

Is obesity a high-risk factor for laparoscopic colorectal surgery?

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Abstract

Background: The aim of this study was to assess the outcome of laparoscopic colorectal surgery in obese patients and compare it to that of a nonobese group of patients who underwent similar procedures.

Methods: All 162 consecutive patients who underwent an elective laparoscopic or laparoscopic-assisted segmental colorectal resection between August 1991 and December 1997 were evaluated. Body mass index (BMI; kg/m^2) was used as an objective index to indicate massive obesity. The parameters analyzed included BMI, age, gender, comorbid conditions, diagnosis, procedure, American Society of Anesthesiologists classification score, operative time, estimated blood loss, transfusion requirements, intraoperative complications, conversion to laparotomy, postoperative complications, length of hospitalization, and mortality.

Results: Thirty-one patients (19.1%) were obese (23 males and 8 females). Conversion rates were significantly increased in the obese group (39 vs 13.5%, $p = 0.01$), with an overall conversion rate of 18%. The postoperative complication rate in the obese group was 78% vs 24% in the nonobese group ($p < 0.01$). Specifically, rates of ileus and wound infections were significantly higher in the obese group [32.3 vs 7.6% ($p < 0.01$) and 12.9 vs 3.1% ($p = 0.03$), respectively]. Furthermore, hospital stay in the obese group was longer (9.5 days) than in the nonobese group (6.9 days, $p = 0.02$).

Conclusion: Laparoscopic colorectal segmental resections are feasible in obese patients. However, increased rates of conversion to laparotomy should be anticipated and the risk of postoperative complications is significantly increased, prolonging the length of hospitalization when compared to that of nonobese patients.

Key words: Laparoscopy — Laparoscopic surgery — Colorectal surgery — Obesity — Colectomy

Laparoscopic colorectal surgery has gained increasing attention during the past 7 years. The potential benefits of rapid recovery, decreased postoperative pain, and reduction in pulmonary dysfunction make it an attractive alternative for many patients [32]. However, obesity has been regarded as a relative contraindication to laparoscopy [20]. Moreover, obesity is a risk factor for wound infection and incisional hernia after elective abdominal surgery [14]. The complications associated with laparoscopy have been extensively reviewed [11, 34]. Comparison of laparoscopic cholecystectomy in obese and nonobese patients showed no significant difference between both groups [25, 26]. However, in a review of laparoscopic urological surgery, complication rates of obese patients were higher than those of the general population [21].

A review of the literature failed to reveal any study that reviewed complications in obese patients after laparoscopic colorectal surgery. Therefore, our goal was to define the incidence of complications and the outcome in this subset of patients.

Materials and methods

All consecutive patients who underwent an elective laparoscopic or laparoscopic-assisted segmental colorectal resection were evaluated. Laparoscopic total abdominal colectomy and abdominoperineal resection are associated with a higher complication rate than are other laparoscopic colorectal procedures [13, 28]; however, the feasibility of laparoscopic colorectal segmental resection has been well established [13]. Therefore, all procedures such as total colectomy, total restorative proctocolectomy, abdominoperineal resection, enterolysis procedures, stoma creation or closure, prolapse operations, and emergency operations were excluded.

The body mass index (BMI height and body weight; kg/m^2) was used as an objective measure of obesity because it fulfills the necessary criteria for an epidemiological index of obesity [18]. In this study, obesity was defined as a BMI greater than 30.

Table 1. Classification of patients according to body mass index

Body mass index category	No. of patients	Age (range, years)	Gender (male/female)	Comorbid condition
Nonobese (<30)	131 (80.9%)	59.5 ± 18.7 (15–89)	59/72	41 (31.3%)
Obese (>30)	31 (19.1%)	61.8 ± 17.4 (29–88)	23/8	16 (51.6%)
<i>p</i> value		NS	0.01	0.03

NS, not significant

Parameters studied and analyzed included BMI, age, gender, comorbid conditions, diagnosis, procedure, American Society of Anesthesiologists patient classification, operative time, estimated blood loss, transfusion requirements, intraoperative complications, conversion to laparotomy, early postoperative complications (wound infection, incisional hernia, ileus, etc.), hospitalization, and mortality.

All laparoscopic and laparoscopic-assisted segmental colorectal resections were performed under general endotracheal anesthesia. The technical details of the various procedures have been described in detail elsewhere [6, 15, 36]. Similarly, the definitions of laparoscopic and laparoscopic-assisted procedures have been enumerated in previous publications [1, 3]. Traditionally, we defined conversion to laparotomy as any incision greater than 5 cm, the creation of any unplanned incision, or the need for any planned incision done sooner than intended in the procedure. Our refined definition of conversion included the traditional definition, excluding cases in which the incision was enlarged due to a large specimen size that could not be extruded from a 5-cm incision. Postoperative management was identical in both groups of patients and included removal of the nasogastric tube immediately after surgery, a clear liquid diet within 24 h of surgery, and a solid diet as tolerated by the patient [29].

Identical criteria for discharge home after surgery were applied in both groups and included bowel movements and consumption of a solid diet for at least 1 day in the absence of nausea, vomiting, or abdominal distension. Length of hospitalization was calculated from day of surgery to discharge. Intraoperative complications were defined as conditions that resulted in conversion to laparotomy, such as bleeding, intestinal perforation, incomplete anastomosis, technical failure, or organ injury.

Ileus was defined as a condition requiring reinsertion of a nasogastric tube due to two or more episodes of emesis of more than 200 ml, and wound infection was defined as the need for either antibiotics or wound exploration. Postoperative complications were classified as minor and major. Major complications were defined as conditions that prolonged the length of hospitalization or required surgical intervention, including ileus, anastomotic leakage, intraabdominal abscess, bacteremia, myocardial infarction, renal failure, pneumonia, or thrombosis. Conversely, minor complications did not prolong hospital stay or require surgery and included wound infection, cardiac arrhythmia, urinary retention, urinary tract infection, atelectasis, pleural effusion, superficial phlebitis, pseudogout, and hypercalcemia.

Statistical analysis

Statistical analysis was done by the chi-square test, Student's *t*-test, and Fisher's exact test where appropriate. Statistical significance was defined as $p < 0.05$. All data were expressed as mean ± SD except when otherwise indicated.

Results

Between August 1991 and December 1998, 307 patients underwent laparoscopic colorectal surgery, 162 of whom had elective laparoscopic or laparoscopic-assisted segmental colonic resection. Thirty-one patients (19.1%) of a mean age of 61.8 ± 17.4 years were obese (23 males and 8 females) (Table 1). These patients were compared with 131 nonobese patients (59 males and 72 females) with a mean age of 59.5 ± 18.7 years. 51.6% (16 pa-

Table 2. Indications for surgery

Indication	Obese (%)	Nonobese (%)
Polyp	10 (32)	30 (23)
Carcinoma	8 (26)	19 (15)
Crohn's disease	6 (19)	35 (27)
Diverticular disease	5 (16)	29 (22)
Other disease	2 (6)	18 (14)
Procedure		
Right hemicolectomy	19 (61)	67 (51)
Sigmoidectomy	7 (23)	52 (39)
Left hemicolectomy	2 (6)	9 (7)
Transverse colectomy	2 (6)	2 (2)
Anterior resection	1 (3)	1 (1)

p = not significant for all

tients) of obese patients and 31.3% (41 patients) of nonobese patients had comorbid conditions, including hypertension, diabetes mellitus, cardiovascular disease, cerebrovascular accident, arrhythmia, liver dysfunction, asthma, or chronic obstructive pulmonary disease ($p = 0.03$) (Table 1).

The indications and procedures performed in each group are outlined in Table 2. There were no significant differences between the two groups relative to either procedure or diagnosis. Thus, despite their disparate size, the two groups were well stratified by clinical criteria.

Rates and indications for conversion to laparotomy are listed in Table 3. There was a significant increase in the conversion rate in the obese group (39 vs 13.5%) using the "refined" definition of conversion (Table 3). As can be seen in Table 4, the mean operating time and estimated blood loss for the nonobese group were not significantly different from those for the obese patients. However, an increased number of ports were used for performing the procedure in the obese group.

The mean length of hospitalization in the nonobese group was 6.9 days, whereas in the obese group it was 9.5 days ($p = 0.02$). Similarly, the complication rate in the obese group was 78% versus 24% in the nonobese group (major and minor complications combined, $p < 0.01$) (Table 5). Specifically, the major complication rate in obese patients was significantly higher than that in nonobese patients ($p < 0.01$).

Discussion

Obesity is defined as excessive enlargement of the body's total quantity of fat or excessive accumulation of body fat [17]. Obesity is a common condition in the United States and its prevalence has risen in recent years; a

Table 3. Indications for conversion

Complications	Obese (%)	Nonobese (%)	<i>p</i>
Adhesions	6 (19)	7 (5)	
Bleeding	1 (3)	5 (4)	
Unclear anatomy	4 (13)	2 (1.5)	
Stapler misfire		2 (1.5)	
Splenic injury		1	
Bladder injury		1	
Bowel perforation	1 (3)		
Total	12 (39)	18 (13.5)	0.01
Specimen related	8 (26)	23 (17)	NS

NS, not significant

Table 4. Operative data

	Obese	Nonobese
Operative time (min)	177.1 ± 70	170.8 ± 64.1
Estimated blood loss (ml)	204.8 ± 124.1	186.2 ± 179.4
Number of ports (%)		
3*	5 (16)	62 (47)
4*	23 (74)	58 (44)
5*	3 (12)	12 (9)

**p* = 0.001, obese vs nonobese

Table 5. Postoperative complications

	Obese (%)	Nonobese (%)
Major*	17 (52)	16 (12)
Ileus*	10 (32.3)	10 (7.6)
Anastomotic leak		2 (1.5)
Intraabdominal abscess	2 (6.5)	
Bacteremia	1 (3.2)	
Cardiopulmonary	4 (12.9)	3 (2.3)
Renal failure		1 (0.8)
Minor	7 (26)	15 (12)
Wound infection**	4 (12.9)	4 (3.1)
Other	3 (9.7)	11 (8.3)

p* < 0.01; *p* = 0.03, obese vs nonobese

recent report estimated the prevalence to be up to 33.4% of the total population of American adults [19]. In addition, colorectal diseases such as neoplasia have been associated with obesity [5]. Thus, it is useful to know the anticipated outcome of surgery in this expanding segment of the population. In this series the most frequent indication for colorectal surgery in obese people was neoplasia. The link between obesity and colorectal polyps has been reported, even though the precise relation is difficult to establish [5]. For instance, high levels of triglycerides, a condition usually associated with obesity, may be related to the development of colonic polyps. In any case, the positive relation between colorectal adenomatous polyps and obesity has been emphasized [23]. In addition, obesity, weight gain, and unstable adult weight may be independently associated with colorectal carcinogenesis [4]; the risk of adenoma recurrence can also be linked to obesity [7]. Therefore, polyps and cancer may represent the most frequent indication for colorectal surgery in the obese population.

Traditionally, performing surgery in obese patients was considered to be laborious; even the safe positioning

of the patient on the operating room table could be demanding. The manipulation of fatty tissues is difficult, as is gaining access to deeper areas. These concerns are germane to laparoscopic surgery in obese patients. Originally, morbid obesity was considered a contraindication for laparoscopic cholecystectomy [9]. However, growing experience with minimally invasive surgery has changed this concept. Recently, laparoscopic cholecystectomy was even proposed as the best approach for gallbladder removal in morbidly obese patients [22].

The results obtained regarding operative parameters displayed the feasibility of laparoscopic colorectal surgery in the obese population. There was no significant difference regarding operative time, estimated blood loss, or transfusion requirements when comparing obese to nonobese people. However, conversion rates were significantly increased in the obese group. This finding is discordant with previous reports comparing laparoscopic cholecystectomy in obese and nonobese patients [22, 24, 26]. Likewise, two reviews of laparoscopic appendectomy [8, 16] compared with laparotomy showed that obesity did not increase the complication rates, indicating that obesity may be an indication for minimally invasive surgery. Gynecologic investigators reviewed a series of obese patients undergoing gynecologic laparoscopic procedures and recorded no complications [12]. Conversely, in a multiinstitutional review of markedly obese patients undergoing urological procedures the authors found that complication rates were higher than those for the general population undergoing comparable procedures (0.3 vs 21%). Nevertheless, the authors stated that because obese patients have a higher risk for complications after laparotomy, laparoscopy is an acceptable option [21].

Some investigators [2, 25] showed obesity to be a factor for prolonged operative time in laparoscopic cholecystectomy. However, in our study laparoscopic colorectal surgery showed no such correlation. Conversely, postoperative complication rates were significantly higher in the obese group than in the nonobese group. Specifically, ileus and wound infections were the most frequent postoperative complications perhaps due to difficulty in handling the "obese" bowel. Ileus may also be the most common reason for prolonged hospitalization in obese patients compared with nonobese patients. Furthermore, postoperative wound infections have been shown to be almost expected in obese patients [35].

Pitkin [27] studied 300 obese women weighing 200 pounds or more undergoing total abdominal hysterectomy. In comparison with nonobese controls, the most striking difference between the two groups was the incidence of wound complications in the obese group—seven times higher than that in nonobese patients. Moreover, specifically studying the effect of obesity in two controlled trials of antibiotic prophylaxis in "at-risk" abdominal surgery patients, Roberts and Bates [31] found that abdominal wound infection rates were significantly related to obesity. Riou et al. [30] applied multivariate analysis to determine the relative contribution of several risk factors to wound dehiscence. They found that obesity was a systemic factor contributing to wound

dehiscence. Nevertheless, other comorbid conditions such as diabetes mellitus related to wound complications are more frequent in the obese group. Accordingly, as shown in our study, the increased incidence of comorbidity in the obese population rather than the obesity may explain the higher postoperative complication rate. Several strategies have been proposed to decrease wound complications in obese patients. Israelsson and Jonsson [14] prospectively studied 998 patients undergoing mid-line incision with subsequent closing using continuous monofilament suture in one layer (including all layers except skin). Obesity was identified as a risk factor for wound infection and incisional hernia, but such association was eliminated when a suture length to wound length ratio of 4:4.9 was used. Likewise, use of subcutaneous drains [10] and subcutaneous retention sutures [33] has also been suggested to improve the outcome in obese patients. Therefore, wound complications represent an unresolved issue in the postoperative management of obese patients.

In conclusion, obese patients are at significantly higher risk for both postoperative complications and prolongation of hospitalization than are their nonobese counterparts. However, the high rate of comorbid conditions in these obese patients may also contribute to postoperative complications and/or significantly prolonged hospitalization after laparoscopic colorectal surgery. One must exercise caution when offering elective laparoscopic colorectal segmental resection to obese patients, anticipating an increased rate of conversion to laparotomy.

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