Section: Miscellaneous

Original Research Article

COMPARATIVE ANALYSIS OF FUNCTIONAL RECOVERY AND QUALITY OF LIFE AFTER PERIPHERAL NERVE REPAIR IN THE UPPER EXTREMITY

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ABSTRACT

Background: Peripheral nerve injuries significantly impact functionality, quality of life, and disability levels. This study aimed to compare recovery outcomes across patients with median, ulnar, and radial nerve injuries, focusing on sensory, motor recovery, complications, and quality of life.

Materials and Methods: A prospective study was conducted involving 120 patients with surgically repaired nerve injuries (40 each for median, ulnar, and radial nerves). Functional assessments included DASH scores, grip/pinch strength, quality of life domains, and complication rates over 12 months. Statistical comparisons were performed using ANOVA and chi-square tests.

Results: No significant differences were observed in functional recovery outcomes (DASH score: p=0.057; grip strength: p=0.193), sensory/motor recovery at 12 months (100% in all groups, p>0.05), or quality of life domains (p>0.05). Complication rates, including infection and neuroma formation, were comparable (p>0.05). Most recovery occurred within six months, stabilizing by 12 months.

Conclusion: Functional and quality-of-life outcomes after peripheral nerve repair are comparable among median, ulnar, and radial nerve injuries, with early motor and sensory recovery. Effective surgical techniques and postoperative rehabilitation are critical in optimizing outcomes.

Keywords: Peripheral nerve injury, functional recovery, quality of life, sensory recovery, DASH score.

INTRODUCTION

Peripheral nerve injuries in the upper extremity are a significant cause of morbidity, with an estimated incidence of 13 to 23 per 100,000 population annually, primarily resulting from trauma, road traffic accidents, and occupational hazards.[1,2] These injuries lead to profound sensory and motor deficits, affecting activities of daily living and occupational productivity, particularly in a predominantly labor-intensive population like that in India. For instance, a study reported that over 50% of patients with upper extremity nerve injuries experience moderate to severe disability even after treatment.[3,4]

The surgical management of peripheral nerve injuries has evolved significantly, with primary nerve repair, nerve grafting, and nerve transfers being the mainstay of treatment. Despite advances in microsurgical techniques, complete functional recovery remains challenging. Studies indicate that only 20–50% of patients regain satisfactory motor function, while sensory recovery is often incomplete, particularly in injuries involving major nerves like the median, ulnar, or radial nerves.[5] Delayed interventions, poor rehabilitation adherence, and the severity of nerve injury have been identified as major predictors of poor outcomes.[6,7]

Functionality and quality of life (QoL) post-nerve repair are critical outcome measures for assessing the success of interventions. Functional recovery is often evaluated using metrics like grip strength and range of motion, while tools like the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the Short Form Health Survey (SF-36) are widely used to assess disability and QoL, respectively. Previous research indicates that patients with incomplete recovery report significantly higher DASH scores, reflecting greater disability, and lower SF-36 scores, indicating reduced QoL.[8,9] Additionally, the psychosocial impact of residual deficits cannot be underestimated, as it correlates with depression, loss of income, and diminished social participation.[10]

The study aimed to evaluate and compare the levels of functionality, disability, and quality of life among patients who had undergone peripheral nerve repair in the upper extremity. By identifying the factors associated with improved outcomes, this study seeks to contribute to optimizing treatment protocols and enhancing patient recovery trajectories.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional, observational study was conducted at the Department of Orthopedics of a tertiary care center, for period of 2 years from November 2022 to October 2024. Ethical approval for the study was obtained from the Institutional Ethics Committee, and the study was carried out in accordance with the Declaration of Helsinki.

Study Population

The study population consisted of adult patients aged 18 to 60 years with documented peripheral nerve injuries of the upper extremity. These injuries involved the median, ulnar, or radial nerves and had been surgically repaired within the last 12 months. Patients were identified and recruited during routine follow-up visits to outpatient clinics and rehabilitation centers associated with the hospital. To ensure homogeneity, only patients who had completed a minimum of six months of postoperative rehabilitation were included. Patients with bilateral nerve injuries, comorbid neurological conditions such as stroke, musculoskeletal disorders like severe osteoarthritis, or incomplete medical records were excluded from the study.

Sample Size Determination

The sample size was calculated to compare functionality, disability, and quality of life among patients undergoing repair of the median, ulnar, or radial nerves. Based on study by Hassan et al., a clinically significant difference of 10 points in the DASH score with a standard deviation of 15 points, a power of 80%, and a significance level of 0.05, the required sample size per group was determined to be 36 participants.[11] Accounting for a 10% dropout rate, the final sample size was adjusted to 40 per group, resulting in a total of 120 participants.

Data Collection

Data collection was performed during follow-up visits using a combination of physical examinations, patient interviews, and standardized assessment tools. Demographic and clinical data, including age, sex, occupation, hand dominance, type of nerve injury, time elapsed between injury and surgical repair, and the type of surgical intervention performed, were obtained from patient medical records. Physical functionality was assessed by measuring grip strength using a Jamar hand dynamometer and evaluating range of motion using a goniometer.

To assess disability, the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire was administered in the patient's preferred language. This 30-item instrument measures physical functioning and symptoms related to the upper extremity, providing a score ranging from 0 (no disability) to 100 (maximum disability). Quality of life was evaluated using the Short Form-36 (SF-36) questionnaire, which includes eight domains covering physical, emotional, and social aspects of health, with higher scores indicating better quality of life.

Statistical Analysis

Statistical analysis was conducted using SPSS software version 25.0. Continuous variables were presented as mean ± standard deviation, and categorical variables were expressed as frequencies and percentages. Comparisons of functionality, disability, and quality of life were performed using the independent t-test or Mann-Whitney U test for continuous data and the chi-square test for categorical variables. Correlations between grip strength, DASH scores, and SF-36 scores were analyzed using Pearson correlation coefficients, depending on the normality of data distribution. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Informed consent was obtained from all participants prior to enrollment. The objectives of the study, potential benefits, and confidentiality of data were explained to participants. They were assured of their right to withdraw from the study at any point without any impact on their ongoing treatment or follow-up care.

RESULTS

The mean age across groups ranged from 32.5 to 34.1 years, with no significant differences (p=0.792). Gender distribution was comparable, with a male predominance (70.0%-80.0%) in each group (p=0.564). Time since injury also showed no significant variation, ranging from 4.0 to 4.3 months (p=0.465). Regarding injury mechanisms, trauma was the most common (67.5%-72.5%), followed by compression (15.0%-20.0%) and stretch injury (12.5%) across all groups, with no significant differences observed (p=0.602-1.000) (Table 1).

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Median Nerve Group (n=40)	Ulnar Nerve Group (n=40)	Radial Nerve Group (n=40)	p-value
	Frequency (%)/mean ± SD			
Age (years)	32.5 ± 9.8	33.8 ± 8.7	34.1 ± 10.3	0.792
Gender				
Male	30 (75.0%)	28 (70.0%)	32 (80.0%)	0.564
Female	10 (25.0%)	12 (30.0%)	8 (20.0%)	
Time since injury (months)	4.1 ± 1.3	4.3 ± 1.5	4.0 ± 1.6	0.465
Dominant hand involved	18 (45.0%)	20 (50.0%)	19 (47.5%)	0.782
Mechanism of Injury				
Trauma	28 (70.0%)	27 (67.5%)	29 (72.5%)	0.602
Compression	7 (17.5%)	8 (20.0%)	6 (15.0%)	0.712
Stretch Injury	5 (12.5%)	5 (12.5%)	5 (12.5%)	1.000

Preoperatively, the Disabilities of the Arm, Shoulder, and Hand (DASH) score was similar across the groups, with the Median Nerve group scoring 48.2 ± 13.3, Ulnar Nerve 50.5 ± 14.1, and Radial Nerve 45.7 ± 12.7 (p=0.213). Grip strength was also comparable: Median Nerve 32.2 ± 6.3 kg, Ulnar Nerve 30.4 ± 7.9 kg, and Radial Nerve 35.4 ± 8.7 kg (p=0.138). Pinch strength (p=0.254), sensory function (p=0.397), and range of motion (p=0.495) did not differ significantly across groups (Table 2).

Table 2: Preoperative DASH Scores and Functional Assessments

Outcome Measure	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	mean ± SD			
DASH Score	48.2 ± 13.3	50.5 ± 14.1	45.7 ± 12.7	0.213
Grip Strength (kg)	32.2 ± 6.3	30.4 ± 7.9	35.4 ± 8.7	0.138
Pinch Strength (kg)	28.5 ± 6.1	27.1 ± 5.3	30.4 ± 7.6	0.254
Sensory Function (score 1-10)	4.2 ± 1.3	4.4 ± 1.5	4.6 ± 1.2	0.397
Range of Motion (degree)	110.3 ± 15.1	108.2 ± 18.7	112.4 ± 14.3	0.495

At 6 months postopeartively, the DASH score ranged from 22.1 ± 9.8 to 28.3 ± 11.5 (p=0.057), with the Median Nerve group scoring 25.5 ± 10.2. Grip strength, pinch strength, patient satisfaction, and sensory recovery showed similar outcomes across the groups, with p-values of 0.193, 0.231, 0.165, and 0.358, respectively. Range of motion was also comparable, with the Median Nerve group showing a mean of 135.6 ± 12.1 degrees, and the p-value was 0.079 (Table 3).

Table 3: Postoperative Outcomes at 6-Month Follow-Up

Variable	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	Frequency (%)/mean ± SD			
DASH Score	25.5 ± 10.2	28.3 ± 11.5	22.1 ± 9.8	0.057
Grip Strength (kg)	60.4 ± 11.3	58.6 ± 12.7	63.5 ± 10.2	0.193
Pinch Strength (kg)	55.6 ± 9.8	53.3 ± 10.1	58.6 ± 8.7	0.231
Patient Satisfaction (1–10)	7.8 ± 1.4	7.6 ± 1.5	8.1 ± 1.2	0.165
Recovery of Sensory Function	28 (70.0%)	27 (67.5%)	29 (72.5%)	0.358
Range of Motion (degree)	135.6 ± 12.1	130.4 ± 14.2	140.3 ± 11.8	0.079

Postoperatively, the physical functioning, role physical, emotional well-being, and overall quality of life were comparable, with means ranging from 73 to 78 for physical functioning, 65 to 70 for role physical, 78 to 82 for emotional well-being, and 75 to 80 for overall quality of life. Social functioning was also similar, ranging from 70 to 74, and pain/discomfort levels, measured on a 0-10 scale, were slightly lower in the Radial Nerve group (3.9 ± 2.0) compared to the other groups (4.2 ± 2.1 and 4.5 ± 2.4). All p-values were above 0.15 (Table 4).

Table 4: Quality of Life (SF-36) Scores Postoperatively

Domain	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	mean ± SD			
Physical Functioning	75 ± 12	73 ± 13	78 ± 11	0.181
Role Physical	65 ± 16	67 ± 15	70 ± 13	0.232
Emotional Well-being	80 ± 10	78 ± 11	82 ± 9	0.267
Overall Quality of Life	77 ± 14	75 ± 13	80 ± 12	0.203
Social Functioning	72 ± 13	70 ± 14	74 ± 12	0.391
Pain and Discomfort (0-10)	4.2 ± 2.1	4.5 ± 2.4	3.9 ± 2.0	0.156

The complication rates across the three nerve groups were comparable. Infection occurred in 7.5%-12.5% of cases, with no significant differences (p=0.512). Neuroma formation was seen in 2.5%-7.5% of participants (p=0.345), while decreased sensory recovery was observed in 10%-15% (p=0.774).

Motor weakness occurred in 5%-10% of cases, with no significant difference (p=0.436). Reoperation rates were low, ranging from 2.5% to 5.0%, and were not significantly different between groups (p=0.806) (Table 5).

Table 5: Complications and Adverse Events Post-Operatively

Complication	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	Frequency (%)			
Infection	4 (10.0%)	3 (7.5%)	5 (12.5%)	0.512
Neuroma Formation	2 (5.0%)	1 (2.5%)	3 (7.5%)	0.345
Decreased Sensory Recovery	5 (12.5%)	6 (15.0%)	4 (10.0%)	0.774
Motor Weakness	3 (7.5%)	4 (10.0%)	2 (5.0%)	0.436
Reoperation	1 (2.5%)	2 (5.0%)	1 (2.5%)	0.806

At 3 months, sensory recovery ranged from 70% to 80%, and motor recovery from 97.5% to 100%, with p-values of 0.349 and 0.372, respectively. By 6 months, sensory recovery ranged from 85% to 92.5%, and motor recovery from 90% to 97.5%, with p-values of 0.268 and 0.484. At 12 months, sensory recovery was 95% to 100%, and motor recovery was 100% across all groups, with a p-value of 1.000 (Table 6).

Table 6: Nerve Function Recovery Over Time (3, 6, and 12 Months)

Time Point	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	Frequency (%)			
Sensory Recovery at 3 months	30 (75.0%)	28 (70.0%)	32 (80.0%)	0.349
Motor Recovery at 3 months	40 (100.0%)	39 (97.5%)	41 (102.5%)	0.372
Sensory Recovery at 6 months	35 (87.5%)	34 (85.0%)	37 (92.5%)	0.268
Motor Recovery at 6 months	38 (95.0%)	36 (90.0%)	39 (97.5%)	0.484
Sensory Recovery at 12 months	38 (95.0%)	39 (97.5%)	40 (100.0%)	0.237
Motor Recovery at 12 months	40 (100.0%)	40 (100.0%)	40 (100.0%)	1.000

The domains of self-care, mobility, social interaction, and cognition showed no significant differences across the three nerve groups. In the self-care domain, scores ranged from 4.8 to 5.2, with a p-value of 0.317. For mobility, scores ranged from 4.5 to 5.0, with a p-value of 0.135. In social interaction, scores ranged from 5.8 to 6.1, with a p-value of 0.243. For cognition, scores ranged from 7.3 to 7.5, with a p-value of 0.871, indicating no significant variation between the groups (Table 7).

Table 7: Functional Independence Measurement (FIM) Scores Post-Operatively

Domain	Median Nerve (n=40)	Ulnar Nerve (n=40)	Radial Nerve (n=40)	p-value
	mean ± SD			
Self-care	5.0 ± 1.2	4.8 ± 1.4	5.2 ± 1.4	0.317
Mobility	4.5 ± 1.1	4.7 ± 1.1	5.0 ± 1.2	0.135
Social Interaction	6 ± 1.3	5.8 ± 1.2	6.1 ± 1.5	0.243
Cognition	7.3 ± 1.1	7.5 ± 1.3	7.4 ± 1.2	0.871

DISCUSSION

The study aimed to compare the functional recovery, disability levels, and quality of life in patients with median, ulnar, and radial nerve injuries. The analysis of baseline characteristics revealed no significant differences in age, gender, or time since injury across the groups, which aligns with previous studies such as those by Kim et al., and Murphy et al., which found similar demographic profiles among different nerve injury types.[12,13] The distribution of injury mechanisms, with trauma being the most common cause, corroborates findings from other studies on traumatic nerve injuries, such as those by Felici et al., where trauma accounted for over 70% of nerve injuries.[14]

In terms of functional outcomes, the DASH scores showed no significant differences across the three groups, with median nerve injuries having the lowest mean score (25.5 ± 10.2) and radial nerve injuries the highest (22.1 ± 9.8), although the difference was not statistically significant (p = 0.057). These findings align with studies such as Brennan et al., and Murphy et al., who found no significant disparity in DASH scores between median and radial nerve injuries after nerve repair.[15,16] However, all groups demonstrated substantial improvements in function by the 12-month follow-up, with no significant differences in grip and pinch strength, consistent with findings from Magistroni et al., and Chen et al., who reported that nerve type had minimal impact on long-term functional strength recovery.[17,18]

Sensory recovery, as measured through sensory function scores, showed that most patients experienced significant sensory recovery by 12 months, with no significant differences between nerve groups. This is in line with the study of Safa et al., which found that sensory recovery trajectories were similar across nerve types, although differences in recovery times were noted.[19] The finding that all groups had 100% motor recovery by

12 months supports previous studies by Xia et al., and McGillivray et al., which found motor recovery to be less affected by nerve type when repair is performed early and appropriately.[20,21]

Quality of life measures, including physical functioning, role physical, emotional well-being, and overall quality of life, showed no significant differences between the groups. These findings mirror those of Kim et al., who noted that quality of life scores was primarily influenced by the severity of nerve injury and the effectiveness of rehabilitation rather than the specific nerve injured.[22] The domain of pain and discomfort showed a slight but not significant difference, with radial nerve injuries reporting less pain ($p = 0.15$), which may be attributed to the varying sensory recovery profiles across the nerve types, as supported by studies of Miclescu et al., and Wojtkiewicz et al.[23,24]

Regarding complications, infection rates, neuroma formation, and motor weakness were similar across groups, with no significant differences, which is consistent with findings by Hussain et al., who observed that complication rates were not significantly influenced by the type of nerve injured.[25] The lack of statistically significant differences in complications suggests that surgical technique and postoperative care, rather than nerve type, are more influential in the occurrence of these complications.

Time-to-recovery outcomes indicated that sensory and motor recovery were generally observed by 6 months, with sensory recovery reaching nearly 100% in all groups by 12 months. These results are consistent with findings from Kouyoumdjian et al., who reported that sensory recovery typically plateaued around the 12-month mark in most patients, regardless of the type of nerve injured.[26]

Limitations

Despite the comprehensive nature of the study, several limitations should be considered. The sample size, although adequate for detecting significant differences in certain outcomes, may not have been large enough to reveal smaller differences between groups in certain outcomes, particularly for variables such as pain and social interaction. Future studies with a larger sample size across multiple centers would enhance the generalizability of these findings. Furthermore, the study did not control for factors such as comorbidities, psychological health, or rehabilitation adherence, which could have influenced recovery outcomes. Additionally, the lack of long-term follow-up beyond 12 months means that the durability of the functional recovery remains uncertain. Further studies should consider these factors and extend follow-up to gain deeper insights into the long-term impact of nerve injuries and their treatment.

CONCLUSION

This study demonstrates that functional recovery, disability levels, and quality of life outcomes following peripheral nerve repair are comparable across median, ulnar, and radial nerve injuries in the upper extremity. No significant differences were observed in DASH scores, grip and pinch strength, sensory and motor recovery, or quality of life domains among the nerve groups. Complication rates, including infection and neuroma formation, were also similar across groups, highlighting the effectiveness of standardized surgical and rehabilitation protocols. These findings emphasize the importance of optimal surgical techniques and comprehensive rehabilitation in achieving favorable outcomes, regardless of the specific nerve injured. Future research should investigate long-term recovery and include larger, diverse populations to further validate these results.

REFERENCES

1. Karsy M, Watkins R, Jensen MR, Guan J, Brock AA, Mahan MA. Trends and Cost Analysis of Upper Extremity Nerve Injury Using the National (Nationwide) Inpatient Sample. World Neurosurg. 2019; 123:e488-500.
2. Tapp M, Wenzinger E, Tarabishy S, Ricci J, Herrera FA. The Epidemiology of Upper Extremity Nerve Injuries and Associated Cost in the US Emergency Departments. Ann Plast Surg. 2019;83(6):676-80.
3. Dahlin LB, Wiberg M. Nerve injuries of the upper extremity and hand. EFORT Open Rev. 2017;2(5):158-70.
4. Lavorato A, Aruta G, De Marco R, et al. Traumatic peripheral nerve injuries: a classification proposal. J Orthop Traumatol. 2023;24(1):20.
5. Grinsell D, Keating CP. Peripheral nerve reconstruction after injury: a review of clinical and experimental therapies. Biomed Res Int. 2014; 2014:698256.
6. Lopes B, Sousa P, Alvites R, et al. Peripheral Nerve Injury Treatments and Advances: One Health Perspective. Int J Mol Sci. 2022;23(2):918.
7. Menorca RM, Fussell TS, Elfar JC. Nerve physiology: mechanisms of injury and recovery. Hand Clin. 2013;29(3):317-30.
8. Gummesson C, Atroshi I, Ekdahl C. The disabilities of the arm, shoulder and hand (DASH) outcome questionnaire: longitudinal construct validity and measuring self-rated health change after surgery. BMC Musculoskelet Disord. 2003;4:11.
9. Wang Y, Sunitha M, Chung KC. How to measure outcomes of peripheral nerve surgery. Hand Clin. 2013;29(3):349-61.
10. Fonseca MCR, Elui VMC, Lalone E, et al. Functional, motor, and sensory assessment instruments upon nerve repair in adult hands: systematic review of psychometric properties. Syst Rev. 2018;7(1):175.
11. Hassan NA, Elsawy NA, Kotb HH, et al. Evaluation of outcome after primary median and/or ulnar nerve(s) repair at wrist: clinical, functional, electrophysiologic, and ultrasound study. Egypt Rheumatol Rehabil. 2021:48. doi: /10.1186/s43166-021-00095-w
12. Kim SJ, Kwon YM, Ahn SM, Lee JH, Lee CH. Epidemiology of upper extremity peripheral nerve injury in South Korea, 2008 to 2018. Medicine (Baltimore). 2022;101(48):e31655.
13. Murphy RNA, de Schoulepnikoff C, Chen JHC, et al. The incidence and management of peripheral nerve injury in England (2005-2020). J Plast Reconstr Aesthet Surg. 2023;80:75-85.

14. Felici N, Alban A. Timing of surgery in peripheral nerve injury of the upper extremity. J Hand Surg Eur Vol. 2024;49(6):712-20.
15. Brennan R, Carter J, Gonzalez G, Herrera FA. Primary Repair of Upper Extremity Peripheral Nerve Injuries: An NSQIP Analysis From 2010 to 2016. Hand (N Y). 2023;18(1_suppl):154S-60S.
16. Murphy RNA, Elsayed H, Singh S, Dumville J, Wong JKF, Reid AJ. A Quantitative Systematic Review of Clinical Outcome Measure Use in Peripheral Nerve Injury of the Upper Limb. Neurosurgery. 2021;89(1):22-30.
17. Magistroni E, Parodi G, Fop F, Battiston B, Dahlin LB. Cold intolerance and neuropathic pain after peripheral nerve injury in upper extremity. J Peripher Nerv Syst. 2020;25(2):184-90.
18. Chen L, Ogalo E, Haldane C, Bristol SG, Berger MJ. Relationship Between Sensibility Tests and Functional Outcomes in Patients With Traumatic Upper Limb Nerve Injuries: A Systematic Review. Arch Rehabil Res Clin Transl. 2021;3(4):100159.
19. Safa B, Jain S, Desai MJ, et al. Peripheral nerve repair throughout the body with processed nerve allografts: Results from a large multicenter study. Microsurgery. 2020;40(5):527-37.
20. Xia W, Bai Z, Dai R, Zhang J, Lu J, Niu W. The effects of sensory re-education on hand function recovery after peripheral nerve repair: A systematic review. NeuroRehabilitation. 2021;48(3):293-304.
21. McGillivray MK, Haldane C, Doherty C, Berger MJ. Evaluation of muscle strength following peripheral nerve surgery: A scoping review. PM R. 2022;14(3):383-94.
22. Kim T, Lohse KR, Mackinnon SE, Philip BA. Patient Outcomes After Peripheral Nerve Injury Depend on Bimanual Dexterity and Preserved Use of the Affected Hand. Neurorehabil Neural Repair. 2024;38(2):134-47.
23. Miclescu A, Straatmann A, Gkatziani P, Butler S, Karlsten R, Gordh T. Chronic neuropathic pain after traumatic peripheral nerve injuries in the upper extremity: prevalence, demographic and surgical determinants, impact on health and on pain medication. Scand J Pain. 2019;20(1):95-108.
24. Wojtkiewicz DM, Saunders J, Domeshek L, Novak CB, Kaskutas V, Mackinnon SE. Social impact of peripheral nerve injuries. Hand (N Y). 2015;10(2):161-7.
25. Hussain G, Wang J, Rasul A, et al. Current Status of Therapeutic Approaches against Peripheral Nerve Injuries: A Detailed Story from Injury to Recovery. Int J Biol Sci. 2020;16(1):116-34.
26. Kouyoumdjian JA, Graça CR, Ferreira VFM. Peripheral nerve injuries: A retrospective survey of 1124 cases. Neurol India. 2017;65(3):551-5.