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Radiation oncology and medical physicists quality assurance in British Columbia Cancer Agency Provincial Prostate Brachytherapy Program

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ABSTRACT

PURPOSE: To describe in detail British Columbia (BC) Cancer Agency (BCCA) Provincial Prostate Brachytherapy (PB) Quality Assurance (QA) Program.

METHODS AND MATERIALS: The BCCA PB Program was established in 1997. It operates as one system, unified and supported by electronic and information systems, making it a single PB treatment provider for province of BC and Yukon. To date, >4000 patients have received PB (450 implants in 2011), making it the largest program in Canada. The Program maintains a large provincial prospective electronic database with records on all patients, including disease characteristics, risk stratification, pathology, preplan and postimplant dosimetric data, follow-up of prostate-specific antigen, and toxicity outcomes.

RESULTS: QA was an integral part of the program since its inception. A formal QA Program was established in 2002, with key components that include: unified eligibility criteria and planning system, comprehensive database, physics and oncologist training and mentorship programs, peer review process, individual performance outcomes and feedback process, structured continuing education and routine assessment of the program's dosimetry, toxicity and prostate-specific antigen outcomes, administration and program leadership that promotes a strong culture of patient safety. The emphasis on creating a robust, broad-based network of skilled providers has been achieved by the program's requirements for training, education, and the QA process.

CONCLUSIONS: The formal QA process is considered a key factor for the success of cancer control outcomes achieved at BCCA. Although this QA model may not be wholly transferable to all PB programs, some of its key components may be applicable to other programs to ensure quality in PB and patient safety.

Keywords: Quality assurance; Prostate brachytherapy

Introduction

The British Columbia (BC) Cancer Agency (BCCA) Provincial Prostate Brachytherapy (PB) Program is the largest in Canada and one of the largest in the world. This manuscript describes the history and development of the program. In particular, it details our quality assurance (QA) procedures, an integral part of the program since its inception. Specific aspects of the QA procedures are described in detail, including those involving: training and mentorship, peer review, planning, physics, and treatment database and system safety mechanisms.

BCCA is a provincial government-funded treatment and research organization operating under the umbrella of Provincial Health Services Authority. This publically funded system provides a province-wide, population-based cancer control program for more than 5 million residents of British

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Columbia and the Yukon through five regional multidisciplinary clinics: Vancouver, Victoria, Surrey, Kelowna, and Abbotsford with a common electronic information system. The BCCA's mandate covers basic and clinical research as well as the spectrum of cancer care, from prevention and screening, to diagnosis, treatment, and through to rehabilitation (http://www.bccancer.bc.ca). Of an estimated 3200 new prostate cancer cases diagnosed in BC in 2010, over half were referred to BCCA in 2010. BCCA is the exclusive provider of radiation oncology services with 29 high-energy units, 3 operating rooms (ORs), 50 radiation oncologists, 35 medical physicists, and numerous allied support staff to provide full range of radiation treatments.

The Prostate Brachytherapy (PB) Program was established in November 1997 by four radiation oncologists and two medical physicists. The first implant was performed in July 1998. To date, more than 4000 patients have received PB in BC. At present, 16 radiation oncologists and 20 physicists are actively involved in the program and perform implants in four regional centers. In 2010, 450 patients received PB. The program provides peer review guidelines for consistent brachytherapy eligibility criteria, treatment planning algorithms, and quality control (1). The program maintains a large province-wide prospective electronic database with records on all patients, including demographics, disease characteristics, including pretreatment/initial prostate-specific antigen (iPSA), Gleason score (GS), clinical stage (CS), percent positive cores for risk stratification, pre- and postimplant dosimetric data, and clinical and biochemical (PSA) follow-up (FU) data (Table 1 and Fig. 1). Toxicity data are collected on all patients who attend one of four BCCA provincial cancer centers (Fig. 2). Outcome analysis of the first 1006 consecutive patients revealed a 5-year actuarial Kaplan–Meier freedom from biochemical failure of 95.7% (2).

It is well documented that PB outcomes (both PSA and toxicity) may vary widely based on individual and institutional experience and expertise (3–6). On June 21, 2009, two articles in large metropolitan newspapers prominently reported on questionable quality and safety of PB at Pennsylvania Veterans Administration Medical Clinic (PVAMC) (7). A subsequent chain of events lead to the U.S. Senate held field hearing followed by a VA's Secretary and Congress request for a review of the VA PB at PVAMC by the Veterans Administration's (VA's) Office of Inspector General (7). A subsequent chain of events led to U.S. Senate hearings and Congressional involvement, resulting in a review of the PVAMC by the VA's Office of Inspector General (7). These events have raised significant interest in QA for PB programs in North America and appropriate regulatory evaluation of medical events (8). Subsequent review of the PVAMC's services by the U.S. Nuclear Regulatory Commission (NRC) highlighted the need to articulate and communicate the QA procedures in PB programs (7). As very little has been published on the practical implementation of a comprehensive QA program for PB, the purpose of this article is to discuss those components that, in our opinion, are necessary for achieving excellence in the setting of a large multicenter group practice. We briefly outline our eligibility criteria, treatment planning philosophy, postimplant dosimetry, and procedures. We also describe the procedures, training, and credentialing requirements for oncologists and physicists involved in the program.

Table 1
Database pre- and posttreatment patient and disease

Initial patent pretreatment assessment data	Follow-up
Patient name	Postoperative infection
Date of birth	**Toxicity:**
BCCA chart number	RTOG urinary toxicity
Clinical stage (TNM)	IPSS
Diagnosis date	RTOG rectal toxicity
Biopsy results:	Rectal EPIC modified scale
If US-guided biopsies were used or not	Continence
Number of cores obtained	Erectile function (physician scored, SHIM with overall satisfaction score) use of sexual aids.
If disease is bilateral or not	Secondary malignancy.
Number of cores containing cancer	PSA (q 6 months to 1 year)
GS (primary, secondary, and sum GS)	Testosterone (q 6 months to 1 year)
Pretreatment PSA (iPSA)	**Disease status:**
Testosterone	bNED
Use of hormones	PSA failure date
Pretreatment TURP	local or distant failure and dates
Comorbidities (hypertension and diabetes)	PSA bounce
Follow-up:	Secondary intervention date
BCCA clinic or	
Remote (out of province patients)	
Baseline urinary, rectal and sexual function	
Urinary function-IPSS and bother scores.	
Continence	
Erectile function (physician scored and SHIM with overall satisfaction score)	
Use of sexual aids	
Rectal function: rectal EPIC-modified scale	

GS = Gleason score; iPSA = initial prostate-specific antigen; TURP = transurethral resection of prostate; BCCA = British Columbia Cancer Agency; RTOG = Radiation Therapy Oncology Group; IPSS = International Prostate Symptom Score; SHIM = Sexual Health Inventory for Men; EPIC = Expanded Prostate Index Composite; bNED = freedom from biochemical failure.

PB eligibility criteria

Between 1998 and 2009, eligible patients included those with low-risk disease (CS ≤ T2a, iPSA ≤ 10 ng/mL, and GS ≤ 6), and "low-tier" intermediate-risk patients (≤T2c and iPSA = 10–15 ng/mL with GS ≤ 6 or GS = 7 with iPSA < 10 ng/mL). Patients with low-risk disease and a prostate volume of ≤50 cc (≤40 cc in the first year) were