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Record Review of the Management of Patients Admitted for Diabetic Foot Complications

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Abstract

The human burden of diabetes is a consequence of devastating chronic complications. Common complications of diabetes are micro vascular disease (nephropathy, retinopathy and neuropathy) and increased risk of macro vascular disease (stroke, heart attack and peripheral vascular disease).

With the onset of neuropathy, many diabetic people are at risk of developing diabetic foot. Foot complications, especially foot ulcers, constitute a major public health problem for diabetes patients in sub-Saharan Africa and are an important cause of prolonged hospital admission and death in patients from this part of the continent

Aim

The descriptive study aims to determine clinical features, foot-related and cardiovascular risk factors, management, and clinical outcomes of patients admitted with diabetic foot in general surgery wards of the Pretoria Academic Hospital.

Methods and Materials

A retrospective audit of the surgical ward register and patient files was conducted for a period of two years – 2005 to 2006. All those patients who were admitted for the first time with diabetic foot complication were included in the analysis.

Results: Patients admitted with diabetic foot complications were 2.52 % and 4.58% out of the total admissions in female and in male surgical wards respectively.

A total of 81 records were identified, reviewed and analysed. Results of the study showed that 54.3% (n=44) were females and the mean age of the sample was 61.44 (± 12.9) years. Of the total number of patients 18.5 % (n 15) were smokers, 29.6% (n=24) had never smoked, and 37% (n=30) were ex-smokers.

The source of referral to surgical wards was not found in records for the majority of admissions, others were either sent from government hospitals or private practitioners to casualty. The mean length of stay in surgical wards was 13 (±11) days. The mean duration of diabetes was 12 years. First glucose on admission measured in 95 % of the sample was 12.6mmol/l and HbA1c was measured in only 30%.

Peripheral pulses were examined in 85% and in 18% of cases; both pulses were absent in the affected foot. Assessment of neurological status using Semmes Weinstein 5.07 monofilament was not done or other non-specific methods were used. Ulcers were assessed in 44% of cases but the documentation of size of site and appearance was poor. No classification system or grading of ulcers was used. Regarding cardiovascular risk; 67% had HT and were taking treatment. Lipid values were measured in less than 10% of subjects. Renal function was measured in 94%. Of all admissions 48% had below knee and 18.5 % above knee amputations. Approximately 33% of patients were readmitted, of which 23% of admissions were for problems in the same foot. On discharge 43% were prescribed ACE inhibitors, 33% aspirin and only 12% statins. Very few (n=03) patients reached the Diabetic Clinic of Pretoria Academic Hospital for follow up in the three months following discharge and none in reached the Kalafong Diabetic Clinic.

Conclusions

This study found that there was no standardised protocol for ulcer grading, detection of neuropathy or evaluation of cardiovascular risk. Long-term care of these patients could possibly be improved by involving other disciplines during the admission of patients with diabetic foot.

DECLARATION

I, Dr Rukhsana Khan hereby declare that the work on which this dissertation is based is original and that neither the whole work or any part of it has been, is being, or shall be submitted for another degree at this or any other university, institution for tertiary education or examining body.

Signed………………………….. Date……………………………….

Dr. Rukhsana Khan

DEDICATION

I dedicate this work to my husband and children who were always there whenever the going got tough. I thank my family for getting along when I was busy in my work and could not fully perform my duty as a wife and as mother and for all their support and prayers.

To my mother and my father, although they are not here to see me through this step of life, I shall always be glad that God Almighty gave me the best start in life through them.

God bless you all

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Ultimately, I would like to thank God Almighty for giving me life, inspiration, wisdom, knowledge and good health that enabled me to carry out this research successfully and get this far in life. To accomplish this, it was only by His grace. May His name always be praised.

ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ARBs	Angiotensin Receptor Blockers
CI	Confidence Interval
CRP	C Reactive Protein
CVD	Cardiovascular Disease
DM	Diabetes Mellitus
DCCT	Diabetes Control and Complications Trial
HDL	High Density Lipoproteins
HIV	Human Immuno-Deficiency Virus
HMG CoA	Hydroxymethylglutaryl Co Enzyme A
HTN	Hypertension
LDL	Low Density Lipoproteins
UKPDS	United Kingdom Perspective Diabetes Study

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Chapter 1

1.1 Introduction

Diabetes Mellitus (DM) is a chronic illness that requires continuous medical care and patient self-management education to prevent acute complications and to reduce the risk of long-term complications.[1]

Diabetes is a large and growing global health problem. It is projected that the number of individuals with diabetes will increase from an estimated 135 million in 1996 to a projected 300 million in 2025.[2] In America alone 182 000 deaths are linked to diabetes, making it the country with the third highest rate of deaths from diabetes in the world.

The human burden of diabetes is a consequence of devastating chronic complications.[3] Common complications of diabetes is micro vascular (nephropathy, retinopathy and neuropathy) and macro vascular disease (stroke, heart attack and peripheral vascular disease).[4]

With the onset of neuropathy, many diabetic people are at risk of developing a "diabetic foot". This is one of the main complications of diabetes and is defined as infection, ulceration and/or destruction of deep tissue associated with neurological abnormalities and various degrees of peripheral vascular disease in the lower limb.[5]

As many as 83% of non-traumatic lower-extremity amputations in America can be directly attributed to diabetes mellitus.[6]. According to the literature 25% of all hospital admissions of patients with diabetes in America and United Kingdom (UK) are for the treatment of infected foot ulcers. Fewer than 14% of patients admitted for diabetic foot complications receive appropriate lower extremity evaluation and when foot ulcers do develop one in five of these patients eventually has to undergo amputation.[7] Amputation rate is high in people with diabetes and the wound failure rate is also high. Even with successful healing of

primary amputation site, amputation of the part of same or contra lateral limb is as high as 50 %.[8]

Foot complications, especially foot ulcers, constitute a major public health problem for diabetes patients in sub-Saharan Africa and are an important cause of prolonged hospital admission and death in patients from this part of the continent.[9]

Africa is rapidly embracing western life style cultures, with a resultant increase in the prevalence of both diabetes and cardiovascular diseases. Because of this, a heavy burden is being imposed on the health care systems of African countries.[10]

Cardiovascular disease (CVD) is the major cause of mortality for individuals with diabetes. It is also a major contributor to morbidity and to the indirect costs of diabetes. Emphasis should be placed on reducing cardiovascular risk factors where possible, and clinicians should be alert for signs and symptoms of atherosclerosis.[11] Studies have shown that control of glycaemia, hypertension and hyperlipidemia significantly reduces the risk of micro vascular and cardiovascular complications in patients with diabetes. Many outcome studies suggest that unified care is an effective approach for the patients with diabetic foot problems.

1.2 Background

Among people diagnosed as having diabetes mellitus, the lifetime risk of developing a foot ulcer is estimated to be 15%.[12] On the basis of recent studies, the annual population-based incidence ranges from 1.0% to 4.1% and the prevalence ranges from 4% to 10%.[13] Lower extremity disease, including peripheral arterial disease, peripheral neuropathy, foot ulceration, or lower extremity amputation, is twice as common in diabetic people as in non-diabetic people and it affects 30% of diabetic people who are older than 40 years.[14] Foot ulcers cause substantial emotional, physical, productivity, and financial losses. The estimated costs of treating a diabetic foot ulcer were $28000 in a 1999 US

study, and $18000 (with no amputation) and $34000 (with amputation) in a 2000 Swedish study.[15]

Lower-extremity amputation varies from 1.5 to 7% and about 12 % of all hospitalised diabetic patients have foot ulceration.[16]

There is strong evidence from the main cohort studies of the diabetic population in developed countries that the duration of diabetes, metabolic control, blood pressure and ethnic and genetic factors are the main known determinants of vascular complications in diabetic people. Macrovascular complications of diabetes have been considered rare in Africa despite a high prevalence of hypertension. Coronary heart disease may affect 5-8% of all type 2 diabetic patients. Both population and hospital-based investigations now provide evidence of an increasing burden of CVD in Africa, diabetes mellitus being a great contributor to CVD.[16]

Health systems in Africa have evolved to treat acute infections rather than chronic diseases. This means that the training of health staff and health service organisations is not pre-disposed to the efficient and effective treatment of people with diabetes and its complications. It has been estimated that about 50% of amputations in diabetic patients are made necessary because of neglect and could have been prevented with early intervention.[17]

1.3 Literature Review

Diabetes mellitus (DM) is a group of metabolic diseases characterised by hyperglycaemia that results from defects in insulin secretion, insulin action or both, and is often accompanied by other metabolic and clinical abnormalities. It is a common cause of mortality and morbidity. The prevalence of Type 2 DM in adults in South Africa is approximately 4% in whites, 5% to 8% in blacks and 13% in Indians. In all groups, the incidence rises from the age of 35 to 40, and increases with advancing age, so that the prevalence is 30 times higher than the average in people aged 60.[18]

Diabetes is the commonest risk factor for non-traumatic lower-limb amputations. Annual population-based incidence of diabetic foot ulcers ranges from 1% to 4%, while the prevalence of foot ulcers is reported at between 5.3% and 10.5%. The lifetime risk for foot ulcer is estimated at 15%. [19]

A study from Mbanya and Sobngwi[16] summarises evidence of micro- and macro vascular diseases in diabetic patients, gathered from hospital and population base studies carried out in African continent over the past 10-15 years.

Diabetic micro vascular disease occurs as a result of the interplay of metabolic and haemodynamic factors. Blood pressure and metabolic control are the main determinants of the progression of disease in predisposed individuals.

Patients of African origin are thought to be at greater risk of developing micro vascular complications than Caucasians. Poor compliance with treatment blood pressure and blood glucose control and possibly genetic predisposition are the hypothesised contributors to this greater risk .[20]

Macro vascular disease occurs mostly in patients with type 2 diabetes, either as complication of diabetes or as part of the syndrome X. There is evidence from population studies of the rising prevalence of components of the metabolic syndrome.[21, 22]

Table 1 (adapted from a study by Jean Claude Mbanya and Eugene Sobngwi) shows the prevalence of diabetes complications in selected populations of Africa.[16]

Table 1. Prev of Diabetes Complications in Sel Population of Africa

Country	Author Reference	Year	Types of Diabetes	Sample Size	Sample Specificities	Prevalence
South Africa	Rolf et al [43]	1988	1 and 2	600		Nephropathy 23.8%
Sudan	El Mahdi et al[44]	1989	1 and 2	448	83% poorly controlled	Nephropathy 11.6% Retinopathy 18.5% Neuropathy 28.1% Peripheral vascular Disease 6.2% Coronary heart disease 4.2%
Nigeria	Akanji et al [45]	1990	1 and 2	50	Foot ulcer	Nephropathy 20%
Ethiopia	Lester et al [14]	1991	1 and 2	121	Duration >20 years	Nephropathy 29.8% Retinopathy 45.5% Neuropathy 36.4%
Ethiopia	Lester et al [12]	1992	1	431	Mean duration 15 years	Nephropathy 6.0% Retinopathy 9.5% Neuropathy 7.9%
Sudan	Elbagir et al [25]	1995	1	128	Duration ≥ 1 year	Nephropathy 22% Retinopathy 43% Neuropathy 37% Peripheral vascular disease 10% Cerebrovascular accidents 5.5%
South Africa	Gill et al [19]	1995	1	64	Mean duration 13.6 years	Nephropathy 28% Retinopathy 52% Peripheral Neuropathy 42%
South Africa	Levitt et al [46]	1995	IDDM and PD	30+30	Mean duration 7.5and 8.0 years	Microalbinuria 33 (ID) and 33% Retinopathy 40 (ID) and 33%
Burkina	Drabo et al [20]	1996	1 and 2	400	All patients followed 1991 - 1994	Nephropathy 24.8% Retinopathy 15.8% Peripheral Neuropathy 35.0%
Uganda	Nambuya et al [47]	1996	1 and 2	252	Newly diagnosed patients	Nephropathy 17.1% Peripheral Neuropathy 46.4% Impotence 22.2% of the men. Ischaemic heart disease 4.8% Foot ulcers 4.0%
South Africa	Levitt et al [8]	1997	1 and 2	300	Mean duration 8 years	Microalbuminuria 36.7% Retinopathy 55.4% Peripheral Neuropathy 27.6% Absent foot pulses 8.2% Amputations 1.4%
Ethiopia	Rahlenbeck et al [16]	1997	1 and 2		Duration > 5 years	Microalbuminuria Type 1: 33% Type 2: 36%
Cameroon	Sobngwi et al [9]	1999	1 and 2	64	Mean duration 5 years	Microalbuminuria 53.1% Retinopathy 37.5%
Libya	Kadiki et al [48]	1999	2	8922	All the patients followed between 1981 and 1990	Nephropathy 25.2% Retinopathy 30.5% Neuropathy 45.7%
Benin	Djrolo et al [43]	2001	1 and 2	152	Duration < 1 year	Nephropathy 28%

Peripheral vascular disease prevalence varies across sites from 4 to 28%.[23,24] The diagnosis of Doppler-diagnosed vascular lesion is reported as between 18 and 28%, contrasting with low clinical (absence of pulses) prevalence (4.4 to 8.2%).[24,25] A high proportion of patients have lower-limb arterial disease that

contributes to the development of diabetic foot lesions. It is common to see patients with diabetic foot ulcers as the presenting complaint of diabetes.

Foot problems are the most common reason for hospitalisation among diabetic patients, accounting for up to 25% of admissions. Regrettably, less than 14% of patients admitted for diabetic foot complications receive adequate lower-extremity evaluation and, when foot ulcers develop, one in five of these patients eventually have to undergo amputation.[26]

It is of primary importance that if a foot at risk is present other complications of DM must be sought and blood pressure, lipids and glucose treated optimally[16].

1.3.1 Risk Factors for Foot Ulceration

Foot-related conditions that increase the risk of ulcers and amputation are peripheral neuropathy, altered biomechanics, peripheral vascular disease, skin pathology, and trauma. Aside from these multiple causes, other contributory factors predispose to foot lesions (Table2)[22]. Intrinsic risk factors are those metabolic or biological characteristics which may or may not be related to diabetes but nevertheless contribute to the etiology of ulceration. Abnormal biomechanical functions often result from these complications of diabetes and predispose the foot to injury. Extrinsic factors include not only trauma (mechanical, thermal or chemical) but other factors, as set out in table 2. below.

Table 2. Intrinsic and Extrinsic Risk Factors for Foot Ulceration

Intrinsic Factors	Extrinsic Factors
Neuropathy	Minor trauma (mechanical)
Sensorimotor	*high planter pressures*
Autonomic	*shoe pressure*
Vascular Disease	*High impact*
Macro vascular	Thermal Injury
Micro vascular	*hot soaks*
Immunopathy	*Frostbite*
Susceptibility to infection	Chemical burns
Structural deformity	Bathroom Surgery
Limited joint Mobility	Occupational hazards
Nephropathy	Poor knowledge of diabetes
Age	Cigarette smoking
Duration of diabetes	Living alone
Previous ulceration	

1.3.2 Pathogenesis of Diabetic Foot Ulcers

Neuropathy

Nerve damage in persons with diabetes affects the motor, sensory and autonomic fibres. Motor neuropathy results in muscle weakness, atrophy and paresis. Sensory neuropathy leads to loss of the protective sensation to pain, pressure and temperature. In the absence of pain many problems may occur in an insensate foot, including ulceration, trauma and Charcot's neuroarthropathy. A combination of motor and sensory dysfunction can cause the patient to place abnormal stresses on the foot, resulting in trauma that may lead to infection. Autonomic sympathetic neuropathy causes vasodilatation and decreased sweating, which results in warm, over dry feet that are particularly prone to skin breakdown, as well as functional alterations in micro vascular flow. Autonomic dysfunction also results in loss of skin integrity, which provides an ideal site for skin infection.[23]

Ischemia

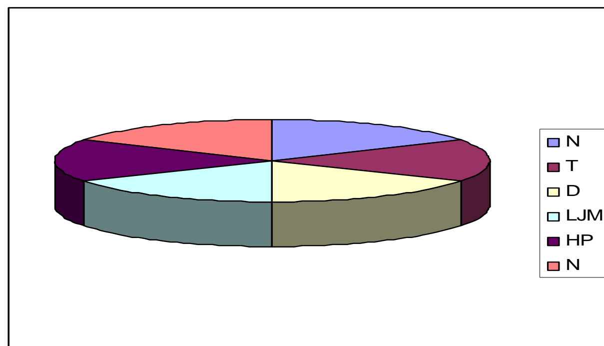
Peripheral arterial disease, characterised by arterial stenosis and occlusions, is the product of advanced atherosclerosis that can occur in patients with diabetes in the femoral, dorsalis pedis and posterior tibial arteries. These vessels are often only one to two cm in diameter and can develop atherosclerotic plaque, which seriously decreases blood flow Patients with diabetes and peripheral arterial disease are more prone to ischemic ulceration than those without disease.[23]

Causal Pie Theory

In 1990, Pecoraro et al[22] determined the causal pathways, using the model established by Rothman. The causal sequence was defined by both component and sufficient causes. Component causes are risk factors that are essential components, but not independently sufficient, in the causal sequence to cause the outcome of interest (amputation or ulceration).When a component cause is removed or blocked from the specific causal chain the other causes will be rendered insufficient to produce the outcome. A sufficient cause is a causal pathway to disease containing a complete set of minimal conditions or events (components causes) that inevitably produce the outcome. Pecoraro et al found

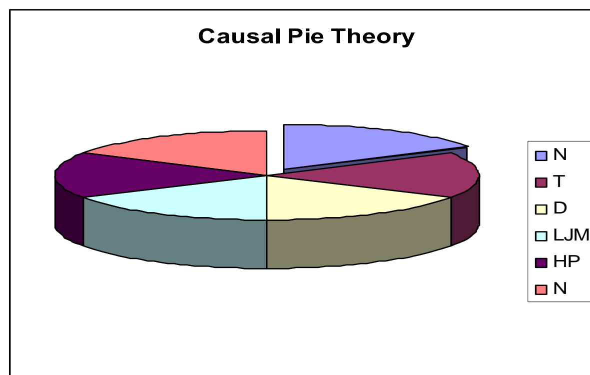
that the particular triad of minor injury, cutaneous ulceration and wound healing failure accounted for 72% of the amputations often in combination with gangrene and infection.[22]

Figure 1a. Sufficient Cause – invariably produces the effect – restricted to the minimal number of component causes required for Causation



N=neuropathy T=minor trauma D=deformity LJM= limited joint mobility HP=high pressures

Figure 1b. Removing one Cause Prevents a Completed Causal Pathway



Removing one component cause has the effect of preventing a completed causal pathway and no ulceration develops.[22]

1.3.3 Identifying Risk Factors

Singh et al (2005) conclude in their study: "Preventing Foot Ulcers in Patients with Diabetes" that while diabetes increases dramatically the risk of foot ulceration, the risk may be reduced to some degree by appropriate screening and

intervention measures.[24] Screening allows clinicians to assign patients to a risk category that dictates both the type and frequency of foot intervention needed.

Early identification of risk factors for diabetic foot ulcer and initiation of proper treatment reduce the occurrence of complications, including the need for amputation. The risk factors that contribute to ulceration in diabetic patients include neuropathy, structural deformity, and a previous history of ulceration or amputation and poor glucose control. The effects of these risk factors are cumulative. The triad of peripheral neuropathy, vasculopathy, and susceptibility to infection is the classic high-risk scenario for amputation.[25]

The presence of peripheral diabetic complications that may lead to amputation is also associated with systemic complications. The dominant metabolic derangement in diabetes is hyperglycaemia. The UK Perspective Diabetes Study (UKPDS), published in 1998[23] and Diabetes Control and Complications Trial (DCCT) published in 1993 showed that intensive control of blood glucose results in a reduction in the number and severity of micro vascular complications of between 25% and 70%. The investigators found that intensive therapy reduced the risk of peripheral sensory neuropathy by 60%.[26]

Patients with diabetes and high-risk foot condition should be educated about their risk factors and the appropriate management of the condition. Initial screening for peripheral vascular disease should include screening for a history of claudication and an assessment of pedal pulses.[27]

1.3.4 Management of Foot Ulcers

Complete evaluation of the lower extremities is vital when one is undertaking treatment of a diabetic foot ulcer, starting with an evaluation of the cause of the problem. Clinical assessment should include an assessment of the appearance of the ulcer, the presence of any local or systematic infection, the degree of neuropathy and peripheral vascular disease, and the patient’s metabolic status.[28]

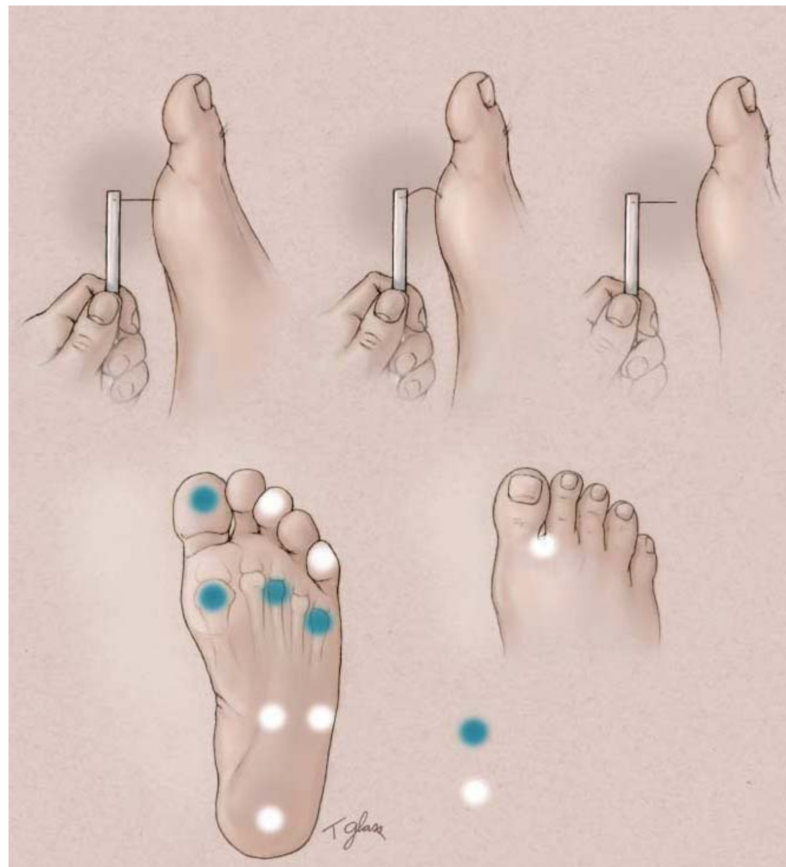
Patient Evaluation

All individuals with diabetes should receive an annual foot examination to identify high-risk foot conditions. This examination should include an assessment

of protective sensation, foot structure and bio-mechanics, vascular status and skin integrity. Nerve conduction studies are generally considered the standard criterion for diagnosing peripheral neuropathy. They are less useful in screening for loss of protective sensation (i.e. the degree of neuropathy beyond which the patient has a measurably increased risk for diabetic foot ulceration) and are not widely available.

Evaluation of neurological status in the low-risk foot should include a quantitative somatosensory threshold test by means of the Semmes Weinstein 5.07 monofilament. This examination tests a patient's pressure perception by pressing the filament against the skin of distal planter foot while the patient's eyes are closed. While authorities recommend eight to ten sites, testing just four planter sites on the forefoot (great toe and base of first, third, and fifth metatarsals) identifies 90% of patients with an insensate site.[24]

Figure 2. Monofilament Test for Light Touch Sensation



(*Source: JAMA Jan 12, 2005- Vol. 293(2): 219)*

A centrally calibrated biothesiometer can be used to measure a patient's threshold of perception of vibration.

The location of the ulcer and its characteristics and depth should be measured. Identifying ischemia in patients with diabetic foot complications can be more difficult than usual because diabetes masks ischemia. An index of the vascular status of the foot can be derived according to the presence or absence of dorsal pedal and posterior tibial pulses. Doppler studies and pulse volume waveforms, which do not depend on vessel wall compressibility, are more reliable than an ankle brachial index.[29]

When a patient with diabetic foot ulcer is first seen, a comprehensive history and treatment plan must be put into place. Additional information to be acquired includes blood pressure, height and weight to calculate body mass index, and laboratory values, some of which are known to correlate with complications of diabetes (e.g., heart disease, renal failure, nephropathy, retinopathy, neuropathy, and microalbuminuria).[29]

Laboratory Data

Tests done on admission should include complete blood count, haemoglobin A1C level, lipid profile, liver function, albumin level, erythrocyte sedimentation rate, and urinary micro albumin level. Whether all these factors have a correlation with foot ulcer healing and amputation rate is still not clear.[23]

Treatment

Ideally, patients should keep their weight totally off the limb with the use of crutches, a walker or wheelchair with a foot extension. Where staying off the limb is not feasible, inappropriate or ill-fitting footwear should be replaced with healing sandals. In some instances, because of an underlying osseous prominence (e.g. metatarsal head, sesamoid bone, bunion, hammer toe), reducing pressure is not sufficient to accomplish healing. Early surgical intervention for the correction of the problem may be prudent and, if the blood supply is adequate, correction of

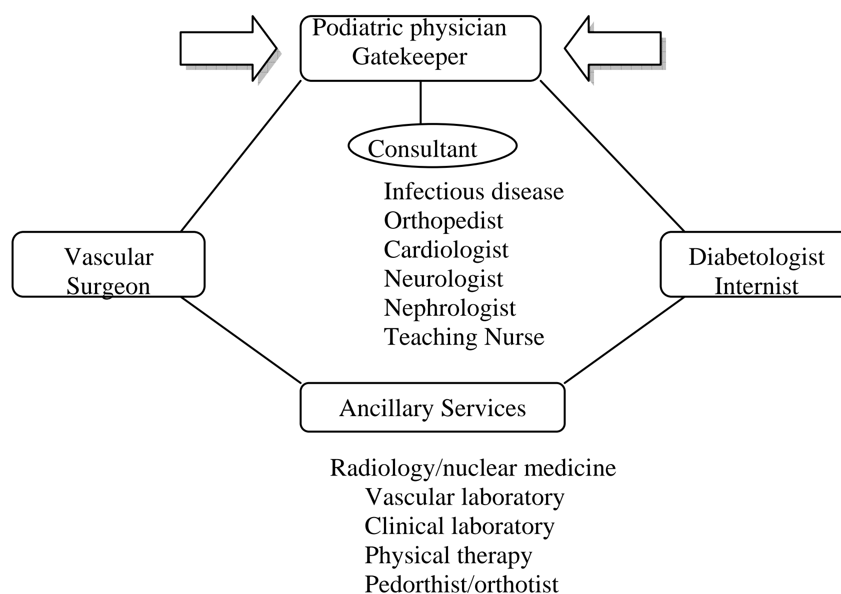
underlying osseous abnormality usually results in ulcer resolution when more conservative care has failed.[30]

Successful treatment of a diabetic foot ulcer relies on reducing or eliminating pressure, resolving infection, correcting ischemia, and maintaining a warm, moist, clean environment that promotes wound healing. Success in these efforts not only preserves quality of life for diabetic patients but also saves money for the health care system.[31]

Team Approach in Diabetic Foot Management

A significant reduction in the incidence of ulceration, infection and lower extremity amputation can be realised through the institution of an organised foot care service in community medical centres and major academic medical centres.[32] A multidisciplinary approach to diabetic foot problem has gained much favour in the last several years. The specialists involved include a vascular surgeon, a foot and ankle surgeon, an endocrinologist or diabetologist, an infectious disease specialist, wound care nurses and educators, and a qualified pedorthist.[33]Putting together a team of health professionals dedicated to limb preservation for patients with DM should prevent or at least minimise the level of amputation for these patients.[8]

Figure 3. Paradigm for Multidisciplinary Diabetic Foot Service



(Source – *Int J Epidemiology* 1998; 28: 183)

Diabetic Limb Salvage

Limb salvage is defined as survival without an amputation at the level of leg or thigh. DeNamur and Pupp[34] did a retrospective review of 19 diabetic patients with significant lower extremity pathology to determine the success of limb salvage in cases of varying complexity The patients were either scheduled or at risk for below -the- knee amputation before intervention. After the intervention the patients were followed for four months to nine years. Eighteen patients went on to have successful procedures, avoiding below-the-knee amputation; one patient had an above-the-knee amputation. These results demonstrate the benefits of an aggressive team approach with limb salvage as a goal.

1.3.5 Associated CVD in Patients with Diabetic Foot

The incidence of and mortality from all forms of CVD (myocardial infarction, cerebrovascular disease, peripheral vascular disease, and congestive heart failure) are strikingly more frequent in people with diabetes than in people without diabetes.[34] CVD is also a major contributor to morbidity and to the direct and indirect cost of diabetes. Type 2 diabetes is an independent risk factor for macro vascular disease, and its common coexisting conditions (e.g. hypertension and dyslipidemias) are also risk factors.

Hypertension (HTN) (blood pressure $\geq$ 140/90) is a common co-morbidity of diabetes and is a major risk factor for CVD and micro vascular complications. Lowering of blood pressure to < 130 mm Hg systolic and < 80 mm Hg diastolic with regimes based on anti-hypertensive drugs, including ACE inhibitors, angiotensin receptor blockers (ARBs), B-blockers, diuretics and calcium channel blockers, has been shown to be effective in lowering cardiovascular events.[35]

Patients with type 2 diabetes have an increased prevalence of lipid abnormalities that contribute to higher rates of CVD. Lipid management aimed at lowering low density lipoproteins (LDL), raising high density lipoproteins (HDL) and lowering triglycerides has been shown to reduce macro vascular disease. In studies that have used HMG (hydroxymethylglutaryl) CoA reductase inhibitors (Statins) patients have shown benefit.

It is predicted that globally the death from non-communicable diseases will increase by 77% between 1990 and 2020, and that most of these deaths will occur in developing regions of the world.[35]

1.4. Rationale for the Study

The clinical outcomes of individuals with acute diabetes-related foot complications require improvement for which early identification, assessment and proper management of risk factors are proposed in several studies. Randomised controlled clinical trials, completed over the past several years, have clearly and unambiguously demonstrated the benefits in diabetic patients of meticulous glycaemic control, aggressive blood pressure control, lowering of low-density lipoproteins (LDL) cholesterol, and use of aspirin therapy. There can no longer be any excuse for medical personnel to ignore these important risk factors.

Much effort and research have been directed towards the primary prevention of foot disease in patients with diabetes. It is clear that all individuals with diabetes should receive ongoing foot care education and regular foot examination by medical and other health professional personnel alike if the incidence of foot complications is to be reduced. However, many individuals are still not receiving optimal preventive care and the number of patients with diabetes that require admission for acute foot pathology remains high.

South Africa has a quadruple burden of disease compounded by an exploding epidemic of HIV/AIDS.[36] The complex disease pattern places high demands on health services undergoing transformation in the face of shrinking budgets and other infrastructure development demands.

Since the health care systems of African countries are not prepared to cope with the rising burden of diabetes, patients hospitalised for foot complications do not have appropriate risk identification and management of associated cardio vascular diseases. In the absence of costly therapeutic interventions, a well-

planned cost-effective strategy is required. Therefore , one of the most important steps to reduce cost in the management of diabetic foot is to avoid amputations.

As there is a paucity of epidemiological data on cardiovascular outcomes in the South African population (since these studies are expensive as well as difficult to conduct, at least in the short term), it would be feasible to address the known populations at risk, e.g. diabetic populations and, among these populations, those who are hospitalised for complications like diabetic foot. This would help in determining the quality of care and cardiovascular and foot-related outcomes of these patients. A team approach to diabetic limb salvage should be the standard of care and it is the responsibility of health care provider to arrange the appropriate consultations.

The results of this study might help medical personnel in devising pre-and post-discharge interventions at a later stage for the patients admitted for acute diabetic foot complications.

Chapter 2

2.1 Aim

The aim of this study was to determine the clinical features, risk factors, management, and clinical outcomes of patients admitted with a diagnosis of diabetic foot in general surgical wards of the Pretoria Academic Hospital.

2.2 Objectives

The study had the following objectives:

1. To determine the proportion of patients admitted with diabetic foot problems out of the total patients in the general surgical wards of the Pretoria Academic Hospital in the past year;
2. To determine the risk factors (peripheral neuropathy, peripheral vascular disease, history of foot ulcers) responsible for foot problems and whether they were evaluated;
3. To evaluate the cardiovascular risk-factor assessment and subsequent management;
4. To describe the clinical and biochemical characteristics of patients with diabetic foot problems;
5. To determine the outcomes of these patients with regard to type of procedure and complications; and
6. To determine whether post-discharge referral includes referral to an appropriate diabetes clinic.

Chapter 3

Patients and Methods

3.1 Study Site

The study site constitutes the male and female general surgical wards of the Pretoria Academic Hospital.

3.2 Sampling Frame

The sampling frame consisted of ward and theatre registers of both male and female wards for the time period January 2005 to December 2006 for female wards and July 2005 to December 2006 for male wards. Only the records of those patients who were admitted for any foot complications for the first time during the period of study were used for data collection

3.3 Sample Population

The sample includes diabetic patients with type 1 or type 2 diabetes mellitus if these patients had been admitted during the study period for any foot complication (foot ulcer, claudication/ischemic rest pain, gangrene, cellulites etc.)

Inclusion Criteria

Those patients who were admitted for the first time during the data collection period only their records were selected for analysis. All those patients who were re-admitted their records were included for the purpose of finding the total proportion of patients with diabetic foot complications

3.4 Study Design

The study design is descriptive (cross sectional).

3.5 Measurement

A retrospective audit of the ward register and patient files was conducted with the intention of determining:

- Proportion of patients admitted with diabetic foot complications out of all the admissions in the wards;
- Socio-demographic details (such as age, gender, smoking status);
- Clinical characteristics (type and duration of diabetes, glycated haemoglobin (HbA1c), Serum Albumin, Serum CRP);
- Risk assessment (neuropathy assessment, vascular assessment including ankle brachial index/doppler studies, lipid values, renal function, and urine albumin);
- Procedures (major or above-ankle amputations, minor or below-ankle amputations, bypass surgery or angioplasty);
- Complications (infection requiring antibiotics, wound dehiscence, re-amputation, hypertension, renal failure, death);
- Discharge medication (Statins, ACE inhibitors, Aspirin); and
- Post-discharge clinic referrals, e.g. surgery and diabetes clinics.

Note: It was expected that the records would contain all these variables and it has been said that it was the intention?

3.6 Sample Size

In this study, no hypothesis is being statistically tested; the only sample size constraint is whether a proportion with a narrow confidence interval can be established.

For a proportion of 30% to be estimated for any given endpoint with a ±10% confidence interval (CI) the sample size needed was 75 patients.

3.7 Data Collection and Management

For data collection the principal investigator reviewed the ward register of male and female surgical wards for all those patients who were admitted with diabetic foot complications during the study period. Their files were located and the required information collected.

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3.8 Analysis Strategies

Descriptive statistics was with SPSS statistical software. Summary statistics for continues variables and proportions for discrete variables were calculated.

3.9 Ethical Aspects of Study

The protocol for this study was presented for the Ethics Committee of the Faculty of Human Health Sciences of the University of Pretoria granted assessment and full approval.

Since this study required retrospective examination of ward and clinic records, initial consent from the heads of departments and approval by the CEO of the hospital were obtained before the study was undertaken.

The researcher collected data anonymously so that confidentiality could be ensured.

Chapter 4

Results

This chapter seeks to outline the results of the research report. Initially variables were selected with the understanding that from the records all information would be extracted. However, some information could not be obtained from records or, if it was present, it was not uniformly set out in the records.

Data was extracted using ward registers for male and female wards. Since not all the registers for the specified time of one year were available, registers for two years at different times during those years were used to achieve the sample size.

When the ward registers for male and female surgical wards were evaluated, there were a total of 147 patients 81 in male ward and 66 in female wards who were diagnosed with DF were but only 81 files could be retrieved from the record room. Rest of the files were either not available or did not meet the inclusion criteria which met inclusion criteria for analysis.

Male Ward - From July 2005 – Dec 2006.

Percentage out of Total Admissions:

A total of 1768 patients were admitted in surgical ward 6.5 during this time period and 81 had diabetic foot complications. The percentage of total admission for diabetic foot was 4.58 %.

Female Ward -From Jan 2005 – Dec 2006.

Percentage out of Total Admissions:

A total of 2616 patients were admitted in the female surgical ward during this time period out of which 66 had diabetic foot complications. The percentage out of total admission is 2.52 % with diabetic foot complications.

4.1 Sociodemographic Characteristics of the Sample

There were a total of 81 files from which data was extracted. Of this number 54.3% (n=44) were female and 45.7%(n=37) were male patients.

The mean age of the sample was 61.34 (+12.9) years. Minimum age was 19 and maximum was 93yrs.

Smoking Habits of the Sample

Eighteen point five percent (n=15) of patients were smokers, 29.6% (n=24) had never smoked, 37% (n=30) were ex smokers and in 14.8% (n=12) of cases the smoking status was unknown.

Table 3. Referral Source to Surgical Wards

Referral sources	Frequency	Percentage
Emergency Room	21	37
Surgical Outpatient Department	4	4.9
Other Govt. Hospitals	13	16
Private Practitioners/Clinics	7	8.6
Other Wards	6	7.4
Unknown	30	37

In 37 (n=30) cases the source of referral could not be obtained from the records. Other government hospitals mainly included Tshwane District Hospital, and Kalafong and Mamelodi hospitals. Private institutions included private clinics, hospitals and general practitioners.

Duration of Stay

From the records patients' dates of admission and discharge were noted and days of hospitalisation were calculated. It was found that mean duration was 13 ($\pm$ 11) days with a minimum stay of one day and a maximum of 51 days.

4.2 Clinical Characteristics of the Sample

The majority of the patients (84 % (n=68)) had type 2 diabetes, only 13.6% (n=11) had type I whereas in 2.5% of cases (n=2) this information was missing.

Table 4. Clinical Characteristics of the Sample

Clinical Characteristics	Measured in % (n)	Mean (SD)	Median	Range
Duration of Diabetes (yrs)	43.2(35)	12(10.40)	10	1-47
First Glucose on Admission (mmol/l)	95.1(77)	12.6(7.2)	10.3	5-46
HbA1c (%)	30.9%(25)	10 (3.4)	10.3	5-17.2

In Table 4, the column showing " measured in" shows the percentage of records from which this information were available; in the rest of the records this information was not captured.

As regards hypertension, which is a co morbidity of DM, 66.7(n=54) patients had the condition and were taking treatment, 24.7% (n=20) did not have accompanying hypertension, and in 8.6% (n=7) of cases this information was not recorded.

4.3 Risk Assessment

4.3.1 Peripheral Neuropathy

In none of the cases was a Semmes Weinstein 5.07 monofilament used to assess the neurological status of the patient's feet.

Other methods used for neurological assessment were light touch, using cotton wool or pinprick. These procedures were conducted in 37 % (n=30) of patients only. In the majority of patients (67.9% (n=55)), no mention of neurological testing was made.

Charcot joint was present in only 4.9% (n=4) cases

4.3.2 Peripheral Vascular Disease

Pedal pulses were assessed in 85.2% (n=69) of cases. In the files the examiners mentioned whether the pulses were present or not in the affected foot. In 44 % (n=36) of cases pedal pulses were absent in the affected foot and in 37% these were not affected.

Table 5. Absent Pedal Pulses

Pedal Pulses Absent	Frequency	Percent age
Dorsalis Pedis	15	41.6
Posterior Tibial	3	8.4
Both	18	50

As seen in Table 5 in most of the cases both pulses were absent in the affected foot.

Gangrene was mentioned in (50.6% (n=51)) of cases. Femoral bruit was mentioned in only 2.5% (n=02) of cases. Information on angiograms was available in 9.9% (n=8) of cases and arterial Doppler studies were only mentioned in 18.5 %(n=15) cases.

4.3.3 Ulceration

Table 6. Presence of Ulcers

Ulceration	Frequency	Percentage
Present	46	56.8
Not present	34	42
Missing	01	1.2

Ulceration was present in (56.8% (n=46)) of cases.

Figure 4. Assessment of Foot Ulcers

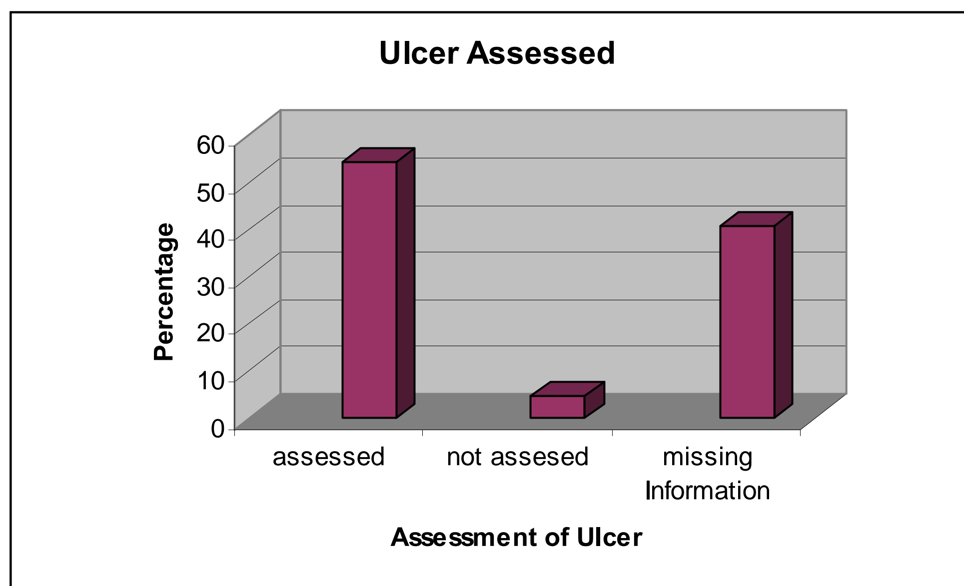


Figure 6 shows that in 54.3% of cases ulcers were assessed by health care providers. Not assessed in figure shows that the ulcers were present but the health care provider did not assess them. . No standard classification methods like Wagner classification and grading of ulcers was done; the ulcer was only briefly described.

4.3.4 Consultations

Table 7 . Consultations in Ward

Consultation	Frequency	Percent
Physician	18	22.2
Orthopaedic Surgeon	1	1.2
Ophthalmologist	3	3.6
Neurologist	1	1.2
Nephrologist	1	1.2
Cardiologist	1	1.2
Not mentioned	55	67.9

As can be seen in Table 7, physicians were consulted in 22.2 %(n=18) for their related problems in the ward. The majority of records did not mention consultations.

4.3.5 Cardiovascular Risk Factors

Hypertension. From the records it was seen that there were 66.7% (n=54) patients who had hypertension and were receiving treatment. Twenty percent had a normal blood pressure and in 8.6% of the files this information was missing.

Table 8 . Lipid Values

CV Risk Factor	Measured	Percentage	Mean (SD)
Total Cholesterol	8	9.9	4.30(0.56)
SLDL	5	6.2	1.8 (0.36)
SHDL	7	8.6	1.4 (0.56)
S Triglycerides	7	8.6	2.2(0.63)

Table 8 shows that lipid values were measured in only less than 10% of the admitted patients.

4.3.6 Renal Functions

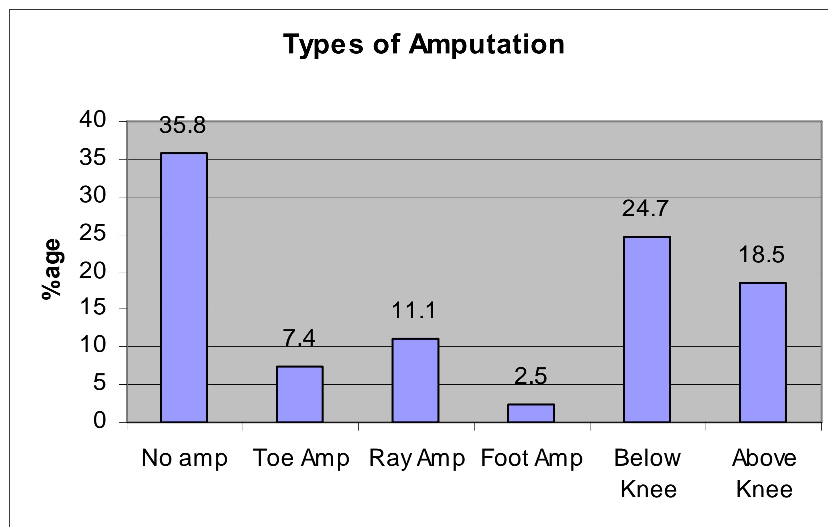
Table 9. Renal Functions

Renal Functions	Measured	Percentage	Mean (SD)
Serum Creatinine	74	91.4	110.9(66.4)
Serum Urea	74	91.4	7.7 (5.4)
Serum Potassium	74	91.4	6.1 (14.8)

As shown in Table 9, renal functions were measured in the majority (91.4 %(n=74)) patients admitted for diabetic foot complications.

4.4 Outcome

Figure 5. Types of Amputation



As an outcome of diabetic foot complications among the patients admitted to surgical wards, 24.7% (n=20) patients underwent below-knee amputation, whereas 35.8% (n=29) were discharged without amputation.

Among those without amputation 13.8% (n=12) were given antibiotic treatment only and (4.9%) had a skin graft. Others had either incision drainage, hyperbaric oxygen or just wound care.

Debridement only was done in 26% (n=20) of the patients and about 5% of patients went through peripheral by pass procedure.

Readmissions

Records that were selected for analysis were of the patients who were admitted to surgical wards for the first time during the study period. Out of 81 records, 33.3 % (n=27) patients were readmitted in the surgical wards during the study period. Of these 23% (n=19) were readmitted for complications in ipsilateral foot and 9.9% (n=8) for contra lateral foot.

Discharge Management

Table 10. Discharge Management

Discharge Management	Frequency	% age
Discharge on Statins	10	12.3
Discharge on ACE Inhibitors	35	43.2
Discharge on Aspirin	27	33.3

Table 10 shows the percentages of patients discharged with some essential medications.

Whether the Patients Reached an Appropriate Diabetic Clinic

Out of the 81 patients whose records were reviewed only 06 were registered at the Diabetes Clinic of Pretoria Academic Hospital and only 03 patients consulted this clinic within three months of being discharged from the surgical ward. None of them was registered at Kalafong Hospital Diabetes Clinic.

Chapter 5

Discussion, Conclusions and Recommendations

Diabetes was considered rare in sub-Saharan Africa until recently, but as a result of demographic and lifestyle changes as well as increasing recognition, it is being identified as a major health problem. The management of diabetes in hospitals is generally considered secondary in importance compared with the conditions that prompted admission.

5.1 This Study

This study is a record review of patients admitted with diabetic foot problems in surgical wards of Pretoria Academic Hospital in 2005 and 2006.

Initially, it was intended to review records from January 2005 to December 2005 in both male and female wards but because of the non-availability of ward registers from January to June 2005 in the male wards, only records from July to December were available. In the female ward records were available for the whole year. But the sample size of 75 could not be achieved and records for year 2006 were also included both from male and female wards. A total of 66 cases from female ward registers and 81 from male ward registers were identified in the above-mentioned time period. But only 81 records from both wards were included in study. The reason is that from the record room all the files were not retrieved. Secondly, some of the patients had foot lesions but they were not diabetic or they were not admitted for the first time during the study period, so their files were excluded.

This study is unique as in the literature globally not much could be found about the assessment of risk factors, including cardiovascular risks, and the outcome of hospitalised patients with diabetic foot admitted in surgical wards for management.

The data reflects several factors related to patient characteristics, clinical variables, and delivery of care and outcome of patients admitted to surgical wards.

5.2 Study Results in Relation to Other Studies

The prevalence of diabetes in hospitalised adult patients is not precisely known. In this study the proportion of male patients is higher than that of females out of the total admissions in surgical wards, which is consistent with the epidemiology of foot ulcers in developing countries as mentioned by Abbas *et al.* [9]

The mean age of the sample was around 61 years. As mentioned in a study by Singh *et al*[12], about 50% of diabetic patients older than 60 years develop some degree of peripheral neuropathy, which is one of the component causes in the causal pathway leading to foot ulceration.

Only 18% of the sample was current smokers and 37% were ex smokers. As mentioned in the American Diabetes Association's Clinical Practice Recommendation 2004: Position Statement[27], cigarette smoking contributes to one in every five deaths in America. Much of the prior work documenting the impact of smoking on health did not separately discuss results on subsets of individuals with diabetes. Some other studies of diabetics have consistently found a heightened risk of morbidity and premature death associated with the development of macro vascular complications among smokers.

The majority of patients in the sample had Type 2 diabetes, which corresponds to a study by Benotmane *et al*[37], which states that > 90% of lower-extremity complications associated with diabetes occur in Type 2 diabetes sufferers.

The risk of ulcers or amputation is increased in people who have had diabetes for more than ten years and have poor glucose control [27]. These findings are consistent with the sample used in the current study as the mean duration of diabetes was 12 years and the mean value of glucose and Hba1c at admission was 10.3 and 10 respectively.

The mean duration of stay was 13 (± 11) days in this study. This is much less than (43±21) days in a study by Benotmane *et al* but that data was collected over a five-year period and the sample size was large. However the duration of stay in this study is consistent with the length of stay referred to in the study by Wraight *et al*[38], in a12-month audit.

In our retrospective audit of 81 patients admitted in surgical wards with diabetes-related foot problems, Semmes Weinstein 5.07 monofilament was not used at all to assess the neurological status of patients' feet, which is recommended as the screening test of choice for detecting loss of protective sensation. Neurological status was assessed in a small percentage of cases only, by means of other procedures, such as pinprick or soft touch. In three prospective studies the Semmes Weinstein monofilament identified persons at increased risk of foot ulceration with a sensitivity of 66- 91%, a specificity of 34- 86% and positive predictive value of 94 to 95%. [39,40,41] It is important to recognise that people with diabetic neuropathy are at major risk of developing pressure ulcers.

Peripheral pulses were examined in 85 % of the records used in the current study. In 18% both dorsalis pedis and posterior tibial pulses were absent in the affected limb. The prevalence of peripheral vascular disease is 20-30% in the adult diabetic population. It involves the distal arterial tree, particularly arteries below the knee. It is important to recognise that patients with coexisting neuropathy and ischeamia may lack symptoms despite severe peripheral ischemia. The presence of femoral artery bruit is a strong indicator of disease. In this review there was no mention of assessing femoral artery bruit in the records of the hospitalised patients. In past years percutaneous angioplasty (PTA) became the main revascularisation procedure in lower-limb salvage in diabetic foot syndrome.[42]

In 95% of the records the presence or absence of foot ulcers was mentioned. In about 57% cases foot ulcers were present but ulcers were not classified using any system of classification. Documentation of site, size, depth and general appearance of ulcers was poorly done. As mentioned in a study by Wraight *et al*[38]

"each classification leads to a specific investigation and management pathway", which is not possible with such poor recording of information.

As indicated by Mbanya *et al*[22] hypertension prevalence is higher among diabetic patients than in the general population. This sample also had a majority of patients with hypertension who were on treatment. But according to Medhat *et al*[43], in their study hypertension was not a risk factor for diabetic complication of the lower extremity. In the same study the presence of macro vascular involvement, indicated by history of cardiac disease, was noticed to be related to development of lower-limb complications.

Cardiovascular disease has been considered as rare in Africa but both population-based and hospital-based investigations provide evidence for the increasing burden of cardiovascular disease, diabetes mellitus being a great contributor. In our sample, lipid values, one of the cardiovascular risk factors, was only measured in 8-10% of patients

Lipid values are not measured as part of routine investigations in surgical wards but only if the patient has been referred to a physician for any existing cardiac disease.

Tests for renal functions were found in records of the majority (91%) of cases. Measurement of renal function is important to detect the presence of acute or chronic renal failure. Since most surgical procedures are usually carried out under general anaesthesia, this is a routine test in surgical wards.

Once an individual has undergone an amputation there is a 50% risk of an amputation of the remaining limb within five years. Wraight *et al*[38]confirmed in their study findings from the current study, where out of 81 patients 27 had a readmission and 19 of them for a complication in the same foot In our sample the majority of patients had a below-knee amputation

A substantial number of patients with diabetes and peripheral vascular disease still do not receive an adequate vascular evaluation prior to amputation. Some problems regarding vascular evaluation in DM are demonstrated in a study by Rheeder *et al*[44], according to which ankle brachial index (ABI) should be used in clinical setting before more invasive angiography. ABI has a predictive value for delayed wound healing and amputation. An ABI < 0.9 is 95% sensitive and almost 100% specific in detecting angiogram-positive disease. No patient should undergo amputation without a previous assessment with regard to the possibility of vascular intervention.[5] In our sample information about angiogram or arterial doppler studies was not available in most of the cases.

Debridement only was done in 26% (n=21) patients. As recommended by Singh *et al*[12], this procedure prevents planter pressure by 26% and should be routinely provided by trained personnel.

Randomised controlled clinical trials completed over the past several years have clearly and unambiguously demonstrated the benefits in diabetic patients of meticulous glycaemic control, aggressive blood pressure control, lowering of LDL, cholesterol, and use of aspirin therapy. There can no longer be any excuse for medical personnel to ignore these important risk factors.

Still, in our audit fewer than 50% of patients were discharged on ACE inhibitors, although these have been shown to improve cardiovascular outcomes in high-cardiovascular-risk patients with or without HTN.

Lipid values were measured in fewer than 10% of cases. As mentioned in the American Diabetic Association's (ADA) standards of medical care in diabetes[11], lipid management aimed at lowering LDL cholesterol, raising HDL cholesterol and lowering Triglycerides has been shown to reduce macro vascular disease and mortality in patients with type 2 DM. Only 12% of patients from our sample were discharged with statins, which is proven to reduce coronary and cerebrovascular events in diabetics.

Aspirin, which is recommended as a primary and a secondary therapy to prevent cardiovascular events in diabetic and non-diabetic individuals, was given at discharge to only 33% of patients

It is difficult to obtain consent for major or even minor surgery involving amputation. Also, many patients with foot ulcers discharge themselves against medical advice. These ulcers progress rapidly in home settings and frequently cause patients to be readmitted for amputation.

From the records we tried to discover the location from which the patients were referred for admission into surgical wards. In the majority of cases this information was missing. In those records that had this information most of the patients were referred to surgical wards from casualty. Patients generally consult many doctors, especially GPs, before deciding to go to a hospital, probably because of the fear of amputation.

Very few patients reached appropriate diabetic clinic after discharge from surgical wards. There were no records for following up these patients and finding out where in the system they were lost

5.3 Limitations of Study

To date, most of the published studies have relied on retrospective data collection methods and have the limitation of underestimating the results. The same limitation applies to our study. It is also impossible to draw any conclusion about causal relationship between the variables investigated and the outcome of interest.

5.4 Conclusions

A guideline is required to assist health care providers in surgical wards. As seen in the surgical wards the surgeons look at the foot complication only, but do not try to evaluate and manage the risk factors of diabetes. Referral to appropriate specialist or clinic and discharge planning was missing from the records.

5.5 Recommendations

- Assessment investigation and management approaches should be standardised using the most highly ranked evidence-based information incorporated into clinical practice
- A prospective audit may be may be incorporated in future into the activities of the foot care team in order to assess and improve clinical care.
- Guidelines should be given to assist health care providers to make informed decision about appropriate clinical assessment, investigations and treatments for all aspects relevant to the care of individuals admitted with acute diabetes-related foot complications.
- Ideally, these guidelines should be used in conjunction with a multidisciplinary diabetic foot team
- No data could be found relating to discharge planning of patients admitted with acute diabetic foot problems. However, lessons can be learnt from examples in other conditions. For example, the benefit of discharge planning and post-discharge support for patients in congestive heart failure could be replicated for hospitalised patients with diabetic foot complications

5.6 Future Studies

- A study with prospective data collection method, to assess knowledge and practices of foot care in patients hospitalised with diabetic foot.
- A randomised controlled trial to introduce an educational programme for hospitalised patients and health care staff, including discharge planning and post-discharge support for the prevention of amputation.

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Serial App “A”

QUESTIONNAIRE

Socio-demographics Characteristics

Age in Yrs:	
Gender	M / F
Education in yrs	
Smoking	Y / N Ex / U
Hospital No.	
Ward	Gen Surgery / Vascular Surgery
Referred from (be as specific as possible)	
Date of Admission: / / 20	
Date of Discharge: / / 20	

Clinical Characteristics

Weight	kgs
Type of Diabetes	Type – 1 / Type 2 (TIDM Insulin use within 1 Yr)
Onset of DM (e.g. 1980)	
First Glucose on admission	
Hb A1c	
Hypertension on treatment	Y / N / U
First BP on admission	
Hypercholesterdemia on status	Y / N / U

Risk Assessment

Peripheral Neuropathy	
10 gms Monofilament Used	Y / N
Other assessment of Neuropathy	Y / N
Neuropathy	Y / N / U
Diagnosis of charcot joint mentioned as absent or present Y / N (Joint Deformity, Pain/Tenderness, focal Erythema, bounding Padel Pulses, Swelling)	

Peripheral Vascular Disease

Pedal Pulses Assessed	Y / N
Absent Pulses any foot	Y / N / U
If yes which	
Femoral Bruit mentioned	Y / N
Gangrene mentioned	Y / N
Arterial Dopplers mentioned	Y / N
Angiographs mentioned	Y / N

Ulcerations

Ulcer present	Y / N
If yes, Wagner’s Classification mentioned	Y / N
If yes	
Grade 0	
Grade 1	

Grade 2	
Grade 3	
Grade 4	
Grade 5	
Consultations (e.g. Physician)	

Lipid values (first Lipogram)	
S-Total Cholesterol	
S-LDL	
S- HDL	
S-Triglycerides	
Renal Function	
S-Creatinine	
S-K+	
S-Urea	

Outcomes	
Amputation	
Above knee	Y / N
Below knee	Y / N
Foot / Toe	Y / N
Ray	Y/ N
Debridement only	Y / N
Peripheral bypass procedure	Y / N
Others, mention	
Number of theatre visits	
Discharged alive	Y / N
Discharged on statins	Y / N
Discharged ob ACE I	Y / N / U
Discharged on Aspirin	Y / N / U
Referred post discharge?	Y / N
If Yes Where to	
Readmission	Y/N
If yes for ipsilateral /contra lateral foot	