RESEARCH ARTICLE

Neuropathy following intramuscular injections: a clinical and neurophysiological study from a tertiary care centre in Pakistan

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Abstract

Objective: To assess the clinical and neurophysiological profile of peripheral nerve injuries in patients following intramuscular injections.

Method: The descriptive, cross-sectional study was conducted at the Department of Neurology, Mayo Hospital, Lahore, Pakistan, from July 2019 to January 2021, and comprised adult patients of either gender with isolated peripheral nerve injuries following intramuscular injections. Nerve conduction studies were performed for each patient. Data was analysed using SPSS 26.

Results: Of the 99 patients, 59(59.6%) were males and 40(40.4%) were females. The mean age was 26.7+/-18.1 years, 34(34.3%) patients were under weight and 78(78.8%) were either illiterate or had low literacy level. Radial nerve was involved in 56(56.6%) cases, followed by sciatic in 39(39.4%) and axillary nerve 4(4.04%). Overall, 14(14.14%) injection had been administered by doctors, while the other 85(85.85%) were given by paramadics. Marked reduction in compound muscle action potential 72(72.7%) and sensory nerve action potential 82(82.8%) was noted, while re-innervation was seen in 78(78.7%).

Conclusion: Intramuscular nerve injuries can be greatly minimised by spreading awareness regarding safe injection techniques and strict implementation of standard operating procedures in hospitals and clinics.

Key Words: Intramuscular injections, (M, Peripheral nerve injuries, PNI, Neuropathy.

(JPMA 73: 1179; 2023) **DOI: 10.47391/JPMA.4794**

Introduction

Intramuscular injection (IM) has been used for centuries as a mode of parenteral drug delivery. However, reasons for using the IM route for administration of drugs and the technique adopted vary worldwide.[1] IM injection may be necessary when there is a need to ensure the delivery of medication, such as when the patient is uncooperative or non-responder to oral treatment or when oral administration is not possible.[2] In developing countries, like Pakistan, injections are frequently used to treat common ailments. IM injections may damage peripheral nerves at the injection site.[3] The World Health Organization (WHO) has estimated that nearly 16 billion injections are administered globally every year, but 90% of them are given in medical care and most of them are given unnecessarily.[4]

It is a dilemma of developing countries, such as Pakistan, that injections are frequently used to treat minor ailments, altogether ignoring the risks associated with it. This malpractice can be attributed to multiple factors, including cultural norms, social myths, misbeliefs, lack of education, unawareness and quackery, to name a few.[1]

Neurological sequelae can range from minor transient sensory disturbances to severe sensory disturbances and paralysis with poor recovery.[5] The most common causes of injection nerve palsy are unnecessary injections, faulty techniques and administration of injections by unqualified personnel.[6,7,8]

Several mechanisms are associated with injection-related nerve injury, like direct needle trauma, toxic effects of injected agents on nerve fibres and surrounding tissues, nerve compression due to haematoma or oedema formation, and many others.

Among them, direct needle trauma is the most frequent factor. Therefore, sufficient knowledge of anatomy, an understanding of the injection procedure, and proper skills in needle placement are essential to avoid these complications.[9,10]

The current study was planned to assess the clinical and neurophysiological profile of peripheral nerve injuries (PNIs) in patients following IM injections.

Patients and Methods

The descriptive, cross-sectional study was conducted at

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the Department of Neurology, Mayo Hospital, Lahore, Pakistan, from July 2019 to January 2021. After approval form the institutional ethics review committee, the sample size was calculated with 95% confidence level, 9% absolute precision and expected percentage of PNIs 67% using the formula.[11]

$$n = \frac{Z_{21-a/2}\, p(1-p)}{d^2}$$

where; Z21-a/2= confidence level, p= prevalence, q=1-p and d=absolute precision.

"Sample size determination in health studies" was used to calculate sample size.

Patients were collected by Non-probability consecutive sampling technique. Those included were adult patients of either gender with isolated PNIs following IM injections. Those who did not want to participate were excluded.

After taking informed consent from the patients, demographic data was collected using a predesigned proforma. Patients were specifically inquired about the site of injection and who had dispensed the injection. Patients who had neurological pain immediately or soon after IM injection in upper arm or buttock, or weakness of arm and foot were referred to the electromyography (EMG) laboratory. The nerve conduction study (NCS) was done using Cadwell Excel Electromyography (Kennewick, WA, United States). The electrophysiological findings were recorded, and compound muscle action potential (CMAP) and sensory nerve action potential (SNAP) were categorised into grade I (amplitude not affected), grade II (amplitude 50-100% of the reference lower limit or 40-50% of the intact side) and grade III (amplitude <50% of the lower reference limit).[12,13]

Data was analysed using SPSS 26. Data was expressed as frequencies and percentages. The comparison of nerve damage among various factors was performed using the chi-square likelihood ratio test. P≤0.05 was considered statistically significant.

Results

Of the 105 patients enrolled, 99(94.3%) finished the study. Of them, 59(59.6%) were males and 40(40.4%) were females. The mean age was 26.7+/-18.1 years, 34(34.3%) patients were underweight and 78(78.8%) were either illiterate or had low literacy level. The cause of injection was analgesia for 58(58.6%), antibiotic 23(23.2%) and 13(13.1%) had no apparent reason. Also, 73(73.7%) had no knowledge of the drug administered, and 31(31.3%) had requested the injection themselves. Overall, 14(14.14%) injections had been administered by doctors, and 28(28.2%) injections had been administered in a hospital setting. Motor findings were noted in 32(32.3%) cases, while in 61(61.6%) case both motor and sensory clinical findings were noted (Table 1).

Table-1: Characteristics of the patients.

Characteristics		N	%
BMI(kg/m^2)	≤ 18.5	34	34.3
	18.5 – 22.9	39	39.39
	23- 27.49	25	25.25
	>27.5	1	0.01
Duration (months)	≤ 1.0	3	3
	1.0 – 2.5	24	24.2
	2.5 – 4.0	47	47.5
	4.0 +	25	25.3
Medicine	Diclofenac	11	11.1
	Dimenhydrinate	5	5.1
	Methycobalamin	5	5.1
	Drotaverine	5	5.1
	UNKNOWN	73	73.7
Visit	First	49	50
	Routine	49	50
Prescribed by	Doctor	68	68.7
	Self	31	31.3
Given by	Doctor	14	14.1
	Dispenser	53	53.5
	Nurse	32	32.3
Given in	Hospital	28	28.3
	Dispensary	71	71.7
Symptoms	Immediate	90	90.9
	Delayed	9	9.1
Findings	Motor	32	32.3
	Sensory	6	6.1
	Both	61	61.6

BMI: Body mass index. Caleyachetty R, M Barber T, Mohammed NI, Cappuccio FP, Hardy R, Mathur R, et al. Ethnicity-specific BMI cutoffs for obesity based on type 2 diabetes risk in England: a population-based cohort study. The Lancet. July 2021; 9(7): 419-426.[18]

Table-2: Distribution of peripheral nerve involvement

	Axillary (n=4)		Radial (n=56)		Sciatic (n=39)		*p-value*
	n	%	N	%	N	%	
Gender							
Male	4	6.8	37	62.7	18	30.5	0.018
Female	Nil	0.0	19	47.5	21	52.5	
Given by							
Doctor	Nil	0.0	5	35.7	9	64.3	0.060
Dispenser	4	7.5	32	60.4	17	32.1	
Nurse	Nil	0.0	19	59.4	13	40.6	
Given at							
Hospital	Nil	0.0	17	60.7	11	39.3	0.029
Dispensary/Clinic	4	5.6	39	54.9	28	39.4	

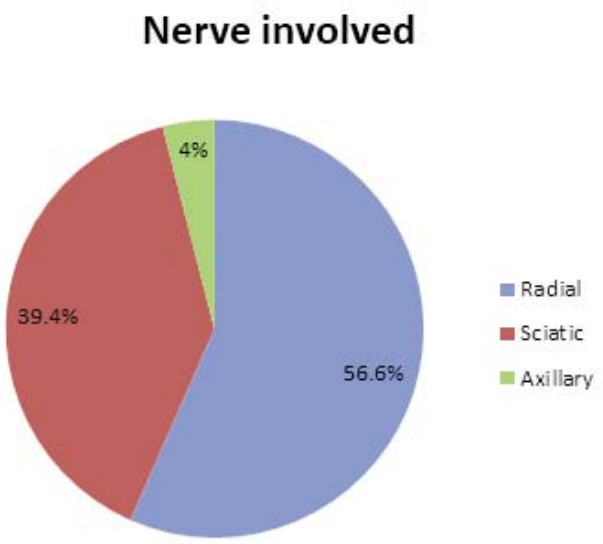

Figure: Pattern and distribution of nerve involvement

Radial nerve was involved in 56(56.6%) cases, followed by sciatic in 39(39.4%) and axillary nerve 4(4.04%) (Figure). Gender was significant in terms of the nerve involved in the injury ($p<0.05$), while majority of the radial nerve damage was caused by dispensers and nurses (Table 2).

Marked reduction in CMAP 72(72.7%) and SNSP 82(82.8%) was noted, while re-innervation was seen in 78(78.7%) cases (Table 3).

Table-3: Electrophysiological findings on NCS/EMG

Clinical findings	CMAP			SNAP			Total
	Grade I	Grade II	Grade III	Grade I	Grade II)	Grade III	
Motor	Nil	12(12.1%)	20(20.2%)	Nil	9(0.09%)	23(23.2%)	32(32.3%)
Sensory	Nil	6(0.06%)	Nil	Nil	2(0.02%)	4(0.04%)	6(0.06%)
Both	1(0.01%)	8(0.08%)	52(52.5%)	1(0.01%	5(0.05%)	55(55.5%)	61(61.6%)
Total	1(0.01%)	26(26.2%)	72(72.7%)	1(0.01%	16(16.1%)	82(82.8%)	99

NCS: Nerve conduction study, EMG: Electromyography (EMG), CMAP: Compound muscle action potential, SNAP: Sensory nerve action potential,)

Discussion

IM nerve injuries are a lingering problem even in this day and age. Of 16 billion injections administered worldwide annually, 90% given in curative care are unsafe and most of them are unnecessary.[4] Nerve injuries are perceived to be a constant health and economic burden for patients and healthcare systems in developing countries, like Pakistan. In the current study, almost half (50%) of the patients affected with nerve injury routinely had IM injections for ailments, and 30% insisted on having an injection instead of tablet even without their physician's recommendation. Analgesia was the most common cause for an IM injection, followed by antibiotic usage and antiemetic administration. The findings are similar to that of Pandian et al.[11]

In the current study, 53% patients had had injection from dispensers and nurses, and 70% had low or no basic education. Lack of education has an obvious association with poverty. In a study in India, 82% patients suffering from nerve injuries were associated with low socioeconomic status.[11] Lack of education and poverty could be linked to the increased tendency to visit unqualified dispensers.[14] A total of 73% patients in the current study had no information about the drug administered to them. This can be attributed to low education level. A similar study reported 18% cases with severe nerve injury were due to IM injections.[15] The current study showed that most of the patients with PNIs were male (59.6%) and had low BMI (34.3%). The injuries may have been due to lack of protective pad of fat among such subjects.[16] This male predominant trend was similarly seen in another study[12].

The most common nerve affected was radial, followed by sciatic and axillary in the current study. This observation is contrary to those of other reported studies in which the sciatic nerve was more commonly affected than the radial nerve.[14] The increased tendency of radial nerve damage in Pakistan could be due to reluctance for gluteal region exposure in Pakistani population attributable to religious and cultural norms.

In the current study, there was no significant association between clinical and electrophysiological findings. This is in contrast to a study in South Korea where significant association was found between the two.[17] In contrast, other studies show no association between clinical and electrophysiological findings which is similar to the current study. [12]

The small sample size of the current study was a limitation, and, also, patients were not followed up to monitor progress of recovery in these cases.

Conclusion

IM nerve injuries can be greatly minimised by spreading awareness regarding safe injection techniques and strict implementation of standard operating procedures in hospitals and clinics across Pakistan.

Disclaimer: None.

Conflict of Interest: None.

Source of Funding: None.

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