Original Article

Intraoperative Colonoscopy: Is It a Better Way of Detecting Leakage after Circular Stapler Anastomosis?

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Background: Surgery for colorectal cancer can significantly improve the survival of patients. Although surgical techniques and equipment have improved over the past 20 years, anastomosis leakage after colorectal cancer surgery continue to be a significant complication. Multiple comorbidities and mortality after colorectal anastomosis leakage have been described for example, increasing the need for a permanent colostomy and increased recurrence rate of cancer.

Objective: To evaluate the impact of intraoperative colonoscopy as an intraoperative air leak test in colorectal cancer surgery.

Materials and Methods: One new technique in the procedure of colorectal anastomosis is the circular staple autosuture, which decreases the operative time of colorectal surgery. However, there is no standard technique for testing or checking for colorectal anastomosis leakage.

Results: Data were collected from 33 patients who had colorectal cancer and underwent tumor resection. Eight patients (24%) underwent surgery using the open technique, 13 patients (39%) by the laparoscopic-assisted technique, and 12 patients (36%) by hand-assisted laparoscopic technique. After the tumor was resected, the proximal and distal end of colon and/or rectum were anastomosed using a circular stapler. Afterwards, the anastomosis leak test was carried out by intraoperative colonoscopy to investigate any leakage of air and/or bleeding from the anastomosis site. The intraoperative colonoscopic findings were compared to the postoperative clinical evidence of possible anastomosis leakage. From the present study, there was no air leakage from the anastomosis by using this technique, which correlated to no evidence of postoperative clinical symptoms of leakage.

Conclusion: Detection of anastomosis leakage after circular stapler by intraoperative colonoscopy is an accurate and safe technique for the detection of leakage and bleeding.

Keywords: Intraoperative colonoscopy, Anastomosis leakage test, Circular stapler autosuture

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There is an increased incidence of colorectal cancer in Asia[1]. Multimodal treatments for colorectal cancer have been developed to increase the survival and curative rate. Surgical resection of colorectal cancer is currently the only option for a cure and increases the opportunity for long-term survival. There have been massive improvements in both surgical techniques and equipment over the last 20 years, which have helped to address one of the most serious surgical complications, that of anastomosis leakage. The overall incidence of anastomosis leakage was 3% to 21%[2,3]. The anastomosis leakage mortality rate was 6% to 22%, with an increased risk of permanent colostomy of between 10% and 100%[4,5]. The five year disease recurrence rate in the anastomosis leakage group compared with no leakage was 25.1% and 10.4%, respectively, and the five year survival rates were 52.8% and 63.9%, respectively[5].

Colorectal surgery has been converted to laparoscopic surgery for standard treatment in the recent era. The superior advantages of laparoscopic surgery to the conventional open exploratory laparotomy include low systemic response to injury of the surgical wound, rapid healing rate of the surgical wound, recovery of bowel function, less analgesic requirements, and a shorter hospital stay[6,7]. The result and curative rates of patients undergoing laparoscopic surgery compared to the conventional exploratory laparotomy are not significantly different[8-13]. The circular anastomosis autosuture was created to decrease the incidence of anastomosis leakage and facilitates good low rectal anastomosis in cases where there was a narrow, potentially difficult, pelvic approach. Many studies showed no difference in anastomosis leakage rate

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when the circular stapler autosuture technique was used compared to the conventional hand-sewn technique. However, patients who had the circular stapler autosuture technique had a higher incidence of anastomosis stenosis, 8% compared to 2% in cases of hand-sewn sutured anastomosis[14,15].

Many studies showed that factors influencing anastomosis leakage were patient and surgical factors[16-21]. Patients with many underlying diseases or who were taking immunosuppressive drugs or had previous pelvic radiation, had higher incidence of anastomosis leakage. Main surgical related factors contributing to leakage were difficulties in performing anastomosis, septicemia, emergency surgery, and fecal load in the colon[22].

Prevention and early detection of anastomosis leakage could decrease the risk of the need for permanent colostomy and reduce tumor recurrence rate. Intra-operative anastomosis leakage testing was created for decreasing the leakage rate and may be an indication for a protective colostomy if the testing showed any leakage[23].

No anastomosis leakage testing technique has been documented as a gold standard technique. The present study evaluated a technique that used a colonoscope to check the anastomosis. The hypothesis was that this might be a better technique to show anastomosis leakage and identify the leakage site.

Materials and Methods

The present study was designed as an observational study. Data was collected using an ambispective cohort study design, with retrospective data collected between June 1, 2009 and March 31, 2010, and prospective data collected between April 1, 2010 and December 31, 2010, a total of 19 months.

Population

Colorectal cancer patients studied were operated at the Colorectal Unit, General Surgery Department, Faculty of Medicine, Chiang Mai University. The operations included exploratory laparotomy, laparoscopic-assisted, or hand-assisted laparoscopic surgery. The colorectal anastomosis was using the circular stapler autosuture technique. The collected data included operations in the period between June 1, 2009 and December 31, 2010.

The present study did not calculate sample size estimation because this setting was rare case of colorectal cancer after circular stapler anastomosis. Thus, the present study included every patient between June 1, 2009 and December 31, 2010 (total n = 33 case).

The inclusion criteria were colorectal cancer (any stage), exploratory laparotomy, laparoscopic assisted, or hand-assisted, circular stapler autosuture anastomosis, and intra-operative colonoscopy.

The general data of patients were collected including gender, age, underlying diseases, history of smoking, other comorbidity, immunosuppressant therapy or prior chemotherapy, disease and staging of colorectal cancer, and neoadjuvant therapy of colorectal cancer.

Perioperative data collected included clinical and preoperative vital signs, bowel preparation, operative time, intra-operative blood loss, anastomosis site, intra-operative complications, completion of anastomosis ring, and intra-operative colonoscopy results.

Post-operative data were collected at post-operative days 1, 3, 5, 7, discharge date, and follow-up dates at two and six weeks, including vital signs and post-operative fever, post-operative leukocytosis, post-operative complications, post-operative peritonitis, progression of dietary intake, post-operative abdominal imaging, and other treatments in the same admission.

The collected data were analyzed in a descriptive statistical study to identify incidence of anastomosis leakage, correlation between intra-operative colonoscopy anastomosis testing results and post-operative clinical anastomosis leakage or peritonitis.

Operative technique

After the tumor was resected, the proximal and distal ends of the colon or rectum were anastomosed by circular stapler autosuture. After the autosuture device was removed, the completion of the anastomosis ring specimen was checked. Sterile normal saline solution [NSS] was filled intraperitoneum to drown the anastomosis site. The intra-operative colonoscopy was carried out by inserting a flexible colonoscope gently via the anus and rectum until the anastomosis site was seen. The colon was then gently inflated intraluminally with air.

The stapler line was checked intraluminally and bleeding was checked at the site of anastomosis by direct visualization. Anastomosis leakage was checked extraluminally by looking for air bubble leakage from the underwater anastomosis site.

Statistical analysis

The authors presented frequency and percentage.

Results

Thirty-three patients treated surgically for

colorectal cancer were enrolled onto to the present study. In all, 20 male patients and 13 female patients were enrolled, all of whom had been diagnosed with colorectal cancer. The mean age of all patients was 58.8 years-old (Table 1). Three patients (9%) were diagnosed with descending colon cancer, 10 patients (30%) with sigmoid colon cancer, nine patients (27%) with rectosigmoid colon cancer, and 11 patients (33%) with rectal cancer. Most patients, 13 (40%), were diagnosed with stage 2 cancer. There were a variety of underlying diseases in the patients, the common co-morbid included hypertension, diabetes mellitus, dyslipidemia, end-stage renal disease [ESRD], pulmonary disease, and ischemic heart disease. Three patients suffered from other comorbidities in the same admission such as deep venous thrombosis [DVT], intra-abdominal infection, and lower gastrointestinal [GI] hemorrhage. Only three patients (9%) had received neoadjuvant chemotherapy before surgery (Table 1).

Table 1. Patient characteristics and diseases (total n = 33)

General aspect	n (%)
Age, mean (range)	58 (32 to 81)
Gender	
Male	20 (60)
Female	13 (40)
Underlying disease	
Hypertension	10 (30)
Diabetes mellitus	4 (12)
Dyslipidemia	3 (10)
COPD	2 (6)
ESRD	2 (6)
Asthma	1 (3)
Coronary disease	1 (3)
Cirrhosis	1 (3)
BPH	2 (6)
Arthritis	2 (6)
Comorbidity	
Deep vein thrombosis	1 (3)
LGIH	1 (3)
Intra-abdominal infection	1 (3)
Smoking	6 (19)
Neoadjuvant chemotherapy	3 (10)
Character of disease	
Diagnosis	
• CA descending colon	3 (10)
• CA sigmoid colon	10 (30)
• CA rectosigmoid colon	9 (27)
• CA rectum	11 (33)
Staging	
• I	6 (18)
• II	13 (40)
• III	11 (32)
• IV	3 (10)

COPD = chronic obstructive pulmonary disease; ESRD = end-stage renal disease; BPH = benign prostatic hyperplasia; LGIH = lower gastrointestinal hemorrhage; CA = cancer

One patient had a previous active lower GI hemorrhage before surgery. No patients experienced obstructive symptoms before surgery. No patients had emergency surgery, and all the patients were able to undergo sufficient preparation of the bowel before surgery. The operation was performed using an exploratory laparotomy technique in eight patients (25%), laparoscopic-assisted surgery in 13 patients (39%), and hand-assisted laparoscopic surgery in 12 patients (36%). The mean operative time was 260 minutes. The mean estimate intra-operative blood loss was 195 ml (Table 2).

The most common sites of anastomosis were in the descending colon-rectal area in 18 patients (54%), in the sigmoid colon-rectal area in 11 patients (33%), in the transverse-sigmoid colon area in two patients (6%), and in the ileal-rectal and sigmoid colon-anal area in one patient (3%). None of the patients had any intra-operative complications. All the anastomosis specimen completions were checked with all the ring specimens showing a complete ring anastomosis. After the anastomosis was completed, an intra-operative colonoscope was inserted via the anus upwards to the anastomosis site. There was no anastomosis leakage or anastomosis bleeding identified from the intra-operative colonoscopy investigation. No interventions were required for any of the patients who had undergone anastomosis (Table 3).

The mean post-operative hospital stay was 6.7 days. Twenty patients (60%) had post-operative

Table 2. Peri-operative data of the patients (total n = 33)

Peri-operative data	n (%)
Operative technique	
Open	8 (25)
Laparoscopic	13 (39)
Hand-assisted laparoscopic	12 (36)
Operative time, median (range)	260 (155 to 390)
Estimated blood loss, median (range)	194 (30 to 2,000)
Anastomosis site	
Ileal-rectum	1 (3)
Transverse-sigmoid	2 (6)
Descending-rectum	18 (24)
Sigmoid-rectum	11 (33)
Sigmoid-anus	1 (3)
Intra-operative complications	0 (0)
Ring completion of EEA	33 (100)
Anastomosis leakage	0 (0)
Anastomosis bleeding	0 (0)

EEA = end-to-end anastomosis

Table 3. Post-operative data of the patients (total n = 33)

Post-operative data	n (%)
Post-operative fever	
Yes	20 (60.6)
No	13 (39.4)
Post-operative complication	
Yes	4 (12.1)
No	29 (87.9)
Post-operative peritonitis	0 (0.0)
Post-operative anastomosis leakage	0 (0.0)

fever on the second day after surgery, but only six patients had post-operative febrile leukocytosis. The most common cause of post-operative fever was lung atelectasis. One patient suffered from a surgical wound infection, which improved after local wound care and a course of oral antibiotics. No patients developed post-operative peritonitis or anastomosis leakage and bleeding. This showed a correlation with intra-operative colonoscopic findings (Table 3).

Discussion

The development of surgical techniques and equipment for colorectal surgery has improved the quality of life and survival rate for patients. Laparoscopic-assisted and hand-assisted laparoscopic surgery can reduce post-operative pain, reduce the post-operative inflammatory process and the length of hospital stay, and improve cosmetic results[6-11]. These benefits have caused laparoscopic-assisted surgery to become the gold standard for colorectal surgery in the current era.

Laparoscopic-assisted surgery for patients who suffer from recto-sigmoid or rectal cancer can be performed safely and give better outcomes than the open technique mainly because the anatomy of the pelvic cavity causes difficulties in dissection. The greatest difficulty for the open technique is anastomosis in the pelvic cavity such as low anterior anastomosis or colo-anal anastomosis. Circular stapler autosuture is an innovation for colorectal surgery that assists surgeons in performing difficult anastomosis in the pelvic cavity and reduces the operative time[14,15].

The most serious complication of colorectal anastomosis is anastomosis leakage. Hand-sewn anastomosis and circular stapler autosuture had the same anastomosis leakage rate but an early detection of anastomosis leakage, especially intra-operative detection, provides the earliest resolution and repair of any anastomosis leakage. Another complication that could create a severe morbidity is bleeding of the anastomosis, thus, early detection is very important[14,15,17].

No standard technique for testing an anastomosis leak has been described before. The most common technique for testing was using an air leak test and look for air bubbles from anastomosis line under water. However, the technique could not check the anastomosis directly and could not identify the leakage site[23].

Intra-operative colonoscopy uses a combination technique of the air leak test and direct visualization. This technique can identify a leakage site and can perform any intervention of anastomosis bleeding or can provide a guide for repairing any anastomosis leakage. In the present study, 33 patients were included. These patients suffered from left side colonic cancer or rectal cancer that required an anastomosis in the left side colon or pelvic cavity (Table 1). Intra-operative colonoscopy in the cases of left side anastomosis or pelvic anastomosis could be carried out safely because a flexible colonoscopy provides easy insertion due to the low position of the anastomosis and low air pressure in anastomosis area, which causes very low tension for the anastomosis site.

As shown in Table 2 and 3, after the circular stapler autosuture was fired, completion of the EEA ring specimens was checked. All 33 anastomoses revealed complete stapler ring. Intra-operative colonoscopies were performed after the anastomoses were completed in each case and there was no anastomosis leakage or bleeding found intra-operatively. Routine general post-operative care had been completed but signs of anastomosis leakage and peritonitis were checked for. Post-operative fever occurred in 20 patients, but the cause of fever was not an anastomosis complication. At the discharge date and follow-up dates there were no signs of anastomosis leakage or bleeding in all patients. The correlation between the intra-operative colonoscopic findings and post-operative symptoms of the patients give strong evidence that an intra-operative colonoscopy can be carried out safely, and this is a good technique as an anastomosis leakage test.

There were many limitations of the present study. Firstly, data were collected for an ambispective design and retrospective data could not be fully collected. Secondly, the descriptive study and number of patients could not show the full accuracy of this technique as the small sample size could not give a statistically significant positive or negative predictive value of anastomosis leakage.

Conclusion

Detection of anastomosis leakage after using a circular stapler by intraoperative colonoscopy is an accurate and safe technique for the detection of leakage and bleeding. This technique can be applied in case of hand-sewn suture anastomosis and further comparative study will assure the accuracy of this technique. This may be the new gold standard technique to be used as an anastomosis leakage test in the future.

What is already known on this topic?

Anastomosis leakage is a common complication after colorectal cancer surgery[2,3]. This complication increases morbidity and mortality rate, an increased risk of permanent colostomy[4,5]. The five year disease recurrence rate in the patients who had anastomosis leakage was high[5]. Prevention and early detection of anastomosis leakage could decrease the risk of the complication. Intra-operative anastomosis leakage testing was created for decreasing the leakage rate and may be an indication for a protective colostomy if the testing showed any leakage[23].

What this study adds?

No anastomosis leakage testing technique has been documented as a gold standard technique or the best technique. This study evaluated a technique that used a colonoscope to check the anastomosis intraoperatively. This technique is safe and easy to perform. The result from this study showed that there was no air leakage from the anastomosis carried out using this technique, which correlated with no evidence of postoperative clinical symptoms of leakage. This technique could be one of the testing techniques in colorectal cancer surgery for detecting leakage.

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Potential conflicts of interest

The authors declare of no conflict of interest.

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