



RISK FACTORS FOR OCCURRENCE OF ANASTOMOSIS LEAKAGE IN COLORECTAL SURGERY

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ABSTRACT

Introduction: The occurrence of anastomosis leakage in colorectal surgery is related to high mortality, more frequent relaparotomy and increased duration of hospital stay. Numerous studies have investigated the risk factors leading to insufficiency.

Aim: To investigate and acquire more information about risk factors leading to anastomosis leakage in gastric, pancreatic biliary and liver surgery.

Material and methods: A query in PubMed, Cochrane and Google Scholar was conducted between 1972 and 2012. Key words used were anastomosis insufficiency, risk factors, colorectal surgery.

Conclusions: Two groups of risk factors for anastomosis leakage occurrence in colorectal surgery have been identified: patient-specific and operative

Key words: anastomosis leakage, risk factors

INTRODUCTION

Anastomosis leakage is among the most serious complications in abdominal surgery. The consequences include a high frequency of sepsis, need from continuous intensive care, in-hospital stay, need for resurgery and high post operative mortality (1, 2, 3, 4, 5, 6).

The incidence of gastrointestinal anastomosis leakage is highly variable but the differentiation of patients at high risk results in the set up of behaviour standards. The early diagnosis and the timely decision for operative treatment determine the favourable outcome in such patients.

According to the severity and therapeutic measures needed to cope with, Rahbari NN classifies anastomosis leakage into three grades (7):

- grade A – the leakage requires no changes in the behaviour
- grade B – requires intensive treatment with percutaneous drainage
- grade C – require relaparotomy or relaparoscopy

The clinical diagnosis of anastomosis leakage is usually made between post operative days 7 and 11 (8). A longer time interval has been reported in some studies – 45 days. As the long interval has been associated with high morbidity and mortality, patients at risk should be intensively monitored for early signs of insufficiency (9). That is why, Dekker et al. introduce a scoring system (Colon Leakage Score) for evaluation of patients at risk for anastomosis leakage. The prognostic value of the system was $P < 0.01$. This scoring system was designed to help surgeons towards setting up an individual behaviour for each patient in order to safe decision make up about making anastomosis or making a stoma (10).

MATERIAL AND METHODS

A query in PubMed, Cochrane and Google Scholar was conducted between 1972 and 2012. Key words used were anastomosis insufficiency, risk factors, colorectal surgery.

Materials used for anastomosis

During the last decades, a lot of different materials have been used for anastomosis, including catgut, stainless steel, monofilament and absorbable sutures. Recently, the mechanical suturing devices were introduced (11).

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Nevertheless, the choice of technique for making anastomosis is still disputable among the different schools (12).

Most foreign materials provoke inflammatory reaction in human bodies, surgical sutures are not an exception. Silk provokes a local inflammatory reaction which could persist for weeks after placing of stitches, whereas polypropylene, polyglycol etc. provoke a milder inflammatory response. The difference between absorbable and non-absorbable filaments with regard to anastomosis strength is not consistent.

Mechanical staplers have been developed by Hülthl in 1908, but their use has increased after the introduction of new and reliable disposable staplers during the last 30 years (11).

Regardless of that, the occurrence of anastomosis leakage is higher as compared to manually made anastomosis (13)

Yet, the choice of a technique should be made on the basis of previous experience, clinical circumstances and the available resources. The systematic review made by MacRae HM *et al.* has shown that both techniques were efficient and so, the choice could be made according to personal preferences (14).

DISCUSSION

The leakage of anastomosis after colon resection has an enormous influence on the course of disease, mortality and the quality of life of patients. The mortality rate after anastomosis leakage could attain 30% (15).

The clinically symptomatic leakage requires one or more reoperations, with increased need for intensive care and more prolonged in-hospital treatment (16)

According to literature data, the incidence of this complication varied from 1% to 24% (17, 18, 19, 20). Unlike it, stenosis is observed only in 1.2% – 4.2% of cases (21, 22).

Risk factors could be divided into two principal groups: patient-related factors and operative factors.

Patient-specific factors are some clinical and biological parameters such as BMI > 30, male gender, continuous administration of high doses of corticosteroids, excessive smoking

and alcohol abuse, previous surgeries and comorbidity – COPD, IHD, diabetes, arterial hypertension, all of them increasing ASA score over III (23 - 30).

As ischaemia is considered one of the causes for anastomosis leakage, the investigation of vascular disorders, i.e. atherosclerosis could be a different approach as proposed by Foster ME *et al.* (31).

The analysis of factors known to promote atherosclerosis such as hypertension, dyslipidaemia, smoking, diabetes, could be an interesting option for the group of potential risk factors (32, 33, 34)

The research of Iancu *et al.* (2008) has investigated the relationship of body weight, gender, alcohol abuse, emergency operative intervention, histological features and stage of tumour, with only weight loss, smoking, cardiovascular diseases, lung diseases, diabetes, leukocytosis, preoperative anaemia (Hgb < 110 g/l), preoperative hypoproteinaemia (Pr < 60 g/l) were significantly associated with the incidence of anastomosis insufficiency. The performed multivariate analysis has shown that only low haemoglobin and serum protein concentrations were independent predictors of this complication (35).

In their study, Ghariani *et al.* associated 4 preoperative factors with high incidence of anastomosis dehiscence – ASA score > III ($p = 0.008$), emergency surgical intervention ($p = 0.03$), neoplastic etiology ($p = 0.006$) as well as 5 post operative factors – respiratory, heart diseases ($p = 0.001$), neurological disorders and prolonged post operative ileums (36). The multivariate analysis has shown only three substantial factors – respiratory diseases ($p < 0.0001$), neurological disorders ($p < 0.0001$) and prolonged post operative ileus ($p < 0.0001$) (6).

Despite the strong correlation of these factors with the increased risk for anastomosis leakage, some of patients identified as low-risk exhibited high frequency of anastomosis complications, which was most probably due to the performed surgical intervention (37, 38)

The poor preparation of the colon, peritonitis, the considerable intraoperative bleeding, ischaemia of anastomosis margins,

anastomotic tension, accumulation of peritoneal exudate with subsequent poor drainage, are the main surgery-related factors for anastomosis leakage (6, 39, 40, 41, 42, 43, 44).

During the last years, the attempts for sphincter-preserving surgery in low rectal cancer patients in order to procure a high quality of life along with good oncologic purity have resulted in a problem with low anastomosis, which is at high risk for leakage (44, 45).

In such patients, a number of factors were shown to increase the risk of insufficiency: need of post operative blood transfusion ($P < 0.001$), the anastomosis type (manual – one or two-staged, with intraluminal stapler $p=0.004$), combined surgery (adnexectomy $P = 0.004$, hysterectomy $P = 0.006$, cystectomy $P = 0.014$), anastomosis with intraluminal stapler ($P = 0.005$), TNM stage over II ($P = 0.026$), abdominal cavity and lower pelvic drainage ($p=0.026$). There was also a relationship with the tumour height in the lower rectum, where leakage was encountered in 24.4% which is a significantly higher incidence than that of middle and high rectal cancers ($P < 0.001$). The lack of pelvic drainage and protective stoma are factors associated with insufficiency. Mesorectal excision providing oncologic purity and improved survival rate, is also associated with increased risk of leakage ($>10\%$) (39, 46, 47, 32, 35, 36, 48, 49, 50).

In patients with low rectal cancer, preoperative radiation therapy is a behavioural standard. In them, the risk of anastomosis leakage increased in male gender, lack of protective stoma, anastomosis level < 4 cm and intraoperative blood loss > 200 mL (50).

Factors as age, preoperative haemoglobin, tumour markers, peritoneal lavage, communication of the process with adjacent organs, pre- and postoperative radiation and chemotherapy, histological type and histological grade were not proved to be predictors of increased leakage insufficiency (51, 52, 53).

Laparoscopic resection of the rectum is an attractive surgical alternative for low rectal carcinomas. It has several advantages – offers a better visualisation, fine instrumentation and delicate dissection of the small pelvis,

associated with preservation of the hypogastric plexus and erectile nerves. This ensures a better quality of life after oncologic surgery. The mortality after laparoscopic intervention (1%) is lower than that in open surgery (2% - 3%) and is mainly due to systemic complications (54).

The frequency of anastomosis insufficiency in laparoscopic surgery varies from 2.5% to 12% (55 - 61).

According to the query with Cochrane, there was no difference between the incidence of leakage after laparoscopic and open surgery (62).

As with laparoscopic surgery, several significant factors have been identified – anastomosis at less than 5 cm of the anal margin ($P < 0.001$), and prolonged intraoperative time ($P < 0.001$). (63)

In the study of Qian-Lin Zhu *et al.*, the clinical parameters associated with post operative complications were the tumour size, the localisation, the pathological staging and the gender, while the age and the histological type of the cancer were not significantly related to the incidence of leakage (64). Thus, a tumour size over 3 cm and hypoproteinaemia were related to a considerable increase in post operative insufficiencies. Lipska *et al.* analysed 98 cases of laparoscopic interventions to observe that a tumour located < 6 cm from the linea dentata was associated with high incidence of surgical complications and anastomosis leakage ($p= 0.01$). (52) Furthermore, intraoperative factors that trophic disturbances of the wall, anastomotic tension, intraoperative bleeding, damage to the urethra, urinary bladder and small pelvis contamination were related to high anastomosis leakage prevalence in laparoscopic surgery (64).

In a large multi-centre research from 2011, Kube R. has used logistic regression to determine the following independent predictors of anastomosis leakage: duration of surgery, ASA risk score, male gender, ileus, cardiovascular diseases, anastomosis with automatic stapler, one-layer manual anastomosis, intraoperative complications, liver diseases, BMI (**Table 1**).

Table 1: Risk factors for anastomosis leakage in colorectal surgery (65)

Risk factors	Odds ratio	95% confidence interval	p-value
Duration of surgery	1.003	1.002–1.004	<0.001
ASA score	1.47	1.26–1.72	<0.001
Male gender	1.58	1.37–1.83	<0.001
Ileus	1.9	1.54–2.33	<0.001
Localisation of the tumour in the left colon	1.45	1.28–1.73	<0.001
Cardiovascular disease	1.35	1.13–1.61	0.0011
Anastomosis with automated stapler	3.62	1.72–7.60	0.0011
One-layer manual suturing	1.26	1.09–1.46	0.0016
Intraoperative complication	1.56	1.18–2.23	0.0018
Liver disease	1.48	1.08–2.04	0.0145
BMI > 30 kg/m ²	1.2	1.01–1.44	0.0366

CONCLUSION

The anastomosis leakage is a complication that no surgeon could prevent, regardless of his experience. It could result in severe complications requiring emergency surgery. Also, 25-37 % of fatal outcomes in colorectal surgery patients were caused by anastomosis leakage (66).

If risk factors of anastomosis leakage could be predicted, some protection could be ensured, for instance, temporary protective ileostoma (67, 68).

The surgical team should perform a very careful clinical monitoring, especially for patients at increased risk for anastomosis leakage.

In conclusion, two groups of risk factors for anastomosis leakage occurrence could be outlined: patient-specific and surgery-related. Provided that the first group could not be influenced, our aim should be to decrease the effect of factors from the latter group.

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