

Anastomotic Leak in Laparoscopic Colorectal Surgery: Risk Factors and Prevention

Abdullah Badawi

ABSTRACT

Background: Anastomotic leakage (AL) is a common complication and still is a significant problem following laparoscopic colorectal surgery. Risk factors and prevention for AL are not well-defined.

Methods: A systematic search of electronic databases. Cohort, case-control studies and randomized controlled trials that examined clinical risk factors and prevention for AL were included.

Conclusions: In conclusion, tumor location ≤ 6 cm from the anal verge, tumor size > 5 cm, preservation of the left colic artery, male gender, severe malnutrition, body mass index (BMI) ≥ 25 , preoperative Neoadjuvant therapy and steroid therapy, American Society of Anesthesiologists (ASAs) score ≥ 3 , tobacco abuse, operating time ≥ 180 minutes, precompression before stapler firing and multiple firing of the stapler are associated with increase the risk of developing AL. On the other hand, Improve nutritional status, control comorbidities, stop smoking at least 2 weeks before surgery and preoperative use of mechanical bowel preparation, assessment and subsequent adaptation of operative technique without multiple firings of stapler or precompression before stapler firings and the use of transanal tube postoperatively, showed decrease in the AL rate following laparoscopic colorectal procedures.

Keywords: Anastomotic leak, Colon cancer, Colorectal cancer, Laparoscopic colorectal surgery, Laparoscopy, Prevention of anastomotic leakage, Risk factor of anastomotic leakage.

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BACKGROUND

Anastomotic leakage (AL) is a common complication and still is a significant problem following laparoscopic colorectal surgery. Risk factors for AL are not well-defined. Herein, data analysis and systematic review to quantify the predictive risk factors for AL and prevention in

patients who underwent laparoscopic colorectal surgeries were collected.

METHODS

A systematic search of electronic databases (PubMed, NCBI, Annals journal, WJOLS, SLS journal, WJGS, Medscape and UpToDate) for 31 studies published from January 2009 to September 2015 was performed. Cohort, case-control studies and randomized controlled trials that examined clinical risk factors and prevention for AL were included.

INTRODUCTION

Since the beginning of laparoscopic surgery, minimally access techniques have been used by surgeons and gynecologists for multiple elective procedures, some emergency procedures, benign and malignant tumors. In 1987, big step toward the minimally invasive techniques and away from more invasive open techniques, after the promising outcome of the laparoscopic cholecystectomy.⁴⁰ The first laparoscopic colectomy was reported in 1991 by Jacobs et al and showed better outcome and less recovery period.⁴¹

Many surgeons performed laparoscopic colectomy for benign diseases, oncologic concerns made the application of minimally access surgery (MAS) to malignant colorectal disease slow.⁴² By the time, after numerous studies (randomized controlled trials) comparing laparoscopic to open surgery for colon cancer were published, were showed that in experienced hands, appropriate oncologic resections can be performed and the results of laparoscopic techniques equivalent to the open techniques.⁴³⁻⁴⁶ After the minimally access procedures became widely accepted, many surgical innovators and industries develop new technology with even less invasive approaches. Single-incision laparoscopic surgery (SILS) allows the surgeons to operate through single incision.⁴⁸ Robotic procedures at the beginning was popular in other specialties, such as urology, and some surgeries for rectal cancer to overcome the limitations of conventional laparoscopy in the confined working space of the pelvis.^{49,50} In 2000, the da Vinci Surgery System broke new ground by becoming the first robotic surgery system approved by the FDA for general laparoscopic surgery.

Surgical Resident

Department of Surgery, King Abdulaziz General Hospital and Trauma Center, Jeddah, Saudi Arabia

Corresponding Author: Abdullah Badawi, Surgical Resident, Department of Surgery, King Abdulaziz General Hospital and Trauma Center, Jeddah, Saudi Arabia, Phone: 00966126375555, e-mail: dr.abdullah_badawi@hotmail.com

Natural orifice transluminal endoscopic surgery (NOTES) to colorectal disease has not yet fully transpired, though there have been major advances as instrumentation improves and transitional techniques allow natural orifice specimen extraction following laparoscopic colorectal surgeries.⁵¹⁻⁵⁴

AIM

The aim of this paper is to review the published studies regarding the risk factors and the prevention of AL following MAS for colorectal cancer.

CONTENT

Anastomotic fistula after colorectal surgery represents a major and potentially life-threatening postoperative complication. The incidence rate has been reported to be as high as 1 to 19%.^{6,36,37,38,55-58} Mortality rate postoperatively associated with anastomotic complications ranges from 3 to 20%.^{6,56,58,59} and accounts for approximately 30% of all deaths following colorectal surgery.⁶⁰ There is still three significant diversity between surgeons in what they define as AL. In a systematic review of gastrointestinal anastomotic leakage, 49 papers were found with 29 different definitions.⁶¹ In 2010, specific guidelines on the definition of an anastomotic leak with a grading system of severity following rectal surgery were published by the International Study Group of Rectal Cancer.⁶² According to that paper, AL should be defined as a defect of the intestinal wall at the anastomotic site (including suture and staple lines of neo-rectal reservoirs) leading to a communication between the intra- and extra-luminal compartments.

MATERIALS

Studies Population

From the 31 studies published from January 2009 to September 2015 involving 6,921 patients underwent elective laparoscopic colorectal procedures with stapling technique (ST) anastomosis.

RESULT

Tumor Location

The selected data showed that the overall AL rate was 6.21% (430/6921 patients). A total of 6,921 patients, male patients represented (63.2%) with a median age of 65 (50–74) years at the time of surgery were included. Data analysis showed that most common risk factor for leakage in all papers was distance of the anastomosis from the anal verge.¹⁻⁴ The lower the anastomosis (almost below 6 cm) the higher is the risk of developing fistula.

Vitali-Goriainov and Andrew J Miles showed in their study the height of anastomosis has been shown to affect the incidence of anastomotic leak and a life-threatening clinical AL occurred in anastomosis lower than (6 cm). Lopez-Kostner et al showed the rate of leak was 8.4% when it was below 10 cm from the anal verge, 5.4% when it was 10 to 15 cm from the anal verge and 0.14% when the anastomoses was above 15 cm, in a study performed on 819 patients with rectal or sigmoid cancers.⁵ Rullier et al have shown that the leak rate was 6.5 times higher in anastomoses located <5 cm from the anal verge, with overall leak rate of 13% in a study of 272 patients with consecutive anterior resections and⁶ a leak rate of 7.7% after low rectal stapling (<7 cm of the anal verge) compared with 1% for high stapling, reported by Vignali et al in a review of 1014 patients with stapled rectal anastomoses.⁷ A study of laparoscopic anterior resection with intracorporeal rectal transection and double-stapling technique (DST) anastomosis for rectal cancer showed results suggest that tumor localization and preservation of the left colic artery are predictive factors for clinical AL.³⁵

Tumor Size

Multiple studies suggest that tumor size is risk factor for an anastomotic leak (tumor size >5 cm).³⁸⁻⁶³

Transanal Tube

Transanal tube placement was effective for prevention of AL following laparoscopic low anterior resection and decreases the risk of reoperation after symptomatic leakage. In study performed on 96 patients, a transanal tube was placed after anastomosis, the frequency of leakage was 4.2% (4/96) in group with transanal tube and was 13.8% (15/109) in group without transanal tube. The rate of leakage was significantly lower in with transanal tube.³⁴

Mechanical Bowel Preparation

There is good evidence supporting the use of mechanical bowel preparation (MBP) in the preoperative management of patients undergoing elective right-sided and left-sided colorectal surgical resections. In another study showed no evidentiary indications for more severe complications in patients without preoperative bowel preparation.³⁹

Surgical Technique

Important risk factor for anastomotic leak was precompression before stapler firings. Study of 154 rectal cancer patients who underwent laparoscopic LAR with DST showed precompression before stapler firings and

multiple firings of the linear stapler, were significantly associated with AL.³⁷ Most probably, it will affect the blood supply to the anastomotic site.

Several studies confirmed that laparoscopic colorectal surgery improved early postoperative outcomes in terms of reduced intraoperative blood loss, postoperative pain, ileus and hospital stay.⁸⁻¹⁰

Men vs Women

Anastomotic leakage after colorectal anastomosis was reported to be more common for men. Law et al reported in their study male gender as a risk factor for AL after low anterior resection.¹¹ Rullier et al have showed that fistula was 2.7 times higher in men compared to women after analyzing variables associated with AL in 272 consecutive anterior resections.⁶ A systematic review and meta-analysis of 4,580 patients and an analysis of 753 patients showed that men more to have anastomotic leak than women.^{36,38} Lipska et al also showed in a study of 541 patients that men are at a higher risk. The rate of AL increases in men with previous abdominal surgery, rectal cancer lower than 12 cm from the anal verge or prolonged operating time. The risk of AL increased when two or more risk factors were present.¹²

Body Mass Index

Most of studies reported that body mass index (BMI) ≥ 25 is risk factor for AL.³⁸

Malnutritions

Malnutrition can affect the healing process of the anastomosis. A study showed that significant effects on colonic AL and wound infection can occur only with severe degrees of malnutrition.¹³ Malnutrition exerts an adverse effect on tissue healing by affecting processes, such as collagen synthesis or synthesis of sulfated mucopolysaccharides or affecting fibroblast proliferation. Some studies have showed a relationship between preoperative serum albumin level and the occurrence of anastomotic fistulas and the reduction of value of serum albumin in 5th POD were the factors that were associated significantly with the development of clinical AL.⁶

Study reported a rate of 6.9% of fistula in patients with albumin level less than 3 mg/dl, and 2.8% incidence of fistulae for the patients with the level of serum albumin higher.¹⁴ Several studies reported a preoperative serum albumin level less than 3.5 g/dl to be a significant risk factor for anastomotic leaks.¹⁵⁻¹⁸

Hemoglobin and Blood Transfusion

The level of hemoglobin preoperatively and in 5th POD was not significant risk factors. Recent studies have

suggested a negative role of blood transfusions in the outcome of patients with cancer.¹⁹⁻²² Blood transfusions lead to depression of the immune system increasing the risk of postoperative infectious complications and the incidence of anastomotic fistulas. Study showed that blood transfusions increase the incidence of anastomotic abscess and poor healing of anastomoses.²³ Study also found that postoperative blood transfusion is an independent predictive factor for anastomotic leakage.²⁴

American Society of Anesthesiologists (ASAs) Score

Most authors, the American Society of Anesthesiologists (ASAs) score ≥ 3 was associated with an increased risk for anastomotic leak.²⁵⁻²⁸ Around the 2.5 times increased risk of anastomotic leak with every unit increase in the ASA score.²⁹ Another author confirmed high ASA grade as independent risk factor for anastomotic leak.³⁰ Medical comorbidities (pulmonary, cardiac, renal) are risk factor for AL.

Operation Time

Operating time ≥ 180 minutes identified as a risk factor.

Neoadjuvant Therapy and Steroid Therapy

Neoadjuvant therapy tended to be associated with the development of AL. Preoperative chemotherapy reported as risk factor for anastomotic leak.³⁸ Chronic steroid therapy was significantly associated with leaks.^{14,18,31,32} In a study showed that, the incidence of AL was significantly higher in seven patients treated with long-term corticosteroids (50% leak) and in patients taking corticosteroids preoperatively (19% leak).³³

OTHER FACTORS

Data analysis demonstrated that AL was more common in patients with tobacco abuse. Not significant with Alcohol abuse.³⁶

CONCLUSION

Colorectal anastomotic leak is one of the most common complications of laparoscopic colorectal surgeries. In conclusion, tumor location ≤ 6 cm from the anal verge, tumor size > 5 cm, preservation of the left colic artery, male gender, severe malnutrition, BMI ≥ 25 , preoperative Neoadjuvant therapy and steroid therapy, ASA score ≥ 3 , tobacco abuse, operating time ≥ 180 minutes, pre-compression before stapler firing and multiple firing of the stapler are associated with increase the risk of developing AL. On the other hand, Improve nutritional status, control comorbidities, stop smoking at least 2 weeks before surgery and preoperative use of mechanical bowel

preparation, assessment and subsequent adaptation of operative technique without multiple firings of stapler or precompression before stapler firings and the use of transanal tube postoperatively, showed decrease in the AL rate following laparoscopic colorectal procedures.

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