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RESEARCH

Compliance with local diabetic guidelines at a district hospital in KwaZulu-Natal, South Africa

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Background: Diabetes mellitus (DM) represents a major health-related problem in South Africa and throughout the world. The management goals of diabetes are first to maintain normal blood glucose levels and second to prevent the development of complications. Local guidelines developed by the Society for Endocrine Metabolism and Diabetes South Africa (SEMDSA) have shown that tight glycaemic control and appropriate monitoring can prevent or delay the development of diabetic complications. The demographic profile of patients with type 2 DM and the compliance of doctors to the guidelines were determined.
Methods: Five hundred records of patients with type 2 DM were selected from the medical outpatients' department (MOPD) by systematic sampling. Demographic information on age, sex and ethnicity was obtained. The performance and timing of recommended investigations were recorded and compared with the 2012 SEMDSA guidelines.
Results: The mean age of patients was 61 years. Black and Indian patients formed the majority, comprising 44.4% and 43.0% respectively. Glycated haemoglobin was measured in 29.2% of patients once and 13.2% of patients twice in the past year. Lipid studies were done on 40.4% of patients. A serum creatinine (sCr), estimated glomerular filtration rate (eGFR) and serum potassium were done on 38.2% of patients. Eye examinations were done on 13.60% patients and examination of the foot was done on 7.8% of patients. Some 15% had a urine dipstick test done at least once in the past year and 10.4% had a urine albumin/creatinine ratio (ACR) requested. Only 21 patients (4.2%) were compliant with the SEMDSA guidelines. Measurements of blood pressure and blood glucose were 100% compliant. Anthropometric measurements (height, weight and body mass index), dietitian referral and foot examinations were the least compliant, being performed 4.2%, 5.0% and 7.8% of the time respectively.
Conclusion: Black and Indian patients formed the majority of the study population. The screening for chronic complications of type 2 DM was poor in the majority of patients. Evaluation of selected records demonstrated compliance with the SEMDSA guidelines in only 4.2% of patients. There is an urgent need to review barriers to the implementation of guidelines in South Africa.

Key words: Diabetes mellitus, adherence, guidelines

Introduction

Diabetes mellitus (DM), like many other non-communicable diseases, represents a major health-related problem throughout the world.[1] The 2015 report released by the International Diabetes Federation (IDF) showed that there are currently around 451 million people affected with diabetes worldwide and this is predicted to increase to over 693 million by 2045.[2]

Type 2 DM is the most commonly diagnosed form of diabetes and accounts for more than 90% of people living with diabetes.[3] Historically DM was thought to be very uncommon in Africa, however some epidemiologists predict that the economic impact of diabetes, as well as the consequent death toll, will surpass the ravages of HIV and AIDS in the near future.[4] Currently more than 22 million people within Africa have diabetes.[3]

In South Africa there were 2.3 million cases of diabetes in 2015 with a national prevalence of 7.0%.[5] DM is common amongst all race groups with the highest prevalence amongst the Indian population (15.8%), followed by the Black (4.8%) and White (3.5%) populations.[3,6]

Long-term cardiovascular, renal, neurological and retinal complications of type 2 DM are major causes of morbidity and mortality.[1–6] These complications impact negatively on the patient, his/her family and the community in which he/she resides and works.

Diabetes is the fourth leading cause of death in the world.[3,6,7] In 2015 approximately 5.0 million people died from diabetes worldwide. The 2015 IDF estimated that there were 57 319 diabetic-related deaths in the South Africa.[2] The mean health expenditure per person was approximately US$ 918.9.[5]

The primary goals in the management of type 2 DM are first to maintain normal blood glucose levels throughout the day and second to prevent the development of complications by a systematic and standardised screening programme.[5,7]

DM is a major concern for National Health Systems worldwide because of its impact on morbidity and mortality. Routine measurements such as blood glucose, haemoglobin A1c (HbA1c), lipid determination, blood pressure measurement, annual eye and albuminuria screening have proved to be effective in identifying and treating patients at risk.[3,5,7]

The Society for Endocrine Metabolism and Diabetes of South Africa has developed guidelines based on a number of local and international trials, which showed that tight glycaemic control leads to a reduction in the development of diabetic

complications.[5,7] These guidelines are targeted at the resource-limited South African context and all required tests and examinations are readily available in both the public and private sector. They were first published in 2009 with the aim of providing guidance on the most appropriate management for people with diabetes mellitus and its complications at primary health care level. They are reviewed regularly at 3–4-year intervals and the information is freely available to healthcare professionals by means of journal publications such as the Journal of Endocrinology, Metabolism and Diabetes of South Africa, various online publications and seminar presentations.

Several studies, however, both in developed and developing countries, have shown poor compliance with local guidelines by doctors caring for patients with diabetes.[1,6,7] A study conducted in Italy in 2003 reviewed 31 104 persons with diabetes and concluded that only 20% of patients received adequate screening for complications as per their recommended local guidelines.[1] Uganda, a low-income developing country, reported only 14% of patients had their lipid profiles done annually. In addition only 12.4% of patients were screened for diabetic nephropathy, no patient was assessed for microalbuminuria and similar poor results of screening for retinopathy, peripheral vascular disease and cardiac complications were identified.[8] Two studies published in 2013 conducted in the North West province and KwaZulu-Natal reported similar poor compliance with the locally recommended SEMDSA guidelines.[9,10] Studies conducted at district hospitals providing generalist services, which remain the entry point for the majority of patients to primary health care, are severely lacking.

A large number of patients with diabetes are seen at Northdale Hospital (NH) medical outpatients' department (MOPD) for review and prescribing of their chronic medication. They are seen at six-monthly intervals or more often as requested by the MOPD doctors. There are no statistics available on the demographic profile of these patients. NH has an on-site laboratory, dietetics department and an eye clinic. Many patients, however, are admitted from the MOPD or the emergency department with complications arising from type 2 DM such as strokes, heart attacks and renal failure. Many other patients are referred to the ophthalmologist with advanced stages of diabetic retinopathy. The high occurrence of potentially preventable complications has prompted this study to assess the compliance of healthcare providers with local diabetic guidelines. Observational analysis has shown that recommended screening linked with a reduction in the HbA1c resulted in several benefits. For every 1% reduction in the HbA1c, there was a 14% reduction in myocardial infarction, a 37% reduction in microvascular complications and a 21% reduction in deaths related to DM.[5]

The objectives of the study were to review the demographic profile of patients with type 2 DM presenting to an MOPD at a district hospital and to review compliance of doctors with the 2012 SEMDSA guidelines in terms of performing recommended examinations and investigations.

Methods

The study was performed in a large district hospital in the uMgungundlovu health district, KwaZulu-Natal. The hospital provides medical services to a predominantly low-to-middle income population with a high prevalence of diabetes and hypertension. The MOPD sees approximately 2 450 patients with diabetes per year and receives referrals from 12 clinics. It is staffed mainly by medical interns and junior medical officers.

A study sample of 500 patients' charts was reviewed, representing 20% of the 2 450 patients. This is a descriptive study that does not test any statistical hypothesis; the issue of power was not considered. This study included patients who were diagnosed with type 2 DM and were attending the MOPD for more than one year. Patients with type 1 DM or gestational diabetes were excluded from the study due to differing monitoring practices and a lower prevalence in the community.

Systematic random sampling was achieved by randomly assigning a number between 1 and 5 to the charts. Every fifth record was chosen until 500 charts were selected. These records were subsequently assessed against the 2012 SEMDSA guidelines.

The following were assessed: demographic data, presence of hypertension, height, weight, body mass index (BMI), waist circumference, blood pressure, comprehensive foot examination, comprehensive eye examination, blood glucose, HbA1c, lipid profile, sCr, eGFR, potassium, urine dipstick, urine albumin/creatinine ratio (ACR), ECG, referral to dietitian and current therapy. Results were recorded as either performed or not performed and the number of times performed if applicable.

The data collected were captured on an Excel® spreadsheet (Microsoft Corp, Redmond, WA, USA) and subsequently analysed using the Statistical Package for the Social Sciences (SPSS; IBM Corp, Armonk, NY, USA). Descriptive statistics such as percentages were used to summarise categorical data.

Permission to conduct the study was obtained from the management of NH, UKZN Biomedical Research Ethics Committee (BE551/16) and the KZN Department of Health. Confidentiality of patients' information was maintained by excluding their names and file numbers during the processing of data.

Results

There were 296 females (59.20%) and 204 males (40.80%). The mean age was 61 years (42–91 years), 222 (44.40%) of the patients were Black, 215 (43%) were Indian, 34 (6.8%) were Coloured and 29 (5.8%) were White. A total of 275 (55%) were also receiving treatment for hypertension and 82 (16.2%) patients were receiving insulin therapy (Actraphane™ or Protophane™), with the balance being managed with oral anti-diabetic agents (Metformin and Glibenclamide or Gliclazide) (Table 1).

Screening tests for complications as per the guidelines were not performed consistently (Table 2). Of the 500 patients, only 21 had a weight, height, BMI and waist circumference recorded. The eye examination was done in only 68 (13.60%) patients. In

Table 1: Demographic profiles and disease characteristics

Parameter	Categories	*N*	%
Sex	Male	204	40.8
	Female	296	59.2
Race	Black	222	44.4
	Indian	215	43
	White	34	6.8
	Coloured	29	5.8
Treatment	Oral therapy only	418	83.8
	Insulin therapy	82	16.2
Presence of hypertension	Hypertension present	275	55
	Hypertension not present	225	45

N: given as a number; %: percentage.

Table 2: Screening tests for complications

Test performed	Compliance with the 2012 SEMDSA Guidelines	
	n	%
Height	21	4.2
Weight	21	4.2
BMI	21	4.2
Waist circumference	21	4.2
Blood pressure	500	100
Blood glucose	500	100
Eye examination	68	13.6
Foot examination	39	7.8
HbA1c annually HbA1c biannually	146 66	29.2 13.2
Lipids	202	40.4
sCr and eGFR	191	38.2
Urine dipstick	62	12.4
Urine ACR	52	10.4
ECG	64	13.2
Dietitian	25	5.0

n: given as a number; %: percentage.

addition, patients receiving insulin were more likely to be referred for an annual eye examination (50 of the 68 patients) compared with those on oral therapy only.

Examination of the foot was recorded in 39 (7.8%) patients. Older patients with a mean age of 58.2 years were more likely to have this examination performed.

An HbA1c was done on 146 (29.2%) patients once in the year and only 66 (13.2%) patients had an HbA1c done twice in the preceding year. Both males and females were equally likely to have this test requested with a male:female ratio of 1:1.12. A lipid analysis including total cholesterol, low density lipoprotein, high density lipoprotein and triglycerides was done on 202 (40.4%) patients. A serum creatinine (SCr), eGFR and serum potassium were done on 191 (38.2%) of patients.

Seventy-six (15.2%) had a urine dipstick test done at least once in the past year and 52 (10.4%) had a urine ACR requested. An ECG was done on 64 (13.2%) occasions and only 25 (5%) patients had been reviewed by the dietitian.

There were no statistical differences in tests performed in relation to age and sex (Tables 3 and 4).

All patients had their blood pressure and blood glucose checked at every visit. The observations are routinely performed by nurses prior to patients consulting with doctors.

Table 3: Relationship between sex and tests performed

Parameter	Males	Females	Chi-squared	*p*-value
HbA1c	92	120	1.0646	0.5873
Lipogram	89	114	1.1062	0.2929
u-ACR	27	36	0.0476	0.8272
Eye test	33	36	1,.316	0.2513

u-ACR: urine albumin creatinine ratio.
HbA1c: Glycated haemoglobin.

Table 4: Relationship between age and tests performed

Parameter	40–59 years *n* = 264	60 years and more *n* = 236	Chi-squared	*p*-value
HbA1c	115	97	7.21	0.081
Lipogram	112	91	6.8551	0.0767
u-ACR	36	37	2.1887	0.5342
Eye test	35	34	2.1997	0.5546

n: number of patients.
HbA1c: glycated haemoglobin.
u-ACR: urine albumin creatinine ratio.

Discussion

In this study, females formed the majority of the patients with a female to male ratio of 1.45:1.

The overall mean age was 61 years. Black and Indian patients represented the majority of the sample population at 44.4% and 43% respectively.

This study demonstrated the poor adherence of medical personnel to the SEMDSA guidelines and poor screening of the long-term complications of type 2 DM.

Nurse-driven examinations such as recording of blood pressure and blood glucose were performed routinely. However, height, weight, BMI, abdominal circumference and urine dipstick were done with less frequency. This was surprising as these tests require little time, equipment or skill. Other similar studies showed varying results with a South African study reporting a more than 90% compliance with these bedside tests whilst another African study showed less than 50% compliance.[10,11] There was no identifiable reason for their omission in this study. It is possible that a lack of understanding of their significance in the guidelines may have contributed to their omission.

Laboratory tests including HbA1c (29.2%), Scr, eGFR and potassium (38.2%), and lipids (40.4%) were performed more frequently but well below recommendations. Studies done in KwaZulu-Natal (KZN) and North West province showed better results with 30–90% of investigations being performed.[9,10] The presence of an on-site laboratory and phlebotomist simplifies the process for doctors to request blood tests. Doctors may not always be familiar with the guidelines and thus not order recommended tests timeously.

Examinations requiring more clinical skills, including a comprehensive foot examination (7.8%) and eye examination (13.6%), were done less frequently. These results mirrored the 2012 study in KZN, which showed only 6% of patients received a foot exam.[10] More specialised diabetic centres however, seem to place greater emphasis on examination of the foot with a Ugandan study reporting a 75% uptake of this test.[8] Time constraints due to high patient load and uncertainty of clinical skills may have contributed to these outcomes.

Systemic hypertension was common in this study sample with 55% of patients being managed for both their hypertension and type 2 DM at the MOPD. Although this did not fall under the specific objectives of this study, it is well documented that hypertension is an important modifiable risk factor for both microvascular and macrovascular disease.[5,7,12] Patients with diabetes and hypertension are therefore more likely to develop target organ damage.[5,7,11,12]

A 2009 study published in the Annals of African Medicine showed that the major predictor of resource use in type 2 DM patients in developing countries was the presence of complications as well as inadequate glycaemic control.[11]

Diabetic retinopathy is possibly the most common microvascular complication of diabetes and is responsible for approximately 10 000 new cases of blindness every year in the USA.[9,12–14] Studies in Africa have recorded the prevalence of diabetic retinopathy to range from 7% in Kenya to 63% in South Africa.[3,7,10] A 2010 survey conducted in Cape Town showed that diabetic retinopathy was responsible for 8% of blindness and 11% of severe visual impairment.[15] Loss of vision in patients with diabetes is disabling as it may impair their ability to self-monitor blood glucose and administer insulin. In addition, it puts them at greater risk of falling and leads to loss of independence.[5,7] Early identification of retinopathy and appropriate management has been shown to prevent or slow the progression to visual impairment and blindness.[7,15] Only 13.6% of patients received an annual eye examination. This finding is unexpected as there is an on-site eye clinic with a senior medical officer in ophthalmology.

Diabetic nephropathy is the leading cause of renal failure in the USA.[3,5,7] The estimated prevalence in South Africa is 14–16%.[4–6] As many as 7% of patients with type 2 DM may already have microalbuminuria at the time of diagnosis.[10] In the United Kingdom Prospective Diabetes Study (UKPDS), the incidence of microalbuminuria was 2% per year in patients with type 2 DM and the 10-year prevalence after diagnosis was 25%.[16] Diabetic patients with microalbuminuria typically progress to proteinuria and overt nephropathy if appropriate interventions are not initiated early in the course of the disease.[5,7,16,17] In a resource-limited area such as South Africa, diabetic nephropathy is a major concern as therapeutic options are limited once a patient reaches the stage of renal failure. A urine dipstick, urine ACR and Scr converted into an eGFR are the recommended investigations by SEMDSA to screen for diabetic nephropathy.[4,6] Only 15.2% of patients in this study had a urine dipstick done once in the year, 10.4% had a urine ACR and 40.4% had a Scr and eGFR done. A 2009 study conducted in a teaching hospital in Nigeria showed similar poor results with urinalysis and serum creatinine done only 50% of the time.[11]

Foot examinations and education on foot care is an essential step in diabetic care. It is aimed at identifying persons at risk for ulceration and lower extremity amputation.[5,7] A thorough examination of the peripheries should be done initially and at least annually thereafter.[5,7,17] The skin, bones, nerves and vasculature should be assessed. Screening for peripheral neuropathy is done with a monofilament or 128 Hz tuning fork. It should include testing for sensation to light touch, vibration and temperature. Abnormalities in more than one test of peripheral sensation are > 87% sensitive in detecting the presence of peripheral neuropathy.[5,7,13] Patients who have lost 10-g monofilament sensation are at risk of developing foot ulceration.[5,7] In the NH MOPD, only 39 (7.8%) patients had documentation of a foot examination being performed. There was, however, no mention of the use of a monofilament or tuning fork and no grading of risk documented. A 2008 study in the Western Cape and a 2011 study in KwaZulu-Natal showed similar poor outcomes with 11.3% and 6% of records documenting foot examinations respectively.[9,10]

Routine measurements such as blood glucose, HbA1c, lipid determination, blood pressure measurement, annual eye examination and albuminuria screening have proved to be effective in identifying and treating patients at risk, thereby preventing or delaying the progression of target organ damage.[3,5,7,13] The early detection of abnormalities is crucial and assists the healthcare provider to decide if treatment needs to be modified, further investigations are warranted or referral to a specialist is indicated. Overall, in this study, compliance with the guidelines was disappointing, which puts patients at a higher risk of developing potentially avoidable complications.

Limitations of the study

This was a retrospective study with small numbers. The data assessment tool only identified whether investigations were performed; it did not comment on any specific values or appropriateness of actions if results were found to be abnormal.

Conclusions and recommendations

Compliance with the SEMDSA guidelines for screening of patients with type 2 DM was poor. This could lead to the late identification of complications, resulting in poor outcomes for the patient and an increased demand on health services.

Recommendations from this study are as follows:

- A quality improvement process should urgently be put in place to identify the reason for the discrepancy between current practice and recommended evidence-based practice.
- Continuing medical education should be ensured with emphasis on the SEMDSA guidelines to healthcare workers managing patients with diabetes.
- A simplified data collection tool should be developed and attached to the file of each patient being managed for DM. This should specify the type and frequency of investigation required to ensure that all processes of care are followed.
- With the high prevalence of type 2 DM in the community being serviced by NH, a diabetic clinic in consultation with all stakeholders should be implemented to further improve care for patients with diabetes.
- Patients should be empowered through the principles of Diabetes Self-Management Education and Support.

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Authors' contribution – KR was responsible for the project design, data collection and presentation of results. SR made major contributions and corrections during the project design and writing of the manuscript. MK made corrections during the writing of the manuscript.

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