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MINISTRY OF HEALTH

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Project ECHO

DIABETIC EMERGENCIES

EMERGENCY APPROACH

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DIABETES?

Outline

- General initial approach to diabetic emergencies.

- Specific managment diabetic emergencies

Hypoglycemia/DKA/Hyperosmolar Hyperglycemic state

INITIAL MANAGEMENT: PRIMARY SURVEY

- Vitals Signs

- DEFG: Don't Ever Forget Glucose: finger stick glucose!

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FIRST FIVE MINUTES

ABCs

Vital signs

O2 as needed

IV

- 2L IV Fluid bolus in adults
- **No bolus in children unless shock: risk of brain oedema**
  - **10ml/kg IV over 1 hour.**

Glucose level

Cardiac Monitor & Pulse Oximeter

AIRWAY

Secure airway only if absolutely necessary:

- Profound altered mental status necessitating intubation more common in HHNS than DKA.
- Avoid succinylcholine, if possible; may worsen hyperkalaemia.
- **Attempt to avoid intubation in DKA if possible** → if must intubate, hyperventilate (RR 30, flow 60 liters/minute initially) to blow down acidosis.

HISTORY AND PHYSICAL EXAM

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KEY HISTORICAL FEATURES

- Known diagnosis of DM?
- Medications? Missed doses?
- Diet? Recent sugar?
- Time of onset, progression
- Treatments at home? (Extra insulin taken?)
- Blurred vision?
- Thirst? Decreased PO intake?
- Frequent urination?

SIGNS AND SYMPTOMS

Signs of hypoglycaemia

- Altered mental status or confusion
- Dizziness, weakness, fatigue
- Vomiting
- Severe dehydration
  - Dry mucus membranes, poor skin turgor

Signs of shock

- Cool extremities
- Hypotension, tachycardia
- Delayed capillary refill

SIGNS AND SYMPTOMS

Signs DKA:

- Kussmaul's respirations
  - Deep, labored respirations
  - Goal to exhale CO_2 in attempt to compensate for metabolic acidosis
- **Increased respiratory rate**
- Ketotic breath odor
  - Fruity acetone smell
- Generalized abdominal tenderness:
  - DKA may present with vague abdominal tenderness.
  - Check glucose in abdominal pain patients.

SIGNS AND SYMPTOMS

Signs HHNS:

- Stroke-like symptoms
  - Hemiplegia
  - Visual blurring
  - Hemianopsia
  - Must differentiate from hyperglycaemia due to real stroke vs HHNS presenting with stroke-like stymptoms
- Altered mental status
  - May be severe
  - May necessitate intubation and mechanical ventialtion

Categorize elevated glucose:

- HHNS?
  - Severely elevated glucose (often >500mmol/L) with elevated osmolality and altered mental status
- DKA?
  - Metabolic acidosis with (+) ketones and hyperglycaemia
- Elevated glucose alone?
  - Patients with chronic, poorly controlled DM-II may have high glucoses at baseline
  - Non-diabetic patients may have hyperglycaemia due to physiologic stress response

INVESTIGATIONS

Evaluate DKA/HHNS

- Lab
  - Electrolytes, including magnesium and phosphorus
    - Potassium bedside testing, if possible
  - Renal function
  - VBG
    - Mild acidosis in HHNS; more severe acidosis in DKA
  - Serum osmolality
    - Increased osmolality is a marker of HHNS
  - Urine ketones
  - Serum ketones
    - Urine dipstick only tests 1 kind of ketones
  - Lactate

INVESTIGATIONS

Search for trigger:

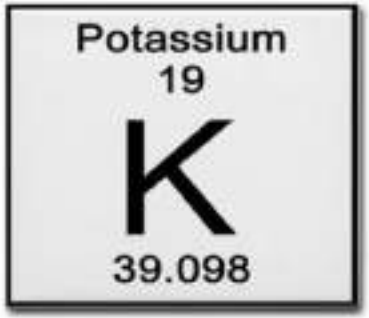
- Lab
  - Full blood picture
  - Urine pregnancy
  - Urine analysis for WBC, leukocyte esterase, nitrites, gram stain, culture
- ECG
  - Ischaemia?
- CXR
  - Pneumonia?

INTERPRETING LABS

Sodium (Na):

- Markedly elevated glucose affects sodium
- Use UNCORRECTED sodium to calculate anion gap
- Use CORRECTED sodium to evaluate fluid status:
- **Sodium corrected = Sodium measured + (Glucose/4) (in mmol/L)**

INTERPRETING LABS



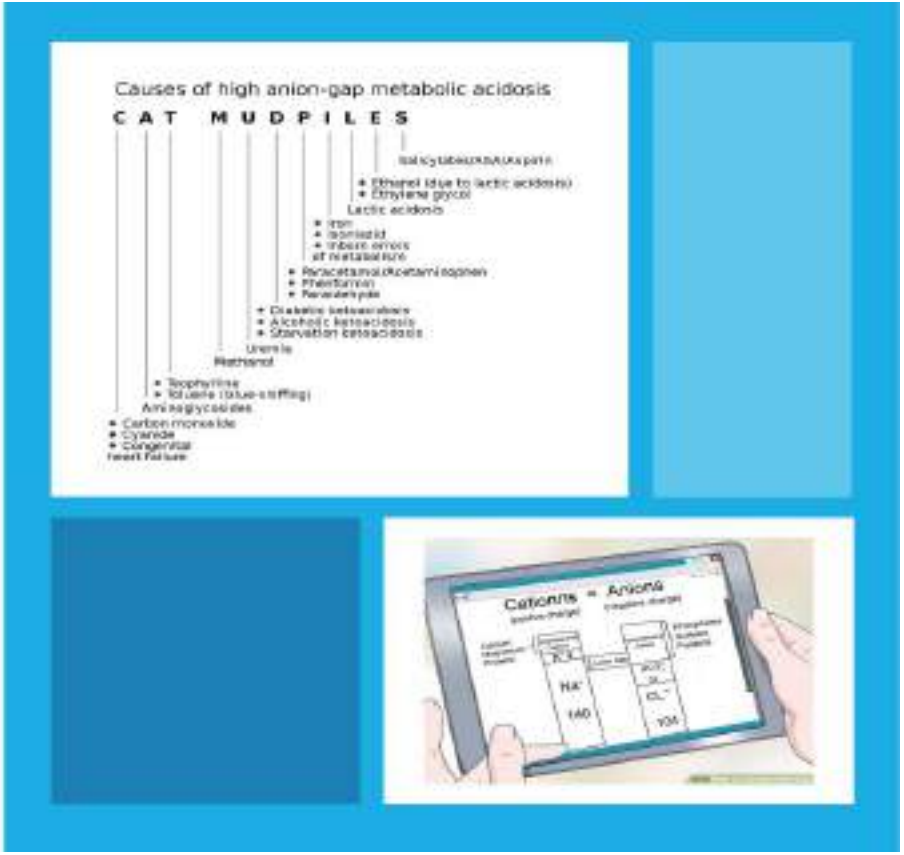
Potassium (K):

- Potassium levels can fluctuate severely with insulin and glucose changes.
- Measured serum K+ is higher than total body K+
  - May still cause symptomatic hyperkalaemial
- Giving insulin shifts K+ back into cells → will decrease K+ rapidly

CALCULATIONS

Anion Gap Acidosis in DKA:

- Defined by presence of acidosis + anion gap
- Acidosis: pH <7.35
- Anion gap = Na - (Cl + HCO3)
- AG >15 is significant



GENERAL MANAGEMENT

Goals of acute management:

- Correct life-threatening electrolyte abnormalities.
- Restore intravascular volume.
- Correct acidosis.
- Identify and treat causes and complications:
  - Medication compliance
  - Infection, sepsis, stroke, MI

GENERAL MANAGEMENT

What are the two treatments that are most important in both DKA and HHNS?

Give Fluids.

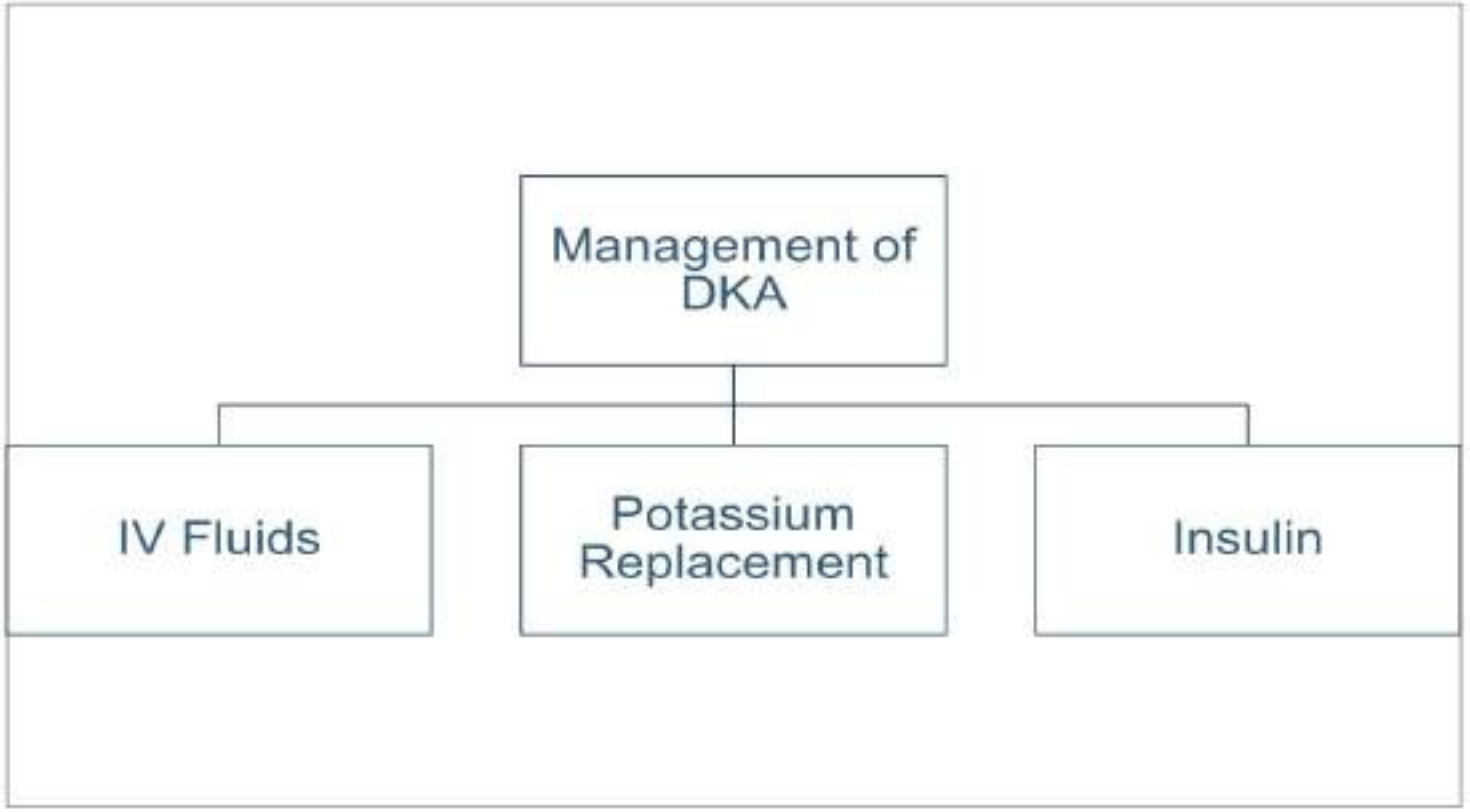
Correct Electrolytes.

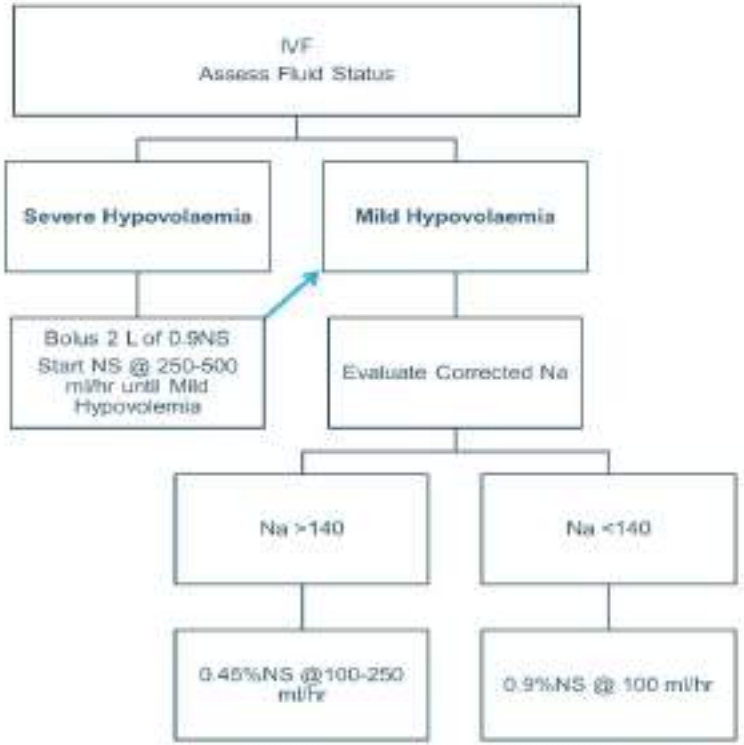
MANAGEMENT

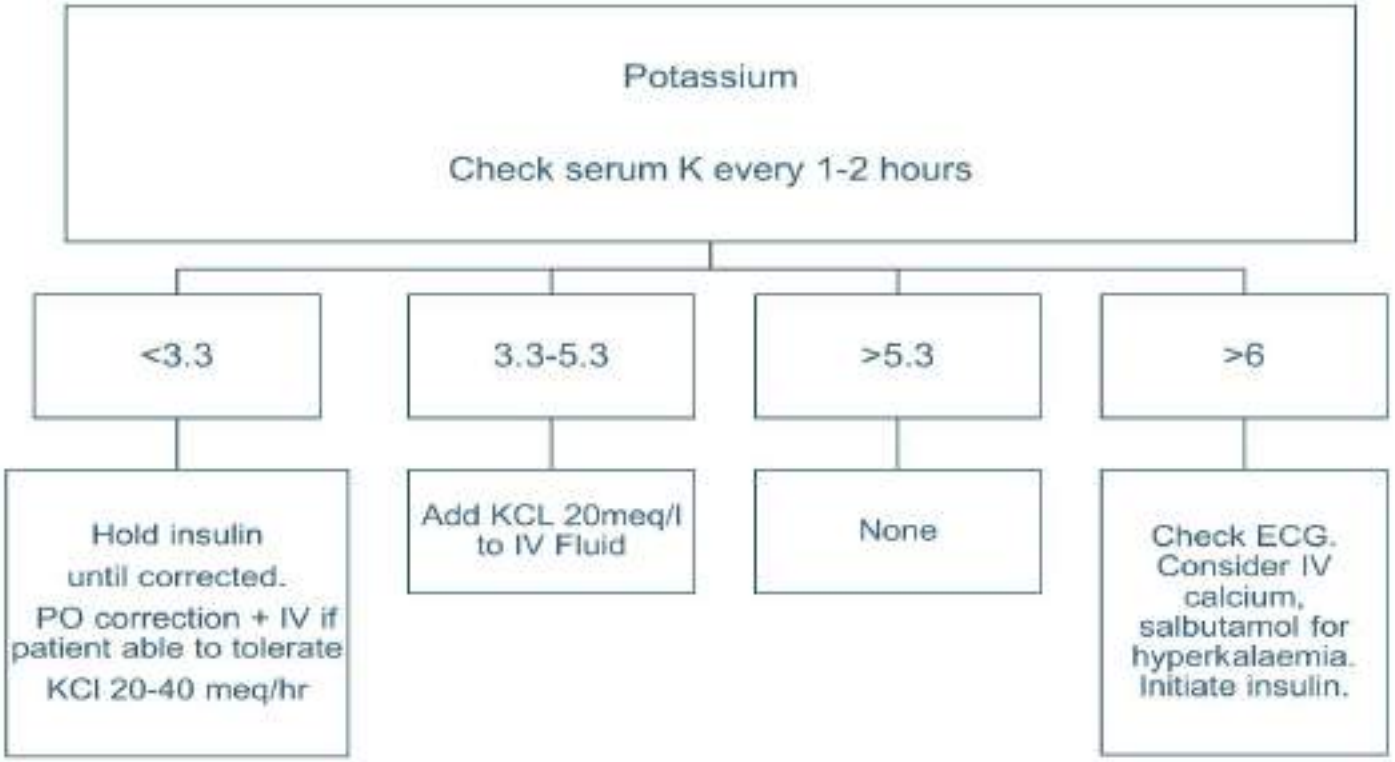
Rehydration and electrolyte correction + identification of underlying cause often are sufficient.

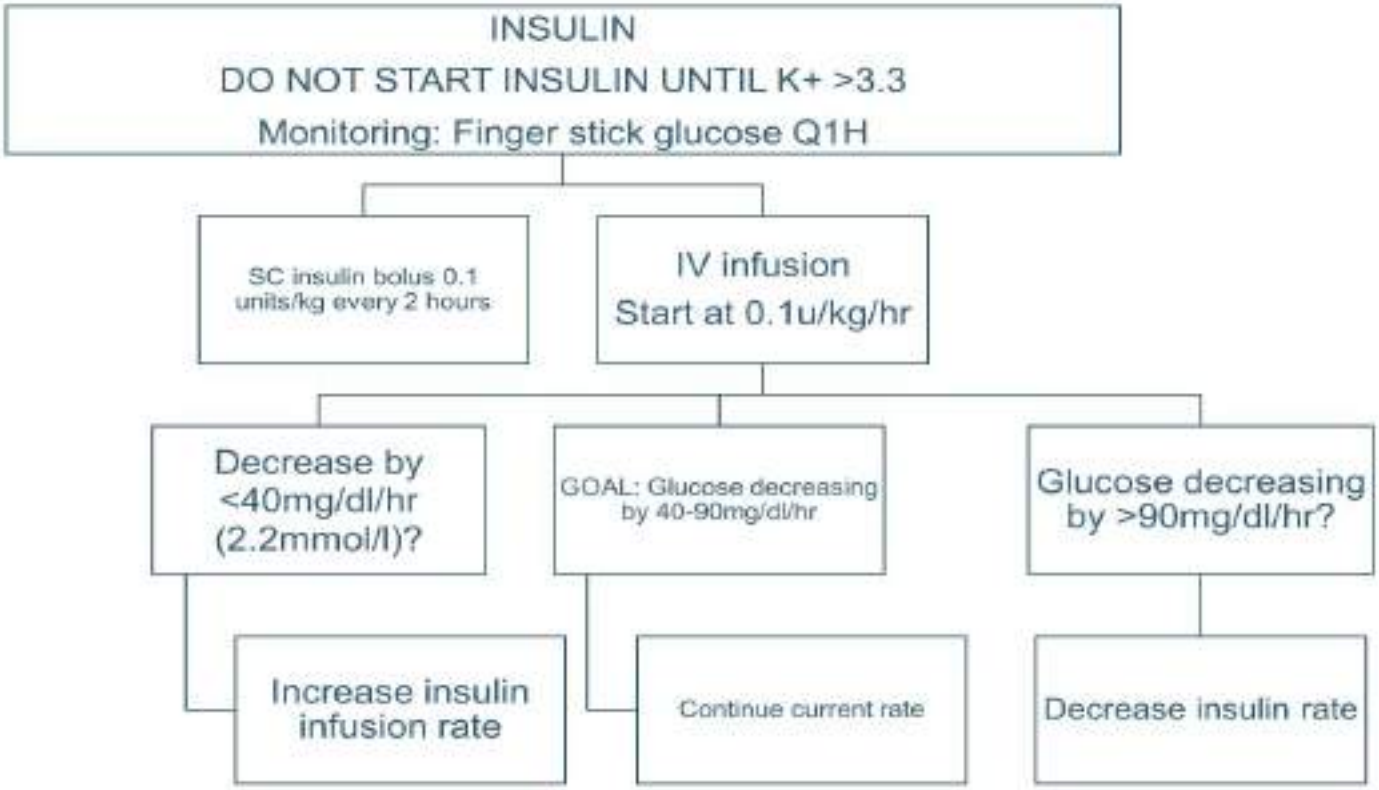
Fluid replacement will correct much of elevated glucose in HHNS and in DKA

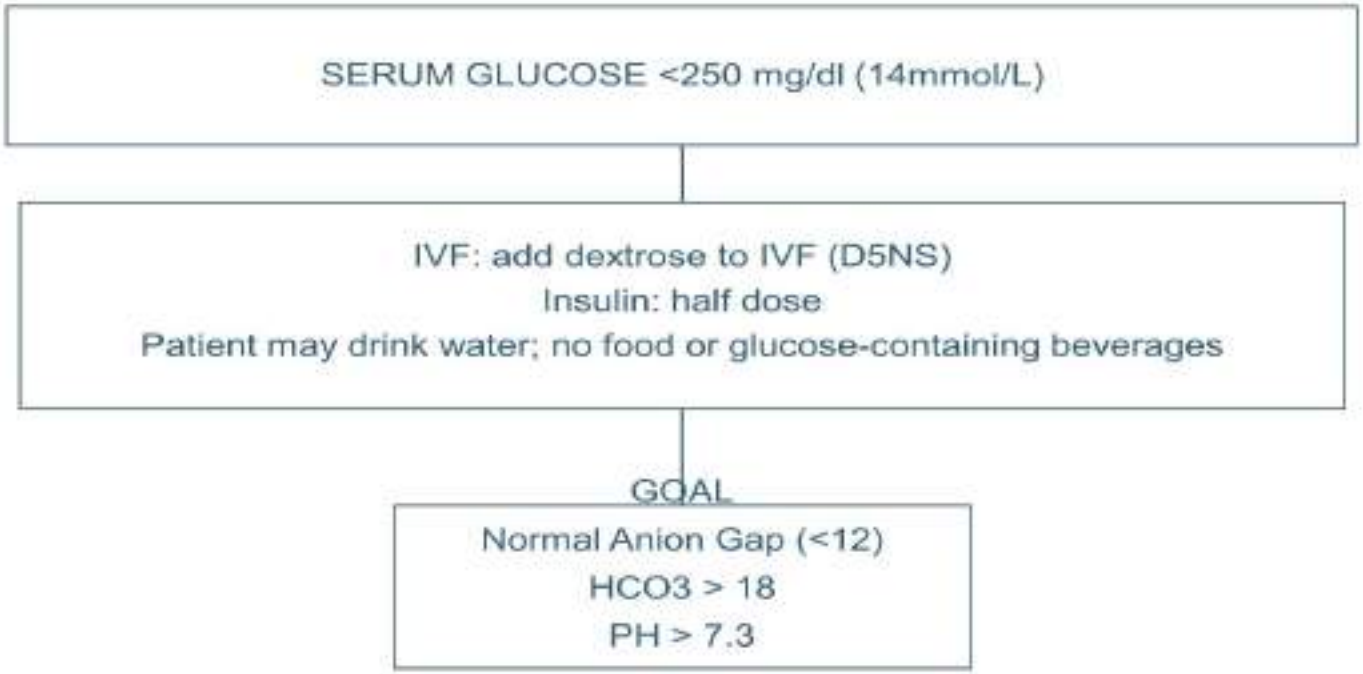
If elevated glucose refractory to fluids, may manage with insulin infusion as per DKA.


Management of DKA
IV Fluids
Potassium Replacement
Insulin


IVF
Assess Fluid Status
Severe Hypovolaemia
Mild Hypovolaemia
Bolus 2 L of 0.9NS
Start NS @ 250-500 ml/hr until Mild Hypovolemia
Evaluate Corrected Na
Na >140
Na <140
0.45%NS @100-250 ml/hr
0.9%NS @ 100 ml/hr


Potassium
Check serum K every 1-2 hours
<3.3
3.3-5.3
>5.3
>6
Hold insulin until corrected. PO correction + IV if patient able to tolerate KCl 20-40 meq/hr
Add KCL 20meq/l to IV Fluid
None
Check ECG. Consider IV calcium, salbutamol for hyperkalaemia. Initiate insulin.


INSULIN
DO NOT START INSULIN UNTIL K+ >3.3
Monitoring: Finger stick glucose Q1H
SC insulin bolus 0.1 units/kg every 2 hours
IV infusion Start at 0.1u/kg/hr
Decrease by <40mg/dl/hr (2.2mmol/l)?
GOAL: Glucose decreasing by 40-90mg/dl/hr
Glucose decreasing by >90mg/dl/hr?
Increase insulin infusion rate
Continue current rate
Decrease insulin rate


SERUM GLUCOSE <250 mg/dl (14mmol/L)
IVF: add dextrose to IVF (D5NS)
Insulin: half dose
Patient may drink water; no food or glucose-containing beverages
GOAL
Normal Anion Gap (<12)
HCO3 > 18
PH > 7.3

DISPOSITION: DKA/HHNS

- Both HHNS and DKA are potentially life threatening emergencies that require inpatient admission preferably to high care setting such as an ICU.

- New diagnosis diabetes mellitus requires education and training in insulin self-administration.

TAKEWAYS....

- Goal of treatment is not normal blood glucose!
- Common confusion: giving insulin until blood glucose is normal
  - Results in early discontinuation of treatment; DKA is not resolved
  - Anion gap opens up again, patient becomes acidemic and shocked again
- Insulin is given to correct the ketosis, NOT to correct the hyperglycemia.
- Administer insulin until anion gap is closed, reflecting correction of DKA state.
- **Anion gap = Na - (Cl + HCO3)**

HYPOGLYCEMIA

HYPOGLYCEMIA

Hypoglycaemia not recognized or not treated appropriately → coma, death

Symptoms and glucose level at which symptoms occur vary widely

- Adults: <4mmol/l (70mg/dL)
- Children: <3.5mmol/l (50mg/dL)

MANAGEMENT

Adults

- 25-50 mL of 50% dextrose

  or

- 125-250 mL of 10% dextrose

- Start maintenance fluids containing 5-10% dextrose after giving the initial bolus.
- Do NOT use D5W or D10W as maintenance fluid. Must contain electrolytes.

MANAGEMENT

Infants and children:

- 5 mL/kg of 10% dextrose

- Start maintenance fluids containing electrolytes and 5 or 10% dextrose after initial bolus
- Do NOT give D5W or D10W as maintenance
- Do not give infants and children concentrated dextrose (e.g., 50%) through an IV, as it can cause venous sclerosis.

Thank you