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ORIGINAL RESEARCH

Role of probiotics in surgical site infections at a tertiary care teaching hospital of border region of North India

[1]Dr. Ashutosh Talwar, [2]Dr. Ashwani Kumar, [3]Dr. Nitin Nagpal, [4]Dr. Ashish Chhabra

[1]Assistant Professor, [2]Associate Professor, [3]Professor, Department of Surgery, GGSMC, Faridkot, Punjab, India
[4]Associate Professor, Paediatric Surgery, GGSMC, Faridkot, Punjab, India

Correspondence:
Dr. Ashwani Kumar
Associate Professor, Department of Surgery, GGSMC, Faridkot, Punjab, India

Abstract
The aim of the present study was to estimate the effect of the perioperative administration of probiotics in patients undergoing abdominal surgeries. The study focused on a total of 251 consecutive surgeries carried out from among all the elective surgeries performed between April 2021 and May 2022. The patients involved in surgeries undertaken between April 2021 and October 2021 were placed in the non-probiotic group (group A, 116 patients) and those involved in surgeries between November 2021 and May 2022 were placed in the probiotic group (group B, 135 patients). Postoperative infectious complications were recorded, and the immune responses and fecal microbiota were determined. A breakdown of infectious complications showed that 21 (8.36%) patients experienced superficial incisional surgical site infections, of which 16 patients were from group A (6.5%), and five patients from group B (1.99%). In conclusion, probiotic treatment can reduce superficial incisional surgical site infections in patients undergoing surgeries. Perioperative probiotic treatment can enhance immune responses and improve the intestinal microbial environment.
Keywords: probiotics, surgical site infections, abdominal surgeries

Introduction

The occurrence of surgical site infection extends the duration of hospitalization, raising the costs of admission and potentially reducing the quality of life of the patients[1]. Since the publication of the Guideline for the Prevention of Surgical Site Infection in 1999 by the Center for Disease Control and Prevention[2], there has been a declining trend in surgical site infection. Takesue *et al* [3] reported, based on the results of a multi-center research project, that the implementation of effective infection prevention practices can maintain surgical site infections incidence rates to <15%.

Probiotics that improve the intestinal microbial balance in the host are considered to have beneficial effects on human health[4]. By comparing the intestinal environment in patients with colonic cancer and healthy individuals, Wang *et al* [5] found that there is an intestinal microbial imbalance in patients with colon cancer, represented by a reduction in the number of butyrate producers and an increase in opportunistic pathogens. This disturbance is caused by the stress of invasive surgery, the administration of antibacterial drugs to prevent infection, the weakness of intestinal tract peristalsis and the atrophy of the intestinal mucosa due to the perioperative fasting and intestinal tract ischemia[6].

We hypothesized that the perioperative administration of probiotics should reduce the incidence of surgical site infections among the patients undergoing elective surgeries. In

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addition, the study was designed to investigate the effect of the perioperative administration of probiotics and surgical outcome in the clinical setting.

Materials and methods

Patient enrolment

The present study focused on 251consecutive surgeries carried out by the same team from April 21 to May 2022 performed in GGS Medical college, Faridkot following the exclusion of inoperable patients and the provision of informed consent from the patients. The patients involved in surgeries conducted between April 2021 and October 2021 were placed in the non-probiotic group (group A, 116 patients) and those involved in surgeries between November 2022 and May 2022 were placed in the probiotic group (group B, 135 patients).

All surgeries were performed by the same team, which included three surgeons, and perioperative management was performed under the same conditions for all patients. For the probiotic treatment combination of lactic acid bacteria and bifidobacteria capsules were administered orally daily. All patients received a regular diet preoperatively. The administration of the capsules was started three to 15 days prior to the surgery, and then was restarted the same day the patient started drinking water.

Recording of infectious complications

Detailed daily records of the postoperative course were kept for each patient. The infectious complications included surgical site infections (superficial incisional / deep incisional), postoperative pneumonia, urinary tract infections and enteritis. These were recorded for up to 30 days after surgery. A surgical site infection was defined as spontaneous or surgically released purulent discharge with positive culture results.

Statistical analysis

The statistical analysis was performed using the χ^2 and t-tests to compare the two groups, and a surgical site infections on analysis for the multivariable analysis. Significant differences were concluded from results using a value of $P<0.05$ in all cases.

Results

Demographic characteristics of study participants

A total of 251 patients were surgical site infections assigned to one of the two treatment arms. The demographic characteristics of the study patients are shown in Table 1 Both groups were similar, showing no statistical differences in demographic and clinical characteristics (Table 1).

Table 1: Demographic characteristics

Characteristic	Group A (n=116)	Group B (n=135)
Age	62.5	60.1
Gender	M 82 F 34	M 98 F 37
Diabetes mellitus	12	16
Heart disease	10	12
Lung disease	5	5

Whether or not the surgical procedure was performed by an open or laparoscopic method was noted. With regard to the intraoperative characteristics, no significant difference was noted. With regard to the postoperative course, the length of time prior to the passage of gas and meal intake in group B was significantly shorter than that in group A.

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TABLE II	**Group A,**	**Group B**	
Time of flatus (days)	2.8±2.0	1.8±1.1	
Time of meal intake (days)	3.4±1.2	2.0±1.5	

A surgical site infection was observed in 26 (10.7%) of the 251 patients. A breakdown of the infectious complications showed that 21 were in group A (8.1%) and five of who were in group B (1.9%). There was also a significant difference between the groups in relation to other infectious complications. Other complications included Pneumonia in 1 patient, UTI in one patient in placebo group as shown in Table III. The incidence of non infectious postoperative complications such as nausea, vomiting, abdominal distension, ileus, diarrhea or constipation was not different between the study groups (p=0.161). The mean hospitalization time was 11.2 days for the patients in the symbiotics group and 12.69 days for the patients in the control group was, with no statistical significance. There were no significant differences between the groups regarding mortality rates and re-hospitalization.

Table III: Infectious complications

Complications	**N**	**Group A**	**Group B**
Surgical site infections	26	21(8.1%)	5(1.9%)
Pneumonia	1	1(1.2%)	
Urinary tract infection	1	1(1.2%)	0

Discussion

Recent clinical studies have evaluated the effect of immunomodulatory diets with probiotics and symbiotics on the incidence of infections related to different gastrointestinal surgeries. Promising results were demonstrated in resections of the pancreas, liver and esophagus5

The development of various perioperative management techniques has contributed to a decrease in the incidence of Surgical site infection; however, the rate of superficial incisional Surgical site infections incidence in elective surgeries remains between 2.5 and 20.5% (7). In the present study, the rate of was 1.9%.

Previous studies have reported that incisional surgical site infections are caused by the imbalance of infectious bacteria, surgical technique and the patient's condition (3). The factors associated with infectious bacteria are the use of preoperative, non-absorbable, oral antibiotics and prophylactic antibiotic use (8). The factors associated with the surgical technique are the preoperative skin preparation, the length of the surgery, the use of open versus laparoscopic surgery, the creation or closure of an ostomy, the suture material used for fascial closure and the type of skin closure (9). It has been reported that the relevant factors associated with the patient's condition are the gender, BMI, ASA score, immunosuppresurgical site infections on, smoking, surgical site infections, requirement for a blood transfusion, subcutaneous fat thickness and postoperative hyperglycemia (10).

In our study, the use of symbiotics also reduced the incidence of remote infections such as pneumonia, which only occurred in the control group. This finding is in line with the results of a meta-analysis conducted by Yang *et al.11* that analyzed 28 randomized trials involving 2511 patients undergoing different abdominal surgeries, including esophagectomies, pancreatectomies, hepatectomies, liver transplants and colectomies. The incidence of infections was lower among patients receiving symbiotics than in controls, particularly for respiratory, urinary, and wound infections. Hospitalization time was also shorter in patients receiving symbiotics. In our study, however, there was no difference between groups in relation to the length of hospital stay.

In our study, we included not only patients submitted to minimally invasive surgeries, but also conventional open surgeries, which represented the majority of our cases. One of the potential advantages of minimally invasive surgery is less surgical trauma, with less acute

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inflammatory response and immune disorders. All infection cases occurred among patients undergoing open surgery, which suggests that the symbiotics effect is more important in this type of surgery.

We observed, therefore, that the perioperative administration of symbiotics in patients submitted to elective surgery significantly reduced the rates of postoperative infection. Our results suggest that preoperative and postoperative oral ingestion of symbiotics may represent a promising strategy to prevent surgical infections.

It has recently been reported that perioperative probiotic and synbiotic treatment can reduce infectious complications, such as incisional Surgical site infections, in esophageal cancer, biliary cancer and abdominal surgery [12]; however, the evidence in those reports was relatively weak, and neither perioperative probiotic treatment nor synbiotic treatment were found to be independently associated as a risk factor of incisional Surgical site infections.

It has been demonstrated that probiotics can improve the intestinal microbial environment and activate host immune function, leading to the prevention of infectious complications[13-14] .

In the present study, probiotics (combination of lactic acid bacteria and bifidobacteria capsules) were administered orally daily all of which are well-documented beneficial bacteria, and these can be effectively absorbed to increase the ratio of beneficial bacteria in the body [15-16].

In the present study, the administration of probiotics induced a decrease in superficial incisional Surgical site infections incidence. Probiotic administration therefore appears to result in the perioperative enhancement of the host immune function. In conclusion, consecutive preoperative and postoperative probiotic treatment could reduce the incidence of superficial incisional Surgical site infections, and could increase the ratio of beneficial bacterial in the feces.

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ISSN: 0975-3583,0976-2833 VOL13, ISSUE 07, 2022

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