



Benchmarking clinical outcomes in elective colorectal cancer surgery: The interplay between institutional reoperation- and mortality rates[☆]

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Abstract

Background: “Unplanned reoperations” has been advocated as a quality measure in colorectal cancer surgery as it is correlated with complications and postoperative mortality at a patient level. However, little is known about the relation between reoperation rates and postoperative mortality rates at a hospital level.

Methods: Data were derived from the Dutch Surgical Colorectal Audit 2009–2012 database. Hospitals with significantly higher and lower reoperation rates than average were identified and grouped accordingly. Postoperative mortality rates were compared between the groups.

Results: Some 28,667 patients who underwent elective colorectal cancer resections in 92 hospitals were analyzed. Fourteen hospitals had significantly higher (mean 14.6%) adjusted reoperation rates than average (10%), 20 had lower (5.3%) rates than average. Adjusted mortality rates were similar in groups with high reoperation rates and the majority cohort (3.5–3.2%) and significantly lower in hospitals with low reoperation rates (2.3%). However, individual hospitals with relatively high reoperation rates had low mortality rates and vice versa.

Conclusions: Reoperation rates after elective colorectal cancer resections varied. Hospitals with significantly higher reoperation rates than average did not have higher mortality rates. The group with lowest reoperation rates also had lower postoperative mortality rates; however, this did not apply to all hospitals in the group. In conclusion, ‘reoperations’ seems suitable as benchmark information to hospitals but less suitable to detect poor performers. Best practices should be identified as hospitals with both low reoperation- and mortality rates.

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Keywords: Colorectal resection; Benchmark; Reoperations; Postoperative mortality; Hospital comparisons; Quality of care

Introduction

There is an increasing demand for transparency of information that aids in rating hospitals’ performance, both from

policy makers and patients. At the same time, clinical outcome registries are becoming more widespread, helping caregivers to improve by generating benchmark information.¹ As a result, measuring and comparing quality of surgical care has become increasingly important in the last decades, and in several quality improvement projects, quality indicators have been defined.² Quality indicators measure a certain aspect (structure, process, or outcome³) of care and are compared against a standard or average. They may be used for internal purposes (feedback and

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quality improvement) as well as external purposes (making public of information on hospital performance).

Colorectal surgery is associated with relatively high surgical postoperative morbidity rates⁴ and accounts for a disproportionate share of reoperations within the spectrum of general surgery.⁵ “Unplanned reoperation” is a well-accepted quality measure for colorectal surgery. In the Netherlands, it is a compulsory quality indicator collected by the Dutch Healthcare Inspectorate. Many publications have concluded that the measure is suitable as a quality measure because it is a factor independently associated with other adverse outcomes such as prolonged hospital stay and postoperative mortality.^{5–7} Obviously, this is because of the close relationship between reoperations and surgical complications such as anastomotic leak or hemorrhage. An advantage over postoperative mortality as an outcome indicator would be that in elective surgery, postoperative mortality is less frequent and may therefore not discriminate worse performing hospitals from better performing hospitals. On the other hand, timely reoperations in case of complications may save the patients’ life and higher reoperation rates may in fact be associated with lower postoperative mortality rates.⁸ Although on a patient level the association between reoperations and postoperative mortality is well established, little is known about the relation between reoperation rate and postoperative mortality rate at a hospital level.

This study aims to investigate the value of reoperation rates as a marker for quality of care in elective colorectal cancer surgery by exploring hospital variation, the presence of hospitals with significantly lower or higher reoperation rates than average (low and high outliers) and the association with postoperative mortality rates.

Materials and methods

Data

Data was derived from the Dutch Surgical Colorectal Audit (DSCA), a nationwide clinical registry and continuous quality improvement project in which a wide range of variables concerning patient and disease-specific details, diagnostics, treatment, and outcomes are collected prospectively. The dataset is disease-specific for colorectal cancer and shows a case ascertainment of >95% and high accuracy level on comparison against the Netherlands Cancer Registry (NCR) dataset.^{9,10}

Patients

For this study, no ethical approval or informed consent was required under Dutch law. All patients undergoing a surgical resection for primary colorectal cancer between the 1st of January 2009 and 31st of December 2012, and registered in the DSCA before March 15th 2013, were evaluated. Minimal data requirements to consider a patient

eligible for analyses were information on tumor location, date of surgery, and mortality. In total, 35,749 patients were eligible.

Patients undergoing non-elective surgery ($n = 5546$), local tumor excisions ($n = 393$), and surgery for multiple synchronous colorectal tumors ($n = 1122$) were excluded from analysis.

The total number of patients diagnosed with stage I–IV colorectal cancer in the Netherlands during the study period was 52,046; increasing from 12,423 in 2009 to 13,408 in 2012.¹¹

Outcomes

Primary outcomes

Reoperations were defined as unplanned operations within 30 days from the primary operation. Postoperative mortality was defined as death within 30 days from the primary operation and/or during the index admission.

Statistical analysis

Categorical variables were compared using a chi-square test, and continuous variables using the independent samples *t*-test. A 2-sided $p \leq 0.05$ was considered statistically significant.

Potential, clinically relevant risk factors for adverse events were selected from the dataset and logistic regression models were employed to estimate expected outcomes. The variables age, gender, ASA score, Charlson comorbidity index, BMI, TNM stage, neoadjuvant therapy, type of index procedure and extended resections were incorporated in the model. Data were aggregated at a hospital level and observed-to-expected rates were multiplied with the average outcome in the study population in order to obtain casemix-adjusted outcomes for each hospital.

Hospital variation in adjusted reoperation rates is illustrated in a funnel plot, showing the overall average reoperation rate with its 95% confidence limits, based on a Poisson distribution, varying in relation to the population size. The funnel plot was used to identify hospitals with reoperation rates that were significantly higher or lower than the national average (high and low outliers, hospitals that are outside the 95% confidence limits). Hospitals were grouped accordingly (higher reoperation rate than average; lower reoperation rate than average; and the majority cohort with reoperation rates within the 95% confidence limits). Outcomes were compared between these groups.

Also after aggregating the data on a hospital level, comparison of outcomes between the three hospital groups was performed. This was done by applying the analysis of variance (ANOVA). Pairwise comparisons between the hospitals groups were carried out by using one-way multiple comparisons with Bonferroni correction. All statistical analyses were performed in PASW Statistics, version 20 (Chicago, IL, USA).

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