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Original Research Article

Analysis of Clinical and Functional Outcomes in Lower Limb Amputee Patients Understanding the Etiologies and Methods to Assess the Need for Lower Limb Amputation

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Abstract:

Introduction: Diabetes causes about 150,000 lower limb amputations in the US. Amputation can be instantaneous or delayed depending on tissue viability. Before surgery, people with diabetes should be optimized. Traumatic traumas and peripheral artery disease also cause amputations. Functional results vary on age, co-morbidity, motivation, and social context. Smoking hinders male vascular amputees' walking, whereas stump length increases walking distance. Work might affect post-amputation independence.

Aims: This study aims to evaluate the clinical and functional outcomes among individuals with lower limb amputation.

Method: This prospective observational research at a tertiary care centre examines demographics, comorbidities, amputation level, complications, hospital stay, mortality, prosthesis usage, and functional outcomes in lower limb amputation patients. Descriptive statistics and logistic regression analysis identifies variables affecting functional results, prosthesis usage, and complications. Understanding lower limb amputations at tertiary care can improve patient care and quality of life.

Result: Based on Table 1, peripheral vascular disease (51.7%) and diabetic foot (41.7%) are the leading causes of amputation. Transfemoral amputations were 58.3% and transtibial 41.7%. Ghost pain affects 45% and stump pain 60%. Traveling over 500 meters, 56.7% can. With 26.7% wearing prostheses. Table 2 shows physical and mental well-being disparities for below-knee and above-knee amputations. Patient outcomes and problems are indicated by LCI Score distribution.

Conclusion: According to the study, mechanical benefits and stump-length therapy improve the quality of life for below-knee amputees. Early prosthetic intervention and an integrative medical-psychosocial approach can improve amputees' well-being. Amputees' quality of life has improved with prosthetics and stump pain treatment.

Keywords: Diabetes, Stump-Length Therapy, Amputation, Prosthetic Intervention.

Introduction

In the US, more than 150000 individuals have their lower limbs amputated annually. The incidence of nerve damage, soft tissue septicemia, & peripheral artery occlusive illness is inversely associated with this frequency. This connection is due to the rising incidence of diabetes mellitus, which is to blame for 82% of any lower extremity amputations brought on by vascular disease in the United States. Persons with diabetes mellitus encounter a staggering 30 times greater lifetime risk of suffering an amputation than persons without the condition, which costs hospitals more than $4.3 billion yearly in the USA. If a lower extremity trauma is present, significant soft tissue damage, widespread wound contamination, and loss, approximately 20% of patients may require an amputation. Around 2% of war victims need limb amputation, while 93% of battle-related explosive incidents result in amputation [1].

This exercise will concentrate on amputations distally and encompass amputations previously, though, and beneath the knee at the level below the femur. Additionally, it will discuss how to treat particular foot people with disabilities (Syme, Chopart, & Boyd). However, the reader is

recommended to discover additional in-depth information. Texts to examine these procedures. Amputations are surgical operations, albeit they can occasionally and, in certain circumstances be done via computation [2].

Depending on the degree of tissue necrosis and viability, amputation can be done simultaneously or in phases (amputation followed by repair). The decision between the two approaches is highly influenced by the patient's clinical state and the soft tissues below the planned level of amputation, with the primary goal being the removal of all infected and non-viable tissue. In general, the suitability of the extent of amputation will depend on the nature of soft tissues & the likelihood of acquiring bone covering. It's critical to remember that skin grafts are still an option for those who lack the muscle to conceal their skin but have enough muscle to do it [3].

Diabetes mellitus patients can display a wide range of symptoms, from a non-healing foot infection brought on by osteomyelitis to a highly infected lesion that causes septic shock. The choice to remove the vascular is made when non-healing wounds develop and there are no viable options for reestablishing blood flow to the peripheral arteries. These patients are typically present in one of two ways: acutely with infected necrosis (which is referred to as "wet gangrene") that results in sepsis or chronically using ischemic necrosis (also designated as "dry gangrene"), when the tissue is necrotic instead there are no symptoms during systemic impairment [4]. Increasing the patient from a medical perspective is crucial before choosing to amputate. All efforts should be made to achieve sufficient glycemic control and start antibiotic therapy as soon as possible in diabetic patients to reduce the possibility of infection at the surgical site & increase the duration of non-infected cells, respectively. If the soft tissue quality permits it, deciding whether these patients are eligible for a single procedure is feasible. The clinical condition of the patient will determine whether a single procedure, phased reconstruction, an open (guillotine) amputation, or both should be done in the case of a patient who presents with septic shock. The priority aim is to accomplish sufficient source control, leaving reconstruction at a later time [5].

Intravenous antibiotics may be used as the first line of therapy for patients with severe cellulitis and symptoms related to a systemic inflammatory reaction. A less severe case of cellulitis can make it possible to amputate at a more distant level than first planned and complete the procedure in one step.

High-energy traumatic injuries sustained at the scene of the accident might lead to amputation. Sometimes patients will go to the hospital with a fractured extremity that can't be fixed. To decide if sophisticated reconstruction choices should be explored, many rating methods might be used. However, since individuals can present with several, potentially fatal injuries, the major focus should be on using the Advanced Trauma Life Support procedure. This includes determining whether the wound is bleeding, achieving hemostasis, and providing adequate resuscitation [6]. The ability to survive the extent of an amputation is required will depend on how many soft tissues are used to obtain bone coverage. It is crucial to keep in mind that individuals who previously qualified or limb salvage due to severe catastrophic lower torso injuries may now need to have their limbs amputated because of infection, difficulty in acquiring insurance for either bone or only hardware, continuously high pain levels, and a lack of desire to go through protracted reconstructive surgeries for poor functional results.

Patients with advanced peripheral artery disease are typically elderly, have diabetes, and several concurrent conditions, and have little physiologic reserve. Therefore, medically optimising these individuals before a significant procedure is ideal. The hazards of operation anaesthesia must be laid out for the patient and/or chosen advocates since an emergency limb amputation can be necessary for clinical growth [7].

With inadequate cardiopulmonary reserve, some patients receive vasoactive infusions and severe sedation in the critical care unit. Although amputation would be necessary, their urgent illness prevents it. It is appropriate to postpone an amputation until after clinical optimisation. Computation, which refers to the idea of freezing an ischemia limb that cannot be saved in severely sick patients, is an alternative to this. Several methods are mentioned, including dry ice, ice bags, ice water immersion, and mechanical refrigeration. With the proper nursing staff training & the creation of institutional resources, it may be used efficiently even if it is time-consuming norms. Once the metabolic disturbances have healed and the benefits have outweighed the dangers of the operation, an official amputation procedure can be performed [8].

Review of possible functional outcome factors

Age: Age appears to play a significant factor in how functionally lower-limb amputees fare. Even though it is unclear if age in and of itself determines functional outcomes or whether ageing-related illness and physical decline do.

Body mass, sex, and smoking: Pohjolainen as well as In the male group among vascular trans-tibial (lT) amputees, Alaranta (1991) found that smoking had a negative correlation with walking

time, capacity to go outside, and distance travelled. The study concentrated on parameters that might predict functional abilities after lower limb amputation. There was no correlation between the amputees' body mass index or sex and their walking ability [9].

length, kind, and bilaterality of the amputation

The length of the stump exhibited a significant positive correlate with walking distance for the group of transtibial (TT) amputees and a minor beneficial relationship in the group of transfemoral (TF) amputees, according to Pohjolainen and Alaranta's study from 1991.

Co-morbidity

The postoperative functional performance of the lower limb amputee will probably be impacted by co-morbidity. A diagnosis of diabetes mellitus was regarded in one research as a possible risk factor for poor functional results in older amputees due to the possibility of multi-organ damage and a greater rate of re-amputations. However, most studies found no difference between the presence of diabetes mellitus and functional outcome.

Motivation

Environmental and physical variables affect motivation. based on Zijp et al. (1992). The patient's motivation and the functional result were shown to be highly correlated [10].

Social circumstance

Being employed before a TF and 'lT amputation exhibited good relationships with all ambulation functions. However, employment is closely associated with age and showed patterns comparable to functional ambulation. Five bilateral TT people with disabilities who had jobs around the time after their second amputation then resumed their jobs. Wearing prostheses were profiled by Thornhill et al. in 1986. Preoperative associations between independence from social support and functional ability and postoperative reliance following lower limb amputation were good [11].

Method

Research Design

This prospective observational research tertiary care centre, examines all lower limb amputation patients. In addition to patient demographics, comorbidities, amputation level, complications, duration of hospital stay, mortality, prosthesis utilization, and functional outcomes, data was extracted from medical records. Descriptive statistics will be utilized to characterize patient characteristics, while logistic regression will be employed to ascertain factors associated with functional outcomes, prosthesis utilization, and complications. Through a thorough evaluation of the consequences and determinants that impact lower limb amputations, this research framework aims to generate significant knowledge that can guide and augment patient care and administration at tertiary care center. Ultimately, this will result in enhanced treatment approaches and improved patient living standards.

Inclusion and Exclusion

Inclusion

- Peripheral vascular disease
- Diabetes Mellitus
- Spreading cellulitis
- Osteomyelitis

Exclusion

- Traumatic amputations
- Age < 18 years
- Amputations for Orthopedic neoplasia
- Patients unfit for surgery.
- Patients who were reluctant to oblige for the study.

Statistical analysis

The study evaluated the medical records to evaluate factors such as demographic information, multiple disorders, degree of amputation, issues, duration of hospitalization, death rates, use of prostheses, and functional results. The statistical methods used in this study to assess the presence of significant differences across subgroups were the Student t-test, 2 test, and Fisher's exact test.

Result

Table 1 shows the study patients' baseline characteristics. The most common cause of amputations is peripheral vascular disease (51.7%), followed by diabetic foot (41.7%), spreading cellulitis (5%), and osteomyelitis (1.6%). Transtibial amputations account for 41.7% of instances, whereas transfemoral ones account for 58.3%. There is stump discomfort in 60% of patients and none in 40%. Phantom pain affects 45% of patients and not 55%. On mobility over 500 meters, 56.7% of patients and 43.3% cannot. Finally, 26.7% of patients wear a prosthesis, whereas 73.3% do not. These baseline parameters reveal the patient population and their unique situations, which may help explain the study's results and implications for amputation etiologies and degrees.

Table 1: Baseline characteristics of patients

Etiology	**Number of patients**	**Percentage**
Peripheral Vascular Disease	31	51.7
Diabetic Foot	25	41.7
Spreading Cellulitis	3	5
Osteomyelitis	1	1.6
Level of Amputation	**Number of patients**	**Percentage**
Transtibial	25	41.70%
Transfemoral	35	58.30%
Stump Pain	**Number of patients**	**Percentage**
Present	36	60%
Absent	24	40%
Phantom Pain	**Number of Patients**	**Percentage**
Present	27	45%
Absent	33	55%
Mobility of 500 metres	**Number of Patients**	**Percentage**
Present	34	56.70%
Absent	26	43.30%
Prosthesis use	**Number of Patients**	**Percentage**
Yes	16	26.70%
No	44	73.30%

Table 2 shows patient outcomes for below-knee and above-knee amputations. Amputation patients with below knees had a mean Physical Component Score of 43.84 (SD 7.2) compared to those with above knees, who had 38.47 (SD 8.07), demonstrating a significant difference in physical well-being. Below-knee amputees have a higher mean Mental Component Score of 43.91 (SD 7.89) than above-knee amputees, with 39.43 (SD 6.26), showing mental health and emotional well-being disparities. Below-knee amputees have a mean stump length of 20.35, whereas above-knee amputees have 24.2. Last, the LCI Score distribution of the patients is shown, with the majority (6 patients) in the 30-40 range and 3 each in the 40-50 and 50-60 ranges, suggesting a range of outcomes or challenges in this group.

Table 2: Outcomes of amputation of patients

Type of amputation	**Physical component score**	
	Mean	SD
Below knee	43.84	7.2
Above knee	38.47	8.07
Type of Amputation	**Mental Component Score**	
	Mean	SD
Below knee	43.91	7.89
Above knee	39.43	6.26
Type of amputation	**Stump length mean**	
Below knee	20.35	
Above knee	24.2	
LCI Score	**Number of patients**	
30-40	6	
40-50	3	
50-60	3	

Discussion

A study was conducted previously to evaluate functional outcomes depending on the amount of amputation and to look at Functioning results following lower-extremity amputation due to trauma. We anticipated that above-the-knee amputations would be less common than through-the-knee or below-the-knee amputations favourable results. A secondary goal was to examine the variables that affect results in addition to the amount of amputation, such as the kind of soft-tissue covering, specific patient characteristics, and the prosthetic device's degree of technological sophistication. Three, six, twelve, or twenty-four months after the accident 161 people who suffered above-the-ankle amputations at trauma centres within three months following the accident were prospectively studied Tracked [12]. The primary outcome measure was the self-reported measure of functional state known as the Sickness Effect

Profile. The level of discomfort, independence in getting in and out of a chair, walking, and climbing stairs, the self-chosen walking speed and the physician's satisfaction regarding the limb's clinical, working, & cosmetic recovery, were all secondary outcomes. After adjusting for variables, we utilised longitudinal multivariate regression approaches to see if outcomes varied with the degree of amputation [13].

Regardless of the amount of amputation, severe impairment always follows trauma-related above-the-ankle lower-extremity amputation. Clinicians should carefully consider whether through-the-knee amputations are necessary for patients with catastrophic injuries. The study's findings further highlight the necessity of controlled experiments examining the relationship between prosthetic device type, fit, and functional results [14].

One's life is changed by lower limb amputation (LLA). Given that shorter residual legs have been shown to put patients beneath more physiological demands than longer residual limbs, there is an ongoing debate on whether through-knee amputees have greater advantages than above-knee amputations. A study aimed to provide an answer to that issue by meticulously gathering and synthesising material on this subject that has been published and unpublished. The study illustrates how different levels of LLA impact patients' lives. The results support the medical approach of maintaining maximum length or, if possible, doing TKA as opposed to AKA since TKA patients had a better physical state of health than those with an AKA. A retrospective examination of individuals who underwent substantial lower extremity surgery at a university and Department of Veteran Affairs (VA) hospital amputations and rehabilitation was done [15]. Operative mortality, afterwards, survival, the median time for an incision to heal, secondary surgical operations for wound care, and conversions of the transition from below-knee amputation (BKA) for AKA were the primary outcome factors. For patients that survived, their standard of life was assessed based on independence, use of a prosthesis, and level of ambulation, such as living in a community or a nursing home. In the study, despite rare prosthesis usage and outside ambulation, vascular patients in a modern context who need significant lower limb amputation and rehabilitation frequently maintain independence. Although saving the knee joint is necessary for this population to have any chance of postoperative ambulation, significant effort should only be used on high-risk patients irrespective of the morbidity associated with both wound closure as well as rehabilitation procedures. In the vascular population, it is difficult to predict ambulation following BKA [16].

Medical professionals must make difficult choices regarding whether to remove or save a lower limb which has been injured. To the best of our knowledge, there hasn't been any research on how various surgical choices affect functional & decision-making results related to mental health following substantial rehabilitation. After completing a comprehensive U.K. Military rehabilitation, both unilateral amputation groups had a significant functional advantage compared to both the limb-salvage and bilateral amputee groups programme. In contrast to patients who underwent limb salvage beneath the knee, we discovered that patients who chose delayed amputation that follows. After attempting to save the limb, the knee showed higher functional gains in mobility and suffered no functional disadvantage compared to individuals who went through immediate amputation. The likelihood of complete reintegration back into society was maximized since the mental health results were comparable to standards for the general population [17].

The research examined the level of functioning on Day 21 following a major lower limb amputation due to desvascularity compared to one month before the amputation and assessed factors that might affect the outcome. The results show that the quality of postoperative care can affect the short-term functional outcome, underscoring the necessity of paying more attention to postoperative care to preserve basic function and create and offer daily rehabilitation for those who endured dysvascular lower limb surgery in the broader community amputees [18].

There is a dearth of data to back up many clinical procedures in prosthetics. Therefore, it is crucial that clinicians thoroughly record and assess their day-to-day activities. To document preoperative details and functional results for patients who had their lower limbs amputated and to look into differences between prosthesis users and non-users. The six-month functional result shows that lower limb amputees have significant movement restrictions. The investigation could not confirm any differences in preoperative parameters between prosthesis users and non-users [19].

Conclusion

This study concluded that below-knee amputees have a higher quality of life than above. In addition to mechanical benefits from a more extended lever arm, successful amputee rehabilitation stresses stump length. Awareness programs that emphasise pre-prosthetic gait training and early prosthetic fitting may improve amputees' prosthesis usage, health, and employment prospects. Re-integration to pre-amputation levels of daily living requires a holistic approach to rehabilitation involving medical and psychosocial aspects and a well-

coordinated interdisciplinary team of physiotherapists, occupational therapists, nurses, psychologists, and social workers. In addition, developments in prosthetic interface technology and better stump pain management methods have made important contributions to improving amputees' quality of life, which is a direct result of these two research areas.

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