Brachial Plexus Injury—Indian Perspective

Kanwaljeet Garg[1] Prashant Sharma[1] Deepak Agrawal[1]

[1]Department of Neurosurgery, All India Institute of Medical Sciences, New Delhi, India

Address for correspondence Kanwaljeet Garg, MBBS, MCh, Department of Neurosurgery, Room no 720, All India Institute of Medical Sciences, New Delhi, Delhi 110029, India (e-mail: kanwaljeetgarg@gmail.com).

J Peripher Nerve Surg 2020;3:19–21

Abstract

Brachial plexus injury is a common peripheral nerve injury. It is seen in young age group and road traffic accidents are the commonest cause. The surgery for BPI has undergone significant advancements resulting in the improvement in results. However, developing countries like India face significant challenge in the management of brachial plexus injuries due to scarcity of the surgeons interested and involved in the care of these patients.

Keywords
- brachial plexus
- India
- injury
- nerve graft
- neurotization

Introduction

Brachial plexus injury (BPI) is a devastating and life-altering injury. The reports of BPI dates back to the time of Hippocrates. There was a time in the ancient militaristic Sparta, when babies with obstetric injuries were thrown alive into the gorge to get rid of the impurities.[1] The results of brachial plexus surgery were very disappointing till 1970s. Even the very experienced authors recommended conservative treatment or amputation of the affected extremity for them.[2,3] Similar thoughts were shared in the International Society for Orthopedic Surgery and Traumatology Congress held in Paris in 1966.[4]

With the advancements in science, the neurosurgical techniques have improved and so has the outlook of BPIs. The surgery for brachial plexus reconstruction was popularized in the 1970s by Millesi (Vienna) and Narakas (Laussane).[5,6] There is no doubt about the efficacy of surgery now. The results of various surgical techniques are encouraging, especially in partial BPIs, when the treatment is offered in appropriate time. The results of complete BPI are still not very promising and are a matter of concern. The various technological advancements include the development of operating microscope, intraoperative electrophysiology, suture materials, biological tissue glues, etc. Other areas where advances have been made include the neurobiology of nerve injury and regeneration.[6] Nerve allografts and nerve conduits for bridging the gaps are very frequently used these days.[7-9] Another advancement is an attempt to neurotize the muscles close to the motor end plate to get early and better improvement.[9-11]

The primary goal of any intervention in BPI is restoration of patient's function to improve the quality of life.[12,13] The intervention can be surgical intervention to restore the neuronal continuity or it can be just rehabilitation. The role of physiotherapy cannot be ignored as it is essential to prevent the development of contracture formation.

Self-appearance and body image are very important for psychological well-being of an individual, more so in the young individuals. Differences regarding an individual's perception of their appearance and body image in patients following BPI have been reported in literature.[13,14] It has also been reported that altered self-perception is a cause of poor functional outcome and poor satisfaction following BPI. This aspect needs to addressed routinely as a part of rehabilitation.

Management Strategies of Brachial Plexus Injuries

There are many requirements for the proper management of BPIs. It includes a combination of comprehensive care, multispecialty expertise, prolonged hours of surgery, and a dedicated team for pre- and postoperative physiotherapy.[9] Hence great effort on the part of the patient and the treating team is required apart from the necessary expertise. However, good results are not guaranteed despite the proper management of a patient with BPI.[15]

The surgical options for a patient with traumatic BPI include neurolysis, neurotization which can be either intraplexal or extraplexal and with or without a nerve graft.[16,17] Secondary procedures in the management of BPIs include functioning free-muscle and pedicled muscle transfers, tendon transfers, and arthrodesis.

Usually a trial of conservative treatment for 3 months is prescribed for postganglionic lesions before considering

DOI https://doi.org/10.1055/s-0040-1703988.

surgery. Few of the patients improve significantly precluding the need of surgery. Some patients with pan brachial involvement may recover function in wrist and hand and require different surgical procedure. The chances of spontaneous recovery in patients with preganglionic lesions are very less and an early surgical intervention is usually offered.[8,18] The nerve transfer usually offered to a patient with upper trunk BPI is aimed at providing stabilization and abduction of shoulder, and elbow flexion. Spinal accessory nerve to suprascapular nerve transfer is done for achieving shoulder abduction, which can be done through the anterior supraclavicular approach. Recently, this neurotization procedure has also been tried through the posterior suprascapular approach in prone position. Recently, transfer of the branch to triceps of radial nerve to axillary nerve has also been tried. Colbert et al concluded that the posterior approach for the transfer of spinal accessory to suprascapular and triceps branch to axillary nerve is ideal for restoration of shoulder function of upper trunk BPIs due to the proximity of the target muscles.[19,20] All these transfers can also be performed with the patient in supine position, as per a recent article.[20] Second to fourth intercostal to musculocutaneous transfer and spinal accessory to suprascapular nerve transfer can be done in patients with pan BPI. The other options in these patients include contralateral C7 to lateral cord or posterior cord transfer. Fifth and sixth intercostal nerves can be anastomosed to the radial nerve to achieve elbow extension. Free flap gracilis transfer can also be performed and sutured to flexor pollicis longus and flexor digitorum profundus. However, all these require a multispecialty expert team.

Factors Affecting Functional Recovery

The functional recovery after neurotization depends predominantly on two factors.[21] The first factor is the number of axons that successfully cross the anastomotic site. It has been estimated that approximately 30% of the axons are lost across one anastomotic site and all attempts to decrease this loss have not yielded significant success.[9,22] The second factor in determining the surgical outcome is the reestablishment of original fascicular connections by outgrowing axons. This factor can be controlled by the surgeon by connecting related fascicles in the proximal and distal stumps.[9,21] Sinha et al suggested that the misalignment of axons after the presently popular techniques of nerve transfer and neurotization is a distinct possibility, which has a significant negative bearing on the surgical outcome after nerve repairs.[9] Based on this theory the fascicular nerve repairs should produce better results than epineurial repairs and might be best what a surgeon can offer the patient with traumatic BPI.

Current Status/Problems in the Field of Peripheral Nerve Surgery in India

There are multiple specialties involved in the care of BPI in India. Neurosurgeons and plastic surgeons are the primary specialties taking care of BPI. In addition, there are a few orthopaedic surgeons who are doing some cases of peripheral nerve injury. A lot depends on the training institutes. There are institutes, some central reputed institutes, which are not doing peripheral nerve surgery at all. The residents trained at these institutes will not have any exposure to this subspecialty and thus will not be practicing it during their careers. Moreover, peripheral nerve surgery is not as glamourous as some of the other neurosurgical procedures. Hence, one who is not exposed to peripheral nerve surgery during residency is less likely to make extra efforts to learn it. Moreover, the ones who are exposed also give peripheral nerve surgery very low priority. BPI results from motor vehicular accidents in 99% of the cases.[13]

Since the BPIs are found more often in young individuals due to the most common mode of injury being road traffic accidents, especially ones involving two wheelers, hence, it is the responsibility of every neurosurgeon to be well-versed with this field and offer surgery in time to the affected patients. At present there are only a few centers which are offering peripheral nerve surgery in India. This results in long waiting list in the tertiary care public hospitals, which are already burdened with patients suffering from other ailments. This results in delay in the treatment which in turn makes the results even poorer. This forms a vicious cycle and even the interested surgeons lose interest in this less popular specialty. We will take the example of our center, an apex trauma center. A total of 229 patients underwent repair of BPI between 2013 and 2017. As expected, most patients were from the young and productive age group (76.8% from 18 to 40 years age group). The patients with partial and pan BPI were 56 and 43.7%, respectively. Early surgical intervention (within six months of injury) was done in 42.7% (n = 98) of the patients, while 57.3% (131) were operated upon more than 6 months after injury. There were 21 patients (9%) who underwent surgery more than 12 months after injury. This fact highlights the problem of not many surgeons/centers offering brachial plexus surgery in India and patients have to wait for much longer periods to get the necessary surgical intervention than what is ideally recommended.

References

1 Plutarch, Plutarch's Lives. Cambridge, MA: Harvard University Press; 1948
2 Seddon HJ. Nerve grafting. J Bone Joint Surg Br 1963;45:447–461
3 Seddon HJ, Medawar PB, Smith H. Rate of regeneration of peripheral nerves in man. J Physiol 1943;102(2):191–215
4 Robotti E, Longhi P, Verna G, Bocchiotti G. Brachial plexus surgery. An historical perspective. Hand Clin 1995;11(4):517–533
5 Garg K, Sinha S, Satyarthee GD, et al. Microsurgical outcome of post-traumatic peripheral nerve injuries: an experience of 23 cases and review of literature. Turk Neurosurg 2016;26(2):297–301
6 Narakas AO, Hentz VR. Neurotization in brachial plexus injuries. Indication and results. Clin Orthop Relat Res 1988;237:43–56
7 Midha R. Emerging techniques for nerve repair: nerve transfers and nerve guidance tubes. Clin Neurosurg 2006;53:185–190
8 Midha R. Nerve transfers for severe brachial plexus injuries: a review. Neurosurg Focus 2004;16(5):E5
9 Sinha S, Prasad GL, Lalwani S. A cadaveric microanatomical study of the fascicular topography of the brachial plexus. J Neurosurg 2016;125(2):355–362
10 Oberlin C, Béal D, Leechavengvongs S, Salon A, Dauge MC, Sarcy JJ. Nerve transfer to biceps muscle using a part of ulnar nerve for C5-C6 avulsion of the brachial plexus:

anatomical study and report of four cases. J Hand Surg Am 1994;19(2):232–237
11 Venkatramani H, Bhardwaj P, Faruquee SR, Sabapathy SR. Functional outcome of nerve transfer for restoration of shoulder and elbow function in upper brachial plexus injury. J Brachial Plex Peripher Nerve Inj 2008;3:15
12 Mancuso CA, Lee SK, Dy CJ, Landers ZA, Model Z, Wolfe SW. Expectations and limitations due to brachial plexus injury: a qualitative study. Hand (N Y) 2015;10(4):741–749
13 Verma CV, Vora T, Thatte M, Yardi S. Patient perception after traumatic brachial plexus injury: a qualitative case study. Hand Therapy 2019;24(2):55–61
14 Franzblau L, Chung KC. Psychosocial outcomes and coping after complete avulsion traumatic brachial plexus injury. Disabil Rehabil 2015;37(2):135–143
15 Siqueira MG, Martins RS. Surgical treatment of adult traumatic brachial plexus injuries: an overview. Arq Neuropsiquiatr 2011;69(3):528–535
16 Kim DH, Cho Y-J, Tiel RL, Kline DG. Outcomes of surgery in 1019 brachial plexus lesions treated at Louisiana State University Health Sciences Center. J Neurosurg 2003;98(5):1005–1016
17 Bhandari PS, Sadhotra LP, Bhargava P, Bath AS, Mukherjee MK, Bhatti T, Maurya S. Surgical outcomes following nerve transfers in upper brachial plexus injuries. Indian J Plast Surg 2009;42(2):150–160
18 Kandenwein JA, Kretschmer T, Engelhardt M, Richter H-P, Antoniadis G. Surgical interventions for traumatic lesions of the brachial plexus: a retrospective study of 134 cases. J Neurosurg 2005;103(4):614–621
19 Colbert SH, Mackinnon S. Posterior approach for double nerve transfer for restoration of shoulder function in upper brachial plexus palsy. Hand (N Y) 2006;1(2):71–77
20 Prasad GL. An all-anterior approach for quadruple nerve transfer for upper trunk brachial plexus injuries. World Neurosurg 2018;120:e651–e659
21 Siqueira MG, Foroni LHL, Martins RS, Chadi G, Malessy MJA. Fascicular topography of the suprascapular nerve in the C5 root and upper trunk of the brachial plexus: a microanatomic study from a nerve surgeon's perspective. Neurosurgery 2010;67(2, Suppl Operative):402–406
22 Tannemaat MR, Boer GJ, Eggers R, Malessy MJA, Verhaagen J. From microsurgery to nanosurgery: how viral vectors may help repair the peripheral nerve. Prog Brain Res 2009;175:173–186