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Original Article

Diagnostic value of C-reactive protein in recognition of anastomotic leak in subjects undergoing large bowel anastomosis with CT scan taken as a gold standard.

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Abstract

Objectives: This study aimed to determine the association between delayed referral and severe maternal morbidity and adverse perinatal outcomes among obstetric emergency admissions.

Methodology: This prospective observational cohort study was conducted at the Department of Obstetrics & Gynecology, Gomal Medical College, MTI, DI Khan, from January 2026 to June 2026. A total of 250 women with singleton pregnancies who had an emergency cesarean section (CS) during the study period were included. The key variable in this study was cesarean section delay, defined as the time interval from the surgeon's decision to perform a cesarean section to the actual delivery of the baby. We used SPSS version 20 for data analysis.

Results: We enrolled 250 women in this study. Participants were classified by decision-to-delivery interval. Of the total participants, 100 (40%) had emergency CS more than 3 hours after the surgical decision, 65 (26.0%) had a decision-to-delivery interval of 1 to 3 hours, and 85 (34.0%) had less than 1 hour. The most prevalent features responsible for delayed emergency CS were family decision-making/consent, followed by financial issues (65, 39.4%) and healthcare-provider-related factors (30, 18.2%). The results revealed that longer decision-to-delivery time is associated with a rising trend of serious maternal outcomes (P <0.005).

Conclusion: Our study concluded that delayed emergency cesarean sections are a major problem and strongly associated with severe maternal and neonatal morbidity in individuals with obstetric emergency admissions.

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Introduction

Bowel anastomoses are regularly performed in both elective Anastomotic leakage following abdominal surgery is a severe surgical complication that increases mortality and morbidity [1, 2]. It is defined as the seepage of luminal fluid from a surgical junction connecting two organs. After a large bowel anastomosis, patients may have fecal or bilious material in a drain, symptoms of peritonitis, or liquid or air accumulation around the surgical site, as detected by a CT scan [3, 4]. Regular scanning to identify a leak is neither cost-effective nor accurate and may expose patients to radiation. A cost-effective and highly sensitive serum indicator would greatly improve patient safety during discharge. CRP is used to identify postoperative abdominal infections [4]. A C-reactive protein (CRP) test measures the amount of C-reactive protein in the blood. In reaction to inflammation, the liver produces CRP. The body uses inflammation to shield tissues from damage, infection, and other illnesses and to aid in their healing. Further testing for leaks is required if the CRP level is more than 150 mg/dL, especially if the clinical results are alarming [5]. However, CRP has been well investigated as a marker of anastomotic leakage after colorectal cancer operations [6]. Su'a et al. noted notable differences in CRP cutoff thresholds for anastomotic leak prediction [7], which are impacted by the surgical technique and the particular day of CRP testing. With a threshold of 123.5 mg/L on POD 4 prognostic of leaks in standard procedures, Waterland et al. found higher CRP levels in open procedures than in laparoscopic surgeries [8]. A study found that, for predicting infectious complications after colorectal surgery, serial postoperative CT scans are no better than serial CRP measurements [9]. Despite these differences, several studies support CRP's usefulness in early leak identification. This study aimed to determine the diagnostic value of C-reactive protein in identifying anastomotic leak in subjects undergoing large bowel anastomosis, with CT scan as the gold standard.

Materials and method

This cross-sectional study was carried out at the Surgery Department, Multan Medical and Dental College, Multan, from January 2026 to June 2026 after approval from the hospital ethics committee. Individuals of both sexes and different age groups (above 12 years) who had undergone colorectal bowel anastomosis were included. We obtained a brief history of the patient's symptoms and demographics [9]. On the fifth postoperative day, we measured serum CRP values; values above 100 mg/L were considered anastomotic leak. To confirm anastomotic leakage, patients with CRP>100 mg/L or those suspected based on clinical signs (tachycardia, fever, and localized peritonitis) underwent CT with intravenous and oral/rectal contrast. We used SPSS version 21 to analyze the data. Age, CRP level, length of operation, and weight were expressed as mean + standard deviation. For anastomotic leaks on CRP and CT, elective and emergency operations, and gender, frequencies and percentages were computed. We calculated sensitivity, specificity, PPV, NPV, and diagnostic accuracy.

Results: We enrolled 130 individuals who underwent large bowel anastomosis; 83 (63.8%) were male, and 47 (36.2%) were female. The mean age of the study population was 44.27 ± 8.02 years. The mean CRP was 97.23 ± 13.70, and 87 (66.9%) individuals had a surgery duration of less than four hours. 83 (63.8%) cases underwent emergency surgery, and 47 (36.2%) individuals had elective surgery. CRP levels detected anastomotic leakage in 20 cases (15.5%), compared with CT scans (26 cases, 20.0%) following surgery. The overall diagnostic accuracy of CRP was 82.50%, with specificity 89.60%, sensitivity 89.60%, PPV 48.80%, and NPV 93.40%. These results showed that CRP measurement may be particularly effective as another tool to identify people at minimal risk of anastomotic leakage.

Table 1. Clinical and Demographic Characteristics of Study Participants (n = 130)

Variables	Frequency, n (%) / Mean ± SD
Mean age (years)	44.27 ± 8.02
Sex	
Female	47 (36.2%)
Male	83 (63.8%)
Mean CRP level (mg/L)	97.23 ± 13.70
Type of surgery	
Elective	47 (36.2%)
Emergency	83 (63.8%)
Duration of surgery	
Less than 4 hours	87 (66.9%)

Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are presented as frequency and percentage. CRP: C-reactive protein.

Table 2. Detection of Anastomotic Leakage Using CT Scan and CRP Levels (n = 130)

Diagnostic method	Frequency, n (%)
Anastomotic leakage detected on CT scan	20 (15.5%)
CRP suggestive of leakage (>100 mg/L)	26 (20.0%)

CT scan was considered the gold-standard diagnostic method for confirming anastomotic leakage. CRP levels above 100 mg/L were considered suggestive of anastomotic leakage—CT: computed tomography; CRP: C-reactive protein.

Table 3. Diagnostic Accuracy of C-Reactive Protein for Detecting Anastomotic Leakage

Diagnostic parameter	Study result (%)
Sensitivity	63.2%
Specificity	89.6%
Positive predictive value (PPV)	48.8%
Negative predictive value (NPV)	93.4%
Overall diagnostic accuracy	82.5%

We assessed CRP diagnostic performance using CT scan findings as the reference standard. Sensitivity, specificity, PPV, NPV, and overall diagnostic accuracy are expressed as percentages. CRP: C-reactive protein; PPV: positive predictive value; NPV: negative predictive value.

Discussion

Early detection of a subsequent surgical anastomotic leak improves outcomes. C-reactive protein is being studied as a key indicator of anastomotic healing because it has consistently high negative predictive values from postoperative day 4 onward[10]. CRP is an excellent marker of inflammation. Its production is unaffected by diet or health status, except in hepatic failure, which reduces production. Synthesis shows little diurnal change and is not influenced by diet, age, gender, or race. Within five hours of an inciting stimulus, blood CRP levels rise dramatically due to control of IL-6 transcription and translation. This stable blood analyte allows accurate, reliable measurement by immunoassay methods [11]—C-reactive protein as an indicator to detect sepsis in surgical departments. The levels of this protein on day one following surgery 3-5 have been demonstrated to give useful information about the risk of AL [12]. Procalcitonin is another intriguing diagnostic of AL, but its significance is unclear [9]. Warschkew et al. performed a meta-analysis assessing the prognostic usefulness of CRP for infectious complications following colorectal surgery [14]. Singh et al. recently published another meta-analysis [8], which identified CRP as a leak indicators on days following surgery — 3, 4, and 5 [12.]The authors reported equal diagnostic accuracy of CRP at the three time intervals indicated above, with a high NPV of 97 percent but a low positive predictive value of 21-23%[13]. These findings revealed that CRP is a valuable negative test but not a reliable positive predictor of AL. In our study, 130 individuals who underwent large bowel anastomosis were enrolled, of whom 83 (63.8%) were male, and 47 (36.2%) were female. The mean age of the study population was 44.27 ± 8.02 years. Ahmed et al. reported similar demographic features, supporting our study [15]. Anastomotic leakage is a serious consequence of rectal anastomosis. Proximal de-functioning reduces the risk of leakage but does not eliminate it. The lower the anastomosis, the higher the risk of leaking. A high index of suspicion is necessary to detect early, nonspecific signs of anastomotic leakage. Surgical expertise is essential to avert life-threatening situations [16]. In our study, anastomotic leakage was observed using CRP levels in 20 cases (15.5%), compared with CT scan in 26 cases (20.0%) following surgery. CRP had an overall diagnostic accuracy of 82.50%, specificity of 89.60%, sensitivity of 89.60%, PPV of 48.80%, and NPV of 93.40%. Our findings are similar to those of Ahmed [15], in which CRP was used to detect anastomotic leakage in 18% of individuals. In contrast, CT scans revealed anastomotic leakage in 18 (18.7%) individuals, but overall diagnostic accuracy was 61.11%. These findings support our study that the diagnostic value of C-reactive protein in recognizing anastomotic leak is useful in bowel anastomosis. A study found that C-reactive protein predicts anastomotic leakage 3 days after surgery. The study evaluated two patient groups and found that those with anastomotic leakage had significantly higher CRP levels than those without [17,18]. A study found that C-reactive protein is a negative indicator of anastomotic leakage during oesophago-gastric surgery. The study had 145 participants. Of these people, 13 (9%) experienced anastomotic leakage. CRP readings on days 2, 3, and 6 post-

surgery were the most reliable indicators. Postoperative CRP is a reliable negative predictor of anastomotic leakage after oesophagogastric surgery. This might aid in distinguishing between people with a higher risk of anastomotic leakage and those who are less likely to have it[18].

Conclusion

Our study concluded that individuals with anastomotic leak after large bowel anastomosis had elevated CRP levels when using CT scan as the gold standard.

Ethical Approval

The Hospital Research and Ethics Committee (IREB) approved this study under Document No. reference number, Ref. **No. 5240/2021**, before the study commenced.

Informed Consent

We obtained written informed consent from all participants before enrolment. We informed participants and their parents or legal guardians about the study objectives, procedures, and the voluntary nature of participation. Participation was entirely voluntary.

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This study received no external funding and used available institutional resources.

Conflict of Interest

The authors declare no competing interests or conflicts of interest related to this study.

Authors' Contributions

Muhammad Shahzeb Asghar: Contributed to conceptualization, study design, data collection, interpretation of findings, manuscript drafting, critical revision, and final approval. He also accepts accountability for all aspects of the work.

Muhammad Waqas Arshad, Khadim Hussain: Contributed to study design, data collection, data curation, literature review, data interpretation, manuscript revision, and final approval. He also accepts accountability for all aspects of the work.

Muhammad Sabir, Ghulam Murtaza, Muhammad Aamir Shahzad: Contributed to conceptualization, study supervision, clinical assessment, interpretation of findings, and critical revision of the manuscript for important intellectual content. She also approved the final version and accepts accountability for all aspects of the work.

All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work in accordance with the ICMJE authorship criteria.

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