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Association between the time to surgery and survival among patients with colon cancer: A population-based study

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Abstract

Factors associated with time-to-surgery (TTS) and survival in colon cancer has not been well studied. Cancer Care Ontario recommends surgery within 42 days of diagnosis and that 90% of patients meet this benchmark. We describe factors associated with TTS and survival in routine clinical practice.

Methods: Retrospective population-based cohort study of patients receiving elective colonic resection after diagnosis of colon cancer in Ontario, Canada from 2002 to 2008 followed until 2012. Factors associated with TTS were identified using multivariate log-binomial and Quantile regression at 42 days and 90th percentiles. The association between TTS and cancer-specific (CSS) and overall survival (OS) were examined using multivariate Cox regression.

Results: 4326 patients; median age 71 years and 52% male. Median TTS was 24 days (IQR 14–37); at the 90th percentile 56 days. Factors associated with TTS $\geq$ 42 days and >90th percentile included older age, co-morbid illness, surgeon volume, and stage I disease ($P < 0.05$ for all). In patients whose TTS was either at 42 days or 90th percentile, those $\geq$80 years old waited two weeks longer than those <60 years, individuals with co-morbid illness waited 10 days longer than without co-morbidity, and patients with stage I disease waited 10 days longer than those with stage IV disease ($P < 0.05$ for all). Delay in TTS > 42 days or >90th percentile was not associated with OS or CSS.

Conclusion: Age, co-morbidity, and stage of cancer are associated with TTS. There was no association between TTS and CSS or OS.

Keywords: Time-to-surgery; Overall survival; Cancer-specific survival; Institute for Clinical Evaluative Sciences; Ontario Cancer Registry

Introduction

The wait-time from cancer diagnosis to surgery, herein referred to as time-to-surgery (TTS), is of concern to the healthcare system, healthcare providers, and patients. TTS has been suggested to impact treatment outcomes in several different tumor sites[1–3] and quality of life.[4,5] From a system and provider perspective, the TTS is becoming a 'benchmark' for quality cancer care while from the patient perspective, TTS has been associated with increased anxiety and fear around cancer progressing during the waiting interval.[5] Despite the lack of high-quality evidence on wait-time outcomes, many societies have developed recommendations on the acceptable interval from cancer diagnosis to surgery. In Canada, the Cancer Care Ontario (CCO) expert panel has published recommendations supporting a TTS of 42 days for those patients who do not meet criteria for emergent surgery. This includes a 14 day time from consult to decision-to-treat and a further 28

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days from ready-to-treat to operation with a goal of having 90% of patients reaching these benchmarks.[6]

Of great interest to both physicians and patients is whether a delay in receiving curative surgery is associated with survival. Endoscopists are frequently the physicians who make the initial endoscopic diagnosis of colon cancer and disclose this information to their patients. This is commonly followed by questions by patients regarding the process of proceeding from diagnosis to colon cancer surgery and whether a delay to surgery will impact their outcomes. A delay in TTS in populations with breast cancer,[1,7] bladder cancer[2] and rectal cancer[8,9] has been associated with worse long-term survival. In contrast, the majority of studies to date in patients with colon cancer have not shown a relationship between a delay to surgery and mortality.[9–12] However, these studies have, for the most part, been limited to single centre experiences, included both colon and rectal cancers, had inconsistencies in the definition of the wait-time interval being evaluated, and uncontrolled confounding. Further, few studies have explored clinical factors associated with a delay in TTS which could help identify populations where interventions to improve access to surgical intervention may facilitate the achievement of cancer wait-time benchmarks.

The aims of the current study were to identify patient-, disease-, and treatment-related factors associated with TTS in patients with surgically resected colon cancer in addition to exploring the association between delay in TTS and cancer specific and overall survival at the population-level. Given our local CCO recommendations, we explored TTS as a delay $\geq$42 days in addition to >90th percentile as a more universal wait-time benchmark.

Methods

Study design and population

This is a retrospective population-based cohort study of patients treated for colon cancer in the Canadian province of Ontario. Ontario has a population of approximately 13.5 million people and a single-payer universal health insurance program. The cohort included a 25% random sample of all patients with primary colon cancer who underwent resection in Ontario between 2002 and 2008. To define the study cohort we used the Ontario Cancer Registry (OCR) to identify all incident cases of colon cancer in Ontario diagnosed during 2000–2008 with follow-up until December 31, 2012. The OCR does not capture stage of disease for all patients; therefore we obtained surgical pathology reports for a random sample of 25% of cases using a computer random number function. Reports were not available for patients with surgery in 2005; as such the study cohort is restricted to patients who had surgery in 2002–2004 and 2006–2008. From this cohort, we identified the study population including all individuals who had an outpatient colonoscopy or sigmoidoscopy (Ontario Health Insurance Plan billing codes Z555, Z580, Z535, Z536) with pathological confirmation of colon cancer within 24 weeks prior to their surgical admission who did not receive neoadjuvant treatment. We excluded patients who had endoscopy during their surgical admission or those without endoscopy as they were thought to represent patients who required emergent treatment. The study was approved by the Research Ethics Board of Queen's University and the institutional review board at Sunnybrook health Sciences Centre, Toronto, Canada.

Data sources and linkage

The OCR is a passive, population-based cancer registry that captures diagnostic and demographic information on at least 98% of all incident cases of cancer in the province of Ontario.[13] The OCR also provides information about vital status and cause of death. Records of hospitalization from the Canadian Institute for Health Information (CIHI) provided information about surgical procedures; these records are known to have a very high level of completeness for colorectal cancer surgery.[14] Provincial physician billing records from the Ontario Health Insurance Plan, treatment records from regional cancer centres, and provincial records of chemotherapy delivery were used to identify chemotherapy utilization. A team of trained data abstractors reviewed the pathology reports and entered information about extent of disease into an electronic database. These datasets were linked using unique encoded identifiers and analyzed at the Institute for Clinical Evaluative Sciences (ICES).

Measures, outcomes, and co-variates

We chose to use two exposure variables when evaluating TTS and our survival outcomes. We looked at first a cut-off of $\pm$42 days as this is the current recommendation from CCO and would therefore inform whether this recommendation, although not evidence-based, is supported by our analysis. When then also chose to look at the 90th percentile for TTS to evaluate the association between TTS and survival in the most extreme outliers. We evaluated a number of co-variates in the association between TTS and survival. Disease-related co-variates were abstracted from the primary pathology reports obtained from OCR and included the stage of disease based on the AJCC TMN staging system, the presence of lymphovascular invasion, and tumour grade. Indicators of the socioeconomic status (SES) of the community in which patients resided at diagnosis were linked as described previously.[15] Quintiles (Q) of the median household income were based on the household income distribution for the full province of Ontario. Q1 represents the communities where the poorest 20% of the Ontario population resided. Geographic regions reflect the catchment areas for Ontario's regional cancer centres and were evaluated in order to determine the effect of

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