Comparison of Quality of Life in Patients with Major Lower Limb Trauma Undergoing Amputation Versus Limb Salvage or Conservative Treatment

Abstract

Introduction: In some cases of major lower limb trauma, either amputation or limb preservation is performed. The aim of this study was to compare the quality of life in patients undergoing amputation versus limb preservation.

Materials & Methods: In a cross-sectional comparative study, patients with major lower limb trauma who underwent either lower limb amputation or limb preservation were evaluated at least six months post injury. Quality of life was assessed and compared between the two groups using SF-36 questionnaire.

Results & Discussion: A total of 94 patients, including 80.9% male and 0.9% female, with mean age of 41.5 years (range 18 to 64), with the mean study period of 6 months, were included in the study. There was no statistically significant difference between the two study groups regarding age, gender, marital status, number of children, education level, smoking, or substance and alcohol abuse. The sub-scales of general health (P = 0.001) and vitality (energy) (P = 0.002) were significantly higher in the amputation group in comparison with the limb-preservation group within the six- months post injury.

Conclusion: In patients with major trauma, attempts to preserve the limb, instead of immediate amputation results into longer hospital stays, increased incidence of infections, and higher rates of re-operation. Amputation, within a minimum of six months, leads to improved quality of life, particularly in the domains of general health and vitality.

Keywords: Amputation, Quality of life, Trauma.

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Introduction

Limb injury is a common trauma in hospital emergencies. When evaluating limb injuries, vessels, bones, nerves and soft tissues should be assessed and compared in two limbs. Damage to three of those four components effectively constitutes a mangled extremity[1,2]. In many cases, limb salvage is aa option even in the presence of a mangled extremity. Although, in certain circumstances, for saving the life of patent, primary amputation during the initial operation is required.

Blunt trauma usually is the major cause of severe limb injuries in civilians, penetrating or combined mechanisms in 12% of non-military limb injuries[3]. Among civilians with non-fatal trauma, lower limb damage is the first cause of hospital admission. More than 30% of hospitalized patients present with severe or limb-threatening injuries. In a systematic review of 3,187 lower limb injuries that required vascular repair, 10% secondary amputation was reported[4].

In 2012, the National Trauma Data Bank (NTDB) recorded 278,100 cases of lower extremity injury classified as non-military trauma[5]. Traumatic injuries account for approximately 3,700 amputations annually.

The decision to attempt limb salvage or primary amputation is not straightforward. The Western Trauma Association has a management algorithm that shows the complexity of decision and the lack of high-quality evidence for guiding[6].

If preserving the limb can be attempted in first operation without jeopardizing the patient's life, it is recommended to pursue salvage, even when multiple risk factors for limb loss are present. This approach gives patients and their families or caregivers time to accept amputation if it later becomes necessary[7].

The disadvantages of limb salvage are an increased risk of acute injury to kidney and also longer hospital stays with the same mortality rates[8]. Patients with severely mangled limbs, traumatic or near-complete amputations with devitalized distal tissues, or massive tissue loss should undergo amputation[9].

Amputation imposes multiple limitations on social, professional, and leisure activities[10,11]. Although, in some cased, amputation could improve the function and quality of life of patients. But chronic ischemic lower limb or chronic limb infection usually will accompanied with pain, limited mobility, and inability to perform daily tasks. In such cases, amputation can reduce disability[12,13]. Nevertheless, the disruption of bodily integrity inevitably decreases quality of life (QoL) through reduced mobility, persistent pain, altered physical wholeness, also affected psychological and social life[10]. Psychological disorders such as depression, anxiety, and, in severe cases, suicidal ideation may occur[10,14]. Clearly, lower limb amputation—regardless of the cause—strongly impacts emotional, functional and physical, domains, thereby influencing the quality of life of amputees[15–18].

This study was aimed to compare the quality of life of amputated and limb salvage patients after a major lower limb trauma. Given the factors mentioned, quality of life varies depending on cultural, economic, and social contexts. Moreover, in our country, issues such as access to appropriate prosthetic devices, the cost of obtaining them, and the stigma associated with amputation are significant concerns. Hence, investigating this subject may yield findings that differ from those reported in other settings.

Materials & Methods

This study was conducted as a comparative cross-sectional study. The inclusion criteria were patients with major lower extremity trauma between 18-65 years of age who were treated at Imam Khomeini Hospital, Sari, in 2023, and at least six months elapsed since initial trauma management, no history of major depressive disorder or other acute psychiatric illnesses, no use of psychotropic medications within the past eight weeks. Patients were excluded if they did not consent to participate, had impaired consciousness (GCS < 15), sustained spinal cord injuries, had third-degree burns, were unable to walk prior to trauma, or had bilateral lower-limb amputation. The sample size was calculated using STATA version 16. With a type I error of 0.05 and a statistical power of 90%, and based on the mean and standard deviation reported by Tekin et al.[18] for quality of life in amputated patients (64.38 ± 20.35) versus those with limb salvage (50.31 ± 21.60), the required total sample size was estimated at 94 patients (47 in each group).

This study was approved by the Research Ethics Committee of Imam Khomeini Hospital, Sari. Eligible patients were divided into two groups: those who had undergone primary lower-limb amputation based on orthopedic indications and the decision of an orthopedic surgeon, and those in whom the injured limb had been preserved and managed conservatively. To assess patients' quality of life, the Short Form-36 (SF-36) questionnaire was utilized[19,20] and it was validated in the Iranian population by Montazeri et al.[21]. The distribution of quantitative variables was first examined using the Shapiro–Wilk test. Qualitative variables were described using frequency (percentage). For comparative analyses, the independent samples t-test was applied when data followed a normal distribution, and the Mann–Whitney U test was used for non-normal distributions. The Chi-square test or Fisher's exact test for associations between qualitative variables were assessed. The p-value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 26.

Results

47 patients in each group -amputation and limb salvage - was assessed in this study and all were Gastillo 2b and 2c in terms of injury severity and Mangel score 8 or higher. The mean age of in the amputation group was 41 years (18–63) and in the limb-salvage group was 45 years (19–64). There was no statistically significant difference in age distribution between the two groups (P = 0.543).

87.2% in amputation and 74.5% in limb-salvage were male. There was no statistically significant difference in sex distribution between the groups (P = 0.116). (Table 1). No statistically significant difference in marital status, education level, smoking, substance or

alcohol use was observed between the groups (Table 1). The median duration of initial hospitalization was 20 days (21–40) in the amputee and 26 days (22–45) in the limb preserved group. This difference was statistically significant (P = 0.047). The infected cases in amputation group were 2 patients and, in the limb, -salvage group were 3. In the amputation group, 55.3% of patients used a cane, 29.8% used a prosthetic limb, and 8.5% used a wheelchair, while 6.4% did not use any assistive device. In the limb-salvage group, 29.8% of patients used a cane and 10.6% used a wheelchair, whereas 59.6% did not use any assistive device. Overall, limb-salvage patients used assistive devices less than amputee group (P < 0.001) (Table 2). Readmitting in hospital for amputated was 10.6% and 29.8% for the limb-salvage group and was statistically significant (P = 0.021). 17% of amputated group and 85.1% of the limb-salvage group reported returning to work that difference was statistically significant (P < 0.001) (Table 3).

The median score for general health in the amputation cases was 63 and in limb salvage groups was 48. General health was significantly better in the amputation group (P = 0.001).

The median pain score, physical functioning score, mental health score, role limitation – physical score, role limitation – emotional score and Physical Component Summary (PCS) in the amputation and limb salvage groups did not have any statistically significant difference. But the median vitality (energy) score in the amputation group had significantly higher (P = 0.002). (Table 4). The mean Mental Component Summary (MCS) scores of the SF-36 questionnaire were nearly equal in both groups 58.7 ± 9.02 in amputated and 57.7 ± 8.28 in the limb preservation (P = 0.585).

Table 1: Demographic Characteristics, Smoking, and Alcohol Use in Study Groups

Variable		Amputation n(%)		Limb Salvage n (%)		Chi-Square
		No.	Percentage	No.	Percentage	P-Value
Sex	Male	41	87.2	35	74.5	0.116
	Female	6	12.8	12	25.5	
Marital status	Married	36	76.6	32	68.1	0.642
	Single	7	14.9	9	19.1	
	Divorced	4	8.5	6	12.8	
Education level	Primary school	6	12.8	5	10.6	
	Middle school	7	14.9	4	8.5	
	High school	15	31.9	15	31.9	
	University	15	31.9	21	44.7	
Smoking	Yes	33	70.2	25	53.2	0.090
	No	14	29.8	22	46.8	
Substance or alcohol use	Yes	10	21.3	9	19.1	0.797
	No	37	78.7	38	80.9	
History of underlying comorbidities	Yes	23	48.9	19	40.4	0.407
	No	24	51.1	28	59.6	

Table 2: Comparison of underlying comorbidities and the use of assistive devices between the study groups

Variable		Amputation		Limb salvage		Chi-Square
		No.	%	No.	%	P-Value
Use of assistive devices	None	3	6.4	28	59.6	< 0.001
	Cane	26	55.3	14	29.8	
	Prosthetic limb	14	29.8	–	–	
	Wheelchair	4	8.5	5	10.6	

Table 3: Readmission and return-to-work in two study groups						
Variable		Amputation		Limb-Salvage		Chi-Square
		n	%	n	%	P-Value
Readmission	Yes	5	10.6	14	29.8	0.021
	No	42	89.4	33	70.2	
Return to work	Yes	8	17.0	40	85.1	< 0.001
	No	39	83.0	7	14.9	

Table 4: General health from SF-36 in the study groups							
Variable	Amputation			Limb Salvage			Mann-Whitney
	Min	Max	Median	Min	Max	Median	P-Value
General Health	14	78	63	10	76	48	0.001
Pain	3	74	51	2	73	49	0.072
Physical Activity	10	71	60	18	68	55	0.329
Social Activity	5	82	63	2	75	58	0.064
Mental Health	15	71	61	18	69	57	0.112
Role Limitation – Physical	4	72	52	4	66	39	0.300
Role Limitation – Emotional	3	75	53	3	78	41	0.108
Vitality (Energy)	10	83	64	10	73	54	0.002
Physical Component Summary (PCS)	37	76	62	50	74	56	0.444

Discussion

Patients with a major limb injury is usually need a longer time for functional recovery[22] MacKenzie et.al reported 50% experience of severe disability in their patents after seven years follow up[23]. This study confirmed that older and female patients with poor health , low income , in low educational level with smoking history, mostly associated with poor outcomes[23]. The socio-economic level of patients has more effect on their functional recovery than their initial severity of trauma[24-26].

Possibility of amputation after a blunt injury is higher than the other types of limb injuries[27-29]. Two studies reported 3% and 18% amputation after a penetrating injury into femoral arteries[27,28].

Injury to popliteal artery in 10–15% of limbs leads to amputation and representing the highest rate of lower limb vascular injury. No single risk factor reliably predicts delayed amputation[4]; however, complex pain symptoms with neurological dysfunction will increase the risk, especially if combined with severe foot trauma or fracture of distal tibial in initial trauma. Although , long-term functional outcomes for severe limb injuries show no significant differences between amputation and limb salvage patients , but many patients initially don't want to have amputation[30].

Limb salvage procedure needs long term recovery and also increased risk of complications and reoperations while tolerating more stress by patients and their families that may finally forced them to accept the amputation[31]. In the present study, the functional status and quality of life of patients undergoing amputation were compared with those receiving limb-salvage surgery, revealing differences in quality of life, specifically general health and vitality. Individuals with lower limb amputations face multiple challenges. The SF-36 questionnaire was used to assess quality of life, a widely applied[32,33] and validated tool in amputee populations[34-38]. Some studies, such as Dagum et al.[38], found significant differences favoring limb salvage only in functional scores[35,37,39]. Conversely, when amputee and non-amputee patients were compared, SF-36 scores were worse in the amputation group. In this study, however, better general health and vitality scores were observed in the amputation group.

Amputees are often encouraged by clinicians and their social environment to engage in physical activities. In contrast, patients with preserved limbs, who fall between fully healthy and disabled categories, are often advised to protect their limbs, which may ultimately reduce mobility. This may explain the higher vitality scores observed in amputees, as these patients tend to be more active and motivated. Other studies have shown that limb salvage patients may experience more complications, including prolonged hospital stays, multiple surgeries, and sometimes non-functional limb outcomes[40-43]. Consistent with these findings, in this study, 14 of 47 limb-salvage patients and 5 of 47 amputees required readmission for additional surgery. Meta-analyses and study by Poutoglidou[44] and Edelstein[45] similarly reported significantly lower readmission rates in amputees. The results of the Poutoglidou study[44] showed that the length of hospital stay was longer in patients with limb-sparing therapy, while only in the Fioravanti study[46] was this difference statistically significant. In four similar studies[43,45,47,48], the need for reoperation was higher in the limb-sparing therapy group than in the amputation group. The meta-analysis by Poutoglidou[44] also indicated that patients in the limb-salvage group returned back to work sooner than amputees but not statistically significant but, in this study, the difference was statistically significant. Although the amputation group had higher median scores for the physical function subscale, this difference was not statistically significant. Functional outcomes in previous studies have been inconsistent; some showed better physical performance in amputees[45-47,49-52], while others favored limb-salvage patients[38,45,53,54]. Regarding mental health, similar studies[49,51,55] reported higher depression rates in amputees patients, but these differences were generally not statistically significant. In the present study, the mental health subscale was slightly better in the amputation group, but the difference was not statistically significant.

Poutoglidou[44] and colleagues also reported significantly lower rates of infection and osteomyelitis in amputees patients, consistent with the findings of the present study.

Conclusion

In patients with major trauma, attempting limb salvage compared to amputation results in longer hospital stays, higher rates of infection, and more frequent repeat surgeries. After at least six months, amputee patients had better quality of life compared to limb salvage, particularly in terms of general health and vitality.

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