Outcomes and Quality of Life in Patients with Upper Limbs Amputations in Cotonou National Teaching Hospital- Benin

Iréti Fiacre Tidjani,
Eric Lawson,
Abdourahmane Ouangre,
Pascal Chigblo,
Department of Traumatology-Orthopedy
National Teaching Hospital CNHU-HKM, Cotonou, Benin
Etienne Alagnide,
Department of Physic Medicine and Rehabilitation
National Teaching Hospital CNHU-HKM, Cotonou, Benin
Marius Boko,
Soumaïla Madougou,
Aristote Hans-Moevi Akue,
Department of Traumatology-Orthopedy
National Teaching Hospital CNHU-HKM, Cotonou, Benin

Doi:10.19044/esj.2019.v15n27p31 URL:http://dx.doi.org/10.19044/esj.2019.v15n27p31

Abstract

Background: Upper limbs amputations disturb relational life. Outcomes of upper limb amputees were studied, functional outcomes and quality of life were analyzed. **Objectives**: The purpose of this study was to examinate the outcomes of an upper limb amputation on a functional, social and economic level, and to investigate the epidemiological and clinical factors that bear the functional outcomes and quality of life of these patients. **Methods**: an analytical prospective study over seven years which included 37 patients managed at the referral hospital in Benin was performed. They were mean aged of 36.3 years and 22 were in couple. The mean time of follow-up was 3.0 ± 2.1 years. The rate of fitting prosthesis, relateralization, presence of bi-manual activity, Disabilities of the Arm, Shoulder and Hand (DASH) score, handicap imposed by the amputation, and its socio-economic impact were recorded. Quality of life of amputees evaluated using Nottingham Health Profile (NHP) score was also studied. Statistical analysis was performed with Chi^2 and Kruskal-Wallis tests. A p-value ≤0.05 was established as statistically significant. **Results**: No patient had been fitted; one had been able to re-

lateralize; 24 patients demonstrated bi-manual activity. The mean DASH score was 40.1 ± 13.7. Thirteen patients were able to dress themselves and 10 needed an additional help to go to the toilet. Socially, 21 patients had given up their hobbies, and 5/22 were no longer in a couple. Economically, 27 patients had a decreased monthly income. Factors influencing functional outcomes were the level of amputation and gender (p of 0.005 and 0.006, respectively). The mean NHP score was 5.8 ± 0.2. There was a statistically significant relationship between quality of life, age and level of amputation (p of 0.02 and 6x10-4, respectively). **Conclusion**: Upper limb amputations strongly affect quality of life. A better social reintegration policy for upper limb amputees should be contemplated in Benin.

Keywords: Amputation, Upper limb, Outcomes, Social reintegration

Introduction

The upper limb is a crucial body part in the relationship life of humans. It connects subject to society and facilitate a grip (Masmejean, 2000). Unfortunately, amputations of this limb are common and constitute a major public health issue. In the United States, more than half a million people were living with upper limb amputations in 2008 and this incidence has been predicted to rise to an even greater value (Ziegler-Graham, 2008). These amputees, even in developed countries, face serious problems related to their socio-professional rehabilitation (Solarz, 2016; Resnik, 2017). Numerous studies on the epidemiology and characteristics of limb amputations in developing countries can be found in the literature (Muzembo Ndundu, 2012; Walla, 2015). But very few have studied the implication of an upper limb amputation on patients in Africa (Walla, 2015). The purpose of this study was to examinate the outcomes of an upper limb amputation on a functional, social and economic level, and to investigate the epidemiological and clinical factors that bear the functional outcomes and quality of life of these patients.

Patients and methods

Study Design

This is a prospective, analytical study that took place over a period of 7 years from January 1st 2009 to December 31st 2015. Our study focused on upper limb amputations performed on adults in the trauma and orthopaedics department of Cotonou National Teaching Hospital. This department is the national level-1 referral center for the management of diseases affecting the musculoskeletal system. Patients who had previously a limb amputation and those with limb agenesis were excluded from this study. The mean follow-up time was 3.0 ± 2.1 years (6 months-7 years).

Population

Data from 37 patients were collected. There were 19 men and 18 women giving a male/female ratio of 1.05. The mean age of patients was 36.3 years (range=18-73 years). Twenty-two patients were in a couple and 15 were single prior to their amputation. On a professional level, 8 patients were labor workers (22%), 6 were craftsmen (16%), 6 were civil servants (16%), 5 were traders (14%), and four were police officers (11%). Twenty-two patients had their dominant limb removed. The clinical features of amputations are summarized below in table I.

Table I : *Clinical features of amputations (N= 37*

	Frequency	**Percentage**
Reason of amputation		
Trauma	29	78%
Bone tumour	5	14%
Osteitis	3	8%
Amputation level		
Trans-humeral amputation	2	5%
Trans-radial amputation	5	14%
Radio-carpal disarticulation	3	8%
Trans-metacarpal amputation	4	11%
Metacarpophalangial disarticulation	14	38%
Interphalangeal disarticulation	1	2%
Trans-phalangeal amputation	8	22%

Variables

Some variables as the rate of fitting prosthesis, the outcomes of amputees on a functional, social, economic level and their quality of life were recorded.

The functional impact was evaluated by assessing patients' re-lateralization, the existence of bimanual activity and their DASH score based on its French version (Sharma, 2000; Dubert, 2001)**.** Similarly, the level of disability was appreciated based on patients' ability to get dressed, go to the toilet and eat.

The social impact was estimated by the aptitude to resume driving and return to work, the adaptation of the work place, the practice of leisure activities, the rate of divorce and termination.

Economically, we compared patients' monthly income after amputation to their pre-amputation income.

Patient's quality of life was assessed with the French version of Nottingham Health Profile score (NHP). The aforementioned version contains six dimensions of health: mobility, social isolation, pain, emotional reactions, energy and sleep. We considered that there was a perceived health impairment in one dimension when at least one item is positive (Besnier, 2010)**.**

Ethical considerations

Written informed consent was obtained from each patient prior to participating in the study. Investigators guaranteed the total anonymity of the information derived from the research.

Statistical analysis

The statistical analysis was done with the software EPI Info version 7.1.5.0. The statistical relationships between variables were established with the Chi^2 of Pearson and Kruskal-Wallis tests as appropriate with calculation of the p-value. A value of $p \leq 0.05$ was considered statistically significant with a 95% confidence interval.

Results

Prosthesis fitting

No patient in this category had been fitted for new equipment.

Functional outcomes

- *Re-lateralization*

One patient out of the 22 with the dominant upper limb amputation was able to re-lateralize.

- *Bi-manual activity*

Twenty-four out of 37 patients (65%) were able of bi-manual activity, while the 13 other patients (35%) could not perform any bi-manual activity. There was no correlation found between on one hand the existence of bi-manual activity and sex (p-value = 0.8; Chi^2=0.03), age (p-value = 0.5; Chi^2=3.1), or the cause of amputation (p-value 0.6; Chi^2=1.3), on the other hand. However, there was a statistically significant difference between the ability of bi-manual activity and the level of amputation, with a p-value of 0.03 (table II): the higher the amputation level was, the lower an ability to perform bi-manual activity was conserved.

***Table II** : ability to perform bi-manual activity based on amputation level*

	Ability to perform bi-manual activity			
	Yes	**No**	**Total**	
Trans-humeral Amputation	2	0	2	
Trans-radial Amputation	5	0	5	p = 0.03
Radio-carpal Disarticulation	3	0	3	Chi^2 = 11.8

Trans-metacarpal Amputation	0	4	4
Metacarpophalangeal Disarticulation	3	11	14
Inter-phalangeal Disarticulation	0	1	1
Trans-phalangeal Amputation	0	8	8
Total	13	24	**37**

- *DASH Score*

The mean DASH score was 40.1 ± 13.7 ranging from 24.16 to 73.33. A statistically significant difference was found between the DASH score, patient's sex and the level of amputation with p values of 0.006 and 0.005 respectively.

- *Disability*

As demonstrated in figure 1 below, 35% of upper limb amputees were not able to dress themselves alone and 27% couldn't go to the toilet in 27% of cases.

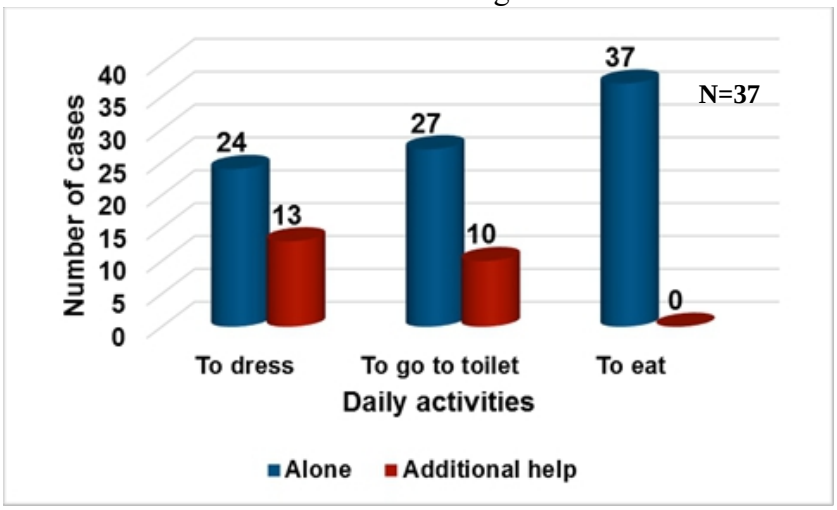

Figure 1: *Distribution of Upper limb amputees' ability to perform daily activities*

Socio-economic impact

All social parameters studied were affected as shown in figure 2. Economically, 73% of patients had a decreased monthly income post-amputation, while 27% had a similar income as their income prior to the amputation.

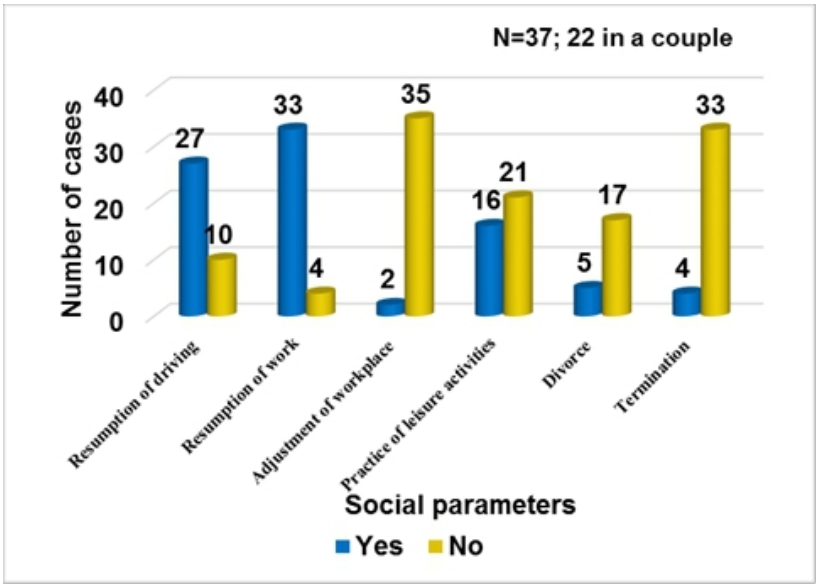

Figure 2: *Distribution of upper limb amputees based on social parameters*

- *Quality of life*

All the dimensions of health defined by the NHP score have been affected. Emotional reactions were found to be the most affected dimension as they were present in 24 (65%) patients (figure. 3).

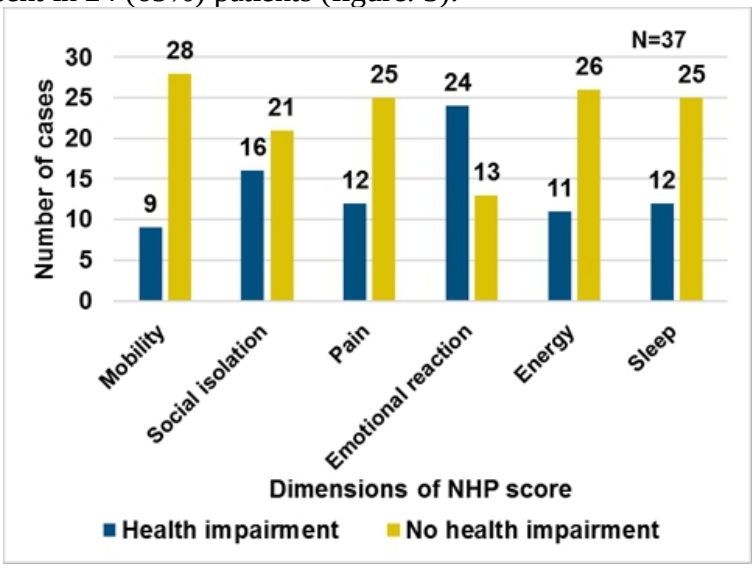

Figure 3: *Distribution of patients based on the qualitative impairment of NHP score dimensions*

As the NHP score was assessed quantitatively, the minimum, maximum and mean values of patients were summarized in table III below.

Table III: *Quantitative distribution of the dimensions of NHP score among amputees*

	Minimum	**Maximum**	**Mean value ± standard deviation**
Mobility	74.74	100	99.1±4.7
Social isolation	79.57	100	94.5±9
Pain	82.34	100	98.2±4.7
Emotional reactions	86.76	100	95±4.7
Energy	0	100	94.5±19.8
Sleep	77.14	100	97.2±7.18

The overall mean of NHP score was 5.8 ± 0.2 with range of 4.8 to 6. It was noted that younger patients had a better quality of life, with a statistically significant relationship between quality of life and age (p-value =0.02). Similarly, a high amputation level was associated with a lower quality of life, with a statistically significant relationship between quality of life and the level of amputation on the limb (p-value = $6x10^{-4}$).

Discussion

This study is innovative because it's the first of its kind in our work environment. Indeed, only very few studies on upper limb amputees outcomes conducted in Africa can be found across the literature (Walla, 2015; Mohammed, 2014)**.** This prospective, analytical study is limited by its mono-centric character, which makes it tougher to generalize our conclusions to the entire population of Benin. Alternatively, a procedural bias was identified during the assessment of the functional outcomes of patients due to the use of scores which are not validated in the local languages, as a large proportion of the population isn't scholarized. Moreover, to evaluate the quality of life according to the NHP score, it was necessary to fill out the forms ourselves for subjects who could express themselves but were unable to read and write in French. However, the limitations of this study do not diminish the value of its results which were carried out in the national referral hospital of Benin. The later provided us with a sufficiently large sample size to allow statistical analysis that lead to conclusive results.

Prosthesis fitting

No patient in this study had been fitted with a prosthetic limb. In Lomé (Togo), in the short series of Walla et al**.** (Walla, 2015), only one patient was fitted out of three major upper limb amputees. The lack of prosthetic fitting in low-income countries contrasts with its high rate among amputees in

developed countries (Masmejean, 2000; Pérot, 2012). This can be explained by the lack of financial resources of patients for whom the prosthesis is very expensive to purchase. Indeed, an aesthetic prosthesis of the upper limb costs $2512.24-3864.68 (USD); that means 34.1-52.5 times higher than the guaranteed minimum inter-professional salary in Benin which is $72.99 (USD). Legislations to facilitate access to cheaper prostheses such as Jaipur's Arm or Jaipur's Hand used in India and some African countries (Mysore, 2016), as well as the introduction of mandatory work fund to subsidize the purchase of prostheses could increase the rate of fitting.

Apart from the scarcity of funds, the lack of functional, mechanic and myoelectric prostheses in the country would be a factor of discouragement for some patients who would then consider it unnecessary to have a prosthesis only for aesthetic reasons while cumbersome. At last, similarly to the lower limb, fitting prosthesis is not always systematic for upper limb amputations and depends on multiple conditions. When these conditions are not met, about 20% of the patients fitted end up giving up their prostheses (Biddiss, 2007; Salminger, 2016; Meier, 2014).

Functional outcomes

- *Re-lateralization*

Of the 22 patients amputated of their dominant limb, only one (4.5%) was able to re-lateralize. This ratio is lower than that found by Malherbe et al**.** (Malherbe, 2013), whose results indicated that all their patients amputated of their dominant upper limb had achieved re-lateralization. The low rate of re-lateralization observed in this study could be explained by an absence of functional rehabilitation in upper limb amputees. On one hand, this rehabilitation program is not systematically recommended by the healthcare staff. On the other hand, when it is prescribed, patients who do not understand the beneficial effects tend not engage fully in the rehab program, especially since they rarely accept the fitting prosthesis. Moreover, they perceive this rehabilitation as an additional source of expenses given the lack of public social coverage, and the low rate of insured patients. This situation could be attenuated if the management of amputees was handled by a multidisciplinary team composed of surgeons, psychiatrists, physiotherapists, and social assistants.

- *Bi-manual activity*

In 24 out of 37 patients (64.9%), the ability of bi-manual activity was re-established. Malherbe et al. (Malherbe, 2013) found a predominance of mono-manual activities among major upper limb amputees as described in the literature. The higher the level of amputation, the lower the possibility of bi-manual activity (p-value = 0.03). This finding is explained by the fact that, in the absence of fitting prosthesis a major amputation of the upper limb results

in the use of the amputated limb only to help catch and make a humero-thoracic forceps (Malherbe, 2013).

- *DASH score*

The mean of DASH score was 40.1 ± 13.7. It is better than that reported by Malherbe et al. (Malherbe, 2013), and much worse than that of Ostlie et al (Ostlie, 2011). Males retained more functionality in their upper limbs compared to females (p-value = 0.006) and the higher the amputation level, the less functional the upper limb was (p-value = 0.005). The amputation of the upper limb therefore clearly affects physical function.

- *Disability*

Upper limb amputees lost their independence regarding their ability to dress themselves in 35% of cases, and to go to the toilet in 27% of cases. As such, they presented more disability than those in Malherbe et al. (Malherbe, 2013) study in which all patients remained completely independent in their daily activities. This finding could be explained by the lack of functional rehabilitation in our patients with upper limb amputations.

Socio-economic impact

At the social level, all the parameters studied had been affected by the upper limb amputations. Economically, 73% of patients had a decreased monthly income. According to the Forensic Evaluation Scale, Permanent Partial Incapacity after amputation in a non-fitted subject ranges from 2% to 65% in the upper limb (Société de Médecine légale et de Criminologie de France, Association des Médecins Experts en Dommage corporel, 2000). In this study, the population consisted mainly of subjects aged 18-30 years old (46%). A great reduction in functional abilities and productivity was noted especially among the most active age groups. Not only is the impact of an upper limb amputation seen affecting the autonomy of the patients, but it also contributes to increase poverty state in developing countries by essentially striking the active subjects.

Quality of life

In terms of quality of life, all the health dimensions defined by the NHP score had been affected especially the emotional reactions' dimension: 24 out of 37 cases.

Quantitatively, the overall NHP score was 5.8 ± 0.2. This shows the impact of amputation on the quality of life of these subjects. The NHP score is a generic quality of life scale originally described for the elderly, but has demonstrated reproducibility and reliability in amputees (Demet, 2002). However, it would be interesting to develop specific scales of assessment of the quality of life among amputees.

The quality of life of the patients evaluated according to this NHP score was statistically significantly influenced by the age of the patients (p value = 0.02) and the level of the amputation on this limb (p-value = $6x10^{-4}$). These patients

once discharged from the hospital should not be left to themselves, but are accompanied to better handle this new and irreversible situation of amputee.

Conclusion

Upper limb amputations, far from being insignificant, strongly affect quality of life. Associated with serious consequences, an amputation must be supported by a collection of therapeutic tools and integrated into a multidisciplinary care approach to facilitate amputee's recovery. The implementation of this collection of therapies would require financial resources involving a better health coverage policy for these patients often impoverished.

References:

1. Masmejean E, Ouaknine M, Valenti P, Camilleri A, Chiesa G. (2000). Amputations et désarticulations des membres. Membre supérieur. Encycl Méd Chir, Techniques chirurgicales-Orthopédie-traumatologie; 44-106 : 15p.
2. Ziegler-Graham K, MacKenzie EJ, Ephraim PL, Travison TG, Brookmeyer R. (2008). Estimating the prevalence of limb loss in the United States: 2005 to 2050. Arch Phys Med Rehabil; 89:422-9.
3. Solarz MK, Thoder JT, Rehman S. (2016). Management of Major Traumatic Upper Extremity Amputations. Orthop Clin N Am; 47: 127-36.
4. Resnik L, Borgia M, Silver B, Cancio J. (2017) Systematic Review of Measures of Impairment and Activity Limitation for Persons With Upper Limb Trauma and Amputation. Arch Phys Med Rehab; 98 :1863-92
5. Muzembo Ndundu J, Motumbe Likita B. (2012). Prise en charge des amputés des membres inférieurs au centre orthopédique de Kalembe-lembe (Kinshasa) : étude rétrospective sur six ans. J réadapt méd; 32:114-8.
6. Walla A, Amakoutou K, James E Y, Ayouba G, Bakriga B, Abalo A, Dossim A M. (2015). Devenir des macro-amputes traumatiques du membre thoracique : cas d'un pays en développement. European Sci; 11: (12) 117-24.
7. Sharma R, Dias JJ. (2000). Validity and reliability of three outcome measures for hand disorders. J Hand Surg; 25B : 593- 600.
8. Dubert T, Voche P, Dumontier C, Dinh A. (2001). Le questionnaire DASH. Adaptation française d'un outil d'évaluation international. Chir Main ; 20 : 294-302.
9. Besnier A, Colliard-Moisan C. (2010). L'échelle de Nottingham health Profile. Ann Gerontol; 3(2) : 99-101.

10. Mohammed SA, Shebl AM. (2014). Quality of Life among Egyptian Patients with Upper and Lower Limb Amputation: Sex Differences. Advances Med; Article ID 674323. 8p. http://dx.doi.org/10.1155/2014/674323.
11. Pérot C, Chambon JP. (2012). Amputations des membres supérieurs. EMC - Techniques chirurgicales - Chirurgie vasculaire ; 7(4) :1-6
12. Mysore H. (2016). The Jaipur Foot: India's most popular prosthetic for amputees is not the latest in technology, but it's still the most suitable option for many patients almost 50 years after its development. IEEE Pulse ;7(3):30–3.
13. Biddiss EA, Chau TT. (2007). Upper limb prosthesis use and abandonment: a survey of the last 25 years. Pros-thet Orthot Int. ; 31: 236 – 57.
14. Salminger S, Sturma A, Roche AD, Hruby LA, Paternostro-Sluga T, Kumnig M, et al. (2016). Functional and Psychosocial Outcomes of Hand Transplantation Compared with Prosthetic Fitting in Below-Elbow Amputees: A Multicenter Cohort Study. PLoS ONE 11(9): e0162507. doi:10.1371/journal. pone.0162507
15. Meier RH, Melton D. (2014). Ideal Functional Outcomes for Amputation Levels. Phys Med Rehabil Clin N Am ; 25: 199–212
16. Malherbe M, Cheval D, Lejacques B, Vaiss L, Kerfant N, Le Nen D. (2013). Macro-amputation du membre supérieur : que sont devenus les patients ? A propos de 22 cas. Chir main; 32 :219–25.
17. Ostlie K, Franklin RJ, Skjeldal OH, Skrondal A, Magnus P. (2011). Assessing physical function in adult acquired major upper-limb amputees by combining the Disabilities of the Arm, Shoulder and Hand (DASH) Outcome Questionnaire and clinical examination. Arch Phys Med Rehabil; 92: 1636-45.
18. Société de Médecine légale et de Criminologie de France, Association des Médecins Experts en Dommage corporel. (2000). Barème d'évaluation médico-légale. Paris : Editions ESKA ; Chapitre 2, Fonction motrice :35-68.
19. Demet K, Guillemin F, Martinet N, Andre JM. (2002). Nottingham Health Profile: reliability in a sample of 542 subjects with major amputation of one or several limbs. Prosthet Orthot Int; 26(2): 120–3.