Original article:

Spectrum of occupational peripheral nerve injuries due to metallic foreign body

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Abstract:

The knowledge of nerve injuries, historically has been refined and learnt during war. In peace time, acute PNIs generally result from motor vehicle accidents, lacerations with sharp objects, penetrating trauma, stretching or crushing trauma and fractures, and gunshot wounds. It has been found that the commonest cause of PNI varies according to the region of study, number of hospitals included, and the social context at the time of study being carried out .Nerve injuries have a huge disabling effect on the person because they take a long time to heal and not in-frequently leave a residual disabilitydespite the best possible treatment. It has been found that PNI patients had >20% loss of daily activities, lived with moderate pain and 39% of them had signs of clinical depression.

Keywords: peripheral nerve

Introduction:

The knowledge of nerve injuries, historically has been refined and learnt during war. In peace time, acute PNIs generally result from motor vehicle accidents, lacerations with sharp objects, penetrating trauma, stretching or crushing trauma and fractures, and gunshot wounds[1]. It has been found that the commonest cause of PNI varies according to the region of study, number of hospitals included, and the social context at the time of study being carried out[2].Nerve injuries have a huge disabling effect on the person because they take a long time to heal and not in-frequently leave a residual disabilitydespite the best possible treatment. It has been found that PNI patients had >20% loss of daily activities, lived with moderate pain and 39% of them had signs of clinical depression[4]

Occupational nerve injuries are generally due to penetrating injuries or high velocity sharp foreign bodies which not only affect the nerve but also surrounding vessels, muscles and tendons, thereby compounding the complexity. Occupational nerve injuries are sparsely reported in literature. Occupational nerve injuries have a separate dimension of its own in the sense that it affects the economically productive age group and lead to significant decline in livelihood of affected person and his dependents.

The study was carried out in a tertiary care teaching hospital catering to patients from industrial area and one of the largest steel fabrication industrial area is in our drainage area. So, a lot of patients with occupational nerve injuries have reported to us. This study is an attempt to address the prevalence, effect and prevention of such injuries.

Material and Methods:

This is a retrospective study in which records of industrial workers who sustained on site nerve injuries during their course of employment and presented to our hospital between 2010 and 2016 were analysed. 37 patients in the age group of 18-60 years of age with nerve injury were included. The epidemiological factors, nerve involved in injury, anatomic location of injury, any associated tendon and vascular injuries and time span between injury and surgery were recorded. All these patients' had penetrating nerve injuries while working on machines from metallic foreign body and were operated at our hospital. Most of these patients reported late to us as they took initial treatment at some primary centre. Patients having nerve injuries along with fracture of long bone were excluded.

IBM SPSS version 22 was used to carry out descriptive statistical analysis. Categorical data was expressed as frequency and percentage. Quantitative data was expressed as mean,standard deviation (SD), median (interquartile range). Ethical clearance was taken by the ethical committee of the institute.

Results:

The study included 34 men (91.89%) and 3 women (8.11%). The mean age of the patients was 33.3 years (range: 18-60 years). Age wise distribution of peripheral nerve injury in patients is shown in figure 1. The right side was found to be injured on 83.78% occasion while the left 16.22%. All our patients were right hand dominant.

Most commonly injured nerve among all nerves was median nerve (n=26; 70.27%). Figure 2 shows the involvement of all the nerves. In seven cases there were more than one nerve injured. Median nerve was the only nerve to be injured along with one of the other nerves (table 1). The most common anatomic site of nerve injury was proximal third forearm (35.14%) (table 2).

The entry wound of metallic foreign body was from the medial side of the upper extremity on 45.95% of the cases while 40.54% cases had from the flexor aspect. The rest happened from the lateral side while none from extensor side. There were associated injuries like tendon injuries (2 cases) and vascular injuries in few cases (brachial artery-3, ulnar artery- 2). The mean time span between the injury and the surgery was 57.16 days (p25=8, p50=42, p75=96)(range 0- 214 days).

Table 1* Distribution of combined lesions

Nerve	Frequency
Radial nerve	1
Ulnar nerve	4
Posterior interosseous nerve	2

*All the above cases involved median nerve along with one other nerve.

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Table 2[#]

LOCATION	Frequency	Percent
Mid third arm	5	13.51
Distal third arm	12	32.43
Proximal third arm	13	35.14
Middle third forearm	3	8.11
Distal third forearm	4	10.81

[#]Distribution of nerve injuries according to the location.

Figure 1: Age wise distribution of peripheral nerve injury

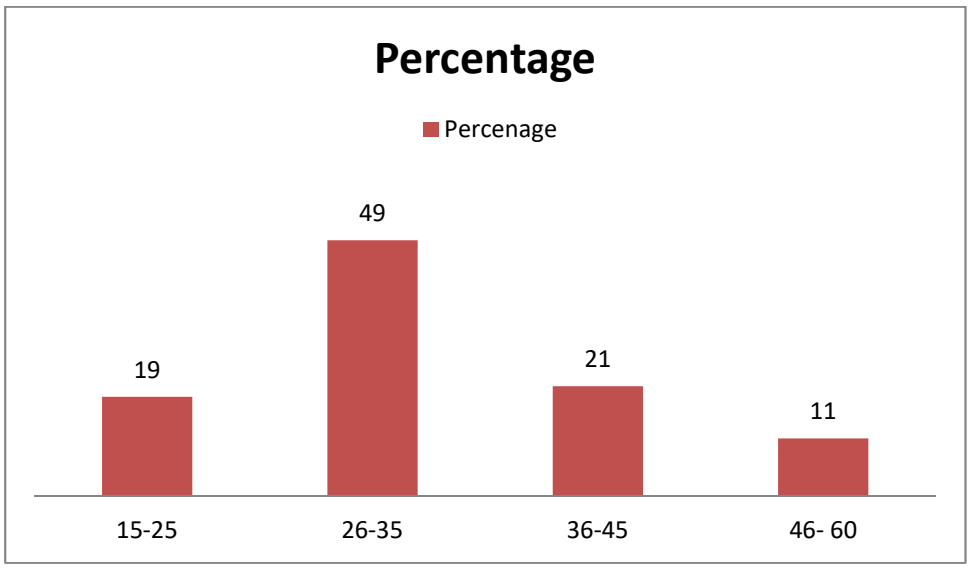

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Figure 2: Distribution of peripheral nerve injuries.

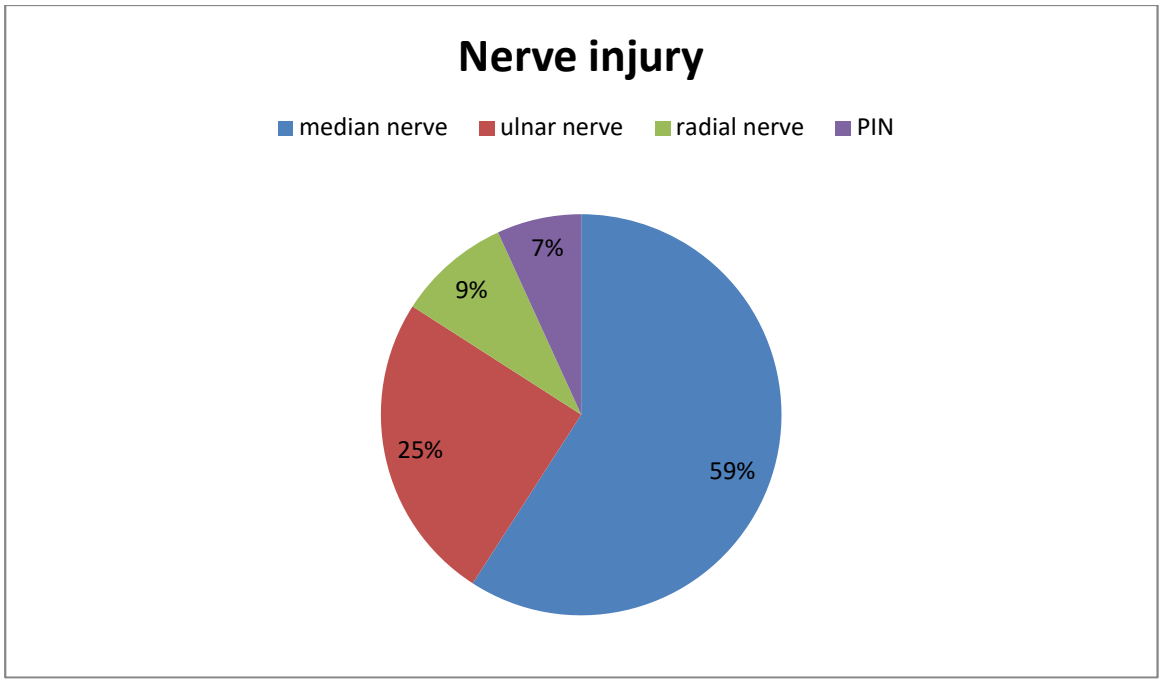

Figure 3: Radiographs showing metallic foreign body at different locations.

A)AP and lateral views of arm

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B) AP and lateral views of elbow

c) AP and lateral views of distal third forearm

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Figure 4: Intraoperative exposure of metallic foreign body.

Figure 5: Scar marks on upper extremity of different patients

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Discussion:

In 1956, Marinacci *et al.*[5]in California carried out a studywith industrial workers having traumatic lesions of peripheral nerve. They described atrophy of disuse along with neurogenic muscular atrophy due to traumatic peripheral neve lesions in these workers and how electromyography would be useful to make diagnosis. The present study is unique in its own way, only those cases were included which were diagnosed to have traumatic peripheral nerve injury due to foreign metallic body. Figure 3 shows metallic foreign body at different locations in our case series.

Nemethi [6](1956) looked at data of industrial clinic and evaluated the nerve injuries of hand. It was found that 90% of those cases had common volar digital nerve injuries. Their patients had injuries due to sharp cutting instruments, semi-sharp spinning tools and blunt objects as well. Sharp cutting injuries resulted in a clean division of nerve. Similarly, a review through the operative notes of patients included in this study reported injury to nerve due to sharp metallic pieces of steel (figure 4).

The mean age of patients in our study is 33.3 years. They all fall into the working productive age group. This is similar to another recent study[7]that looked at the epidemiology of traumatic PNI in Puerto Rico (Miranda and Torres, 2016). Males are found to have far more traumatic PNI. This again is very similar to other studies carried out in past[7,8]. Thus, all around the globe it is the same strata of population that is being affected by traumatic PNI.

Upper extremity is more prone for traumatic PNI especially in industrial workers. This study is focussed on upper extremity traumatic PNIs. When both upper and lower extremity were studied over a periodof 16 years along with several etiological factors it was found that in almost 3/4th cases upper limb was involved[8]. Isolated nerve lesions form the major chunk of total PNIs. But combined lesions are not uncommon. 18.91% cases in the present study had more than one nerve involved. Combined lesions most commonly involved median and ulnar nerve. It is important to note that same nerves have been reported in highest numbers in combined lesions in other study[8,9].This probably is due to their relative anatomic proximity. Occurrence of combined median and ulnar nerve lesions has been reported as high as 32.5%[9].

Traumatic PNI have been reported to have associated vascular injuries. According to the site of injury the vascular component varies. In the present study, on three instances brachial artery and twice ulnar artery was found to be damaged intraoperatively on exploration of the wound. Along with these two arteries even radial artery has been reported to be injured in studies which reported about PNIs in wounds over palmer side of wrist[9].They reported vascular injury in 75% of their cases. They took variety of etiological causes of PNI at wrist level. In the present study, two out of four PNI cases at distal third forearm had vascular injury. Injuries at this level are highly prone for nerve and arterial injuries. Thus, it can be inferred that at wrist level strict protective measures should be taken in order to prevent such injuries which have poor prognosis.

The proximal forearm was the most common anatomical site to be injured in this study (figure 5); we recommend special protective wear around elbow and wrists. More so, majority of the injuries (>85%) took place from medial and anterior aspect of upper extremity. This probably could be because of the posture of the limb while working. Based on these findings, protective wear can be redesigned, as the primary targets for prevention of injuries have been identified.

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All the patients reported late to us as they always approached small nursing homes because their primary concern after injury is to achieve hemostasis and it was later that they realized about motor-sensory loss.

Due to this a significant number were not suitable for end to end anastomosis and cable nerve grafting was needed to repair the injured nerves.

There are a few limitations of this study. NCV and EMG data was not available for analysis. Results of surgical procedure could not be assessed as patients were lost to follow up. In the future, study over longer period of time with more number of patients can be conducted.

Conclusion:

So, from this study we can infer that better care on prevention of traumatic PNIs in industrial workers should be taken. It gives us the primary targets to focus on for development of better protective wear. As traumatic PNIs are complex injuries requiring high cost acute surgical repair, preventing them would mean cost reduction in healthcare expenditure as well as reduction in compensations. In the long term, this will reduce the incidence of disability in the productive age group all over the world.

References:

1) Robinson LR. Traumatic injury to peripheral nerves. Muscle & nerve. 2000 Jun 1;23(6):863-73.
2) Campbell WW. Evaluation and management of peripheral nerve injury. Clin Neurophysiol. 2008 Sep;119 (9):1951-65.
3) McAllister RM, Gilbert SE, Calder JS, Smith PJ. The epidemiology and management of upper limb peripheral nerve injuries in modern practice. Journal of Hand Surgery. 1996 Feb;21(1):4-13.
4) Bailey R, Kaskutas V, Fox I, Baum CM, Mackinnon SE. Effect of upper extremity nerve damage on activity participation, pain, depression, and quality of life. The Journal of hand surgery. 2009 Nov 30;34(9):1682-8.
5) Marinacci AA, Rand CW. Nerve lesions in industry—atrophy of disuse as a confusing element in diagnosis; the value of electromyography. California medicine. 1958 Jan;88(1):33.
6) Nemethi CE. Repair of nerve injuries in the hand. California medicine. 1956 Jan;84(1):35.
7) Miranda GE, Torres RY. Epidemiology of traumatic peripheral nerve injuries evaluated with electrodiagnostic studies in a tertiary care hospital clinic. Puerto Rico health sciences journal. 2016 May 24;35(2):76-80.
8) Kouyoumdjian JA. Peripheral nerve injuries: a retrospective survey of 456 cases. Muscle & nerve. 2006 Dec 1;34(6):785-8.
9) Kilinc A, Ben SS, Dubert T, Dinh A, Osman N, Valenti P. Results of primary repair of injuries to the median and ulnar nerves at the wrist. Chirurgie de la main. 2009 Apr;28(2):87-92.

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