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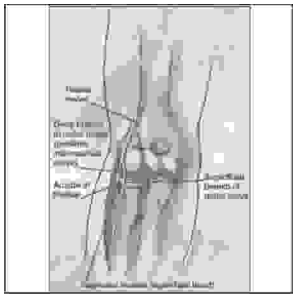
RADIAL NERVE INJURIES;
PRESENTING AS WRIST DROP-ANALYSIS OF 100 PATIENTS



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ABSTRACT… Objective: To highlight etiological factors leading to radial nerve injury resulting in wrist drop, with particular reference to iatrogenic causes. **Design:** Retrospection & Descriptive. **Material & Methods:** One hundred patients of all ages and both sexes with wrist drop. Data of clinical assessment after detailed history and examination as well as electro diagnostic studies was recorded on pre-designed assessment proforma. The outcome was charted down for frequency of etiology of the wrist drop. **Setting:** Rehabilitation Medicine Department of Combined Military Hospital (CMH) Multan and Armed Forces Institute of Rehabilitation Medicine (AFIRM). **Results:** The major cause of injury was splinter/gun shot injury 31%, mis-placed injection at mid-arm 21%fracture of humerus was 21%, compression neuropathy 16%, and stab wound 11% caused wrist drop. Electro-physiological studies revealed that 85% patients had injury to radial nerve at mid-arm, 9% had injury to posterior interosseous nerve while 4% had injury to superficial branch of radial nerve and only 2% had normal study. Electrodiagnostic studies also revealed that majority of the patients suffered from axonotmesis (44%) and neurapraxia (38%), whereas (16%) were neurotmesis. **Conclusion:** The most common cause of radial nerve injury is trauma. It is also found that the frequency of radial nerve palsy due to iatrogenic causes is quite high. In addition to the clinical examination, the nerve conduction studies and electromyography proved to be the better investigation technique in the assessment of the location, severity and extent of the peripheral nerve injury and subsequently guides in starting the proper treatment option due to early referral of patient to the concerned fields.

Key words: Radial nerve injury, wrist drop, nerve conduction study, electromyography, Neuraprexia, Axonotmesis, Neurotmesis.

INTRODUCTION

Wrist drop is the most common presentation of radial nerve palsy due to humeral shaft fractures, gun-shot wounds, mis-placed injections and compression or

ischemia. The risk results from the anatomic position of radial nerve which runs around the distal portion of shaft of humerus, in contact with bone[1].As a rule, pattern of clinical involvement is dependent on level of injury[2]. In spite of increased experience in the management of theses devastating injuries, there remains considerable debate about the optimum management, even in the best centers[3] .

The aim of this study was to highlight etiological factors leading to radial nerve injury resulting in wrist drop with particular references to iatrogenic causes in patients who have reported in Rehabilitation Department for treatment.

MATERIAL & METHODS

This is a retrospective descriptive study. It was conduced at Combined Military Hospital (CMH) Multan in collaboration with Armed Forces Institute of Rehabilitation Medicine (AFIRM) Rawalpindi, which is a tertiary health care center mainly for Armed Forces personnel, their dependents and civilian population of upper Punjab, NWFP, Northern Areas and Kashmir.

One hundred patients of all ages and both sexes were studied. Non-probability sampling technique was used. The study included patients having wrist drop due to radial nerve along with paralysis or weakness of extensors of wrist, fingers and thumb, supinator and/ or anesthesia on the dorsal aspect of hand and muscle wasting. Most of the patients included were outdoor cases referred by consultants or primary health care physicians.

Patients with wrist drop due to upper motor neuron lesions like Cerebral palsy (in children), following stroke (in adults) and brain tumors were excluded from the study. The study also excluded patients with wrist drop due to systemic manifestations like Diabetes mellitus, Rheumatoid Arthritis, Leprosy etc. and due to brachial plexus injury (post cord injury or injury to roots, $C_{6,7,8}$). Patients were examined after detailed history with special references to mode of injury. Data of clinical assessment was recorded on pre-designed proforma.

Nerve conduction studies were done using surface electrodes to evaluate sensory and motor nerves of upper extremity. The sensory and motor conduction velocities, latencies and amplitude in these nerves were noted. Electromyography was carried out with concentric needle electrodes, intentional activity, involuntary activity like fibrillations and positive sharp waves were noted. Recommended protocol of electro-diagnostic studies for radial nerve was followed. Statistical analysis of data was done by SPSS 10 for windows.

RESULTS

out of 100, (n=100), 65% patients were male and 35% females (Table I).

Table-I. Distribution in Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	65	65.0	65.0	65.0
Female	35	35.0	35.0	100.0
Total	100	100.0	100.0	

The age ranged between 17 and 34 years (mean age 28.6 years). During clinical assessment 22% patients had suspicion of no injury, 63% with radial nerve injury at mid arm, 11% with deep branch injury. Superficial branch of radial nerve was thought to be injured in 4% patients (Table II). Commonest cause of radial nerve injury was splinter injury / gun shot wound (31%), while misplaced injection and fracture of humerus were second most common (21% each). Compression neuropathy caused wrist drop in 16% cases and stab wounds 11% (Table III and Figure 1).

NCS / EMG studies revealed 2% patients had no injury, 85% with radial nerve injury mid-arm level, 9% with posterior interosseous nerve injury nerve injury 4% had injury to superficial branch of radial nerve (Table IV).

Table-II. Level of Injury Clinically				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Normal	22	22.0	22.0	22.0
Radial Nerve Midarm	63	63.0	63.0	85.0
Posterior Interosseous Nerve	11	11.0	11.0	96.0
Superficial Branch of Radial Nerve	4	4.0	4.0	100.0
Total	100	100.0	100.0	-

Table-III. Frequencies of Etiology				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Misplaced Injection	21	21.0	21.0	21.0
Gun shot/Splinter injury	31	31.0	31.0	52.0
Stab Wound	11	11.0	11.0	63.0
Fracture	21	21.0	21.0	84.0
Compression	16	16.0	16.0	100.0
Total	100	100.0	100.0	-

Table-IV. Level of Injury on NCS/ EMG				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No Injury	2	2.0	2.0	2.0
Injury Radial Nerve	-	-	-	-
Mid-arm	85	85.0	85.0	87.0
Injury Posterior	-	-	-	-
Interosseous Nerve	9	9.0	9.0	96.0
Injury Superficial	-	-	-	-
Branch Radial Nerve	4	4.0	4.0	100.0
Total	100	100.0	100.0	-

82% patients had injury to only one nerve while 16% had involvement of more than one nerves (Table V). In 48% of the patients (n=48) the injury was on right side while in 52% (n=52) the injury was left sided (Table VI).

Table-V. No. of Nerves Involve				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid No Injury	2	2.0	2.0	2.0
Single Nerve	82	82.0	82.0	84.0
More than one nerve	16	16.0	16.0	100.0
Total	100	100.0	100.0	-

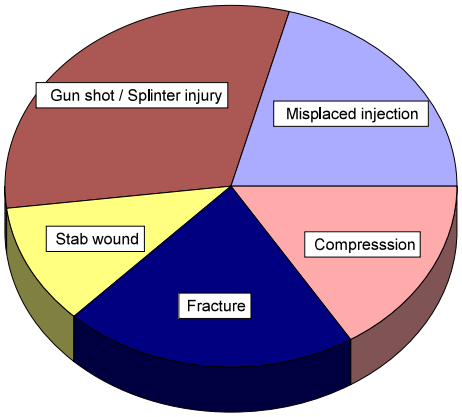
Table-VI. Slides Involved				
	Frequency	%age	Valid %age	Cumulative %age
Valid Right Side	48	48.0	48.0	48.0
Left Side	52	52.0	52.0	100.0
Total	100	100.0	100.0	-

Table-VII. Type of Nerve Injury				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Normal	2	2.0	2.0	2.0
Neuroprexia	38	38.0	38.0	40.0
Axonotmesis	44	44.0	44.0	84.0
Neurotmesis	16	16.0	16.0	100.0
Total	100	100.0	100.0	-

Majority of the patients suffered from axonal lesion (44%) while neurapraxia was the second (38%) common cause (Table VII). 80% patients showed good results (MRC scale 4 or more) with conservation treatment while18% had to be referred for surgical option. Only 5% patients showed poor results with all available measures of management and rehabilitation (Table VIII).

Table-VIII. Management				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Conservative	80	80.0	80.0	80.0
Surgical	18	18.0	18.0	98.0
Management				
Not Required	2	2.0	2.0	100.0
Total	100	100.0	100.0	-

Fig-1. Causes of radial nerve injury in this study



DISCUSSION

Peripheral nerve injuries remain, of great economic and industrial importance because of their effect on human quality of life. Wrist drop is a common presentation of many localized or systemic disorders involving peripheral or central nervous system[4]. Radial nerve is one of the most frequently injured of all nerves[5]. Radial nerve palsy in arm most commonly is caused by fracture of humerus[6]. This palsy may occur acutely at the time of injury, secondary to fracture manipulation, or from a healing callus. Radial nerve may be injured at axilla by direct pressure such as "crutch palsy" caused by improper crutches or pressure caused by hanging the arm over the back of chair "Saturday night palsy"[7]. A patient with wrist drop should be thoroughly investigated because a lot of causes can be traced like intoxicated sleep[(7)], mis-placed injections, improper position during anesthesia, tourniquet effects, soldiers and professional shooters while practicing in kneeling position, posterior dislocation of shoulder joint and radiculopathy C [7,8]. Nerve palsy following operation is one of causes of the iatrogenic peripheral nerve injury[8].

Trauma to peripheral nerves is unfortunately not uncommon in our country. Although exact figures at national level are not available, but incidence of peripheral nerves especially radial nerve is on the rise, primarily due to increase in road traffic accidents and upsurge of violence in our society in general. The potential for permanent neurological deficit as well as the immediate threat to life and limb has challenged those dealing with traumatic peripheral nerves injuries. These injuries are infrequent in civilian practice. In recent military conflicts they have made up 2.6% to 14% of all peripheral nerve injuries treated[3,9].

Peripheral nerve injury in modern warfare result most frequently from low velocity missiles, endangers a wide distribution of nerves, and is often associated with bone fractures and vascular injuries[9]. Accurate diagnosis essential for prescribing appropriate treatment. The electro-diagnosis is the tool of choice for objective evaluation of the functional status of involved peripheral nerves[(10)] . These studies are technically demanding but are of great value in localizing the lesion, assessing underlying pathophysiology and it gives useful information regarding severity and subsequent prognosis[11].

As far as the type of nerve injury is concerned the axonal lesions cause immediate clinical weakness and numbness. Wallerian degeneration, takes 4 to 7 days to develop, up to this time distal NCS remains normal. After wallerian degeneration amplitude of nerve potentials decreases, with relative preservation of conduction velocities and distal latencies. However in the demyelinating lesions the conduction velocity (CV) is less than 75% of normal and distal latency (DLAT) 130% of upper limit of normal. Neurotmesis being the least common (18%) but has worst prognosis. The mean age in our study was 28.5 years and 65% patients were male, as in accordance with study by Brich the mean age was 28 years[12].

Gun shot/splinter injuries are the leading cause (31%) in our study. This is comparable with study of Guo Y. et al[(13)] who carried out their study in one of country hospital and found that gunshot wounds and trauma (blunt) are the leading causes. In our study misplaced injections and fractures (21% each) are the second most common causes, while compression neuropathy (19%) being the third these results are comparable with study of Huang Y[14] conducted in the Institute of Orthopedics and

Traumatology, Fourth Military Medical University, Xi'an, China, which revealed that iatrogenic nerve injuries incurred through injection of therapeutic agents in 84 patients (19%) out of 226 and undue compression from an ill-fitting splint or plaster cast in 26 patients (6%).

As for as extent of injury is concerned the lesion in continuity i.e neuraprexia (38%) and axonal lesion (44%) being the most common type of injury, this is again in consistent with the international studies[12,15,16]. Injury to single nerve was found most commonly (82%), while involvement of more than one nerve was seen in 16% of the patients. These results are comparable with the study of Markovic D et al[17]. There was a reasonably good correlation between clinical assessment and results of NCS/EMG. In our study clinically 63% patients were suspected to have injury of radial nerve at mid-arm level, while on NCS / EMG 85% of patients showed injury to radial nerve mid-arm. 11% cases were suspected to have injury of posterior interosseous nerve clinically while on NCS/EMG percentage was 9%. Clinically 4% were thought to have injury to superficial branch of radial nerve which was also the same on elector diagnostic studies. Electrodiagnostic studies picked up abnormalities in 98% of cases where as clinically 88% were suspected to injury.

Non-operative treatment should be considered for all patients with nerve injury at the first place. The first advice to the patients is avoidance of activities which resulted in trauma and irritation to the nerve. Conservation treatment produced good results in 80% of patients in our study [Medical Research Council (MRC) scale 4 or more], while 18% had to be referred for surgical intervention. Only 5% of patients showed poor result with all available rehabilitation measures.

CONCLUSION

Radial nerve injuries are a commonly encountered problem especially in armed forces medical services. The most common cause of such injuries is gun shot wounds and other blunt traumas. However iatrogenic causes are also on a rise. These causes are easily avoidable with proper training of paramedical staff and incurred, satisfactory results can be excepted and its consequences can be minimized when recognized and treated early and properly. Thorough and appropriate knowledge of anatomy is the responsibility of all the health care professionals especially while dealing such problems in order to detect the patients at earlier stage and planing such appropriate treatment in order to prevent the occurrence of complications.

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