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# Analyzing the Role of Mechanical Bowel Preparation on Surgical Outcomes in Colorectal Surgery

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## ABSTRACT

Despite improved postoperative recovery from the use of minimally invasive procedures and enhanced recovery after surgery protocols in recent decades, colectomy is still associated with morbidity. Surgical site infections range from trivial wound infections to potentially deadly colonic anastomotic leaks. **Objectives:** To compare the outcome results regarding postoperative complications of Mechanical Bowel Preparation and Non-Medical Bowel Preparation groups in elective colorectal surgery at a Tertiary Care Hospital in Peshawar, Pakistan. **Methods:** The research was a quasi-experimental study. In this study, 210 patients were included; they were divided into 2 groups: Mechanical Bowel Preparation Group and the Non-Mechanical Bowel Preparation Group. Data were collected through electronic health records. The data were analysed using SPSS software version 26.0. Descriptive statistics, such as the Chi-Square test, were applied to the results. **Results:** There was no statistically significant difference regarding the surgical outcomes and the demographics between the Mechanical Bowel Preparation and Mechanical Bowel Preparation groups. The escalation of the surgical site infection looked lower when the Mechanical Bowel Preparation was not in use i.e 20 (19.05%) in the Mechanical Bowel Preparation group and 14 (13.33%) in the Non-Mechanical Bowel Preparation group, but it did not seem to be, statistically significant; p-value=0.261014. The anastomotic leak rates and intra-abdominal collection rates do not differ significantly between the two groups; p>0.05. **Conclusions:** It was concluded that there was no statistical significance between the groups of mechanical bowel preparation and non-mechanical bowel preparation concerning surgical site infections, anastomotic leakages, and other colorectal surgery complications.

## INTRODUCTION

Patients undergoing colorectal resections were all treated with preoperative Mechanical Bowel Preparation (MBP) and/or preoperative oral antibiosis for many years. However, several other studies carried out in the late 1990s and early 2000s questioned the role of MBP [1]. Although postoperative recovery has improved over the last two decades with the introduction of minimally invasive surgery and implementation of enhanced recovery after surgery (ERAS), protocols, colectomy remains associated with morbidity. The most common form of such morbidity relates to surgical site infection (SSI). This can take the form of minor infections of the wounds, but also life-threatening colonic anastomotic leaks [2, 3]. By using MBP, the dissection is facilitated, and endoscopic review is possible. It will also lessen the volume of faeces and, hence, bacteria colonization, therefore reducing the chance of postoperative complications such as anastomotic leak and wound infection [4]. Anastomotic leak refers to the projection of faeces through the drainage opening or the incision in the wound from the site of the anastomosis [5]. In mechanical bowel preparation, laxatives or enemas are used to try and empty the colon before surgery in an attempt to improve safety and visibility [4, 6]. The benefits of MBP must be weighed against its detrimental effects

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concerning patient distress and electrolyte imbalance [7]. Mechanical bowel preparation before elective colorectal surgery has taken on a new focus. This is a burning issue now, one that's controversial not because the data are bad, but because the research in it has generated a wide range of outcomes [8]. It is no surprise that there isn't concurrence among international rules in the Asia Pacific Region, Europe, and America. Australian guidelines are one of the recent international guidelines recommended against the routine use of MBP during colonic surgery [9]. Mechanical bowel preparation is studied in great detail by the medical fraternity to achieve a balance between advantages and disadvantages to increase patient satisfaction while undergoing colorectal surgery. The current study will evaluate MBP in colorectal surgery at large and particularly in a tertiary care centre in Peshawar, Pakistan. Since this practice is age-old, MBP has been used extensively in this geographical region with the belief that it improves surgical outcomes. There is an absolute need to determine its real impact on surgical outcomes.

This study aimed to elucidate the worth of MBP in the local setup based on the peculiar demographics of patients' surgical practices and postoperative complications. Such an appraisal is essential in informing clinical decisions that will lead to effective patient care with potential revision of existing practices based on the evidence obtained.

## METHODS

This quasi-experimental study was carried out at the Northwest General Hospital and Research Centre (II), Peshawar, Pakistan, a tertiary healthcare setting. Spanning from January to December 2023, the research focused on a detailed exam of patients undergoing elective colorectal surgical procedures. The study's protocol acquired approval from the Institutional Review Board and Ethical Committee (IRB&EC) of the Northwest School of Medicine, Peshawar (No: IRB&EC/2023-SM/070). The study's goals and objectives were explained to the participants, they received assurances about their confidentiality, and their consent was obtained. A general of 210 patients were carefully selected and randomly assigned into two classes: The Mechanical Bowel Preparation (MBP) Group and the Non-Mechanical Bowel Preparation (Non-MBP) Group, following particular standards. Randomization turned into the usage of a random number desk, where sufferers assigned odd numbers were located in the MBP Group and those with even numbers in the Non-MBP Group. Patients in the preparation group received oral MBP, reconstituted with two packs of polyethene glycol in a two-litre water solution, starting 12 to 16 hours pre-surgery, as scheduled. Blood pressure, hydration status, pulse rate, and electrolytes were monitored before and after preparation, and deficits, if any, were corrected. The patients were allowed only liquid diets till midnight of the evening before surgery. The unprepared patients were allowed a residue-free diet until midnight of the day preceding the day of surgery. Premedication included a tablet of diazepam 10 mg orally the night before surgery to allay anxiety and for sound sleep, and a tablet of ranitidine 150 mg the previous night with sips of water. In the perioperative, all patients in both cohorts were administered intravenous broad-spectrum antibiotics before the commencement of the surgical procedure. This included a 1 g injection of ceftriaxone and an injection of metronidazole at 500 mg dosage. Postoperatively this course of antibiotics was continued for another 72 hrs. The operating surgeon was also kept blind about the status of preparation of the patients to avoid any bias. Inclusion criteria included both male patients and female patients aged 18 years and above waiting to undergo elective colorectal surgeries for conditions like colorectal cancer, diverticular disease, inflammatory bowel disease, and other non-malignant diseases. The exclusion criteria were cases with incomplete data, patients who had received a colonoscopy within one week of surgery, those who refused or would not provide informed consent, those patients with renal failure defined as a serum creatinine >3 mg/dL, and those patients with obstructive symptoms that required more urgent intervention, such as emergency surgery cases. Also excluded from the study were patients with pre-existing hypertension, coronary artery disease, diabetes, immunodeficiency, coagulopathy, asthma and chronic obstructive pulmonary disease. The outcomes following surgery were judged by clinical (vital signs, physical examination findings, and drain outputs) as well as radiological assessment (ultrasonography and CT scans where necessary). The specific complications that had to be looked for especially included anastomotic leaks, intra-abdominal septic collections, and wound infections. Wound infection was defined as the requirement to reopen the incision wound partially or completely for drainage of accumulated fluids. Anastomotic leak was presumed where there was observable faecal drainage from abdominal drains or when a leak was confirmed by imaging techniques (Computed Tomography (CT) Scan; with contrast, indicated by the presence of extraluminal contrast material or fluid collections near the anastomosis). An abdominal or pelvic collection was defined as the presence of a collection seen on ultrasonography or computed tomography scans along with elevated temperature or total leukocyte count. The duration of postoperative hospital stay in days was also recorded very carefully. Data were extracted from (EHRs) electronic health records that were recorded by health professionals, covering a wide range of variables, including demographic data, comorbidities, nutritional status before surgery, surgical variables, and postoperative outcomes. The main factors analyzed were age, sex, body mass index

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(BMI), American Society of Anaesthesiologists (ASA) classification (Patients were categorized as ASA I, II, or III), surgical procedure type, operative duration, intraoperative blood loss (by measuring suction canister volumes, estimating blood-soaked sponges, and accounting for irrigation fluids), hospital stay duration, occurrences of postoperative complications, and SSI cases. The SPSS software version 26.0 was used to carry out the statistical analysis, where descriptive statistics summarized the demographics and surgical outcomes among the patients, and the chi-square test with a significance value of 0.05 was used to identify the independent predictors of postoperative complications and SSI. This gives a complete evaluation of factors affecting surgical outcomes.

## RESULTS

In the current study, 210 patients scheduled for elective colorectal surgery were included. The average age was 58.4 ± 12.3 years in the MBP group and 60.1 ± 11.8 years in the Non-MBP group. One hundred three patients were male and 107 were female. The average BMI was slightly higher in the Non-MBP group with 28.3 kg/m$^2$ than in the MBP group with 27.8 kg/m$^2$. Both groups had a similar distribution across American Society of Anesthesiologists (ASA) classifications, with the majority being ASA II reflecting mild systemic disease with minimal impact on daily activities, ensuring similar baseline health conditions between the groups. The Non-MBP group has a slightly higher proportion of ASA III patients, who have more severe systemic disease (10.50% vs. 9.50% in the MBP group). This slight difference indicates a potentially marginally higher risk of complications in the non-MBP group, but the overall ASA classification is comparable, supporting an equitable comparison of surgical outcomes. Colorectal cancer was the main indication for surgery in both groups (Table 1).

**Table 1:** Demographic Data and Clinical Characteristics of Patients

| Characteristic | Mechanical Bowel Preparation (MBP) Group (n=105) | Non-Mechanical Bowel Preparation (Non-MBP) Group (n=105) |
|---|---|---|
| Age (years), Mean ± SD | 58.4 ± 12.3 | 60.1 ± 11.8 |
| Sex (Male/ Female), n (%) | 52 (49.50) / 53 (50.50) | 51 (48.60) / 54 (51.40) |
| BMI (kg/m$^2$) Mean ± SD | 27.8 ± 4.1 | 28.3 ± 4.2 |
| **American Society of Anaesthesiologists (ASA) Classification, n (%)** | | |
| ASA I | 38 (36.20) | 35 (33.30) |
| ASA II | 57 (54.30) | 59 (56.20) |
| ASA III | 10 (9.50) | 11 (10.50) |
| **Indication for Surgery, n (%)** | | |
| Colorectal Cancer | 65 (61.90) | 59 (56.19) |
| Diverticular Disease | 20 (19.05) | 26 (24.76) |
| Inflammatory Bowel Disease | 17 (16.19) | 14 (13.33) |
| Benign Colorectal Conditions | 3 (2.86) | 6 (5.71) |

The operative time, blood loss, and length of stay in the hospital are practically the same in both groups of patients. There was, however, a trend suggesting a decrease in surgical site infections in the group of patients receiving mechanical bowel preparation, albeit it was not statistically significant (Table 2).

**Table 2:** Surgical and Post-Operative Outcomes of Patients

| Surgical Outcome Measure Mean ± SD | Mechanical Bowel Preparation (MBP) Group (n=105) | Non-Mechanical Bowel Preparation (Non-MBP) Group (n=105) |
|---|---|---|
| Operative Time (minutes) | 185.50 ± 45.7 | 198.20 ± 49.1 |
| Blood Loss (mL) | 225 ± 85 | 210 ± 92 |
| Length of Hospital Stay (days) | 7.6 ± 2.1 | 7.2 ± 2.3 |
| **Postoperative Complications, n (%)** | | |
| Surgical Site Infection | 20 (19.0%) | 14 (13.3%) |
| Anastomotic Leak | 10 (9.5%) | 8 (7.6%) |
| Intra-Abdominal Collections | 10 (9.5%) | 8 (7.6%) |
| Extra-Abdominal Septic Complications | 25 (23.8%) | 23 (21.9%) |

(Extra-abdominal septic complications: Chest infection, UTI, Septicaemia)

The SSI incidence was indicated in 19.05% or 20 of the 105 patients who belong to the MBP group, while it was 13.33% or 14 of 105 participants constituting the Non-MBP group, which has $\chi^2$=1.2634 with the p-value of 0.261014. From this evidence, indeed, both groups did not show any significant difference in the development of SSI (Table 3).

**Table 3:** Comparison of Surgical Site Infection Occurrence Based on MBP Status

| Surgical Site Infection | MBP Group n (%) | Non-MBP Group n (%) | Total n (%) | $\chi^2$-value | p-value |
|---|---|---|---|---|---|
| Yes | 20 (19.05) | 14 (13.33) | 34 (16.19) | 1.2634 | 0.261014 |
| No | 85 (80.95) | 91 (86.67) | 176 (83.81) | | |
| Total | 105 (100) | 105 (100) | 210 (100) | | |

Whereas 9.50% (10 out of 105) participants suffered from leakage in the MBP group, 7.60% (8 out of 105) participants did so in the Non-MBP group, with the chi-square value being $\chi^2$=0.2431 and the p-value was 0.622008, therefore the difference is not significant (Table 4).

**Table 4:** Anastomotic Leakage Rates Comparison Between Patients with and without MBP

| Anastomotic Leakage | MBP Group n (%) | Non-MBP Group n (%) | Total n (%) | $\chi^2$-value | p-value |
|---|---|---|---|---|---|
| Yes | 10 (9.50) | 8 (7.60) | 18 (8.57) | 0.2431 | 0.622008 |
| No | 95 (90.50) | 97 (92.40) | 192 (91.43) | | |
| Total | 105 (100) | 105 (100) | 210 (100) | | |

A total of 9.50% which is, 10/105, in the MBP group

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developed intra-abdominal collections. At the same time, 7.60% which is, 8/105 in the Non-MBP group did. $\chi 2$=0.2431, p-value 0.622008. Thus, no significant difference is demonstrated in the incidence of intra-abdominal collections between the two groups (Table 5).

**Table 5:** Occurrence of Intra-Abdominal Collections About Medical Bowel Preparation (MBP) Status

| Intra-Abdominal Collections | MBP Group n (%) | Non-MBP Group n (%) | Total n (%) | $\chi^2$-value | p-value |
|---|---|---|---|---|---|
| Yes | 10 (9.50) | 8 (7.60) | 18 (8.57) | | |
| No | 95 (90.50) | 97 (92.40) | 192 (91.43) | 0.2431 | 0.622008 |
| Total | 105 (100) | 105 (100) | 210 (100) | | |

Extra-abdominal septic complications in the MBP group, 23.80% or 25 of 105. In the Non-MBP group, however, 21.90% or 23 of 105 were affected. $X^2$=0.108, p=0.742404 There is no significant difference between the two groups in the occurrence of extra-abdominal septic complications (Table 6).

**Table 5:** Comparing the incidence of Extra-Abdominal Septic Complications Concerning the Implementation or Absence of Medical Bowel Preparation (MBP)

| Extra-Abdominal Septic Complications | MBP Group n (%) | Non-MBP Group n (%) | Total n (%) | $\chi^2$-value | p-value |
|---|---|---|---|---|---|
| Yes | 25 (23.80) | 23 (21.90) | 48 (22.86) | | |
| No | 80 (76.20) | 82 (78.10) | 162 (77.14) | 0.108 | 0.742404 |
| Total | 105 (100) | 105 (100) | 210 (100) | | |

(Extra-abdominal septic complications: Chest infection, UTI, Septicaemia)

## DISCUSSION

The results of the present study indicated that the surgical site infections were less in the Non-MBP group (13.33%) than in the MBP group (19.05%), although not statistically significant (p=0.261014). This may infer that Non-MBP has some advantage in decreasing the risk of postoperative infections [10]. This is in contrast with the traditional reasoning for MBP: decreasing infection rates through a clean surgical field. The lack of statistical significance in the results suggests that there is room for debate over how much those reductions would, in practical medical terms, be considered important [11]. On the other hand, as shown in the anastomotic leak and intra-abdominal collections rates, p=0.622008, between MBP and non-MBP, there is no statistically significant difference between them. This proves that the occurrence of these two complications isn't dependent upon the performance or not performance of MBP [12]. The findings are not statistically valid, invalidating the old, recommended perception that MBP reduces the number of anastomotic leaks importantly and, in general, complications associated with surgery [13]. Discussion from the study of Ozturk *et al.*, reported that there was no significant association of MBP with the intraoperative visibility of the surgical site or easy surgery. However, MBP was found to have no beneficial positive effect on surgically operating patients with high BMI and undergoing these surgeries. Based on the findings, the authors do not advocate for the routine use of MBP before laparoscopic gynaecological surgeries [14]. The results from this study add to the continued debate and understanding of the performance of MBP in colorectal surgery. MBA recently became disputable as to how effective and useful it is now [15]. Wang *et al.*, Questioned the same widely held dogmas, arguing that patients would recover their gastrointestinal function more quickly after gynecologic malignancies surgery without prior MBP [16]. Further support for the theory that MBP does not significantly reduce Extra-abdominal septic complications is provided by the fact that no statistically significant differences exist, p=0.742404 [17]. The potential risks of MBP treatment concern patient discomfort, electrolyte imbalances, and dehydration, and are the most disputed subjects. The key takeaway is that despite no statistically significant differences in anastomotic leaks and other complications throughout the study, the balance between the projected benefits and drawbacks of MBP remains a critical consideration [18]. The new guidelines emphasize a personalized approach to preoperative care, considering factors such as the patient's overall health, the specifics of the surgical procedure, and any individual risk factors that might increase the likelihood of complications; this approach is reflected in the second-wave MBP, which is gaining traction in colorectal surgery [19, 20]. This prospective study is well-designed, minimizing bias and enhancing the reliability of the results. The thorough inclusion criteria encompass a large patient population, ensuring robust data. Additionally, blinding the operating surgeon helps prevent any potential biases that could arise during the procedures. However, there are two major limitations of this study: it is single-canter, and, hence generalizability of results might suffer as a result, while the relatively short duration of follow-up might not capture long-term complications or outcomes. Also, the exclusion of patients with some comorbidities, like atrial fibrillation, limits the application of findings to wider clinical populations.

## CONCLUSIONS

This study concluded that the Non-Mechanical Bowel Preparation group had lower surgical site infections as compared with the Mechanical Bowel Preparation group; however, it was not statistically significant. Also, there wasn't any statistical significance for anastomotic leakages as well as other postoperative complications in both categories.

### Authors Contribution

Conceptualization: MU, AAS, NSA, AAK, AK
Methodology: MU, AAS, NS, AK, SZ
Formal analysis: MU, AAS, SZ

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Writing review and editing: MU, NS, AAK, AK, SZ

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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