Characteristics of Patient with Brachial Plexus Injury in Neurophysiology Laboratory of Dr. Hasan Sadikin General Hospital Bandung, Indonesia, from 2003 to 2012

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Abstract

Background: Brachial plexus is a network of nerves that controls the upper limb. Unfortunately, it can be injured easily which is called brachial plexus injury (BPI). It can cause disability. Until now, the epidemiology of BPI in Indonesia is still lacking. The aim of this study was to describe the characteristics of patients with BPI in Bandung, in order to increase knowledge and attention of health care provider and community to prevent BPI.

Methods: This was a descriptive retrospective study. Data from medical records of patients with BPI who underwent electromyography (EMG) in Neurophysiology Laboratory Dr. Hasan Sadikin General Hospital, Bandung from 2003 to 2012 were collected. The data included age, sex, mode of injury, affected side and distribution of paralysis. Collected data were presented as percentages shown in tables.

Results: A total of 91 cases were collected during study period, which consisted of 69 males and 22 females (76% vs. 24%). Most of them were in productive age group (11–20 years and 21–30 years). The main cause of brachial plexus injury was traffic accident (76%), followed by birth injury. Distribution of paralysis was mostly in postganglionic area of cervical (C)5, C6, C7, C8 and thoracal (T)1 (67%). Around two third of the cases involved the right side of upper limb.

Conclusions: The study showed that most of patients with BPI are male in their productive ages. Traffic accident is the most common cause, and the most affected side is the right side of upper limb. [**AMJ**.2015;2(3):319–23]

Keywords: Birth injury, brachial plexus injury, traffic accident

Introduction

Brachial plexus injury (BPI) is one of the peripheral nerve disorders characterized by lesion in the brachial plexus. BPI can cause disability, and its manifestations are diverse, ranging from movement disorders to arm deformation. Mode of injury and location of the nervous damage determine the clinical manifestations.[1]

The BPI can be caused by trauma (contusion and avulsion), compression, radiation, and surgery.[1] According to McKinley et al[2], the prevalence of BPI is 10% of the total peripheral nerve disorders and the incidence increases every year. The increasing number of cases is likely due to an increasing number of traffic accidents both in developed and developing countries. According to a study in India[3], there are 94.4% cases of BPI caused by traffic (motor vehicle) accidents.

The epidemiological study revealing the characteristics of patient with BPI is important, as it can be a tool to increase public awareness and service of care providers for this disease. There are some epidemiological studies in BPI, but the data are limited in Indonesia. Furthermore, studies of BPI put more emphasis on the incidence of BPI due to birth injury rather than describing the incidence of BPI in adult population. The aim of this study was to describe the characteristics of patients with BPI between 2003 to 2012 in the Neurophysiology Laboratory of Dr. Hasan Sadikin General Hospital Bandung.

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Table 1 The Age Group and Sex Distribution of the Patients

Age in years	Sex		n	%
	Male	Female		
<1	4	3	7	8
1–10	2	4	6	7
11–20	16	7	23	25
21–30	20	1	21	23
31–40	12	2	14	15
41–50	4	1	5	5
51–60	5	3	8	9
61–70	5	0	5	5
71–80	1	0	1	1
81–90	0	0	0	0
91–100	0	1	1	1
Total	69 (76%)	22 (24%)	91	100

Methods

The total population of medical records of patient with BPI who underwent electromyography (EMG) for the first time in the Neurophysiology Laboratory of Dr. Hasan Sadikin General Hospital Bandung from January 2003 to December 2012, were included in this study. It concluded 91 medical records.

Data were retrieved from medical records and archives of EMG results, including age, sex, mode of injury, affected side and distribution of paralysis. The collected data were analyzed using descriptive statistical analysis. Frequency distribution and percentage of the mentioned variables were calculated. This study was approved by the Health Research Ethics Committee Faculty of Medicine Universitas Padjadjaran.

Results

In this study, almost half of the cases of BPI were found in teenager and young adult (11–20 years and 21–30 years), i.e. 25% and 23%, respectively. In total, there were 63patients (69%) who were in productive age group (11–50 years). There were 52% of male patients in this study who were in productive

Table 2 Distribution of Affected Side and Level Paralysis

Level of paralysis	Affected side		n	%
	Right	Left		
C5, C6, C7, C8, T1 (postganglionic)	40	21	61	67
C5, C6, C7, C8, T1 (preganglionic)	1	1	2	2
C5, C6 and C8, T1	2	0	2	2
C5, C6 (superior)	12	5	17	16
C8, T1 (inferior)	3	2	5	9
C5, C6, C7	2	0	2	2
C6, C7, C8, T1	1	0	1	1
C7, C8, T1	0	1	1	1
Total	61 (67%)	30 (33%)	91	100

Table 3 Distribution of Level Paralysis and Mode of Injury

Mode of Injury	Level of paralysis								n	%
	C5–T1 (post)	C5–T1 (pre)	C5, C6 C8, T1	C5, C6 (sup)	C8, T1 (inf)	C5–C7	C6–T1	C7–T1		
Traffic Accident	52	2	2	7	4	2	0	0	69	76
Birth Injury	4	0	0	4	1	0	0	1	10	12
Fall from Height	2	0	0	2	0	0	0	0	4	4
Neuropathy	1	0	0	2	0	0	1	0	4	4
Radical Mastectomy	1	0	0	0	0	0	0	0	1	1
Carrying Heavy Backpack	0	0	0	2	0	0	0	0	2	2
Working Injury	1	0	0	0	0	0	0	0	1	1
Total	61	2	2	17	5	2	1	1	91	100

age (11–30 years old). Male female ratio of BPI in this study was 3:1 (Table 1).

Traffic accident was the most common cause of BPI, and accounted for 69 patients (76%). In addition, there were 22 patients who suffered BPI not caused by traffic accident. There were ten patients with history of birth injury, four patients fell from height, four neuropathy patients, two patients carried a heavy backpack, one patient had radical mastectomy, and one patient had working injury.

Most lesions in this study were global plexus palsy that involved postganglionic of cervical (C)5, C6, C7, C8 and thoracal (T)1 which was accounted for 61 patients (67%). The ratio between postganglionic and preganglionic of global palsy is 61:2. In this study, the patient with C5, C6 (superior) BPI was more than C8, T1 (inferior) BPI. The right side was involved more than the left side (Table 2).

The BPI related to traffic accident had lesion that were mostly postganglionic in C5, C6, C7, C8, T1 (n=52; 57%). Two patients carrying heavy backpack had the lesion in C5, C6 (superior brachial plexus). All patients with radical mastectomy had lesion at postganglionic of global palsy sites namely, C5, C6, C7, C8, T1. The most common lesion in patients with neuropathy was C5, C6 (superior brachial plexus). There was a balanced distribution of lesions between postganglionic of global palsy sites namely, C5, C6, C7, C8, T1 and C5, C6 (superior brachial plexus) in patients with birth injury and fall from height (Table 3).

Discussion

Brachial plexus is a part of peripheral nerve that combines and forms a network structure consisting of the root, trunk, division and cord. The final branches of brachial plexus are the five major nerves, i.e. the axillary nerve, musculocutaneous nerve, median nerve, radial nerve, and the ulnar nerve.[1,4]

Epidemiology of BPI in different area in the world is various. In this study, 69% patients were in the productive age (11–50 years), and 76% of the total study population were male. This is consistent with three studies that have been conducted in Western countries. According to Steven et al.[5], Doi et al.[6] and Dubuisson[7], most patients with BPI are men aged between 15–25 years old. The similar results have been submitted by Darshan et al.[3] and Kaewpralad et al.[8] who conducted the studies of BPI in Asia. According to Darshan et al.[3] most of patients with BPI in India between 2002 to 2011 are male in the productive age group (21–30 years). According to Kaewpralad et al.[8], out of 178 patients with BPI, 156 of them were male with an average age of 29.6 years in Thailand.

The BPI could be caused by the events of traction, compression, radiation and surgery. Traction is an attracted or detached (contusions) root of brachial plexus due to an increase in the distance between the head and the shoulder. As much as 95% of patients with BPI are caused by traction events.[9] Traction events are mostly caused by traffic accidents, but it could be also caused by birth injury,

fall or accident involving the shoulder. This is consistent with the results of this study. The most causes in patients with BPI who performed EMG examination in this study were caused by traction from traffic accidents, accounted for 69 people (76%).

Traffic accident became the main cause of BPI because there were a huge of energy to make distance between arm and neck. The principal factors determining the extent of injury are the energy imparted by the blow and to a lesser degree, the direction and the relationship between arm and neck during the injury.[10] The result is consistent with theories for the characteristics of patients with BPI proposed by Narakas[11] that 70% of cases of BPI were caused by traffic accidents and 70% were associated with motor accidents. The results of this study are also in accordance with the results of a national survey for BPI in India. There were 94.4% cases of BPI in India[3] caused by road traffic accidents from 2002 to 2011.

In this study, there were 10 patients (11%) who had lesion caused by birth injury, therefore birth injury became the second most frequent cause of BPI in this study. The incidence of birth injury of the plexus has been reported as between 3.6 cases per 1000 live birth.[12] Bilateral BPI due to birth injury are seen almost exclusively in the setting of breech presentation, in which traction on both shoulder may be applied to deliver the head. In another side of traction, brachial plexus injuries have been reported in cardiac surgery, orthopedic, Schwannoma and general surgery as well as breast reconstruction.[13,14]

There is a wide variety of distribution of paralysis from BPI. It can occur due to differentiation of topography from each branch of nerve and the process of injury. The length of the root and the angle between root and spinal cord is influencing the lesion of BPI. According to measurement of Sunderland in 1976, the length of each root is different. The length of C5, C6, C7 are 15mm, C8 17 mm, T125mm and each angle of the root of the brachial plexus is C5 1380; C61230; C7 1140; C81000; T1850.[4]

In this study, the distribution of lesion mostly occurred at postganglionic of C5, C6, C7, C8, T1 or global palsy on the right arm. The right arm as a dominant arm was found to be the most commonly injured (67%), which might be partially caused by the fact that the right arm as dominant arm has a reflex for protection. The lesion at postganglionic is more than preganglionic of C5, C6, C7, C8, T1 (ratio=61:2). Lesion on preganglionic of brachial plexus occurs if there is an avulsion proximal to dorsal root ganglion that involves central nervous system that causes preganglionic lesion has worse prognosis than postganglionic lesion.[15]

In this study, 85% cases were caused by traffic accidents; and in 61 patients with lesion on C5, C6, C7, C8, T1 postganglionic, since in traffic accidents has occurred the traction, impaction and compression of the body that caused an extensive damaged of brachial plexus. Seventeen patients had lesion at C5, C6 (superior of brachial plexus) or Erb's palsy. The distribution of Erb's palsy was more in patients with traffic accidents and birth injury.16 According to measurement of Sunderland, C5 and C6 have the short length of ramus. It makes nerves become more susceptible to damage when the traction occurred.[4] There was one patient (1%) with radical mastectomy in this study. Actually, injuries to the brachial plexus during mastectomy and axillary dissection are rare.[17] The cause of BPI during mastectomy are direct surgical injuries to the brachial plexus, over-traction during axillary exploration, or over manipulation of the upper extremity in order to improve exposure.[18]

This study has some limitations. It was conducted only in one hospital, which may not reflect the real epidemiology of BPI in general population. Moreover, the collected data were from medical records. This situation caused the researcher could not explore deeper about the sort of vehicles used by patients, who were the birth attendants, fell from how many metres, what was the occupation of the patients, etc.

It can be concluded, most of the patients with BPI are in productive age group (11–20 years and 21–30 years). The main cause of brachial plexus injury is traffic accident (76%), followed by birth injury. Furthermore, distribution of paralysis is mostly in postganglionic area of cervical (C) 5, C6, C7, C8 and thoracal (T)1 (67%). Around two third of the cases involves the right side. Efforts need to be conducted to lower the incidence of traffic accident and birth injury.

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