ORIGINAL ARTICLE

Depression associated variables among lower limb amputees in Santa Catarina State – Brazil

Fatores associados à depressão em pacientes amputados de membros inferiores no Estado de Santa Catarina – Brasil

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ABSTRACT

The amputation of the lower limbs and depression has been studied by different groups with a wide prevalence range and some variables were related to depressive symptoms. Depression and anxiety have been related with a major impact on adherence to rehabilitation, functional prognosis, and quality of life. Knowing the patients at highest odds of presenting depressive symptoms may favor an early approach and treatment, ultimately optimizing the rehabilitation process and social reintegration. Depression can be related to a lower rate of adaptation to the prosthesis and its use. **Objective:** To determine the association among demographic, socioeconomic, clinical variables with depressive symptoms in amputees before the prosthetic adaptation. **Method:** A case-control study was performed to analyze variables associated with depression (Beck Depression Inventory-II) in lower limb amputees. **Results:** Patients with previous depression (OR= 17,08; CI95:2,14-136,28) and low socioeconomic class (OR= 3,04; CI95:1,24-7,47) are at highest odds of depression after amputation in the state of Santa Catarina. The model explained 71,4% of cases, classifying 88,1% of negative and 23,8% of positive cases. According to our model amputees recruited rarely presented the diagnosis of depression if they belong to a higher socioeconomic class and have no previous depression. On the other hand, patients who presented Brazilian low socioeconomic class D-E, and previous depression should be referenced to a psychological evaluation because they have a chance of depression, close to 1 in 4 cases. **Conclusion:** Previous depression and low social class were associated with the highest odds of depression after amputation in our population.

Keywords: Amputees, Lower Extremity, Depression

RESUMO

Sintomas depressivos em pacientes com amputação de membros inferiores foram foco de diversos estudos, com amplos intervalos de prevalência encontrados, e algumas variáveis foram relacionadas com os sintomas depressivos. Depressão e ansiedade têm grande impacto na aderência à reabilitação, no prognóstico funcional e na qualidade de vida. Conhecer os pacientes que têm maior risco de apresentar sintomas depressivos pode favorecer uma abordagem precoce e seu tratamento, potencializando a reabilitação, a reinserção social, a adaptação à prótese e seu uso. **Objetivo:** Determinar associação entre fatores demográficos, socioeconômicos, e clínicos com sintomas depressivos em pacientes amputados antes da protetização. **Método:** Estudo tipo caso-controle para avaliar fatores associados - dados demográficos, socioeconômicos e comorbidades - à depressão (utilizando escala de depressão de Beck-II) em pacientes com amputação de membro inferior. **Resultados:** Pacientes com depressão prévia (OR= 17,08, IC95:2,14-136,28) e baixa classe social (OR= 3,04, IC95:1,24-7,47) apresentam alta chance de depressão após amputação em Santa Catarina. O modelo explica 71.4% dos casos, classificando adequadamente 88,1% dos negativos e 23,8% dos positivos. E encontrou-se maior capacidade de predizer casos negativos - amputados raramente apresentaram diagnóstico de depressão se pertenciam a uma classe social mais alta e se não tinham diagnóstico prévio de depressão. Pacientes de classes sociais D-E, e diagnóstico prévio de depressão devem ser referenciados para avaliação psicológica devido à chance de depressão próxima de 1 a cada 4 casos. **Conclusão:** Depressão prévia à amputação e classes sociais mais baixas apresentaram maior chance de desenvolver sintomas depressivos após amputação na população estudada.

Palavras-chaves: Amputados, Extremidade Inferior, Depressão

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INTRODUCTION

The amputation of the lower limbs, besides the mobility changes, is also a major alteration in the body image and self-concept and associated with decreased quality of life.[1] Also, amputees have problems returning to work after lower limb amputation, with the need to change work and/or work part-time.[2]

Amputation of the lower limbs and depression has been subject of several studies, in different moments of the patient follow up, such as pre and post-surgery,[3] pre and post prosthesis adaptation[4,5] with a wide range of depression prevalence. Also, numerous authors reported variables related to depressive symptoms (e.g., personal relationships, schooling years, labor status, type of amputation).[4,6]

In a Brazilian study in the city of São Paulo, Sabino et al.[7] evaluated depression in amputees with the Beck Depression Inventory (BDI). According to BDI, 22,58% were classified as mild depression, 16,13% moderate depression, and 9,68% severe depression. The patients with a partner had less symptoms of anxiety and depression than those without a partner.

In 2019, according to the Brazilian Public Health System administrative database (DATASUS)[8] 34.952 lower-limb amputations were performed in Brazil. Of those, 1.089 were in the state of Santa Catarina. In this state, patients attending the Public Health System (Sistema Único de Saúde - SUS) are referred to a single center of rehabilitation to provide prosthesis or wheelchair.

For lower limb amputation patients, the rehabilitation main goal is their reintegration to society, restoring their previous premorbid lifestyle. The high prevalence of depressive or anxious symptoms has a major impact on adherence to rehabilitation, functional prognosis, and quality of life.[9]

Knowing the patients with the highest odds of depressive symptoms may favor an early approach and treatment, ultimately optimizing the rehabilitation process and social reintegration.

OBJECTIVE

The objective of our study is to determine the association among several variables and depressive symptoms in a case-control study.

METHODS

We performed a matched case-control study to determine the association among demographic, socioeconomic, comorbidities, clinical factors, and access to Rehabilitation Public Health services variables with depression in patients with lower limb amputation. These variables are described in Chart 1. Cases and controls were matched by gender, age, educational level, and amputation etiology.

Participants

The Brazilian Public Health System has several Specialized Rehabilitation Centers (Centro Especializado em Reabilitação – CER)10 that provide regional rehabilitation programs. The State of Santa Catarina has five CER. The Rehabilitation Center of Santa Catarina State (Centro Catarinense de Reabilitação - CCR) is the only public facility in the state of Santa Catarina to provide a prosthesis for amputees in the Brazilian Public Health System (SUS) for rehabilitation.

Participants were attended at the OPMAL (Órteses, Próteses e Meios Auxiliares de Locomoção - Orthosis, Prosthesis and Auxiliary Means of Locomotion) outpatient clinic and were interviewed before prosthesis use between September 2019 and January 2020; due to the COVID 19 pandemic the inclusion was suspended and resumed punctually in October 2020.

The inclusion criteria were: 1) age at or above 18 years; 2) lower limb amputees (transfemoral; transtibial; partial foot; hip, knee, ankle disarticulation); 3) not previously prothesized. The exclusion criteria were: 1) finger amputees only; 2) any visual/ hearing impairment or neurological disorder (e.g., dementia) that would prevent the individual from answering the protocol adequately.

Procedure

The data collection was made in a single individual session lasting approximately 30 minutes in a private room. A structured interview for evaluation of demographic data, health status was applied, followed by the Brazilian social class score and Beck Depression Inventory-II (BDI-II).

The previous presence of comorbidities was based on the pathologies referred by the participant (e.g. depression, diabetes, hypertension, smoking) as the use of medications. The distance and time of travel from the city of origin to the CCR location was estimated by Google Maps® using the respective city downtown as a reference.

The social class score was calculated according to the Brazilian Market Research Association,[11] which includes several variables (number of bathrooms, domestic servant, automobiles, personal computer, dishwasher, refrigerator, freezer, washing machines, DVD player, microwave oven, motorcycle, clothes dryer), householder education and access to public utility services (piped water, paved street).

This Brazilian socio-economic class score allowed the distribution of individuals into four different social classes (A, B, C, D-E), from higher to lower points, respectively. Each social class implies an average annual household income in US dollars, 2018 currency (US$1 - R$3,875), as follow: A-US$79.135,98; B1-US$34.928,94; B2-US$17.470,88; C1-US$9.555,03; C2-US$5.414,98; D-E-US$2.229,08.

For the evaluation of depressive symptoms, the BDI-II[12,13] was applied. The BDI-II comprises 21 items, with 4 alternatives each, and scores ranging from 0 to 3 for each item. The final score allows the classification of participants in no depression (0 – 13 points), mild depression (14 – 19 points), moderate depression (20 – 28 points), severe depression (29 – 63 points).

However, according to Gorenstein et al.[14] for populations without previous depression, it is recommended that the term depression should be used only for scores of 20 and over. Therefore, the outcome was categorized as presence of depression (above 19 points) or absence of depression (below 20 points).

Sample size calculation was performed using the following parameters: significance level of 95%, and power of 80%. The

minimum size sample was based on a previous cross-sectional study with the same population (unpublished data) where we found an OR of 5,21 to present depression (above 19 points) in the group of patients that wait more than 1 year between the amputation and their first attendance at OPMAL, when compared to those who wait less than 1 year.

The ratio case/control was 1 case to 2 controls, because there was a low prevalence of depression in that population. The final size was defined as 21 cases to 42 controls (calculated using Open Epi software version 3.01).[15]

Data analyses

The data were processed with the IBM SPSS® Statistics Grad Pack Software Premium version 27.0. A Chi-square test was performed to analyze the associations among cases and controls.

All variables that were found associated with the outcome with $p<0.2$ at Chi-square test were included at dichotomous logistic regression by Backward Likelihood Ratio Non-conditional technique. Fisher test was applied when Chi-square test could not be applied (one or more expected frequencies less than 5). All independent variables were categorized as described in Chart 1.

Ethics statement

All procedures followed the Code of Ethics of the World Medical Association.[16] The Ethics Committee of the Federal University of Santa Catarina (Process No 3.499.325) approved it, and all participants provided written informed consent. All patients with identified depressive symptoms were referred for psychological evaluation in our facility and if necessary, support at the primary care.

Chart 1. Description of the variables included

Variables	Description	Modalities	Analytic categorization	Source of information
Sex	Patient sex	Male or female	Male*; female	Interview
Age	Years of life	Years completed at the time of the interview	≤35; 35 -60; >60*	Interview
Type of amputation	Level of amputation	Transfemoral or knee disarticulation; transtibial or ankle disarticulation	Above knee*; below the knee	Interview and clinical Evaluation
Etiology	Amputation cause	Traumatic Vascular Oncologic	Traumatic*; non-traumatic	Interview and clinical records
Socioeconomic class	ABEP classification	A, B1, B2, C1, C2, D-E	Higher level (A-C); lower level* (D- E)	Interview
Previous Depression	Reported diagnosis	Presence of previous depression or absence	Presence*; absence	Interview
Diabetes	Reported diagnosis	Diabetic or non-diabetic	Diabetic*; non-diabetic	Interview
Hypertension	Reported diagnosis	Hypertensive or non-hypertensive	Hypertension*; no hypertension	Interview
Smoking	Smoker	Smoker or non-smoker	Smoker*; non-smoker	Interview
Educational level	Years of education	Up to 8 years; above 8 years	High; Low level*	Interview
Partner	Has a companionship	Married, stable union, single, widow, divorced	Partner; no partner*	Interview
Distance	Distance from residence to CCR	Reside up to 200km to CCR; reside more than 200Km to CCR	Near; Far*	Google Maps®
Time Travel	Time travel from residence to CCR	Time travel up to 120 min; time travel more than 120 min	Long time travel*; short time travel	Google Maps®
Location	City of residence	Belong to Grand Florianópolis (Florianópolis, Palhoça, Biguaçu, São José)	Grand Florianópolis/ Not Grand Florianópolis*	Interview
CER	City of residence has a reference CER	Reference CER or absence of a reference CER	Referenced CER; No referenced CER*	Public data
Regular Income	Has a regular monthly income	Working, retired, pensionist, government financial assistance, unemployed, no income	Income; no income*	Interview
Time of amputation	Time in months from amputation to first clinical evaluation	Up to 6 months; 6 to 12 months; more than 12 months	< 6; ≥6m <12m; ≥12m*	Interview
Work	Currently working	Has a job or not	Not working*; working	Interview

* risk variable referenc

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RESULTS

A total of 21 cases and 42 controls were enrolled. They were mainly male (71,4%), over 60 years old, low educational level (90,4%), with non-traumatic amputation (76,2%). The characteristics of the demographic, socioeconomic and health status of the sample studied are detailed in Table 1.

Table 1. Sociodemographic, socioeconomic and health status

Variables	Case n (%)	Control n (%)
Sex - Male	15 (71,4)	30 (71,4)
Age >60a	13 (61,9)	24 (57,1)
Above knee	13 (61,9)	21 (50)
Traumatic	5 (23,8)	10 (23,8)
Lower level	9 (42,8)	11 (26,1)
Previous Depression	5 (23,8)	2 (4,7)
Diabetes	11 (52,3)	23 (54,7)
Hypertension	15 (71,4)	26 (61,9)
Smoking	10 (47,6)	12 (28,5)
No partner	7 (33,3)	17 (40,4)
Reside more than 200Km	5 (23,8)	14 (33,3)
Time travel more than 120 min	9 (42,8)	27 (59,5)
Not Grand Florianópolis	16 (76,1)	38 (90,4)
No referenced CER	5 (23,8)	18 (42,8)
No Income	7 (33,3)	12 (28,5)
More than 12m since amputation	6 (28,5)	11 (26,1)
Educational Level <= 8 years	19 (90,4)	36 (90,4)

Demographic, socioeconomic and comorbidities variables were tested, and no covariances were found. Previous depression was the only variable significantly related to current depression in amputees (p=0,02) at bivariate analysis. The following variables were included at multivariate analysis based on a p-value <0,20: previous depression, smoking, location, CER. Table 2 shows the bivariate analysis performed by Chi-square test.

The model adjustment, defined by Hosmer and Lemeshaw test, was $X2 = 2,654$ with p= 0,753. The accuracy of the model was 71,4%, adequately classifying 88,1% of negatives (no depression) and 23,8% of positives (depression). There was no collinearity among variables in the final model.

According to the analyses above, the variables associated with the diagnosis of depression among amputees, evaluated with BDI-II, are the existence of previous depression (OR= 17,08, CI95:2,14-136,28) and socioeconomic class (OR= 3,04; CI95:1,24-7,47). Despite regular income presented no statistical significance, it was included in the final model because it contributed for its adjustment.

This occurred because the behavior of the disease may be modulated by the stability of the income among different socioeconomic class.[4] The model that best explained the results is summarized in Table 3.

Table 2. Chi-square analysis - association of depression and clinical and socioeconomic variables

Variable	Chi-square	p value	Variable at risk	Fisher# Mid-P
Previous depression	5,14	0,0233	Yes	0,04033
Diabetes	0,03	0,8581	Yes	
Hypertension	0,56	0,4548	Yes	
Smoking	2,23	0,135	Yes	
Etiology	0	1	Traumatic	
Level of amputation	0,28	0,5926	Above the knee	
Socioeconomic class	3,4	0,136	Class D and E	
Years of education	0	1	< 8 years	0,9738
Partner	0,3	0,5821	No	
Gender	0	1	Male	
Age	0,76	0,3837	> 35 years	0,4212
Age	0,22	0,6388	> 45 years	0,6733
Age	0,13	0,3587	> 60 years	
Regular income	0,15	0,6979	Unstable or no income	
Time of amputation	1,01	0,3178	> 6 months	0,3379
Time of amputation	0,04	0,8409	> 12 months	
Work	0,32	0,5708	Changed	
Distance	0,6	0,4375	Housing > 200 Km	
Time travel	0,3	0,5821	> 120 minutes	
Location	2,33	0,1267	Not Florianópolis, Palhoça, Biguaçu, São José	0,1581
CER	2,19	0,1389	Do not have CER or referenced CER	
Rehabilitation	0,03	0,8581	Do not have CER	

- *Use of Fisher's exact test; CER - Specialized Rehabilitation Center (Centro Especializado em Reabilitação)*

Table 3. Multivariate model that best explained the outcome "presence of depression"

Variables	B	SE	DF	Signif	OR	CI95
Previous depression	2,838	1,06	1	0,007	17,08	2,14 – 136,28
Socioeconomic class	1,113	0,458	1	0,015	3,04	1,24 – 7,47
Regular income	-0,782	0,658	1	0,235	0,457	0,126 – 1,66
Constant	-6,254	2,432	1	0,008	0,002	-

SE – standard error; DF – degrees of freedom; OR – odds ratio; CI – confidence interval

DISCUSSION

The model in our study has a high capability to predict negative cases, i.e., amputees that were referred for the use of prosthesis will rarely present the diagnosis of depression if they belong to a higher socioeconomic class (C1 and C2 compared to D - E) and without a previous diagnosis of depression.

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On the other hand, patients who presented low socioeconomic class D - E, and previous diagnosis of depression should be referenced to a psychological evaluation, because they have a chance of 1 in 4 cases to be diagnosed with depression.

There is no consensus in the literature about the variables related to depression in lower limb amputees; there is a wide heterogeneity among study populations and variables studied, time of follow up and evaluation (e.g. pre surgery, prosthesis adaptation use). That reinforces the importance of our study in a Brazilian population.

Unemployment is a known risk factor for poor mental health.[17] The presence of a regular income is a wider approach as it includes besides employment income other forms of income as pensions, retirement (public or private), government support (disease aid). Although not statistically significant, the regular income presents rationale for a better mental health[4,11] and therefore was tested as a factor and improved our model.

In line with our findings, Singh et al.[18] in a cohort of 105 patients found that amputees who previously expressed anxiety and depression were more likely to have recurrence of symptoms again. Also, they found no correlation of symptoms with features such as age, level of amputation etiology, living alone or gender.

Pedras et al.[3] also showed a significant effect of symptoms of anxiety and depression at pre-surgery (amputation) on the prediction of these same symptoms one month after lower limb amputation. In their study, patients showed higher anxiety levels than depressive symptoms at pre-surgery, only anxiety significantly decreased one month after surgery. Both anxious and depressive symptoms contributed to the occurrence of current depression after lower limb amputation, although depression at pre-surgery did not predict depression at post-surgery.

Low socioeconomic status is generally associated with high psychiatric morbidity, more disability, and poor access to healthcar.[19] It is also associated with a higher blood pressure[20] and incidence of diabetes,[21] known risk factors for vascular disease. Low socioeconomic status is part of our final model and contributed to depression in lower limb amputees.

The same finding was observed in the study of Cansever et al.[22] that found a positive correlation between depression and poor economic status in surgical patients. On the other hand, a Brazilian study of Sabino et al.[7] with 31 amputees showed that patients who had a partner have lower levels of anxiety and hopelessness, although socioeconomic class and presence of previous depression were not evaluated in their study. However, the finding of the presence of a partner as a resilience factor against depression was not found in studies of other countries.[4,18,23]

Our study presents some limitations. High socioeconomic class stratum (A and B) had no representation in our sample. That could be related to the fact that they can afford a better prosthesis that is not provided by the Public Health System and that amputation was mostly related to vascular etiology (64.8%) in our population (unpublished data) which is related to a worse clinical control in low socioeconomic stratum.[24]

The pain associated with the amputation (i.e., phantom limb pain) was not evaluated. However, phantom limb pain seems to present no influence on depression as Katz & Melzack[25] found no significant difference in standardized tests of psychological dysfunction between patients who experienced phantom pain and those who did not. The presence of pain was also not a significant predictor of anxiety and depression at post-surgery in the study of Pedras et al.[3]

Identifying depression as a relevant problem allows an early treatment dealing with depression before prosthesis use, therefore, this should increase the success rate of prosthesis adaptation and rehabilitation.

Mental health evaluation should always be evaluated to receive the best appropriate approach to reduce anxious and depressive symptoms to promote adequate psychological adjustment to the limb loss. It is essential to have an interdisciplinary team, both at a pre-surgical and immediate post-surgical moment and on inpatient and outpatient level, to decrease the impact of disability and improve functional outcomes and quality of life – account physical and physiological conditions, social and environmental barriers.

CONCLUSION

In this study, patients with previous depression and low social class have higher odds of depression after amputation. Health care professionals should be aware of these variables and offer appropriate early treatment to diminish the impact of depressive symptoms in the rehabilitation of amputees.

We recommend facilities involved with lower limb rehabilitation to adopt structured social interviews and psychological evaluation in order to identify patients at the highest odds of depression, to increase the success of prosthetic adaptation and their social reinsertion.

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