Fractures and diabetes

Rowan Hillson

Sheila: ‘I don’t know life without diabetes: I was diagnosed with the condition as a baby in Canada, about 80 years ago, and was lucky enough to have been put under the care of Dr. Banting, one of the discoverers of insulin, who put me straight onto insulin injections… When having a hypo one day, I fell and broke my hip and while I was on bed rest I got blood blisters on my heel – I really wasn’t used to sitting still for so long! Unfortunately, this led to the amputation of my lower leg which means I now have to use a wheelchair and have to pay for extra care at home. I can’t ever remember having foot checks and it may be that had I got all the checks I needed I could have avoided the amputation.’

People with diabetes have multiple risk factors for injury and multiple reasons for bony vulnerability.

Fracture risk

One review found an increase in hip fracture risk in people with type 1 diabetes (RR 6.94, 95% CI 3.25–14.78) and in those with type 2 diabetes (1.38, 1.25–1.53) – both compared with non-diabetic people. Increased hip fracture risk compared with people without diabetes was confirmed in another review in people with type 1 diabetes (RR 6.3, 2.6–15.1) and in those with type 2 diabetes (RR 2.8, 1.2–6.6). In the Nurses’ Health Study, with 2.22 million woman-years of follow up, relative risk of hip fracture on multivariate analysis – including BMI, smoking, physical activity, menopausal status, daily intake of calcium, vitamin D, protein, and postmenopausal hormone use – was 6.4 (3.9–10.3) in type 1 diabetes and 2.2 (1.8–2.7) in type 2 diabetes compared with non-diabetic women. Longer diabetes duration increased the risk.

A meta-analysis found the relative risk of any fracture in people with type 1 diabetes compared with non-diabetic peers was 3.16 (1.51–6.63) – hip fracture 3.78 (2.05–6.98); spinal fracture 2.88 (1.71–4.82). Asymptomatic vertebral fractures are more likely in people with type 1 diabetes than in those without. In patients <40 years old, 24.4% of those with type 1 diabetes had vertebral fractures versus 6.1% of non-diabetic comparators. Reduced lumbar spinal bone mineral density correlated with vertebral fractures in the subjects overall, but not in those with type 1 diabetes although they were more likely to have reduced bone mineral density.

In the Women’s Health Initiative following postmenopausal women over seven years, the risk of fracture was higher in women with pre-existing type 2 diabetes (RR 1.20, 1.11–1.30) compared with others. Hip and spine bone mineral density were higher in women with diabetes.

Would one expect insulin-treated type 2 diabetes patients to have more fractures than those off insulin? While early studies found this, others did not once confounders were accounted for.

There is decreased peak bone mass with adolescent diabetes onset. Renal disease adversely affects bone.

All of these studies are potentially affected by coding/recording issues. Smaller fractures – for example of toes – may not be recorded (or even diagnosed). The diabetes may not be documented either!

Hypoglycaemia

‘My son, type 1 diabetic, lives alone in Chicago… He went into insulin shock… and ended up with a skull fracture and traumatic brain injury. I worry about him crashing when he is by himself… I am scared to death.’

As with any condition causing confusion, incoordination or coma, hypoglycaemia risks injuries. Risk quantification is difficult as neither the patient nor the physician may report hypoglycaemia. (Patients fear loss of their driving licence.)

A US study of people aged ≥65 years with type 2 diabetes prescribed at least two hypoglycaemic drugs found that the odds ratio (OR) for fall-related fractures in those with recorded hypoglycaemia compared with those without was 1.70 (1.58–1.83). The ACCORD trial did not show an increased risk of falls or fractures in the intensively-treated group versus the standard control group. Sulphonylurea-treated patients with documented hypoglycaemia had an increased risk of hip fracture (OR 2.42, 1.35–4.3) compared with those without hypoglycaemia.

Charcot foot

‘On May 30th… I noticed a slight swelling of my right foot. I didn’t think too much about it… The swelling got worse… I developed redness… My family doctor diagnosed it as cellulitis… because of the warmth and prescribed an antibiotic. When the redness and swelling didn’t resolve… he had me take 2 different antibiotics… I [had] a venous Doppler test… [Then] he referred me to a vascular surgeon.

‘The vascular surgeon on July 8th… said that it was lymphedema and prescribed a compression stocking. [In] August… the vascular surgeon noted that the swelling had gone down… what I thought was swelling was actually bone… the sole of my foot had totally flattened out. He said that I had Charcot foot and recommended an orthopedic surgeon… the earliest appointment… was for September 9th…

‘Not wanting to wait a month, I made an appointment with a podiatrist…

‘The first thing that they did was take X-rays of the foot. The podiatrist… confirmed that I had a Charcot process going on… He also said that there was a fracture on the side of my foot and the bones in the arch were disintegrating.’

‘Charcot foot, is a condition affecting the bones, joints, and soft tissues of the foot and ankle… The interaction of… diabetes, sensory-motor neuropathy,
autonomic neuropathy, trauma, and metabolic abnormalities of bone results in an acute localized inflammatory condition that may lead to bone destruction, subluxation, dislocation, and deformity. 15

Jean-Martin Charcot (1825–93), who first described the neuropathic arthropathy, said: ‘to learn how to treat a disease, one must learn how to recognize it.’ 16

‘People with diabetes and neuropathy who develop unexplained inflammation of the foot should be assumed to have an acute Charcot foot and referred by phone for urgent assessment by the MDT. They should be told not to take weight on the foot until they have been seen.’ 17

Drugs

Thiazolidinediones are associated with an increased risk of fracture in women (especially upper limb). 18 In the PROactive study, the incidence of fractures in women with type 2 diabetes was 5.1% on pioglitazone versus 2.5% on placebo. 19 There has also been concern about increased fracture risk with SGLT2 inhibitors. The FDA warns: ‘An increased risk of bone fracture, occurring as early as 12 weeks after treatment initiation, was observed in patients using canagliflozin. Canagliflozin has also been linked to decreases in bone mineral density at the hip and lumbar spine.’ 20

Sulphonylureas may increase fracture risk, perhaps through hypoglycaemia. In one study, both men (OR 1.46, 1.17–1.82) and women (OR 1.83, 1.25–2.66) on sulphonylureas had an increased risk of hip fracture compared with patients not using these drugs. 13

Falls

People with diabetes fall more often than their non-diabetic peers. A prospective study of women aged ≥67 years found that 18% fell more than once a year. When compared with non-diabetic women, having diabetes was associated with an increased age-adjusted risk of falling more than once a year (OR 1.68 [1.37–2.07] for non-insulin-treated diabetes and OR 2.78 [1.82–4.24] for insulin-treated diabetes). 21 Over five years, the risk of falling in people with diabetes whose mean age was 73.6 years was increased by neuropathy (reduced peroneal nerve response amplitude), renal impairment, poorer visual contrast sensitivity and low HbA1c (<6% [42mmol/mol]) in patients on insulin. 22

Summary

Fractures are more likely among people with diabetes than in non-diabetic individuals. General and bony metabolic factors, increased risk of falling, complications, infection, and diabetes medication with or without hypoglycaemia all contribute to the increased fracture risk. In people with neuropathy, abnormal gait, stumbling, and unawareness of injury combine with reduced pain sensation to cause fracture and delayed diagnosis. Remember Charcot foot – miss this and your patient faces lifelong disability. Visual impairment is surprisingly common. 23 Existing disability, for example stroke or amputation, increases risk of falling.

Warn patients with relevant complications about the risk of injury and advise them to check for trip hazards at home. Do a falls assessment in all diabetic inpatients or residential/nursing home residents. 24

Ensure that your patients have adequate calcium and vitamin D intake. 25

Prevent hypoglycaemia, remembering sulphonylurea-treated patients. Assess all injuries carefully, even if apparently minor. People with diabetes may have more problems than you think!

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References