Monitoring of Blood Glucose Concentration after Administration of Intravenous Dexamethasone 2 mg and 4 mg for PONV in Patients Undergoing Surgery under General Anaesthesia

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ABSTRACT

BACKGROUND

Post-Operative Nausea and Vomiting (PONV) are some of the most common postoperative complications in patients undergoing a surgical procedure under general anesthesia. The main objective of this study was to monitor the change in blood glucose concentration in patients undergoing surgery under general anesthesia and also to compare the efficacy of two different doses of dexamethasone on the prevention of PONV.

METHODS

A prospective randomized, double-blind comparative study has conducted at S.V.R.R.G.G.H, Tirupati, Andhra Pradesh, between December 2016 to November 2017 after obtaining permission from the institutional scientific and ethical committee among 90 patients of ASA grade 1 & 2, aged about 18 to 60 years, meeting inclusion and exclusion criteria. Informed consent was obtained from all patients.

RESULTS

Dexamethasone significantly reduced morbidity by decreasing PONV and postoperative pain during the first 24 hours of the postoperative period. The postoperative pain score was significantly lesser at 12 hours and 24 hours in the study group, and there was no significant difference in the pain scores at 0, 4, 8, 12 hours in both the study groups.

CONCLUSIONS

Injection dexamethasone significantly reduced morbidity by decreasing PONV and postoperative pain during the first 24 hours of the postoperative period with no significant rise in blood glucose levels. Also, better analgesia was noted compared to the placebo group.

KEYWORDS

Monitoring Glucose, Dexamethasone, General Anaesthesia, PONV

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BACKGROUND

Post-Operative Nausea and Vomiting (PONV) are some of the most common postoperative complications in patients undergoing a surgical procedure under general anesthesia,[1,2] which is distressing both the patients and physicians. It considered a sickness following anesthesia - the incidence of postoperative nausea and vomiting in extensive studies as being reported to be 20-30%.[2] Specific surgical procedures like gynecological, laparoscopic, middle ear, and strabismus procedures are associated with a high risk of PONV.[1,2]

Various modalities of treatment for PONV currently followed that includes traditional antiemetic therapy with anticholinergic, phenothiazine's, butyrophenones, serotonin receptor antagonist, antihistamines, benzodiazepines and non-traditional antiemetic therapy with propofol, ephedrine, corticosteroids, neurokinin-1 antagonists.[3,4,5] corticosteroids have evaluated for their usefulness in preventing PONV after they found to be effective in preventing chemotherapy-induced nausea and vomiting.[6] However, This could be due to the anti-inflammatory effect or due to the membrane stabilizing effect.

Dexamethasone administered alone or in combination with other antiemetic drugs has proven effective in preventing nausea and vomiting and provides postoperative analgesia. Although adverse events related to single-dose corticosteroids not well defined, particularly the effect of a single dose of dexamethasone on perioperative blood glucose levels when given in a low dose.

METHODS

A prospective randomized, double-blind comparative study has conducted at S.V.R.R.G.G.H., Tirupati, Andhra Pradesh between December 2016 to November 2017. After obtaining permission from the institutional scientific and ethical committee, written and informed consent have taken from the patients. And then, the study was carried out on 90 patients with ASA grade 1&2, aged about 18 to 60 years, meeting inclusion and exclusion criteria. Moreover, they were scheduled for elective surgical procedures under general anesthesia.

All patients were randomly divided into 3 groups, group 1-is the control group, group 2-is the dexamethasone 2 mg group, group 3-is the dexamethasone 4 mg group. All the patients were premedicated with tablet alprazolam 0.5 mg and tablet ranitidine 150 mg night before and on the morning of surgery. In the operating room baseline, HR, SBP, DBP, and SpO2 were monitored, and baseline blood glucose measurement has taken by glucometer. After securing IV access with 18G cannula, injection glycopyrrolate 0.2 mg IV 5 min before the induction was given. Analgesia was provided with injection fentanyl 2 mcg/Kg/ intravenously. All patients were pre-oxygenated with 100% oxygen for 3 min. Standard induction of anesthesia included injection thiopentone 4 mg/Kg intravenously until the loss of eyelash reflex and injection atracurium 0.5 mg/Kg intravenously for muscle relaxation. Immediately after induction of anesthesia, all the patients have received the test drug according to their randomization. Group 1 is the control group and received 1 ml normal saline IV; Group-2 received injection dexamethasone 2 mg in 1 ml solution (reconstituted with normal saline); Group 3 –received injection dexamethasone 4 mg in 1 ml solution.

All the patients were intubated with an appropriately sized cuffed oral endotracheal tube and maintained on sevoflurane with intermittent doses of injection atracurium 1/5 of the loading dose. Finger prick capillary blood glucose concentration measured at baseline and 1st, 2nd, 4th, 6th, and 24th hour intra-operatively and postoperatively. All the capillary blood glucose readings have measured with Freestyle Optimum glucometer. Glucose free IV fluids were administered to all the patients intra-operatively and postoperatively.

At the end of the surgery, injection paracetamol IV 15 mg/Kg infusion administered to all the patients who are having VAS (visual analog pain scoring scale) score above 4. Immediate postoperative period pain noted using VAS scale with score 0 being no pain and 10 being severe pain. All the patients were followed for 24 hours postoperatively. Any episode of nausea, retching, and vomiting was recorded, assessed, and evaluated on a five-point PONV ordinal scale. That is 0=none, 2=retching, 3=vomiting, 4=severe vomiting. In case of any event of nausea and vomiting was noted, injection Ondansetron 4 mg IV administered.

Inclusion Criteria

- ASA 1 & 2.
- Patients are willing to participate in the study.
- Patients with Age group of more than 18 to 60 years.
- Elective surgical procedures require general anaesthesia.

Exclusion Criteria

- ASA 3 & 4.
- Patients are not willing to participate in the study.
- Patients with uncontrolled diabetes mellitus.
- Patients with associated pancreatic tumours.
- Patients with associated adrenal tumours.
- Patients with associated migraine.
- Patients with known allergy to the drug.

RESULTS

This study showed that injection dexamethasone significantly reduced morbidity by decreasing PONV and also postoperative pain during the first 24 hours of the postoperative period with no significant difference between 2 mg and 4 mg doses of injection dexamethasone on raising blood glucose and PONV. We found that the postoperative

pain score was significantly lesser at 12 hours and 24 hours in the study group (2 & 3), and there was no significant difference in the pain scores at 0, 4, 8, 12 hours in both the study groups. All three groups were age-matched, and there is no significant difference between the groups. There is a significant difference between the groups in 4 hours postoperative PONV score with a P-Value of 0.001. PONV score at 4 hours postoperative period are significantly lower in dexamethasone groups (Group 2 & 3) compared to the control group (Group 1). There is no significant difference in blood glucose levels between the groups.

	Group-A	Group-B	Group-C	P-Value
No. of patients	30	30	30	-
Age in years	37.63.63	32.9010.91	39.9712.33	0.062
Gender (ratio) M:F	16: 14	16: 14	14: 16	0.842
Duration of surgery (min)	122.3328.398	118.1728.932	124.6725.829	0.422

Table 1. Demographic Data

PONV Time Interval (hr)	Group-1	Group-2	Group-3	Total	P-Value
0 hours	1.60±0.498	1.50±0.572	1.37±0.490	1.49±0.525	0.226
4 hours	1.30±0.466	0.93±0.450	0.67±0.479	0.97±0.529	0.001*
8 hours	0.63±0.490	0.50±0.509	0.47±0.507	0.53±0.502	0.400
12 hours	0.37±0.490	0.20±0.407	0.17±0.379	0.24±0.046	0.159
24 hours	0.23±0.430	0.13±0.346	0.13±0.346	0.17±0.375	0.496

Table 2. Comparison of PONV Score

PONV time interval in (hrs.)	Group 1 vs. Group 2		Group 1 vs. Group 3		Group 2 vs. Group 3	
	Difference	P-Value	Difference	P-Value	Difference	P-Value
0 hours	0.10	0.473	0.23	0.073	0.13	0.336
4 hours	0.37	0.003	0.63	0.000	0.27	0.030
8 hours	0.13	0.305	0.17	0.201	0.03	0.800
12 hours	0.17	0.157	0.20	0.082	0.03	0.744
24 hours	0.10	0.325	0.10	0.325	0.00	1.000

Table 3. Pairwise Comparison of PONV Score in the Three Groups

Time Interval (hours)	Group-1	Group-2	Group-3	Total	P-Value
Baseline	84.33±8.02	85.73±8.49	86.03±8.09	85.37±8.14	0.694
1st hour	130.50±15.21	135.97±10.93	132.93±11.89	133.13±12.86	0.259
2nd hour	146.10±15.70	152.87±10.86	148.87±10.71	149.28±12.80	0.120
4th hour	155.37±17.67	159.27±11.72	156.23±10.91	156.96 ±13.72	0.517
6th hour	134.27±11.70	139.73±9.60	138.33 ±9.74	137.44 ±10.53	0.112
24th hour	123.77±10.26	127.33±9.51	127.43 ±9.08	126.18±9.67	0.249

Table 4. Comparison of Blood Glucose Levels

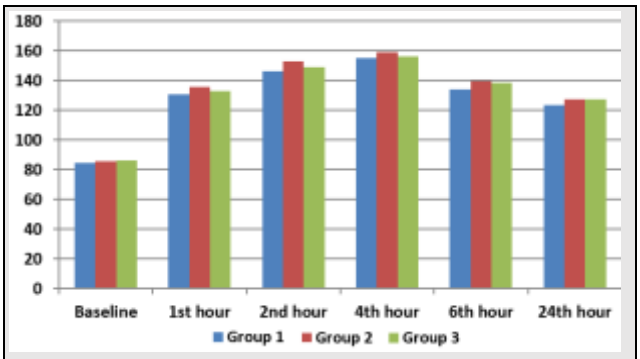

Figure 1

Glucose Time Interval	Group-1		Group-2		Group-3	
	Difference	P-Value	Difference	P-Value	Difference	P-Value
Baseline						
1st hour	46.17	0.00	50.24	0.00	47.76	0.00*
2nd hour	61.77	0.00	67.14	0.00	63.91	0.00*
4th hour	71.04	0.00	73.54	0.00	71.59	0.00*
6th hour	49.94	0.00	54.00	0.00	52.07	0.00*
24th hour	39.44	0.00	41.60	0.00	40.81	0.00*

Table 5. Intra-Group Comparison of Blood Glucose Levels from Baseline in the Three Groups

There is a significant rise in blood glucose levels in all groups with time. But there is no statistically significant difference in rising blood glucose between the groups.

DISCUSSION

In this study, the effects of two different doses of injection dexamethasone (2 mg & 4 mg) on intraoperative and postoperative blood glucose concentration, PONV, and pain scores recorded. As noted in a recent editorial, hyperglycemia is a recognized steroid-induced complication, but the effect of single low dose therapy on blood glucose concentrations has not well characterised.[6] Several studies have evaluated the effect of injection dexamethasone on PONV and pain after laparoscopic surgery.[7-9]

The antiemetic properties of injection dexamethasone well established, but the mechanisms underlying this antiemetic's effect remain largely unknown. A possible mechanism of direct inhibition of prostaglandins, serotonin, or endorphin production has postulated. In our study, we found that a single dose of injection dexamethasone given at the induction of anesthesia results in reduced incidence of PONV and improved pain scores in the postoperative period. Even a small dose of injection dexamethasone 2 mg is also significantly reduced the postoperative morbidity by decreasing PONV and pain score.

Kang et al., on the other hand, found that 2.5 mg of injection dexamethasone has the minimum effective dose to prevent nausea and vomiting after major gynecological surgery with no influence on postoperative pain.[10] A wide dose range of Injection dexamethasone (8 – 32 mg) has been used in the prophylaxis of emesis related to chemotherapy and after pediatric and gynecological surgery. Pappas et al. observed a decreased in the overall incidence of postoperative vomiting and improved quality of oral intake during the 24 hours after discharge in children undergoing tonsillectomy who received injection dexamethasone 1 mg/Kg after the induction anesthesia as compared.[11]

In a recent meta-analysis of 17 randomized controlled trials, a single dose injection dexamethasone in combination with 5-HT_3 receptor antagonists significantly reduced nausea and vomiting when compared with placebo, but the optimal dose of this combination still needs to be identified.[12] Elhakim et al. have shown that the incidence of PONV reduced from 83% to 16% with 4 mg Ondansetron and 8 mg dexamethasone.[13]

Bano et al. in a randomized controlled trial comprising 100 patients in two groups, found that dexamethasone 8 mg with ondansetron 4 mg significantly reduced the risk of PONV when compared to injection dexamethasone alone.[14] Lim et al. found that intravenous injection of dexamethasone before and after laparoscopic cholecystectomy has been effective in reducing postoperative pain.[15]

A study by Fukami et al. showed that 8 mg of intravenous dexamethasone has significantly reduced postoperative pain and fatigue after laparoscopic cholecystectomy.[16] A study by Pasternak et al. concluded

that if injection dexamethasone is used as a 10 mg single dose during craniotomy, intraoperative blood glucose concentration was carefully monitored, and hyperglycemia is treated. But Paternak et all used a high dose (10 mg) of dexamethasone and stated significant hyperglycemia does occur after administration, but the usual dose of prevention of PONV is 4 mg.[17]

A non-randomized trial by Hans et al. concluded that after 10 mg injection dexamethasone, blood glucose levels increase in non-diabetic and type 2 diabetic patients undergoing abdominal surgery. But being a non-randomized trial and high dose injection dexamethasone demerits the study.[18] An observational study by Abdelmannan et al. used peroral doses of 2 mg, 4 mg, and 8 mg dexamethasone in healthy patients and concluded that fasting plasma glucose concentrations were high with 8 mg dexamethasone and the rise in plasma glucose after 2 mg and 4 mg was not significant. However, this was done in healthy persons and did not consider the effect of any additional stress-induced plasma glucose rise that may alter the study result. Moreover, oral dexamethasone is of not much use in a surgical case scenario.[19]

A study by Murphy et al. concluded that because blood glucose concentration during the first 24 hours after administration of single low dose dexamethasone 4 mg did not differ from those observed after saline administration, these results suggest clinicians need not avoid using dexamethasone for nausea and vomiting prophylaxis out of concerns related to hyperglycemia.[20] The results of the present study showed that injection dexamethasone significantly reduced morbidity by decreasing PONV and postoperative pain during the first 24 hours of the postoperative period with no significant rise in blood glucose levels. Though there is no significant difference between 2 mg and 4 mg doses of injection dexamethasone on blood glucose and PONV, we found that postoperative pain scores were significantly lesser at 12 hours and 24 hours with injection dexamethasone 2 mg and 4 mg, and there was no significant difference in the pain score at 0,4,8,12 hours in both the groups.

CONCLUSIONS

Injection dexamethasone significantly reduced morbidity by decreasing PONV and postoperative pain during the first 24 hours of the postoperative period with no significant rise in blood glucose levels. Besides, better analgesia was noted compared to the placebo group.

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