

Elective Laparoscopic Left Colectomy for Diverticular Disease: A Monocentric Study on 205 Consecutive Patients

¹João Odilo Gonçalves Pinto, ¹Basmah Fallatah, ¹Phillipe Espalieu, ¹Gilles Poncet, ²Alvine Bissery
¹Jean-Claude Boulez

¹Department of General and Digestive Surgery, Edouard Herriot Hospital, University Claude Bernard Lyon 01–Lyon, France
²Department of Biostatistics, Hospices Civils de Lyon, University Claude Bernard Lyon 01 – Lyon, France

Correspondence: Pr Jean-Claude Boulez. Hôpital Edouard Herriot, Service de Chirurgie Digestive–Pavillon D4, Place d’Arsonval, 69437 Lyon CEDEX 03, Telephone : +33 472110107, Fax: +33 472116252
E-mail: jean-claude.boulez@chu-lyon.fr

Abstract

This study was aimed to analyze the outcomes of laparoscopic colectomy for diverticular disease performed over a 17 year period at a single institution. Between April 1990 and May 2007.

Keywords: Diverticular disease; laparoscopic colectomy; diverticulitis.

MATERIALS AND METHODS

Population

Between April 1990 and May 2007, a total of 210 elective laparoscopic colonic resections for diverticular disease were performed at the D4 Unit of General and Digestive Surgery at the Edouard Herriot Hospital – Lyon, France. This study included the 205 left colectomy procedures comprising 185 sigmoidectomies (90, 24%) and 20 left hemicolectomies (9,76%). The three right colectomies and two total colectomies were excluded.

Patients were first referred for surgical consultation either from the gastroenterology department consultants, the community physicians or the emergency department. Pertinent information was then collected in a comprehensive sheet throughout preoperative consultations, subsequent hospitalizations and postoperative follow-up. Data were later entered into a computer database and updated every time new information was obtained. Those included the patient’s antecedents, mode of presentation, surgical indications, pre-operative work-up, details of the operative procedure, complications, hospital stay, mortality and follow-up results.

Usual surgical indications were: (1) after a documented diagnosis of complicated diverticulitis either acute or chronic (abscess, perforation, fistula, stenosis); (2) after the second non-complicated acute attack of diverticulitis; (3) after the first non-complicated acute attack of diverticulitis in special situations such as the patient aged < 50 years and immunosuppressed

patient; (4) diverticular disease complicated with bleeding; (5) diverticular disease with associated lesions of surgical treatment such as the colonic neoplasms. Although uniformly followed in our surgical unit, those indications varied along the years and could be anticipated or postponed according to the medical consultants’ referrals. After an episode of complicated diverticulitis, whether or not an invasive procedure was needed, an interval of at least one month was respected before the elective operation was scheduled (Table 1).

Surgical Technique

A total laparoscopic operative technique was used in which a stapled intra-abdominal anastomosis is made. The resected specimen is removed through a small prolongation of a 12 mm left lower quadrant (LLQ) trocar incision, occasion that is profited to place a circular stapler anvil into the descending colon stump at the same time. The stapler is then passed through the anus to complete the anastomosis after closing the small incision and re-establishing the pneumoperitonium. Some variations were tried at the beginning of the experience with the removal incision being used either to insert a hand-port (15 cases) or to manually perform the anastomosis in a laparoscopic-assisted technique (7 cases). The procedure is performed with the surgeon placed on the right side of the patient and with the aid of four trocars. In 158 (77,07%) cases, it was judged necessary to release the splenic flexure of the colon. In those occasions, the procedure was started with the surgeon placed between the legs of the patient and an additional 5 mm trocar could be placed. An aspirative drain was placed most of the time (96,1% of cases) and a protection colostomy was rarely necessary (03 cases).

The steps sequence of the operation are as follows:
(1) release of the splenic flexure of the colon (when necessary

TABLE 1: Indications for surgery

	<i>Nr. patients</i>	<i>%</i>
Non-complicated acute diverticulitis*	164	80
Complicated diverticulitis (acute or chronic)	37	18.05
	Abscess (10) Peritonitis/Perforation (4) Fistula (6) Stenosis (17)	
Bleeding diverticular disease*	4	1.95
Total	205	100

for descending the proximal colonic stump after an adequate resection); (2) systematic identification of the left ureter with placement of a provisory landmark; (3) medial mesocolic dissection for ligation of the left colonic vessels as appropriate; (4) distal dissection and division of the rectum sufficiently below the rectosigmoid junction; (5) liberation of the descending colon by a lateral approach; (6) exteriorization and transection of the left colon through a small LLQ incision and insertion of the stapler anvil; (7) closure of the small incision and completion of the anastomosis intra-abdominally after reestablishing the pneumoperitoneum.

Statistical Analysis

A statistical logistic univariate and multivariate model was built trying to identify possible risk factors for adverse outcomes in the population studied. Multiple different variables were tested for its effects over the rates of conversion, complications, re-operation and postoperative functional disorder. The Fisher's exact test was used for qualitative variables analysis, Student t-test for quantitative variables analysis and Mann and Whitney test for non parametric variables analysis. To build logistic multivariate analysis, only variables which were statistically significant in univariate model ($p < 0.1$) were kept. Results for logistic multivariate model are presented as odds-ratio. All statistical analysis were done using Stata 10.0 software (Stata Corp LP, College Station, TX).

RESULTS

Preoperative

Patients were 107 (52.2%) women and 98 (47.8%) men with a median age of 60 (30-90) years. There were 46 (22.4%) subjects aged ≤ 50 years. The mean BMI was $25.3 (\pm 3.5)$ kg/m² with

obese patients (BMI ≥ 30) representing 11.7% of the population studied.

Antecedents of past abdominal surgery were noted in the majority (60%) of the patients. The most frequent previous scars founded were those of appendectomy (n = 28), diverse laparotomies (n = 31), both appendectomy and laparotomy (n = 30) and Pfannestiel (n = 13). Comorbidities included diabetes in 12 (5.8%) and steroid therapy in 6 (2.9%) of subjects with 79% being ASA classification 1 or 2, 13.1% of ASA 3 and only 0.5% of ASA 4.

The median time from the onset of symptoms was 15 (1-240) months, with a median of 2 (0-12) previous acute attacks and a median of 1 (0-4) previous hospitalizations for acute attacks. The most frequent surgical indication was for non-complicated acute diverticulitis (80%), acute or chronic complicated diverticulitis (18.05%) and bleeding diverticular disease (1.9.5%) (Table 1). The complicated diverticulitis consisted of stenosis (n = 17), abscess (n = 10), fistula (n = 6) and peritonitis/perforation (n = 4).

Preoperative studies used were contrast enema (95.6%), colonoscopy (84.8%), ultrasonography (77%) and CT scan (72.7%).

Causes of conversion, risk factors and complications of the surgery is presented in Table 2 to 9.

Operative

Associated lesions were presented 40 (19.51%) of patients. Those consisted of gallbladder stones (n = 15); benign colonic neoplasms (n = 12); hernias of the abdominal wall (n = 5); adnexal masses (n = 4); colon cancer (n = 1); Meckel's diverticulum (n = 1); renal cyst (n = 1) and a cyst of the biliary tract (n = 1). Intraoperative adhesions were noted in 36 (17.56%) cases.

There were 10 intraoperative complications (Table 10).

TABLE 2: Causes of conversion (n= 12, 5.85%)

<i>Causes</i>	<i>Nr. of patients</i>
Failure of dissection due to inflammatory adhesions	9
Colonic injury*	1
Tear of rectal stump below anastomosis	1
Repair of injury in the right external iliac artery*	1

*During dissection of the inflammatory process

TABLE 3: Postoperative complications

<i>Type</i>	<i>Nr</i>	<i>Management</i>
Anastomotic stenosis	9	Endoscopic dilatation (05 cases) Open reoperation (04 cases)
Paralytic Ileus	6	Conservative
Incisional hernia	5	Open repair
Pelvic collection	4	Conservative (01 case) Radiological drainage (02 cases) Laparoscopic re-operation (01 case)
Fistula	3	Open re-operation – Hartmann procedure
Obstruction due to adhesions/bands	3	Conservative (01 case) Open reoperation (02 cases)
Fecal incontinence	2	Conservative
Missed small bowel injury	1	Laparoscopic reoperation
Missed large bowel injury	1	Open reoperation – Hartmann procedure
Abdominal wall hematoma	1	Conservative
Abdominal pain with obstipation	1	Laparoscopic reoperation
Urinary tract infection	1	Medical
Pulmonary embolism	1	Medical
Septicemia	1	Medical
Rectorrhage	1	Conservative
Pancreatitis	1	Medical
Sexual dysfunction	1	Conservative
Total	42	

TABLE 4: Risk factors studied in univariate analysis for postoperative complications

	<i>Postoperative complications</i>		
	<i>Yes (n = 40)</i>	<i>No (n = 165)</i>	<i>p-value**</i>
Age (yrs)	62.2 ± 11.6	58.6 ± 11.7	0.084
BMI (kg/m ²)	25.2 ± 3.9	25.3 ± 3.41	0.828
Steroid therapy	0	6 (3.9%)	0.349
Past abdominal surgery	26 (65%)	97 (59.5%)	0.524
Time from onset of symptoms (yrs)	31.3 ± 36.5	37.9 ± 45.6	0.792*
Complicated diverticulitis	6 (15%)	31 (18.8%)	0.654
Previous acute attacks (≤ 2)	26 (65%)	96 (63.2%)	0.829
Past urgent treatment	2 (5.3%)	8 (5.1%)	1.000
Associated lesions	6 (15%)	34 (21.4%)	0.508
Adhesions	5 (12.5%)	31 (19.5%)	0.365
Intraoperative complication	3 (7.5%)	7 (4.2%)	0.414
Conversion	4 (10%)	8 (5%)	0.261
Associated procedure	10 (25%)	56 (35%)	0.229
Total length of the procedure (min)	226.4 ± 63.3	204.6 ± 55.0	0.031
Length of the colectomy (min)	209.3 ± 59.8	191.4 ± 48.2	0.049

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 5: Risk factors studied in multivariate analysis of postoperative complications

	<i>Odds ratio</i>	<i>SE</i>	<i>p-value</i>
Age (yrs)	1.029	0.0165	0.07
Length of the colectomy (min)	1.006	0.0033	0.064

TABLE 6: Risk factors studied in univariate analysis for conversion

	<i>Conversion</i>		<i>p-value**</i>
	<i>Yes (n=12)</i>	<i>No (n =189)</i>	
Age (yrs)	68 ± 10.9	58.6 ± 11.5	0.006
BMI (kg/m ²)	24.7 ± 3.3	25.4 ± 3.5	0.56
Steroid therapy	1 (9.1%)	5 (2.7%)	0.297
Past abdominal surgery	10 (83.3%)	112 (59.6%)	0.132
Time from onset of symptoms (yrs)	34.7 ± 32.3	36.7 ± 44.7	0.57*
Complicated diverticulitis	4 (33.3%)	33 (17.5%)	0.24
Previous acute attacks (≤ 2)	8 (66.7%)	114 (60.3%)	0.8
Past urgent treatment	2 (18.2%)	8 (4.4%)	0.103
Associated lesions	1 (9.1%)	39 (20.7%)	0.697
Adhesions	2 (18.2%)	34 (18.1%)	1
Intraoperative complication	3 (25%)	7 (3.7%)	0.016
Associated procedure	3 (27.3%)	63 (33.3%)	1

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 7: Risk factors studied in multivariate analysis of conversion

	<i>Odds ratio</i>	<i>SE</i>	<i>p-value</i>
Age (yrs)	1.091	0.0378	0.012
Intraoperative complication	18.65	17.34	0.002
Past urgent treatment	4.46	4.27	0.119

TABLE 8: Risk factors studied in univariate analysis of postoperative functional disorder

	<i>Post-operative functional disorder</i>		<i>p-value**</i>
	<i>Yes (n =18)</i>	<i>No (n =183)</i>	
Age (yrs)	59.4 ± 11.7	59.1 ± 11.7	0.926
BMI (kg/m ²)	25.4 ± 3.5	25.3 ± 3.5	0.923
Steroid therapy	0 6 (3.4%)	1	
Past abdominal surgery	14 (77.8%)	108 (59.4%)	0.204
Time from onset of symptoms (yrs)	31.5 ± 37.9	37.1 ± 44.6	0.7219*
Complicated diverticulitis	1 (5.6%)	36 (19.7%)	0.205
Previous acute attacks (≤ 2)	12 (66.7%)	110 (60.1%)	0.801
Past urgent treatment	1 (5.6%)	9 (5.1%)	1
Associated lesions	8 (44.4%)	32 (17.7%)	0.012
Adhesions	2 (11.1%)	34 (18.8%)	0.537
Intraoperative complication	1 (5.6%)	9 (4.9%)	1
Conversion	1 (5.6%)	10 (5.5%)	1
Associated procedure	9 (50%)	57 (31.3%)	0.120
Total length of the procedure (min)	213.9 ± 49.3	208.9 ± 58.3	0.727
Length of the colectomy (min)	185.2 ± 38.6	196.1 ± 52.2	0.390
Length of the associated procedures (min)	28.7 ± 35.4	12.9 ± 29.2	0.0213*

* Mann and Whitney test
** Student t-test or Fisher exact test

TABLE 9: Risk factors studied in multivariate analysis of postoperative functional disorder

	Odds ratio	SE	p-value
Associated lesions	3.19	1.7	0.029
Length of the associated procedures (min)	1.0088	.0064851	0.173

TABLE 10: Intraoperative complications (n = 10, 4.89%)

Complication	Nr	Management
Tear of the mesocolon	1	Laparoscopic repair
Colonic injury	3	Conversion for repair (01 case) Laparoscopic repair (02 cases)
Inferior mesenteric artery injury	1	Laparoscopic repair
Superficial epigastric vessels injury	1	Laparoscopic repair
Hypogastric artery injury	1	Laparoscopic repair
External iliac artery injury	1	Conversion for ligature
Left ureter injury	1	Laparoscopic repair
Tear of rectal stump below anastomosis	1	Conversion for repair
Total	10	

BIBLIOGRAPHY

- Lee SW, Yoo J, Dujovny N, Sonoda T, Milsom JW. Laparoscopic vs. hand-assisted laparoscopic sigmoidectomy for diverticulitis. *Dis Colon Rectum* 2006;49:464-69.
- Rafferty J, Shellito P, Hyman NH, Buie WD and the Standards Committee of the American Society of Colon and Rectal Surgeons. Practice Parameters For Sigmoid Diverticulitis. *Dis Colon Rectum*, 2006;49:939-44.
- Kohler L, Sauerland S, Neugebauer E. Diagnosis and treatment of diverticular disease: results of a consensus development conference. The Scientific Committee of the European Association for Endoscopic Surgery. *Surg Endosc* 1999;13:430-36.
- Purkayastha S, Constantinides VA, Tekkis PP, Athanasiou T, Aziz O, Tilney H, Darzi AW, Heriot AG. Laparoscopic vs open surgery for diverticular disease: a meta-analysis of nonrandomized studies. *Dis Colon Rectum* 2006;49:446-63.
- Alves A, Panis Y, Slim K, Heyd B, Kwiatkowski F, Mantion G. and the Association Française de Chirurgie. French multicentre prospective observational study of laparoscopic versus open colectomy for sigmoid diverticular disease. *Br J Surg* 2005;92:1520-25.
- Chapman JR, Dozois EJ, Wolff BG, Gullerud RE, Larson DR. Diverticulitis: a progressive disease? Do multiple recurrences predict less favourable outcomes? *Ann Surg* 243: 876-830 discussion 2006;880-83.
- Chapman J, Davies M, Wolff B, Dozois E, Tessier D, Harrington J, Larson D. Complicated diverticulitis: is it time to rethink the rules? *Ann Surg* 2005;242:576-81 discussion 581-83.
- Ambrosetti P. Sigmoid diverticulitis: when and to whom should an elective colectomy be offered? *Ann Chir* 2002;127: 413-15.
- Shaikh S, Krukowski ZH. Outcomes of a conservative policy for managing acute sigmoid diverticulitis. *Br J Surg* 2007;94: 876-79.
- Farmakis N, Tudor RG, Keighley MR. The 5-year natural history of complicated diverticular disease. *Br J Surg* 1994;81: 733-35.
- Ambrosetti P, Robert J, Witzig JA, Mirescu D, de Gautard R, Borst F, Meyer P, Rohner A. Prognostic factors from computed tomography in acute left colonic diverticulitis. *Br J Surg* 1992;79: 117-19.
- Pessaux P, Muscari F, Ouellet JF, Msika S, Hay JM, Millat B, Fingerhut A, Flamant Y. Risk factors for mortality and morbidity after elective sigmoid resection for diverticulitis: prospective multicenter multivariate analysis of 582 patients. *World J Surg* 2004;28:92-96.
- Stevenson AR, Stitz RW, Lumley JW, Fielding GA. Laparoscopically assisted anterior resection for diverticular disease: follow-up of 100 consecutive patients. *Ann Surg* 1998;227:335-42.
- Trebuchet G, Lechaux D, Lecalve JL. Laparoscopic left colon resection for diverticular disease. *Surg Endosc* 2002;16:18-21.
- Pugliese R, Di Lernia S, Sansonna F, Scandroglio I, Maggioni D, Ferrari C, Costanzi A, Chiara O. Laparoscopic treatment of sigmoid diverticulitis: a retrospective review of 103 cases. *Surg Endosc* 2004;18:1344-48.
- Perniceni T, Burdy G, Gayet B, Dubois F, Boudet MJ, Levard H. Results of elective segmental colectomy done with laparoscopy for complicated diverticulosis. *Gastroenterol Clin Biol* 2000;24:189-92.
- Bouillot JL, Berthou JC, Champault G, Meyer C, Arnaud JP, Samama G, Collet D, Bressler P, Gainant A, Delaitre B. Elective laparoscopic colonic resection for diverticular disease: results of a multicenter study in 179 patients. *Surg Endosc* 2002;16: 1320-23.

18. Berthou JC, Charbonneau P. Elective laparoscopic management of sigmoid diverticulitis. Results in a series of 110 patients. *Surg Endosc* 2002;13:457-60.
19. Boulez J, Blanchet MC, Espalieu P. Colonic diverticulosis and laparoscopy. Analysis of a series of 60 cases. *Ann Chir* 1999;53:1033-38.
20. Scheidbach H, Schneider C, Rose J, Konradt J, Gross E, Barleher E, Pross M, Schmidt U, Kockerling F, Lippert H. Laparoscopic approach to treatment of sigmoid diverticulitis: changes in the spectrum of indications and results of a prospective, multicenter study on 1,545 patients. *Dis Colon Rectum* 2004;47:1883-88.
21. Schwandner O, Farke S, Fischer F, Eckmann C, Schiedeck TH, Bruch HP. Laparoscopic colectomy for recurrent and complicated diverticulitis: a prospective study of 396 patients. *Langenbecks Arch Surg* 2004;389:97-103.
22. Senagore AJ, Delaney CP. A critical analysis of laparoscopic colectomy at a single institution: lessons learned after 1000 cases. *Am J Surg* 2006;191:377-80.
23. Janes SE, Meagher A, Frizelle FA. Management of diverticulitis. *BMJ* 2006;332:271-75.
24. Lesurtel M, Fritsch S, Sellam R, Molinier N, Mosnier H. Does laparoscopic colorectal resection for diverticular disease impair male urinary and sexual function? *Surg Endosc* 2004;18:1774-77.
25. Reissfelder C, Buhr HJ, Ritz JP. What is the optimal time of surgical intervention after an acute attack of sigmoid diverticulitis: early or late elective laparoscopic resection? *Dis Colon Rectum* 2006;49:1842-48.
26. Ambrosetti P, Becker C, Terrier F. Colonic diverticulitis: impact of imaging on surgical management—a prospective study of 542 patients. *Eur Radiol* 2002;12:1145-49.
27. Rawlings AL, Woodland JH, Crawford DL. Telerobotic surgery for right and sigmoid colectomies: 30 consecutive cases. *Surg Endosc* 2006;20:1713-18.
28. Thaler K, Baig MK, Berho M, Weiss EG, Noguera JJ, Arnaud JP, Wexner SD, Bergamaschi R. Determinants of recurrence after sigmoid resection for uncomplicated diverticulitis. *Dis Colon Rectum* 2003;46:385-88.