

EARLY DIAGNOSIS OF ANASTOMOTIC LEAKAGE AFTER ELECTIVE COLO-RECTAL SURGERY USING DUTCH LEAKAGE SCORE – A PROSPECTIVE OBSERVATIONAL STUDY

SUJIT KUMAR MOHANTY¹, SHUSHRUTA MOHANTY, ASHIS KUMAR SUKLA, SANJAYA KUMAR SAHOO*¹,
 IPSITA SAHOO

¹Department of General Surgery, S.C.B MCH, Cuttack, Odisha, India. ²Department of Pathology, M.K.C.G Medical College, Berhampur, Odisha, India, ³Department of FMT, M.K.C.G Medical College, Berhampur, Odisha, India. ⁴Department of Community Medicine, DDMCH, Keonjhar, Odisha, India. ⁵Department of General Surgery, Fakir Mohan MCH, Balasore, Odisha, India.

*Corresponding author: Sanjaya Kumar Sahoo; Email: sanju_dr97@yahoo.co.in

Received: 04 October 2023, Revised and Accepted: 15 November 2023

ABSTRACT

Objective: To validate the Dutch Leakage Score for early detection of anastomotic leak in colorectal surgeries involving bowel anastomosis.

Methods: Total 110 patients were enrolled after written informed consent during March 2021–October 2022 at a tertiary care hospital in Odisha. DLS was measured before surgery and on POD2, POD3, and POD6.

Results: Among the 110 patients, the AL rate was 16.4%. With respect to AL, DLS cutoff of 2.5 on POD2 had positive predictive value (PPV) of 53.10% and a negative predictive value (NPV) of 98.70%. DLS cutoff of 4.0 on POD3 had a PPV of 80.90% and a NPV 98.90%. DLS cutoff of 3.0 on POD6 had a PPV of 84.20% and a NPV of 96.70%. The most common day of AL was the fifth P.O.D (in seven patients) followed by sixth P.O.D (in five patients).

Conclusion: DLS is a good positive and excellent negative predictor of AL. DLS is an easy bedside assessment to gauge the likelihood of AL in the early post-operative period.

Keywords: Colorectal surgery, Intestinal anastomosis, Anastomotic leak, Dutch Leakage Score.

© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2023v16i12.49967>. Journal homepage: <https://innovareacademics.in/journals/index.php/ajpcr>

INTRODUCTION

Intestinal anastomosis is a common major surgical procedure done in both elective and emergency settings and the outcome of which depends on parameters related to patient, disease, and operating technique.

Anastomotic leak is a serious complication of intestinal surgery that occurs when the surgery-created connection between the intestines leaks [1-5].

The rate of leakage can range from 1% to 12% following colorectal resections and from 10% to 14% in low rectal surgeries [6-12]. Anastomotic Leak is defined as a defect of continuity localized at the surgical site of the anastomosis, creating communication between intra-luminal and extra-luminal compartments after initial resection by The International Study Group of Rectal Cancer (ISREC) [13]. In 2020, an international expert panel of colorectal surgeons and researchers also recommended that the ISREC definition should be considered the generally accepted definition of colorectal AL [14].

The acute and rapid clinical deterioration of a patient with AL is preceded by non-specific signs and symptoms [15]. Fever, pain, tachycardia, purulent, or fecal content in the abdominal drain and ileus are the usual clinical signs and symptoms of AL. Radiographic signs are fluid collections or gas-containing collections. On re-exploration, there will be gross enteric spillage and anastomotic dehiscence. Laboratory marker such as leukocytosis, C-reactive protein (CRP), and serum procalcitonin can also be used [16,17].

Early diagnosis of leak can lead to early intervention and prevent the development of severe sepsis, but the often-subtle presentation may lead to delay. Therefore, various risk stratification systems have been proposed. The Dutch Leakage Score (DLS) (Table 1) uses easily

accessible clinical parameters scorable on a daily basis. A score of fewer than 4 points was considered negative while a score of 4 or more was considered positive. Patients with a higher score need additional investigations. The DLS was shown to reduce the delay in diagnosis of anastomotic leakage from a median of 4–1.5 days, with a concomitant reduction in mortality from 39% to 24% [15].

Aim of the study

The aim of the study was to validate the DLS for early detection of AL in colorectal surgeries involving bowel anastomosis.

Table 1: Items scored and points given for DLS

General	Fever	>38°C	1
	Heart Rate	>100/min	1
	Respiratory rate	>30/min	1
	Urinary production	<30 ml/h or 700 mL/day	1
	Mental status	Agitation or lethargic	2
Local physical examination	Clinical condition	Deterioration	2
	Bowel obstruction	Present	2
	Gastric retention	Present	2
	Fascial dehiscence	Present	2
	Abdominal pain, other than wound pain	Present	2
Lab investigation	Signs of infection	≥5% increase in TLC or CRP	1
	Kidney function	≥5% increase in urea or creatinine	1
Diet	Nutritional status	Tube feeding/TPN	1/2

METHODS

Place of study

The prospective and observational study was conducted at SCB Medical College and Hospital, Cuttack after obtaining ethical clearance from the Ethical Committee of the institute.

Study period

The present study was undertaken from March 2021 to October 2022.

Inclusion criteria

All consecutive patients undergoing elective or emergency colorectal surgery with resection and anastomosis were enrolled.

Exclusion criteria

Patients with stoma at the time of surgery were excluded from the study.

Sample size

A total of 110 patients who met inclusion criteria and gave written informed consent were enrolled.

A detailed clinical history was taken and physical examination was performed. Patients were evaluated preoperatively with routine hematological and radiological investigations needed for the surgery.

Intraoperative details such as duration of surgery, amount of blood loss, and type of incision were noted. All the patients underwent open surgery with hand-sewn anastomosis.

On each consecutive post-operative day, the following parameters were recorded: temperature, heart rate, respiratory rate, urine output, mental status (normal, agitated, or lethargic), clinical condition (deteriorating, stable, or improving), local physical examination (signs of bowel obstruction, gastric retention, abdominal wound dehiscence, and abdominal pain), laboratory investigation (leukocyte count, CRP, urea and creatinine), and nutritional status (normal diet, tube feeding, or total parenteral nutrition). The DLS was measured before surgery and on POD2, POD3, and POD6.

The primary end-point was anastomotic leakage. Anastomotic leakage was defined as either clinically apparent leakage (such as fecal discharge from drains or abdominal wound) or radiological or surgically proven leakage. Diagnostic procedures were only performed if indicated.

Statistical analysis

Quantitative values are expressed as mean (SD) or median values, with ranges and 95% confidence interval. Categorical data are shown with percentage frequencies. Differences in continuous variables were

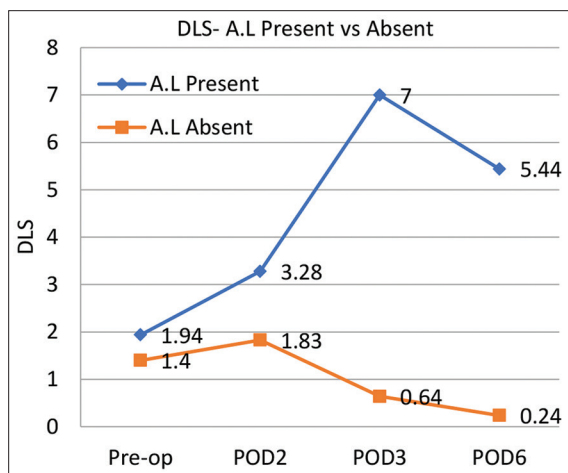


Fig. 1: Pre- and post-operative values of Dutch Leakage Score according to the presence or absence of anastomotic leak

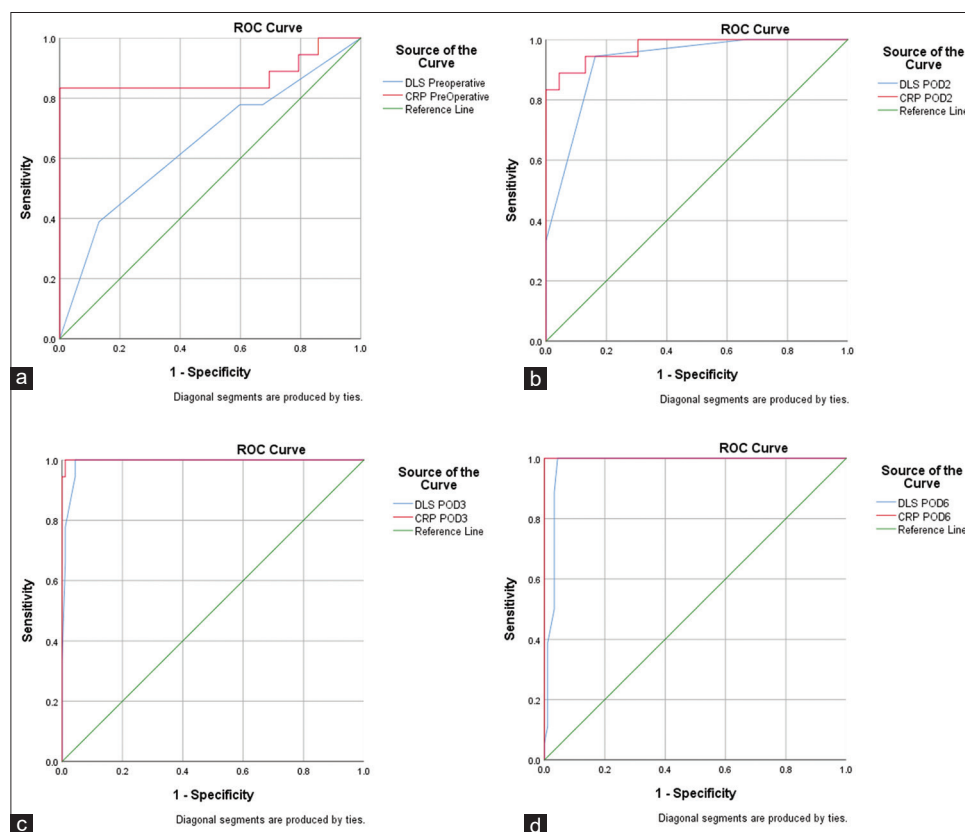


Fig. 2: Area under the receiver operating characteristic curve for anastomotic leakage for DLS and CRP – (a) pre-operative (b) POD2 (c) POD3 and (d) POD6

Table 2 : Pre- and post-operative values of DLS and according to the presence or absence of anastomotic leak

Anastomotic Leakage								
Variable	Time	Present		Absent		Mann Whitney U test	z	p
		Mean	SD	Mean	SD			
Dutch leakage score	Pre-operative	1.94	1.16	1.4	1.08	584.5	-2.1	0.03
	POD2	3.28	0.57	1.83	0.69	120.5	-6.07	<0.001
	POD3	7	1.85	0.64	1.18	16.5	-7.07	<0.001
	POD6	5.44	2.43	0.24	1.19	37.5	-8.98	<0.001

Table 3: ROC curve analysis

Area under the curve					
Test result variable (s)	Area	Std. Error	Significance	95% confidence interval	
				Lower bound	Upper bound
DLS Pre-operative	0.647	0.077	0.049	0.497	0.797
DLS POD2	0.927	0.029	<0.001	0.870	0.984
DLS POD3	0.990	0.007	<0.001	0.976	1.000
DLS POD6	0.977	0.013	<0.001	0.951	1.000

analyzed with the Mann-Whitney U test. AUC values were calculated for DLS on POD2, POD3, and POD6. With respect to the primary endpoint of AL, optimal cutoff points for DLS were obtained by applying Youden's index (sensitivity + specificity - 1), choosing AUC values where the index was maximal. Negative (NPVs) and positive (PPVs) predictive values were also calculated. All patients with AL as defined above and with values of the potential predictors (DLS, CRP) above the cut-off point were considered to be true positives, and all patients without AL and with potential predictor values below the cutoff point were considered true negatives.

RESULTS

Of the 110 patients enrolled in the study, 67 patients (60.9%) were male while the remaining 43 patients (39.1%) were females. The age of the patients ranged from 21 to 75 years. The mean age was 50.4 years. Most common age group undergoing colorectal resection and anastomosis in this study population is between 51 and 60 years with 35 patients (32%), followed by 28 patients (25%) in the age group of 41-50 years. 33 patients (30%) were operated in elective manner. Rest 77 patients (70%) were operated in emergency due to Acute Intestinal Obstruction or following trauma.

Out of the 110 cases operated, 18 cases had AL postoperatively. Incidence of AL in the study population is 16.4% (9% for elective cases and 19% for emergency cases). Out of the 18 patients with AL, 14 patients (77.8%) were male. The other 4 patients (22.2%) were female. The mean age of the patients with AL was 55 years in the study population. The mean age in the male patients was 55.4 years and in the female patients was 53 years. AL occurred most commonly in patients with left-sided Colo-colonic anastomosis. Most common associated diagnosis was sigmoid volvulus (seven patients) followed by obstructed inguinal hernia (four patients). The most common day of AL was the fifth P.O.D (in seven patients) followed by sixth P.O.D (in five patients). Out of the 18 patients with AL, 14 patients recovered and were discharged. Thirteen patients had a low output fistula and were managed conservatively. One patient was reoperated and an end stomy was done. The average P.O.D of discharge in these patients was 16.2 days. Out of the 18 patients, four patients died. The most common cause of death was septicemia.

Analysis of DLS to predict AL

The mean pre-operative DLS was 1.94 S.D 1.16 (AL present) versus mean of 1.4 S.D 1.08 (AL absent). The mean DLS on POD2 was 3.28S.D 0.57 (AL present) versus mean of 1.83 S.D 0.69 (AL absent). The mean DLS on POD3 was 7 S.D 1.85 (AL present) versus 0.64S.D 1.18

(AL absent). The mean DLS on POD6 was 5.44S.D 2.43 (AL present) versus mean of 0.24 S.D 1.19 (AL absent) (Fig. 1 and Table 2).

The AUC for the pre-operative DLS is 0.647 with optimal cutoff value of 1.50. However, it is not statistically significant (p=0.049). The PPV was 20.3% and NPV was 90.2% (Fig. 2 and Table 3).

The AUC for the POD2 DLS is 0.927 (p<0.001) with optimal cutoff value of 2.50. The PPV was 53.10% and NPV was 98.70% (Fig. 2 and Table 3).

The AUC for the POD3 DLS is 0.990 (p<0.001) with optimal cutoff value of 4. The PPV was 80.9% and NPV was 98.9% (Fig. 2 and Table 3).

The AUC for the POD6 DLS is 0.977 (p<0.001) with optimal cutoff value of 3.0. The PPV was 84.2% and the NPV was 96.7% (Fig. 2 and Table 3).

DISCUSSION

Incidence of anastomotic leak in our study population is 16.4% but in a study done by Martin G et al. [18] the rate of AL was 12% with an associated mortality of almost 17%.

In our study The AUC for the POD2 DLS is 0.927 (p<0.001) with optimal cut-off value of 2.50. The AUC for the POD3 DLS is 0.990 (p<0.001) with optimal cut-off value of 4. The AUC for the POD6 DLS is 0.977 (p<0.001) with optimal cut-off value of 3.0. The DULK-score, evaluated in the study done by Martin G et al.[18] was useful, and statistically significant (P < 0.01) between days 1 and 7 post-operatively, with an AUC of 0.83 during the first four days of surveillance. A DULK-score > 3 was predictive of AL with a sensitivity of 91.7% and a negative predictive value of 98%.

CONCLUSION

Anastomotic leak is usually clinically detected by post-operative day 5-7 by presence of intestinal contents in drain or at surgical sites or detected radiologically. It can rapidly progress and cause peritonitis and septicaemia and is associated with increased morbidity and mortality. The DLS is a good positive and excellent negative predictor of AL. A value of ≥2.5 On POD2 and ≥4 on POD3 should raise the suspicion of anastomotic leakage in the near future and the patient can be subjected to additional investigations. The DLS has a PPV of 53.1% on POD2 and 80.9% on POD3. The DLS has a NPV of 98.7% on POD2 and 98.9% on POD3. Being an inexpensive, easy to apply and can be done in any hospital setting. In our study we only focussed on DLS method for early diagnosis of AL but other methods such as the CRP and procalcitonin levels should be explored.

for early diagnosis of anastomotic leakage. It favours early re-intervention, improves prognosis and survival, decreases hospital stay and health care costs.

REFERENCES

- Boccola MA, Buettner PG, Rozen WM, Siu SK, Stevenson AR, Stitz R, *et al.* Risk factors and outcomes for anastomotic leakage in colorectal surgery: A single-institution analysis of 1576 patients. *World J Surg* 2011;35:186-95. doi: 10.1007/s00268-010-0831-7, PMID 20972678
- Phillips B. Reducing gastrointestinal anastomotic leak rates: Review of challenges and solutions. *Open Access Surg* 2016;5:5-14. doi: 10.2147/OAS.S54936
- Branagan G, Finnis D, Wessex Colorectal Cancer Audit Working Group. Prognosis after anastomotic leakage in colorectal surgery. *Dis Colon Rectum* 2005;48:1021-6. doi: 10.1007/s10350-004-0869-4, PMID 15789125
- 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. doi: 10.1097/SLA.0b013e3182128929, PMID 21394013
- Chambers WM, Mortensen NJ. Postoperative leakage and abscess formation after colorectal surgery. *Best Pract Res Clin Gastroenterol* 2004;18:865-80. doi: 10.1016/j.bpg.2004.06.026, PMID 15494283
- Boushey R, Williams LJ. Management of Anastomotic Complications of Colorectal Surgery; 2018. Available from: <https://www.uptodate.com/contents/management-of-anastomotic-complications-of-colorectal-surgery>
- Slieker JC, Komen N, Mannaerts GH, Karsten TM, Willemsen P, Murawska M, *et al.* Long-term and perioperative corticosteroids in anastomotic leakage: A prospective study of 259 left-sided colorectal anastomoses. *Arch Surg* 2012;147:52. doi: 10.1001/archsurg.2011.1690, PMID 22249852
- Kingham TP, Pachter HL. Colonic anastomotic leak: Risk factors, diagnosis, and treatment. *J Am Coll Surg* 2009;208:269-78. doi: 10.1016/j.jamcollsurg.2008.10.015, PMID 19228539
- Hyman N, Manchester TL, Osler T, Burns B, Cataldo PA. Anastomotic leaks after intestinal anastomosis: It's later than you think. *Ann Surg* 2007;245:254-8. doi: 10.1097/01.sla.0000225083.27182.85, PMID 17245179
- Bruce J, Krukowski ZH, Al-Khairy G, Russell EM, Park KG. Systematic review of the definition and measurement of anastomotic leak after gastrointestinal surgery. *Br J Surg* 2001;88:1157-68. doi: 10.1046/j.0007-1323.2001.01829.x, PMID 11531861
- Russ A, Kennedy GD. Postoperative complications. In: Steele SR, Hull TL, Read TE, Saclarides TJ, Senagore AJ, Whitlow CB, editors. *ASCRS Textbook of Colon and Rectal Surgery*. 3rd ed. New York: Springer; 2016. p. 121-40.
- Platell C, Barwood N, Dorfmann G, Makin G. The incidence of anastomotic leaks in patients undergoing colorectal surgery. *Colorectal Dis* 2007;9:71-9. doi: 10.1111/j.1463-1318.2006.01002.x, PMID 17181849
- 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. doi: 10.1016/j.surg.2009.10.012, PMID 20004450
- van Helsingden CP, Jongen AC, de Jonge WJ, Bouvy ND, Derikx JP. Consensus on the definition of colorectal anastomotic leakage: A modified Delphi study. *World J Gastroenterol* 2020;26:3293-303. doi: 10.3748/wjg.v26.i23.3293, PMID 32684743
- den Dulk M, Witvliet MJ, Kortram K, Neijenhuis PA, de Hingh IH, Engel AF, *et al.* The DULK (Dutch leakage) and modified DULK score compared: Actively seek the leak. *Colorectal Dis* 2013;15:e528-33. doi: 10.1111/codi.12379, PMID 24199233
- Benedetti M, Ciano P, Pergolini I, Ciotti S, Guercioni G, Ruffo G, *et al.* Early diagnosis of anastomotic leakage after colorectal surgery by the Dutch leakage score, serum procalcitonin and serum C-reactive protein: study protocol of a prospective multicentre observational study by the Italian ColoRectal anastomotic Leakage (iC. *G Chir* 2019;40:20-5. PMID 30771794
- Barker-Antonio A, Jarquin-Arremilla A, Cruz EH, Garcia-Manzano RA, Davila-Ruiz EO. Validation of the Dutch leakage score as a predictor of anastomotic leakage in intestinal surgery in a third level hospital. *Int J Res Med Sci* 2021;9:3251-5. doi: 10.18203/2320-6012.ijrms20214406
- Martin G, Dupré A, Mulliez A, Prunel F, Slim K, Pezet D. Validation of a score for the early diagnosis of anastomotic leakage following elective colorectal surgery. *J Visc Surg* 2015;152:5-10. doi: 10.1016/j.jviscsurg.2014.12.002