Is there enough evidence to standardise bowel and bladder preparations for patients undergoing external beam radiotherapy for prostate cancer? – A narrative review

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BACKGROUND

Prostate cancer is the most common cancer in men in the UK, >50% of diagnoses being in men over 70, this is set to rise to 69% by 2030 due to the aging population[1].

Treatments: active surveillance, surgery, brachytherapy and external beam radiotherapy (EBRT). 30% will have EBRT as their treatment[2].

EBRT side effects: changes in function of bowel and bladder, including; pain, bleeding, increase frequency, haematuria and incontinence[3].

The ultimate goal is to improve the "therapeutic ratio" - the balance between killing the cancer and harming the healthy cells, achieved by combining IMRT and IGRT[4].

The prostate moves independently to the bony anatomy so a common way to immobilise the prostate is to control the volume of the bladder and rectum – the best method is unknown[5].

AIMS AND OBJECTIVES

- Identify and critically appraise the evidence for the clinical need for bladder/bowel preparation with EBRT for prostate cancer.
- Synthesize and critically engage with current evidence to decide whether it is sufficient to influence a change in practice.
- Identify any potential clinical benefits to introducing bowel and/or bladder preparations into current practice in radiotherapy centres.

METHODS

A narrative review was conducted to review the primary data regarding the title; the evidence was then interpreted and critiqued using the Preferred Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist[6].

Searches used the 'PICO' framework to ensure all relevant studies were found[7]:

- **P**articipants: *Prostate cancer, Prostate carcinoma, Prostate radiotherapy*
- **I**ntervention: *Bowel preparation, Bladder preparation*
- **C**omparison: *Full bladder, Empty bladder, Empty rectum, No preparation*
- **O**utcome: *Set-up error, Toxicity, Dose volume histogram, Control rates*

Once the searches had been conducted, inclusion and exclusion criteria were introduced to filter them.

Inclusion criteria	Exclusion criteria
Papers written in English	Pre-2000
Primary data sources	Editorials
	Duplicated papers

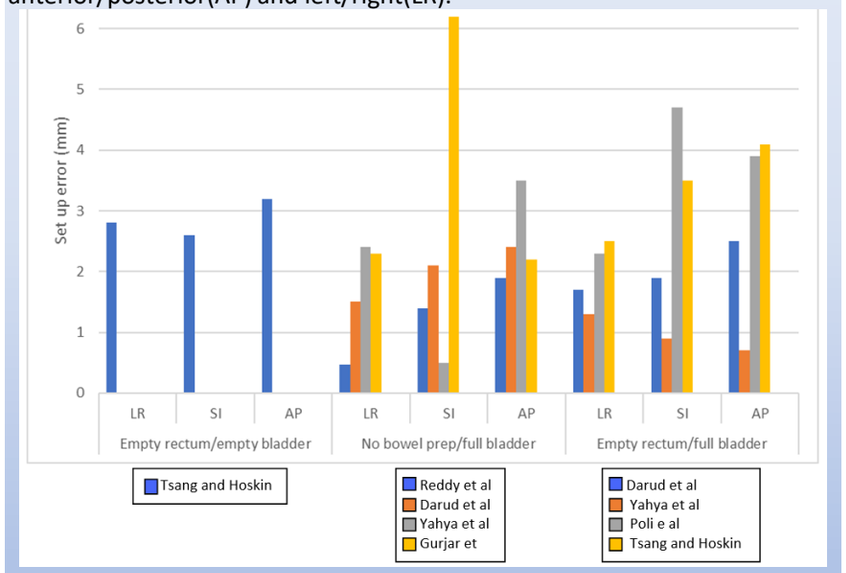
All titles and abstracts were used to assess their relevance to this narrative review and this in turn enabled the right papers to be extracted; the full texts were then assessed. These were critically reviewed to analyse the quality of the data and to draw conclusions on whether there is sufficient data to standardise bowel and/or bladder preparation in current practice.

RESULTS AND DISCUSSION: SET-UP ERRORS

The most common way used to analyse the influence of bowel and bladder status was set-up corrections using IGRT. There were several methods of IGRT used in these studies[8-13].

- **CBCT** - allows for bony match and soft tissue registration[8]. Daily imaging also removes the risk of random error due to gas or bladder variabilities, however, there is additional radiation dose, which depends upon a number of factors; patient size, beam quality, tube output and scanning geometry[14].
- **2DKV** - used with fiducial markers implanted in the prostate then registered with the planning CT, this is a lower additional dose, however the fiducials can migrate which can make the image matching less accurate[9,12].
- **Transabdominal ultrasound** - obtains transverse and sagittal images of the bladder, rectum and prostate, then aligned with the planning CT[8].

Set-up corrections stated throughout the papers are; superior/inferior(SI), anterior/posterior(AP) and left/right(LR).



None of the methods consistently reduced the set up-error, there is no general trend and no direction is larger. This goes against the theory that the AP move is generally larger, as the rectum fills, it moves the prostate anteriorly and as the bladder fills, it pushes the prostate posteriorly, therefore changes in the bowel and bladder volumes will cause set-up errors[13].

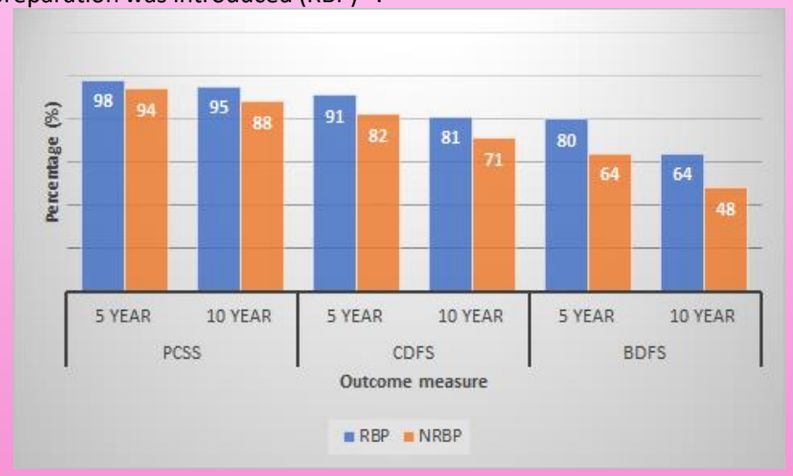
Only 22% of the mean set-up errors were more than 3mm, which is usually allowed for within the CTV-PTV expansion. However as 100% of the set-up errors were not less than 3mm, this highlights the importance of using IGRT to ensure precise radiotherapy.

RESULTS AND DISCUSSION: DISEASE FREE SURVIVAL

The primary goal of radical prostate radiotherapy is to control the tumour; this can be measured using:

- **Prostate Cancer Specific Survival (PCSS):** the percentage of patients in the study that have not died specifically due to prostate cancer in a defined period of time.
- **Clinical Disease-Free Survival (CDFS):** the measure of time after treatment during which no sign of cancer is found.
- **Biochemical Disease-Free Survival BDFS:** the survival time of a person with prostate cancer during which a biochemical marker does not rise or rises very little[15]

Maggio et al used these as endpoints, a retrospective study comparing patient outcomes who were treated before 2003 with no rectal/bladder preparation (NRBP), and those treated after 2003 the year rectal/bladder preparation was introduced (RBP)[16].



Although these results show that having a rectal/bladder protocol is beneficial, the results may be skewed, since only 29.5% of the patients were in the NRBP cohort and 70.5% in the RBP cohort.

Using disease free survival is one of the most appropriate ways to measure the impact of the interventional preparation technique. However, in order to use this as an end point, the follow up time is a minimum of 5 years, compared to using an end point such as set-up errors in which the data is available instantaneously after each fraction.

CONCLUSIONS

This review has reconfirmed that the prostate is a mobile organ and will move independently to the bony anatomy, this movement can be influenced by the volume of the rectum/bladder. However, it is still not clear what method is completely successful at stabilising its location, therefore the main conclusion from this review is that IGRT is essential when treating prostate cancer with EBRT.

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