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Evaluation of hyperglycaemic response to anti-emetic dose of dexamethasone in diabetic patients undergoing cholecystectomy

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Abstract
Background: To evaluate hyperglycaemic response to an anti-emetic dose of dexamethasone in diabetic subjects undergoing Cholecystectomy surgery.
Materials and Methods: A prospective study was conducted, over 120 ASA I and II, aged 16-60 years patients posted for Cholecystectomy under General Anaesthesia for a period of October 2021 to October 2022. Prior to the anaesthetic induction, diabetic and non-diabetic patients were randomly distributed by numbers generated computationally in two groups: Group A, 60 diabetic patients received 8 mg dexamethasone. Group B, 60 non-diabetic patients received 8 mg dexamethasone. Data were analysed using Statistical Package for Social Sciences, version 23 (SPSS Inc., Chicago, IL). Student t-test was used for group comparison. A p-value of <0.05 was considered statistically significant.
Results: The distribution of studied patients was based on a comparison of duration of surgery in both groups and it was observed that the mean duration of surgery in group A and group B was 2.0±0.0 min and 2.0±0.0 min respectively.
Conclusion: Dexamethasone caused a significant rise in blood sugar in diabetic patients but the hyperglycaemic response was not exaggerated beyond expected physiology, so no pharmacological intervention was required.

Keywords: Diabetes, vomiting, cholecystectomy

Introduction
Dexamethasone is a synthetic glucocorticoid with potent anti-inflammatory and metabolic effects". It is a long-acting, synthetic derivative of Cortisol (Hydrocortisone); with a chemical structure of 1-dehydro-9-fluoro-16-methyl hydrocortisone. It is an agonist of glucocorticoid receptors. It is widely used as a premedication in patients undergoing surgeries under Anaesthesia. "It is frequently administered in the perioperative period, most commonly for the prophylaxis and treatment of postoperative nausea and vomiting (PONV) [1]. The consequences of PONV include delayed discharge from PACU, unanticipated hospital admission, increased incidence of pulmonary aspiration and significant postoperative discomfort. "The ability to identify high-risk patients for prophylactic intervention can significantly improve the quality of patient care and satisfaction in PACU". "Patients are more often concerned" about "PONV" than pain or other risks associated with anaesthesia and surgery. The incidence of "PONV" varies with many potential causes. Patients often experience nausea and emesis after discharge from PACU, which may coincide with increased oral intake or waning effect of antiemetics. Surgeries associated with higher risks of PONV are eye procedures, peritoneal or intestinal irritation, ear nose and throat procedures, and laparoscopic and open cholecystectomy. PONV is a major problem in perioperative care occurring in 25%-30% of all surgical patients and upto 70% to 80% in high-risk populations(eg: Tonsillectomy, Strabismus, Mastoidectomy and laparoscopic and open Cholecystectomy surgeries). Without prophylaxis, and it adversely affects the patient's satisfaction and care in the postoperative period [2, 3]. Perioperative hyperglycemia is reported in 20-40% of patients undergoing general surgery and approximately 80% of patients after cardiac surgery" [4, 5].

A recent report examining point-of-care glucose testing in 3 million patients, across 575 American hospitals, reported a prevalence of hyperglycemia (blood glucose>180 mg/dl, 10 mmol/l) as 32% in both intensive care (ICU) patients and non-ICU patients" [6]. "Most patients with hyperglycemia have a known diagnosis of diabetes". "However, 12-30% of patients who experience intra and/or post-operative hyperglycemia do not have a history of diabetes before surgery, a state often described as 'stress hyperglycemia" [7, 8]. Stress hyperglycemia typically resolves as the acute illness or surgical stress abates. "However, cross-sectional and longitudinal studies show that between 30-60% of these patients have impaired carbohydrate intolerance when assessed by oral glucose tolerance testing after hospital discharge" [9]. "Furthermore, 60% of patients admitted with new hyperglycemia had confirmed diabetes at 1 year" [9]. "Measurement of HbA1c in patients with hyperglycemia during hospitalization provides the opportunity to differentiate patients with stress hyperglycemia from those with diabetes who were previously undiagnosed" [10]. "The Endocrine Society guidelines indicate that patients with hyperglycemia and HbA1C of 6.5% or higher can be identified as having diabetes [11].

"The true incidence of PONV is difficult to determine because of the lack of a single stimulus of onset as well as the range of possible etiologies (medical, surgical, and patient and anaesthesia associated)". "In the absence of antiemetic treatment, the incidence of PONV is estimated to be 25% to 30% for all surgical interventions and patient populations" [12]. However, the incidence rate of PONV after laparoscopic cholecystectomy (LC) is higher than that after other types of surgery [13]. Hence, this study was done for the evaluation of perioperative hyperglycaemic response to an anti-emetic dose of dexamethasone in diabetic patients undergoing cholecystectomy.

Materials & methods

A prospective study was conducted, of over 120 ASA I and II, aged 16-60 years patients posted for Cholecystectomy under General Anaesthesia for a period of October 2021 to October 2022. A detailed history of the event and clinical examination was conducted in all the patients and noted in a case file. Demographic data collected were age, weight, and height and BMI. Hyperglycaemia is defined as blood glucose greater than 125 mg/dl while fasting and greater than 180 mg/dl 2 hours postprandial. A detailed pre-anaesthetic evaluation was carried out to rule out the presence of any significant co-morbidity. A standardized anaesthetic technique was used in the two groups. Patients were pre-medicated with 1mg midazolam, injection of Metoclopramide 10 mg, Injection glycopyrrolate 0.01 mg/kg and an injection Fentanyl 2 mcg/kg. Thereafter, anesthesia was induced by propofol (2-2.2 mg/kg), atracurium (0.6 mg /kg) as muscle relaxant to facilitate endo-tracheal intubation. Anesthesia was maintained with isoflurane or sevoflurane (0.5-1.0 MAC) in oxygen (FiO2-0.5). The ventilation was controlled and adjusted to keep EtCO2 between 30-35 mmHg. Prior to the anesthetic induction, diabetic and non-diabetic patients were randomly distributed by numbers generated computationally in two groups: Group a, 60 diabetic patients received 8 mg dexamethasone. Group B, 60 non-diabetic patients received 8 mg dexamethasone. After surgery, patients were extubated in the operating room. In the post-operative care unit patients were evaluated for nausea and vomiting. Post-operative pain was assessed by numeric rating scale for pain (0 = no pain, 10= worst possible pain). Data were analysed using Statistical Package for Social Sciences, version 23 (SPSS Inc., Chicago, IL). Student t-test was used for group comparison. A p-value of <0.05 was considered statistically significant.

Results

It was observed that the mean age of Group A and Group B of patients were 52.26±6.79 years and 40.0±11.72 years respectively. The mean height of Group A and Group B of patients were 156.40±3.63 (cms) and 157.62±3.25 (cms) respectively. The mean weight (kg) of Group A and Group B of patients were 63.68±5.12 (kg) and 61.08±4.65 (kg) respectively. The mean BMI (kg/m^2) of Group A and Group B of patients were 26.05±1.65 and 25.67±1.41 respectively. The association of age and weight in both groups was found to be statistically significant (p<0.05).

Table 1: Distribution of studied patients based on comparison of demographic details of patients of both groups

	Group-A (n=60)	Group-B (n=60)	p-value
Age in years (Mean ± SD)	52.26±6.79	40.0±11.72	**<0.001**
Height (cms)	156.40±3.63	157.62±3.25	0.056
Weight (kg)	63.68±5.12	61.08±4.65	0.145
BMI (kg/m^2)	26.05±1.65	25.67±1.41	0.180

The distribution of studied patients based on comparison of duration of surgery in both groups and it was observed that the mean duration of surgery in group A and group B was 2.0±0.0 min and 2.0±0.0 min respectively.

Table 2: Distribution of studied patients based on comparison of duration of surgery in both groups

	Group-A (n=60)	Group-B (n=60)	p-value
Duration of surgery (min) (Mean ± SD)	2.0±0.0	2.0±0.0	---

It was observed that the mean value of RBS Baseline (Preoperative) in Group A and Group B was 135.7±7.94 and 109.9±15.02respectively. The mean value at 1 hour in Group A and Group B was 139.4±8.72 and 112.5±16.03 respectively. The mean value at 2 hours in Group A and Group B was 143.4±9.0 and 113.8±12.78 respectively. The mean value at 3 hours in Group A and Group B was 142.3±9.15 and 112.5±10.06 respectively. The mean value at 4 hours in Group A and Group B was 139.2±9.58 and 111.1±11.58 respectively. The association of RBS in group A was found to be statistically significant (p<0.05).The association of RBS in group B was found to be statistically non-significant (p>0.05).

Table 3: Distribution of studied patients based on comparison of RBS in both groups

RBS	Group-A (n=60)	p-value	Group B (n=60)	p-value
	Mean ± SD		Mean ± SD	
Baseline (Preoperative)	135.7±7.94	<0.001	109.9±15.02	0.143
At 1 hours	139.4±8.72	<0.001	112.5±16.03	0.156
At 2 hours	143.4±9.0	<0.001	113.8±12.78	0.133
At 3 hours	142.3±9.15	<0.001	112.5±10.06	0.164
At 4 hours	139.2±9.58	<0.001	111.1±11.58	0.125

It was observed that in preoperative ≤7.50 and 7.51+ mean was 135.02 and 137.29 respectively. In RBS at 01 ≤7.50 and 7.51+ mean was 138.30 and 142.17 respectively. In RBS at 02 ≤7.50 and 7.51+ mean was 142.27 and 146.17 respectively. In RBS at 03 ≤7.50 and 7.51+ mean was 141.88 and 143.47 respectively. In RBS at 04 ≤7.50 and 7.51+ mean was 138.00 and 142.23 respectively. The correlation between HbA1c and blood sugar was found to be statistically significant (p<0.05).

Table 4: Distribution of studied patients based on correlation between HbA1c and blood sugar

Time duration	HbA1c levels (%)	N	RBS Mean	Std. Deviation	P value
Preoperative RBS	≤7.50	43	135.02	8.44	<0.001
	7.51+	17	137.29	6.43	
	Total	60	135.66	7.94	
RBS_at_01hrs after giving inj dexamethasone	≤7.50	43	138.30	8.90	<0.001
	7.51+	17	142.17	7.79	
	Total	60	139.40	8.72	
RBS_at_02hrs after giving inj dexamethasone	≤7.50	43	142.27	9.45	<0.001
	7.51+	17	146.17	7.24	
	Total	60	143.38	9.00	
RBS_at_03hrs after giving inj dexamethasone	≤7.50	43	141.88	9.84	<0.001
	7.51+	17	143.47	7.28	
	Total	60	142.33	9.15	
RBS_at_04hrs after giving inj dexamethasone	≤7.50	43	138.00	8.85	<0.001
	7.51+	17	142.23	10.93	
	Total	60	139.20	9.58	

It was observed that majority 91(75.83%) patients had Mild pain and 29(24.17%) patients had no pain.

Table 5: Distribution of studied patients based on numeric rating scale for pain

No pain (%)	Mild Pain (%)	Moderate Pain (%)	Severe Pain (%)
29(24.17%)	91(75.83%)	0(0%)	0(0%)

The distribution of studied patients based on postoperative nausea and vomiting and it was observed that majority 116 (96.67%) patients were belonged to No nausea/No vomiting group and 4 (3.33%) patients were belonged to Nausea and Vomiting group respectively.

Table 6: Distribution of studied patients based on postoperative nausea and vomiting

No nausea/No vomiting (%)	Nausea and Vomiting (%)
116 (96.67%)	4 (3.33%)

Discussion

Postoperative nausea and vomiting (PONV) are known to occur within 24 hours after surgery, affecting 20.0%-30.0% of the patients [14]. Various scoring systems have been devised to identify patients at high risk [14, 15]. According to Apfel simplified scoring system, the incidence of PONV is quantified according to a number of risk factors, namely, female gender, prior history of motion sickness or PONV, non-smoker, and the use of postoperative opioids. [16] If none, one, two, three, or four of these risk factors were present, the incidences of PONV were 10.0%, 21.0%, 39.0%, 61.0%, and 79.0%, respectively. The incidence of PONV has also been reported to be very high in some commonly performed procedures such as laparoscopic cholecystectomy (LC), middle ear, and ophthalmic surgeries. It has been reported to be as high as 46.0%-75.0% after LC in patients who did not receive antiemetics perioperatively [17]. Hence, this study was done for the evaluation of perioperative hyperglycaemic response to anti emetic dose of dexamethasone in diabetic patients undergoing cholecystectomy.

In the present study, it was observed that the mean age of Group A and Group B of patients were 52.26±6.79 years and 40.0±11.72 years respectively. The mean height of Group A and Group B of patients were 156.40±3.63 (cms) and 157.62±3.25 (cms) respectively. The mean weight (kg) of Group A and Group B of patients were 63.68±5.12 (kg) and 61.08±4.65 (kg) respectively. The mean BMI (kg/m^2) of Group A and Group B of patients were 26.05±1.65 and 25.67±1.41 respectively. The association of age and weight in both groups was found to be statistically significant (p<0.05). The distribution of studied patients based on a comparison of duration of surgery in both groups and it was observed that the mean duration of surgery in group A and group B was 2.0±0.0 min and 2.0±0.0 min respectively. A study by Pasupaleti SL *et al.* [18] and Gülmez DD *et al.* [19] "who did a study on blood glucose concentration Profile after administration of intravenous dexamethasone for prevention of postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy under general Anesthesia and the effects of peri-operative administration of steroids on the blood glucose levels of patients with and without diabetes undergoing laparoscopic cholecystectomy

respectively".

In the present study, it was observed that the mean value of RBS Baseline (Preoperative) in Group A and Group B was 135.7±7.94 and 109.9±15.02respectively. The mean value at 1 hour in Group A and Group B was 139.4±8.72 and 112.5±16.03 respectively. The mean value at 2 hours in Group A and Group B was 143.4±9.0 and 113.8±12.78 respectively. The mean value at 3 hours in Group A and Group B was 142.3±9.15 and 112.5±10.06 respectively. The mean value at 4 hours in Group A and Group B was 139.2±9.58 and 111.1±11.58 respectively. The association of RBS in group A was found to be statistically significant (p<0.05).The association of RBS in group B was found to be statistically non-significant (p>0.05). Hans P *et al*. in which a significant linear correlation was observed between HbA1c and maximum blood glucose concentrations": the higher the HbA1c, the higher the blood glucose concentration [20].

In the present study, it was observed that in preoperative ≤7.50 and 7.51+ mean was 135.02 and 137.29 respectively. In RBS at 01 ≤7.50 and 7.51+ mean was 138.30 and 142.17 respectively. In RBS at 02 ≤7.50 and 7.51+ mean was 142.27 and 146.17 respectively. In RBS at 03 ≤7.50 and 7.51+ mean was 141.88 and 143.47 respectively. In RBS at 04 ≤7.50 and 7.51+ mean was 138.00 and 142.23 respectively. The correlation between HbA1c and blood sugar was found to be statistically significant (p<0.05). Dexamethasone has already been reported to produce significantly larger increases in blood glucose concentrations in non-diabetic patients undergoing elective craniotomy" [21]. "Patients not taking dexamethasone before surgery but receiving it during and after operation have been reported to have a greater increase in blood glucose concentrations from preinduction values than patients who did not receive dexamethasone or those normally on dexamethasone and who also received it during operation". "Pasternak JJ *et al*. [21] examined the effects of 10 mg of dexamethasone administered to prevent cerebral edema in patients undergoing craniotomy", and found that the mean blood glucose levels were significantly higher in patients who had received dexamethasone than in those who had received the placebo. "Lukins MB *et al*. [22] included 34 patients without diabetes undergoing craniotomy in their study". of these, one group of patients received placebos only, one group received preoperative dexamethasone, one group received 10 mg of intravenous dexamethasone, and one group of patients received 4 mg of intravenous dexamethasone 6 h after surgery. "All the patients exhibited an increase in blood glucose levels for a period of 12 h. The highest increase in blood glucose levels was observed within the first 8 to 10 h in patients that had received intraoperative dexamethasone". In the present study, it was observed that majority 91(75.83%) patients had Mild pain and 29(24.17%) patients had no pain. The distribution of studied patients based on postoperative nausea and vomiting and it was observed that majority 116 (96.67%) patients belonged to No nausea/No vomiting group and 4 (3.33%) patients belonged to Nausea and Vomiting groups respectively. Gupta R *et al*. [23] in which a fixed dose Midazolam which is usually used as a premedicated, 0.04 mg/kg was used with variable doses of Dexamethasone. The minimum dose for prevention of nausea was 4 mg of dexamethasone and for vomiting, it was 2 mg. There was significant reduction in nausea and pain severity as well as in incidence of use of rescue antiemetics and analgesics in 4 mg and 8 mg group of D compared with the placebo. The results were similar to those of Yeo J *et al*, [24] and El Deeb A *et al.*, [25] that combination of studied drugs is more effective for PONV prevention. Out of 120 patients, mild pain was experienced by 75.83% of cases in which we have to give rescue analgesic drug whereas 24.17% experienced no pain at all.

Conclusion

Out of 120 patients, only 3.33% of patients experienced nausea and vomiting. It was observed that dexamethasone caused a significant rise in blood sugar in diabetic patients but the hyperglycaemic response was not exaggerated beyond expected physiology, so no pharmacological intervention was required. There is an insignificant rise in blood sugar in non-diabetic patients and there was no incidence of hyperglycaemia a good control of blood sugar and weight is suggested for diabetic patients for any type of surgery. There is very less or no need to use rescue anti emetics and rescue analgesic drugs in postoperative period.

Conflict of Interest

Not available

Financial Support

Not available

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