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Original Research

Exploring Factors Influencing Low Back Pain in People With Nondysvascular Lower Limb Amputation: A National Survey

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Abstract

Background: Chronic low back pain (LBP) is a common musculoskeletal impairment in people with lower limb amputation. Given the multifactorial nature of LBP, exploring the factors influencing the presence and intensity of LBP is warranted.
Objective: To investigate which physical, personal, and amputee-specific factors predicted the presence and intensity of LBP in persons with nondysvascular transfemoral amputation (TFA) and transtibial amputation (TTA).
Design: A retrospective cross-sectional survey.
Setting: A national random sample of people with nondysvascular TFA and TTA.
Participants: Participants (N = 526) with unilateral TFA and TTA due to nondysvascular etiology (ie, trauma, tumors, and congenital causes) and a minimum prosthesis use of 1 year since amputation were invited to participate in the survey. The data from 208 participants (43.4% response rate) were used for multivariate regression analysis.
Methods (Independent Variables): Personal (ie, age, body mass, gender, work status, and presence of comorbid conditions), amputee-specific (ie, level of amputation, years of prosthesis use, presence of phantom-limb pain, residual-limb problems, and nonamputated limb pain), and physical factors (ie, pain-provoking postures including standing, bending, lifting, walking, sitting, sit-to-stand, and climbing stairs).
Main Outcome Measures (Dependent Variables): LBP presence and intensity.
Results: A multivariate logistic regression model showed that the presence of 2 or more comorbid conditions (prevalence odds ratio [POR] = 4.34, $P = .01$), residual-limb problems (POR = 3.76, $P < .01$), and phantom-limb pain (POR = 2.46, $P = .01$) influenced the presence of LBP. Given the high LBP prevalence (63%) in the study, there is a tendency for overestimation of POR, and the results must be interpreted with caution. In those with LBP, the presence of residual-limb problems ($\beta = 0.21$, $P = .01$) and experiencing LBP symptoms during sit-to-stand task ($\beta = 0.22$, $P = .03$) were positively associated with LBP intensity, whereas being employed demonstrated a negative association ($\beta = -0.18$, $P = .03$) in the multivariate linear regression model.
Conclusions: Rehabilitation professionals should be cognizant of the influence that comorbid conditions, residual-limb problems, and phantom pain have on the presence of LBP in people with nondysvascular lower limb amputation. Further prospective studies could investigate the underlying causal mechanisms of LBP.
Level of Evidence: To be determined.

Introduction

Low back pain (LBP) is a common musculoskeletal impairment affecting between 50% and 80% of people with transfemoral amputation (TFA) and transtibial amputation (TTA) [1-3]. Although some prevalence studies report that people with TFA experience more LBP than those with TTA [1,4], other studies show no differences [2,5]. Regardless of the levels of amputation, LBP has been reported as "more bothersome" than phantom- or residual-limb pain in people with TFA and TTA [1].

LBP is a multifactorial impairment with physical, personal, and amputee-specific factors contributing to symptoms and disability [6]. Physical factors such as asymmetrical postures (eg, lifting) [7] and gait patterns (eg, Trendelenburg gait) [8], reduced spinal muscle strength and endurance [9], and postural asymmetries (eg, leg-length discrepancy and increased anterior pelvic tilt) [10] may contribute to the intensity of LBP in people with lower limb amputation (LLA). Personal factors identified to influence LBP in the general population include older age [11], gender,

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increase in body mass [12], work status [6], and the presence of comorbid conditions (eg, heart disease, diabetes, depression, and arthritis) [13,14]. In terms of amputee-specific factors, the presence and intensity of LBP is thought to be worse for people with TFA compared to TTA [1], longer years of prosthetic use [15], and the presence of phantom- or residual-limb pain [2]. The interaction among the physical, personal, and amputee-specific factors is best illustrated using an example. It is common for people with TFA to lateral trunk lean toward the prosthetic side during walking (ie, Trendelenburg gait). As they age, and with greater years of prosthetic use, they may be less able to adapt to this movement strategy, and the potential for LBP may increase, which, in the long-term, may alter cortical pain mechanisms [16] and contribute to the intensity of LBP.

Given the complex interrelationship of physical, personal, and amputee-specific factors influencing the presence and/or intensity of LBP in people with LLA, multivariate analyses provide scope for identifying which of these factors are the most influential in people with LLA and may help clinicians to focus their treatment on the most critical factors that can modify the presence and intensity of LBP.

To date, the only previous prediction study [2] found that the odds for the presence of LBP were less for men (odds ratio [OR] = 0.7; 95% confidence interval [CI] = 0.5-1.0) and older adults (OR = 0.6; 95% CI = 0.4-0.9), and increased with household poverty (OR = 1.4; 95% CI = 1.0-2.0). The odds for the presence of LBP did not vary across people with TFA or TTA ($P > .05$) and longer years of prosthetic use ($P > .05$). Although the study demonstrated the impact of personal factors (ie, gender, age, and economic status) affecting the presence of LBP, the potential influence of amputee-specific factors such as phantom- and residual-limb pain contributing to the presence and intensity of LBP were not investigated. Moreover, the study included participants with both upper- and lower-extremity amputations, which limited the generalizability of study results.

As such, there is a need for further research with the following aims: (1) to identify which personal (ie, age, body mass, gender, work status, and presence of comorbid conditions), and amputee-specific factors (ie, level of amputation, years of prosthesis use, presence of phantom-limb pain, residual-limb problems, and nonamputated limb pain) are associated with the presence of LBP in people with nondysvascular LL; and (2) in those individuals who report LBP, identify which physical (ie, pain-provoking postures, including standing, bending, lifting, walking, sitting, sit-to-stand, getting in and out of the car, and climbing stairs), personal, and amputee-specific factors are associated with the intensity of LBP in people with nondysvascular LLA.

Methods

Inclusion and Exclusion Criteria

Participants with unilateral TFA or TTA aged 18-65 years with amputation due to trauma or tumors were included. A threshold of 65 years was decided a priori, as the focus of the survey was to investigate the LBP prevalence in younger and middle-aged adults with LLA. We included only individuals with nondysvascular amputation (ie, trauma or tumor) because those with nondysvascular amputation tend to be younger, to present with fewer comorbid conditions, and to be more active prosthesis users [17-19] than those with nondysvascular amputation (ie, peripheral vascular disease and diabetes) [20]. Thus, we sought to investigate a relative young and healthy sample as a way to control for the influence of comorbid conditions that might influence LBP. Furthermore, owing to younger age at the time of amputation, persons with nondysvascular amputation continue to live with their prosthesis for more years [21], potentially increasing the risk of developing secondary musculoskeletal impairments such as LBP. A minimum prosthesis use of 1 year since amputation was chosen, similar to that in previous surveys conducted in this population [5,20]. Participants with bi-lateral LLA and those with a history of lower back surgery were excluded from the survey.

Study Design

A cross-sectional survey was administered to a national sample of people with TFA and TTA due to trauma and tumors in XX. Q4

Sample Size Calculation

This study was powered to be able to estimate the overall prevalence of LBP within a margin of error of ±5%. Based on the Dillman sample size formula [22], 295 participants were required with nondysvascular TFA and TTA in XX, assuming a 95% confidence level and a 50/50 split for choosing a "yes" or "no" response to the LBP question. Given that a recent national survey of the same population had a 56% response rate [3], and that people with TTA are twice as common as those with TFA [23], it was estimated that 526 surveys would need to be distributed to potential participants.

Survey Implementation

A list of potential participants satisfying the inclusion criteria (N = 1268) was extracted a priori from the XX Artificial Limb Service (XXXXX) national electronic database (updated in 2012) [23]. For confidentially reasons, access to the XXXXX database is restricted only to executive officials of regional artificial limb centers