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One Minute Poster Pitches

Abstract number 1

Outcomes for patients with prostate cancer treated with External beam radiotherapy with High dose rate brachytherapy (HDR) boost at the Dorset Cancer Centre

Aun-Kyaw Sun, Ben Masters
University Hospital Dorset

Purpose: To assess the outcomes including biochemical failure and toxicity for patients treated with HDR boost after setting up the technique at our centre.

Methods: Retrospective analysis of all patients treated with HDR boost with external beam radiotherapy between April 2017 to December 2019
at the Dorset Cancer Centre.

Results: The study included 34 patients, and among them 79% of cases were T3a grades whereas 58% were Gleason 8-10 grading and 47% were PSA >20. The data demonstrated 91% had overall 5 year biochemical free survival and overall survival with only 23% having grade 2+ toxicity.

Conclusion: Our results are comparable to other studies showing that HDR brachytherapy boost is an effective treatment for intermediate and high risk prostate cancer. However it also confirms that it is associated with a higher rate of toxicity than external beam radiotherapy alone.

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2. UK national protocol for high dose rate brachytherapy boost in prostate cancer (Peter Hoskin)

3. RCR Radiotherapy Dose-Fractionation, third edition - prostate cancer

4. UHD Brachytherapy protocol

Abstract number 2

Comparison of pre and post implant LUTS with implant dosimetry to determine cause of increase in post implant complications

Sara Hodkinson, Jennifer Beeby, Ben Medford
Maidstone and Tunbridge Wells NHS Trust

Purpose: An increased number of LDR permanent seed implant brachytherapy patients have been experiencing LUTS beyond the expected levels up to 6 months post-implant. The aim of this data collection was to identify possible causes for this increase in patient issues, looking at catheterisation/re-catheterisation rates, and the interventions needed. We aimed to compare implant statistics against clinical history of patients to highlight possible trends and consistencies that we could then evaluate and implement to improve the service.

Methods: We collated and compared implant statistics against qualitative and quantitative patient information using a database of post-implant dosimetry (including V150 and D90) and clinical history. We then compared hotter V150 and D90 doses against patients who experienced these increased LUTS to establish if this was a potential cause. We looked at pre-implant flowmetry results, and used IPSS scores where available, to build a broader picture of the patient's urinary baseline to facilitate drawing conclusions and to provided a point of comparison for each patient.

Results: Currently, our findings suggest that patients with increased LUTS sometimes had hotter V150s and D90s, with approximately 4% of patients between March 2022 and 2023 having catheterisation post-implant. Pre-implant Q max does not appear to be a considerable factor in this, with a majority of patients requiring re-catheterisation having qmax >20.

Conclusion: This audit is ongoing, but findings so far suggest our audit needs to continue in order to establish other trends. Once more trends have been identified, we can aim to implement changes to the implant procedure.

References:
International Prostate Symptom Score Dosimetry database

Abstract number 3

Development of a commissioning protocol for micro silica bead thermo-luminescent dosimeters (TLDs) for use in high dose rate brachytherapy.

William Hamblyn, Amani Chowdhury, Gerry Lowe, Peter Hoskin
Mount Vernon Cancer Centre, Northwood, UK

Shakardokht Jafari,Nigel Biggs
TrueInvivo, Surrey, UK

Purpose: To develop a commissioning protocol for micro silica bead thermo-luminescent dosimeters (TLDs) for use in high dose rate brachytherapy using an Iridum-192 radioactive source.

Methods: TrueInvivo provided the micro-silica TLDs and read-out services. Calibration involved two templates: 1) 20 TLDs placed 20mm from the central point in a circle and 2) 48 TLDs arranged in 4 spiral arms placed between 10 to 100mm from the centre. A spiral design was selected to prevent shielding from the inner beads. Each template underwent irradiation to 7Gy at 20mm from an Ir-192 source, with a reference calibration performed using a 6MV LINAC.

Results: The results indicate an energy response factor (ERF) of 1.085 ± 0.004 at 20mm from the circular template. For reproducibility, an ERF from the four beads at 20mm on the spiral template was calculated to be 1.07 ± 0.2, demonstrating reasonable agreement between the two template irradiations. The ERFs from the spiral template normalised at 20mm displayed a linear relationship with distance from the source with an even spread of residuals and an R-squared value of 0.97. Beyond 40mm there is good agreement and no noticeable systematic difference between the arms. Below 40mm, on average arms 1 and 2 read 6% higher than arms 3 and 4 at 15mm, 20mm, 25mm, and 30mm. This is potentially attributed to the asymmetry in where the source comes to rest in the inner lumen of the needle. An anomaly at 10mm where arm 4 is 10% higher than arm 2 is likely attributed to the increased sensitivity to bead placement close to the source where the dose gradient is high.

Conclusion: These promising results demonstrate the silica bead's potential for in-vivo use in HDR brachytherapy. Further testing and validation are warranted to develop confidence, particularly in the high gradient region close to the source (<40mm).

Abstract number 4

The impact of needle reconstruction uncertainties on TRUS prostate plan parameters

Jennifer Wilson
Royal Devon University Healthcare NHS Foundation Trust

Purpose: This study aimed to explore the impact of uncertainties in needle reconstruction on trans-rectal ultrasound prostate planning. While an independent plan check, inclusive of needle reconstruction, is standard practice, accurate reconstruction proves challenging due to needle visualisation limitations caused by ultrasound image distortion from the stainless-steel needles, and subtle discrepancies among planners can occur.

Methods: Systematic shifts were applied between needles and contours in 5 previous plans, simulating a worst-case scenario. Shift magnitudes were determined by visual needle position uncertainty assessments, resulting in lateral and ant/post shifts of 1.5mm each, and a 3mm shift in the sup/inf direction. The plans were then recalculated based on these shifted positions and compared with the original treatment plans using clinically relevant parameters.

Results: Lateral needle positioning uncertainties of 1.5mm had least impact on PTV coverage, with a mean reduction in D90 of 1.3±0.7%. The most significant impact on PTV D90 (-1.9±0.7%) resulted from the 3mm shifts in the sup/inf direction. Errors in rectal doses were pronounced when needles were erroneously reconstructed higher than their actual positions, leading to a potential 13% increase in rectal D2cc with a 1.5mm shift in this direction. Urethral doses were less affected, with mean differences in D10 and D30 <1.5% for all shifts, although V150>0 was introduced in some cases.

Conclusion: An independent plan check with a focus on needle reconstruction is essential for gross error detection. Minor uncertainties in lateral and sup/inf needle positioning may not significantly affect PTV coverage or OAR doses, although particular attention should be paid when needles are close to OARs. Incorrectly positioning needles anteriorly may elevate rectal doses and should be a focus for checking. During planning, leaving space between isodoses and critical structures can mitigate overlap risks stemming from reconstruction uncertainty.

Abstract number 5

RTT-led follow-up using patient-reported outcome measures following HDR-brachytherapy for prostate cancer

Sarah Stead, Lauren Oliver, Richard Walshaw, Chinnamani Eswar, Isabel Syndikus, R Hunter
The Clatterbridge Cancer Centre

Purpose: High dose rate (HDR) brachytherapy is an important treatment for patients with prostate cancer. Limited data are available using patient reported outcome measures (PROMs) which may provide a robust measure of longterm toxicity compared to clinician-reported outcomes (1,2). We aimed to profile late effects using PROMs to enable us to better inform patients prior to treatment of potential outcomes.

Methods: Retrospectively-identified patients who had received HDR brachytherapy in the last 6-36 months were sent a paper questionnaire containing validated PROMs tools (IIEF-5, IPSS and ALERT-B) and questions on lifestyle factors.

Results: 28 patients (62%) returned questionnaires. Mean age was 67 years (50-78), median follow-up was 28 months (11-47). 21 (75%) had T3 disease, 18 (64%) Gleason 8. 18 (64%) of patients received androgen deprivation therapy (ADT) for 2 years, (20) 71% received EBRT after brachytherapy. Of those who received primary treatment, 20/24 (83%) had no biochemical recurrence.
Post treatment, 17 (61%), 8 (29%) and 3 (11%) experienced mild, moderate and severe urinary toxicity, respectively. 21 (75%) reported mild or no bowel symptoms. 19 (68%) reported significant erectile dysfunction, of whom 12 were still undergoing ADT.
There was no correlation between toxicity and caffeine/alcohol intake or smoking.

Conclusion: Longterm toxicity as assessed by PROMs was acceptable. A significant proportion of patients did not return the questionnaire. We are now undertaking a prospective project using electronically-gathered PROMs longitudinally. This may improve return rates, and provide a clearer picture of how toxicity evolves over time.
Radiation therapists (RTT) can play an important role in identifying toxicities of radiotherapy (3-7). This study will also pilot extending their role in long term follow-up after brachytherapy. Patients with significant symptoms using predefined criteria will be triaged by brachytherapy RTTs to start additional management/refer to other health care professionals as appropriate.

References:

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4. Verma R, Treasure P & Hughes R. Development and evaluation of radiographer led telephone follow up following radical radiotherapy to the prostate. A report of a Macmillan Cancer Support Sponsored Pilot project at Mount Vernon Hospital. Radiography. 2015 Feb;21(1):16-24. doi: 10.1016/j.radi.2014.05.003

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Abstract number 6

Development of a self TWOC service for out Brachytherapy service.

Claire Johnson, Alice Gamble
Maidstone Hospital, Kent Oncology Centre

Purpose: To develop a service where patients can safely remove their catheter at home, negating the need for them to travel back to the hospital, the day after their surgery and G&A. The catchment area of this hospital covers 4 counties Kent, East Sussex, Essex and Surrey (patient choice) and it is quite common for patients to travel in excess of 90 miles (round-trip) to attend for Brachytherapy. Along with the impact of patients having to find an escort for another day, we felt we should look at our service and attempt to make the patient experience better.

Methods: We Reviewed documents kindly provided to us by Royal Surrey County Hospital NHS trust that they use for their post TWOC RALP patients, and discussed within the team if this was something we could adapt for our Brachytherapy patients.
From here we developed the documentation and started a trial of patients, patients were chosen based on distance from Brachytherapy centre, colour of urine post-Surgery and patient choice.

Results: Reflecting of the data collected from our trial group, the patients seemed to be happy with this service.

Conclusion: We will be adopting this as our normal process after all final draft documents are approved by all bodies involved.

References: Documents adapted from Royal Surrey County Hospital, Figures from these websites: Bard care and myflexicare. full link disclosed in documentation.

Abstract number 7

A Quality Improvement Project for prescribing for local anaesthetic trans-perineal prostate biopsies: outcomes from 944 patients.

Tomas Austin, Joshuah Hill, Sean Pellow, Sally Deverill, Matt Crockett, Dominic Hodgson
Portsmouth Hospitals University NHS trust

Purpose: Trans-perineal biopsy (TPB) for prostate cancer diagnosis is a very common local anaesthetic, outpatient procedure, but has potential significant complications of the development of urinary retention and infection. There is uncertainty as to whether the use of alpha-blocking drugs and/ or antibiotics can reduce such risks. We have routinely performed local anaesthetic trans-perineal prostate biopsies since 2019 having previously limited these to general anaesthetic day case procedures when an alpha blocker and prophylactic antibiotics were administered. We repeated this approach (using Tamsulosin 400mcg O.D. for a week, and Ciprofloxacin 500mg for two doses) until 2020 when an audit of our outcomes identified a low incidence (0.7%) of infection, and we stopped routinely prescribing anti-biotics. In 2023 we established, again through audit, a low incidence of retention in our men (0.3%), and so, similarly, ceased routinely prescribing Tamsulosin. This current study, then, compares the incidence of infection and retention within these three cohorts.

Methods: A retrospective audit of 944 biopsies was performed, assessing the post procedure incidence of urinary retention and infection complications.

Results: A total of 252 patients received both Tamsulosin and Ciprofloxacin with an incidence of 0.7% (2 patients) of infection and 0.7% (2 patients) of urinary retention.
A total of 343 patients then received Tamsulosin only as prophylaxis with an incidence of 0.8% (3 patients) of infection and 2% (7 patients) of urinary retention. Out of these seven patients who developed urinary retention six were already taking tamsulosin at the time of their biopsy.
Of the 349 patients who received no prophylaxis an incidence of 0.2% (1 patient) of infection and 0.5% (2 patients) of urinary retention.

Conclusion: Neither prophylactic antibiotics or an alpha-blocker seem to decrease the risk of developing post-procedure infections and retention following local anaesthetic trans-perineal prostate biopsy and their routine use may not be necessary.

Abstract number 8

A 3D Printed Phantom for Training in Ultrasound Guided Prostate Brachytherapy

Siobhan Gorman
Glan Clwyd Hospital

Sreelish Kariyarambath
Poole Hospital

Peter Gribbin

Purpose: We have produced a phantom for training in transrectal ultrasound guided HDR and LDR prostate brachytherapy. It is low-cost and more environmentally friendly than existing commercial options because it is almost entirely reusable.

Methods: After outlining the concept and defining the requirements of the phantom, a design engineer produced several iterations of the device. Each version improved upon the last based upon testing. This iterative process was enabled by 3D printing.

Results: We have produced a low-cost phantom which is comprised of 3D printed components, a prostate shaped agar jelly and off the shelf parts. The prostate jelly is formed by the user in advance using a 3D printed mould, this is then disposed of at the end of the training session. The prostate and urethra (made of silicone tubing) can be clearly seen on ultrasound imaging for contouring in the planning system. The phantom has proven successful as a treatment planning training aid. It can be used to simulate the planning process end-to-end so it is preferable to using stored images. A further accessory is a fixture for the needle grid for reproducible positioning.

Conclusion: We have found the 3D printed phantom to be useful as a training aid in treatment planning for prostate brachytherapy whilst avoiding the prohibitive cost of alternative options.

Abstract number 9

Environmental Sustainability in Brachytherapy: A UK study

Gerry Lowe, Amanda Tate, Priya Narga-Martin
Mount Vernon Cancer Centre

Purpose: Following a poster presented at the 2021 UK & Ireland Prostate Brachytherapy UsersGroup meeting an informal working group was established to estimate the carbon footprint of brachytherapy.

Methods: Twelve centres participated; data have so far been received from eight. Four clinical brachytherapy pathways were considered, with a suggested sample size of ten patients per centre per pathway:

- Prostate LDR;
- Prostate HDR;
- Cervix HDR;
- Vaginal vault HDR.

Categories of data collected:

- Power consumption by equipment, theatres, and wards;
- Anaesthetic gases and equipment;
- Consumables;
- Waste processing, and packaging used to deliver sources;
- 'Embedded carbon' in sources;
- Patient travel.

Results: Major carbon footprint factors per patient include time spent on wards and in theatre (52 and 34 kgCO2e respectively) and patient travel (38 kgCO2e). Other power consumption contributes 13 kgCO2e, and single-centre data showed a small contribution of 4 kgCO2e from consumables. Differences between procedures arise due to different levels of inpatient care: multi-fraction cervix treatments require theatre and ward time which increases their footprint compared to outpatient vault treatments (191 vs. 42 kgCO2e).

There are significant uncertainties in these figures, and differences between centres. The power consumption contribution (theatre, wards and equipment) for LDR prostate at centre 1, with ward stays of 12-24 hours, is 54 kgCO2e, compared to 35 kgCO2e for centre 2 where patients are admitted as day cases.

Conclusion: The total footprint is similar to that measured for external beam treatments by a UK study [1]; however, whereas for EBRT it is patient travel that dominates, in the case of inpatient brachytherapy, theatre and ward times are also significant.

This study is a baseline against which further work can be done to refine the data, and consider how best to reduce the carbon emitted in future.

References:

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Abstract number 10

MRI registration with the Transrectal ultrasound in LDR Prostate Brachytherapy

Prabakar Sukumar, Helen Winter
Oxford University Hospitals

Purpose: The standard MR imaging in prostate cancer provides the staging and prognostic information. Here in Oxford, we utilise diagnostic MR to estimate the number of seeds required by preplanning. To aid contouring during the implant procedure we need to register the MR with the Transrectal ultrasound (TRUS). In this paper, we studied three MR-US registration methods using the Variseed treatment planning system: (1) Manual registration without reformat (MR); (2) reformatted manual registration (MRWR); (3) Reformatted template registration (TR).

Methods: Eighteen prostate cancer patients who had diagnostic MR images available were retrospectively included in this study. Prostate volumes were contoured on the T2 axial MR images by the oncologists. MR images were reformatted using the Varian Variseed 9.0.1 Reformat option. The images were rotated along the rectal axis and resliced to a thickness of 5 mm. The template grid was aligned symmetrically with the bottom grid matched with the posterior prostate, and the base of the prostate was defined. MR images with reformat (MRWR) and without reformat (MR) were manually registered with the TRUS images. Another set of MR images with reformat was imported based on the template registration (TR). The difference in volume, Dice coefficient, and centroid shift between the TRUS prostate volume and the MR image volume were calculated.

Results: The Dice coefficients of the three registration methods (MR, MRWR and TR) were 0.83±0.05, 0.84±0.03 and 0.72±0.11, respectively. The centroid shifts between the TRUS and MR contours were 0.24±0.16 mm, 0.22±0.09 mm and 0.65±0.34 mm, respectively. The average volume differences were 2.5±3.0 cc, -0.21±5.6 cc and 2.24±5.4 cc. The volume change appears to be significant with MR and TR.

Conclusion: Reformatted manually registered (MRWR) images have higher Dice values with smaller deviations and lower centroid shifts than the other two registration methods. Template registration (TR) needs to be investigated to identify the reformatting process that can be utilized in the planning process.

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Abstract number 11

Comparative analysis of pre-operative LDR Treatment Planning based on MRI and US prostate volume studies

Inna O'Hea, Wojciech Polak, Sarah Wilby, Harry Gibbard
Portsmouth Hospitals University NHS trust

Purpose: The primary objective of this study is to investigate the variability in prostate volume studies obtained through magnetic resonance imaging (MRI) and transrectal ultrasound examination (TRUS), specifically in the context of pre-treatment LDR brachytherapy planning and to explore the feasibility of replacing US volume studies with MRI.

Methods: Data of 10 patients was collected retrospectively, involving measurements from both MRI and TRUS scans. Prostate volumes were calculated using the ellipsoid formulae. The study compares the two imaging techniques by assessing their impact on seed orders and implant dosimetry. Statistical analyses were performed to determine any significant differences.

Results: ANOVA single factor test shows ($p=0.612$, $F(test)= 0.5 < F(crit) = 3.354$) that there is statistically no significant difference between clinical volumes obtained on US scanner during LDR treatment and pre-operational MRI volumes. Two sets of pre-operative treatment plans were created based on these volumes to analyse implant dosimetry, which demonstrated that the dosimetric planning criteria can be met for seeds arrangements based on pre-operative MRI volume study.

Conclusion: MRI volume study can be used in general clinical practice for provisional LDR brachytherapy planning. Transitioning to MRI-based volume assessment is expected to enhance time efficiency and cost-effectiveness for the procedure.

Abstract number 12

Development of a Prostate Tissue Mimicking Material and Reusable Phantom for MRI Biopsy and Brachytherapy

Sarah Wilby, Antony Palmer, Wojciech Polak
Portsmouth Hospitals University NHS trust

Andrea Bucchi, Petko Petkov
University of Portsmouth

Purpose: Develop and test, a novel reusable phantom for simulation of MRI-guided prostate biopsy and brachytherapy.

1) Evaluate MRI and mechanical properties of a novel prostate tissue mimicking material (PTMM).
2) Construct a reusable prostate phantom (PROM) for brachytherapy or biopsy.

Method: MRI evaluation of PTMMs to determine relaxation times for gels containing 0 to 0.6 ml of Gadovist and 0 to 6 g of Konjac powder (per 100 ml final product).

Mechanical measurement of force needed for needle insertion into PTMMs, whilst moving at a constant 8mm/s, for PTMMs containing 2 to 12 g Konjac. Calculation of Youngs Modulus (EM) at 10% strain.

Needle-tissue interaction plots, of Force vs Distance through the PROM phantom, were generated.

Results: Imaging: T1 increased (250 to 1725 mS) and T2 reduced (300 to 30 mS) as Gadovist was increased from 0 to 0.6 ml/100 ml, incorporating typical T1 / T2 times for prostate [1]. With ≥ 0.2 ml of Gadovist present, the quantity of Konjac has no effect on relaxation times.

A key feature of the PROM phantom is the refillable soft silicon prostate shell abutting a full or empty bladder, to simulate a fixed or mobile prostate respectively.

Live MRI biopsy showed ≤ 1.5 cm and ≤ 0.36 cm of prostate displacement in the superior and anterior directions respectively, in line with clinical data [2].

Mechanical: At 30 mm insertion distance, force on the needle was 0.05 N and 1.5 N, with 2 and 12 g of Konjac respectively. EM increased from 5 to 53 kPa (2 and 12 g Konjac respectively). Plots of force versus distance through the PROM phantom showed detectable anatomical boundaries.

Conclusions: Gadovist and Konjac within the PTMM allow augmentation of mechanical properties whilst maintaining MR characteristics. The PTMM can be used within the PROM phantom for repeated biopsy / brachytherapy training.

References:

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Abstract number 13

Possibility of salvage re-irradiation of perineal prostate cancer nodule following prostate low dose rate brachytherapy (LDR-BT).

Mark Long
Royal Surrey County Hospital

Purpose: To address the technical challenges of retreatment of prostate/pelvic relapse following previous radiotherapy (including brachytherapy). A specific case study demonstrating this process is highlighted: SABR following prostate LDR-BT for a 62-year-old gentleman who was originally treated in 2016 with LDR-BT, 145Gy to whole prostate using I-125 seeds.

Methods: The patient was offered salvage SABR 30Gy in 5 fractions on alternate days. Radiobiological calculations were used to derive bespoke planning aims for the urethral planning organ-at-risk volume (PRV) in the region of treatment overlap near the I-125 seeds.
Due to the time since the previous treatment a tissue recovery factor of 20% was used, and alpha/beta ratio of 3 was taken for the urethral tissue. The planning CT was acquired with an indwelling catheter to maximise accuracy of daily image guided radiotherapy (IGRT) thus limiting urethral dose and ensuring cumulative dose estimates remain accurate through the course of treatment.

Results: A clinically acceptable plan was generated that met the required constraints to maximise dose to the surrounding target and minimise potential urethral complications. The high dose region was highly conformal around the PRV whilst maintaining high dose SABR coverage to the remaining target with maximum doses of >125% achieved, even in this unusual case of re-irradiation following permanent brachytherapy implant.

Conclusions: At 3 months post-SABR, the patient experienced no acute toxicity and his PSA has reduced from 7.4 to 5.7 microg/L. The importance of a multi-disciplinary approach was highlighted and the possibility of salvage radiotherapy to the prostate after brachytherapy remains a suitable option.

Abstract number 14

An analysis of LDR prostate brachytherapy outcomes in a single centre over 18 years

Bowen J, Mirza S, Al-Eryani K, Berman B, O'Hea I, Hodgson D
Portsmouth Hospitals University NHS trust

Purpose: Low dose rate (LDR) brachytherapy is a well-established treatment option for prostate cancer in appropriate patients. Our local service started in 2005. We present a review of our outcomes since.

Methods: We performed a single-centre retrospective analysis of all 310 patients who underwent prostate brachytherapy between 2005 and 2023. Total population analysis assessed trends in patient demographics, Gleason grade at diagnosis and D90 dosimetry calculated on a CT scan approximately a month after implant.
Subset analysis was performed on 125 patients who underwent brachytherapy between 2005 and 2013 (before our target D90 dose increased from >135Gy to >140Gy), to assess the correlation between dosimetry and oncological outcomes.

Results: Analysis demonstrated a higher proportion of ISUP (International Society of Urological Pathology) group 2 and 3 disease, rather than group 1, in recent years. D90 dosimetry has also increased over the course of our service.
Post implant dosimetry ranged from 56.88 to 214 with a median dose of 149.9. Follow-up duration ranged from 1 to 19 years.
In our subset analysis, we know that at least 22 of 125 patients (16.8%) required further prostate cancer treatment. Hormone therapy was given to 16 patients (13%) and chemotherapy to 5 (4%). Overall mortality rate was 23%, with 6% related to prostate cancer.

Conclusion: The increased Gleason grade of our population is an interesting finding and may represent a conscious shift away from over-treatment of men with low-risk prostate cancer. Our subset analysis has indicated a significant proportion of patients going on to require further treatment and our next step will be to extend our review to assess whether this holds true for those patients treated since 2013.

Proffered Presentations

Abstract number 15

Can low dose rate brachytherapy be considered a treatment option for patients with prostate cancer with intermediate or high risk features?

Rebecca Morgan, Patrick Isola, Susannah Brock, Ben Masters
Poole General Hospital

Purpose: Not all patients are suitable for external beam radiotherapy or surgery. This retrospective analysis aimed to see whether patients with one or more intermediate or high risk features (IHRF) could still respond well to low dose rate (LDR) brachytherapy.

Methods: We reviewed 63 patients treated with LDR brachytherapy between 02/06/2011 and 21/12/2017, all with at least one IHRF (stage T3a prostate cancer, Gleason Score (GS) 7 (4+3) or PSA >15). 3 were excluded as they had died of unrelated conditions. The ages of patients ranged from 52-83 years. Of the 60 included patients, 7 had stage T3a and the remainder had stage T1c-T2c. 1 had GS of 6 (3+3), 9 had GS 7 (3+4), 47 had GS 7 (4+3) and 3 had GS 8. 9 patients had a PSA >15. 4 patients had 2 IHRFs and 1 had 3 IHRFs.

Results: 83% (50/60) showed no evidence of PSA relapse at 5 years.
Of the 10 patients that relapsed, 1 had 3 IHRFs, 2 had 2 IHRFs and 6 had 1 IHRF. The mean number of months to relapse was 44 (SD 34).
The average PSA at the start of treatment was 12.91 in the relapse group compared to 9.19 in those who did not relapse. Of the 10 patients that relapsed, 90% had a GS 7 (4+3), whereas 78% of the total patients in this study had a GS of 7 (4+3).

Conclusion: Our findings suggest that LDR brachytherapy can be considered a treatment option for patients with prostate cancer with certain intermediate or high-risk features. This may be particularly useful for patients unsuitable for surgery or external beam radiotherapy. However, a larger study would be needed to confirm these findings.

Abstract number 16

QOL outcomes in patients receiving Low dose rate brachytherapy boost with EBRT for unfavorable intermediate and high risk prostate cancer: A single institution experience

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Purpose: This retrospective study aims to evaluate the genitourinary (GU), gastrointestinal (GI) morbidity and sexual dysfunction for men diagnosed with unfavorable intermediate and high risk prostate patients who received combination EBRT and Brachytherapy Boost at our institution in the past 10 years.

Methods: We performed chart review on all patients treated with EBRT and BT combined treatment between 2013 and 2023. Patients with unfavorable intermediate and high risk prostate cancer were offered BT boost with or without Androgen Deprivation Therapy. EBRT was prescribed to 46 Gy and BT boost using I125 were prescribed to 110Gy, 1 to 4 weeks after EBRT. The technique for EBRT were 3D Conformal and at a later stage VMAT.
Prior to the initiation of the treatment, patients underwent pre-treatment assessments, during which baseline data on quality of life symptoms were recorded.
Clinical follow-ups were conducted at weekly intervals during the EBRT sessions, and additional assessments were performed 1 month, 6 months, and then annually after the brachytherapy boost. Modified LENT-SOMA scale was used as criteria for G3 genitourinary (GU) and gastrointestinal (GI) morbidity, along with specific information on urinary incontinence, catheter use, and erectile function that were identified.

Results: 57 male participants with a median age of 66 were treated with BT Boost of which 50 received ADT for at least 1 year duration. The median follow-up duration was 2 years (ranging from 6 months to 5 years).
The overall incidence of grade 3 and above urinary tract and gastrointestinal symptoms during any point in the follow-ups were 1.7% and 1.7% respectively.
Concerning sexual function, a substantial decline compared to baseline occurred in 12 patients, representing 21% of the study cohort.

Conclusion: Our study demonstrated lower occurrences of grade 3 genitourinary (GU), gastrointestinal (GI), and sexual toxicities in comparison to randomized international trials.

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Abstract number 17

Analysis of Survival Following Low-Dose Rate Brachytherapy Boost for Prostate Cancer at the Royal Surrey Hospital: A Comparison with the Androgen Suppression Combined with Elective Nodal and Dose Escalated Radiation Therapy (ASCENDE-RT) Trial

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Purpose: Comparing dose-escalated external beam boost (DE-EBRT) with low-dose-rate brachytherapy boost (LDR-BB), and at a median follow-up of 10 years, ASCENDE-RT published its updated results on time to progression (TTP) and survival endpoints in 2022, showing a clear TTP benefit of LDR-BB over DE-EBRT (10-year Kaplan-Meier TTP estimates of 85% and 67%, respectively). Our study aimed to evaluate LDR-BB outcomes in a high-volume prostate brachytherapy centre in comparison to ASCENDE-RT LDR-BB arm, and additionally compare our outcomes between the eras of two-stage (2S) and one-stage real-time intra-operative planning (4D) brachytherapy techniques.

Methods: Using our prospectively collected patient database, a detailed analysis of patients treated at the Royal Surrey Hospital with LDR-BB was conducted. Patients selected for analysis must have received androgen deprivation therapy (ADT) and external beam radiotherapy with a brachytherapy boost and had an implant date recorded. Relapse was defined as having annotation on the database, with dates, for clinical progression, withdrawal due to receiving treatment other than brachytherapy, salvage therapy, or evidence of biochemical failure, using the Phoenix definition (nadir PSA + 2 ng/mL), when a patient has a baseline and at least 3 PSA follow-up values.

Results: In our hospital, 734 patients received LDR-BB (40% with intermediate-risk and 60% with high-risk disease) 126 from 1999 to 2008 with 2S and 608 from 2009 to 2023 with 4D techniques. The 10-year relapse-free survival (RFS) rates were 94% for 4D and 81% for 2S ($p<0.0001$), compared to ASCENDE-RT's 85%. Ten-year OS was 93% for 4D and 87% for 2S ($p=0.00088$), versus ASCENDE-RT's 80%. Ten-year prostate cancer-specific survival (PCSS) rates were 97% and 93%, for 4D and 2S, respectively ($p=0.0027$), compared to 95% in ASCENDE-RT.

Conclusion: Our study showcases favourable 10-year survival outcomes compared to ASCENDE-RT, with superior RFS, OS and PCSS observed in the 4D era compared to 2S.

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Abstract number 18

HDR brachytherapy boost in Gleason 9-10 prostate cancer

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Purpose: A retrospective cohort study performed by Kishan et al [1] demonstrated that in Gleason 9-10 prostate cancer, the use of a brachytherapy boost (HDRB) led to better outcomes than either surgery or external beam radiotherapy (EBRT) alone. We completed an audit of Gleason 9-10 prostate cancer treated at United Lincolnshire Hospitals NHS Trust to assess outcomes from patients treated with HDRB versus EBRT at our centre.

Methods: A dataset of 4254 patients receiving prostate radiotherapy at ULH between 2004 and 2023 was used. From this we selected patients with Gleason 9-10 prostate cancer, staged as T1-4 N0 M0 treated with radical radiotherapy between 2009 and 2018. This included patients treated with EBRT and HDRB.

Results: 40 HDRB patients and 105 EBRT patients meeting inclusion criteria were identified. The median age was for the HDRB and EBRT cohorts was 69.5 and 75.0 years respectively. PSA readings were higher in the EBRT cohort (50% measuring over 20, versus 28% in the HDR cohort). The majority of patients treated had T3 disease (65% in the HDR cohort versus 61% in the EBRT cohort). The Gleason scores (whether 4+5, 5+4 or 5+5) were similar between the two cohorts. A higher proportion of patients were alive and disease free in the HDR cohort (58% versus 36% in the EBRT cohort). In the EBRT cohort there was a higher proportion of deaths from causes other than prostate cancer (30% versus 10% in the HDR cohort).

Conclusion: Our local practice shows that patients treated with an HDRB are more likely to be alive and disease free. Increased deaths from causes other than prostate cancer in patients treated with EBRT alone reflect the older age and increased comorbidities of these patients. Whilst outcome metrics are not equivalent, a similar trend towards better results seems to match published evidence.

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Abstract number 19

High dose-rate salvage brachytherapy in prostate cancer with isolated seminal vesicle relapse

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Purpose: To evaluate biochemical control rates after high dose-rate (HDR) salvage brachytherapy in patients with isolated seminal vesicle (SV) recurrence.

Methods: A single-institution retrospective analysis (2013-2023) of patients undergoing salvage HDR brachytherapy for prostate cancer with isolated seminal vesicle relapse was conducted. Toxicity was graded using the Radiation Therapy Oncology Group (RTOG) criteria. Recurrence after salvage was defined as PSA 2.0ug/L above nadir or radiological evidence of disease.

Results: Between 2013-2023, 134 patients underwent salvage brachytherapy for locally recurrent prostate cancer. Of these, 16 cases had an isolated SV relapse. Prior primary treatment included: external beam radiotherapy (4), low-dose-rate seed brachytherapy (8), high intensity focused ultrasound (1), prostatectomy and prostate bed radiotherapy (1) and HDR brachytherapy (1). The median time to biochemical failure from initial treatment was 72 months.
Median PSA at time of salvage brachytherapy was 4.34ug/L. In 15 cases a single 19Gy dose was delivered; the remaining patient received 26Gy in 2 fractions using a single implant procedure. The clinical target volume (CTV) ranged from 3.4-20.12cc and planning target volume (PTV) 9.8 - 37.3cc. The median follow-up was 29 months (range 1-88 months) and the median relapse-free interval was 38.5 months (range 6 months - not reached). The median time to PSA nadir after salvage brachytherapy was 10.5 months (range 3-16 months). 9 cases were found to have subsequent disease relapse: local (5 cases), regional (3 cases) and distant (1 case). Among the 5 cases with local relapse, 2 recurred within the prostate, 2 within the re-treatment volume and 1 relapsed within the seminal vesicle outside of the re-treatment volume. Late grade 3 side effects were experienced in 4 patients (3 patients developed a urethral stricture; 1 patient required a trans-urethral resection of the prostate).

Conclusion: Isolated SV recurrence is uncommon and can be salvaged successfully with HDR brachytherapy with minimal toxicity.

Abstract number 20

Reirradiation Options for Previously Irradiated Prostate cancer (RO-PIP): Feasibility Study Investigating Toxicity Outcomes Following Reirradiation with Stereotactic Body Radiotherapy (SBRT) vs. High Dose-Rate Brachytherapy (HDR-BT)

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Purpose: Radiotherapy is the most common curative treatment for non-metastatic prostate cancer, however up to 13% of patients will develop local recurrence within 10 years. Systematic review shows that high dose rate brachytherapy (HDR-BT) and stereotactic body radiotherapy (SBRT) have the best outcomes in terms of biochemical control and side effects. The RO-PIP trial aims to determine the feasibility of recruitment to a trial randomising patients to salvage HDR-BT or SBRT and provide prospective data on patient recorded toxicity outcomes that will inform a future phase III trial.

Methods: This study was approved by the Yorkshire and the Humber - Bradford Leeds Research Ethics Committee (Reference: 21/YH/0305) (1). The primary endpoint of the RO-PIP feasibility study is to evaluate the patient recruitment potential over 2 years to a trial randomising to either SBRT or HDR-BT for patients who develop local recurrence of prostate cancer following previous radiation therapy. The aim is to recruit 60 patients across 3 sites over 2 years and randomise 1:1 to SBRT or HDR-BT. Secondary objectives include recording clinician and patient reported outcome measures (PROMs) to evaluate treatment-related toxicity. In addition, the study aims to identify potential imaging, genomic and proteomic biomarkers that are predictive of toxicity and outcome based on hypoxia status, a prognostic marker of prostate cancer.

Results: To date, out of 16 screened patients 8 patients have been recruited to the trial, 5 randomised to HDR-BT and 3 to SBRT. Out of the patients not recruited, 2 were not suitable for HDR-BT (1 high risk for deep vein thrombosis and 1 unfit for general anaesthetic), 5 awaiting further investigations and one did not meet inclusion criteria for biochemical recurrence.

Conclusion: The RO-PIP study will provide data on PROMs and toxicity outcomes that will inform a future phase III trial evaluating salvage prostate radiotherapy options.

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Abstract number 21

Using ProKnow to set up an inter Trust database of post implant dosimetry for prostate iodine-125 implants.

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Purpose: An inter-Trust collection of post implant LDR brachytherapy prostate patients has been set up in ProKnow to:
(i) Assess how dosimetry across multiple centres compares against RCR minimum guidelines [1].
(ii) Acquire insights into how different techniques could affect dosimetry.
(iii) Evaluate ProKnow for reporting post implant dosimetry.

Methods: Participating Trusts within NHS England exported post-implant DICOM data from their treatment planning system (TPS) to an organisation collection in ProKnow where the data is effectively anonymised. Patients were implanted in 2023 and prescribed 145 Gy.
A dosimetric scorecard was attached to the collection based on RCR minimum guidelines, including D90% prostate > 130.5 Gy and D2cc rectum < 145 Gy [1].
Additional implant information was acquired using custom metrics and a questionnaire.
ProKnow uses the dose cube to recalculate dose-volume parameters. Centres compared calculated parameters in ProKnow and their TPS for a minimum of 10 patients.

Results: There are 340 patients in the ProKnow collection from eight Trusts. Data collection is ongoing.
95% received D90% prostate > 130.5 Gy and 91% received D2cc rectum < 145 Gy. Mean values were 164 ± 18 Gy for D90% prostate and 108 ± 29 Gy for D2cc rectum.
Between Trusts the mean D90% prostate varied from 153 Gy to 177 Gy and the mean D2cc rectum varied from 88 Gy to 130 Gy.
Mean differences between ProKnow and TPS calculations of D90% prostate ranged from -2.8% to 4.5% depending on Trust and TPS system.

Conclusion: The tools in Proknow enable individual Trusts to compare their LDR prostate post implant results and discuss/investigate results locally. At least 90% patients met the RCR minimum requirements. The data collected would be useful to new centres starting LDR.

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Abstract number 22

Commissioning for HDR prostate Brachytherapy: Early Clinical Experience

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Purpose: To outline the comprehensive commissioning process for High Dose Rate (HDR) prostate brachytherapy and present our early clinical experience. At Guy's and St Thomas', we implemented a CT and MR based HDR prostate treatment technique by inserting catheters into the prostate using ultrasound guidance [1]. This method involves CT and MR scans, image fusion, planning and treatment delivery. A final verification CT is taken before the patient is treated to check for catheter displacement.

Methods: An anthropomorphic phantom was used to ascertain the most efficient treatment planning pathway in Oncentra (V4.6), including optimal catheter reconstruction, inverse planning algorithm class solution [2] and fusion technique. Dosimetry verification measurements were performed in a mini water phantom fitted with an in-house manufactured jig that allowed mimicking an interstitial prostate HDR treatment delivery whilst measuring with two different detectors, namely a PTW pinpoint chamber and TLDs.

Results: The commissioning process confirmed a good agreement between the calculated dose on the TPS against the measurements taken with the water tank. The results showed the favourable detector to verify the TPS dose were using TLDs, as a result of an energy dependence on the ionisation chamber. The anthropomorphic phantom was successfully utilised to design a complete pathway to deliver accurate and safe treatment in an optimal timeframe. Since the service has gone clinical, we have successfully treated 3 patients.

Conclusion: Our HDR prostate BT commissioning followed a well streamlined process providing an efficient, effective and robust foundation for the implementation of this treatment modality in clinical practice. Our early clinical experience suggests that HDR prostate brachytherapy is an effective option for prostate cancer patients, with favourable treatment outcomes.

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Abstract number 23

MRI-guided Needle Placement Robot for Prostate Brachytherapy

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Purpose: Brachytherapy aims to deliver a precise and targeted dose of radiation directly to the cancerous tissue while minimizing exposure to surrounding healthy tissues [1]. Accurate seed placement ensures that the radiation reaches the intended area, maximizing its effectiveness in treating the tumor [2]. Combining low-field Magnetic Resonance Imaging (MRI) with brachytherapy can enhance the targeting accuracy by providing detailed anatomical information during seed placement. This is particularly important for ensuring that the radioactive sources are precisely positioned within and around the tumor or the target area. This study introduces an innovative MRI-safe needle guidance system integrated with the single-sided low-field Promaxo MRI system (Promaxo Inc., Oakland, California, United States).

Methods: The needle guidance system, constructed from MRI-safe materials and featuring 5 degrees of freedom (DOF), is compact and utilizes pneumatic stepper motors for actuation. The system facilitates needle insertion from various angles by employing a spherical parallel mechanism. Following angulation, a translation screw is employed to insert needles or cannulas at different depths.

Results: To assess its performance, the system underwent evaluation using a multi-modality prostate phantom model that mimics the human prostate and surrounding structures (Yezitronix Group Inc. Automation & Control Industries Inc.). In a benchtop experiment, needle placement accuracy was verified by piercing the phantom along a vertical line spaced at equal depth and then comparing the achieved distances with the distance between air tracks in Computed Tomography (CT) scan images of the phantom. The experimental results reveal an absolute error (mean ± SD) of 0.75±0.73 mm on the vertical line and 0.24±0.14 mm in depth.

Conclusion: These preliminary experimental findings suggest the potential for precise robotic manipulation during brachytherapy procedures, offering a pathway to reduce the likelihood of human errors in procedures potentially improving patient outcomes.

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Abstract number 24

Innovative Approaches to Prostate Biopsy Decision-Making: A Machine Learning and Optimisation Framework

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Purpose: In the UK, around 190,000 prostate biopsies are performed every year [1], and the annual costs of pre-biopsy MRIs and biopsies for men with suspected cancer are over £32 million [2]. However, there does not exist a framework that guides healthcare professionals in personalising biopsy decisions for an individual patient. The principal objective of this study is to develop a decision support system (DSS) for prostate cancer (PCa) diagnosis to increase the detection of significant PCa while mitigating the risks associated with overdiagnosis. It involves an extensive analysis of data from prostate biopsies at Portsmouth Hospitals University NHS Trust (PHU) with the aim of developing patient-specific biopsy decision rules to assist healthcare professionals.

Methods: The retrospective data of +2000 patients who underwent a prostate biopsy at PHU between 2018 and 2023 were extracted. The dataset comprises diverse features, including PSA, number of lesions, location of the lesions, PI-RADS score, number of cores taken from each lesion, and result. Aiming to classify the patients and support prostate biopsy-decisions, different machine learning algorithms are applied to the data set to identify relevant patient features and corresponding threshold values. In addition, an optimisation model has been developed to optimise the biopsy sampling plan, which maximises the detection rate whilst minimising the number of cores. The trade-offs between the detection rate and number of cores are then analysed to identify the optimal number of biopsy cores for each patient class.

Results: A patient classification and decision framework have been proposed to facilitate the prostate biopsy decision-making process and generate patient-specific biopsy plans.

Conclusion: A data-driven decision support system will support healthcare professionals in generating patient-specific biopsy plans that optimise the diagnosis of PCa and improve overall efficiency.

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Abstract number 25

Predictive factors in US-MRI fusion prostate biopsy: a review of 2347 case.

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Purpose: Identify parameters, via a retrospective review of US-MRI fusion targeted biopsies, that predict detection rates of prostate cancer (PCa), in order to rationalise our service.

Methods: Lesions scored PI-RADS 3, for 2347 patients biopsied between 2018 and 2023, were included. Biopsy histopathology results were evaluated using descriptive statistics and ROC analysis, alongside PI-RADS score, prostate-specific antigen (PSA) & PSA density (PSAd). The impact on detection rates of the clinicians involved and the use of general or local anaesthesia, was also considered.

Results: Cancer was detected in 1489 (63.4%) patients, of which 1124 (47.9%) had a clinically significant PCa (Gleason score >6). Cancer detection rates for PI-RADS 3, 4 and 5 lesions were 24.6% (200/813), 54.6% (962/1762) and 69.8% (609/873), respectively, and 12.2% (99/813), 38.1% (672/1762) and 56.7% (495/873) respectively for clinically significant PCa.
PSA was not as effective a predictor of PCa as PSAd. Area Under Curve for PSA was 0.559 and 0.750 for PSAd. 486 patients had a maximum PI-RADS score of 3, with 606 reported lesions. 22.9% (139/606) had a positive biopsy and 12.7% (77) were clinically significant. Excluding patients with a PSAd of >0.1 ng/ml2 this detection rate reduces to 11.2% (24/214) and 6.1% (13/214) clinically significant [1].
Detection rates for patients who had a general and a local anaesthetic were 60.6% (1595) and 69.7% (745) respectively. A large range in detection rates between radiologists was identified; 16-36% (PI-RADS 3), 48-81% (PI-RADS 4) and 51-96% (PI-RADS 5). A comparatively smaller range was found when accounting for surgeons and medical physicists; 24-26% (PI-RADS 3), 54-65% (PI-RADS 4) and 77-80% (PI-RADS 5).

Conclusion: Clinically significant PCa detection in this cohort of patients with a PI-RADS score of 3 and PSAd of less than 0.1 ng/ml2 was just 6.1%, raising questions as to whether biopsies could be avoided in this group.

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