Diabetes

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Glycemic Effects

- What problems can you have with "the sugar"?

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Case 1

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- 911 call for altered mental status
- Aid car arrives on scene, pt actively seizing
- Medics arrive, pt postictal with glucose gel on face

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- Vitals
  - HR 110
  - BP 138/82
  - SPO2 98%
- Blood Glucose Level - 20

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- Causes of hypoglycemia?
  - Low Food
  - High insulin
  - Illness
  - Increased activity

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How do you want to treat this patient?

Tell me about D50

- How much sugar is in D50?
- 50g sugar in 100ml
- Aunt Jemima
  - 32g in 60ml
- Coke
  - 39g in 355ml

Downsides of D50

How else can we deliver sugar?

- D25 – Available in amps
- D10w – Bags – 250 and 500 cc
- D5w – 100, 250, 500, 1000 cc

D50 vs D10???

- Downsides of D50
  - Rebound hypoglycemia
    - May occur in up to 20% of patients
  - Overshooting target
    - Post administration glucose up to 250
      - High glycemic variability is a predictor for morbidity and mortality in diabetic patients
  - Hypertonic Toxicity

Hypertonic Tonicity

- pH = ~3.5
- D50 = 2500 mOsm/L
- 900 mOsm/L is threshold for central administration
- D10 = 500 mOsm/L
- Rate of extravasation is 10% or higher!

PREHOSPITAL CARE

Dextrose 10% or 50% in the treatment of hypoglycaemia out of hospital? A randomised controlled trial

C Moore, M Woollard

Emerg Med J 2005;22:512–515. doi: 10.1136/emj.2004.020693

Objective: To investigate whether 10% dextrose given in 5 g (50 ml) aliquots is more effective than 50% dextrose given in 5 g (10 ml) aliquots in the treatment of out of hospital hypoglycaemia.
Design: Randomised controlled trial.
Setting: Out of hospital patients attended by paramedics from a large UK ambulance service.
Participants: 51 unresponsive adult patients with blood glucose levels ≤ 4 mmol/l.
Intervention: 5 g (50 ml) intravenous aliquots of 10% dextrose or 5 g (10 ml) intravenous aliquots of 50% dextrose to a maximum dose of 25 g.
Main outcome measures: To compare for each dextrose concentration the time to achieve a Glasgow Coma Scale (GCS) score of 15, and the dose required to obtain a blood glucose level of >4.5 mmol/l.
Results: There were no statistically significant differences between the groups with regard to age or sex, median pretreatment GCS, pretreatment blood glucose level, or proportion of patients with insulin dependent diabetes. Following treatment, there were no statistically significant differences in median time to recovery (8 minutes), median post-treatment GCS, or number of subjects experiencing a further hypoglycaemic episode within 24 hours (four per group). The median total dose of dextrose administered was significantly less with the 10% concentration (10% = 10 g, 50% = 25 g, p<0.001) and median post-treatment blood sugar levels were also significantly lower (10% = 6.2 mmol/l and 50% = 9.4 mmol/l, p=0.003). There were no reports of extravasation injuries in either group.
Conclusions: Dextrose 10% delivered in 5 g (50 ml) aliquots is administered in smaller doses than dextrose 50% delivered in 5 g/10 ml aliquots, resulting in lower post-treatment blood glucose levels. We therefore recommend it as the intravenous treatment of choice for adult hypoglycaemia.

See end of article for authors' affiliations

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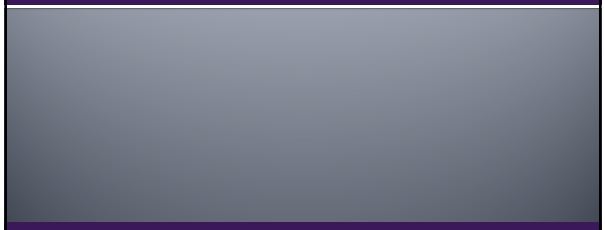
Best practice approach

- Hang D10, bolus 100 – 200 cc
- If small catheter (22g or 24g), use light pressure to bag
- Clamp tubing between boluses
- Reassess for mental status improvements, recheck fingerstick
- Rebolus until alert and oriented or normoglycemia (>70)

Case 2



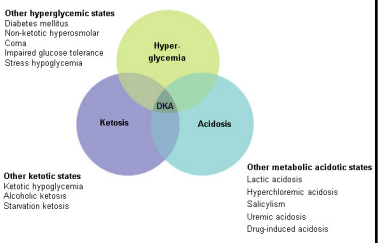
- 48 year old male
- Cough, altered mental status
- PMH: Diabetes
- Fruity smell…

- Vitals
  - HR – 130
  - BP – 92/41
  - Spo2 – 92%
- Blood Glucose = "High"

- Labs in ED
  - VBG
    - pH = 7.18
  - Hydroxybutyrate – high
  - Glucose 724
  - Anion Gap 24

D..... K..... A.....

- Diabetic (High glucose)
- Keto (ketones in blood / urine)
- Acidosis (low blood pH)



Presentations of Hyperglycemia

- What have you seen???
- Can you smell ketones?

Honk???

- Hyperosmolar
- Nonketosis

Table 2.1 Clinical features of diabetic ketoacidosis (DKA) and hyperglycaemic hyperosmolar state (HHS)

	DKA	HHS
Patients	Type 1 diabetes (but see Chapter 1 for important exceptions)	Type 2 diabetes
Duration of symptoms	Short, often <24 hours	Longer, often several days, sometimes insidious over weeks
Pathogenesis	Insulin deficiency Glucagon (and other counter-regulatory hormone) excess Abnormal metabolism of non-esterified fatty acids	Insulin deficiency Renal impairment Reduced thirst
Mortality	<< 4%	~ 15%
Complications	Cerebral oedema, especially in the young Respiratory distress syndrome Thromboembolism Rhabdomyolysis	Thromboembolism Rhabdomyolysis
Working biochemical definition	Blood pH < 7.3 (mild 7.25–7.30; moderate 7.00–7.24; severe < 7.0) Blood bicarbonate < 17 mmol/L (in early compensated phase, bicarbonate buffers ketoacids, so bicarbonate is low but pH normal) Urinary ketones ≥ 2+	Arterial pH > 7.3 Plasma osmolality > 320 mosmol/kg Bicarbonate >18 mmol/L

Prehospital Treatment of Hyperglycemia

- IV Fluids!
  - Often intravasculary depleted
- Supportive care as needed

Hospital Treatment

- Infusion of insulin
- Fluids (may require large amounts)
- Supportive care

Case 3

Case 3

- 42 year old female in West Seattle
- Dispatch is for Altered mental status
- BLS finds an argumentative patient with a glucose of 32

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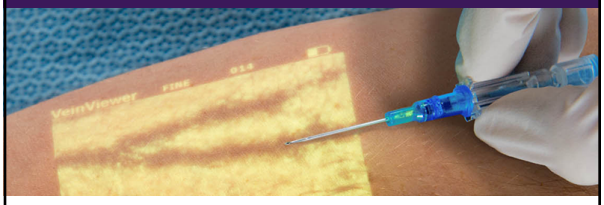

- Pt refusing to take oral intake
- Unable to gain IV access

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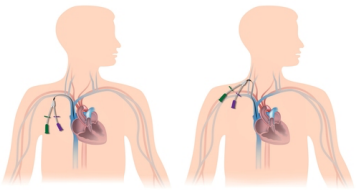
What are your options?

Central Venous Catheter



Subclavian vein insertion Internal jugular vein insertion

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2 Strategies

DRILL AND FILL

- IO then glucose
- Downsides?

MAGIC IM INJECTION

- What is this magic you speak of???

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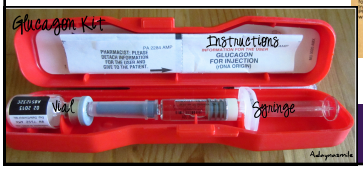
Glucagon

- Peptide produced by pancreas
- Tells liver to make glucose from stored glycogen



Glucagon

- WHO list of essential medicines
- Contraindications
  - Malnutrition
  - Pheochromocytoma
  - Insulinoma

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Glucagon in EMS…

- Eagles survey
  - Used on 1-2 per 1000 calls
- NEMSIS Data
  - 1 per 1000 calls
- Some agencies throw away 3 for every 1 used
  - $400 per dose!!

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Exotic Strategies

- Intranasal Glucagon
  - Stage 3 clinical trials
  - Price unknown – probably high!
  - Fast action, much faster and better delivered than IM glucagon by lay persons
- Rectal glucose?
  - Absorbed poorly!
- IM Epinephrine
  - If no other options, can transiently raise blood glucose

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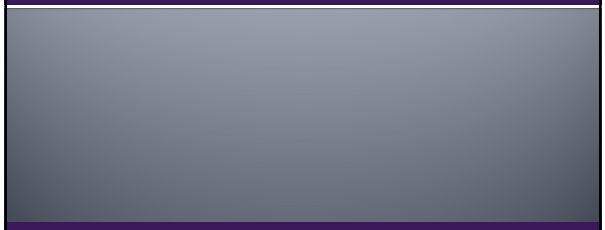
Case 4



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- 5 year old male patient
- Altered mental status
- At recess at school, became confused and lethargic

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- Vitals
  - HR 132
  - BP 103/65
  - SPO2 98%
  - Blood Glucose 22

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- What type of diabetes is this?

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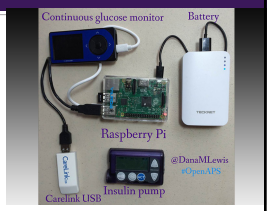
Insulin Pumps



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Management of Insulin Pump by EMS

- Stop it!
  - 1. Turn it off ("suspend")
  - 2.

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OK. Insulin is stopped. Now what?

- What is next?

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IV in place

- Lets give some sugar….. Tell me how!!

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Options

- Use D10
- Or
- Make D10!
  - ½ amp D50 in 250cc D5W!

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Summary

- D50 vs D10
- Drill and Fill?
- Hyperglycemia
- Stop the pump!

Questions?

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