Cerebral venous thrombosis during diabetic ketoacidosis

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Neurological deterioration during an episode of diabetic ketoacidosis is usually assumed to be caused by cerebral oedema. We present a case of cerebral venous sinus thrombosis presenting in a similar manner, also associated with severe iron deficiency anaemia. Computed tomography scanning provided the correct diagnosis and allowed institution of anticoagulation with improvement in neurological outcome. Neuroimaging should always be performed in suspected cerebral oedema associated with diabetic ketoacidosis in order to exclude other pathologies.

Cerebral oedema is the major cause of death and neurological morbidity in children with insulin dependent diabetes. However, other intracranial pathologies may present in a very similar manner and unless neuroimaging is performed, appropriate treatment may be withheld. We present a case where neuroimaging provided the correct diagnosis of cerebral venous sinus thrombosis, allowing anticoagulation to be started, and resulting in an improved clinical outcome.

CASE REPORT

A 5 year old previously fit and well white girl with insulin dependent diabetes was admitted to her local hospital with a 12 hour history of vomiting and lethargy. She had had diabetes since she was 2 years old and was well controlled on twice daily insulin (0.7 units/kg/day).

On admission she was pale, afebrile, moderately dehydrated, and lethargic. No infective focus was found on clinical examination and there were no focal neurological manifestations. Admission laboratory studies revealed an increased true blood glucose of 14.8 mmol/l, with a compensated metabolic acidosis (pH 7.33, pCO2 3.2 KPa, bicarbonate 12 mmol/l, base excess -11 mmol/l). Urinalysis showed ketones of 16 mmol/l.

A blood count showed a microcytic anaemia, with a haemoglobin of 41 g/l, a mean cell volume of 59.3fL, a white cell count of 10.2 x 10^9/l, and platelet count of 348 x 10^9/l. A clotting screen was normal and laboratory investigations were consistent with iron deficiency anaemia. The patient had no history of chronic blood loss, pica, dietary deficiencies, or symptoms of coeliac disease.

A diagnosis of mild diabetic ketoacidosis (DKA) with moderate dehydration and microcytic anaemia was made. Over the next 12 hours she was treated with around 30 ml/kg 4.5% albumin intravenously and commenced on a normal maintenance fluid rate (0.45% saline/5% dextrose) and intravenous insulin (0.05 units/kg/h). Her condition initially began to improve. However 12 hours after admission she became increasingly confused and by morning she was unconscious, responding to painful stimuli only and was found to have limb rigidity and fisting. Her pupils were reacting and her fundi were normal on fundoscopy. The blood glucose had risen to 20 mmol/l overnight, plasma bicarbonate remained between 11 and 14 mmol/l, and the pH had risen to 7.35. Ketonuria was still present. She was immediately treated for suspected cerebral oedema with mannitol (0.5 g/kg) and dexamethasone and then transferred to the intensive care unit where she was intubated and commenced on artificial ventilation. Empirical antibiotics and acyclovir were commenced after blood cultures were taken. She received a transfusion of packed red blood cells. She was transferred to the regional paediatric intensive therapy unit for further management of suspected cerebral oedema.

On arrival, a brain computed tomography (CT) scan was done which showed an appearance consistent with thrombosis in the straight sinus and the vein of Galen with ischaemic changes in the thalamus (fig 1). A lumbar puncture was performed (white cell count 0, red blood cells 160, no organisms seen). An intracranial pressure transducer was inserted to monitor intracranial pressure but this remained stable and no treatment was required. The transducer was removed after 24 hours. Her blood glucose concentration was well controlled on intravenous insulin and maintenance dextrose saline. After

Abbreviations: CT, computed tomography; CVT, cerebral venous thrombosis; DKA, diabetic ketoacidosis
two days of artificial ventilation, she was extubated without difficulty but remained encephalopathic. A further CT brain scan showed extension of the thrombus involving the cortical venous system. A decision to anticoagulate was made and intravenous heparin was commenced 48 hours after admission to the intensive therapy unit, with some improvement in neurological status. Warfarin treatment was started after several days with a plan to continue it for three months.

The child was slow to improve neurologically, remaining irritable with poor comprehension and no verbal communication. She had a right sided hemiplegia and was unable to support herself sitting or standing. She was fed via a nasogastric tube and her normal subcutaneous regime of insulin was restarted once full enteral feeding had been established. She was transferred back to her local hospital 13 days after admission.

She made a remarkably good neurological recovery at her local hospital and after several weeks was walking stably, using her upper limbs and vocalising a little. The warfarin was discontinued after three months. Two years after her illness she has no motor deficit and very mild learning difficulties; she attends a mainstream school with some extra help. Her diabetes remains well controlled and her haemoglobin has remained stable after a course of iron.

The following further laboratory investigations were normal: blood, CSF, urine, and stool cultures; thrombophilia screen; haemoglobin electrophoresis; immunoglobulins; antitigliadin antibodies; thyroid function test; and short synacthen test. No cause for her severe iron deficiency anaemia was ever found.

**DISCUSSION**

This is the first published report of central venous thrombosis (CVT) occurring in association with DKA in a child. Other neurological conditions (particularly cerebral oedema) may occur during treatment for DKA, but this case highlights the importance of making a specific neurological diagnosis because of the management implications. Many children presenting with apparent cerebral oedema during DKA do not have neuroimaging. However, unless CT scanning had been carried out, this girl may have been treated only for cerebral oedema, with no much less favourable outcome. A diagnosis of CVT was made.

The diagnosis was not made on purely clinical grounds. In DKA there is no good correlation between the degree of obtundation and blood glucose, serum osmolality, and pH; in the absence of focal neurological signs the initial lethargy would have been ascribed to DKA with dehydration. Cerebral oedema can also occur with cautious fluid replacement.

CVT is an infrequent condition with diverse clinical presentations. In this case CVT mimicked cerebral oedema in the setting of a child being treated for mild DKA who also had iron deficiency anaemia. The diagnosis of CVT should therefore be suspected in similar clinical settings, and the diagnosis confirmed by neuroimaging, so that appropriate treatment can be instituted.

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9 year old male presented with a two year history of a painless mass overlying the fourth finger of the right hand. Of note was that he had been started on antituberculous treatment two weeks prior to presentation. A chest radiograph showed right upper lobe airspace disease with associated hilar adenopathy consistent with pulmonary tuberculosis (TB); a radiograph of the right hand (fig 1) showed a cystic, expansile lesion of the distal portion of the proximal phalanx of the right ring finger. The margins were well defined and there were internal septations and associated cortical sclerosis. There was cortical destruction but no periosteal reaction. A large soft tissue mass surrounded the bone lesion. This was diagnosed as tuberculous dactylitis based on the imaging findings and the coexisting diagnosis of pulmonary TB.

Bone and joint TB occurs in 1–5% children who have untreated initial pulmonary TB. Spread to the skeletal system occurs during the initial infection via the lymphohaematogenous route. The skeletal infection often becomes symptomatic within 1–3 years after the initial infection. Eighty five per cent of patients with TB dactylitis are younger than 6 years of age and its incidence among children with TB is reported to be 0.65–6.9%. The bones of the hands are more frequently affected than bones of the feet, with the proximal phalanx of the index and middle fingers the commonest sites for infection. The condition usually presents as a painless swelling of a digit of a few months duration. The radiographic features of cystic expansion of the short tubular bones has led to the name of “spina ventosa” being given to TB dactylitis of the short bones of the hand. Periosteal reactions and sequestra are not common features but may occur. Sclerosis may be seen in long standing cases.

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References

Figure 1  Cystic, expansile lesion of the distal end of the proximal phalanx of the fourth right finger. Cortical destruction, sclerosis, and internal septation are present but there is no periosteal reaction.