients, 37 with fracture of the greater tuberosity. Axillary nerve injury was reported in 38 patients (15.83 %). Axillary nerve injury with shoulder dislocation was in 23 patients (9.5 %) and nerve injury with fracture in 15 patients (6.25 %). Electromyography study was done after 20 days post injury and this may explain the higher incidence of axillary nerve injury than that reported in this study [17].

De laet et al. (1994) studied the frequency and distribution of nerve lesions in patients with primary shoulder dislocation or fracture of the humeral neck in 101 patients, 57 with a humeral neck fracture, 37 with primary shoulder dislocation and 7 patients with fracture dislocation ( anterior shoulder dislocation associated with fracture of the greater tuberosity) . 37 % of patients had axillary nerve injury, only 8 (7.9%) patients had solitary axillary nerve injury and most of cases are elderly. The study of de Laet et al. did not distinguish between dislocation or fracture groups and reported that all injuries were due to low energy trauma [18].

Our study included 135 patients (78 male patients and 57 female patients), 53 patients (39.3%) presented with acute anterior shoulder dislocation and 82 patients (60.7%) presented with proximal humeral fractures. Axillary nerve injury reported in 18 patients (13.3%); 3 patients (2.2%) with anterior shoulder dislocation and 15 patients (11.1%) with proximal humeral fractures.

In Our study there *are some risk factors* for axillary nerve injury with acute shoulder trauma; it may occur more in high velocity trauma than low velocity trauma, in elderly than in young patients, in female than in male patients, in fractures of the proximal humerus than in anterior shoulder dislocations and in fracture dislocations and displaced fractures than in non-displaced fractures.

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## Conclusion

Axillary nerve injury reported 13.3%; associated with anterior shoulder dislocation in 2.2% and associated with proximal humeral fractures in 11.1%.

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