

Extremities Amputations in King Abdulaziz University Hospital (2005-2009)

Mohammed M. Badri¹, SSG-GS, **Wail A. Tashkandi¹**, ABGS,
Saleh M. Aldaqal, FRCSI, SBGS, **Abrar A. Nawawi**, MD,
Ahmed M. Kensarah, FRCS(Ed), and **Hasan A. Alzahrani¹**, FRCS
(GLASG)

*Department of Surgery, Faculty of Medicine and ¹Mohammed Hussein Al-Amoudi Chair for Diabetic Foot Research, King Abdulaziz University, Jeddah, Saudi Arabia
drbadri99@yahoo.com*

Abstract. Diabetic foot disorders are responsible for the majority of limb amputations in Jeddah. They represent at least 50% of causes of lower limb amputations. A retrospective study was designed to identify the pattern of amputations, aetiological factors, and the percentage of diabetic extremities amputations performed at King Abdulaziz University Hospital over five years. The records of 222 patients who had 252 limb amputations were reviewed. The median age of patients reviewed was 63 years. The male to female ratio was 3:1. Foot ulcer was the most common presentation among diabetic who underwent amputation (90%). Lower limb amputations were the most common (96.4%) and more than half of it (55%) was minors. *Diabetes mellitus* headed the list of indications in lower limb amputations (90%). Most of the amputations were carried out by general surgeons followed by vascular surgeons and orthopedics. Re-amputation was necessary in 24 patients. The mortality rate was (7.2%) and only 8.8 % of the amputees have been rehabilitated post amputations. Accordingly, every effort should be made to avoid amputation in diabetics, particularly with limited resources for rehabilitation in developing countries.

Keywords: *Diabetes mellitus*, Amputations, Limbs, Peripheral vascular disease.

Correspondence & reprint request to:

Dr. Mohammed M. Badri
P. O. Box 80215, Jeddah 21589 Saudi Arabia

Accepted for publication: 10 January 2011. Received: 01 April 2011.

Introduction

Diabetes is the cause of at least 50% of all non-traumatic lower limb amputation worldwide^[1,2]. It is estimated that lifetime risk for amputation is 10-15%, which is 10-30 times higher in comparison with the general population^[3]. Foot problems are the most common indication for hospital admission in diabetics^[4]. Peripheral neuropathy and foot vascular insufficiency are long term complications of *diabetes mellitus* (DM). Both problems can lead to the loss of protective sensation, poor healing of ulcers and lowered resistance to infection^[2,5,6]. Another risk factors for limb amputation include having a previous ulcer and prior amputation^[2,7]. Beginning of ulceration and consequent amputation are associated with increase in mortality, morbidity and treatment cost. Limb amputation is always a tragic event for patient and surgeon. It may affect those family members who depend on the patient for their livelihood. The financial burden both, to patient and society is heavier and rehabilitation facilities are often limited^[8-11]. Beside increase health care costs, people who have foot ulcers and/or lower limb amputations have decreased health-related quality of life. These patients have often long treatment periods that is usually time consuming with much time spent on clinic visits hospitalization and frequent foot ulcer dressing changes with or without long term antibiotics therapy^[5].

This study aimed to find out the most common indication for amputation in our centre. The pattern of limb amputation, post-operative complication and mortality associated with amputation. Attention is also paid to those re-amputations which can be prevented.

Study Design and Methods

This is a retrospective study which was carried out in King Abdulaziz University Hospital (KAUH) which is the only teaching hospital in Jeddah with the bed capacity amounting to 715 beds. The present study looked at all limb amputations over a five year period (January 2004 – December 2008). The medical records of all amputees were reviewed according to a pre-designed Performa to establish the pattern of amputations and aetiological factors. When more than one cause was found the primary one was considered as a leading cause. The presenting symptoms and signs of the patients who had undergone amputations were identified. Amputations were classified according to site into major and

minor limb amputations. The major ones included all amputations proximal to the ankle and wrist joints and the minors are distal to these joints. Surgeon's qualification and his/her specialty were also considered in the study. In cases of re-amputation, the cause of failure and complications, if any, were reported. Mortality was defined as death within 30 days of amputation irrespective of cause. Progress with rehabilitation, if any, was recorded during the follow-up.

Results

There were a total of 222 patients who had 252 amputations; 198 undergone amputations once and the rest had multiple amputations whether twice ($n = 20$) or thrice ($n = 4$). Two patients had both lower and upper limb minor amputations at the same setting for polydactyly raising the number to 252 amputations (performed in 250 operations).

The median age accounted for 63 years (Fig. 1 shows the age distribution of the studied sample) and there was preponderance of males (75.7%) over females (24.3%), and the Saudis constituted almost one-third (34.2%) of the patients who had undergone amputation.

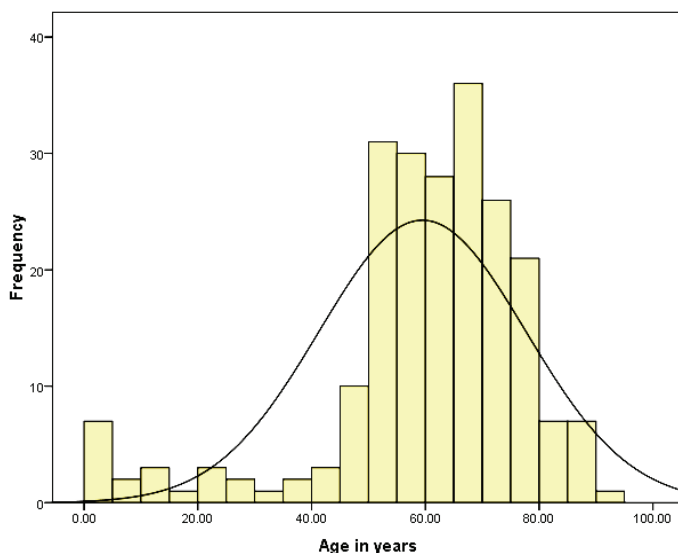


Fig. 1. Histogram for age of the patients included in the study.

Half of the amputations 125 (50%) were done for more than one clinical presentation. The most frequent presentation indicating

amputations were foot ulcer action in 161 (64.4%) patients, followed by abscesses in 128 (51.2%) patients and ischemia in 89 (35.6%) patients. The least frequent were gangrene in 24 (6.9%) patients and polydactyly 10 (4.0%) (Fig. 2).

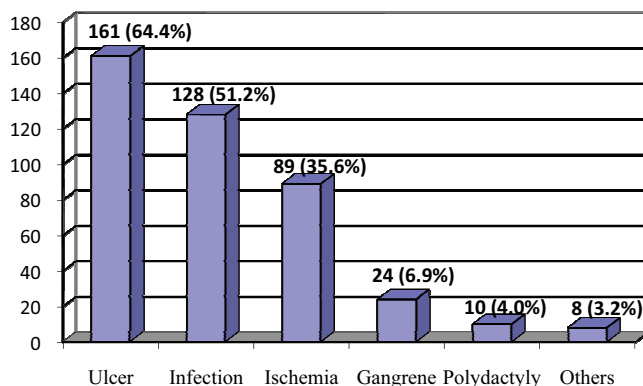


Fig. 2. Presenting symptoms and signs indicating amputations (n = 250).

The majority of amputations were done in the lower limb (96.4%) and more than half of it (55.1%) was minor amputations, and the rest (41.3%) were major. Most of the upper limb amputations were minor (3.2%) compared to only (0.4%) major upper limb amputations (Table 1).

Table 1. Site of extremities amputations.

Number of Amputations	Frequency	%
Minor lower limb amputations	139	55.1%
Major lower limb amputations	104	41.3%
Minor upper limb amputations	8	3.2%
Major upper limb amputations	1	0.4%

The main indication for vast majority of amputations were DM 225 (90%) followed by infection 152 (60.8%) and ischemia 89 (35.6%). The congenital factors as an indication for amputations accounted for 10 (4%) and the neoplasm mounted to 8 (3.2%) (Fig. 3).

The types of amputations according to the anatomical site are shown in Table 2. The amputations of one toe constituted about one quarter of the total amputations (26%) and almost equal percentage (25.2%) for amputations of more than one toe. The above knee amputations (27.2%)

were double the below knee amputations (13.6%). On the other hand, the amputations distal to the wrist joint accounted for (3.2%) and only one amputation (0.4%) was done proximal to the wrist joint. Most of the post-operative complications attributed to infection. Almost all mortalities were due to septic shock and occurred among patients who had undergone lower limb amputations (11.8%).

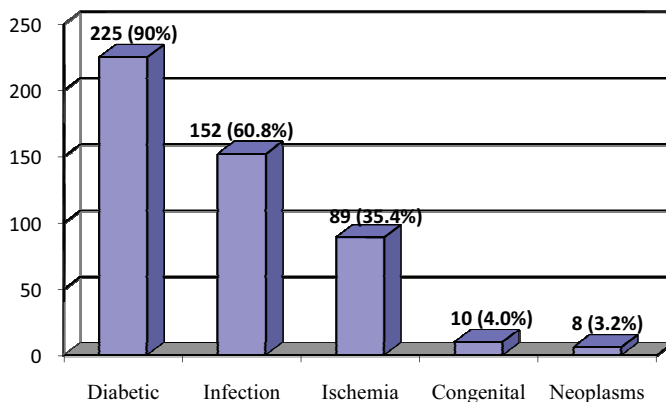


Fig. 3. Primary causes (etiologic factors) for amputations (n =250).

Table 2. Types of extremities amputations according to anatomical site (n = 250).

Types of Amputation	Frequency	%
Lower extremities amputations		
One toe	65	26%
More than one toe	63	25.2%
Transmetatarsal (TMA)	13	5.2%
Below knee (BKA)	34	13.6%
Above knee (AKA)	68	27.2%
Upper extremities amputations		
Distal to the wrist joint	8	3.2%
Proximal to the wrist joint	1	0.4%

Most of the amputations were undertaken by a specialized surgeon. The general surgeons carried out the majority of amputations followed by vascular and orthopedic surgeons. Regarding the rank of the operating physicians, it was noticed that post-operative complications were decreasing significantly towards senior physicians. All procedures were performed under supervision of a qualified specialist. However, it ranged

between 44.4% among patients who had been operated by residents to 30.1% and 19% among those who had been operated by registrars and consultants, respectively. This difference was statistically significant p value < 0.05 .

The post-operative complications were more frequent among those whom their wounds were left open (31.7%) compared to those who had primary closure. Re-amputation was necessary in 24 patients. A total of 9 out of these 24 patients ended up with above knee amputations, and 7 of 24 ended up with below knee amputations. Also, it was noted that three patients out of the four patients who had 3 consecutive amputations started with one toe amputation.

There was a significantly consistent increase in the percentage of the patients who stayed in the hospital for more than 10 days after amputation with increased size of amputated part; it ranged between 50% for those who had undergone one toe amputation to 91% from patients who had undergone above knee amputation.

Similarly, and as expected, it was found that the patients who experienced post-operative complications stayed for significantly longer durations in the hospital (57.1% stayed for > 30 days) when compared with those who had no post-operative complications (16.8% stayed for > 30 days) $p < 0.05$.

Mortality rate accounted for (7.2%) as 16 patients among those who undergone amputations died within 30 days after amputation due to cardiovascular causes. Regarding post-operative rehabilitation, it was noted that only 8.8% who had major limb amputation and survived were fitted with an artificial limb.

Discussion

Over the last two decades, many studies have been published about diabetic foot disorders and limb amputation in diabetics, however, only few have been reported from Saudi Arabia^[9]. In this study, the median age of patients reviewed was 63 years compared to 71.7 years in Dutch population^[11]. This may indicate that we have younger patients presented with diabetic foot complications. This can be attributed to lack of proper screening programs^[3,10], which are directed to diabetics as only 22,000 (10%) out of estimated 400,000 diabetics are enrolled in diabetic foot

centers care in Jeddah^[11]. The present results coincided with other studies in the literature where males usually predominate (75.7%) over females (24.3%)^[12].

Saudi Arabia is a country which accommodates more than 6 million of expatriates, *i.e.*, 30% of population. However, the non-Saudis represented about 66% which is two thirds of our sample. This may be attributed to the eligibility criteria of the patients in other hospitals in Jeddah area which accepts mainly Saudis.

The most common presentation among diabetic patients who had undergone amputation was foot ulceration (64.4%), followed by ischemic manifestations (35.6%), and the least frequent was frank gangrene (6.9%) and polydactyly (4.0%). These findings compare favorably with a similar study from Hong Kong^[13].

In diabetics, amputation is usually related to multiple etiological factors including infection, peripheral arterial disease and neuropathy. All these factors play important roles in the background of accidental trauma. Most of the amputations are preventable. The importance of basic foot care education programs in the prevention of initial trauma, ulcer formation and subsequent limb amputation in diabetic patient was emphasized in several recent studies^[10,14-18]. In addition, extensive investigations including detailed vascular assessment are needed followed by liberal use of various reconstructive vascular procedures, where applicable^[18,19].

Most of our patients (96.4%) had lower limb amputations. More than half of it (55.1%) was minor amputations and the remaining (41.3%) was major. The great majority of amputations were on diabetics (90%). There was evidence of infection in 60% and ischemia in 35% of the sample. The congenital anomalies accounted for 4% and neoplasm mounted to (3.2%).

The percentage of amputations in diabetics is much higher than what was reported by our group two decades ago (90% vs. 50%)^[8]. This could be attributed to the increasing prevalence rates of diabetes in the last two decades^[4], changes in living patterns and eating habits towards western style^[8]. Polydactyly accounts for only (4.0%) of minor amputations and was performed by plastic surgeons. This reflects the referral pattern of our hospital.

The majority of amputations were done by general surgeons followed by vascular surgeons and orthopedics. The lower complication rates among those operated by qualified surgeons may indicate closer supervision on performing amputations by less experienced surgeons, such as residents in training and specialists. Our re-amputation rates were higher compared to other hospital in Jeddah, *i.e.*, King Fahad General Hospital (KFGH), King Abdulaziz Hospital and Oncology Center (KAH&OC) and this finding coincides with similar finding reported by Tashkandi *et al.*^[12]. Further research is needed on the risk factors for re-amputation in this subset of patients. However, the mortality rate among patients who undergone amputations accounted for 16 patients (7.2%) within 30 days after amputation, and this is due to septic shock and cardiovascular causes. This relatively low mortality rate was related to the good post-operative care as most of those high risk patients were managed in the Intensive Care Unit (ICU) after surgery. Most post-operative complications were due to infections, and almost all mortalities were due to septic shock and other co-morbidities.

Unfortunately, only 8.8% were rehabilitated postoperatively. This indicates that rehabilitation services are not coping with advancement in management of these diabetic foot cases. Rehabilitation of these patients in a developing country is still lagging behind other developed countries, mainly due to financial problems^[20].

According to the most recent Saudi Ministry of Health Annual Report (2008), 652 limb amputations were performed on diabetics^[11]. It's believed that this could be the only major amputations as we have more than 3 million diabetics. The gap in the reported amputation indicates the need for national registry for limb amputations in diabetics.

Every effort should be made to avoid amputation, particularly with the limited financial resources for rehabilitation in developing countries. This goal can be achieved to great extent by knowledge of the common aetiological factors, their presentation and their prevention^[21-23]. Public health education programs, early detection and referral to specialized centers of diabetic foot services are recommended^[24-26]. Applying a national standardized protocol for clinical practice guidelines, and how to prevent and manage diabetic foot diseases in a multidisciplinary approach are essential ingredients for any progress in saving more limbs of diabetics^[10,14,18,27,28]. More prospective and wider scales studies should

be performed to accurately determine the real DM related amputation and its underlying aetiological factors^[29].

Amputation in diabetics is preventable in most cases of diabetic foot disorders. However, it is still a major health problem in Saudi Arabia which is witnessing a “pandemic” of diabetes complications.

Acknowledgments

We would like to extend our appreciation to members of the surgical departments in KAUH and also to Dr. Adel Ibrahim for assisting us in the bio-statistical analysis of the data. Our thanks also extend to Mohammad Hussein Al-Amoudi, Chair for Diabetic Foot Research for financial support, and a special gratitude to Mrs. Joy Almeda De Silva for her secretarial assistance in typing this manuscript.

References

- [1] **Tentolouris N, Al-Sabbagh S, Walker MG, Boulton AJ, Jude EB.** Mortality in diabetic and non-diabetic patients after performed amputation (1990-1995) 5-year follow-up study. *Diabetes Care* 2004; **27**(7): 1598-1604.
- [2] **Larijani B, Afshari M, Darvishzadeh F, Bastanagh MH, Pajouhi M, Baradar Jalili R, Moradi M.** Lower limb amputation in patient with diabetic foot ulcer: A 22-year review. *MJIRC* 2006; **8**(3): 21-24.
- [3] **Papazafiropoulou A, Tentolouris N, Soldatos RP, Liapis CD, Dounis E, Kostakis AG, Bastounis E, Katsilambros N.** Mortality in diabetic and nondiabetic patients after amputations performed from 1996-2005 in tertiary hospital: 3-year follow-up study. *J Diabetes Complications* 2009; **23**(1): 7-11.
- [4] **Surahio AR, Khan AA.** Amputation and *diabetes mellitus*: an institutional experience. *J Surg Pak* 2008; **13**(3): 124-127.
- [5] **Senior PA, McMurtry MS, Tsuyuki RT.** Diabetes and lower limb amputation in Alberta. In: *Alberta Diabetes Atlas*. Alberta, Canada: Institute of Health Economics. 2007, Chp 5. 73-81. <http://www.albertadiabetes.ca/pdf/atlas/Ch5_DMandLLAmputation.pdf>
- [6] **Muller IS, de Grauw WJ, van Gerwen WH, Bartelink ML, van Den Hoogen HJ, Rutten GE.** Foot ulceration and lower limb amputation in Type 2 diabetic patients in dutch primary health care. *Diabetes Care* 2002; **25**(3): 570-574.
- [7] **Izumi Y, Satterfield K, Lee S, Harkless L.** Risk of re-amputation in diabetic patients stratified by limb and level of amputation. A 10-year observation. *Diabetes Care* 2006; **29**(3): 566-570
- [8] **Alzahrani H, Ghandourah N, Merdad H.** Limb amputation in Western Saudi Arabia. *Asian J Surg* 1992; **15**(3): 119-122.
- [9] **Al-Wahbi AM.** The diabetic foot in Arab world. *Saudi Med J* 2006; **27**(2): 147-153.
- [10] **Larsson J, Eneroth M, Apelqvist J, Stenström A.** Sustained reduction in major amputation in diabetic patients 628 amputation in 462 patients in a defined population over 20-years period. *Acta Orthop* 2008; **79**(5): 655-673.

- [11] [No authors listed]. Ministry of Health MOH Annual report, 2008.
- [12] **Qari FA, Akbar D.** Diabetic foot. *Saudi Med J* 2000; **21**(5): 443-446.
- [13] **Leung HB, Ho YC, Wong WC, Guerin J.** Seasonal variations in non-traumatic major lower limb amputation in Hong Kong Chinese diabetic patients. *Hong Kong Med J* 2007; **13**(5): 379-381.
- [14] **Trautner C, Haastret B, Mauckner P, Gätcke LM, Giani G.** Reduced incidence of lower limb amputations in the diabetic population of German city, 1995-2005 results of the Leverkusen Amputation Reduction Study (LARS). *Diabetes Care* 2007; **30**(10): 2633-2637.
- [15] **Krishnan S, Nash F, Baker N, Fowler D, Rayman G.** Reduction in diabetic amputations over 11 years in a defined U.K. population: benefits of multidisciplinary team work and continuous prospective audit. *Diabetes Care* 2008; **31**(11): 99-101.
- [16] **Fitzgerald RH, Mills JL, Joseph W, Armstrong DG.** The diabetic rapid response acute foot team 7 essential skills for targeted limb salvage. *Eplasty* 2009; **9**: e15.
- [17] **Rerkasem K, Kosachunhanun N, Tongprasert S, Khwanngern K, Matanasarawoot A, Thongchai C, Chimplee K, Buranapin S, Chaisrisawadisuk S, Mangklabruks A.** Reducing lower extremity amputations due to diabetes: the application of diabetic foot protocol in Chiang Mai University Hospital. *Int J Low Extrem Wounds* 2008; **7**(2): 88-92.
- [18] **Hedetoft C, Rasmussen A, Fabrin J, Kølendorf K.** Four-fold increase in foot ulcer in type 2 diabetic subjects without an increase in major amputation by multidisciplinary setting. *Diabetes Res Clin Pract* 2009; **83**(3): 353-357.
- [19] **Ribu L, Birkeland K, Hanestad BR, Moutt RT.** A longitudinal study of patients with diabetes and foot ulcers and their health-related quality of life: wound healing and quality of life changes. *J Diabetes Complications* 2008; **22**(6): 400-407.
- [20] **Malone JM, Moore W, Leah JM, Childers SJ.** Rehabilitation of lower limb extremity amputation. *Arch Sur* 1981; **116**(1): 93-98.
- [21] **Nather A, Bee CS, Huak CY, Chew JL, Lin CB, Neo S, Sim EY.** Epidemiology of diabetic foot problem and predictive factors for limb loss. *J Diabetes Complications* 2008; **22**(2): 77-82.
- [22] **Lavery LA, Armstrong DG, Wunderlich RP, Mohler MJ, Wendel CS, Lipsky BA.** Risk factors for foot infections in individual with diabetes. *Diabetes Care* 2006; **29**(6): 1288-1293.
- [23] **Al-Mahroos F, Al-Roomi K.** Diabetic neuropathy foot ulceration, peripheral vascular disease and potential risk factors among patients with diabetes in Bahrain: a nationwide primary care diabetes clinic-based study. *Ann Saudi Med* 2007; **27**(1): 25-31.
- [24] **Markowitz JS, Gutterman EM, Magee G, Margolis DJ.** Risk of amputation in patients with diabetic foot ulcers: a claims-based study. *Wound Repair Regen* 2006; **14**(1): 11-17.
- [25] **Unnikrishnah AG.** Approach to a patient with a diabetic foot. *Natl Med J India* 2008; **21**(3): 134-137.
- [26] **Mountford WK, Soule JB, Lackland DT, Lipsitz SR, Colwell JA.** Diabetes-related lower extremity amputation rates fall significantly in South Carolina. *South Med J* 2007; **100**(8): 787-790.
- [27] **Canavan RJ, Unwin NC, Kelly WF, Connolly VM.** Diabetes- and nondiabetes-related lower extremity amputation before and after the introduction of better organized diabetes foot care: continuous longitudinal monitoring using a standard method. *Diabetes Care* 2008; **31**(3): 459-463.

- [28] **Van Damme H, Limet R.** Amputation in diabetic patients. *Clin Podiatr Med Surg* 2007; **24**(3): 569-582.
- [29] **Rayman G, Krishnan STM, Baker NR, Wareham AM, Rayman A.** Are we underestimating diabetes-related lower extremity amputation rates? Results and benefits of the first prospective study. *Diabetes Care* 2004; **27**(8): 1892-1896.

بتر الأطراف في مستشفى جامعة الملك

عبدالعزيز (٢٠٠٥ - ٢٠٠٩م)

محمد مصطفى بدري، ووائل عبدالحفيظ طاشكندي، وصالح محمد الدقل،

وأبرار يوسف ناوي، وأحمد محمد كنساره، وحسن علي الزهراني

قسم الجراحة؛ كلية الطب وكرسي الشيخ محمد حسين العمودي لأبحاث

القدم السكرية، جامعة الملك عبدالعزيز

جدة - المملكة العربية السعودية

المستخلص. تعتبر مشاكل القدم السكرية هي المسؤولة عن غالبية حالات بتر الأطراف في جدة. حيث إنها تمثل ما لا يقل عن ٥٠٪ من أسباب بتر الطرف السفلي. تم تصميم دراسة بأثر رجعي للتعرف على نمط البتر، والعوامل المسببة، ونسبة بتر الأطراف نتيجة القدم السكرية التي أجريت في مستشفى جامعة الملك عبدالعزيز على مدى خمس سنوات. حيث تم مراجعة سجلات ٢٢٢ مريضاً أجريت لهم ٢٥٢ عملية لبتر الأطراف. وكان متوسط عمر المرضى ٦٣ عاماً. وكانت نسبة الذكور إلى الإناث ١:٣. وكانت قرحة القدم أكثر الأسباب شيوعاً بين مرضى السكري الذين خضعوا لعمليات البتر (٩٠٪). وكانت عمليات بتر الأطراف السفلى الأكثر شيوعاً (٤٩٦٪) ووجد بأن أكثر من نصفها (٥٥٪) كان في منطقة القدم. وتصدر داء السكري قائمة العوامل المؤدية إلى بتر الأطراف السفلية (٩٠٪). ونفذت معظم عمليات البتر من قبل أطباء الجراحة العامة يليهم أطباء جراحة الأوعية الدموية وأطباء جراحة العظام. واحتاج ٢٤ مريضاً إلى عمليات إعادة بتر. ووصل معدل الوفيات إلى (٢,٧٪) بين مبتوري الأطراف وتم إجراء عملية استعاضة وإعادة التأهيل للطرف المبتور

بأطراف صناعية في ٨,٨٪ فقط. عليه ينبغي بذل كل جهد ممكن لتجنب
البتة في مرضى السكري وخاصة في ظل قلة الموارد لإعادة التأهيل في
البلدان النامية.