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CORRELATION OF MULTIPARAMETRIC MRI (MPMRI) WITH PSA IN ASSESSMENT OF RESPONSE TO COMBINED HDR PROSTATE BRACHYTHERAPY AND EXTERNAL BEAM RADIOTHERAPY FOR UPPER TIER INTERMEDIATE AND HIGH-RISK PROSTATE CANCER

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Purpose: mpMRI has been demonstrated to be very useful for staging and surveillance of localized prostate cancer. The PiRads system has been developed for scoring the malignant probability of lesions. We identified the dominant intra-prostatic lesion (DIL) on mpMRI for intermediate- and high-risk prostate cancer before and 15 months after radiation to determine if the PiRads system could be useful in assessing the radiologic response to treatment.
Methods and Materials: From August 2012 to July 2013, 26 patients with predominantly unilateral disease consented to a University Ethics-approved Phase 2 study of selective dose escalation. HDR brachytherapy was performed in weeks 1 and 3 of treatment, each delivering one fraction of 10 Gy to the whole prostate. External beam consisted of 46 Gy/23 fractions starting within one week after the first HDR fraction. Pre-treatment T2 FSE images were obtained using 1.5T endorectal MRI in transverse, sagittal and coronal planes followed by Dynamic Contrast Enhancement after injection of gadolinium. Apparent Diffusion Coefficient maps were calculated. Following image registration, the DIL was transposed to the intra-operative TRUS with source-delivery catheters in place for the purpose of a 25% escalation in dose. At median 15.6 mo (12-18.6) mp MRI was repeated in the 16 patients who did not receive ADT.
Results: Twenty-five out of 26 patients initially had a visible DIL. Mean pre-treatment PiRads score was 4.1 (range 3-5 for region of biopsy-proven disease). Coverage of the DIL was excellent with a median of 97% receiving the planned escalation of 25%. Mean PiRads score in follow up mpMRI in 16 patients at a median of 15 months post-treatment was 2.7. Median PSA was 0.2. Only two MRI's still received a PiRads score of 4 and PSA for these two patients was 1.4 and 1.2; all others were < 0.5 ng/ml. Current PSA is 1.1 and 1.02 for these two patients and biopsies show scattered foci of residual tumour with marked RT effect.
Conclusions: mpMRI using the PiRads classification may be adjunctive to PSA to assess response to radiation. Optimal timing and correlation with biopsy findings needs to be determined in a larger population.

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ACUTE AND LATE TOXICITY IN HIGH-RISK PROSTATE CANCER PATIENTS TREATED WITH ANDROGEN SUPPRESSION AND HYPOFRACTIONATED RADIOTHERAPY (HYPORT) TO THE PROSTATE AND PELVIC NODES

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Purpose: Moderate HypoRT is an acceptable option in the curative treatment of prostate cancer. Among different fractionation regimens, the dose of 60 Gy in 20 fractions was used in prospective randomized trials (PROFIT, CHiiP), mainly for low and intermediate-risk patients where the PTV is only the prostate(+/- seminal vesicle(SV) but not the pelvic nodes. We report here the acute and late toxicity in high-risk prostate cancer patients treated with androgen suppression and HypoRT to the prostate and pelvic nodes with doses of 60 Gy to prostate and 44 Gy to the pelvic nodes given in 20 fractions with a simultaneous integrated boost.
Methods and Materials: Localized high-risk prostate cancer patients (T3, or PSA>20ng/ml, or GS >8) were treated with androgen suppression (6-24 months) started 2-3 months before HypoRT. Radiotherapy was delivered using IMRT with daily IGRT. Constraints for organs at risk were the same of RTOG-0126 corrected with the linear-quadratic model (α/ß=3Gy). A dose of 44 Gy (2.2 Gy/fraction) was delivered to the pelvic nodes and 60 Gy (3 Gy/fraction) to the prostate (+/-SV) with a concomitant boost in 20 fractions (4 weeks). Cone beam CT was used daily to guide the treatment accuracy. Acute and late toxicities were assessed prospectively and scored using the National Cancer Institute Common Terminology Criteria for Adverse Events, version3.0. Biochemical failure was determined using the Phoenix definition.
Results: 105 patients treated between September/2010 and November/2013 were reviewed. Median age, median initial PSA and T stage were 72 years (52-84), PSA=14(1.8-108), T1c = 36 and T3= 22 patients. Median follow up is 35 months (12-61). Acute GI toxicity (%) was as follows: Grade 0 = 38, Grade 1 = 45, Grade 2 = 16 and Grade 3 = 1. Acute GU toxicity(%): Grade 0 = 32, Grade 1 = 50, Grade 2 = 14 and Grade 3 = 3. The worst late GI toxicity(%) was, as follows: Grade 0 = 74 Grade 1 = 19, Grade 2/3 = 7. The worst late GU toxicity(%) was: Grade 0 = 77, Grade 1 = 15, Grade 2/3 = 8. There was no Grade>3 toxicity. At the last follow-up the incidences of grade 2 late GU and GI toxicity were 5% and 3%, respectively (no residual grade >2 toxicity). At this limited follow-up, 13 patients developed biochemical failure at a median time of 27 months with 8 of them showing evidence of metastatic disease. Three patients died so far, and one from prostate cancer.
Conclusion: Androgen suppression with moderate HypoRT IMRT and IGRT to the prostate (60Gy) and pelvic nodes (44Gy) delivered with simultaneous integrated boost in 4 weeks (20 fractions) is feasible and well tolerated. Further follow-up is needed to establish long-term PSA control rates and survival outcomes.

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A POPULATION-BASED STUDY OF RADIATION THERAPY REFERRAL AND TREATMENT PRACTICES POST-PROSTATECTOMY OVER A DECADE (2003-2012)

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Purpose: Adjuvant radiotherapy (ART) post-radical prostatectomy (RP) has been shown to benefit patients with pathologic T3 or margin-positive prostate cancer. Early salvage radiotherapy (SRT) is commonly practiced, but it remains unclear if SRT confers equivalent outcomes to ART. Recent Ontario Practice Guidelines recommend referral to radiation oncology (RO) within six months of RP to discuss ART and SRT. Our objectives were to describe patterns of care over time to (1) assess post-RP referral patterns to RO; (2) describe ART and SRT utilization; and (3) compare time trends before and after seminal trials and guidelines were published, and in doing so, provide indications of access to quality care.
Methods and Materials: This was a retrospective cohort study. Electronic clinic visit and RT treatment records were linked to the population-based Ontario Cancer Registry. The study population included all prostate cancer cases treated with RP in Ontario January 1, 2003 - November 30, 2012. ART was defined as curative RT within six months of RP, and SRT was 6 - 24 months post-RP. Changes in RO referral and RT rates over time were statistically analyzed using the Cochran-Mantel-Haenszel Chi-Square test.
Results: Over the study period, 30,447 prostate cancer patients received RP and 15.2% saw an RO within six months of RP. This proportion doubled between 2003 and 2012 (from 10.7% in 2003-2004 to 21.7% in 2011-2012, $p < 0.001$ for trend). The annual percentage change was largest 2009-2011 (3.4% increase). In comparison, the proportion seen within 24 months of RP remained stable at 32.3% ± 1.4%. Amongst the 4,641 patients seen by an RO within 6 months of RP for consideration of ART or SRT, the proportion receiving ART remained relatively constant at 51.0% ± 3.0%. Commensurate with RO referral trends, there

was a doubling in ART rates amongst all RP cases, ranging from 5.4% in 2003-2004 to 11.0% in 2011-2012 ($p < 0.001$), compared to relatively stable SRT rates of 8.5% ± 0.2% (7.9% in 2003-2004, 8.9% in 2010-2011). Consequently, the total proportion receiving RT within 24 months of RP increased from 14.1% in 2003-2004 to 19.8% in 2010-2011 ($p < 0.0001$).
Conclusions: There was an increase in access to early RO referral post-RP and in ART utilization in Ontario from 2003 to 2012, following publication of key clinical trials and guidelines.

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SURVEYING THE LANDSCAPE: CONGRUENCE OF A PROVINCIAL CANCER AGENCY PATIENT EDUCATION PROGRAM WITH NATIONAL STANDARDS
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Purpose: Patient education interventions are recognized as an essential component of cancer treatment. They improve treatment compliance and decrease anxiety, stress and health care costs. The Canadian Partnership Against Cancer (CPAC) Cancer Patient Education Framework (CEF) recommended that each cancer organization should have an embedded comprehensive cancer patient education program. The CEF defined the essential components of patient education as assessment of learning needs, development of a learning plans, defined delivery methods and evaluation. Unfortunately, many Canadian cancer centres lack identifiable patient education programs, program leadership, and financial resources. In a recent survey, of a provincially coordinated cancer care program, patients identified significant gaps in patient education initiatives. We sought to undertake a provincial review of our current programs, from the perspective of health care providers. By using an established conceptual model from the CEF for interpretation of the results we hoped to identify both strengths and gaps.
Methods and Materials: Between 2013-2015 a multi-phased project was conducted. First, an environmental scan was undertaken to describe current practices in our six provincial cancer centres, associated provincial health agencies and national cancer centres. In the second phase, three focus groups were held. The CEF provided the scaffold for interview question development. In the final phase, themes emerging from the focus groups guided the development and administration of an electronic survey distributed provincially to 254 health care providers (HCP).
Results: The environmental scan confirmed that in comparison to other local, provincial and national health care agencies, there are significant gaps in the existing provincial patient education program. The focus groups identified three major themes of logistical (e.g. methods of educational delivery), intrinsic (e.g. provider knowledge) and extrinsic (e.g. physical space) factors that impacted educational delivery. With respect to the electronic survey, 190/254 HCPs completed it. While 88% of respondents felt teaching was an essential activity, 66% lacked knowledge in effective education techniques. Seventy-two percent of respondents always assessed their patient's capacity for processing information yet only 17% developed individual patient learning plans. 55% of HCPs felt they lacked time and resources. Only 8% of HCPs reported their teaching or programs were evaluated routinely.
Conclusions: By applying the CEF to analyze a current provincial cancer program, strengths and gaps were highlighted. While many HCPs view patient education as critical to clinical care activities, there are deficiencies in assessment of patient needs, development of learning plans, barriers to delivery and little evaluation of outcomes. These results will help strengthen current provincial delivery methods and may be informative for other cancer centres.

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DEVELOPMENT OF A QUALITY AND SAFETY COMPETENCY CURRICULUM FOR RADIATION ONCOLOGY RESIDENCY: AN INTERNATIONAL DELPHI STUDY
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Purpose: The purpose of this study was to develop an entry-to-practice quality and safety competency profile for radiation oncology residents to guide training in this area.
Methods and Materials: A list of 1211 potential quality and safety competency items was compiled from a range of international sources, including quality-related course objectives, competency profiles for radiation therapy and medical physics, and other quality-focused organizations such as the World Health Organization and the Canadian Partnership for Quality Radiotherapy. Items that were redundant or beyond scope were eliminated by investigator consensus, generating a refined list of 105 unique potential competency items. This list was subjected to an international two-round modified Delphi process with experts in radiation oncology, radiation therapy, and medical physics. In the first round, each item was individually scored on a 9-point Likert scale to indicate agreement that an item should be included in the competency profile. Items with a mean score of 7.0-9.0 were included, < 4.0 were excluded, and 4.0-6.9 were refined and rescored in Round 2 for inclusion or exclusion in the competency profile following a web-conference discussion. Items ranked for inclusion by > 75% of Round 2 participants were included in the final competency profile.
Results: Fifteen of the 50 invited experts participated in Round 1: 10 radiation oncologists, four radiation therapists, and one medical physicist from 13 centres in five countries. All 105 items were scored in Round 1, resulting in a mean score of 7.0-9.0 for 80 items, < 4.0 for one item, and 4.0-6.9 for 24 items (intermediate group). Certain categories emerged as more controversial, for example: change management, equipment quality assurance (QA), and human factors. Web conference with five of the participants resulted in nine of the 24 intermediate group items edited for content and/or clarity. In round 2, 12 participants rescored all intermediate group items. Ten items were ranked for inclusion by > 75% of participants and the remaining 14 items excluded. The final 90 enabling competency items were organized into thematic groups consisting of 18 key competencies under headings adapted from Deming's System of Profound Knowledge, specifically: Appreciation for a System (Process, Standardization & Benchmarking, Organizational & Systems Structure, Accessibility, Risk Management), Knowledge of Variation (Incident Management, Patient QA, Equipment QA), Theory of Knowledge (Change Management, Outcomes), Psychology (Human Factors, Quality Culture), and Safety (Radiation Safety, General/Patient Safety).
Conclusions: This quality and safety competency profile may inform minimum training standards for radiation oncology residency programs and assist in CanMEDS2015 implementation. Other relevant professional groups may benefit from the groundwork laid through this process.

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THE APPLICATION OF HUMAN FACTORS AND SYSTEM ENGINEERING IN DETERMINING THE IMPACT OF TECHNOLOGY ON RADIATION THERAPY SAFETY
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Purpose: Radiation oncology is an increasingly complex discipline. As this complexity grows, however, so too does the risk of medical error and patient harm. The interaction of practitioners, environment and technology is the focus of human