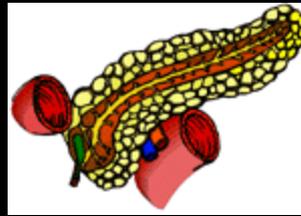


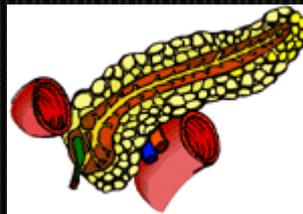
Perioperative management of diabetes mellitus



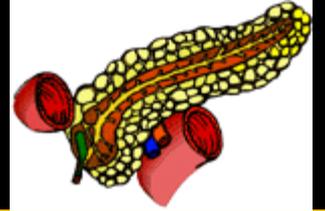
Dr. Ruchi Gupta & Dr. Lakshmi
Professor & Head, Asstt Professor
Deptt. Of Anaesthesiology
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Amritsar

WHO defines diabetes

Metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of **carbohydrate**, **fat** and **protein** metabolism resulting from defects in insulin secretion, insulin action, or both.



Diagnosis of Diabetes



A₁C ≥6.5%

OR

Fasting plasma glucose (FPG)
≥126 mg/dl (7.0 mmol/l)

OR

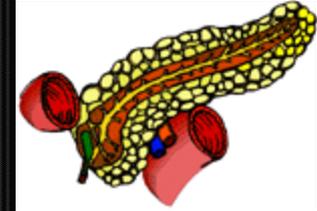
Two-hour plasma glucose ≥200 mg/dl (11.1 mmol/l)
during an OGTT

OR

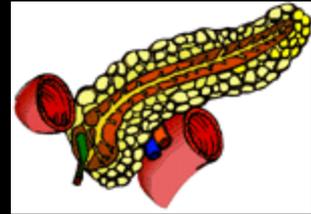
A random plasma glucose ≥200 mg/dl (11.1
mmol/l)

Classification of Diabetes

- Type 1 diabetes
 - β -cell destruction
- Type 2 diabetes
 - Progressive insulin secretory defect
- Other specific types of diabetes
 - Genetic defects in β -cell function, insulin action
 - Diseases of the exocrine pancreas
 - Drug- or chemical-induced
- Gestational diabetes mellitus



Type 1 Diabetes



- Absolute Insulin Deficiency
- Autoimmune destruction of pancreatic β cells
- Signs of diabetes develop when 80% of β cells are destroyed

TREATMENT

- Insulin therapy- long and short acting
- Newer developments- aerosols
continuous pumps



Insulin Therapy

- Short Acting- Regular, Lispro/Aspart
- Intermediate Acting- NPH, Lente
- Long Acting- Lantus, Ultralente

Regimens

- 2Regular+ 2NPH
- 3Regular +1NPH
- 3Regular+ 1 Lantus
- Subcutaneous Infusion of Insulin(Insulin Pump)

Type 2 Diabetes

- Insulin resistance and relative insulin deficiency or increased hepatic glucose production
- **Obesity** – risk factor



TREATMENT - multimodal therapy

- Diet
- Exercise
- Oral hypoglycemic Agents
- OHA + Basal Insulin
- Insulin therapy



Spectrum of Oral Hypoglycemic Agents

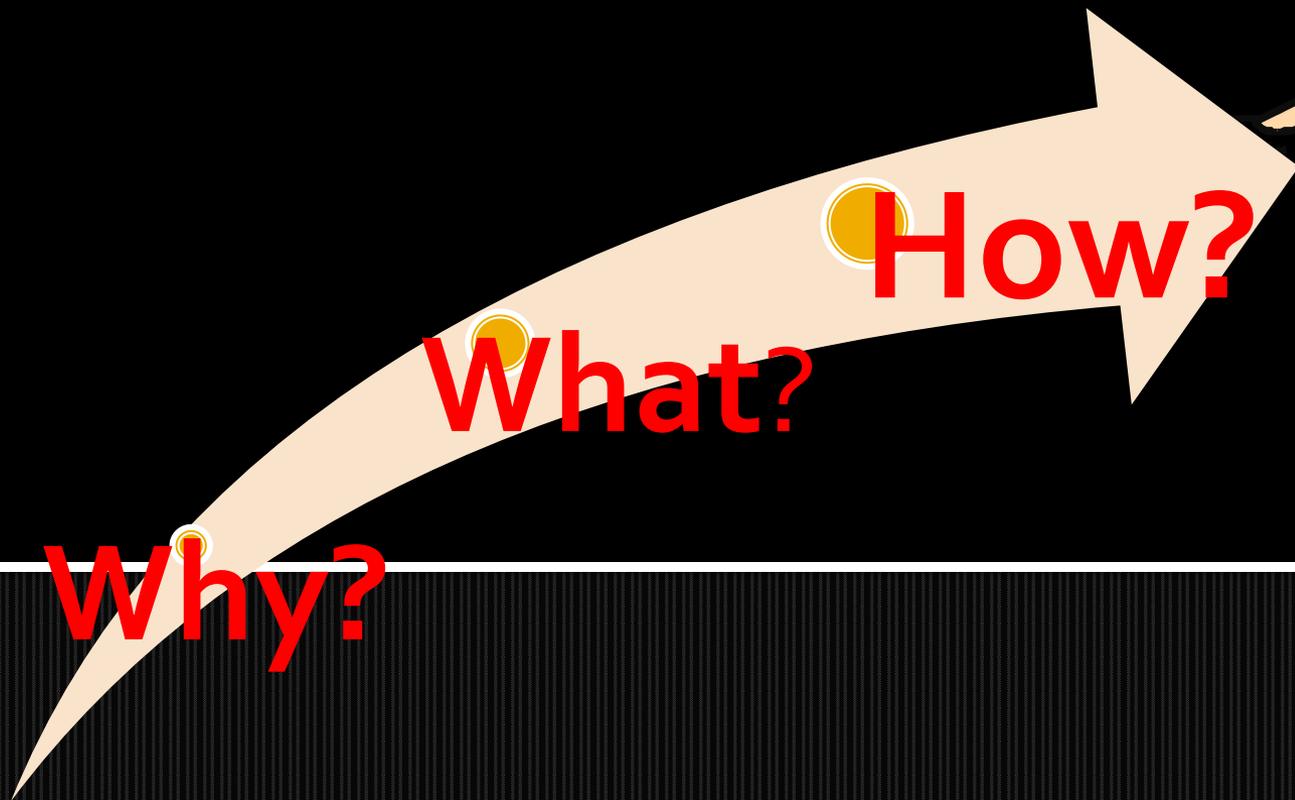
Secretagogues/ Sulphonylureas	Glibenclemide, Gliclazide	Increase Glucose availability
Biguanides	Metformin	Suppress excessive hepatic glucose release
Thiazolidinediones /Glitazones	Rosiglitazone , Pioglitazone	Improve glucose sensitivity
α-Glucosidase inhibitors	Acarbose, miglitol	Delay GIT glucose absorption

Clinical Situations

1. A 50 year old man, DM, taking medication OHA, for nail extraction surgery.
2. A 45 year old female , Diabetic, well controlled on OHA for cholecystectomy.

Contd.....

1. A 22 year old male,diabetic on regular insulin therepy for removal of ganglion wrist
2. A 30 year old lady on insulin therapy for brain tumor



Why?

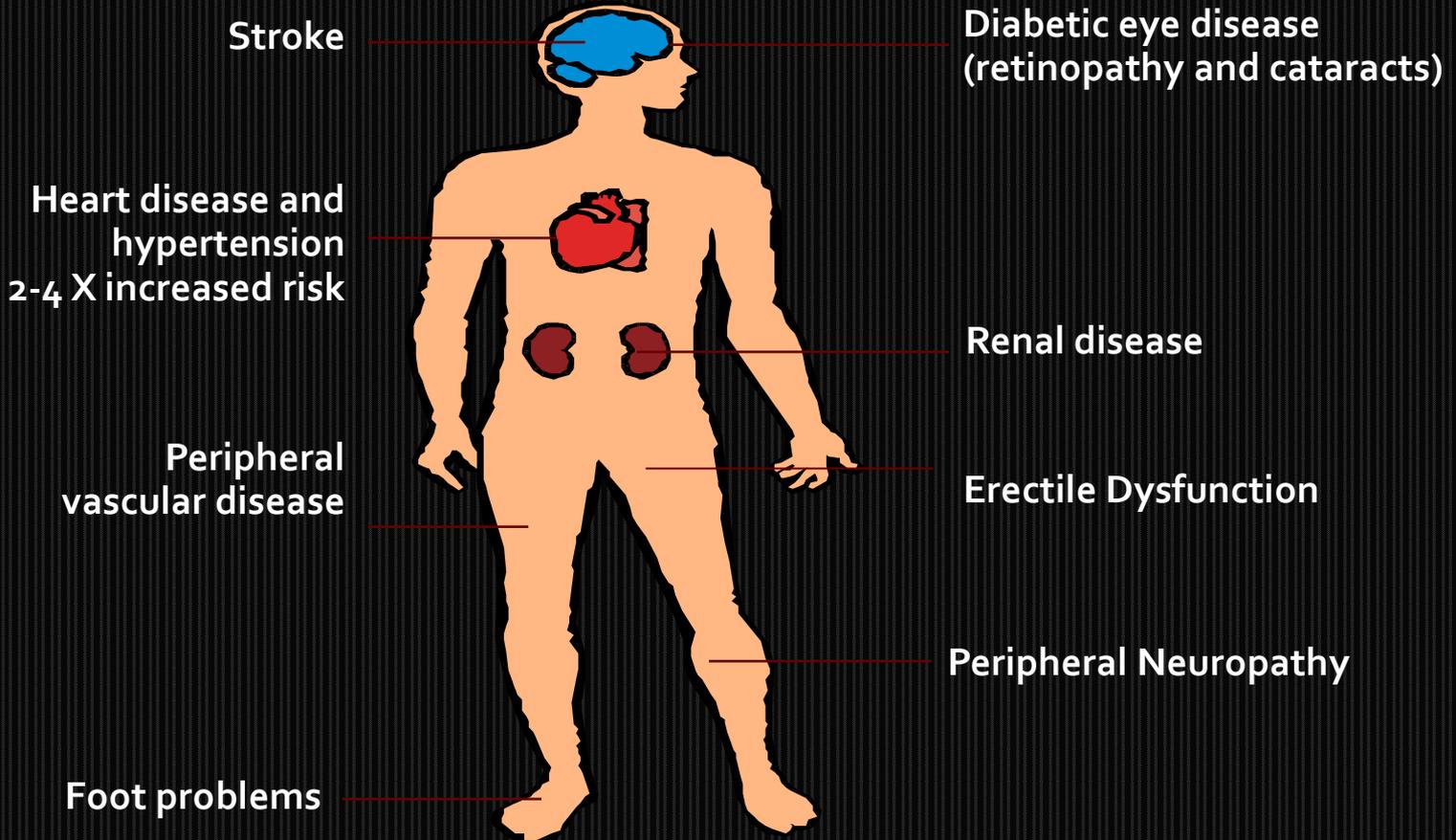
What?

How?

Why? Complications

Macrovascular

Microvascular



WHAT are the issues?

- **Cardiac Involvement** - Silent Myocardial Ischemia
 - ECG: may not show anomaly
 - Autonomic neuropathy blunts angina
 - Empirical Beta-adrenergic blockade preoperatively-mask

- **Renal Involvement**
 - Intravenous fluid sensitivity high leads to volume overload
 - Increase half-life of insulin and risk of hypoglycemia
 - GFR & Creatinine Clearance affected- Drug kinetics altered

Diabetic Neuropathy

Sensorimotor neuropathy (acute/chronic)

Autonomic neuropathy

Mononeuropathy

Spontaneous

Entrapment

External pressure palsies

Proximal motor neuropathy

Autonomic Neuropathy

Symptomatic

Postural hypotension
Gastroparesis
Diabetic diarrhea
Neuropathic bladder
Erectile dysfunction
Neuropathic edema
Charcot arthropathy
Gustatory sweating

Subclinical abnormalities

Abnormal pupillary reflexes
Esophageal dysfunction
Abnormal cardiovascular reflexes
Blunted counter-regulatory
 responses to hypoglycemia
Increased peripheral blood flow

■ **Autonomic imbalance implications**

- Intra-operative hypotension/ hypertension
- Perioperative cardiac arrhythmias
- Gastroparesis: aspiration
- Unawareness - Hypoglycaemia
- Increased decubitus ulceration
- Increased vascular damage and poor post-op healing

HOW ?- Pre-operative Checkup



Complete physical and clinical assessment



Biochemical assessment



Drug therapies - optimization

History and Examination

- Duration of DM
- Blood Pressure
- Palm Print Sign
- Prayer Sign- difficult intubation
- Fundoscopy
- Thyroid palpation



Tests for AUTONOMIC NEUROPATHY

		NORMAL	ABNORMAL
Sympathetic system	Measure systolic blood pressure lying down then standing.	Decrease <10mmHg	Decrease >10mm Hg
Parasympathetic system	Measure heart rate response to deep breathing	Increase rate > 15 beats /min	Increase rate < 10 beats /min

Preoperative Investigations

- Complete blood count
- Blood sugar and serum electrolytes
- Renal function tests
- Coagulation profile
- Liver function tests
- Chest X-ray
- ECG, Echocardiogram, stress testing
- Urine for sugar and ketones
- Fasting lipid profile

Drug Therapy Optimization

- Well controlled blood sugar levels – 48 hrs
- Uncontrolled DM – prior hospitalization
- Major Surgery – shift OHA to Insulin

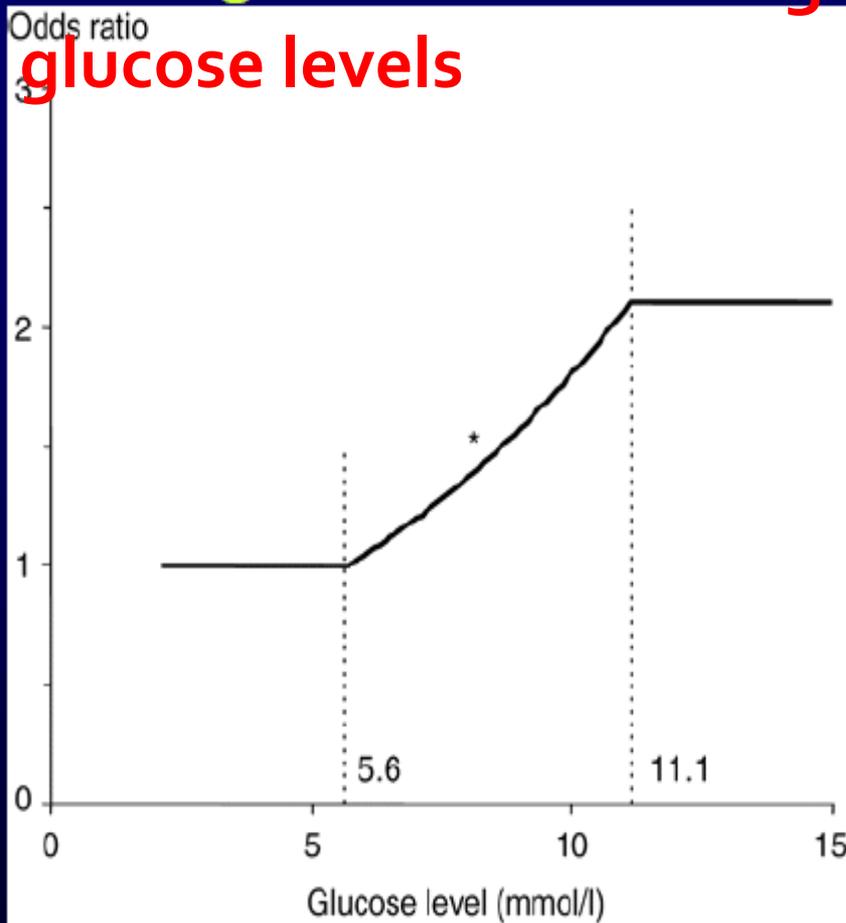
Stop OHA before Surgery

- **Sulphonylureas**- stopped 3 days prior to surgery, convert to shorter acting drugs or insulin if major surgery
- **Metformin**- continued upto 24 hrs before surgery
 - Risk of lactic acidosis extremely rare
- **Acarbose** - Avoid due to GI side effects
- **DPP₄ inhibitors**: delays gastric emptying

OMIT MORNING OHA DOSE

Glucose levels and mortality

Perioperative mortality increases with increasing glucose levels



Intraoperative Glycemic Control

Cardiac Surgery

- Lazar et al *Circulation* 2004; 109
 - Prospective randomized trial
 - Tight glycemic control with GIK infusion during perioperative period improved survival and decreased perioperative complications
- Ouattara et al *Anesthesiology* 2005; 103
 - Poor intraoperative short-term glucose control during cardiac surgery is associated with worse postoperative outcomes

Other Consequences

- Marked hyperglycemia
- Dehydration
- Electrolyte abnormality
- Impaired wound healing
- Predispose to infections

AIMS of Management

1. Hypoglycaemia

Dangerous in anaesthetised or neuropathic patient –
warning signs absent

2. Hyperglycaemia

Osmotic diuresis, delayed wound healing, exacerbation of brain, spinal cord and renal damage by ischaemia

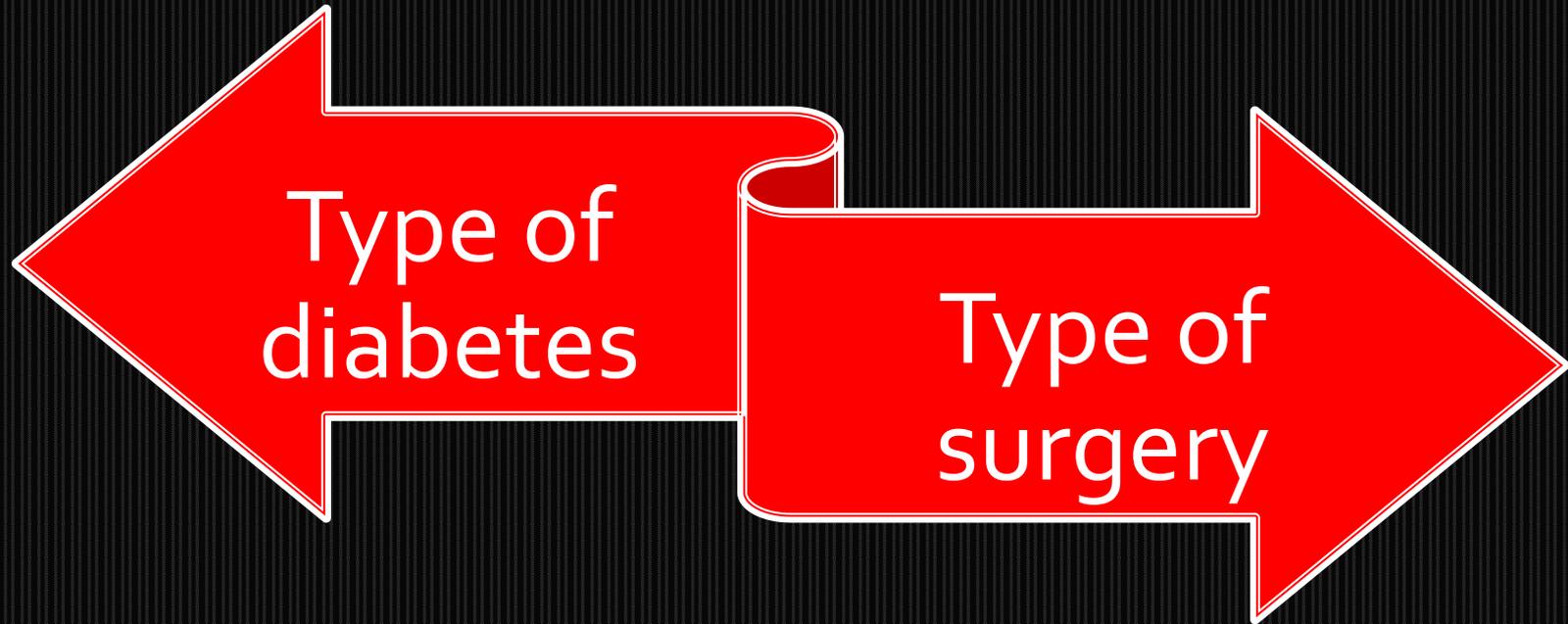
3. Ketoacidosis

Precipitated by the stress response, infection, MI, failure to continue insulin

4. Electrolyte abnormalities

Potassium, magnesium, phosphate

Anaesthetic Management



Preoperative Orders

- NPO 6-8 hrs prior to surgery
- Informed consent
- FBS on morning of day of surgery
- Urine – sugar, ketones and S. electrolytes if patient is on insulin
- Adequate anxiolysis- reduces stress of surgery
- Anti aspiration prophylaxis
- Prefer to keep first on OT list
- Avoid lactate containing fluids

Minor surgery in type 2 DM (diet/OHA)

- Omit OHA on the day of operation and avoid glucose infusions
- Check FBS. Kept 1st on list.
- For afternoon cases, can have clear fluids only
- Oral medication should be restarted as normally prescribed with the first meal. The only exception to this is for patients taking Metformin

Minor surgery in type 2 DM (OHA+ basal insulin)

- Hold oral agents(on combination therapy) on the day of surgery
- Check FBS
- Fair metabolic control(FBS <180 mg/dl)
- * Give half of intermediate-acting insulin (NPH) morning of surgery
- *if on Lantus- should receive usual basal insulin dose night before
- *infuse dextrose 5% saline plus KCl (10-20 mEq/L) at 100 mL/hr + regular or rapid-acting insulin- as guided by FBS

contd

- Patients with “poor” metabolic control (FBS > 180 mg/dL)
 - While NPO, infuse dextrose 5% plus KCl (10-20 mEq/L) at 100 mL/hr + continuous insulin infusion (50 units regular insulin in 50 ml saline piggy-backed)
 - Check blood glucose every 4 to 6 hours – supplement short-acting insulin

Minor surgery in type 1 DM

- “first on list”
- on a multiple injection regimen - usual basal (long acting) insulin prior evening
- on twice daily insulin – usual prior evening insulin
- NPO
- omit the morning insulin
- Check blood glucose before and after the procedure

Contd..

- Resume the usual insulin where expected to be eating within 2 hours of the procedure
- If on BD insulin regimen half of the normal 'breakfast' insulin dose should be prescribed with lunch after procedure
- If the patient is unable to tolerate diet or the blood glucose is >14 mmol/L, then a GKI infusion or alternative (see below) will be required

Major surgery in Type 1 and 2 DM treated with insulin

- Hold oral agents the day of surgery
- Start continuous insulin infusion (GIK) prior to surgery and continue during perioperative period (sliding Scale)
Postoperatively- Start S/C insulin 2 hrs prior to discontinuation of insulin infusion

“NON-TIGHT CONTROL” REGIMEN

- Aim: To prevent hypoglycemia, ketoacidosis and hyperosmolar states
- NPO after midnight
- Intravenous fluids containing 5% dextrose @ 125 mL/hr
- Give half the usual morning insulin dose s/c
- In recovery room, monitor blood glucose and treat on a sliding scale.

“TIGHT CONTROL” REGIMEN

- Aim: plasma glucose levels 79 to 120 mg/dL
- Intravenous infusion of 5% dextrose in water at a rate of 50 mL/hr
- **“Piggyback” an infusion of regular insulin (50 units in 50 mL of NS to the dextrose infusion with an infusion pump .**
- Repeat RBS every hour and adjust insulin accordingly

Improves wound healing
and prevents infections

Improves neurological
outcome after global or
focal CNS ischaemic
insults

Advantages of Tight Control Regimen

Improve weaning from
cardiopulmonary bypass

Retards all harmful
affects associated with
glucotoxicity

Insulin Dose

Initial insulin rate- blood sugar(mg/dl) /100

Insulin infusion

- **Normal adult patient:** 0.02u/kg/hour
- **Severe infection:** 0.04u/kg/hour
- **Steroid-Dependent State:** 0.04u/kg/hour
- **CABG or on Vasopressors:**0.06u/kg/hour

Hourly RBS- insulin dose adjustment

NO ROOM FOR URINE SUGAR MONITORING

Postoperative Management

- Continue GKI solution infusion as determined by blood glucose and potassium every 4-6 hrs
- Start regular insulin sc overlapping with the infusion for 1-2 hrs before stopping the infusion
- Additional 20 % insulin may be required- presence of infection
- Start preoperative regimen - when patient resumes normal diet

DM and Emergency Surgery

- Increased risk of developing **DKA** and **HHS**
- If possible delay surgery for 4 to 6 hours- optimize patient's metabolic status
- Precipitating factors:
 1. Infection
 2. Gastrointestinal obstruction
 3. Acute stress- trauma ,emotional
 4. Hypovolemia
 5. Failure to take insulin



Case Scenario

- A 45 year man for foot debridement ,
Ketones +, Blood sugar-432mg/dl, Urine
Sugar +++++

OPTIMISATION- fluid therapy

Replace fluids: 2–3 L of 0.9% saline over first 1–3 h (10–15 mL/kg per hour)

0.45% saline at 150–300 mL/h

change to 5% glucose and 0.45% saline at 100–200 mL/h when plasma glucose reaches 250 mg/dL

- **Short-acting insulin**: IV (0.1 units/kg) or IM (0.3 units/kg), then 0.1 units/kg per hour by continuous IV infusion; increase 2- to 3-fold if no response by 2–4 h
- Potassium <3.3 meq/L, do not administer insulin
- **Potassium, magnesium and phosphate** deficiencies replaced when adequate urine output documented
- Check **RBS** every 1–2 h, ABG every 4 hrly
- Ph < 7.10, give **sodium bicarbonate**

Take Home message

- Superiority of any method remains controversial
- Individualized decision making for each patient
- Clinical judgement remains key component in good perioperative treatment

Islets of Humor

One year
my resolutions will
be more realistic!

NO
CARBS

WALK
80 min

© Jgarnero

THANK YOU