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Original Research Article

The role of C-reactive protein as a predictor of difficult laparoscopic cholecystectomy or its conversion

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) can be the easiest or the most difficult laparoscopic operation. Conversion to open surgery has been a traditional marker of difficult LC. Recent studies have shown that C-reactive protein (CRP) may be helpful to surgeon in knowing the pathological condition of gall bladder before removal. Aim of this study was to evaluate the role of CRP as a predictor of difficult LC or its conversion.
Methods: This study was done from 1 march 2016 to may 2017 in department of general surgery, SMS hospital Jaipur, under single unit. All patients with cholelithiasis admitted in single unit of SMS hospital undergoing LC were included in this study. Exclusion criteria were high BMI (>35), proven congenital anomaly of gall bladder, previous abdominal surgery, any conditions increasing CRP and immunocompromised patients. CRP was done for each patient.
Results: Mean age of our 148 patients was 50.41 years. Female to male ratio was 4.28:1. Mean CRP was 22.2±18.2 mg/dl for simple cholecystectomy, 46.5±32.0 mg/dl for difficult cholecystectomy and 83.6±22.4 mg/dl for laparoscopic converted to open cholecystectomy, which was statistically significant (p value 0.0002).
Conclusions: CRP is a potent predictor of difficult laparoscopic cholecystectomy and its conversion preoperatively. Patients with preoperatively high CRP have higher chance of complication intraoperative and high chances of conversion to open.

Keywords: C-reactive protein, Difficult laparoscopic cholecystectomy, Laparoscopic cholecystectomy

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the procedure of choice for majority of patients with gall bladder disease because it is associated with less pain and faster return to normal activity than after open cholecystectomy.[1] LC can be the easiest or the most difficult laparoscopic operation. Conversion to open surgery has been a traditional marker of difficult LC (2-7%). Anticipation of conversion can help in consenting patients and preparing them for longer stay and complications. Severe inflammation makes laparoscopic dissection technically more demanding, with a higher gall bladder wall perforation rate and spillage of the infected bile into the peritoneal cavity.[2]

There is no clear cut guideline as to the extent to which a surgeon should struggle to complete the procedure laparoscopically and when to convert to open procedure.

If laparoscopic cholecystectomy is extended for more than 2 hours, the risk of perioperative complications is four times higher than that with a surgery that lasts between 30 to 60 minutes.[3]

When operating on a high risk patient, the surgeon has to make an early decision to convert if dissection seems to be very difficult; early conversion shortens the operation time and decreases morbidity.[4]

Many publications pointed out that age over 60-65, previous upper abdominal surgery, clinical and ultrasound signs of severe acute cholecystitis at admission and white blood count (WBC) >10000 per mm^3 and male sex were significantly associated with conversion to open cholecystectomy. Infiltration of inflammation may disturb the anatomy of Calot's triangle resulting in an increased risk of bile duct injury. Severe inflammation is also responsible for serious complications occurring in the postoperative course.[5]

Recent studies have shown that certain biochemical tests may be helpful to surgeon in knowing the pathological condition of gall bladder before removal. C-reactive protein (CRP) is one identified as predictor of such complications. CRP is the first acute-phase protein to be described and is an exquisitely sensitive systemic marker of inflammation and tissue damage. Its circulating concentration is determined by its rate of synthesis reflecting the intensity of the pathological process, and hence it is a good indicator of severity of inflammation.

The CRP concentration is thus a very useful nonspecific biochemical marker of inflammation, measurement of which contributes importantly to (a) screening for organic disease, (b) monitoring of the response to treatment of inflammation and infection, and (c) detection of intercurrent infection in immunocompromised individuals, and in the few specific diseases characterized by modest or absent acute-phase responses.[6]

In healthy young adult volunteer blood donors, the median concentration of CRP is 0.8 mg/L, the 90th centile is 3.0 mg/L, and the 99th centile is 10 mg/L.[7] But following an acute-phase stimulus, values may increase from less than 50 µg/L to more than 500 mg/L, that is 10,000-fold.

Aim of this study was to evaluate the role of CRP as a predictor of difficult laparoscopic cholecystectomy or its conversion.

METHODS

This descriptive analysis of LC with special reference to CRP and difficult dissection was done from 1 march 2016 to may 2017 in department of general surgery, SMS hospital Jaipur, under single unit. All patients with cholelithiasis admitted in single unit of SMS hospital undergoing LC were included in this study. Exclusion criteria were high BMI (>35), proven congenital anomaly of gall bladder, previous abdominal surgery, any conditions increasing CRP and immunocompromised patients. CRP was done for each patient. This study was approved with ethical committee of our institute.

Statistical analysis

Statistical analysis was performed with the SPSS, version 21 for Windows statistical software package (SPSS inc., Chicago, IL, USA). The Categorical data was presented as numbers (percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05. Sample size was calculated 148 subjects at 95% confidence limit.

RESULTS

Mean age of our 148 patients was 50.41 years. Female to male ratio was 4.28:1 (120 females and 28 males). Pain abdomen was the most common presenting symptoms (97.3%) and vomiting was the next common complaint (74.3%) in this study.

Table 1: Comparison of CRP level, duration of surgery and duration of postoperative stay in simple, difficult and laparoscopic converted to open cholecystectomy.

	Simple cholecystectomy (n=109)	Difficult Cholecystectomy (n=32)	Conversion to open (n=7)	P value
Mean CRP level (mg/L)	22.2±18.2	46.5±32.0	83.6±22.4	0.0002
Mean duration of surgery (minutes)	30.6±7.8	54.6±14.6	84.3±14.2	0.0003
Mean duration of post op stay (days)	2.1±0.6	3.4±1.9	5.4±3.8	0.0002

Out of total 148 cases, 109 cases (73.64%) were of simple cholecystectomy, 32 cases (21.62%) of difficult cholecystectomy and 7 cases (4.72%) of conversion to open cholecystectomy. Adhesions and thickened GB wall were most commonly encountered intraoperative finding in case of difficult laparoscopic cholecystectomy (DLC).

Rest intraoperative findings were calot's triangle abnormality, peri-gallbaldder collection and bleeding.

In this study, CRP level increased significantly with increase difficulty of dissection. Mean CRP was 22.2±18.2 mg/dl for simple cholecystectomy, 46.5±32.0 mg/dl for difficult cholecystectomy and 83.6±22.4 mg/dl for laparoscopic converted to open cholecystectomy, which was statistically significant (p value 0.0002) (Table 1).

Mean duration of surgery for simple cholecystectomy was 30.6±7.8 minutes while for difficult cholecystectomy it was 54.6±14.6 minutes and highest mean duration of surgery was 84.3±14.2 minutes for laparoscopic converted to open cholecystectomy (p value 0.0003). Post operative stay was 2.1±0.6 days for simple cholecystectomy, 3.4±1.9 days for difficult cholecystectomy and 5.4±3.8 days for laparoscopic converted to open (p value 0.0002). Duration of surgery and post operative stay both were increased with increased difficulty in dissection and relation is found to be statistically significant.

Table 2: Level of CRP in simple, difficult and laparoscopic converted to open cholecystectomy.

	CRP <22 mg/L	CRP >22 mg/L	P value
Simple cholecystectomy (N=109)	63 (57.8%)	46 (42.2%)	0.0002
Difficult cholecystectomy (N=32)	7 (21.9%)	25 (78.1%)	0.003
	CRP <46 mg/L	**CRP >46 mg/L**	
Conversion to open (N=7)	1 (14.3%)	6 (85.7%)	0.039

In present study, there was significant association of CRP levels with type of operation. In difficult cholecystectomy, 25/32 cases (78.1%) showed CRP value >22 mg/dl, while 6/7 cases (85.7%) of laparoscopic converted to open showed CRP value >46mg/dl and 63/109 cases (57.8%) of simple cholecystectomy shows CRP value <22 mg/dl (Table 2).

DISCUSSION

At the beginning surgeons would feel comfortable dealing with simple gall bladders but with increase in expertise and introduction of newer armamentarium, difficult gallbladders are being subsequently dealt with. As of now, laparoscopic cholecystectomy can safely be declared as the gold standard for dealing with any kind of benign gall bladder disorder.

Authors through present study aim to predict difficult laparoscopic cholecystectomy by calculating preoperatively CRP, to forecast the technical problems during the surgery. In present study difficult laparoscopic cholecystectomy is defined on the basis of intraoperative findings such as calot's triangle anatomy, gall bladder wall thickness, adhesions, bleeding and peri gall bladder collection.

The aim of the study is to evaluate CRP as a reliable preoperative factor to predict difficult laparoscopic cholecystectomy and its conversion. Also, it may benefit patients because they can be informed of the possibility of complications and conversion to open procedure.

The patient can be mentally prepared and can adjust his or her expectations accordingly. In addition, the surgeon can directly perform the classical open cholecystectomy in the patient with presumed difficult surgery thus saving operating time and conversion rate.

In present study there is significant association of duration of surgery with difficulty encountered intraoperative in terms of adhesions, peri GB collection, bleeding, thickened GB wall, altered anatomy of Calot's triangle.

Bansal et al reported longer duration of surgery is due to time required for removal of inflammatory pericholecystic adhesion, intra-operative gall bladder decompression and longer learning curve.[8]

In present study mean post-operative stay in days for simple cholecystectomy is 2.10 days while in difficult laparoscopic cholecystectomy the mean post-operative stay is 3.43 days and in cases of conversion to open the men post-operative stay is 5.42 days. This result shows a significant relationship between increasing difficulty and duration of post-operative stay (p=0.0002).

In present study of 148 cases of laparoscopic cholecystectomy 109/148 cases are simple cholecystectomy without any intraoperative difficulty (bleeding, adhesions, peri GB collection, thickened GB wall, abnormal calot's triangle) with mean CRP level is 22.16 mg/l.

In 32/148 cases of difficult laparoscopic cholecystectomy (having any one intraoperative difficulty) the mean CRP was found to be 46.46 mg/l and in 7 cases out of 148 which are converted to open having mean CRP in range of 83.57 mg/l. Authors noticed significant association (p=0.0002) between increasing difficulty and CRP levels in present study.

Mokk et al. reported that CRP of 200 appears to be the best cut off point for predicting for gangrenous gall bladder.[9] Asai et al reported a significant correlation between high risk bactobilia and advanced age, high levels of CRP, and the evidence of significant gall bladder infection. In their study, the cut-off value was found to be 134 mg/L for bactobilia.[10]

Andrei et al concluded that CRP measurement does not influence management of patients with acute cholecystitis. To improve the quality of care and to minimize health care provider costs fit patients with more advanced forms of acute cholecystitis and higher values of CRP should have their operation performed earlier than patients with mild acute cholecystitis and a lower concentration of CRP.[11]

Díaz-Flores A et al concluded that preoperative CRP with values ≥11 mg/dL was associated with the highest odds (OR = 17.9) of presenting DLC.[12]

In present study 6/7 cases of LC converted to open had CRP value greater than 46mg/l showing significant association (p=0.039) of CRP levels with difficulty in dissection. DLC had 25/32 cases having CRP greater than 22mg/l showing significant association in predicting DLC preoperatively.

Esin et al, concluded that CRP, a well-known acute phase reactant that increases rapidly in various inflammatory processes, can be accepted as a strong predictor in classifying grades of the disease, and treatment can be reliably planned according to this classification.[13]

In a study of Schäfer et al, CRP level on admission along with American Society of Anaesthesiology grade, duration of symptoms, age and WBC count on admission were found to be determinants of surgical approach-laparoscopic or open.[14]

Conversion to open cholecystectomy in present study was resorted to in 7 patients (4.72%) undergoing laparoscopic cholecystectomy, which is in accordance to the literature (2% - 11%).[15,16]

In present study cases undergoing conversion has more operating time and more post-operative stay in hospital. In all the cases undergoing conversion there is association of intra operative difficulty parameters. No significant association of either sex with conversion seen.

CRP values shows significant correlation (p=0.0002) with increasing difficulty in dissection and showed mean value of 22.16 mg/l for simple LC and 46.46 mg/L for DLC and a mean value of 83.57 mg/L for laparoscopic converted to open cases.

CONCLUSION

Present study showed that CRP is a potent predictor of difficult laparoscopic cholecystectomy and its conversion preoperatively. Patients with preoperatively high CRP have higher chance of complication intraoperative and high chances of conversion to open.

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