Complex relationships requiring long-term follow-up: Obesity, bariatric surgery-induced diabetic remission and the diabetic foot

Catherine Gooday, Rachel Murchison, Ketan Dhatariya

Obesity is fuelling the rapid, worldwide rise in the incidence of type 2 diabetes. Surgery to aid weight loss and induce diabetes remission is becoming more common. Despite improvements in biochemical markers following bariatric surgery, and subsequent reductions in cardiovascular morbidity and mortality, diabetic neuropathy does not show the same improvement. Patients with established diabetic neuropathy remain at high risk of developing foot complications following bariatric surgery, and may be exacerbated by increased activity levels following dramatic weight loss. Here, the authors present a case highlighting the necessity of keeping this patient group – even if their diabetes enters remission – under the care of diabetic foot protection teams and, if necessary, specialist multidisciplinary foot clinics.

The incidence of obesity is a major public health problem. The World Health Organization (WHO; 2013) reports that obesity levels worldwide have doubled in the past 30 years. Data from Public Health England (2013) show that the prevalence of obesity among adults rose from 15% to 25% between 1993 and 2012, with more recent reports suggesting that the prevalence may rise to >50% by 2030 (State of the Nation's Waistline, 2014).

NICE (2006) defines adults with a BMI ≥25 kg/m^2 as overweight, and those with a BMI of ≥30 kg/m^2 as obese. Further NICE classifications of obesity by BMI in adults are as shown in *Table 1*.

Being overweight or obese can increase the risk of health problems including coronary heart disease, stroke, some cancers, and reduce life expectancy (Guh et al, 2009). Obesity is also recognised as one of the leading causes of type 2 diabetes (Mokdad et al, 2000). The WHO (2013) reports that 44% of cases of diabetes are attributable to overweight and obesity, while other authors suggest this figure could be as a high as 80%–85% (Diabetes UK, 2012).

Table 1. NICE (2006) classifications within obesity by BMI in adults.

Obesity class	BMI (kg/m^2)
I	30–34.9
II	35–39.9
III	≥40

The impact on the foot

One of the complications of diabetes is foot ulceration, which can affect up to 25% of people with diabetes during their lifetime (Bakker et al, 2012). Neuropathy, peripheral arterial disease (PAD) and foot deformity (resulting in altered biomechanics) have all been associated with the development of foot ulceration in diabetes (Abbott et al, 2002). Foot ulceration has been identified as the precursor of amputation in 84% of cases (Pecoraro, 1990), and the risk of amputation is 20-times higher among people with diabetes than those without (Kerr, 2012).

Alongside the risk described earlier there are several factors that combine to further increase the risk of obese people with diabetes developing foot problems. Foot function and shape can change in the presence of obesity, altering gait patterns (Stuck et al, 2008). Although obese people are often inactive, pressures going through their feet when weight bearing will be higher than in non-

Citation: Gooday C, Murchison R, Dhatariya K (2014) Complex relationships requiring long-term follow-up: Obesity, bariatric surgery-induced diabetic remission and the diabetic foot. *Diabesity in Practice* **3**: 59–67

This article was first published, in a modified form, in *The Diabetic Foot Journal* (2014, Vol 17, No 1).

Article points

1. Obesity is a risk factor for foot complications.
2. Unlike the macrovascular complications of diabetes such as atherosclerosis, there is limited evidence that neurological complications such as peripheral neuropathy improve.
3. Risk of foot complications in people whose diabetes has improved or gone into remission following significant weight loss remains at at-risk of foot complications and should remain under life-long follow-up for diabetic foot disease.

Key words

- Bariatric surgery
- Diabetic foot disease
- Diabetic remission
- Obesity

Authors

Catherine Gooday is Principal Podiatrist. Rachel Murchison is Podiatrist in Diabetes. Ketan Dhatariya is Consultant Endocrinologist. All are based at the Diabetic Foot Clinic, Elsie Bertram Diabetes Centre, Norwich.

Table 2. Bariatric surgery is recommended by NICE (2006) as a treatment option for adults with obesity if all of the following criteria are fulfilled.

- They have a BMI of 40 kg/m^2 or more, or between 35 kg/m^2 and 40 kg/m^2 and other significant disease (for example, type 2 diabetes or high blood pressure) that could be improved if they lost weight.
- All appropriate non-surgical measures have been tried but have failed to achieve or maintain adequate, clinically beneficial weight loss for at least 6 months.
- The person has been receiving or will receive intensive management in a specialist obesity service.
- The person is generally fit for anaesthesia and surgery.
- The person commits to the need for long-term follow-up.

obese people, and contribute to an increased risk of ulceration. Sohn et al (2011) demonstrated a BMI ≥40 kg/m^2 to be a significant risk factor for ulceration. Furthermore, the ability to effectively self-care is often reduced in obese people due to their inability to reach or see their feet. Purchasing appropriately fitting (i.e. wide) footwear can also be difficult.

Butterworth (2012) reports a significant association between increased BMI and foot pain. It has previously been reported by Stuck et al (2008) that there is increased plantar pressure as a result of biomechanical changes and increased load going through the foot which could contribute to the foot pain. However, in the presence of diabetic neuropathy, pain signals will be reduced or absent and people will continue to mobilise on a foot subjected to potentially damaging trauma. This may account in part for the increased risk of foot ulceration in obesity that is often associated with diabetes.

Management of obesity and diabetes

The management of obesity and diabetes and their related complications represents a considerable financial burden. Overweight or obesity costs the NHS more than £5 billion annually (Scarborough, 2011). An economic analysis by Kerr (2012) found that the annual cost of diabetic foot disease to healthcare agencies is £1 of every £150 of the NHS budget. With the increasing prevalence of these conditions, these costs are likely to escalate.

Improved diabetes control reduces the risk of developing microvascular complications of diabetes (UK Prospective Diabetes Study Group, 1998). A reduction in weight has been shown to improve glycaemic control, and weight loss is now advocated as one of the mainstays of treatment in type 2 diabetes (Inzucchi et al, 2012). This can be achieved through lifestyle changes, pharmacological or surgical management, or a combination of these approaches.

Bariatric surgery achieves weight loss by restrictive or malabsorption mechanisms. It has been shown that diabetes goes into remission – by increasing the efficiency of insulin secretion and decreasing insulin resistance – and that this can be maintained (Sjöström et al, 1999). These improvements may lead to a reduction in some diabetes-related complications, hyperlipidaemia, hypertension and, ultimately, mortality rates (Pories et al, 1992). Bariatric surgery is recommended by NICE (2006) as a treatment for obesity for those adults in whom the criteria listed in *Table 2* are met.

Pathology of the diabetic foot

People with diabetes and peripheral sensory neuropathy, peripheral vascular insufficiency and foot deformity are among those most likely to develop foot ulceration (Abbott et al, 2002), and it is these items that are at the core of the screening programme for "at risk" feet in the UK via the Quality and Outcomes Framework incentive scheme for GPs (NHS Commissioning Board et al, 2013).

Peripheral neuropathy

Neuropathy is one of the microangiopathic complications of diabetes and the risk of the development of this complication is related to glycaemic control (American Diabetes Association, 2000). The presence of sensory neuropathy means that an individual can traumatise the foot without being aware of the trauma. Motor neuropathy leads to muscle atrophy, foot deformity and altered pressure distribution across the foot; whereas autonomic neuropathy leads to altered regulation of cutaneous blood flow, the loss of sweating and hence dry, fragile skin that is prone to cracking and fissures.

Factors other than poor glycaemic control that may make the development of neuropathy more likely are the consumption of excess alcohol, vitamin B12 deficiency and obesity (NHS Choices, 2012). Obesity, as well as hypertriglyceridaemia, may directly increase the risk of the development of peripheral neuropathy independent of glycaemic control. There may be differential effects on the small nerve fibres compared with the large fibres, with the latter seeming to be more affected by hyperglycaemia (Smith and Singleton, 2013). This possible independent role of obesity in peripheral neuropathy risk, adds even greater significance to the need to treat weight, as well as type 2 diabetes, in people with diabesity.

Peripheral arterial disease

Approximately one in six people with type 2 diabetes have PAD at the time of diabetes diagnosis and this proportion rises to around 50% in those with comorbid foot ulceration (Hinchliffe et al, 2012). The increased risk of the development of PAD along with other macrovascular diseases in people with type 2 diabetes and obesity is well recognised (e.g. Standl, 2012).

Triggers of active foot disease

While neuropathy and PAD undoubtedly put the person with diabetes at risk of foot disease, ulceration and/or Charcot's neuroarthropathy are often precipitated by trauma. Charcot's neuroarthropathy is a condition affecting the bones, joints and soft tissues of the foot and ankle, which is characterised by inflammation in the earliest phase (Rogers et al, 2011). In the North-West Diabetes Foot Care Study (Abbott et al, 2002), more than half the participants experienced a precipitating traumatic event that was related to inappropriate or ill-fitting footwear. This can be a particular problem in people with comorbid obesity, who may have significant problems buying shoes that provide a good fit.

Case study

This case describes a woman with type 2 diabetes diagnosed in 1989. She was originally referred to the authors' diabetic foot clinic in 2007 for treatment of an ulcerated right first metatarsophalangeal joint (MPJ). At this time, her HbA_{1c} was 69 mmol/mol (8.5%). She was obese (class III), with a BMI of 54.5 kg/m^2. She required assistance to put on her shoes and with general foot care. There was evidence of obesity-related foot deformity with a flat foot shape evident on X-ray (*Figure 1*). She had palpable foot pulses, but was neuropathic with negative monofilament perception and vibration perception in excess of 49 volts.

The ulceration was initially slow to heal. The patient agreed to treatment in a non-removable below knee cast and the ulceration improved dramatically (*Figure 2*) and healed within 3 months. Hospital footwear (*Figure 3*) and custom-made orthotics were provided and their efficacy was checked with an F-Scan® (Tekscan) in-shoe pressure measurement system. Following resolution of the problem the patient was discharged into the care of the local foot protection team (FPT) for ongoing management.

She was referred back to the foot clinic by the FPT after 5 years, with a recurrence of the right first MPJ ulcer. On assessment she had a hot swollen foot and ankle with a temperature difference of 3.5°C compared with the contralateral foot. She had undergone bariatric surgery 1 year previously and her weight had dropped by 46 kg and her BMI had fallen to 34.6 kg/m^2. Her diabetes control had improved significantly, with her HbA_{1c} being 40 mmol/mol (5.8%). Although her diabetes had not gone into remission in the long term, she had initially stopped all treatment post-surgery for her diabetes and was then restarted on gliclazide (80 mgs twice daily) as her HbA_{1c} had started to rise again and at 18 months post-surgery was 58 mmol/mol (7.5%). Although diabetes has been found to go into remission following bariatric surgery, complete

Figure 1. X-ray illustrating the flat foot deformity of the case reported.

Page points

1. Approximately one in six people with type 2 diabetes have peripheral arterial disease at the time of diabetes diagnosis and this proportion rises to around 50% in those with comorbid foot ulceration.
2. Charcot's neuroarthropathy (the latter being a condition affecting the bones, joints and soft tissues of the foot and ankle, which is characterised by inflammation in the earliest phase.

Page points

1. In the present case, the patient reported that she had become more physically active and had decided to stop going for podiatry treatment because she was enjoying her new found freedom.
2. Her weight loss had also reduced the size of her foot and the orthotic service had not been alerted to the need reassess her footwear.
3. Despite significant improvements in diabetes control and subsequent improvement in mortality risk – neuropathy and previous foot deformity remained following bariatric surgery and contributed to the development of further ulceration and Charcot's neuroarthropathy in the present case.

and long-term resolution rates vary considerably in the literature from 16%–60% (Keogh et al, 2013). These differences are in part due to variations in definition of remission and length of follow-up. They also often reflect the baseline characteristics of the selected patient group including duration of diabetes and HbA_{1c} prior to surgery.

As a result of her weight loss, she reported that she had become more physically active and had decided to stop going for podiatry treatment because she was enjoying her new-found freedom of being able to look after her own feet and "did not want to be a burden". Her weight loss had also reduced the size of her foot and the orthotic service had not been alerted to the need to reassess her footwear; this may have contributed to the development of the ulceration.

The possibility of an underlying acute Charcot's neuroarthropathy was suspected alongside the ulceration and the patient was treated with dressings, debridement, and a non-removable below-knee total-contact cast. An X-ray showed no bone abnormalities and an MRI demonstrated diffuse subcutaneous oedema of the foot, but was not diagnostic. Despite these findings, the clinical indications remained highly indicative of an early Charcot's neuroarthropathy, with a temperature difference of >2°C–4°C in the ulcerated foot when compared to the contralateral foot, and was treated accordingly.

The ulceration healed after 2 months in the cast. The patient remained in the cast for a further 3 months. After 5 months the bilateral temperature difference settled and remained consistently <2°C.

She was initially transferred into a below-knee walker, then hospital footwear and was discharged 7 months after her initial referral. During the time the patient was in the cast for the treatment of Charcot's neuroarthropathy, the ulceration healed quickly. The application of the cast facilitated ulcer healing and the early suspicion of Charcot's neuroarthropathy and quick treatment resulted in no further foot deformity.

The patient was discharged back to the care of the FPT and given advice on the continued importance of foot care and foot checks.

Discussion

In the case described – despite significant improvements in diabetes control and subsequent improvement in mortality risk – neuropathy and previous foot deformity described by Pinzur (2005) remained following bariatric surgery and contributed to the development of further ulceration and Charcot's neuroarthropathy.

Obesity often restricts physical activity and following successful weight loss surgery as in the case described people are likely to become more active. Sohn (2011) demonstrated a J-shaped association between BMI and diabetic foot ulcers, with people of healthy weight being at elevated risk compared those with a BMI 25 kg/m^2–34.9 kg/m^2. The authors cannot account for this but suggest it might be another instance of the "obesity paradox", where people who are moderately overweight are at lower risk than those of a healthy weight – perhaps in this instance due to being less active. The significant weight loss

Figure 2. Plantar ulcer in the case reported.

Figure 3. Custom made footwear for the case reported.

achieved following bariatric surgery moved this patient from one end of the spectrum to another. When a person is significantly overweight, though they are relatively inactive, the pressures going through the foot can be high albeit for a short period of time, however when weight drops and activity levels increase the pressure can be lower but more frequent.

The relative inactivity of people with obesity can lead to osteopaenia. People who have undergone bariatric surgery have increased bone turnover and decreased bone mass (Coates et al, 2004; Stein et al, 2013). Neuropathy and increased physical activity following bariatric surgery combined with a previous decrease in bone density may increase the risk of either major or repeated microtrauma to the foot. Trauma is one of the identified risk factors for the development of acute Charcot's neuroarthropathy. This change in bone density may have been one of the precipitating factors in the case described, although further work needs to be done to confirm this hypothesis.

In practice: Providing care for this complex population

The authors have experienced many similar cases where patients' BMI has dropped significantly following bariatric surgery and they have subsequently become more active (Murchison et al, 2014). All of these patients had pre-existing neuropathy and then developed ulceration and/or Charcot's neuroarthropathy, and been treated with non-removable casts. For people who have regained their independence the application of a cast for several months is extremely frustrating and may lead to weight gain through disillusionment and inactivity. The need for prolonged casting is likely to have a significant impact on quality of life, often rendering these patients unable to carry out simple daily activities; these patients need to be carefully monitored and, where possible, strategies introduced to help them manage.

Not every patient who undergoes bariatric surgery goes on to develop foot problems; for many this surgery is without further complications, however clinicians need to ensure that both patients and fellow clinicians managing other aspects of care, are aware of and monitored for potential foot problems.

Programmes for weight loss must take into account the potential increased risk of the patient developing foot ulceration. Careful consideration must be given to footwear and regular monitoring of the foot undertaken. Zimmet et al (2011) recommend that bariatric surgery could be considered earlier in the treatment of type 2 diabetes and, therefore, reduce the development of complications. If successful, management of obesity and improvements in diabetes control are achieved early in disease duration then the complication of neuropathy may not develop. The improvement in mortality and morbidity associated with macrovascular disease might be transferable to microvascular complications.

Recommendations

The authors make the following recommendations for the foot care of people who have undergone bariatric surgery but in whom existing microvascular and peripheral neurological damage leaves them at continued risk of podiatric complications:

- People who have undergone significant weight loss after which their diabetes has either improved significantly or gone into remission need to continue to receive podiatric care from the FPT and, if necessary, multidisciplinary foot teams. The level of care needed should continue to be assessed according to their risk status as defined by NICE guidance (2004). Following bariatric surgery, the recognised triad of complications – neuropathy, ischemia and foot deformity – and the risk of foot ulceration, remain. Continued foot care education for this group of people is critical to try and prevent the development of acute foot complications, such as ulceration and Charcot's neuroarthropathy.
- Establishing links between FPTs and bariatric services may be one way to ensure that these people do not fall out of the system and present late. Identifying patients' foot risk status prior to surgery as part of peri-operative assessment could be one method of ensuring that clinicians remain vigilant as to the risk of future foot problems, thereby ensuring they remain on the appropriate foot care pathway.
- Patients with pre-existing foot complications such as neuropathy and peripheral arterial

Page points

1. Neuropathy and increased physical activity following bariatric surgery combined with a previous decrease in bone density may increase the risk of either major or repeated microtrauma to the foot.
2. Programmes for weight loss must take into account the potential increased risk of the patient developing foot ulceration.
3. Establishing links between Foot Protection Teams and bariatric services may be one way to ensure that people do not fall out of the system and present late with acute foot disease following bariatric surgery.

"This case illustrates the importance of continued surveillance not only of biochemical markers, but also for microvascular and peripheral neurological complications – specifically of the foot [in the post-bariatric surgical patient]."

disease undergoing bariatric surgery need to be properly counselled as to their continued risk of foot problems post-surgery.

- Foot screening surveillance programs need to include this group of people in which diabetes has gone into remission and they need to be identifiable on GP registries. They need continued monitoring to check that diabetes does not reoccur. A new READ code for "diabetes in remission" needs to be created to allow this to happen.
- Commissioning teams developing referral pathways must take into account this unique group of people.

Conclusion

Long-term follow-up is crucial following bariatric surgery and is stressed by NICE (2006). This case illustrates the importance of continued surveillance, not only of biochemical markers, but also microvascular and peripheral neurological complications – specifically of the foot. Diagnosis may be delayed – and outcomes poor – if healthcare professionals fail to register the underlying neuropathy in those individuals without a current diagnosis of diabetes, or if the patient no longer has FPT access. ■

Abbott CA, Carrington AL, Ashe H et al (2002) The North-West Diabetes Foot Care Study: incidence of, and risk factors for, new diabetic foot ulceration in a community based cohort. *Diabet Med* **19**: 377–84

American Diabetes Association (2000) Implications of the United Kingdom Prospective Diabetes Study. *Diabetes Care* **23** (Suppl 1): S27–31

Bakker K, Apelqvist J, Schaper NC, on behalf of the International Working Group on the Diabetic Foot Editorial Board (2012) Practical guidelines on the management and prevention of the diabetic foot. *Diabetes Metab Res Rev* **28**: 225–31

Butterworth PA, Landorf KB, Smith SE, Menz HB (2012) The association between body mass index and musculoskeletal foot disorders: a systematic review. *Obes Rev* **13**: 630–42

Coates PS, Fernstrom JD, Fernstrom MH et al (2004) Gastric bypass surgery for morbid obesity leads to an increase in bone turnover and a decrease in bone mass. *J Clin Endocrinol Metab* **89**: 1061–5

Diabetes UK (2012) *Key Statistics On Diabetes*. Available at: http://bit.ly/1kRN07i (accessed 14.01.14)

Guh DP, Zhang W, Bansback N et al (2009) The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. *BMC Public Health* **9**: 88

Hinchliffe RJ, Andros G, Apelqvist J et al (2012) A systematic review of the effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral arterial disease. *Diabetes Metab Res Rev* **28**(Suppl 1): 179–217

Inzucchi SE, Bergenstal RM, Buse JB et al (2012) Management of hyperglycaemia in type 2 diabetes: a patient-centered approach. Position statement of the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD). *Diabetes Care* **35**: 1364–79

Keogh JB, Turner KM, McDonald F et al (2013) Remission of diabetes in patients with long-standing type 2 diabetes following placement of adjustable gastric band: a retrospective case control study. *Diabetes Obes Metab* **15**: 383–5

Kerr M (2012) *Foot Care For People With Diabetes – The Economic Case For Change*. NHS Diabetes, London. Available at: http://bit.ly/1kRN07i (accessed 17.01.14)

Mokdad AH, Ford ES, Bowman BA et al (2000) Diabetes trends in the U.S.: 1990-1998. *Diabetes Care* **23**: 1278–83

Murchison R, Gooday C, Dhatariya KD (2014) The development of a Charcot foot after significant weight loss in people with diabetes – 3 cautionary tales. *J Am Podiatr Med Ass* [in press]

NHS Choices (2012) *Causes of Peripheral Neuropathy*. NHS, London. Available at: http://bit.ly/1d9QB0X (accessed 14.01.14)

NHS Commissioning Board, British Medical Association, NHS Employers (2013) *Quality And Outcomes Framework Guidance For GMS Contract 2013/14*. NHS, London. Available at: http://bit.ly/Xk1mq1 (accessed 17.01.14)

NICE (2004) *Type 2 Diabetes. Prevention And Management Of Foot Problems CG10*. NICE, London. Available at: http://www.nice.org.uk/cg10 (accessed 14.01.14)

NICE (2006) *Obesity: Guidance On The Prevention, Identification, Assessment And Management Of Overweight And Obesity In Adults And Children CG43*. NICE, London. Available at: http://www.nice.org.uk/cg43 (accessed 14.01.14)

Pecoraro RE, Reober GE, Burgess EM (1990) Pathways to diabetic limb amputation. Basis for prevention. *Diabetes Care* **13**: 513–21

Pinzur M, Freeland R, Juknelis D (2005) The association between body mass index and foot disorders in diabetic patients. *Foot Ankle Int* **26**: 375–7

Pories WJ, MacDonald KG, Morgan EJ et al (1992) Surgical treatment of obesity and its effect on diabetes: 10-y follow-up. *Am J Clin Nutr* **55**(Suppl 2): 582S–585S

Public Health England (2013) *About Obesity: UK Prevalence And Trends*. Department of Health, London. Available at: http://bit.ly/1gFUuvk (accessed 14.01.14)

Rogers LC, Frykberg RG, Armstrong DG et al (2011) The Charcot foot in diabetes. *Diabetes Care* **34**: 2123–9

Scarborough P, Bhatnagar P, Wickramasinghe KK et al (2011) The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006-07 NHS costs. *J Public Health (Oxf)* 33: 527–35

Sjöström CD, Lissner L, Wedel H, Sjöström L (1999) Reduction in incidence of diabetes, hypertension and lipid disturbances after intentional weight loss induced by bariatric surgery: the SOS Intervention Study. *Obes Res* **7**: 477–84

Smith AG, Singleton JR (2013) Obesity and hyperlipidemia are risk factors for early diabetic neuropathy. *J Diabetes Complications* **27**: 436–42

Sohn MW, Budiman-Mak E, Lee TA et al (2011) Significant J-shaped association between body mass index (BMI) and diabetic foot ulcers. *Diabetes Metab Res Rev* **27**: 402–9

Standl E (2012) Dysglycemia and abdominal obesity. *Curr Vasc Pharmacol* **10**: 678–9

State of the Nation's Waistline (2014) *Obesity In The UK: Analysis And Expectations*. National Obesity Forum, London. Available at: http://bit.ly/1doX7xf (accessed 14.01.14)

Stein EM, Carrelli A, Young P et al (2013) Bariatric surgery results in cortical bone loss. *J Clin Endocrinol Metab* **98**: 541–9

Stuck RM, Sohn MW, Budiman-Mak E et al (2008) Charcot arthropathy risk elevation in the obese diabetic population. *Am J Med* **121**: 1008–14

UK Prospective Diabetes Study Group (1998) Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). UK Prospective Diabetes Study (UKPDS) Group. *Lancet* **352**: 837–53

World Health Organization (2013) *Obesity and Overweight. Fact Sheet Number 311*. WHO, Geneva. Available at: http://bit.ly/18pCdAN (accessed 23.04.2014)

Zimmet P, Alberti KG, Rubino F, Dixon JB (2011) IDF's view of bariatric surgery in type 2 diabetes. *Lancet* **378**: 108–10

Online CPD activity

Visit www.diabetesonthenet.com/cpd to record your answers and gain a certificate of participation

Participants should read the preceding article before answering the multiple choice questions below. There is ONE correct answer to each question. After submitting your answers online, you will be immediately notified of your score. A pass mark of 70% is required to obtain a certificate of successful participation; however, it is possible to take the test a maximum of three times. A short explanation of the correct answer is provided. Before accessing your certificate, you will be given the opportunity to evaluate the activity and reflect on the module, stating how you will use what you have learnt in practice. The CPD centre keeps a record of your CPD activities and provides the option to add items to an action plan, which will help you to collate evidence for your annual appraisal.

1. According to NICE guidance (2006), which BMI is the THRESHOLD LEVEL at which an adult is defined has having "class lll obesity"? Select ONE option only.

A. 27
B. 30
C. 35
D. 40
E. 50

2. What proportion of cases of type 2 diabetes does the World Health Organization estimate to be attributable to overweight and obesity? Select ONE option only.

A. 24%
B. 44%
C. 80%
D. 85%
E. None of the above

3. The risk of lower-limb amputation among people with diabetes is how many times that of those without diabetes? Select ONE option only.

A. 10
B. 15
C. 20
D. 25
E. 30

4. Which of the following is LEAST likely to worsen diabetic foot complications post-bariatric surgery induced dramatic weight loss? Select ONE option only.

A. Easier self-care
B. Increased exercise capacity
C. Poorly fitting shoes
D. Reduced foot clinic attendance

5. According to a recent economic analysis, which is the most appropriate estimate of the proportion of the total annual NHS budget spent on diabetic foot disease? Select ONE option only.

A. £1 in every £50
B. £1 in every £150
C. £1 in every £1500
D. £1 in every £15 000
E. £1 in every £150 000

6. According to a 2012 review of published data, which is the BEST expected long-term remission rate of type 2 diabetes following bariatric surgery? Select ONE option only.

A. 10%
B. 25%
C. 33%
D. 50%
E. 60%

7. Which three items are at the core of the Quality and Outcomes Framework incentive scheme for GPs' screening programme for "at risk" diabetic feet in the UK? Select ONE option only.

A. Peripheral sensory neuropathy, peripheral vascular insufficiency and foot deformity
B. Peripheral sensory neuropathy, peripheral vascular insufficiency and obesity
C. Peripheral sensory neuropathy, peripheral vascular insufficiency and hypertriglyceridaemia
D. Peripheral sensory neuropathy, peripheral vascular insufficiency and alcoholism
E. Peripheral sensory neuropathy, peripheral vascular insufficiency and B12 deficiency

8. Which SINGLE percentage represents the estimated number of people with type 2 diabetes and a foot ulcer who have underlying peripheral arterial disease (PAD)? Select ONE option only.

A. 10%
B. 25%
C. 33%
D. 50%
E. 75%

9. Which single BMI is LEAST associated with diabetic foot ulceration? Select ONE option only.

A. 18
B. 23
C. 30
D. 35
E. 40

10. Which of the following features of the post-bariatric patient places them at increased risk of Charcot neuroarthropathy following surgery? Select ONE option only.

A. Increased bone turnover
B. Decreased bone mass
C. Established neuropathy
D. Increased physical activity
E. All of the above