ORIGINAL RESEARCH

Assessment of impact of intraoperative glycemic control as a biomarker for postoperative recovery characteristics among diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy under general anesthesia

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ABSTRACT

Background: Diabetes mellitus encompasses a collection of chronic metabolic disorders, all of which are marked by increased blood glucose concentrations due to the body's insufficient insulin production, insulin resistance, or a combination of both. Hence; the present study was conducted for assessing impact of intraoperative glycemic control as a biomarker for postoperative recovery characteristics among diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy under general anesthesia. **Materials & methods:** 40 patients of either sex, of age above 30 and below 60 years and American Society of Anesthesiologists (ASA) Grade I-II undergoing laparoscopic cholecystectomy under general anesthesia were enrolled in present study. Pre anesthetic checkup was done a day prior to surgery. Demographic information, clinical comorbidities, and operative details were abstracted from the clinical records using standardized definitions. Patient diabetic status, history of medication in past and insulin use, smoking status, weight, height, history of coronary artery disease, history of hypertension, indication for surgery were noted. Complete general physical examination and systemic examination was done in pre anesthetic evaluation. Baseline glucose measurement was obtained in preoperative assessment at central laboratory. All the patients were divided the patients into 2 groups: Group A: Controlled diabetics (20 patients), and Group B: Non diabetics (20 patients).Intra-operative monitoring was done. Intraoperative glycemic profile was recorded. Postoperative follow-up was done in all the patients was assessed. **Results:** Mean age of the diabetic patients and non-diabetic patients was 43.9 years and 41.8 years respectively. Majority proportion of patients were males. Among diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 130.8 mg/dL, 138.6 mg/dL, 159.9 mg/dL, 133.9 mg/dL and 135.4 mg/dL respectively. Among non-diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 93.6 mg/dL, 92.9 mg/dL, 92.5 mg/dL, 93.6 mg/dL and 94.7 mg/dL respectively. Significant correlation was seen between postoperative recovery profile and intraoperative glycemic profile among diabetic group. **Conclusion:** Diabetes has the potential to impact various organ systems within the body, and if left unmanaged, it may result in significant complications over time. Intraoperative glycemic profile can be useful in predicting recovery profile in diabetic patients.

Key words: Glycemic, Diabetes, Anesthesia

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INTRODUCTION

Diabetes mellitus encompasses a collection of chronic metabolic disorders, all of which are marked by increased blood glucose concentrations due to the body's insufficient insulin production, insulin resistance, or a combination of both. Nonmodifiable risk factors associated with type 2 diabetes include age, racial or ethnic background, familial history indicating genetic susceptibility, previous occurrences of gestational diabetes, and low birth weight. The incidence and prevalence of diabetes tend to rise with advancing age.Cholecystectomy represents the most frequently conducted intraabdominal surgical intervention.[1- 3]The ultimate effect of various endocrine changes among patients undergoing surgeries under general anesthesia is increased catabolic activity by increased secretion of catabolic hormones like cortisol and glucagon. The effect of these endocrine and metabolic changes ultimately leads to increased neo-glucogenesis and hyperglycemia. So, this stress response may be quantified by the incidence of hyperglycemia.[4, 5]

Current thought places the regulatory mechanisms within the central nervous system as well as the periphery. Individuals undergoing surgery, however, show transient hyperglycemia, long considered a secondary response to the stress associated with surgical insult. Although anesthetists may consider this a normal phenomenon, especially in patients with compromised -cell function, endocrinologists suggest that stress hyperglycemia represents a dysregulation of intermediary and glucose metabolism and may signify prediabetes or an early decompensated state of insulin insufficiency. Alternatively, perioperative glycemic dysregulation may be a disease-specific manifestation or evidence of glucose intolerance or undiagnosed diabetes.[6- 8]Hence; the present study was conducted for assessing impact of intraoperative glycemic control as a biomarker for postoperative recovery characteristics among diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy under general anesthesia.

MATERIALS & METHODS

The current research aimed for assessing role of intraoperative glycemic control as a biomarker for postoperative recovery characteristics among diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy under general anesthesia.40 patients of either sex, of age above 30 and below 60 years and American Society of Anesthesiologists (ASA) Grade I-II undergoing laparoscopic cholecystectomy under general anesthesia wereenrolled in present study. Pre anesthetic checkup was done a day prior to surgery. Demographic information, clinical comorbidities, and operative details were abstracted from the clinical records using standardized definitions. Patient diabetic status, history of medication in past and insulin use, smoking status, weight, height, history of coronary artery disease, history of hypertension, indication for surgery were noted. Complete general physical examination and systemic examination was done in pre anesthetic evaluation.Baseline glucose measurement was obtained in preoperative assessment at central laboratory. All thepatients were dividedthe patients into 2 groups: Group A: Controlled diabetics (20 patients), and Group B: Non diabetics (20 patients).Intra-operative monitoring was done. Intraoperative glycemic profile was recorded. Postoperative follow-up was done in all the patients was assessed.All the results were analyzed by SPSS software. Chi- square test and Mann Whitney U test were used for assessment of level of significance. P-value of less than 0.05 was taken as significant.

RESULTS

Mean age of the diabetic patients and non-diabetic patients was 43.9 years and 41.8 years respectively. Majority proportion of patients were males.Among diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 130.8 mg/dL, 138.6 mg/dL, 159.9 mg/dL, 133.9 mg/dL and 135.4 mg/dL respectively. Among non-diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 93.6 mg/dL, 92.9 mg/dL, 92.5 mg/dL, 93.6 mg/dL and 94.7 mg/dL respectively. Significant correlation was seen between postoperative recovery profile and intraoperative glycemic profile among diabetic group.

Table 1: Demographic and bassline data

Variable	Diabetic group	Non-diabetic group
Mean age (years)	43.9	41.8
Males	12	14
Females	8	6
Mean BMI (Kg/m^2)	23.3	22.7
HbA1c (%)	7.1	4.8

Table 2: Intraoperative glycemic profile (RBS- mg/dL)

Intraoperative time	Diabetic group	Non-diabetic group
Baseline	130.8	93.6
5 mins intraoperative	138.6	92.9
10 mins intraoperative	159.9	92.5

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20 mins intraoperative	133.9	93.6
30 mins intraoperative	135.4	94.7

Table 3: Insulin given intraoperatively

Insulin given	Diabetic group	Non-diabetic group
Number	11	0
Percentage	55	0
p-value	0.001 (Significant)	

Table 4: Postoperative complications

Insulin given	Diabetic group	Non-diabetic group
Number	5	1
Percentage	25	5
p-value	0.001 (Significant)	

Table 5: Pearson's correlation of postoperative recovery profile and intraoperative glycemic profile

Pearson's correlation	Diabetic group	Non-diabetic group
r^2-value	1.225	0.129
p-value	0.001 (Significant)	0.328

DISCUSSION

Diabetes mellitus is a condition marked by irregularities in carbohydrate metabolism, which manifests as hyperglycemia. If not managed appropriately, it can lead to significant health complications, including chronic organ failure and dysfunction. Type 1 diabetes (DM1) arises from the autoimmune destruction of pancreatic beta-cells that produce insulin, resulting in a total lack of insulin secretion. In contrast, Type 2 diabetes (DM2), the most prevalent type of diabetes, is primarily due to insulin resistance in peripheral tissues and is often accompanied by a gradual decline in insulin secretion over time, stemming from the impairment of pancreatic beta-cells.[6- 9] A recent meta-analysis demonstrated that in surgical patients managed in intensive care environments, tight control of glucose levels postoperatively is associated with a reduced risk for septicemia. One of the initiatives to contain surgical site infection at our institution is comprehensive perioperative blood glucose control. This recommendation is based on an extrapolation of data from patients undergoing cardiac surgery and has not been examined or validated in patients undergoing general surgery. Given the multiple factors that may confound perioperative blood glucose levels, such as host factors (age, sex, premorbid state), the nature of surgery, and medications and infusions administered, the impact of glycemic excursion during surgery is unclear. In addition, there is no universally agreed cutoff for plasma glucose deviation from normal in surgical patients, aside from the diagnostic value of 7.1 mmol/L (127 mg/dL) accepted in ambulatory, non-stressed individuals.[10, 11]Hence; the present study was conducted for assessing impact of intraoperative glycemic control as a biomarker for postoperative recovery characteristics among diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy under general anesthesia.

Mean age of the diabetic patients and non-diabetic patients was 43.9 years and 41.8 years respectively. Majority proportion of patients were males. Among diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 130.8 mg/dL, 138.6 mg/dL, 159.9 mg/dL, 133.9 mg/dL and 135.4 mg/dL respectively. Among non-diabetic group, mean RBS at Baseline, 5 mins intraoperative, 10 mins intraoperative, 20 mins intraoperative and 30 mins intraoperative was 93.6 mg/dL, 92.9 mg/dL, 92.5 mg/dL, 93.6 mg/dL and 94.7 mg/dL respectively. Significant correlation was seen between postoperative recovery profile and intraoperative glycemic profile among diabetic group. Kotagal M et al studied the association between diabetes status, perioperative hyperglycemia, and adverse events in a statewide surgical cohort. Among 40,836 patients, 19% had diabetes; 47% underwent a perioperative blood glucose (BG) test, and of those, 18% had BG ≥180 mg/dL. Diabetes mellitus (DM) patients had a higher rate of adverse events than non-diabetes mellitus (NDM) patients. After adjustment, among NDM patients, those with hyperglycemia had an increased risk of adverse events compared with those with normal BG. Among NDM patients, there was a dose-response relationship between the level of BG and composite adverse events. Conversely, hyperglycemic DM patients did not have an increased risk of adverse events, including those with a BG 180 or more. NDM patients were less likely to receive insulin at each BG level. For NDM patients, but not DM patients, the risk of adverse events was linked to hyperglycemia. Underlying this paradoxical effect may be the underuse of insulin, but also that hyperglycemia indicated higher levels of stress in NDM patients than in DM patients.[12]Goodenough CJ et alassessed the role of preoperative glycosylated hemoglobin and postoperative glucose together in

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predicting major complications after abdominal surgery. All patients with HbA1c within 3 months before surgery were included. The primary end point was major complication, using the Clavien-Dindo complication system, within 30 days of surgery. Among 438 patients who had a measured HbA1c, 96 (21.9%) experienced a major complication. On multivariate analysis, HbA1c ≥ 6.5% was found to be the most significant predictor of major complications. Glyosylated hemoglobin and glucose were strongly correlated. Predicted probabilities demonstrated that both HbA1c and glucose together contributed to major complications; and HbA1c impacted the ability to achieve optimal perioperative glucose control. Patients with a BMI >30 kg/m(2), history of coronary artery disease, and nonwhite race were more likely to have a HbA1c ≥ 6.5%. Elevated HbA1c ≥ 6.5% and perioperative hyperglycemia were associated with an increased rate of major complications after abdominal surgery. Elevated peak postoperative glucose levels were correlated with elevated HbA1c and were independently associated with major complications.[13]

CONCLUSION

Diabetes has the potential to impact various organ systems within the body, and if left unmanaged, it may result in significant complications over time. Intraoperative glycemic profile can be useful in predicting recovery profile in diabetic patients.

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