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Functional and psychological outcomes of delayed lower limb amputation following failed lower limb reconstruction

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ABSTRACT

Purpose: The purpose of this study was to evaluate the functional and psychological outcomes of patients who underwent delayed lower limb amputation following failed limb salvage surgery.
Methods: This retrospective, descriptive study evaluated functional outcomes using the Sickness Impact Profile (SIP) and Short Form-36 (SF-36) in 12 patients. Inclusion criteria included patients who underwent limb reconstruction and delayed amputation between July 2006 and December 2014, with an age range between 18 and 80 years of age, the ability to ambulate independently, a time interval between the last salvage procedure and amputation greater than six months, and a minimum follow-up of 24 months. Patients were contacted via telephone by the principal investigator and both the Sickness Impact Profile (SIP) and Short Form-36 (SF-36) were completed. Descriptive analysis (means and standard deviation) was used to determine outcomes for both SIP and SF-36 health profiles.
Results: Ten patients who had amputations following failed reconstruction (2006–2014) with a mean age of 53 ± 10 years were interviewed. Six patients had a SIP <5, three patients scored between five and 10 points and one scored >10 points. The main deficit on the SF-36 was in the physical component. The SF-36 scores demonstrated a mean score of 40.8 ± 11.5 for the physical component, and 57.4 ± 7.9 for the mental component. Three patients returned to work after amputation and continued performing their pre-injury duties as farmers. Three other patients returned to work, but were allocated to administrative duties. Two patients were pensioners at the time of their injuries, and the only female patient was a housewife. One patient went into early retirement.
Conclusion: The results of this study strongly suggest that delayed amputation following failed limb salvage surgery can still result in good and satisfactory outcomes in the majority of patients and achieves results similar to early amputation and limb reconstruction techniques.
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Introduction

Lower limb injuries continue to place a significant burden on the orthopaedic trauma patient. Previous research has consistently demonstrated that major trauma results in significant functional limitations and has a negative impact on mental health [18,22,26]. The management of high energy trauma remains challenging, often involving multiple procedures that may take years to complete reconstruction and rehabilitation [33].

Treatment options include limb salvage, early, and delayed amputation [5,7]. The decision whether to reconstruct or salvage remains controversial [34]. Swiontowski, et al. suggested that muscle injury, absence of sensation, and vascular injuries influence that decision; patient factors did not play a significant role, with the exception of alcohol consumption and socioeconomic status [34]. Advances in orthopaedic, vascular, and plastic surgery have made it possible to treat severely injured lower limbs with salvage procedures [5,21]. However, limb salvage may not be in the patient's best interest as it is commonly associated with higher

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rates of rehospitalization, more surgical procedures, and a higher rate of complications when compared to primary amputation [7]. A recent meta-analysis by Busse, et al. did not observe significant differences for long-term functional outcome, return to work, and pain between patients undergoing limb-salvage or early primary amputation [7]. Regardless of the selected treatment modality, poor functional outcomes are consistently reported [2,7,24].

The timing of amputation appears to influence both subjective and objective outcomes. Several authors report early amputation results in better functional outcomes, lower rates of post-traumatic stress disorder, and a higher likelihood to engage in sporting activities [11,27,31]. In contrast, patients who underwent delayed amputation had significantly higher rates of out-patients visits, wound complications, and infections [27]. In addition, this cohort had higher rates of post-traumatic stress disorder and substance abuse; interestingly, these rates were similar to patients who underwent limb salvage surgery [27]. In those patients with persistent symptoms, delayed amputation subjectively improved function and resulted in a high degree of patient satisfaction [17].

The purpose of this study was to evaluate the functional and psychological outcomes of patients who underwent delayed lower limb amputation following failed limb salvage surgery. We hypothesized that patients undergoing delayed amputation would have satisfactory functional and psychological outcomes.

Methods

The database from the XX was searched for all patients who were treated with delayed lower limb amputations following limb salvage surgery for major lower limb trauma. The following inclusion criteria were applied: limb reconstruction and delayed amputation between July 2006 and December 2014; 18–80 years of age; ability to ambulate independently; time interval between the last salvage procedure and amputation more than six months; and a minimum follow-up of 24 months. Patients were excluded if they sustained multi-trauma, contra-lateral lower limb injury, traumatic brain injury or systemic pathology unrelated to their trauma. Ethical approval was obtained from the University's Faculty of Health Sciences Research Ethics Committee (Ref.: 546/2015).

Outcome measures

The Sickness Impact Profile (SIP) and Short Form-36 (SF-36) were utilized to establish both perceived functional outcomes as well as emotional and mental health. The SIP is a validated functional measurement tool [10]. The SIP scores range from 0 to 100 points, with higher values indicating greater disability. The general population scores range between 2 and 3 points. A SIP of $\leq$5 post-injury suggests an acceptable recovery, and a SIP >10 points indicates substantial residual disability [9,13]. The SIP is a multidimensional measure of self-reported health status that can be self or interviewer administrated. It consists of 136 statements about limitations in twelve categories of function: (1) walking, (2) mobility, (3) body care and movement, (4) social interaction, (5) alertness, (6) emotional behaviour, (7) communication, (8) sleep and rest, (9) eating, (10) work, (11) home management, and (12) recreation and pastimes. Respondents are asked to endorse only the statements that describe their health most accurately on that given day. Scores are calculated for the overall instrument, for all twelve categories, and for the two major dimensions: physical health (summarized by the first three categories), and psychosocial health (a summary of the second four categories) [3].

One of the major benefits of the use of a generic health questionnaire is that the patient's psychological status can be assessed [14,16]. The SF-36 is a multi-purpose, short-form health survey consisting of 36 questions in eight sections; (1) vitality, (2) physical functioning, (3) bodily pain, (4) general health perception, (5) physical role functioning, (6) emotional role functioning, (7) social role functioning and (8) mental health. The score is transformed into a 0–100 scale for each section; with a score of zero equivalent to maximum disability and a score of 100 denoting no disability [35,36].

All patients were contacted via telephone by the principal investigator and both the Sickness Impact Profile (SIP) and Short Form-36 (SF-36) were completed. Study participants were allocated a study number to preserve anonymity. Descriptive analysis (means and standard deviation) was used to determine outcomes for both the SIP and SF-36 health profiles.

Results

Thirteen patients (13 male and one female) were eligible for inclusion. One patient could not be contacted, and two patients were excluded because the amputation was performed within one month of the last salvage procedure. The ten remaining patients with a mean age of 53 ± 10 years were contacted by the principal investigator between November and December 2015. The demographic details of all patients are summarized in Table 1.

The mechanism of injury in two patients was due to a fall, five sustained motorcycle accidents, and three patients were involved in motor vehicle accidents. The mean number of surgical salvage procedures was 7.1 ± 2.8. The number of salvage procedures per patient involved in motorbike accidents was twice as high, with a mean of 8.6 ± 2.9 compared to 4.3 ± 0.6 for those patients involved in a motor vehicle accident. In addition, all patients involved in a

Table 1
Demographic data of all patients included.

	age	gender	Mechanism of injury	Previous Procedures	Flap Coverage	Type of Amputation	Interval Injury – Amputation	Interval Amputation – Interview	Interval Injury – Interview
1	61	M	MBA	9	Y	TKA	10	68	78
2	52	F	FALL	6	N	BKA	24	25	49
3	45	M	MVA	5	Y	TKA	61	49	110
4	45	M	MBA	8	Y	BKA	11	23	44
5	48	M	MVA	4	N	BKA	20	40	60
6	75	M	MBA	13	Y	BKA	26	85	111
7	39	M	MBA	8	Y	BKA	33	58	91
8	55	M	FALL	9	N	BKA	15	38	53
9	55	M	MBA	5	Y	BKA	7	66	73
10	55	M	MVA	4	N	BKA	52	29	81
Mean/ SD	53 ± 10			7.1 ± 2.8			25.9 ± 18.1	48.1 ± 20.7	75 ± 23.9

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