

Diabetic ketoacidosis and new onset diabetes

Diabetic ketoacidosis is a presenting feature of both type 1 and type 2 diabetes mellitus in the elderly. The diagnosis and management of new onset diabetes is discussed along with the challenges in an older age group. It is important that symptoms associated with new onset in the elderly are not limited to those associated with hyperosmolar hyperglycaemic states.

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Despite classic medical school teaching, type 1 diabetes can occur at any stage throughout life. The incidence is reported at 1 in 100 children and 1 in 300 adults¹ or 8.2 new cases per 100,000 per year at a steady rate from the age 30 years onwards.² The pathogenesis, autoimmune destruction of the β -cells in the Islets of Langerhans is the same in all age groups.³

Diabetic ketoacidosis (DKA) can occur in either type 1 or type 2 diabetes. The proportion of type 2 diabetes in adult patients presenting with DKA was 60% in a Northern American study⁴ in a population largely made up African-Americans. Up to 50% of patients of African or Hispanic descent presenting with DKA are diagnosed with type 2 diabetes compared with less than 10% of Caucasian patients.⁵ Therefore, although most cases of ketoacidosis occur in people with type 1 diabetes, DKA can happen in type 2 diabetes (mostly in patients of African or Hispanic descent but reports in Caucasians do exist).⁶

Based on the Quality and

Outcomes Framework data in 2008, diabetes mellitus now affects at least 3.86% of the population and is rising annually; hence, GPs are increasingly likely to encounter unusual or atypical cases.

Diagnosis

At the time of diagnosis, some people present with the classic osmotic symptoms associated with hyperglycaemia. These include weight loss, polydipsia and polyuria. Others present with DKA. Once diabetes has been confirmed, diagnosing the type of diabetes can present more of a challenge, particularly in the elderly patient.

Errors of diagnosis in type 1 diabetes made simply on the basis of age have been reported.² For example, a 93-year-old lady was diagnosed with hyperglycaemia, assumed to have type 2 diabetes and discharged home on a sulfonylurea. It was only the presence of continuing symptoms that alerted her primary care physician to

question the diagnosis followed by a positive anti-islet cell antibody titre that confirmed the presence of type 1 diabetes.

Features such as the lack of family history of diabetes, low body weight and the presence of heavy ketonuria⁷ would support a diagnosis of type 1 diabetes. Furthermore, a de novo presentation of diabetes with a history of other components of polyendocrine autoimmunity or even autoimmune neurological conditions should increase the suspicion that the diagnosis is type 1 diabetes.⁸ C-peptide levels can be used to confirm the diagnosis and, if low, would reflect a loss of pancreatic β -cell function. In the case described (box) these levels were normal, indicating that the diagnosis was likely to be insulin resistance and type 2 diabetes mellitus. However, it is accepted that a normal C-peptide does not exclude a diagnosis of type 1 diabetes — this test only becomes reliable when the patient has had type 1 diabetes for many years. This

is because at diagnosis the patient with type 1 diabetes often still has some residual β -cell function (hence the “honeymoon” period). The diagnosis is a clinical one and it is possible that the patient in the case described actually has type 1 diabetes.

Widely available antibody tests for anti-glutamic decarboxylase (GAD) and anti-islet cell autoantibodies can also be used to identify type 1 diabetes mellitus. These tests cost in the region of £26 for the GAD antibody, and £32 for the anti-islet cell antibody test. The tests are not ideal with sensitivities reported between 74 and 80% but with a specificity of 100%.^{9,10} Islet cell antibodies are more frequently found in paediatric type 1 diabetes mellitus, but the incidence of GAD antibodies is not affected by age and hence it is the most sensitive test for adults.¹¹ In patients found to have positive GAD antibody titres, but who are currently well controlled on oral hypoglycaemics, 80% will require insulin treatment within six months.¹¹ The diabetes subtype in these cases is named latent autoimmune diabetes in adults (LADA).¹¹ This could be the diagnosis the case described.

A further clue to diagnosing the correct type of diabetes is the dose of insulin required to achieve good glycaemic control. In the case vignette, the insulin requirement was 0.45 units/Kg to achieve good control suggesting insulin resistance. In true new onset type 1 diabetes, it is often the case that small doses are required after the initial illness because of a) residual β -cell and b) the lack of insulin resistance. Dose requirements may be as

Box: Case study

An 88-year-old Caucasian man was admitted with a three-week history of feeling unwell. He had a two-week history of a productive cough, loss of appetite, polyuria, polydipsia and fatigue and one week of blurred vision. He was sent in for diabetic ketoacidosis (DKA) when he was found to have glycosuria and ketonuria by his primary care physician.

Past medical history included atrial fibrillation, ischaemic heart disease and thyroidectomy for multinodular goitre but no microvascular complications. There was no family history. BMI was 23.5 Kg/m².

A diagnosis of DKA was made. He was discharged with twice daily pre-mixed insulin. Anti islet-cell autoantibodies were negative, anti-GAD antibody level was 1 μ /ml (1–5) and C-peptide level was 724 pmol/L (174–960). Admission HbA1c was 115 mmol/mol (12.7%). These results are consistent with type 2 diabetes mellitus presenting unusually with DKA. Four months later, HbA1c was 41 mmol/mol (5.8%) on 36 units/day of insulin.

low as 0.05 to 0.1 units/Kg to maintain euglycaemia.

Besides ethnic origin, clinical features of ketosis-prone type 2 diabetes include male gender, middle age, family history of type 2 diabetes, and obesity. Glucose levels and acid-base disturbances are often the same in DKA associated with type 1 and in DKA associated with type 2 diabetes, and are therefore not helpful in differentiating between the two. Autoantibody tests are rarely positive in people with type 2 diabetes, with a maximum rate reported of 18%⁵ allowing differentiation of ketosis-prone type 2 from type 1 and LADA.

The most useful test in general practice is a urine dipstick looking for ketones in either the young or elderly presenting with suspected DKA. This is because this potentially life threatening condition can occur at any age in both type 1 and 2 diabetes. Thus, it is worth

remembering that new onset type 1 diabetes is not solely a diagnosis made in the young.

Treatment

The treatment of DKA is no different in either type of diabetes nor does age (without the presence of comorbidities) influence treatment. Recent guidelines have been published on the inpatient management of DKA.¹² Presentation of DKA in type 2 diabetes mellitus patients is, however, associated with a higher incidence of early insulin treatment as opposed to the majority of patients with type 2.⁵ The only other differences that might be encountered are the effects of polypharmacy and the existence of comorbidities that might not be seen in younger patients. This could affect not only immediate management such as fluid and electrolyte balance, but also affect the choice of agents used for long-



Diabetic ketoacidosis is not a diagnosis limited to young patients or to those with type 1 diabetes

term management of the diabetes.

The key to the management of diabetes at any age is to balance optimal control (with its association with reduction in development of micro- and macrovascular complications) with side effects of therapy and poor quality of life associated with intensive testing, injections and diet control.

Diagnosis at an older age could potentially affect both sides of this decision process. Primary prevention of cardiovascular disease, for example, may already be obsolete as ischaemic heart disease increases in prevalence in the elderly and is hence encountered commonly. There will be those who also have life-limiting diagnoses whose main aim is to maintain the quality of their life potentially at the expense of quantity. Osmotic symptoms, visual disturbance, risk of recurrent infections and other

symptoms due to high plasma glucose concentrations will be the main “targets” to treat in these cases.

The main risk associated with insulin use in older patients is hypoglycaemia. This can be frightening for any age group, but can have a large impact in a population who are already at increased risk of falls.

The initiation of insulin therapy can also affect driving. The length of a driving licence for private vehicles becomes limited to three years, and the patient must be aware of hypoglycaemia. Many older patients use cars typically for short journeys to local destinations such as shops. The added burden of having to test glucose levels before driving or the added fear of suffering a hypoglycaemic episode while driving may lead to the patient surrendering their license. Driving is often a key component of a person

maintaining their independence in their own home and its loss could increase the burden of care.

Prognosis

Type 2 diabetes tends to get worse with age and the dose of agents used to treat the condition increases, as well as the number of agents used. With the tightening of targets to try to reduce the microvascular and macrovascular complications associated with diabetes, more and more people require insulin treatment. However, it is important to recognise that they do not then have “type 1 diabetes”, they have “type 2 diabetes on insulin”. However with onset of diabetes in later life, it is likely that the complications associated with diabetes will have less impact on morbidity and mortality than for

those developing it in childhood or young adulthood.

Conclusion

Diabetic ketoacidosis is not a diagnosis limited to the young, and is not limited to people with type 1 diabetes. People presenting with symptoms of hyperglycaemia should have their urine tested for ketones, and if found to be positive should be referred urgently for specialist assessment. Once insulin treatment has been started, there is a considerable amount of education necessary for diabetes particularly when associated with insulin use.

There are many patient information sources available, a good example of which is via Diabetes UK (www.diabetes.org.uk). Further information on diagnosis and management is available via NICE (www.nice.org.uk). For driving guidelines see the DVLA website (www.dft.gov.uk/dvla/medical/ataglance.aspx).

Conflict of interest: Dr Dhatariya was an author for the Joint British Diabetes Societies Guidelines for the Management of Diabetic Ketoacidosis

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