Original Article

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Effects of Preoperative Administration of Dexamethasone on Postoperative Pain in Patients Undergoing Laparoscopic Cholecystectomy

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Author`s Contribution

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ABSTRACT

Objective: To determine the effect of single dose administration of dexamethasone on post-operative pain in patients undergoing laparoscopic cholecystectomy.

Methodology: This randomized control trial was conducted at PAF Hospital Islamabad from January 2023 till June 2023. Ninety-two patients of both genders underwent laparoscopic cholecystectomy and were randomly assigned to two groups. Group A was given 8 mg dexamethasone (dissolved in 100ml 0.9% isotonic normal saline) intravenously 30 minutes before induction of anaesthesia (n=46). Group B patients received 100ml 0.9% normal saline only (n=46). Episodes of pain were recorded using VAS (visual analogue scale) at baseline, 1 hour, 3 hours, 6 hours, 12 hours and 24 hours post-anaesthesia.

Results: Age range in this study was from 20 to 60 years. Out of 92 patients, 51 were males and 41 were females with male to female ratio of 1.2:1. VAS was 5.17 ± 1.10 in group A and 5.02 ± 1.14 in group B at baseline, 4.87 ± 0.86 in group A and 4.85 ± 0.87 in group B at 1 hours, 3.46 ± 1.00 in group A and 4.65 ± 0.74 in group B at 3 hours, 2.93 ± 0.95 in group A and 4.50 ± 0.78 in group B at 6 hours, 3.11 ± 0.77 in group A and 4.50 ± 1.09 in group B at 12 hours. VAS score of Group A were lower (2.41 ± 1.39) than that of Group B (4.61 ± 0.77) at 24 hours.

Conclusion: Single dose of dexamethasone at the time of induction of anaesthesia significantly decrease the pain in 24 hours of laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, post-operative pain, dexamethasone.

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Introduction

Gallstone disease is a commonly seen problem in developed countries. Autopsy and clinical investigations have shown that at least 10% of adults have gallstones. Whereas 40-60% of people with gallstones exhibit a symptomatic clinical course. 20% of symptomatic patients with gallstones present with acute cholecystitis, while 10% present with complications like jaundice, cholangitis, pancreatitis & 60-70% with chronic cholecystitis.[1]

The first successful gallbladder drainage procedure was performed on a 30-year-old female patient by John Stough Bobbs in Indiana in 1867. The first cholecystectomy was performed by Carl Langenbuch in the Lazarus hospital Berlin on 15 July 1882. In 1931, William L. Estes describe operation for gangrenous gall bladder with induration of the cystic and common ducts, which was performed in 1929, and named 'partial cholecystectomy.[2]

In 1985 Erich Muhe, a renowned surgeon, performed the first laparoscopic cholecystectomy (LC). LC became gold

standard in the treatment of gallstones and undoubtedly decreased the complications faced with open surgery[3]. However, postoperative pain remains a common cause of patient discomfort and increased duration of hospital stay after surgery for gallstones to this day. Laparoscopic cholecystectomy is a safe ambulatory procedure in appropriately selected patients. Still, day case rates remain low in gall bladder surgery in Pakistan. Since its introduction, the length of stay (LOS) associated with LC has steadily reduced and it is now widely accepted as an appropriate and safe ambulatory procedure in carefully selected patients.[4,5]

Various medications have been used in the postoperative period aiming to reduce the LOS and complications like pain, nausea and vomiting being the most common[6]. Dexamethasone is a synthetic glucocorticoid used to reduce patient discomfort postoperatively. The effects of preoperative administration of dexamethasone was examined in many randomized control trail (RCTs), with reduction in LOS, pain, nausea and vomiting noted amongst patients receiving dexamethasone compared with placebo.[7,8,9]

One of the cause of post-operative pain after surgery is post-operative nausea & vomiting (PONV). In Medulla Oblongata, there is an area in the on the floor of the fourth ventricle known as Chemoreceptor Trigger Zone (CTZ). It is outside the blood–brain barrier and can be effected by harmones & medicines circulating in the blood. Neurotransmitters implicated in the control of nausea and vomiting include acetylcholine, dopamine, histamine (H1 receptor), substance P (NK-1 receptor), and serotonin (5-HT3 receptor). Ondansetron & Dexamethasone by anti-serotonin mechanism has emerged as a potentially useful prophylaxis for patients at high risk of PONV with minimal side effects.[10]

When cholecystectomy was performed through open technique, patients used to stay in hospital for 3 to 4 days. In the era of LC, patients can be discharged on same day. Major hurdle is control of pain & Post-operative nausea & vomiting (PONV). Fifty-nine studies with a total of 13,219 patients were included in a systematic review by Weiwei Chen. In total, the median same-day discharge rate was 90%.[11] Most patients undergoing laparoscopic cholecystectomy experience pain in the first 24 h after surgery, with port sites being the most painful. Second is visceral pain due to the trauma of gallbladder resection and referred pain to right shoulder. However, the frequency and intensity of incisional pain were higher than visceral pain after laparoscopic cholecystectomy. Therefore, to optimize postoperative pain control in these patients, analgesic studies should focus on reducing incisional pain as well as visceral pain[12].

Many studies conducted which specifically proved effect of Dexamethasone given pre-operatively for postoperative pain in LC[13]. Dexamethasone is the most powerful anti-inflammatory drug with a long half-life and its administration is considered safe for periods shorter than two weeks. In addition to this, LC is the commonest surgical procedure done on the routine elective lists. In many canters, it is conducted as a day case. Still in majority of hospitals in Pakistan, there is a delay from discharge due to pain & immobility. The rationale of this study is to determine whether preoperative dexamethasone administration will reduce postoperative pain in patients undergoing LC in our setup with a view to limit post-operative stay & early mobilization.

Methodology

This randomized control trial was conducted at Department of Surgery, PAF Hospital Islamabad from December 2022 to June 2023. Patients of both genders age 20-60 years, ASA status I & II undergoing elective laparoscopic cholecystectomy for symptomatic gall stones were included in this study. Patients with co-morbidities e.g. diabetes, hypertension, chronic kidney disease, heart failure, patients undergoing LC that had converted to open surgery due to intraoperative events & those taking medication for chronic pain were excluded from this study. Sample size calculated by WHO sample size calculator was 92, with level of significance = 5%, power of study=80%.[14] Non-probability, consecutive sampling was employed for this study Data was collected on pre designed proforma with VAS on it.

After approval from institutional ethical review committee, informed consent was taken from each participant. The patients were divided into two groups randomly (46 in each group). Group A received 8mg dexamethasone (dissolved in 100ml 0.9% isotonic normal saline) intravenously 30 minutes before induction of anaesthesia. Group B patients received 100ml 0.9% normal saline only. Surgery was performed by consultant with minimum 3 years' experience. Post-operative pain was recorded at 0, 3, 6, 12 and 24 hours in both groups by visual pain score (VAS). An additional 15mg/kg paracetamol was given intravenously if pain score was ≥4. Intravenous tramadol 100mg was administered if pain score was ≥7. All the data was recorded on specially designed pro-forma.

Data was analyzed using SPSS version 25. Quantitative variables like age, height, weight, BMI and VAS were described as mean ± standard deviation. Categorical variables like gender and ASA status were presented in terms of frequencies and percentages. Independent sample T test was applied to calculate the mean pain in two groups. Effect modifiers like gender, age, BMI type, ASA status were controlled by stratification. Post stratification independent sample T test was applied to see their effect on outcome. P value less than 0.05 was considered as significant.

Results

Age range in this study was from 20 to 60 years with mean age of 43.87 ± 10.11 years. The mean age of patients in group A was 44.04 ± 10.02 years and in group B was 43.74 ± 10.25 years. Majority of the patients i.e. 59 (64.13%) were between 41 to 60 years of age. Out of 92 patients, 51 (55.43%) were males and 41 (44.56%) were females with male to female ratio of 1.2:1

94.57 % of patients were in ASA I with no comorbidity. Only 5.43 % of patients had well controlled disease like diabetes or hypertension. Mean height was 2.81 ± 0.33 mm. Mean weight was 60.87 ± 6.57 kg. Mean BMI was 21.81 ± 2.80 kg/m^2. P value was not significant & almost equal for both groups as far as BMI was concerned. (Table I)

In our study, it was calculated that P value was significant after second hour of operation and patient feel much less pain in group A as shown in table II.

Table III demonstrates a significant reduction in postoperative pain at 24 hours in the dexamethasone group (Group A) across all stratified variables, including age, gender, BMI, and ASA status. Patients in Group A consistently reported lower VAS scores compared to Group B, with statistically significant differences (p=0.0001), confirming the efficacy of preoperative dexamethasone in pain management.

Discussion

In our study, age range was 20 to 60 with mean age 43 years. However, Sivesh K. Kamarajah and his colleagues showed higher average age in his study.[15] Same results were shown by Mark D. Stringer who conducted a study in Newzeland showed higher age for gall stone disease. Most probably, it is due to better socioeconomic & health facilities in the first world which resulted in increase of average age of their population. Median age was 51 years in his study group with 70% were female as compare to more males in our study. 33% of their patients were

Table I: BMI distribution for both groups (n=92).

	Group A (n=46)		Group B (n=46)		Total (n=92)	
BMI (kg/m2)	No. of patients	%	No. of patients	%	No. of patients	%
≤25	40	86.96	40	86.96	80	86.96
>25	06	13.04	06	13.04	12	13.04
Mean ± SD	21.85 ± 2.79		21.80 ± 2.83		21.81 ± 2.80	

Table-II: Comparison of the mean postoperative pain in patients of group A & B (n=92).

VAS score	Group A (n=46)	Group B (n=46)	P-value
Baseline	5.17 ± 1.10	5.02 ± 1.14	0.522
At 1 hour	4.87 ± 0.86	4.85 ± 0.87	0.912
At 3 hours	3.46 ± 1.00	4.65 ± 0.74	0.0001
At 6 hours	2.93 ± 0.95	4.50 ± 0.78	0.0001
At 12 hours	3.11 ± 0.77	4.50 ± 1.09	0.0001
At 24 hours	2.41 ± 1.39	4.61 ± 0.77	0.0001

Table III: Stratification of post-operative pain at 24 hours with respect to gender, age, BMI type and ASA status.

		Group A (n=46) VAS score at 24th hours		Group A (n=46) VAS score at 24th hours		P-value
		Mean	SD	Mean	SD	
Age (years)	20-40	2.50	1.41	4.76	0.83	0.0001
	41-60	2.37	1.40	4.52	0.74	0.0001
Gender	Male	2.56	1.33	4.46	0.81	0.0001
	Female	2.24	1.48	4.80	0.70	0.0001
ASA status	I	2.43	1.42	4.60	0.79	0.0001
	II	2.00	0.00	4.67	0.58	0.0001
BMI (kg/m^2)	≤25	2.38	1.39	4.83	0.75	0.0001
	>25	2.67	1.51	4.58	0.78	0.0001

overweight with body mass index ≥ 30. In our study, weight of patients was lower & Mean BMI was 21.81 ± 2.80 kg/m^2.[16]

In our study, males were slightly more as compare to females with ratio of 1.2 to 1. In contrary to this, other studies showed higher incidence of gall stones in female population. The overall incidence of gallstone disease was almost double (18.8 %) in women than (9.5 %) in men according to L. Ansaloni & his colleagues[17]. On the other hand, Dragos Serban showed no statistically significant differences in terms of gender distribution in their study group.[18]

94% of our patients were ASA I. Many studies done on cholecystectomy showed majority of the patients were ASA I or II. Mingkwan Wongyingsinn showed that majority of his patients were age less than 49, and maximum were ASA II[19]. In our study, mean BMI was 21.81 ± 2.80 kg/m^2. Obesity is considered as one of the risk factors for PONV. Reem M. Elsaid & his colleagues calculated that almost half of his patients were overweight. According to his research, dexamethasone, have been used as opioid-sparing alternatives.[20]

We use 8 mg of single dose of dexamethasone IV at the induction of anaesthesia & proved to be significant value in decreasing post-operative pain for the first 24 hours. Post-operative pain, nausea & vomiting are the major hurdle in discharging the patient early from the hospital. PONV itself are major contributing factors for pain themselves. A number of studies at present documented

in literature on the role of Dexamethasone alone or in combination with other medications for the control of pot-operative pain & PONV after laparoscopic surgery. Many of these specifically addressing the issue of control of pain & early discharge from hospital after laparoscopic cholecystectomy.[21] In most of the previous studies, dexamethasone was used in a single dose with different amounts (e.g., 4, 6, and 8 mg in different studies), in different combinations, to prevent pain & PONV. Now, based on evidence, a single-dose of 8 mg IV dexamethasone injection at the time of induction was considered an effective and common antiemetic to prevent pain & PONV.[22]

Other studies which demonstrated the role of dexamethasone in preventing pain & PONV in various surgical procedures, such as laparoscopic cholecystectomy and other procedures are by Eman A Ismail[23], by Satoshi Nagase et al where they used combination therapy of dexamethasone and droperidol[24] & Jong-Ho Kim where he used combination of dexamethasone and ramosetron demonstrated a superior effect in preventing PONV for 48 h after surgery than saline in patients at low risk of developing PONV.[25]

There is a meta analysis consist of 11 randomized controlled trials showed that granisetron in combination with dexamethasone was significantly more effective than granisetron alone in preventing PONV in patients undergoing laparoscopy surgery[26] & double-blind clinical trial by Siamak Rekei who aimed to compare the prophylactic effect of dexamethasone and dexmedetomidine and their combination in reducing postoperative nausea and vomiting in patients undergoing laparoscopic cholecystectomy. The dexmedetomidine and dexamethasone combination decreased postoperative nausea and vomiting significantly in his patients.[27]

Another problem faced by surgeon is laparoscopic surgery in diseased liver. Techniques like use of preoperative dexamethasone, local anaesthesia in skin and muscles, instillation of diluted lignocaine in gall bladder bed are considered are effective & safe in early cirrhotic patients as stated by Abdul Razzaq[28] and Zakir khan et al[29] in their respective studies.

Conclusion

This study concluded that the single dose of dexamethasone at the time of induction of anesthesia significantly decrease the pain in 24 hours of laparoscopic cholecystectomy. So, we recommend that single dose of dexamethasone should be used preferably in preventing post-operative pain in these patients in order to reduce the patient's morbidity.

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