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Original Article

Quality of Radiation Therapy Referral and Utilisation Post-prostatectomy: A Population-based Study of Time Trends

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Abstract

Aims: Adjuvant radiotherapy post-prostatectomy has been shown to benefit patients with adverse pathology. It remains unclear whether salvage radiotherapy confers equivalent outcomes. Practice guidelines recommend referral to radiation oncology within 6 months after prostatectomy to discuss adjuvant and salvage radiotherapy. The study objectives were to assess, at a population level: (i) post-prostatectomy referral patterns for radiotherapy; (ii) adjuvant and salvage radiotherapy utilisation; and (iii) time trends in relation to clinical trials and guidelines. These findings provide indications of access to quality care.

Materials and Methods: This was a retrospective cohort study. Electronic radiotherapy consultation and treatment records were linked to the population-based Ontario Cancer Registry. The population included prostate cancer cases treated with prostatectomy in Ontario between 2003 and 2012. Radiotherapy referral and treatment rates over time were analysed using the chi-squared trend test.

Results: Over the study period, 30 447 prostate cancer patients received prostatectomy. The proportion seen by radiation oncology within 6 months after prostatectomy doubled from 10.7% in 2003–2004 to 21.7% in 2011–2012 ($P < 0.0001$ for trend), with the largest annual percentage difference in 2009–2011 (3.4%). Among 4641 patients seen within 6 months, adjuvant radiotherapy rates remained at $51.0\% \pm 3.0\%$. Contemporaneous with radiation oncology referral trends, overall adjuvant radiotherapy use increased from 6.2% in 2003–2004 to 11.0% in 2011–2012 ($P < 0.001$), while salvage radiotherapy remained at $8.4\% \pm 0.4\%$. Consequently, the total proportion receiving radiotherapy within 24 months increased from 14.1% in 2003–2004 to 17.7% in 2009–2010 ($P < 0.0001$).

Conclusions: There was an increase in access to early radiation oncology referral post-prostatectomy and adjuvant radiotherapy in Ontario between 2003 and 2012, following guideline publication.

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Key Words: Health care quality, access, and evaluation; prostatic neoplasms; prostatectomy; radiation oncology; radiotherapy, adjuvant

Introduction

The effectiveness of post-radical prostatectomy adjuvant radiotherapy (ART) was reported starting in 2004 in three randomised trials showing a reduction in biochemical relapse in patients with adverse pathology (positive margins, extracapsular extension or seminal vesicle invasion) [1–7]. In 2009, Thompson *et al.* [8] reported a corresponding survival advantage at 10 years.

Although the state of knowledge describes the benefits of ART, there is ongoing debate as to whether early salvage radiotherapy (SRT) at the time of first detection of prostate-specific antigen (PSA) confers equivalent disease outcomes [9–12]. Early SRT is attractive as about half of patients do not relapse within 5 years, despite having high-risk features [3,4,6]. Randomised trials are underway evaluating the efficacy and timing of SRT versus ART [10,13–16].

On the basis of evolving evidence surrounding ART and SRT, the Genitourinary Radiation Oncologists of Canada (GUROC) published consensus statements in 2008, recommending that ‘consultation with a radiation oncologist early in the postoperative period is advised to discuss benefits and side effects of adjuvant radiotherapy in those with adverse pathological features at prostatectomy’

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[17,18]. Similarly, Cancer Care Ontario (CCO) 2008 and 2010 guidelines state that 'in patients found at radical prostatectomy to have positive surgical margins, extracapsular extension or seminal vesicle invasion, early referral to a radiation oncologist is recommended for consideration of adjuvant external beam radiotherapy with the aim of prolonging survival' [19]. Early referral implied involving the radiation oncologist in a decision regarding initiating ART 6–18 weeks after radical prostatectomy or identifying patients suitable for follow-up with a view to early SRT.

Despite cumulative evidence and guidelines recommending early referral for radiotherapy after radical prostatectomy, there is a gap in the literature with respect to the impact on rates of early radiation oncology referral after radical prostatectomy at the population level. With advancement of medical knowledge there is a need for the assessment of the effect on care delivery. In an influential framework put forth by the Institute of Medicine, quality of care was defined as 'the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge' [20]. Large-scale population-based studies investigating referral patterns after radical prostatectomy in light of recent evolving evidence are lacking.

The aim of this large population-based study was to investigate the impact of advancement in medical knowledge (including clinical trials and guidelines) on radiation oncology referrals among patients treated with radical prostatectomy in Ontario between 2003 and 2012, to provide an indication of quality of care. A secondary aim was to characterise the extent to which ART and SRT practices have been adopted.

Materials and Methods

Study Design

This was a retrospective cohort study. The study population included all men who underwent radical prostatectomy for prostate cancer in Ontario between 1 January 2003 and 30 November 2012. The study was approved by the Queen's University research ethics board.

Data Sources and Linkage

Ontario has a population of 13.8 million people, and a publicly funded universal health insurance plan. The provincial cancer agency, CCO, is responsible for coordinating provincial cancer centres, which are the only providers of radiotherapy in Ontario. Radical prostatectomy is carried out in a wider range of public hospitals.

The Ontario Cancer Registry is a population-based registry that collects demographic and clinical characteristics of all patients diagnosed with cancer in Ontario, reported to be >95% complete for all sites combined based on a capture–recapture methodology [21]. Records on incident

prostate cancer cases were utilised. Registry data were linked to hospital separation data identifying radical prostatectomy cases (Canadian Institute for Health Information) and to radiotherapy treatment data and radiation oncology visit data (routinely electronically compiled by CCO from each radiotherapy centre).

Radiation oncology visit data from 1 January 2003 to 31 May 2013 were linked to radical prostatectomy cases from 1 January 2003 to 30 November 2012. Radiotherapy records were complete to the end of May 2013, allowing us to report on radiotherapy use within 6 months of radical prostatectomy for cases with index surgery date up to 30 November 2012. Patients treated with palliative intent were excluded.

Definitions of Radiation Oncology Consultation and Radiotherapy Utilisation

The primary outcomes of this study were whether patients were seen by radiation oncology for consideration of ART or SRT and receipt of radiotherapy. We defined early radiation oncology consultation as a first radiation oncology visit within 6 months after radical prostatectomy. All patients who receive a radiation oncology consultation after radical prostatectomy were included in the analysis, regardless of whether they were also seen before radical prostatectomy. ART was defined as curative-intent radiotherapy initiation within 6 months of radical prostatectomy, as previously described [14,22–24]. Sensitivity analyses defining ART as initiation of ART within 4 and 8 months, respectively, were carried out. Curative radiotherapy administered 6–24 months after radical prostatectomy was defined as early SRT. Long-term data are limited by the last date for which we had complete radiotherapy records.

Statistical Methods

Cumulative incidence functions were used to describe cumulative radiation oncology referral and radiotherapy utilisation rates as a function of time since radical prostatectomy. Patients were censored if they did not receive a radiation oncology visit or radiotherapy before 31 May 2013, which was the last date for which we had complete radiotherapy records. Trends in radiation oncology consultation and radiotherapy utilisation over time were statistically tested using the Cochran-Mantel-Haenszel chi-squared trend test. SAS, version 9.4, was used for all statistical analyses.

Results

We identified 30 447 incident cases of prostate cancer treated with radical prostatectomy between 2003 and 2012. The median age at diagnosis was 62 years (interquartile range: 57, 66). The median number of radical prostatectomy cases annually was 3073 (interquartile range: 2774, 3242). We observed that 4641 (15.2%) were seen by radiation oncology within 6 months after radical

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