TEACHING OF DIABETES MELLITUS TO MEDICAL STUDENTS AND PRIMARY HEALTH CARE NURSES: A FAMILY MEDICINE PERSPECTIVE

Care patterns learned in training are reflected in later practice, which emphasises the importance of good teaching at medical school.

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Care patterns learned in training are reflected in later practice. While understanding the pathophysiology of diabetes mellitus provides a scientific basis for therapy, there is no substitute for learning the practical management of diabetic patients by active participation in the primary care team under the supervision of an excellent role model.

The American Diabetes Association (ADA) advocates 6 services in the proper management of patients with diabetes mellitus:

- determination of HbA_{1c} levels
- documentation of self-monitoring of blood glucose
- annual dilated eye examination
- foot examination
- annual assessment of urine protein
- annual lipid screening.

HBA_{1C} DETERMINATIONS

HbA_{1c} is a reflection of the patient's average blood glucose over the past 3 months. Attachment of glucose on the haemoglobin molecules (glycosylation) lasts for the lifespan of red blood cells (120 days). The higher the level of blood sugar, the higher the percentage of glycosylation. Therefore, HbA_{1c} determination is the best test for blood glucose control. The Diabetes Control and Complications Trial (DCCT) demonstrated that lowering the HbA_{1c} percentage can delay or prevent the development of retinopathy, nephropathy and neuropathy in diabetic patients. The study also showed that any decrease in HbA_{1c} lowers the risk of complications.

The HbA_{1c} goal for diabetics is less than 7%. The DCCT findings showed that diabetic patients whose HbA_{1c} levels are close to 7% have a much better chance of delaying complications than those with levels of 8% or higher. A change in treatment is almost always needed if a patient's HbA_{1c} is over 8%. It is important to note that there is no point in having the patient's HbA_{1c} measured if no action will be taken to achieve good control.

SELF-MONITORING OF BLOOD GLUCOSE

It is recommended that HbA_{1c} be measured at least twice a year (depending on the success of control of the patient's blood glucose level). Therefore patients should be taught to use a glucometer and to monitor their own glucose levels. Increased blood glucose levels can easily be spotted and managed before the HbA_{1c} is found to be elevated a few months later. Self-monitoring of blood glucose enables patients to see and record how food, physical activity, and medication affect their blood sugar. Patients are thus empowered to work with their health care providers to adjust their treatment plan accordingly.

EYE EXAMINATION

Eye examination in diabetic patients is aimed at preventing visual impairment. Blindness is one of the most dreaded complications of diabetes, with a yearly incidence of 50 - 65 per 100 000 diabetic population in Europe. This complication can be avoided if patients receive appropriate care. Risk factors for retinal disease have been identified (Table I).

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Tight control of blood glucose reduces the risk of onset and progression of diabetic eye disease in types 1 and 2 diabetics.

Table I. **Risk factors for diabetic retinal disease**

- Poor glycaemic control
- Raised blood pressure
- Increasing number of microaneurysms
- Duration of diabetes
- Microalbuminuria and proteinuria
- Raised triglycerides and lowered haematocrit
- Pregnancy

Patients with multiple risk factors should be considered at high risk of developing diabetic retinal disease. This condition affects especially type 1 diabetic patients. There is a two-fold increased risk of cataracts in diabetic patients, which increases with poor glycaemic control. Tight control of blood glucose reduces the risk of onset and progression of diabetic eye disease in types 1 and 2 diabetics. Significantly, reducing HbA_{1c} by 1.5% and, if possible, to 7% in both types of diabetes, coupled with the reduction of blood pressure to 140/80 mmHg in type 2 diabetics, reduces the incidence and progression of sight-threatening diabetic eye disease.

It is important for diabetic patients to be screened for retinopathy annually, and those with identified retinal disease more frequently. Evidence has shown that patients with type 2 diabetes should be screened from the time of diagnosis, and those with type 1 from the age of 12 years. If the onset of type 1 diabetes is after puberty, screening should start 3 years after diagnosis. In primary health care settings, visual acuity measurements help in the interpretation of maculopathy. Consequently the need for medical students and primary health care nurses to be properly trained in eye examination cannot be over-emphasised.

DIABETIC FOOT CARE

Diabetic foot problems are a common complication of diabetes, with a prevalence of 35% for neuropathy, 16% for vascular disease and 6% for foot ulceration. Diabetic patients experience higher amputation rates than do non-diabetics. In the presence of associated risk factors, such as smoking, hypertension and hypercholesterolaemia, patients with diabetes mellitus are at a higher risk of peripheral vascular disease (PVD). Table II lists the factors associated with diabetic foot ulceration.

Table II. **Factors associated with diabetic foot ulceration**

- Peripheral vascular disease (PVD)
- Peripheral neuropathy
- Previous amputation
- Previous ulceration
- Presence of callus
- Joint deformity
- Visual or mobility problems
- Male sex

Peripheral vascular disease and peripheral neuropathy often occur in combination.

A multidisciplinary approach in diabetic foot care (comprising the family physician, diabetic physician, nurse, podiatrist, vascular and orthopaedic surgeons), as well as patient education, ensures maximum benefit to the patient. Education should include recommendations on footwear: high-quality, cushion-soled shoes and custom-made footwear. Orthotic insoles should be used to reduce callus severity and ulcer recurrence.

DIABETIC NEPHROPATHY

Persistent proteinuria indicates the presence of a glomerular lesion, and is a forerunner of kidney disease. It may play a central role in the pathogenesis of progression of glomerulonephropathies to end-stage renal failure. Therefore, persistent proteinuria has been regarded as nephrotoxic. To this end the use of angiotensin-converting enzyme (ACE) inhibitors or angiotensin-receptor blockers (ARBs), aimed at mitigating glomerular hyperfiltration, has been recommended by consensus.

The first voided morning specimen is used to establish if proteinuria is persistent. The commonly used dipstick detects mainly albumin among the variety of proteins contained in the urine. This test is sensitive to albumin concentrations as low as 15 mg/dl. However, it is not sufficiently sensitive to detect albumin in the microalbuminuria range (30 - 300 mg/dl in an adult). The threshold for transition from microalbuminuria to frank albumin (300 mg protein excreted per day in an adult) corresponds to a concentration of 15 mg/dl if the daily volume is 2 litres. At this threshold level the dipstick gives a trace result. The dipstick test for protein provides a crude semiquantitative estimation of protein concentration (Table III).

Diabetic nephropathy is defined as a raised urinary albumin excretion of > 300 mg/day (clinical proteinuria) in a patient with or without a raised serum creatinine level and with co-existing diabetic retinopathy. A urinary albumin creatinine ratio

Table III. **Correlation of dipstick results and protein concentration estimation**

Dipstick results	Protein concentration (mg/dl)
Trace	5 - 20
1+	30
2+	100
3+	300
4+	> 2 000

(ACR) of > 30 mg/mmol in a spot sample also indicates diabetic nephropathy. Clinical proteinuria represents a more severe and established form of renal disease and is more predictive of total mortality, cardiovascular morbidity and mortality, and end-stage renal failure than microalbuminuria. Risk factors associated with development of diabetic nephropathy are listed in Table IV.

Table IV. **Risk factors associated with diabetic nephropathy**

- Hyperglycaemia
- Raised blood pressure
- Baseline urinary albumin excretion
- Increasing age
- Duration of diabetes
- Presence of retinopathy
- Smoking
- Genetic factors
- Raised cholesterol and triglyceride levels
- Male sex
- Serum homocysteine levels

In diabetic patients, once proteinuria has been established, it heralds the inevitable progression of diabetic nephropathy. Poor glycaemic control ($HbA_{1c} \geq 8\%$) is a major risk factor for diabetic nephropathy. The earliest indicator of glomerular damage is microalbuminuria. The use of ACE inhibitors or ARBs as renoprotective therapy before an overt nephropathic syndrome emerges is recommended.

ANNUAL LIPID SCREENING

Parameters of the lipid profile are total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL) and triglycerides.

Table V. **Priorities for lowering lipids/ lipoproteins (ADA)**

Priorities	Action
1	Lowering of LDL cholesterol levels
2	Lowering of triglyceride levels
3	Raising of HDL cholesterol levels

Table VI. **Recommended lipid profile target values**

Patient profile	Total cholesterol
Low risk for CVD	5.18 mmol/l
Moderate risk for CVD	5.18 - 6.22 mmol/l
High risk for CVD	> 6.22 mmol/l
	LDL goal
Pre-existing CVD or diabetes	2.59 mmol/l
≥ 2 risk factors	3.37 mmol/l
0 or 1 risk factor	4.14 mmol/l
	Triglyceride goal
Normal fasting levels	1.70 mmol/l
	HDL level
Increased risk of CVD	1.04 mmol/l
Average risk of CVD	1.04 mmol/l
Less than average risk of CVD	1.55 mmol/l
	Total cholesterol to HDL ratio
Target ratio	< 5:1
Optimum ratio	3.5:1

CVD = cardiovascular disease; HDL = high-density lipoprotein; LDL = low-density lipoprotein.

Diabetes mellitus is associated with an increased risk of cardiovascular disease (CVD). Dyslipidaemia is prevalent in both types of diabetes, although different in nature in each: poor glycaemic control and the presence of nephropathy in type 1; elevated triglyceride levels and decreased HDL cholesterol in type 2. It must be noted that, although the concentration of LDL cholesterol in type 2 diabetics is not significantly different from that in non-diabetics, in the former the LDL cholesterol tends to have smaller and denser LDL particles that increase atherogenicity. The ADA has laid down priorities for lowering lipids/lipoproteins (Table V).

Table VI lists the recommended lipid profile target values.

LIFESTYLE INTERVENTION

This should be the first step in the management of diabetic patients with dyslipidaemia. The ADA recommends aerobic exercise at 50 - 70% maximum O_2 uptake for 20 - 45 minutes at least 3 days per week, and reduction of saturated fat intake. Saturated fat should be replaced in the diet by carbohydrate, or by poly- or mono-unsaturated fat. Mono-unsaturated fat is preferred because it tends to result in lower triglyceride levels and better glycaemic control than carbohydrates.

CONCLUSION

Diabetes mellitus is a condition that every medical student and primary health care nurse should be able to manage with confidence. Knowledge of the quality-of-care measures as discussed above will ensure the attainment of this goal to the benefit of the health care consumer – the patient.

Further reading

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IN A NUTSHELL

Medical students should be aware of the significance of HbA_{1c} determination as a reflection of the quality of the patient's glycaemic control.

Self-monitoring of blood glucose empowers the patient to work together with his/her health care provider to monitor blood glucose on a daily basis.

Tight control of blood glucose reduces the risk of onset and progression of diabetic retinopathy in both types of diabetes.

Diabetic foot care is crucial in diabetic patients since they experience higher amputation rates than non-diabetics.

Poor glycaemic control ($HbA_{1c} \geq 8\%$) is a major risk factor for diabetic nephropathy.

Lifestyle intervention should be the first step in the management of diabetic patients with dyslipidaemia.

SINGLE SUTURE

UNDERPAID AND AGEING FASTER

People who are at the bottom of the pile in work are not only underpaid and often overworked, but they age faster than those higher up. People from lower socio-economic groups are more likely to die earlier than people in non-manual jobs and about a third of this mortality is due to unhealthy habits such as lack of exercise, poor diet, excess weight and smoking. Now Tim Spector and colleagues from St Thomas's Hospital in London have found that cells from women with more menial jobs age faster, even taking these factors into account. They looked at white blood cells from 1 552 female twins and measured the lengths of telomeres, the repeating bits of DNA that cap the end of chromosomes to protect them. Telomeres grow shorter every time the cell divides, so the shorter the telomeres in the cell, the more times it has divided and the more stress it is likely to be under. In the women in their study, on average, the cells were 7 years 'older' than those from women of the same chronological age with non-manual jobs. The suggestion is that low status might drive cellular ageing because such people are under greater psychological stress, which could have subtle metabolic effects, such as oxidative stress, which does make telomeres shorter.

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