

# Effectiveness of placing prophylactic mesh with the Sugarbaker technique via laparoscopic abdominoperineal resection for rectal cancer

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## Abstract

*Introduction:* The aim of this study was to assess the efficacy of parastomal hernia prevention with the Sugarbaker technique via laparoscopic abdominoperineal resection for rectal cancer after a one-year follow-up at University Medical Center in Ho Chi Minh City.

*Patients and methods:* Intervention study. Between 11/2018 and 7/2022, 43 patients with low rectal cancer underwent laparoscopic abdominoperineal resection and were divided into two groups: intervention (n = 15) with prophylactic mesh placement using the Sugarbaker technique and control (n = 28). All patients were tracked for at least a year and had an abdominal computed tomography scan. The Kaplan Meier method was used to calculate the rate of parastomal hernia after one year. To compare the rates of parastomal hernia in two groups, the logrank test was used.

*Results:* This study included 43 patients; the male to female ratio was approximately equal to 1:1; the median age was 62; the youngest age was 40; and the oldest age was 92. Rectal cancer stage III was found in 41.8% of people. Neoadjuvant chemoradiotherapy was used in 27.9% of cases. The average duration of operation was 184 minutes. The average time for mesh placement was 15 minutes. The overall complication rate was 16.4%. There were no issues with mesh placement. At one year, the control group had a higher cumulative rate of parastomal hernia than the intervention group (35.7% versus 0%, logrank 6.4, p = 0.01).

*Conclusions:* Prophylactic mesh placement using the Sugarbaker technique during laparoscopic abdominoperineal resection for rectal cancer is safe, does not increase complications, and reduces the cumulative rate of a parastomal hernia at 1 year in patients who have undergone prophylactic mesh placement.

*Keywords:* Prophylactic mesh placement, Sugarbaker technique, Laparoscopic abdominoperineal resection.

## Introduction

Rectal cancer is a malignant disease that has a high morbidity and mortality rate both globally and in Vietnam. Rectal cancer is expected to account for the greatest proportion of gastrointestinal cancers by 2025 [1]. With advancements in rectal cancer treatment, laparoscopic abdominoperineal resection (APR) has fewer complications, improved postoperative recovery, decreased cancer recurrence and mortality, and increased overall survival [2], [3]. Aside from the obvious benefits, laparoscopic APR still has issues with the permanent colostomy. A common complication of permanent colostomy after APR surgery is parastomal hernia, which occurs more frequently in patients with cancer, obesity, the elderly, and respiratory diseases (asthma, chronic obstructive pulmonary disease) [4], [5]. According to some studies, one-third of parastomal hernias occur within 12 months of surgery, with the majority occurring within the first two years [6], [7]. The recurrence rate of parastomal hernia repair is high. Untreated parastomal hernia can cause serious complications such as bowel necrosis in some cases [8]. Extraperitoneal stoma does not aid in the prevention of parastomal hernia [9], [10]. Recent studies have concentrated on techniques for reducing parastomal hernia complications, particularly in patients with rectal cancer [11], [12].

In 2012, López used the Sugarbaker technique to implant a prophylactic mesh during laparoscopic APR. Short-term outcomes demonstrated that this technique was safe and did not increase the risk of colostomy complications [13]. Other studies suggested using the Sugarbaker technique to place a prophylactic mesh at the same time as colostomy creation to reduce the rate of parastomal hernia [14],[15]. Regarding whether the Sugarbaker technique for placing prophylactic mesh indeed lowers the rate of parastomal hernia, recent studies are still debatable. The effectiveness of placing prophylactic mesh using the Sugarbaker technique during laparoscopic abdominoperineal resection for rectal cancer was therefore conducted.

## Patients and methods

### Study design

This prospective intervention study was conducted at University Medical Center, Ho Chi Minh City, Vietnam. The aim of the study was to determine whether placing mesh using Sugarbaker technique at the same time as laparoscopic APR was effective in preventing parastomal hernia.

### Patients

We recruited all rectal cancer patients who were admitted to University Medical Center in Ho Chi Minh City between November 2018 and August 2022 and underwent laparoscopic APR with a life expectancy of more than one year. We excluded patients who had previously undergone total colectomy, hernia repair, or who had synchronous right or left colon cancer.

Pathology, chest-abdominal computed tomography (CT), and pelvic magnetic resonance imaging (MRI) were used to diagnose and stage rectal cancer using the American Joint Committee on Cancer (AJCC) TNM system [16].

Patients were assigned to either the control (conventional sigmoid end colostomy without mesh) or study groups (conventional sigmoid end colostomy with a synthetic mesh using Sugarbaker technique). Following surgery, all patients were followed up on at University Medical Center's outpatient clinics. Patients were examined one month, six months, and twelve months after surgery. All patients had CT scans 12 months after surgery or whenever a clinical sign suggested parastomal hernia.

### Data collection

The relevant data was extracted from electronic medical records. Abdominal computed tomography was used to confirm the presence of a parastomal hernia. Age, sex, operation time, mesh placement time, blood loss, conversion to open procedure, length of hospital stay, bowel function resumption time, cancer stage, neoadjuvant chemoradiotherapy (nCRT), and mesh infection were also recorded.

### Statistical analysis

The statistical analysis was performed using

the SPSS Statistics, version 25. For categorical variables, data were expressed as frequency (percentage); for continuous variables, data were expressed as mean, standard deviation, and median (interquartile range). The Kaplan-Meier estimation method and the log-rank test were used to calculate the cumulative rate of parastomal hernia. Whenever possible, the statistical test results were provided with a 95% confidence interval (CI). A P-value of less than 0.05 was used to determine statistical significance. For categorical parameters in univariate analysis, the Chi-square test was used. All statistical tests

were two-tailed, and statistical significance was defined as a P-value less than 0.05.

#### Study ethics

The present study was approved by the Institutional Review Board of University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam (approval number: 621/HDDD-DHYD). The informed consent for participation was obtained from the patients. All methods were performed in accordance with the Declaration of Helsinki.

#### Results

Table 1. Patients characteristics in two groups

| Characteristics   |        | Study group n = 15 (%) | Control group n = 28 (%) | N=43 (%)        | p-value |
|-------------------|--------|------------------------|--------------------------|-----------------|---------|
| Sex               | Male   | 8 (53.3%)              | 13 (46.4%)               | 21 (48.8%)      | 0.6     |
|                   | Female | 7 (46.7%)              | 15 (53.6%)               | 22 (51.2%)      |         |
| Median age (year) |        | 58 ± 13 (40-86)        | 64 ± 11 (42-92)          | 62 ± 12 (40-92) | 0.1     |
| Cancer stage      | 0      | 2 (13.3%)              | 1 (3.6%)                 | 3 (7%)          | 0.3     |
|                   | I      | 2 (13.3%)              | 12 (42.8%)               | 14 (32.6%)      |         |
|                   | II     | 2 (13.3%)              | 3 (10.7%)                | 5 (11.6%)       |         |
|                   | III    | 8 (53.4%)              | 10 (35.7%)               | 18 (41.8%)      |         |
|                   | IV     | 1 (6.8%)               | 2 (7.2%)                 | 3 (7%)          |         |
| nCRT              | Yes    | 4 (26.7%)              | 8 (28.6%)                | 12 (27.9%)      | 1       |
|                   | No     | 11 (73.3%)             | 20 (71.4%)               | 31 (72.1%)      |         |

#### Patients characteristics

From November 2018 to August 2022, 82 cases of rectal cancer underwent laparoscopic APR, with 41 cases receiving prophylactic mesh and 41 cases receiving no mesh. After a 12-month follow-up period, 43 cases met the inclusion criteria and were recruited for the study, 15 in the study group and 28 in the control group. Table 1 shows the characteristics of two groups. The median age was 62. The male/female

ratio was comparable in both groups. Rectal cancer stage III was the most common (41.8%), followed by stages I and II. Rectal cancer stage IV had three cases (7%), all of which were liver metastasis, with the liver tumor removed concurrently with laparoscopic APR. The rates of neoadjuvant chemoradiotherapy were comparable between the two groups (26.7% versus 28.6%). Three cases (7%) completely responded to neoadjuvant chemoradiotherapy.

Table 2. Morbidity – mortality tolerance and complications in two groups

| Characteristics                      | Study group n=15 (%) | Control group n=28 (%) | Total n=43 (%)     | p-value |
|--------------------------------------|----------------------|------------------------|--------------------|---------|
| Postoperative mortality              | 0                    | 0                      | 0                  | --      |
| Overall postoperative morbidity      | 2 (13.4%)            | 4 (14.3%)              | 6 (16.4%)          | 1       |
| Operative time (min)                 | 187 ± 100 (120-490)  | 183 ± 47 (120-300)     | 184 ± 69 (120-490) | 0.8     |
| Conversion to open procedure         | 0                    | 0                      | 0                  | --      |
| Mesh placement time (min)            | 15 ± 2 (10-20)       |                        |                    | --      |
| Blood loss (ml)                      | 48 ± 73 (10-300)     | 89 ± 71 (20-300)       | 68 ± 74 (10-300)   | 0.1     |
| Intraoperative complication          |                      |                        |                    |         |
| Bleeding                             | 1 (6.7%)             | 1 (3.6%)               | 2 (7.1%)           | 1       |
| Postoperative complication           |                      |                        |                    |         |
| Urinary retention                    | 1 (6.7%)             | 2 (7.1%)               | 3 (7.0%)           | 1       |
| Ileus                                | 0                    | 1 (3.6%)               | 1 (2.3%)           | 1       |
| Total                                | 1 (6.7%)             | 3 (10.7%)              | 4(9.3%)            | 1       |
| Mesh infection                       | 0                    | 0                      | 0                  | --      |
| Complication related to colostomy    | 0                    |                        |                    | --      |
| Reoperation                          | 0                    | 0                      | 0                  | --      |
| Bowel function resumption time (day) | 2.2 ± 0.9 (1-4)      | 2.1 ± 0.5 (1-4)        | 2.1 ± 0.7 (1-4)    | 0.73    |
| Length of hospital stay (day)        | 7.1 ± 2.4 (4-14)     | 7.0 ± 2.0 (4-11)       | 7.0 ± 2.1 (4-14)   | 0.9     |
| Follow up time (month)               | 12                   | 12                     | 12                 | --      |

### Intraoperative results

The median operative time was 184 minutes. The median time to place mesh using the Sugarbaker technique was 15 minutes, with the shortest time being 10 minutes and the longest time being 20 minutes. Median blood loss was 68 ml, mostly arised from bleeding pelvic vessles during laparoscopic total mesenteric resection (TME). There was no difference in blood loss between two groups. All cases were treated with laparoscopic surgery, no case was converted to open surgery.

### Complications

The rate of complications was 16.4%. Postoperative urinary retention was the most common. There were no serious complications that necessitated surgical intervention or resulted in death.

#### Complications related to Sugarbaker technique

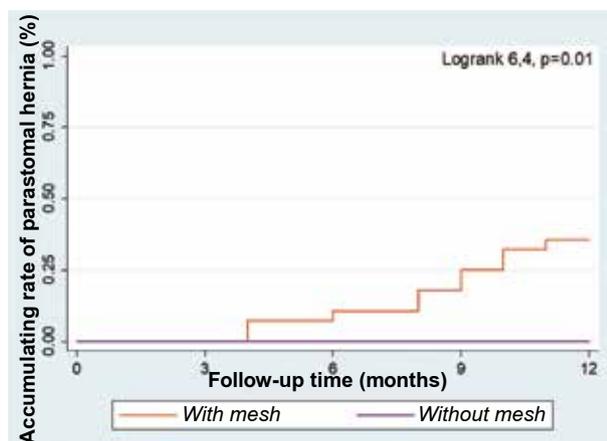
There were no complications associated with the Sugarbaker technique in 15 cases of mesh placement to prevent parastomal hernia.

#### Bowel function resumption time

The median time to resume bowel function was

2.1 days, which did not differ between two groups.

Figure 1. Kaplan-Meier curve for the cumulative rate of parastomal hernia detected by CT scan



### Parastomal hernia

In the study group, after 12 months of follow-up, no parastomal hernia was found in 15 cases of prophylactic mesh placement.

In the control group (without mesh), parastomal hernia appeared as early as 4 months and occurred in 2 cases (7%). After a year, the cumulative rate of parastomal hernia in the control group was 35.7%, which was higher than in the study group (Log Rank test 6.4,  $p=0.01$ ).

### Discussion

Placing prophylactic mesh using Sugarbaker technique is an additional part after performing laparoscopic APR, in order to reduce the incidence of parastomal hernia. Mesh placement concurrent with APR did not increase operative time or slow the patient's recovery after surgery. The median bowel function resumption time in a comparative study of 28 APR cases was 2.6 days, which did not differ between two groups. The median mesh placement time was 15 minutes, and it did not extend the operative time [6].

The use of prophylactic mesh at the same time

as laparoscopic APR did not increase the overall complication rate. Most of the complications was related to the stage of TME, included urinary tract infection (5%), perineal hernia (5%) [17]. However, complications related to the Sugarbaker technique are uncommon, including bleeding from the inferior epigastric artery, colonic obstruction at the mesh placement site, intestinal perforation, and mesh infection. In 28 cases of APR plus prophylactic mesh placement, López (2016) reported a 0% mesh infection rate [14]. Similarly, Hauters (2016) reported no complications related to the placement of prophylactic mesh in 29 cases of APR between 2008 and 2014 [11].

Although the evidence for using prophylactic mesh placement during APR procedures is overwhelming, with a significant reduction in parastomal hernia rate, implementation in routine clinical practice remains controversial. The European Hernia Society recommends inserting mesh behind the rectus abdominis muscle (open surgery) to prevent parastomal hernia [18]. López (2012) performed the first laparoscopic surgery to place intraperitoneal mesh using Sugarbaker technique. In 2016, López published the results of a study that showed mesh placement reduced the rate of parastomal hernia after a 26-month follow-up (25% in the mesh group compared to 64.3% in the non-mesh group). Mesh infection was not recorded in 24 cases [14]. Mika Vierimaa (2015) compared 35 cases of laparoscopic mesh placement using the Keyhole technique to 35 cases of mesh removal. According to the results of the study, the rate of parastomal hernia in the two groups was comparable (51.4% versus 53.1%) [19]. Most of the studies used insoluble synthetic mesh for hernia prevention, only two studies used biologic mesh [18]. After a 12-month follow-up, the non-mesh group in our study had a higher cumulative rate of parastomal hernia than the mesh group (35.7% vs. 0%, Log rank

test 6.4,  $p=0.01$ ). Figel and Lawrence proposed that when the study population has a high frequency of parastomal hernia, low mesh costs, and low rates of mesh infection, the cost-effectiveness of installing routinely preventative mesh at the same time as laparoscopic APR would be significant [20],[21].

## Conclusion

Laparoscopic placing mesh using Sugarbaker technique at the same time as APR in rectal cancer reduces the cumulative rate of parastomal hernia compared with the non-mesh group after 12 months follow-up, which do not increase the rate of complications.

### *Conflicts of Interest*

The authors have declared that no competing interests exist.

### *Human Ethics*

Consent was obtained or waived by all participants in this study. Institutional Review Board of University of Medicine and Pharmacy at Ho Chi Minh City, Vietnam issued approval 621/HDDD-DHYD. The informed consent for participation was obtained from the patients or their family members. All methods were performed in accordance with the Declaration of Helsinki.

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