Traumatic Peripheral Nerve Injury in the Philippines: A Retrospective Study

Kathleen Joy O. Khu, MD, Abdelsimar T. Omar II, MD, SM and Karlo M. Pedro, MD

Division of Neurosurgery, Department of Neurosciences, College of Medicine and Philippine General Hospital, University of the Philippines Manila

ABSTRACT

Background. Traumatic peripheral nerve injury (TPNI) is a debilitating condition that may result in significant disability. There is variability in the epidemiology, clinical profile, and mechanism of injury worldwide, but data for low- and middle-income countries (LMICs) such as the Philippines are sparse.

Objective. We aimed to determine the demographic and clinical characteristics, management, and outcomes of patients who sustained TPNI in our center.

Methods. We performed a retrospective cohort study of all patients referred for TPNI at our institution from 2013 to 2019. Data on demographics, clinical features, etiology, surgical management, and status on last follow-up were collected.

Results. Forty-four patients with injuries to 62 peripheral nerves were included in the cohort, which had a strong male predilection (98%). The mean age at diagnosis was 35.5 years, with 78% of patients aged between 16-45 years. The most common etiologies were laceration due to sharp objects (39%), stab wound (23%), hacking injury (14%), and vehicular crash (14%). In terms of mechanism of nerve injury, the most common was sharp laceration (80%), followed by stretch injury/nerve injury in continuity (14%). The most commonly injured nerves were the ulnar (36%) and median nerves (32%), more often on the right side (66%). Nerve repair surgery was performed in 80% of cases.

Conclusion. TPNIs in a tertiary center in the Philippines most commonly involved young males in the working age group and were caused by occupational and domestic accidents. Appropriate surgical management of TPNI is feasible in low resource settings.

Keywords: peripheral nerve injuries, trauma, Philippines

Paper presentation - Academy of Filipino Neurosurgeons' Annual Scientific Meeting, December 5-6, 2019, Manila, Philippines.

eISSN 2094-9278 (Online)
Published: September 15, 2025
https://doi.org/10.47895/amp.v59i13.10237

Corresponding author: Kathleen Joy O. Khu, MD
Division of Neurosurgery
Department of Neurosciences
Philippine General Hospital
University of the Philippines Manila
Taft Avenue, Ermita, Manila 1000, Philippines
Email: kokhu@up.edu.ph
ORCiD: https://orcid.org/0000-0003-4526-6235

INTRODUCTION

Trauma ranks among the top causes of disability and death globally, with the burden of disease higher in low- and middle-income countries (LMICs).[1,2] Paradoxically, epidemiologic data on trauma in LMICs are sparse, with the majority of published trauma research performed in developed nations.[1,2] These include studies on peripheral nerve injuries, which can occur in up to 5% of all trauma patients.[3-6]

Traumatic peripheral nerve injury (TPNI) is an important cause of disability in the working population, leading to loss of economic productivity.[3,4,7] Its profile exhibits both geographic and temporal variability, and is affected by socioeconomic factors.[6,8,9] Accurate knowledge of the epidemiology and the mechanisms of TPNI will help inform health professionals and policy makers regarding the proper allocation of health resources for preventive measures and treatment.[4,10] This data is lacking for the Philippines.

In this study, we determined the demographic and clinical characteristics of TPNI referred to a neurosurgical service in a tertiary public hospital in Manila, Philippines. We also discussed the management of these lesions from the perspective of neurosurgeons in LMICs.

MATERIALS AND METHODS

Study Design and Study Site

After securing approval from the University of the Philippines Manila Research Ethics Board (UPM REB 2019-458-01), we performed a retrospective descriptive study using chart review. The study site was the country's largest tertiary public hospital located in Manila, Philippines. We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement guidelines for observational studies.[11]

Patients and Eligibility

We screened the Neurosurgery database to identify all cases of TPNI admitted at the hospital from January 1, 2013 to December 31, 2019. TPNI is defined as acute injury to any of the peripheral nerves distal to the spinal nerve root in both the upper and lower extremities due to trauma or iatrogenic causes. The diagnosis was made clinically (motor and/or sensory deficit) or intra-operatively (finding of nerve transection). Exclusion criteria included cranial nerve injures, peripheral neuropathy from non-traumatic causes, and records with missing data.

Data Collection

Using piloted collection forms, the following data were collected: age, sex, neurological examination findings, etiology (i.e., sharp object laceration, stab wound, vehicular crash, gunshot wound, iatrogenic), mechanism of nerve injury (i.e., sharp laceration, blunt laceration, stretch injury/nerve injury in continuity), time from injury to hospital admission, nerve involved, associated injuries (i.e., fractures, vascular injury, tendon injury), type of nerve repair surgery (i.e., epineurorrhaphy, tagging of nerve ends, graft repair), and surgical management of associated injuries. The motor function was assessed using the Medical Research Council (MRC) Grading for Strength, while sensory function was reported as percentage of the deficit. Recovery of motor function on last follow-up was assessed and classified as good (MRC >3), fair (MRC 3), or poor (MRC <3).[12]

Data was analyzed with descriptive statistics (percentages, frequencies, and measures of central tendency), using Microsoft Excel 15.13.3 (Microsoft Corporation, USA).

RESULTS

A total of 44 patients with injuries to 62 peripheral nerves were included in the cohort. The mean age was 35.5 ±11.8 years, with 78% of patients falling within the 16-45-year-old age group. There was a strong male predilection (98%) (Table 1).

Table 1. Demographic Characteristics of Patients with Traumatic Peripheral Nerve Injury Managed at our Institution from 2013 – 2019 (n=44)

	Number of patients	Percentage
Age (years)		
0 - 15	2	4
16 – 30	13	30
31 – 45	21	48
46 – 60	6	14
≥60	2	4
Sex		
Female	1	2
Male	43	98
Etiology		
Sharp object laceration	17	39
Stab wound	10	23
Hacking injury	6	14
Vehicular crash	6	14
Gunshot wound	3	7
Iatrogenic	2	4
Mechanism of nerve injury		
Sharp laceration	35	80
Blunt laceration	3	7
Stretch injury/nerve injury in continuity	6	14
Time from injury to consult (hours)		
<6	5	11
6-12	24	54
12-24	7	16
24-48	6	14
>48	2	4

The most common etiology in our series was laceration due to sharp objects such as glass, incurred during occupational or domestic accidents (39%). This was followed by stab wounds (23%), hacking injuries (14%), vehicular crash (14%), gunshot wounds (7%), and iatrogenic causes (4%). The most common mechanism of nerve injury was sharp laceration (80%), followed by stretch injury/nerve injury in continuity (14%), and blunt laceration (7%).

The vast majority of patients (81%) consulted within 24 hours of the injury. Most patients presented with motor and sensory deficits attributable to the injured nerve(s), but a reliable physical examination could not be performed at times because the patient had to be brought to the operating room immediately to address an accompanying arterial injury.

The most commonly injured nerve in the series was the ulnar nerve, seen in 36% of all patients, or 16 of the 62 reported nerve injuries (26%). This was closely followed by the median nerve and brachial plexus. The right side was twice as often injured as the left, and multiple nerve injuries were seen in 29% of patients. The most common associated injury was vascular injury, seen in 50% of all cases (Table 2).

Table 2. Peripheral Nerve and Associated Injuries in the Cohort (n=44)

	Number of patients	Percentage
Nerve involved*		
Ulnar	16	36
Median	14	32
Brachial plexus	12	28
Radial	7	16
Musculocutaneous	5	11
Medial cutaneous	2	4
Lumbosacral plexus	1	2
Femoral	1	2
Tibial	1	2
Common peroneal	1	2
Lateral cutaneous	1	2
Long thoracic	1	2
Laterality		
Right	29	66
Left	14	32
Bilateral	1	2
Number of nerve elements injured		
1	31	70
2	8	18
3	5	11
Associated injuries		
Vascular injury	22	50
Fracture	4	9
Pneumothorax	4	9
Tendon injury	4	9
Cervical spine injury	1	2
Esophageal injury	1	2
None (except superficial soft tissues)	8	18

**Some patients sustained multiple nerve injuries*

Table 3. Surgical Management of Patients with Traumatic Peripheral Nerve Injury Managed at our Institution from 2013 – 2019 (n=44)

	Number of patients	Percentage
Peripheral nerve surgery*		
Epineurorrhaphy	29	66
Tagging of nerve ends	5	11
Graft repair	2	4
Neurolysis	1	2
No surgery	9	20
Other surgical procedures		
Arteriorrhaphy	20	45
Chest tube thoracostomy	3	7
Tendon repair	3	7
Open reduction and internal fixation of fracture	2	4
Esophageal repair	1	2
Amputation	1	2

**Two patients had more than one operation*

Of the 44 patients in the cohort, 35 (80%) underwent nerve repair surgery, with two patients undergoing two operations each. The most common surgical procedure was primary epineurorrhaphy, performed within hours of consult. This was performed on 66% of patients and comprised 29 of the 46 procedures performed on 44 patients. This was followed by tagging of nerve ends and graft repair. The two patients who underwent two nerve procedures sustained a sharp laceration with a wide gap between the two ends, precluding direct repair, so tagging of the nerve ends was performed during the first surgery. They subsequently underwent graft repair during the second surgery. Due to the presence of associated injuries, other procedures such as arteriorrhaphy were also performed in the same sitting, prior to the nerve repair (Table 3). There was only one immediate post-operative complication, a superficial surgical site infection that was treated with antibiotics.

Only nine patients had complete follow-up records at the outpatient department. Overall, eight patients improved while one did not. Five patients had good motor recovery (MRC >3), three had fair recovery (MRC 3), while one had poor recovery (MRC<3). The follow-up period for these nine patients ranged from three months to two years.

DISCUSSION

Epidemiologic Features of TPNI

The majority of traumatic peripheral nerve injuries seen by our neurosurgical service occurred in males in the working age group, involved the upper extremities, and were caused by lacerations from sharp objects.

The overwhelming predilection for young males is consistent with previous studies showing the association of this demographic with high risk behavior and trauma.[5,6,9,13,14] Trauma remains a "disease of the young," being the leading cause of death under the age of 45 years worldwide.[15] For TPNI in particular, the predilection for males was also seen in cohorts published in Italy, Turkey, Puerto Rico, Brazil, and Pakistan.[5,6,9,13,14] Only one large series in the United States showed an equal percentage of males and females.[4]

Similar to other studies, TPNIs in our cohort also more often involved the right side, the upper limbs, and the ulnar nerve in particular.[5,6,8,9] Unfortunately, ulnar nerve injury will render the hand almost non-functional and severely impair a person's ability to carry out activities of daily living.[16] The disproportionate burden of TPNI in the productive age group, its preferential involvement of the dominant extremity, and its predilection to involve nerves integral to completion of occupational tasks highlight its potential to cause long-term disability and loss of economic productivity.

Consistent with previous reports, the most common associated injury in our cohort was vascular injury, which was seen in 50% of all cases. Shaw et al. noted that an associated brachial plexus injury was seen in up to 80% of patients with subclavian and axillary artery injuries.[17] Similarly, Noble

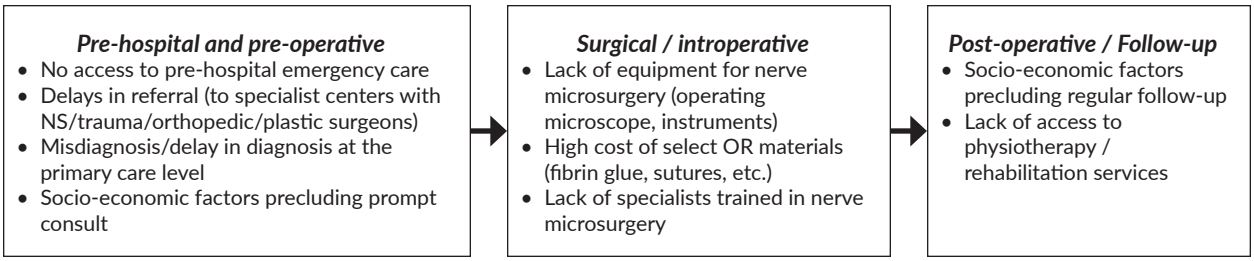

Figure 1. Barriers in the pre-, intra-, and post-operative management of traumatic peripheral nerve injuries in LMICs.

et al. noted traumatic peripheral nerve injuries in half of the patients with brachial artery injuries.[3] This observed association should raise the suspicion of vascular injuries in all patients referred for TPNI, especially since these injuries may be limb threatening.

Etiologies of TPNI

While the epidemiologic data were similar across studies, there was variety in the etiologies of TPNI, presumably due to socioeconomic determinants such as income level, local peace and order situation, rates of interpersonal violence and self-harm, presence of laws restricting gun ownership and use, and local regulations on road safety. The most common etiology in our cohort was laceration due to sharp objects, particularly glass, incurred in domestic or occupational accidents. This was followed in decreasing order by stab wound, hacking injury, vehicular crash, and gunshot wound (GSW). Similar to our study, laceration due to sharp objects was the most common cause in studies from the United Kingdom and Iran.[18,19] In the UK series, glass was the most commonly implicated object followed by knives and machinery. In Puerto Rico and Pakistan, GSW was the top cause of TPNIs.[6,13] Gun control is relatively strict in the Philippines, which may have led to the relatively low frequency of GSW in our cohort. In Brazil, Turkey, and Italy, vehicular crash was the top etiology for TPNIs, compared to only 14% of cases in our cohort.[5,9,14] However, a consistent finding in these studies, including our own, was that the brachial plexus was the most commonly injured nerve element in vehicular crash.[5,9,14]

Nerve Repair Surgery

In our cohort, the most common mechanism of nerve injury was sharp laceration, so the most common surgical procedure was primary epineurorrhaphy (66%). For blunt laceration, tagging of nerve ends (11%) was performed during the first exploratory surgery, while the second, definitive surgery was a graft repair using sural nerve grafts. None of the patients with stretch injury of the brachial plexus underwent surgery or had outpatient follow-up.

Outcome

Among the nine patients with follow-up data, a favorable outcome (MRC ≥3)[12] was observed for most. While the cohort is too small to draw any conclusion regarding factors predictive of good functional outcome, we posit that the relatively young mean age of the cohort and optimal timing of surgery contributed to the favorable outcome in our series. In a meta-analysis of the predictors of response to microsurgical repair of ulnar and median nerve injuries, Ruijs et al. determined that age and delay were the most significant factors affecting both sensory and motor outcome.[20] A young age was believed to be associated with greater regeneration potential, and in children, a shorter regeneration distance to reach the target muscles.[20] Another factor was that all nine patients incurred a sharp laceration, resulting in a nerve transection with cleanly divided edges. This made it possible for an immediate primary repair to be achieved, which is also believed to contribute to higher rates of functional recovery.[21]

TPNI in LMICs

Performing nerve repair surgery in a low resource setting comes with its own unique challenges (Figure 1). Pre-operatively, there may be a delay in surgery due to several reasons. First, pre-hospital care is largely non-existent for trauma patients in the Philippines, so it is incumbent upon patients and caregivers to seek consult, with as many as 79% of patients self-transported to the hospital, according to a local study.[22] The delay may be aggravated by the fact that many hospitals do not have the capacity for microsurgery and thus, would have to refer patients to tertiary centers with specialty services. It is encouraging, however, that the majority of our patients (81%) consulted within 24 hours of the injury.

Intraoperatively, the lack of adequate equipment for nerve microsurgery and the high cost or unavailability of some surgical supplies have led us to adapt and change our technique. Trainees have learned to use only surgical loupes when performing primary epineurorrhaphy and some cases of graft repair, because of the limited number of surgical microscopes that are also being used in elective cases. Fine sutures are expensive and not readily available, so we have to be frugal when using them. We also do not use fibrin glue to reinforce the nerve repair, since this is not available in the Philippines.

Post-operative care is similarly affected by socioeconomic factors. While medical care is free at our center, healthcare remains costly for our patients in the primary care clinics and secondary centers in their respective locales. The

Philippines has no universal healthcare coverage, with out-of-pocket expenses accounting for up to 54% of total health expenditure.[23] As such, most patients were unable to undergo physiotherapy in local rehabilitation facilities due to financial limitations, so we advised them to perform passive range of movement exercises on their own, with varying degrees of compliance. Patient follow-up was also very poor, since many live far from the hospital and did not have the funds or the support system to enable follow-up visits.

Recommendations

There are several things we would want to do if the resources were available, but two things stand out: good patient follow-up and post-operative physiotherapy. Our follow-up rate was dismal, with only 9/44 (20%) patients with follow-up data. Adequate follow-up is crucial in these cases; it would give us feedback on whether our technique (surgery using loupes, no fibrin glue) was effective, and it would enable us to identify the patients who did not improve and refer them for other procedures such as tendon or muscle transfer. Post-operative physiotherapy is also important, to maintain good range of movement and prevent muscle atrophy. These challenges can be overcome by hiring a dedicated nurse to facilitate patient follow-up, providing incentives to patients such as transportation allowance, developing alternative follow-up methods such as video calls, and liaising with a local physician who can monitor the patient and arrange for physiotherapy at the local level.

This study has shown that appropriate surgical management of TPNIs is feasible in LMICs such as the Philippines. Compared to other subspecialties of neurosurgery, peripheral nerve surgery is not dependent on expensive and high-technology equipment, instruments, implants, and consumables. A good knowledge of anatomy, excellent microsurgical skills, and operative magnification in the form of a surgical microscope or loupes would be enough to perform a good operation; thus, it would not be difficult to do these surgeries in a low resource setting. Furthermore, international neurosurgical organizations such as the World Federation of Neurosurgical Societies (WFNS) can help with training and logistic support, through its educational materials, training programs, and neurosurgical equipment support program.[24]

We also want to emphasize the importance of educating other healthcare providers about the timely management of TPNIs and the good outcomes that can achieve if there is no delay in treatment. Some general physicians and emergency response physicians may think that TPNIs are irreparable and hence, do not make the appropriate and timely referrals. To raise awareness, peripheral nerve surgeons can give talks during medical meetings or interviews in the media. Pamphlets can be provided in hospitals and doctors' clinics, and the same information can be shared in the hospital's website and social media accounts. It is also important to educate patients with TPNI regarding their condition, because recovery is not immediate and they need to be motivated to continue participating in their own care, e.g., physiotherapy.

Limitations

The limitations of the retrospective study design were reflected in missing information in some patient records. Assessment of outcomes was severely limited by the poor follow-up in our cohort, seen in common with other studies set in low- and middle-income countries. The epidemiologic profile may also be skewed by the study involving only a single, tertiary referral center, and as such, referral bias is likely. The absence of a hospital-wide protocol regarding the management of peripheral nerve injuries also raises the possibility of some patients being managed by other services such as Orthopedics, Plastic Surgery, and Trauma. These patients were not included in the analysis.

CONCLUSION

Traumatic peripheral nerve injuries in a tertiary center in the Philippines were most commonly seen in young males of the working age group. The ulnar and median nerves were the most common nerve elements injured, and laceration from sharp objects was the most common etiology. Appropriate surgical management of traumatic peripheral nerve injuries is feasible in low resource settings.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

All authors declared no conflicts of interest.

Funding Source

None.

REFERENCES

1. Wong E, Gupta S, Deckelbaum D, Razek T, Kushner A. Prioritizing injury care: a review of trauma capacity in low and middle-income countries. J Surg Res. 2015 Jan;193(1):217–22. doi:10.1016/j.jss.2014.08.055. PMID: 25277355.
2. Tropeano M, Spaggiari R, Ileyassoff H, Park K, Kolias A, Hutchinson P, et al. A comparison of publication to TBI burden ratio of low- and middle-income countries versus high-income countries: how can we improve worldwide care of TBI? Neurosurg Focus. 2019 Nov; 47(5):E5. doi:10.3171/2019.8.FOCUS19507. PMID: 31675715.
3. Noble J, Munro C, Prasad V, Midha R. Analysis of upper and lower extremity peripheral nerve injuries in a population of patients with multiple injuries. J Trauma Inj Infect Crit Care. 1998 Jul;45(1):116–22. doi:10.1097/00005373-199807000-00025. PMID: 9680023.
4. Taylor C, Braza D, Rice J, Dillingham T. The incidence of peripheral nerve injury in extremity trauma. Am J Phys Med Rehabil. 2008 May;87(5):381–5. doi:10.1097/PHM.0b013e31815e6370. PMID: 18334923.
5. Kouyoumdjian J, Graç C, Ferreira V. Peripheral nerve injuries: A retrospective survey of 1124 cases. Neurol India. 2017 May-Jun; 65(3):551-5. doi:10.4103/neuroindia.NI_987_16. PMID: 28488619.

6. Miranda G, Torres R. Epidemiology of traumatic peripheral nerve injuries evaluated with electrodiagnostic studies in a tertiary care hospital clinic. P R Health Sci J. 2016 Jun;35(2):76–80. PMID: 27232868.
7. Castillo-Galván M, Martínez-Ruiz F, de la Garza-Castro O, Elizondo-Omaña R, Guzmán-López S. Study of peripheral nerve injury in trauma patients. Gac Med Mex 2014 Nov-Dec;150(6):527–32. PMID: 25375283.
8. Uzun N, Tanriverdi T, Savrun F, Kiziltan M, Sahin R, Hanimoglu H, et al. Traumatic peripheral nerve injuries: Demographic and electrophysiologic findings of 802 patients from a developing country. J Clin Neuromuscul Dis. 2006 Mar;7(3):97–103. doi:10.1097/01.cnd.0000203641.38887.63. PMID: 19078793.
9. Eser F, Aktekin L, Bodur H, Atan C. Etiological factors of traumatic peripheral nerve injuries. Neurol India 2009 Jul-Aug;57(4):434-7. doi:10.4103/0028-3886.55614. PMID: 19770544.
10. Huckhagel T, Nüchtern J, Regelsberger J, Lefering R. Nerve injury in severe trauma with upper extremity involvement: evaluation of 49,382 patients from the TraumaRegister DGU® between 2002 and 2015. Scand J Trauma Resusc Emerg Med. 2018 Sep 10;26(1):76. doi:10.1186/s13049-018-0546-6. PMID: 30201025; PMCID: PMC6131878.
11. Von Elm E, Altman D, Egger M, Pocock S, Gøtzsche P, Vandenbroucke J. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: Guidelines for reporting observational studies. Int J Surg. 2014 Dec;12(12):1495-9. doi:10.1016/j.ijsu.2014.07.013. PMID: 25046131.
12. Devi B, Konar S, Bhat D, Shukla D, Bharath R, Gopalakrishnan M. Predictors of surgical outcomes of traumatic peripheral nerve injuries in children: An institutional experience. Pediatr Neurosurg. 2018;53(2):94–9. doi:10.1159/000484174. PMID: 29166638.
13. Babar S. Peripheral nerve injuries in a Third World country. Cent Afr J Med. 1993 Jun;39(6):120-5. PMID: 8131200.
14. Ciaramitaro P, Mondelli M, Logullo F, Grimaldi S, Battiston B, Sard A, et al. Traumatic peripheral nerve injuries: epidemiological findings, neuropathic pain and quality of life in 158 patients. J Peripher Nerv Syst. 2010 Jun;15(2):120–7. doi:10.1111/j.1529-8027.2010.00260.x. PMID: 20626775.
15. Sakran J, Greer S, Werlin E, McCunn M. Care of the injured worldwide: trauma still the neglected disease of modern society. Scand J Trauma Resusc Emerg Med. 2012 Sep 15;20:64. doi:10.1186/1757-7241-20-64. PMID: 22980446. PMCID: PMC3518175.
16. Woo A, Bakri K, Moran S. Management of ulnar nerve injuries. J Hand Surg Am. 2015 Jan;40(1):173–81. doi:10.1016/j.jhsa.2014.04.038. PMID: 25442770.
17. Shaw A, Milne A, Christie J, Jenkins A, Murie J, Ruckley C. Vascular trauma of the upper limb and associated nerve injuries. Injury. 1995 Oct;26(8):515–8. doi:10.1016/0020-1383(95)00090-V. PMID: 8550137.
18. Saadat S, Eslami V, Rahimi-Movaghar V. The incidence of peripheral nerve injury in trauma patients in Iran. Turkish J Trauma Emerg Surg. 2011 Nov;17(6):539–44. doi:10.5505/tjtes.2011.75735. PMID: 22290008.
19. McAllister R, Gilbert S, Calder J, Smith P. The epidemiology and management of upper limb peripheral nerve injuries in modern practice. J Hand Surg Br. 1996 Feb;21(1):4-13. doi:10.1016/S0266-7681(96)80004-0. PMID: 8676027.
20. Ruijs A, Jaquet J, Kalmijn S, Giele H, Hovius S. Median and ulnar nerve injuries: A meta-analysis of predictors of motor and sensory recovery after modern microsurgical nerve repair. Plast Reconstr Surg. 2005 Aug;116(2):484–94. doi:10.1097/01.prs.0000172896.86594.07. PMID: 16079678.
21. Elhoseny A, Zeineldin A, Mohammed M. Comparative study between primary versus delayed peripheral nerve repair after various types of injury. Menoufia Med J. 2015 Jan;28(1):80-6. doi:10.4103/1110-2098.155949.
22. Consunji R, Marinas J, Maddumba J, Dela Paz Jr. D. A profile of deaths among trauma patients in a university hospital: The Philippine experience. J Inj Violence Res. 2011 Jul;3(2):85–9. doi:10.5249/jivr.v3i2.39. PMID: 21498971; PMCID: PMC3134925.
23. World Health Organization Global Health Expenditure Database [Internet]. [cited 2021 Oct 9]. Available from: https://apps.who.int/nha/database/country_profile/Index/en.
24. World Federation of Neurosurgical Societies [Internet]. [cited 2021 Oct 9]. Available from: https://www.wfns.org/.