

# EPIDEMIOLOGICAL STUDY OF TRAUMATIC BRACHIAL PLEXUS INJURIES

## ESTUDO EPIDEMIOLÓGICO DAS LESÕES TRAUMÁTICAS DO PLEXO BRAQUIAL

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### ABSTRACT

**Objective:** To conduct an epidemiological study on brachial plexus injuries, through data collection of patients treated in the Hospital São Paulo, which is the referral center for high complexity in this region. **Methods:** We conducted a retrospective study with a review of the electronic medical records of the Hospital, from August 2008 to June 2013. **Results:** We estimated an 1.88/100,000 annual incidence, considering that the Hospital is the only referral center for brachial plexus injuries. The mean time between injury and the first visit to the reference hospital was 8.25 months. The mean time interval between injury and surgery was 11.25 months. The percentage of total injuries was 33%, while the upper and middle trunk injuries were 33% and 28%, respectively. **Conclusion:** We observed many aspects in common with those reported by other centers of excellence in Brazil such as: sex, age and mechanism of injury. However, some findings were different from most other epidemiological studies, namely: level of injury, time between the accident and the first appointment and the time between injury and surgery. **Level of evidence IV, case series.**

**Keywords:** Epidemiology. Brachial Plexus Surgery. Brachial. Plexus Injury.

### RESUMO

**Objetivo:** Realizar um estudo epidemiológico das lesões do plexo braquial através do levantamento de dados dos pacientes atendidos no Hospital de referência para alta complexidade da região metropolitana de São Paulo. **Métodos:** Estudo retrospectivo com avaliação dos prontuários eletrônicos do HMC-SA, de agosto de 2008 até junho de 2013. **Resultados:** Levando-se em consideração que o Hospital é o único centro de referência para lesões do plexo braquial, chegamos a uma incidência anual estimada em 1,88/100.000 habitantes. A média de tempo entre a lesão e a primeira consulta no hospital foi de 8,25 meses. O intervalo de tempo entre a lesão e a cirurgia foi em média de 11,25 meses. A porcentagem de lesões totais foi de 33%, enquanto as lesões de tronco superior e tronco superior e médio foram de 33% e 28%, respectivamente. **Conclusão:** Observamos muitos aspectos em comum com os relatados por outros centros de referência no Brasil, tais como: gênero, idade e mecanismo de trauma. No entanto, alguns achados foram diferentes da maioria dos outros estudos epidemiológicos: nível de lesão, tempo decorrido entre o acidente e o primeiro atendimento e o intervalo de tempo entre a lesão e o tratamento cirúrgico. **Nível de evidência IV, série de casos.**

**Descritores:** Epidemiologia. Plexo Braquial, cirurgia. Plexo Braquial, lesões.

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### INTRODUCTION

Traumatic brachial plexus injuries are very prevalent in large urban centers due to the association with traffic accidents, especially motorcycles<sup>1</sup>. The functional loss caused by these injuries is significant, resulting in different degrees of paralysis and anesthesia of the affected upper limb according to the extent of the neurological injury, also causing loss of work capacity and quality of life<sup>2</sup>. In addition to the initial extent of the injury, the functional prognosis of these patients depends on early surgical treatment, since they are neurological injuries.<sup>3</sup> Therefore, there is a need to shorten the period between trauma and surgical treatment as much as

possible in patients with indication for surgery.<sup>3</sup> Surgical procedures in this situation are generally of high complexity, requiring adequate hospital infrastructure and a highly specialized team, which is the reason why the centers specialized in the treatment of these injuries are scarce in Brazil, even in the state of São Paulo (Instituto de Ortopedia e Traumatologia do Hospital das Clínicas de São Paulo – IOTFMUSP, Hospital São Paulo – Universidade Federal de São Paulo – UNIFESP, Santa Casa de São Paulo). Hospital Estadual Mario Covas is the only reference center in the treatment of brachial plexus injuries in the “ABC” metropolitan region, which includes the population of the municipalities of

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The study was conducted at the Faculdade de Medicina do ABC, Hand Surgery and Microsurgery Service, Santo André, SP, Brazil.

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Santo André, São Bernardo do Campo and São Caetano, and the adjacent municipalities of Mauá, Diadema, Ribeirão Pires and Rio Grande da Serra (DATASUS). Epidemiological studies on this injury in the large urban centers of the country are scarce, and inexistent in the metropolitan region<sup>1,4</sup>. Our study sought to conduct an epidemiological study of brachial plexus injuries in this region through data collection of patients treated in the Hospital São Paulo, which is the reference center for high complexity surgery in the metropolitan region of São Paulo.

## MATERIALS AND METHODS

A retrospective study of traumatic brachial plexus injuries was conducted with evaluation of the electronic medical records of the Hospital from August 2008 to June 2013.

The survey of medical records was based on the MV-2000 search system, the electronic medical records program used in the institution since 2007, with the International Code of Diseases (ICD-10) of traumatic brachial plexus injury (S14.3, G54.0) as a parameter. The patients included in our study signed the informed consent form according to the ethics committee protocol (68035417.4.0000.0082) of the institution. The following exclusion criteria were adopted in the survey of medical records:

- Patients with clinical picture not compatible with traumatic brachial plexus injury;
- Children classified as traumatic brachial plexus injury according to the ICD, but of obstetric palsy nature;
- Incomplete medical records, which did not contain the date and mechanism of injury;
- Patients who were not located and were, therefore, not evaluated or examined by the authors.

The data obtained from the medical records were:

- Patient's sex and age;
- Date of accident;
- Affected side;
- Level of brachial plexus injury;
- Mechanism of injury;
- Associated injuries;
- Time between the date of the injury and the first appointment in the group;
- Time between the date of the injury and the surgical procedure;
- The surgical procedures performed.

## RESULTS

From August 2008 to June 2013, 94 patients with ICD-10 compatible with traumatic brachial plexus injury were treated. Of these patients, 30 (32%) were excluded from our analysis due to the following reasons:

- 4 due to incomplete medical records;
- 2 due to ICD-10 not compatible with the clinical picture;
- 24 due to obstetric palsy

Therefore, 64 of the 94 patients tracked in this period were included in our study. All patients were residents of the metropolitan region and were treated by the Hand Surgery and Microsurgery team of the Hospital São Paulo. Of the patients selected, 95% were men and 5% women.

Right-side injury was more frequent, with 57% of cases, and then left-side injury, with 41%. There was a case of bilateral injury, corresponding to 2% of the sample.

The mean age of the patients affected was 26 years, ranging between 12 and 50 years. This injury was more frequent in patients between 20 and 24 years.

The mean time between the occurrence of trauma and the first evaluation in the outpatient clinic was 8.25 months, ranging between

3 days and 15 months. Most patients (25%) were evaluated within 4 weeks after the accident.

Traffic accidents were the most frequent mechanism of injury, especially motorcycle accidents, which affected 48 patients (75%). Also, bicycle accidents affected three people (5%), and two patients (3%) were hit by car.

The other mechanisms of injury were:

- 6 due to gunshot wound (9%);
- 2 due to lacerations (3%);
- 1 due to direct trauma (2%);
- 2 due to syncope, followed by a fall (3%).

Forty-one patients (64%) were polytraumatized, while 23 patients (36%) had isolated brachial plexus injuries. Of the associated injuries, 4 (6%) affected both lower and upper limbs, 12 (19%) affected only the lower limbs and 10 (16%) only the upper limbs. Nine patients (14%) had severe traumatic brain injury – TBI, while 3 patients (4%) had severe abdominal or thoracic trauma. (Tables 1, 2 and 3)

Forty-two patients (66%) underwent some type of surgical treatment, 59 (90%) nervous reconstruction procedures and 6 (10%) orthopedic procedures.

**Tabela 1.** Percentage of the level of injury.

Injury level	Number of Patients	Percentage
C5C6	21	33%
C5C6C7	17	26%
C8T1	5	8%
Total Injury	21	33%

**Table 2.** Percentage of neurological surgeries performed.

Surgery	Number of patients	Percentage
Neurlysis/Exploitation	5	12%
Median to biceps	12	29%
Ulnar to biceps	3	7%
Median and ulnar to biceps	1	2%
Radial axilla	3	7%
Intercostal to biceps	10	24%
Nerve grafting	0	0%
Phrenic to supra	1	2%
Suprascapular nerve accessory	3	7%

**Table 3.** Percentage of orthopedic surgeries performed.

Surgery	Percentage
Free transfer from gracilis muscle	2%
Muscle transfers	7%

Twenty-two patients (34%) could not undergo surgical treatment due to the following reasons:

- 12 due to spontaneous neurological recovery of the key muscles initially compromised (18.75%): 4 patients with C5-C6 injury, 2 patients with C5-C7 injury, 2 patients with total injury and 5 patients with C8-T1 injury.
- 3 due to comorbidities that counter-indicated surgical treatment (4.7%)
- 3 due to treatment abandonment (4.7%)

- 4 due to recent injuries with less than 6 months of follow-up (6.25%)

The mean time between injury and surgery was 11.6 months, ranging between 5 and 48 months.

## DISCUSSION

We found only three epidemiological studies on traumatic brachial plexus injuries in Brazil.<sup>4-6</sup> Studies on this injury are scarce even in other countries.<sup>7</sup>

The population of the ABC metropolitan region is about 2,771,554 inhabitants, according to DATASUS source (August 7, 2019). We estimated an 1.88/100,000 annual incidence in ABC, considering that the Hospital Estadual Mario Covas is the only reference center for high complexity traumas, with 12.3 cases of traumatic brachial plexus injury per year. This value was similar to the 1.75/100,000 incidence per year estimated by Flores<sup>5</sup> in the population of the Federal District-DF.

Of all patients, 95% were men and only 5% women. This is consistent with the prevalence found in the literature, which shows a greater prevalence of men.<sup>4-6</sup>

The mean age of the patients affected was 26 years, ranging between 12 and 50 years, also consistent with the literature, in which most patients are young, making this injury even more devastating from the socio-economic point of view.<sup>4-6</sup>

The right-side injury was more frequent, with 57% of cases, versus 41% cases of left-side injury. This finding agrees with the results observed by Flores and Rocha et al.<sup>4,5</sup> However, a higher frequency of left-side injury was observed in the study by Faglione et al.<sup>6</sup>

In our study, the mean time between the trauma and the first appointment in the reference hospital was 8.25 months, ranging between 3 days and 15 months. This interval was longer when compared with the study of Flores et al., in which the mean interval between accident and care ranged between 2 and 5 months.<sup>5</sup> A larger population and area of coverage of the health service in our study could, partially, explain the greatest delay for the correct referral of patients with brachial plexus injury. On the other hand, this may also reflect a better organization and communication among hospitals that are part of primary trauma care in the DF region.

Regarding the interval between injury and surgery, the mean of 11.25 months in our study was higher when compared with studies by Rocha et al. and Faglione et al.<sup>4,6</sup>

In the comparative evaluation of the etiology of the injury, motorcycle accident was responsible for 73% of the cases, while this proportion ranged between 28.8% and 79% in the literature.<sup>4-6</sup> Firearm injuries accounted for 9% of cases in our study. This proportion was 3% in Rio de Janeiro-RJ, 20% in Brasília-DF and 4.1% in a large health center

in São Paulo. Bicycle accidents occurred in 5% of the cases, while in other studies this proportion ranged between 1.5% and 3.2%.<sup>4,6</sup> The occurrence of syncope (two cases) as a causal factor of brachial plexus injury in our sample was not reported in previous studies.

Most patients (65%) were polytraumatized and had associated injuries of the lower and upper limbs. More severe life-threatening injuries occurred in 14% of cases. These findings agree with the results found in the literature and were already expected, considering that most patients were victims of motorcycle accidents.<sup>4-6</sup>

Regarding the level of brachial plexus injuries, the percentage of total lesions was 33%, while upper and middle trunk injuries were 33% and 28%, respectively. The proportion of patients with total injury was lower than the proportion observed in the literature (50% to 70%), while the proportion of patients with upper trunk injury was higher (between 15% and 25%).<sup>4-7</sup>

The percentage of patients with isolated lower trunk injury in our study (8%) was similar to that observed in the studies of Rio de Janeiro and the Federal District.<sup>4,5</sup> However, this proportion was much lower in the study by Faglioni et al. (2.9%).<sup>6</sup>

Moreover, we observed a spontaneous neurological recovery of the compromised key muscles in twelve patients (18.75%) in less than 6 months, which made reconstruction or nerve repair unnecessary. All five patients with isolated lower trunk injury recovered without the need for surgical intervention. This proportion was 19% for upper trunk injuries and 11.7% for C5-C7 injuries and total injuries. These data are extremely relevant, but they were not mentioned in other studies.

Sixty-six percent of all patients underwent some type of surgical treatment, which was a nerve repair/reconstruction or orthopedic procedure. The most performed procedures were neurotizations to biceps and shoulder reinnervation. Noteworthy, the transfer of intercostal nerves to the motor branch of the biceps accounted for 24% of the procedures, while the transfer of a motor branch of the median or ulnar nerve accounted for 36%, and the transfer of the accessory spinal nerve to the nerve suprascapular accounted for 7%.

## CONCLUSION

We observed many aspects in common with those reported by other reference centers in Brazil after epidemiological analysis of the population with traumatic brachial plexus injury in the region (ABC metropolitan region), namely: sex, age and mechanism of injury. However, some findings were different from other epidemiological studies: level of injury, time between accident and first appointment and time between injury and surgical treatment. We emphasize that almost 20% of our patients had spontaneous functional recovery during outpatient follow-up and did not need surgical treatment.

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