

Counseling Patients About Complications of Diabetes

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US Pharmacist 28(11), 2003. © 2003 Jobson Publishing

Posted 12/09/2003

Introduction

The World Health Organization has stated that diabetes mellitus is at an epidemic level.^[1] To be diagnosed with diabetes mellitus is to enter a realm where everyday aspects of life are altered. The patient who has type 1 diabetes mellitus must adhere to rigid dietary advice, be physically active, and take great care in administration of medication. The patient who has type 2 diabetes mellitus is urged strongly to follow similar lifestyle protocols. Failure to observe medical advice opens patients who have diabetes to the possibility of devastating and irreversible damage to several tissues and organ systems, greatly increasing the risk of death or lifelong disability.

Counseling diabetic patients about complications consists partly of providing information about their increased risk of morbidity and premature death. The pharmacist should stress that proper control of the condition can lower these risks. Counseling can also include helpful steps in dealing with the various complications, such as techniques to prevent foot damage and periodontitis.

How Hyperglycemia Damages Tissues

Explaining how high blood glucose causes tissue and organ damage is complicated, as several pathogenic processes exist, and there is a differing genetic susceptibility to the specific risk of any single complication.^[2] The two prime pathways for glucose damage are protein glycation and the polyol pathway. In the first, exposure of proteins to glucose initiates a multistep reaction in which complexes called *advanced glycated proteins* are produced.^[2] Some patients cannot efficiently clear them, and they attach to functional and structural protein. Their interaction with collagen in vessel walls thickens the walls. Glycated proteins also facilitate the release of cytokines, which contribute to retinopathy, nephropathy, and neuropathy. To prevent the development of glycated proteins, patients must follow all of the guidelines for tight blood glucose control, including close attention to diet, exercise, and blood glucose testing as recommended by the physician.^[3]

In the polyol pathway, sorbitol accumulation in noninsulin-dependent cells may be responsible for retinopathy, neuropathy, and nephropathy, although the mechanism for this damage is not clearly elucidated.

Diabetes and the Cardiovascular System

Diabetes has serious and compelling effects on the cardiovascular system.^[4,5] Coronary artery disease is two to three times more common in diabetic patients than in nondiabetic persons and is more extensive and diffuse when it does occur.^[2,6] The risk of death is two or more times higher for all cardiovascular syndromes.^[6] Diabetes is connected to 25% of acute myocardial infarctions.^[2]

The prevalence of hypertension in diabetic patients is one and one half to two times that of the general population.^[7] Coronary artery disease and stroke associated with hypertension are four to five times more likely to cause death in diabetic patients. The underlying causes of hypertension in diabetes are multifactorial but include increased volume, altered sodium homeostasis, increased peripheral vascular resistance, hyperinsulinemia, and insulin resistance.^[7]

An alarming trend is the increase in body fat and abdominal fat in children and adolescents, with a concomitant increase in their risk for type 2 diabetes mellitus. As a result, the number of children diagnosed with insulin resistance and heightened cardiovascular risk rises each year.^[8] Epidemiological studies reveal that those at greatest risk include African-American, Hispanic, and Native American children, especially around the onset of puberty.^[8]

Awareness of the devastating consequences of stroke has slowly grown in the general population. Likewise, the average patient has a passing familiarity with myocardial infarction and hypertension. The pharmacist can make an impact on the diabetic patient's compliance with medical advice by stressing that aggressive glycemic control can improve clinical outcomes, particularly with respect to the cardiovascular system.^[9] To further lower cardiovascular risk, the patient should stop smoking, comply with cholesterol-lowering interventions, and lose weight.

Diabetes and Sight

Diabetes is the leading cause of blindness in the United States.^[1] Fully 2% of diabetics will lose all vision within 15 years of developing diabetes, and 10% will have severe visual impairment.^[10] Damage to retinal vessels is the major etiology.^[11] However, the diabetic patient also has an increased risk of glaucoma, the second highest cause of legal blindness in the US.^[12] The pharmacist can provide useful information about this preventable cause of blindness. Open-angle glaucoma does not cause symptoms for the patient. Increased intraocular pressure (IOP) slowly pushes the head of the optic nerve inward (a process known as *cupping*), irreversibly destroying the millions of nerve cells of which it is composed. The patient is usually unaware of any loss of vision, since the condition is painless. Early visual loss is peripheral, while later loss is central. The patient does not notice the early peripheral loss, because other parts of the visual field compensate, just as people are unaware of the blind spot (a "dead space" in the visual field caused by the optic nerve). By the time a patient actually notices that vision is awry, damage may be central and disabling. The pharmacist should urge all diabetic patients (as well as nondiabetic patients) to have yearly IOP checks by an optometrist/ophthalmologist. The diabetic patient may also need to have a full visual field

examination to detect and monitor visual loss. Early detection of glaucoma and aggressive control with eye drops such as nonspecific beta-blockers and prostaglandin analogs can keep the IOP within acceptable limits and prevent further damage to the optic nerve.

Diabetes and Limb Loss

The incidence of foot ulcers in the diabetic patient is 2% to 3% and the prevalence is 4% to 10%.^[13] Impaired wound healing hampers the ability of many diabetic patients to recover from these ulcerations; about 85% will require amputation.^[13,14] Diabetes is the major cause of limb loss due to amputations in the US.^[1] Experts estimate that 54,000 diabetics require amputation yearly, with 50% having amputation below the ankle and 50% above.^[13] Having an amputation is the beginning of a downhill course for an appreciable number of patients. At least 28% to 51% will require a second amputation within five years, and 39% to 68% will expire within five years of the first amputation.^[13]

A major cause of amputations is diabetic foot ulcers. Diabetic neuropathy lessens or destroys normal perception of painful stimuli, so the diabetic patient is more prone to damage from such seemingly minor matters as wearing shoes that are slightly too small.^[15] Patients with normal perception will periodically slip off new shoes to allow the foot to recover from an uncomfortably tight fit or will frequently interchange them with older, broken-in shoes. The diabetic patient who cannot perceive the frictional discomfort is not prompted to take these protective maneuvers. Thus, overwearing new shoes can lead to frictional ulcer.

This month's patient information page teaches the patient several important measures meant to prevent injury to the foot. In addition to the steps listed, pharmacists should advise patients to sit two to three times a day and elevate the feet. They should rotate the ankles and wiggle the toes to improve blood flow. They should be cautioned against crossing one knee over the other or tucking a foot or leg underneath them as they sit and to also avoid wearing tight socks.^[13]

Periodontal Disease

Periodontitis is a devastating bacterial disease that can, in its later stages, cause tooth mobility through destruction of the periodontal ligament that holds teeth tightly in their bony socket. Once teeth become mobile, their loss is imminent unless countermeasures are taken swiftly. Periodontal disease is not confined to diabetic patients and is found in many patients with insufficient oral hygiene. However, it has a peculiar occurrence with diabetes, known as a *bidirectional relationship*.^[16] That is, the presence of diabetes increases the risk of periodontal disease, but the presence of periodontal disease has also been shown to predispose the patient to diabetes. The offending chemicals linked to both diseases may be proinflammatory cytokines continually released when the patient has either diabetes or periodontitis. These chemicals further damage periodontal tissues and may predispose patients to type 2 diabetes mellitus. When a patient has poor glycemic control coupled with advanced periodontitis, aggressive treatment of the periodontitis (eg,

scaling and root planing) and administration of antibiotics can improve glycemic control. The pharmacist can suggest oral hygiene measures designed to prevent periodontitis in the diabetic patient, such as brushing twice daily with a soft-bristle brush. As an alternative, many dentists recommend ultrasonic brushes that destroy dental plaque at the gum line before it can harden into calculus and extend below the gingiva to produce periodontitis. The pharmacist can also point out that daily use of dental floss allows the patient to clean areas that cannot be accessed by a brush, such as interdental spaces (between the teeth) and behind the back molars. The pharmacist should also recommend daily use of a periodontal aid (eg, Perio-Aid II) to facilitate removal of plaque from the gingival margins. Instituting these three cornerstones of good dental health can help prevent the diabetic complication of tooth loss.

References

1. Patel M, Rybczynski PJ. Treatment of non-insulin-dependent diabetes mellitus. *Expert Opin Investig Drugs*. 2003;12:623-633.
2. Swidan SZ, Montgomery PA. Effect of blood glucose concentrations on the development of chronic complications of diabetes mellitus. *Pharmacotherapy*. 1998;18:961-972.
3. Nuckolls JG. Process improvement approach to the care of patients with type 2 diabetes. Providing physicians with tools to increase compliance and improve outcomes. *Postgrad Med*. 2003;Spec No:53-62.
4. Toumilehto J, Lindstrom J. The major diabetes prevention trials. *Curr Diab Rep*. 2003;3:115-122.
5. Drexler AJ. Lessons learned from landmark trials of type 2 diabetes mellitus and potential applications to clinical practice. *Postgrad Med*. 2003;Spec No:15-26.
6. Fisher M. Diabetes: can we stop the time bomb? *Heart*. 2003;89 Suppl 2:ii28-30.
7. Sahay BK, Sahay RK. Hypertension in diabetes. *J Indian Med Assoc*. 2003;101:12, 14-15, 44.
8. Goran MI, Ball GD, Cruz ML. Obesity and risk of type 2 diabetes and cardiovascular disease in children and adolescents. *J Clin Endocrinol Metab*. 2003;88:1417-1427.
9. Trence DL, Kelly JL, Hirsch IB. The rationale and management of hyperglycemia for in-patients with cardiovascular disease: time for change. *J Clin Endocrinol Metab*. 2003;88:2430-2437.
10. World Health Organization. Diabetes mellitus. www.who.int/inf-fs/en/fact138.html.
11. Aiello LM. Perspectives on diabetic retinopathy. *Am J Ophthalmol*. 2003;136:122-135.
12. Distelhorst JS, Hughes GM. Open-angle glaucoma. *Am Fam Physician*. 2003;67:1937-1944.
13. Culleton JL. Preventing diabetic foot complications. Tight glucose control and patient education are the keys. *Postgrad Med*. 1999;106:74-78, 83.
14. Greenhalgh DG. Wound healing and diabetes mellitus. *Clin Plast Surg*. 2003;30:37-45.

15. Sibbald RG, Armstrong DG, Orsted HL. Pain in diabetic foot ulcers. *Ostomy Wound Manage.* 2003;49(4 Suppl);24-29.
16. Mealey BL, Rethman MP. Periodontal disease and diabetes mellitus: bidirectional relationship. *Dent Today.* 2003;22:107-113.
17. Sasaki K, Yoshimura N, Chancellor MB. Implications of diabetes mellitus in urology. *Urol Clin North Am.* 2003;30:1-12.
18. Pommerville P. Erectile dysfunction: an overview. *Can J Urol.* 2003;10 Suppl 1:2-6.

Sidebar: Urologic Complications of Diabetes

Urologists recognize several urologic complications of diabetes mellitus, such as diabetic cystopathy (difficulty in voiding due to impaired bladder sensation) and erectile dysfunction (ED).^[17, 18] As both progress, the patient grows slowly more frustrated. In the case of ED, the patient may reluctantly ask the advice of the pharmacist, especially in regard to the use of herbal supplements. The pharmacist must stress that no herbal medication or dietary supplement has ever been proven safe or effective for diabetes-induced ED; suggest a physician appointment instead.

Sidebar: Patient Information - If You Are Diabetic, Care for Your Feet

Diabetes exists in two forms: type 1 and type 2. Regardless of which type you have, you are more likely to have foot problems than people who do not have diabetes. If your foot problems are severe enough, you may be forced to have your foot, and possibly part of your leg, amputated. Understanding some of the common foot problems before they occur and following some commonsense advice can help prevent foot injury, infection, and amputation. If you are concerned about a foot problem, see a podiatrist or physician who regularly treats diabetic patients.

Check your feet often. Think of checking your feet as a daily activity, in the same way you do bathing. In fact, after your morning shower is a good time to take a careful look at your feet. Look at the toenails, sides, heels, and soles of your feet. You may need a mirror and an additional light to get a close enough look. If you cannot inspect your feet thoroughly enough because of the awkward positions required or because you have limited vision, ask a family member or someone else to help you.

What Should I Watch For?

Look to see that your toenails are pink and fully attached. If they are white or crumbling or appear loose, contact your doctor. If your foot has any areas that are cut, reddened, swollen, or callused, you should see your doctor. Pain, swelling, warmth, and redness (all of which are signs of infection) should always be reported.

Do I Need to Avoid any Foot Products?

Never treat corns or calluses with products containing salicylic acid (liquids, pads, or patches), which can burn the feet. Always avoid products designed to reduce the size of calluses, such as pumice stones, files, and razors. These can cause severe damage to your feet. To prevent serious, perhaps disabling burns, avoid putting any heat product, such as a heating pad or a hot water bottle, on your feet.

How Should I Care for My Toenails?

Cut your nails straight across and file the tops so that they are smooth. Do not cut your nails with an angle down into the corners, as they might become ingrown and start an infection. If you cannot reach your feet, a podiatrist can cut your toenails for you. In addition, if you have an ingrown toenail, see a podiatrist or physician, since there is no self-care product to treat it.

How Should I Bathe My Feet?

Wash your feet gently each day with warm water. When you bathe, test the water temperature with your elbow before putting your feet in. If you get into a bathtub feet first without testing the water, you may burn your feet badly, since they often do not have full feeling in them. When you are done, dry your feet completely, especially between the toes, to prevent a fungal infection. However, do not use a heated-air blow dryer.

Other Advice

Break in new shoes by wearing them for short periods each day. Before putting on your shoes, check to make sure they do not have stones or other objects that can irritate your feet inside them. Always wear socks with your shoes to help prevent blisters. Never walk barefoot, and always wear hard-soled shoes to protect your feet.

It is also important to moisturize your feet since nerve damage may prevent your body from properly supplying oil to them. You should rub a thin layer of unscented lotion or petroleum jelly on the tops and bottoms of your feet, avoiding the areas between the toes. Also, soaking your feet may cause them to dry out.

Finally, if your feet have become mishapen or deformed, you should speak to your podiatrist about special shoes that will help prevent further injury to them.

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