



Comparison of various stress response after laparoscopic and open cholecystectomy

KEYWORDS

'Essential Postnatal Care' Instructional Package, primiparous postnatal mothers, care givers, postnatal maternal health outcome, infant health outcome.

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ABSTRACT Surgical trauma by incision and dissection of tissue stimulates the body to respond proportionately to the extent of injury.

This study was conducted to compare metabolic and inflammatory responses after laparoscopic and open cholecystectomy namely serum cortisol and C-reactive protein levels before and after operation, as non-randomized controlled trial. It was found that metabolic responses like serum cortisol were significantly higher after open procedure 6 hours and 48 hours postoperatively. Similarly, inflammatory response indicator C-reactive protein was raised significantly higher 48 hours after open as compared to laparoscopic cholecystectomy. It was concluded that open cholecystectomy caused more tissue responses as compared to its laparoscopic alternative.

Introduction

Acute trauma, whether accidental or surgical, stimulates a series of hormonal, metabolic and inflammatory changes¹. The stress response depends directly on the extent of injury. Cholecystectomy, being an intra-abdominal procedure, may be regarded as a major surgical stress. Laparoscopic cholecystectomy reduces the extent of the peritoneal incision and is less stressful than the conventional procedure. The advantage of this new method compared to open cholecystectomies are: minimal postoperative pain, prompt postoperative bowel activity (6-24 hours), reduced postoperative infections, shorter hospitalization (1-3 days), diminished neuroendocrine metabolic response and earlier return to normal activity². In this study, the systemic stress responses after laparoscopic and conventional open cholecystectomy were compared as a non-randomized prospective trial.

Materials and methods

This was a non-randomized, prospective and comparative study, conducted at the Department of Surgery, Yenepoya Medical College Hospital, Karnataka from December 2014 to July 2016. One hundred patients were included in this study and were divided into two groups of open and laparoscopic cholecystectomy. The allocation of patients in different groups was done on the basis of patient's choice after explaining the study procedure and taking informed consent.

Inclusion Criteria:

- Patients with symptomatic cholelithiasis
- Uncomplicated gall stone disease
- Age: 20 to 55 years.

Exclusion Criteria

- Patients with concomitant illness like hypertension, diabetes, pregnancy, chronic pulmonary disease, cardiac disease, and other comorbidities.
- Any need for conversion, preoperative cholangiography, or CBD exploration.
- Duration of surgery more than 90 minutes.

Out of these 100 patients, 40 underwent open cholecystectomy and 60 laparoscopic cholecystectomy. Preoperative, intraoperative, postoperative and anaesthetic medications were standardized in all the patients. All patients were kept nil per oral from midnight. Intravenous fluids started half an hour before surgery. Inj. Ceftriaxone 1 gm was given to all patients intravenously pre op after test dose. Premedication was done with Inj. Metoclopramide, Inj. Tramadol and Tab. Diazepam. Induction of anesthesia was done with Inj. Succinyl choline followed by Inj. Vecuronium. Maintenance was done with Entonox and reversal with Inj. Neostigmine.

In the patients who underwent laparoscopic procedures,

pneumoperitoneum was created with CO₂, and the standard four-port method was used to carry out the procedure. In the patients subjected to open cholecystectomy, a subcostal incision was used varying from 10-14cm. In both approaches, cholecystectomy was carried out by dissection of Calot's triangle and ligating/clipping of cystic duct and artery. A drain was placed in the subhepatic space in all the patients.

In the postoperative period; all patients were managed with antibiotic Inj. ceftriaxone 1 gm, analgesic Inj. Diclofenac, antiemetic Inj. Metoclopramide and iv fluids as per body weight. Fluid administration was stopped in the evening and all the patients were allowed oral fluid intake.

In all the 100 patients, blood samples were collected half an hour before the operations from the antecubital vein for estimation of serum cortisol, and at 6 hours and 48 hours postoperatively for estimation of serum cortisol and C-reactive protein.

C-reactive protein (CRP) was measured by CRP ELISA kit with ELISA reader. Serum cortisol was measured by radioimmunoassay technique in the department of biochemistry

Statistical Analysis

Results were expressed in terms of mean with standard deviation. Statistical comparison was performed using Student's t-test. Statistical significance was accepted when the p-value was less than 0.05.

Observations:

Among 100 patients, 78 patients were female and 22 were male. Male to female ratio was found to be 1:3.55. In the 60 patients who underwent laparoscopic cholecystectomy, male to female ratio was 12:46 and in the open group this ratio was 1:3.2.5.82 yrs ranging between 26-55 yrs and for the female patients it was 34.6.46.24 yrs, with a range of 20 to 55 yrs. The average age of male patients was 42.6. The average age of the patients was 39.36

Serum cortisol was evaluated in both groups preoperatively, 6 hrs and 48 hrs after the operation.

Figure 1

Table 1: Serum cortisol level at different intervals of time

TIMING	LAP (MEAN +/- SD) N=60	OPEN (MEAN +/- SD) N=40	P VALUE
PREOPERATIVE	0.44 +/- 0.05	0.42 +/- 0.04	NS

6 HRS POST OPERATIVE	0.57 +/- 0.03	1.4+/-0.26	<0.001
48 HRS POSTOPERATIVE	0.57+/-0.05	0.97+/-0.07	<0.001

Normal range of serum cortisol was 0.16-0.81mol/l, which shows a fall in the level of cortisol in the open group as compared to the level at 6 hours. However, the level was still significantly higher as compared to the laparoscopic group at 48 hours after the operation. The level of serum cortisol was not significantly changed postoperatively in the laparoscopic group. The differences between the two groups were statistically significant at 6hrs. postoperatively ($t=27.7$, $p0.07$ mol/l and $0.970.05$ mol/l) at 6 hours postoperatively. The rise of serum cortisol was significant in the open group at 6 hours after the operation. At 48 hours, the levels were (0.570.26mol/l and 1.40.03mol/l) in the laparoscopic and in the open group, respectively, which was comparable and there was no significant difference.

C-reactive protein (CRP): C-reactive protein is an important marker of acute inflammatory response of the body system. Its level reflects the amount of stress due to any surgical procedure. The mean CRP level was 15.35

A CRP of 15.35.3.99 in the laparoscopic group at 48 hrs after the procedure and a CRP of 41.67 10.57 was seen in open cases.

Figure 2

Table 2: C-reactive protein 48 hrs. postoperatively

Procedure	CRP (Mean +/-SD)	P value
Lap (n=60)	15.35 +/-3.99	<0.001
Open (n=40)	41.67 +/-10.57	<0.001

On analyzing, it was found that CRP level in open cholecystectomy was much higher than in laparoscopic cholecystectomy at 48 hrs. The difference was statistically highly significant ($t=17.6$, $P<0.001$). This indicates that inflammatory stress is higher in open cholecystectomy.

Discussion

Elective surgical wounds and trauma elicit similar physiological responses. They include increased stress hormone release, interaction of intermediary metabolism and fluid balance, negative nitrogen balance and increased hepatic production of acute-phase proteins. These responses are mediated by both afferent neural stimuli and circulating factors such as catabolic hormones and cytokines that are released by wounds. Blockage of these circulating factors is potentially more difficult to achieve as compared to attenuating neural responses.

Minimally invasive surgery has presented an alternative approach to diminishing metabolic responses by avoidance of a substantial abdominal incision, reduced tissue manipulation and faster patient recovery^{3,4}.

Serum cortisol is one of the most important hormone rises after acute stress. Its level reflects the extent of stimulation of the hypothalamic-pituitary-adrenal axis. Cortisol acts directly or indirectly on different homeostatic mechanisms of body to attenuate the stress. Corticosteroid increases extracellular osmolarity to provide the driving force for fluid shift from intracellular to extracellular space in conditions like haemorrhage⁵. It also inhibits glycogenolysis, stimulates gluconeogenesis and inhibits protein synthesis^{6,7}.

In different previous studies it has been clearly demonstrated that the level of serum cortisol rises significantly after open cholecystectomy as compared to laparoscopic cholecystectomy from postoperative day one up to day three^{8,9}.

In the present study, we found a marked increase in the serum cortisol level after open cholecystectomy. The rise of serum cortisol was significant in the open group at 6 hours after the operation as compared to the laparoscopic group. This level showed a slight fall at 48 hours as compared to the level at 6 hours. However, this level was still higher as compared to the laparoscopic group. At both intervals of time, 6 hours and 48 hours, the serum cortisol level was significantly higher in the open group.

The systemic stress response is also mediated by inflammatory mediators originating from the surgical wounds. Of these mediators, IL-6 has a crucial role in the induction and control of acute-phase protein synthesis, particularly of CRP, by human hepatocytes¹³. Hepatic acute-phase protein production, especially of CRP, is a sensitive marker of inflammatory response¹⁶. The level of IL-6 raises, parallel to CRP, more in open cholecystectomy.^{13,14,15,17}

The result of the present study confirms previous reports in the literature indicating that open cholecystectomy causes more significant stress response in the form of raised CRP as compared to laparoscopic cholecystectomy at 48 hours after the operation^{8,9}.

This may result from decreased release of IL-6 from a smaller wound surface of laparoscopic cholecystectomy as compared to open cholecystectomy, which leads to a diminished rise of the CRP level after laparoscopic cholecystectomy.

Conclusion: Metabolic and inflammatory stress responses of human body are higher after open as compared to laparoscopic cholecystectomy, because the body faces more trauma in open procedures.

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