ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.31609/jpmrs.2019-66556

The Effect of the Level of Amputation on Depression, Body Image Perception and Locomotor Capacity in Patients Using Lower Extremity Prosthesis

Alt Ekstremite Protezi Kullanan Hastalarda Amputasyon Düzeyinin Depresyon, Beden İmaj Algısı ve Lökomotor Kapasite Üzerine Etkisi

Gökşen GÖKŞENOĞLU[a],
Mustafa Aziz YILDIRIM[a]

[a]İstanbul Physical Medicine and Rehabilitation Training and Research Hospital, İstanbul, TURKEY

Received: 19.04.2019
Received in revised form: 19.06.2019
Accepted: 19.06.2019
Available online: 21.06.2019

Correspondence:
Gökşen GÖKŞENOĞLU
İstanbul Physical Medicine and Rehabilitation Training and Research Hospital, İstanbul, TURKEY/TÜRKİYE
goksengoksenoglu@hotmail.com

ABSTRACT Objective: The aim of the study was to evaluate the effects of the amputation levels on depression, body image perception and locomotor capacity in patients using lower extremity prosthesis. **Material and Method:** In total, 62 patients were included in the study. The demographic data and clinical characteristics of the patients were recorded.The patients were divided into four groups depending on the level of amputation: transfemoral, transtibial, foot amputation and knee disarticulation. The locomotor capabilities index-5 was used to grade the locomotor capacity of the patients, amputee body image scale was used to measure the body image perception and beck depression inventory was used to assess the symptoms of depression. **Results:** The mean age of the 62 patients (74.2% male, 25.8% female) was 43.8±14.6 years. No significant difference was found between the mean scores for the amputee body image scale and Beck depression inventory scores that were determined according to the amputation levels, whereas a significant difference was observed with respect to the locomotor capabilities index-5 scores. When the mean the locomotor capabilities index-5 scores of the four amputee groups were compared, significant differences were found between scores of patients with knee disarticulation and transfemoral amputation, transtibial amputation, foot amputation. It was determined that patients with knee disarticulation had significantly lower locomotor capabilities than that of other amputation levels. **Conclusion:** In our study, although body image and locomotor capabilities were found to be lower among patients with knee disarticulation compared with other amputation levels, no significant difference was found in terms of depression and body image perception.

Keywords: Amputation; disarticulation; depression; body image; locomotion

ÖZET Amaç: Bu çalışmanın amacı; alt ekstremite protezi kullanan hastaların amputasyon seviyelerinin depresyon, beden imaj algısı ve lökomotor kapasitesi üzerine etkilerinin değerlendirilmesiydi. **Gereç ve Yöntemler:** Çalışmaya 62 hasta alındı. Hastaların demografik verileri ve klinik özellikleri kaydedildi. Hastalar amputasyon seviyesine göre transfemoral, transtibial amputasyon, ayak amputasyonu ve diz dezartikülasyonu olarak 4 gruba ayrıldı. Hastaların lökomotor kapasitelerini derecelendirmek için lökomotor beceri indeksi-5, beden imaj algısını ölçmek için ampute beden imaj ölçeği ve depresyon belirtilerini değerlendirmek için Beck depresyon ölçeği kullanıldı. **Bulgular:** Çalışmada ortalama yaşları 43,8±14,6 yıl olan (%74,2'si erkek %25,8'i kadın) 62 hasta mevcuttu. Amputasyon seviyesine göre ampute vücut imaj ölçeği skoru ve Beck depresyon ölçeği skoru ortalamaları arasında anlamlı fark olmadığı aksine lökomotor beceri indeksi-5 skoru ortalamaları açısından anlamlı fark olduğu saptandı. Lökomotor beceri indeksi skoru ortalamaları dört grupta karşılaştırıldığında diz dezartikülasyonlu ve transfemoral ampute, diz dezartikülasyonlu ve transtibial ampute, diz dezartikülasyonlu ve ayak amputasyonlu olgular arasında anlamlı fark olduğu saptandı. Diz dezartikülasyonlu olguların lökomotor becerisinin diğer gruplara göre anlamlı olarak daha düşük olduğu saptandı. **Sonuç:** Çalışmamızın sonucunda, diz dezartikülasyonlu hastalarda lökomosyon becerisi diğer amputasyon seviyelerine göre daha kötü tespit edilse de, depresyon ve beden imaj algısı açısından anlamlı fark tespit edilememiştir.

Anahtar Kelimeler: Amputasyon; dezartikülasyon; depresyon; beden imajı, lökomosyon

Amputation is the complete or partial removal of extremities through surgical methods, leading to changes in the physical functions of and psychosocial difficulties in individuals.[1,2] Amputation is followed by a suitable physical therapy, rehabilitation and prosthesis training.[3] The most common cause of amputation is vascular diseases, whereas other causes include trauma, tumour, acute and chronic infections and necrosis resulting from congenital and metabolic diseases. Lower extremity amputations (LEAs) constitute 80-85% of all amputations.[4,5] From the distal to the proximal, the levels of LEAs can be listed as partial foot amputation, Syme's amputation, transtibial amputation, knee disarticulation, transfemoral amputation, hip disarticulation and hemipelvectomy. Although amputations are seen as the final point of surgical treatment today, they also constitute, from a different standpoint, the starting point of the rehabilitation process that aims to ensure walking with a prosthesis.[6] Following amputation, the unsuitability of the applied prosthesis can lead to significant problems in the individual's life. The success of these prostheses depends on good psychological and physical rehabilitation. It has been shown that psychosocial factors negatively affect patient satisfaction, which affects the prosthesis rehabilitation process.[7]

We aimed to evaluate the effects of the amputation levels on depression, body image perception and locomotor capacity in patients using lower extremity prosthesis.

MATERIAL AND METHODS

In total, 62 patients aged between 18 and 65 years, who use a lower extremity prosthesis for various reasons and who presented to our physical therapy and rehabilitation outpatient clinic, were included in the study. Patients who had been using a lower extremity prosthesis for at least six months and who were sufficiently communicative were included in the study. Bilateral amputees and patients with rheumatoid arthritis; systemic inflammatory diseases, such as spondyloarthropathy and systemic neurological diseases, such as multiple sclerosis and Alzheimer's disease were excluded from the study.

The socio-demographic data and amputation-related clinical characteristics of the patients were recorded. The patients were divided into four groups depending on the level of amputation: transfemoral, transtibial, foot amputation and knee disarticulation. The Locomotor Capabilities Index-5 (LCI-5) was used to grade the locomotor capacity of the patients, Amputee Body Image Scale (ABIS) was used to measure the body image perception and Beck Depression Inventory (BDI) was used to assess the symptoms of depression.

THE SCALES

Locomotor Capabilities Index-5

This scale assesses the patient's ability to perform 14 types of activity with his/her prosthesis.

Following the question 'Would you say that you are able to do the following activities with your prosthesis on?', each item of the scale is scored on a five-point ordinal scale (0: no, 1: Yes, if someone helps me, 2: Yes, if someone is near me, 3: Yes, alone with ambulation aids and 4: Yes, alone without ambulation aids). The maximum total score of the scale is 56, and a higher score is associated with a higher locomotor capacity.[8]

Amputee Body Image Scale

The scale comprises 20 items that assess how the amputee perceives and feels about his/her own body experiences. The respondents are asked to answer the items on a rating scale (1: never, 2: rarely, 3: sometimes, 4: frequently and 5: all the time). Three of the items (3, 12 and 16) are scored inversely. Patients will receive a score varying ranging from 20 to 100, with higher scores being associated with higher impairment in body image.[9,10]

Beck Depression Inventory

The inventory measures the physical, emotional and cognitive symptoms of depression. It is a self-assessment scale comprising 21 categories of symptoms. The highest possible score on the scale is 63, and an increasing score directly corresponds to the increasing severity. The validity and reliability study for the scale in Turkey was performed by Hisli.[11]

Approval for the study was obtained from the Bakırköy Sadi Konuk Training and Research Hospital's Ethics Committee, and the study group was informed about the purpose and content of the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

STATISTICAL ANALYSIS

The fit of the data to a normal distribution was analysed via the Kolmogorov-Smirnov test, whereas the fit of the data to a normal distribution in the sub-groups was analysed with the Shapiro-Wilk test. Continuous variables that showed normal distribution were expressed as arithmetic mean and standard deviation, whereas those that did not show normal distribution were expressed as median and interquartile range. Categorical variables were presented as frequency and percentage. Group means were compared with the Kruskal-Wallis test. A p value of <0.05 was considered to be statistically significant. When a difference was identified between the groups, the Mann-Whitney U test was used for paired comparisons. Multiple comparisons were made using the Bonferroni correction, with a p value of <0.017 being considered as statistically significant. The Spearman test was used for correlation analysis. A valid correlation was considered to exist in cases wherein the coefficient of correlation was $r>0.20$ and $p<0.05$. Statistical analysis was performed using the PASW 18.0 software.

RESULTS

In our study, the mean age of the patients using lower extremity prosthesis was 43.8±14.6 years. Of these 62 patients, 74.2% (n=46) were male, whereas 25.8% were female (n=16). The mean time since amputation was 176.5±156.8 months. The socio-demographic characteristics of the patients are presented in Table 1.

The most frequent type of amputation was transtibial amputation (48.4%), followed by transfemoral amputation (32.3%). Trauma was the most common etiology (38.7%), followed by vascular causes (32.3%). Amputation levels, amputation side and etiology of the participating patients are presented in Table 2.

The types of prostheses used by the patients at the time of admission are shown in Table 3 in percentages.

The patients who participated were divided into groups according to the level of amputation; the LCI-5, ABIS and BDI score of these patients are presented in Table 4.

No significant difference was found between the mean scores for the ABIS and BDI scores that were determined according to the amputation levels, whereas a significant difference was observed with respect to LCI-5 scores. When the mean LCI-5 scores of the four amputee groups were compared, significant differences were found between scores of patients with knee disarticulation and

TABLE 1: Demographic and anthropometric characteristics of the groups.

		Age (years)	BMI	Education (years)	Time since amputation (months)
Transfemoral amputation	Median	41.0	23.9	10.0	132.0
	IQR	11.0	7.9	10.0	309.0
Knee disarticulation	Median	50.0	22.9	8.0	126.0
	IQR	25.3	9.5	2.0	163.5
Transtibial amputation	Median	48.0	27.2	8.0	144.0
	IQR	26.0	11.5	7.0	303.0
Foot amputation	Median	54.0	25.6	8.5	132.0
	IQR	31.3	9.0	9.3	155.5
P value*		0.893	0.541	0.785	0.859

* Kruskal-Wallis test; IQR: Interquartile range.

TABLE 2: Amputation, amputation level, amputation side and etiology of the patients.

		Frequency	Percentage
Amputation etiology	Peripheral vascular disease	20	32.3
	Trauma	24	38.7
	Tumour	1	1.6
	Infection	7	11.3
	Congenital	6	9.7
	Burn or freezing	3	4.8
	Nerve lesions	1	1.6
Amputation level	Transfemoral amputation	20	32.3
	Knee disarticulation	6	9.7
	Transtibial amputation	30	48.4
	Foot amputation	6	9.7
Amputation side	Right	34	54.8
	Left	23	37.1
	Bilateral	5	8.1
Gender	Male	46	74.2
	Female	16	25.8
Civil Status	Single	27	43.5
	Married	35	56.5

TABLE 3: Types of prosthesis at the time of admission of the patients.

	Frequency	Percentage
Below-the-knee active vacuum prosthesis	29	46.8
Below-the-knee silicone liner prosthesis	2	3.2
Hydraulic knee disarticulation prosthesis	2	3.2
Mechanical modular knee disarticulation prosthesis	2	3.2
Hydraulic above-the-knee prosthesis	11	17.8
Mechanical modular above-the-knee prosthesis	7	11.3
Pneumatic above-the-knee prosthesis	1	1.6
Silicone liner knee disarticulation prosthesis	2	3.2
Foot prosthesis	6	9.7
Total	62	100.0

those who underwent transfemoral amputation (p=0.016); between scores of patients with knee disarticulation and those who underwent transtibial amputation (p=0.009) and between scores of patients with knee disarticulation and those who underwent foot amputation (p=0.002). It was determined that patients with knee disarticulation had significantly lower locomotor capabilities than that of other amputation levels.

DISCUSSION

According to the results of our study, body image and locomotor capabilities of patients with knee disarticulation were worse than the patients in other amputee groups. There was no difference among the groups in terms of depressive symptoms.

Accurately determining the level of amputation is important with respect to the physical and psychological treatments received by the patients during their stay in the hospital and during the postoperative period, their re-adaptation to normal life and their functional gains.[12] LEAs are five times more common than upper extremity amputations. Transtibial and transfemoral amputations constitute 39% and 31% of all amputations, respectively.[13.]

In our study, it was determined that locomotor capabilities increased as the amputation level moved caudally, and patients who underwent a knee disarticulation had significantly lower locomotor capabilities. Because knee disarticulation involves the knee joint, the knees of the patient are not at the same level, and the amputated leg appears longer when the patient sits.[14] A study conducted by Penn-Barwell demonstrated that the physical component of the Short-Forms (SF-36) also shows a progressive and significant decrease as amputation level moves proximally, from below the knee to the level of knee or above the knee. It was determined that patients with below-knee amputations and knee disarticulations were able to walk for 500 metres with greater ease than those with above-knee amputations. It was also noted that the amputation level should be kept as distal as possible. Furthermore, although the prevalence of stump pain was found to be similar between patients with below-knee and above-knee amputations, it was significantly higher among patients with knee disarticulations.[15] Previous studies have emphasised that in cases wherein amputation is inevitable, an effort should be made to preserve as much length as possible. The reasons cited for preferring knee disarticulation over above-knee amputation include increased stability while transferring and sitting and decreased dependence on long-term nursing care following knee disarticulation. Conversely, Stirnemann et al. reported a higher risk of delayed wound healing and re-amputation among patients with knee disarticulation

TABLE 4: Mean scores for the Locomotor Capabilities Index-5, Amputee Body Image Scale and Beck Depression Inventory according to the amputation levels.

		Locomotor Capabilities Index-5	Amputee Body Image Scale	Beck Depression Inventory
Transfemoral amputation	Median	52.50	53.00	3.50
	IQR	14.75	26.75	24.50
Knee disarticulation	Median	34.00	59.00	18.00
	IQR	18.50	44.25	25.50
Transtibial amputation	Median	53.00	38.50	5.00
	IQR	15.00	31.00	20.00
Foot amputation	Median	53.50	35.00	0.00
	IQR	6.50	10.50	2.25
P value*		0.04	0.224	0.074

* Kruskal-Wallis test; IQR: Interquartile range.

than that of above-knee amputees. A possible explanation for this is the continuing ischaemia owing to the low amputation level.[16,17] In their study on patients with peripheral artery diseases, Met et al. reported a higher frequency of complications after knee-level amputations and a lack of a significant difference in terms of function between above-knee and below-knee amputees.[18] Moreover, in a study comparing the walking pattern of patients with knee disarticulation and transfemoral amputation, patients with knee disarticulation were found to have greater asymmetry between their walking results for the prosthesis side and normal side.[19]

Looking at society in general, it can be said that there is a need for investigating the physical problems of amputees who represent a special population and their depressive symptoms. It is thought that improving the depressive symptoms of these individuals will also result in an improvement in their quality of life.[20,21] Asano et al. determined in their study that age, mobility level, social support, comorbidities, social activity, prosthesis-related problems and depression have significant effect on the quality of life and that among these factors, depression was the most important factor that had a negative effect on the quality of life.[22] Taking into account the high prevalence rate and the impact on the quality of life, it can be stated that psychological factors are important in the rehabilitation of amputees. In this study, we found no significant difference between the mean BDI scores calculated according to the amputation levels. Many previous studies have investigated the rates of anxiety and depression in lower extremity amputees, and although these rates tend to vary, values of up to 64% have been reported.[7,23-25] In a study conducted by Hawamdeh et al. on 56 patients who underwent unilateral lower extremity amputation, anxiety and depression were observed at rates of 37% and 20%, respectively. The study also identified a lack of a statistically significant difference in the rates of depression between patients with below-knee and above-knee amputations; between men and women; between married and single patients and between employed and unemployed patients.[7] In his study on 69 patients who underwent amputation, Ide determined that 33.3% of the patients had moderate-to-severe depression. A large majority of the patients with complaints of depression reported that they had to undergo amputation owing to work-related trauma, and patients in this group also stated that their most significant complaint was pain in the amputated extremity.[26] In our study group, the rate of patients with depressive symptoms was 37.1%. The lack of difference in the depression scores between patients who have undergone amputations at different levels may be related with the using prostheses for walking. This difference might be explained with the fact that our patients were emotionally examined at least six months after amputation.

In a study conducted by Rybarczyk et al., in which body image perception (BIP) was described as a form of self-stigmatisation, a relationship was

identified between the quality of life and the patient's adaptation to the prosthesis, independent of the patient's body image, social support and perceived social stigmatisation.[27] The same study also determined that BIP and the perceived social stigmatisation were two important determining factors of depression. In our study, we examined the impacts on body image using the ABIS and found that cases with knee disarticulation had lower body image perceptions. A study investigating patients who do and do not use protheses found that the BIP scores were significantly more positive among prosthesis users. This result might be associated with better adaptation to social life of patients with protheses in comparison with those without and also to a greater mobility of prosthesis users.[28] In our study, all patients were prosthesis users, were independently mobile and did not require any ambulation aids. We believe that this might have caused the lack of a statistically significant difference among the groups in terms of BIP scores. The first strength of our study is that in the literature, we could not come across any study that compared depression scores, body image index and the locomotor capacity of the cases with reference to the amputation level of lower extremity. Secondly, our study's strength is that the used scales have Turkish validity and reliability. The limitations of our study is that although the number of patients included was generally not low, the rates of patients with knee disarticulation and foot amputation were relatively low in the study group and the assessment parameters were subjective and based on patients report.

CONCLUSION

Body image and locomotor capabilities were found to be lower among patients with knee disarticulation compared with patients with transfemoral amputation. During the rehabilitation of amputees, the rehabilitation process should take into account the amputated extremity and entire locomotor system. Moreover, we believe that improving the body image of amputees and providing them with psychiatric support, if necessary, might positively affect the healing of these individuals.

Acknowledgements

We would like to extend our special thanks to Assoc. Prof. Nurdan Paker, M.D.

REFERENCES

1. Karami G, Ahmadi Kh, Nejati V, et al. Better mental component of quality of life in amputee. Iran J Public Health. 2012;41:53-8.
2. van der Sluis CK, Hartman PP, Schoppen T, et al. Job adjustments, job satisfaction and health experience in upper and lower limb amputees. Prosthet Orthot Int. 2009;33:41-51. [Crossref] [PubMed]
3. Aygan İ, Tuncay İ, Tosun N ve ark. Amputasyonlar: nedenleri ve seviyeleri (retrospektif klinik çalışma). Artroplasti Artroskopik Cerrahi. 1999;10:179-83.
4. Christensen J, Ipsen T, Doherty P, et al. Physical and social factors determining quality of life for veterans with lower-limb amputation(s): a systematic review. Disabil Rehabil. 2016:38:2345-53. [Crossref] [PubMed]
5. Dillingham TR, Pezzin LE, MacKenzie EJ. Limb amputation and limb deficiency: epidemiology and recent trends in the United States. South Med J. 2002;95:875-83. [Crossref] [PubMed]
6. Arwert HJ, van Doorn-Loogman MH, Koning J, et al. Residual-limb quality and functional mobility 1 year after transtibial amputation caused by vascular insufficiency. J Rehabil Res Dev. 2007;44:717-22. [Crossref] [PubMed]
7. 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] [PubMed] [PMC]
8. Franchignoni F, Orlandini D, Ferriero G, et al. Reliability, validity, and responsiveness of the locomotor capabilities index in adults with lower-limb amputation undergoing prosthetic training. Arch Phys Med Rehabil. 2004;85:743-8. [Crossref] [PubMed]
9. Safaz I, Yılmaz B, Goktepe AS ve ark. Turkish version of the amputee body image scale and relationship with quality of life. Bull Clin Psychopharmacol. 2010;20:79-83. [Crossref]
10. Gallagher P, Horgan O, Franchignoni F, et al. Body image in people with lower-limb amputation: a Rasch analysis of the Amputee Body Image Scale. Am J Phys Med Rehabil. 2007;86:205-15. [Crossref] [PubMed]
11. Hisli N. A study on the validity of Beck Depression Inventory. Psikoloji Dergisi. 1988;6:118-22.
12. McAnelly RD, Faulkner VW. Lower limb prostheses. In: Braddom RL, Buschbacher RM, Dumitru D, Johnson EW, Matthews D, Sinaki M, eds. Physical Medicine and Rehabilitation. Philadelphia: WB Saunders; 1996. p. 286-320.
13. Esquenazi A. Amputation rehabilitation and prosthetic restoration. From surgery to community reintegration. Disabil Rehabil. 2004;26:831-6. [Crossref]
14. Esquenazi A, DiGiacomo R. Rehabilitation after amputation. J Am Podiatr Med Assoc. 2001;91:13-22. [Crossref] [PubMed]
15. Penn-Barwell JG. Outcomes in lower limb amputation following trauma: a systematic review and meta-analysis. Injury. 2011;42:1474-9. [Crossref] [PubMed]

16. Stirnemann P, Mlinaric Z, Oesch A, et al. Major lower extremity amputation inpatients with peripheral arterial insufficiency with special reference to the transgenicular amputation. J Cardiovasc Surg (Torino). 1987;2: 152-8.
17. Lim TS, Finlayson A, Thorpe JM, et al. Outcomes of a contemporary amputation series. ANZ J Surg. 2006;76:300-5. [Crossref] [PubMed]
18. Met R, Janssen LI, Wille J, et al. Functional results after through-knee and above-knee amputations: does more length mean better outcome? Vasc Endovascular Surg. 2008;42:456-61. [Crossref] [PubMed]
19. Alsancak S, Güner S. Why transfemoral amputation instead of knee disarticulation? Ankara Sağlık Hizmetleri Dergisi. 2018;17:21-4. [Crossref]
20. Rybarczyk BD, Nyenhuis DL, Nicholas JJ, et al. Social discomfort and depression in a sample of adults with leg amputation. Arch Phys Med Rehabil. 1992;73:1169-73.
21. Darnall BD, Ephraim P, Wegener ST, et al. Depressive symptoms and mental health service utilization among persons with limb loss: results of a national survey. Arch Phys Med Rehabil. 2005;86:650-8. [Crossref] [PubMed]
22. Asano M, Rushton P, Miller WC, et al. Predictors of quality of life among individuals who have a lower limb amputation. Prosthet Orthot Int. 2008;32:231-43. [Crossref] [PubMed]
23. Siedel E, Lange C, Wetz HH, et al. Anxiety and depression after loss of a lower limb. Orthopade. 2006;35:1152-8. [Crossref] [PubMed]
24. Cansever A, Uzun O, Yildiz C, et al. Depression in men with traumatic lower part amputation: a comparison to men with surgical lower part amputation. Mil Med. 2003;168:106-9. [Crossref] [PubMed]
25. Mosaku KS, Akinyoola AL, Fatoye FO, et al. Psychological reactions to amputation in a sample of Nigerian amputees. Gen Hosp Psychiatry. 2009;31:20-4. [Crossref] [PubMed]
26. Ide M. The association between depressive mood and pain amongst individuals with limb amputations. Eur J Trauma Emerg Surg. 2011;37:191-5. [Crossref] [PubMed]
27. Rybarczyk B, Nyenhuis DL, Nicholas JJ, et al. Body image, perceived social stigma, and the perception of psychological adjustment to leg amputation. Rehabil Psychol. 1995;40:95-110. [Crossref]
28. Atay IM, Turgay O, Atay T. The prevalence of prosthesis use with the effects on body image, depression, anxiety and self-esteem in lower-extremity amputations. Turk J Phys Med Rehab. 2014;60:184-8. [Crossref]