

Importance of C-Reactive Protein As A Clinical Diagnostic Tool For The Recognition of Anastomotic Leakage In Patients Undergoing Large Bowel Anastomosis

Tanweer Ahmed,^{1*} Zakia Nehal,¹ Imran Khan,¹ Muhammad Mansoor Iqbal,¹ Muhammad Iqbal Khan,¹ Surghra Perveen¹

ABSTRACT

Objective To determine the diagnostic importance of C-reactive protein (CRP) in prediction of anastomotic leak in subjects who underwent large bowel anastomosis with CT scan taken as a gold standard.

Study design Cross sectional study.

Place & Duration of study Department of Surgery, Unit I, Jinnah Postgraduate Medical Centre Karachi, from February 2017 to August 2017.

Methodology A total of 115 patients (both male and female) of age group 13-50 years who underwent large bowel anastomosis either electively or in emergency with minimum intra peritoneal contamination, were enrolled. Serum CRP values were acquired on postoperative day (POD) 5 and values >100 mg/L were considered indicative of anastomotic leak out. A CT scan was done for confirmation and occurrence of hyperdense region considered as an anastomotic leak.

Results Mean age of the subjects was 43.26 ±8.01 year. Males were more commonly underwent surgery (n=73 - 63.5%) as compared to females (n=42 - 36.5%). Anastomotic leakage utilizing CRP was observed in 23 (20%) subjects. On the other hand 18 (15.7%) subjects were observed as an indicator of anastomotic leakage utilizing CT Scan. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and overall diagnostic accuracy were found as 61.11%, 87.63%, 47.83%, 92.39% and 83.47% respectively.

Conclusion The diagnostic precision of C-reactive protein was found in recognition of anastomotic leak in patients with large bowel anastomosis considering CT scan as a gold standard.

Key words C-reactive protein, Anastomotic leak, Bowel anastomosis.

INTRODUCTION:

Bowel anastomoses are commonly performed in elective as well as emergency abdominal surgeries¹. Anastomotic leakage is stated as 'a seep out of luminal contents from a surgical joint connecting two

hollow viscera.² They are the most significant complication to identify following a gastrointestinal surgery.³ Anastomotic leakage is a foremost and destructive situation after bowel anastomosis resulting in increased morbidity and mortality, a longer hospital stay in addition to increased economic burden on patients, as well as hospitals.⁴

¹ Department of Surgery, Ward 3 Jinnah Postgraduate Medical Centre Karachi

Correspondence:

Dr. Tanweer Ahmed ^{1*}
Department of Surgery, Ward 3
Jinnah Postgraduate Medical Centre
Karachi
E mail: drtanweer73@gmail.com

The site of an anastomosis is found to be the most reliable determinant of the anastomotic leakage. The more distal the anastomosis, the greater is the probability of leakage. Resection of a distal rectal cancer has nearly a five-fold elevated risk of anastomotic leak as compared with resection for colon cancer.⁶ Anastomotic leakages are responsible

for around one-third of all fatalities following bowel anastomoses.⁷ Hence early identification of the complication is vital for better outcome.

Regular imaging including X-rays and CT-scans are not cost effective in identifying leaks. They cannot anticipate imminent leaks in addition to having the disadvantage of radiation.⁸ Therefore the biological marker which can forecast this complication prior to the development of leak could be of high clinical significance.⁹

C-reactive protein is generated in the and its level is calculated by testing the blood in order to determine the level of inflammation in the body. CRP is identified as an acute phase reactant, meaning that its volume will increase in reaction to inflammation.¹⁰ It is commonly available and cost effective. CRP level has a tendency to increase in postoperative period due to surgical stress and stabilize swiftly in patients with uncomplicated course, because of its shortened half-life of approximately 19 hours.¹¹

Latest researches have demonstrated that an increase in CRP levels can be used as an early predictor of abdominal complications post esophageal, pancreatic as well as rectal surgeries. Currently, most patients undergoing colorectal surgery are discharged early. An early predictor of septic problems could evade readmissions as well as reduce morbidity.¹²

The results of a study showed that sequential postoperative CT scan is not beneficial over serial CRP measurements with reference to the prediction of infectious complications after colorectal surgical procedures.¹³ Cut-offs for CRP values can be applied for safe early-discharge in a fast track procedure and also as a threshold for further examinations, including CT scan imaging, even in absence of clinical signs, to authenticate or eliminate major complications.¹⁴ Infectious complications after major abdominal surgical procedures are found to be very improbable in subjects with a CRP level less than 159 mg/L on POD 3.¹⁵ This study was conducted to find out utility of CRP level in predicting anastomotic leakage after colorectal surgery.

METHODOLOGY:

This was a cross sectional study conducted in the Department of General Surgery ward- 3 Jinnah Postgraduate Medical Centre Karachi, from February 2017 to August 2017. All patients who underwent bowel anastomosis (colorectal) either elective or emergency, above 12 years of age, of both genders were included. Immunocompromized patients

(deranged liver function, renal failure and uncontrolled diabetes and hypertension) and presented with peritonitis of more than 3 days were excluded.

Informed consent obtained from the patients after explaining purpose, procedure, risk and benefits of the study. Brief history regarding symptoms and demographics was taken. Bowel anastomoses was done using the hand sewn technique. Serum CRP levels was tested on 5th postoperative day and levels >100 mg/L was considered as anastomotic leak. A CT scan with intravenous and oral/rectal contrast was performed in patients of either CRP level more than 100mg/L or suspected on clinical findings (tachycardia, fever and localized peritonitis) to confirm the anastomotic leakage.

The data was analyzed on SPSS version 21. The quantitative variables like age, CRP level, duration of surgery and weight are presented as mean+standard deviation. Frequency and percentages were calculated for anastomotic leak on CRP and CT, elective / emergency surgeries and gender. Sensitivity, specificity, PPV, NPV and diagnostic accuracy were calculated. Effect modifiers like age, gender, type of surgery (elective or emergency), duration of surgery and weight were controlled through stratification, to find out effect on diagnostic accuracy.

RESULTS:

A total of 115 patients of colorectal carcinoma were included in the study. Average age of the subjects was 43.26 ±8.01 year. Male preponderance was observed (n-73 63.5%) as compared females (n-42 36.5%). Mean CRP level of the subjects was 98.24 ±13.69mg/L.

In most of the patients (n=77- 67%) the duration of surgery was less than 4 hours. Emergency surgical procedure was carried out in 73 (63.5%) patients whereas elective surgical procedure was performed in 42 (36.5%). Anastomotic leakage on CRP was observed in 23 (20%) patients while on CT scan it was observed in 18 (15.7%) patients. The common CT scan findings were pneumoperitoneum, localized collection and leakage of contrast. Sensitivity, specificity, positive predicted value (PPV), negative predicted value (NPV) and overall diagnostic accuracy was found to be 61.11%, 87.63%, 47.83%, 92.39% and 83.47% respectively.

DISCUSSION:

Anastomotic leakage is considered as a grave complication of rectal anastomosis. Proximal

defunctioning alleviates the outcome of leakage but does not eliminate the danger. The lower the region of anastomosis the greater the possibility of leakage. A high index of suspicion is required to identify the early non-specific signs of anastomotic leakage. Critical surgical acumen is required to prevent a life threatening situation.¹⁷

Anastomotic leak is the reason of nearly one-third of all deaths following bowel anastomoses; hence early identification of the issue is important. Anastomotic leakage represents a major complication after anterior resection of the rectum. The occurrence of anastomotic leakage varies significantly amongst clinical studies in part due to the lack of a uniform definition of this condition.¹⁸ Standard imaging (X-rays and CT-scans) is expensive with reference to identifying leaks.¹⁹

A study determined the predictive significance of C-reactive protein in anastomotic leakage within three days following colorectal surgery. The study was based on comparison between two groups of subjects and values showed that the CRP levels in the group with anastomotic leakage (127 ± 17.586 mg/l) was considerably elevated as compared to the group exclusive of anastomotic leakage (49.81 ± 11.466 mg/l - $P = 0.000$).²⁰

A study identified the C-reactive protein as a functional negative indicator of anastomotic leakage in oesophago-gastric surgical procedures. A set of one hundred and forty-five subjects were included in the study. Out of these patients, 13 (9%) developed anastomotic leakage. The CRP values on postoperative days 2, 3 as well as 6 were the best indicators. It was concluded that postoperative CRP is a precise negative prognostic marker for the occurrence of anastomotic leakage post oesophago-gastric surgery. It may help in categorizing patients with increased possibility of leak than those in whom anastomotic leakage is improbable to happen.²²

CONCLUSIONS:

The level of C-reactive protein was high in patients with anastomotic leak following large bowel anastomosis while taking CT scan as a gold standard.

REFERENCES:

1. Goulder F. Bowel anastomoses: the theory, the practice and the evidence base. *World J Gastrointest Surg.* 2012;27;4:208-13.
2. Kon K, Rai M, editors. *Microbiology for surgical infections: diagnosis, prognosis and*

- treatment. 1st Edition. Elsevier; 2014;18.
3. Choudhuri AH, Uppal R. Epidemiology of septic shock following anastomotic leak after major gastro intestinal surgery: an audit from a tertiary care institute. *J Critical Care.* 2013;1;28:e45.
4. Phillips B. Reducing gastrointestinal anastomotic leak rates: review of challenges and solutions. *Open Access Surg* 2016;9:5-14. <https://doi.org/10.2147/OAS.S54936>
5. Daley BJ. Peritonitis and abdominal sepsis treatment & management. Medscape. [Internet] Available from URL <https://emedicine.medscape.com/article/180234-treatment> accessed on April 2019.
6. Mirnezami A, Mirnezami R, Chandrakumaran K, Sasapu K, Sagar P, Finan P. Increased local recurrence and reduced survival from colorectal cancer following anastomotic leak: systematic review and meta-analysis. *Ann Surg.* 2011;253:890-9.
7. Vasiliu EC, Zarnescu NO, Costea R, Neagu S. Review of risk factors for anastomotic leakage in colorectal surgery. *Chirurgia (Bucharest, Romania; 1990).* 2015;110:319-26.
8. Ortega-Deballon P, Radais F, Facy O, d'Athis P, Masson D, Charles PE, et al. C-reactive protein is an early predictor of septic complications after elective colorectal surgery. *World J Surg.* 2010;34:808-14.
9. Gans SL, Atema JJ, van Dieren S, Koerkamp BG, Boermeester MA. Diagnostic value of C-reactive protein to rule out infectious complications after major abdominal surgery: a systematic review and meta-analysis. *Int J Colorectal Dis.* 2015;30:861-73.
10. Bray C, Bell LN, Liang H, Haykal R, Kaikow F, Mazza JJ, Yale SH. Erythrocyte sedimentation rate and C-reactive protein measurements and their relevance in clinical medicine. *WMJ.* 2016;115:317-21.
11. Straatman J, Cuesta MA, Tuynman JB, Veenhof AA, Bemelman WA, van der Peet DL. C-reactive protein in predicting major postoperative complications are there differences in open and minimally invasive colorectal surgery? Substudy from

- a randomized clinical trial. *Surg Endosc.* 2018 1;32:2877-85.
12. Ortega-Deballon P, Facy O, Rat P. C-reactive protein to rule out infections after major abdominal surgery. *Int J Colorect Dis.* 2016;31:779-80.
13. Oberhofer D, Juras J, Pavièiæ AM, Ranèiæ Žuriæ I, Rumenjak V. Comparison of C-reactive protein and procalcitonin as predictors of postoperative infectious complications after elective colorectal surgery. *Croatian Med J.* 2012 15;53:612-9.
14. Straatman J, Harmsen AM, Cuesta MA, Berkhof J, Jansma EP, van der Peet DL. Predictive value of C-reactive protein for major complications after major abdominal surgery: a systematic review and pooled-analysis. *PLoS one.* 2015 15;10:e0132995.
15. Fujii T, Tabe Y, Yajima R, Tsutsumi S, Asao T, Kuwano H. Relationship between C-reactive protein levels and wound infections in elective colorectal surgery: C-reactive protein as a predictor for incisional SSI. *Hepatogastroenterology.* 2011;58:752-5.
16. de Noo ME. C-reactive protein and anastomotic leakage after colorectal cancer surgery: useful marker or not?. *Sci Rep* .
17. Moran BJ, Heald RJ. Risk factors for, and management of anastomotic leakage in rectal surgery. *Colorect Dis.* 2001 15;3:135-7.
18. Rahbari NN, Weitz J, Hohenberger W, Heald RJ, Moran B, Ulrich A et al. Definition and grading of anastomotic leakage following anterior resection of the rectum: a proposal by the International Study Group of Rectal Cancer. *Surgery.* 2010;147:339-51.
19. The Hidden Dangers of Medical Scans. [Internet] Available from URL <https://time.com/3601047/medical-scans-hidden-dangers/> accessed on April 2019.
20. Vaziri-Moghaddam A, Kargar S, Jafari J. Prognostic value of C-reactive protein in anastomotic leakage within three days after colorectal surgery. *J Basic Clinic Med.* 2017;6:21-4.
22. Gordon AC, Cross AJ, Foo EW, Roberts RH. C-reactive protein is a useful negative predictor of anastomotic leak in oesophago-gastric resection. *ANZ J Surg.* 2018;88: 223-7.

Received for publication: 28-05-2019

Accepted after revision: 30-06-2019

Author's Contributions:

Tanweer Ahmed: Data collection, Manuscript Writing, Literature search,
Zakia Nehal: Conceive Idea, Data analysis, Manuscript Writing.
Imran Khan: Interpretation of data, Manuscript Writing, Data collection.
Muhammad Mansoor Iqbal: Data collection, Manuscript Writing
Muhammad Iqbal Khan: Data analysis, Study design
Surgra Perveen: Manuscript final reading and approval

Conflict of Interest:

The authors declare that they have no conflict of interest.

Source of Funding:

None

How to cite this article:

Ahmed T, Nehal Z, Khan I, Iqbal MM, Khan MI, Perveen S. Importance of C-reactive protein as a clinical diagnostic tool for the recognition of anastomotic leakage in patients undergoing large bowel anastomosis. *J Surg Pakistan.* 2019;24(2):95-98. Doi:10.21699/jsp.24.2.10.