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Editorial: Mitina et al Which patients benefit...

Which patients benefit from post-implant CT dosimetry after real-time intraoperative planning for LDR prostate brachytherapy: When can we turn our backs on international consensus guidelines?

In this edition of JMIRO Mitina et al ask the question “Which patients benefit from post-implant CT dosimetry after real-time intraoperative planning for LDR prostate brachytherapy...” The authors performed an audit of their first 34 consecutive patients treated within their institution, having now treated more than 100 patients since their program began in 2008. Based on their observation that none of their patients have required re-implantation as a result of inadequate post-implant dosimetry they question the need for post-implant CT based dose assessment. This is a reasonable question given the additional cost and radiation dose from the CT scan. The audit results confirm a correlation between TRUS and CT prostate volumes, although the D90, V100 and V150 values were lower for their post-implant CT dosimetry study compared with the values derived from the real-time planning study. Their results however, were found to be consistent with those found in the literature and hence, presumably considered satisfactory. The paper therefore concludes that post-implant CT dosimetry is only recommended for difficult cases or where there are concerns regarding the real-time planned dosimetry. So in this editorial we will consider if this report from a single institution has provided sufficient justification for such a radical recommendation that contradicts international recommendations [3, 7, 8].

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We see from the consensus reports (and as acknowledged by the authors) that the purpose of post implant dosimetry is to not only assess the quality of the implant for the individual patient, but to also learn from the experience so that future patients will benefit from the exercise. Davis et al, on behalf of the ABS consensus group, notes “Careful postimplant assessment provides the brachytherapy team with objective measures of implant quality allowing for continual technical improvement” [3]. Indeed, Morris et al [1] describes the steep learning curve during their first 100 patients despite having an “unusual level of standardisation, structured training and educational support” in place prior to patient recruitment. I have seen in my own experience that the skill in driving needles to planned locations develops over time and at a highly variable rate. It is not unusual for individuals, or a team, to gradually change implantation technique, either consciously or unconsciously, with resulting systematic changes in post-implant dosimetry results. In addition, changes in staff occur, and attentions are directed towards introducing “efficiencies” – or “short cuts” to save time. So when is it appropriate to decide, when doing real-time intraoperative planning, that it is no longer necessary to do routine CT post-implant dosimetry? I would say there is no simple answer to this question as it will depend on the skill of the team, the number of patients the team implants each month, the quality of the review at the end of the procedure, and many other factors that might influence the ability to review implant quality at the time of the procedure.

Next we must ask when is the quality of an implant so poor that re-implantation (or some other remedial action) is required? There have been several reports demonstrating that post-implant metrics (eg D90, V100) are dependent on the imaging method(s) employed (eg [5, 9]). Whilst CT based post-implant dosimetry is considered the standard, it is well recognised that defining the prostate volume in the presence of multiple seed artefacts is problematic [5]. Ultrasound imaging is also not ideal; the pre-implant prostate volume under-estimates the post-implant volume, and the post-implant volume is difficult to define due to seed artefacts and poor resolution due to haematoma and oedema [2]. The relationship of the rectum to the prostate may also be distorted with the TRUS probe in place. Mitina et al claim they have consistency in prostate voluming between both (ultrasound and CT) imaging modalities, however this is uncommon [5] and could be a result of bias [1]. Furthermore, the correlation of the commonly used D90 (dose delivered to 90% of the prostate) with clinical outcome is controversial [6], and at best, the value that discriminates between outcome (treatment failure) varies depending on which paper you read. I quote Morris et al [1] “readers are reminded that comparing dose metrics between institutions that share no

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following seed implant.

common experience or training is problematic at best". I would therefore suggest that a 34 patient cohort with minimal follow up is insufficient to be confident that the ultrasound based post-implant review will accurately predict the need for corrective action. Review Fig 1, this patient was referred to my centre for confirmation of local recurrence. On close inspection we can see that the seed distribution in this plane (close to the base) is poor. Poor implants can occur for a variety of reasons but one would hope that this implant had been reviewed before the procedure ended, but if that was the case then it is unclear why the cold spot was not filled in.

Let's now consider the issue of toxicity. We all know that in the low risk group of prostate patients, the majority will achieve biochemical control of their disease [4]. So what (potentially) separates one implant team from another is treatment related toxicity. A number of studies have demonstrated a dose response relationship with urinary and rectal toxicity [3, 10]. Zilli et al., for example, used a real-time planning approach to investigate the effect of introducing a urethral-sparing technique. Lowering the dose to the urethra could potentially lead to underdosing the prostate, hence the need for careful monitoring of implant quality, which these authors did using CT post-implant dosimetry. Using a real-time planning approach allows for the introduction of such techniques, but given the long time-course to treatment failure (see Morris et al, this could be >8 years[1]) use of such techniques should be used with caution. I would argue that this is where any team will benefit from the review of implant quality that will allow for continual technical improvement.

It is important to not forget that the paper we are reviewing has implemented an intraoperative planning technique, unlike the 2-stage process traditionally practiced by most centres. This could well explain the excellent CT post-implant dosimetry results and biochemical control rates achieved in the Mitina et al patient cohort. However, sadly post-implant dosimetry (regardless of imaging or timing) is not a precise science and I would argue that 34 patients is an insufficient number to conclude that adequate experience has been gained to predict treatment failure or adverse toxicity. Furthermore, I would suggest that halting CT based post-implant dosimetry studies after reviewing the first 34 implants is denying the team an opportunity for a more detailed review of their performance after treating many more patients – regrettably at some point a biochemical failure is likely to be observed, or an unexpected toxicity. At that point the team may question the possibility that a systematic change in technique has gradually been introduced which may impact on many more patients down the track. So to answer the question "*Which patients benefit from post-implant CT dosimetry after real-time intraoperative planning for LDR prostate brachytherapy*" – I would say "future patients".

1. Morris WJ, Spadinger I, Keyes M, Hamm J, McKenzie M Pickles T. (2014) Whole prostate D90 and V100: a dose-response analysis of 2000 consecutive (125)I monotherapy patients. *Brachytherapy*, 13. 32-41.
2. Marcu LG Gowda R. (2013) Comparison of 3 different postimplant dosimetry methods following permanent 125I prostate seed brachytherapy. *Med Dosim*, 38. 309-14.
3. Davis BJ, Horwitz EM, Lee WR, Crook JM, Stock RG, Merrick GS, et al. (2012) American Brachytherapy Society consensus guidelines for transrectal ultrasound-guided permanent prostate brachytherapy. *Brachytherapy*, 11. 6-19.
4. Grimm P, Billiet I, Bostwick D, Dicker AP, Frank S, Immerzeel J, et al. (2012) Comparative analysis of prostate-specific antigen free survival outcomes for patients with low, int. & high risk prostate cancer treatment by radical therapy. *BJU Int*, 109 Suppl 1. 22-9.
5. De Brabandere M, Hoskin P, Haustermans K, Van den Heuvel F Siebert FA. (2012) Prostate post-implant dosimetry: interobserver variability in seed localisation, contouring and fusion. *Radiother Oncol*, 104. 192-8.
6. Morris WJ, Halperin R Spadinger I. (2010) Point: the relationship between postimplant dose metrics and biochemical no evidence of disease following low dose rate prostate brachytherapy: is there an elephant in the room? *Brachytherapy*, 9. 289-92; discussion 297-8.
7. Nath R, Bice WS, Butler WM, Chen Z, Meigooni AS, Narayana V, et al. (2009) AAPM recommendations on dose prescription and reporting methods for permanent interstitial brachytherapy for prostate cancer: report of Task Group 137. *Med Phys*, 36. 5310-22.
8. Salembier C, Lavagnini P, Nickers P, Mangili P, Rijnders A, Polo A, et al. (2007) Tumour and target volumes in permanent prostate brachytherapy: a supplement to the ESTRO/EAU/EORTC recommendations on prostate brachytherapy. *Radiother Oncol*, 83. 3-10.
9. Haworth A, Ebert M, St Clair S, Carey BM, Flynn A, Bottomley DM, et al. (2005(I)) Impact of selection of post-implant technique on dosimetry parameters for permanent prostate implants. *Brachytherapy*, 4. 146-53.
10. Lee WR. (2004) Permanent prostate brachytherapy: the significance of postimplant dosimetry. *Rev Urol*, 6 Suppl 4. S49-56.

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