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Determining Sleep Quality and its Associated Factors in Patients with Lower Limb Amputation

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Abstract

Objective: This study aims to evaluate sleep quality in male patients with lower limb amputation (LLA) and to identify factors that may contribute to sleep disturbance.
Material and Methods: This study includes a total of 35 patients with LLA and 35 healthy controls. The demographic data of the patients were recorded, the level of amputation-related pain of the patients was assessed by visual analogue scale, and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Furthermore, the emotional state of the patients was assessed by the Beck Depression Inventory (BDI) and Beck Anxiety Inventory (BAI).
Results: The patients had significantly higher scores in the subscores, excluding sleep duration, and total scores of PSQI in comparison with the controls. The BAI ($p<0.01$) and BDI scores ($p<0.05$) were correlated with PSQI total score in the patients. The multivariate regression analyses indicated that the anxiety state and age were the most significant factors to predict the sleep quality ($p<0.05$).
Conclusion: Our study has revealed that there is impairment in the sleep quality of the patients with LLA compared with that of controls and that age and emotional state are related to the sleep quality. Therefore, in the elderly and in those patients with impaired emotional state, multifaceted treatment approaches are required to resolve sleep disorders. However, there is a requirement for further studies that are to be conducted with larger series of patients demonstrating the reasons for sleep impairment and its effects on the general health.
Keywords: Amputation, extremity, sleep quality, anxiety, depression

Introduction

Extremity loss is an important cause of disability, which affects the well-being and health of individuals throughout the world (1). Lower limb amputations (LLA) constitute 80%–85% of all amputations, and peripheral vascular diseases such as atherosclerosis, diabetes mellitus, and Buerger's disease are the most important causes of acquired lower extremity losses (2). It is reported that patients with LLA have major problems in maintaining their physical and mental functions (3,4).

The incidence of sleep problems in the general population is 24%–27% (5,6), and it is associated with deteriorated physical health, increased functional disability, and impaired quality of life (7,8). Some studies have been performed for evaluating sleep quality in various neurological and rheumatic diseases causing disability (9,10). However, the number of studies evaluating sleep disturbance in patients with LLA is quite limited, although it is an important cause of disability. Besides that, sleep has been investigated as a subgroup of life quality in studies evaluating only life qualities of patients (11). In a study evaluating life qualities of 149 amputated patients, the sleep score of the Nottingham Health Profile was found to be lower than that in the control group (12).

It is known that insufficient sleep is modulated by the state of disease and behavioral and psycho-social factors (13,14). In

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literature, there are many studies demonstrating that emotional state and chronic pain are associated with insomnia (6,15-18). It is also known that chronic pain affects the functional state, sleep quality, and life quality. In 2 different studies, it was revealed that most amputated patients had phantom pain and 62% of these patients had impaired sleep quality (19,20).

In light of previous studies in literature, we propose hypotheses that sleep quality can be impaired in patients with LLA because it is an important disease that can lead to disability and that clinical features and emotional states of patients can affect sleep quality. The aim of this study is to evaluate sleep quality of patients with LLA by comparison with the normal population and to determine the factors affecting sleep quality in these patients.

Material and Methods

This cross-sectional study included 35 patients with LLA, who applied to the outpatient clinic of physical medicine and rehabilitation between October 2013 and April 2014. Ethical approval was received for this study from the Medical Research Ethics Committee of Dicle University, and the study group was informed about the aim and content of the study. The patients who accepted to participate in the study signed the "informed consent form", and they were included in the study. Patients who underwent amputation surgery at least 6 months ago, who had no history of sleep and emotional disorders before amputation, who had adequate cognitive functions, and who did not have any systemic disease that could affect sleep were involved in the study. On the other hand, patients who were younger than 18 years and older than 65 years of age; had systemic diseases (pulmonary, cardiovascular, hepatic, hematologic renal, or endocrine disease), psychiatric diseases, and malignancies; used drugs that could affect sleep (antiepileptics, antidepressants, and others); and excessively consumed alcohol and caffeine were excluded from the study.

The control group consisted of healthy volunteers with similar demographic features, who were randomly selected among the hospital staff and their relatives and matched in terms of age and gender. Socio-demographic data of the study group and patients' clinical features related to amputation were recorded. Amputation-induced pain was evaluated using the visual analog scale (VAS 0–10 cm), and sleep quality within the last 1 month was evaluated with the Pittsburgh Sleep Quality Index (PSQI). Moreover, the Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI) were used for determining emotional states of patients.

Measurements

Pittsburgh Sleep Quality Index (PSQI)

Pittsburgh Sleep Quality Index is a sleep questionnaire that is used for assessing sleep quality, sleep duration, sleep disturbance, and its severity over the last 1 month (21). Its validity and reliability study in Turkish was performed by Ağargün et al. (22).

This scale consists of 19, items and it evaluates 7 subcomponents of sleep quality, including subjective sleep quality (C1), sleep latency (C2), sleep duration (C3), habitual sleep efficiency (C4), sleep disturbances (C5), use of sleeping medication (C6), and daytime dysfunction (C7). The total PSQI score is obtained by adding 7 subscores, and the total score is between 0 and 21. The total PSQI score definitely distinguishes good sleepers (total PSQI score≤5) from poor sleepers (PSQI >5) (21).

Beck Depression Inventory (BDI)

Beck Depression Inventory measures physical, emotional, and cognitive signs of depression. It is a self-assessment scale including 21 categories of signs. The highest score that can be obtained is 63. A high total score shows the severity of depression (23). In Turkey, its validity and reliability study was performed by Hisli (24).

Beck Anxiety Inventory (BAI)

The Beck Anxiety Inventory measures the frequency of anxiety symptoms. It consists of 21 items and is a Likert-type self-evaluation scale that is scored between 0 and 3. A high total score shows highly severe anxiety. It was developed by Beck et al. (25), and its validity and reliability were studied by Ulusoy et al. (26) in Turkey.

Statistical Analysis

Data were statistically analyzed using Statistical Package for the Social Sciences (SPSS Inc.; Chicago, IL, USA) version 16 software. The results were demonstrated with mean ±standard deviation for measurable variables and with number and percentage for categorical variables. Considering the numbers of cases in the patient and control groups, Student's t-test was used for comparing the means of the groups. The difference between categorical variables was measured by chi-square test. The relationship between sleep quality and clinical data of amputation and emotional state was evaluated by Spearman's correlation analysis. To detect the variables determining sleep quality of

Table 1. Demographic features of the patients and controls

	Patient (n=35)	Control (n=35)	p
Age (year)	42.48±10.71	41.71±10.50	>0.05
Gender, n (%)			>0.05
Female	5 (14.3)	7 (20)	
Male	30 (86.7)	28 (80)	
Education, n (%)			>0.05
Literate	2 (5.7)	5 (14.3)	
Illiterate	33 (94.3)	30 (86.7)	
Income level, n (%)			>0.05
Good	9 (25.7)	7 (20)	
Moderate	11 (31.4)	14 (40)	
Poor	15 (42.9)	14 (40)	
Living area, (%)			>0.05
Rural areas	16 (45.7)	14 (40)	
City	19 (54.3)	91 (60)	

Table 2. Clinical features of patients and sleep and emotional states of the study group

	Patient (n=35)	Control (n=35)	p
Age at the time of surgery, (year)	26.88±11.76		
Amputation duration, (month)	184.970±98.46		
Causes of amputation			
Traumatic, n (%)	27 (77.14)		
Nontraumatic, n (%)	8 (22.85)		
Amputation level			
Below the knee, n (%)	18 (51.42)		
Above the knee, n (%)	17 (48.57)		
VAS^{pain}	1.53±1.87		
Poor sleep quality, (%)			<0.01
Yes	29 (83.1)	18 (51.4)	
Depression, n (%)	13 (37)	6 (17)	>0.05
Anxiety, n (%)	15 (43)	3 (8.5)	<0.001

Table 3. Patients' PSQI subscores and total scores

	Patient (n=35)	Control (n=35)	p
C1	1.45±0.70	0.54±0.61	<0.01
C2	2.00±0.87	0.62±0.49	<0.001
C3	0.08±0.50	0.00±0.00	>0.05
C4	0.85±0.55	0.40±0.73	<0.05
C5	1.94±0.53	0.14±0.42	<0.001
C6	1.05±0.87	0.62±0.54	<0.05
C7	3.48±1.70	1.45±1.22	<0.001
C^{Total}	8.40±3.55	6.25±3.04	<0.01

PSQI: Pittsburgh Sleep Quality Index; C1: subjective sleep quality; C2: sleep latency; C3: sleep duration; C4: habitual sleep efficiency; C5: sleep disturbances; C6: use of sleeping medication; C7: daytime dysfunction

patients with LLA, multiple-stage linear regression analysis was performed. Statistical controls of hypotheses were performed at the significance level of α=0.05 (namely, the values of p<0.05 were accepted to be statistically significant).

Results

The mean age of patients was 42.48±10.71 years, and the mean age of the control group was 41.71±10.50 years. There was no statistically significant difference between the 2 groups (p>0.05) (Table 1). Of 35 patients, 30 (86.7%) were male and 5 (14.3%) were female. Only 2 patients never enrolled in a school, and the income status of 15 patients was poor (Table 1).

The mean age for amputation surgery was 26.88±11.76 years, and the etiological factor was trauma in 77% of them (Table 2). The numbers of patients with below-knee and above-knee amputations were almost equal. In total, 40% of patients had amputation-induced chronic pain (phantom pain or stump pain). In the evaluation of the quality of sleep and emotional state, the total PSQI score was 5 and over in 29 patients and the anxiety score was 8 and over in 15 patients (43%). Comparison of these rates with those of the control group revealed a significant difference (p<0.01 and p<0.00, respectively).

Other subscores of patients, except sleep duration, (subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction) and total PSQI score were significantly higher than those in the control group (Table 3).

The relationship between the total PSQI score and patients' clinical features, emotional states, and life qualities is given in Table 4. While the ages of patients positively correlated with C1, C2, C5, C6, C7, and total PSQI score, there was no correlation with other demographic data. The total PSQI score showed a significant correlation with BDI (p<0.05) and BAI (p<0.01).

According to multiple regression analysis, when the total PSQI score was considered as a dependent variable, the most important factors affecting the quality of sleep were the ages and anxiety states of patients (R^2=0.35) (p<0.05) (Table 5).

Table 4. Correlations between sleep quality and clinical features and emotional state

	C1	C2	C3	C4	C5	C6	C7	$PSQI^{Total}$
	r	r	r	r	r	r	R	r
Age	0.569**	0.336*	0.025	0.079	0.524**	0.447**	0.635**	0.621**
Amputation duration	0.158	–0.047	0.14	–0.072	0.105	–0.133	0.076	0.034
Age at the time of surgery	0.406*	0.354*	–0.087	0.121	0.407*	0.499**	0.528**	0.545**
VASpain	–0.149	0.132	–0.081	–0.157	–0.056	–0.252	–0.18	–0.173
BDI	0.434**	0.397*	–0.144	0.01	0.478**	0.147	0.325	0.385*
BAI	0.515**	0.422*	–0.082	0.035	0.578**	0.252	0.417*	0.493**

Statistical significance level: * p<0.05; ** p<0.01
C1: subjective sleep quality; C2: sleep latency; C3: sleep duration; C4: habitual sleep efficiency; C5: sleep disturbances; C6: use of sleeping medication; C7: daytime dysfunction; PSQI: Pittsburgh Sleep Quality Index; VAS: visual analog scale; BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory

Table 5. The relationship between sleep quality and independent variables

n=35	β	t	p
Age	0.497	2.834	<0.05
BDI	–0.193	–0.600	>0.05
BAI	0.357	2.089	<0.05

BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory

Discussion

This study was conducted to evaluate sleep quality in patients with LLA and to investigate the effects of demographic, clinical, and emotional states on sleep. The results of the study revealed a significant impairment in the patient group in comparison with in the control group in terms of subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. Furthermore, there was a relationship between sleep quality and patients' ages and emotional states. No study on the evaluation of sleep quality in patients with LLA has been found in the literature. We suggest that our study is valuable from this point of view.

In the literature, different results were obtained from the studies investigating demographic and clinical features of patients with LLA. Bäck-Pettersson and Björkelund (4) reported that 56% of patients with LLA who were aged 60 years and above were male and cardiovascular system diseases were found to be the most common etiological factor. In other 2 studies, the mean age of patients with LLA was reported as 55 years, the rate of male patients was between 81% and 83%, and the frequency of trauma varied between 53% and 74% (27, 28). Our data are consistent with those of these 2 studies. However, the mean age of our patients was lower than that in both studies (mean age: 26 years). This difference can be explained by the fact that our patients had different geographical and socio-demographic features (almost half of them lived in rural areas and had low socioeconomic levels).

It has been reported that sleep disturbance is associated with major psychological and physiological stress and affects cognitive and functional abilities negatively (29,30). Nontreated sleep disturbance leads to restricted social interaction and increased morbidity and mortality (31,32). Despite the existence of some studies on the relationship between sleep disorders and diseases causing disability such as ankylosing spondylitis, rheumatoid arthritis, multiple sclerosis, and Alzheimer (9,33,34), there are a few studies evaluating sleep quality in LLA. All these studies have evaluated life quality (3,11,12). Bäck-Pettersson and Björkelund (4) reported that pain and sleep disturbance developed 6 months after lower extremity amputation. Abdelgadir et al. (11) found that the life quality sleep score of 60 LLA patients with diabetes was significantly lower than that of the control group. In our study, PSQI, which provides more subjective data than the life quality scale, was used for evaluating sleep quality. According to this assessment scale, sleep quality of our patients was found to be affected substantially.

Moreover, the factors affecting sleep were evaluated in our study. Multiple regression analysis showed that age and emotional state affected sleep quality but chronic pain did not. It is known that with increasing age, both quantitative and qualitative changes occur in sleep quality (35). It has been demonstrated that compared with the normal population, the rates of depression and anxiety increase in patients with LLA (36-38). In addition, there are many studies showing a relationship between sleep disturbance and anxiety and depression (8,18,39). Lindberg et al. (39) conducted an epidemiological study with 529 people and revealed a relationship between various sleep disorders and anxiety. Shukla et al. (40) emphasized that 60% of all amputated patients had some psychiatric symptoms in the postoperative period. Levels of anxiety and depression were found to be lower in our study than in Shukla's study. This difference can be explained by the fact that our patients were emotionally evaluated at least 6 months after amputation surgery. Moreover, in our study, the scores of BAI and BDI were correlated with the subscores and total scores of PSQI. However, only anxiety state and age were independent variables determining sleep quality. Sleep disturbance is an important cause of morbidity and mortality. Therefore, particularly LLA patients with advanced age and high anxiety level must be closely followed up and treated for sleep disturbance.

In amputated patients, chronic pain is a significant problem and its incidence in LLA patients is reported to be between 31.7% and 67% (11,41,42). Some studies showing that chronic pain is associated with sleep disturbance are available in the literature (8). However, we did not encounter any study investigating the relationship between chronic pain and sleep quality in patients with LLA. Consistent with other studies in the literature, our study revealed that 40% of patients had amputation-induced pain. However, no relationship was found between chronic pain and sleep quality. This may have resulted from the fact that our patients had mild pain.

One of the important limitations of this study is that the number of female patients was insufficient in comparison with the number male patients. Most LLA patients' being male because of the differences in geography and socio-cultural structure can be an effective factor. Another limitation is that polysomnography was not used for evaluating sleep. Instead, PSQI, the validity and reliability of which were proven, was used because it is cheaper and easier to be applied and it does not require any technical equipment.

Conclusion

In this study, it was found that subjective sleep quality, sleep latency, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction were significantly impaired in patients with LLA in comparison with the control group. Moreover, age and emotional state were detected to be important factors determining sleep quality. Therefore, multidirectional treatment approaches are essential for dissolving sleep disturbances in patients with advanced age and impaired emo-

tional state. However, further studies should be conducted with a larger population to reveal the causes of sleep disturbances and their effects on the general health condition.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Dicle University Medical Research Ethics Committee.

Informed Consent: Written informed consent was obtained from patients and healty controls who participated in this study.

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References

1. Leonard JA, Meier RH. Upper and lower extremity prosthetics. In: Delisa JA, Gans BM, eds. Rehabilitation medicine principles and practice. Philadelphia: J.B. Lippincott Company. 1998:669-96.
2. Eftekhari N. Amputation rehabilitation: In: O'Young B, Young MA, Stiens SA, eds. PMR Secrets. Philadelphia Hanley&Belfus, INC. 1999:214-22.
3. Hawamdeh ZM, Othman YS, Ibrahim AI. Assessment of anxiety and depression after lower limb amputation in jordanian patients. Neuropsychiatr Dis Treat 2008;4:627-33. [CrossRef]
4. Bäck-Pettersson S, Björkelund C. Care of elderly lower limb amputees, as described in medical and nursing records. Scand J Caring Sci 2005;19:337-43. [CrossRef]
5. Leger D, Poursain D. An international survey of insomnia: Underrecognition and undertreatment of a polysymptomatic condition. Curr Med Res Opin 2005;21:1785-92. [CrossRef]
6. Sutton DA, Moldofsky H, Badley EM. Insomnia and health problems in Canadians. Sleep 2001;24:665-70.
7. Katz DA, McHorney CA. The relationship between insomnia and health related quality of life in patients with chronic illness. J Fam Pract 2002;51:229-35.
8. Da Costa D, Zummer M, Fitzcharles MA. Determinants of sleep problems in patients with spondyloarthropathy. Musculoskeletal Care 2009;7:143-61. [CrossRef]
9. Batmaz I, Sarıyıldız MA, Dilek B, Bez Y, Karakoc M¸ Çevik R. Sleep quality and associated factors in ankylosing spondylitis: relationship with disease parameters, psychological status and quality of life. Rheumatol Int 2013;33:1039-45. [CrossRef]
10. Giannoccaro MP, Moghadam KK, Pizza F, Boriani S, Maraldi NM, Avoni P, et al. Sleep disorders in patients with spinal cord injury. Sleep Med Rev 2013;17:399-409. [CrossRef]
11. Abdelgadir M, Shebeika W, Eltom M, Berne C, Wikblad K. Health related quality of life and sense of coherence in Sudanese diabetic subjects with lower limb amputation. Tohoku J Exp Med 2009;217:45-50. [CrossRef]
12. Pell JP, Donnan PT, Fowkes FG, Ruckley CV. Quality of life following lower limb amputation for peripheral arterial disease. Eur J Vasc Surg 1993;7:448-51. [CrossRef]
13. Drake CL, Roehrs T, Roth T. Insomnia causes, consequences, and therapeutics: an overview. Depress Anxiety 2003;18:163-76. [CrossRef]
14. Power JD, Perruccio AV, Badley EM. Pain as a mediator of sleep problems in arthritis and other chronic conditions. Arthritis Rheum 2005;53:911-9. [CrossRef]
15. Tsuno N, Besset A, Ritchie K. Sleep and depression. J Clin Psychiatry 2005;66:1254-69. [CrossRef]
16. Hall M, Buysse DJ, Nowell P, Nofzinger EA, Houck P, Reynolds CF 3rd, et al. Symptoms of stress and depression as correlates of sleep in primary insomnia. Psychosom Med 2000;62:227-30. [CrossRef]
17. LeBlanc M, Beaulieu-Bonneau S, Merette C, Savard J, Ivers H, Morin CM. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. J Psychosom Res 2007;63:157-66. [CrossRef]
18. Taylor DJ, Lichstein KL, Durrence H, Reidel BW, Bush AJ. Epidemiology of insomnia, depression, and anxiety. Sleep 2005;28:1457-64.
19. Ellis K. A review of amputation, phantom pain and nursing responsibilities. Br J Nurs 2002;11:160-3. [CrossRef]
20. Kern U, Busch V, Rockland M, Kohl M, Birklein F. Prevalence and risk factors of phantom limb pain and phantom limb sensations in Germany. A nationwide field survey. Schmerz 2009;23:479-88. [CrossRef]
21. Buysse DJ, Reynolds CF 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: A new instrument for psychiatric practice and research. Psychiatry Res 1989;28:193-213. [CrossRef]
22. Ağargün MY, Kara H, Anlar Ö. Pittsburgh Uyku Kalitesi İndeksi'nin geçerliliği ve güvenirliği. Türk Psikiyatri Dergisi 1996;7:107-15.
23. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. Arch Gen Psychiatry 1961;4:561-71. [CrossRef]
24. Hisli N. Beck Depresyon Envanteri'nin geçerliği üzerine bir çalışma. Psikoloji Dergisi 1988;6:118-22.
25. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: Psychometric properties. J Consult Clin Psychol 1988;56:893-7. [CrossRef]
26. Ulusoy M, Şahin N, Erkmen H. Turkish Version of The Beck Anxiety Inventory: psychometric Properties. J Cognitive Psychotherapy 1998;12:28-35.
27. Ehde DM, Czerniecki JM, Smith DG, Campbell KM, Edwards WT, Jensen MP, et al. Chronic phantom sensations, phantom pain, residual limb pain, and other regional pain after lower limb amputation. Arch Phys Med Rehabil 2000;81:1039-44. [CrossRef]
28. Behr J, Friedly J, Molton I, Morgenroth D, Jensen MP, Smith DG. Pain and pain-related interference in adults with lower-limb amputation: comparison of knee-disarticulation, transtibial, and transfemoral surgical sites. J Rehabil Res Dev 2009;46:963-72. [CrossRef]
29. Morin C, Rodrigue S, Ivers H. Role of stress, arousal and coping skills in primary insomnia. Psychosom Med 2003;65:259-67. [CrossRef]
30. Ohayon MM, Vecchierini MF. Daytime sleepiness and cognitive impairment in the elderly population. Arch Intern Med 2002;162:201-8. [CrossRef]
31. Foley D, Ancoli-Israel S, Britz P, Walsh J. Sleep disturbances and chronic disease in older adults: results of the 2003 National Sleep in America Survey. J Psychosom Res 2004;56:497-502. [CrossRef]
32. Martin JL, Webber AP, Alam T, Harker JO, Josephson KR, Alessi CA. Daytime sleeping, sleep disturbance and circadian rhythms in the nursing home. Am J Geriatr Psychiatry 2006;14:121-9. [CrossRef]
33. Treharne GJ, Lyons AC, Hale ED, Douglas KMJ, Goodchild CE, Booth DA, et al. Sleep disruption frequency in rheumatoid arthritis: Perceived stress predicts poor outcome over one year. Musculoskeletal Care 2007;5:51-64. [CrossRef]

34. Palma JA, Urrestarazu E, Iriarte J. Sleep loss as risk factor for neurologic disorders: a review. Sleep Med 2013;14:229-36. [CrossRef]
35. Floyd JA, Janisse JJ, Marshall Medler S, Ager JW. Nonlinear components of age-related change in sleep initiation. Nurs Res 2000;49:290-4. [CrossRef]
36. Machado Vaz I, Roque V, Pimentel S, Rocha A, Duro H. Psychosocial characterization of a Portuguese lower limb amputee population. Acta Med Port 2012;25:77-82.
37. Asadollahi R, Saghafinia M, Nafissi N, Montazeri A, Asadollahi M, Khatami M. Anxiety, depression and health-related quality of life in those injured by landmines, Ilam, Islamic Republic of Iran. East Mediterr Health J 2010;16:1108-14.
38. Singh R, Hunter J, Philip A. The rapid resolution of depression and anxiety symptoms after lower limb amputation. Clin Rehabil 2007;21:754-9. [CrossRef]
39. Lindberg E, Janson C, Gislason T, Björnsson E, Hetta J, Boman G. Sleep disturbances in a young adult population:can gender differences be explained by differences in psychological status? Sleep 1997;20:381-7.
40. Shukla GD, Sahu SC, Tripathi RP, Gupta DK. A psychiatric study of amputees. Br J Psychiatry 1982;141:50-3. [CrossRef]
41. Ellis K. A review of amputation, phantom pain and nursing responsibilities. Br J Nurs 2002;11:155-7. [CrossRef]
42. Bone M, Critchley P, Buggy DJ. Gabapentin in postamputation phantom limb pain. Reg Anesth Pain Med 2002;27:481-6. [CrossRef]