

Original Research Article

Assessment of different stress responses after laparoscopic and open cholecystectomy in patients attending tertiary care hospital, Bhuj, Gujarat, India: a prospective study

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ABSTRACT

Background: Surgical trauma by incision and dissection of tissue stimulates the body to respond proportionately to the extent of injury. This study was conducted with an aim to compare metabolic and inflammatory responses after laparoscopic and open cholecystectomy namely serum cortisol and C-reactive protein levels before and after operation at Bhuj, Kutch, India.

Methods: Present study was non-randomized, and comparative study carry out in the General Surgery Department at Gujarat Adani prospective institute of Medical Science, Bhuj, Kutch, Gujarat, India for an era of two years. One hundred and two patients were included in this study and were divided into two groups of open and laparoscopic cholecystectomy. Out of these 102 patients, 41 undergo open cholecystectomy and 61 laparoscopic cholecystectomy. Preoperative, intraoperative, postoperative and anesthetic medications were consistent in all the patients.

Results: 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.

Conclusions: Open cholecystectomy caused further tissue responses as compared to its laparoscopic alternative.

Keywords: Bhuj, Cortisol, C-reactive protein, Open cholecystectomy, Prospective

INTRODUCTION

Acute trauma, whether accidental or surgical, stimulates a series of hormonal, metabolic and inflammatory changes.¹ The stress response depends straight on the amount of injury. Cholecystectomy, being an intra-abdominal procedure, may be considered as a major surgical stress. Laparoscopic cholecystectomy reduces the amount of the peritoneal incision and is less traumatic than the usual procedure.

The advantage of this new method compared to open cholecystectomies are: negligible postoperative pain, rapid postoperative bowel activity (6-24 hours), abridged postoperative infections, shorter hospitalization (1-3

days), diminished neuroendocrine metabolic response and earlier return to normal activity.² In the present study, the systemic stress rejoinders after laparoscopic and conventional open cholecystectomy were compared as a non-randomized prospective trial.

METHODS

Present study was non-randomized, prospective and comparative study carry out in the General Surgery Department at Gujarat Adani institute of Medical Science, Bhuj, Kutch, Gujarat, India for an era of two years. One hundred and two patients were included in this study and were divided into two groups of open and laparoscopic cholecystectomy. Ethical clearance was

taken from ethical committee of the institute. Written consent was obtained from all the participant patient of the study. The distribution of patients in different groups was done on the foundation of patient's option after explaining the study procedure.

Inclusion criteria

Patients with symptomatic cholelithiasis, uncomplicated gall stone disease, age: 19 to 56 years.

Exclusion criteria

Patients with associated illness like hypertension, diabetes, pregnancy, chronic pulmonary disease, cardiac disease, and other co morbidities. Any need for conversion, peroperative cholangiography, or CBD exploration, period of surgery more than 90 minutes.

Out of these 102 patients, 41 undergo open cholecystectomy and 61 laparoscopic cholecystectomy. Preoperative, intraoperative, postoperative and anesthetic medications were consistent in all the patients. All patients were reticent nothing per oral from midnight. Injection ceftriaxone 1gm was given to all patients intravenously pre op after test dose. Premedication was done with injection metoclopramide, injection tramadol and tablet diazepam. Induction of anesthesia was done with Inj. Succinyl choline followed by injection vecuronium. Maintenance was done with Entonox and reversal with injection neostigmine.

In the patients who go through laparoscopic procedures, pneumoperitoneum was bent with CO₂, and the standard four port methods was utilized to carry out the procedure. In the patients subjected to open cholecystectomy, a subcostal incision was used varying from 10-14cm. In both techniques, cholecystectomy was conceded out by dissection of Calot's triangle and ligating/clipping of cystic duct and artery. A drain was positioned in the sub hepatic space in all the patients.

In the postoperative period; all patients were managed with antibiotic injection ceftriaxone 1 gm, analgesic injection diclofenac, antiemetic injection metoclopramide and i.v. fluids as per body weight. Fluid management was clogged in the evening and all the patients were permitted oral fluid intake. In all the 102 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.

Statistical analysis

The data was coded and entered into Microsoft excel spreadsheet. Analysis was done using SPSS version 15 (SPSS Inc. Chicago, IL, USA) Windows software program. The variables were assessed for normality using the Kolmogorov-Smirnov test. Descriptive statistics were

calculated. Statistical assessment was done utilizing student's t-test. Statistical significance was set at p=0.05.

RESULTS

Among 102 patients, 79 patients were female and 23 were male. In the 61 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 years ranging between 25-56 years and for the female patients it was 35.44 years, with a range of 19 to 56 years. The average age of male patients was 43.1. The average age of the patients was 38.24.

Serum cortisol was evaluated in both groups preoperatively, 6 hours and 48 hours after the operation. Fall in the level of cortisol in the open group contrast to the level at 6 hours. Nevertheless, the level was still significantly elevated 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 6 hours. The increase of serum cortisol was significant in the open group at 6 hours after the operation. At 48 hours, the levels were in the laparoscopic and in the open group comparable and there was no significant difference.

C-reactive protein is a significant marker of acute inflammatory response of the body system. Its level reflects the total of stress due to any surgical procedure. The mean CRP level was 14.99. A CRP of 14.99.3.99 in the laparoscopic group at 48 hours after the procedure and a CRP of 42.55 was observed in open cases.

On analyzing, it was found that CRP level in open cholecystectomy was much superior to in laparoscopic cholecystectomy at 48 hours. The dissimilarity was statistically highly significant (p<0.05). All these findings indicate that inflammatory stress is advanced in open cholecystectomy.

Table 1: Serum cortisol level at different intervals of time among study participants.

Timing	Laparoscopic cholecystectomy Mean ±SD	Open cholecystectomy Mean ±SD	p-value
Pre-operative	0.43±0.02	0.41±0.23	0.56
6 hours postoperative	0.58±0.12	1.39±0.90	0.03*
48 hours postoperative	0.58±0.17	0.96±0.09	0.002*

*indicates statically significant difference at p=0.05. Test of significance- Student t test, SD: Standard deviation.

Table 2: C-reactive protein 48 hours postoperatively among study participants.

Procedure	CRP Mean \pm SD	p-value
Laparoscopic cholecystectomy	14.99 \pm 3.99	0.001*
Open cholecystectomy	42.55 \pm 9.36	0.02*

*indicates statically significant difference at p=0.05. Test of significance- Student t test, SD: Standard deviation.

DISCUSSION

Discretionary 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. Obstruction of these circulating factors is potentially trickier to accomplish as compared to attenuating neural responses.

Minimally invasive surgery has presented a different loom to retreating metabolic responses by avoidance of a substantial abdominal incision, reduced tissue manipulation and faster patient recovery.^{3,4} Serum cortisol is one of the mainly significant 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 assuage the stress. Corticosteroid increases extracellular osmolarity to offer the driving force for fluid shift from intracellular to extracellular space in conditions like haemorrhage.⁵ 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 elevates significantly after open cholecystectomy as compared to laparoscopic cholecystectomy from postoperative day one up to day three.^{8,9}

In the present study, marked increase in the serum cortisol level was found after open cholecystectomy. The rise of serum cortisol was momentous in the open group at 6 hours after the operation as compared to the laparoscopic group. This level demonstrates a slight fall at 48 hours as compared to the level at 6 hours. However, this level was still advanced 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.¹⁰⁻¹²

The systemic stress response is also mediated by inflammatory mediators originating from the surgical wounds. Of these mediators, IL-6 has a critical role in the induction and control of acute-phase protein synthesis, particularly of CRP, by human hepatocytes.¹³ Hepatic acute-phase protein production, especially of CRP, is a

sensitive marker of inflammatory response. The level of IL-6 raises, equivalent to CRP, more in open cholecystectomy.¹³⁻¹⁷ The Findings of the present study confirms previous reports in the literature representing that open cholecystectomy causes more significant stress response in the form of raised CRP as compared to laparoscopic cholecystectomy at 48 hours after the operation⁹This 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 superior subsequent to open as compared to laparoscopic cholecystectomy, since the body faces more traumas in open procedures.

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REFERENCES

- Weissman C. The metabolic response to stress: an overview and update. *Anaesthesiol.* 1990;73:308-27.
- Le Quesne LP, Cochrane JPS, Fieldman NR. Fluid and electrolyte disturbance after trauma: The role of adrenocortical and pituitary hormone. *British Med Bull.* 1985; 41: 212-7.
- Frazer RC, Roberts JW, Okeson GC. Open vs. laparoscopic cholecystectomy. *Ann Surg.* 1991;213:651-3.
- Grace PA, Quareshi A, Choleman J, Keane R. Reduced postoperative hospitalization after laparoscopic cholecystectomy. *Br J Surg.* 1991;78:160-2.
- Pirkle JC Jr, Gann DS. Restitution of blood volume after haemorrhage: role of adrenal cortex. *Am J Physiol.* 1976;320:1683-7.
- Derbishire DR, Smith G. Sympathoadrenal response to anaesthesia and surgery *Br J Anaesth.* 1984;56:725-39.
- Gann DS. Endocrine control of plasma protein and volume. *Surg Clin North Am.* 1976;56:1135-45.
- Mrksic M, Cabafi Z, Feher I, Mirkovic M. Surgical trauma in laparoscopic and classical cholecystectomy. *Med Pregl.* 2001;54(7-8):327-31.
- Luo K, Li JS, Li LT. Operative stress response and energy metabolism after laparoscopic cholecystectomy compared to open surgery. *World J Gastroenterol.* 2003;15(9-4):847-50.
- Julien F, Biebuyck MB. The metabolic response to stress: An overview and update. *Anaesthesiol.* 1990;73:308-27.

11. Hendler RG, Sherwin RS. Epinephrine stimulated glucose production is not diminished by starvation: Evidence for an effect on gluconeogenesis. *J Clin Endocrinol Metab*. 1984;58:1014-21.
12. Russell RCG, Walker CJ, Bloom SR. Hyperglucagonemia in the surgical patients. *Br Med J*. 1975;1:10-2.
13. Jakeways MSR, Mitchell V, Hashim IA. Metabolic and inflammatory response after open or laparoscopic cholecystectomy. *Br J Surg*. 1994;81:127-31.
14. Glaser F, Sannwald GA, Buhr HJ, Kuntz C. General stress response to conventional and laparoscopic cholecystectomy. *Ann Surg*. 1995;221(4):372-80.
15. Karayiannakis AJ, Makri GG, Mantzioka A. Systemic stress response after laparoscopic or open cholecystectomy: A randomized trial. *Br J Surg*. 1997;84:467-71.
16. Stuart J, Lewis SM. Monitoring the acute phase response. *Br Med J*. 1998;2:1143-4.
17. Schietroma M, Rossi M, Fraioli F. Inflammatory markers after laparoscopy vs. laparotomy cholecystectomy. *Ann Ital Chir*. 2001;72(4):477-83.

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