



Original Article

Assessment of Levels of CRP As A Measure of Stress Response After Open and Laparoscopic Cholecystectomy

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ABSTRACT

Laparoscopic cholecystectomy (LC) is supposed to be a first line treatment for complicated bile stones and is regarded as the minimally invasive surgery. **Objectives:** To determine the levels of CRP as a measure of stress response after open and Laparoscopic cholecystectomy. **Methods:** A total of 120 patients of both genders aged 20 years or above with fever, abdominal pain, vomiting, nausea and anorexia with symptomatic gall stone were chosen. Laboratory tests, ultrasound and chest radiography were carried out to verify the diagnosis of cholecystectomy and prevent a negative abdomen exploration. The comparison of CRP levels between the two groups was done at 4, 8 and 24 hours. The values of CRP in both procedures were compared with the t-test with P=0.000 taken as significant. **Results:** The patients mean age was 36.09 ± 8.10 years. There were 50 men and 70 women. Mean CRP was 7.20 ± 2.10 after 4 hours of laparoscopic cholecystectomy; however, after open cholecystectomy, it was 11.30 ± 1.80, CRP after 8 hours in LC was 13.50 ± 7.01 and 21.04 ± 2.14 after open cholecystectomy. The mean CRP levels in laparoscopic cholecystectomy after 24-hrs were 23.40 ± 7.92 and 34.81 ± 7.04 after open cholecystectomy. The most affected age group was 20-35 years in 39(32.5%) patients, 31-50 in 47(39.2%) and 51-65 in 34(28.3%) patients. This study did not find postoperative complications or mortality. **Conclusions:** CRP is a valuable marker in determining the response to stress in subjects with laparoscopic and open cholecystectomy.

INTRODUCTION

All over the world, laparoscopic cholecystectomy (LC) is supposed to be a first line treatment for complicated bile stones and is regarded as the minimally invasive surgery with short hospital stay, minimal scar, reduced postoperative pain, lower costs, early return to normal routine works in comparison to open cholecystectomy [1, 2]. The stress response in various surgical procedures causes the release of stress hormones as a normal physiological stimulus, regulation of metabolic and fluid

balance, negative nitrogen balance and augmented release of acute phase reagents [3, 4]. After surgical incision; various stimulatory events occur including inflammatory cytokines depending on the size of the injury [5, 6]. The acute phase reactant is CRP which is a sensitive inflammatory marker and plays a very important role in inflammation [7]. Various researches have shown that in open cholecystectomy there is a stronger stress response than laparoscopic cholecystectomy [8]. Shukla and his

friends found a significant increase in CRP levels in the postoperative period with a statistically significant value in LC in comparison to open cholecystectomy [9]. Cochrane's study conducted by Matovic and his friend showed a reduction in incidence of morbidity and stress response post-operatively in LC patients compared to open cholecystectomy [10]. Zhang et al., found in his system review that the levels of CRP release depend on the surgical injury extent and the degree of invasiveness of the procedure [11]. Krog and his friends also found a lower level of metabolic and stress response in LC patients in comparison to open cholecystectomy [12]. The purpose of this analysis was to determine the levels of CRP as a measure of stress response after open and Laparoscopic cholecystectomy.

METHODS

This cross-sectional observation study was held in the surgical department of KMU IMS Kohat and THQ hospital, Kakki Bannu during the period from November 2021 to April 2022. A total of 120 patients of both genders aged 20 years or above with fever, abdominal pain, vomiting, nausea and anorexia with symptomatic gall stone were chosen. From this study, patients with jaundice, serious infections or metabolic disorders, neurological or psychiatric diseases, coagulation disorders and patients who did not agree were excluded. The patient or his guardian have given informed consent to participate in this study. The patient's age, name, admission number, gender and surgery date were documented. The operation was performed by an experienced surgeon with over five years of experience. Two groups were formed with lottery method; Laparoscopic cholecystectomy was done in group 1 and open cholecystectomy in group 2. The lottery method was used to divide patients into groups. The comparison of CRP levels between the two groups was done at 4 hours, 8 hours and 24 hours. The upper reference limit for CRP was 3 mg/dl measured by the ELISA test. The data was analyzed with SPSS software version 20.0. The age of the patient is taken as continuous variable and duration of symptoms and CRP were expressed as the mean \pm SD. Qualitative variables were expressed as frequency and percentage. The values of CRP in both procedures were compared with the T test with P=0.000 taken as significant.

RESULTS

120 patients selected for laparoscopic and open cholecystectomy were included. The patients mean age was 36.09 ± 8.10 years shown in table 1. There were 50 men and 70 women.

Features	N(%)
Gender	
Males	50(41.7%)
Females	70(58.3%)
Mean Age	36.09 ± 8.10 years

Age-Range in years	
20-35	39(32.5%)
31-50	47(39.2%)
51-65	34(28.3%)

Table 1: Shows the demographic features of the patients Mean CRP was 7.20 ± 2.10 after 4 hours of laparoscopic cholecystectomy; however, after open cholecystectomy, it was 11.30 ± 1.80 , CRP after 8 hours in LC was 13.50 ± 7.01 and 21.04 ± 2.14 after open cholecystectomy. The mean CRP levels in laparoscopic cholecystectomy after 24-hrs were 23.40 ± 7.92 and 34.81 ± 7.04 after open cholecystectomy. The most affected age group was 20-35 years in 39(32.5%) patients, 31-50 in 47(39.2%) and 51-65 in 34(28.3%) patients shown in table 2. This study did not find postoperative complications or mortality.

CRP Levels	Laparoscopic Cholecystectomy	Open Cholecystectomy
At 4hrs	7.20 ± 2.10	11.30 ± 1.80
At 8hrs	13.50 ± 7.01	21.04 ± 2.14
At 24hrs	23.40 ± 7.92	34.81 ± 7.04

Table 2: Shows the mean CRP values at various time intervals

DISCUSSION

Every year, laparoscopic cholecystectomy is the most commonly used procedures from over 500,000 operations with <1.5% complication rate and a mortality below 0.1% [11, 12]. In comparison with open cholecystectomy, laparoscopic cholecystectomy has been a surgery since 1991 due to less morbidity, mortality and earlier return to work [13,14]. CRP is a strong inflammatory marker and is called the acute phase reactant. Various analysis has exhibited that CRP often increases in patients after laparoscopic cholecystectomy due to pneumoperitoneum and abdominal lift as well as in open cholecystectomy postoperatively [15, 16]. Helander et al., found that surgical procedure or intervention is considered a form of trauma in itself, followed by an inflammatory, hormonal and immune response [17]. It is known, however, that laparoscopic cholecystectomy is associated with smaller complications and stress for the patient and minimally invasive surgery [18]. In our study, most patients belonged to age groups from 21 to 35 and 35 to 50 years old, and the frequency of gall stones in women was higher than in men. This discovery is similar to the results of gallstones in previous studies [19, 20]. Our study also showed similar results of a reduced response to stress in patients with LC in comparison to open cholecystectomy. In our study, both groups were compared with the average CRP value with a statistically significant correlation P-value of 0.000. Open cholecystectomy is an acceptable alternative to patients from the high-risk group or patients with complicated cholecystitis. Various analysis have revealed that the high preoperative CRP, the high number of TLC and the increased gallbladder thickness are related with a higher

percentage of problems and a higher conversion rate of open cholecystectomy [21]. In patients with high CRP before surgery, Kingo et al., found that the frequency of transition to open cholecystectomy was higher [22]. Beliaev et al., also found that high CRP in serum significantly increased the OC in comparison to patients with LC ($8.88 \pm 1.96\%$ compared to $10.52 \pm 1.96\%$) and came to the conclusion that LC was less traumatic [23]. Incision of the skin causes maximum tissue injury and is therefore responsible for the severity of the acute phase responses in OC. Therefore, LC prevents reduction of injury, reducing blood counts, length of stay in the hospital, and thus reducing the incidence, and thus lowering the CRP level [24].

CONCLUSIONS

CRP is a valuable marker in determining the response to stress in subjects with laparoscopic and open cholecystectomy.

Conflicts of Interest

The authors declare no conflict of interest

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REFERENCES

- [1] Fleszar MG, Fortuna P, Zawadzki M, Hodurek P, Bednarz-Misa I, Witkiewicz W, et al. Sex, Type of Surgery, and Surgical Site Infections Are Associated with Perioperative Cortisol in Colorectal Cancer Patients. *Journal of clinical medicine*. 2021 Feb; 10(4): 589. doi: 10.3390/jcm10040589
- [2] Naz A, Junaid T, Usmani MS, Zia MK. Estimation of CRP levels on a measure of stress response after laparoscopic and open cholecystectomy. *Pakistan Journal of Surgery*. 2017 Nov; 33(1): 4-8.
- [3] Xu D, Zhu X, Xu Y, Zhang L. Shortened preoperative fasting for prevention of complications associated with laparoscopic cholecystectomy: a meta-analysis. *Journal of International Medical Research*. 2017 Feb; 45(1): 22-37. doi: 10.1177/0300060516676411
- [4] Jukić M, Pogorelić Z, Šupe-Domić D, Jerončić A. Comparison of inflammatory stress response between laparoscopic and open approach for pediatric inguinal hernia repair in children. *Surgical Endoscopy*. 2018 Dec; 33(10): 3243-50. doi: 10.1007/s00464-018-06611-y
- [5] Kärkkäinen J, Aspinen S, Harju J, Juvonen P, Pulkki K, Eskelinen M. Plasma glutathione peroxidase (GPX1) levels and oxidative stress in gallstone patients operated with two different cholecystectomy techniques: a randomized study with special reference to cancer patients. *Anticancer Research*. 2017 Dec; 37(12): 6921-7. doi: 10.21873/anticancer.12156
- [6] Micić D, Lalić N, Djukić V, Stanković S, Trajković G, Oluić B, et al. Influence of IL-6, TNF- α and hs-CRP on insulin sensitivity in patients after laparoscopic cholecystectomy or open hernia repair. *Journal of Medical Biochemistry*. 2018 Jul; 37(3): 328. doi: 10.1515/jomb-2017-0043
- [7] Koo BW, Oh AY, Ryu JH, Lee YJ, Han JW, Nam SW, et al. Effects of deep neuromuscular blockade on the stress response during laparoscopic gastrectomy Randomized controlled trials. *Scientific Reports*. 2019 Aug; 9(1): 1-6. doi: 10.1038/s41598-019-48919-2
- [8] Micić D, Stanković S, Lalić N, Dukić V, Polovina S. Prognostic value of preoperative neutrophil-to-lymphocyte ratio for prediction of severe cholecystitis. *Journal of medical biochemistry*. 2018 Apr; 37(2): 121. doi: 10.1515/jomb-2017-0063
- [9] Shukla U, Kumar M, Srivastava S, Srivastava S. A comparative study of modulation of neuroendocrine stress response by dexmedetomidine versus fentanyl premedication during laparoscopic cholecystectomy. *Anesthesia, Essays and Researches*. 2020 Oct; 14(4): 589. doi: 10.4103/aer.AER_22_21.
- [10] Matovic E and Delibegovic S. Adrenocorticotrophic hormone (ACTH) and cortisol monitoring as stress markers during laparoscopic cholecystectomy: standard and low intraabdominal pressure and open cholecystectomy. *Medical Archives*. 2019 Aug; 73(4): 257. doi: 10.5455/medarh.2019.73.257-261
- [11] Zhang N, Wu G, Zhou Y, Liao Z, Guo J, Liu Y, et al. Use of enhanced recovery after surgery (ERAS) in laparoscopic cholecystectomy (LC) combined with laparoscopic common bile duct exploration (LCBDE): a cohort study. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research*. 2020 Sep; 26: e924946-1. doi: 10.12659/MSM.924946
- [12] Krog AH, Thorsby PM, Sahba M, Pettersen EM, Sandven I, Jørgensen JJ, et al. Perioperative humoral stress response to laparoscopic versus open aortobifemoral bypass surgery. *Scandinavian journal of clinical and laboratory investigation*. 2017 Feb; 77(2): 83-92. doi: 10.1080/00365513.2016.1268264
- [13] Moldal ER, Kjelgaard-Hansen MJ, Peeters ME, Nødtvedt A, Kirpensteijn J. C-reactive protein, glucose and iron concentrations are significantly altered in dogs undergoing open ovariohysterectomy or ovariectomy. *Acta Veterinaria Scandinavica*. 2018

- May; 60(1): 1-8. doi: 10.1186/s13028-018-0384-6
- [14] Abbas AM, Swidan KH, Ali AM, Sweed MS. Tissue trauma and inflammatory response following laparoscopic versus abdominal hysterectomy: a prospective randomized clinical trial. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*. 2020 Oct; 9(10): 4262-8. doi: 10.18203/2320-1770.ijrcog20204324
- [15] Fialho L, Santa-Maria AF, Madureiru FA, Iglesias AC. Comparative study of systemic early postoperative inflammatory response among elderly and non-elderly patients undergoing laparoscopic cholecystectomy. *Revista do Colégio Brasileiro de Cirurgiões*. 2018 Mar; 45(02): 1-7. doi: 10.1590/0100-6991e-20181586
- [16] Alhayan A, McSorley S, Roxburgh C, Kearns R, Horgan P, McMillan D. The effect of anesthesia on the postoperative systemic inflammatory response in patients undergoing surgery: A systematic review and meta-analysis. *Surgery Open Science*. 2020 Jan; 2(1): 1-21. doi: 10.1016/j.sopen.2019.06.001
- [17] Helander EM, Webb MP, Menard B, Prabhakar A, Helmstetter J, Cornett EM, et al. Metabolic and the surgical stress response considerations to improve postoperative recovery. *Current Pain and Headache Reports*. 2019 May; 23(5): 1-8. doi: 10.1007/s11916-019-0770-4
- [18] Straatman J, Cuesta MA, Tuynman JB, Veenhof AAFA, Bemelman WA, van der Peet DL. C-reactive protein in predicting major postoperative complications are their differences in open and minimally invasive colorectal surgery? Substudy from a randomized clinical trial. *Surgical Endoscopy*. 2017 Dec; 32(6): 2877-85. doi:10.1007/s00464-017-5996-9
- [19] Eskelinen M, Saimanen I, Koskela R, Holopainen A, Selander T, Eskelinen M. Plasma Concentration of the Lipid Peroxidation (LP) Biomarker 4-Hydroxynonenal (4-HNE) in Benign and Cancer Patients. *in vivo*. 2022 Mar; 36(2): 773-9. doi: 10.21873/in vivo.12764
- [20] Xu L, Tan H, Liu L, Si S, Sun Y, Huang J, et al. A randomized controlled trial for evaluation of lower abdominal laparoscopic cholecystectomy. *Minimally Invasive Therapy & Allied Technologies*. 2017 May; 27(2): 105-12. doi: 10.1080/13645706.2017.1327445
- [21] Pache B, Jurt J, Grass F, Hübner M, Demartines N, Mathevet P, et al. Compliance with enhanced recovery after surgery program in gynecology: are all items of equal importance?. *International Journal of Gynecologic Cancer*. 2019 May; 29(4): 810-5. doi: 10.1136/ijgc-2019-000268
- [22] Kingo PS, Nørregaard R, Borre M, Jensen JB. Postoperative C-reactive protein concentration and clinical outcome: comparison of open cystectomy to robot-assisted laparoscopic cystectomy with extracorporeal or intracorporeal urinary diversion in a prospective study. *Scandinavian Journal of Urology*. 2017 Sep; 51(5): 381-7. doi: [10.1080/21681805.2017.1334698](https://doi.org/10.1080/21681805.2017.1334698)
- [23] Beliaev AM, Angelo N, Booth M, Bergin C. Evaluation of neutrophil-to-lymphocyte ratio as a potential biomarker for acute cholecystitis. *Journal of Surgical Research*. 2017 Mar; 209: 93-101. doi: 10.1016/j.jss.2016.09.034
- [24] Choi HR, Song IA, Oh TK, Jeon YT. Perioperative C-reactive protein is associated with pain outcomes after major laparoscopic abdominal surgery: a retrospective analysis. *Journal of Pain Research*. 2019 Nov; 12: 1041-51. doi: 10.2147/JPR.S187249