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# Laparoscopic versus open colorectal surgery for colon cancer: the effect of surgical trauma on the bacterial translocation. A prospective randomized study

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**KEYWORDS:**
Laparoscopy;
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**Abstract**

**BACKGROUND:** Several studies suggest that surgical manipulation of the intestine and increased intra-abdominal pressure promotes bacterial translocation (BT). This prospective randomized study has investigated the effect of surgery on BT in patients undergoing elective colectomy for colon cancer by comparing the laparoscopic with the open approach.

**METHODS:** One hundred nineteen consecutive patients underwent colectomy for colon cancer: 59 cases underwent open resection and 60 cases underwent laparoscopic resection. For bacterial identification, tissue samples were taken from the liver, spleen, and mesenteric lymph nodes.

**RESULTS:** The incidence of BT increased in laparoscopic and open group after bowel mobilization (prior to ligation of the vascular pedicle), compared with the before mobilization ($P < .05$). There was not a statistically significant difference in BT value between the 2 groups.

**CONCLUSION:** BT increase was observed during the open and laparoscopic resection for colon cancer, without significant statistical difference between the 2 groups.


The intestinal epithelium undergoes a process of continuous renewal and consists of cells in various stages of differentiation. The integrity of the intestinal epithelium is critical to health[1] and any damage to the cells can influence proliferation and differentiation, leading to altered cell population and functional changes in the intestine. The intestine acts as a barrier to the luminal contents, which include bacteria and endotoxins. The gut barrier is altered in some pathological conditions such as shock, trauma, or surgical stress, resulting in bacterial and/or endotoxin translocation from the gut lumen into the systemic circulation.[2] This has been implicated in postoperative complications, such as systemic inflammatory response syndrome, sepsis, and multiorgan failure.[3]

Bacterial translocation, a process by which viable bacteria cross the intact epithelial barrier to reach mesenteric lymph nodes (MLNs) and beyond, is fundamental to this hypothesis and may account for postoperative sepsis.[4]

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There is growing evidence from animal and human studies, suggesting that gentle manipulation of the bowel during surgery by itself can induce bacterial translocation, comparable with that associated with ligation of the superior mesenteric artery.[5,6]

The oncologic safety of laparoscopic approach is discussed and it is not yet clear whether the laparoscopic approach offers significant immunological advantages over the conventional approach.[7–10] Some have suggested that the differences in cytokine and immune response noted after laparoscopic colorectal surgery are related to the extent of abdominal wall trauma, and thus one would anticipate less marked differences following laparoscopic-assisted colectomy.[8]

As laparoscopic colorectal surgery is recognized as a "mini-invasive" kind of surgery, in this prospective randomized study, we investigated the effect of surgical intervention on bacterial translocation (microbiologic assessment) in patients undergoing elective colectomy for colon cancer comparing laparoscopic with open approach.

## Patients and Methods

From March 2007 to February 2014, we studied, in a prospective randomized study, 119 patients consecutively (73 men and 46 women; mean age 69.2 years) with colon cancer (Table 1). Patients were randomly assigned to be treated with laparoscopic or open approach, according to a computer-generated table of random numbers. Randomization was performed by an independent computer consultant. The patient and the surgeon were informed about the type of approach just before the intervention. The study protocol was approved by the Ethical Committee of Faculty of Medicine of the University of L'Aquila, and informed consent was obtained for every patients.

Patients with a known immune dysfunction (advanced liver disease, human immunodeficiency virus infection, and hepatitis C virus infection) and cardiac or pulmonary insufficiency were excluded for the study. Patients were also excluded if they had evidence of intraperitoneal sepsis or peritoneal contamination and if they had received antibiotics within 2 weeks prior to surgery. During hospitalization, patients were not given antispastic drugs, steroids, or nonsteroidal anti-inflammatory drugs. The patients were classified as grade I, II, or III according to the American Society of Anesthesiologists (ASA) grading system[11] (Table 1). Twenty-nine patients had primary adenocarcinoma of the right colon and 90 of the left colon (Table 2).

Open resection (OR) was performed in 9 patients, while laparoscopic resection (LR) was adopted for 60 patients (Tables 1 and 2).

Minimally invasive colorectal surgery was performed as a laparoscopic-assisted procedure with removal of the resected specimen method by a horizontal minilaparotomy (mean 5.6 cm, range 5 to 8 cm) just above the mons pubis. The pneumoperitoneum is established using an open technique. Initial insufflation of $CO_2$ was 1 L/min and after 1 L of $CO_2$ was insufflated, the flow of $CO_2$ was increased to greater than or equal to 6 L/min. Once the 15 mm Hg limit is reached, the actual flow of $CO_2$ will cease. At this point, approximately 3 to 6 L of $CO_2$ should have been instilled into the abdomen. Laparoscopic surgery was performed using a 4-trocar technique with 1 trocar (10 mm) inserted through a paraumbilical incision (camera

**Table 1** Colon cancer: open (Group 1) and laparoscopic resection (Group 2)

| Characteristics | | |
|---|---|---|
| Parameters | Open resection | Laparoscopic resection |
| Number of patients | 59 | 60* |
| Age (years) | 38–79 (67.1) | 43–87 (71.4) |
| Sex (male/femme) | 36/23 | 37/23 |
| Body mass index | 17.2–36.5 (24.4) | 19.1–36.4 (25.2) |
| ASA grade | | |
| 1 | 5 (8.4%) | 4 (6.6%) |
| 2 | 24 (40.6%) | 23 (38.3%) |
| 3 | 30 (50.8%) | 33 (55%) |
| Incision length (cm) | 14–24 (17.8) | 5–8 (5.6) |
| Anesthesia (min) | 112–385 (199.1) | 118–399 (203.4) |
| Operative time (min) | 106−372 (193.2) | 111–388 (197.4) |
| Blood transfusions | | |
| Number of patients | 6 (10.1%) | 5 (8.3%) |
| Overall complications | 11 (18.6%) | 8 (13.3%) |
| Postoperative hospitalization (days) | 7–20 (10.4) | 6–21 (9.7) |

Values are expressed as range (mean).
ASA = American Society of Anesthesiologists.
*Converted to open surgery in 5 patients (8.3%).