EFFICACY OF MECHANICAL BOWEL PREPARATION FOR ELECTIVE COLORECTAL SURGERY

Adnan Aqil Khan, Fahim Ullah Naz, Muhammad Qasim Butt, Filza Saeed*, Bilal Munir*, Asad Malik**

Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Pak Emirates Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, **Armed Forces Institute of Pathology/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To compare the postoperative infective complications like wound infections and anastomotic leakage, of mechanical bowel preparation with non-mechanical bowel preparation in patients undergoing elective colorectal surgeries.
Study Design: Comparative - cross sectional study.
Place and Duration of Study: We conducted our study in surgical department of Surgery, Pak Emirates Military Hospital and Combined Military Hospital Rawalpindi, from Feb 2015 to Aug 2015.
Methodology: One hundreds and sixty patients were included in this study, which were further divided into groups A and B of 80 patients in each group. Group A was subjected to mechanical bowel preparation before surgery and group B was subjected to non-mechanical bowel preparation.
Results: Our study showed that anastomotic leakage was seen in 11 patients (13.8%) of group A and 14 patients (17.5%) in-group B. While surgical site infection was developed in 8 patients (10.0%) in-group A and 12 patients (15.0%) of group B. There was no statistically significant difference between two groups.
Conclusion: We concluded in our study that infective complications like sepsis, due to anastomosis leakage after elective colorectal surgery were not severe in patients without bowel preparation done before operation, when compared to patients with bowel cleaning.

Keywords: Anastomotic leak, Elective colo-rectal surgeries, Mechanical bowel preparation, Surgical site infection.

INTRODUCTION

The importance of bowel preparation mechanically in prevention of post-operative anastomotic dehiscence and infectious complications has been a dogma for surgeons for more than a century. Clinical individual experiences and observational studies have documented that mechanical bowel preparation is important in decreasing mortality and morbidity in patients post operatively who underwent colorectal surgery but there are randomized clinical trials that have questioned the importance of mechanical bowel preparation in colorectal surgery[1].

There are two theories about mechanical bowel preparation; surgeons supporting are of the opinion that mechanical bowel preparation decreases gut load of feces and bacterial colonization and thus decreases contact of contaminated material with the newly made anastomosis thus decreasing the chances of anastomotic leakage and infectious complications[1]. Surgeons who have the opinion that it is not necessary also have reasons for it, they say that bowel preparation liquefies gut contents and there is more spillage of gut contents during surgery thus increasing chances of infection[2,3]. They also think that it is associated with prolonged hospital stay due to gastric intolerance, low serum potassium level, bowel explosion, mucosal lesions, electrolyte disturbance and fluid overload. Different studies conducted in various world renowned centers have different results some in favor of mechanical bowel preparation before elective colorectal surgeries, others have proved results that are denying mechanical bowel preparation[3-5] due to different complications associated with mechanical bowel

Correspondence: Dr Adnan Aqil Khan, Surgical Specialist, CMH Murree Pakistan (*Email: adnan2123@hotmail.com)*
Received: 11 Jul 2019; revised received: 11 Oct 2019; accepted: 18 Oct 2019

preparation that have been named earlier in the para.

In our center no specific protocol was followed for preparing gut before colorectal surgeries, some surgeons prefer the mechanical bowel preparation while the others prefer the non-mechanical bowel preparation. We conducted this study to compare the efficacy of mechanical bowel preparation with the efficacy of non-mechanical bowel preparation, in patients undergoing elective colorectal surgery. Purpose of the study was which ever protocol would be found to have better efficacy, would be adapted in routine practice for the patients undergoing colorectal surgery.

METHODOLOGY

A comparative cross sectional study was conducted in the department of Surgery, Pak Emirates Military Hospital and Combined Military Hospital, Rawalpindi, over a period of six months from Feb 2015 to Aug 2015. Sample size was calculated with WHO calculators with level of significance of 5%, power of test of 80%. Anticipated population proportion 1 was 19%[1] and anticipated population proportion 2 was 5.8%[2]. Based on these parameters the minimum sample size in each group came out to be 80 and total of 160. Consecutive sampling, Non-probability technique was employed.

Inclusion criteria was patients of both genders, from 15 to 70 years of age who underwent elective colorectal surgeries. Exclusion criteria was patients with lesions in large gut that were unresectable, those on chemotherapeutic agents or on immunosuppressive drugs like steroids. Patients with ascites, patients already in a state of sepsis and ongoing organ failure and those presented as acute intestinal obstruction in emergency were also excluded.

Total of 160 patients who were admitted in surgical wards and underwent colorectal surgery, and furthermore fulfilling inclusion and exclusion criteria as already mentioned; were included in this study. Permission from hospital ethical review committee was taken. Informed consent (written and duly signed) from the patients was also obtained. Patients were divided randomly by lottery method into group A and B. Group A was subjected to mechanical bowel pre-paration pre-operatively and group B was subjected to non-mechanical bowel preparation. The operating surgeon had a minimum 5 years post fellowship experience. After surgery, patients in both the groups were kept under observation for development of complications. After surgery, the patients were examined by the registrar on 1st post op day and were followed up until discharge. Later on patient were reviewed on weekly basis. Complications were explained to the patients and were advised to report immediately to hospital if any occurs within 21 days. Data regarding the development of complications in both the groups was endorsed on preformed proforma. All participants had the rights to withdraw from study group at any point and time during the study.

Data was entered and analyzed in SPSS-23. Mean age with standard deviation and male to female ratio was calculated for the patients in the study groups. Frequency of complications like anastomotic leakage and surgical site infection was calculated in both the groupsand compared by applying chi-square test. *p*-value was only considered significant when it was ≤0.05.

RESULTS

Total of 160 patients, 80 in each group i.e A and B, were studied. Group A was subjected to mechanical bowel preparation before surgery and group B was subjected to non-mechanical bowel preparation.

Patients ranged between 30-70 years of age. Mean age of the patients was 48.51 ± 9.82 and 48.48 ± 9.97 in group A and B respectively. There were 60 males (75%) in group A and 66 (82.5%) in group B while 20 females (25%) were in group A and 14 (17.5%) in group B. Male to female ratio was 3:1 in group A and 3.3:0.7 in group B.

DISCUSSION

Bowel preparation performed mechanically is considered to help in reducing postoperative infective complications after colorectal surgery. It

decreases sfecal load in the guts and decreasing anastomosis leakage by reducing fecal impaction at anastomosis point. Therefore, the risks of fecal contamination of peritoneum and abdominal wound are consideredto be minimal. Scabini *et al*[2] states that elective colon and rectal operations when prepared preoperatively with mechanical preparation and antibiotic prophylactic use, that

Table-I: Distribution of patients by gender.

Gender	Group A (Mechanical bowel preparation)	Group B (Non-mechanical bowel preparation)
	Number and Percentages	Number and Percentages
Male	60 (75%)	66 (82.5%)
Female	20 (25%)	14 (17.5%)
Male: Female	3:1	3.3 : 0.7

Table-II: Distribution of patients by anastomotic leakage (n=160).

Anastomotic leakage	Group A (Mechanical bowel preparation)	Group B (Non-mechanical bowel preparation)	*p*-valve
Yes	11 (13.8%)	14 (17.5%)	0.514
No	69 (86.2%)	66 (82.5%)	

Table–III: Distribution of patients by surgical site infection.

Anastomotic leakage	Group A (Mechanical bowel preparation)	Group B (Non-mechanical bowel preparation)	*p*-valve
Yes	8 (10%)	12 (15%)	0.339
No	72 (90%)	68 (85%)	

too in combination with better surgical techniques and optimized peri-operative care, resulted in much lower complications especially infective, in colorectal surgery. Mechanical bowel preparation, preoperatively to elective colorectal surgical operations has become a topic of surgical debate. There are ambiguities in scientific evidence showing the effectiveness of this practice in curtailing infectious complications. The agents that are now generally used for mechanical bowel preparation like polyethylene glycol and sodium phosphate, which are considerably strong agents. However, despite the use of such agents the colon is not completely clean and dry at the time of operation and proves especially problematic at time of anastomosis[18]. In the experience of Scabini *et al*[2] liquid or semiliquid stool was often found in the patients of the prep group. When preparation for colonoscopy was carried out, liquid stool could be easily aspirated to attain the requisite cleansing for a safe and effective colonoscopy. In contrast to colonoscopy, when patients were prepared for surgery with same method, it was very difficult to control liquid or semiliquid stool than solid one. This liquidity of faces might lead to the significantly higher rate of intra-operative spillage of bowel content. In patients where mechanical bowel preparations are not used, rather the gut when prepared only with use of clear fluids, liquid diet few days before surgery, in combination with the cathartic agent, leads to improved quality of the gut per-operatively and reduces the liquid colonic content.

Mechanical bowel preparation in colonic surgery has been a bone of contention for quite some time now with mounting evidence[4] disproving its use & this study adds to this body of evidence. While Manikandan *et al*[4] showed that post-operative complications, long claimed to be reduced by mechanical bowel preparation are not impacted significantly by avoiding mechanical bowel preparation. In fact the incidence of anastomotic leakage in the mechanical bowel preparation group was 3/25 compared to nil in non mechanical bowel preparation group, although this difference was not found to be statistically significant. Manikandan *et al*[4] used post-operative reappearance of bowel sounds & passage of flatus as surrogate makers for bowel motility. They reported that mechanical bowel preparation reduces bowel motility thereby prolonging the time to bowel emptying. They further concluded that colonic surgery can be done safely without mechanical bowel preparation thereby saving the patient from its morbidity. They also proved that there was no statistically significant difference between preparing & not preparing the bowel in terms of wound infection & anastomotic leak & that there is a statistically significant difference in

favor of no preparation in terms of post-operative passage of flatus. Both these findings favor avoiding bowel preparation for colon surgeries.

A recent study published by Brown *et al*[5] in 2014 showed that mechanical bowel preparation has a detrimental effect on colon mucosa. They proved that preparation reduces mucosal cellular proliferation by PCNA & immune histochemical staining with an additional decrease in the butyrate transport protein within the colonic mucosa. This study was done in rats & is yet to be validated in humans.

Jung *et al*[6] published a study showing that mechanical bowel preparation delayed post-operative bowel peristalsis in open colon surgery. Bucher *et al*[7] showed that bowel preparation delayed bowel emptying in left sided colon surgeries. The reasons for bowel hypomotility due to bowel preparation are unclear but there are some theories as to its cause, Bingol-Kologulu *et al*[8] showed in rats that polyethylene glycol increases bile production & induces congestion and edema in small & large bowels but not in the stomach. Moreover, McKenna *et al*[9] showed that even a small volume of polyethylene glycol causes small bowel dilatation for many hours although its effect on post-operative bowel movement recovery is yet to be validated. There are limited studies yet seeking to identify cause of bowel hypomotility in humans. The significance of bowel hypomotility lies in the fact that early recovery from postoperative bowel dymotility enables early enteral feeding thereby reducing the incidence of complications. This is one of the cardinal reasons why mechanical bowel preparation has been omitted from enhanced recovery protocols being practiced currently worldwide[10,11].

Mechanical bowel preparation results in more liquid faeces, which could increase the risk of spoilage during operation and thus resulting in the contamination of operative field leading to postoperative infective complications[12,13]. Some investigators consider mechanical bowel preparation as potent method to bacterial load reduction in the bowel. However, at the same time the large & numerous amount of micro-organisms in the small and large gut makes this extremely difficult if not impossible[14,15]. Mechanical bowel preparation has been shown to have potentially negative side effects along with delaying gut motility. The is danger of bacterial trans location[16], electrolyte imbalances[17], and last but not the least a discomfort to patients[18]. The discomfort to the patient, includes nausea, abdominal distention and diarrhea. Mechanical bowel preparation also causes electrolyte imbalance and dehydration. This may complicate the anesthesia, peri-operative and post-operative intensive care as well as smooth recovery. Thus, in our opinion, mechanical bowel preparation should be used when properly indicated and not as routine procedure.

Poole *et al*[17] have also validated the claim that there is no added benefit to bowel prepared mechanically pre-operatively for elective colorectal resection and suggested that bowel preparation should not be used. Bretagnol *et al*[18] says that omission of bowel preparation may be associated with much lower postoperative complications in elective rectal cancer surgery. However, despite these disadvantages, mechanical bowel preparation is routinely performed in some centers before colorectal surgery. This practice continues without any substantial evidence from randomized trials[19]. Out of 3 published meta-analyses, the first with 497 patients showed that those with bowel prepared mechanically had a significantly higher rate of wound infection than those who did undergo gut preparation[20]. The 2nd meta-analysis demonstrate that in 9 trials comprising of 1592 patients, mechanical bowel preparation was associated with a much greater rate of anastomotic leakage. However, the wound infection rate and other complications was not substantially different between groups[21]. The 3rd meta analysis showed that in 7 trials, consisting of 1454 patients, those with mechanical prepared gut had more anastomotic leakages[22].

A recently updated Cochrane-review[23], which included 13 randomized controlled trials with a total of 4,777 patients, gave no evidence that patients benefit from MBP prior to elective

colonic and rectal surgery. An anastomotic leakage is a severe complication often leading to septic complications resulting in high morbidity and mortality. This may explain why surgeons are reluctant to omit MBP, especially in patients undergoing rectal resections[24].

A limited number of trials have investigated the effect of MBP in rectal resections; among these are a Cochrane-review[23], Wille-Jorgensen *et al* Smeta-analysis, a case-control study and a randomized prospective trial. These studies included between 62 and 275 patients. None of the four studies showed a positive effect in the use of MBP in rectal resections. Our study also did not show any differences in anastomotic leakage and surgical site infection among patients who underwent preoperative mechanical bowel preparation before elective colorectal operation and those who had no mechanical bowel preparation.

A newly published subgroup analysis by Sant *et al*[25] including a total of 449 patients who underwent a low anterior resection with a primary anastomosis showed that MBP had no significant influence on anastomotic leakage, septic complications.

LIMITATION OF STUDY

We had a small study sample to work with and there were different surgical teams involved in the treatment of these patients. But despite these limitations our findings were largely in line with studies done elsewhere.

CONCLUSION

The results suggested that oral zinc sulphate is more effective than cryotherapy in the treatment of viral warts.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

REFERENCES

1. Bretagnol F, Panis F, Rullier E, Rouanet P, Berdah S, Dousset B, et al. Rectal cancer surgery with or without bowel preparation the french greccar iii multicenter single-blinded randomized trial. Ann Surg 2010; 252(5): 863-68.
2. Scabini S, Rimini E, Romairone E. Colon and rectal surgery for cancer without mechanical bowel preparation: one-centre randomised prospective trial. World J Surg Oncol 2010; 8(1): 35-39.
3. Van't Sant HP, Weidema WF, Hop WCJ, Oostvogel HJ, Contant CM, et al. The influence of mechanical bowel preparation in elective lower colorectal surgery. Ann Surg 2010; 251(1): 59-63.
4. Manikandan L, Kumar RT, Prathapan VK, Sasi MP. Colon surgery with and without mechanical bowel preparation: a comparative study. J Med Sci Clini Res 2015; 3(5): 5723-27.
5. Brown S, Ali M, Williams M, Swisher J, Rice W, Coviello L, et al. Cellular changes of the colon following mechanical bowel preparation. J Surg Res 2014; 193(2): 619-25.
6. Jung B, Lannerstad O, Pahlman L, Arodell M, UnossonM, Nilson E. Preoperative mechanical preparation of the colon:the patient's experience. Bio Med Center Surg 2007; 7(1): 5-9.
7. Bucher P, Gervaz P, Soravia C, Mermillod B, Erne M, Morel P, et al. Randomized clinical trialof mechanical bowel preparation versus no preparation before elective left-sided colorectal surgery. Br J Surg 2005; 92(4): 409-14.
8. Bingol-Kologlu M, Senocak ME, Talim B, Kale G, Ocal T, Buyukpamukcu N. A comparative histopathologic evaluation of the effects of three different solutions used for wholebowel irrigation: an experimental study. J Pediatr Surg 2000; 35(4): 564-68.
9. McKenna DA, Roche CJ, Murphy JM, McCarthy PA. Polyethylene glycolsolution as an oralcontrast agent for MRI of the small bowelin a patient population. Clin Radiol 2006; 61(11): 966-70.
10. Sugihara T, Yasunaga H, Horiguchi H, Matsuda S, Fushimi K, Kattan MW, et al. Does mechanical bowel preparation ameliorate damage from rectal injury in radical prostatectomy? Analysis of 151 rectal injury cases. Int J Urol 2014; 21(6): 566-70.
11. Bragg D, El-Sharkawy AM, Psaltis E, Maxwell-Armstrong CA, Lobo DN. Postoperative ileus: recent developments in pathophysiology and management. Clin Nutr 2015; 34(3): 367-76.
12. Hedrick TL, McEvoy MD, Mythen MM, Bergamaschi R, Gupta R, Holubar SD, et al. American society for enhanced recovery and perioperative quality initiative joint consensus statement on postoperative gastrointestinal dysfunction within an enhanced recovery pathway for elective colorectal surgery. Anesth Analg 2018; 126(6): 896-907.
13. Watanabe M, Suzuki H, Nomura S, Maejima K, Chihara N, Komine O, et al. Risk factors for surgical site infection in emergency colorectal surgery: a retrospective analysis. Surg infect 2014; 15(3): 256-61.
14. Cao F, Li J, Li F. Mechanical bowel preparation for elective colorectal surgery: updated systematic review and meta-analysis. Int J Colorectal Dis 2012; 27(6): 803-10.
15. Mahajna A, Krausz M, Rosin D. Bowel preparation is associated with spillage of bowel contents in colorectal surgery. Dis Colon Rectum 2005; 48(8): 1626–31.
16. Fa-Si-Oen PR, Verwaest C, Buitenweg J. Effect of mechanical bowel preparation with polyethylene glycol on bacterial contamination and wound infection in patients undergoing elective open colon surgery. Clin Microbiol Infect 2005; 11(2): 158-60.
17. Poole GV. Spontaneous bacterial peritonitis during bowel preparation: an example of clinical translocation. South Med J 1991; 84(11): 1412-13.
18. Bretagnol F, Alves A, Ricci A. Rectal cancer surgery without mechanical bowel preparation. Br J Surg 2007; 94(10): 1266-71.
19. Guenaga KFG, Matos D, Wille-Jørgensen P. Mechanical bowel preparation for elective colorectal surgery. Cochrane Database Sys Rev 2009; 4(9): 1-5.

20. Platell C, Hall J. What is the role of mechanical bowel preparation in patients undergoing colorectal surgery? Dis Colon Rectum 1998; 41(7): 875-82.
21. Guenaga KF, Matos D, Castro AA, Atallah AN, Wille Jørgensen P. Mechanical bowel preparation for elective colorectal surgery. Cochrane Database Syst Rev 2005; 9(1): 1-6.
22. Slim K, Vicaut E, Panis Y, Chipponi J. Meta-analysis of randomized clinical trials of colorectal surgery with or without mechanical bowel preparation. Br J Surg 2004; 91(12): 1125-30.
23. Karakaş DÖ, Yeşiltaş M, Gökçek B, Eğin S, Hot S. Etiology, management, and survival of acute mechanical bowel obstruction: Five-year results of a training and research hospital in Turkey. Turk J Trauma Emergency Surg 2019; 25(3): 268-80.
24. Platell C, Makim G. Randomized clinical trial of bowel preparation with a singlephosphate enema or polyethy-lene glycol before elective colorectal surgery. Br J Surg 2006; 93(4): 427-33.
25. Van't Sant HP, Weidema F, Hop WCJ. The influence of mechanical bowel preparation in elective lower colorectal surgery. Ann Surg 2010; 251(1): 59-63.