

HOSPITAL BASED MANAGEMENT OF DIABETES MELLITUS

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THE PROBLEM

- CURRENT FIGURES FOR 2010-11 - 51 MILLION DIABETIC PATIENTS IN INDIA ; PROJECTED TO INCREASE TO 87 MILLION IN 2030
- A SIGNIFICANT PROPORTION OF INPATIENTS WITH HYPERGLYCAEMIA HAVE UNDIAGNOSED DIABETES AND STRESS HYPERGLYCAEMIA
- HOSPITALIZATION SHOULD BE RESORTED TO IN DIABETES PATIENTS WHEN ABSOLUTELY NECESSARY AND NOT SIMPLY FOR THE PURPOSE OF GLYCAEMIC CONTROL

Glycemic Control in the Hospital: An Elusive Goal



“Stress hyperglycemia”

D/C outpatient regimens

IV D5/ TPN / PPN

Steroids

↓ Physical activity

Fear of hypoglycemia



↓ Nutrition

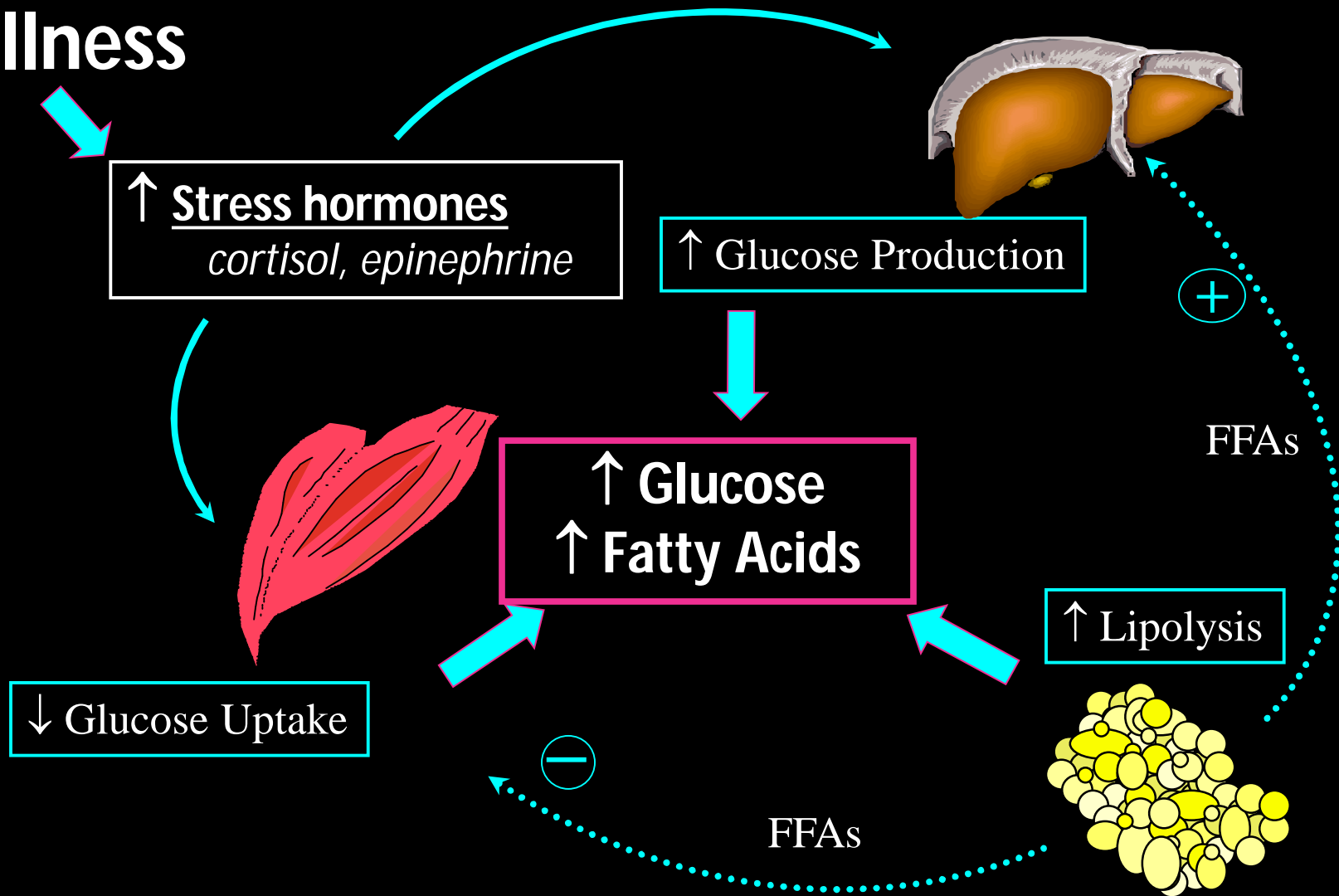
Meal interruptions

Monitored compliance

Insulin ‘stacking’

Illness leads to Stress Hyperglycemia

Illness



"Stress Hyperglycemia" Exacerbates Illness

Illness

↑ Stress hormones
cortisol, epinephrine

↑ Glucose Production

↑ Glucose
↑ Fatty Acids

↓ Glucose Uptake

Hemodynamic insult
Electrolyte losses
Oxidative stress
Myocardial injury
Hypercoagulability
Altered immunity
↓ Wound healing
↑ Inflammation
↓ Endothelial function

FFAs

Hospitalization of the Patient With Diabetes

- Acute metabolic complications
- Chronically poor metabolic control
- Severe chronic complications of diabetes
- Newly diagnosed diabetes (children)
- Uncontrolled diabetes during pregnancy
- Acute or chronic problems unrelated to diabetes
- Insulin pump institution or intensive regimens

Barriers to GLUCOSE CONTROL

- Increased insulin requirement due to illness
- Exaggerated variability in subcutaneous insulin absorption
- NPO status; inconsistent oral intake; interruption of meals by procedures
- care of diabetes per se becomes subordinate to care for the primary diagnosis
- Decreased physical activity (in previously active patients) also exacerbates hyperglycaemia

THE DIABETES INPATIENT TEAM

1. THE PATIENT
2. CONSULTANT PHYSICIAN / DIABETOLOGIST / ENDOCRINOLOGIST
3. DIABETES SPECIALIST NURSES
4. DIABETES EDUCATORS
5. DIABETES SPECIALIST DIETICIAN

New AACE-ADA Consensus Statement on Inpatient Glycemic Control

ICU Setting

- Insulin infusion preferred
- Starting threshold not higher than 180 mg/dl
- Maintain BG 140-180 mg/dl (greater benefit likely at lower end of this range)
- Lower targets (not evidence-based) may be appropriate in selected patients if already being successfully achieved
- <110 NOT recommended (not safe)

Non-ICU Setting

- Most patients:
 - pre-meal BG <140 mg/dL
 - random BG <180 mg/dL
- More stringent targets may be appropriate in stable patients
- Less stringent targets may be appropriate in patients with severe comorbidities

COMMON ERRORS IN MANAGEMENT

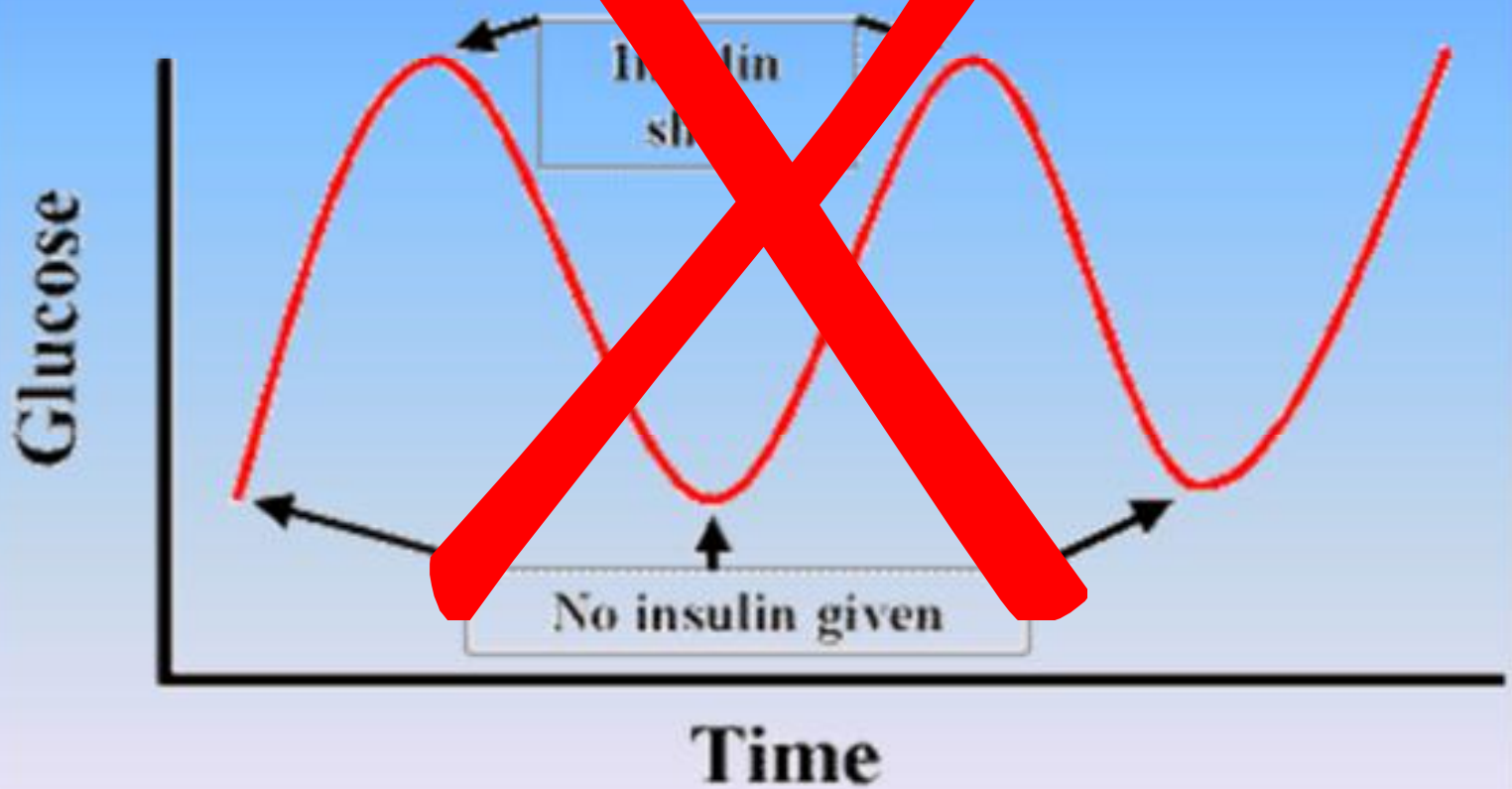
- ADMISSION ORDERS AND LACK OF THERAPEUTIC ADJUSTMENT
- HIGH GLYCAEMIC TARGETS
- OVERUTILIZATION OF "SLIDING SCALES"
- UNDERUTILIZATION OF INSULIN INFUSIONS

SITUATIONS IN WHICH SLIDING SCALES MAY BE USEFUL

- To adjust pre-prandial insulin based on the premeal capillary glucose level and the anticipated carbohydrate consumption
- With basal insulin analogues, such as glargine
- To evaluate patient's initial response to insulin
- In patients receiving parenteral nutrition, in whom each 6-hour period is similar to the last

Roller Coaster Effect of Insulin

Sliding Scale



INSULIN INFUSION

Indication for intravenous insulin infusion among nonpregnant adults with established diabetes or hyperglycemia

- Diabetic ketoacidosis and nonketotic hyperosmolar state A
- General preoperative, intraoperative, and postoperative care C
- Postoperative period following heart surgery B
- Organ transplantation E
- MI or cardiogenic shock A
- Stroke E
- Exacerbated hyperglycemia during high-dose steroid therapy E
- NPO status in type 1 diabetes E
- Critically ill surgical patient requiring mechanical ventilation A
- Dose-finding strategy, anticipatory to initiation or reinitiating of subcutaneous insulin therapy in type 1 or type 2 diabetes C

INSULIN INFUSION

ADVANTAGES

- TIGHTEST CONTROL
- GOOD ABSORPTION
- RAPID

ADJUSTMENTS

DISADVANTAGES

- FREQUENT MONITORING
- NURSING TIME!
- CATHETER COMPLICATIONS
- PROBLEMS WHEN SWITCHING TO SQ REGIMEN

GENERAL RECOMMENDATIONS

- Determine whether a patient has the ability to produce endogenous insulin

Characteristics of Patients with insulin deficiency

- Known type 1 diabetes
- History of pancreatectomy or pancreatic dysfunction
- History of wide fluctuations in blood glucose levels
- History of diabetic ketoacidosis
- History of insulin use for > 5 years and / or diabetes for > 10 years

GENERAL RECOMMENDATIONS

- Patients with type 1 diabetes will require some insulin at all times to prevent ketosis, even when not eating
- The insulin regimen should be revised frequently (every 1 to 2 days) based on glucose monitoring
- Sliding scale is not recommended as the sole therapy
- Intermediate-acting insulin added once or twice daily, even at small doses, will stabilize control

PATIENT SPECIFIC RECOMMENDATIONS

PATIENT ON OAD's & NOT EATING

- SECRETAGOGUES/ METFORMIN/ α GI/
PIOGLITAZONE
- ADD INSULIN – SHORT ACTING
- + CONSIDER INTERMEDIATE/ LONG ACTING INSULIN

PATIENT ON OAD's AND EATING

- IF SUGARS CONTROLLED, CONTINUE OAD, BUT CONSIDER DOSAGE REDUCTION, DUE TO THE LIKELIHOOD OF BETTER DIETARY ADHERENCE
- IF HYPERGLYCAEMIA DOES NOT IMPROVE RAPIDLY, INSULIN SHOULD BE STARTED

PATIENT ON INSULIN & NOT EATING

- INTRAVENOUS INSULIN INFUSION CONSIDERED IN TYPE 1 DM
- HALF TO TWO THIRDS OF THE PATIENT'S DOSE OF INTERMEDIATE INSULIN MAY BE GIVEN ALONG WITH SHORT-ACTING INSULIN
- 5% DEXTROSE IV AT 75 TO 125 ML/H PROVIDED, UNLESS PATIENT IS HYPERGLYCEMIC (>200 MG/DL).

PATIENT ON INSULIN & EATING

- CONTINUE INSULIN
- CONSIDER DOSAGE REDUCTION IN WELL-CONTROLLED PATIENTS AS MORE RIGID DIETARY ADHERENCE

PATIENT FOR SURGERY

- IN GENERAL, PATIENT'S TREATMENT PROGRAM IS LEAST AFFECTED IF SURGERIES ARE SCHEDULED FOR EARLY MORNING
- BLOOD GLUCOSE LEVELS SHOULD BE MONITORED EVERY 1 TO 2 HOURS BEFORE, DURING, AND AFTER THE PROCEDURE

TYPE 1 DIABETES

- INSULIN INFUSION WITH A 5% DEXTROSE SOLUTION ADJUSTED TO MAINTAIN GLUCOSE BETWEEN 100 AND 150 MG/DL
- ALTERNATIVELY, ONE HALF TO TWO THIRDS OF THE USUAL DOSE OF INTERMEDIATE INSULIN ON MORNING OF PROCEDURE
- DO NOT GIVE SHORT-ACTING INSULIN UNLESS THE BLOOD GLUCOSE LEVEL IS >200 MG/DL.

TYPE 2 DIABETES

- PATIENT ON OAD, HOLD ON THE DAY OF PROCEDURE AND RESUME WHEN TOLERATING A NORMAL DIET
- PATIENT ON INSULIN, GIVE ONE HALF OF INTERMEDIATE-ACTING INSULIN ON THE MORNING OF PROCEDURE. DO NOT GIVE SHORT-ACTING INSULIN UNLESS THE BLOOD GLUCOSE LEVEL IS >200 MG/DL. ALTERNATIVELY, AN INSULIN INFUSION CAN BE USED.

SPECIFIC CLINICAL SITUATIONS

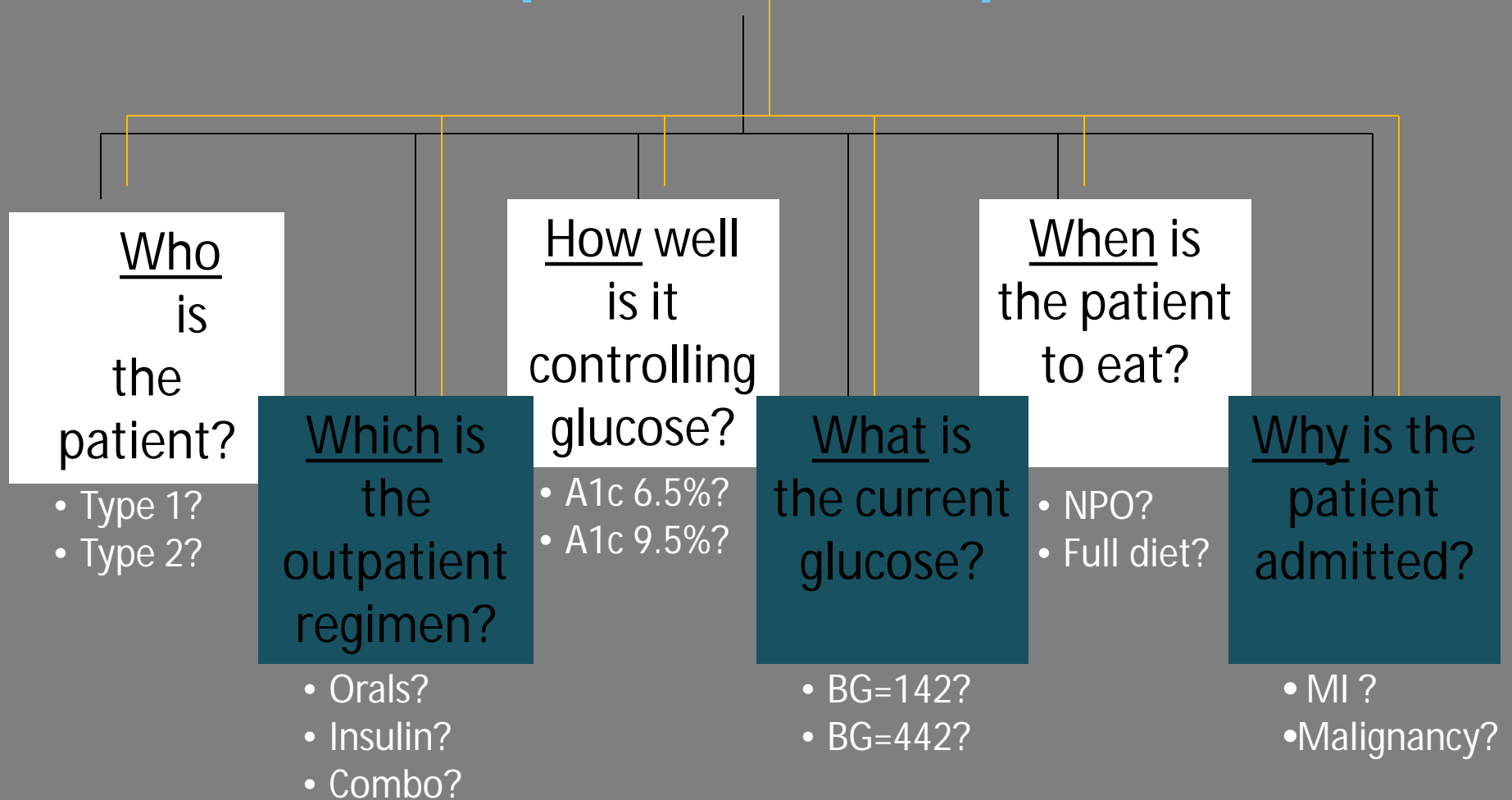
1. INSULIN PUMPS
2. ENTERAL NUTRITION
3. PARENTAL NUTRITION
4. GLUCOCORTICOID THERAPY
5. SWITCH FROM IV TO SC INSULIN

CAUSES OF HYPOGLYCEMIA IN PATIENT ON INSULIN

- SUDDEN REDUCTION IN ORAL INTAKE OR NPO STATUS
- DISCONTINUATION OF ENTERAL FEEDING / TPN / IV DEXTROSE
- PREMEAL INSULIN GIVEN AND MEAL NOT INGESTED
- UNEXPECTED TRANSPORT FROM NURSING UNIT AFTER RAPID ACTING INSULIN GIVEN
- REDUCTION/ OMISSION OF CORTICOSTEROID DOSE

Insulin Orders in the Hospital

What to do depends on several questions



DISCHARGE PLANNING

- It is important to anticipate the post-discharge drug regimen in all patients with diabetes
- Patients (and their families) should be familiar with their glucose targets as outpatients and should understand any changes made in their regimen

ISSUES TO BE ADDRESSED

1. Level of understanding related to the diagnosis of diabetes
2. Self monitoring of blood glucose (SMBG) and explanation of home blood glucose goals
3. Recognition, treatment, and prevention of hyperglycaemia and hypoglycaemia
4. Identification of health care provider who will provide diabetes care after discharge

ISSUES TO BE ADDRESSED (ctd)

5. Information on consistent eating patterns
6. When and how to take oral medications and insulin administration
7. Sick-day management
8. Proper use and disposal of needles/lancets/syringes

Inpatient Management of Hyperglycemia

SUMMARY

1. Hyperglycemia is a frequent occurrence in the hospital, in both patients with and without diabetes. It is also a predictor of adverse outcomes, including mortality
2. Intensive glucose management in the critical care setting has led to improved outcomes in some single-center studies
3. data suggests that good (140-180 mg/dl), but not stringent (80-110 mg/dl) glucose control is the most reasonable strategy in the ICU.
4. IV insulin infusion, using a protocol to minimize hypoglycemia, is the preferred approach in this setting.

Inpatient Management of Hyperglycemia

SUMMARY

5. Much less is known about the effects of tight glycemic control in non-critically ill patients.
6. Specific targets outside of the ICU are not evidence-based. BGs >180 mg/dl should likely be avoided. A pre-meal goal of <140 mg/dl is reasonable and achievable in most patients.
7. Physiological insulin replacement (“basal-bolus”) is an increasingly popular strategy. It is the most flexible approach, but requires a knowledgeable, trained staff.
8. The smooth transition to outpatient care is an important (but often forgotten) feature of quality hospital glucose management.

“Survival Skills”



How & when to take meds / insulin

How & when to monitor

How to treat hypoglycemia

Basics regarding meal plan

‘Sick day’ management

Date of next appointment

How to access outpt. DM education

When to call healthcare team

THANK YOU...!