



Peritoneal carcinomatosis is less frequently diagnosed during laparoscopic surgery compared to open surgery in patients with colorectal cancer

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Abstract

Background: During resection of a colorectal tumor a careful inspection of the abdomen should be performed to detect metastases. The aim of the current study was to compare the proportions of patients diagnosed with peritoneal carcinomatosis (PC) during laparoscopic resection (LR) and open resection (OR).

Methods: All patients who underwent resection for colorectal cancer in the Eindhoven Cancer Registry area between 2008 and 2012 were included. Proportions of patients with PC were compared between surgical techniques. Multivariate logistic regression analysis was performed.

Results: 6687 Patients underwent resection for colorectal cancer, of whom 1631 patients (24%) underwent LR, 4665 patients (70%) underwent OR. Conversion took place in 391 patients (19% of laparoscopic treated patients). PC was diagnosed in 1.4% of patients undergoing LR, in 5.0% of patients undergoing OR, and in 3.3% of patients in whom LR was converted to OR ($p < 0.001$). After adjustment for patient and tumor characteristics (e.g., T- and N-stage), patients who were treated by LR had a lower chance to be diagnosed with PC during surgery than patients undergoing OR (odds ratio = 0.42, $p < 0.001$).

Conclusions: Patients undergoing surgery for colorectal cancer are less frequently diagnosed with PC during LR in comparison to OR. Since effective treatment is currently available for selected patients with PC, a thorough inspection of the peritoneum during surgery is of paramount importance to offer these patients a chance for long-term survival and even cure.

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Introduction

During colorectal cancer surgery, a systematic inspection of the abdominal cavity should be performed prior to resection of the tumor, in order to screen for previously undetected synchronous metastatic disease such as small liver metastases or peritoneal carcinomatosis (PC). Timely detection of PC is of increasing importance with new treatment strategies

now offering a chance of long-time survival or even cure in selected patients with PC, especially in early stages.^{1–5}

Recently, laparoscopic colorectal cancer surgery was successfully and safely introduced in the hospitals of the Netherlands.⁶ Indeed, laparoscopic resection (LR) was associated with a lower risk of mortality, major morbidity, complications, prolonged hospital stay and irradical resection as compared to open resections (OR). However, no data were given on intra-operative findings with regard to synchronous metastases.

PC typically consists of small lesions of tumor attached to sites that may be difficult to visualize during surgery,

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such as the right diaphragm behind the liver and the Douglas pouch. Other preferred sites include the omentum, the mesentery and falciform ligament.⁷

Currently, it is unknown whether the type of surgical approach has an influence on the proportion of patients being diagnosed with synchronous PC. Therefore, the aim of the current study was to investigate whether the surgical approach (LR vs OR) affected the detection of PC.

Methods

The Eindhoven Cancer Registry registers all newly diagnosed cancer patients in the southern part of the Netherlands. This area includes 10 community hospitals, 6 pathology departments and 2 radiotherapy institutions, comprising 2.4 million inhabitants. Since the Eindhoven Cancer Registry collects data on laparoscopic surgery since 2008, the study included colorectal cancer patients diagnosed between 2008 and 2012. Patients who were diagnosed with PC prior to surgery were excluded. All patients underwent LR, OR or surgery initiated as LR converted to OR. Information on patient and tumor characteristics was routinely extracted from the medical records by specially trained administrators of the cancer registry. By means of an independent case ascertainment method, the completeness of the registration is estimated to exceed 95%.⁸ In case of unknown pN, cN was used and in case of unknown (y)pT, cT was used for analyses. The decision to perform OR or LR was highly dependent on hospital and surgeon and was mainly based on a history of abdominal surgery and extent of the tumor. Reasons for conversion included adhesions, ingrowth of the tumor into other organs or abdominal wall and in one patient surgery was converted due to bleeding. Urgency of the surgery was only registered for colonic and rectosigmoid cancer patients and not for patients with rectal cancer since emergency procedures are relatively rare in these patients. If the resection was planned less than 12 h before the start of the operation it was classified as “acute”.

Statistical analysis

Differences in proportions treated by LR and OR were compared using a Chi-square test. Logistic regression analysis, correcting for age, comorbidity, socioeconomic status, T-stage, N-stage and differentiation grade of tumor was used to calculate odds ratios and their 95% confidence intervals (CIs) for the diagnosis of PC. A subanalysis was performed including these patients to adjust for type of surgery by adding this variable to the logistic regression model. All tests of statistical significance were two sided. SAS/STAT statistical software (SAS system 9.3, SAS Institute, Cary, NC) was used for all analyses.

Results

Between 2008 and 2012 6687 patients underwent surgery for colorectal cancer. LR was performed in 1631 patients (24%) and 4665 patients (70%) underwent OR. In 391 patients (19% of laparoscopically treated patients) the surgical approach was converted from LR to OR. Patient characteristics are shown in Table 1, showing differences between surgical methods in age, gender, number of comorbid conditions, acute or planned surgery, T-stage and N-stage ($p < 0.05$).

During open surgery, 5.0% of the patients were diagnosed with PC as compared to 1.4% of the patients undergoing LR ($p < 0.001$, Table 2). PC was diagnosed in 3.3% of the patients in whom the laparoscopic procedure was converted to open surgery. PC was diagnosed more frequent in patients undergoing conversion compared to patients undergoing LR ($p = 0.010$).

After adjusting for sex, age, the presence of comorbidity, socioeconomic status, T-stage, N-stage, tumor differentiation grade, and tumor localization (colon vs

Table 1

General characteristics of patients undergoing resection for colorectal cancer between 2008 and 2012 in the South of the Netherlands.

| | Open resection (n = 4665) | | Laparoscopic resection (n = 1631) | | Conversion (n = 391) | | p-Value |
|--------------------------------------|------------------------------|-----|---|-----|-------------------------|-----|---------|
| | N | (%) | N | (%) | N | (%) | |
| Age (yrs) | | | | | | | |
| <60 | 801 | 17 | 336 | 21 | 61 | 16 | |
| 60–69 | 1298 | 28 | 468 | 29 | 107 | 27 | |
| 70–79 | 1669 | 36 | 582 | 36 | 140 | 36 | |
| >80 | 897 | 19 | 245 | 15 | 83 | 21 | <0.001 |
| Gender | | | | | | | |
| Male | 2573 | 55 | 907 | 56 | 242 | 62 | |
| Female | 2092 | 45 | 724 | 44 | 149 | 38 | 0.036 |
| Number of comorbid conditions | | | | | | | |
| 0 | 1323 | 28 | 529 | 32 | 96 | 25 | |
| 1 | 1301 | 28 | 440 | 27 | 111 | 28 | |
| ≥2 | 1967 | 42 | 643 | 39 | 178 | 46 | |
| Unknown | 74 | 2 | 19 | 1 | 6 | 2 | 0.017 |
| Type of surgery^a | | | | | | | |
| Acute | 393 | 12 | 20 | 2 | 11 | 4 | |
| Planned | 2989 | 88 | 1152 | 98 | 272 | 96 | <0.001 |
| T stage of primary tumor | | | | | | | |
| T1 | 251 | 5 | 165 | 10 | 28 | 7 | |
| T2 | 895 | 19 | 385 | 24 | 72 | 18 | |
| T3 | 2752 | 59 | 955 | 59 | 226 | 58 | |
| T4 | 709 | 15 | 102 | 6 | 63 | 16 | |
| Tx | 58 | 1 | 24 | 1 | 2 | 1 | <0.001 |
| N stage of primary tumor | | | | | | | |
| N0 | 2051 | 44 | 909 | 56 | 195 | 50 | |
| N1 | 773 | 17 | 273 | 17 | 75 | 19 | |
| ≥N2 | 207 | 4 | 67 | 4 | 14 | 4 | |
| Nx | 1634 | 35 | 382 | 23 | 107 | 27 | <0.001 |
| Localization of primary tumor | | | | | | | |
| Colon | 3318 | 71 | 1139 | 70 | 273 | 70 | |
| Rectum | 1347 | 29 | 492 | 30 | 118 | 30 | 0.566 |

^a Only available in colon and rectosigmoid patients.

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