

Original Article

An Evaluation of Phantom Pain among Traumatic Lower Limb Amputees in Lahore

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Conflict of Interest: None.

Aslam M., et al. (2024). 4(2): DOI: <https://doi.org/10.61919/jhrr.v4i2.924>

ABSTRACT

Background: Amputation is the surgical removal of all or part of an irreparably damaged limb due to injury or disease. Trauma is the leading cause of lower limb amputation in Pakistan. Phantom limb pain (PLP) is a common and distressing complication following amputation, affecting the quality of life and functional outcomes.

Objective: The primary objective of this study was to assess the occurrence and intensity of phantom limb pain in patients who had undergone lower limb amputation due to traumatic causes in Pakistan.

Methods: A descriptive cross-sectional study was conducted over six months, involving 73 patients who had undergone lower limb amputation due to trauma. The study was carried out in Ghurki Trust Teaching Hospital, Sheikh Zayed Hospital, and Mayo Hospital. Patients aged 20-45 years, with amputations performed within one year, were included. Exclusion criteria were non-traumatic amputations and amputations older than one year. Non-probability convenience sampling was used. Participants were divided into three groups based on the level of amputation: hip disarticulation (n=12), transfemoral (n=28), and transtibial (n=33). Phantom limb pain was assessed using the Numeric Pain Rating Scale (NRPS), an 11-item scale ranging from 0 (no pain) to 10 (severe pain). Data were analyzed using SPSS version 25, and descriptive statistics were presented in tables and graphs. Ethical approval was obtained from the Ethics Committee of Lahore College of Physical Therapy (ERC-LCPT/298/2019). Written informed consent was obtained from all participants.

Results: The study found that 83.6% of the participants experienced phantom limb pain. Among the hip disarticulation group, 91.7% reported PLP, with a mean NRPS score of 7.3. In the transfemoral group, 89.3% experienced PLP, with a mean NRPS score of 6.8. In the transtibial group, 75.8% reported PLP, with a mean NRPS score of 5.4. The association between the level of amputation and the presence of PLP was significant, with p-values of 0.003 for hip disarticulation, 0.000 for transfemoral, and 0.001 for transtibial amputations.

Conclusion: Phantom limb pain is a prevalent and significant issue among patients with traumatic lower limb amputations in Pakistan, with varying intensity across different levels of amputation. These findings underscore the need for targeted pain management strategies and comprehensive rehabilitation programs to address PLP and improve the quality of life for amputees.

Keywords: phantom limb pain, lower limb amputation, traumatic amputation, Numeric Pain Rating Scale, NRPS, Pakistan, pain management, rehabilitation, prosthetics, orthopedic surgery, quality of life.

INTRODUCTION

Amputation is defined as the surgical removal of all or part of an irreparably damaged limb due to an injury or disease. The most common cause of lower limb amputation worldwide is peripheral vascular disease, followed by trauma, tumor, and infection. In Pakistan, trauma is the leading cause of lower limb amputation, with a prevalence of 75%. Lower limb amputation is one of the oldest surgical practices, dating back to prehistoric times. Major amputations in the lower extremity are performed at various levels, determined by the need to remove all non-viable tissue while creating a healed, functional, and potentially prosthetically suitable residual limb. The most common level of lower limb amputation in Pakistan is documented as the trans-tibial amputation. The level of amputation is of significant importance depending upon the extent and etiology of damage. The most common types of

amputation in the lower extremity are trans-femoral and trans-tibial amputations. Other types or levels of lower limb amputation include hemipelvectomy, hip disarticulation, Syme's, Chopart, trans-metatarsal, and interphalangeal amputations.

The most common complications after amputation include surgical site infection, phantom limb pain, wound dehiscence, stump overgrowth, osteomyelitis, hypertrophic scar, and severe depression. Amputation of the lower limb can be a handicapping experience, causing activity limitation, inhibition of functional performance, and a reduction in general quality of life. It has a direct effect on mobility, balance, and mental health. Phantom pain is the experience of pain in a limb that no longer exists. Pain itself is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. Phantom pain is a component of the phantom limb complex, which includes phantom limb sensation, phantom limb pain, and stump pain. The incidence of phantom limb pain was first described by a 16th-century French military surgeon, Ambrose Paré. The term "phantom limb pain" was coined by Silas Weir Mitchell, a famous Civil War surgeon, in the nineteenth century. The prevalence of phantom limb pain has been reported to be 80% in lower limb amputations.

The exact pathophysiological mechanism behind phantom pain is not fully understood yet. Various theories have been proposed to provide insight into the mysterious nature of this phenomenon. Currently, the most prominent explanation is the cortical remapping theory (CRT), which describes the changes in cortical maps and the reorganization of the homunculus affected by stimulus and somatosensory alteration, explaining the plastic malleability of the brain, a phenomenon known as neural plasticity. Other theories include changes in the neuro-matrix signature, peripheral mechanisms such as neuroma formation that evoke ectopic discharges, subcortical theories explaining maladaptive alteration at thalamic levels, and the pain memory theory. However, none of these theories are widely rejected or accepted, and the explanation of the phantom pain phenomenon remains debatable. In the past, it was considered a purely psychiatric illness, but recent studies have not supported this theory and suggest that psychological factors may play a role in influencing the course and severity of phantom pain.

Phantom pain is a common post-amputation complication. Its onset is reported to occur within 24 hours in 50% of patients and within the first week in the remaining 25%. It is usually experienced distally to the missing limb and is described as burning, shooting, throbbing, or squeezing pain. Phantom pain can be a very distressing experience after major amputation, significantly affecting the quality of life. Phantom pain after amputation has been an under-researched medical condition in Pakistan, and the literature gap calls for studies to fill the dearth of related data in our population. Moreover, this study aims to observe phantom pain in the most common levels of lower limb amputation and to promote awareness among medical professionals to focus on this problem and its treatment by incorporating management goals in rehabilitation programs to help improve quality of life after amputation.

MATERIAL AND METHODS

A descriptive cross-sectional study was conducted on 73 amputees who had undergone lower limb amputation due to trauma, using non-probability convenience sampling. The study was carried out in three hospitals: Ghurki Trust Teaching Hospital, Sheikh Zayed Hospital, and Mayo Hospital. The sample size was calculated using the World Health Organization (WHO) sample size calculator, based on a prevalence (P) of 0.75% (3), with a 95% confidence interval (1- α) and a precision (d) of 0.10. The duration of the study was six months.

Participants included in the study were amputees aged 20-45 years old who had undergone amputations due to traumatic causes within the previous year. The levels of amputation considered were hip disarticulation, transfemoral, and transtibial amputation. Amputees with non-traumatic causes and those who had undergone amputation more than one year prior were excluded from the study.

Patients were assessed using the Numeric Pain Rating Scale (NRPS). They were provided with explanations about the phenomenon of phantom pain and were asked about its presence or absence, as well as the intensity of pain if present. Patients were contacted via telephone to arrange visits for assessment. The NRPS is a quantitative, unidimensional measure of pain intensity, consisting of an 11-item scale ranging from 0 to 10, where 0 indicates no pain, 5 indicates moderate pain, and 10 indicates severe pain. The NRPS has a high test-retest reliability and a validity range of 0.86-0.95.

Data were collected and entered into the Statistical Package for Social Sciences (SPSS) version 25, which was also used for data analysis. Descriptive statistics, including tables, graphs, and percentages, were used to present the study variables. Ethical approval was obtained from the Ethics Committee of Lahore College of Physical Therapy (ERC-LCPT/298/2019). Written informed consent was obtained from all participants, explaining the nature and purpose of the study. Participants were assured that all information provided would remain confidential and would not be disclosed.

RESULTS

The study adhered to the principles outlined in the Declaration of Helsinki, ensuring ethical standards were maintained throughout the research process. The methodology was designed to ensure that data collection, assessment, and analysis were conducted rigorously and in accordance with established medical research standards.

Table 1: Level of Amputation

Level of Amputation	Frequency	Percent
Hip Disarticulation	12	16.4
Transfemoral	28	38.4
Transtibial	33	45.2
Total	73	100.0

Table 2: Cross Tabulation of Pain Scores According to Level of Amputation

Pain Scores	Hip Disarticulation	Transfemoral	Transtibial	Total
No pain	1 (8.3%)	3 (10.7%)	8 (24.2%)	12 (16.4%)
Presence of pain	11 (91.7%)	25 (89.3%)	25 (75.8%)	61 (83.6%)
Total	12 (100.0%)	28 (100.0%)	33 (100.0%)	73 (100.0%)
P-value	0.003	0.000	0.001	

Table 3: Frequency of Phantom Limb Pain

Phantom Limb Pain	Frequency	Percentage
No pain	12	16.4
Presence of Pain	61	83.6
Total	73	100.0

The results of the study indicate that the most common level of lower limb amputation among the participants was transtibial, with a frequency of 33 cases, accounting for 45.2% of the total amputations (Table 1). This was followed by transfemoral amputations, which comprised 28 cases or 38.4% of the sample, and hip disarticulation, which represented 12 cases or 16.4% of the total amputations. The data underscores the prevalence of transtibial amputations in the study population, reflecting a significant portion of traumatic lower limb amputations in the observed medical settings.

Regarding pain scores, a notable 83.6% of the amputees reported experiencing phantom limb pain, while only 16.4% reported no pain (Table 2). Specifically, among those with hip disarticulation, 91.7% (11 out of 12) reported phantom limb pain, with only 8.3% (1 out of 12) reporting no pain. Similarly, 89.3% (25 out of 28) of the transfemoral amputees experienced phantom limb pain, and 10.7% (3 out of 28) reported no pain. For transtibial amputees, 75.8% (25 out of 33) experienced phantom limb pain, whereas 24.2% (8 out of 33) did not report any pain. The higher percentage of phantom limb pain in hip disarticulation and transfemoral amputees highlights the severity and prevalence of this post-amputation complication in these groups.

The cross-tabulation of pain scores according to the level of amputation reveals significant findings. Hip disarticulation patients had a very high incidence of phantom limb pain at 91.7%, compared to a lower but still substantial 75.8% in transtibial amputees. The statistical analysis showed a significant association between the level of amputation and the presence of phantom limb pain, with p-values of 0.003 for hip disarticulation, 0.000 for transfemoral, and 0.001 for transtibial amputations (Table 2). These p-values indicate a strong correlation, suggesting that the level of amputation is a critical factor influencing the likelihood of experiencing phantom limb pain.

Overall, the frequency of phantom limb pain was significantly high, with 83.6% of the study participants reporting its presence (Table 3). This finding emphasizes the need for targeted interventions and pain management strategies to address this pervasive issue among lower limb amputees. The results underscore the importance of including phantom limb pain management in the rehabilitation programs for amputees, to improve their overall quality of life and functional outcomes.

DISCUSSION

The primary purpose of this study was to assess the occurrence of phantom limb pain (PLP), a phenomenon of ongoing noxious perception in the nonexistent limb after amputation, in patients who had undergone lower limb amputation due to traumatic etiology. The exact pathophysiology of PLP remains inscrutable, although various theories attempt to explain the phenomenon, and

many more are emerging to provide insight into its process (16). In this study, 73 patients were included and further divided into three groups according to different levels of lower limb amputation: Group I (Hip Disarticulation) n=12, Group II (Transfemoral) n=28, and Group III (Transtibial) n=33. Patients were briefly explained about the phantom limb pain and asked if they had experienced a similar phenomenon following lower limb amputation. Patients with a positive response were further asked to rate the intensity of pain on the Numeric Pain Rating Scale, a numeric version of the Visual Analog Scale (17). The VAS has been used in previous studies to measure the severity and intensity of PLP (18, 19).

The results from patients who completed the questionnaire suggest that phantom limb pain is present in 83.6% of cases, which is consistent with records found in previous studies (20). An additional finding showed that patients with hip disarticulation reported the highest level of PLP, followed by transfemoral and transtibial amputations. Previous studies have suggested that pain levels are higher in more proximal amputation sites (21). However, other studies have concluded that PLP is independent of the level of amputation (22). There was no significant association between gender and the behavior of phantom limb pain, which contrasts with a few studies showing gender-based differences in PLP (23, 24). Differences observed in gender may be due to different coping styles among males and females or other biological and psychological factors, as mentioned in a study by Derbyshire (25).

The contrast in the current and previous studies may be attributed to the etiological origin, ethnicity composition, and duration of surgery, as this study only included patients with a traumatic cause of lower limb amputation performed within one year. This study's strengths include a focused approach on traumatic amputations within a specified period, which helps reduce variability in the sample. However, the limitations include the relatively small sample size and the exclusion of non-traumatic etiologies and older cases of amputation, which may limit the generalizability of the findings.

PLP is a distressing condition for patients, and its occurrence has been shown to be alleviated by interventional strategies like the mirror imaging technique (26, 27). A more sophisticated form of mirror therapy, including virtual reality, has recently been employed as a treatment for PLP and also shows promising results (28). Other treatment options include the use of transcutaneous electrical nerve stimulation (TENS) (29), Capsaicin 8% patch treatment, and medications such as anticonvulsants, antidepressants, anesthetics, N-methyl-D-aspartate receptor antagonists, and opioids (30).

Future studies should focus on other domains of phantom limb pain, including a detailed description of the pain, frequency, and duration of each episode. It is recommended that future research includes patients with non-traumatic etiological origins to provide a broader understanding of PLP. Additionally, comparisons between phantom limb pain among upper limb and lower limb amputations should be made, and retrospective studies including older cases of amputations should be conducted to gain a comprehensive understanding of the condition.

The study results concluded that phantom limb pain is a frequent occurrence in patients with traumatic lower limb amputation, with varying intensity and severity as measured by the Numeric Pain Rating Scale. The findings underscore the importance of recognizing and addressing PLP in post-amputation care to improve patient outcomes and quality of life.

CONCLUSION

The study concluded that phantom limb pain is a prevalent and significant issue among patients with traumatic lower limb amputations, with a majority experiencing varying levels of pain intensity. These findings underscore the need for effective pain management strategies and comprehensive rehabilitation programs to address PLP. The implications for human healthcare include the importance of early identification and treatment of PLP to enhance the quality of life and functional outcomes for amputees. Integrating advanced therapies such as mirror therapy, virtual reality, and appropriate pharmacological interventions into standard care practices is essential to mitigate the distress associated with PLP and promote overall well-being in this patient population.

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