ketoacidosis - a very very short overview
Outline

1. pathophysiology
   - ketoacid generation

2. clinical presentations
   - acetonaemic vomiting
   - diabetic ketoacidosis, typical course
   - diabetic ketoacidosis, complications
   - alcoholic ketoacidosis

3. good bye
   - conflicts of interest
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(ICU, Herlev Hospital, Copenhagen)
ketone bodies

source: http://en.wikipedia.org/wiki/Ketosis
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acetonämisches Erbrechen in der Praxis

von T. BRANDEL


Summary: Acetonemic vomiting in actual practice. After a brief initial or prodromal phase which may result in errors and incorrect diagnosis, the clinical appearance — ketonuria / ketonemia — has a pronounced attacklike character. After previous mental manifestations or minimal febrile infections it has a predilection for infants. The symptoms which may progress to severe coma are caused by a disturbance of the fatty acid metabolism, i.e., by incomplete oxidative break-down and a dangerous increase of acetone acetic acid and betaoxybuteric acid in the blood and urine. The author explains in what manner mothers can be instructed to perform Gerhard's test and how it is possible as an immediate measure in the medical office and, most of all, in the patient's house to avoid a threatening coma.

Brandel, Das acetonämische Erbrechen in der Praxis
MunchMedWochenschr 1968, 110(45) 2659-60
In a susceptible child anything from a common respiratory infection or even psychological alterations to genetic metabolic illnesses can initiate a vicious cycle of vomiting, starvation metabolism, consequent ketoacidosis and more vomiting.

In modern terminology this is better known as “cyclic vomiting”.

acetonaemic vomiting 2

when your small child simply will not stop vomiting
acetonaemic vomiting

when your small child simply will not stop vomiting

Treatment is simple - give glucose and fluids!
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diabetic ketoacidosis 1

a young person in severe distress, the common presentation
diabetic ketoacidosis 1

a young person in severe distress, the common presentation

- polyuria, polydipsia
- general weakness
- nausea and vomiting
  - abdominal pain
diabetic ketoacidosis 2

a young person in severe distress, the common presentation
diabetic ketoacidosis 2

a young person in severe distress, the common presentation

- severe dehydration
- circulatory compromise
- somnolence, stupor, coma
  - acetone smell
- Kußmaul breathing
- pseudoperitonitis
- signs and symptoms pointing to another illness triggering ketoacidosis, especially an infection
diabetic ketoacidosis 3

a young person in severe distress, the common presentation
diabetic ketoacidosis 3

a young person in severe distress, the common presentation

- hyperglycaemia
- fluid loss of 10% of body weight
- severe losses of Na\(^+\) and K\(^+\), 500 to 1000mmol
- hyperosmolarity: \(2 \cdot ([\text{Na}^+] + [\text{K}^+]) + [\text{glucose}] + [\text{urea}]\)
- severe metabolic, “unknown anion” acidosis
- initially often low serum-Na and high serum-K values
- moderate leukocytosis
diabetic ketoacidosis 4

typical treatment recommendations
diabetic ketoacidosis 4

typical treatment recommendations

- as ever: ABC - if necessary, secure the airway!
- replace fluid losses, typically 2l isotonic crystalloid during the first two hours
  - be prepared to replace $[K^+]$-losses, eventually $[Mg^{2+}]$
- continuous insulin administration
- shift to half strength electrolyte fluids and glucose administration with serum-glucose falling to below 15mmol/l
diabetic ketoacidosis 5

a typical course in a young adult
diabetic ketoacidosis 5

a typical course in a young adult
diabetic ketoacidosis 6

pH during the first 24 hours of therapy

DKA cases during one year at Central Hospital Skaraborg, Skövde, 2004/2005

(ICO, Herlev Hospital, Copenhagen)
Diabetic ketoacidosis 7

Base excess during the first 24 hours of therapy

DKA cases during one year at Central Hospital Skaraborg, Skövde, 2004/2005

(ICU, Herlev Hospital, Copenhagen)
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(ICC, Herlev Hospital, Copenhagen)
diabetic ketoacidosis 14

when all goes wrong in a young adult
**diabetic ketoacidosis 14**

when all goes wrong in a young adult

a young adult with known type 1 diabetes mellitus

impulsive behaviour, in an angry fit just ignores her insulin needs

admitted with severe diabetic ketoacidosis
diabetic ketoacidosis 14

when all goes wrong in a young adult

a young adult with known type 1 diabetes mellitus

impulsive behaviour, in an angry fit just ignores her insulin needs

admitted with severe diabetic ketoacidosis
diabetic ketoacidosis 15

when all goes wrong in a young adult
diabetic ketoacidosis 15

when all goes wrong in a young adult

slow resolution of the ketoacidotic derangement
no resolution of the hyperchloraemic component
increasingly inadequate respiratory response
10 hours after admission to ICU severe vomiting, aspiration, respiratory and cardiac arrest
severe persistent central nervous damage inspite of CPR in an ICU environment
diabetic ketoacidosis 16

comorbidity and atypical presentations in the ageing diabetic patient
diabetic ketoacidosis 16
comorbidity and atypical presentations in the ageing diabetic patient

a 57 year old lady at six in the morning
diabetic ketoacidosis 16

comorbidity and atypical presentations in the ageing diabetic patient

a 57 year old lady at six in the morning

40 years of type 1 diabetes mellitus
injects insulin only once daily
nausea and vomiting for a whole day
refuses to get medical attention, her husband finally manages to drive her to hospital
walks through the door, becomes restless
anaesthesiologist immediately contacted and present (me .... )
15 minutes after walking in, severe bradacardia and circulatory arrest
diabetic ketoacidosis 17

comorbidity and atypical presentations in the ageing diabetic patient
diabetic ketoacidosis 17

comorbidity and atypical presentations in the ageing diabetic patient

ABC! - intubation, ventilation, adrenalin, fluids

first blood gas analysis:
pH 6.86, SBE -27mEq/l, PCO$_2$ 5kPa (38mmHg)

Ringer’s solution and trometamol- Na-bicarbonate given
diabetic ketoacidosis 22

a dreaded complication in paediatric cases: cerebral oedema
diabetic ketoacidosis 22

a dreaded complication in paediatric cases: cerebral oedema

Cerebral oedema is reported to be the leading cause of paediatric mortality due to diabetic ketoacidosis, affecting about 1% of all cases. 61 of 6977 hospital patients with DKA had clinically apparent cerebral oedema, with 13 of 15 deaths occurring in this group.

diabetic ketoacidosis 23

a dreaded complication in paediatric cases: cerebral oedema

Risk factors associated with cerebral edema would be: age inferior to 5, recent DM diagnosis, long-standing symptoms, hypocapnia, severe acidosis, bicarbonate treatment for acidosis, excessive volume replacement in the first 4 hours and insulin administration in the first hour of fluid replacement.

diabetic ketoacidosis 23

a dreaded complication in paediatric cases: cerebral oedema

”Risk factors associated with cerebral edema would be: age inferior to 5, recent DM diagnosis, long-standing symptoms, hypocapnia, severe acidosis, bicarbonate treatment for acidosis, excessive volume replacement in the first 4 hours and insulin administration in the first hour of fluid replacement“

Diabetic ketoacidosis 24

A dreaded complication in paediatric cases: cerebral oedema

MRI imaging, though, suggests vasogenic oedema due to ischaemia.

https://clinicaltrials.gov/ct2/show/NCT01365793
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alcoholic ketoacidosis 1

when the stomach just will not take more ethanol
alcoholic ketoacidosis 1
when the stomach just will not take more ethanol
alcoholic ketoacidosis 2

when the stomach just will not take more ethanol

As in the small child with cyclic vomiting, these patients are caught in a vicious circle of vomiting, starvation metabolism and more vomiting.

As with the paediatric patients, the decisive point is recognising this clinical presentation.
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conflicts of interest

*my two conflicts of interest!*
conflicts of interest

my two conflicts of interest!
conflicts of interest

my two conflicts of interest!

http://www.acidbase.org/presentations/