



Anastomotic Leakage after Right Hemicolectomy – A Retrospective Analysis of Complication Management and Outcome

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Abstract

Background: Anastomotic leakage after right hemicolectomy occurs in 6.4% to 8.8%. Risk factors have been described in numerous studies, however, there are rare publications about the complication management.

Materials and Methods: This retrospective study is based on data of 641 patients who underwent right hemicolectomy between the years 2010 and 2019 at the Department of General and Visceral Surgery at the Kepler University Clinic (KUK) in Linz, Austria. Patients' data include information on age, sex, BMI, ASA score, surgical indication, surgical approach, postoperative morbidity and mortality, anastomosis technique, occurrence of leakage, complication management and postoperative hospital stay. In this study, the focus is on the management of 24 cases of anastomotic leakage.

Results: Of 641 patients, 41% underwent laparoscopic and 59% open right hemicolectomy. In 3.9% (n=24) of patients with a primary anastomosis, anastomotic leakage occurred. In 12.5% (n=3) the leak was sewn, in 50% (n=12) an anastomosis redo was performed and in 37.5% (n=9) the patient received a terminal ileo-/jejunostomy. 33.3% of the leaking anastomosis were hand-sewn, 66.7% were stapled. With a median postoperative hospital stay of 24 days, patients with over-sewn leaks and anastomosis redo were significantly earlier discharged compared to those with a terminal stoma (55 days; p=0.040*).

Conclusion: Regarding the management of postoperative anastomotic leakage after right hemicolectomy, sewing the leakage or redoing the anastomosis is the best choice if suitable. Patients with a terminal stoma had a longer hospital stay. Comparing the leakage management, no difference in the postoperative morbidity and mortality was shown.

Keywords: Anastomotic leakage; Right hemicolectomy; Complication management

Highlights

- It is safe to over-sew a leak, to perform a redo anastomosis or to do a terminal ileo-/jejunostomy depending on the patient's general condition and the intraoperative situs.
- Similar postoperative mortality and morbidity rates in different complication management groups after right hemicolectomy (ileo-/jejunostomy vs. over-sewing vs. anastomosis redo).
- Sewing the leakage or redoing the anastomosis is the best choice if suitable.
- Patients with an over-sewn leakage or a redo anastomosis are earlier discharged from hospital.

Background

Anastomotic leakage after right hemicolectomy is occurring in 6.4% up to 8.8% of laparoscopic and open surgeries [1-3].

Often this complication is followed by a higher postoperative morbidity and mortality and an extensive use of resources (longer stay in hospital, financial resources). Risk factors for anastomotic leakage are male gender, obesity, an advanced tumor stage and intraoperative complications. There are several studies about risk factors for anastomotic leakage but data about the management of an occurring anastomotic leakage is rare. Therefore, we conducted this retrospective analysis to

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evaluate the management in case of anastomotic leakage after right hemicolectomy in our hospital [2-10].

Materials and Methods

Between 2010 and 2019, data of all patients undergoing right hemicolectomy at the Department of General and Visceral Surgery at the KUK – Med Campus III in Linz, Austria was analyzed retrospectively (Complete Mesocolic Excision (CME) was established in 2015). Demographic data and information on sex, age, Body Mass Index (BMI), preoperative health status, surgical indication, surgical approach, postoperative morbidity and mortality, anastomosis technique, the occurrence of anastomotic leakage, need of a terminal ileo- or jejunostomy, postoperative revisional surgery, postoperative dietary intake, intraoperative peritonitis, corticosteroid intake at the time of surgery, Patient Controlled Epidural Analgesia (PCEA) and Patient Controlled intravenous Analgesia (PCA), highest postoperative C-Reactive Protein (CRP) level, Lymph Node stage (N) and the number of retrieved lymph nodes (in general and positive ones) were statistically analyzed and have already been published by Schuster et al. [4] in 2021.

In this study, the focus was on the 24 patients with anastomotic leakage undergoing revisional surgery and how they were managed.

For classifying the postoperative morbidity and mortality, the Clavien-Dindo classification was used [11].

The lymph node stage was determined using the TNM classification [12] and the American Society of Anesthesiologists (ASA) score was used for the preoperative health status [13].

According to other trials, an anastomotic leakage was defined as a defect of the intestinal wall at the anastomotic site including staple lines and sutures with following communication between the intra- and extraluminal compartments.

The hand-sewn anastomosis was sutured isoperistaltically in a single layer technique with a seromuscular running monofilament (4-0) suture (Monosyn 4-0 (B. Braun Austria GmbH, Otto Braun-Straße 3-5, 2344 Maria Enzersdorf, Austria)), whereas the stapled ones were mostly created extracorporeally, anti-peristaltically and side-to-side using a linear stapling device (Medtronic Signia (Medtronic Österreich GmbH, Handelskai 94-96, 1200 Vienna, Austria)) with a violet cartridge (60 mm).

During the preparation of this work, no Artificial Intelligence (AI) or AI-assisted technologies were used by the authors.

Our study was approved by the local institutional human research review committee (JKU Ethics Commission of the Faculty of Medicine, Linz, Austria; EK number: 1152/2020).

Statistical analysis

All data of continuous variables were checked for normal distribution (test of normality: Kolmogorov-Smirnov with Lilliefors significance correction, type I error =10%) variables with normally distributed data were compared by the t-test for independent samples. For variables without normally distributed data and for variables measured on ordinal scales the Mann-Whitney U test (exact or asymptomatic version) was used. Dichotomous variables were compared by the Fisher's exact test, the other categorical variables by the Chi-Square test (exact or with Monte Carlo simulation). Missing values were not replaced.

The influence of the anastomosis technique, age, BMI, ASA score, sex, surgical indication, surgical approach, anastomotic technique, postoperative dietary intake, PCEA/PCA, peritonitis, highest postoperative CRP level and number of retrieved lymph nodes (in general and positive ones) on anastomotic leakage was investigated by logistic regression analyses (stepwise forward based on the likelihood ratio approach).

Since the type I error was not adjusted for multiple testing, the results of inferential statistics are only descriptive and the use of the term "significant" in the description of the study results always reflects only a local $p < 0.05$ but no error probability below 5%. Statistical analysis was performed using the open-source R statistical software package, version 3.6.1 (The R Foundation for Statistical Computing, Vienna, Austria).

Results

A number of 641 patients underwent right hemicolectomy. 263 patients (41.0%) had laparoscopic (with 7.2% conversion rate, $n=19$) and 378 (59.0%) had open surgery. 26 (4.1%) of these patients received a terminal ileostomy and were excluded from further calculations, ending up with a final number of 615 ($n=615$) who had right hemicolectomy with a primary anastomosis done. 284 (46.3%) were female and 331 (53.8%) were male patients with an average age of 68 years and an average BMI of 26.20 kg/m². The overall postoperative mortality within 30 days was 4.2%. In the leakage group (leakage rate of 3.9% after right hemicolectomy), the 30-days postoperative mortality of 16.7% was significantly higher ($p=0.015^*$) compared to patients with a sufficient anastomosis. Further demographic data about the population of these 615 patients have already been published by Schuster et al. [4] and can be found in their publication.

Anastomotic leakage after right hemicolectomy was occurring in 24 (3.9%) patients. This study is now concentrating on these 24 patients with anastomotic leakage and focusing on the management of the leakage and outcome (Table 1).

Initially, 33.3% of the leaking anastomosis were hand-sewn, 66.7% were stapled ones. 11 (45.8%) patients had acute surgery, whereas 13 (54.2%) had elective surgery done before. In 14 (58.3%) patients the surgical approach was open and in 10 (41.7%) laparoscopic with a conversion rate of 2% (Table 1, 2). A possible explanation for the high number of open surgical approach might be the acute indication for surgery in 45.8% (e.g. inflammation, perforation, etc.).

Analyzing the management of patients with leaking anastomosis, 3 (12.5%) patients were over-sewn, 9 (37.5%) received a terminal ileo- or jejunostomy and 12 (50%) had a redo anastomosis created.

The 30-days postoperative morbidity in the subgroups can be found in Table 3. The 30-days postoperative mortality after leakage (= Clavien-Dindo Grade V) was 16.7% ($n=4$).

Four (16.7%) of 24 patients with leaking anastomosis had a second event of leakage. Three (12.5%) of those 4 patients with a second leakage had a redo anastomosis performed at their first leaking event. One patient had a leaking stapler line after he had received a terminal stoma at the first revisional surgery. Those 4 patients with a second leaking event received a terminal stoma in the end.

Patients with anastomotic leakage had an ASA score between ASA 2 and ASA 4 (Table 4).

Table 1: Data of patients with anastomotic leakage.

Parameter						
		Female	Male			
Sex	Oversewn (n=3)	1 (33.3%)	2 (66.7%)			
	Stoma (n=9)	5 (55.6%)	4 (44.4%)			
	Redo (n=12)	3 (25.0%)	9 (75.0%)			
	Leakage (n=24)	9 (37.5%)	15 (62.5%)			
		Hand-sewn	Stapled			
Anastomosis technique	Oversewn (n=3)	2 (66.7%)	1 (33.3%)			
	Stoma (n=9)	4 (44.4%)	5 (55.6%)			
	Redo (n=12)	2 (16.7%)	10 (83.3%)			
	Leakage (n=24)	8 (33.3%)	16 (66.7%)			
		Acute surgery	Elective surgery			
Surgical indication	Oversewn (n=3)	2 (66.7%)	1 (33.3%)			
	Stoma (n=9)	4 (44.4%)	5 (55.6%)			
	Redo (n=12)	5 (41.7%)	7 (58.3%)			
	Leakage (n=24)	11 (45.8%)	13 (54.2%)			
		No peritonitis	Peritonitis			
Fecal peritonitis	Oversewn (n=3)	2 (66.7%)	1 (33.3%)			
	Stoma (n=9)	9 (100%)	0 (0.00%)			
	Redo (n=12)	10 (83.3%)	2 (16.7%)			
	Leakage (n=24)	21 (87.5%)	3 (12.5%)			
		Minimum	Median	Average	Maximum	Standard deviation
Age	Oversewn (n=3)	56.00	60.00	62.33	71.00	7.77
	Stoma (n=9)	46.00	78.00	72.11	89.00	13.24
	Redo (n=12)	61.00	67.50	70.25	82.00	7.86
	Leakage (n=24)	46.00	69.00	69.96	89.00	10.26
BMI	Oversewn (n=3)	21.10	28.00	27.37	33.00	5.98
	Stoma (n=9)	17.80	28.10	27.28	39.00	7.27
	Redo (n=12)	20.94	26.10	27.35	39.00	5.36
	Leakage (n=24)	17.80	27.10	27.33	39.00	5.89
Postoperative stay at hospital in days	Oversewn (n=3)	22.00	23.00	24.00	27.00	2.65
	Stoma (n=9)	18.00	60.00	55.43	78.00	28.42
	Redo (n=12)	18.00	21.00	23.67	24.00	7.81
	Leakage (n=24)	18.00	24.00	35.42	99.00	23.32
Number of revisional surgeries (incl. leakage revision)	Oversewn (n=3)	1.00	1.00	1.33	2.00	0.58
	Stoma (n=9)	1.00	2.00	2.67	8.00	2.35
	Redo (n=12)	1.00	1.00	1.50	3.00	0.67
	Leakage (n=24)	1.00	1.00	1.92	8.00	1.59
Postoperative day of first revisional surgery	Oversewn (n=3)	5.00	10.00	8.67	11.00	3.21
	Stoma (n=9)	4.00	7.00	9.11	21.00	5.42
	Redo (n=12)	2.00	5.50	8.58	38.00	9.84
	Leakage (n=24)	2.00	7.00	8.79	38.00	7.58
Postoperative start with a light to normal diet in days (paralysis parameter)	Oversewn (n=3)	5.00	5.50	5.50	6.00	0.71
	Stoma (n=9)	3.00	6.00	6.40	12.00	3.78
	Redo (n=12)	2.00	3.00	4.50	11.00	2.92
	Leakage (n=24)	2.00	3.00	5.18	12.00	3.03

Highest postoperative CRP (mg/dl)	Oversewn (n=3)	19.90	27.20	32.72	51.10	16.32
	Stoma (n=9)	22.40	27.80	32.26	50.80	9.48
	Redo (n=12)	3.20	29.35	25.82	34.60	9.57
	Leakage (n=24)	3.20	28.45	29.10	51.10	10.46

Table 2: Anastomosis technique, surgical indication and approach.

Parameter		
Anastomosis technique (n=24)	Hand-sewn 8 (33.3%)	Stapled 16 (66.7%)
	Side-side 22 (91.7%)	End-side 2 (8.3%)
Surgical indication (n=24)	Acute surgery 11 (45.8%)	Elective surgery 13 (54.2%)
Surgical approach (n=24)	Open surgery 14 (58.3%)	Laparoscopic surgery [conversion rate] 10 (41.7%) [2 (2.0%)]

Table 3: 30-days postoperative morbidity (Clavien-Dindo).

30-days postoperative morbidity Clavien-Dindo (p=0.212)	Oversewing (n=3)	Terminal ileo- or jejunostomy (n=9)	Redo anastomosis (n=12)
Grade 0	0 (0%)	0 (0%)	0 (0%)
Grade I	0 (0%)	0 (0%)	0 (0%)
Grade II	0 (0%)	0 (0%)	0 (0%)
Grade IIIa	0 (0%)	0 (0%)	0 (0%)
Grade IIIb	3 (100%)	4 (44.4%)	8 (66.7%)
Grade IVa	0 (0%)	3 (33.3%)	2 (16.6%)
Grade IVb	0 (0%)	0 (0%)	0 (0%)
Grade V	0 (0%)	2 (22.2%)	2 (16.7%)

Table 4: ASA score.

ASA score	Oversewing (n=3)	Terminal ileo- or jejunostomy (n=9)	Redo anastomosis (n=12)
ASA 1	0%	0%	0%
ASA 2	0%	28.6%	30.5%
ASA 3	100%	57.1%	57.1%
ASA 4	0%	14.3%	14.3%
ASA 5	0%	0%	0%

Patients who received a terminal ileostomy after their leaking event had a longer hospital stay (55.43 days) compared to those who had their leak oversewn (24 days) and those with an anastomosis redo (23.67 days). In a subgroup analysis of those three groups, a statistically significant difference was found in the postoperative stay at hospital (p=0.040*, Table 5).

The first postoperative dietary intake happened 5.5 days after surgery in patients with oversewn leaks, 6.4 days in those with a terminal stoma and 4.5 days in patients with a redo anastomosis.

Discussion

Interpreting our retrospective study results, the postoperative morbidity and mortality rates were similar in the different management subgroups and independent of the primary surgical approach (open vs. laparoscopic surgery) as well as independent of the surgical indication (acute vs. elective surgery) (Table 5).

How to manage an anastomotic leakage is depending on factors like the general patient's condition, peritonitis grade or comorbidities. Our study has shown that it is safe to oversee a leak, to perform a

Table 5: Subgroup analysis (oversewing vs. stoma vs. redo).

Parameter	p-value (*... p<0.05)
Acute/elective surgery	0.860
Age	0.248
Anastomosis technique	0.278
ASA score	0.799
BMI	0.986
Highest postoperative CRP level	0.711
Laparoscopy/open surgery	0.932
Number of revisional surgeries	0.456
Peritonitis	0.333
Postoperative 30-day morbidity (Clavien-Dindo)	0.212
Postoperative 30-day mortality	>0.999
Postoperative start with light/normal diet	0.377
Postoperative stay at hospital	0.040*
Sex	0.533

redo anastomosis, as well as to create a terminal stoma depending on the patient's condition and the intraoperative situs. In comparison, according to Wu et al. [14] ileostomy should be the first choice in case of an anastomotic leakage, however, each of their 8 patients received a terminal ileostomy and no other surgical options like oversewing or redo anastomosis were used.

The only statistically significant difference in the subgroup analysis was found in the postoperative stay at hospital. Patients who received a terminal ileo- or jejunostomy after their leaking event had the longest stay (p=0.0400*). Their hospital stay of 55.43 days in average was more than double the length of the stay in the other two subgroups. A possible explanation for the longer hospital stay might be a general worse condition and the patient's stoma education after receiving a terminal stoma. The conclusion to create a terminal stoma in case of an anastomotic leakage is more likely to be made in seriously ill patients with e.g. septic peritonitis, single-/multi-organ failure and comorbidities. Even though, no statistically significant difference was measured, a tendency of a higher ASA score in the subgroups "terminal ileo- or jejunostomy" and "redo anastomosis" was shown.

Furthermore, the individual surgeon and his or her level of experience might influence the surgical outcome concerning anastomotic leakage [15]. We did not document the surgeon's experience and if there was an influence on the surgical outcome. However, a resident has never performed an anastomosis without the supervision of a senior surgeon.

A limitation of our study could be the small number of patients (n=24) who had anastomotic leakage. Therefore, further data has to be analyzed and prospective studies need to be conducted.

Conclusion

In conclusion, the postoperative morbidity and mortality rates were similar in the different subgroups and independent of the

primary surgical approach (open vs. laparoscopic surgery) as well as independent of the surgical indication (acute vs. elective surgery). In case of a leaking anastomosis after right hemicolectomy, it is safe to oversew a leak, to perform an anastomosis redo, as well as to create a terminal ileo- or jejunostomy depending on the patient's general condition and the surgeon's expert knowledge.

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