Abstract. Aim: To compare subtotal colectomy to segmental colectomy for malignant left-sided colonic obstruction. Patients and Methods: Obstruction was defined by failure to trespass a colonic stenosis during endoscopy, by truncation of the contrast column during contrast enema, by severe colonic dilatation (cecum >10 cm, transverse colon >8 cm, descending colon >6 cm) or by serosal tears. From 53 consecutive patients treated for malignant left-sided colon obstruction at our surgical department from July 2002 to July 2010, 19 patients had subtotal colectomy and 30 patients had segmental colectomy. Four patients were excluded: two of them had non-colorectal primary cancer and the other two had a two-stage procedure. Results: The rate of severe colonic dilatation and serosal tears, the physiological severity score and the expected morbidity were higher in the group with subtotal colectomy than in the group of segmental colectomy (p<0.05). However, the anastomotic leak rate was lower in the group with subtotal colectomy (0/19) than in the group with segmental colectomy (6/30) (p=0.042). Overall, there were no statistically significant differences regarding mortality or morbidity between the two groups. Conclusion: Despite worse preoperative conditions, patients who underwent subtotal colectomy for left-sided obstructing colonic cancer had a significantly lower anastomotic leak rate than those who underwent segmental colectomy. This fact supports the concept of subtotal colectomy for this entity. However, perioperative mortality seems to be independent of the presence or absence of an anastomotic leak.

Left-sided colonic obstruction caused by colonic cancer is an infrequent surgical entity with high morbidity (40-50%) and mortality rates (15-20%) (1); the latter are markedly higher than in patients with non-obstructing lesions (2). Although the surgical strategy remains controversial, one-stage procedures (3-8) seem to be superior to two- and three-stage procedures (3, 9-13) in terms of morbidity and mortality if the outcomes of the multiple procedures are summarized (1, 3).

There are only few studies dealing with one-stage procedures for malignant left-sided colonic obstruction. Most of the publications on this topic are of rather poor methodological quality due to the inclusion of a potpourri of diseases and dubious definitions of colonic obstruction (1). Indeed, there is only one randomized study, with 91 patients recruited from 12 different centers (14), that compares segmental colectomy with subtotal colectomy for malignant left-sided colonic obstruction.

Furthermore, the current trend and recent guidelines (15) seem to favor one-stage procedures for malignant left-sided colonic obstruction. Therefore, focusing clinical research on the optimization of one-stage procedures seems to be justified and necessary. In a cohort of 49 consecutive patients from one surgical department, we compared subtotal colectomy with segmental colectomy for strictly defined left-sided colonic obstruction, exclusively caused by colonic cancer, regarding morbidity and mortality.

Patients and Methods

A retrospective cohort study was carried out on all consecutive patients (n=53) with malignant left-sided colonic obstruction treated at our department from July 2002 to July 2010. A database including all colorectal surgical procedures was used to detect the relevant cases in this time period.
Obstruction was defined by failure to trespass a colonic stenosis during endoscopy (12 mm endoscope), by truncation of the column of contrast observed in contrast enema, by severe colonic dilatation (cecum >10 cm, transverse colon >8 cm, descending colon >6 cm) or by serosal tears due to colonic dilatation. Primary colonic malignancy was confirmed by histopathological examination of the specimens. Two patients with primary cancer in other organs were excluded. Two patients underwent two-stage procedures and were also excluded from further analyses. Thus, forty-nine patients that had undergone colonic resection and primary anastomosis without proximal diversion for left-sided large bowel obstruction caused by colonic cancer were included for further analyses.

Surgical strategy and techniques. Surgical strategy adhered to recent guidelines for malignant left-sided colonic obstruction (15). The standard procedure for malignant left-sided colonic obstruction was segmental colectomy and primary anastomosis. Subtotal colectomy and primary anastomosis was only performed in the case of cecal ischemia, perforation, serosal tear or questionable viability of the colonic wall, or in cases of synchronous colonic tumour. Subtotal colectomy was defined as removal of the colon with an ileo-colonic or ileo-rectal anastomosis. The distance of the anastomosis from the anal verge was a median of 15 cm (range 7-30 cm). Providing the superior rectal artery could be preserved with regard to oncological surgical quality, the anastomosis was performed up to 20 cm from the anal verge. In the case of ileosigmoidostomy, a hand-sewn anastomosis was performed using a continuous double-layered suture with a thread of polypropylene USP 5-0 (n=7). However, in the case of ileorectostomy, a circular stapler with double stapling technique was used (n=12). The diameter of the circular stapler was 33 mm (n=6) or 29 mm (n=6).

Segmental colectomy was defined as removal of a segment of the colon with colorectal or colo-colic anastomosis preferably performed in the proximal rectum. If possible, open colonic decompression by suction was carried out. If hard and bulky fecal matter proximal to the obstacle was present, on-table lavage was carried out by means of an appendectomy and insertion of a tube into the cecum. The colonic stump was fixed to a plastic bag and then the colon was rinsed with lactated Ringer’s solution. The distance of the anastomosis from the anal verge was a median of 13 cm (range 8-30 cm). The anastomosis was always performed with a 33 mm stapler (double-stapling technique); only in one case was a hand-sewn anastomosis performed in the same fashion as above.

When performing stapled anastomosis, the distance of the anastomosis from the anal verge was measured by using the rigid handle bar of the introduced stapler, while in the case of hand-sewn anastomosis, the distance was measured with a ruler; thus, the rectosigmoidal junction was defined by means of macroscopic signs, such as the cessation of the surgical mesocolon with loss of the teniae coli and cessation of appendices epiploicae.

A leak test was always performed intraoperatively by introducing a Foley catheter, inflating it and gently withdrawing it to provide tight contact with the sphincter apparatus and then inflating the rectum with air and looking for air bubbles. If air bubbles were detected, a suture repair was performed.

An omental patch was routinely positioned and fixed near the anastomosis. Drainage was routinely positioned in both procedures, but always withdrawn within five days.

A leak test by post-operative contrast enema (computed tomographic scan or conventional X-ray) was performed in cases of clinical suspicion of anastomotic leak. After January 2005, a routine post-operative contrast enema (conventional X-ray) was performed as part of a prospective study. However, there was no statistically significant difference in the number of contrast enemas performed between the two groups (see Table III).

Assessment of health condition and outcome measures. The physiological severity score (PSS), based on age, cardiac and respiratory morbidities, vital signs, blood tests (16), and the expected overall morbidity by physiologic and operative severity score for the enumeration of mortality and morbidity (POSSUM) score based on PSS, operative severity, number of procedures, operative blood loss, peritoneal soiling, malignancy and mode of surgery (16) were calculated.

Statistics. The Wilcoxon rank-sum test was used for numerical data. A one-sided Fisher’s exact test was used for categorical data due to the number of patients included in this study. Results are expressed as medians and range. In order to demonstrate the differences between the groups more clearly, results of the different scores were expressed as mean values. p-Values <0.05 were considered as being significant.

Results

Nineteen patients had subtotal colectomy performed and thirty patients had segmental colectomy performed. An overview of the study design can be seen in Figure 1.

The group with subtotal colectomy had a higher PSS as a surrogate marker for adverse outcome as shown in Table I. Several surgical risk factors for adverse outcome were also higher in this group, as shown in Table II. The differences in the surgical techniques between the two groups are shown in Table III.

In both groups, effective overall morbidity was lower than expected by calculating the POSSUM score, as shown in Figure 2. However, the leakage rate was significantly higher in the group undergoing segmental colectomy, as shown in Figure 3. On-table lavage was performed in eight patients undergoing segmental colectomy (n=30). Concerning the leakage rate, there was no statistically significant difference between the subgroups with or without on-table lavage (p=0.480).

Mortality was 15.8% in the group undergoing subtotal colectomy vs. 13.3% in the group undergoing segmental colectomy (p=0.561). The causes of death were: cecal perforation and diffuse fecal peritonitis with multiple organ failure (n=1); heart failure in a 92-year-old patient with severe heart disease (n=1); myocardial infarction (n=1); cardiac arrest associated with anastomotic leakage (n=1); aspiration pneumonia (n=1); diffuse liver metastases with death on day 23 after surgery (n=1); indefinite cause, but with no signs of anastomotic leakage in contrast enema (n=1). The median age of the deceased patients was 83 (range=71-93) years.
Recent guidelines for malignant left-sided colonic obstruction recommend segmental colectomy and primary anastomosis in cases of rectal anastomosis and/or known pre-existing continence disturbance, and subtotal colectomy and primary anastomosis in cases of cecal ischemia, perforation or serosal tear, or in cases of synchronous colonic tumour (15). These guidelines are based on a few studies with rather poor methodology (1).

There are several reasons for favoring subtotal colectomy as the standard procedure for malignant left-sided colonic obstruction: the entire dilated and potentially ischemic damaged colon is removed, a lower frequency of wound contamination is to be expected because no on-table lavage is needed (15), the surgical time is comparable to that for segmental colectomy and on-table lavage, and no additional material for on-table lavage is required. The oncological quality of the resection is optimal because the inferior mesenteric artery and the middle colic artery can both be resected with a central ligature if necessary.

Synchronous colonic cancer has an incidence of 2-11% (17, 18) and in the case of obstruction, the incidence seems to be even higher (19). These types of cancer often cannot

### Table I. Baseline data: systemic risk factors.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Subtotal colectomy</th>
<th>Segmental colectomy</th>
<th>p-Value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age in years (range)</td>
<td>76 (54-100)</td>
<td>73 (42-95)</td>
<td>0.211²</td>
</tr>
<tr>
<td>Pulmonary comorbidity, n=16 (33%)</td>
<td>n=8 (42%)</td>
<td>n=8 (27%)</td>
<td>0.208²</td>
</tr>
<tr>
<td>Cardiovascular comorbidity, n=31 (63%)</td>
<td>n=12 (43%)</td>
<td>n=19 (63%)</td>
<td>0.612²</td>
</tr>
<tr>
<td>Tobacco abuse, n=11 (22%)</td>
<td>n=5 (26%)</td>
<td>n=6 (20%)</td>
<td>0.429²</td>
</tr>
<tr>
<td>Renal insufficiency, n=7 (14%)</td>
<td>n=4 (21%)</td>
<td>n=3 (10%)</td>
<td>0.252²</td>
</tr>
<tr>
<td>Diabetes mellitus, n=8 (16%)</td>
<td>n=3 (16%)</td>
<td>n=5 (17%)</td>
<td>0.630²</td>
</tr>
<tr>
<td>Physiological severity score (mean)</td>
<td>23.7</td>
<td>19.1</td>
<td>0.008²</td>
</tr>
<tr>
<td>ASA score (mean)</td>
<td>2.74</td>
<td>2.67</td>
<td>0.901²</td>
</tr>
</tbody>
</table>

¹Wilcoxon rank-sum test; ²Fisher’s exact test, one-tailed. ASA: American Society of Anesthesiologists.

### Table II. Baseline data: Surgical risk factors.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Subtotal colectomy</th>
<th>Segmental colectomy</th>
<th>p-Value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serosal rupture</td>
<td>n=8 (42%)</td>
<td>n=0 (0%)</td>
<td>0.0002²</td>
</tr>
<tr>
<td>Severe colonic dilatation (cecum &gt;10 cm, transverse colon &gt;8 cm, descending colon &gt;6 cm)</td>
<td>n=12 (63%)</td>
<td>n=8 (27%)</td>
<td>0.013²</td>
</tr>
<tr>
<td>Failure to trespass the colonic stenosis during endoscopy</td>
<td>n=10 (53%)</td>
<td>n=21 (70%)</td>
<td>0.364²</td>
</tr>
<tr>
<td>Truncation of the column of contrast observed in contrast enema</td>
<td>n=0 (0%)</td>
<td>n=1 (3%)</td>
<td>0.620²</td>
</tr>
<tr>
<td>Median operative blood loss (range), ml</td>
<td>350 (100-1200)</td>
<td>200 (0-900)</td>
<td>0.062²</td>
</tr>
</tbody>
</table>

¹Wilcoxon rank-sum test, ²Fisher’s exact test, one-tailed.

### Table III. Baseline data: Surgical techniques.

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Subtotal colectomy</th>
<th>Segmental colectomy</th>
<th>p-Value¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median distance (cm) of anastomosis from anal verge (range)</td>
<td>15.0 (7-30)</td>
<td>13.25 (8-30)</td>
<td>0.030³</td>
</tr>
<tr>
<td>Number of hand sewn anastomoses (%)</td>
<td>7 (36.8%)</td>
<td>1 (3.3%)</td>
<td>0.013³</td>
</tr>
<tr>
<td>Number of EEA staplers with a diameter of 29 mm used (% of all stapled anastomoses)</td>
<td>6 (12%)</td>
<td>0 (0%)</td>
<td>0.002³</td>
</tr>
<tr>
<td>Number of postoperative contrast enemas (CT scan or conventional X-ray)</td>
<td>6 (47%)</td>
<td>23 (77%)</td>
<td>0.229³</td>
</tr>
</tbody>
</table>

¹Wilcoxon rank-sum test, ³Fisher’s exact test, one-tailed. EEA: End-End-Anastomosis; CT: computed tomography.
be diagnosed preoperatively by means of endoscopy and intraoperative palpation is also not reliable (19). However, they can also be treated by subtotal colectomy.

Patients with colorectal cancer have an increased risk of metachronous colorectal cancer and thus need regular follow-up. In cases of subtotal colectomy, this risk is lower and follow-up can be easily performed by sigmoidoscopy, which is less invasive than colonoscopy. The continence apparatus is not harmed by subtotal colectomy or by segmental colectomy, thus anal incontinence is not a problem after these procedures (15). Bowel movement frequency and diarrhea depend on the length of colon left in situ, however, they can be controlled by means of anti-diarrheal agents if required (15). As surgical measures against these problems, it is very important that less than 10 cm of the terminal ileum is excised and that at least 10 cm of colon is left in situ (3, 15).

The leakage rate was significantly higher in the group with segmental colectomy compared to subtotal colectomy, although only patients with severe dilatation or synchronous colonic cancer had a subtotal colectomy performed. Thus, although healthier patients with a significantly lower PSS and with less acute left-sided colon obstruction were selected for segmental colectomy, they had a significantly higher leakage rate than the more sick patients selected for subtotal colectomy.

There are several possible reasons for the significantly lower leak rate in patients who underwent subtotal colectomy. In subtotal colectomy, healthy, often non-dilated ileum, with its naturally rich blood supply, is used for anastomosis, while dilated colon, with its consecutively impaired microcirculation, is used for anastomosis in segmental colectomy. Furthermore, the column of feces is completely removed in subtotal colectomy. Technical problems, such as potentially hazardous stapler anastomosis due to hypertrophy of the chronically congested colon might also play a role regarding anastomotic leakage.

It might be suggested that the surgical sewing or stapling technique might have had an important impact on the leakage rate. However, the number of hand-sewn anastomoses known to be associated with a higher leakage rate than stapled anastomoses (20), and the number of anastomoses performed with a 26 to 29 mm stapler, known to be associated with a 6.29-fold higher rate of late stenosis than anastomoses performed with a 31 to 33 mm stapler (21), and thus assumed to be associated with a higher leakage rate, were significantly
higher in the group of patients who underwent subtotal colectomy compared to segmental colectomy. Thus, these factors cannot be blamed for the higher leakage rate observed with segmental colectomy.

It could be assumed that there might have been more occult anastomotic leakages in the group that underwent subtotal colectomy, leading to a screening bias. However, there was no statistically significant difference between the number of post-operative contrast enemas performed in the two groups.

Performing subtotal colectomy seems to solve all these problems at the same time. Thus the aphorism, “when in doubt, cut it out”, might be the correct response in left-sided colonic obstruction caused by colonic cancer.

Limitations. This retrospective study is based on prospectively collected data. However, a bias favoring the group that underwent subtotal colectomy can be excluded, since all consecutive patients from one center were analyzed for a predefined period and since the calculated risk scores were in favour of patients who underwent segmental colectomy, but not in favour of those who underwent subtotal colectomy.

Conclusion

Despite worse pre-operative conditions, patients who underwent subtotal colectomy for left-sided colonic obstruction caused by colonic cancer had a significantly lower anastomotic leak rate than those who underwent segmental colectomy. This supports the concept of subtotal colectomy for obstructing left-sided colonic cancer, especially in the presence of a damaged large bowel wall due to dilatation.

References


Kaser et al.: Surgery for Malignant Colonic Obstruction

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