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STUDY OF BRACHIAL PLEXUS INJURY

Plastic Surgery

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ABSTRACT

Introduction The introduction of novel distal nerve transfers has changed the way in which brachial plexus surgery is being performed. Although full recovery of function after brachial plexus reconstruction still remains unachievable, the exciting developments of the past several years have considerably improved surgical outcomes, and future directions for research are promising. **Aim And Objective** To review incidence, mechanics, various patterns, treatment regimes, outcome and morbidity factors of various types of Brachial plexus injury and various circumstances which led to Brachial plexus injury in our department. **Material And Methods** This study is prospective study and 24 patients with adult brachial plexus injury admitted during the period from 2014 to 2017 are included in this study. Patients with adult brachial plexus injury, initially treated elsewhere and referred to our department are also included in the study. Paediatric brachial plexus injury obstetric brachial plexus palsy are not included in this study **Results** In this study brachial plexus injury injuries are more common in male (90%) compared to female (20%), more in age group of 20-30 years(54%), road traffic accident is the most common mode of injury (79.16%), maximum number of patients presented between 3 to 6 months of injury(50%), 75% patients had preganglionic injury and supraclavicular injury(95.8%) ,more common in right side(62.5%), upper and middle trunk mostly involved(90% and 83.3% respectively). 79.16% patients were operated with anterior approach. Neurotization with spinal accessory nerve (SAN) to suprascapular nerve (SSN) done in 95% patients out of 24 patients through posterior approach. Neurotization with phrenic to musculocutaneous nerve (MC) and intercostal nerve (ICN) to musculocutaneous nerve through anterior approach in 79% and 21% patients respectively. **Conclusion** This study gives an insight into the epidemiological aspects of brachial plexus injuries in our unit which reflects the situation in India and also about the few parameters of quality of life following brachial plexus injuries.

KEYWORDS

Brachial plexus injury, SAN- Spinal accessory nerve, SSN- Suprascapular nerve, MC-Musculocutaneous nerve, ICN- Intercostal nerve

INTRODUCTION

In the early 19th century, well before microsurgical equipment and techniques were developed, surgeons published encouraging results of brachial plexus reconstruction. Subsequently, others reported poor results and high complication rates. Little else was published on reconstruction of the brachial plexus until the 1970s and 1980s, when surgeons began to apply the fascicular nerve grafting techniques described by Millesi to birth and traumatic injuries of the brachial plexus. These pioneers established indications and techniques for plexus reconstruction and reported better recovery in operated patients than in those observed without surgical reconstruction. In the late 1980s and early 1990s, advances occurred in diagnostic and surgical techniques. New surgical procedures and experimental non-operative treatments were introduced. In the late 1990s, very aggressive reconstructions using extra-plexal sources for re-innervations of vascularised muscle transfers were reported. In the past 10 years, the role of nerve transfers has expanded. The introduction of novel distal nerve transfers has changed the way in which brachial plexus surgery is being performed. Although full recovery of function after brachial plexus reconstruction still remains unachievable, the exciting developments of the past several years have considerably improved surgical outcomes, and future directions for research are promising.

MATERIAL AND METHODS

This hospital-based prospective study was conducted in year 2014–2017 under department of burns and plastic surgery, Civil Hospital, Ahmedabad in 24 patients of adult brachial plexus injury to review incidence, mechanics, various patterns, treatment regimes, outcome and morbidity factors of various types of Brachial plexus injury and various circumstances which led to brachial plexus injury in our department.

All patient had brachial plexus injury underwent for physiotherapy and nerve current therapy before and after surgery. Before surgery all patient were investigate in form of MRI study, EMG –NCV, Muscle charting of affected limb, Ultrasonography of abdomen and thorax for check the diaphragmatic movement. Colour Doppler ultrasound done in selected cases in which suspected for vascular injury.

Inclusion criteria :

- All patients with adult brachial plexus injury admitted during the period from 2014 to 2017 are included in this study.
- Patients with brachial plexus injury, initially treated elsewhere and referred to plastic surgery department for further treatment are included in the study.

Exclusion criteria :

- Patients operated outside following Brachial plexus injury are not included.
- Pediatric brachial plexus injury
- Obstetric brachial plexus palsy

OBSERVATIONS AND RESULTS

In this study brachial plexus injury injuries were more common in male (90%) compared to female (20%). As per this study, all patients fall in the age between 20 to 58 years hence we divided them in to two groups according to age , in 20-30 years age group there were 13 patients, 30-40 years age group 3 patients, 40-50 years age group 4 patients and 4 patients were above the age of 50 years. So data suggest that brachial plexus injury occurs more commonly in age group of 20-30 years.

Table 1:

AGE IN YEARS	NO OF PATIENTS	PERCENTAGE (%)
20-30	13	54
30-40	03	13
40-50	04	16.5
>50	04	16.5

Road traffic accident was the most common mode of injury (79.16%) and remaining patients had mode of injury was fall from height (20.84%).

Table 2:

ATTENDANCE BASE	NO OF PATIENTS	PERCENTAGE (%)
0-3 MONTHS	07	29.5
3-6 MONTHS	12	50
>6 MONTHS	05	20.5
Total	24	100

As shown in table 2 maximum number of patients presented between 3 to 6 months of injury, followed by early presentation at 0 to 3 month, whereas 5 patients presented late i.e. more than 6 months of injury.

Table 3:

TYPE OF INJURY	NO OF PATIENTS	PERCENTAGE (%)
HEAD INJURY	6	25
BONY INJURY	4	16.5
THORACIC INJURY	2	8.5
NO INJURY	12	50

In this study 6 patients had associated head injury, 4 had bony injury, 2 had thoracic injury, and 12 patient had no other associated injury. Data of this study suggested that maximum patients presented with brachial plexus injury had no associated injuries.

75% patients had preganglionic injury and supraclavicular injury(95.8%) and more common in right side(62.5%).

Table 4:

SITE OF INJURY	NO OF PATIENTS	PERCENTAGE (%)
UPPER TRUNK	22	90
MIDDLE TRUNK	20	83.3
LOWER TRUNK	15	62.5
GLOBAL	08	33.3

In this study, it was noted that injury of upper and middle trunk was maximum i.e. 22 (90%) and 20 (83.3%) respectively whereas global injury was found only in 8 patients (33.3%).

Table 5:

TYPE OF INJURY	NO OF PATIENTS	PERCENTAGE (%)
SUPRA CLAVICULAR	23	95.8
INFRA CLAVICULAR	01	4.2
BOTH	01	4.2

This study showed that maximum number of patients had supraclavicular injury (95.8%) as compared to infraclavicular injury (4.2%).

Table 6:

NEUROTIZATION	NO OF PATIENTS	PERCENTAGE (%)
PHRENIC TO MC	15	79
ICN TO MC	04	21
SAN TO SSN	23	95

Out of 24 patients 23 patients (95%) were operated via posterior approach and neurotization with spinal accessory nerve (SAN) to suprascapular nerve (SSN) done. Neurotization with phrenic to musculocutaneous nerve (MC) and intercostal nerve (ICN) to musculocutaneous nerve through anterior approach in 79% and 21% patients respectively.

In follow up period, 23 patients who underwent SAN to SSN neurotization shows good shoulder recovery (95%). While phrenic and intercostal to musculocutaneous neurotization in 19 patients shows good recovery in elbow function (79.16%).

DISCUSSION

There are varying statistics about the epidemiology of traumatic brachial plexus injuries in different parts of the world. The report by S Raja Sabapathy is considered as an important reference. It is a larger series with 304 patients over a span of 12 years elucidating the type of presentation and treatment of brachial plexus injuries [1]. Our results were compared and variation in our population were noted.

Terzis from USA studied the outcomes of 204 patients who underwent reconstruction for brachial plexus injuries over the period of 18 years and enumerated few of the epidemiological aspects in her study like the gender ratio, injured side, vehicle associated with brachial plexus injury, speed of the vehicle at which the accident occured and the associated injuries [2]. Kim from USA studied the outcome of surgery in 1019 brachial plexus lesions but this study included tumours and thoracic outlet syndrome [3]. Our study group involves only post-traumatic brachial plexus injuries and does not include iatrogenic injuries or tumours of the brachial plexus. This study is also a prospective study as other studies, but in addition we have the data from 24 patients as to their long-term status.

Road traffic accidents are the predominant cause of traumatic brachial plexus injuries in most of the studies but the contribution of road traffic accidents towards the brachial plexus injuries varies in different studies. Songcharoen reported that 91% of the brachial plexus injuries in Thailand were due to road traffic accidents [4]. Dubuisson from Belgium reported that 60% of the traumatic brachial plexus injury were due to road traffic accident and 31% occurred while riding a two wheeler [5]. Kandenwein from Germany found that 81% traumatic brachial plexus injuries were due to road traffic accidents and 65% of the injuries involved two wheelers [6]. S Raja Sabapathy from,Ganga Hospital, Tamil Nadu , India found that 94% of the traumatic brachial plexus injuries were due to road traffic accidents and 90% of these road traffic accidents are associated with two wheelers[1]. In our study, we found that 87.5% of the traumatic brachial plexus injuries were due to road traffic accidents and, which is similar to the other literature. This clearly indicates the kind of vehicles used and the economic status of the country.

We found no open injuries, whereas the study done by Dubuisson had 23 open injuries out of 100 patients [5]. Kim from USA reported 19% open injuries in the form of laceration and gunshot injuries to brachial plexus [3]. In our study, 50% of the patients were part of poly-trauma and 50% were isolated brachial plexus injuries. In S Raja Sabapathy study, 54% of the patients were part of poly-trauma and 46% were isolated brachial plexus injuries. This study gives an idea of the pattern of brachial plexus injury which a referral centre will see [1].Terzis showed that 57% had some fracture and 20% had clavicle fracture in the involved extremity [2].

In centres which receive more high-velocity trauma, vascular injury appears to be more common. Clavicle was the most frequently associated fracture reported by Kandenwein, which was 20.9%, whereas in our study we found clavicle fracture in 11% of the patients [6]. There were two individuals who had a clavicle fracture and an associated vascular injury. Lesser number of associated injuries suggests that the injuries sustained in our population could be due to low velocity when compared to the west. Femur was the most common bone to be fractured, followed by humerus, clavicle and radius ulna in our series.

In our study, it was recorded that maximum number of patients had pre-ganglonic injury which was 75% as compared to postganglionic injury which was 37.5%. With only 12.5% patients having both pre and post ganglionic injury, noted that association of upper and middle Trunk injury was maximum which was 90% and 83.3% and lower trunk 62.5% respectively whereas global injury was found in only 33.3% patients. In our study 95.8 per cent of patient had supraclavicular injury. Eighty-nine per cent had at least one of the roots avulsed. Of the avulsed roots, 59% involved C7, C8 and T1. Ninety-six per cent of the patients who underwent brachial plexus exploration had supraclavicular lesion. Brophy had found that 70-75% of the lesions were supraclavicular [7].

The dominant arm was found to be the most commonly injured, which is the right side. This is similar to many other studies. This reinforces that the side of the road used for driving does not determine the side of the arm affected [8].

The average time interval from the date of injury to exploration of the brachial plexus was 6 month and 19 (79.5%) patients presented to us within this duration. This reflects the awareness among the patients about centres treating brachial plexus injuries. This is a good trend in a developing country. Patient, public and peer education can even probably reduce this time interval.

The presence of pain has shown a wide range of incidence in various studies. In our study, all of the patients had pain at the time of presentation. In our study we preferred posterior approach for shoulder function in which we obtained recovery of function in 95 % patients and anterior approach was used for elbow function of which 87.5 % patients had recovery.

CONCLUSION

This study gives an insight into the epidemiological aspects of brachial plexus injuries in our unit which reflects the situation in India and also about the few parameters of quality of life.

Brachial plexus injury is more common in younger age group between 20-40 years and more common in male. Road traffic accidents are the most common mode of traumatic brachial plexus injury which accounted for 87.5% and of the known causes of road traffic accident injuries.

Associated injuries like fractures, thoracic injuries and head injuries

are much less probably due to the low velocity nature of these injuries.

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