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Letter to the Editor

Importance of hyperglycemia in preoperative, intraoperative and postoperative periods in COVID-19 patients

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Dear Editor,

Diabetes and hypertension are the most common comorbidities associated with poor prognosis in Coronavirus disease 2019 (COVID-19) patients [1]. Hyperglycemia is recognized as an independent predictor of mortality in COVID-19 cases, indicating the importance of addressing high blood glucose levels. Numerous factors especially inflammation, impaired immune response, decreased intracellular bactericidal activity, and elevated risk of lung disease contribute to increased disease severity. Therefore, management of glucose levels in COVID-19 patients is essential. Studies showed that about one-third of patients who were admitted to hospitals without any history of diabetes have hyperglycemia, which increased the hospital length of stay, surgical site infections (SSI), ICU admission rates, and increase morbidity/mortality rates. In surgical cases, perioperative hyperglycemia elevates lung failure, neurologic disorders, cardiovascular morbidity, and postoperative mortality rates [2].

Hyperglycemia in hospitals commonly occurs in patients with acute trauma, viral infection, septicemia, burns, myocardial infarction, stroke, and cardiac surgery [3]. Hyperglycemia is related with the risk of atrial fibrillation, infection, cardiovascular diseases, myocardial infarction, pericarditis, cerebral ischemia, impaired wound healing, as well as respiratory and neurologic complications [4]. It has been reported that 20–40% of patients undergoing general surgery and nearly 80% of patients after cardiac surgery experienced perioperative hyperglycemia [4]. Hyperglycemic patients are more susceptible to surgical and other nosocomial infections [3]. The stress of anesthesia and surgery results in change of endogenous hormone secretion (e.g., elevated catecholamines, cortisol, growth hormone, and glucagon), inflammatory reaction, and subsequent hyperglycemia and inflammation [4]. It has been established that postoperative SSI is a well-known cause of death worldwide. In surgery patients, SSI is the most common hospital infection (about 38%) [3].

In the below section we summarizes the key points and recommendations for management of hyperglycaemia in preoperative, intraoperative and postoperative periods [2–4].

1. Preoperative period

- Hyperglycemia can develop in diabetic patients and non-diabetic patients undergoing surgery
- Stress, dextrose-containing solutions, hypothermia, and heparin administration can induce hyperglycemia
- Perioperative hyperglycemia in general surgery elevates the risks of postoperative infections and mortality rate, independent of diabetes
- The American Diabetes Association recommends to target blood glucose levels at 80–180 mg/dL in the perioperative setting.
- The recommended target blood glucose level is less than 180 mg/dL in critical patients and less than 140 mg/dL in stable patients
- Physicians should actively prevent ketoacidosis, fluid and electrolyte imbalance, severe hyperglycemia or hypoglycemia in patients
- The HbA1c levels in patients with hyperglycemia can be used to differentiate patients with undiagnosed diabetes from those with stress hyperglycemia
- Physicians should confirm the targeted blood glucose levels with regular glucose monitoring
- Surgeons should cancel any non-emergency operation if patients present with metabolic abnormalities (hyperglycemic hyperosmolar syndrome, ketoacidosis) or a glucose level of more than 400–500 mg/dL
- A strict insulin protocol is recommended to control hyperglycemia in patients with stroke, myocardial infarction, diabetes, and patients undergoing operations

2. Intraoperative period

- A rise of only 20 mg/dL in intraoperative glucose concentration is associated with about a 30% rise in lung and renal complications and death

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- In surgical patients, severe hyperglycemia which occurs during operation is a known predictor of mortality and morbidity
- In surgeries longer than 4 hours can lead to hemodynamic fluctuations and massive fluid shifts. Any blood glucose level of more than 180 mg/dL should be controlled with insulin injection, and glucose levels should be checked once every 1–2 h
- The aim is to maintain glucose levels in this period to less than 180 mg/dL
- For minor operations, the preoperative glucose protocols should be continued

3. Postoperative period

- Careful management of glucose concentration after major surgeries can reduce mortality and morbidity risks
- Hyperglycemia in non-diabetic surgical patients (after cardiac, orthopedic or other surgical procedures) can increase the risk of surgical site infection (SSI) in both the stable and ICU populations
- To target the postoperative glucose levels to range between 140 and 180 mg/dL
- If the glucose concentration remains low after operation, a dextrose infusion rate of 5–10 g of glucose /hour should be started
- If the glucose concentration is low after surgery, a dextrose infusion (5–10 g glucose/hour) can prevent concomitant ketosis and hypoglycaemia from developing
- If patients cannot tolerate oral nourishment, total parenteral nutrition (TPN) should be considered

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Guarantor

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References

[1] E. Abbasi-Oshaghi, F. Mirzaei, F. Farahani, I. Khodadadi, H. Tayebinia, Diagnosis and treatment of coronavirus disease 2019 (COVID-19): laboratory, PCR, and chest CT imaging findings, Int. J. Surg. 79 (2020) 143–153, https://doi.org/10.1016/j.ijsu.2020.05.018.

[2] J.E. Richards, J. Hutchinson, K. Mukherjee, A.A. Jahangir, H.R. Mir, J.M. Evans, et al., Stress hyperglycemia and surgical site infection in stable nondiabetic adults with orthopedic injuries, J. Trauma Acute Care Surg. 76 (2014) 1070–1075, https://doi.org/10.1097/ta.0000000000000177.

[3] A. Ata, J. Lee, S.L. Bestle, J. Desemone, S.C. Stain, Postoperative hyperglycemia and surgical site infection in general surgery patients, Arch. Surg. 145 (2010) 858–864, https://doi.org/10.1001/archsurg.2010.179.

[4] E.W. Duggan, K. Carlson, G.E. Umpierrez, Perioperative hyperglycemia management: an update, Anesthesiology 126 (2017) 547–560, https://doi.org/10.1097/aln.0000000000001515.

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