Langenbeck's Arch Surg (1998) 383: 49–55

ORIGINAL ARTICLE

W. Schwenk · B. Böhm · O. Haase · T. Junghans
J. M. Müller

Laparoscopic versus conventional colorectal resection: a prospective randomised study of postoperative ileus and early postoperative feeding

Received: 17 December 1997

Abstract *Background:* A shorter duration of postoperative ileus and earlier oral alimentation of patients may be a clinically relevant benefit of laparoscopic compared with conventional colorectal resection. *Patients/Methods:* A total of 60 patients were randomised to either laparoscopic (n=30) or conventional (n=30) resection of colorectal tumours. Major endpoints were the postoperative time to the first bowel movement and the time until oral feeding without parenteral alimentation was tolerated. Minor endpoints were the postoperative interval to the first peristalsis and first passage of flatus, the distribution of radio-opaque markers in abdominal radiographs on day 3 and day 5 and the incidence of postoperative vomiting. *Results:* Age, gender, ASA-classification and type of resection were comparable in thetwo groups. Peristalsis was first noticed 26±9 h after laparoscopic and 38±17 h after conventional colorectal resection (P<0.01). First flatus occurred 50±19 h after laparoscopic and 79±21 h after conventional surgery (P<0.01). The incidence of postoperative vomiting was similar in both groups. Three days after surgery radio-opaque markers were found more often in the right colon (P<0.01) and less often in the small intestine (P<0.05) in laparoscopic compared with conventional patients. Five days after laparoscopic surgery, more markers had reached the left colon (P<0.05). The first bowel movement occurred 70±32 h after laparoscopic and 91±22 h after conventional resection (P<0.01). Oral feeding without additional parenteral alimentation was tolerated 3.3±0.7 days after laparoscopic and 5.0±1.5 days after conventional surgery (P<0.01). *Conclusion:* The shorter duration of postoperative ileus allows earlier restoration of oral feeding after laparoscopic compared with conventional colorectal resection and therefore increases quality of life immediately after resection of colorectal tumours.

Key words Colorectal resection · Laparoscopic surgery · Postoperative ileus · Early postoperative feeding

W. Schwenk · B. Böhm · O. Haase · T. Junghans · J. M. Müller
Department of Surgery, Medical Faculty
of the Humboldt-University at Berlin,
Charité, Germany

W. Schwenk (✉)
Universitätsklinik und Poliklinik für Chirurgie,
Medizinische Fakultät der Humboldt-Universität zu Berlin,
Charité, Schumannstrasse 20/21, D-10117 Berlin, Germany
Tel.: +49 030 2802 5048; Fax: +49 030 2802 1175

Introduction

Postoperative ileus is a transient phenomenon occurring after abdominal surgery. Clinically, it is characterised by disturbed bowel motility and loss of peristaltic bowel sounds, abdominal meteorism and absence of flatus or bowel movements. It may be accompanied by abdominal convulsions with nausea and vomiting. There is general agreement that postoperative ileus is caused by an inhibition of intestinal motility resulting from sympathic reflex as part of the operative trauma. The sympathic hyperreactivity is assumed to be induced or promoted by laparotomy, continuous manipulation of the intestine and mesentery, prolonged surgery and extensive resections [11, 16].

Animal experiments [6, 33] and clinical studies [15] suggest that intestinal motility might recover faster after laparoscopic colorectal resection than after conventional surgery. Since patients considerably benefit from rapid restoration of normal gastrointestinal motility after surgical interventions and early oral nutrition, we performed a prospective randomised study to investigate the effect of laparoscopic and conventional surgery on the duration of postoperative ileus.

Material and methods

Study hypothesis, endpoints and sample-size calculation

The study was performed to test the hypothesis that postoperative ileus resolves faster after laparoscopic resection of colorectal tumours than after conventional surgery. Major endpoints were the postoper-

Table 1 Inclusion and exclusion criteria for enrolment in the prospective randomised study

Inclusion criteria	
	Colorectal tumour
	Elective resection by right colectomy, sigmoid resection, anterior rectum resection or abdominoperineal rectum extirpation
Exclusion criteria	
	Rectum carcinoma within 12 cm of the anus, scheduled for sphincter-preserving anterior rectum resection with total mesorectal excision
	Tumour of the transverse colon or the flexures scheduled for extended colectomy
	Tumour infiltration of adjacent organs
	Anaesthesia risk >ASA III
	Scheduled for abdominoperineal rectum extirpation with dynamic gracilis plasty
	Excessive obesity with a body mass index >32 kg/m^2
	Pronounced peritoneal adhesions from previous interventions
	Synchronous second tumour in extracolonic location
	Coagulopathy not responding to treatment
	Intestinal obstruction
	Transverse tumour diameter more than 8 cm on CT
	Immunopathy
	Pregnancy
	Age <18 years

ative time to the first bowel movement and the time required until return to fully normal oral alimentation. Minor endpoints were the distribution of radio-opaque markers in abdominal radiographs on the 3rd and 5th postoperative days, the interval to first peristalsis and first passage of flatus, and the incidence of postoperative vomiting.

The number of cases required was calculated prior to initiation of the study. Based on a mean clinical duration of postoperative ileus after conventional colorectal resection of 90±20 h, 30 patients in each group was considered adequate to identify a reduction of this interval by 25% at P=0.05 (2-tailed test) and β=0.2 with a power of 80%.

Patients

All patients scheduled for elective resection of a colorectal tumour, between May 1995 and November 1996, by right colectomy, anterior sigmoid resection, anterior rectum resection (for tumours above 12 cm) or abdominoperineal rectum extirpation (infiltration of the sphincter) were included in the study. Inclusion and exclusion criteria are listed in Table 1.

Conduct of the study

All patients were informed about the type of intervention, the principles of laparoscopic and conventional resection of colorectal tumours, and the design of the study. Written informed consent was obtained from all patients. Preoperative preparation included orthograde bowel cleansing in all cases. After induction of anaesthesia, the patients received 2 g cefotiam and 0.5 g metronidazole for antibiotic prophylaxis. Anaesthesia was performed as total intravenous anaesthesia with administration of propofol, sulfentanyl and atracium by the same anaesthesiological team in all cases. Spinal or peridural anaesthesia was not utilised in any of the patients. All patients underwent diagnostic laparoscopy at the beginning of the surgical intervention. After the surgeon had declared the patient eligible for the laparoscopic approach, the result of randomisation was disclosed and the intervention was continued according to randomisation as a laparoscopic or a conventional resection. Patients who were identified as not being eligible for laparoscopic resection were excluded from the study and were resected conventionally. Patients of the laparoscopic group in whom it became necessary during laparoscopic resection to change to the laparoscopic-assisted or conventional technique were analysed as ‘intent to treat’ together with the laparoscopy patients.

The technique of laparoscopic resection has already been described in detail elsewhere [27]. Conventional resections were performed by wide median laparotomy [17, 19]. Both the laparoscopic and the conventional approach were performed as R0 resections with proximal ligation of the major vascular pedicle, including systematic regional lymphadenectomy. The nasogastric tube and drains were removed from all patients in the morning of the first postoperative day. Upon admission to the surgical intensive care unit, all patients received patient-controlled analgesia with morphine, which was continued until the morning of the fourth postoperative day. Thereafter, patients received tramadol at an oral dose of 100 mg as required. All patients were examined with respect to the study endpoints at regular intervals as follows: at 22 00 hours on the day of surgery; at 06 00 hours, 14 00 hours and 22 00 hours on the first 3 postoperative days; at 08 00 hours and 20 00 hours on days 4–6; and thereafter once daily at 08 00 hours until discharge or day 14. The time intervals to the first passage of flatus and the first bowel movement were recorded. Patients were asked about vomiting at the above-mentioned time points. To differentiate postoperative vomiting from retching due to postanaesthetic nausea, vomiting on the first postoperative day was not regarded as a relevant event; only amounts of more than 200 ml were interpreted as vomiting in the sense of the study endpoint. All patients ingested a capsule containing 10 radio-opaque markers (Janssen-Clinag, Baar, Switzerland) of various shapes (e.g. day 1 rods; day 2 beads; day 3 rings) in the morning of the first 3 postoperative days. Survey radiography of the abdomen was performed at noon on the third and fifth day. The radiographs were evaluated by an investigator who was blinded to the patient’s individual postoperative course at the time of interpretation. The investigator first determined the number of markers of the different shapes and the sum of all markers present. This was followed by assigning the markers to the different gastrointestinal segments (stomach, small intestine, right colon, left colon) following the technique described by Metcalf et al. [26]: right colon, lateral to the vertebral column on the right and above a line from the spinous process of the fifth lumbar vertebra to the right acetabulum; left colon, lateral to the vertebral colon on the left and above a line from the spinous process of the fifth lumbar vertebra to the left acetabulum; and stomach, upper abdomen in the region of intragastric accumulation of air. In unclear cases, the markers were assigned taking into account both radiographs and the sequence of ingestion. In patients who had undergone right colectomy, markers in the area of the right abdomen were assigned to the small bowel.

On the day of surgery, all patients received total hypocaloric parenteral alimentation. Oral feeding was started on the first postoperative day and was carried out in five steps: step 0, parenteral alimentation; step 1, tea and water ad libitum, hypocaloric parenteral alimentation; step 2, tea and soup, hypocaloric parenteral alimentation; step 3, mashed food, no parenteral alimentation; and step 4, strict basic diet, no parenteral alimentation. Each step lasted 1 day. Patients who reported fullness, heartburn or hiccups were returned to the previous step which they had tolerated until cessation of the complaints. Additionally, these patients received medication with propulsive action (metoclopramide three times 10 mg by infusion or cisaprid two times 10 ml orally). Only patients who explicitly asked for a more rapid return to oral nutrition were allowed mashed food on the second postoperative day. All patients were asked about their actual diet at the above-mentioned time points and their answers were recorded as steps 0–4. The study was approved by the ethics committee of the Medical Faculty of Humboldt University, Berlin, Germany.

Data recording and statistical analysis

Metric parameters were tested for normal distribution by means of the Shapiro-Wilks test. Normally distributed parameters are given as means (± standard deviations); differences between the groups were analysed by means of the *t*-test. Parameters not showing normal distribution are given as medians (95% percentile) and were analysed using Wilcoxon’s rank sum test. Categorial data were analysed using Fisher's exact test. Multivariate regression analysis of the time intervals to first peristalsis, first passage of flatus and first bowel movement was performed to identify clinically relevant parameters with an independent effect on the duration of postoperative ileus [32]. The following parameters were included in the stepwise regression model: age, gender, operative technique (conventional versus laparoscopic), type of resection (right colectomy, sigmoid resection or anterior rectum resection, abdominoperineal rectum extirpation), UICC tumour stage (adenoma, stage I, stage II, stage III, stage IV). The criterion for inclusion of a parameter in the regression analysis was a *P* level of less than 0.15 in univariate analysis. Parameters were excluded from regression analysis at a *P* level of greater than 0.05 in multivariate analysis [32]. Data analysis and the statistical tests were performed using the Statistical Analysis System (SAS) for Windows 6.08.

Results

Intraoperative randomisation assigned 30 patients to laparoscopic resection and 30 patients to conventional resection. The distribution of age, gender, ASA classification and type of resection was similar in both groups. The duration of the intervention was about 70 min longer in the laparoscopy group than in the conventionally resected patients (Table 2). A total of 11 postoperative complications were observed. In the laparoscopy group, urinary-tract infections occurred in two patients (6.7%). In the conventionally treated group, eight patients suffered postoperative complications (26.7%). These included pneumonia in two cases, two catheter-related complications (infection and brachial plexus lesion) and one symptomatic hyperglycaemia. Bleeding from the greater omentum after conventional sigmoid resection required relaparotomy in one patient on the first postoperative day. An intra-abdominal abscess without evidence of anastomotic leak had to be revised 17 days after conventional right colectomy.

The regular clinical examinations showed that the peristalsis-free interval was much shorter in the laparoscopy group than in the conventional group. The first passage of flatus was reported much earlier by the laparoscopic patients than by the conventionally treated patients. The first bowel movement occurred after 70±32 h in the laparoscopy patients compared with 91±22 h in the conventional group ($P<0.01$) (Table 3).

Due to the better tolerability, the laparoscopy patients reached step 3 of the postoperative diet (mashed food) after a mean of 3.3±0.7 days as opposed to 5.0±1.5 days ($P<0.01$) in the conventionally resected group. Age, gender, tumour stage, tumour localisation and type of resection were not found to be associated with the interval until oral feeding was tolerated. Postoperative vomiting was reported by three patients of each group (10%). Reinsertion of the gastric tube was not required in any of the cases. Two patients of the laparoscopic group (one sigmoid, one rectum resection) and one patient who had undergone conventional right colectomy reported vomiting in the morning of the second postoperative day. None of the patients had reached the stage of oral feeding at the time of vomiting. Two other patients vomited 4 days after conventional sigmoid resection when their diet therapy had reached the stage of tea and soup. Propulsive medication was prescribed in four patients of the laparoscopy group (13.3%) compared with 12 patients of the conventionally resected group (40.0%) ($P<0.05$).

Age, gender, tumour localisation, type of resection and incidence of postoperative complications did not correlate with the duration of postoperative ileus or the time required until patients reached the stage of oral alimentation. Multivariate analysis identified the operative technique as the only factor that had an independent influence on the time to the first peristalsis and the first passage of flatus. The interval to the first bowel movement was likewise decisively influenced by the operative technique, with tumour stage as the covariate factor. The interval to oral alimentation was also markedly affected by the operative technique (Tables 4–7). The laparoscopic technique shortened the postoperative interval until first peristalsis by 12 h (parameter estimate 12.01), until first passage of flatus by 28 h (parameter estimate 27.84) and until first bowel movement by 20 h (parameter estimate 19.49). In addition, laparoscopically resected patients reached the stage of oral nutri-

Table 2 Age, gender distribution, type of resection, duration of surgery, intraoperative sulfentanyl dose and operative technique

	Laparoscopic (*n*=30)		Conventional (*n*=30)		*P*-value
Age (years)	63.3±12.2		64.8±14.7		0.7[a]
Duration of surgery (minutes)	219±64		146±41		<0.01[a]
	n	(%)	*n*	(%)	
Gender					
Male	14	47.6	16	53.3	0.8[b]
Female	16	53.3	14	46.7	
ASA classification					
I	14	46.7	9	30.0	0.3[b]
II	14	46.7	19	63.3	
III	2	6.7	2	6.7	
Type of resection					
Right colectomy	4	13.3	3	10.0	1.0[b]
Sigmoid resection	15	50.0	17	56.7	
Rectum resection	7	23.3	7	23.3	
Abdominal peritoneal exstirpation	4	13.3	3	10.0	

[a] *t*-test; [b] Fisher's exact test

Table 3 Postoperative interval (h) to first peristalsis, first passage of flatus and the first bowel movement in relation to the operative techniques

	Laparoscopic (*n*=30)	Conventional (*n*=30)	*P*-value[a]
Interval to:			
1st peristalsis	26±9	38±17	<0.01
1st passage of flatus	50±19	79±21	<0.01
1st bowel movement	70±32	91±22	<0.01

[a] *t*-test

Table 4 Results of multivariate regression analysis of the influence of clinically relevant factors on the postoperative interval to first peristalsis, first passage of flatus and first bowel movement

	Parameter estimate	R^2 of the model	F	*P*-value
Intercept	59.59673577	–	–	–
Operative technique	–12.01009588	0.1613	11.16	0.002
Type of resection	6.63505386	0.2001	2.76	0.1
Age	–0.21786904	0.2235	1.68	0.2
BMI	–0.76481260	0.2398	1.18	0.3
UICC stage	–1.08605698	0.2472	0.53	0.5
Gender	–	0.2472	0.00	1.0

Table 5 Interval to first passage of flatus

	Parameter estimate	R^2 of the model	F	*P*-value
Intercept	98.87191041	–	–	–
Operative technique	–27.83538847	0.3575	32.28	0.0001
UICC stage	3.45172415	0.3844	2.49	0.1
BMI	–1.10819748	0.4077	2.20	0.1
Type of resection	6.63505386	0.4148	0.67	0.4
Age	0.13500221	0.4198	0.46	0.5
Gender	–	0.2201	0.03	0.9

Table 6 Interval to first bowel movement

	Parameter estimate	R^2 of the model	F	*P*-value
Intercept	–10.67785804	–	–	–
Operative technique	–19.49083495	0.1354	8.77	0.005
UICC stage	7.29071083	0.1973	4.24	0.04
Age	0.51813098	0.2308	2.35	0.1
BMI	2.12872972	0.2638	2.37	0.1
Type of resection	–	0.2638	0.00	1.0
Gender	–	0.2638	0.00	1.0

Table 7 Interval to oral alimentation

	Parameter estimate	R^2 of the model	F	*P*-value
Intercept	3.68401597	–	–	–
Operative technique	–1.72458065	0.3647	30.43	0.0001
BMI	0.05319024	0.3747	0.83	0.4
Gender	–	0.3751	0.03	0.9
Age	–	0.3756	0.07	0.8
UICC stage	–	0.3759	0.09	0.8
Type of resection	–	0.3769	0.18	0.7

tion 1.7 days (parameter estimate 1.72) earlier than conventionally treated patients. However, the regression analysis could only explain 25% (R^2 model peristalsis 0.247) to 42% (R^2 model passage of flatus 0.419) of the variances occurring in the model.

The distribution of radio-opaque markers could be analysed in 56 patients (28 of each group). One patient refused the X-ray examination and one woman who had undergone conventional right colectomy could not be X-rayed because of a hyperglycaemia with transient neurological symptoms on the third postoperative day. Logistical problems prevented the X-ray examination on the third postoperative day in seven patients (five laparoscopic, two conventional) and in another seven patients on the fifth postoperative day (two laparoscopic, five conventional). All other patients underwent the X-ray examinations as scheduled. The radiographs of the third postoperative day showed 29±5 markers compared with 26±8 markers on the fifth day. The two groups did not differ significantly in the number of markers identified on the third and fifth days. On the third postoperative day, fewer markers were identified in the small intestine and more in the right colon in the laparoscopy group ($P<0.05$) than in the conventionally resected patients. On the fifth postoperative day, more markers had reached the left colon after laparotomy than after conventional resection ($P<0.05$) (Table 8). Age, gender, tumour stage, tumor localisation and type of resection were not found to be associated with differences in the distribution of markers.

Discussion

Measurement of postoperative intestinal motility by means of bipolar electrodes (myoelectric intestinal activity) and

Table 8 Distribution of radio-opaque markers on abdominal X-rays on day 3 and day 5 after surgery in relation to the operative technique (given as medians; 5–95% percentile)

Number of markers	Laparo-scopic	Conven-tional	*P*-value[a]
Third postoperative day	(*n*=25)	(*n*=28)	
Bowel segments:			
Stomach	0 [0–10]	0 [0–12]	0.1
Small intestine	12 [0–30]	27 [0–30]	<0.05
Right colon	9 [0–26]	0 [0–8]	<0.01
Left colon	0 [0–3]	0 [0–4]	0.07
Rectum	0 [0–3]	0 [0–1]	1.0
Fifth postoperative day	(*n*=28)	(*n*=25)	
Bowel segments:			
Stomach	0 [0–1]	0 [0–0]	0.3
Small intestine	3 [0–26]	16 [0–29]	0.2
Right colon	6 [0–29]	7 [0–29]	1.0
Left colon	1 [0–19]	0 [0–6]	<0.05
Rectum	0 [0–3]	0 [0–4]	0.8

[a] Wilcoxon's rank sum test

strain gauges (muscle contraction) or radio-opaque markers (intestinal transit time) has shown that postoperative ileus following conventional intestinal resection resolves in a regular pattern [14, 23, 30, 31]. Peristaltic activity of the small intestine returns after 6–12 h, that of the stomach after 12–24 h and that of the colon after 48–120 h. As a rule, this kind of disturbed motility is not influenced to any significant degree by pharmacological treatment; thus, early postoperative oral feeding in patients having undergone gastrointestinal resection typically leads to nausea and vomiting [4, 37]. Since postoperative ileus is a transient event, early postoperative feeding in a routine clinical setting will typically be based on passage of flatus or bowel movement.

There is agreement that one should aim for early enteral nutrition since it will prevent atrophy of the gastrointestinal mucosa, which is associated with exclusively parenteral alimentation and will lead to a rapid restoration of the physiological intestinal flora [1, 2, 12]. Preservation of the intestinal mucosa additionally reduces the incidence of bacterial translocation from the intestine to parenchymal organs, and early postoperative enteral alimentation has a beneficial effect on the patient's immune status [7]. These favourable effects of early enteral alimentation reduce the incidence and severity of postoperative septic infections in patients after trauma or abdominal surgery [7, 20]. In addition, the psychological advantages of early resumption of oral feeding should likewise not be neglected. Therefore, the markedly shorter duration of postoperative ileus and early postoperative return to oral alimentation represent a clear advantage of laparoscopic colorectal resection over conventional intestinal interventions.

The assumption that laparoscopic surgery is actually associated with a significantly shorter duration of postoperative ileus is corroborated by both animal experiments and clinical studies. It has been shown in dogs that normal intestinal motility after laparoscopic cholecystectomy [33] and right colectomy [6] is restored earlier than with conventional interventions. Numerous observational studies have reported a shorter clinical duration of postoperative ileus and better tolerance of oral nutrition after laparoscopic colorectal resection than after conventional resections [9, 21, 24, 25, 29, 34, 36]. In 1993, Garcia-Caballero et al [15] compared patients who had undergone either conventional or laparoscopic cholecystectomy. The clinical duration of ileus was much shorter in the laparoscopic group than after conventional cholecystectomy. Drug therapy shortened the duration of ileus after conventional cholecystectomy, but not to the same extent as achieved by laparoscopy. The authors conclude from these results that there is practically no postoperative ileus after laparoscopic cholecystectomy and attribute this favourable outcome to the fact that there is only little manipulation of the intestinum and the abdominal wall in laparoscopic interventions.

The data available so far on the duration of ileus after laparoscopic and conventional colorectal resections are contradictory. According to Ramos et al. [29], laparoscopic colorectal resection is associated with a shorter interval to first flatus (3.5 days vs 4.5 days) and first bowel movement (3.7 days vs 5.3 days) as well as an earlier toleration of oral feeding (1.9 days versus 4.7 days). Tate et al. [35] reported a return to oral nutrition after laparoscopic resection within 2.5±0.2 days compared with 3.6±0.3 days after conventional surgery, while nausea was identical in both groups after 24 h. Senagore et al. [34], likewise, found an earlier restoration of intestinal function (3.0±0.3 days) in patients in whom completely laparoscopic surgery could be performed, while the duration of ileus was the same after conventional resection (4.9±0.2 days) and conversion (4.3±0.6 days). In contrast to these favourable results, Fleshman et al. [13] observed no difference in the interval until tolerance of oral fluid ingestion or the first passage of flatus and stool. Bokey et al. [5], likewise, found no differences between laparoscopic and conventional right-sided resections.

However, the prospective randomised studies performed thus far suggest a shorter duration of postoperative ileus. Lacy et al. [22] found a reduced time to first flatus (35.5±15.7 h) and toleration of oral fluid (50.9±20.0 h) in 25 patients who had undergone laparoscopic colon resection compared with 26 conventionally resected patients (71.1±33.6 h and 98.8±48.6 h, respectively), although conversion was necessary in four patients of the laparoscopic group. Hotokezaka et al. [18] did not observe any differences in myoelectric intestinal activity, duration of ileus or time to resumption of oral feeding. However, the number of cases was very small (*n*=14) in this study, and the authors themselves caution that the laparoscopy group included one patient who had to be converted with a total duration of the intervention of almost 10 h. The unfavourable data for this patient had a decisive influence on the overall results of the study.

In the present study, we found clear advantages for the laparoscopy group with regard to the parameters peristalsis, passage of flatus and bowel movement. Likewise, the distribution of radiodense markers supported that intestinal transit recovers faster in the laparoscopy group than the conventionally resected patients. Since, in our study, postoperative ileus was only one endpoint, besides pulmonary function, pain, immune status, postoperative fatigue and quality of life, we did not perform the time-consuming motility tests using bipolar electrodes (myoelectric intestinal activity) and strain gauges (muscle contraction). Although the distribution of radio-opaque markers on radiographs on the third and fifth postoperative day is, as yet, not adequately validated as an objective instrument for determining postoperative intestinal motility, the purely descriptive evaluation of marker distribution shows that the markers are more rapidly transported to distal bowel segments in the laparoscopy group and that this observation correlates well with the clinical duration of ileus.

Several study groups have also tried to restore early oral alimentation after conventional colorectal resection. These studies show that early oral nutrition is tolerated well by approximately 86% of patients having undergone conventional colorectal resection [8]. However, vomiting occurred in 10–44% of these patients, and insertion of a gastric tube was required in 0–19% of the cases. In comparison, the incidence of vomiting in patients with delayed oral nutrition was 15–25%, while reinsertion of a gastric tube was likewise necessary in 0–19% [4, 10]. Wolff et al. [37] studied the incidence of vomiting and reinsertion of a gastric tube in over 500 patients with conventional nutritional management after colorectal resection. Postoperative nausea was noted in 22% of the cases and postoperative vomiting in 15%. Reinsertion of a gastric tube was necessary in 9% of the 500 patients. In our prospective randomised study of 60 patients, vomiting after the first postoperative day occurred in 10% of the cases without any differences between the laparoscopy group and the conventionally resected patients. Reinsertion of a gastric tube was not required in any of the cases and none of the affected patients had recurrent vomiting after interruption of the postoperative diet.

The effect of modified anaesthesia and analgesia protocols has been investigated in several studies by Kehlet et al. [3, 28]. After a combination of epidural anaesthesia, prednisolone, indomethacin and a regular hospital diet on the first postoperative day, postoperative vomiting occurred in 47% of the cases, but oral feeding could be continued in all patients. Data on recurrent vomiting are not given by the authors [28]. In a smaller study by the same group, patients who had undergone laparoscopic colorectal resection under epidural anaesthesia tolerated the regular diet from the first day onwards and no vomiting occurred [3].

Conclusion

The data available do not support the widespread practice of prescribing alimentary abstinence for several days after elective colorectal resections. Rather, early postoperative resumption of oral feeding is associated with clinically relevant advantages, even in patients who have undergone intestinal resection [1, 2, 7, 12, 20]. Early oral alimentation is tolerated well by a majority of patients having undergone conventional colorectal resection. Nevertheless, the data also suggest that postoperative ileus is shorter after laparoscopic colorectal resection than after conventional surgery. With the earlier restoration of normal propulsive activity in the gastrointestinal tract and the lower incidence of postoperative nausea, patients who have undergone laparoscopic resection can completely resume oral nutrition with regular hospital food on the second postoperative day, without nausea or vomiting. The shorter duration of postoperative ileus thus represents a major advantage of laparoscopic colorectal resection. However, the short-term advantages in the postoperative period such as shorter duration of ileus and earlier oral nutrition alone are not a sufficient basis for the general use of laparoscopic resection in colorectal cancer. Only when the long-term results of laparoscopic and conventional resections of colorectal carcinoma in prospective randomised multi-centre studies will demonstrate comparable relapse and survival rates for both approaches can the minimal invasive technique be recommended for the treatment of colorectal cancer.

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