

## Original Research Article

# Role of oral antibiotic preparation in bowel preparation for colorectal surgery in reducing surgical site infection

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### ABSTRACT

**Background:** Mechanical bowel preparation for colorectal surgeries is thought to clear the bowel lumen of stool, thus decreasing intraluminal pressure of hard, potentially impacting stool and reduce ischemia at the new anastomosis. This reduces the dreaded complication of organ space surgical site infection (SSI) that leads to anastomotic leak which is most commonly seen in colorectal surgeries. Oral antibiotic preparation is thought to reduce the bacterial concentration of colonic mucosa which is thought to further bring down the incidence of organ space SSI in colorectal surgery. Aim of this study was to evaluate the role of oral antibiotics given preoperatively as an adjunct to mechanical bowel preparation and intravenous antibiotics, in reducing SSI in colorectal surgeries.

**Methods:** Comparative study of 60 cases of colorectal surgery divided into two equal groups (group A-patients who received oral antibiotic preparations (OABP) with mechanical bowel preparations (MBPs) and ivAb preoperatively (oral antibiotic preparation and mechanical bowel preparation +intravenous antibiotic) versus group B-patients who only received MBP and ivAb preoperatively. Outcomes of SSI results were compared.

**Results:** Incidence of SSI in group A was 16% whereas it was 40% in group B. Incidence of anastomotic leak in group A was 3.3% and in group B was 13.3%. *E. coli* was found in the pus culture of 60% cases of SSI in study groups whereas *S. aureus* was found to be the causative organism in rest of the cases that developed SSI.

**Conclusions:** The study supports the use of OABP as an adjunct to MBP and ivAb preoperatively in colorectal surgery for the prevention of SSI and its related complications.

**Keywords:** Bowel preparation, Colorectal surgeries, Surgical site infection, Anastomotic leak

### INTRODUCTION

Surgical site infection (SSI) is one of the most common health care associated complications of colorectal surgery that leads to prolonged hospital stay, morbidity and emergency conditions like burst abdomen. In a tertiary health centre of a resource poor state like Bihar, this becomes a major issue in the setting of poor health standards and unhygienic living conditions and therefore preventive measures become all the more necessary to avoid occurrence of SSIs post-surgery.

SSIs encompass the infection of the area of body, internally and externally, that involves the entire operative site. SSIs can occur at superficial, deep and organ space level leading to prolonged hospital stays, weak scars and also increased readmission rates.

Numerous medical measures are advocated to reduce the incidence of such complications both preoperatively (smoking cessation, nutritional status improvement, colonic decontamination using oral antibiotics and intravenous antibiotics) and intraoperatively (hypothermia prevention, oxygen supplementation, skin preparation, abdominal wall protection and minimally invasive

approaches). Utilization of bowel preparations before elective colorectal surgeries has declined owing to the increased scrutiny being given to its practice.<sup>1</sup> Although long considered a standard component of preoperative care in colorectal surgery, MBP has consistently failed in numerous randomised clinical trials to demonstrate an independent protective effect against postoperative SSI or anastomotic leakage.<sup>2</sup> This lack of any identifiable benefit, combined with the discomfort that mechanical cleansing can cause patients, has led some to conclude that MBP should no longer be routinely performed.<sup>3</sup>

There are several potential or perceived advantages of mechanical bowel preparations (MBPs). Historically, the possibility of having the high bacterial load content of faeces coming in contact with a newly performed anastomosis led to the construction of a defunctioning stoma when colon was not prepared. An MBP was also thought to clear the bowel lumen of stool and leave only gas. Theoretically, this would decrease the intraluminal pressure of hard, potentially impacting stool, and reduce ischemia at the new anastomosis. In laparoscopic surgery, an empty colon may be easier to manipulate than a colon full of stool. And certainly, when the surgeon knows he or she needs to rely on palpation to locate the lesion, having an empty colon is an advantage. However, in recent years, the necessity and benefits of a MBP have been questioned and data supporting abandonment of this practice is mounting.

Calls for the abandonment of routine MBP have been met with strong reservation by other investigators, primarily because most of the trials that have suggested no benefit to MBP have failed to include the co-administration of oral antibiotic preparations (OABP) in their study protocols.<sup>4</sup> It is the oral antibiotic, not the mechanical cleansing, that reduces the bacterial concentration of colonic mucosa. The primary reason for mechanical cleansing is to reduce fecal bulk and thereby increase the delivery of oral antibiotics to the colonic mucosa. Those studies that have attempted to define the isolated association between MBP and post colectomy infectious complications are therefore fundamentally flawed if they do not include the co-administration of an OABP.

The purpose of this study was therefore to compare the incidence of SSI in patients receiving oral antibiotic as an adjunct to intravenous antibiotic and mechanical bowel preparation and patients who do not receive oral antibiotics preparations. Through this study the most commonly isolated microorganism will also be delineated in order to determine the most effective OABP against it. This will help in avoiding the unnecessary usage of broad spectrum antibiotics.

#### **Aims and objectives**

Aims and objectives of the study were to perform a prospective cohort study to evaluate the role of oral antibiotic preparation given preoperatively as an adjunct to

MBP and iv Ab in prevention of SSI in colorectal surgery. We also evaluated the role of OABP in prevention of anastomotic leak in colorectal surgery.

The pus from the cases that developed SSI was collected and sent for culture and sensitivity to determine the causative organism of SSI.

#### **METHODS**

This study was a prospective study started after taking all necessary permissions from the institutional ethics committee of Patna Medical College and Hospital. The due permissions from the head of department of surgery was also obtained.

#### **Study subjects**

Sample size was 60, obtained through convenience sampling method and patients were divided into two groups group A (patients receiving OABP along with MBP and ivAb preoperatively) and group B (patients receiving only MBP and ivAb preoperatively) by simple randomisation.

Convenience sampling method is a type of non-probability sampling that involves the sample being drawn from that part of population that is close to hand.

The sample size was taken by convenient sampling method after discussing with the college statistician. The sample size was also affected by the fact that many patients did not adhere to the treatment and did not give consent to be a part of the study. The fact that a portion of this study extends into the COVID-19 pandemic should also be kept in mind.

#### **Study duration**

The study took place from 01 October 2020 to 30 September 2022.

#### **Inclusion criteria**

All patients undergoing colorectal surgery requiring bowel preparation for various causes were included in this study.

#### **Exclusion criteria**

All such patients undergoing colorectal surgery who have undergone pre op radiotherapy and chemotherapy were not included in the study. All such patients who were immunosuppressed e.g. steroid dependent, HIV/AIDS, were not included in this study.

#### **Pre requisites**

A preformed proforma eliciting patient's demographic details, chief complaints along with history, clinical

findings on physical examination, laboratory assessment and follow up observations of all cases were maintained.

All patients of group A and group B were instructed to switch to clear fluids and additionally the patients were administered 2 litres of oral polyethylene glycol till 6 pm in the evening before the surgery. Both groups were given intravenous ceftriaxone 1 g 1 hour prior to skin incision and the dosage was repeated in case the surgery lasted for more than 4 hours. Additionally, group A patients were given oral antibiotic preparation of metronidazole 500 mg at 2 pm, 4 pm and 6 pm on the day before the operation.

**Surgical technique**

All the colorectal surgeries were performed by senior consultant surgeon. The affected segment of the bowel was resected as per the standard technique (abdomino perineal resection) in cases of carcinoma cases requiring the same. The anastomosis in both the cases (Hartmann’s reversal and colonic carcinoma) were end-to-end extra mucosal single layer type of anastomoses. Suture material used was vicryl 2-0. Mucosal eversion was strictly avoided. Only enough pressure was applied to the suture to avoid ischaemia of the anastomosis. The edges of the mesentery were closed to prevent any internal herniation.

**Follow up**

In terms of post op data, we studied the incidence of SSI and anastomotic leaks in both the study groups. Also the causative organism isolated from the pus of patients that developed SSI was detected. The data collected was compared between the two groups and presented in tabular form after analysis. The findings were compared with those of previous study to come to a conclusion.

**RESULTS**

This study consists of a total of 60 cases undergoing colorectal surgery. 2 groups, group A and B were evaluated for incidence of SSI to evaluate the role of OABP in prevention of SSI in colorectal surgery.

**Incidence of SSI in study group**

Out of 30 patients in the group A, 5 developed SSI and in 30 group B patients, 12 developed SSI. Incidence of SSI in group A and group B was found to be 16% and 40%, respectively. Hence, the overall incidence was found to be 28%. The p value was 0.044 which was significant.

**Incidence of anastomotic leak in study groups**

In this study, 2 patients (3.3%) developed anastomotic leak in group A whereas 8 patients (13.3%) developed anastomotic leak in group B. The p value was found to be 0.037 which is significant, i.e. group A has significantly less anastomotic leak rate due to the usage of OABP as an

adjunct to MBP+ivAb. Overall leak rate is 16% (10 out of 60) in both study groups.

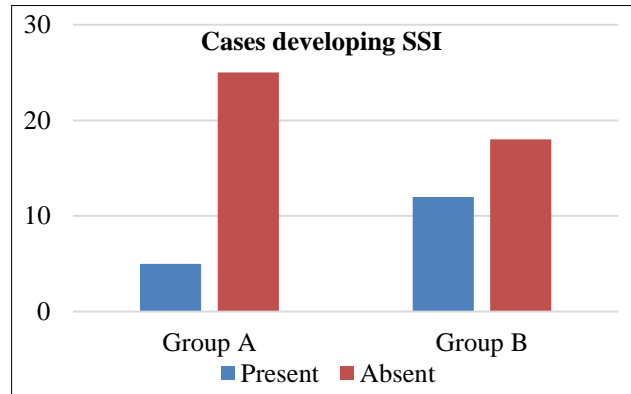


Figure 1: Cases developing SSI in two group.

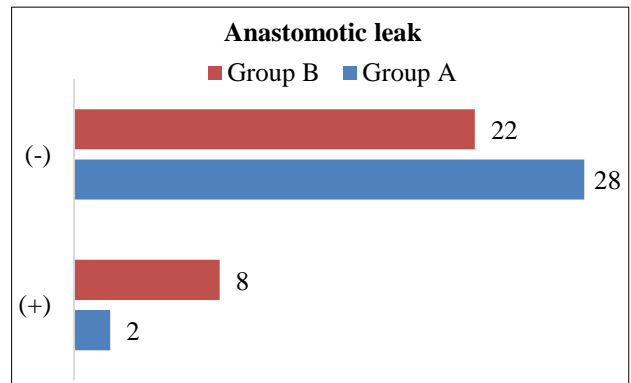


Figure 2: Cases developing anastomotic leak.

**Organism isolated from the pus culture of cases developing SSI**

In group A, the causative organism for SSI in 3 of the 5 cases were found to be *E. coli* while *S. aureus* was isolated from the pus culture of other 2. In group B, the causative organism for SSI in 7 out of 12 patients were found to be *E. coli*, while *S. aureus* was isolated from pus culture of other 5 cases. Thus, 60% of the total cases developing SSI in the two study groups were caused by *E. coli* whereas, *S. aureus* caused SSI in the remaining cases.

Table 1: Microorganism isolated from the pus culture of patients developing SSI.

Bacteria isolated	Group A	Group B	P value	Test of significance
<i>E. coli</i>	3	7	1	Chi square test
<i>S. aureus</i>	2	5		

**DISCUSSION**

In this study, we assessed the impact of pre-operative bowel preparation done for elective colorectal surgeries at

surgery department of Patna Medical College and Hospital. We found that patients who received combined MBP+OABP+ ivAb preoperatively, sustained a lower incidence of postoperative SSI and anastomotic leakage when compared to the group receiving only MBP+ivAb preoperatively.

Chen et al in their study reported incidence of SSI to be significantly lower in patients receiving OABP+MBP+ivAb compared with patients who received systemic antibiotics alone and mechanical bowel preparation, i.e., 7.2% in the former group whereas 16% in latter (p value was 0.00001 and significant).<sup>5</sup>

Kiran et al in their study posted the incidence of SSI in mechanical bowel preparation along with OABP and ivAb to be 6.2% whereas 12.1% cases in their study developed SSI that received only MBP+ivAb preoperatively.<sup>6</sup>

In a study by Anjum et al 8 and 26 surgical site infections occurred in the mechanical bowel preparation with oral antibiotics and mechanical bowel preparation groups, respectively.<sup>7</sup>

Scarborough et al in their study of total 4999 patients, concluded that combined OABP with mechanical cleansing result in significance lowering of SSI rates in colorectal surgeries, as in their study 3.2% patients who received combined preparation developed SSI whereas 9% patient who received only mechanical bowel cleansing developed SSI.<sup>8</sup>

Cannon et al through their study made a similar conclusion as their study demonstrated the superiority of combined preparation of MBP+OABP+ivAb over MBP+ivAb alone with 9.2% patients receiving oral antibiotics plus mechanical bowel preparation developed SSI whereas 20% patients who received only mechanical bowel preparation developed SSI.<sup>9</sup>

In our study the incidence of SSI in patients receiving oral antibiotic preparation along with mechanical bowel preparation was found to be 16% whereas the incidence of SSI in patients receiving only mechanical bevel preparation was found to be 40%.

Chen et al in their study demonstrated that of MBP+OABP+ivAb did not reduce anastomotic leakage as the incidence was 4% whereas incidence of anastomotic leakage among patients receiving only MBP+ivAb to be 4.8%.<sup>5</sup>

Kiran et al through their study demonstrated a similar finding in their study with 3.5% patients who received combined preparation developed anastomotic leakage and 2.1% patients receiving only mechanical cleansing developed the same. The study demonstrated no beneficial effect of combined preparation in reducing anastomotic leakage in colorectal surgery.<sup>6</sup>

The study done by Scarborough et al however demonstrated a contrasting result from the above two studies in the role of combined preparation in reducing anastomotic leakage.<sup>8</sup> The incidence of anastomotic leakage in their study for combined preparation was 2.8% whereas it was 5.7% in the group receiving only mechanical bowel preparation. This showed that combined preparation could significantly reduce anastomotic leakage in their subjects.

Our study showed a significant role of combined preparation in lowering the incidence of anastomotic leakage in colorectal surgery, with only 3.3% subjects developing anastomotic leakage in the combined group whereas, 13.3% patients in the MBP+ivAb only group developed the aforementioned complication.

In a study done by Sahu et al most of the wound cultures showed monobacterial growth, of which *Escherichia coli* (50%) followed by *Staphylococcus aureus* (20%) was noted.<sup>10</sup>

Our showed a similar incidence of *E. coli* and *S. aureus* as causative organism of SSI post colorectal surgery, with 60% and 40% incidences, respectively.

### Limitations

The sample size of our study is less resulting in low number of patient in each study groups. Also the follow up period was short (15 days post-surgery) and so the long-term results of each study group in terms of re admission rates and late presentation of other complications could not be taken into account in the result of this study.

### CONCLUSION

The observation and results of this study concluded that usage of oral antibiotic (metronidazole) in addition to the usual mechanical bowel preparation and intravenous antibiotics has a remarkably good impact on reduction of surgical site infections and post-operative complications (anastomotic leaks) following colorectal surgery.

An addition of oral antibiotic to the usual bowel preparation shows improved rates of recovery in patients undergoing colorectal surgery with cost effective, less hospital stays and reduced morbidity and mortality following a major surgical procedure. Better surgical outcome after a major surgery provides a confidence both to the patient and the doctor.

Therefore, every patient undergoing a colorectal surgery who needs bowel preparation a day prior to the surgery should include an additional oral antibiotic for better surgical outcome.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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