Seed GLOBAL HEALTH

Project ECHO

Overview, Assessment, Investigations, Management And Complications – Diabetic Emergencies

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Presentation outline

- Introduction
- Diabetic ketoacidosis
- Overview of management
- Hyperosmolar hyperglycaemic state
- Hypoglycaemia

Introduction

In regular clinical practice there are three common diabetic emergencies:

- Diabetic ketoacidosis – quite common and may be the initial presentation, particularly in Type 1 Diabetes mellitus
- Hypoglycaemia – also common and often missed
- Hyperosmolar Hyperglycaemic state (HHS)

All could be rapidly fatal

Diabetic ketoacidosis

Have a high index of suspicion

History and physical examination should not delay treatment

Symptoms - Polyuria and polydipsia reflect hyperglycemia Other important symptoms – vomiting, abdominal pain, and/or shortness of breath indicate the likelihood of ketoacidosis. Symptoms of any precipitating condition may also be present.

Signs - dehydration; tachycardia; hypotension; hyperventilation (Kussmaul respiration); drowsiness or coma; and the smell of ketones on breath

Diabetic ketoacidosis

Diagnosis of DKA

All of these must be present to make the diagnosis

The 'D' – a blood glucose concentration of >11.0 mmol/L or known to have diabetes mellitus

The 'K' – The 'K' – a capillary or blood ketone concentration of >3.0 mmol/L or significant ketonuria (2+ or more on standard urine sticks)

The 'A' – a bicarbonate concentration of <15.0 mmol/L and/or venous pH <7.3.

- +- anion gap > 20

Diabetic ketoacidosis

Severe DKA:

- venous bicarbonate <10mmol/L;
- arterial pH <7.0 (if measured);
- hyperventilation;
- hypotension with a systolic BP <90mmHg;
- and a depressed conscious level - document the Glasgow Coma Scale

Diabetic ketoacidosis

Treatment should be commenced immediately to avoid mortality

Obtain good intravenous (IV) access – if peripheral access is difficult, insert a central line.

Commence IV saline and insulin immediately.

Consider using the Intensive or High-Dependency Units (ITU/ HDU) if the patient is confused, unconscious, or hypotensive (systolic BP <90mmHg), or if venous bicarbonate is <10mmol/L (or pH <7.0). If no ITU/HDU is available then **as much intensive monitoring as is practical in the circumstances is highly recommended**.

Diabetic ketoacidosis

Intravenous fluids

- Give 1L 0.9% sodium chloride solution over the first hour
- Rate of fluids thereafter depends on age/fitness of patient, typically:
  - – 1L in next hour
  - – 2L in next 2–4 hours
  - – then 1L 4–6 hourly
- Reduce rate in elderly/cardiac disease/mild DKA (HCO_3 >10)
- More rapid infusion increases risk of respiratory distress syndrome
- Switch to 5% glucose 1L 8 hourly once BG ≤ 14mmol/L; continue 0.9% sodium chloride concomitantly if patient still volume depleted

Overview of management

Fluid administration and deficits:

- There is universal agreement that the most important initial therapeutic intervention in DKA is appropriate fluid replacement followed by insulin administration.
- The main aims for fluid replacement are:
    - Restoration of circulatory volume
    - Clearance of ketones
    - Correction of electrolyte imbalance
- Typical deficits in DKA in adults
    - Water - 100 ml/kg
    - Sodium - 7-10 mmol/kg
    - Chloride - 3-5 mmol/kg
    - Potassium - 3-5 mmol/kg

Overview of management

Insulin therapy:

- A fixed rate intravenous insulin infusion at 0.1 units/per kilogram body weight is recommended (may have to settle for SC in our setting if adequate fluid administration is being done).
- It may be necessary to estimate the weight of the individual.
- Insulin has several effects, but the following are the most important when treating DKA:
    - Suppression of ketogenesis
    - Reduction of blood glucose
    - Correction of electrolyte disturbance

  The insulin infusion is made up of 50 units of soluble human insulin in 49.5 ml 0.9% sodium chloride solution (i.e. 1 unit /ml).

Overview of management

Insulin therapy:

- Once glucose falls to < 14 mmol/L reduce dose of insulin to 0.05 IU/kg and add a dextrose infusion (5 – 10 %)

Potassium:

Serum potassium (mmol/L)	**Potassium chloride to be added to each litre of fluid**
>5.5	Nil and check K^+ in 2 hours
4–5.4	20mmol
<4	40mmol

Overview of management

Investigations:

- blood glucose;
- urea and electrolytes;
- venous bicarbonate;
- ECG;
- CXR;
- urine and blood cultures
- Arterial gases especially if there is a reduced conscious level; respiratory distress; or if the patient is hypotensive.
- Other investigations may be clinically indicated e.g. throat swab, lumbar puncture, CT brain scanning etc…

Overview of management

Other measures:

- strict fluid balance – urinary catheter if incontinent or if no urinary output after two hours;
- consider inserting a central venous pressure line if the patient is elderly or has evidence of poor left ventricular function;
- insert a nasogastric tube if the conscious level is impaired, remembering to also protect airway;
- and consider thromboprophylaxis if there is severe dehydration or the patient is elderly.
- Broad spectrum antibiotics should be given if there is evidence of infection (we mostly start and IV antibiotic)

Overview of management

Complications:

- **Hypoglycaemia and hypokalaemia.** Monitor carefully to anticipate and prevent – very common.
- **Aspiration.** Ensure nasogastric tube and airway protection in the unconscious patient.
- **Underlying conditions.** Ensure these are identified and treated appropriately.

Overview of management

- **Complications:**
  - **Cerebral oedema.** This condition is uncommon but may occur, particularly in young adults.
    - *Cerebral oedema, symptoms/signs:*
    - – Headache.
    - – Bradycardia and rising BP.
    - – Change in neurological status (decreased conscious level, rest lessness, irritability).
    - – Focal neurological signs.
    - – Convulsions.
    - – Papilloedema.
    - *Cerebral oedema, management:*
    - – Exclude hypoglycaemia.
    - – Transfer to ITU.
    - – Give mannitol 20% 5ml/kg over 20 minutes.
    - – Obtain CT scan of head to exclude other causes.

Overview of management

- **Hypophosphataemia.** This may occur in DKA and has been associated with a wide range of metabolic disturbances. Phosphate depletion persists for several days after resolution of DKA. However, prospective studies have failed to show clinical benefit from phosphate replacement.

Hyperosmolar hyperglycaemic state

Hyperosmolar hyperglycaemic state

This condition is characterized by hyperglycaemia and high plasma osmolality without significant keton-uria or acidosis.

Clinical characteristics

- Type 2 diabetes, usually in patients over 60 years. Up to 40% of cases occur in previously undiagnosed patients. The onset is often insidious with vague symptoms including confusion and drowsiness with features of dehydration. It is necessary to look for a precipitating medical condition, e.g. sepsis, myocardial infarction etc. In this condition, the haemodynamic state is the best indicator of severity of illness.

Hyperosmolar hyperglycaemic state

Diagnosis

- Hyperglycaemia (blood glucose usually >50mmol/L) with a calculated osmolality (2[Na + K] + glucose) of >;
- Serum bicarbonate is >15mmol/L and the urinary ketones ++ or less on the standard Dipstix.

Hyperosmolar hyperglycaemic state

Management

- Management is as for DKA but note the following.
- The insulin infusion rate should be halved as paradoxically these patients can be quite insulin sensitive. This should be reviewed in two hours.
- Elderly patients are more likely to need a CVP line to optimise fluid replacement.
- If serum sodium is >155mmol/L consider giving 0.45% sodium chloride initially, although many units give ‘ normal’ saline (0.9%) as this is relatively hypotonic in this situation.
- Risk of thromboembolic disease is high – **anticoagulate** fully if no contraindications.
- Most patients can eventually be managed with oral hypoglycaemic agents and diet, but recovery of insulin secretion may take time and insulin may be required for a few weeks.

Hypoglycaemia

Hypoglycaemia

Adults who are conscious, orientated and able to swallow –

- ABCDE – should not take a lot of time
- Stop insulin infusion if patient is on an infusion
- 150-200ml pure fruit juice (e.g. orange juice)
- 3-4 heaped teaspoons of sugar dissolved in water
- Repeat capillary blood glucose measurement 10-15 minutes later. If it is still less than 4.0mmol/L, repeat as above.
- Monitor in 30 – 45 min. Patient should have a meal – sulphonylurea related hypoglycaemia may linger on

Hypoglycaemia

Adults who are unconscious and/or having seizures and/or are very aggressive

- ABCDE
- Stop the insulin infusion if on an infusion
- If IV access is available give 100ml of 20% glucose at 400ml/hour or 200ml of 10% glucose at 800ml/hour over 15 minutes.
- Repeat glucose 10 min later and if less than 4 mmol/L repeat the 10/20 per cent glucose infusion
- Once the patient recovers – they should have a normal meal

Hyperglycaemia

Hypoglycaemia symptoms

- Autonomic:
  - Sweating
  - Palpitations
  - Shaking
  - Hunger
- Neuroglycopenic
  - Confusion
  - Drowsiness
  - Speech difficulty
  - Incoordination
- General malaise
  - Headache
  - Nausea

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Reference

Savage, MW (Practical Diabetes 2006)

Joint British Diabetes Societies for In patient care (2023)

THANKS FOR LISTENING.

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