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PREDICTION OF ANASTOMOTIC LEAKS IN GASTROINTESTINAL SURGERIES USING "EVALUATION OF PHYSIOLOGICAL ABILITY AND SURGICAL STRESS SCORING SYSTEM"

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ABSTRACT

BACKGROUND: Gastrointestinal surgeries involving bowel anastomosis is one of the commonly performed surgical procedure in both elective and emergency. Despite recent advances in Gastrointestinal surgery, anastomotic leakage and other complications of intestinal anastomosis are still commonly encountered in ward. A leaking anastomosis almost doubles the hospital stay (increased morbidity) and has been associated with significant mortality. Objective of this study is to predict the anastomotic leak in gastrointestinal surgeries using E-PASS scoring system. Evaluation of Physiological Ability and Surgical Stress (E-PASS) scoring system is designed by Haga et al mainly for predicting the post operative course in GI surgeries. Later E-PASS scoring system is also validated for its use in predicting anastomotic leak in gastro intestinal surgeries

AIM: To predict the intestinal anastomotic leak in gastro intestinal surgeries involving anastomosis of bowel.

OBJECTIVE:

1. To identify risk factors for post operative intestinal anastomotic leak.
2. To study the incidence of anastomotic leak between surgeries involving anastomosis of different segments of bowel
3. To study morbidity and mortality associated with the surgeries involving bowel anastomosis with postoperative anastomotic leak

PATIENTS AND METHODS:

50 patients admitted in General Surgery department in M K C G Medical College and Hospital undergoing laparotomy involving bowel anastomosis will be studied prospectively during December 2022 to November 2023. Detailed history, clinical examination findings and intra operative

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details were collected from the patients. Three components of E-PASS scoring system like Preoperative Risk Score, Surgical Stress Score and Comprehensive Stress Score were computed. Patients were followed up in the post operative period and observed for anastomotic leak and other complications. Outcome of patients were compared with the individual scores of E-PASS scoring system.

RESULTS:

Incidence of anastomotic leaks in the present study is 18%. All the three scores namely Preoperative Risk Score, Surgical Stress Score and Comprehensive Stress Score were found to be significantly associated with the incidence of anastomotic leak with p value<0.01.

CONCLUSION:

Comprehensive Risk Score of more than 0.9 is significantly associated with anastomotic leaks. In all patients undergoing anastomotic surgeries E-PASS scores should be calculated prior to surgery and if CRS is more than 0.9 alternative options for anastomosis should be considered.

KEY WORDS: Intestinal Anastomosis, Anastomotic Leaks, E-PASS scoring system, Preoperative Risk Score (PRS), Surgical Stress Score (SSS), Comprehensive Risk Score (CRS).

INTRODUCTION:

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

Intestinal anastomosis is associated with number of complications; the most dreaded being the anastomotic leak. Incidence of the anastomotic leak ranges from 1.5 to 27% depending on type of anastomosis and whether it was done in elective or emergency setting [(1)].

Despite recent advances in Gastrointestinal surgery, anastomotic leakage and other complications of intestinal anastomosis are still commonly encountered in ward. A leaking anastomosis almost doubles the hospital stay (increased morbidity) and has been associated with significant mortality.

M K C G Medical College Hospital Berhampur is a tertiary referral centre, where we get a good number of patients undergoing intestinal resection and primary anastomosis. This study is an effort to predict the most dreaded complication of Gastro intestinal surgeries namely the anastomotic leak so that a primary anastomosis of the structures can be avoided by opting for a diversion surgery primarily and later on restoring the bowel continuity once general condition of the patient improves. This prevents morbidity and mortality of surgeries involving anastomosis of bowel.

Various scoring systems are available for predicting postoperative course of a patient.

According to Haga Y et al [(2)] (2001) E-PASS scoring system is more accurate in evaluating elective digestive surgeries than any other existing system. Again, Haga Y et al [(3)] (2011) validated E-PASS Scoring System as a useful tool in predicting anastomotic leaks.

As mentioned above E-PASS scoring system has been shown to predict post operative course in patients particularly undergoing gastrointestinal surgeries. Application of this scoring system has not been studied in Indian patients. As this scoring system can predict anastomotic leak it will be a very useful tool for intra operative decision making in cases requiring intestinal anastomosis.

Components of E-PASS SCORING SYSTEM:

1. Preoperative Risk Score (PRS)
2. Surgical Stress Score (SSS)
3. Comprehensive Risk Score (CRS)

All the above three scores have been shown to have positive correlation with incidence and grading of complications mainly in abdominal surgeries.

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Variables for Preoperative Risk Score:

- Age in years
- Presence or Absence of severe heart disease (NYHA class III or IV)
- Presence or Absence of Pulmonary disease (defined as vital capacity less than 60%)
- Diabetes Mellitus (based on definition of WHO criteria)
- Performance Status Index (described by Japanese cancer society)
- ASA score

Variables for Surgical Stress score:

- Approximate blood loss (ml/kg)
- Operating time (in hours)
- Extent of skin incision. Three scores are given for incision. (0-minor incision, 1-laparotomy, 2-laparotomy with thoracotomy).

Equations:

1. **Pre operative Risk Score =** -0.0686 + 0.00345(F1) + 0.323(F2) + 0.205(F3) + 0.153(F4) + 0.148(F5) + 0.0666(F6)

Factors used to calculate PRS are,

- F1: age,
- F2: presence (1) or absence (0) of severe heart disease,
- F3: presence (1) or absence (0) of severe pulmonary disease,
- F4: presence (1) or absence (0) of diabetes mellitus,
- F5: performance status index (0-4),
- F6: American Society of Anaesthesiologists physiological status classification (1-5).

2. **Surgical Stress Score =** -0.342 + 0.0139(F1) + 0.0392(F2) + 0.352(F3)

- F1: blood loss/ body weight (g/kg),
- F2: operation time (hours)
- F3: extent of skin incision

3. **Comprehensive Risk Score =** -0.328 + 0.936 (PRS) + 0.976 (SSS)

AIM:

To predict the intestinal anastomotic leak in gastro intestinal surgeries involving anastomosis of bowel

OBJECTIVE OF THE STUDY:

1. To identify risk factors for post operative intestinal anastomotic leak.

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2. To study the incidence of anastomotic leak between surgeries involving anastomosis of different segments of bowel
3. To study morbidity and mortality associated with the surgeries involving bowel anastomosis with postoperative anastomotic leak

MATERIALS:

SOURCE OF DATA:

* 50 patients admitted in M K C G Medical College and Hospital Berhampur undergoing laparotomy involving intestinal anastomosis

STUDY PLACE:

* M K C G Medical College and Hospital Berhampur

STUDY DESIGN:

* Prospective Observational Study

SAMPLE SIZE:

* 50 PATIENTS

STUDY PERIOD:

* December 2022 to November 2023

INCLUSION CRITERIA:

* Patients undergoing abdominal surgeries (Emergency or Elective) involving anastomosis of bowel. *Age > 18 years

EXCLUSION CRITERIA:

* Patients initially underwent a diversion procedure with a stoma and having Re-laparotomy for stoma reversal.

- 50 patients admitted in general surgery department in M K C G Medical College Berhampur undergoing laparotomy involving bowel anastomosis will be studied prospectively during study period.
- A detailed clinical history was taken from all the patients consented for study. Thorough physical examination was done for all the patients
- Patients were evaluated preoperatively with routine haematological and radiological investigations needed for the surgery
- Intra operative details like duration of surgery, amount of blood loss and type of incision was noted
- Followed up post operatively and observed for any complications particularly anastomotic leak

Evaluation of physiological ability and surgical stress (E-PASS) score was estimated by calculating Preoperative Risk Score (PRS) Surgical Stress Score (SSS) and Comprehensive Risk Score (CRS). These scores were calculated and individually analysed regarding prediction of anastomotic leak.

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RESULTS AND DATA ANALYSIS:

AGE DISTRIBUTION

Most common age group undergoing intestinal anastomosis among present study population is 41-60yrs. Among 50 patients, 16 are in this age group. Mean age is 47.96years. Lowest age is 13 years and highest age is 78 years.

Table 1: Age distribution of study population

Age group	No	Percent
10-20 yrs	**3**	**6**
21-30 yrs	**4**	**8**
31-40 yrs	**9**	**18**
41-50 yrs	**13**	**26**
51-60 yrs	**13**	**26**
61-70 yrs	**6**	**12**
71-80 yrs	**2**	**4**
Total	**50**	**100**

SEX DISTRIBUTION

Table 2: Sex Distribution of study population

	No	Percent
Male	29	58
Female	21	42
Total	50	100

CASE DISTRIBUTION

Table 3: Distribution of cases in study population

DIAGNOSIS	NUMBER OF CASES
1. Carcinoma colon	**4**
2. Carcinoma pancreas	**2**
3. Carcinoma stomach	**12**
4. Enteric TB	**5**
5.Peri-ampullary carcinoma	**5**
6. Pseudocyst of pancreas	**5**
7. Benign Gastric outlet obstruction	**1**
8. Blunt injury abdomen	**2**
9. Bowel ischemia	**4**
10. Strangulated Hernia	**5**
11. Adhesive obstruction	**5**
Total cases	**50**

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MODE OF SURGERY

Among 50 cases in study population 21 cases were taken as emergency without any bowel preparation while rest 29 cases as taken electively with proper bowel preparation.

NO. ELECTIVE CASES: 21

NO. OF EMERGENCY CASES: 29

INCIDENCE OF ANASTOMOTIC LEAK

Table 4: Incidence of anastomotic leak

	No	Percent
No	41	82
Yes	9	18
Total	50	100

Out of 50 cases, 9 cases had postoperative anastomotic leak. Incidence of anastomotic leak is around 18%

Comparison of diagnosis and anastomotic leak

Among 9 patients with anastomotic leak, the diagnosis for which they are operated are as follows

Table 5: Etiologies of anastomotic leak

DIAGNOSIS	NUMBER OF CASES	Number of cases with anastomotic leak
1. Carcinoma stomach	12	1
2. Enteric TB	5	2
3.Peri-ampullary carcinoma	5	2
4. Blunt injury abdomen 5. Bowel ischemia	2 4	1 2
6. Strangulated Hernia	5	1
Total	50	9

Anastomotic leak in emergency and elective surgeries:

Table 6: Anastomotic leaks in elective and emergency cases

	Leak	**No Leak**	**Total**
Elective	3	**26**	**29**
Emergency	**6**	**15**	**21**

Association between anastomotic leak and emergency surgery is be significant at 10% level. Chi square value -2. 7414.p value -0.09.

Relevance E-pass scoring system in association with incidence of post operative anastomotic leak

Three scores of E-pass scoring system namely Pre operative Risk Score (PRS), Surgical Stress Score (SSS) and Comprehensive Risk Score (CRS) for each patient were computed. Mean value of each score among patients with anastomotic leak and among patients without anastomotic leak are calculated. And their significance is tested using T-test for equity of means.

Pre operative risk score (PRS)

Mean PRS for patients with anastomotic leak: 1.08; S.D.= 0.25

Mean PRS for patients without anastomotic leak: 0.70; S.D.= 0.23

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		Preoperative Risk Score (PRS)		
		Mean	**S.D**	**No.**
Leak	**No**	**0.70**	**0.23**	**41**
	Yes	**1.08**	**0.25**	**9**

T-test for equality of means:

T	**df**	**P-value**
4.401	**48**	**0.01**

Pre-operative Risk Score was compared between patients who had leak and those who have not had leak. The mean value of Pre-operative Risk Score for patients with anastomotic leak is 1.08 with SD of 0.25. It is significantly higher than the patients who had no anastomotic leak which is 0.70 with SD of 0.23. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

Surgical Stress score:

Mean SSS for patients with anastomotic leak: 0.37; S.D.= 0.19

Mean SSS for patients without anastomotic leak: 0.19; S.D.= 0.09

		Surgical Stress Score (SSS)		
		Mean	**S.D**	**No.**
Leak	**No**	**0.19**	**0.09**	**41**
	Yes	**0.37**	**0.19**	**9**

T-test for equality of means:

t	**Df**	**P-value**
4.239	**48**	**0.01**

Surgical Stress Scores were compared between patients who had leak and those who have not had leak. The mean value of Surgical Stress Score for patients with anastomotic leak is 0.37 with SD of 0.19. It is significantly higher than the patients who had no anastomotic leak which is 0.19 with SD of 0.09. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

Comprehensive Risk Score

Mean CRS among patient who died in post operative period is 1.14 and among normal patients is 0.5. Among nine patients with Comprehensive Risk Score more than 0.9, eight patients had postoperative anastomotic leak. Among 41 patients with Comprehensive Risk Score less than 0.9, only one patient had post operative anastomotic leak.

	ANASTOMOTIC LEAK	NO LEAK
CRS >0.9	**8**	**01**
CRS <0.9	**1**	**40**

CRS more than 0.9 is significantly associated with the incidence of anastomotic leak ($p<0.01$)

Mean CRS for patients with anastomotic leak: 1.04; S.D.= 0.20

Mean CRS for patients without anastomotic leak: 0.52; S.D.= 0.23

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		Comprehensive Risk Score (CRS)		
		Mean	**S.D**	**No.**
Leak	**No**	**0.52**	**0.23**	**41**
	Yes	**1.04**	**0.20**	**9**

T-test for equality of means:

T	**df**	**P-value**
6.253	**48**	**0.01**

Comprehensive Risk Scores were compared between patients who had leak and those who did not had leak. The mean value Comprehensive Risk Score for patients with anastomotic leak is 1.04 with SD of 0.20. It is significantly higher than the patients who had no anastomotic leak which is 0.52 with SD of 0.23. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

DISCUSSION:

Anastomotic leak is a disastrous complication which is frequently encountered by a general surgeon in post operative ward. Anastomotic leak significantly increases duration of hospital stay, morbidity and mortality associated with the surgery. Incidence of anastomotic leak varies from 1.5% to 27% depending upon various factors. Many studies have identified several risk factors for disruption of anastomotic sutures such as male gender, ASA score, excessive smoking, low preoperative serum albumin, increased operating time and amount of blood loss [(4,5)]. But not many studies are available to predict the actual incidence of anastomotic leakage. This study is an effort to predict the anastomotic leakage using 'E-PASS' scoring system. This scoring system is based on the hypothesis that patient's homeostasis is disturbed when the surgical stress overwhelms the physiological reserve of the patient.

Anastomotic leakage is commonly seen in emergency surgeries than in elective surgeries. Incidence of anastomotic leak is around 10% in elective surgeries and 28.5% in emergency surgeries. Out of 21 emergency cases 6 had anastomotic leak and out of 29 elective cases 3 had anastomotic leak. In our present study association between anastomotic leak and emergency surgery is found to be significant at 10% level. ($p=0.09$). Increased incidence of anastomotic leak in cases undergoing emergency surgery is noted in many studies which is due to many factors such as faecal contamination of gut, poor general condition, poor nutritional status, impaired oxygen transport to the peri-anastomotic site due to anaemia, hypoxemia and unprepared bowel. Though conflicts are present regarding bowel preparation [(6)] in elective cases, increased bacterial proliferation and sepsis in emergency situations affects healing of anastomosis.

Michael Quintel et al clearly demonstrated the deleterious effects of increased abdominal compartment pressure in the pulmonary system particularly in previously injured lung [(7)]. Proper resuscitation and pre op management can improve the pulmonary function in patients with acute abdomen which in turn can increase peri-anastomotic oxygen tension and prevent development of anastomotic leak in postoperative period. In patients with severely impaired pulmonary status primary anastomosis can be avoided and diversion procedures can be done in emergency setting. Definitive procedure could be done after improving the pulmonary function.

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Analysis of E-PASS scoring system:

Three scores of E-pass scoring system namely Pre operative Risk Score (PRS), Surgical Stress Score (SSS) and Comprehensive Risk Score (CRS) for each patient were computed. Mean value of each score among patients with anastomotic leak and among patients without anastomotic leak are calculated. And their significance is tested using T-test for equity of means.

Pre-operative Risk Score was compared between patients who had leak and those who have not had leak. The mean value of Pre-operative Risk Score for patients with anastomotic leak is 1.08 with SD of 0.23. It is significantly higher than the patients who had no anastomotic leak which is 0.70 with SD of 0.23. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

Surgical Stress Scores were compared between patients who had leak and those who have not had leak. The mean value Surgical Stress Score for patients with anastomotic leak is 0.37 with SD of 0.19. It is significantly higher than the patients who had no anastomotic leak which is 0.19 with SD of 0.09. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

Comprehensive Risk Scores were compared between patients who had leak and those who have not had leak. The mean value Comprehensive Risk Score for patients with anastomotic leak is 1.04 with SD of 0.20. It is significantly higher than the patients who had no anastomotic leak which is 0.52 with SD of 0.23. The t-test for equity of means conducted was found to be significant at 0.01 level ($p<0.01$).

Each score in E-PASS scoring system is significantly associated with the incidence of post operative anastomotic leak. Comprehensive Risk Score of more than 1.0 is 100% associated with the postoperative anastomotic leak. Among the patients who had anastomotic leak nearly 90% of them had Comprehensive risk score more than 0.9. Calculation of pre operative risk score needs only six variables namely age, presence of co-morbid conditions like pulmonary disease, heart disease, diabetes, ASA score and performance index score. These details can be quickly obtained preoperatively. For calculation of surgical stress score three variables are needed namely approximate operating time, expected blood loss and intended surgical incision. These factors can also be judged pre operatively with reasonable accuracy by operating surgeon.

Comprehensive risk score of more than 0.9 is significantly associated with incidence of post operative anastomotic leak at 1% level (p value<0.01). With nine readily available variables E-PASS scores can be calculated easily before surgery. If the comprehensive score is more than 0.9 surgeons can decide about doing a minimal procedure in emergency setting and do intestinal anastomosis after improving the physiological status of the patient.

It is also noted in the study that mean value of CRS in patient who died in post operative period is 1.14. Mean CRS value of alive patients is 0.5. Thus, increasing value of CRS is also correlates with mortality rate.

CONCLUSION:

- Incidence of anastomotic leak in gastro intestinal surgeries is around 18%.
- Anastomotic leaks occur more commonly in men than women.
- Emergency surgeries are significantly associated with anastomotic leaks than elective surgeries.
- Most common cause associated with anastomotic leak is mesenteric ischemia.
- Impaired pulmonary function is significantly associated with anastomotic leaks than other co morbid factors. Hence resuscitation and improving pulmonary status improves outcome in surgeries involving intestinal anastomosis.

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- Incidence of anastomotic leak is also associated with prolonged stay in hospital and high mortality rates.
- All the three scores computed in E-PASS scoring system namely Pre operative Risk Score, Surgical Stress Score and Comprehensive Risk Score are significantly associated with incidence of anastomotic leak.
- Comprehensive Risk Score of more than 0.9 is significantly associated with anastomotic leaks. In all patients undergoing anastomotic surgeries E-PASS scores should be calculated prior to surgery and if CRS is more than 0.9 alternative options for anastomosis should be considered.

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