J Gastrointest Surg (2014) 18:2192–2200
DOI 10.1007/s11605-014-2660-8

ORIGINAL ARTICLE

Morbidity of Loop Ileostomy Closure after Restorative Proctocolectomy for Ulcerative Colitis and Familial Adenomatous Polyposis: a Systematic Review

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Received: 3 August 2014 / Accepted: 3 September 2014 / Published online: 18 September 2014

Abstract
Background Temporary loop ileostomy is a routine procedure to reduce the morbidity of restorative proctocolectomy. However, morbidity of ileostomy closure could reduce the benefit of this concept. The objective of this systematic review was to assess the risks of ileostomy closure after restorative proctocolectomy for ulcerative colitis or familial adenomatous polyposis.
Materials and Methods Publications in English or German language reporting morbidity of ileostomy closure after restorative proctocolectomy were identified by Medline search. Two hundred thirty-two publications were screened, 143 were assessed in full-text, and finally 26 studies (reporting 2146 ileostomy closures) fulfilled the eligibility criteria. Weighted means for overall morbidity and mortality of ileostomy closure, rate of redo operations, anastomotic dehiscence, bowel obstruction, wound infection, and late complications were calculated.
Results Overall morbidity of ileostomy closure was 16.5 %, there was no mortality. Redo operations for complications were necessary in 3.0 %. Anastomotic dehiscence occurred in 2.0 %. Postoperative bowel obstruction developed in 7.6 %, with 2.9 % of patients requiring laparotomy for this complication. Wound infection rate was 4.0 %. Hernia or bowel obstruction as late complications developed in 1.9 and 9.4 %, respectively.
Conclusion The considerable morbidity of ileostomy reversal reduces the overall benefit of temporary fecal diversion. However, ileostomy creation is still recommended, as it effectively reduces the risk of pouch-related septic complications.

Keywords Ileostomy · Ulcerative colitis · Familial adenomatous polyposis · Morbidity

Introduction

Restorative proctocolectomy with ileal pouch-anal anastomosis is the surgical standard therapy for patients with refractory ulcerative colitis or familial adenomatous polyposis who require proctocolectomy.[1] Despite the evolving surgical techniques, including double stapling anastomosis and omission of routine proctomucosectomy, pouch-related septic complications remain feared consequences of pouch-anal anastomosis. They occur in about 10 % of restorative proctocolectomies.[2–4] Pouch-related septic complications have substantial negative impact on pouch function and pouch failure rate,[5–9] and they account for more than half of all pouch failures.[9] Temporary fecal diversion by loop-ileostomy is a very effective strategy to reduce these complications. In her meta-analysis, *Weston-Petrides*[2] calculated a risk of anastomotic dehiscence of 9.4 % without covering ileostomy versus 4.3 % with covering ileostomy (OR=2.37, p=0.002).

However, in most publications (including the abovementioned meta-analysis) morbidity of ileostomy reversal is not taken into account. This morbidity is generally underestimated and several studies reported morbidity rates of more than 10 %.[10–12] In our own series of two-stage restorative proctocolectomies, the morbidity surrounding ileostomy closure of 14.8 % substantially reduced the

Presented as podium presentation at the 130th annual congress of the German Society of Surgery, München, Germany, 30 April–03 May 2013.

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advantages of loop ileostomy.[10] In some series, the risks of ileostomy creation and reversal even outweighed its advantages, leading to the recommendation of single-stage procedures in selected patients.[13–15]

The aim of this systematic review was to clarify the risks of ileostomy reversal after restorative proctocolectomy in order to allow a critical assessment of advantages and risks of fecal diversion.

Materials and Methods

This systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and checklist.[16] The A MeaSurement Tool to Assess systematic Reviews (AMSTAR) checklist was used as additional reference to ensure methodological quality.[17] Objective of the review and specific outcomes of interest (see below) were defined before starting the literature search.

Eligibility Criteria

All studies reporting outcomes of ileostomy reversal after restorative proctocolectomy for ulcerative colitis or familial adenomatous polyposis were considered. Language restrictions were made to English and German language.

Inclusion Criteria (All Must be Fulfilled)

1. Study includes patients with ileostomy reversal after restorative proctocolectomy.
2. Study reports at least one of the defined outcome criteria (see below).
3. Sufficient data extraction (calculation of exact number of affected patients) is possible.

Exclusion Criteria (None is Allowed)

1. Study does not include patients with ileostomy reversal after restorative proctocolectomy.
2. Study does not report any of the defined outcome criteria.
3. Double publication (in this case, the newest publication is included in the analysis).
4. Sufficient data extraction is not possible (e.g., study reporting pooled outcomes of ileostomy reversals both after rectal resection for cancer and after proctocolectomy, not allowing to calculate the outcome criteria for proctocolectomy separately).
5. Case reports.
6. Case series reporting exclusively patients developing complications (morbidity 100 %).

Literature Search

The literature search was performed in Medline using PubMed. The latest search date was October 28, 2011. The following search string was used: (Loop Ileostomy OR Defunctioning Ileostomy OR Ileostomy) AND (Reversal OR Closure) AND (Complications OR Complication OR Morbidity) AND (Ulcerative Colitis OR FAP OR Proctocolectomy OR Familial Adenomatous Polyposis).

This search led to 223 results. References of all papers were cross-checked, leading to the identification of further nine publications. The flow diagram of study selection is depicted in Fig. 1.

The assessment of all publications was independently performed by two reviewers (RM and WS); in any case of different assessment a consensus was reached by discussion with all authors. Screening of abstracts led to the exclusion of 89 publications, the full text of the remaining studies was carefully reviewed (n=143). After exclusion of double publications and assessment of eligibility and exclusion criteria, 26 publications[10–12,15,18–39] were included in the data analysis. The study selection and review procedure including the reason for exclusion for each study was protocolled.

Outcome Criteria

1. Demographic data on study populations, such as age, gender, and underlying disease (ulcerative colitis or familial adenomatous polyposis).
2. Surgical details of ileostomy reversal (e.g., type of anastomosis, need for laparotomy, and length of hospital stay).
3. Morbidity of ileostomy reversal, including early complications (such as redo operation, anastomotic dehiscence at the stoma closure site, postoperative bowel obstruction, and wound infection) and late complications (stoma site hernia and bowel obstruction later than 30 days after ileostomy reversal).
4. Mortality of ileostomy reversal.

Data Analysis

Raw data (numbers) of affected patients and patients at risk were calculated from the included studies for the respective outcome criterion. If only percentages were given, raw numbers were calculated whenever possible. Weighted means (percentages) of all studies reporting the respective outcome criterion were calculated dividing the number of patients affected by the number of patients at risk. A funnel plot was used as visual aid to identify a possible publication bias or systematic heterogeneity of the included studies.

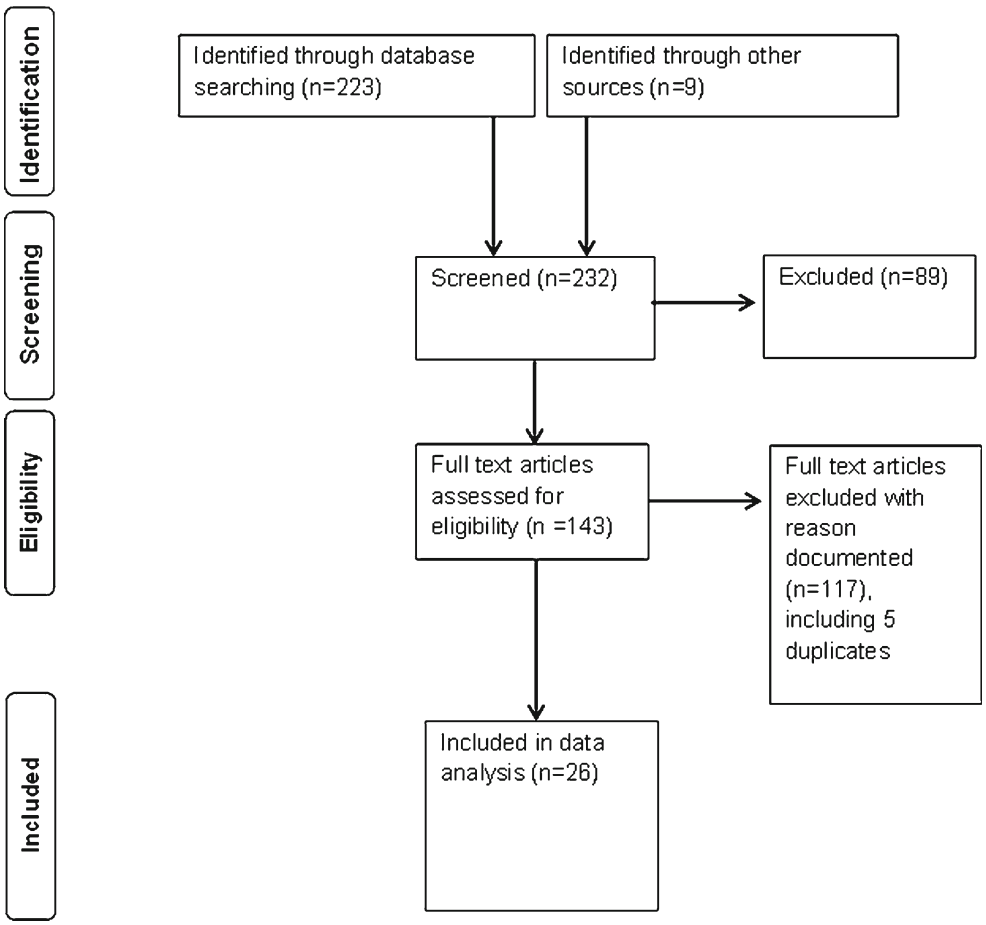

Fig. 1 Flowchart of study selection and review

Results

Characteristics of Included Studies and Study Populations

After the review process, 26 publications were included in the data analysis[9–11,14,17–38] (Table 1). Publication years ranged from 1985 to 2011. Most studies were retrospective series (n=18), whereas eight studies declared prospective data collection during follow-up, e.g., by means of a prospectively maintained database.[11,18,19,24,25,27,28,34] However, there were no controlled prospective randomized trials.

Two thousand seven hundred twenty-four patients were reported in these studies. However, as several studies were not exclusively reporting patients with restorative proctocolectomy, 2429 patients with ulcerative colitis or familial adenomatous polyposis undergoing restorative proctocolectomy were identified. About 91.1 % of these patients (n=2212) had a temporary ileostomy while the remainder had a one stage procedure. A temporary ileostomy was created during a two-stage proctocolectomy in 82.5 %, during a three-stage procedure in 17.5 %. As some patients did not undergo planned ileostomy reversal, some 2146 ileostomy reversal procedures remained for inclusion in the analysis of morbidity.

The total study population consisted of 56.7 % men and 43.3 % women, with a mean age of 35.5 years. The indication for restorative proctocolectomy was ulcerative colitis in 94.3 % and familial adenomatous polyposis in 5.7 %, respectively. Immunosuppressive medication was present at the time of proctocolectomy in 61.7 % of patients, as reported in seven studies.[10–12,15,18,25,33] Although it can be presumed that steroids and immunosuppressive medication were completely weaned before ileostomy reversal in virtually all patients, most authors did not explicitly comment on this topic.

Details of Ileostomy Reversal

Fifteen studies provided data on the time interval between proctocolectomy and ileostomy reversal.[11,18–21,25–27,30–33,35–37] The weighted mean duration of fecal diversion was 92 days; the range of reported means was 61–128 days. All 13 authors who commented on this topic performed routine pouchoscopy and pouchography before ileostomy reversal in 100 % of patients.[10,11,23,25–28,30–32,35,36,38]

Ileostomy reversal technique, as reported in eight publications,[10,20,21,23–25,27,32] was hand-sewn anastomosis in 56.6 % and stapler anastomosis in 43.4 %. A laparotomy was

Table 1 Characteristics of the included studies

Author	Year	Total patient number	UC/FAP patients		UC/FAP patients with temporary ileostomy		Two-stage procedure		Three-stage procedure	
			n value	%	*n* value	%	*n* value	%	*n* value	%
Dolejs	2011	390	390	100.0	390	100.0	354	90.8	36	9.2
Mennigen	2011	122	122	100.0	89	73.0	72	80.9	17	19.1
Fajardo	2010	124	124	100.0	124	100.0	124	100.0	0	0.0
Selvaggi	2010	118	118	100.0	118	100.0	104	88.1	14	11.9
Araujo	2005	10	10	100.0	10	100.0	10	100.0	0	0.0
Ikeuchi	2005	245	242	98.8	92	38.0	–	–	–	–
Gunnarsson	2004	192	143	74.5	143	100.0	–	–	–	–
Fonkalsrud	2000	77	39	50.6	39	100.0	–	–	–	–
Dolgin	1999	30	14	46.7	14	100.0	4	28.6	10	71.4
Edwards	1998	77	17	22.1	17	100.0	–	–	–	–
Bain	1996	40	20	50.0	20	100.0	–	–	–	–
Khoo	1994	203	203	100.0	203	100.0	203	100.0	0	0.0
Seow-Choen	1994	27	13	48.1	13	100.0	13	100.0	0	0.0
Braun	1992	69	49	71.0	48	98.0	–	–	–	–
Poppen	1992	69	69	100.0	69	100.0	0	0.0	69	100.0
De Silva	1991	88	38	43.2	38	100.0	13	34.2	25	65.8
Sugerman	1991	83	83	100.0	64	77.1	–	–	–	–
Sutter	1991	21	21	100.0	21	100.0	5	23.8	16	76.2
Lewis	1990	50	50	100.0	50	100.0	–	–	–	–
Matikainen	1990	46	21	45.7	21	100.0	–	–	–	–
Wexner	1990	180	180	100.0	174	96.7	152	87.4	22	12.6
Feinberg	1987	117	117	100.0	117	100.0	76	65.0	41	35.0
Harms	1987	15	15	100.0	15	100.0	14	93.3	1	6.7
Nasmyth	1986	39	39	100.0	39	100.0	26	66.7	13	33.3
Metcalf	1985	188	188	100.0	180	95.7	161	89.4	19	10.6
Nicholls	1985	104	104	100.0	104	100.0	–	–	–	–
Total:		*2724*	*2429*	*89.2 %*[a]	*2212*	*91.1 %*[b]	*1331*	*82.5 %*[c]	*283*	*17.5 %*[c]

UC ulcerative colitis; *FAP* familial adenomatous polyposis

[a] TOTAL patient number (n=2 724) set as 100 %

[b] TOTAL UC/FAP patient number (n=2 429) set as 100 %

[c] TOTAL number of patients with information on type of procedure (n=1 614) set as 100 %

needed for stoma reversal in 8.0 % (as reported in six publications).[20,23,25,28,35,38]

Morbidity of Ileostomy Reversal: Early Complications

Morbidity of ileostomy reversal including different categories of early complications is summarized in Table 2. Overall morbidity was 16.5 %; there was no mortality. Postoperative complications mandated redo surgery in 3.0 % of patients. Anastomotic dehiscence at the stoma closure site occurred in 2.0 %, postoperative bowel obstruction in 7.6 %. Most cases of postoperative bowel obstruction could be managed conservatively; however, 2.9 % required laparotomy for postoperative bowel obstruction. The rate of wound infection after ileostomy reversal was 4.0 %.

Despite the routine endoscopy and pouchography before ileostomy reversal, pouch-related septic complications (including dehiscence of the pouch-anal anastomosis, pouch fistula, and pelvic abscess) developed early after stoma reversal in 1.9 % (as reported in eight studies).[10,26,29,33,34,37–39]

Morbidity of Ileostomy Reversal: Late Complications

Stoma site hernias and bowel obstruction (developing later than 30 days after ileostomy reversal) were studied as late complications (Table 3); they occurred in 1.9 and 9.4 %, respectively.

Table 2 Morbidity of ileostomy reversal (early complications)

Author	Year	Number of ileostomy reversals	Overall morbidity		Mortality		Redo-operation for complication		Anastomotic dehiscence		Postoperative bowel obstruction		Laparotomy for bowel obstruction		Wound infection	
			n value	%	*n* value	%	*n* value	%	*n* value	%	*n* value	%	*n* value	%	*n* value	%
Dolejs	2011	390	–	–	–	–	–	–	–	–	13	3.3	4	1.0	–	–
Mennigen	2011	81	12	14.8	0	0.0	4	4.9	1	1.2	4	4.9	4	4.9	8	9.9
Fajardo	2010	124	22	17.7	–	–	–	–	–	–	–	–	–	–	–	–
Selvaggi	2010	115	–	–	0	0.0	–	–	3	2.6	–	–	–	–	4	3.5
Araujo	2005	10	1	10.0	0	0.0	–	–	–	–	1	10.0	1	10.0	–	–
Ikeuchi	2005	91	17	18.7	–	–	–	–	1	1.1	–	–	–	–	3	3.3
Gunnarsson	2004	143	28	19.6	0	0.0	–	–	1	0.7	22	15.4	10	7.0	5	3.5
Fonkalsrud	2000	39	–	–	–	–	2	5.1	2	5.1	–	–	–	–	4	10.3
Dolgin	1999	14	2	14.3	–	–	1	7.1	1	7.1	–	–	–	–	–	–
Edwards	1998	13	4	30.8	–	–	–	–	–	–	3	23.1	–	–	0	0.0
Bain	1996	20	6	30.0	–	–	–	–	–	–	4	20.0	2	10.0	1	5.0
Khoo	1994	201	–	–	–	–	–	–	3	1.5	–	–	–	–	1	0.5
Seow-Choen	1994	13	2	15.4	–	–	1	7.7	–	–	–	–	–	–	–	–
Braun	1992	48	–	–	0	0.0	–	–	1	2.1	–	–	–	–	1	2.1
Poppen	1992	69	4	5.8	0	0.0	–	–	1	1.4	1	1.4	1	1.4	1	1.4
De Silva	1991	38	2	5.3	0	0.0	–	–	–	–	–	–	–	–	1	2.6
Sugerman	1991	64	–	–	–	–	2	3.1	1	1.6	–	–	–	–	–	–
Sutter	1991	19	0	0.0	–	–	–	–	–	–	–	–	–	–	–	–
Lewis	1990	40	–	–	–	–	–	–	–	–	–	–	–	–	1	2.5
Matikainen	1990	21	–	–	–	–	–	–	–	–	–	–	–	–	3	14.3
Wexner	1990	159	–	–	0	0.0	1	0.6	–	–	–	–	–	–	–	–
Feinberg	1987	110	22	20.0	–	–	–	–	4	3.6	16	14.5	3	2.7	3	2.7
Harms	1987	15	2	13.3	0	0.0	–	–	–	–	–	–	–	–	2	13.3
Nasmyth	1986	38	8	21.1	0	0.0	–	–	1	2.6	2	5.3	2	5.3	3	7.9
Metcalf	1985	173	–	–	0	0.0	–	–	–	–	–	–	3	1.7	–	–
Nicholls	1985	98	–	–	–	–	–	–	–	–	–	–	–	–	6	6.1
Total		*2146*	*132*	*16.5 %*	*0*	*0.0 %*	*11*	*3.0 %*	*20*	*2.0 %*	*66*	*7.6 %*	*30*	*2.9 %*	*47*	*4.0 %*
Study population (100 %)[a]			798		889		370		1 013		874		1 034		1 180	

[a] The number of patients with available data on the respective item are set as 100 %

In 3.5 % of patients, the initial diagnosis of ulcerative colitis was revised to Crohn's disease during follow-up (as reported in nine studies).[19,22,27–29,31,34,37,39] Although this cannot be considered as "surgical" late complication, Crohn's disease led to pouch failure at a later stage in 2.4 % of patients in these studies.

Assessment of Possible Publication Bias: Funnel Plot

As a visual aid to detect a possible publication bias or systematic heterogeneity of the studies, a funnel plot of effect size (reported morbidity of ileostomy reversal) against study size (number of ileostomy reversals included in the respective study) was created, Fig. 2. The funnel plot shows a roughly symmetric inverted funnel shape which makes publication bias unlikely. Reported morbidity values of larger studies are close to the average morbidity (16.5 %), whereas smaller studies report lower and higher values without systematic preference.

Sensitivity Analysis

Since the effect sizes may differ according to the size of the included studies, a sensitivity analysis was performed including only studies reporting on more than 50 ileostomy reversal procedures, thus excluding extreme values of smaller studies (see funnel plot, Fig. 2). In this subset of large studies, overall morbidity of ileostomy reversal was 17.0 % (as reported in six

Table 3 Late complications of ileostomy reversal

Author	Year	Number of ileostomy reversals *n* value	Hernia		Bowel obstruction	
			n value	%	*n* value	%
Dolejs	2011	390	–	–	58	14.9
Mennigen	2011	81	6	7.4	–	–
Fajardo	2010	124	–	–	–	–
Selvaggi	2010	115	–	–	–	–
Araujo	2005	10	–	–	–	–
Ikeuchi	2005	91	–	–	15	16.5
Gunnarsson	2004	143	–	–	–	–
Fonkalsrud	2000	39	–	–	3	7.7
Dolgin	1999	14	–	–	1	7.1
Edwards	1998	13	–	–	–	–
Bain	1996	20	0	0.0	–	–
Khoo	1994	201	0	0.0	1	0.5
Seow-Choen	1994	13	–	–	–	–
Braun	1992	48	–	–	3	6.3
Poppen	1992	69	3	4.4	–	–
De Silva	1991	38	–	–	5	13.2
Sugerman	1991	64	2	3.1	–	–
Sutter	1991	19	–	–	–	–
Lewis	1990	40	0	0.0	3	7.5
Matikainen	1990	21	–	–	6	28.6
Wexner	1990	159	–	–	–	–
Feinberg	1987	110	0	0.0	5	4.5
Harms	1987	15	–	–	–	–
Nasmyth	1986	38	–	–	1	2.6
Metcalf	1985	173	–	–	–	–
Nicholls	1985	98	–	–	5	5.1
Total		*2146*	*11*	*1.9 %*	*106*	*9.4 %*
Study population (100 %)[a]			585		1128	

[a] The number of patients with available data on the respective item are set as 100 %

studies[10,11,15,20,28,35]), redo surgery was necessary in 2.3 % (as reported in three studies[10,30,34]), anastomotic dehiscence occurred in 1.7 % (as reported in eight studies[10,15,19,20,25,28,30,35]), postoperative bowel obstruction in 7.1 % (as reported in five studies[10,18,20,28,35]). These parameters showed no systematic trend towards higher or lower values compared to the complete study population.

Discussion

This systematic review of ileostomy reversals after proctocolectomy for ulcerative colitis and familial adenomatous polyposis reveals a considerable morbidity of 16.5 % associated with this procedure. Redo surgery for complications was necessary in 3.0 % of patients, and postoperative bowel obstruction was the main determinant of early postoperative morbidity, occurring in 7.6 %.

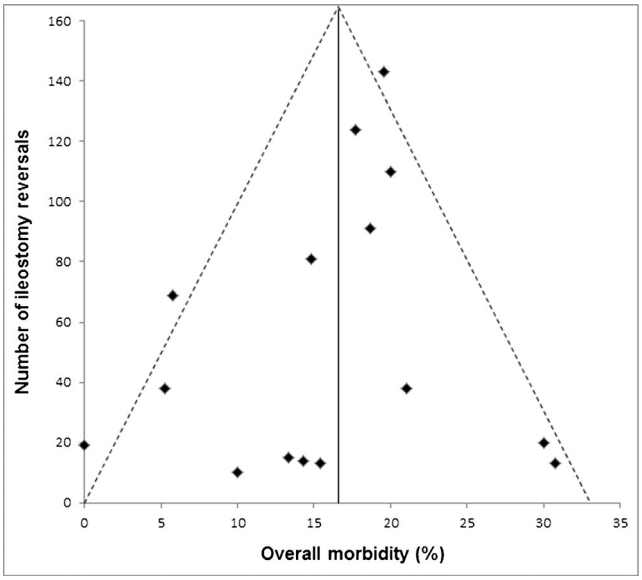

Fig. 2 Funnel plot of the included studies (*x*-axis; overall morbidity of ileostomy closure, *y*-axis; number of ileostomy reversals in the respective study)

Most surgeons prefer to create a temporary loop ileostomy during restorative proctocolectomy,[40] and this policy is supported by several studies demonstrating the reduction of severe complications, especially pouch-related septic complications.[10,41–45] However, some publications suggested that one-stage procedures can be considered for selected low-risk patients.[46–49] This issue has been elucidated by a meta-analysis of studies on the use or omission of a diverting ileostomy.[2] The risk of anastomotic dehiscence was significantly reduced; however, a difference for pouch-related sepsis was only found if exclusively high-quality studies were included in the analysis. The advantage of fecal diversion was challenged by a higher rate of anastomotic strictures in the ileostomy group (15.3 versus 5.1 % without stoma; $p=0.045$). Importantly, the risks of scheduled ileostomy reversal were not included in the overall morbidity.[2]

The risks of ileostomy closure tend to be underestimated. Usually, it is regarded as low-risk standard procedure; in many centers, this is a typical operation to be done by trainees under the supervision of an experienced senior surgeon. However, details on the degree of experience of the operating team are not available from the studies included in this review. Only few publications discussing the potential benefits of a covering ileostomy take the morbidity of stoma reversal into account. For restorative proctocolectomy, the cumulative morbidity of ileostomy creation and reversal often outweighed the morbidity reduction achieved for the proctocolectomy.[10,13–15] The systematic review of ileostomy reversals by *Chow*[50] was

one of the first reports that brought into mind the concerning complication rates of about 17 %. Recently, several publications on morbidity of ileostomy reversal report rates of 20–40 %,[51–56] possibly reflecting an increasing awareness and an honest reporting of this issue. These values are higher than those found in the actual review and in that of *Chow,*[50] so it seems possible that there is a certain publication bias (underreporting) in older studies. Interestingly, the interpretation of these complication rates can differ completely; while many authors are concerned about the rather high complication rates, other authors even propose performing ileostomy reversal as day case surgery.[57,58]

Previous reports on the morbidity of ileostomy reversal, including the abovementioned systematic review by *Chow,*[50] do not differentiate the underlying primary procedures that led to ileostomy creation; they rather provide pooled data on various indications, such as anterior rectal resection, colonic resection, or restorative proctocolectomy. A priori, we hypothesized that patients after restorative proctocolectomy might have a different risk profile compared to patients after rectal or colonic resection. From the technical point of view, after restorative proctocolectomy, the ileostomy site usually is located more proximal in the ileum. Furthermore, the lack of the ileocecal valve and of residual colon could make a difference especially for postoperative bowel obstruction. Therefore, we exclusively included patients undergoing ileostomy reversal after restorative proctocolectomy in our present analysis.

However, the main outcome measures (overall morbidity, redo operations, and postoperative bowel obstruction) found in our study were quite similar to those reported by *Chow*[50] indicating that the underlying type of surgery does not significantly influence complication rates. Nevertheless, there are two important novel aspects in our study that are only relevant after restorative proctocolectomy. First, we could show that 1.9 % of patients develop pouch-related septic complications after ileostomy reversal. This indicates that preoperative endoscopy and pouchography cannot completely rule out unapparent fistulas and leakages that lead to these complications once the fecal stream is reestablished. Second, 3.5 % of patients supposed to have ulcerative colitis will later be diagnosed as having Crohn′s disease. This is important, as the pouch failure rate is as high as 20 % at 10 years after proctocolectomy in patients with Crohn′s disease.[4]

The high morbidity of ileostomy reversal leads to the question if the policy of covering ileostomy should be modified. On one hand, adding the morbidities of proctocolectomy and ileostomy reversal basically leads to comparable overall morbidity rates for one- and two-stage proctocolectomy procedures, and ileostomy creation means one additional surgical procedure and a longer total hospital stay for the patient. On the other hand, pouch-related septic complications are significantly reduced by ileostomy,[2] even if the few cases developing pouch-related septic complications after stoma reversal are taken into account. These severe complications have the greatest impact on pouch function and failure rate, and they are difficult to manage.[5–9,59] Taken together, the reduction of pouch-related septic complications is achieved by accepting other complications, like bowel obstruction, wound infections, and others. Because of the extraordinary impact of pouch-related septic complications on pouch function, pouch failure, and postoperative quality of life, routine creation of a covering ileostomy still is advocated. However, the considerable morbidity of ileostomy reversal has to be recognized, especially when informing the patient about indication and risks of a covering ileostomy.

The reported work-up before ileostomy reversal was basically similar in all studies; all authors performed endoscopy and pouchography; the mean time interval between fecal diversion and ileostomy reversal was 3 months. However, as mentioned above, routine pouchography did not prevent pouch-related septic complications after ileostomy reversal. *Selvaggi*[60] recently showed that negative pouchography does not exclude future complications. In addition, all anomalies detected by pouchography were already suspected clinically. This led to the conclusion that routine pouchography may be safely omitted before ileostomy closure.[60]

Postoperative bowel obstruction was the main determinant of early postoperative morbidity after ileostomy reversal, and strategies to reduce this type of complication are necessary. The recent HASTA trial[61] showed similar rates of postoperative bowel obstruction for both hand-sewn and stapler anastomosis, so there is no recommendation on either technique in this respect. Laparoscopic surgery might improve the situation, as a recent report demonstrated that ileostomy reversal after laparoscopic surgery was associated with a significantly lower rate of overall complications compared to previous open surgery.[62] Bowel obstruction was the most common complication in both groups; however, due to small numbers of complications, the difference of bowel obstruction rate did not reach significance. *Royds*[63] performed a randomized clinical trial comparing standard ileostomy reversal with and without consecutive laparoscopy allowing the diagnostic assessment of the peritoneal cavity. If adhesions were present, these were divided completely during laparoscopy. Additional laparoscopy was associated with shorter hospital stay, faster return to normal bowel function, lower overall morbidity, and reduced costs.

But even if the rate of early postoperative bowel obstruction can be reduced, bowel obstruction at a later time point remains a problem. At 1 year after ileostomy reversal, the cumulative incidence of bowel obstruction is about 15.0 %, and laparoscopic approach of the previous restorative proctocolectomy does not appear to change this risk.[18] A meta-analysis[2] comparing restorative proctocolectomy with and without ileostomy showed that there is a non-significant trend towards lower rates of bowel obstruction as long-term

adverse event in patients without ileostomy (odds ratio=0.65, 95 % CI=0.38–1.12; P=0.12). Possible reasons for this observation remain speculative; additional adhesions induced by stoma creation and reversal could be an explanation for a potentially higher risk of bowel obstruction in diverted patients.

Some limitations of our study have to be addressed. The studies included in the analysis were different in design and setting, and most of them were retrospective in nature. In most studies, morbidity of ileostomy reversal was not a primary outcome measure. The potential risk of publication bias (with the actual morbidity possibly being underestimated) has already been discussed. The pooled data of such different studies do not allow an analysis of the impact of certain factors, like patients′ risk factors, type of anastomosis, laparoscopic surgery, and others, on morbidity of ileostomy reversal.

Conclusion

The considerable morbidity of ileostomy reversal after restorative proctocolectomy reduces the benefit of temporary fecal diversion. However, ileostomy creation is still recommended, as it effectively reduces the total number of pouch-related septic complications, which in turn are the main risk factor for bad pouch function, impaired quality of life, or even pouch failure.

Funding There was no funding for this study.

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