Blood Glucose: Critical Care Patients

What We Know

› Critical illness or trauma can impair the body’s ability to regulate blood glucose levels, resulting in hyperglycemia or hypoglycemia, both of which can adversely affect outcomes in critically ill patients\(^{(3,4,8)}\)
  - Hyperglycemia occurs in hospitalized patients who have diagnosed or undiagnosed diabetes mellitus (DM) or as a result of acute or chronic illness (also known as stress hyperglycemia)\(^{(2,3,4,8,12)}\)
    - Examples of illnesses/conditions that may result in hyperglycemia include metabolic and endocrine disorders (e.g., Cushing’s syndrome, primary hyperaldosteronism, pheochromocytoma), pancreatitis, pancreatic tumor, pregnancy, head injury, and sepsis; drugs associated with hyperglycemia include glucocorticoids, EPINEPHrine, thiazide diuretics, thyroid hormones, and oral contraceptives\(^{(4,6)}\)
  - Hypoglycemia can result from infection, liver or renal failure, insulin-secreting tumors, and surgery\(^{(2)}\)
  - Compared with critical care patients with stress hyperglycemia, those with preexisting DM are at increased risk for complications of hypoglycemia, but may be less susceptible to the effects of hyperglycemia\(^{(2)}\)

› The literature is conflicting about the benefit of tight blood glucose control in patients who are admitted to a critical care unit\(^{(2)}\)
  - Tight blood glucose control is defined by the American Diabetes Association (ADA) as maintaining blood glucose levels between\(^{(1)}\)
    - 70 and 130 mg/dL before meals
    - < 180 mg/dL 2 hours after the beginning of a meal
    - < 7% glycosylated hemoglobin (HbA1c) level (i.e., the percentage of hemoglobin to which glucose is attached; HbA1c level identifies the level of a patient’s long term glucose control because it is a measure of average blood sugar levels for the 2–3 month period prior to HbA1c testing)

› Several research teams have reported that tight blood glucose control is beneficial in critical care patients\(^{(2,11,13,14)}\)
  - Authors of one systematic review found that medical and surgical ICU patients treated with I.V. insulin to maintain tight blood glucose control had lower rates of mortality and morbidity and fewer hypoglycemic episodes\(^{(13)}\)
  - In a randomized controlled study involving 700 pediatric ICU patients, researchers found that maintaining blood sugar at age-adjusted normal fasting levels reduced mortality, the incidence of infection, and the length of stay in the ICU\(^{(11)}\)
  - Researchers in Britain who conducted another randomized controlled trial found that tight blood glucose control (72–108 mg/dL) reduced mortality in obese critical care patients when compared with usual glycemic control (< 198 mg/dL)\(^{(2)}\)
  - Other researchers have reported conflicting results, finding either no benefit or adverse effects of tight blood glucose control in critical care patients\(^{(3,5,9)}\)
• Authors of one meta-analysis found that glucose-insulin-potassium (GIK) infusion had no effect on mortality in critical care patients with acute myocardial infarction or following cardiovascular surgery\(^2\).

• Cochrane reviewers found insufficient evidence to support routine tight blood glucose control in ICU patients during the perioperative period in order to prevent surgical site infections\(^2\).

• Investigators who conducted the randomized controlled NICE-SUGAR study concluded that tight blood glucose control increases mortality in adults in the ICU\(^2\).

– Of 6,104 adult patients admitted to the ICU, 3,054 were randomized to the intensive glucose control (treatment) group and 3,050 were randomized to the usual care (control) group.

– The patients in the treatment group had their blood glucose maintained within a range of 81–108 mg/dL, while the patients in the control group had their blood glucose maintained at ≤ 180 mg/dL.

– Severe hypoglycemia (defined as a blood glucose level ≤ 40 mg/dL) developed in 6.8% of the treatment group and 0.5% of the control group.

– Mortality was higher in the treatment group (27.5%) than in the control group (24.9%), but there were no differences in days on mechanical ventilation or length of ICU or overall hospital stay.

› The results of the NICE-SUGAR study prompted the ADA and the American Association of Clinical Endocrinologists (AACE) to update their recommendations regarding blood glucose control in inpatients of critical care units\(^8\).

• I.V. insulin should be initiated in critically ill patients whose blood glucose is ≥ 180 mg/dL with the goal of maintaining levels at 140–180 mg/dL\(^8\).

– Lower targets may be indicated in some patients, but levels should not fall below 110 mg/dL\(^8\).

– Blood glucose levels should be monitored frequently in order to achieve and maintain appropriate levels and reduce the incidence of hypoglycemia and hyperglycemia\(^8\).

› Use of a closed-loop glycemic control device, which continuously monitors blood glucose levels and automatically infuses insulin or glucose to maintain the target blood glucose level, allows clinicians to maintain tight blood glucose control without causing hypoglycemia and might reduce variability in blood glucose levels in critical care patients\(^14\).

• High glucose variability is associated longer duration of ICU stay and increased risk for in-hospital mortality\(^14\).

› A blood glucose monitoring system that can be used at the bedside in critical care settings has recently been approved by the U.S. Food and Drug Administration. This device allows more rapid testing of patients’ blood sugar than testing performed in the hospital laboratory or other laboratories\(^10\).

**What We Can Do**

› Learn about blood glucose control in critical care patients so that you can accurately assess your patients’ personal characteristics, and adjust treatment plans according to the unique needs of each patient; share this knowledge with your colleagues.

› Monitor blood glucose frequently per facility protocol or the treating clinician’s orders.

› Educate patients/family members on the importance of blood glucose control.

**Note**

› Recent review of the literature has found no updated research evidence on this topic since previous publication on March 4, 2016.
References


