

Managing diabetes emergencies

June James

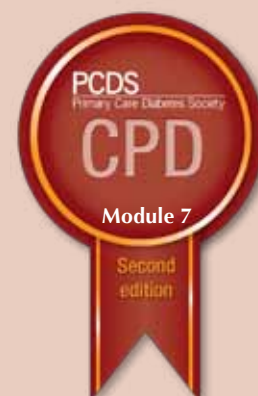
At any one time up to 15% of people in hospital beds in England and Wales have diabetes; this accounted for more than 12 000 people on the day of the National Diabetes Inpatient Audit. Nearly 85% had been admitted as an emergency compared with approximately 81% of all hospital admissions. This article focuses on the more common clinical emergencies, including diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS), hypoglycaemia, the diabetic foot and the care of newly diagnosed children with diabetes. Each section contains case studies that align theories and recommendations for good practice.

At any one time, up to 15% of people in English and Welsh hospital beds have diabetes, accounting for more than 12 000 people on the day of the National Diabetes Inpatient Audit (National Diabetes Inpatient Audit [NaDIA], 2011). Nearly 85% of these had been admitted as an emergency, compared with approximately 81% of all hospital admissions. The vast majority of patients were not admitted because of their diabetes; two thirds (66.6%) were admitted for a medical problem and only 9% were admitted specifically for management of their diabetes. Where diabetes was the main reason for admission, 47% were admitted because of active foot disease.

Diabetes inpatient care is expensive and impacts on the individual and the NHS. Between £2.3 and £2.5 billion is spent on diabetes care annually and at least £600 million of this is excess when compared with those of the same age group admitted to

hospital without diabetes (Kerr, 2011). The NaDIA results found that inpatients with diabetes admitted as an emergency stayed an extra 2 days compared with those who had a planned admission. The median length of stay overall for inpatients with diabetes was 3 days longer than those without. This is mirrored in other existing studies (8 days versus 5 days) and demonstrates that this disparity has not changed over time (Davies et al, 2001; Sampson, 2007)

The National Information Centre Diabetes Audit Team published two reports in 2012, after investigating data relating to over 2.15 million people with diabetes. The first, which reviewed care processes and treatment targets (NDA, 2012a), focused predominantly on the level of care and surveillance carried out in primary care and achievement of HbA_{1c} targets. It found that treatment targets for glucose and blood pressure control were less likely to be achieved



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Learning objectives

After reading this article the participant should be able to:

1. Outline the prevalence of diabetes in the hospital setting.
2. List the common reasons for emergency admission to hospital related to diabetes.
3. Describe key aspects of the more common diabetes-related emergencies.

Key words

- Children
- Diabetic ketoacidosis
- Emergencies
- Hyperosmolar hyperglycaemic state

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“Diabetic ketoacidosis occurs mainly in people with type 1 diabetes but can present in type 2 diabetes”

in people with type 1 diabetes than people with type 2 diabetes. When combined with the longer average duration of diabetes, this predicts higher levels of future complications for people with type 1 diabetes, which, in turn, impacts on the need for specialist treatment at some stage in the individual’s life. Younger people (those under 55 years of age) with either type 1 or type 2 diabetes were less likely than older age groups to have completed all their annual checks or achieved their treatment targets. This represented one quarter of people audited and led to concerns that this would be a predictor of poor outcomes and future complications in this group of individuals.

The second report (NDA, 2012b) focused on complications and mortality. It investigated the prevalence of cardiovascular complications – many of which would require hospital admission, such as angina, myocardial infarction (MI), heart failure, stroke – and serious kidney disease (as measured by the uptake of renal replacement therapy), foot disease including minor amputation, major amputation, diabetic ketoacidosis (DKA), and retinopathy. This audit revealed that diabetes was responsible for 22 200 additional deaths in England and 1920 additional deaths in Wales in 2010–2011 (NDA, 2012b).

These reports, along with the Commissioning Outcomes Framework and National Quality Diabetes Standards (NICE, 2011; NICE, 2012) provide the foundation for clinical commissioning groups (CCGs) and challenge healthcare providers and clinicians to review clinical processes and access to patient-centred and peer-reviewed structured education, in order to reduce variations in care and hospital admissions.

Diabetes emergencies are more often than not preventable. This article focuses on the more common clinical emergencies, including DKA and hyperosmolar hyperglycaemic state (HHS), hypoglycaemia, the diabetic foot and the care of newly diagnosed children with diabetes. Each section contains case reports that align theories and recommendations for good practice.

Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS)

DKA occurs mainly in people with type 1 diabetes but can occasionally present in people known to have type 2 diabetes. HHS is a condition that affects only people with type 2 diabetes. Both conditions are life-threatening. They are caused by a complete or relative lack of insulin and require emergency hospital admission. The rate of mortality in people with DKA has reduced over a 20-year period from 7.96% to 0.67% (Lin et al, 2005). Another study from Wang et al (2006) demonstrated that deaths due to hyperglycaemic crisis overall in the US amount to close to 5% for DKA and 10–15% for HHS. The rate of mortality in people with HHS remains high at 10–15%. The prognosis in both conditions is substantially worsened at the extremes of age and in the presence of coma and hypotension (Hansen and Møller, 2010). There is an ongoing rise in rates of DKA in the UK, with 8472 people admitted to hospital at least once for this complication during 2010–2011. Clinical services and commissioners are tasked to investigate new approaches to reverse this trend and reduce admissions to hospital.

DKA

Diagnosis of DKA can be difficult and patients may be defined as having DKA but may simply be hyperglycaemic. Case report 1 (*Box 1*) shows a case of recurrent attendance in an acute medical unit, and demonstrates how staff education can prevent admission or frequent attendance for the treatment of hyperglycaemia.

Precipitating factors for DKA include infection, intercurrent illness, post-surgery, and omission of insulin. People with DKA tend to be younger and there is a link to socioeconomic, psychosocial and educational factors contributing to poor compliance to insulin therapies (Randall et al, 2011). Diagnosis is dependent on three components: uncontrolled hyperglycaemia, ketonaemia and acidaemia (NHS Diabetes, 2010). Successful treatment has traditionally focused on frequent monitoring, correction of hypervolaemia and “hyperglycaemia”, correction of electrolyte

Box 1. Case study 1, “William”.

“William”, a 56-year-old physically active man was referred to the integrated care diabetes service (ICDS) for assessment after repeated attendances at the Acute Medicines Unit (AMU) for hyperglycaemia. He had type 1 diabetes (HbA_{1c}, 68 mmol/l [8.4%]) and was receiving long-term care in a brain injury unit. At least once a month, the care home staff called the paramedics to assess him for hyperglycaemia. On each occasion he was taken to the hospital, where after several hours he was treated with a bolus of short-acting insulin and then discharged. On ICDS assessment he was found to have erratic blood glucose readings, which coincided with the erratic lifestyle he was living. Hyperglycaemia only occurred when his behaviour was more agitated or aggressive; during these days he raided the tuck shop. On other days he was more often than not hypoglycaemic. His insulin doses over the previous 2 years had only varied by 2–4 units with the exception of additional short-acting insulin. His insulin dose was reduced initially to prevent hypoglycaemia, and at the same time a management plan was put in place whereby the staff tested for ketones if the blood glucose reading was 15 mmol/L or more. They were only to call for assistance if the ketone readings were raised (urinary ketones +++ to ++++ or blood ketones >1.5 mmol/L) or if he was unable to keep fluids down. Since the start of the management plan there have been no more attendances to the AMU in the past 18 months and hypoglycaemia is rare; William’s HbA_{1c} has increased by 1% but he is asymptomatic.

losses, and investigation for the precipitating cause. However, recent national guidelines recommend that, rather than focusing on hyperglycaemia, the reduction in ketones is a more effective measure of success. Readmission rates for DKA, however, are high with an average of 31% of patients readmitted with DKA within a year of their initial admission (Joint British Diabetes Societies Inpatient Care Group, 2010).

The majority of cases occur in people with a known history of diabetes and should be largely preventable through early detection, and by the education of patients and healthcare professionals. The NICE quality standards (NICE, 2011) emphasise the important part that structured education for people with diabetes plays in enabling people to manage their own diabetes, and that if admitted for DKA, recommends that they receive educational and psychological support prior to discharge. In practice, access to psychological support is limited in the UK so healthcare professionals need to ensure that patients know how to prevent reoccurrence and readmission following an event. During periods of intercurrent illness in people with diabetes, prevention of DKA can play a major part in reducing admissions to hospital. Recently, TREND-UK formed an expert working group representative of all the major professional organisations in the UK, to formulate guidance and ensure consistency in advice given around managing intercurrent illness. (This document,

entitled “*Managing diabetes during intercurrent illness in the community*”, will be available via www.trend-uk.org). In general, regarding suspected DKA, the “rule of thumb” is that children or pregnant women, or any patient who is unable to keep fluids down, should always be admitted to hospital as an emergency.

HHS

This condition is often the result of poorly treated type 2 diabetes or delayed diagnosis of type 2 diabetes. Affected patients are usually frail, with altered levels of consciousness, severely dehydrated and clinically very unwell. Infection or cardiovascular events are the most common predisposing factors. Strict differentiation between HHS and DKA is often difficult as some patients with HHS may present with ketones. The onset of symptoms with HHS is very slow whereas symptoms of DKA occur rapidly (*Table 1*) and the presenting blood glucose readings are often the key sign as readings can be 35–40 mmol/L or more. This, combined with a calculated serum osmolality of >320 mOsm/kg, is diagnostic. Treatment of HHS usually follows the principles of those for DKA: rehydration, correction of hyperosmolality, electrolyte imbalance and hyperglycaemia. These individuals are usually more sensitive to insulin (Joint British Diabetes Societies Inpatient Care Group, 2012).

Sick day education given through structured education programmes at the diagnosis of

Table 1. Differential diagnosis – diabetic ketoacidosis (DKA) and hyperosmolar hyperglycaemic state (HHS; Joint British Diabetes Societies Inpatient Care Group, 2010; 2012).

DKA	HHS
<ul style="list-style-type: none"> ● Rapid-onset hyperglycaemia ● Ketonuria ● Rapid weight loss ● Polyuria ● Polydipsia ● Kussmaul respiration ● Abdominal pain ● Lethargy 	<ul style="list-style-type: none"> ● Slow-onset and progressive hyperglycaemia with blood glucose reading over 35 mmol/L ● Severe dehydration ● Typically affects elderly patients with type 2 diabetes ● Patients usually have significant marked comorbidities ● Confusion

diabetes and reinforced at annual review may play a part in reducing occurrences of HHS or DKA.

Hypoglycaemia

Hypoglycaemia is the most common diabetes-related reason for ambulance call-out and is associated with increased morbidity and mortality (Brackenridge et al, 2006). It is estimated that there are 70 000–100 000 emergency call-outs for hypoglycaemia per year (NHS Diabetes, 2012a). These events are expensive and it is estimated that ambulance call-outs cost the NHS £13.6 million per year (Farmer et al, 2012). Each admission to hospital

because of hypoglycaemia costs the NHS about £1000 (Amiel et al, 2008). People with diabetes fear hypoglycaemia, which can impact on adherence to medication and agreed glycaemic targets (Wild et al, 2007).

CCGs are tasked with reducing the number of people with diabetes requiring medical attention as a result of a hypoglycaemic episode, and with reducing the rate of recurrence of an episode of hypoglycaemia requiring medical attention over 12 months (NICE, 2011). If commissioners are to meet this requirement, patient and staff education will play a major part, along with innovative commissioning processes.

National guidance regarding hypoglycaemia is readily available for hospital and community staff and includes algorithms and care pathways (NHS Diabetes, 2010; TREND-UK, 2011). Other easily accessible online training on hypoglycaemia for staff and patients is included in a suite of e-learning modules (NHS Diabetes, 2012b). New innovative ways of reducing admissions are being implemented across the UK; case study 2 (*Box 2*) describes a pilot study being undertaken in Leicestershire aimed at reducing repeated episodes of hypoglycaemia and enabling people living with diabetes to prevent and manage hypoglycaemic episodes.

The diabetic foot

Around one in 20 people with diabetes will develop a foot ulcer in 1 year and diabetes is the most common cause of lower limb amputations. There are 70 amputations a week, of which 80% are potentially preventable. Despite this, in 2007 and 2008, nearly a quarter (23%) of people did not have a foot check. Up to 80% of people will die within 5 years of having an amputation as a result of diabetes, which is greater than colon cancer (49%), prostate cancer (20%) or breast cancer (17%; Diabetes UK, 2012a). The NaDIA 2011 figures found that 47% of people who had been admitted as an emergency were admitted as a result of foot ulceration and that 2.2% of other admissions developed a foot ulcer during admission. In terms of costs, diabetic foot care

Box 2. Case study 2. A partnership approach to the prevention of recurrent hypoglycaemia.

An increasing number of paramedic call-outs for people with hypoglycaemia resulting in admission to hospital led to a successful partnership between the East Midland Ambulance Service and University Hospitals of Leicester NHS Trust. Forty-three patients who had been treated for hypoglycaemia by paramedics were given the option of referral within two working days to the local diabetes specialist nursing team. Audit demonstrated that telephone contact was made within one working day of the event and no patients were admitted to hospital immediately following the intervention. Of the 47 referred patients, two were admitted to hospital as a result of hypoglycaemia in the 30 days following the event. This initiative is now being rolled out across Leicestershire, with all patients being referred to the service unless they opt out within 24 hours of the event. All will be offered free access to the NHS Diabetes e-learning module on the “safe management of hypoglycaemia”.

is estimated to be 20% of the total diabetes budget, and it is estimated that between £600 million and nearly £700 million is spent each year on foot ulcers and amputations. People at highest risk of foot ulceration are those that have:

- A previous history of ulceration.
- Neuropathy or nerve damage.
- End stage renal disease.
- Vascular disease.

National initiatives such as the “Putting Feet First” Campaign and the development of the “National Minimum Skills Framework” (NHS Diabetes and Diabetes UK, 2011) required for the management of the diabetes are the gold standard of care and help to inform clinicians and commissioners of the foundation for good foot care in diabetes.

Prevention of foot disease and referral

If the incidence of diabetic foot disease is to reduce, there needs to be effective foot screening in place along with foot protection teams, care pathways and information for staff and people with diabetes that is given routinely and repeatedly. The development of a simple tool to identify if people with diabetes have reduced sensation and are at risk of foot ulceration is available online for all to access (“Touch The Toes” test; Diabetes UK, 2012b). The “traffic light” referral system developed by Diabetes UK is easy to use and gives clear guidance on when to refer (Figure 2). Case study 3 (Box 3) demonstrates how, with effective care, neuropathic ulcers can be healed but that early referral is needed. Intravenous antibiotics can be given at home, and in the example provided in case 3, was more cost-effective than hospital admission and suitable for the needs of this woman with learning disabilities.

Children newly diagnosed with diabetes

There are around 29000 people under the age of 17 with diabetes in England. Of these, 97% have type 1 diabetes, 1.5% have type 2 and 1.5% are recorded as “other” (Diabetes UK, 2012a). In type 1 diabetes in the UK this amounts to one in every 700–1000 people, and the peak age of diagnosis is 10–14 years. DKA is a common problem in

Box 3. Case study 3, “Carol”.

“Carol” is 60 years old and lives with her husband. She has learning difficulties and has had type 2 diabetes (now insulin treated) for 9 years. She presented to the specialist diabetic foot team with a 10 cm “grade 4” foot ulcer to (L) dorsum following referral from the district nurse who had been treating the ulcer for some time. Carol thought she had dropped something onto the foot 2 months before attending the clinic. After assessment and appropriate investigation from the specialist team, which included a microbiologist, she was treated with intravenous antibiotics given at home, with dressings also done at home along with regular review by the specialist foot team. The ulcer healed within 3 months.

children with diabetes, and the frequency of DKA at clinical onset of diabetes varies widely by geographical region from approximately 15% to 75%. Approximately 25% of children in the UK with newly diagnosed type 1 diabetes have DKA. Other reports estimate that 15.5% of children and young people have had one episode of DKA in the previous 5 years, and 10.4% of children and young people have had two or more episodes of DKA in the previous 5 years (The Health and Social Care Information Centre, 2011). The overall mortality rate in paediatric patients with DKA ranges between 0.15% and 0.3% (Lawrence, 2005).

There are approximately 10 deaths from DKA a year in the UK in children with diabetes (Ali et al, 2011). It is vital that clinicians are aware of the signs and symptoms of type 1 diabetes in children (Table 2). Symptoms in those under 2 years of age are more difficult to identify but will include lethargy, polydipsia and polyuria.

A marked elevation of the blood glucose level confirms the diagnosis. If ketones are present

Table 2. Presentation of newly diagnosed diabetes in children and young people (International Diabetes Federation and International Society for Pediatric and Adolescent Diabetes, 2011).

Presenting symptoms	Clinical signs giving indication of diabetic ketoacidosis
● Polyuria including bed wetting in a previously “dry” child	● Confusion
● Polydipsia	● Dehydration
● Blurring of vision	● Kussmaul breathing
● Weight loss in association with glycosuria and ketonuria	● Smell of ketones on the breath (not everyone can detect this)
● Abdominal pain	● Lethargy/drowsiness
● Recurrent infections/genital thrush	● Nausea and vomiting

Diabetes Footcare Pathway

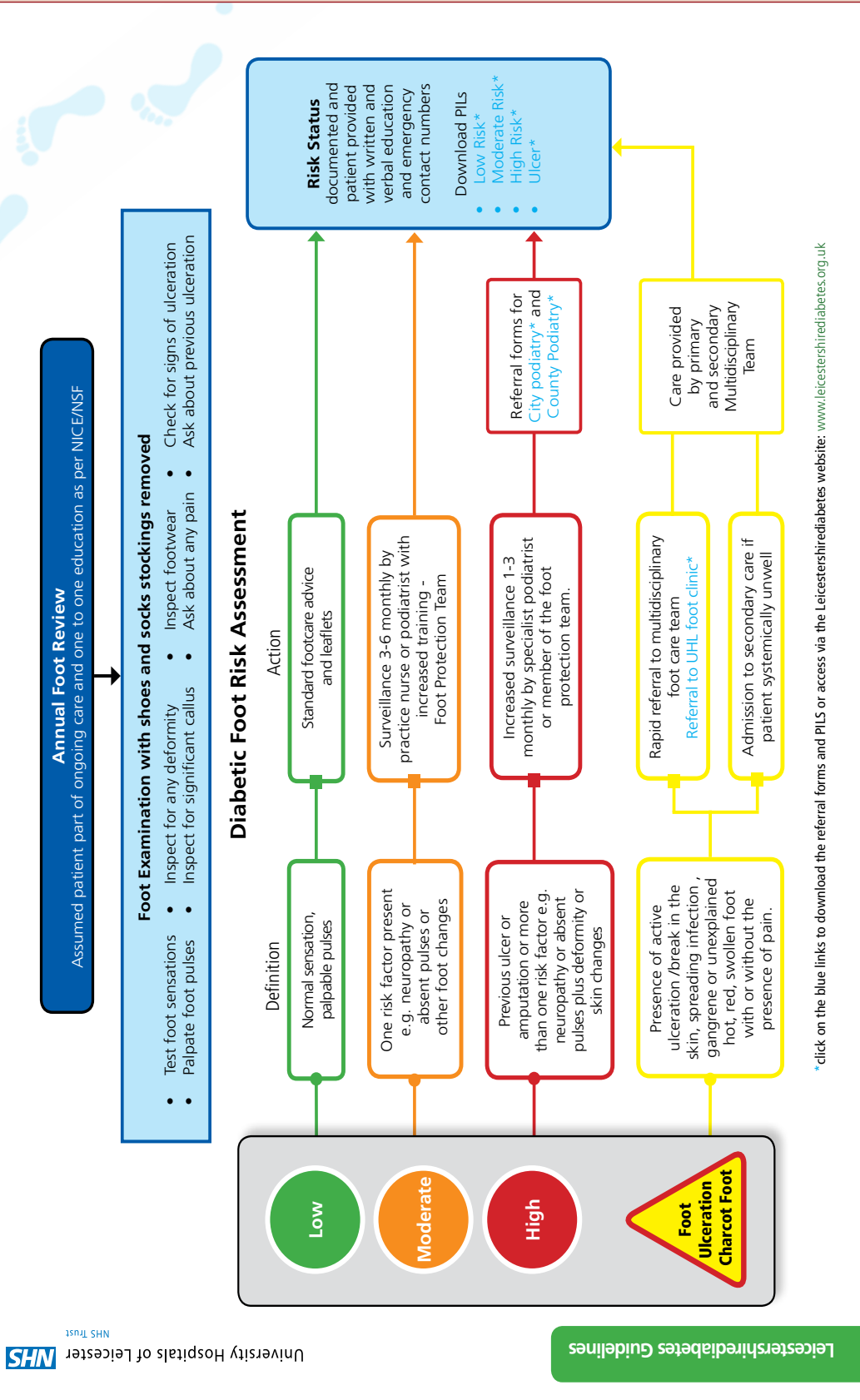


Figure 2. Example of a diabetes footcare pathway. Adapted for local use from the Diabetes UK and NHS Diabetes "Putting Feet First" footcare pathway 2011 (NHS Diabetes and Diabetes UK, 2011). Reproduced with kind permission of Diabetes UK.

Box 4. Case study 4, “George”.

“George” is a 14-year-old boy who lived with his mother and two other children. He had been feeling very thirsty and was getting up every hour or so to pass urine. George needed extra support at school as he had learning difficulties and his schoolwork was poor. He was tall for his age and, along with his friends, tended to dress using multiple layers, as was the “fashion” at the time. He did not complain about feeling unwell except to avoid going to school. It was only when his mother caught him rushing naked to collect a towel after a bath one evening that she saw how thin he was. She took him to see the GP who, after assessment, correctly diagnosed type 1 diabetes and George was admitted to hospital. Further questioning after insulin initiation and hospital discharge revealed that his schoolwork had deteriorated because his vision was so blurred. Indeed he couldn't see to write his Mum's “Mother's Day” card. He hadn't thought to say anything about it.

in blood or urine, treatment is urgent, and the child should be referred the same day to avoid the development of ketoacidosis. Insulin therapy should be instituted in most cases as soon as the diagnosis of diabetes is made, to prevent development of DKA.

A specialist team with expertise in diabetes and paediatrics should care for children with diabetes and their families. This should include the child and their family, a paediatrician, a DSN educator, a dietitian, a paediatric social worker and/or a psychologist or psychiatrist. Ongoing care encompasses structured education, links with nurseries, schools and colleges and community teams, assessment of growth and development and psychological support as well as the traditional markers for glycaemic control, treatment options and prevention of complications.

Case study 4 (*Box 4*) acknowledges the difficulty of diagnosis in some children and young people, when even the closest of relatives may not recognise that the individual is ill. General practitioners and practice nurses are the first point of contact and need to be vigilant and ask the right questions to ensure that a correct diagnosis is made, which was the case for “George” in the example provided.

Conclusions

Diabetes-specific emergencies requiring hospital admission are not common but they do, in general, require prompt diagnosis and treatment. It is important that healthcare professionals have the correct knowledge skills

and competencies to recognise the different emergency situations, treatment and referral pathways, to support people living with diabetes.

Information for healthcare professionals and individuals living with diabetes is now freely available and accessible and should be offered to patients at diagnosis and at annual review. Structured education programmes can reinforce the message and enable attendees to recognise when they may need urgent assessment and assistance. Clinical management plans should be in place for all urgent and emergency care ensuring appropriate referral and assessment by the “right” healthcare professional, for the “right” individual at the “right” time. ■

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Page points

1. Diabetes-specific emergencies requiring hospital admission are not common but they do, in general, require prompt diagnosis and treatment.
2. Healthcare professionals should have the correct knowledge, skills and competencies to recognise the different emergency situations, treatment and referral pathways.
3. Clinical management plans should be in place for all urgent and emergency care, ensuring appropriate referral and assessment.

“Diabetes-specific emergencies requiring hospital admission are not common but they do, in general, require prompt diagnosis and treatment.”

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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 new 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.

- Over 12000 people with diabetes occupied hospital beds on the day of the 2011 National Inpatient Audit. Of these, 9% were admitted because of their diabetes. Which ONE of the following was the COMMONEST reason for admission? Select ONE option only.
 - Active foot disease
 - Diabetic ketoacidosis (DKA)
 - Hyperosmolar hyperglycaemic state (HHS)
 - Hypoglycaemia
 - New diagnosis of type 1 diabetes
- The following have been ranked in order of HIGHEST mortality rate first to LOWEST last. Which ONE is the MOST appropriate ordering? Select ONE option only.
 - DKA, Hypoglycaemia, HHS
 - DKA, HHS, Hypoglycaemia
 - HHS, DKA, Hypoglycaemia
 - HHS, Hypoglycaemia, DKA
 - Hypoglycaemia, HHS, DKA
- A 67-year-old woman with type 2 diabetes had her left second toe amputated recently because of damage secondary to peripheral vascular disease and diabetic neuropathy. The wounds have healed well and she has been discharged from the vascular surgery clinic. According to the diabetes footcare pathway, what is the most appropriate action to now recommend? Select ONE option only.
 - Rapid referral to multidisciplinary footcare team
 - Review 3-monthly by a practice nurse
 - Specialist podiatrist monthly review
 - Standard footcare advice from the GP
 - Surveillance 6-monthly at a specialist footcare clinic
- According to a national audit in 2012, approximately what percentage of people with diabetes have not completed their annual checks or achieved their treatment targets? Select ONE option only.
 - 10%
 - 25%
 - 33%
 - 50%
 - 66%
- A 27-year-old woman with type 1 diabetes is admitted with DKA. On average, what is the approximate likelihood of her being re-admitted with another episode of DKA in the following 12 months? Select ONE option only.
 - 1 in 2
 - 1 in 3
 - 1 in 5
 - 1 in 6
 - 1 in 10
- A 45-year-old woman with type 1 diabetes has suspected food poisoning and has vomited several times in the past few hours. Her blood glucose was 25 mmol/L in the night, but she gave herself six extra units of insulin. This morning her blood glucose is 19 mmol/L and blood ketones 3 mmol/L. Which is the MOST appropriate management plan? Select ONE option only.
 - Admit to hospital as an emergency
 - Prescribe antiemetics and review in 4 hours
 - Recommend an additional 6 units of insulin every 4 hours until blood glucose is less than 13 mmol/L
 - Test blood glucose and ketones every 2 hours, giving additional insulin according to the results
 - Test blood glucose and ketones every 4–6 hours, giving additional insulin according to the results
- Which ONE of the following is the MOST appropriate for self-treatment if a person with diabetes develops mild hypoglycaemia? Select ONE option only.
 - A small can of diet lemonade
 - A small carton of smooth orange juice
 - One tube of glucose gel
 - Two dextrose tablets
 - 200 mL of Lucozade
- A “MODERATE risk assessment of a diabetic foot” is confirmed by which one of the following? Select ONE option only.
 - A previous foot ulcer
 - Normal sensation and absent pulses
 - Palpable pulses
 - Presence of active ulceration
 - Presence of a split in the skin with local cellulitis
- Which ONE of the following is NOT typically associated with HHS? Select ONE option only.
 - Blood glucose >35 mmol/L
 - Confusion
 - Ketonuria
 - Serum osmolality >320 mOsm/kg
 - Severe dehydration
- According to recent national guidelines, which ONE of the following is the most effective measure of successful correction of DKA? Select ONE option only.
 - Reduction of blood glucose
 - Reduction of blood ketones
 - Reduction of core body temperature
 - Reduction of finger prick capillary glucose
 - Reduction of venous HbA_{1c}