THE UNIVERSITY OF ZAMBIA
SCHOOL OF MEDICINE
DEPARTMENT OF SURGERY

A STUDY OF INDICATIONS AND COMPLICATIONS OF
LOWER LIMB AMPUTATIONS IN THE UNIVERSITY
TEACHING HOSPITAL, LUSAKA, ZAMBIA.

BY

DR. TEMBO PENIAS, BSc(Hb),MBChB
DEPARTMENT OF SURGERY

SUBMITTED AS PARTIAL FULFILMENT FOR THE AWARD
OF MASTER OF MEDICINE (SURGERY) DEGREE OF THE
UNIVERSITY OF ZAMBIA

JULY 2000
CONTENTS

Page

Declaration ................................................................. i
Approval ................................................................. ii
Dedication ............................................................... iii
Acknowledgements ....................................................... iv
Abstract ................................................................. v
Introduction .............................................................. 1
Statement of the Problem ............................................... 2
Aims and Objectives .................................................... 4
Rationale/Justification .................................................. 5
Literature Review ......................................................... 6
Bias and Shortcomings .................................................. 15
Patients and methods .................................................... 16
Results ................................................................. 17
Discussion ............................................................... 29
Conclusion ............................................................... 35
Recommendations ....................................................... 36
References ............................................................... 37
Appendix ................................................................. 41
Proforma ................................................................. 45
DECLARATION

I, PENIAS TEMBO, do hereby declare that the work presented in this study for the
Degree of Master of Medicine (General Surgery) has not been presented either wholly or
in part for any other degree and is not being currently submitted for any other degree.

Signed: 

Date 31/07/2000

I have read this dissertation and have approved it for examination.

Signed: 

Supervisor 

Date: 1/8/2000
APPROVAL

This dissertation of Dr. Penias Tembo is approved as fulfilling part of the requirement for the award of the degree of Master of Medicine (Surgery) by the University of Zambia.

Signature: ................................................................. Date: 1/8/00

................................................................. 9/5/00
DEDICATION

I dedicate this work to my wife Vitalline and my two sons Penias Tembo Jr. and Willy.
ACKNOWLEDGEMENTS

I wish to sincerely thank Mr. Y. Mulla, my supervisor for his guidance during the study. Also, special thanks go to Mr. Nkhata, Superintendent of Theatres for his assistance in the data analysis, together with Mr. Mweemba and Mr. A. Mwale. My other thanks go to Mrs Jane Mwale who type the proposal and part of the script and not forgetting Mss Ketiwe and Miss Changu who typed the later part of the script.
ABSTRACT

A study to find out the indications and complications of major lower limb amputations was done between October 1997 and April 1999 in the University Teaching Hospital (UTH). The aims and objectives of the study was:

1. To determine the indications of amputations at the University Teaching Hospital in Lusaka.
2. To identify the common complications encountered in these amputees.
3. To identify the problems associated with management of these amputees that lead to these complications and recommend ways of reducing these complications.

This was a prospective study of 54 patients who underwent major lower limb amputations. The data required for study was obtained by administering a structured questionnaire. The data was analysed using EPI-info statistical software.

From this study, it was found that the commonest indication for amputation was trauma in 17 (31.5%) patients and road traffic accidents were the major contributors to this trauma group in 12 patients (22%). The second commonest was dry gangrene in 12 patients (22%) followed by tumours and diabetes in 5 patients (9%) in each case. Others were burns 3 (5.5%), infections, tumours and snake bites.
Also, from the study, it was observed that the majority of the stumps healed primarily before discharge in 21 (39%). However, the commonest complication was infection in 14 patients (26.0%) and this lead to revision of stumps in 8 patients (15%). There were 7 mortalities, e of these were related to the primary pathology such as trauma and diabetes.

Of the 8 patients who had revision of stumps six had below knee amputation, one above knee and needed a high above knee and one ray amputation needed a below knee. Given the fact that the commonest indication for amputation was trauma, a Chi-square test against the outcome was done with the P value 0.0000. This was less than 0.05 and was statistically significant. This means that the general trend in the outcome in the majority of the patients is primary wound healing before the patients are discharged. However, infection of the stump was the commonest complication.
INTRODUCTION

Background Information

The study was carried out at the University Teaching Hospital (UTH) in Lusaka. The city has over one million inhabitants and it is geographically centrally located in the country. University Teaching Hospital is the largest tertiary referral centre for the whole country, with a bed capacity of over 1800 (1). Thus, the hospital does not only cater for the Lusaka residents but also those coming from distant places in rural areas.

Medical records and audits have shown that the majority of amputations are done by five general surgical units. There are, however, a few amputations which are done by orthopaedic units, and these are mainly because of tumours. The problem is that the general surgeons are very busy with other emergencies. Thus there is divided attention especially in terms of preparation of stumps for prosthesis which is not usually done (1). The other problem is congestion in the wards and patients are usually discharged early before adequate arrangements for prostheses are made. Also, follow up of these patients is difficult as some come from distant places.
STATEMENT OF THE PROBLEM

Amputation of a limb is always distressing and the consequences of this loss can be devastating. In the developing world it is often impossible to obtain a prosthesis and a large extended family may be dependent on the amputee for their livelihood. The University Teaching Hospital, being a national referral centre, receives patients from all over the country and previous studies have shown that these patients who eventually require amputation are in the prime of their lives with maximum family responsibilities and earning capacities.

Trauma due to road traffic accidents is the commonest indication for amputation in Lusaka (1). Trauma is beyond the surgeons’ control and should be tackled by those in authority at the national level. There are, however some preventable conditions such as diabetes, skin tumours and burns which with a timely intervention could prevent the serious consequences developing and leading to amputation.

The problem starts when deciding the optimum time for an amputation. Many patients come in an emergency setting and amputations are done by busy general surgical units. Depending on the pathology, some patients seek advice very late when the disease process is advanced whereas other patients do not give consent readily and this delays the operation and in case of early infections, dissemination is more likely with time.

Selection of the optimum level for amputation can be difficult especially in inexperienced hands. Apart from the nature of flaps used and tension applied on sutures, post operatively wound care and congestion in the ward predispose the patient to infections.
Preparation of the stump for prosthesis is almost never done. Prosthetists and social workers are not usually involved while the patient is admitted. It is against this background that this study was done.
AIMS AND OBJECTIVES

1. To determine the common indications for amputations

2. To identify the common complications encountered in these amputees.

3. To identify the problems associated with management of these amputees that lead to these complications and advise remedial measures.
RATIONALE/JUSTIFICATION

There is need to select an optimum level of amputation if some of the early complications are to be avoided (2,3,4). Review of audits in general surgical units, for example, have shown an increase in the revision of stumps after an initial amputation. This is not only a drain on the already meagre resources as the patient will be operated more than once in theatre, but also patients tend to stay longer on the wards occupying a bed which would have been occupied by another patient had the initial operation been done at the right level. Also, the longer the patient stays the greater are the chances of developing other complications which may not necessarily be related to the initial pathology; hypostatic pneumonia especially in the elderly being the most important (5). Cross infection is another possibility particularly in an environment which deals with a large load of sepsis.
LITERATURE REVIEW

(i) Definition

Amputation is the removal of a limb or other appendage or outgrowth of the body (6) In this case, it is the practice of removing a limb.

(ii) Historical Perspective

It is the most ancient of all operations and it was used as a form of punishment in many of the so called older civilised societies and is still carried out today in some primitive cultures. Archeological evidence indicates that even among prehistoric people amputations were performed (1,7).

Early surgical amputation was a crude operation by which a limb was rapidly severed from an unanaesthetised patient; and for haemostasis, the open stump was crushed or was dipped in boiling oil. Early in the sixteenth century amputation surgery and prosthetics were much improved by Ambroise Pare, a French military surgeon. He was the first to use ligature for haemostasis.

(iii) Indications:

Colloquially the indications for amputations are the three - Ds-(3) the dead, the dangerous and the damn nuisance limbs (3,8,9).

(a) Dead Limb: A Limb may be dead due to peripheral vascular disease. There may be occlusion or stenosis of the vessel resulting in ischaemia to the limbs and later gangrene. Occlusion may be caused by either thrombosis in situ or embolism, the former being commoner (10). In the western countries the most common indication for amputation remains obliterative arterial disease leading to ischaemia (1,3,4,9). The risk factors associated with this type of ischaemia include smoking, old age and high fat diet (11).
J.R.M. Miller (12) reported in 1980 that in East, Central and Southern Africa there exists a different type of ischaemia which affects limbs of relatively young patients of about 30 years and at times even the very young. The common feature which these patients had was a background of chronic ill health - including severe malnutrition, chronic diarrhoea and pulmonary tuberculosis. He called this condition tropical coagulopathic ischaemia (12).

As recent as 80 years ago, the only treatment of acute limb ischaemia even in developed countries was amputation (13). To-day, there are a number of treatment options available to patients who present early.

Early symptoms of peripheral vascular disease in lower limbs include; intermittent claudication and rest pain, and these may progress to ulceration and gangrene if there is no intervention (1,3,9,14). Before embarking on amputation, an ischaemic limb may be salvaged by observing certain basic rules such as doing exercises. This has been observed especially when a patient is experiencing intermittent claudication. Other basic measures include stopping smoking.

In developed nations who have better facilities for localising the site of occlusion such as Doppler, several methods have been used to recanalise or bypass such damaged vessels (13,15). If such methods are employed and successful, amputations become less likely.

Other causes of ischaemia which may lead to the death of a limb are diabetes, Buerger’s disease and Raynaud’s disease. Another cause of dead limb is severe trauma such as a traumatic amputation or where there is neurovascular damage in open tibial fracture type IIIc. This is common in road traffic accident, train accidents and gunshots and landmine injuries (16). A limb which has been crushed is not only dead, but also, dangerous as it may lead to crush syndrome and renal failure (3,8,9). A severely burnt limb may be dead, primarily because
of the depth or secondarily due to compartment syndrome in eschar formation (1,8). These are common in children and adults who are epileptic.

In Zambia, in the University Teaching Hospital Lusaka, Mulla et al found that the commonest indication for a dead limb was trauma, mainly due to road traffic accidents (1). In the same study it was found that the patients who suffer from trauma are relatively young compared to the ones in the Western world, making it easier for the former to undergo rehabilitation using prosthesis (1). This is in agreement with other studies done in the West where ischaemia in elderly patients is the commonest indication (1,4,9,16) and in developing countries where trauma is the commonest indication. In the Sudan, for example, trauma due to road traffic accident was the commonest indication followed by diabetes and Madura foot and then war injuries. Thus we find here that war situation can influence the prevalence of amputations (17).

(b) **The deadly or dangerous limb.** This includes crushed limbs, with gas or wet gangrene. Other causes are chronic osteomyelitis and cellulitis (1, 3). A limb that harbours a malignant tumour is also dangerous for it is locally destructive and eventually spreads systemically. An example is osteosarcoma (3,8).

(c) **The damn nuisance limb** - severe contracture or paralysis like in poliomyelitis may make the limb impossible to use or may hinder walking or any other movement. In such cases, amputation may improve mobility. In severe rest pain without gangrene in a patient with an ischaemic foot, amputation may improve quality of life (3,18).

(iii) **Amputation Levels of the Lower Limb.** (Also see Diagrams in the appendix).

Amputations through the lower limb account for 85% of all amputations performed at the present time and are statistically the most important. Recent innovations in amputation techniques and in post operative care, especially the rigid dressing approach and the newer prosthetic techniques have greatly altered the approach to surgery and
rehabilitation. The amputation stump and its prosthesis must assume the walking and weight-bearing functions of the amputated limb. A strong and dynamic stump must be created, that will function as a motor and sensory end organ. Burgers has pointed out that the stump should function as a foot-like end organ with the prosthesis serving as the "shoe" on this "foot" (7,19).

Many of the older ideas regarding levels of amputation, placement of scars and techniques of surgery have been discarded or found to be relatively unimportant in view of recent advances. Modern total contact prosthesis can be fitted satisfactorily on any properly constructed and well healed lower extremity amputation stump, usually resulting in excellent function.

Numerous reports in the literature have established that the success of rehabilitation following amputation is directly related to the level of limb loss. At least 90% of patients with below-knee amputations will successfully use prosthesis in contrast to a success rate of 25% or less of those with above knee amputations. The primary factor is the marked increase in energy requirement by the amputees with above-knee prosthesis compared to patients with a below knee prosthesis (7).

The following are the sites at which amputation can be done (1,3,4,9)

(a) Toe - this is the most frequently amputated part of the lower limb.

(b) Ray amputation - It involves the removal of the toe and metatarsal head. There is no prosthesis required. Amputation of the big toe leads to unstable weight bearing and some difficulty with ambulation.

(c) Transmetatarsal - This needs a viable long plantar flap for good healing. It preserves normal weight bearing. There is no increased energy expenditure when walking and gait is smooth.
(d) Symes amputation - Preservation of the posterior tibial vessels which supply the heal pad and the inferior margin of the foot is important.

(e) Below knee amputation. Anterior flap should be 8-10cm below the tibial tuberosity with a long posterior flap or skewed flap. In order to give necessary leverage for the prosthesis the stump should not be less than 12.5 cm long or 7.5 cm above ankle joint.

(f) Through-knee amputation. This gives a wide stump. This together with Gritti Stokes amputation have been described as distal above knee because they lack the knee joint (9). It is unsightly cosmetically. Heals well when equal lateral flaps are used as opposed to conventional anterior/posterior flaps.

(g) Gritti - Stokes amputation - performed at the same level as supracondylar amputation. The patella and quadriceps are preserved. Articular surface of the patella is shaved off and drilled to the lower end of the femur and kept in position by sutures. It heals readily, though prosthesis fitting is not very good (20).

(h) Above knee amputation exact level of amputation not important.

(i) Hip disarticulation – Through an anterior incision running just below the inguinal ligament and extending posteriorly to the lower part of the buttock skin, the femoral triangle is exposed and the femoral artery and vein are ligated at the level of the inguinal ligament. The anterior muscles are divided from the pelvis until the hip joint is exposed. The capsule and iliofemoral ligaments are divided allowing the head to be dislocated. The
The sciatic nerve is divided and secured with a ligature to control the axial artery. Careful haemostasis is obtained and the flaps are closed with suction draw.

(j) Hindquarter amputation – anterior skin incision runs just distal to inguinal ligament and the posterior skin flap incorporates most of the skin of the buttock and some of the muscle fibres of gluteus maximus and medius to carry blood supply.

(k) Translumbar amputation (hemicorporectomy) Amputation is made at the level of the second lumbar vertebra.

Amputations should be performed at the level at which healing is most likely to be complete, but which will also permit the most efficient use of the limb following rehabilitation (1,2,9). Providing there is no contraindication, there is general agreement amongst surgeons and prosthetists that below knee amputation (BKA) is the operation of choice as the patients tend to use less energy when walking with prostheses (1,9,21). Although BKA are preferred, they are associated with poor wound healing resulting in increased rates of re-amputations.

A. Kald et al showed, in their series, that out of 131 patients 76 (58%) had amputations above knee (AKA) and 55 (42%) had below knee amputations (BKA). Of the 55 who had BKA, 8(15%) had a re-amputation and of the 76 who had AKA only 4(5%) had re-amputation. There were 21 (38%) BKA whose wound healing was delayed and 6 (8%) AKA who had this problem. (11). In Khartoum Mohammed et al found that diabetic patients had a higher rate of revisions compared to other conditions (17).

There is no infallible method of selecting the optimum level for amputation (16). Depending on the site of pathology and considerations for prosthesis the following methods have been used to help in the determination of the levels (9,14,20). Note that these are used in the Western World where ischaemia is the main problem.
(a) The measurement of blood pressure in the thigh, ankle and toes with Doppler ultrasound device and pneumatic cuffs.

(b) Xenon (Xe,133) studies - Skin clearance of xenon may help in determining the level.

(c) Transcutaneous measurement of oxygen tension. In many series if Tc P02 is more than 40mmHg, there is a higher chance of the wound healing at that level.

(d) Laser Doppler measurements of velocity of flow in peripheral circulation.

(e) Skin florescence studies with a fluorometer after intravenous injection of dye.

(f) Skin perfusion pressure measurement photoelectrically.

Inspite of using all these high tech methods to help predict the site for a good outcome, no single method is good enough and the best still remains clinical assessment and experience by the surgeon (9).

In developing countries such as Zambia where trauma is the most common indication clinical judgement is important (2). Amputation should not be considered synonymous with failure of therapy. It is a means of achieving the same objectives as arterial surgery or radiation and chemotherapy but in circumstances when the extent of set tissue injury precludes preservation of a functional limb (9).

Recognition of the importance for rehabilitation of conserving the knee joint has led, in recent years, to the marked increase in the ratio of below knee to above knee amputations. However, wound healing in BKA remains a considerable problem. While blood supply and surgical technique are no doubt the most critical factors, post operative care of the stump is important for successful healing.

Some surgeons have used plaster dressings on the stump, but it has the disadvantage of failure by medical staff to inspect the wound, it is heavy and it is difficult to apply and remove, and because of this, it has fallen out of favour (16).

Apart from the selection of the optimum level for amputation and the post operative care, the nature of the flaps contribute greatly to the outcome. There is an anatomical difference in the
blood supply to the skin of the leg. The blood supply is generally assumed to derive from the lower popliteal and tibial vessels. This is augmented by muscular collateral vessels which pierce the deep fascia. This is the rationale behind the adoption of the long posterior musculo cutaneous flaps in the standard below knee amputations (14).

Haertsh (16) showed that there is an arterial plexus which lies just superficial to the deep fascia and from which the skin is supplied. He also showed that the vessels accompanying the saphenous and sural nerves provided a major source of blood supply to the skin on the medial and posterior aspects of the leg. This led to the preference of a more medially based posterior flap in below knee amputations. For similar reasons the concept of the skewed BKA flaps is not new. (16)

In through knee amputations, utilisation of lateral and medial flaps gives better results than the anterior and posterior flaps (9).

(iv) Complications of Amputations

These can be divided into early and late complications (3,4,9).

(a) Early complications include reactionary haemorrhage, haematoma formation and infection of the stump. Infection is commoner in patients with distal sepsis at the time of amputation. A guillotine amputation is advised first. Gas gangrene can be a big problem, especially in above knee amputations due to contamination of the stump by faecal matter from the patients themselves.

Wound dehiscence and gangrene of the flaps may result due to ischaemia. Another, though uncommon problem, is fat embolism. Wound dehiscence may be due to poor blood supply, infection or a high haemoglobin of more than 13g/dl. Haemodilution is advised preoperatively on such cases. Thrombo-embolism is another common complication. This is due to prolonged
immobilisation preoperatively, postoperatively or due to ligation of large veins at operation resulting in formation of thrombi.

(b) In late complications, pain is usually the presenting complaint. This may be due to unresolved infection in case of a sinus, osteitis or sequestrum. Other causes of pain may be an adherent scar to bone or an amputation neuroma; which may become attached to skin, muscle or fibrous tissue.

The phantom limb phenomenon may also be another problem. The patient may not only feel that the amputated part of the limb is still attached, but also that it is a source of pain.

(v) Biomechanical Aspects of Amputees.

Energy expenditure is increased in amputees compared with normal subjects when prostheses are used. In below knee prostheses, energy expenditure is increased 10-40%, in above knee it is 50-70% and when crutches are used, it is 60%. The forward velocity in all amputees is significantly lower, and it is more so in above knee than below knee (9). These considerations should be taken into account when deciding on amputation levels.
BIAS AND SHORTCOMINGS

Literature review has shown that the commonest indication for amputation in most third world countries is trauma either due to road traffic accident or war injuries (17). These patients may suffer other injuries which may influence the morbidity and mortality. Thus the complications seen in this study were often related to other injuries such as head or spinal injuries and were therefore confounding variables.
PATIENTS AND METHODS

This was a prospective study of 54 patients who underwent amputation of their lower limbs in all general surgical and Orthopaedic units in the University Teaching Hospital, Lusaka. In this study the definition of a major amputation was the removal of the lower limb from as proximal as a hindquater, down to a ray amputation. Toe amputations or disarticulations were not included. The study was done between October 1997 to April 1999. Clearance from the Ethical Committee was obtained before the study. The data required for the study was obtained by administering a structured questionnaire.

Indication, selection of the level of amputation and the nature of flaps were determined by the attending surgeons. The influence of the status of the surgeon carrying out the operation was not made a focal point in the study.

Following amputation, the patients were followed up in the wards and healing process monitored. Any complications such as haemorrhage, infection of stump, bacteriology where necessary were noted. Stump care and preparation for prostheses was monitored up to the orthopaedic workshop where prostheses were made. All the patients who disappeared with their files were not included in the study.

Data analysis was done using EPI – Info Statistical software.
RESULTS

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Admission</td>
<td>42</td>
<td>76%</td>
</tr>
<tr>
<td>Referred</td>
<td>12</td>
<td>24%</td>
</tr>
</tbody>
</table>

There were a total of 54 patients who were admitted to UTH between October 1997 and April 1999. Of these 42 (76%) came directly to UTH and 12 (24%) were referred from elsewhere. One of the direct admissions came from a medical ward in the UTH.
### TABLE 2  Referred admissions

<table>
<thead>
<tr>
<th>Place</th>
<th>Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHILANGA</td>
<td>2</td>
</tr>
<tr>
<td>KABOMPO</td>
<td>1</td>
</tr>
<tr>
<td>KAFUE</td>
<td>1</td>
</tr>
<tr>
<td>KASAMA</td>
<td>1</td>
</tr>
<tr>
<td>LITETA</td>
<td>2</td>
</tr>
<tr>
<td>MACHA</td>
<td>1</td>
</tr>
<tr>
<td>MAINA SOKO</td>
<td>1</td>
</tr>
<tr>
<td>MAZABUKA</td>
<td>1</td>
</tr>
<tr>
<td>MEDICAL WARD</td>
<td>1</td>
</tr>
<tr>
<td>MONGU</td>
<td>1</td>
</tr>
<tr>
<td>MUMPASHYA</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

This table shows the places from where the patients were referred.
TABLE 3  Sex Breakdown

<table>
<thead>
<tr>
<th>SEX</th>
<th>NUMBER</th>
<th>PERCENTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEMALE</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>MALE</td>
<td>40</td>
<td>74</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
<td>100</td>
</tr>
</tbody>
</table>

There were more males than females 40 (74%): 14 (26%)M:F; 3:1
TABLE 4  Age Distribution

<table>
<thead>
<tr>
<th>AGE</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 10</td>
<td>4</td>
</tr>
<tr>
<td>11 – 20</td>
<td>5</td>
</tr>
<tr>
<td>21 – 30</td>
<td>13</td>
</tr>
<tr>
<td>31 – 40</td>
<td>7</td>
</tr>
<tr>
<td>41 – 50</td>
<td>5</td>
</tr>
<tr>
<td>51 – 60</td>
<td>7</td>
</tr>
<tr>
<td>61 – 70</td>
<td>8</td>
</tr>
<tr>
<td>71 – 80</td>
<td>4</td>
</tr>
<tr>
<td>81 – 90</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
</tr>
</tbody>
</table>

The age distribution was wide between 1 year and 89 years with the mean age of 41 years.

The majority of the patients fell in the age group between 21 to 30 years (24%).
### TABLE 5 Indications for Amputations

<table>
<thead>
<tr>
<th>INDICATIONS</th>
<th>NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma / Gunshot</td>
<td>1</td>
</tr>
<tr>
<td>Trauma / Infection</td>
<td>1</td>
</tr>
<tr>
<td>Trauma / RTA</td>
<td>12</td>
</tr>
<tr>
<td>Trauma / Train Accident</td>
<td>3</td>
</tr>
<tr>
<td>Burns/Epilepsy</td>
<td>3</td>
</tr>
<tr>
<td>Congenital</td>
<td>3</td>
</tr>
<tr>
<td>Diabetic</td>
<td>5</td>
</tr>
<tr>
<td>Diabetic/Carcinoma – clear cell</td>
<td>1</td>
</tr>
<tr>
<td>Infection – Necrotising fasciitis</td>
<td>3</td>
</tr>
<tr>
<td>Infection + Thrombosis</td>
<td>1</td>
</tr>
<tr>
<td>Infection / Gas Gangrene</td>
<td>1</td>
</tr>
<tr>
<td>Snake Bite / Tourniquet</td>
<td>1</td>
</tr>
<tr>
<td>Tumour</td>
<td>5</td>
</tr>
<tr>
<td>Dry Gangrene</td>
<td>12</td>
</tr>
<tr>
<td>Stab Wound</td>
<td>1</td>
</tr>
<tr>
<td>Trophic Ulcer</td>
<td>1</td>
</tr>
</tbody>
</table>

The commonest indication for amputation was trauma in 17 patients (33.5%) and RTA contributed to this trauma group in 12 patients (22.0%) followed by train accident in 3 (5.5%). The second common cause was dry gangrene 12 (22.0%) followed by tumours in 5 (9%) and diabetes 5 (9%). All patients who had burns also had epilepsy 3 (5.5%). One patient had a snake bite and a tourniquet had been applied before referral from a rural centre.
The pie chart above shows the common levels of amputations. There were 22(40%) above knee amputations and 17(30%) below knee amputations. Of these 3(6%) patients had both lower limbs amputated one of whom had above knee amputation in both limbs and the other two had one above knee on right (RT) side and below knee on left (LT) side.
### TABLE 6  Type of Flaps

<table>
<thead>
<tr>
<th>TYPE OF FLAPS USED</th>
<th>NUMBER</th>
<th>PERCENT</th>
<th>CUMMULATIVE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antero-posterior equal</td>
<td>38</td>
<td>70</td>
<td>70%</td>
</tr>
<tr>
<td>Long Plantar</td>
<td>1</td>
<td>2</td>
<td>72%</td>
</tr>
<tr>
<td>Long Posterior</td>
<td>7</td>
<td>13</td>
<td>85%</td>
</tr>
<tr>
<td>Medial Lateral</td>
<td>2</td>
<td>4</td>
<td>89%</td>
</tr>
<tr>
<td>Open Wound</td>
<td>6</td>
<td>11</td>
<td>100%</td>
</tr>
</tbody>
</table>

The commonest flaps used were antero-posterior equal 38 (70%), long posterior 7 (13%) and 6 (11%) had open wounds, which were closed later.
### TABLE 7  Amputation Stump Preparation

<table>
<thead>
<tr>
<th>STUMP PREPARATION</th>
<th>NUMBER</th>
<th>PERCENT</th>
<th>CUMMULATIVE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandaging</td>
<td>10</td>
<td>18</td>
<td>18%</td>
</tr>
<tr>
<td>None</td>
<td>44</td>
<td>82</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Preparation of stumps was done in only 10 (18%) for prosthesis by way of bandaging.
<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>NUMBER</th>
<th>PERCENT</th>
<th>CUMMULATIVE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contracture Rt. Knee</td>
<td>2</td>
<td>4</td>
<td>4%</td>
</tr>
<tr>
<td>Decubitus ulcer, mortality</td>
<td>1</td>
<td>2</td>
<td>6%</td>
</tr>
<tr>
<td>Healed</td>
<td>21</td>
<td>39</td>
<td>44%</td>
</tr>
<tr>
<td>Healed, Abcess</td>
<td>1</td>
<td>2</td>
<td>46%</td>
</tr>
<tr>
<td>Infected Decubitus Ulcer</td>
<td>1</td>
<td>2</td>
<td>48%</td>
</tr>
<tr>
<td>Infected healed</td>
<td>10</td>
<td>18</td>
<td>67%</td>
</tr>
<tr>
<td>Infected and phantom pain</td>
<td>1</td>
<td>2</td>
<td>69%</td>
</tr>
<tr>
<td>Infected, mortality</td>
<td>2</td>
<td>4</td>
<td>72%</td>
</tr>
<tr>
<td>Mortality</td>
<td>4</td>
<td>7</td>
<td>80%</td>
</tr>
<tr>
<td>Phantom pain, healed</td>
<td>1</td>
<td>2</td>
<td>82%</td>
</tr>
<tr>
<td>Post-op Haemorrhage ligated</td>
<td>1</td>
<td>2</td>
<td>83%</td>
</tr>
<tr>
<td>Revised</td>
<td>8</td>
<td>14</td>
<td>98%</td>
</tr>
<tr>
<td>Wound Breakdown, grafted</td>
<td>1</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>54</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 8 shows the outcome which was variable. The majority of patients had good wound healing at discharge 21(38.9%) patients. The commonest complication was infection which occurred in 14(26%). There were seven mortalities two of the patients had developed severe infections and four mortalities were related to the primary pathology of diabetes and trauma.
infections and four mortalities were related to the primary pathology of diabetes and trauma.

Common infections seen were as shown in the pie chart.

Only eight specimen of pus swabs were collected. The commonest organism isolated was *Pseudomonas aeruginosa* 4 followed by *Proteus mirabilis* 2 Klebsiella species and *Staphylococcus aureus* were isolated once in each case 1.
TABLE 9  \( n = 8 \)

<table>
<thead>
<tr>
<th>ORGANISM</th>
<th>SENSITIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staph aureus</td>
<td>Ciprofloxacin and cloxacillin</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>Ciprofloxacin</td>
</tr>
<tr>
<td></td>
<td>Polymixin B, Gentamicin, Cephalexin, cefotaxime</td>
</tr>
<tr>
<td>Proteus mirabilis</td>
<td>Cefotaxime, Gentamicin, chloramphenicol</td>
</tr>
<tr>
<td>Klebsiella</td>
<td>Ciprofloxacin</td>
</tr>
</tbody>
</table>

The table above shows the sensitivity pattern of the organisms which were isolated. Of note is the fact that out of the 3 commonly used drugs – benzyl penicillin, gentamicin and metronidazole, only gentamicin had an effect on proteus and pseudomonas.
Patients with or without a prosthesis are tabulated below.

**TABLE 10  Prosthetic fitting**

<table>
<thead>
<tr>
<th>PROSTHESIS</th>
<th>NUMBER</th>
<th>PERCENT</th>
<th>CUMMULATIVE TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>44</td>
<td>82</td>
<td>82%</td>
</tr>
<tr>
<td>Given</td>
<td>10</td>
<td>18</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>54</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Forty four (82%) patients did not have a prosthesis fitted and 10 (18%) patients had a prosthesis fitted onto the amputation stump.
DISCUSSION

This prospective study looked at the common indications and complications of major lower limb amputations in the University Teaching Hospital, Lusaka.

There were 54 patients in the study, of which 42 (76%) were admitted directly to the University Teaching Hospital (UTH) and 12 (24%) were referred from elsewhere. This is shown in table 1 and table 2. Of the 42 who were admitted directly to UTH one was initially admitted in the medical ward with cerebro-vascular accident and was later referred to the Department of Surgery when he developed gangrene of the left leg. This pattern of admissions is not surprising as the UTH is the major referral centre in the country.

In this study there were more male 40 (74%) than female 14 (26%) patients, giving a male:female ratio of 3:1. This shows that mainly males are usually the victims of amputations because they are in professions that are likely to be involved in trauma especially road accidents. These could be truck drivers or minibus drivers and others in risky professions.

There was a wide range in terms of age distribution. The commonest age group was between 21-30 years 13 (24%), but the mean age was 41 years. The average age group is slightly less than the quoted in the literature in places such as Angola and Cambodia. This may be due to the fact that the war situation in those countries forces relatively young men to be recruited in their armies unlike Zambia which is not at war (22). Compared to developed countries our amputees are young whereas patients in the developed would are usually above 65 years of age on average (11).
The commonest indication for amputation in our setting was mainly trauma 17 (33.5%) and road traffic accidents contributed to this group in 12 patients (22%). Some of the reasons may be the fact that Lusaka, being not only the capital, but also the most populated city in the country has a heavy traffic load and it probably records the highest number of accidents. The majority of the workers walk to and from work and are at risk of being injured as pedestrians. Those who can afford transport mainly use minibuses which are usually overloaded. Other possible reasons are; drunkenness when driving, poor roads, inadequate signs and lack of traffic controls. On the other hand the common indication in the West is peripheral vascular disease (1,4,9,16)

The second common indication was dry gangrene. What was interesting in this study was that some patients with dry gangrene had no apparent cause. They did not have any wounds on their limbs and were not diabetic. Of note in these patients was the general debility. Good examples were two patients one of whom was on anti-tuberculous treatment and the other had cerebrovascular accident prior to the development of gangrene in the limbs. It is difficult to explain what could have caused this gangrene as clinical evaluation was unhelpful.

J.R.M. Miller (12) described a condition called tropical coagulopathic ischaemia. He described the existence of this condition in East and Southern Africa. This is a condition seen in relatively young patients compared with patients in the developed nations and the common feature which the patients with chronic tropical coagulopathic ischaemia have is chronic ill health. They tend to have a problem with fibrinolysis and hence blood clots in the vessels. More needs to be done to find out the cause of this ischaemia.
The other four unfortunate amputations worthy of discussion were three epileptic patients who sustained deep burns after convulsions and fell on fire and one girl who had a snake bite on her foot and a tourniquet was applied on the leg in order to prevent snake venom from spreading proximally. The girl was referred to UTH five days later with a gangrenous limb. These could have been avoided by appropriate treatment (23,24).

Different studies in different centres have shown different indications for amputations. Within this region Ahuka Ona Longombe and K.M Lusi (25) in their series in a rural hospital of North-eastern Zaire (now Congo DR) found that the common indications for amputation were severe wound infections in 34% and epidermoid carcinoma in (24%). In Nigeria, in a similar setting as in Zaire, malignancies were the commonest followed by trauma (26). And yet in Angola, littered with as many as 15 million land mines-averaging more than one land mine for every man, woman and child the trauma responsible for amputation is mainly landmine and gunshots injuries. Similar reasons are given in Cambodia (22), namely trauma due to landmine and gunshot related injuries.

The commonest level of amputation was above knee followed by below knee. Three patients had both limbs amputated in each case, two of whom had right above knee and left below knee and the third had both limbs above knee. The level of amputation is largely dictated by the nature of the pathology (2,6,9). But cost and energy factors also need to be considered.

(a) Cost of prosthesis -Above knee prostheses cost K120,000 in UTH. And below knee ones cost half the price -K60,000. Through knee prostheses cost K85,000.
Biomechanically there is more energy spent when an above knee prosthesis is used than below knee (4).

Of the 54 patients only 10(18%) had their stumps prepared for prosthesis by way of bandaging, and out of 47 patients who were discharged only eight as at submission of this paper actually had prostheses. The reasons are partly due to the operating surgeons who do not usually inform their patients about the availability of the facility and this is reflected in the number of patients who had their stumps purposely prepared; and partly this was due to the cost of the prostheses. As regards the general surgeons who usually look after the majority of these amputees, they are usually very busy and are already overloaded with other patients and it is difficult for them to concentrate on educating these patients on rehabilitation using an artificial limb. In this regard, social workers and prosthetists may be incorporated in the management of these patients so that information is given to the patients. Another problem is early discharge due to shortage of bed space for so many patients and once the patients are discharged some are not able to come back because of travel expenses as they come from far away places like Kabompo in North-western Province. The majority of amputees cannot afford these prostheses and opt for the simpler and cheaper methods of mobilisation using crutches which cost only K10,000.

Apart from the prostheses the other outcomes were as variable as the indications and some outcomes occurred in combinations. What was clear from the study was that given the common indication as trauma, there was a greater likelihood that the wound would heal primarily. This fact is shown when the indications are related to the outcome by Chi-square test and the P value is <0.000 which is less than 0.05. This is statistically significant.
However, some important outcomes are worth mentioning here. Infection was the commonest complication 33%. There were 8(15%) revision of stumps and these revisions were directly related to severe infections. In this study out of 8 revisions, 6 were below knee and had above-knee revisions, one had ray amputation and underwent a below knee revision and one had an above knee and had a high above knee. Note that those patients who had their stumps left open and were closed later are not included in the number of patients who had revision of stump. Some studies have shown a 30% revision rates, especially for below knee amputations mainly because of ischaemia and infection. In this study the revision rates were almost half of that quoted in the literature for below knee amputations. This was not a very bad outcome.

Only eight specimens of pus swabs were randomly collected from the infected stumps for culture and sensitivity. The reason as to why only few swabs from the infected stumps were done was because of the inavailability of the culture media in the labolatory. Most of the time, the culture media were not in stock. Thus only a few swabs were done only during those times when it was possible to do microscopy, culture and sensitivity. The commonest organism isolated was Pseudomonas aeruginosa, 49% followed by Proteus mirabilis (25%). This may suggest that the infections are nosocomial as these organisms are commonly found in a hospital setting. However, the number of specimens was small and the pattern of organisms responsible for stump infection may not be representative. If however, the general pattern is similar, then the commonly used antibiotics of benzyl penicillin, gentamicin and metronidazole are not very helpful (these were found to be used emperically post operatively in most amputees because they are usually readily available and relatively cheap). The
antibiotics which were found to be very helpful were cefotaxime and ciprofloxacin. Gentamicin had some effects against pseudomonas and proteus. Thus based on this limited data the indiscriminate use of benzyl penicillin and metronidazole does not appear to be cost effective and merits further study.
CONCLUSIONS

1. In the University Teaching Hospital, trauma was the commonest reason for amputation followed by gangrene of undetermined aetiology. Diabetes and tumours were next in frequency. The male:female ratio was 3:1.

2. The commonest complication encountered in these amputees was infection and was found to be the main problem.

3. Below knee amputation was a common factor in stump revision.

4. Most patients were discharged home with crutches, and few had a prosthesis fitted at the time of discharge. Rapid turnover of patients in the surgical wards and cost factors could explain this form of management.

5. The study also found that as in-patients amputees had limited access to the orthopaedic workshop. This could have been a factor for non availability of prostheses at the time of discharge from hospital.

6. More needs to be done on microscopy culture and sensitivity in order to find the common organisms which infect the stump.
RECOMMENDATIONS

1. Guidelines need to be implemented at the University Teaching Hospital to educate staff and patients on the merits of a multi-disciplinary approach to early involvement of prosthetists, physiotherapists and social workers.

2. When in doubt about the level of amputation, an above knee level is advisable.

3. Research is required to determine the aetiology of dry gangrene noted in 22 percent of these patients.

4. A vascular unit with access to Doppler ultrasound is recommended.

5. Conditions such as tourniquet use in snake bites and deep limb burns in epileptics could be prevented in the pre-hospital setting by appropriate education and management by Health Care Workers.

6. The cost effectiveness of antibiotic usage in these patients needs to be the subject of future research.
REFERENCES


Figure 1
(a) Hip disarticulation incision
(b) Post Operative

Figure 2
(a) Above knee amputation - anterior/posterior flaps
(b) Post Operative
Figure 3  (a) (i) Through Knee amputation - Medial/Lateral flaps
   (ii) Anterior/Posterior flaps
(b) Post Operative

Figure 4  (a) Below knee amputation - right leg anterior short flap. Posterior long flap
            - Left leg skewed flap
(b) Post Operative right leg
(c) Post Operative skewed flaps
Figure 5  (a) Symes Amputation  
(b) Post Operative

Figure 6  (a) Toe and ray amputation  
(b) Transmetatarsal amputation
APPENDIX IV

Syme's amputation - showing incision lines (a) and post operative (b)

These diagrams showing incision lines and post operative stumps were adapted from: Operative Surgery and Management, Third edition. Oxford: Butterworth - Heinemann Ltd., 1994: 937 - 955

and

PROFORMA

GENERAL SURGERY AMPUTATIONS

SURNAME:........................................FIRST NAMES:........................................
HOSPITAL NO...............AGE............SEX...............RACE:.............................
X-RAY NO (if any).............DATE OF ADMISSION:.................................
DIAGNOSIS AT ADMISSION:
(1)...............................................................................................................
(2)...............................................................................................................
(3)...............................................................................................................
(4)...............................................................................................................
MODE OF ONSET AND PROGRESSION OF DISEASE:

PAST MEDICAL HISTORY:
1. DIABETES  2. VASCULAR DISEASE  3. OTHER.
LEVEL OF AMPUTATION/ GUILLOTINE......DRESSING USED.........ABOVE KNEE.

NATURE OF FLAPS
1. ANTERIOR/POSTERIOR EQUAL/ BELOW KNEE
2. LONG POSTERIOR FLAP DRAIN/NO DRAIN
3. SKEWED FLAP
4. MEDIAL/LATERAL FBC: .................
SUGAR.......................................U/E........................................

OPERATOR
1. CONSULTANT/SR/REG.........................
OUTCOME OF STUMP:..........................

1) HEALED  2) INFECTED  3) GANGRENOUS  4) HAEMATOMA
5) REVISION AT HIGHER LEVEL
IF INFECTED - --BACTERIOLOGY --- M/C/S. (AEROBIC ONLY)
IF REVISED LEVEL OF REVISION ANTIBIOTICS