Original Article

Causative Factor in Brachial Plexus Injury and Electro-Diagnostic Results in Tertiary Care Hospital

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Objective: To determine the etiological factors of brachial plexus injury (BPI) in relation with electro-phyiolgic results in a tertiary care hospital.

Study Design: Retrospective review of electrophysiological data from 2002 to 2012

Place and Duration of Study: Electrophysiological data of 197 patients from 2002 to 2012 was analyzed in electro-diagnostic centre of the Neurology department of Pakistan Institute of Medical Sciences (PIMS), Islamabad.

Material and Method: After taking a history and clinical examination, Nerve conduction studies (NCS) test was performed with standard procedure. Electromyogram (EMG) study was done to further confirm the severity, site and the level of lesion.

Results: Road traffic accident (RTA) and bullet injury were causes of BPI in majority of patients. They were 43% and 24% respectively. Birth trauma caused 13% BPI. Less common cause includes: fall, bomb blast, and hit by rolling stone from hill. Upper roots (C5-C6) and upper trunk, either alone or in combination with other roots were injured much more frequently than the lower roots and trunk.

Conclusion: Trauma is the number one cause of BPI. This is followed by bullet injury and birth related trauma. In RTA motor cycle accident is the commonest cause. Upper roots are more affected than roots.

Key words: Brachial Plexus injury, Electro-diagnosis, Upper trunk, lower trunk, roots.

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Introduction

The brachial plexus is a network of nerves; originate from C5 –C8 and T1 roots. They all innervate the upper limbs. The upper roots (C5 and C6) mainly supply the shoulder muscles and upper arm except triceps, which also get additional innervations from C7 and C8. The lower roots mainly supply the forearms and hand muscle. Hand muscles are innervated solely by the C8 and T1 roots. Traumatic brachial plexus injury (BPI) is most commonly caused by brachial plexus lesion. These lesions commonly affect the group of muscles of one region or the whole arm if all the roots of brachial plexus are injured. [1,2]

BPI is one of the causes of severe disability. Lesion of upper roots or upper trunk causes shoulder and upper arm weakness. Task involving the arm at level of face or above head is difficult. Lower roots and lower trunk injury affects the hand movements.[3,4]

BPI can occur in a variety of ways like accident, fall from height, gunshot or obstetric injury. The most common mechanism is sudden traction of plexus and their roots when head and neck move violently away from ipsilateral shoulder. In such cases, the injury affects the upper roots (Erb's paralysis). When the arm is moved violently and abducted, lower roots (C8-T1) are typically injured. Where forceful injury occurs to shoulder from the front, as in the case of motorcyclist when his shoulder hits the opposite vehicle, all roots of plexus may be injured or avulsed. [3, 5,6]

Traction injury can result in pre-ganglioninc or post gangliongic lesions. Pre-ganglion lesion is referred to lesions proximal to the dorsal root ganglion, which is in the spinal canal and at the foramen. Pre-ganglionic ruptures may be central or direct from spinal cord, resulting in avulsion of roots, or intra-dural. Pre-ganglionic lesion does not cause Wallarian degeneration or neuroma formation; because the axons remain in continuity with the cell bodies in the dorsal root ganglion. Post-ganglionic lesion affects the roots distal to spinal ganglion and these are physiologically similar to other peripheral nerve injuries.[7, 13,14,16]

Materials and Methods

This was a retrospective study, extending from 2002 to January 2012. Computerized Data recorded in computer of EMG machine, which included clinical findings and electro-diagnostic results, was analyzed. Patient of Brachial plexus injury (BPI) with history of trauma including the birth related injury, referred to the electro-diagnostic centre of the Neurology department of PIMS were included in the study. The BPI lesions were confirmed on nerve conduction and Electromyography studies. Detail history and physical examination was performed. Cause and traumatic events were specifically inquired. Power of muscles and sensory impairment in distribution of affected roots and nerves was assessed in detail. NCS and EMG study was performed on Sierra Cadwel, a USA made machines. Data was computerized and stored. Standard methods were used in testing nerves with surface electrodes. Needle EMG study was performed with disposable concentric needle electrodes. Relevant muscles belonging to each affected nerve and roots were tested to localize the level and severity of lesion. Paraspinal muscles were tested to determine the root involvement. The severity of injury was graded as complete, severe partial or partial on the basis of Amplitude of Compound muscles action potential in NCS test.

Patients with brachial plexus neuritis, root compression associated with degenerative spine disease, compressive lesion caused by tumor, granuloma and large lymph nodes radiotherapy associated neuritis and other non traumatic causes were excluded from the study.

Results

Total study period was 10 years. Total numbers of patient were 197. The average age was 25.6 years. Male were 165 and female were 32, Table I. Study period extended from 2002 to January 2012. Causes of BPI are shown in Figure 1. Road traffic accident was leading cause (84) of BPI. It is followed by bullet injury, a 2nd most common cause. Birth related BPI is another major cause and was found in 26 patients.

Table I: BPI: Brachial plexus injury

Total patient	197
Average age (years)	25.59
Male	165
Female	32
Right BPI	107
Left BPI	85
Bilateral BPI	5

Among the RTA patients, the motor bike accident was the major cause, (Figure 2). Most of these patients were young and below 30 years of age.

Electro-diagnostic results are shown in Figure 3-4 and table 1-2. In majority (147) of cases lesion was at origin of roots. RTA and Birth related injury was the main reason in these patients. In bullet injury; majority of lesion was at or around the shoulder affecting plexus in their course in axilla.

Table II: Electrodiagnostic results

Root, cord and nerves distribution of BPI	No	%
Injury affecting all the roots	79	39
Upper trunk and roots	76	37
Lower trunks and roots/Medial cord	29	13
Posterior cord	5	2
Multiple Long nerves and cords	13	6
Bilateral Br Plexus	5	2

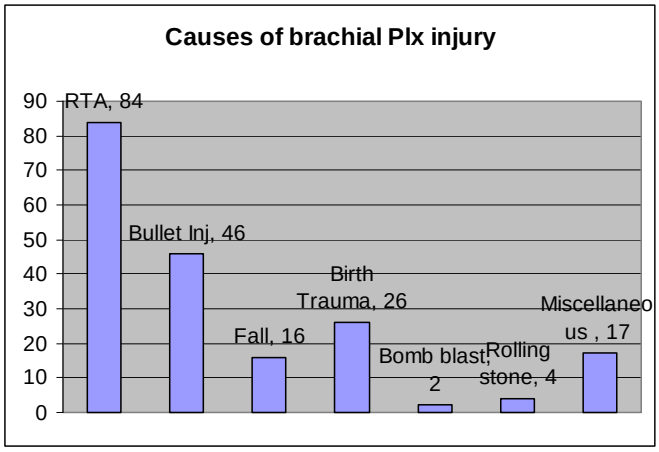

Figure 1. Causes of brachial plexus injury (BPI)

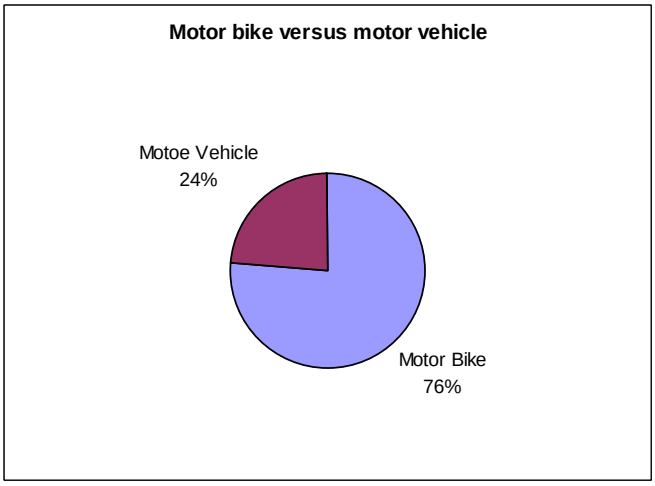

Figure 2. Major causes of RTA.

In five patients, BPI was bilateral. Three were due to birth trauma which involved the upper limbs on both sides. One patient of these patients was physically tortured resulting in injury to all the roots on both sides. The man was tied up with strong rope at arm and hanged, leading to sudden stretching of roots. 5th case was due to multiple bullet injury resulting in bilateral BPI. Severity of lesion is shown in figure 4. Majority of the patients have complete and severe partial lesion of the affected roots, cord or nerves.

The Upper trunk and upper roots of brachial plexus were the most affected parts. They were affected in 76% of cases. In 39% they were affected along with other roots and in 37% were affected alone.

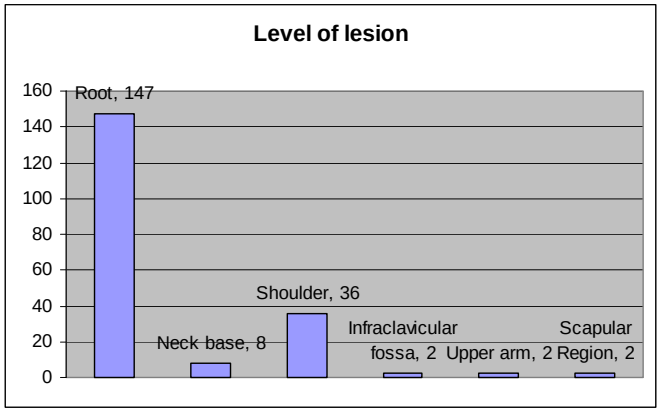

Figure 3. Level of Lesion

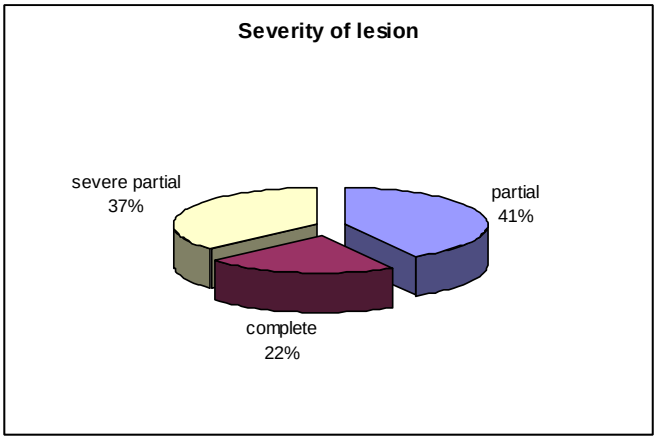

Figure 4. Severity of BPI

Discussion

BPI, if severe causes major disability and most of the time recovery is poor. RTA is the major cause. Motor bike accident is most common reason. Young motor cyclist often drives carelessly. Over speeding, reckless driving, care less over taking and one wheeling is common in our youngsters. All over the world RTA is main reason. Inadequate training and poor knowledge of traffic law is common. Implication of traffic law is also ineffective.[5, 6.] Brachial plexus sustained traction injury when shoulder hit with opposite coming vehicle or with roadside other objects like tree, building and pole etc. In our study 43% BPI are results of RTA. In western world this is about 70%. The lower percentage in our country is because of high incidence of gun shot injury. Bullet injury is another common reasons and has increased because of prevailing law and order situation in our and neighboring country. Bullet related injury is one of far less common cause in western word. Occasional case report is seen. Birth trauma is third most common cause. Shoulder dystocia is one of the common causes.[8-11]

Upper roots of brachial plexus are commonly affected in RTA and obstetrical injury because of exposed situation and traction on the shoulder while neck is pushed or pulled away [4, 5]. In our study upper roots and trunks were affected in 76% of patients either alone or in association with other roots and trunk. In birth trauma upper roots and trunks are more affected. In 85% patient had upper roots and trunk involvement.[12, 13, 15]

Conclusion

Road traffic accident is the most common cause of brachial plexus injury and among these cases motor bike accident is main reason. Most people are young. Proper training and strict implication of traffic law can decrease the incidence.

Bullet injury is second most common cause in our country. Poor law and order situation may be the reason. Early surgery can improve the out come.

Birth trauma is another big reason of Brachial plexus injury; the incidence can decrease with better obstetrical management.

References

1. Coene LN. Mechanism of brachial plexus lesion. Clin Neurol Neurosurg. 1993-95 Suppl:S24-9
2. Dubuisson AS, Kline DG. Brachial Plexus injury: a survey of 100 consecutive cases from a single service. Neurosurgery. 2002 Sep: 51(3): 673-82
3. Shin AY, Spinner RJ, Steinmann SP, Bishop AT. Adult Traumatic brachial plexus injury. J Am Acad Orthop Surg. Oct 2005 13(6): 632-6
4. Goldie BS, Coates CJ Brachial pleuxus injury, a survey of incidence and referral pattern. J hand surg (Br) Feb 1992; 17 (1): 86-8
5. TA Andrew A six month review of motorcycle accident, Journal injury volume 10 Issue May 1979 317-320
6. J W Rosson; Closed Traction of lesion of brachial plexus- an epidemic among the young motor cyclists. Journal Injury Issue 1 January 1988 page 4-6

7. Kual Archana Sinh U S Pathak, YK. et all Fatal Road Traffic accident study distribution, nature and type of injury J Indian Academy of Forensic Medicine: 2005 Apr: 27(2): 71-2
8. Dorsi MJ, Hsu W, Belzberg AJ. Epidemiology of brachial plexus injury in the Pediatric Mulititrauma population in united state. J Neurosurg Pediatr 2010 Jun 5(6) 573-7
9. Hankins GD, Clark SM, Munn MB. Cesarian section on request at 39 weeks: impact on shoulder dystocia, fetal trauma, neonatal encephalopathy, and intrauterine fetal demise. Semin perinatol. 2006 Oct;30(5):276-87.
10. Barman A Chaterjee A Prakash H et all. Traumatic brachial plexus injury; Electrodiagnositic findings from 111 patients in a tertiary care hospital of India j Injury vol 43 Issue 11 Pages 1943-8 Nov 2012
11. Chuang TY, Tsai YA, Chiang Sc, Yen DJ, Cheng H. The Comparison of electrophysiologic findings of traumatic brachial plexopathies in a teriary care centre. injury 2002 Sep; 33((7):591-5.
12. Bowles AO, Graves, DE, Chiou-Tan FY. Distribution and extent of involvement in brachial plexopathies caused by gunshot wounds motor vehicle crashes, and other etiologies: a 10-year electromyography study. Arch Phys Med Rehab. 2004 Oct;85(10): 1708-10
13. Alnot JY, Rostoucher P, Oberlin C, Touam C. C5-C6 and C5-C6-C7 Traumatic paralysis of brachial plexus of adult caused by supraclavicular lesion. Rev Chir orthop Rearatrice Appar mot. 1998 Apr; 84(2):113-23.
14. Kim DH, Murovic JA, Tiel RL, Kline DG. Infraclavicular brachial plexus Stretch injury. Neurosurg Focus. 2004 May 15:16(5): E4
15. Smania N, Berto G, La Marchina E, Melotti C, Midiri A, Roncari L, Zenorini A, Ianes P, Picelli A, Waldner A, Faccioli S, Gandolfi M. Rehabilitation of brachial plexus injuries in adults and children. Eur J Phys Rehabil Med. 2012 Sep;48(3):483-506.
16. Kaiser R, Mencl L, Haninec P. Injuries associated with serious brachial plexus involvement in polytrauma among patients requiring surgical repair. Injury. 2012 May 31.