

Original Research Article

Correlation of ambulation potential with quality of life in lower limb amputees

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ABSTRACT

Background: To identify the effect of walking ability on quality of life in lower limb amputees and draw a correlation between prosthesis use, socio economic status and quality of life. It was an Observational Cross sectional study.

Methods: Lower limb amputees excluding hip disarticulation and bilateral lower limb amputation, individuals above eighteen years of age who attended rehabilitation research centre outpatient door were interviewed. Structured questionnaire including patient background, amputation characteristics and details regarding prosthesis, was administered along with detailed musculoskeletal examination. Outcome variables: Locomotor capability index (LCI) and timed up and go test (TUG) were used for ambulation potential and Short form 36 (SF 36) for quality of life.

Results: Significant correlation was observed between mental health short form 36 score and locomotor capability index (basic and advanced). Poor negative correlation of SF 36 score was observed with age ($r=-0.125$, $p=0.006S$). Significant correlation was observed between Physical Health Short Form 36 score and locomotor capability index (basic and advanced), and this correlation was higher and more significant. Poor negative correlation of SF 36 score was observed with age ($r=-0.203$, $p<0.001S$).

Conclusions: Ability to ambulate is an independent factor that has a positive correlation with quality of life.

Keywords: Quality of life, Lower limb amputation, SF 36, LCI, TUG, Kuppaswamy index

INTRODUCTION

Amputation leads to a permanent disability in an individual. Lower limb amputations are more disabling and much more common than upper limb amputations because they directly affect the walking ability of an individual.¹ It increases the social burden by affecting the quality of life of an individual and decreasing the efficiency of a country's work force. This indirectly reduces the per capita income of the country further weakening its economic condition.

Multiple interactive variables contribute significantly to the functional outcome after amputation, including medical co morbidities, level of amputation, cognition, age, pre-morbid level of function, social support, environmental factors and availability of financial resources.² Outcome in rehabilitation is also influenced by psychological and cognitive wellbeing of an individual, social support, economic status and multiple prosthesis related factors.^{3,4}

After lower limb amputation, the main aim of the rehabilitation team is to restore mobility and optimum physical functioning of an individual. In these patients

assessing physical mobility thus plays an important role. Rehabilitation interventions have the potential to reduce the disability and henceforth, documentation of improvement is of utmost necessity. Numerous clinical studies have been done and a lot many research papers have been published on function and health related quality of life in amputees describing the authenticity of various outcome measures. To accurately monitor the impact of therapeutic interventions, particularly of prosthetic trials, there is a great need for simple and appropriate outcome measures of prosthetic mobility in people with lower limb amputation.^{3,5,6}

Quality of life is each individual's perception of his/her position in life, in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.⁷ Medical interest in QOL has been stimulated because of the increase in life expectancy, better survival rates after major injuries and a zest to provide near normal life to trauma survivors.

In view of the significance that ambulation potential and QOL has gained in past few years, the present study was conducted to assess the QOL and correlate it with ambulation ability among individuals with unilateral lower limb amputation.

METHODS

A total of four hundred and eighty one individuals with lower limb amputation were enrolled for the study from outpatient door of rehabilitation research centre, SMS hospital, Jaipur from January 2014 to December 2014.

Inclusion criteria

All the individuals in the age group of 18 years and above with unilateral lower limb amputation and some ability to walk, complete primary wound healing (a period of at least six months after amputation) who gave consent were enrolled for the study.

Exclusion criteria

Those with bilateral lower limb amputation, hip disarticulation or hemi pelvectomy were excluded. First time users of prosthesis were also excluded from the study to avoid bias on the basis of adaption with prosthesis. Those who had open wounds or co morbid diseases that would impede gait patterns i.e. traumatic brain injury, spinal cord injury or other neurological or vascular problems were also excluded.

Evaluation of the study subjects

All details regarding patient's socio economic status, family support and prosthesis were noted. Detailed neurological and musculoskeletal assessment was done with specific focus on stump examination and gait analysis.

Outcome variables

Short-form 36 (SF-36)

It was developed for use in adults so that subjects with one problem can be compared with subjects having another problem or with age matched controls having no problem.

QOL was measured using the MOS short form health survey (SF-36).⁸ The SF-36 is a multi-purpose short-form health survey consisting of 36 questions, and has been used as an outcome measurement instrument to assess QOL in amputees.^{9,10} The SF-36 measures health status under two broad domains, Physical (PCS) and mental component (MCS) each of it having four sub headings. Physical functioning, role limitations due to physical health problems, bodily pain and general health, come under physical component while mental health functioning, role limitations due to emotional problems, social functioning and vitality come under mental component. Higher scores imply a better QOL.¹¹ The PCS and MCS scores are statistically easier to interpret due to smaller confidence intervals, lower floor and ceiling effects and fewer statistical tests required, thus lowering Type I error.¹²

Locomotor capability index (LCI)

LCI is the 11th item of the Prosthetic Profile of the amputee (PPA, a questionnaire developed and validated for follow up studies in persons with lower limb amputation)¹³, but it can be used separately from general instrument.¹⁴ The LCI is composed of 14 questions (phrased as "would you say that you are able to do the following activities with your prosthesis on?") evaluating person's ability to perform different postural tasks and locomotor activities. It has an older version which used a four point ordinal scale. In this study, we have used the newer version of LCI with five point ordinal scale, named as LCI-5, which is said to have better construct validity and reliability.¹⁵

LCI-5 has divided the upper ordinal level of each item of original scale, "Yes, able to accomplish the activity alone" into "Yes,....alone with ambulation aids" (score:3 points) and "Yes,....alone without ambulation aids" (score:4 points), with a possible maximum score of 56. It can be divided into 7 item sub-scales that cover basic and 7 that cover advanced items.¹⁶ Higher scores reflect greater locomotor capabilities with the prosthesis and less dependence on assistance.

Timed up and go test (TUG test)

This was performed according to procedures outlined by Schoppen et al.¹⁷ Subjects initially sat in a standard arm chair with their back against the chair, arms resting on the arm rests of the chair, and their walking aid at hand. The instructor then counted to three and on three the subject

got up, walked to a line on the floor 3 meter away, turned, walked back to the chair and sat down again. A count of time was kept by the instructor for the patient to complete this test. The end of the test is defined when the patients buttocks first touch the seat surface. A stopwatch is used to time the performance. A TUG test of 19 sec or

more increases the risk of having multiple falls in patients with unilateral lower limb amputation.

RESULTS

Demographics of the study group are given in Table 1.

Table 1: Demographics of study population.

Study variables	n (Number)	Mean (SD)	Frequency (%)
Age (years)	100	37.72 (13.22)	
Gender			
Female	36		7.48
Male	445		92.52
Socio economic status			
Lower class	42		8.73
Lower middle class	87		18.09
Upper class	4		0.83
Upper lower class	321		66.74
Upper middle class	27		5.61
Time since surgery (years)			
≤1	0		0
≤3	15		3.12
≤5	64		13.31
≤10	140		29.11
≤20	163		33.89
≥21	99		20.58
Type of amputation			
Above knee amputation	127		26.4
Below knee amputation	340		70.69
Trans knee amputation	14		2.91
Indication			
Infection	121		25.16
Others	10		2.08
Trauma	315		65.49
Tumor	7		1.46
Vascular injury	28		5.82
No. of procedures (revision)			
1	431		89.6
2 to 3	43		10.19
3+	7		1.46
Education		1.15 (0.577)	
Illiterate	110		22.87
Primary school certificate	53		35.14
Middle school certificate	169		35.14
High school certificate	85		17.67
Intermediate or post high school diploma	24		4.99
Graduate or Post Graduate	27		5.61
Profession or Honors	13		2.70
Occupation			
Unemployed	150		31.19
Unskilled	98		20.37
Semiskilled	30		6.24
Skilled	40		8.32
Clerical, shop owner, farmer	144		29.94
Semi professional	5		1.04
Professional	14		2.91

Income		
1 ≤1865	58	12.06
10=18,498-36,996	257	53.43
12≥36,997	82	17.05
2=1866-5546	37	7.69
3=5547-9248	18	3.74
4=9,249-13,873	24	4.99
6=13,874-18,497	5	1.04
Stump complications		
Skin problems	232	48.23
Phantom pain	33	6.86
Combination	33	6.86
None	183	38.05

A total of 481 cases were studied, with mean age of the study population being 37.72±13.22 (14 to 79) years. Males were predominant (92.52%), with majority (66.74%) belonging to upper lower class on Kuppaswamy scale. Level of amputation was below knee in majority (70.69%) of the individuals followed by above knee amputation (26.40%). Most common indication of amputation was trauma (65.49%) followed by infection (25.16%). Most of the cases who attended the outpatient door of our department (63%) were those in whom the duration of surgery was between 15 to 20 years. Mean number of procedures was 1.15±0.577 (1 to 6). Prosthesis used by almost all individuals was HDPE Exoskeletal prosthesis made in Jaipur (96.05%).

Most common problem in prosthetic limb was ill fitting (87.32%) followed by wear and tear in negligent numbers (9.98%). Part affected in prosthetic limb was a combination of socket and foot in majority (67.36%) with individual part being the socket in most cases (16.83%), as has been illustrated in Table 2.

Table 2: Description regarding the prosthesis.

Type of prosthesis	Number (n)	Percentage (%)
Exoskeletal/HDPE/Jaipur	462	96.05
Exoskeletal/HDPE/outside	19	3.95
Problem in prosthetic limb		
Wear and Tear	48	9.98
Ill fitting	420	87.32
Heavy weight	4	0.84
None	9	1.87
Part affected in prosthetic limb		
Foot	55	11.43
Socket	81	16.83
Suspension	9	1.87
Knee joint	5	1.04
None	7	1.46
Combination	324	67.36

Most of the lower limb amputees in the study group (49.06%) were freely mobile (<10) followed by those (48.02%) who were mostly independent (<20), variable mobility (20-29) in (2.7%) and impaired mobility only in one amputee (0.21%), as assessed on Timed Up and Go test, as documented in Table 3.

Table 3: Timed up and go test.

Time up and go test	Number (n)	Percentage (%)
<10=Freely mobile	236	49.06
<20=Mostly independent	231	48.02
20-29=Variable mobility	13	2.70
>30=Impaired mobility	1	0.21

Significant correlation was observed between Mental Health Short Form 36 score and locomotor capability index (basic) ($r=0.22$, poor positive $p<0.001S$), locomotor capability index (advanced) ($r=0.347$, fair positive correlation, $p<0.001S$), locomotor capability Index (Total) ($r=0.326$, fair positive correlation, $p<0.001S$). Poor negative correlation of SF 36 score was observed with age ($r=-0.125$, $p=0.006S$).

Significant correlation was observed between Physical Health Short Form 36 score and Locomotor Capability Index (Basic) ($r=0.294$, poor positive $P<0.001S$), Locomotor Capability Index (Advanced) ($r=0.450$, fair positive correlation, $P<0.001S$), Locomotor Capability Index (Total) ($r=0.428$, fair positive correlation, $P<0.001S$) but correlation was higher and more significant. Poor negative correlation of SF 36 score was observed with age ($r=-0.203$, $P<0.001S$).

Association of Time Up and Go test was significant with the Mental and Physical Health Short Form 36 score. Mean Mental Health Short Form 36 score was significantly more in freely mobile individuals (86.78 ± 10.57) followed by those who were mostly independent (81.20 ± 14.467). Thus, as the score of Time Up and Go test increases, SF 36 scores decrease.

DISCUSSION

Lower limb amputation is a major event in an individual's life having an adverse effect on overall psychological, physical and social functioning of an individual. Keeping in mind the importance that has been imparted to the role that self-perception and quality of life has on individual's participation in personal and professional activities, this study was done using SF 36 as a marker and outcome measure for the same.

In our study, there were a total of 481 individuals, 445 (92.52%) being males and 36 (7.48%) females. Most other studies on epidemiology of amputations also depict similar trend and is easily explainable by the fact that males have a greater tendency of getting involved in outdoor activities and they go out to earn livelihood more than females¹⁸ putting them at risk of trauma. Age of the individuals varied from 37.72±13.22 (14 to 79) years emphasizing the greater affection of middle aged population that is mostly involved in high risk activities. Cause of amputation was trauma in 315 (65.49%) individuals, infection in 121 (25.16%) followed by vascular injury and tumor in decreasing frequency. This finding is also in complete agreement with the literature.¹⁹

Total individuals with below knee amputation were 340 (70.69%) followed by above knee amputation 127 (26.40%) and trans knee amputation 14 (2.91%). This is explained by the fact that it is a general opinion all over the world amongst surgeons to save as much limb as possible to allow maximum mobility for greater independence.

The social status of these individuals as on Kuppuswamy scale was upper lower class in 321 (66.74%) individuals, lower middle class in 87 (18.69%), lower class in 42 (8.73%), upper middle class in 27 (5.61%) and upper class in 4 (0.83%) amputees. To the best of our knowledge this index to assess economic class in amputee population has been used for the first time till date, though in India it is a standard tool to assess the socio economic status for government statistics.²⁰

Despite the fact that 172 (35.76%) individuals were unemployed, greater than sixty percent individuals belonged to upper lower class. This is in contrast to our general expectation from unemployed individuals. This explains the strength of joint family system in India in which all family members are supported whatever the situation may be. Also, majority of amputees in this study had already been using the prosthesis for long. As time passes, amputee survives and finds new ways to earn livelihood and live life.

A total of 462 (96.05%) amputees in this study were using the prosthesis made in SMS hospital Jaipur since the amputation. All except 9 (1.87%) had problems with

the prosthesis with nearly 420 (87.32%) complaining of ill-fitting followed by wear and tear in 48 (9.98%) and only 4 (0.84%) reporting problems with the weight of the prosthesis. Inadequacy of trained staff and greater patient load might sometimes be responsible for ill fitting. Because most of the amputees come from nearby states where they work in extreme conditions of temperature, plastic may lose its shape and become responsible for ill fit.

Most common stump problem was skin infection in 232 (48.23%) amputees followed by equal number having phantom pain 33 (6.86%) and a combination of both, 33 (6.86%). We could not decipher the impact of phantom pain on quality of life because of the lower number of cases with the same. Other similar studies suggest that phantom pain is linked with reduced quality of life.²¹

Independent ambulation is an important parameter that affects quality of life of an individual. We used the Timed "up and go" test as a measure of physical mobility in the present study which has good interrater and intrarater reliability.^{17,22} A total of 236 (49.06%) amputees were completely independent with a TUG score of less than 10 seconds, 231 (48.02%) individuals had a TUG score of less than 20 who were mostly independent, 13 (2.70%) had variable mobility while only 1 (0.21%) individual had impaired mobility. These results are not in conformation with the results of other studies, which say that amputee population has a poor performance on TUG test.²³ This can be corroborated with the fact that the prosthesis is made completely free of cost in lesser time interval for amputees from all states due to which nearly 338 (70.27%) individuals were fitted with prosthesis in less than 12 months of amputation. Early fitting allows early adaptability and less psychological issues because of the disease per se leading to better outcomes in such individuals. As per the literature, a TUG test of 19 seconds or more increases the risk of having multiple falls in patients with unilateral lower limb amputation.²³

LCI-5 was another test that we used specifically for amputee mobility. LCI-5 demonstrates good internal consistency, test-retest reliability and construct validity, and it has been shown to reduce the ceiling effect associated with the LCI by 50% approximately.²⁴ It has also been recommended for clinical and research use.²⁵ The median score of LCI-5 basic in our study was 28 (range: 12-28) and that of advanced LCI-5 was 27 (range: 9-28). These scores indicate good mobility potential in the amputee population in this study.

Correlation between LCI and physical and mental component of SF-36 was fairly positive which indicates that the greater mobility and independence in itself helps to improve the quality of life. There was a positive correlation between TUG and SF-36 which further reiterates the fact that mobility is an independent variable that predicts the QOL.

CONCLUSION

Early fitting of prosthesis, comprehensive rehabilitation interventions and independent ambulation can help improve the quality of life of individuals with lower limb amputation. It is important for us to focus on skill development in lower income group, especially those who suffer from such injuries to help them get employed and earn their livelihood. All efforts should be made to educate, empower, employ and absorb them in small scale industries to aid in betterment of the society as a whole.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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