

The impact of hospital volume on perioperative outcomes of rectal cancer



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Abstract

Background: The purpose of this study was to investigate the impact of hospital volume on perioperative outcomes of clinical tumour stage (cT)1-3 and cT4 rectal cancer.

Methods: 16.162 patients operated for rectal cancer enrolled in the Dutch Surgical Colorectal Audit were included. Hospitals were divided into low (<20 cases/year), medium (21–50 cases/year) and high (>50 cases/year) volume for cT1-3 rectal cancer, and for cT4 rectal cancer into low (1–4 cases/year), medium (5–9 cases/year) and high (≥10 cases/year) volume. The influence of hospital volume on perioperative outcomes was investigated.

Results: With regards to cT1-3 tumours, low volume had lower rates of complications (33.8% vs. 36.6% and 38.1%, $p = 0.009$), anastomotic leakage (5.4% vs. 8.1% and 8.6%), and reinterventions (11.5% vs. 12.6% and 14.8%, $p = 0.002$) as compared to medium and high volume hospitals. Thirty-day mortality and R0 rates were comparable between groups.

In high cT4 volume hospitals, rates of extensive resection of tumour involvement (49.4% vs. 25.4% and 15.5%, $p < 0.001$) and additional resection of metastasis (17.5% vs. 14.4% and 3.0%, $p < 0.001$) were increased as compared to medium and low volume hospitals. Thirty-day mortality and R0 rates were comparable between groups. In a sub-analysis of pathologic tumour stage 4 patients, irradiated resections were increased in low volume hospitals (33.8% vs. 22.5% and 20.8% in medium and high volume hospitals, $p = 0.031$).

Conclusions: For cT4 rectal cancer, high volume hospitals may offer a better multimodality treatment, while for cT1-3 rectal cancer there appears no benefit for centralization.

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Keywords: Rectal cancer; Surgery; Hospital volume; Outcome

Introduction

The introduction of standardized total mesorectal excision (TME) and neoadjuvant therapies has led to improved oncological results after low anterior resection (LAR) for rectal cancer.^{1,2} The primary goal of surgical treatment of rectal cancer is to achieve a radical resection (R0) since a

positive circumferential resection margin (CRM) is a poor prognostic factor, associated with local recurrence, distant metastasis, and inferior survival after rectal cancer surgery.^{3,4} Generally, neoadjuvant (chemo)radiotherapy is administered for the more advanced stages of rectal cancer, to induce tumour shrinkage to facilitate complete resections and reduce local recurrence rates.^{5,6} Neoadjuvant treatment is usually not necessary for lower stages of rectal cancer,^{5,6} which can be treated by standard TME procedures or even rectal sparing surgery in selected patients.⁷ The most advanced stage of rectal cancer, including clinically staged 4 tumours (cT4) invading the mesorectal fascia and/or surrounding organs, often require an induction treatment for

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tumour downsizing and a more radical surgical approach to achieve a complete resection. These procedures, such as extralevatory abdominoperineal resections (APR) and exenterative procedures, require a more complex surgical dissection beyond the standard TME plane.⁸

In order to further improve the outcome of rectal cancer, the current Dutch standard indicates an overall minimum of 20 rectal resections annually per hospital, irrespective of the tumour stage. In addition, the Dutch guideline recommends centralization of care for patients with advanced stages of rectal cancer in specialized colorectal cancer hospitals.⁹ The impact of hospital volume on surgical outcomes after rectal cancer surgery is under debate. A recent population-based study revealed no differences in 5-year survival rates were between hospital volumes for patients with colorectal cancer, however, outcomes were not stratified for rectal cancer, nor for tumour stage.¹⁰ Little is known regarding the exact effects of hospital volume on different cT1-T4 stages of rectal cancer. The purpose of this study was to evaluate the impact of hospital volume on surgical resection and perioperative outcomes of cT1-3 rectal cancer and cT4 rectal cancer using data from a national registry.

Patients and methods

DSCA

All patients undergoing resection of colorectal cancer in the Netherlands are since 2009 registered in the Dutch Surgical Colorectal Audit (DSCA). The DSCA was initiated by the Dutch Surgical Society to monitor and improve the quality of oncological care in colorectal cancer patients on a national level.¹¹ Nowadays, all 92 Dutch hospitals participate in the DSCA and its data shows a nearly 100% concordance on validation against the National Cancer Registry dataset.¹² Data on patient and tumour characteristics, diagnostics, treatment and short term outcome were collected. Medical ethics committee approval was not required for this study as all patients and hospital information in the DSCA was de-identified. Individual patient data were collected in the treating hospital and transferred in encrypted form to the DSCA database.

Patient selection

All patients operated for rectal cancer, defined as a tumour within 15 cm of the anal verge, enrolled in the DSCA between January 2009 and December 2015 were included. Overall, 19,354 patients with presumed rectal cancer were enrolled in the DSCA. After excluding tumours >15 cm of the anal verge, those with unknown distance between tumour and anal verge, unknown procedures, or other procedures than rectal cancer surgery (i.e. left-sided colectomy), 17,477 patients remained. After

excluding tumours with unknown clinical tumour stage, 16,162 patients remained.

Patients with cT1-3 tumours were stratified based on median annual cT1-3 hospital volume, which was defined as low volume (0–19 cases/year), medium volume (20–50 cases/year) or high volume (>50 cases/year). In addition, cT4 tumours were stratified based on median annual cT4 hospital volume, which was defined as low volume (0–4 cases/year), medium volume (5–9 cases/year), or high volume (>9 cases/year). Subsequently, baseline and operative characteristics, pathologic and postoperative outcomes were compared between cT1-3 hospital volume groups, and cT4 hospital volume groups.

Data analysis

Missing data were not defaulted to negative and denominators reflect only actual reported cases. Nominal variables were compared between groups using the Chi-square test, continuous variables using the One-Way ANOVA test. Multivariable regression analysis was performed to investigate independent effects of hospital volume on a complicated course after resection of cT4 rectal cancer. Hospital volume and variables that were significant in univariable analysis ($p < 0.05$), were included in a multivariable logistic regression model to determine independent associations with this endpoint. SPSS 22 was utilized for the analyses, and a p value < 0.05 was considered significant. The STROBE guidelines were used to ensure the reporting of this observational study.¹³

Results

Overall, 14,651 patients (90.7%) had clinical tumour stage 1, 2 or 3, of which 3,210 (21.9%) were operated in 39 low volume hospitals; 8,730 (59.6%) were operated in 44 medium volume hospitals, and 2,711 patients (18.5%) were operated in 8 high volume hospitals. In addition, there were 1,511 (9.3%) patients with clinical tumour stage 4 (cT4), of which 759 (50.2%) were operated in 72 low volume hospitals; 336 (22.2%) were operated in 8 medium volume hospitals, and 416 (27.5%) were operated in 3 high volume hospitals.

Clinical tumour stage 1–3

Baseline and operative characteristics

Fewer cT1-3 patients underwent neoadjuvant therapy in high volume hospitals (72.7% vs. approximately 75% in medium and low volume hospitals, $p = 0.026$). Clinical tumour stage 3 was more common in medium volume hospitals, while clinical nodal stage 0 was more frequently seen in low volume hospitals ($p < 0.001$). An abdominoperineal resection was more often performed in medium (28.1%) and high volume hospitals (27.8%) as compared to low volume hospitals (26.4%, $p < 0.001$). A

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