

Intraoperative colonoscopy for anastomosis assessment in left sided colorectal surgery; does it prevent anastomotic leak?

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Abstract

Background: Anastomotic leak is the most dreaded complication following colorectal surgery. Objective methods of assessing the anastomosis integrity are needed to minimise these catastrophes. Intraoperative colonoscopy allows immediate assessment of anastomosis integrity and possible bleeding from stapler line.

Purpose: The aim of our study is to evaluate the impact of intraoperative colonoscopy in preventing anastomotic leak following left-sided colorectal stapled anastomosis.

Method: A retrospective study was performed in a colorectal center in Malaysia. All patients who underwent laparoscopic and open left-sided colorectal surgery from 2019 till 2020 were included in this study. Demographic details, surgical procedure details and surgical outcome of participants were collected from their medical records. The incidence of anastomotic leak in patients who underwent intraoperative colonoscopy after anastomosis and those who did not were compared using Pearson's Chi Square test.

Results: A total number of 131 patients were enrolled in this study. 62 (47.3 %) patients underwent intraoperative colonoscopy evaluation and 69 (52.7%) patients without it. In the intraoperative colonoscopy group, 4 (6.5%) anastomotic leak were detected intraoperatively and repaired. Out of it 1 patient had postoperative leak. One patient had a leak during post operative period despite the intraoperative colonoscopy was normal. In patients without intraoperative colonoscopy, 9 (15.7%) anastomotic leak were detected during the postoperative period. The Pearson Chi-Square test value for the association between performing on table scope and surgery outcome was 4.092 ($p=0.043$) which is statistically

significant.

Conclusion: The rate of anastomosis leak is lower among patients who had intraoperative colonoscopy. The detection of threatened anastomosis through intraoperative colonoscopy allows immediate surgical repair and prevention of potential anastomosis leak postoperatively. Therefore, intraoperative colonoscopy has a positive impact in terms of detection and prevention of postoperative anastomotic leak in left-sided surgical resections with stapled anastomosis.

Introduction

Surgical management of colorectal cancers has evolved over the years. Advancement in medical technologies and better understanding of the disease process has made tremendous impact in patient care. Improved surgical skills, technologies and the introduction of neoadjuvant therapy has given favourable results and improved patients' quality of life.

However anastomotic leak following a colorectal resection leads to a devastating outcome for patients. The reported rate of anastomotic leak in colorectal surgery varies from 1.8% to 19.2% with the highest risk in low rectal anastomoses [1]. Anastomotic leak considerably increases the short- and long-term morbidity and mortality rate². It causes poor favorable outcomes in oncological point of view and increases financial burden both to the patient and hospital administration [2].

Factors influencing anastomotic leak can be categorized into patient-related and modifiable factors. Age, male sex, neoadjuvant chemoradiotherapy, tumor location, tobacco use and malnutrition are the known patient-related factors associated with anastomotic leak [3],[4]. Poor technical construction of the stapled anastomosis, anastomosis formed under tension and insufficient perfusion at the anastomotic site are among the modifiable factors that causes anastomosis leak in post operative period [1].

The reduction of rates of anastomosis leak, by improving its prevention, diagnosis and management continues to be a challenge. Surgeons have been routinely using many different intra-operative techniques to assess the integrity and bowel viability following surgery [5]. Usually, surgeons often look

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for the bowel cut edge bleeding, pulsating marginal artery, and serosal mucosal color to determine the perfusion of the bowel before anastomosis. However, these subjective evaluations rarely guarantee a well perfused bowel edge. Karliczek et al. showed that the risk of anastomotic leak is underestimated and the accuracy of surgeons' prediction of anastomotic leak risk is low. The authors indicated a need for a reliable predictive test that could be used intraoperatively [3].

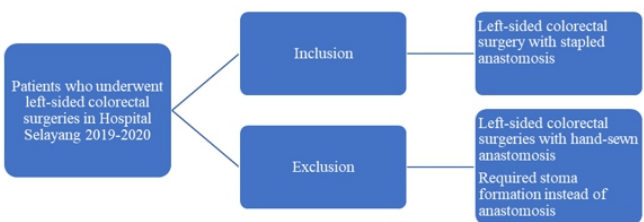
Many different tests are proposed to evaluate the integrity of the anastomosis intraoperatively. However, the ideal intraoperative test to prevent anastomotic leak is yet to be established. We have employed the usage of intraoperative colonoscopy since 2019 at our Centre. In our study we aimed to determine the utility of intraoperative colonoscopy in preventing and reducing anastomotic leak rate following colorectal surgery.

Methodology

This study was performed in a tertiary center hospital in the Klang Valley. It is a retrospective study where all patients who underwent left-sided colon/rectum resection either open or laparoscopic in year 2019 to 2020 were included. Indications for surgery were either colorectal carcinoma or diverticular disease. Both elective and emergency procedures were included. The study endpoint was incidence of anastomotic leak post-surgery.

Type of surgery performed was categorized according to tumor location. Left hemicolectomy was done for descending colon tumors and sigmoidectomy for sigmoid tumors. Anterior resection was performed for rectosigmoid tumors and rectal tumors above the peritoneal reflection, and low anterior resection for tumors below the peritoneal reflection. Anastomosis was constructed using double stapler technique in all cases. Patients with hand-sewn coloanal anastomosis were excluded from the study (Figure 1).

Figure 1: Inclusion and exclusion criteria of the study



Routine visual assessment of the proximal end of the mucosa was performed in all cases to determine the appropriate point of transection. The cut edge of the mucosal surface of the proximal colon was inspected for bleeding to determine the vascularity. Once the anastomosis is created with circular stapler, the donuts left in the device were inspected for completeness. It is mandatory in our institution to carry out an air leak test in all cases. For the air leak test, patients were tilted back to reverse trendelberg and the pelvis filled with water. The proximal end of the bowel was occluded with a grasper and 200mL of air was insufflated with a syringe over a rectal tube into the colorectal segment. The water in the pelvis was observed for bubbles from a possible anastomotic leak.

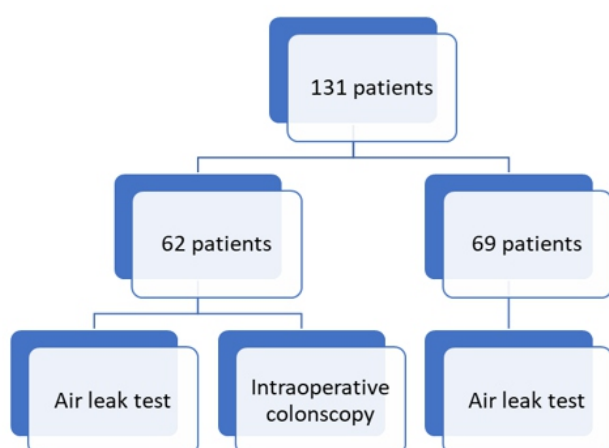
Intraoperative evaluation of anastomosis with colonoscopy was started in our center in late 2019. However, it was not routinely performed and was based on the operating surgeon's preference. After construction of the anastomosis, pelvic cavity was submerged with water. A colonoscopy will be introduced through the anus and advanced until the anastomosis was visualized. Firstly, the anastomosis will be visualized to confirm the integrity. Following that an air leak test will be performed by insufflating air through the scope while the operating surgeon occludes the proximal end of the bowel. All patients were placed in the Lloyd-Davies's position in Allen stirrups before the operation. The endoscopic surgeon stood between the legs of the patient at the end of the operating table, and the monitor was placed adjacent to the patient's left leg so that both the operating surgeon and the endoscopic surgeon could inspect the monitor in the same axis. A laparoscopic soft bowel clamp was carefully applied to occlude the lumen of the proximal bowel. Air insufflation was performed at the level of the anastomosis for an air leak test. Any bleeding or defects were noted and treated as appropriate. Salvage procedures were performed depending on the nature of the abnormality detected.

Results

A total of 131 patients were included in this study. Table 1 shows the sociodemographic details of study participants. The median age of those who underwent surgery was 61 [16-81] years. There was an equal distribution of male and female participants. The majority of surgery was done electively (91.6%) mostly involving malignant tumors (87.8%). Of the 131 patients, 40 (30.5%) underwent open anterior resection while 29 (22.1%) underwent laparoscopy anterior resection. 18 (13.7%) of the patients who had rectal tumor underwent neoadjuvant concurrent chemoradiotherapy.

Table 1: Sociodemographic of study participants

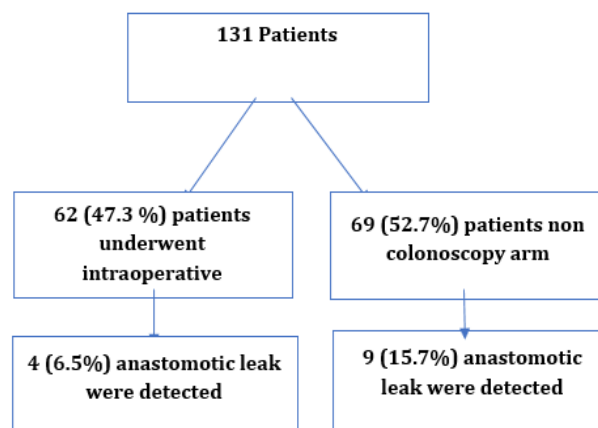
		N (%)
Age (years) Median [Range]		61 [16-81]
Gender		
	Male	65 (49.6)
	Female	66 (50.4)
Ethnicity		
	Malay	72 (55.0)
	Chinese	48 (36.6)
	Indian	10 (7.6)
	Others	1 (0.8)
Type of surgery		
	Open sigmoid colectomy	3 (2.3)
	Open anterior resection	40 (30.5)
	Laparoscopy anterior resection	29 (22.1)
	Open low anterior resection	15 (11.5)
	Laparoscopy low anterior resection	20 (15.3)
	Laparoscopy converted to open anterior resection	13 (9.9)
	Laparoscopy converted to open low anterior resection	7 (5.3)
	Open left hemicolectomy	3 (2.3)
	Laparoscopy left hemicolectomy	1 (0.8)
Setting		
	Elective	120 (91.6)
	Emergency	11 (8.4)
On table scope		
	Yes	62 (47.3)
	No	69 (52.7)
CT done post surgery		
	Yes	24 (18.3)
	No	107 (81.7)
CT noted leak		
	Yes	11 (8.4)
	No	12 (9.2)
	Unsure	1 (0.8)
Tumour type		
	Benign	16 (12.2)
	Malignant	115 (87.8)
Radiotherapy given		
	Yes	18 (13.7)
	No	113 (86.3)

Figure 2.

Out of 131 patients, 47.3% (62) underwent on table colonoscopy after the construction of anastomosis and 52.7% (69) were in the non-colonoscopy arm. In the colonoscopy arm group 4 leakage was detected intraoperatively and was oversewn. However, 1 patient still had anastomotic leak even

after the anastomosis was rectified intraoperatively. During the post operative period 1 patient had a leak detected in spite the intraoperative colonoscopy was normal.

In the non-colonoscopy group, 9 had early post operative anastomotic leak which required surgery.

Figure 3.

The Pearson Chi-Square test value for the association between performing on table scope and surgery outcome was 4.092 ($p=0.043$) which is statistically significant. Based on the results presented in Table 2, it can be deduced that occurrence of leak post-surgery is significantly lower in patients who underwent intra-operative scope compared to those who did not.

Table 2 : Association between performing on table scope and surgical outcome in patients undergoing colorectal surgery

Surgery outcome	On table scope performed	
	Yes [N (%)]	No [N (%)]
No leak	60 (50)	60 (50)
Leak detected	2 (18.2)	9 (81.8)

Discussion

Post operative anastomotic leak carries a major burden in terms of morbidity and mortality [6],[7]. It causes the need for re-surgery, stoma creation, longer hospital stays and delay in adjuvant treatment, leading to poor oncological outcome [6]. Despite identifying several risk factors, intraoperative technical considerations and development of prognostic indexes it is still a challenge to predict and prevent the occurrence of anastomotic leak [3],[4],[6],[7].

Numerous studies have been conducted in the past on application of intraoperative colonoscopy [2],[8]. However,

no clear consensus regarding the benefit of this method has been established till date. In a retrospective study by Shamiyeh et al. from May 1999 to July 2007, impact of intraoperative endoscopy after creation of circular-stapled anastomoses was examined in a cohort of 253 patients. Endoscopic examination allowed intraoperative identification of anastomosis line disruption in 2.4% of patients allowing immediate revision. Nonetheless, no statistically significant reduction in leak rate was appreciated in the endoscopic subset [2],[8]. Additionally, non-randomized controlled trials by Lieto et al., Lanthaler et al., Schmidt et al., and Saknoue et al. featuring application of intraoperative endoscopy were included in a meta-analysis by Nachiappan and colleagues [9]. Of the 950 patients included in this meta-analysis, intraoperative endoscopy permitted detection and immediate repair of anastomotic disruption in 13.8% of the endoscopy subset. Despite this effect, no significant differences in postoperative leak rates were established between test and control subsets [9].

In contrast our study has clearly shown the usefulness of intraoperative colonoscopy in reducing the anastomotic leak rate postoperatively. Intraoperative colonoscopy in a newly formed anastomosis is well tolerated by the patients and does not cause weakness in the integrity of the stapled line. This method of testing is very reliable and its results are reproducible. It is quite easy to perform and does not cost much delay in operative timing. Studies have shown it is relatively a safe procedure and does not cause harm to the anastomosis.

Intraoperative colonoscopy allows the surgeon to assess perianastomotic mucosal viability, mechanical disruptions and intraluminal bleeding. The colonic mucosa is less tolerant to under perfusion compared to the serosa. Therefore, intraluminal view allows one to visualize areas of mucosal ischemia. Furthermore, any bleeding from the stapler line after construction of an anastomosis can be dealt with intraoperative colonoscopy. Air leak test is also possible to be done through intraoperative colonoscopy. Intraoperative measures taken once abnormal colonoscopy findings will reduce the total number of anastomotic leaks postoperatively.

In the past, surgeons were concerned as to the safety and potential complication related to intraoperative colonoscopy. It was speculated that intraoperative colonoscopy can damage the anastomosis due to elevated intraluminal pressure. However, studies have proven that this procedure is safe and well tolerated as the maximum pressure in the neorectum after resection and the colorectal anastomosis can reach up to 200mmHg [1], [10]. The mean maximal pressure during intraoperative colonoscopy in humans is about 42mmHg, while at least 2-fold higher pressure is necessary to

cause leakage in experimental large animal studies [1],[10].

Air leak test which is commonly performed using a catheter or syringe did not effectively reduce the incidence of clinical anastomotic leak. Yang et al. has evaluated the benefit of air leak test with intraoperative colonoscopy [11]. They reported a lower overall incidence of anastomotic leak in the intraoperative colonoscopy group than in the conventional air leak test group. Intraoperative colonoscopy is able to provide air insufflation with adequate and steady pressure for air leak test compared with other methods thus able to detect potential air leakage. Hence, we recommend performing air leak test with intraoperative colonoscopy.

In our present retrospective study air leak test was routinely performed in all patients who underwent left sided colorectal anastomosis. However, the choice of air leak test through syringe or intraoperative colonoscopy is the choice of the operating surgeon. Our results clearly show air leak test using intraoperative colonoscopy is a more reliable method for detecting technical defects in the anastomosis compared to conventional air leak test through syringe method. The higher positive intraoperative leak test in the intraoperative colonoscopy group could indicate that leak assessment through intraoperative colonoscopy is the more efficacious method for detecting defects in the anastomosis.

Furthermore, a retrospective study conducted by Carannante, Filippo, et al. investigated whether implementing a quadruple assessment approach during colorectal anastomosis could help reduce the rate of anastomotic leakage in rectal cancer patients. The protocol involved four key evaluations: an air leak test; indocyanine green fluorescence angiography (ICGFA) to determine the proximal resection margin and assess the rectal stump; endoscopic examination combined with ICGFA; and inspection of both anastomotic doughnuts following circular stapling. A total of 293 patients participated in the study. The group that underwent the quadruple assessment showed a significantly lower incidence of anastomotic leakage compared to the control group (7.7% vs. 16%; $p = 0.001$). This reduction remained significant [12]. This study demonstrates how the structured application of a quadruple assessment during colorectal anastomosis may enhance awareness of anastomotic integrity and help lower the incidence of anastomotic leakage.

There were some limitations in our study. Firstly, it was a retrospective study without randomization of patient selection. Second, relatively small sample size may have impacted overall power and the ability to discern effect on

other key endpoints. The decision to perform intraoperative colonoscopy was dependent on surgeons' preference. There was no documentation on mucosal grading which determines a well perfused anastomosis. Furthermore, the salvage procedure was not highlighted once leak was noted intraoperatively. Future prospective studies with a larger population size are warranted.

Conclusion

Our study has clearly showed the effectiveness of intraoperative colonoscopy in preventing anastomotic leak following left-sided colorectal surgery. We were able to rectify the anastomosis intraoperatively if leak is detected and thus reduce the postoperative leak rate. It has gained popularity among surgeons at our institution as anastomosis done in 2020 has routinely undergone intraoperative colonoscopy.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this study.

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