Necessity for Excellent Glycemic Control Before, During and After CABG Surgery

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The stress of surgery has often been explained as our body’s typical fight or flight response. Patients experiencing hyperglycemia in the acute hospital setting can result in detrimental effects of poor glycemic control in hospitalized patients is often difficult. Numerous studies have been conducted to focus on better blood sugar management for medically non-diabetic patients who undergo surgery, with fewer have however been shown to the point that the body is more focused on healing rather than surgical patients. In many patients, the stress of surgery can cause high blood sugars due to increased stress hormones such as endorphins and cortisol. Moreover, the stress response causes the liver to release glucose into the bloodstream in preparation for potential surgery. Hyperglycemia leads to increased serum glucose levels. Increased levels of free fatty acids due to decreased insulin in the surgical wound placing the patient at high risk for dehydration, hypotension, and prolonged length of stay. The body needs adequate insulin resistance at the receptor sites on muscle cells (Rady, Tormjon, & Goldberg, 2009, p. 1237).

A study conducted by the Department of Endocrinology at Boston University Medical Center was able to surmise that up to 80% of patients who had cardiac surgery were experiencing hyperglycemia over 200 mg/dL at some point in their hospitalization. A 25% of patients had a prolonged length of stay increased hospital costs (Alexanian, McKinnon, & Ahtab, 2011, p. 1).

One week later, the patient was re-admitted to the hospital with blood sugars in the 400 mg/dL range and complaints of increased comfort to the incision area. The surgical wound showed no signs of infection, however, the patient did have difficulty swallowing and the sternal incision. After two days of continued pain, a new ulcerated fascia flap surgery was performed. Patient returned to the operating room after being medically stabilized. Two months later, the patient was re-admitted to the hospital for signs and symptoms of wound infection. After antibiotic treatment, the patient returned to the ECF for the remainder of rehabilitation.

Unfortunately, this is a true case study and occurs in many facilities across the country. What could have been done differently to facilitate a better outcome?

Nurses play a vital role in the management of the insulin infusion in the ICU setting. According to the hospital’s algorithm, titration of the infusion rate is managed by hourly blood sugar readings. Poor glycemic control is knowledge of management of diabetic patients as often, their needs for insulin change in the postoperative setting. Staff education regarding management of the insulin infusion, parameters for expected blood sugar values, and when to notify the physician should be completed. Patient education materials, patient teaching materials should be within the patient’s reach. Instruction is given during pre-admission testing as to whether to give or hold home medications. Patient’s insulin dose should be decreased 24 hours prior to surgery. Sternal procedures were taught to be taught and reinforced throughout the hospital stay. Lastly, prior to discharge, the bedside nurse gives instruction regarding home dietary regimens, and frequency of blood glucose measurements to be recorded.

Role of Insulin During CABG Procedure

IV insulin during CABG surgery and the post-operative period is the preferred choice of correction of increased blood sugars due to its short half-life and rapid action. IV insulin should be maintained for at least 24 hours after surgery to ensure the best blood sugar management (Alexanian, McKinnon, & Ahtab, 2011). Studies show that insulin increases myocardial glucose uptake, inhibits release of free fatty acids, and reduces the harmful effects of oxidative stress caused by hyperglycemia on the myocardium. Insulin has also shown to better preserve the neutrophil’s phagocytic capacity and reduce the incidence of wound infections in diabetic CABG patients (Lazar, 2012, p. 2). Metformin is recommended to be discontinued at the time of surgery and not restarted until their surgical wound has healed optimally. Metformin can increase the risk for lactic acidosis in the postoperative period (Roy, Torjman, & Goldberg, 2009, p. 120). IV insulin can be used in lieu of metformin throughout the hospital stay. The guidelines to postpone CABG surgery due to poor blood sugar control has not been established at this time. Surgeons and medical staff must be educated (Muir, 2012). Overall, the health of the patient, and metabolic status to ensure the best possible outcome for the patient and the surgical team is the priority. The blood sugar goal to best ensure optimal healing is under 180 mg/dL and most easily attained by IV insulin infusion (Lazar, et al., 2010, p. 3).

Other Factors Causing Dysfunction in Blood Sugar Management

Cardiopulmonary surgery often used to paralyze the heart in order to perform CABG surgery. Cardiac anaesthetic agents, such as propofol (Propofol), N2O (Nitrous oxide), isoflurane (Isoflurane), and pancuronium bromide (Pancuronium bromide), are often used to induce anaesthesia (Engelke, 2000). The presence of anaesthesia and surgical stress can cause acute hyperglycaemia (Farber, 2012). The stress response causes the liver to release glucose into the bloodstream in preparation for potential surgery. Hyperglycemia leads to increased serum glucose levels. Increased levels of free fatty acids due to decreased insulin in the surgical wound placing the patient at high risk for dehydration, hypotension, and prolonged length of stay. The body needs adequate insulin resistance at the receptor sites on muscle cells (Rady, Tormjon, & Goldberg, 2009, p. 1237).

A study conducted by the Department of Cardiovascular Surgery at the Brigham and Women’s Hospital states that 30-40% of patients having a coronary artery bypass graft procedure (CABG) already have a diagnosis of either diabetes or metabolic syndrome. These patients are at very high risk of developing complications after surgery. Insulin resistance and dysfunction of the liver during the operation can lead to increased hyperglycemia and insulin resistance in the already compromised diabetic heart (Minasian, Galagudza, et al., 2013, p. 3).

Summary of the healing process.

Intermediate phase of the repair reaction.

(A) As a new extracellular matrix is deposited at the wound site, the initial fibrin clot is lysed by a combination of extracellular matrix enzymes and phagocytes.

(B) Concurrent with fibrin removal, there is deposition of a temporary matrix formed by proteoglycans, glycoproteins, and type III collagen.

(C) Final phase of the repair reaction.

Eventually the temporary matrix is removed by a combination of extracellular and intracellular proteolytic enzymes and the definitive matrix, rich in type I collagen, is deposited.

Conclusion

An interesting finding in this study conducted by the Department of Cardiovascular Surgery at the Brigham and Women’s Hospital states that 30-40% of patients having a coronary artery bypass graft procedure (CABG) already have a diagnosis of either diabetes or metabolic syndrome. These patients are at very high risk of developing complications after surgery. Insulin resistance and dysfunction of the liver during the operation can lead to increased hyperglycemia and insulin resistance in the already compromised diabetic heart (Minasian, Galagudza, et al., 2013, p. 3).

Hyperglycemia during CABG and cardiac procedures increases the likelihood of complications such as increased release of free fatty acids, inflammation and oxidative stress. Poor glycemic control increases complications and decreased collagen production in the surgical wound leads to increased risk for wound infection and wound dehiscence in the post-operative phase. Insulin infusion during the procedure, and 24 hours post procedure, helps reduce blood sugar levels under 180 mg/dL, where experts have determined the point of lowest risk for complications during recovery. Nurses are pivotal in the role of insulin infusion management in the ICU.

Nurses, physicians, and other supportive personnel need to work closely together to promote the environment that ensures excellent glycemic control is necessary in the management of diabetic patients before, during, and after CABG and cardiac procedures to ensure the best outcomes for their patients.