

EVALUATION OF PROGNOSTIC FACTORS IN OUTCOME OF BOWEL ANASTOMOSIS***Dr. Ajinkya N. Puppal and Dr. A. Y. Kshirsagar**

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ABSTRACT

Background and objective: Bowel anastomosis is the surgical procedure done in order to establish communication between two formerly distant portions of the bowel. This surgical procedure restores bowel continuity after the removal of a pathological condition affecting the intestines. A dangerous complication of bowel anastomosis is anastomotic leak causing peritonitis, which is related with a high morbidity and mortality. Good surgical technique and obedience to fundamental principles is vital to ensure successful outcome after bowel anastomosis. Safety in the gastrointestinal surgery may therefore depends to a great extent on the factors that affect the healing of anastomosis. Our information of the gastrointestinal surgery has developed slowly over centuries from a mystical to a scientific level over many eras. Today, surgeries on the gastrointestinal tract are among the most frequent surgical procedures. Our information of the gastrointestinal healing has progressed and we have better understanding of the influence of local and systemic factors on anastomotic healing. Nonetheless, anastomotic leak and dehiscence continue to be recurrent and serious difficulties related with high morbidity and mortality. This study was designed to identify risk factors for anastomotic leakage following bowel anastomosis, to study the incidence of early complications after bowel anastomosis and to study mortality rates for bowel anastomosis. **Methods:** This study is the prospective hospital based time bound study concerning all patients undergoing **Intestinal Resection and Anastomosis** at Krishna Institute of Medical Sciences from 1st December of 2016 to 30th June of 2018. Information was collected from detailed history, clinical examination and investigations (both hematological and radiological investigations) on the patients. A total of 50 patients undergoing resection and anastomosis for different diseases were studied. **Results:** In present study, there were 30 male patients (60%) and 20(40%) female patients. The age of the patients in this study ranged from 18 to 85 years. 43(86%) patients underwent anastomosis in the emergency setting and 7(14%) underwent anastomosis in elective setting. In this study out of 50 total patients, 46 patients (92%) underwent end to end anastomosis, 2 patients (4%) underwent end to side anastomosis and 2 patients (4%) underwent side to side anastomosis. The risk factors which are known to influence the outcome of bowel anastomosis particularly the occurrence of the anastomotic leak were observed and recorded including age, anaemia, hypoalbuminaemia, emergency surgery, peri-operative use of steroids, and intra-abdominal sepsis. The anastomotic leak rate was 27.77%, 40%, 40%, 23.25%, 42.85% and 37.5% respectively. The incidence of early post op complications including surgical site infections, anastomotic disruptions, septicaemia, acute renal failure, respiratory complications and abdominal wound dehiscence were 33%, 22%, 30%, 8%, 30% and 4% respectively. **Interpretation and Conclusion:** Bowel anastomosis conveys a substantial mortality and the morbidity. Emergency small bowel anastomoses and intra abdominal sepsis carry a high risk of anastomotic leak despite detail to technical details during construction. Anastomotic leak rate is not effected by the kind of anastomosis used. Malnourished (with low serum albumin levels) patients are at a high risk for developing anastomotic leak, surgical site infection, morbidity and mortality following intestinal anastomosis. Serum albumin levels can be used as an easy, reliable and economical prognostic pointer in predicting the result of bowel anastomoses. This can be valuable to the surgeon in surgical decision making as well as explanation of the prognosis and surgical risk to the patient. Patients with intra-abdominal sepsis as well as patients treated with perioperative steroids for pulmonary co-morbidity convey a significant risk for anastomotic leak. Therefore in this patient group, it is suggested that anastomoses should be protected by a diverting stoma or Hartmann procedure must be considered to avoid Anastomotic dehiscence.

KEYWORDS: Intestinal anastomosis; Anastomotic leak; Anastomotic dehiscence; Prognostic factors in Anastomotic healing.

INTRODUCTION

Bowel anastomosis is a operative procedure to establish communication between two formerly distant parts of the intestine. The procedure restores bowel continuity after elimination of a pathological condition affecting the intestines. Intestinal anastomosis is one of the most frequently performed operative procedures, especially in emergency setting, and is also frequently performed in the elective setting when resections are done for benign or malignant lesions of the GIT.

A catastrophic complication of bowel anastomosis is anastomotic leak causing peritonitis, which is related with high morbidity and mortality. Proper operating technique and obedience to fundamental principles is imperative to warrant successful outcome after intestinal anastomosis. Safety in gastrointestinal surgery may therefore depend to a larger extent on the factors that affect the healing of anastomosis.

Our knowledge of GI surgery has developed slowly over the centuries from a mystical to a scientific level over several centuries. Today, operations on GIT are among the most common surgical procedures. Our knowledge of gastrointestinal healing has progressed and we have better understanding of the effect of local and systemic factors on anastomotic healing. Nonetheless, anastomotic leakage and dehiscence continue to be frequent and also serious problems related with high morbidity and mortality.

Here in this thesis, I have made an effort to study the effect of several host related factors on the result of bowel anastomosis and determine incidence of early operative complications of bowel anastomosis in all patients undergoing bowel anastomoses for various diseases and indications in the department of general surgery at Krishna Institute of Medical Sciences from 1st December of 2016 to 30th June of 2018.

METHODOLOGY

This study is a prospective study involving all the patients undergoing **Intestinal Resection and Anastomosis** at Krishna Institute of Medical Sciences from 1st December of 2016 to 30th June of 2018.

Data was collected from detailed history, clinical examination and investigations (both hematological as well as radiological) on the patients.

A total of 50 patients undergoing resection and anastomosis for various diseases and indications were studied.

OBJECTIVES

1. To identify the risk factors for anastomotic leak after intestinal anastomosis.
2. To study the incidence of early complications (anastomotic leak, intra-abdominal abscess, sepsis,

surgical site infection and wound gaping) following intestinal anastomosis.

3. To study mortality rates for bowel anastomosis.

Inclusion Criteria

All the patients (aged above 18yrs) admitted to surgical wards and undergoing intestinal resection and primary anastomosis during study period at Krishna Institute of Medical Sciences, Karad.

Exclusion Criteria for Selection of Cases

1. Patients aged below 18yrs.
2. Patients undergoing an initial diversion procedure and simple closure of stoma later.
3. Patients undergoing gastrointestinal and biliary-enteric anastomosis.

METHODS OF COLLECTION OF DATA

The relevant data required for the study were collected by using:

- Detailed history
- Hematological investigations: Hemoglobin, Serum Proteins and Albumin, Serum Electrolytes-Sodium and Potassium.
- Radiological investigations like X-Rays and CT Scans when required.
- Operative Details and Techniques Used.
- Post-operative follow up for any early complications till the discharge of patient.

Variables chosen for analysis

Variables were chosen for the analysis based on the results of previous studies. The risk factors which are known to effect the outcome of bowel anastomosis chiefly the occurrence of the anastomotic leak were observed and noted. The risk factors recorded in this study are:

- Old age (60 years and above)
- Anaemia
- Hypoalbuminemia
- Emergency surgery
- Intra-abdominal sepsis
- Perioperative use of steroids

Anaemia is defined as serum haemoglobin levels of less than 10g/dl. Hypoalbuminemia is defined as serum albumin levels of less than 3.5grams/dl.

Preoperative preparation

All the patients who underwent an elective resection and anastomosis received mechanical bowel preparation with polyethylene glycol solution with or without soap water enemas, a day before the operation. All the patients received prophylactic intravenous antibiotics (most commonly, a combination of third generation cephalosporin and metronidazole) pre-operatively and antibiotics were continued for 5-7 days post-operatively, depending on the surgeons choice.

All the patients with peritonitis received antibiotics for 7-15 days post operatively. Antibiotics were changed postoperatively, if considered required. No preoperative oral antibiotics were used. All the procedures were open surgeries. In the emergency surgeries, all patients were improved hemodynamically before the surgery using crystalloids (and blood or ionotropes if required).

Operative data

The technique of anastomosis varied according to surgeon's choice and also the suture material used for anastomosis. A thorough peritoneal lavage with normal saline was given in all the patients with intra-abdominal contamination. A pelvic drain or a drain at anastomotic site was kept in all the patients. Additionally, few patients had another drain kept at subhepatic space or the pelvis.

Mortality And Mortality Data Collection

The post-operative morbidity and mortality were defined as specific complications and in-hospital deaths respectively.

Patients were followed up during the post-operative hospital stay till the day of discharge and specific complications if any were recorded.

Surgical site infection was defined according to CDC guidelines.

Diagnosis of anastomotic leak

Anastomotic disruption was diagnosed in patients with efflux of bowel contents through the surgical wound or the drain.

Only clinically evident anastomoses were recorded and routine postoperative contrast studies were not done in this study.

Statistical Analysis

Comparisons between groups were analyzed by the chi-square test and p value of <0.05 was considered statistically significant.

RESULTS

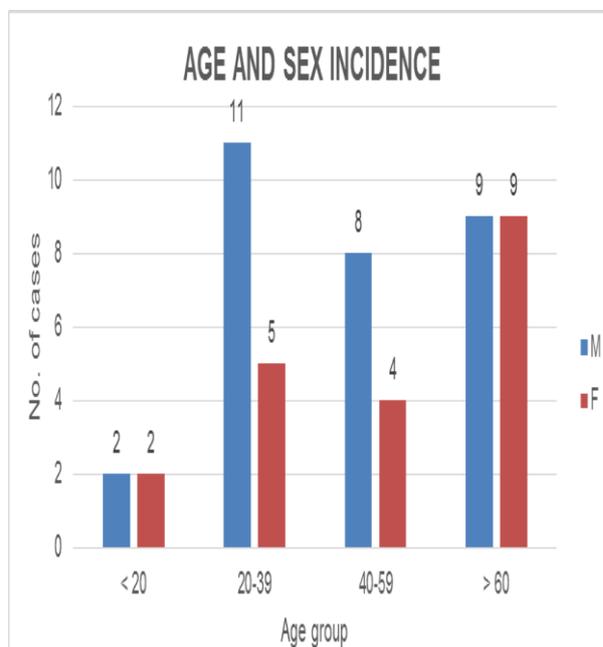
The total number of cases observed and studied was 50. The study included the patients undergoing both emergency and elective surgeries with various indications for resection and anastomosis of bowel during the study period. These patients were considered for the study using the inclusion and exclusion criteria as mentioned above.

AGE AND SEX INCIDENCE

In present study, there were 30(60%) male patients and 20(40%) female patients. The age of the patients in this study ranged from 18 to 84 years.

Table 6: Demographic distribution of study population.

Sl. No	Sex		No of pts
	M	F	
< 20	2	2	4
20-39	11	5	16
40-59	8	4	12
> 60	9	9	18
Total	30	20	50



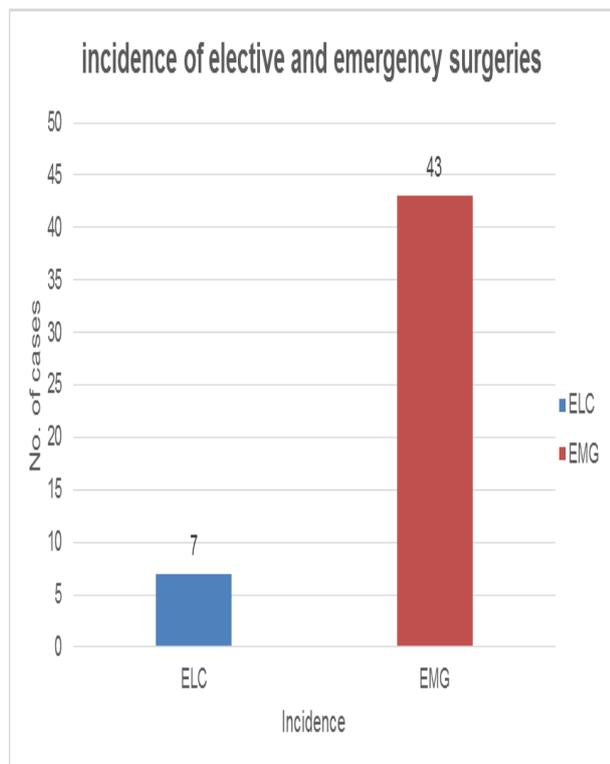
Graph 1: demographic distribution of study population.

Incidence of Emergency and Elective Surgeries

43 (86%) patients underwent anastomosis in the emergency setting and 7 (14%) underwent anastomosis in elective setting.

Table 7: Incidence of elective and emergency surgeries.

	Frequency	Percent
ELC	7	14%
EMG	43	86%
Total	50	100%



Graph 2: Distribution of emergency and elective surgeries among study population.

Type of Anastomosis

In this study out of 50 total patients, 46 patients (92%) underwent end to end anastomosis, 2 patients (2%) underwent end to side anastomosis and 2 patients (4%) underwent side to side anastomosis.

Table 8: Distribution of type of anastomosis in the study population.

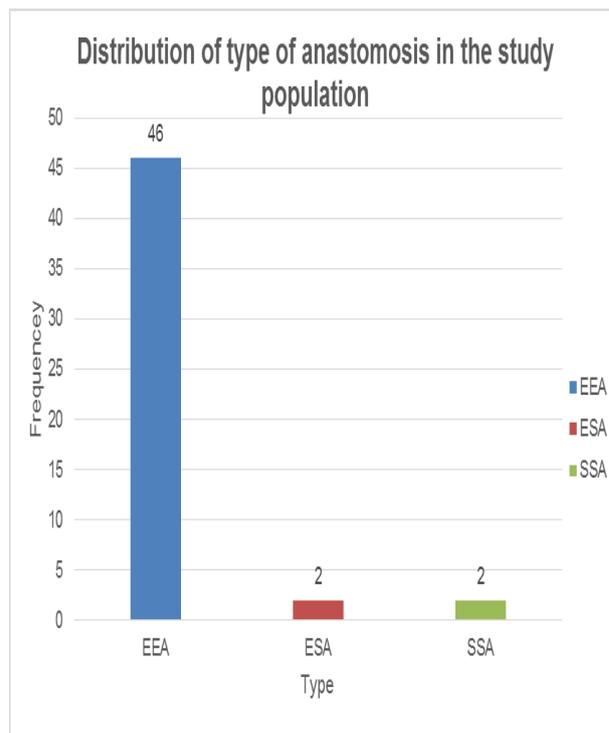
Type	Frequency	Percent
EEA	46	92%
ESA	2	4%
SSA	2	4%
Total	50	100%

Table 9: Incidence of different Host-related risk factors in study population.

sl.no	Risk factor	No of pts	Percentage
1	Old age(60yrs or older)	18	36%
2	Anaemia	15	30%
3	Hypoalbuminemia	20	40%
4	Perioperative steroid use	14	28%

Table 10: Incidence of Disease associated prognostic factors in study population.

sl.no	Risk factor	No of pts	Percentage
1	Emergency surgery	43	86%
2	Intra-abdominal sepsis	24	48%

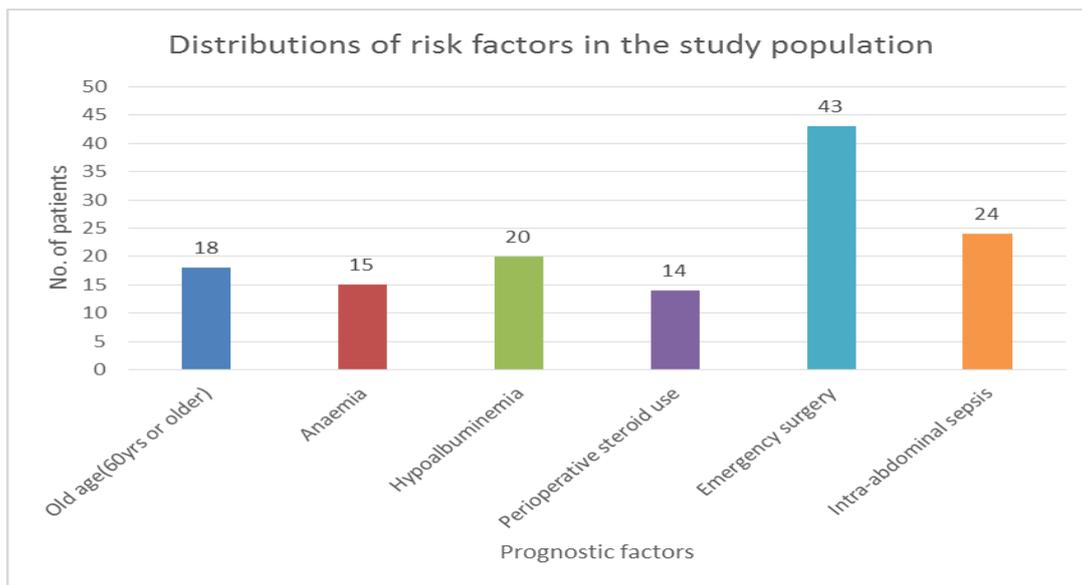


Graph 3: distribution of type of anastomosis in the study population.

Risk Factors Predicting the Outcome of Bowel Anastomosis

The prognostic factors which are acknowledged to have an effect on the result of intestinal anastomosis particularly the incidence of the anastomotic dehiscence were observed.

The following risk factors were recorded in the study:



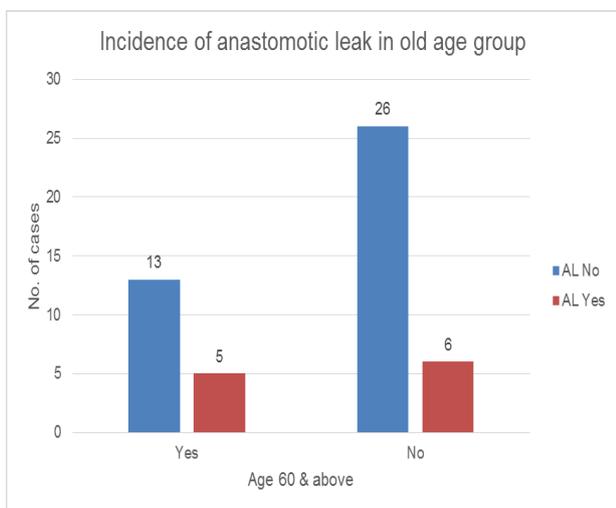
Graph 4: Distributions of risk factors in the study population.

Correlation Between Old Age And The Anastomotic Leak Rates

The number of patients aged 60 years and above in this study is 18(36%). The rate of anastomotic leak is 27.77% (5 patients) and p value is 0.459(<.05).

Table 11: Incidence of anastomotic leak in old age group.

Age 60 & above	AL		Total
	No	Yes	
Yes	13	05	18
No	26	6	32
Total	39	11	50



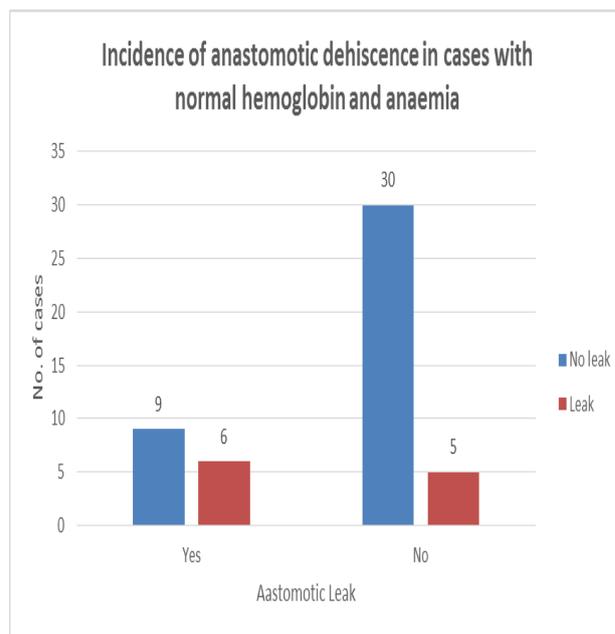
Graph 5: Incidence of anastomotic leak in old age group.

Correlation Between Anaemia And Anastomotic Leak Rates

A total of 15 patients (30%) had anaemia in this study. The anastomotic leak rate in anaemic patients is 40% (6 patients) and p value is 0.044 (<.05).

Table 12: Incidence of anastomotic leak in anaemic patients.

Anaemia	Anastomotic Leak		Total
	No Leak	Leak	
Yes	9	6	15
No	30	5	35
Total	39	11	50



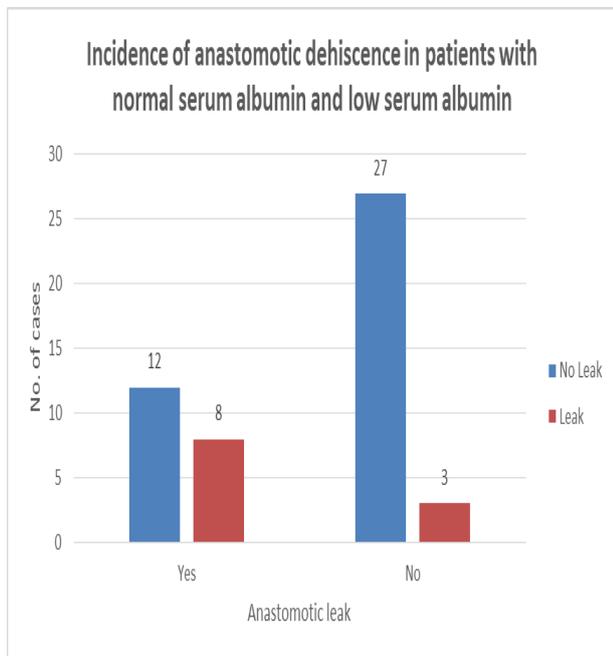
Graph 6: Incidence of anastomotic dehiscence in cases with normal hemoglobin and anaemia.

Correlation Between Hypoalbuminemia With The Anastomotic Leak Rates

A total of 20 patients (40%) had hypoalbuminemia in this study. The anastomotic leak rate in patients with hypoalbuminemia is 40% (8 patients) and p value is 0.012 (<.05).

Table 13: Incidence of anastomotic leak in patients with low serum albumin.

Hypoalbuminaemia	Anastomotic leak		Total
	No Leak	Leak	
Yes	12	8	20
No	27	3	30
Total	39	11	50



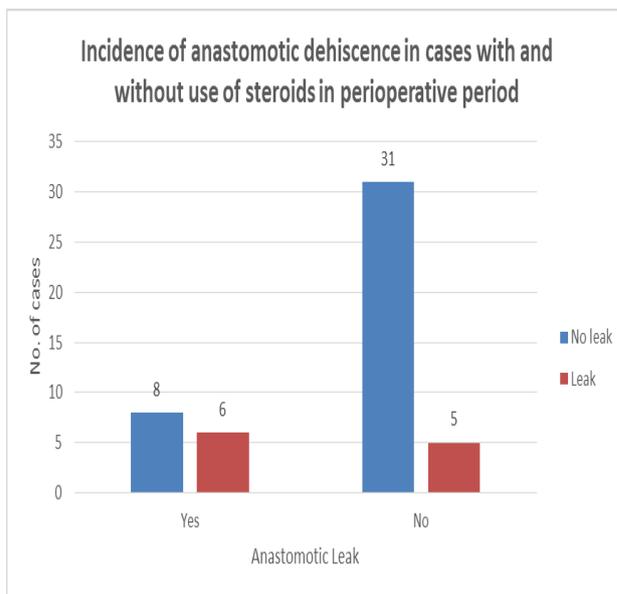
Graph 7: Incidence of anastomotic dehiscence in patients with normal serum albumin and low serum albumin.

Correlation Between Peri-Operative Use of Steroids And Anastomotic Leak

Systemic steroids were used in 14(28%) patients in the study group. Anastomosis leak rate among these patients was found to be 42.85% (6 patients) and p value was 0.026 (<.05).

Table 14: Incidence of anastomotic dehiscence in patients with use of steroids in perioperative period.

Peri Op steroid use	Anastomotic leak		Total
	No Leak	Leak	
Yes	8	6	14
No	31	5	36
Total	39	11	50



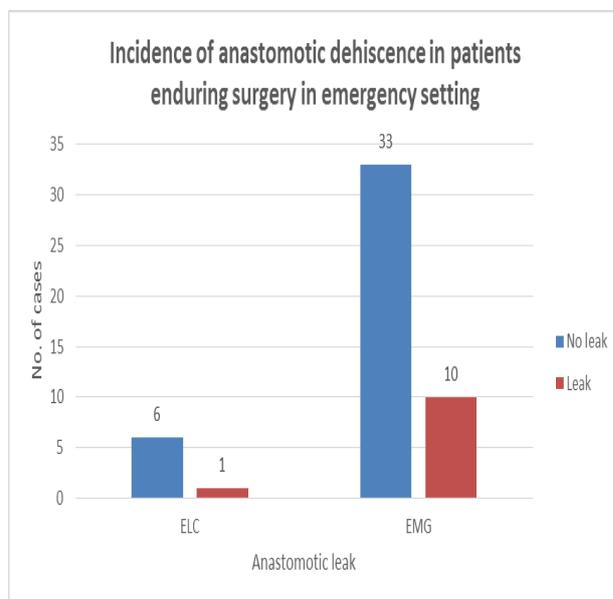
Graph 8: Incidence of anastomotic dehiscence in cases with and without use of steroids in perioperative period

Correlation Between Emergency Surgery With Anastomotic Leak Rates

43(86%) surgeries were done on emergency basis .The rate of anastomotic leak was 23.25% (10 patients) and p value was 0.595 (>.05).

Table 15: Incidence of anastomotic leak in patients undergoing emergency surgery.

Elective/ Emergency	Anastomotic leak		Total
	No Leak	Leak	
ELC	6	1	7
EMG	33	10	43
Total	39	11	50



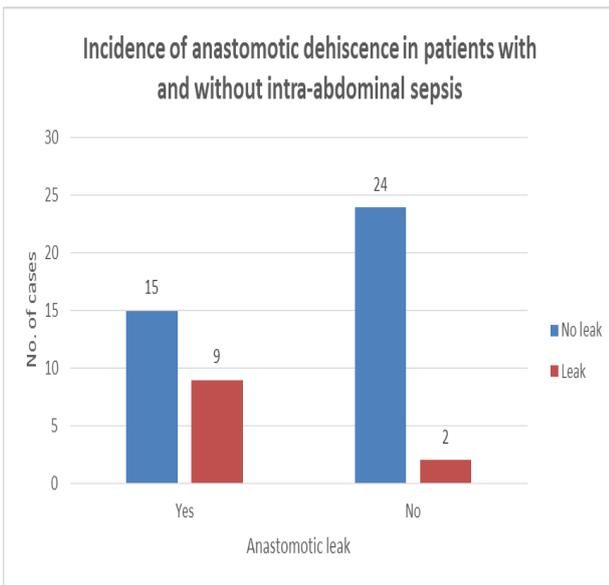
Graph 9: Incidence of anastomotic dehiscence in patients enduring surgery in emergency setting.

Correlation Between Presence Of Intra-Abdominal Sepsis With Anastomotic Leak Rate

24 patients (48%) in this study had intra-abdominal sepsis. The rate of anastomotic leak was 37.5% (9 patients) and p value was 0.011 (<.05).

Table 16: Incidence of anastomotic dehiscence in patients with intra-abdominal sepsis.

Intra abdominal sepsis	Anastomotic leak		Total
	No Leak	Leak	
Yes	15	9	24
No	24	2	26
Total	39	11	50



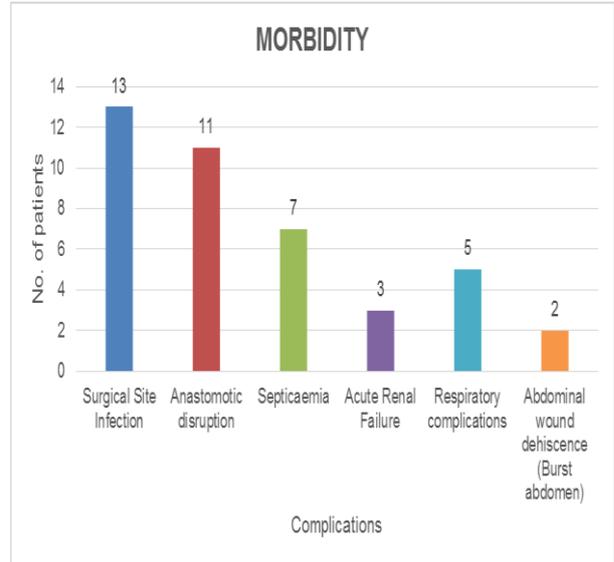
Graph 10: Incidence of anastomotic dehiscence in patients with and without intra-abdominal sepsis.

Morbidity

Postoperative morbidity was observed in 15(30%) patients. Most frequently observed complication was the Surgical Site Infection (26%). The observed complications were as follows:

Table 17: Complications observed and number of patients affected.

Sl. no	Complications	No of patients	Percentage
1.	Surgical Site Infection	13	26%
2.	Anastomotic disruption	11	22%
3.	Septicaemia	7	14%
4.	Acute Renal Failure	3	6%
5.	Respiratory complications	5	10%
6.	Abdominal wound dehiscence (Burst abdomen)	2	4%



Graph 11: Complications following the intestinal anastomosis. Septicaemia, Respiratory complications, Surgical site infections, anastomotic leak, Acute renal failure, Burst abdomen.

Mortality

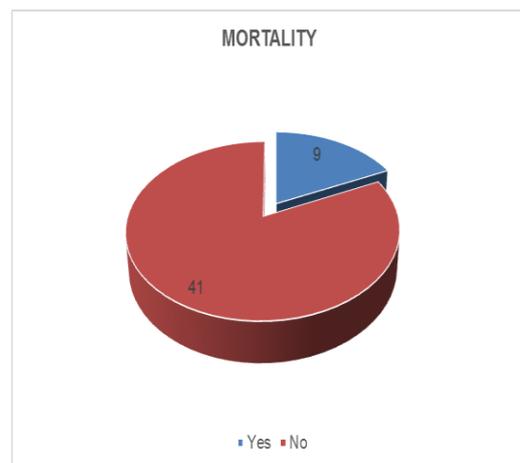
The mortality rate in the present study is 18% (9 patients). Anastomotic disruption was associated in death of 1 patients (11.11%).The causes of the mortality were as follows:

Table 18: Causes of mortality and No of patients affected

S. no.	Causes of mortality	No of patients
1	Septicaemia	2 (55.55%)
2	Anastomotic leak	1 (11.11%)
3	Cardiorespiratory causes	6 (66.66%)

Table 19: Incidence of death and mortality rate in the study.

Mortality	Frequency	Percent
Yes	9	18%
No	41	82%
Total	50	100%



Graph 12: distribution of mortality in the study.

DISCUSSION

Intestinal anastomosis is an operative procedure to form communication between two formerly distant portions of the bowel. This procedure reestablishes intestinal continuity after removal of a pathology affecting the bowel.

Our information of the gastrointestinal healing has progressed and we have greater understanding of the impact of local and systemic factors on the anastomotic healing. Nonetheless, anastomotic leakage and dehiscence remain common and serious problems associated with high morbidity and mortality.

This is a prospective study carried out on all the patients undergoing **Intestinal Resection and Anastomosis** at Krishna Hospital and Medical Research Centre, Karad.

Anastomotic Leaks

A dangerous complication of intestinal anastomosis is anastomotic leak causing peritonitis, which results in high morbidity and mortality rates.^[10] The factors which add to anastomotic leak include hypoalbuminemia,^[6,10] advanced age,^[5,9] presence of intra-abdominal sepsis,^[7] rectal location of the disease,^[50] ASA grade 2 or above,^[50] perioperative blood transfusion,^[10] and anaemia.^[8,13]

The rate of anastomotic leak observed in this thesis is 22%. The reported rate of anastomotic leak ranges between 0.8 to 35%.^[5,6,9,10]

Table 20: Comparison of anastomotic leak rates of present study with previous reported data.

Studies	Reported Rates of Anastomotic Leak
Amit Nair et al ^[6]	35%
Ashok kumar et al ^[9]	14.6%
Jeffrey Hammond ^[5]	6.18%
Theodore R. Schrock et al ^[8]	4.5%
Neil Hyman ^[12]	2.7%
Paul Suding ^[11]	3.6%
W.L.E.M.Hesp ^[7]	Without intra-abdominal infection-0.8% With intra-abdominal infection-7.3%
Present Study	22%

Hypoalbuminemia, intra-abdominal sepsis, anemia, old age and peri operative steroid use were the prognostic factors which were found to be statistically significant. Hypoalbuminemia is very crucial for development of anastomotic leak.^[6,10,11] The method through which malnutrition affects anastomotic healing is not entirely understood and may be owing to lack of amino acids that are essential for collagen synthesis or due to worsening in patients immunocompetence. Hypoalbuminemia causes impairment of the innate immune response; hypoalbuminemia is identified to cause impairment of

macrophage activation and induce macrophage apoptosis.^[14,61,36]

In the study group, 14 patients required administration of systemic steroids indicated for respiratory complications in view of old age, COPD and chronic smoking habit. Of the 14 patients, 6 (42.85%) patients developed anastomotic leak which was also statistically significant. Anastomotic leak was spontaneously closed in 5 patients and one patient was re-operated.

All the anastomotic leaks were diagnosed by clinical criteria stated earlier. The mean postoperative period for diagnosis of clinical AL was 9.4 days (5-14 days). Most of the anastomotic leaks were diagnosed between 5-10 days (9 patients) post-operatively. One patient developed anastomotic leak on post-op day (POD) 11th and another patient on 12 POD.

9 patients (81.1%) with AL were managed conservatively. Among them, 7 patients had spontaneous closure of the leak and 2 patients went against medical advice and couldn't be followed up. 2 patients underwent reoperation for AL. 1 patient underwent temporary ileostomy and succumbed to death on the following day. Another patient underwent re-resection and anastomosis with diversion ileostomy. Patient recovered well post operatively and ileostomy closure was done after two and half months.

Anastomotic leak accounted for 11% of all deaths (1 death). This is lesser than the studied range of 12-37%.^[8,12,56]

Morbidity

The morbidity rate in our study is 30% which is within range compared to the reported series. The morbidity in the intestinal anastomotic surgery ranges between 21%-56.6%.^[6,8,9,12]

Table 21: Comparison of Morbidity of present study with the reported studies.

Studies	Reported rate of morbidity
Ashok kumar et al ^[9]	51.8%
Amit Nair et al ^[6]	44.2%
Arnaud Alves et al ^[12]	35%
Gupta PK et al ^[65]	56.6%
H Wegstapel ^[17]	21%
Present Study	30%

The morbidity in our study must be contributed to the higher incidence of hypoalbuminemia (40%),^[12] peritoneal contamination (48%)^[12] and emergency surgeries (86%)^[58] in our study. Arnaud Alves et al.^[12] and Varut Lohsiriwat et al,^[16] have shown significant association between morbidity and hypoalbuminemia. Gibbs,^[57] et al has observed among major non cardiac surgery cases that a reduction in serum albumin from

more than 4.6g/dl to less than 2.2g/dl was related to an increase in morbidity rates from 10% to 65%.

Mortality

The mortality rate in the present study is 18%. The mortality rate in the reported literature ranges between 1.5%-30%.^[6,7,11,12,17]

Table 22: Comparing the mortality rate of present study with previous studies.

Studies	Reported rate of mortality
H Wegstapel ^[17]	Overall-17% With abdominal previous surgeries-30%
Amit Nair et al ^[6]	17.1%
W.L.E.M.Hesp ^[7]	18%
Arnaud Alves et al ^[12]	3.4%
Gupta PK et al ^[65]	27.9
Paul Suding ^[11]	1.5%
Present study	18%

Most common procedure in our study was emergent small bowel resection and anastomosis (60%). Amit et al,^[6] reported a mortality rate of 17.1% in their prospective study on patients undergoing emergent small bowel resection. H Westapel et al,^[17] reported that the mortality rate of 18% and it increased to 30% in patients with no history of previous abdominal surgeries. Only 4 of our patients gave history of previous abdominal operations.

The most frequent cause for mortality was cardiorespiratory causes (66.6%). This can be explained by the higher incidence of patients undergoing surgery in emergency setting and other underlying co morbidities. The anastomotic leak resulted in death of 1 patients (11.1%) which is less than the reported range of 12-37%.^[8,12,56] The death rate was greater in elderly patients, patients undergoing emergency surgeries, hypoalbuminemia and presence on intra-abdominal contamination. The association between the emergency surgery and mortality has been shown by Arnaud Alves et al.^[12] Gibbs et al,^[57] demonstrated an exponential increase in postoperative mortality from less than 1% to 29% with the decrease in serum albumin levels from 46g/L to 21g/L.

Malnutrition is a risk factor of postoperative mortality. Serum albumin is the best prognostic indicator of the nutritional status because of its ability to detect protein-energy malnutrition, which is not necessarily accompanied by lower body weight and might not be clinically recognizable.^[57]

Surgical Site Infection

The rate of SSI in the present study is 26%. The rate of SSI reported in the literature ranges between 4.3% to 42.8%.^[6,8,15,47,48] The reported SSI in the present study is comparable to that of Eliana Kalakouti.^[66]

Table 23: Comparing the SSI rate of study present study with reported literature.

Studies	Reported rates of ssi
Amit Nair et al. ^[6]	42.8%
Eliana Kalakouti. ^[66]	21%
Reiping Tang. ^[15]	4.7%
Suzana Angelica et al ^[48]	Stapled-5.9% Hand Sewn-4.3%
Present Study	26%

SSI was the most common complication observed. The higher rates of SSI are secondary to higher incidence of class 4 wounds,^[15] with intra-abdominal contamination,^[55] and emergent procedures,^[55] in this thesis. The other cause related with increased risk of SSI is hypoalbuminemia (47.05% vs 15.3%).

Hypoalbuminemia is responsible for the causation of SSI following gastrointestinal surgery.^[14] It is known to increase the morbidity following colorectal resections.^[12] Most of the SSI were managed conservatively with antibiotics and by evacuation of pus by opening one or two sutures. One patient developed an intra-abdominal abscess and required a re-exploration for its evacuation.

2 patients developed abdominal wound dehiscence in this study and all of them had low serum albumin levels.

In all, 8 of 50 patients were re-operated (16%). The indications for surgery in 2 of them was anastomotic dehiscence and 6 were operated for drainage of intra abdominal abscess.

The strong point of this thesis is its prospective nature. Limitations include the small sample size, non uniformity of surgical indications and lack of randomization.

CONCLUSIONS

- Intestinal anastomosis carries with it considerable mortality and the morbidity.
- Emergency small bowel anastomoses and intra-abdominal infection have a great risk of anastomotic leak despite attention to technical details during the procedure.
- Anastomotic leak rate is unaffected by the type of anastomosis performed.
- Malnourished (those with low serum albumin levels) patients are at a greater risk for developing anastomotic leak, SSI, morbidity & mortality following bowel anastomosis.
- Serum albumin levels can be used as a simple, reliable and economical prognostic marker in predicting the outcome of bowel anastomoses. This helps the surgeon in operative decision making as well as explaining the prognosis and operative risk to the patient.

- Patients with intra-abdominal sepsis and patients treated with perioperative corticosteroids for pulmonary disease carry a significant risk for anastomotic dehiscence. Therefore in this patient category, it is recommended that anastomoses should be protected by a diverting stoma.
- In the emergency setting, malnourished patients (after attending the primary pathology) should be ideally considered for creation of a temporary stoma to tide the crisis over and closure of stoma considered in second setting.
- However if an anastomosis is deemed necessary, these patients should be observed thoroughly for any signs of leak postoperatively and should be intervened at the earliest.
- Considering enteral nutritional optimization before elective surgery may be useful in reducing the morbidity and mortality rate.

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