

# Healthcare Professional Guide

## Brachytherapy:

*The precise answer for tackling cancer*



Because life is for living

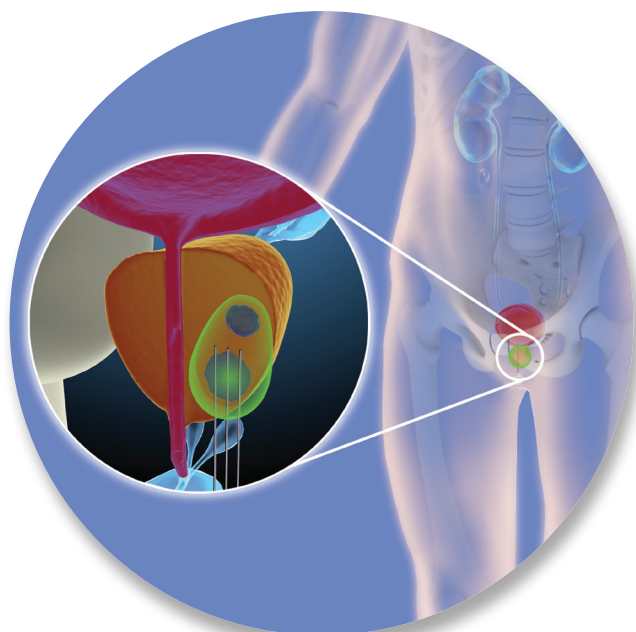
## Radiotherapy; a cornerstone of cancer care

According to the World Health Organization (WHO), cancer remains a leading cause of death worldwide. In 2004, cancer accounted for 7.4 million deaths (or around 13% of all deaths globally).<sup>1</sup> Innovation in cancer treatment is key to addressing the current and future needs of cancer care.

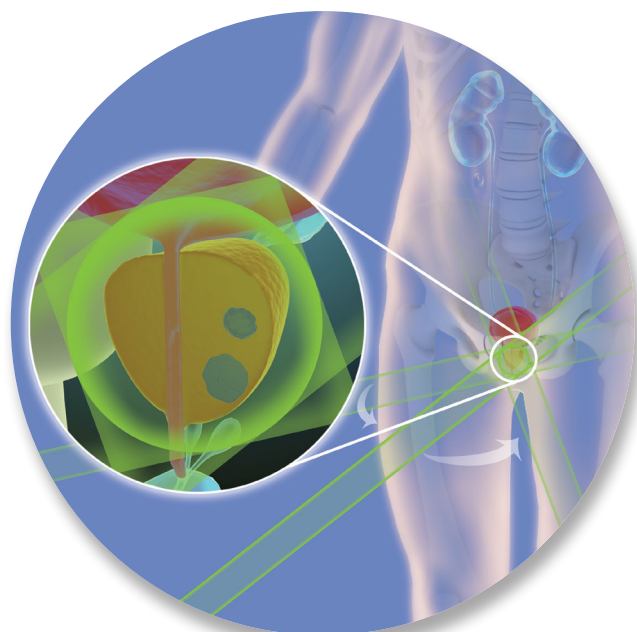
Radiotherapy plays an important role in cancer management. In recent years, treatment goals have shifted from **life preservation** to **cure** with the preservation of quality of life. Remarkable progress has been made in radiotherapy during the last two decades. This results from scientific and technical advances in imaging modalities, computerized planning and delivery, and hardware. In addition to providing clinical efficacy and safety, radiotherapy offers choice, convenience and efficient use of healthcare resources. It thus remains a cornerstone of treatment, alongside chemotherapy and surgery.

## Brachytherapy; treating cancer ‘from the inside, out’

Radiotherapy can be basically divided into **external beam radiotherapy** (EBRT), and internal radiotherapy, frequently referred to as **brachytherapy**. Unlike EBRT, brachytherapy involves placing a radiation source internally, either into or immediately next to the tumor.<sup>2,3</sup> This allows precise dose delivery.



Brachytherapy works ‘from the inside, out’



External beam radiotherapy (EBRT)  
works ‘from the outside, in’



## Why is brachytherapy an integral part of cancer care?

### Precision

Planning software and imaging provides an accurate picture of the tumor size, location and its relation to nearby organs. This translates into a 3D 'virtual patient' to facilitate delivery of a highly targeted, individualized radiation dose.

### Conformity

Radiation dose and distribution is calculated to 'match' the size and shape of the tumor, providing optimum treatment and outcomes.

### Efficacy

Cancer cure rates are comparable to surgery and EBRT when used as monotherapy. Furthermore, efficacy can be enhanced when used in combination with these techniques to deliver the total radiation dose, with an associated reduction in toxicity.<sup>4-9</sup>

### Minimized risk of side effects

Surrounding healthy tissue is spared from unnecessary radiation,<sup>10</sup> with the potential for fewer adverse events than alternatives such as EBRT and surgery.<sup>11,12</sup>

“Brachytherapy will continue to play an important role in the multidisciplinary approach in the treatment of cancer...The insertion of radioactive material into tumors rather than shining beams of radiation in from the outside has always been a most attractive proposition and results soon showed that it was very effective...With the aid of new technologies it is now easier, safer and much more accurate. It is for these reasons that brachytherapy retains such an important role in the multidisciplinary management of cancer.”

### Short treatment times

A course of therapy can be completed in less time than other radiotherapy techniques, typically 1 to 5 days compared to weeks with conventional EBRT. Brachytherapy is more time-efficient and patient-friendly, allowing patients to get back to their everyday life sooner.<sup>13,14</sup>

### Easy to use

Integration of planning, imaging and delivery through sophisticated, advanced technology simplifies the treatment process and saves valuable time for staff and patients. Outcomes are easily reproducible with consistent quality.<sup>15</sup>

### Cost-effective

Short treatment times, the ability to provide outpatient procedures and low investment and maintenance charges mean less cost for both provider and patient.

### Radiation protection

Specially built units (called afterloaders) store and control the delivery of radioactive sources to the tumor, minimizing the radiation risk to staff and patients.



## Brachytherapy; high precision radiotherapy

First practiced over a 100 years ago, today's brachytherapy utilizes a combination of state-of-the-art imaging, computer-based planning and treatment delivery technologies to deliver optimal radiotherapy. The exact radiation dose required for the specific tumor area can be delivered precisely, efficiently and safely. Brachytherapy therefore enables greater accuracy, efficiency, reproducibility and ease of use.

Small or locally advanced tumors which have not metastasized are particularly suited to brachytherapy treatment to cure the cancer.<sup>16</sup>

“The big bonus of brachytherapy is that it is a day case procedure. Patients have the therapy in the morning and go home later the same day. Most take a week off work, but we operated on a member of staff here on a Friday, and he was back at work the following Tuesday. Patients and staff prefer day case treatments.”<sup>17</sup>

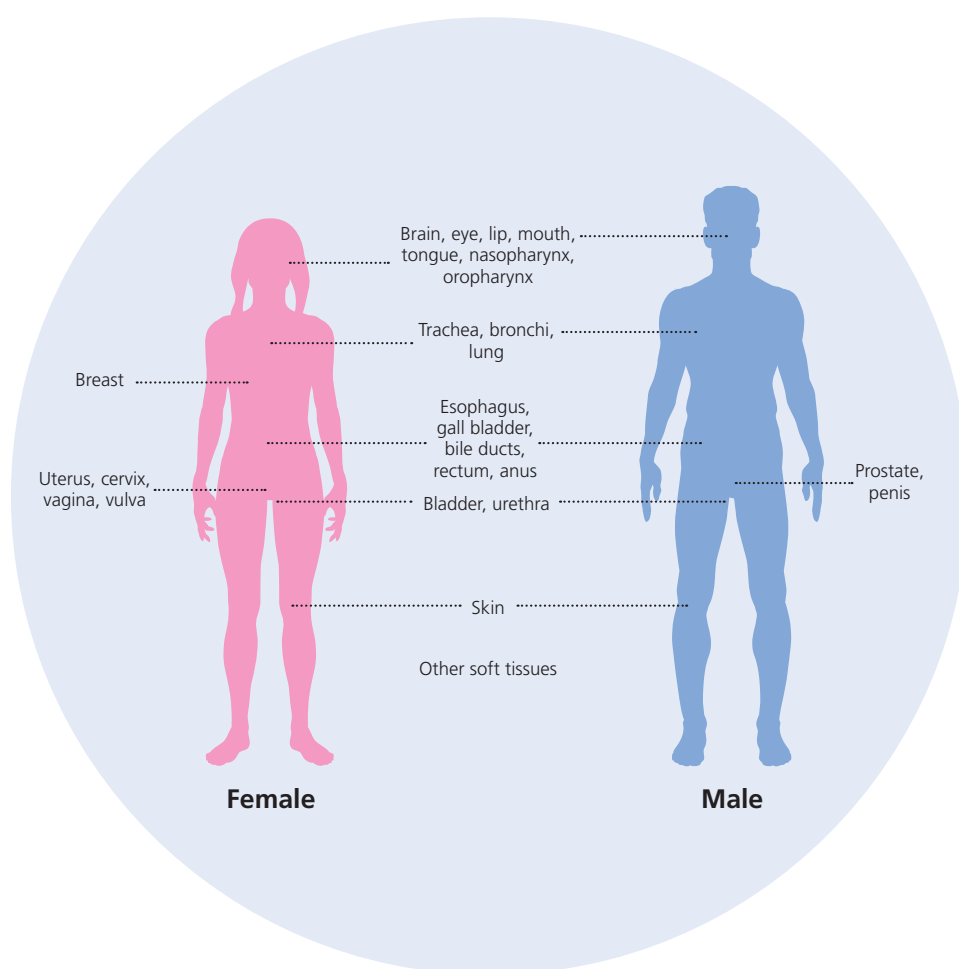
Dr James Wylie, Clinical Oncologist, UK

## Brachytherapy; clinical applications

Brachytherapy has demonstrated **excellent patient outcomes** for suitable tumors of many different body sites.<sup>4-9</sup>

Brachytherapy can be used in combination with other therapies such as surgery, EBRT or chemotherapy, particularly when the tumor is too large or is not easily accessible.

Brachytherapy has been most widely applied in the treatment of **cervical**,<sup>18</sup> **prostate**,<sup>19</sup> **breast**<sup>20</sup> and **skin**<sup>21</sup> **cancers**, demonstrating excellent patient outcomes across all tumor types. Brachytherapy can also be used to treat tumors in several other body sites.



Body sites in which brachytherapy  
can be used to treat cancer

# Cervical cancer

## Treatment goals

- Achieve cancer cure (elimination of cervical cancer tissue) and minimize the need for extensive surgery, whilst avoiding damage to surrounding tissues and organs.

## Place in therapy

- HDR brachytherapy is a global standard of care in the treatment of early or localized cervical cancer, either as an alternative to EBRT or in combination with EBRT and/or chemotherapy. American and European guidelines recommend brachytherapy as a key component of radiotherapy for cervical cancer.<sup>18,22-24</sup>

### Key benefits:

- Fewer complications and prevention of skin irritation compared to EBRT due to high precision and minimal radiation exposure to surrounding tissues<sup>23,25,26</sup>
- Reduced treatment time and increased convenience as procedures can be performed on a 1 day outpatient basis,<sup>4,26</sup> as opposed to 5 to 7 weeks for EBRT
- Provides an effective alternative to hysterectomy in certain tumor stages
- Modern image-guided cervical brachytherapy affords the opportunity to further improve patient outcomes.

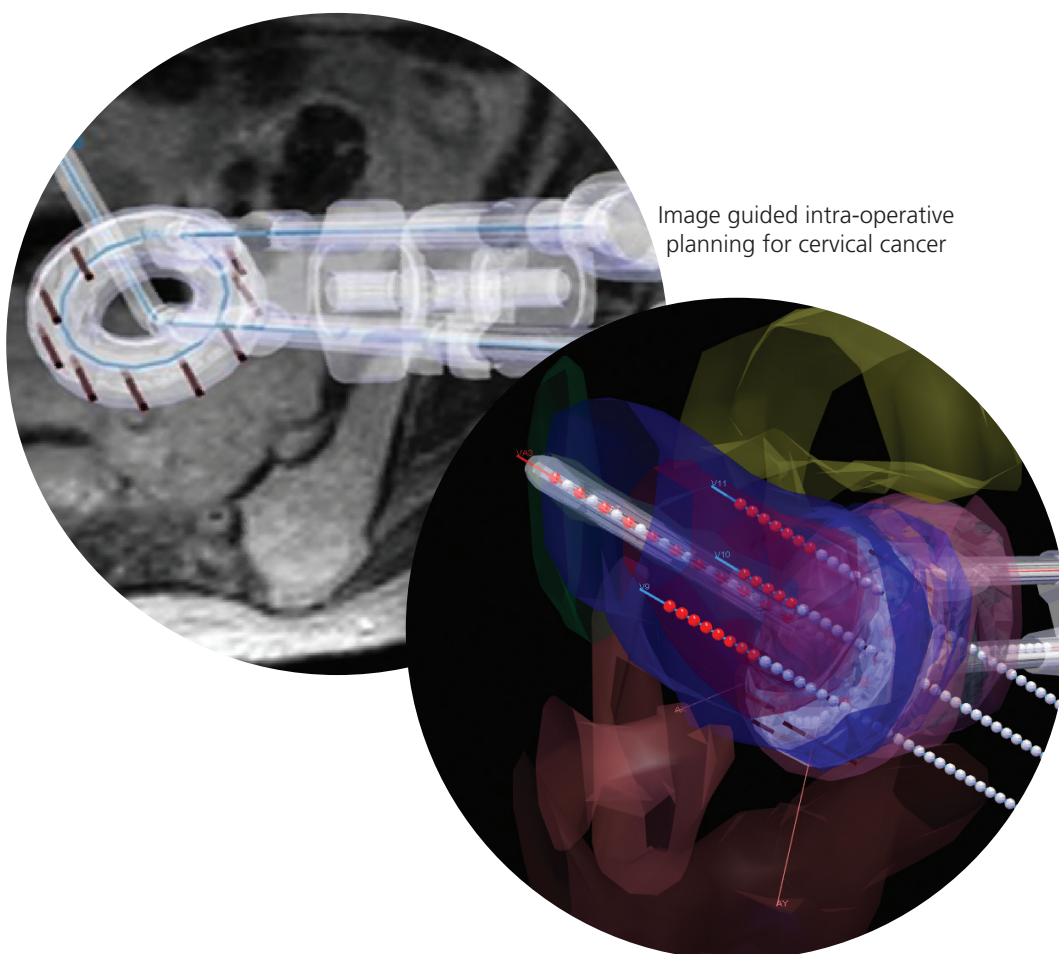


Image guided intra-operative planning for cervical cancer

# Prostate cancer

## Treatment goals

- Achieve cancer cure (elimination of prostate cancer tissue) whilst avoiding damage to key surrounding tissues and organs to preserve continence, erectile function and bowel function.

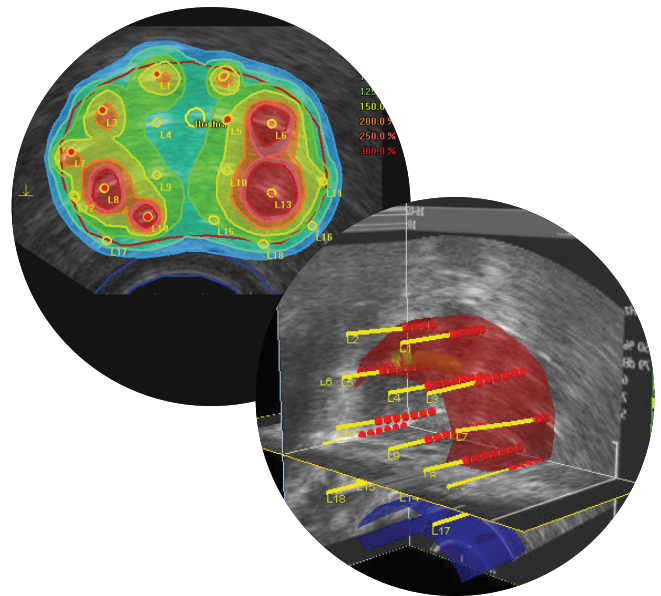
## Place in therapy

- LDR permanent brachytherapy, (or 'seed' therapy) is a clinically effective option for localized, low risk, prostate cancer.<sup>5,27</sup> Small radioactive seeds are implanted directly into the tumor. The radiation gradually depletes over a period of weeks to months and the seeds become inactive
- HDR temporary brachytherapy is a treatment option for intermediate risk tumors, either as monotherapy, or as a 'boost' to EBRT to provide a higher dose of radiation while minimizing risk of unnecessary damage to surrounding healthy tissues and organs.<sup>27,28</sup>

### Key benefits:

- Outcomes and long-term survival rates are comparable to both EBRT and radical prostatectomy (surgery)<sup>5,27,29</sup>
- Fewer urinary, bowel and sexual function complications compared with EBRT due to high precision procedure; complications are also less than radical prostatectomy<sup>13,30-34</sup>
- Reduced treatment time and increased convenience as procedures can be performed on an outpatient basis; typically over 1 to 2 days for seed therapy<sup>35</sup> or 2 days for HDR brachytherapy.<sup>28</sup>

“Permanent seed brachytherapy for prostate cancer has advanced significantly in all areas, including patient selection, treatment planning technique, and technology...These improvements have made transperineal seed implantation an accurate and practical treatment option for men with low, intermediate and high risk disease.<sup>36</sup>”



Clinical examination and tumor imaging to create 3D visualization



Source applicators are placed in the body for accurate positioning



## Breast cancer

### Treatment goals

- Achieve cancer cure (elimination of breast cancer tissue) whilst avoiding damage to surrounding tissues and organs and preserving the natural appearance of the breast.

### Place in therapy

- Brachytherapy enables breast preserving surgical techniques to be used (i.e., lumpectomy rather than mastectomy), by delivering targeted and effective radiation doses to kill any residual cancer cells
- HDR brachytherapy is used post surgery, either:
  - As 'boost' therapy after EBRT of the whole breast,<sup>20</sup> or;
  - Increasingly, as the sole method of radiotherapy (known as APBI; Accelerated Partial Breast Irradiation) to irradiate the region surrounding the original tumor in a shorter time frame.<sup>37-39</sup>

#### Key benefits:

- Provides effective treatment, with excellent long-term local control and cosmetic results<sup>37,40,41</sup>
- High precision minimizes radiation exposure to surrounding healthy breast tissue and adjacent organs and structures, such as the lungs and ribs<sup>42</sup>
- Short treatment course: APBI can be completed within 1 week.<sup>37</sup>

## Skin cancer

### Treatment goals

- Achieve cancer cure (elimination of skin cancer tissue) whilst avoiding damage to surrounding tissues and organs and preserving the natural appearance of the skin.

### Place in therapy

- HDR brachytherapy provides an alternative to the surgical removal of the tumor, thus preventing disfigurement or the need for reconstructive surgery.<sup>21</sup>

#### Key benefits:

- Provides a highly effective treatment, with good cosmetic results<sup>43-45</sup>
- High precision minimizes radiation exposure to surrounding tissues and organs
- Short overall treatment times: therapy can be completed in under 1 week
- Has the potential to become a standard of care.<sup>46</sup>



## Brachytherapy; optimal radiation dose delivery

Brachytherapy is performed using a combination of:

- Highly specific **software** used to define the optimal dose distribution profile
- A specific computer-controlled **treatment delivery device**, referred to as an **afterloader**
- **Specialized applicators**.

Brachytherapy can be characterized according to three main factors: source placement, treatment duration and dose rate:<sup>3</sup>

### Source placement

The delivery of radiation sources to the target tumor area is performed via specialized applicators such as catheters or needles that are directly inserted into either:

- A body cavity (e.g., uterus, vagina), body lumen (e.g., trachea, esophagus) or external surface (e.g., skin) – collectively referred to as **contact brachytherapy**
- The tumor (e.g., prostate, breast) – referred to as **interstitial brachytherapy**.



Specialized applicator called the 'Vienna ring' used in gynecological cancer treatment

### Treatment duration

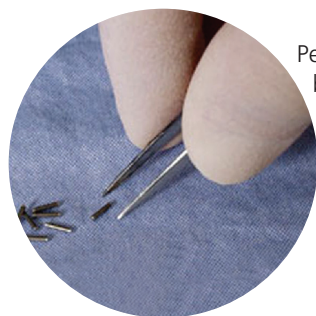
The sources can be left in place temporarily or permanently:

- **Temporary brachytherapy** delivers the radioactive source to the treatment site for a set time, typically minutes, before being withdrawn. The afterloader controls the delivery of the radioactive source, usually iridium, to the tumor site. The afterloader defines how long the source sits in a given position, creating the 'shape' of the delivered dose to follow the predefined plan
- **Permanent brachytherapy** or 'seed implantation', involves implanting 'seeds', each about the size of a grain of rice, into the tumor. The radiation gradually depletes over a period of months.

### Dose rate

Brachytherapy can deliver radiation at various intensities:

- **Low dose rate (LDR)** brachytherapy delivers radiation with a low level of intensity, making it safe for permanent brachytherapy
- **High dose rate (HDR)** brachytherapy delivers radiation at a much greater level of intensity and is always temporary, enabling treatments to be both quick and effective
- **Pulsed dose rate (PDR)** brachytherapy delivers radiation in short pulses to enhance the effectiveness of LDR treatment. PDR brachytherapy is mostly used for gynecological and head and neck cancers.



Permanent brachytherapy 'seeds'

“Imaging and planning of the treatment are now much more sophisticated, and we can implant the seeds in one session rather than two. What is very important is that the modern software we are using allows us to plan and see where we are placing the seeds. The computer provides us with a virtual, three dimensional image of the prostate...A second major development of the equipment used is that the actual insertion of the seeds is optimized and assisted by automated technology, making positioning much more accurate.”<sup>17</sup>

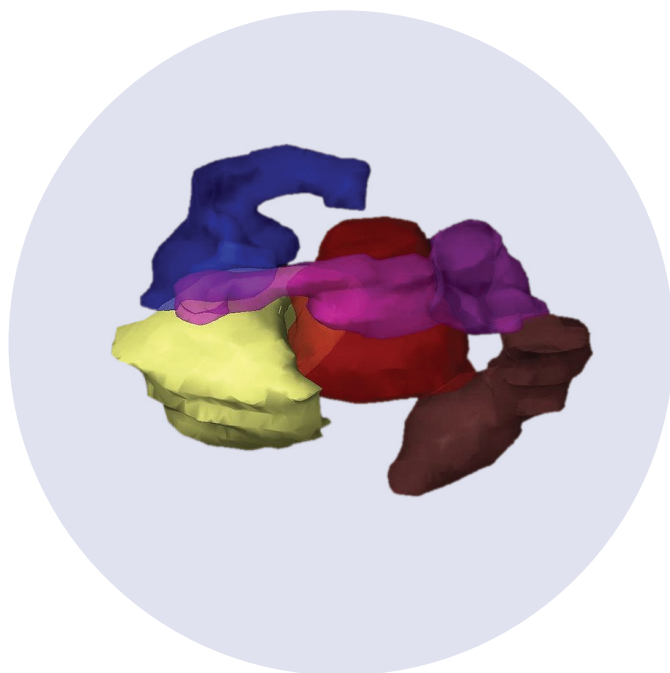
Dr Christof Kastner, Consultant Urologist, UK



## Brachytherapy; cost-effective radiotherapy

Choosing brachytherapy to complement your current arsenal of cancer treatments provides cost-effective cancer care:

- Low installation and maintenance costs compared to other techniques, such as Intensity Modulated Radiation Therapy (IMRT) and proton therapy<sup>47</sup>
- Shorter treatment times and largely outpatient procedures enable efficient use of resources
- Improved patient outcomes reduces future healthcare costs.



Creation of the 3D 'virtual' patient to plan the delivery of brachytherapy

## Brachytherapy; state-of-the-art treatment

**Brachytherapy is at the forefront of innovation in radiotherapy.**

### Heritage

- First used in 1901 to treat cutaneous lupus<sup>48,49</sup>
- Technology and techniques adapted over the years to provide applications for many cancers and diseases

### Standard of care

- Incorporated into practice guidelines throughout the world
- Standard of care for cervical cancer<sup>22,23</sup>

### Evidence

- Over 14,000 publications since the 1950's
- Results comparable to EBRT and surgery for many applications<sup>4-6,8,9</sup>

### Innovation

- Integrated technology provides seamless patient management from treatment planning to treatment delivery
- Cutting edge image-guided technology means precise radiation dose delivery with minimized toxicity

### Brachytherapy

Has been a pioneer in cancer treatment over the last 100 years and continues to set the standard for the future of radiation therapy

“Adaptive image-guided prostate and gynecologic brachytherapy, and increasingly breast brachytherapy, with their comprehensive integration of various new technologies...have set benchmarks exploiting the full potential of advanced radiotherapy with very promising clinical results.”<sup>50</sup>

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For further information on brachytherapy, consult the following resources:

**Speak to colleagues who have successfully integrated brachytherapy into their practice**

**ESTRO** (European Society for Therapeutic Radiology and Oncology)  
[www.estro.org](http://www.estro.org)

**ASTRO** (American Society for Therapeutic Radiology and Oncology)  
[www.astro.org](http://www.astro.org)

**GEC-ESTRO** (Groupe Européen de Curiethérapie and the European Society for Therapeutic Radiology and Oncology)  
[www.estro.org/about/Pages/GEC-ESTRO.aspx](http://www.estro.org/about/Pages/GEC-ESTRO.aspx)

**ABS** (American Brachytherapy Society)  
[www.americanbrachytherapy.org](http://www.americanbrachytherapy.org)

## Brachytherapy:

*The precise answer for tackling cancer*

Reasons to consider brachytherapy in cancer management

- Precision radiotherapy
- Demonstrated efficacy
- Minimized toxicity
- Patient-centered
- Cost-effective
- State-of-the-art

Because life is for living



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