Electrodiagnostic Evaluation of Prognostic Factors Influencing the Surgical Outcomes of Upper Extremity Nerve Injuries Caused by Penetrating Trauma: A Cross-sectional Study

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ABSTRACT

Background: Peripheral nerve damage is a major cause of disability, which can lead to serious limitations in daily and occupational activities. Although primary repair can restore the function of the damaged organ remarkably, factors predicting the prognosis of nerve repair are a topic of constant debate. We aimed to investigate the factors affecting the outcomes of primary nerve repair in patients afflicted by upper extremity nerve injuries following penetrating trauma.

Methods: This cross-sectional study was conducted on 51 patients referred to Shohada-ye Ashayer Hospital in Khorramabad, Iran, from 2016 to 2021. Data including the patient's age, gender, education, type, severity, and mechanism of injury, the damaged nerve, time and of method repair, the surgeon's specialty, as well as the electrodiagnostic findings, were collected and analyzed using SPSS software version 22.

Results: The mean age of the patients was 30.41 ± 12.63 years, and the majority of them (84.3%) were men. A significant relationship was found between the sensory amplitude with education (P=0.002), the type of damaged nerve (P=0.048), and the severity of injury (P=0.012). The positive sharp wave was significantly associated with the surgeon's specialty (P=0.034). Besides, the motor amplitude was considerably related to the patient's age (P=0.040) and the surgeon's specialty (P=0.035).

Conclusion: Factors determining the outcome of peripheral nerve repair following penetrating trauma to the upper extremity include age, education, the type of damaged nerve, the severity of the injury, and the surgeon's specialty.

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KEYWORDS

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INTRODUCTION

Peripheral nerve injuries are a common neuro surgical condition that can attenuate motor and sensory functions, resulting in physical disability 1. About 20 million Americans are afflicted by peripheral nerve injuries each year, resulting in an annual cost of 150 billion dollars 2, 3. Peripheral nerve injuries can be caused by different mechanisms such as trauma and iatrogenic interventions. However, most cases of nerve damage in the upper limbs are caused by trauma 1, 4. These injuries occur mostly in young active individuals and diminish their quality of life 1, 5. The impaired nerve fibers can regenerate spontaneously, however, this ability is limited by the size of the nerve defect, as well as the formation of neuroma and scar, denoting the importance of early nerve reconstruction^{6,7}.

The reconstruction of impaired peripheral nerves is critical for the achievement of a decent regeneration. Nevertheless, recovery from the injuries is usually dissatisfying. Besides the complications of reconstruction, ambiguity in the prognostic factors is a substantial challenge. Early surgical intervention in affected individuals based on their profile of prognostic factors can ameliorate the outcomes of peripheral nerve injury 8. Some modifiable and unmodifiable factors such as age, gender, educational level, type of damaged nerve, and site of the injury have been attributed to the success rate of nerve repair 8,9. However, the outcomes of nerve reconstruction have been seldom examined using valid and reliable tools 10.

Electrodiagnostic studies, including electromyography (EMG) and nerve conduction velocity (NCV), are considered the gold standard for detecting nerve injuries and predicting the outcomes of their reconstruction 11. Given the infrequent use of valid and reliable tools to determine the factors affecting the outcomes of primary nerve repair in previous studies, we aimed to design to examine the prognostic factors for the outcomes of primary nerve repair in patients afflicted by upper extremity nerve injuries following penetrating trauma.

METHOD AND MATERIALS

Study design and participants

This was a descriptive cross-sectional study conducted at the Shohada-ye Ashayer Hospital in Khorramabad, Iran, from 2016 to 2021. The inclusion criteria were undergoing primary nerve repair following upper extremity nerve injuries caused by penetrating trauma. The patients were excluded if their medical files were incomplete. The sampling method was census and 51 patients who met the inclusion criteria were included.

Data collection

After obtaining written and informed consent, data including the patient's age, gender, educational level, type, severity, and mechanism of injury, type of damaged nerve, time and of method repair, and the surgeon's specialty were collected from the patient's medical files. All patients were examined using EMG and NCV tests by the same neurologist. Then, the findings were registered into a researcher-made checklist.

Data analysis

The collected data were analyzed using SPSS software version 22 (IBM Corp., Armonk, NY, USA). Descriptive statistics tools including contingency tables, frequency, and percentage as well as mean and standard deviation and were used to describe the data. Furthermore, the Chi-square test was used to examine the relationship between categorical variables. The significance level was considered < 0.05 for all statistical tests.

Ethical considerations

This study was approved by the Research Ethics committee of Lorestan University of Medical Sciences with the ethical IR.LUMS.REC.1399.381. Written informed consent was obtained from all participants in this study. The checklists were designed anonymously and patients' personal information was kept confidential.

RESULTS

Fifty-one patients with upper limb nerve injuries due to penetrating trauma were studied. The mean age of the patients was 30.41 ± 12.63 with a minimum age of 11 and a maximum of 68 years. Other demographic characteristics are shown in

The frequency distribution of EMG/NCV findings in patients is shown in Table 2. Motor amplitude was normal in 11 patients, while showed a ≤50%

Table 1: Frequency distribution of demographic variables in patients with the upper limb nerve injury

	Variable	Frequency	Percentage
Gender	Female	8	15.7
Gender	Male	43	84.3
A ga (x100#0)	≤30	29	56.9
Age (years)	30<	22	43.1
Underlying diseases	Yes	6	11.8
Underlying diseases	No	45	88.2
	Lower than a high school diploma	31	60.8
Educational level	High school diploma	15	29.4
	College or university degree	5	9.8
Place of residence	Urban	41	80.4
riace of residence	Rural	10	19.6

Table 2: Frequency distribution of EMG/NCV findings in patients with the upper limb nerve injury

Varia	Variable		Percentage
	Normal	11	21.6
Matan amplituda	≤50% decrease	7	13.7
Motor amplitude	50%< decrease	8	15.7
	None	25	49.0
	Normal	7	13.7
Sensory amplitude	Decreased	5	9.8
	None	39	76.5
Docitive cham vyeve	No	22	43.1
Positive sharp wave	Yes	29	56.9
Dolombasiavysva	No	26	51.0
Polyphasic wave	Yes	25	49.0

decrease in 7, and a 50%< decrease in 8 subjects. Sensory amplitude was normal in 7 patients and reduced in 5 patients.

As shown in Table 3, the frequency of patients with no motor amplitude was higher in those aged >30 years (n=13; 59.1%) The statistical analysis showed a significant relationship between motor amplitude and age (P=0.040). Besides, there was a significant association between motor amplitude and surgeon's specialty (P=0.035). As the patients operated by plastic surgeons had the highest frequency of normal motor amplitude (n=10; 34.5%).

However, there was no significant relationship between motor amplitude with gender (P=0.845), place of residence (P=0.347), educational level (P=0.604), damaged organ (P=0.111), the severity of nerve damage (P=0.295), mechanism of injury (P=0.727), damaged nerve (P=0.561), duration between injury and repair (P=0.357), and duration

between repair and electrodiagnostic studies (*P*=0.097).

As shown in Table 4, three patients (7.1%) with complete nerve injury had normal sensory amplitude while four patients (44.4%) with partial injury showed normal amplitude. The analysis revealed a significant relationship between the severity of nerve damage (P=0.012). There was also a remarkable relationship between sensory amplitude and damaged nerve (P=0.048). As eleven patients with ulnar injuries (91.7%) showed no sensory amplitude. Patients with an educational level lower than a high school diploma had the lowest rate of normal sensory amplitude (n=2; 6.5%), and there was a significant relationship between sensory amplitude and educational level (P=0.002).

However, there was no significant relationship between sensory amplitude with gender (P=0.232), place of residence (P=0.813), damaged organ

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(P=0.679), mechanism of injury (P=0.199), age (P=0.886), duration between injury and repair (P=0.348), duration between repair and electrodiagnostic studies (P=0.870), and surgeon's specialty (*P*=0.400).

As shown in Table 5, there was a significant relationship between positive sharp waves with damaged organs (P=0.007). Arm and Forearm injuries were associated with the highest frequency of positive sharp waves. (n=1; 100% and n=12;

Table 3: Relationship between motor amplitude and patient's characteristics

				Motor an	aplitude		
	Variable		Normal	≤50%	50%<	None	<i>P</i> -valu
			Normai	decrease	decrease	None	
	Male	Frequency	9	6	6	22	
Gender	Maie	Percentage	20.9	14.0	14.0	51.2	0.845
Gender	Female	Frequency	2	1	2	3	0.845
	Temate	Percentage	25.0	12.5	25.0	37.5	
	Urban	Frequency	9	5	5	22	
Place of residence	Orban	Percentage	22.0	12.2	12.2	53.7	0.347
r face of residence	Rural	Frequency	2	2	3	3	0.347
	Kurar	Percentage	20.0	20.0	30.0	30.0	
Educational level	College or	Frequency	2	1	0	2	
	university degree	Percentage	40.0	20.0	.0	40.0	
	High school	Frequency	1	2	3	9	0.604
	diploma	Percentage	6.7	13.3	20.0	60.0	0.00-
	Lower than a high	Frequency	8	4	5	14	
	school diploma	Percentage	25.8	12.9	16.1	45.2	
	Wrist	Frequency	9	5	7	11	0.111
	VV 115t	Percentage	28.1	15.6	21.9	34.4	
_	Forearm	Frequency	2	1	0	11	
	rorearm	Percentage	14.3	7.1	.0	78.6	
Damaged organ	Elbow	Frequency	0	0	0	1	
Damaged organ		Percentage	.0	.0	.0	100.0	
	Arm Shoulder	Frequency	0	1	0	0	
		Percentage	.0	100.0	.0	.0	
		Frequency	0	0	1	2	
	Shoulder	Percentage	.0	.0	33.3	66.7	
	Complete	Frequency	7	5	7	23	
Severity of nerve	Complete	Percentage	16.7	11.9	16.7	54.8	0.295
damage	Partial	Frequency	4	2	1	2	0.270
		Percentage	44.4	22.2	11.1	22.2	
	Cut	Frequency	9	7	7	23	
Mechanism of		Percentage	19.6	15.2	15.2	50.0	0.725
injury	Consolina	Frequency	2	0	1	2	0.727
	Crushing	Percentage	40.0	.0	20.0	40.0	
		Frequency	4	2	0	6	
	Radial	Percentage	33.3	16.7	.0	50.0	
The damaged		Frequency	5	4	5	13	+
nerve	Median	Percentage	18.5	14.8	18.5	48.1	0.561
nerve		Frequency	2	1	3	6	+
	Ulnar	Percentage	16.7	8.3	25.0	50.0	+
		Frequency	5	7			
	≤30	Percentage	17.2	24.1	5 17.2	12 41.4	-
Age (years)			+				0.040
	30<	Frequency	6	0	3	13	
		Percentage	27.3	.0	13.6	59.1	

				Motor an	plitude		
Variable			Normal	≤50% decrease	50%< decrease	None	P-value
	1	Frequency	8	4	4	8	
Duration	1	Percentage	33.3	16.7	16.7	33.3	
	2	Frequency	1	0	1	2	
	2	Percentage	25.0	.0	25.0	50.0	0.357
between injury	2	Frequency	2	2	1	6	0.337
and repair (days)	3	Percentage	18.2	18.2	9.1	54.5	
	4≤	Frequency	0	1	2	9	
		Percentage	.0	8.3	16.7	75.0	
Duration	≥2	Frequency	1	0	0	0	0.097
		Percentage	100.0	.0	.0	.0	
between repair and	2-4	Frequency	5	0	2	6	
		Percentage	38.5	.0	15.4	46.2	
electrodiagnostic	>4	Frequency	5	7	6	19	
studies (months)	≥4	Percentage	13.5	18.9	16.2	51.4	
	General	Frequency	0	1	3	7	
Surgeon's specialty	General	Percentage	.0	9.1	27.3	63.6	0.035
	Dlastia	Frequency	10	5	5	9	
	Plastic	Percentage	34.5	17.2	17.2	31.0	
	O., 41 41	Frequency	1	1	0	9	
	Orthopedics	Percentage	9.1	9.1	.0	81.8	

85.7%, respectively). Moreover, patients operated by plastic surgeons showed the lowest frequency of positive sharp waves (n=12; 41.4%). The statistical analysis demonstrated a significant relationship between positive sharp waves and the surgeon's specialty (P=0.034).

However, there was no significant relationship between positive sharp waves with gender (P=0.713), place of residence (P=0.556), educational level (P=0.544), the severity of nerve damage (P=0.150), mechanism of injury (P=0.641), damaged nerve (P=0.559), age (P=0.503), duration between injury and repair (P=0.516), and duration between repair and electrodiagnostic studies (P=0.727).

As shown in Table 6, patients with forearm injury had the lowest frequency of polyphasic waves (n=3;21.4%). There was a significant relationship between polyphasic waves with damaged organs (P=0.014).

However, there was no significant relationship between polyphasic waves with gender (P=0.626), place of residence (P=0.725), educational level (P=0.836), the severity of nerve damage (P=0.075), mechanism of injury (P=0.668), damaged nerve (P=0.404), age (P=0.779), duration between injury and repair (P=0.710), duration between repair and

electrodiagnostic studies (P=0.523), and surgeon's specialty (P=0.091).

DISCUSSION

We investigated the factors affecting the outcomes of primary nerve repair in 51 patients afflicted by upper extremity nerve injuries following penetrating trauma. Prognostic factors of the outcomes of nerve repair following penetrating trauma to the upper extremity included age, education, the type of damaged nerve, the severity of the injury, and the surgeon's specialty. In our study, most of the patients aged ≤30 years. Previous studies have widely demonstrated the highest proportion of peripheral nerve injuries in young people, especially in the age group of 20 to 30 years, who comprise the most active members of societies 12-14. In the studied population, the frequency of men was about 5 times that of women. The male predominance among patients afflicted by peripheral nerve injuries is widely reported in the literature 15, 16. In most societies, men are more involved in occupational activities compared to women. In addition, most of the victims of accidents are reported to be young men, which leads to an increased risk of trauma and

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subsequent nerve injury ¹⁷. However, except for an association between older age and higher frequency of lack of motor amplitude, the present study showed no significant relationship between electrodiagnostic findings with gender and age. Where physical

examination and questionnaires have been used to evaluate postoperative neurological function, women and younger individuals have shown a better recovery from peripheral nerve injuries ⁸. However, few studies that have utilized electrodiagnostic tests

Table 4: Relationship between sensory amplitude and patient's characteristics

	Variable			Sensory amplitude		P-valu
	Variable		Normal	Decreased	None	1 - vaic
	Male	Frequency	6	3	34	
Gender	Marc	Percentage	14.0	7.0	79.1	0.232
Gender	Female	Frequency	1	2	5	0.232
	Temate	Percentage	12.5	25.0	62.5	
Place of residence	Urban	Frequency	6	4	31	
		Percentage	14.6	9.8	75.6	0.813
	Rural	Frequency	1	1	8	0.813
	Kurar	Percentage	10.0	10.0	80.0	
	College or	Frequency	1	3	1	
	university degree	Percentage	20.0	60.0	20.0	
Educational level	High school	Frequency	4	0	11	0.002
Educational level	diploma	Percentage	26.7	.0	73.3	0.002
	Lower than a high	Frequency	2	2	27	
	school diploma	Percentage	6.5	6.5	87.1	
	Wrist	Frequency	5	2	25	0.679
	VV FIST	Percentage	15.6	6.3	78.1	
	Forearm	Frequency	2	3	9	
		Percentage	14.3	21.4	64.3	
Damaged organ	Elbow	Frequency	0	0	1	
Damaged organ		Percentage	.0	.0	100.0	
	Arm	Frequency	0	0	1	
		Percentage	.0	.0	100.0	
	Shoulder	Frequency	0	0	3	
	Shoulder	Percentage	.0	.0	100.0	
	Complete	Frequency	3	5	34	
Severity of nerve	Complete	Percentage	7.1	11.9	81.0	0.012
damage	Partial	Frequency	4	0	5	0.012
	F al tial	Percentage	44.4	.0	55.6	
	Cut	Frequency	5	5	36	
Mechanism of injury		Percentage	10.9	10.9	78.3	0.199
vicciianioni di mjury	Crushing	Frequency	2	0	3	0.19
	Crusning	Percentage	40.0	.0	60.0	
	Radial	Frequency	4	0	8	
		Percentage	33.3	.0	66.7	
The demograd name	Median	Frequency	2	5	20	0.048
The damaged nerve	Median	Percentage	7.4	18.5	74.1	0.048
	Ulnar	Frequency	1	0	11	
	Umar	Percentage	8.3	.0	91.7	
		Frequency	3	3	23	
Age (years)	≥30	Percentage	10.3	10.3	79.3	0.886
1180 (70013)	20 -	Frequency	4	2	16	0.000
	30<	Percentage	18.2	9.1	72.7	7
		Frequency	6	2	16	0.348

to determine the prognostic factors of peripheral nerve injury confirm our findings ¹⁸.

In patients with low-level nerve injuries (forearm and wrist), the frequency of polyphasic waves was lower than in those with high-level injuries. Nerve regeneration occurs at a rate of 1 mm per day while muscle atrophy initiates immediately after denervation. Owing to the longer time needed for the motor endplate to be reinnervated in traumas to the proximal parts of the extremities; it is not

Table 5: Relationship between the presence of positive sharp waves and patient's characteristics

	Variable		Positive sh	narp wave	<i>P</i> -value
	v ariable		No	Yes	r-value
	W 1	Frequency	18	25	
Gender	Male	Percentage	41.9	58.1	0.713
	Female	Frequency	4	4	
	remate	Percentage	50.0	50.0	
	Urban	Frequency	18	23	
Place of residence		Percentage	43.9	56.1	0.556
Trace of residence	Rural	Frequency	4	6	0.550
	Kurai	Percentage	40.0	60.0	
	College or university	Frequency	2	3	
	degree	Percentage	40.0	60.0	
Educational level	High school diploma	Frequency	7	8	0.544
Educational level		Percentage	46.7	53.3	0.544
	Lower than a high school diploma	Frequency	13	18	
		Percentage	41.9	58.1	
	Wrist	Frequency	16	16	-
		Percentage	50.0	50.0	
	Forearm	Frequency	2	12	
	rorearm	Percentage	14.3	85.7	
Damagad argan	Elbow	Frequency	1	0	0.007
Damaged organ	Elbow	Percentage	100.0	.0	0.007
	Arm	Frequency	0	1	
	AIII	Percentage	.0	100.0	
	Shoulder	Frequency	3	0	
	Shoulder	Percentage	100.0	.0	
	Complete	Frequency	16	26	
Severity of nerve	Complete	Percentage	38.1	61.9	0.150
damage	Partial	Frequency	6	3	0.130
	ı aitidi	Percentage	66.7	33.3	

Variable			Positive sl	narp wave	<i>P</i> -value
	T GLIGOTE		No	Yes	r-vaiue
	Cut	Frequency	9	7	
Markaniana Ciri		Percentage	19.6	15.2	0.641
Mechanism of injury	0.11	Frequency	2	0	0.041
	Crushing	Percentage	40.0	.0	
	Radial	Frequency	7	5	
		Percentage	58.3	41.7	-
	36.10	Frequency	10	17	
The damaged nerve	Median	Percentage	37.0	63.0	0.559
	XII	Frequency	5	7	
	Ulnar	Percentage	41.7	58.3	-
Age (years)		Frequency	13	16	
	≤30	Percentage	44.8	55.2	0.503
		Frequency	9	13	
	30<	Percentage	40.9	59.1	
	1	Frequency	13	11	0.516
		Percentage	54.2	45.8	
	2	Frequency	1	3	
Duration between		Percentage	25.0	75.0	
injury and repair (days)	3	Frequency	4	7	0.516
(days)		Percentage	36.4	63.6	
		Frequency	4	8	
	4≤	Percentage	33.3	66.7	-
	≥2	Frequency	1	0	
Duration between	<u> </u>	Percentage	100.0	.0	
repair and	2-4	Frequency	5	8	
electrodiagnostic	2-4	Percentage	38.5	61.5	0.727
studies (months)		Frequency	16	21	
	≥4	Percentage	43.2	56.8	
	Com1	Frequency	3	8	
	General	Percentage	27.3	72.7	0.034
	Plastic	Frequency	17	12	
Surgeon's specialty		Percentage	58.6	41.4	
		Frequency	2	9	-
	Orthopedics	Percentage	18.2	81.8	-

surprising that they are associated with poorer motor recovery ^{8, 19}.

Consistent with the prior assumptions, patients with partial injury showed a higher chance of presenting normal sensory amplitude than those with complete injury. In severe limb trauma, which

leads to complete nerve injury, multiple tissues are usually damaged. Peripheral nerve components of this mixed injury type are often the most difficult to diagnose and treat. This fact is justified by the difficulty in differentiating partial from complete damages without surgical exploration and the

dubious nature of nerve healing ^{20, 21}. In the current study, the majority of patients with ulnar nerve injury showed no sensory amplitude. A vast body of evidence indicates that the outcome of radial nerve injuries is better than the median

nerve and the ulnar nerve has the poorest prognosis. However, the existing data are mostly focused on the motor component of the nerves, and there is a lack of data on factors affecting the rate of recovery of peripheral nerve function after primary repair due

Table 6: Relationship between the presence of polyphasic waves and patient's characteristics

	Variable		Polypha	sic wave	<i>P</i> -value
	variable		Yes	No	P-value
	N/ 1	Frequency	21	22	
0 1	Male	Percentage	48.8	51.2	0.626
Gender	т 1	Frequency	4	4	0.626
	Female	Percentage	50.0	50.0	1
	YY 1	Frequency	21	20	
DI C 11	Urban	Percentage	51.2	48.8	0.525
Place of residence	D 1	Frequency	4	6	0.725
	Rural	Percentage	40.0	60.0	
	College or	Frequency	3	2	
	university degree	Percentage	60.0	40.0	1
	High school	Frequency	7	8	-
Educational level	diploma	Percentage	46.7	53.3	0.836
	Lower than a	Frequency	15	16	7
	high school				7
	diploma	Percentage	48.4	51.6	
	Wrist	Frequency	17	15	
	Wrist	Percentage	53.1	46.9	
	Forearm	Frequency	3	11	
		Percentage	21.4	78.6	0.014
D 1	Elbow	Frequency	1	0	
Damaged organ		Percentage	100.0	.0	
	Arm	Frequency	1	0	
		Percentage	100.0	.0	
	01 11	Frequency	3	0	
	Shoulder	Percentage	100.0	.0	
	0 14	Frequency	18	24	
Severity of nerve	Complete	Percentage	42.9	57.1	0.075
damage	D (1.1	Frequency	7	2	0.075
	Partial	Percentage	77.8	22.2	
	Cut	Frequency	22	24	
M 1 ' C''		Percentage	47.8	52.2	0.660
Mechanism of injury	0.11	Frequency	3	2	0.668
	Crushing	Percentage	60.0	40.0	7
	Radial	Frequency	8	4	
		Percentage	66.7	33.3	7
mi i i	Nr. 1:	Frequency	12	15	0.40:
The damaged nerve	Median	Percentage	44.4	55.6	0.404
		Frequency	5	7	7
	Ulnar	Percentage	41.7	58.3	7
		Frequency	15	14	
	≥30	Percentage	51.7	48.3	+
Age (years)		Frequency	10	12	0.779
	30<	Percentage	45.5	54.5	+
		Frequency	13.3	11	0.710

	Variable		Polypha	isic wave	<i>P</i> -value
				No	<i>P</i> -varue
	1	Percentage	54.2	45.8	
	2	Frequency	2	2	
Duration between		Percentage	50.0	50.0	
injury and repair	3	Frequency	6	5	
(days)	3	Percentage	54.5	45.5	
	4≤	Frequency	4	8	
		Percentage	33.3	66.7	
	≥2	Frequency	1	0	0.523
Duration between		Percentage	100.0	.0	
repair and	2-4	Frequency	5	8	
electrodiagnostic		Percentage	38.5	61.5	
studies (months)	≥4	Frequency	19	18	
	≥4	Percentage	51.4	48.6	
	General	Frequency	3	8	
	General	Percentage	27.3	72.7	
Surgeon's specialty	Plastic	Frequency	18	11	0.091
		Percentage	62.1	37.9	
	0	Frequency	4	7	
	Orthopedics	Percentage	36.4	63.6	

to penetrating trauma of the upper limb ^{22, 23}.

Based on the findings of this study, the duration between injury and repair did not appear to have a significant influence on the surgical outcomes. However, it should be noted that the majority of our subjects had undergone nerve repair within days of injury, while many studies have demonstrated that delay of up to 6 months does not affect the repair outcomes ¹⁹.

The patients operated by plastic surgeons showed the highest frequency of normal motor amplitude and the lowest frequency of positive sharp waves. Peripheral nerve injury is a multi-disciplinary condition, which can be managed by several clinical disciplines, including plastic surgeons, orthopedic surgeons, and neurosurgeons. Although surgeon's experience can highly affect the surgical success rate, the surgeon's specialty has not been linked to the patient's outcomes previously ^{24, 25}. Hence, our finding may be due to the limited sample size in this study.

LIMITATIONS

The limitation of this study was the use of data from a single center and limited sample size. However, different demographic and clinical variables were investigated to aid in determining the prognostic factors of nerve injury in the studied population.

CONCLUSION

Factors affecting the outcome of peripheral nerve repair following penetrating trauma to the upper extremity include age, education, the type of damaged nerve, the severity of the injury, and the surgeon's specialty.

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CONFLICT OF INTEREST

The authors attest that they have no conflict of interest to declare.

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