

## Major Lower Limb Amputation: Causes, Characteristics and Complications

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**Background:** The incidence rates of major amputations vary greatly between different countries. Amputation carries a significant psychological and socioeconomic burden on the individual and the community. Despite that, major lower limb amputation is a relatively frequent procedure in our center. To date, there has been no study published to identify the major cause of amputation and the personal characteristics of the patients.

**Objective:** To identify the causes, patient characteristics and complications of major lower limb amputation.

**Design:** A Prospective Study.

**Setting:** Vascular and Thoracic Surgery Unit, Department of Surgery, Salmaniya Medical Complex, Kingdom of Bahrain.

**Method:** All patients who underwent major amputation of the lower limb/s from 1 May 2015 to 30 April 2016 were included in the study.

**Result:** Forty-five patients were included in this study. Forty-seven major lower limb amputations were performed during the study period. Forty-one (91.1%) patients were Bahrainis. Twenty-nine (64.4%) patients were males and the median age was 66 years. Thirty (66.7%) patients had no university education. Thirty-eight (84.4%) patients underwent amputations due to diabetes mellitus (DM) and its related complications. Seventeen (37.8%) patients had postoperative complications. Surgical site wound infection (SSI) was the most common postoperative complication, 8 (17.8 %) patients. The overall 30-day mortality was 10.6%.

**Conclusion:** Diabetes mellitus and its related complications is the main cause for major lower limb amputation in our study.

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Limb amputation is an ancient surgical procedure first described by Hippocrates in 460–377 BC and was performed throughout the centuries for several punitive and therapeutic reasons<sup>1,2</sup>. A major lower limb amputation is defined as a surgical removal of a part or whole limb by cutting through the bone or joint proximal to the ankle<sup>1</sup>.

Major lower limb amputation carries a significant psychological and socioeconomic burden on the individual and community<sup>1-3</sup>. An individual who lost a limb is often perceived as an incomplete individual. The operation itself carries relative morbidity and mortality rates<sup>2</sup>. The diseased limb may be amputated promptly to save the patient's life. However, the care does not end there

and requires a multi-disciplinary team approach and follow-up would be required<sup>4</sup>. Due to its devastating effect, several studies evaluated and standardized the instruments used in assessing the functional status and quality of life after the major lower limb amputation<sup>5</sup>.

The aim of this study is to identify the causes, patient characteristics and complications of major lower limb amputation.

### METHOD

A prospective study was performed conducted from 1 May 2015 to 30 April 2016. All patients who underwent major lower

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limb amputation, regardless of the cause, were included in the study. All the necessary data were collected prospectively and incorporated in specific modulated electronic Google forms for analysis.

**RESULT**

A total of 45 patients were included in this study. Forty-seven major lower limb amputations were performed during the study period because two patients underwent bilateral amputation, see table 1.

**Table 1: Anatomical Levels of Amputation**

Level of Amputation	N (%)
Above Knee	32 (68.1%)
Through Knee	1 (2.1 %)
Below Knee	14 (29.8%)
<b>Total</b>	<b>47</b>

Forty-one (91.1%) patients were Bahrainis. Twenty-nine (64.4%) patients were males; male to female ratio was 1.8:1 and the median age was 66 years. The majority of the amputations were performed on patients aged 60 years and above, see table 2. Thirty (66.7 %) patients had no university education.

**Table 2: Age Group**

Age Group (Years)	N (%)
< 40	3 (6.7%)
40 – 60	14 (31.1%)
> 60	28 (62.2%)
<b>Total</b>	<b>45</b>

Thirty-eight (84.4%) patients underwent amputations due to DM and its related complications, mainly due to Diabetic neuropathy/infection, 15 (31.9%), Peripheral vascular disease with revascularization, 6 (12.8%), Peripheral vascular disease without revascularization, 17 (36.2%). Non-diabetic complications were acute ischemia in 4 (8.8%), trauma in 2 (4.4%), peripheral vascular disease with revascularization in 2 (4.4%) and without in 1 (2.2%), see table 3.

**Table 3: Indications for Major Lower Limb Amputation**

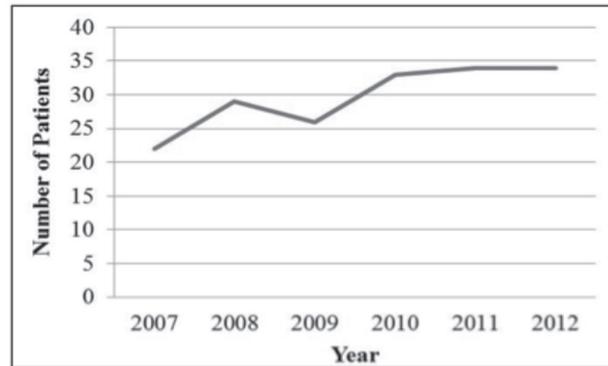
Indication	N (%)	Total
<b>Diabetes and its Complications</b>	Diabetic neuropathy/infection	15 (31.9%)
	Peripheral vascular disease with revascularization	6 (12.8%)
	Peripheral vascular disease without revascularization	17 (36.2%)
<b>Others</b>	Trauma	2 (4.3 %)
	Acute Vascular events/Acute ischemia	4 (8.5 %)
	Peripheral vascular disease with revascularization	2 (4.3 %)
	Peripheral vascular disease without revascularization	1 (2.1 %)
	<b>Total</b>	<b>47 (100%)</b>

Seventeen (37.8%) patients had postoperative complications, see table 4. Surgical site wound infection (SSI) was the most common postoperative complication seen in 8 (17.8 %) patients. The overall 30-day mortality was 10.6%.

**Table 4: Postoperative Complications**

Complications	N (%)
Phantom Pain	1 (2.2%)
Wound Infection	8 (17.8%)
Flexion Contracture	1 (2.2%)
Stump Necrosis	6 (13.3%)
Pulmonary Embolism/Deep Vein Thrombosis	1 (2.2%)
Respiratory Complications	3 (6.7%)
Cardiac Complications	4 (8.9%)
Operative Mortality	5 (11.1%)

We found a continued rise in the yearly rate of amputations, 47 in 2016 compared to 22 in 2007, see figure 1.



**Figure 1: Rate of Amputations per Year**

**DISCUSSION**

The incidence rate of major amputations worldwide remains high. The United States ranks top with the highest rate of major amputations up to 23.6 per 10<sup>5</sup>, while Japan ranks the lowest at 3.8 per 10<sup>5</sup><sup>6</sup>. Higher incidents have been documented in diabetics compared to non-diabetics<sup>7</sup>. Major lower limb amputations globally range from 5.6 to 600 per 10<sup>5</sup> in diabetics<sup>6</sup>. Approximately 1.7 million people are living with limb loss in the United States<sup>5</sup>.

Patients with DM have 30 times greater lifetime risk of amputation compared to non-diabetics<sup>6</sup>. The median survival rate after amputation according to Kulkarni et al was four years. The 5-year and 10-year survival rates are 60% and 57% for above-knee amputees and 30% and 27% for below-knee amputees<sup>8</sup>. Patients with diabetes had lower survival rates<sup>8</sup>.

The majority of the lower extremity amputations are performed due to diabetes and its related complications<sup>2,4-6,9-10</sup>. However, indications for amputation still vary between countries and within different hospitals. In developed countries, DM and peripheral vascular disease are the leading causes for major lower limb amputations, while in some of the developing

countries such as Nigeria and Iran, trauma remains the most common cause<sup>1,2,11</sup>.

In our study, 80.9% of the major lower limb amputations were due to diabetes and its related complications, which include peripheral vascular disease, diabetic neuropathy and infection. A study by Yusof et al found that diabetes and a positive bacterial growth and low albumin levels were strong predictors for lower limb amputations<sup>9</sup>. Similarly, lower limb amputations were found to be associated with DM in 82% in the United States, 75% in Malaysia and 72.6% in Spain<sup>6,9,10</sup>. A study in the United Kingdom concluded that diabetes and its related complications remain the major cause for major amputations<sup>12</sup>. Our results are consistent with other study findings which reported that the major indication for amputations was complications of diabetes<sup>2,4</sup>.

The most common postoperative complication in our study was surgical site infection (SSI), 17.8%. SSI has been accounting for the majority of the complications in several studies<sup>2,4</sup>. However, SSI in our study was lower compared to other studies<sup>2,4</sup>. In our study, we found that 66.7% had no university education and 24.4% were illiterate; that was similar to the study by Chalya et al, where 76.5% of patients had primary or no formal education<sup>2</sup>. Other studies found other social factors, such as low education and income were predictive risks for lower extremity amputation<sup>6</sup>.

Alzahrani reported 222 diabetes-related lower limb amputations<sup>13</sup>. In Saudi Arabia, 3,970 DM related amputations are performed annually, a rate of 2.5 per 10,000<sup>13</sup>. The increase in the prevalence of DM strongly correlates with the increase in the rate of amputations; therefore, it is expected to rise in the coming years<sup>6,13</sup>. England reported a 47% decrease in major amputation rate between 1997 and 2000, while the rates in the United States remained unchanged<sup>6</sup>.

Almaraz et al found an increase of 14% in the incidence of amputations in diabetics; however, non-diabetics had a 12% decrease<sup>10</sup>. Other Northern European countries have reported a decrease in the rate of major lower limb amputation due to diabetes because of the improvement of diabetic foot services<sup>6</sup>.

## CONCLUSION

**Diabetes mellitus was a major cause for lower limb amputations in our study. Despite improvement in wound care and early screening for diabetics, we found that the number of amputation is still increasing. Further studies and strategies are warranted to identify the cause and to reduce the incidence of amputations in the diabetic population.**

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**Competing Interest:** None.

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## REFERENCES

1. Ajibade A, Akinniyi OT, Okoye CS. Indications and Complications of Major Limb Amputations in Kano, Nigeria. *Ghana Med J* 2013; 47(4):185-8.
2. Chalya PL, Mabula JB, Dass RM, et al. Major Limb Amputations: A Tertiary Hospital Experience in Northwestern Tanzania. *J Orthop Surg Res* 2012; 7:18.
3. Ferguson HJ, Nightingale P, Pathak R, et al. The Influence of Socio-Economic Deprivation on Rates of Major Lower Limb Amputation Secondary to Peripheral Arterial Disease. *Eur J Vasc Endovasc Surg* 2010; 40(1):76-80.
4. Vivek H, Kumar KM, Vikranth SN. Major Lower Limb Amputation: A Tertiary Hospital Experience. *International Journal of Current Research* 2016; 8(8): 36162-4.
5. Hawkins AT, Henry AJ, Crandell DM, et al. A Systematic Review of Functional and Quality of Life Assessment after Major Lower Extremity Amputation. *Ann Vasc Surg* 2014; 28(3):763-80.
6. Moxey PW, Gogalniceanu P, Hinchliffe RJ, et al. Lower Extremity Amputations--A Review of Global Variability in Incidence. *Diabet Med* 2011; 28(10):1144-53.
7. Carmona GA, Hoffmeyer P, Herrmann FR, et al. Major Lower Limb Amputations in the Elderly Observed over Ten Years: The Role of Diabetes and Peripheral Arterial Disease. *Diabetes Metab* 2005; 31(5):449-54.
8. Kulkarni J, Pande S, Morris J. Survival Rates in Dysvascular Lower Limb Amputees. *Int J Surg* 2006; 4(4):217-21.
9. Yusof NM, Rahman JA, Zulkifly AH, et al. Predictors of Major Lower Limb Amputation among Type II Diabetic Patients Admitted for Diabetic Foot Problems. *Singapore Med J* 2015; 56(11):626-31.
10. Almaraz MC, González-Romero S, Bravo M, et al. Incidence of Lower Limb Amputations in Individuals with and without Diabetes Mellitus in Andalusia (Spain) from 1998 to 2006. *Diabetes Res Clin Pract* 2012; 95(3):399-405.
11. Sabzi Sarvestani A, Taheri Azam A. Amputation: A Ten-Year Survey. *Trauma Mon* 2013; 18(3):126-9.
12. Ahmad N, Thomas GN, Gill P, et al. The Prevalence of Major Lower Limb Amputation in the Diabetic and Non-Diabetic Population of England 2003-2013. *Diab Vasc Dis Res* 2016; 13(5):348-53.
13. Alzahrani HA. Diabetes-Related Lower Extremities Amputations in Saudi Arabia: The Magnitude of the Problem. *Ann Vasc Dis* 2012; 5(2):151-6.