OUTCOME ANALYSIS OF UPPER BRACHIAL PLEXUS INJURY

AT GOVT. STANLEY HOSPITAL

Dissertation submitted to

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations

for the award of the degree of

M.D.BRANCH XIX –

PHYSICAL MEDICINE AND REHABILITATION

INSTITUTE FOR HAND AND RECONSTRUCTIVE MICROSURGERY,

DEPARTMENT OF PHYSICAL MEDICINE AND REHABILITATION,

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II. **To analyze the functional outcome** of 20 upper brachial plexus injury patients out of 35 total brachial plexus injury cases assessed during the period of 4 months and followed up for nearly 10 months.

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LITERATURE REVIEW

ANATOMY

The brachial plexus is formed by the anterior primary rami of the lower cervical (C5-8) and the first thoracic (T1) spinal nerve, which give motor innervations to the muscles of shoulder, including all anterior and posterior chest muscles related to glenohumeral joint and muscles of entire upper limb (extrinsic and intrinsic muscles) and sensory innervations of entire upper limb, except the skin on the medial aspect of arm.

In prefixed brachial plexus C4 provide significant contribution to C5, but T2 does not contribute. In post-fixed brachial plexus ,T2 has significant contribution to T1 but C4 does not(1).

Prefixed and post-fixed contribute in about 3% of the cases from Narakas (2)The brachial plexus starts at the scalenes, courses under the clavicle, and ends at the axilla. It is typically composed of 5 roots, 3 trunks, 6 divisions (2 from each trunk), 3 cords and terminal branches.

ROOTS

Each spinal nerve is formed by the adjoining of the ventral root (motor fibers) and dorsal root (sensory fibers). The dorsal root ganglia are formed within the inter-vertebral foramen, immediately outside the dura mater of the spinal cord. The dorsal and ventral roots unite a few millimeter distal to the dorsal root ganglion to form a mixed spinal nerve. (3) The C5-7 roots give off branches to form the long thoracic nerve, and the C5 root gives branches to form the dorsal scapular nerve.

TRUNKS

Between the scalene muscles (anterior and middle) and clavicle, the postganglionic spinal nerves initially combine to form the three trunks – upper (C5 and C6 spinal nerve), middle (C7 itself) and lower(C8T1). The superior trunk gives off the suprascapular nerve and a nerve to subclavius.

DIVISIONS

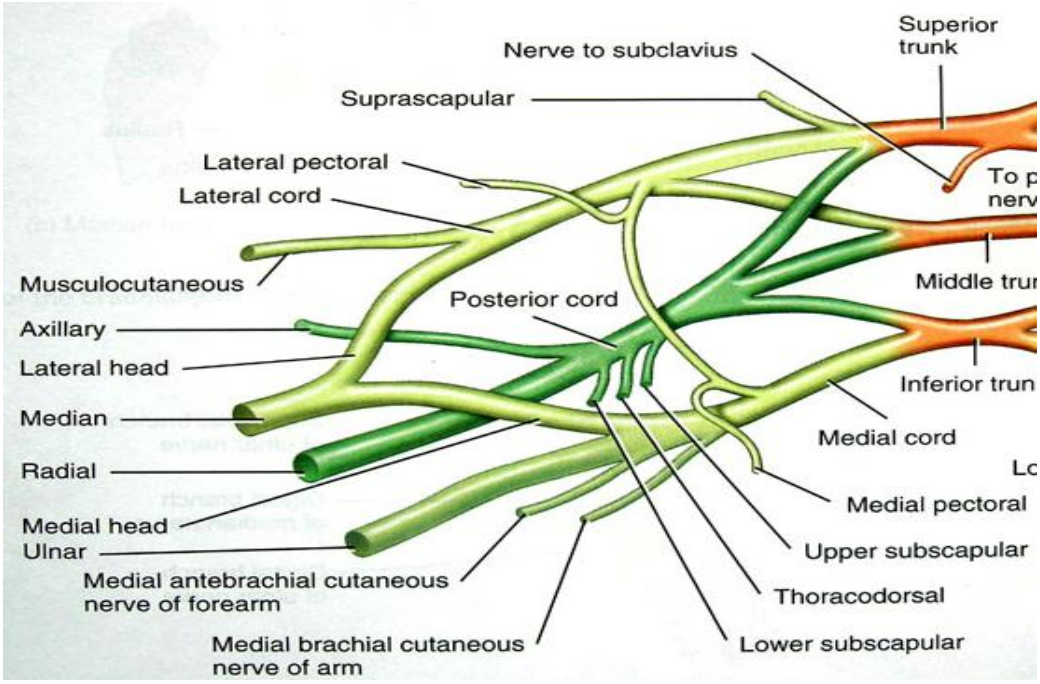
Each trunk is divided into anterior and posterior division just proximal to or directly under the clavicle.

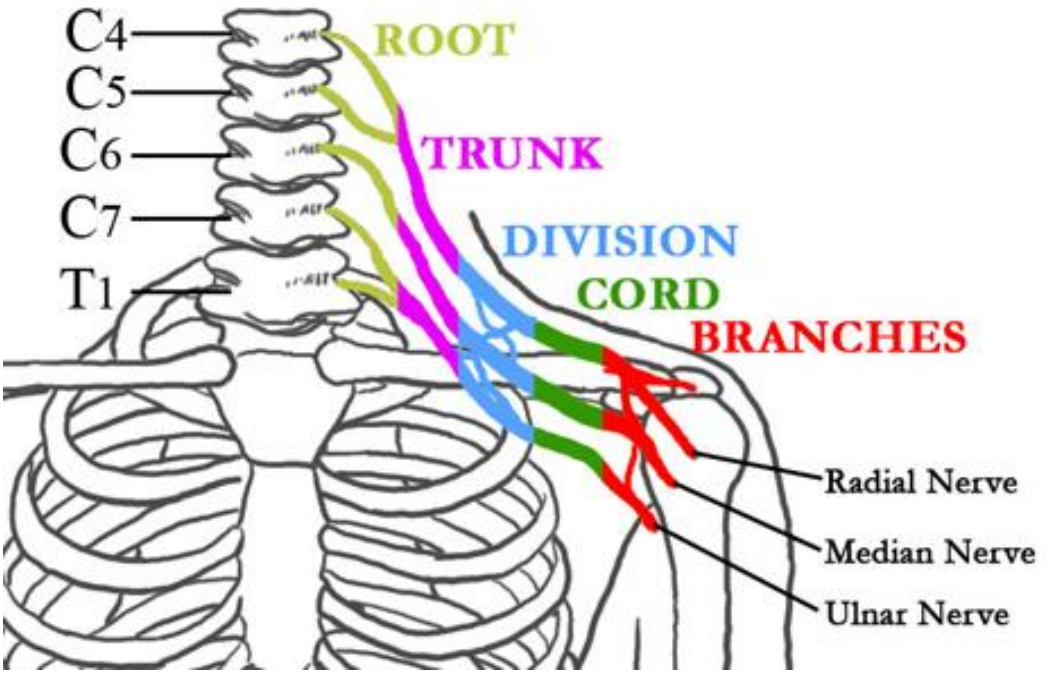
CORD

Each trunk has 2 divisions: 1 division of each of the trunks forms the posterior cord; the anterior division of the superior trunk and the anterior division of the middle trunk form the lateral cord. The anterior division of the inferior trunk forms the medial cord. The medial, lateral, and posterior cord designations describe their relationship to the axillary artery.

The posterior cord has the upper and lower subscapular nerves, with the thoracodorsal nerve between them. The lateral pectoral nerve emanates from the lateral cord, and the medial pectoral nerve from the medial cord but with a connection between the pectoral nerves. The posterior cord then becomes the axillary and radial nerves. The lateral cord continues as the musculocutaneous nerve; a branch from the medial and lateral cords becomes the median nerve; and a branch from the lateral branch joins the medial cord continuation as the ulnar nerve, after the medial cord gives off the medial brachial cutaneous and the medial antebrachial cutaneous nerves. The cords and branches are distal to the clavicle; the roots and trunks proximal. The plexus lies in close proximity to the axillary artery, which exits between the anterior and

middle scalenes. Knowledge of this anatomy may allow localization of lesions from the physical examination.





PATHOPHYSIOLOGY

In traction-type brachial plexus injuries, the head and neck are moved away violently from the ipsilateral shoulder. Upper plexus injuries (C5 and C6) usually predominate if the arm is at the side because the first rib acts as a fulcrum to direct the traction forces preferentially in line with the upper plexus. When the arm is moved violently and abducted overhead, the lower elements (C8-T1) typically are injured, as the force is directed in line with C7. A lower plexus lesion predominates when the arm is raised because the coracoid acts as a fulcrum in a similar fashion. Lower plexus lesions may be more common, in part, because of the well-formed transverse radicular ligaments that help resist traction forces at C5, C6, and C7; C8 and T1 lack these ligaments.

Traction forces can result in preganglionic or postganglionic injuries. Preganglionic injuries refer to lesions proximal to the dorsal root ganglion, which is in the spinal canal, and foramen. Preganglionic ruptures may be central or direct from the spinal cord or intradural. Preganglionic lesions do not cause wallerian degeneration or neuroma formation because the axons remain in continuity with the cell bodies in the dorsal root ganglion. Postganglionic lesions are defined as any

lesions distal to the spinal ganglion and are physiologically similar to other peripheral nerve injuries.

CLASSIFICATION OF BRACHIAL PLEXUS INJURIES

Brachial plexus injury may be caused by trauma (open or closed injury), compression, tumor, infection, inflammation, toxins and others.

Millesi classified brachial plexus injury into four levels(4);

1.Supraganglionic root (level I)

2.Infraganglionic root (level II)

3.Trunk (Supraclavicular), (level III)

4.Cord (infraclavicular) (level IV)

Alnot used a similar classification but included the term preganglionic and postganglionic root lesion to describe the same lesions as Millesi's level I and II.

PRESENTATION

HISTORY

The index of suspicion for a brachial plexus injury is much higher for severe shoulder girdle injuries, particularly motorcycle and motor

vehicle accidents. The mechanism of injury should be considered, as these may occur in polytrauma. Other injuries requiring sedation indicate that detailed follow-up examination of the upper extremity may needed.

The patient may present with the following symptoms:

- Pain, especially of the neck and shoulder. Pain over a nerve is common with rupture, as opposed to lack of percussion tenderness with avulsion
- Paresthesias and dysesthesias
- Weakness or heaviness in the extremity
- Diminished pulses, as vascular injury may accompany traction injury.

TEN SCENARIOS suggestive of preganglionic root injury.

1. Motor paralysis extending to the proximal shoulder girdle and neck muscles such as the levator scapulae, rhomboid serratus anterior and deeper posterior paravertebral muscles.

2. Sensory disturbances extending above glenohumeral joint (i.e C4-3 sensory zone)

3. Intolerable pain (root “shooting” or differentiation pain)

4. Horner’s syndrome;

5. No or weak Tinel sign in response to percussion of the neck;

6. Cervical spine fracture.

7. Elevation of hemi diaphragm.

8. Pseudomeningocele on standard cervical myelography or computed tomographic myelography.

9. Recording of sensory nerve action potential in the anesthetic limb and

10. Negative intraoperative somatosensory evoked potentials.

SCOTT W. WOLFE, MD

Attending Orthopaedic Surgeon, Hospital for Special Surgery Chief of the Hand and Upper Extremity Service, Hospital for Special Surgery Professor of Orthopedic Surgery, Weill Cornell Medical College (5).

Based on the surgeon’s findings, adult patients may be diagnosed with any one of the following conditions:

- Neurapraxia: a stretched nerve
- Neuroma: a condition in which scar tissue has grown around a disrupted nerve
- Rupture: one or more nerves are torn, but not at the spinal cord
- Avulsion: the roots of the nerves are torn away from the spinal cord. Multiple root avulsion is the most common diagnosis in high-energy traumatic brachial plexus injuries, such as occurs in a motorcycle or off-road vehicle accident.

Symptoms include numbness, an inability to use the muscles in the shoulder, arm, and hand, and a crushing or burning pain. Patients with a severe avulsion injury may also have a drooping eyelid, a phenomenon known as Horner's Syndrome.

NON-SURGICAL TREATMENT

- Patients with a stretch neurapraxia may be able to regenerate healthy nerve tissue. However, recovery is unpredictable. In such cases, the orthopedic surgeon conducts frequent and thorough examinations over the first three to six months following the injury and performs additional imaging and electro-diagnostic tests, as needed. If there is no recovery, the patient is assessed for internal damage to the nerve, and surgery may become necessary.

INDICATIONS FOR SURGERY

Formerly, most brachial plexus lesions were treated conservatively. Patients were monitored over 12-18 months for recovery of significant voluntary motor control, and any residual deficit was pronounced permanent. Leffert suggested that after 9-12 months, any residual deficit at the level of the shoulder can be considered permanent. However, recovery of more distal function may occasionally be observed more than a year after injury. The customary treatments were shoulder fusion, elbow fusion, wrist and finger tenodesis and transhumeral amputation.

The 3 crucial factors in restoration of upper arm function after brachial plexus injury are patient selection, timing of surgery, and prioritization of restoration. Open injuries from a sharp object may benefit most from immediate exploration and, if possible, direct, end-to-end repair. With an open injury from a blunt object, a 3- to 4-week delay in repair, after initial debridement and tagging, allows injured nerve ends to demarcate. Low-velocity gunshots injuries may be neuropraxic, and may be observed. High-velocity gunshot injuries need early exploration for significant soft-tissue damage.

Stretch injuries present the most complex issues. Early surgery may preclude opportunities for spontaneous recovery; delayed surgery may allow failure of end plates and reinnervation. Suspected avulsions may be explored at 3-6 weeks, and, generally, failure of adequate reinnervation may be explored at 3-6 months.

Surgical options include nerve (primary) and soft-tissue (secondary) reconstruction. External neurolysis alone may benefit a nerve in continuity that exhibits a nerve action potential (NAP). Postganglionic neuromas or ruptures may benefit from nerve grafting. From an overall perspective, such grafts include C5 for shoulder abduction, C6 for elbow flexion, and C7 for elbow and wrist extension.

Nerve transfers (neurotization) can be performed to accelerate recovery from preganglionic injuries. Such procedures, performed ideally within 6 months, reduce time to reinnervation by reducing the distance to the site of the nerve injury. Sources for transfer include the spinal accessory nerve, intercostal nerves, and the medial pectoral nerve. The Oberlin transfer uses a fascicle of a functioning ulnar nerve, but the median nerve or others may also be used in specific cases.

Significant recovery after nerve grafting can take more than 18 months, and maintaining joint mobility, minimizing edema, and treating deafferentation pain during this period can make postoperative care challenging.

The age of the patient also is important. The ability of nerve transfers to restore functional strength decreases dramatically with patient age. Therefore, many of the surgical options are reserved for younger patients.

CONTRAINDICATIONS

Contraindications to surgery include the following:

- Joint contractures
- Severe edema
- Advanced patient age
- Lack of patient motivation or lack of patient understanding of surgical goals

DEMOGRAPHIC STUDIES

Brachial plexus injury: a survey of 100 consecutive cases from a single service.

By Dubuisson AS, Kline DG, Department of Neurosurgery, Centre Hospitalier Universitaire de Liège, Domaine Universitaire du Sart Tilman, Liège, Belgium(6).

The patient group comprised 80 males and 19 females ranging from 5 to 70 years of age. One male patient had bilateral brachial plexus palsy. Causes of injury were largely sudden displacement of head, neck, and shoulder and included 27 motorcycle accidents. There were 23 open wounds, including 8 gunshot wounds, 6 other penetrating wounds, and 9 wounds caused by operative or iatrogenic trauma. Loss was exhibited at C5-C6 in 19 patients, at C5-C7 in 15 patients, and at C5-T1 in 39 patients, and 8 patients had another spinal root pattern of injury. Nineteen patients had injury at the cord or the cord to nerve level. Associated major trauma was present in 59 patients. Emergency surgery for vessel or nerve repair was necessary in 18 patients. Myelography (n = 57) or magnetic resonance imaging (n = 7) revealed at least one root abnormality in 52 patients. The median interval from trauma to operation was 7 months. Operative exposures used included anterior supraclavicular, infraclavicular, combined supra- and infraclavicular, or a posterior approach in 5, 14, 77, and 4 patients, respectively. The surgical procedures performed included neurolysis alone in 12 patients and nerve grafting, end-to-end anastomosis, and/or neurotization in 81, 5, and 47 patients, respectively. Postoperative follow-up of at least 36

months was conducted in 78% of the patients. Grade 3 recovery according to Louisiana State University Medical Center criteria means contraction of proximal muscles against some resistance and of distal muscles against at least gravity. Among the 18 patients with open wounds, 14 (78%) recovered to a Grade 3 or better level, as did 35 (58%) of 60 patients with stretch injuries. In all cases of C5-C6 stretch injuries repaired by nerve grafting (n = 10), the patients recovered useful arm function.

CONCLUSION

Brachial plexus injury represents a severe, difficult-to-handle traumatic event. The incidence of such injuries and the indications for surgery have increased during recent years. Graft repair and neurotization procedures play an important role in the treatment of patients with such injuries.

Traumatic Brachial Plexus Injuries by Mark R Foster, PhD, MD, FACS; Chief Editor: Mary Ann E Keenan, MD (7)

High-energy trauma to the upper extremity and neck can cause a variety of lesions to the brachial plexus. Most common are traction injuries, in which the head and neck are moved away violently from the ipsilateral shoulder; injuries may also be caused by compression

between the clavicle and first rib, penetrating injuries, or direct blows. Recognition may be delayed by other injuries, particularly to the spinal cord and head. Because this topic is complex, this article focuses primarily on traction injuries, the most common injuries in adults. Such injuries usually are catastrophic for the affected individual. Loss of useful function of the upper extremity is common, but early repair and reconstruction are providing far greater restoration than was possible a few years ago.

FREQUENCY

Reliable information on the incidence of traumatic brachial plexus injuries is difficult to find; the exact incidence is not known. Goldie and Coates suggested that 450-500 closed supraclavicular injuries occur each year in the United Kingdom. Young males are disproportionately affected, mostly between 15 and 25 years of age, as in other types of trauma.

Narakas developed his rule of "seven seventies " in his experience over 18 years with 1068 patients :

- Approximately 70% were motor vehicle accidents (MVAs).
- Of the MVAs, 70% were motorcycles or bicycles.

- Of the cycle riders, 70% had multiple injuries.
- Of the multiple injuries in cycle riders, 70% were supraclavicular injuries.
- Of the supraclavicular injuries, 70% had at least one root avulsed.
- Of the avulsed roots, 70% were lower C7, C8, T1.

Of the 70% avulsed roots, 70% of those were associated with chronic pain.

Adult Traumatic Brachial Plexus Injuries by Alexander Y. Shin, MD, Robert J. Spinner, MD, Scott P. Steinmann, MD and Allen T. Bishop, MD Department of Orthopaedic Surgery, Mayo Clinic.(8)

Adult traumatic brachial plexus injuries are devastating, and they are occurring with increasing frequency.

Patient evaluation consists of a focused assessment of upper extremity sensory and motor function, radiologic studies, and, most important, preoperative and intraoperative electrodiagnostic studies. The critical concepts in surgical treatment are patient selection as well as the timing and prioritizing of restoration of function.

Surgical techniques include neurolysis, nerve grafting, neurotization, and free muscle transfer.

Results are variable, but increased knowledge of nerve injury and repair, as well as advances in microsurgical techniques, allow not only restoration of elbow flexion and shoulder abduction but also of useful prehension of the hand in some patients.

Current concepts of the treatment of adult brachial plexus injuries. By Giuffre JL, Kakar S, Bishop AT, Spinner RJ, Shin AY. Division of Hand Surgery, Departments of Orthopedic Surgery and Neurosurgery, Mayo Clinic, Rochester, MN 55905, USA. J Hand Surg Am. 2010 Jul;35(7):1226. Kakar, Sanjiv (9).

As the number of survivors of motor vehicle accidents and extreme sporting accidents increases, the number of people having to live with brachial plexus injuries increases.

Although the injured limb will never return to normal, an improved understanding of the pathophysiology of nerve injury and repair, as well as advances in microsurgical techniques, have enabled the upper extremity reconstructive surgeon an opportunity to improve function in these life-altering injuries.

The purpose of this review is to detail some of the current concepts of the treatment of adult brachial plexus injuries and give the reader an understanding of the nuances of the timing, available treatment options, and outcomes of treatment.

BRACHIAL PLEXUS INJURIES. BY TUNG TH, MACKINNON SE

Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, Suite 17424 East Pavilion, 1 Barnes-Jewish Hospital Plaza, St. Louis, MO 63110, USA. Clinics in Plastic Surgery [2003, 30(2):269-87].(10)

Severe trauma to the brachial plexus most often occurs in young adult men and is a crippling injury that requires management in a timely fashion for optimal functional recovery and pain control.

The surgical management of such injuries is well established, and the techniques continue to evolve. Current management options consist of primary repair in the acute setting, neurolysis, neuroma resection and nerve grafting, motor and sensory nerve transfers, and muscle and tendon transfers.

Shoulder and wrist fusion can also play a role in the overall management of these patients.

The best operative plan varies depending on the patient's level and extent of injury and the surgeon's preference and experience.

The pre- and postoperative care of these patients is ideally managed by a team that has experience with such problems, including personnel knowledgeable in their postoperative rehabilitation. The total reconstructive process generally consists of more than one operation, and the postoperative rehabilitation is long and intensive. Nevertheless, with a highly motivated patient and a dedicated and specialized surgical team, the prognosis for functional recovery is good, and these patients can still lead productive and satisfying lives

Upper root brachial plexus trauma; patient selection and reconstruction. By Fogarty BJ, Brennen MD. Department of Plastic Surgery, Frenchay Hospital, Frenchay Park Road, Bristol BS16 1EE, UK.(11)

Injury to the brachial plexus is increasingly common and the initial management of these patients is usually focused on associated life threatening injuries. Appreciation of the management of the brachial plexus injury can greatly assist with subsequent reconstruction and thus we review our experience in this field. A total of nine patients who

underwent upper root brachial plexus reconstruction over the period 1980-1998 were reviewed. Causes of injury included road traffic accidents (n=6), open injuries (n=2) and the remaining case was iatrogenic. All patients had cabled grafting of the plexus while one patient had neurotization of the plexus in addition to grafting. Sixty six percent (n=6/9) of patients had a good outcome with return of elbow flexion. Patients with an open injury to the plexus had a better prognosis than those who had a closed injury. Polytrauma patients and those with penetrating neck injuries should be assessed to exclude brachial plexus injury. Baseline assessment and early involvement of surgeons with an interest in this area will help select those patients who will benefit from brachial plexus reconstruction.

The treatment of lesions of the brachial plexus has changed from shoulder fusion, elbow bone block, and finger tenodesis following World War II to far greater functional restoration by advances in nerve repair and microsurgery. The natural history of becoming "one handed" within 2 years has been replaced by early exploration, neurolysis, nerve grafting, neurotization, and free muscle transfers, as well as tendon transfers, for shoulder and elbow function and for wrist or hand prehension. Recent advances in diagnostic imaging, nerve transfers,

electrophysiologic testing, nerve root repair, nerve rootlet replantation, and free muscle transfers make this a dynamic but highly specialized field.

Long-term results of surgery for brachial plexus birth palsy.

Kirjavainen M, Remes V, Peltonen J, Kinnunen P, Pöyhiä T, Telaranta T, Alanen M, Helenius I, Nietosvaara Y.

Department of Orthopaedics and Traumatology, Hospital for Children and Adolescents, Helsinki University Central Hospital, (12)

The long-term results of surgical treatment of brachial plexus birth palsy have not been reported. We present the findings of a nationwide study, with a minimum five-year follow-up, of the outcomes of surgery for brachial plexus birth palsy in Finland.

Two-thirds (63%) of the patients were satisfied with the functional outcome, although one-third of all patients needed help in activities of daily living. One-third of the patients, including all nine with a clavicular nonunion from the surgical approach, experienced pain in the affected limb. All except four patients used the hand of the unaffected limb as the dominant hand. Shoulder function was moderate, with a mean Mallet score of 3.0. Both elbow and hand function were

good, with a mean score on the Gilbert elbow scale of 3 and a mean Raimondi hand score of 4. Incongruence of the glenohumeral joint was noted in sixteen (16%) of the ninety-nine patients in whom it was assessed, and incongruence of the radiohumeral joint was noted in twenty-one (21%). The extent of the brachial plexus injury was found to be strongly associated with the final shoulder, elbow, and hand function in a multivariate analysis.

Following surgical treatment of brachial plexus birth palsy, substantial numbers of the patients continued to need help performing activities of daily living and had pain in the affected limb, with the pain due to a clavicular nonunion in one-fourth of the patients. The strongest prognostic factor predicting outcome appears to be the extent of the primary plexus injury.

Functional outcome of brachial plexus reconstruction after trauma by Ahmed-Labib M, Golan JD, Jacques L Department of Clinical Neurological Sciences, Division of Neurosurgery, University of Western Ontario, London, Canada.

Neurosurgery [2007, 61(5):1016-22; discussion 1022-3](13)

Traumatic brachial plexopathies can be devastating injuries. In addition to motor andsensory deficits, pain and functional limitations can be equally debilitating. We sought to evaluate functional outcome and quality of life using statistically validated tools. The authors identified a consecutive series of patients who underwent surgical repair of a brachial plexus injury by the same surgeon between 1997 and 2004 at the McGill University Health Center. Participating patients were sent a package containing the Short Form 36, the Disability of the Arm, Shoulder, and Hand questionnaire, a pain visual analog scale, and an additional question on their satisfaction with the surgery. Data was recorded and analyzed using statistical software (SPSS version 13.0 for Windows; SPSS, Inc., Chicago, IL).

Thirty-one patients with a mean age of 32.7 years at the time of injury participated in this study. The mean time to surgery was 7.5 months, and the mean follow-up period was 42.7 months. Patients who underwent surgery within 6 months of injury scored consistently better on the Disability of the Arm, Shoulder, and Hand questionnaire ($P = 0.03$) and the Short Form 36 subscale scores. There was no difference between supra- and infraclavicular injuries; however, patients with root avulsion injuries were more likely to have pain ($P = 0.04$) and

scored lower on the Disability of the Arm, Shoulder, and Hand questionnaire (P = 0.05).

Statistically validated tools can be used to evaluate the quality of life, upper extremity function, and pain after brachial plexus repairs. Root avulsion injuries and delayed surgical repair correlated negatively with functional outcomes

MATERIALS AND METHODS

We have clinically assessed 35 patients of brachial plexus injury who presented at the Institute of Hand and Reconstructive Microsurgery and Department of Plastic Surgery from 1.5.2010 to 30.9.2010 and were followed for nearly 10 months.

- Assessment of each patient made and recording made in the proforma shown in subsequent pages.

After the history recording Inspection finding recorded and main examination is to exclude the involvement of root. Examination of suprascapular muscle and Rhomboides muscle are important. How to examine the muscle demonstrated in the picture. We can see the contraction of Rhomboidus Muscle on adduction of scapula and we need to palpate the contraction of the muscle adduction of scapula against resistance. Same way Latismus dorsi muscle also seen contracting on coughing we need to palpate contraction of the muscle when shoulder is extended and adducted against resistance. Pectoralis major is having clavicular and sternal origin should be examined individually and recorded.

The examination of each root supplied muscles described below

- Thumb - tests median nerve supplied by C6
- Middle finger - tests median nerve supplied by C7
- Little finger - tests ulnar nerve suppled by C8
- C5: Shoulder movement in all directions, flexion of elbow (to some degree)
- C6: Flexion of elbow, rotation of forearm, flexion of wrist (to some degree)
- C7: Mainly a sensory trunk. (Produces generalised loss of movement in the arm, without total paralysis in any given muscle group. Always supplies latissimus dorsi.)
- C8: Extension and flexion of fingers, flexion of wrist, hand movement
- T1: Intrinsic muscles of the hand, e.g.adduction or abduction of fingers

Cervical Root	**Clinically Relevant Gross Motor Function**
C5	Shoulder abduction, extension, and external rotation; some elbow flexion
C6	Elbow flexion, forearm pronation and supination, some wrist extension

C7	Diffuse loss of function in the extremity without complete paralysis of a specific muscle group, elbow extension, consistently supplies the latissimus dorsi
C8	Finger extensors, finger flexors, wrist flexors, hand intrinsic
T1	Hand intrinsic

SENSORY EXAMINATION

Sensory system examined on each dermatomes C5,C6,C7,C8 and T1 a small area on the inner aspect of the arm supplied by T2 dermatome.

Sensory modalities examined are touch using cotton, brush or Semmes-Weinstein pressure monofilement 20 probes-1.65 to 6.65 produce pressure 1.5g/mm2-439g/mm2

Vibration-tuning fork,(256-cps)

Pain tested with pinprick

Two point discrimination tested at the finger tip by Manner felt apparatus consisting of two pins placed with distance of 2mm, 4mm, 6mm, 8mm,10mm and 12mm.

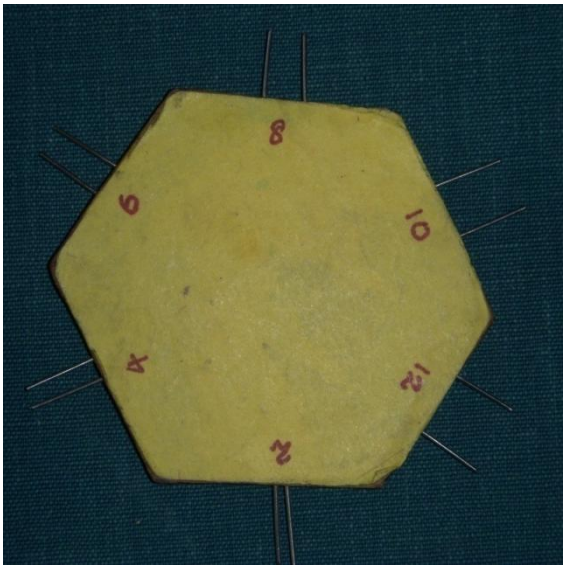
Functional test- for 2point discrimination done in the following way

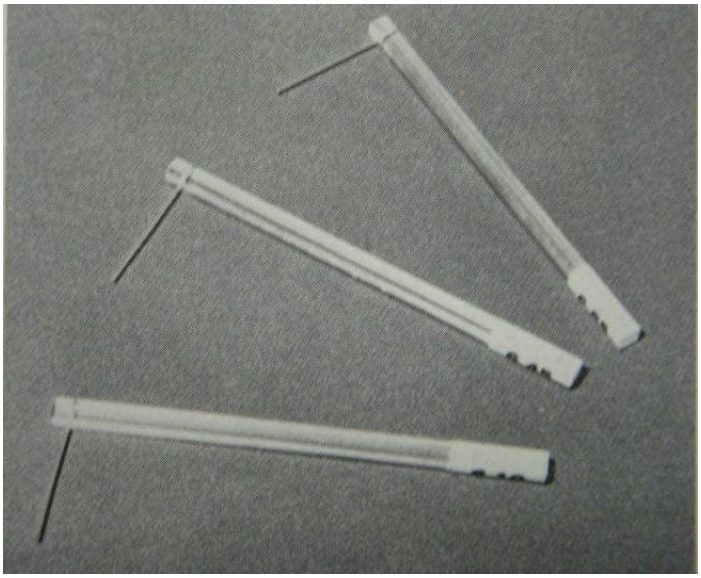
Patient hand supported, vision occluded and finger tips tested

The Disk-Criminator placed longitudinal orientation

Pressure applied light & stopped when blanching of skin appear .

Result 7 out of 10 accurate score Normal 2 point discrimination is less than 6mm Fair 6-10, poor 11-15 Protective 1point felt Anesthetic finger-no point felt





CLINICAL EVALUATION OF THE PATIENT WITH BRACHIAL PLEXUS INJURY

See the contraction of Rhomboid Muscle

Palpate the contraction of Rhomboid Muscle

Latismuss Dorsi Muscle contraction

Conservative management of Brachial Plexus injury consisting of Exercise therapy ;- consist of passive range of movement.

Active assisted exercise , active exercise and active resisted exercise depending on the assed muscle power.

Electrotherapy -consisting of electrical stimulation of muscle by Faradic or Galvanic Current.

Orthotic management consisting of full arm sling, some time abduction splint post operatively

We have used the following proforma in the assessment of these patients

PROFORMA FOR BRACHIAL PLEXUS INJURY EVALUATION

I.R.R.H.& P.S.D &Dept. Rehabilitation Medicine, CHENNAI

PS Number: Date:

Name: Age---------- Sex:-----

Address:

Phone number: Email ID:

Side involved: Dominant Hand:

Date of Accident: Duration since Injury:

Mode of Injury: RTA--(urban----------/rural----------) /
industrial / assault/
Birth injury
Others

Educational Qualification

Occupation-

Monthly income

Absence of duty in months

Money spend so for –Surgery and others

Number of person in the family

Any other persons employed

Socio-economical status

Nature of Injury : Low energy ---------- High energy----------

Mechanism of injury: Neck shoulder---------- arm shoulder----------- separation

History of pain: Continuous------- ---------occasional----------no pain----------

Other injuries : Head Spine
Upper. limb
Lower limb

Horner's Syndrome : Yes---------- No---------

Other associated injuries Yes---------- No---------

Tinel's sign at supraclavicular fossa: Yes----- No-----

Peripheral pulses:

MUSCLE POWER ASSESMENT

	ACTION OF MUSCLES	MUSCLE TESTED	PRELIM	REVIEW			
				I	II	III	IV
SCAPULA	Elevators	LEVATOR SCAPULAE (C3,4)					
		UPPER TRAPEZIUS (CN XI, C3,4)					
	Retractors	RHOMBOIDS (C5)					
	Protracto RS	SERRATUS ANTERIOR (C5,6,7)					
SHOULDER	Flexors	ANTR DELTOID (C 5,6)					
	Abductors	MIDDLE DELTOID (C5,6)					
		SUPRASPINATUS (C5,6)					
	Horizontal abductors	POSTR DELTOID (C5,6)					
	Adductors	PEC MAJOR - CLAVICULAR (C5,6,7)					
		PEC MAJOR -STERNAL (C6,7,8 T1)					
	Extensors	LAT DORSI (C6,7,8)					
		TERES MAJOR (C5,6)					
	Internal rotators	C5 – T1					
	External rotators	INFRASPINATUS (C5,6)					
		TERES MINOR (C5,6)					
ELBOW	Flexors	BICEPS (C5,6)					
		BRACHIORADIALIS (C5,6)					
	Extensors	TRICEPS (C7,8)					
FOREARM	Supinators	SUPINATOR (C6)					
		BICEPS (C5,6)					
	Pronators	PRONATOR TERES (C6,7)					
		PRONATOR QUADRATUS (C8T1)					
WRIST	Extensors	ECRL (C6,7)					
		ECRB (C6,7)					
		ECU (C6,7,8)					
	Flexors	FCR (C6,7)					
		FCU (C7,8T1)					
		P. L. (C7,8)					
HAND		FDS					
		FDP					
		INTRINSICS-----P.A.D					
		INTRINSICS----D.A.B					
		THUMB----OPPOSITION					

RANGE OF MOVEMENTS:

Shoulder	Active	Passive
FLEXION		
EXT		
ABD		
ADD		
IR		
ER		

	Active	Passive
Elbow- Flx		
Elbow- Ext		
F.Arm-Sup		
F-Arm-Pro		
Wrist – Flex		
Wrist- Ext		

RANGE OF MOVEMENTS:

FINGER	MCP joint		PIP joint	DIP joint
	Active	Passive	Active-Passive	Active-Passive
Index				
Middle				
Ring				
Little				
Thumb				

MOTOR INVOLVEMENT

MERLE d'AUBIGNE CHART

Shade boxes with colour pencils: Muscles power 4-5: GREEN Muscles power 3: YELLOW Muscles power 0-2: RED

<table>
<tr><td colspan="2">C6</td><td colspan="3">C8</td></tr>
<tr><td colspan="2">C5</td><td colspan="2">C7</td><td>T1</td></tr>
<tr><td colspan="2">SERR. ANTERIOR</td><td colspan="2">FDS ALL FINGERS</td><td>APB/
OP/FPB</td></tr>
<tr><td rowspan="3">SHOULDER
ABDUCTORS</td><td rowspan="3">ELBOW
FLEXORS</td><td>PRO.
TERES</td><td colspan="2" rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td colspan="3">P.LONGUS & FCR</td><td rowspan="3">ADD.
POLL</td></tr>
<tr><td>ECRL</td><td>TRICEPS</td><td rowspan="2">FPL</td></tr>
<tr><td rowspan="2">SHOULDER
EXT.
ROTATORS</td><td rowspan="2">BRACHIO
RADIALIS</td><td rowspan="2">ECRB</td><td>APL/EPB</td><td rowspan="3">FDP
I/II</td></tr>
<tr><td>EPL</td><td rowspan="3">HYPO
THENARS</td></tr>
<tr><td rowspan="3">SUPINATOR</td><td rowspan="2">EIP
EDM</td><td>EDC</td></tr>
<tr><td>ECU</td></tr>
<tr><td>FCU</td><td>FDP
III/IV</td><td>INTERO
SSEOUS</td></tr>
<tr><td colspan="2">L.D</td><td colspan="2"></td></tr>
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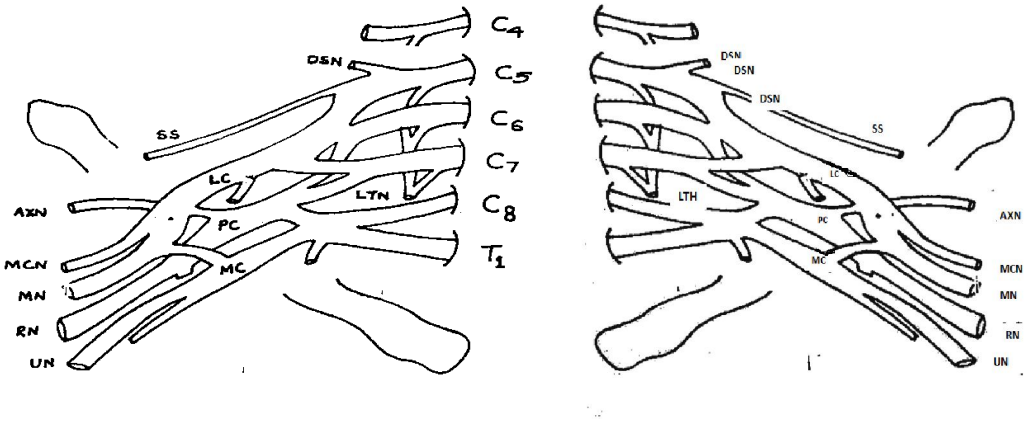
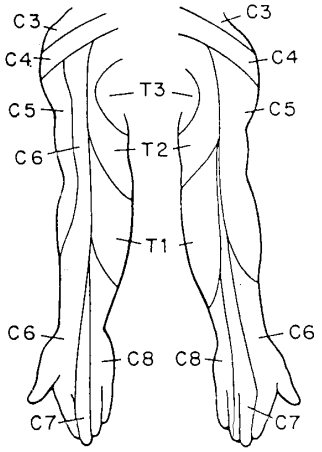
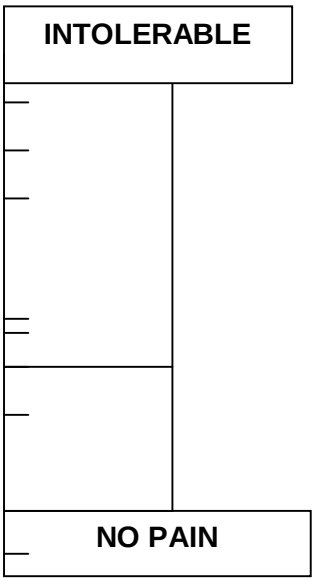


SENSORY INVOLVEMENT





VISUAL ANALOG SCORE FOR PAIN

SENSATION ASSESSMENT

(Please fill in red color for total anaesthesia

Yellow for diminished protective sensation

Green colour for normal)

Investigation reports and findings

X-ray Cervical spine:

X-ray chest –in inspiration and in expiration:

X-ray shoulder:

CT myelography:

MRI Scan:

EMG Studies:

DIAGNOSIS

Probable level of lesion:

Probable site of lesion:

Probable nature of lesion:

PLAN

Physical:-

Surgical:-

SAMPLE OF PROFORMA OF ASSESSED PATIENT

MOTOR INVOLVEMENT

<table>
<tr><td colspan="2">C6</td><td colspan="3">C8</td></tr>
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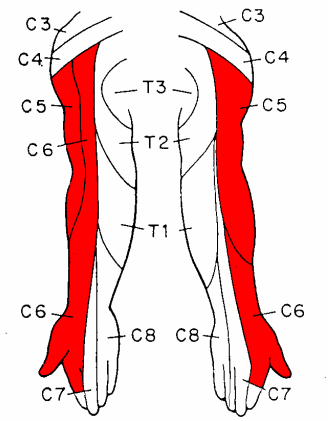
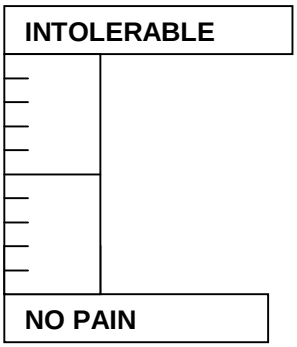
(Shade boxes with colour pencils: Muscles power 4-5: GREEN Muscles power 3: YELLOW Muscles power 0-2: RED)

SENSORY INVOLVEMENT





VISUAL ANALOG SCORE FOR PAIN

SENSATION ASSESSMENT

(Please fill in red color for total anaesthesia, yellow for diminished protective sensation Green colour for normal)

Investigation reports and findings

X-ray Cervical spine: Nil

X-ray chest –in inspiration and in expiration: No difference in diaphragm level

X-ray shoulder: No dislocation

CT myelography: Not done

MRI Scan: Not done

EMG Studies: Not done

Probable level of lesion: **C 5,6**

Probable site of lesion: **Roots**

Probable nature of lesion: **Avulsion**

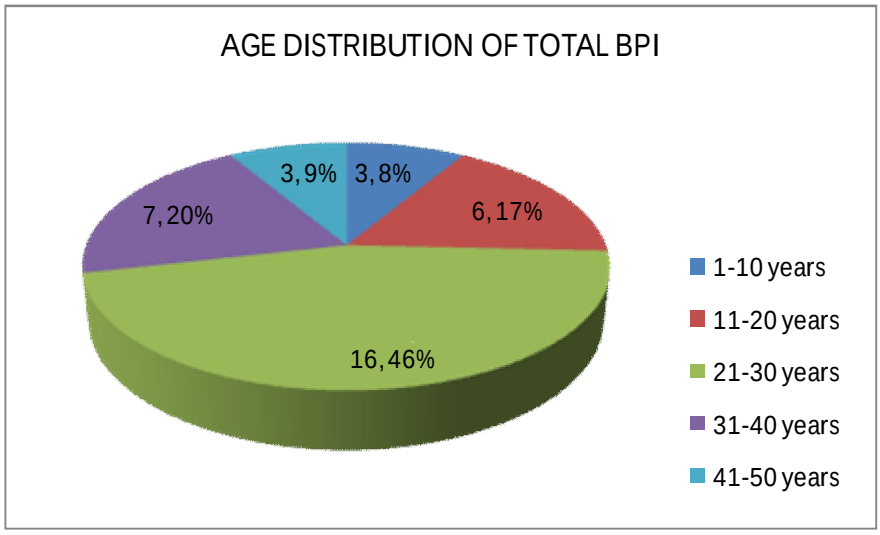
PLAN: **Exploration and Nerve transfer**

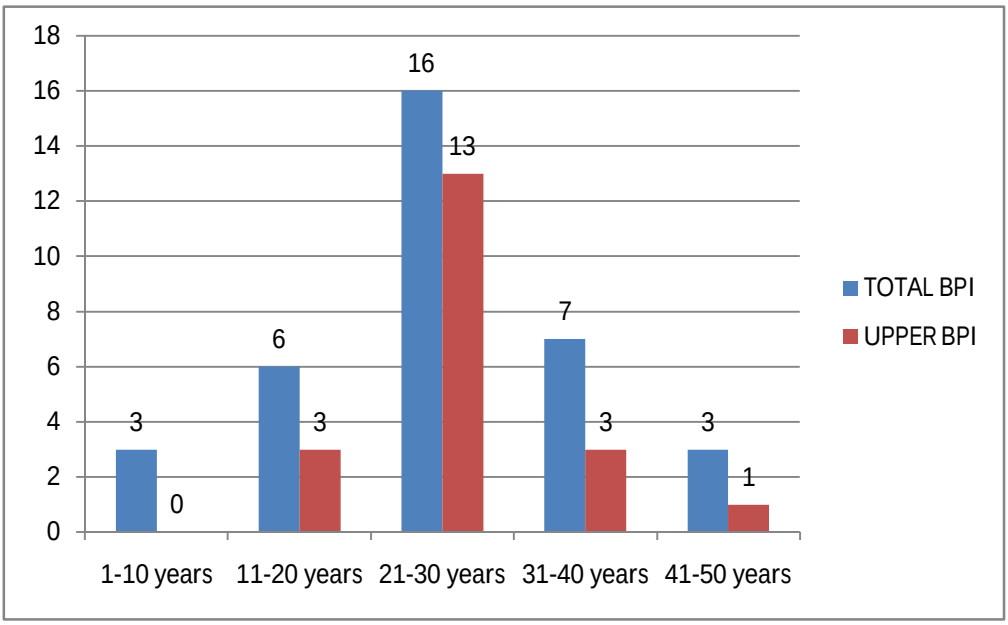
OBSERVATION AND RESULTS

A demographic analysis was done for 35 cases of brachial plexus presenting at our Institute and 20 cases of C 5,6,7 brachial plexus.

I AGE

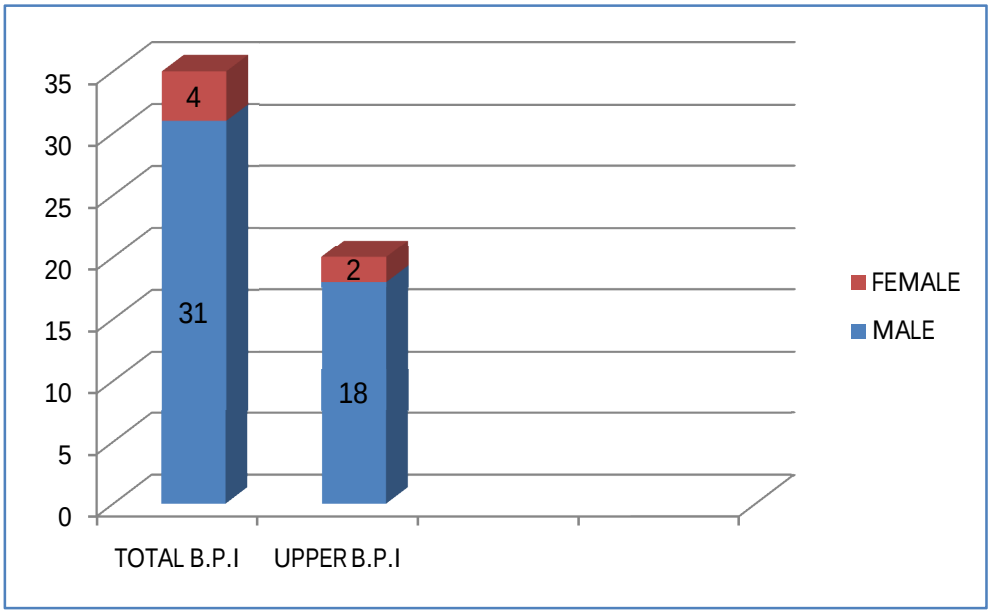
S.NO	AGE DISTRIBUTION	TOTAL CASES	UPPER B.P.I.
1	1-10 years	03	00
2	11-20 years	06	03
3	21-30 years	16	13
4	31-40 years	07	03
5	41-50 years	03	01





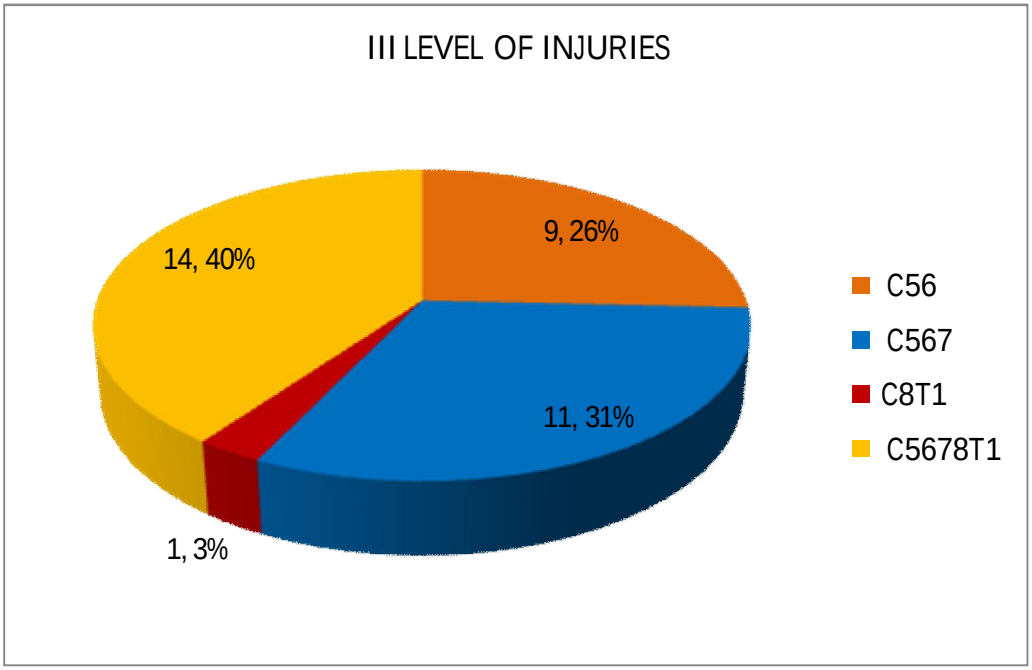
II SEX DISTRIBUTION

	MALE	FEMALE
TOTAL B.P.I	31	04
UPPER B.P.I	18	02



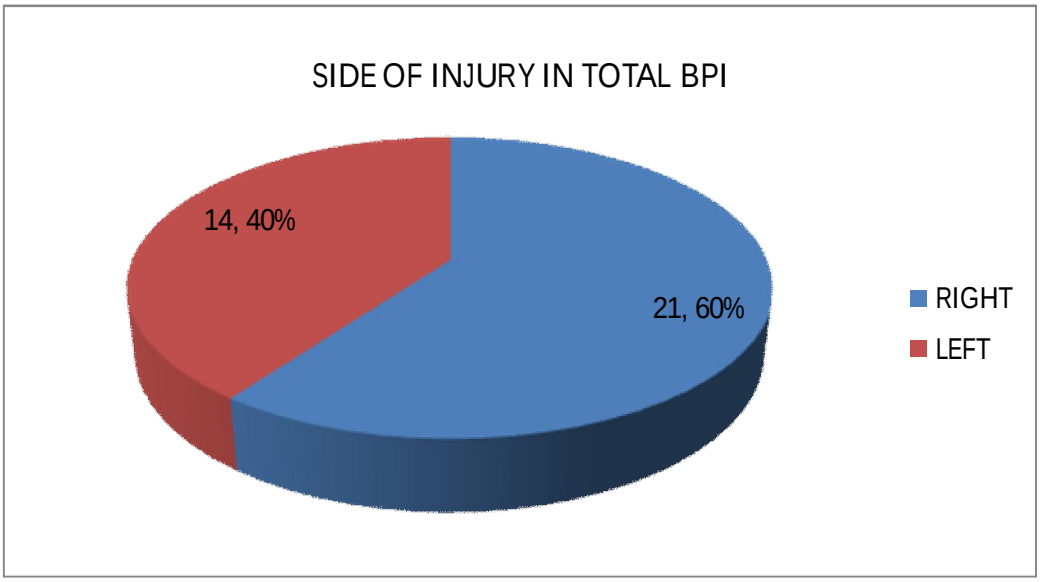
III LEVEL OF INJURY

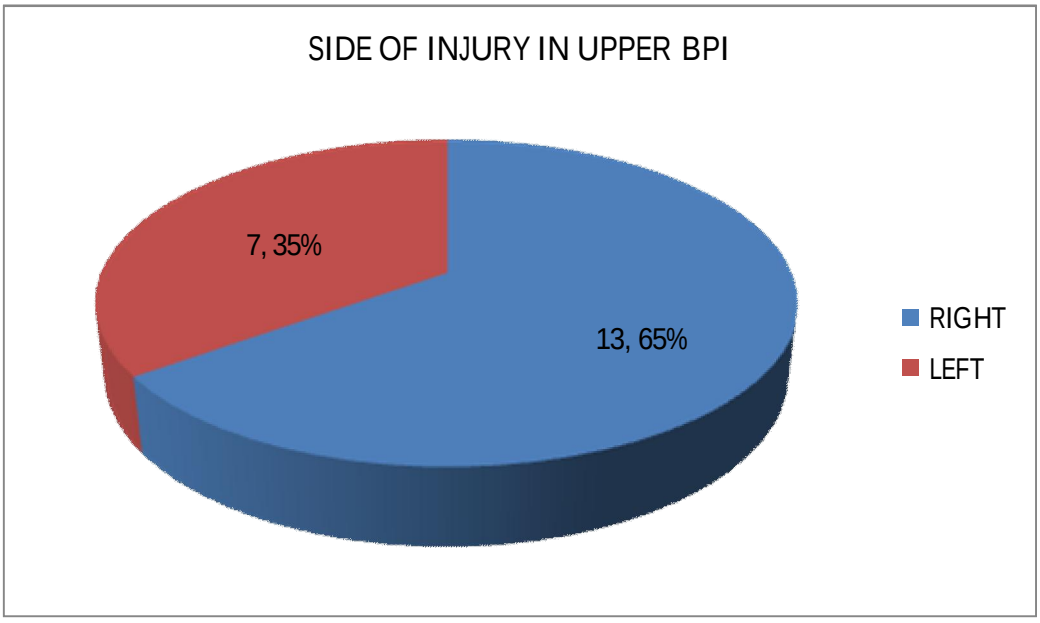
PANPALSY	C56	C567	C8T1
14	09	11	01



IV SIDE OF INJURY

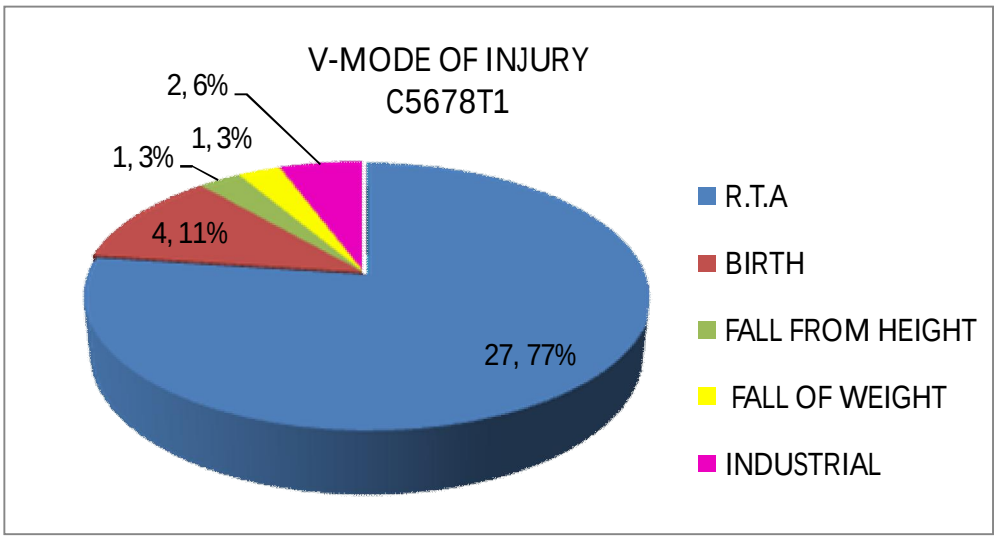
SIDE	RIGHT	LEFT
TOTAL	21	14
UPPER.B.P.I	13	07

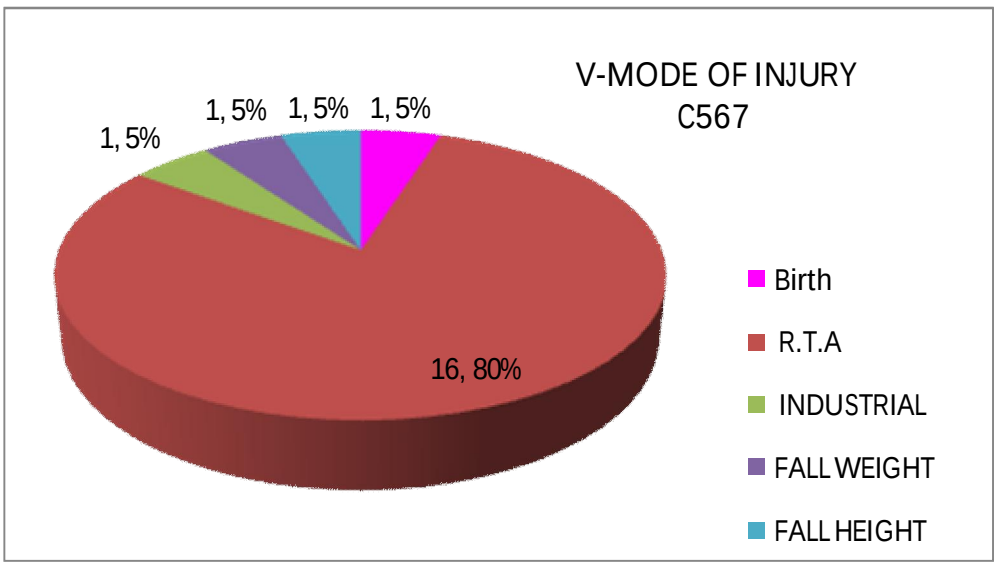




V MODE OF INJURY

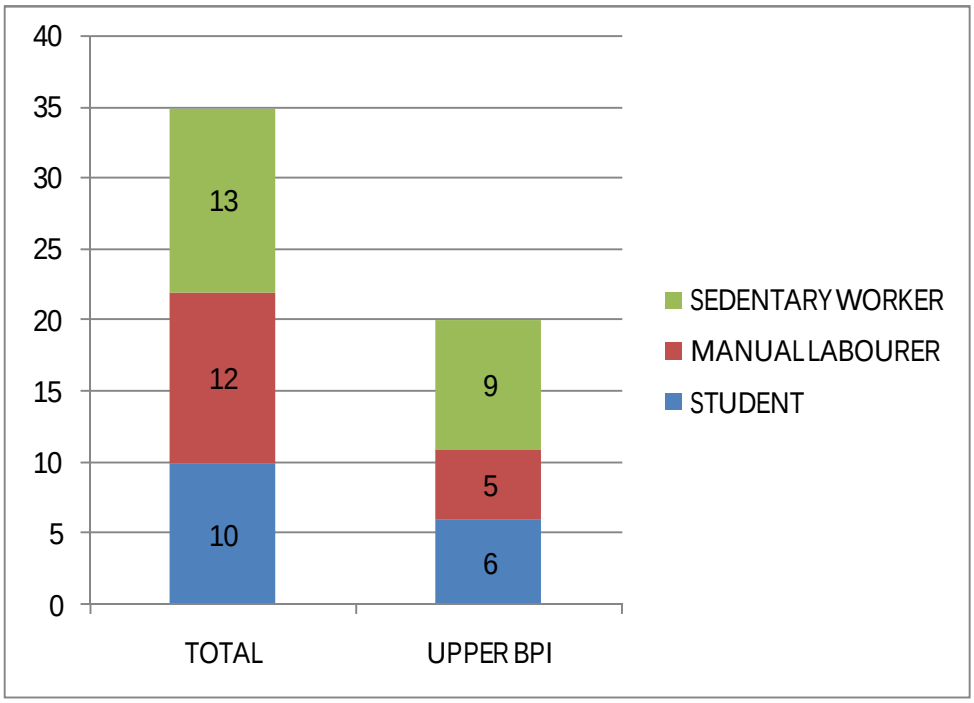
MODE OF INJURY	TOTAL B.P.I	UPPER B.P.I
R.T.A	27	16
BIRTH	04	01
FALL FROM HEIGHT	01	01
FALL OF WEIGHT OVER SHOULDER	01	01
INDUSTRIAL	02	01





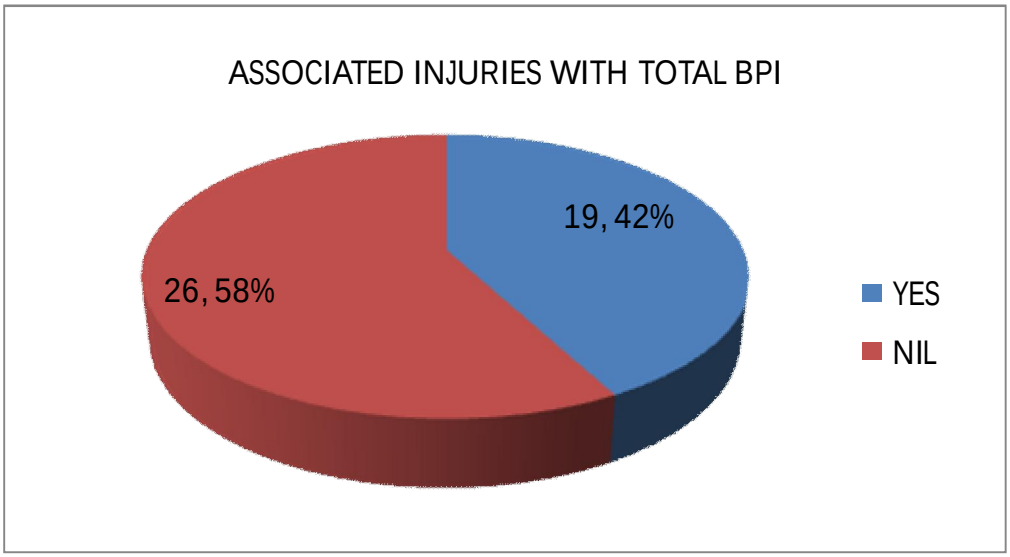
VI OCCUPATION

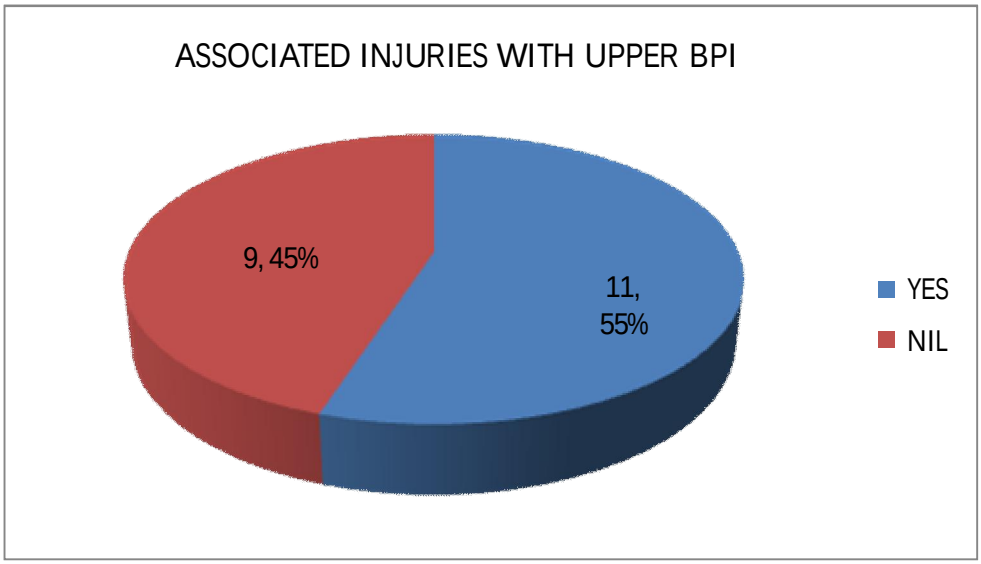
OCCUPATION	TOTAL	UPPER B.P.I
STUDENT	10	06
MANUAL LABOURER	12	05
SEDENTARY WORKER	13	09



VII ASSOCIATED INJURIES

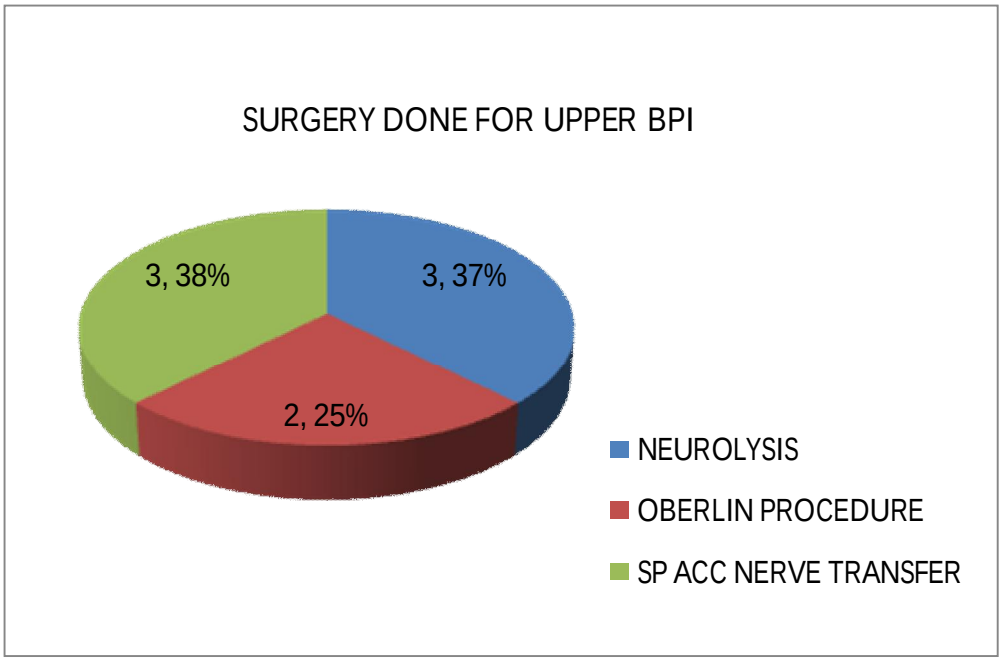
	WITH ASSOCIATED INJURIES	WITHOUT ASSOCIATED INJURIES
TOTAL	19	26
UPPER.B.P.I	11	9





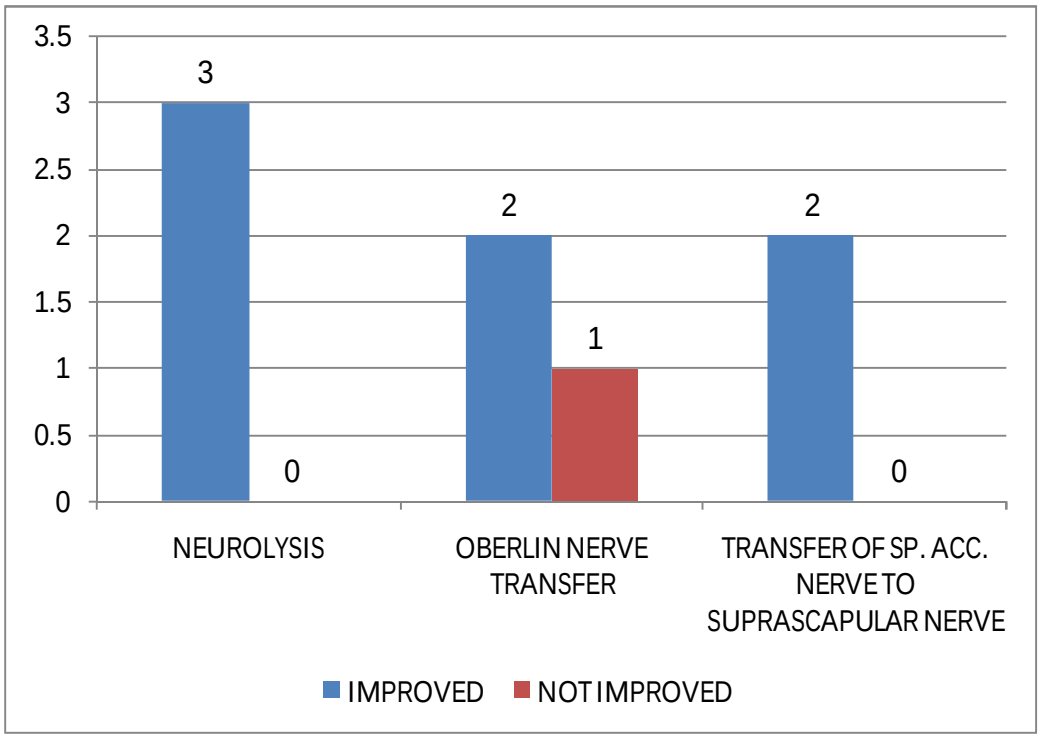
VIII SURGERIES DONE FOR UPPER BPI

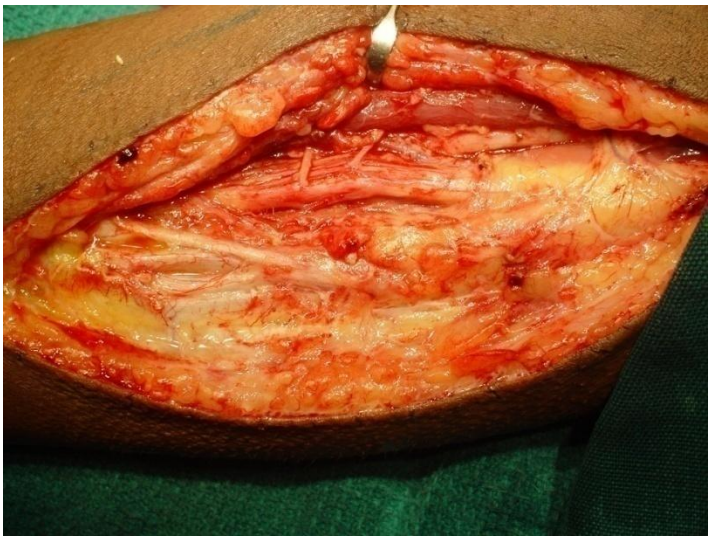
SURGERY DONE	NO OF PATIENTS
NEUROLYSIS	3
OBERLIN NERVE TRANSFER	2
TRANSFER OF SPINAL ACCESSORY NERVE TO SUPRASCAPULAR NERVE	3



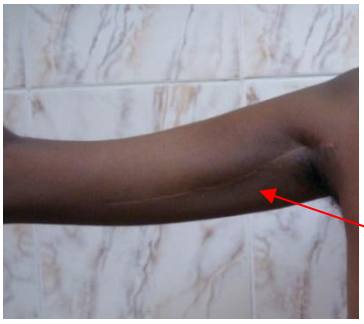
IX RESULTS OF SURGICAL CORRECTION

SURGERY DONE	IMPROVED	NOT IMPROVED
NEUROLYSIS	3	0
OBERLIN NERVE TRANSFER	2	1
TRANSFER OF SP. ACC. NERVE TO SUPRASCAPULAR NERVE	2	0





Photograph showing the Oberlin nerve transfer



Scar Following Oberlin transfer

Scar Following Spinal Acc. nerve Transfer

Scar Follwing Neurolysis

DISCUSSION

In the Rehabilitation department, poliomyelitis was the common neurological case , 15 years ago. It has been now totally eradicated in India. At present brachial plexus injury has taken its place. Because of population explosion and increase of automobile especially two wheeler with high speed engine accident, brachial plexus injury is common and poses a challenge to the hand surgeon and the rehabilitation specialist.

Among the 35 patients who were analysed, the commonest age group involved was the 21 – 30 years age group, which forms about 46%. The next common age group involved was 31 – 40 years group which is about 20%. This group of individuals are important for the development of the family and the nation. Of these 35 patients, 20 patients had upper brachial plexus injury. Even among the patients with upper brachial plexus injury, the commonest age group was 21 – 30 years.

Commonest sex involved is male 90% (M : 18 to F : 2), most probably because it is the males who are the fast motor cycle riders and so more prone for such injuries.

Out of the total of 35 patients involved with brachial plexus injury, 14 patients (40 %) had total palsy which involved all the roots of the brachial plexus. The upper brachial plexus injury contributed 57% of the total. This upper brachial plexus injury consists of C 5,6 and C 5,6,7 lesion categories. The C 5,6 level injury was seen in 9 patients (26%) and C 5,6,7 lesion injuries was seen in 11 patients (31%). Patients with C8T1 injuries formed only 3% of the total brachial plexus injuries analysed. Thus, it is obvious that the second largest group of brachial plexus injury involves the upper trunks, and hence results of surgical correction will be better. This is because, results of C8T1 lesions are proved to be poor.

Side of injury common is right side which is about 60% probably due right being dominant try to protect injury to other part of the body. So the dominant hand is commonly involved. Hence, the skills they learned in years together they lose in a few seconds.

In our analysis R.T.A occupy about 77-80% of the cases. This compares with the review of western literature, where RTA forms about 60% of the cases. The next common mode of injury is gunshot injuries. In our series, the second commonest mode of traumatic brachial plexus injury was industrial accident (6%). In another independent study,

approximately 70% were motor vehicle accidents (MVAs), of the MVAs, 70% were motorcycles or bicycles and of these motorcycle riders, 70% had multiple injuries.

As far as the occupation of the patient was concerned, there was no appreciable difference, with students, manual labourers and sedentary workers being equally involved.

Associated injuries like fracture clavicle, shoulder dislocation, fracture ribs, head injury were more common in the patients with upper brachial plexus injuries about 55%. This was high when compared with patients with total brachial plexus injuries having associated problems, which was about 42% only. This was probably because of the unique mode of injury in upper brachial plexus involvement, where, the forcible separation of the head and upper limb is the causative factor. Hence the force is borne by the head and the shoulder.

Of the 20 patients with upper brachial plexus injuries, only 8 patients were operated upon. The rest of the 12 patients were lost to follow-up. The surgeries done were three in number. They were neurolysis (37%), nerve transfer of the spinal accessory nerve to the suprascapular nerve (37%), and Oberlin transfer (26%). Neurolysis refers to the surgery where the nerves are intact but engulfed in scar

tissue, requiring a release of the scars which cause conduction blocks in the brachial plexus. The surgery of nerve transfer was done in the cases where the proximal nerve root was not available due to avulsion injury, and hence direct nerve suturing was not possible. In these cases, transfer of the intact spinal accessory nerve was done to the suprascapular nerve to achieve neurotisation of the supraspinatus and infraspinatus which would stabilize the shoulder. The third surgery of Oberlin transfer was done for the patients who had upper brachial plexus lesion for whom the neurotisation of the biceps and brachialis muscles was done with intact fascicles from the ulnar nerve and the median nerves.

As far as the results of the surgical correction was concerned, 75% of the patients had improvement.

In the review of literature, six percent of patients had a good outcome with return of elbow flexion. Surgical techniques include neurolysis, nerve grafting, neurotization, and free muscle transfer.

Results are variable, but increased knowledge of nerve injury and repair, as well as advances in microsurgical techniques, allow not only restoration of elbow flexion and shoulder abduction but also of useful prehension of the hand in some patients.

CONCLUSION

The study revealed that the productive age group of 21 to 30 years was commonly injured with brachial plexus injury. It was the males who were mostly involved. Total brachial plexus injury formed a large chunk of the patients with brachial plexus injuries, but the second commonest involvement was the upper trunk lesion of C5,6 or C5,6,7.

It was commonly the right side that was involved and thus involved the dominant hand. Road traffic accidents with two wheelers formed the majority of cases with brachial plexus injuries. The occupation of the patient did not show any significant difference whether student, manual labourer of sedentary labourer was concerned.

The demographic pattern of injuries of brachial plexus was almost similar when the total plexus injury and the upper plexus injury were concerned, except in the presence of associated injuries, where, upper lesions appeared to have more percentage of associated injuries.

Outcome analysis revealed good results in surgical treatment of upper brachial plexus lesions, except in the Oberlin procedure of nerve transfer where the results were comparatively poorer.

Management of the patient is difficult pre and post operatively. A correct evaluation of the patient pre operatively, and planning and execution of the correct surgical procedure and post surgical rehabilitation are essential.

Nevertheless, with a highly motivated patient and a dedicated and specialized surgical team, the prognosis for functional recovery is good, especially in upper brachial plexus injuries, and these patients can still lead productive and satisfying lives.

Education of public regarding speed control, obeying traffic rules should be done especially for college students for prevention of brachial plexus injuries, which is much easier than curing these problems.

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13. Functional outcome of brachial plexus reconstruction after trauma by Ahmed-Labib M, Golan JD, Jacques L Department of Clinical Neurological Sciences, Division of Neurosurgery, University of Western Ontario, London, Canada. Neurosurgery [2007, 61(5):1016-22; discussion 1022-3

BRACHIALPLUXES INJURY ANALYSIS ON JUNE TO SEPTEMBER 2011- 4 MONTHS REGISTERED ANALYSIS

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/ DOMINENT	DATE OF INJURY	MODE OF INJURY	JOB/ STUDENT	ASSOCIATED INJURY	REMARK
1	S.Munian S/o. SubraManian P.S.NO297509	M	29	PAN Palsy	Left --NO	13.09.2009	**RTA-** 2wheeler	Hotel master	Nil	
2	Janakiraman h/o Gandhimathi P.S.NO.299383	M	45	C567	Right -Yes	04.11.2009	RTA- 2Wheeler Vs Bus	Security	Nil	
3	A.Karththikeyan S/OS.Andi P.S.NO.299800	M	24	C567	Right- Yes	25.10.2009	RTA- 2Wheeler Vs Bus	Provisional store keeper	Nil	
4	S.Dhanaraj OP./4523/H/09	M	15	C567	Right- Yes	2008	**RTA** Cycle Vs tractor	STUDENT	Nil	
5	Ramesh S/OShanmugam P.S NO 302566	M	28	C56	Left --NO	19.02.2009	RTA	Film actor	Nil	
6	Sastha S/OMahadevan P.S No 302365	M	24	C56	Right- Yes	23.02.2010	**RTA** Fall from two wheeler	Centering worker	Nil	
7	Jayaraman S/OPoongavanam	M	25	Pan palsy	Right- Yes	17.06.2009	**RTA** Two wheeler	welder	Nil	

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/ DOMINENT	DATE OF INJURY	MODE OF INJURY	JOB/ STUDENT	ASSOCIATED INJURY	REMARK
	P.S NO 296719						Vs lorry			
8	Thirunavukarassu S/o. Venu P.S NO E/2167/H09	M	35	Pan palsy	Right- Yes	23.01.2009	**RTA** Two wheeler VS lorry	Painter	YES S.C fracture Rt femur	
9	Mani S/OGopal P.S NO E/394H07	M	46	Pan palsy	Left --NO	06.01.2009	RTA pedestrian Vs car	Laborer Steel shop	YES Fracture BB fore Arm	
10	Vinayagam S/OKali P.S 301222	M	19	Pan palsy	Right- Yes	05.07.2009	RTA 2wheeler Vs 2wheeler	Cleaner TVS Company	YES Fracture Lt clavicle	
11	Govindaraj S/ORaju P.S NO 300242	M	33	Pan palsy	Left --NO	.08.2009 August month	RTA 2wheeler Vs lamp post	Painter	YES Fracture patella Lt femur	
12	Davis S/OLonappan P.S NO 303074	M	50	Pan palsy	Right- Yes	11.06.2007	RTA 2 wheeler Vs lorry	Welder	YES Rt.clavicle Lt Lower limb	
13	Murugesan S/OSivalingam P.S NO 301423	M	30	C56	Right- Yes	27.02.2010	RTA 2wheeler Vs tractor	Agriculture cooli	YES Clavicle fracture Rt	

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/ DOMINENT	DATE OF INJURY	MODE OF INJURY	JOB/ STUDENT	ASSOCIATED INJURY	REMARK
14	Srimathi D/o Elumalai P.S NO OP/1374/H/08	F	3	Pan palsy	Right- Yes	Since birth	BIRTH INJ			
15	Murugan S/ORama gower P.S NO 303765	M	31	Pan palsy	Right- Yes	04.08.2009	RTA2 wheeler Vs fall from bridge	Tailor	SSG Rt lower limb	
16	Anandamurugan S/OVenkatachal P.S NO 3011229	M	36	Pan palsy	Right- Yes	07.01.2010	TRAUMA fall from height	Mason	YES Right colle's fracture	
17	Thangadurai S/OMariyappan P.S NO278788	M	36	C56	Right- Yes	03.02.2009	RTA 2 wheeler Vs lorry	Sales man	Nil	
18	Saminathan S/OSengamuthu P.S NO 303527	M		C567	Left--NO	17.07.2009	Industrial accident	STONE CRUSHING machine operator	YES FRACTURE humerus	
19	Ramadass S/OGovindaraj P.S NO 303194	M	19	C567	Right- Yes	29.01.2010	RTA pedestrian Vs tractor	STUDENT 2ND YEAR MBA	RT.lower limb amputated	
20	Saravanan S/OGowrishanker P.S NO 302405	M	21	C567	Right- Yes	14.04.2010	RTA 2wheeler Vs lorry	Export garment	YES SHOULDER SUBLUXATION	

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/ DOMINENT	DATE OF INJURY	MODE OF INJURY	JOB/ STUDENT	ASSOCIATED INJURY	REMARK
21	Sridhar S/OSeker P.S NO G/2350/H07	M	22	Pan palsy	Left --NO	01.05.2006	RTA fall from 2 wheeler	WELDER	NIL	
22	Deepak S/ORanganathan P.S NO 35031/H/07	M	20	Pan palsy C5678t1	Left --NO	23.04.2007	INDUSTRIAL Stone crushing machine	Operated Stone crushing machine	NIL	
23	Chrukash S/OBhoopathy P.S NO 374/H/08	M	5	Pan palsy	Left --NO		BIRTH INJURY			
24	Prasad S/ORamiah P.S NO 304466	M	26	C56	Left --NO	03.062010	RTA Auto Vs lamp post	Auto driver	YES Head injury	
25	Rangash S/OSunder P.S NO 250851/05	M	07	Pan palsy	Left --NO	Since birth	BIRTH INJURY	STUDENT		
26	Vinnarasi w/o Shanker P.S NO 304763	F	27	C8T1	Right- Yes	02.04.2010	RTA Jeep toppled	HOUSE WIFE	YES Head inj # humerus	
27	Kathirvel S/OBalan P.S NO 303256	M	22	C567	Right- Yes	20.04.2010	RTA 2 wheeler Vs Car	MASON	YES Shoulder subluxation	
28	Manikandan S/OManickam P.S NO 305175	M	27	C56	Left- NO	26.05.2010	RTA 2 wheeler Vs lorry	Agricultural labour	YES SHOULDER DISLOCATION	

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/ DOMINENT	DATE OF INJURY	MODE OF INJURY	JOB/ STUDENT	ASSOCIATED INJURY	REMARK
29	Lavanya D/o Venkatesan P.S NO 305327	F	12	C56	Right- Yes		BIRTH INJURY	STUDENT VIII STANDARD		
30	Madan mohanS/OVaidhiyanathan P.S NO 305389	M	22	C567	Left --NO	09.072010	TRAUMATIC Fall of iron sheet on shoulder	STEDUENT B.E.	NIL	
31	Premkumar S/OAshokan P.S NO 305425	M	22	C567	Left --NO	25.05.2010	RTA pillion rider	STUDENT B.Com., C.A	YES 1ST Rib FRACTURE	
32	Narash S/ORavichandran P.S NO 305873	M	18	Pan palsy	Right- Yes	28.07.2010	RTA Fall from 2 wheeler	STUDENT 1ST YEAR B.E	YES Shoulder injury	
33	Velmurugan S/OPaldurai P.S NO 305995	M	26	C567	Right- Yes	27.11.2009	RTA 2 wheeler Vs Bus	Medical representative	NIL	
34	Shabeena d/o Sirajudean P.S NO 302327	F	23	C56	Right- Yes	12.08.2010	RTA 2 wheeler Vs car	Medical representative	YES Subluxation of shoulder	
35	Laneesh S/OChandran poolanki P.S NO307280	M	20	C567	Left --NO	02.05.2010	RTA 2 wheeler Vs Auto	B.Com Student	YES Mandible fracture	

BRACHIALPLEXUS INJURY ANALYSIS ON JUNE TO SEPTEMBER 2011- 4 MONTHS REGISTERED ANALYSIS

S. No	Name and PS Number	Sex	Age	Level of Injury	Side/ Dominent	Date of Injury	Mode of Injury	Job/ Student	Associated Injury	Remark
1	Janakiraman h/o Gandhimathi P.S NO 299383	M	45	C567	Right - Yes	04.11.2009	RTA- 2Wheeler Vs Bus	Security	Nil	
2	A.Karththikeyan S/OAndi P.S NO 299800	M	24	C567	Right- Yes	25.10.2009	RTA- 2Wheeler Vs Bus	Provisional store keeper	Nil	OPERATED IMPROVED
3	S.Dhanaraj P.S NO OP/4523/H/09	M	15	C567	Right- Yes	2008	RTA Cycle Vs tractor	STUDENT	Nil	
4	Ramesh P.S NO 302566	M	28	C56	Left --NO	19.02.2009	RTA	Film actor	Nil	Operated no improvement
5	Sastha S/Omahadevan P.S NO302365	M	24	C56	Right- Yes	23.02.2010	RTA Fall from two wheeler	Centering worker	Nil	
6	Murugesan S/OSivalingam P.S NO 301423	M	30	C56	Right- Yes	27.02.2010	RTA 2wheeler Vs tractor	Agriculture cooli	YES Clavicle fracture Rt	
7	Anandamurugan S/OVenkatachal P.S NO 301229	M	36	C56	Right- Yes	07.01.2010	TRAUMA fall from height	Mason	YES Right colle's fracture	OPERATED Improvement
8	Thangadurai S/O Mariyappan P.S NO 278788	M	36	C56	Right- Yes	03.02.2009	RTA 2 wheeler Vs lorry	Sales man	Nil	

S. No	Name and PS Number	Sex	Age	Level of Injury	Side/ Dominent	Date of Injury	Mode of Injury	Job/ Student	Associated Injury	Remark
9	Saminathan S/O Sengamuthu P.S NO 303527	M		C567	Left --NO	17.07.2009	Industrial accident	STONECRUSH machine operator	YES FRACTURE Humerus	
10	Ramadass S/O Govindaraj P.S NO 303194	M	19	C567	Right-Yes	29.01.2010	RTA pedestrian Vs tractor	STUDENT 2ND YEAR MBA	RT.lower limb amputated	
11	Saravanan S/OGowrishanker P.S NO 302405	M	21	C567	Right-Yes	14.04.2010	RTA 2wheeler Vs lorry	Export garment	YES SHOULDER SUBLUXATION	
12	Prasad S/ORamiah P.S NO 304466	M	26	C56	Left--NO	03.062010	RTA Auto Vs lamp post	Auto driver	YES Head injury	
13	Kathirvel S/OBalan P.S NO 303256	M	22	C567	Right-Yes	20.04.2010	RTA 2 wheeler Vs Car	MASON	YES Shoulder subluxation	OPERATED IMPROVED
14	Manikandan S/OManickam P.S NO 305174	M	27	C56	Left--NO	26.05.2010	RTA 2 wheeler Vs lorry	Agricultural labour	YES SHOULDER DISLOCATION	
15	Lavanya D/o Venkatesan P.S NO 3905327	F	12	C56	Right-Yes	Since birth	BIRTH INJURY	STUDENT VIII STANDARD	NIL	
16	Madan mohan S/Ovaidhiyanathan P.S NO 305389	M	22	C567	Left--NO	09.072010	TRAUMATIC Fall of iron sheet on supraclavicular area	STUDENT B.E.	NIL	OPERATED IMPROVED

S. No	Name and PS Number	Sex	Age	Level of Injury	Side/ Dominent	Date of Injury	Mode of Injury	Job/ Student	Associated Injury	Remark
17	Premkumar S/OAshokan P.S NO 305425	M	22	C567	Left--NO	25.05.2010	RTA pillion rider	STUDENT B.Com., C.A	YES 1ST Rib FRACTURE	
18	Velmurugan S/Opaldurai P.S NO 305995	M	26	C567	Right-Yes	27.11.2009	RTA 2 wheeler Vs Bus	Medical representative	NIL	OPERATED Improved well
19	Shabeena d/o Sirajudean P.S NO 302327	F	23	C56	Right-Yes	12.08.2010	RTA 2 wheeler Vs car	Medical representative	YES Subluxation of shoulder	OPERATED Improved
20	Laneesh S/Ochandran poolanki P.S NO 307283	M	20	C567	Left--NO	02.05.2010	RTA 2 wheeler Vs Auto	B.Com Student	YES Mandible Fracture	OPERATED Improved

BRACHIALPLEXUS INJURY ANALYSIS ON JUNE TO SEPTEMBER 2011- 4 MONTHS REGISTERED ANALYSIS

POST OPERATIVE OUT COME C56 AND C567 CASES

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/	DATE OF INJURY	DATE OF SURGERY	NAME OF THE SURGERY	REMARK
1	Janakiraman H/O Gandhimathi P.S.No-299383	M	45	C567	Right	04.11.2009	28.04.2010	Neurolysis of C567	OPERATED Improved
2	A.Karththikeyan S/O Andi P.S.No-299800	M	24	C567	Right-	25.10.2009	June 2010	Neurolysis of C567	OPERATED Improved
3	S.Dhanaraj o.p/4523/H/09	M	15	C567	Right-	2008			
4	Ramesh S/O/Shanmugam P.S.No-302566	M	28	C56	Left	19.02.2009	25.06.2010	EXPLORATION NEUROLYSIS C56 Spinal Accessory N to Supraclavicular N	OPERATED Improved
5	Sastha S/O mahadevan P.S.No=302365	M	24	C56	Right	23.02.2010			
6	Murugesan S/O Sivalingam P.S.No301423	M	30	C56	Right	27.02.2010			
7	Anandamurugan S/O Venkatachal P.S.No-301229	M	36	C56	Right	07.01.2010	November 2010	Oberlin's procedure	OPERATED NO Improvement
8	Thangadurai S/O Murugappan P.S.No-278788	M	36	C56	Right	03.12.2009			
9	Saminathan S/O Sengamuthu P.S.No-303527	M		C567	Left	17.07.2009			
10	Ramadass S/O govindaraj P.S.No-303194	M	19	C567	Right	29.01.2010			

S. NO	NAME AND PS NUMBER	SEX	AGE	LEVEL OF INJURY	SIDE/	DATE OF INJURY	DATE OF SURGERY	NAME OF THE SURGERY	REMARK
11	Saravanan S/O Gowrishanker P.S.No302405	M	21	C567	Right	14.04.2010			
12	Prasad S/O ramiah P.S.No304466	M	26	C56	Left	03.062010			
13	Kathirvel s/o Balan P.S.No-303256	M	22	C567	Right	20.04.2010	August 2010	EXPLORATION NEUROLYSIS C56 Sp. Accessory N to Supracapular N	OPERATED Improved
14	Manikandan s/o Manickam P.S.No-305174	M	27	C56	Left	26.05.2010			
15	Lavanya D/o Venkatesan 9941650343	F	12	C56	Right	Since birth			
16	Madan mohan S/Ovaidhiyanathan P.S.No-305389	M	22	C567	Left	09.072010			OPERATED Improved
17	Premkumar S/OAshokan P.S.No-305425	M	22	C567	Left	25.04.2010			
18	Velmurugan S/Opaldurai P.S.No 305995	M	26	C567	Right	27.11.2009	14.09.2010	Sp. Accessory N to Supracapular N Oberlin's procedure Median N to biceps	OPERATED Improved
19	Shabeena d/o Sirajudean 302327	F	23	C56	Right	13.11.2009	16.06. 2010	EXPLORATION NEUROLYSIS C56 Spinal Accessory N to Supracapular N	OPERATED Improved
20	Laneesh S/Ochandran poolanki 307283	M	20	C567	Left	02.05.2010	Dec 2010	Neurolysis of C567	OPERATED Improved