Brachytherapy

By Kalli Spencer

A previous blog addressed the different focal therapies for prostate cancer and brachytherapy is classified as another treatment modality. It is the implantation of radioactive sources directly into the tumour, also known as interstitial brachytherapy. Brachytherapy is used to treat localised prostate cancer, particularly low and intermediate risk but recent evidence suggests it can be used for well selected high-risk patients too.

Conventional radiation therapy (external-beam [EBRT]) passes from outside the body through the tissues that surround the prostate to reach its internal target. With brachytherapy the radioactive source or seed releases most of its dose close to its location. External-beam radiation therapy or intensity-modulated radiotherapy with image guidance can be combined with interstitial brachytherapy to take advantage of their unique attributes.

Brachytherapy can be further divided into low dose rate (LDR) and high dose rate (HDR). LDR brachytherapy is also known as “permanent” as iodine seeds are implanted into and remain in the prostate. HDR brachytherapy, also called “temporary”, is high activity iridium that is delivered for a short period through needles that are then later removed1.

For LDR brachytherapy (LDR-BT) the seeds are implanted in the operating theatre with ultrasound guidance through the skin of the perineum (between base of scrotum and anus). The prostate is mapped out in real-time and a physicist determines the amount of seeds and radiation dosage required.
The seeds emit a specific amount of radiation over a period of months and then lose their radioactivity. Dr David Joseph and the team from Sir Charles Gairdner hospital, Western Australia, reported on their outcomes for those receiving LDR-BT with 10 year biochemical disease free survival (based on PSA evaluation) of 96% for low-risk, 83% for intermediate-risk and 50% for high risk disease2.

HDR brachytherapy (HDR-BT), also delivered through the perineum, involves placing a certain number of hollow needles throughout the prostate, and then a single small radioactive source attached to the end of a wire moves in and out of the needles for different amounts of time, creating a specific amount of radiation around the entire prostate. The HDR-BT procedure takes 2.5 hours, but the radiation time is 10 minutes. The benefit of an HDR implant is you give a very big dose of radiation to a small area and then the radiation is removed, so there's a lot less exposure to the surrounding bladder and rectum and therefore fewer side effects. Traditionally HDR-BT has been combined with external beam radiotherapy, but emerging evidence suggests that HDR-BT used as a monotherapy is effective for low, intermediate risk and well selected high-risk groups. Professor John Yaxley and team from the Royal Brisbane hospital reported no biochemical evidence of disease rates for those with intermediate- and high-risk disease as 93.3% and 74.2%, respectively, at 5 years and 86.9% and 56.1%, respectively, at 10 years3. In a systematic review by Viani et al biochemical recurrence free survival was 97.5% for low risk, 93.5% for intermediate risk and 91% for selected high-risk patients4. It is recommended that those with intermediate and high-risk disease have androgen deprivation therapy (ADT) for better tumour control.

Modern radiation therapy technology allows for highly accurate doses which conform to targeted volumes while minimising radiation to surrounding tissue (as seen with HDR-BT). Hence there is a low rate of adverse events, but they may include erectile dysfunction, rectal irritation, urination difficulty (bladder irritation, inability to pass urine, development of urethral strictures) especially

with larger prostates (>60g)1. There may also be a small risk of secondary malignancy such as bladder cancer. In a quality-of-life study conducted over 15 years by researchers at the University of Sydney, it was found those who had EBRT and HDR-BT for high risk disease had more bowel symptoms and urinary troubles (especially those also on ADT) compared to those having other forms of treatment5.

Monitoring for disease recurrence after radiation therapy is with PSA. Jeremy Millar from Alfred Health, Victoria, as part of a global team from 6 other institutions found that by 4 years after LDR-BT, most patients will achieve a PSA level of <0.2 ng/mL6. Regardless of risk group, this is associated with rates of freedom from prostate cancer recurrence of 97% to 99% at 10 years. Many patients who do not achieve a PSA <0.2 ng/ml may also remain free of prostate cancer recurrence, but the risk of recurrence is sufficient that they require continued monitoring. It is important to remember, as with all radiation therapy as the prostate is still in-situ sometimes the PSA may rise (PSA bounce), especially if the prostate enlarges or if there is some inflammation or infection. In this case the oncologist will review the trend in PSA rise.

Less than half of all radiation oncology centres in Australia offer some form of brachytherapy service (45%)7. Northern Territory is the only Australian State or Territory that does not currently have any brachytherapy services. HDR-BT is offered in 22 centres nationally. Seventy percent of HDR BT equipment is located in the public sector, while the remaining 30% is located at privately owned facilities. Low-dose-rate brachytherapy is offered in only 14 centres nationally.

Radiation oncologist Dr Andrew See and urologist Professor Jeremy Grummet from the Icon Cancer Centre in Victoria have started the LIBERATE clinical registry to monitor those who have undergone focal brachytherapy for low to intermediate risk prostate cancer and assess long term outcomes and treatment success. It will be interesting to see the results of their study.

As per the European Association of Urology 2021 guidelines there is good evidence to support brachytherapy, where indicated, as a reasonable option for those with good urinary function requiring a less invasive prostate cancer treatment.

References

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Kalli is an internationally renowned Urological Surgeon, specialising in oncology and robotic surgery. He trained and worked in South Africa, before relocating to Australia where he has worked at Macquarie University Hospital and Westmead Hospital. His passion for what he does extends beyond the operating room, through publichealth advocacy, education and community awareness of men's health, cancer and sexuality.

Kalli has been involved with the Prostate Cancer Foundation of Australia for many years, advocating for improved cancer care and facilitating community prostate cancer support groups.