

# Relationship between disability and pain to post-traumatic stress disorder, depression, and anxiety in patient with postoperative brachial plexus injury (BPI)

*by Heri Suroto*

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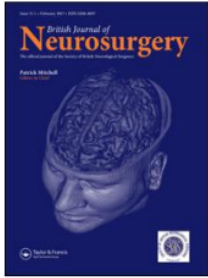
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ORIGINAL ARTICLE



## Relationship between disability and pain to post-traumatic stress disorder, depression, and anxiety in patient with postoperative brachial plexus injury (BPI)

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### ABSTRACT

**Background:** Orthopedic trauma patients have the risk to experience mental disorders, including depression, anxiety, post-traumatic stress disorder (PTSD), and other mental disorders. However, studies that analyze the relationship between mental disorders in orthopedic trauma patients, especially post-operative brachial plexus injury (BPI), are still difficult to find. This study aims to evaluate the relationship between disability and pain to post-traumatic stress disorder, depression, and anxiety in patient with postoperative BPI.

**Materials and methods:** It was an observational analysis with cross-sectional design study. Data were collected from July 2019 to September 2019. All subjects were patients of Orthopedics Clinic Dr. Soetomo General Academic Hospital Surabaya. The Disabilities of the Arm, Shoulder, and Hand (DASH) score was used to determine the disability level in patients. Visual Analog Score (VAS) was an instrument for assessing pain scale and mental disorders used Mini International Psychiatry Interview (MINI).

**Results:** There were 41 subjects met the research criteria, consisted of 10 men (24.39%) and 31 women (75.61%), aged 12–63 years. Based on the status of education, most subjects were graduated from junior/senior high school with 28 subjects (68.29%). The most common cause of BPI was traffic accidents as many as 37 people (90.24%). Mental disorders diagnosed from MINI found ten people (24.39%) were diagnosed with major depression; two subjects (4.87%) had generalized anxiety disorder. The average VAS score was 5.15 and the average DASH score was 52.02. There was no significant difference in VAS scores in the major depression group and PTSD group. However, there was an association between DASH score and depression ( $p < 0.05$ ). Surprisingly, this study found the risk of suicide among BPI (7.3%) and one person with psychotic disorders (2.43%).

**Conclusion:** The level of disability and pain in orthopedic trauma patients with depression tend to more severe than without depression.

### ARTICLE HISTORY

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### KEYWORDS

BPI; mental disorders; disability; pain

### Introduction

Loss of upper limb function after brachial plexus injury (BPI) causes a sensory and motor deficit that requires complex microsurgical reconstruction.<sup>1,2</sup> BPI in adults can be caused by a variety of mechanisms, including puncture injuries, falls, and motor vehicle accidents.<sup>3–5</sup> The incidence of post-traumatic stress disorder (PTSD), depression, and psychological distress are quite high after orthopedic trauma. Some studies show that one-third of patients who experience orthopedic trauma experience mental disorders and signs of mood disorders.<sup>1,6,7</sup> Likewise, upper limb nerve injury affects daily functioning, causing a decrease in perceived quality of life. Various studies that assess quality of life, functional outcomes, and patient satisfaction after brachial plexus injury (BPI) surgery conclude that patients are adversely affected in terms of financial status, employment status, independence in carrying out daily life activities, body image, functional outcomes, subjective health, and overall satisfaction despite improvements in motor results.<sup>8–10</sup>

Although the psychological impact of upper limb peripheral nerve injury has been investigated, the psychosocial and psychological effects of traumatic BPI on adults have not been adequately treated.<sup>6–9,11</sup> Some studies note that complete traumatic avulsion BPI interferes with body image perception, causes difficulty accepting and adapting to BPI, and is associated with a higher incidence of depression.<sup>12,13</sup> However, studies that analyze the relationship between mental disorders in orthopedic trauma patients, especially post-operative BPI are still difficult to find. Knowing that severe upper limb injuries increase the risk of psychological distress and to improve BPI's multidisciplinary treatment, we aim to evaluate the relationship between disability and pain on post-traumatic stress disorder, depression, and anxiety in postoperative BPI.

### Materials and methods

This study was a cross-sectional study design with descriptive-analytic. The study was conducted at the Orthopedics Hospital, Dr. Soetomo, and home visits with the patient's permission.

Table 1. Demographic subjects.

Characteristic	Depression (%)	Anxiety (%)	PTSD (%)	DASH	VAS
Age					
Adolescent (12–25 yo)	4 (40)	0 (0)	0 (0)	50.0553	4.133
Adult (26–45 yo)	5 (50)	2 (100)	2 (100)	46.8355	4.55
Elderly (46–65 yo)	1 (10)	0 (0)	0 (0)	38.9017	2.833
Sex					
Male	7(70)	0 (0)	0 (0)	43.93	4.32
Female	3(30)	2 (100)	2 (100)	55.93	3.6
Educational Background					
Elementary School/Not Finished	4 (40)	2 (100)	2 (100)	63.18	4.2
Junior High School/Senior High School	5 (50)	0 (0)	0 (0)	42.37	4.29
University	1 (10)	0 (0)	0 (0)	52.33	3.63
Occupation					
Housewife	0 (0)	0 (0)	0 (0)	–	–
Student	1 (10)	0 (0)	0 (0)	68.83	3.4
Government Employees	0 (0)	0 (0)	0 (0)	47.5	2.5
Private Employees	2 (20)	1 (50)	1 (50)	43.1	4.77
Informal Workers	3 (30)	1 (50)	1 (50)	24.51	3.67
Entrepreneur	2 (20)	0 (0)	0 (0)	38.82	3.57
Not employer	2 (20)	0 (0)	0 (0)	60.12	4.71
Interval between injury to surgery					
0–6 Months	2 (20)	0 (0)	0 (0)	37.69	4
6–12 Months	4 (40)	1 (50)	1 (50)	55.72	3.43
12–24 Months	1 (10)	0 (0)	0 (0)	64.38	5.13
>24 Months	3 (30)	1 (50)	1 (50)	66.68	4.11
Interval between surgery to follow-up					
0–6 months	3 (30)	1 (50)	1 (50)	57.00	4.40
6–12 months	0 (0)	0 (0)	0 (0)	17.5	5
12–24 months	2 (20)	0 (0)	0 (0)	50.33	3.6
>24 months	5 (50)	1 (50)	1 (50)	45.55	4.17
Affected side					
Left	2 (20)	0 (0)	0 (0)	47.98	4.57
Right	8 (80)	2 (100)	2 (100)	44.62	3.89
Affected hand					
Dominant	8 (80)	2 (100)	2 (100)	47.66	3.91
Non-Dominant	2 (20)	0 (0)	0 (0)	45.41	4.65
Bilateral	0 (0)	0 (0)	0 (0)	52.5	1.00
Marital Status					
Married	6 (60)	1 (50)	1 (50)	39.06	4.28
Not Married	4 (40)	1 (50)	1 (50)	52.95	4.04
Smoking Habit					
Yes	7 (70)	1 (50)	1 (50)	46.88	5
No	3 (30)	1 (50)	1 (50)	46.84	3.79

### Patient selection

The subject was BPI patients who control at the Orthopedic and Traumatology Polyclinic of RSUD Dr. Soetomo Surabaya and the Indonesian BPI Community with Traumatic BPI that meet the research requirements. Approval was obtained from our institutional review board and the medical ethics committee before study initiation and the study protocol followed the principles of the Declaration of Helsinki.

### Inclusion criteria

Inclusion criteria were as follows: (1) BPI traumatic patients who have had nerve or muscle reconstruction surgery; (2) Patients do not have abnormalities/other diseases that affect nerve and muscle function.

### Exclusion criteria

Exclusion criteria were: (1) Patients with nerve or muscle disorders without a history of previous trauma; (2) Patients diagnosed with previous mental disorders; (3) Patients who do not approve Informed Consent.

### Procedural details

The Disabilities of the Arm, Shoulder, and Hand (DASH) and Visual Analog Score (VAS) were used to determine the level of disability in patients and assessing pain scale, respectively. Meanwhile, Mini International Psychiatry Interview (MINI) was used to assessing mental disorders. The interval time between injury and surgery performed and interval time between surgery to follow up were divide into: 0–6 months, 6–12 months, 12–24 months and >24 months. Meanwhile the affected hand was divide into: dominant hand; non-dominant hand and bilateral.

### Statistical analysis

The demographic data were described and tabulated. The bivariate analysis was done using the Mann–Whitney test, Kruskal–Wallis Test and Chi-Square test. A logistic regression test was done to assessed multivariate analysis in the study. Data analysis is performed using SPSS software version 25.0.

### Results

This study obtained 41 subjects. Thirty-seven people suffered BPI injuries due to traffic accidents (90.2%), three people due to

**Table 2.** Analysis of different characteristics of demographics data with DASH, VAS, depression, anxiety, and post-traumatic stress disorder (PTSD).

Variable	N	DASH (Mean Rank)	Siq	VAS (Mean Rank)	Siq	Depression (%)	Siq <sup>c</sup>	Anxiety (%)	Siq <sup>c</sup>	PTSD (%)	Siq <sup>c</sup>
<b>Age<sup>a</sup></b>											
Adolescent (12–25 yo)	15	21.97	0.85	21.27	0.23	4 (40)	0.887	0 (0)	0.332	0 (0)	0.332
Adult (26–45 yo)	20	20.95		23		5 (50)		2 (100)		2 (100)	
Elderly (46–65 yo)	6	18.75		13.67		1 (10)		0 (0)		0 (0)	
<b>Sex<sup>b</sup></b>											
Male	10	24.7	0.26	18.3	0.40	7(70)	0.683	0 (0)	1	0 (0)	1
Female	31	19.81		21.84		3(30)		2 (100)		2 (100)	
<b>Educational Background<sup>a</sup></b>											
Elementary School/Not Finished	5	28.6	0.22	21.6	0.53	4 (40)	0.008	2 (100)	0.001	2 (100)	0.001
Junior High School/Senior High School	28	19.09		22.01		5 (50)		0 (0)		0 (0)	
University	8	23.15		16.85		1 (10)		0 (0)		0 (0)	
<b>Occupation<sup>a</sup></b>											
Housewife	1	37	0.11	33.5	0.49	0 (0)	0.696	0 (0)	0.79	0 (0)	0.79
Student	5	29.7		16.8		1 (10)		0 (0)		0 (0)	
Government Employees	2	22.25		11.5		0 (0)		0 (0)		0 (0)	
Private Employees	13	19.57		24.34		2 (20)		1 (50)		1 (50)	
Informal Workers	6	12.58		18.08		3 (30)		1 (50)		1 (50)	
Entrepreneur	7	16.35		18.07		2 (20)		0 (0)		0 (0)	
Not employer	7	26.64		24.14		2 (20)		0 (0)		0 (0)	
<b>Interval between injury to surgery<sup>a</sup></b>											
0–6 Months	17	16.97	0.14	19.97	0.44	2 (20)	0.088	0 (0)	0.338	0 (0)	0.338
6–12 Months	7	25.14		16.92		4 (40)		1 (50)		1 (50)	
12–24 Months	8	27.68		26.5		1 (10)		0 (0)		0 (0)	
>24 Months	9	19.44		21.22		3 (30)		1 (50)		1 (50)	
<b>Interval between surgery to follow-up</b>											
0–6 months	5	25.40	0.65	22.60	0.87	3 (30)	0.145	1 (50)	0.403	1 (50)	0.403
6–12 months	1	20.00		26.50		0 (0)		0 (0)		0 (0)	
12–24 months	5	22.10		17.80		2 (20)		0 (0)		0 (0)	
>24 months	30	20.45		21.08		5 (50)		1 (50)		1 (50)	
<b>Affected side<sup>a</sup></b>											
Left	14	21.25	0.24	23.57	0.50	2 (20)	0.434	0 (0)	0.545	0 (0)	0.545
Right	26	20.11		19.40		8 (80)		2 (100)		2 (100)	
Left and Right	1	40.5		26.5		0 (0)		0 (0)		0 (0)	
<b>Affected hand</b>											
Dominant	23	21.78	0.86	19.50	0.13	8 (80)	0.208	2 (100)	0.439	2 (100)	0.439
Non-Dominant	17	19.82		24.12		2 (20)		0 (0)		0 (0)	
Bilateral	1	23.00		2.5		0 (0)		0 (0)		0 (0)	
<b>Marital status<sup>b</sup></b>											
Married	18	18.11	0.17	21.44	0.83	6 (60)	1	1 (50)	1	1 (50)	1
Not Married	23	23.26		20.65		4 (40)		1 (50)		1 (50)	
<b>Smoking habit<sup>b</sup></b>											
Yes	12	21.5	0.86	25.33	0.13	7 (70)	1	1 (50)	0.505	1 (50)	0.505
No	29	20.79		19.20		3 (30)		1 (50)		1 (50)	

<sup>a</sup>Tested with Kruskal–Wallis.<sup>b</sup>Tested with Mann–Whitney *U*.<sup>c</sup>Tested with Chi-square.

work accidents (7.3%) and one person due to glass puncture injuries (2.5%). Ten people were diagnosed with depression (24.4%), two people with anxiety (4.87%) and two people with post-traumatic stress disorder (PTSD) (4.87%) as the studied variables. But this study also found another mental disorder that is three people diagnosed with suicide risk (7.3%) and one person with psychotic disorders (2.43%). All respondents in the study still complained of pain with different degrees. Eighteen people (43.9%) complained of mild pain with VAS values 1–3. Seventeen people (41.5%) complained of moderate pain with a VAS value of 4–6, and 6 people (14.6%) had severe pain with a VAS value above 6. The VAS score in the depression group was 3.7, while in the anxiety group and the PTSD, it had the same VAS score average of 3.5. The average VAS score was 5.15 and the average DASH score was 52.02. The average value of the DASH score in the depression group was 58.42; the anxiety group was 55, and the PTSD group was 55. The distribution of each demographic from the primary data can be seen in Table 1.

Table 2 showed there is no significant difference in DASH and VAS scores between all variables. Meanwhile, there was a significant difference in education background in anxiety, depression, and PTSD groups ( $p < 0.05$ ). Table 3 showed there is a

**Table 3.** DASH and VAS Score differentiation test with depression, anxiety, and PTSD.

Variable	N	Depression (Siq)	Anxiety (Siq)	PTSD (Siq)
<b>DASH</b>				
Mild	12	0.017	0.474	0.474
Moderate	14			
Severe	15			
<b>VAS</b>				
Mild	18	0.849	0.722	0.722
Moderate	17			
Severe	6			

significant difference in the DASH score in the depression group and there is no significant difference in VAS score in all groups.

Table 4 showed the results of data processing by logistic regression of all study variables associated with depression, which showed no significant were obtained. Table 5 showed the results of the logistic regression data for all study variables related to VAS and DASH scores. It was found that a significant relationship ( $p < 0.05$ ) between educational status and marital status with the DASH score.

Table 4. Results of logistic regression analysis for depression.

Variable	B	df	Sig.
Sex		2	0.99
Male	-68.86775835	1	0.99
Female	29.6365101	1	0.99
Education	-100.0758593	1	0.99
Work		6	1
Housewife	230.1037446	1	0.99
Student	429.0919604	1	0.99
Government employees	361.8865815	1	0.99
Private employees	318.5269699	1	0.99
Informal workers	445.7841526	1	0.99
Entrepreneur	299.6561692	1	0.99
Marital status	60.65414189	1	0.99
History of smoking	3.211058509	1	0.99
Interval between injury to surgery		3	0.99
0-6 Months	65.91094635	1	0.99
6-12 Months	-43.00083298	1	0.99
12-24 Months	30.20819312	1	0.99
Interval between surgery to follow-up		3	0.99
0-6 months	2.015432424	1	0.99
6-12 months	-19.593523465427	1	0.99
12-24 months	1.20434124654	1	0.99
>24 months	-1.60974879	1	0.99
Side Affected		2	0.99
Left	67.02905731	1	0.99
Right	74.86479521	1	0.99
Affected hand	-1.426978494	1	0.99
VAS		2	0.99
Mild	34.30524127	1	0.99
Moderate	119.6592909	1	0.99
DASH		2	0.99
Mild	63.8700137	1	0.99
Moderate	177.0575865	1	0.99
Constant	-355.7205189	1	0.99

Table 5. Logistic regression results for VAS and DASH score.

Variable	N	Chi-Square	df	Sig.
Sex				
Male	10	4.079273902	2	0.13 <sup>a</sup>
Female	31			
Age				
Adolescent (12-25 yo)	15	1.05651221	4	0.90
Adult (26-45 yo)	20			
Elderly (46-65 yo)	6			
Education background				
Elementary	5	10.80047182	4	0.02 <sup>a</sup>
Junior-senior Highschool	28			
University	8			
Marital Status				
Not married	23	7.70587146	2	0.02 <sup>a</sup>
Married	18			
History of smoking				
No	29	3.088566917	2	0.21
Yes	12			
Affected side				
Left	14	9.099052434	4	0.05 <sup>a</sup>
Right	26			
Left and Right	1			
Affected hand				
Dominant	23	8.73900286	3	0.71
Non-Dominant	17			
Bilateral	1			
Work				
Formal	20	1.376356938	2	0.50
Informal	21			
Interval between injury to surgery				
<6 months	17	3.449203994	2	0.17
>6 Months	24			
Interval between surgery to follow up				
0-24 months	11	4.753438484	4	0.63
>24 months	30			

<sup>a</sup>Model Fitting Sig. 0.176.

## Discussion

Depression, anxiety, and post-traumatic stress disorder affect the functional outcomes of BPI patients who have undergone surgery.<sup>12</sup> This is a factor that must be considered because BPI patients who have undergone surgery must go through a long rehabilitation phase to obtain maximum results. Many studies have evaluated the effect of mental disorders after injury, but few have assessed the psychological aspects after reconstructive surgery in BPI traumatic patients.<sup>12,14,15</sup>

These study results were not much different from Wilson and Chang's study which said 27% of patients with traumatic brachial plexus injury suffer from postoperative depression. As for anxiety and post-traumatic stress disorder, there are only two sufferers each.<sup>16</sup> Educational status gave significant results ( $p < 0.05$ ) on depression, anxiety, and PTSD. This shows the relationship between education level and mental disorder. In this study, mental disorders were found mostly in the category of elementary school education/not graduating as many as eight people, followed by five people middle school/high school, and one person university. The data shows that a higher level of education affects mental disorders. This is consistent with research from Bjelland *et al.* Which states that the higher the level of education becomes a means of protection against depression and anxiety.<sup>17</sup>

Based on the data in this study, the higher the DASH score, is directly proportional to the number of patients diagnosed with depression. But it still cannot be concluded whether the level of disability that causes depression or depression that causes increased disability levels. Impairment in BPI patients themselves is influenced by many factors both during preoperative such as nerve level injury; therapy is given, timing surgery, patient age to post-operative rehabilitation.<sup>3,11,18</sup> In this study, there is a significant relationship ( $p < 0.05$ ) between educational status and marital status with a DASH score. However, according to a study conducted by Wilson *et al.* that depression and anxiety reduce motor outcome after surgery in BPI patients.<sup>16</sup>

This study showed different results from the research of Rasulic *et al.*, which mentions that 76.8 percent of research respondents still complain of pain with varying degrees.<sup>18</sup> Many factors influence the onset of chronic pain in BPI aside from the pathology of the disease itself, such as smoking history, marital status, status education, and mental disorders.<sup>19</sup> But in this study still not found statistically significant figures.

A study by Lander *et al.* in 10 of the 46 patients interviewed after being diagnosed with BPI, they had suicidal ideation.<sup>6</sup> Although the figures obtained are smaller than the study, the risk of suicide in BPI patients needs to be considered in BPI management. This study also found one person diagnosed with a psychotic disorder. Patients complain of symptoms that lead to psychosis disorders felt after the occurrence of injury. However, this matter still needs to be investigated further due to the multifactorial risk of psychosis.<sup>12,20</sup>

As the end of the discussion of this study obtained some notes of research limitations this research method uses a cross-sectional design so that it is difficult to determine the direction of the causal relationship between exposure and the dynamic process. The nature of the study sample is a compelling medical population, so the relationship between the variables studied can be designed by factors that interact in the ability to react to disease, but factors that are confounding variables already existed before this study began. This study uses a questionnaire that relies on the subject's memory, so there is a recall bias toward symptoms or disorders experienced by patients. The research sample in this patient is a patient who has undergone surgery.

Many factors affect the outcome or outcome of operation both in preoperative, intra, and post-operative. Also, the heterogeneity of the level of injury and intervention in BPI management makes the analysis of this study limited. Minimal population samples in this study.

### Conclusions

The level of disability in postoperative BPI patients is related to educational status, marital status, and the presence of depression. The level of education is associated with the presence of generalized anxiety disorder and post-traumatic stress disorder in post-operative BPI patients. There was a significant relationship between educational status and marital status with the DASH score. Meanwhile, there no significant relation between VAS and other variables. The results of this study suggest that psychological aspects need to be considered by clinicians in the management of postoperative BPI patients. Depression on orthopedic trauma patients leads to disabling more and more pain levels than without depression.

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### Disclosure statement

No potential conflict of interest was reported by the author(s).

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