10-10-2024

"An observational study on validity of DULK score as a tool for early diagnosis of anastomotic leakage in immediate post-operative period after elective primary intestinal anastomosis."

ABSTRACT

Background: Anastomotic leakage (AL) is a significant complication of intestinal anastomoses, that contributes to increased morbidity, mortality, and prolonged hospital stay. This study evaluated the effectiveness and accuracy of the Dutch Leakage Score (DULK), a postoperative scoring system, for the early detection of AL following elective open intestinal anastomosis.

Methods: A total of 86 cases meeting the inclusion and exclusion criteria were included in this observational study from SMS Medical College, Jaipur, over a duration of 14 months, from March 2023 to May 2024. Postoperative assessments were conducted using the DULK score on days 1, 3, 5, 7, and 12 to evaluate its validity as an early diagnostic tool for anastomotic leakage and to identify associated risk factors.

Results: The study confirmed that the DULK score is a reliable tool for detecting anastomotic leaks, with a sensitivity of 84.37% and specificity of 79.62%. Key risk factors included anemia (58.3% leak rate), hypoalbuminemia (75% leak rate), and leukocytosis (66.6% leak rate), emphasizing their significance in predicting leak.

Conclusion: DULK score with a cut-off value of 8 is an effective diagnostic tool for anastomotic leaks, demonstrating its significance in early detection and the management of anastomotic leak.

Key words: Anastomotic leakage, DULK score, Early diagnosis, Risk factors, Predictive tool, Surgical outcomes.

INTRODUCTION

Anastomotic leakage (AL) is a serious complication following intestinal surgery, despite

advancements in surgical techniques. Defined as a defect in the intestinal wall at the anastomotic site, AL leads to communication between intra- and extraluminal compartments.[1] The variability in definitions and diagnostic criteria across studies complicates the assessment of AL incidence, with up to 24% reported in distal rectal surgeries, whereas the overall rates for intestinal surgeries range from 6%-7%. [2] Anastomotic leaks results in increased morbidity, mortality, and prolonged hospital stays. In colorectal cancer patients, AL has been linked to decreased long-term survival and higher local recurrence rates.[3]

The clinical presentation of AL can vary widely, from subtle signs, such as low-grade fever and abdominal pain to severe conditions, such as sepsis and peritonitis. Early diagnosis is critical because delayed detection can lead to severe complications, including the need for reoperation and intensive care. Traditional diagnostic methods often fall short, necessitating imaging studies such as CT scans, which are more effective than contrast enemas in identifying leaks. Multiple risk factors contribute to the occurrence of AL, including surgical technique, local sepsis, ischemia at the anastomosis site, and patient-related factors such as age, obesity, and pre-existing health conditions.[4]

Studies have shown that timely intervention can significantly reduce the mortality rates associated with AL, emphasizing the need for effective diagnostic tools. [5] The DULK Score a postoperative scoring system developed for the early detection of AL, has shown promise in previous studies, demonstrating early diagnosis and lower postoperative mortality. This study aimed to evaluate the effectiveness and accuracy of the DULK Score in detecting AL following elective open intestinal anastomosis. Specifically, it will assess the score's sensitivity and specificity, investigate its correlation with AL occurrence, and analyse individual risk factors contributing to anastomotic leak.

Table 1: Various clinical parameters used to assess DULK score [4]

Variables	Threshold	Scores
Fever	> 38° C	1
Respiratory rate	> 30/min	1
Heart rate	> 100/min	1
Oliguria	<30 ml/h or 700 ml/d	1
Mental Status	Agitation or lethargic	2
Clinical condition	Deterioration	2
Ileus/Bowel obstruction	Present	2
Gastric retention	Present	2
Surgical wound dehiscence	Present	2
Abdominal pain other than wound pain	Present	2
Signs of infection	Leucocytosis or	1

	elevated CRP	
Renal function	Creatinine elevation or urea by 5%	1
Nutrition	Parenteral nutrition	2

CRP- C-Reactive Protein

AIM & OBJECTIVES:

Our aim was to assess the validity of the DULK Score as a tool for the early diagnosis of anastomotic leakage in the immediate post-operative period following elective primary intestinal anastomosis through an observational study.

The objectives were:

1. To evaluate the accuracy and reliability of the DULK Score in detecting anastomotic leakage in patients undergoing elective primary intestinal anastomosis.
2. To analyze the association between DULK Score results and the occurrence of anastomotic leakage in the immediate post-operative period.
3. To assess the practicality and feasibility of implementing the DULK Score as a routine diagnostic tool for anastomotic leakage in clinical practice.

MATERIALS AND METHODS

The study involved patients undergoing elective intestinal anastomosis at SMS Medical College, Jaipur, with informed consent obtained prior to participation. A sample size of 86 was chosen, considering a 15% attrition rate. Inclusion criteria included adults over 18, while emergency surgeries and certain patient conditions were excluded. The methodology involved collecting detailed medical histories, conducting comprehensive investigations (blood tests and imaging), and performing elective surgeries. Postoperatively, patients were assessed using the DULK Score to monitor anastomotic leakage risk. Post op monitoring of clinical parameters and investigations was done to calculate DULK score on days 1, 3, 5,7 and 12.

OBSERVATIONS

Incidence and Demographic variables

A total of 86 patients were included in the study, comprising 48 (59%) male and 38 (41%) female patients. Anastomotic leaks occurred in 32 patients (37.2% of the population) with 19 males and 13 females. Males had a 59.3% leak rate at p value of 0.6087, indicating non-significance as a risk factor. The highest incidence was in the 50-60 age group (28%), with

75% of those over 60 experiencing leaks. Over 50% of patients above 40 years developed leaks, while the rate was 20% or less in those under 40.

Association of various Risk Factors with anastomotic leak

In our study, 12 patients (13.9%) were anemic, with 58.3% developing leaks, indicating anemia increases leak risk by 2.7 times ($p = 0.10$). Hypoalbuminemia was present in 27.9% of cases, with a significant 75% leak rate ($p < 0.00001$), making patients 10.2 times more susceptible. Leukocytosis was observed in 34.8%, with 66.6% developing leaks ($p = 0.00003$), raising risk by 7.3 times. Among leak patients, 21.8% had anemia, 62.5% had leukocytosis, and 56.2% had hypoalbuminemia.

Table 2: **Association of various risk factors with percentage anastomotic leak**

Risk factor	No of patients in study group with risk factor	No. of patients with risk factor who develop leak	Percentage
Hypoalbuminemia	24	18	75 %
ASA status (2 or above)	39	29	74.3 %
Raised WBC count	30	20	66.6 %
Anemia	12	7	58.3 %
Immunocompromised	11	6	54.5 %
Chronic disease	44	23	52.2 %
Chronic steroid use	14	7	50 %
Gender (Male)	48	19	39.5 %

ASA- American society of anesthesiologists; WBC- white blood cells;

Timing of leak and DULK Score cut off value

The majority of leaks were identified on postoperative day 5 (56.2%), with only 2 leaks occurring beyond postoperative day 7. Out of 32 patients who had leak 27 patients had DULK score of 8 while only 5 patients had score of less than 8. At cut-off score of 8, the DULK Score exhibited a sensitivity of 84.37%, specificity of 79.62%, positive predictive value (PPV) of 71.05%, and negative predictive value (NPV) of 89.58%.

Table 3: Post op Day when leak is identified

Post Op Day (POD)	No of patients	Percentage
POD-3	4	12.5 %
POD-5	18	56.25 %
POD-7	8	25 %
POD-12	2	6.25 %
Total	32	

Table 4: DULK Score cut-off and Anastomotic leak

DULK Score	Leak	No leak
8 or more	27	11
<8	5	43
Total	32	54

Surgical Techniques, site of anastomosis and duration

Analysis of surgical techniques revealed no significant difference between hand-sewn and stapled anastomoses (p-value: 0.475). Of the 68 patients who underwent hand-sewn anastomosis, 24 (35.2%) experienced leaks, while 8 of 18 patients (44.4%) with stapled anastomosis developed leaks. Colo-colic anastomoses had the highest leak rate (40.7%), followed by ileo-colic (35.2%) and ileo-ileal (34.2%).

Furthermore, prolonged surgery duration (>4 hours) was associated with a higher risk of AL, with 54.5% of patients experiencing leaks

compared to 34.6% for surgeries lasting less than 4 hours. Cases performed by residents under the guidance of consultant showed a higher incidence of leaks (42.5%) compared to those performed by consultants (32.6%), although this difference was not statistically significant (p-value: 0.343).

Table 5: Correlation of anastomotic technique with leak

Technique	Leak	No leak
Hand sewn	24	44
Stapled	8	10
Total	32	54

Table 6: Correlation of site of anastomosis with site of leak

Site	Leak	No Leak	Percentage leak
Ileo-ileal	13	25	34.2
Colo-colic	11	16	40.7
Ileo-colic	6	11	35.2
Jejuno-jejunal	2	2	50
Total	32	54	

DISCUSSION

Our study reinforces the findings of previous research regarding the DULK Score as a significant predictive tool for anastomotic leakage (AL). The DULK score, established to reduce diagnostic delays and associated mortality rates, demonstrated good performance in our cohort, with a cut-off score of 8 yielding a sensitivity of 84.37% and specificity of 79.62%. These metrics highlight the score's utility in early detection, allowing for timely interventions that can significantly alter patient outcomes.

In our analysis of 86 patients, 37.2% developed AL, with the majority of leaks occurring on postoperative day 5 (56.2% of leaks), mirroring previous study done by Das et al (2013) that report a peak detection window between postoperative days 5 and 8.[6] In previous studies it was established that leak rates are high for very proximal (oesophageal) and very distal (low rectal) anastomoses. [7] In our study 40.7% of colo-colic anastomosis and 35.2% of ileo- colic anastomosis developed leak. Leak percentage was lowest in ileo ileal 34.2% concluding leak rates are high for distal anastomoses compared to proximal anastomoses.

Additionally, we identified critical risk factors contributing to AL, including hypoalbuminemia, which was present in 27.9% of cases with a staggering 75% leak rate

among those affected in consistent with study done by Anandan PK et al.[8] Similarly, leukocytosis was found in 34.8% of patients, with 66.6% of these individuals experiencing AL, indicating a 7.3 times higher risk compared to those with normal white blood cell counts comparable to results from study done by Zarnescu et al (2021). [9] Chronic disease status emerged as a significant predictor, with a p-value of 0.0031, affirming its association with increased leakage risk.

These findings emphasize the need for vigilance in monitoring patients with identified risk factors, particularly hypoalbuminemia and leukocytosis. Incorporating the DULK score or modified DULK score [10], which is based on fewer parameters like abdominal pain, tachypnoea, rise in CRP and clinical deterioration into clinical practice or may enable healthcare providers to stratify risk more effectively and implement proactive management strategies, ultimately improving postoperative outcomes for patients undergoing anastomosis.

The study's limitations include a small sample size, single-centre design, potential subjectivity in DULK Score assessments, exclusion of certain patient groups (emergency surgeries), limited follow-up duration, unaccounted confounding variables, and variability in surgical techniques, affecting the generalizability of results.

CONCLUSION

The study explored factors influencing anastomotic leaks following elective intestinal anastomosis, emphasizing the significance of various patient demographics and clinical conditions in predicting leak risk. This study confirms the DULK as a reliable early diagnostic tool for anastomotic leaks, achieving a sensitivity of 84.37% and specificity of 79.62%. Its effectiveness in identifying leaks by postoperative day 5 highlights its potential to enhance clinical decision-making and improve patient management.

Funding: No funding sources

Conflict of interest: None

Ethical approval: The study was approved by the institutional ethics committee

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