

How to Cite:

Hussain, S. A., Badekila, H., Honnani, S. S., & Eram, A. (2022). A study of clinical utility of peri operative c- reactive protein testing in general surgery at tertiary care centre. *International Journal of Health Sciences*, 6(7), 301–311. <https://doi.org/10.53730/ijhs.v6n7.10952>

A study of clinical utility of peri operative c-reactive protein testing in general surgery at tertiary care centre

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Abstract---Background and objectives Clinical diagnosis of infections, inflammatory diseases, and response monitoring can be done by C reactive protein (CRP), an acute-phase protein. CRP measurement in the perioperative period was studied, and patterns of change were analyzed, for elective general surgical patients. Study aimed to test the efficacy of C - reactive protein as a predictor for surgical stress and diagnostic accuracy to detect early postoperative infectious complications. Objective of this study was to estimate perioperative serum C - reactive protein level in patients undergoing elective surgeries. 1. To find out the relation between serum C-reactive protein level and severity of surgical stress. 2.To find out diagnostic accuracy of C-reactive protein to detect early postoperative infectious complications.

Keywords---C-reactive protein, surgical stress.

Introduction

Factors such as bacterial or viral infection, mechanical or thermal trauma, neoplastic tumour growth or tissue ischemia, leading to its necrosis, cause an early non-specific reaction called acute phase response. Accompanied by a sharp increase in production of some plasma protein.

Mainly these are glycoproteins synthesized in the liver, which are called acute-phase proteins. Acute-phase protein works to restore homeostasis of the system via different mechanisms, like inhibition of proteinases activity, blood coagulation controlling, binding and neutralization of pathogens or transport of different metabolites.

A plasma concentration change by at least 25% in the course of acute-phase response is the criterion to include any protein into an acute-phase group.

Need for the study: CRP can be useful as a screening test to detect an inflammatory response early in its course during post operative period and also for monitoring disease activity and response to therapy in conditions where CRP is raised.

A detailed review of the literature reveals that rarely was CRP assessed as a marker for the level of perioperative physiological insult, and rarely was it assessed after general surgery cases. The current study was designed to assess CRP kinetics after various standard general surgical procedures.

More precisely, this study aims to determine whether CRP can be used as a reliable clinical indicator for the degree of surgical trauma incurred after standard general surgical procedures and to determine if further evaluation would be required in detecting postoperative infectious complications in the practice of general surgery.

Method

Materials and method

The data of each patient will be collected on a Performa specially designed for this study and which includes demographic details, clinical features, past medical history, operative details.

The blood sample of patient will be collected 24hrs prior to surgery.

Post operatively the blood samples are collected 24hrs and 72hrs after surgery for analysis of CRP.

Post operation clinical features; pulse rate, fever, local signs of inflammation and laboratory parameters such as CRP, ESR, Total counts and blood culture, in case of raise in CRP.

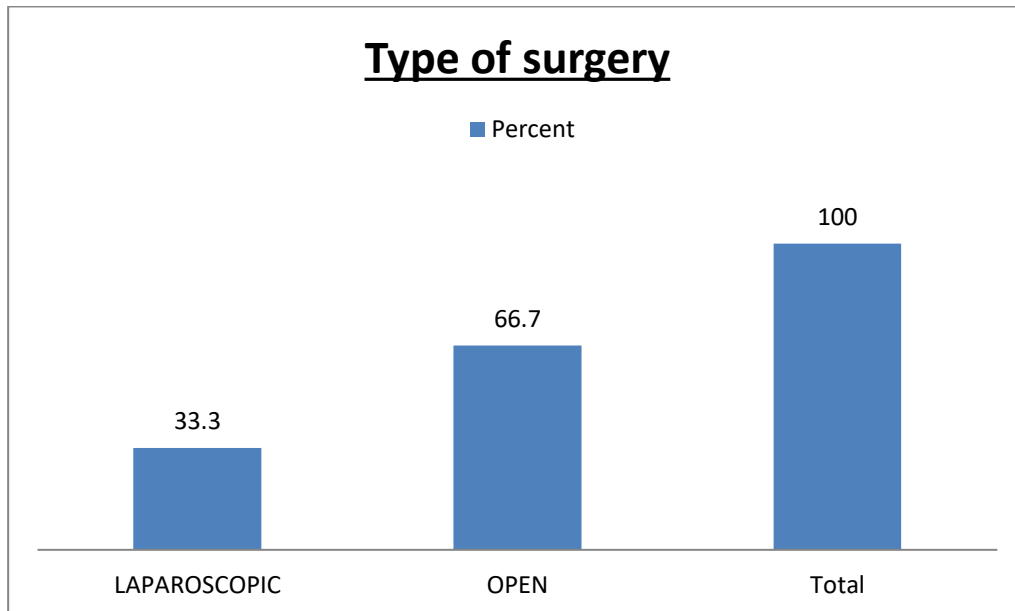
The pre operative and post operative laboratory values analyzed for the statistical significance and correlation.

Results

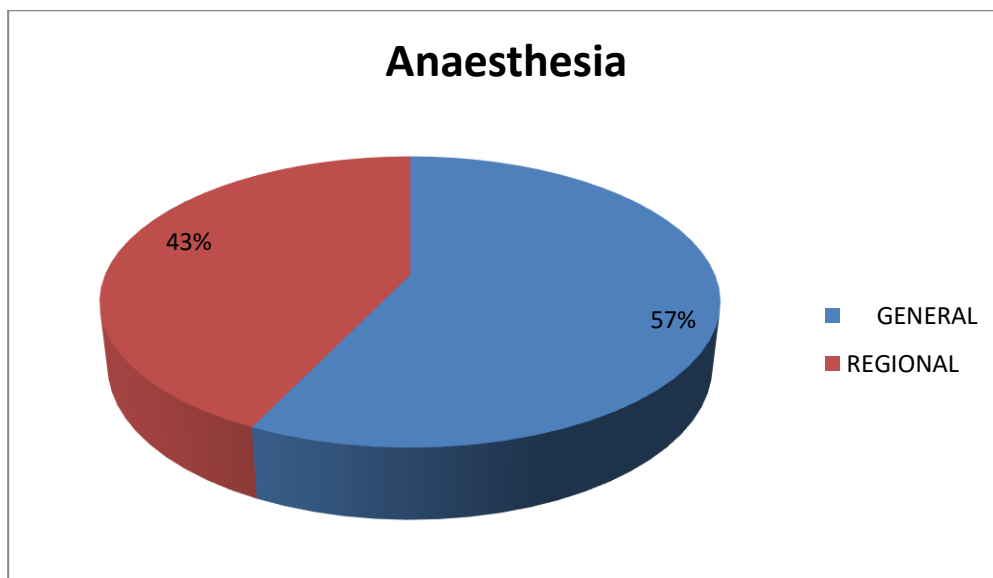
- A total of 63 patients were admitted for elective general surgery operations from March 2021 to October 2021. Patients with elevated C-reactive protein at

the time of admission were excluded from the analysis. The mean age of our study population was 43.33 ± 13.116 years; range: 19-75years. Out of which, the study included 30 females and 33 males.

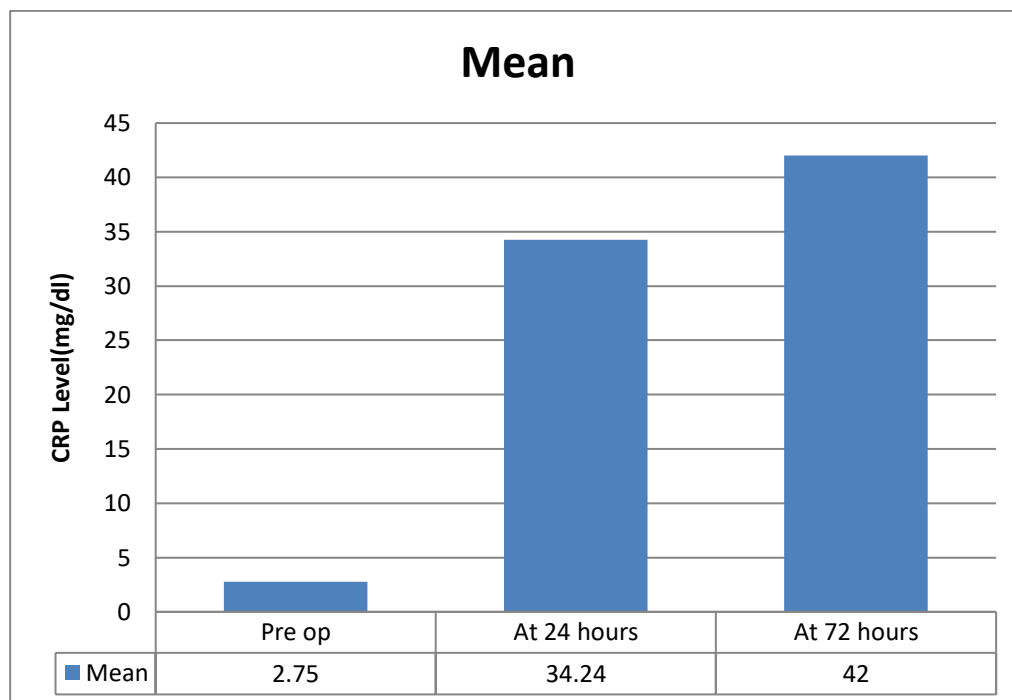
- Open surgeries were performed in 42 (66.7%) patients, and 21(33.3%) underwent laparoscopic procedures .(TABLE 1)



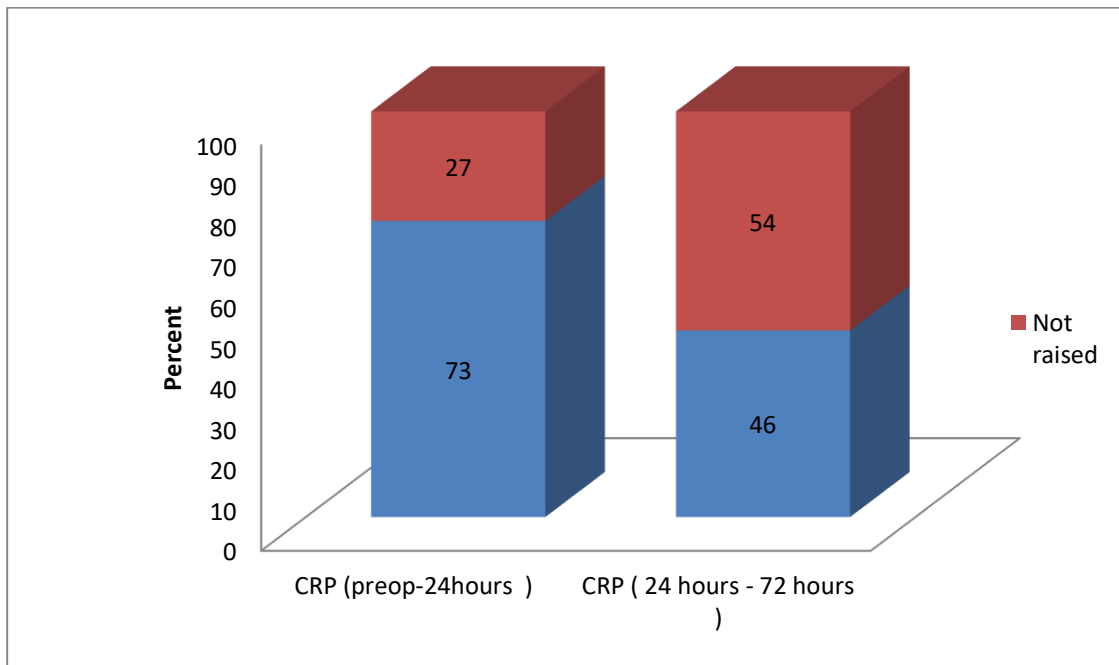
36(57.1%) patients were operated under general anesthesia and 27(42.9%) were Operated under regional anesthesia.(TABLE 2)



- The mean CRP in the preoperative period was 2.75 ± 1.459 , and the CRP significantly increased at 24hrs ($34.24 \pm 39.82\text{mg/dl}$) up to 72hrs ($42 \pm 59.869\text{mg/dl}$) with a p-value of 0.001.(TABLE 3)

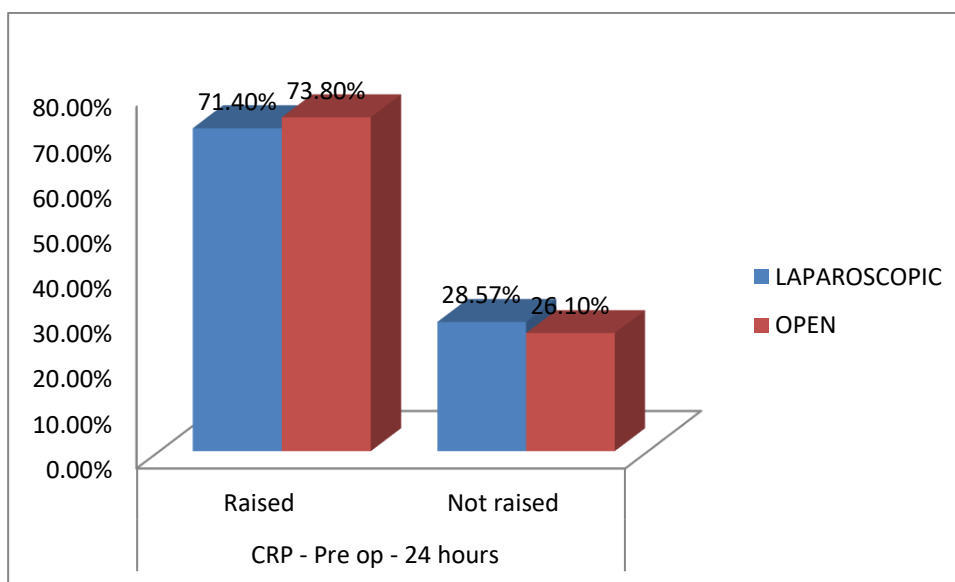


Levels of CRP	CRP (preop-24hours)		CRP (24 hours - 72 hours)	
	Frequency	Percent	Frequency	Percent
Raised	46	73.0	29	46.0
Not raised	17	27.0	34	54.0
Total	63	100.0	63	100.0



There was a substantial increase in CRP levels immediate postoperative period in 73% of the patients, and CRP levels showed a downward trend in 54% over 72hours, but 46% of the patients had persistent increases in CRP due to complications. (TABLE 4)

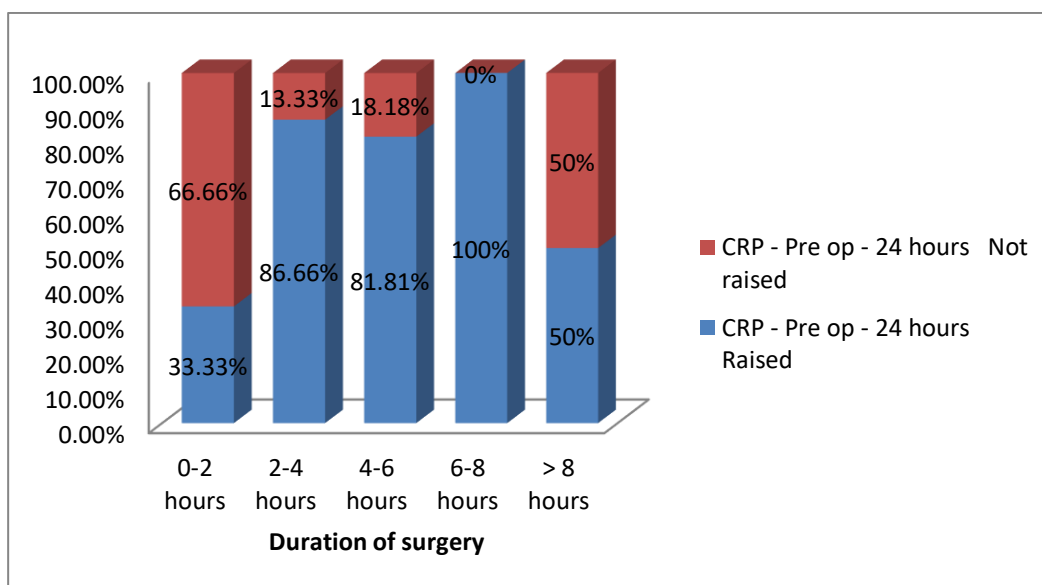
SURGERY	CRP (Pre op - 24 hours)		Total
	Raised	Not raised	
LAPAROSCOPIC	15	6	21
	71.4%	28.57%	100%
OPEN	31	11	42
	73.8%	26.1%	100%
Total	46	17	63
	73.01%	26.98%	100.0%
p value - 0.841			



Type of surgery had no significant difference in CRP level.(TABLE 5)

Laparoscopic surgeries included in the surgery were laparoscopic fundoplication, laparoscopic cholecystectomy, laparoscopic cystogastrostomy and laparoscopic cystodudenostomy. In open surgeries most common procedure done was hernioplasty, mastectomy and thyroidectomy

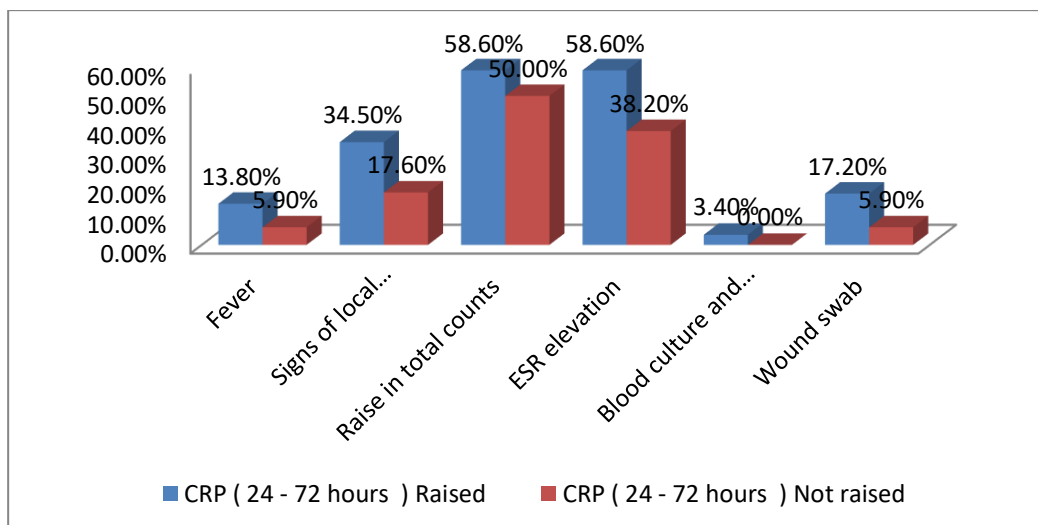
Duration of surgery



Duration of surgery had an impact on the CRP level; that is, shorter the duration (<2hours) had no elevation in CRP in the immediate postoperative period. As the

duration increased, the CRP value had increased in the immediate post period. (TABLE 5)

Features of post operative complication



There was no statistically significant correlation between CRP and features of postoperative complication (TABLE 6).

Only 6 patients had post operative complication such as surgical site infection and required further wound care and management.

Discussion

CRP testing is not a common practice in the preoperative assessment of elective general surgery patients; however, CRP was sent for all patients admitted. Patients with preoperative value of CRP <5mg/dl were included in the study. The mean CRP in the preoperative period was 2.75 ± 1.459 . CRP measurement in the Preoperative period has been shown to be a prognostic indicator for both oesophageal and colorectal carcinoma.¹⁻³ The secretion of CRP by the tumour itself could be the cause of increase⁴, and it was shown to be independent of the tumour stage.

An increased preoperative CRP has been shown to be a risk factor for postoperative infection and predicts higher in-hospital mortality in patients undergoing cardiac surgery^{5, 6}

In a patient with persistently elevated CRP levels after 24hrs of surgery, we studied the following variables, such as body temperature for fever, examination of the local surgical site for signs of local inflammation, blood investigations to look for raise in total counts, ESR elevation and blood culture and sensitivity. Only 46% of the patients had persistent increases in CRP due to complications.

Of these, only 17 patients had elevated ESR and raised total leucocytes, which was not statistically significant (p-value 0.106 and 0.494 respectively).

It can therefore be suggested that preoperative CRP measurement may be useful to risk-stratify elective general surgery patients. However, it wasn't clear how patient management would be altered after finding a high CRP and if clinical decisions taken on this basis influence the rate of infection or other surgical complications.^{5, 6}

Studies are required to assess if reducing inflammatory status and elevated CRP in chronic inflammation conditions will make a difference in the outcome.

It would be advisable to do CRP measurement prior to surgery, early enough to take adequate measures to prevent postoperative complications without delaying the scheduled operation.

CRP is known to rise following surgical trauma and peaks at 48h postoperatively^{7, 12}. The CRP response may be highly variable levels,⁸ it may be incomplete to absent⁹

Brewster et al. have noted a link between the peak postoperative CRP response and degree of surgical trauma,¹⁰ but in our study, we did not find such a correlation when assessing CRP response to different grades surgical procedures such as open procedures and laparoscopic surgeries (p-value 0.841)

Among patients with elevated CRP values, Open surgeries contribute to 66.7% in comparison to 33.3% in patients who underwent laparoscopic procedures. In studies conducted by Grande et al. and Hildebrandt et al., comparing surgical stress following laparoscopic and open cholecystectomy and laparoscopic and open colonic resection, laparoscopic surgeries were associated with lower CRP responses^{11,12} though not all studies agree.¹⁰

CRP was measured at 24 hrs and 72hrs in our study. The mean CRP in the preoperative period was 2.75 ± 1.459 , and the CRP significantly increased at 24hrs ($34.24 \pm 39.82\text{mg/dl}$) up to 72hrs ($42 \pm 59.869\text{mg/dl}$) with a p-value of 0.001. There was a substantial increase in CRP levels immediate postoperative period in 73% of the patients, and CRP levels showed a downward trend in 54% over 72hours, but 46% of the patients had persistent increases in CRP due to complications.

The findings of our study are confirmed by other studies, which assessed CRP levels after other procedures, and reported that CRP levels reflect the extent of surgical trauma.¹³⁻¹⁷

Al -jabi et al. in their prospective study comparing Values of C-reactive protein after the various neurosurgical procedures, found CRP levels on the 2nd postoperative day were highest after surgical procedure for epilepsy (particularly lobotomy) and lowest after stereotactic brain biopsy, concluding that high CRP values on the second postoperative day indicate a major inflammatory response to the operative procedure, and reflect intra-operative tissue damage and antigen load.¹⁸ Similar findings were noted by Neumaier et al., where they compared CRP levels in five different operative techniques and noted that total hip arthroplasty

had the highest CRP when compared to screw insertion for fixation of proximal femoral fracture.¹⁹

Our study did not find any correlation between CRP level and occurrence of infection in the first 3 days; Giannoudis et al. have concluded in their study that CRP is not a good indicator of the presence of early postoperative infection.²⁰ However, we would suggest further evaluation in case of rising CRP to rule out infection after the second or third postoperative day. When infection is diagnosed, CRP has a role in monitoring clinical response to treatment.²¹ Procalcitonin (PCT), is the peptide precursor of calcitonin, consists of 116 amino acids proteins, parafollicular C cells of the thyroid synthesize. It's involved in involved in calcium homeostasis.²²

The reference value for procalcitonin in adults is less than 0.1 ng/mL. Levels greater than 0.25ng/mL can indicate the presence of an infection

Procalcitonin increase significantly in generalized bacterial infections. Hence are used to monitor systemic bacterial and fungal infections, also used to monitor therapeutic interventions.^{22,23,24}

Study done by Takakura et al , suggest PCT, CRP and WBC as reliable biomarkers for predicting surgical site infections post colorectal cancer surgery.⁶²

Conclusion

CRP requesting pre-operatively is uncommon. CRP levels rise in post operative period in most of the patients due to surgical stress. Persistently increasing CRP after third postoperative day is worth evaluating and can be used to monitor response to treatment.

CRP has a role in diagnosis of infection after second postoperative day and in monitoring response to treatment. A peri-operative CRP measurement should be performed in all patients undergoing major surgeries, followed by further evaluation should only be requested if there is a clear clinical indication.

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