

outline

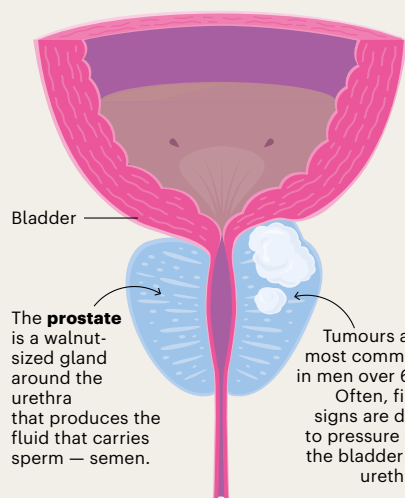
KEEPING TREATMENT OPTIONS OPEN

People with prostate cancer currently have several treatment options available to them. But one of the oldest, brachytherapy, is losing popularity with physicians. Without action, the skills needed to perform this effective therapy could be lost.

By Michael Eisenstein; infographic by Lucy Reading-Ikkanda

OLD THERAPY, NEW APPROACH

Brachytherapy uses radioactive material to kill cancerous cells. The conventional approach involves permanently implanting radioactive pellets in and around the prostate. In a newer form of brachytherapy, radioactive material is introduced temporarily through removable catheters. This might improve safety and efficacy, although only limited clinical data are available.



1 in 9 US men will develop prostate cancer.

Age-standardized cancer rate per 100,000 men¹

31.5 (lung) **29.3** (prostate)



Globally in 2018, prostate cancer was the second most common cancer in men.

Low-dose-rate brachytherapy

Radioactive seeds are injected into the prostate and surrounding tissue. The placement of the iodine-125 or palladium-103 seeds is permanent, and cannot be altered after injection.



Dose: Low-energy isotope seeds emit radiation over an extended period.

Facilities: Outpatient procedure with no specialized facilities.

Administration: Permanent implantation means greater care is needed with seed placement.

Evidence: Decades of clinical data support low-dose-rate (LDR) brachytherapy as a stand-alone and adjunct treatment.

Risk potential: Seeds can migrate to other tissues. Sexual partners might be exposed to radiation until the isotope decays.

High-dose-rate brachytherapy

Soft catheters are inserted into affected areas of the prostate, and radioactive iridium-192 sources are placed in the catheters for each treatment session, which lasts around 2 hours. Multiple treatments are given over 1-2 days in hospital.

Dose: High-energy isotopes are applied in multiple, brief sessions.

Facilities: Specialized equipment and a shielded, radiation-safe site.

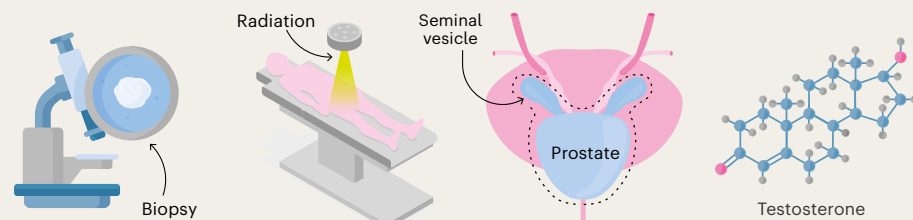
Administration: Isotope positioning can be adjusted between treatment sessions.

Evidence: Robust comparisons of high-dose-rate (HDR) brachytherapy with other therapies are still needed.

Risk potential: No radioactive material is left in the body after treatment, reducing the risk of problems later.

A QUESTION OF RISK

Brachytherapy is one of several treatment options for prostate cancer. Treatment suitability depends on a tumour's level of risk, determined on the basis of factors such as size and cellular structure. Brachytherapy can be used alone for lower-risk tumours, or to boost more aggressive radiotherapy or hormone therapy in higher-risk cases.



Active surveillance

Many clinicians now opt for careful, regular monitoring, rather than immediate treatment, for people with low-risk, slow-growing tumours.

Beam therapy

For higher-risk disease, people are typically offered a more aggressive radiotherapy course, such as external-beam radiation therapy (EBRT).

Radical prostatectomy

The prostate and seminal vesicles, which also secrete fluid found in semen, can be surgically removed to excise the tumour. This type of surgery is often robot-assisted for greater precision.

Hormone therapy

Tumour growth can be stalled by reducing levels of hormones such as testosterone through drugs or surgical castration.

	Tumour risk		
	Low	Intermediate	High
Active surveillance	◆	◆	
EBRT	◆	◆	
Brachytherapy	◆	◆	
Radical prostatectomy		◆	◆
EBRT with brachytherapy		◆	◆
EBRT with hormone therapy		◆	◆
EBRT with brachytherapy and hormone therapy		◆	◆



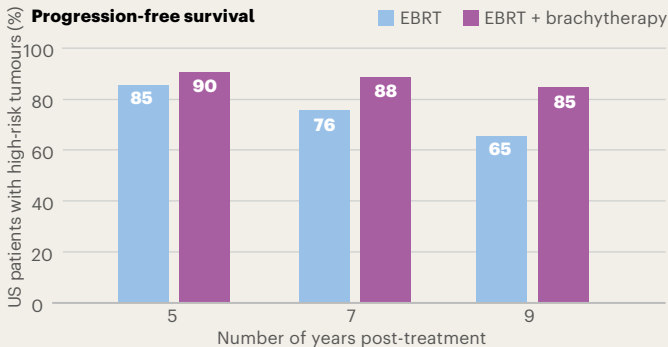
Watch an animation at go.nature.com/2vkgz7j

A VALUABLE OPTION

Randomized controlled trials have shown that brachytherapy has similar benefits as those of other treatments, but can be delivered at a lower cost and, in many cases, with more easily managed side effects.

Survival gains

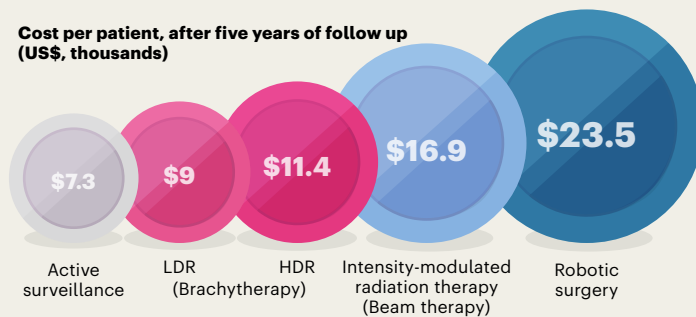
In people with low-risk tumours, brachytherapy is as effective (96%) as robotic surgery (97%) at preventing cancer recurrence within two years². For high-risk disease, combining brachytherapy with EBRT boosts progression-free survival compared with EBRT alone³.



Cost-effective

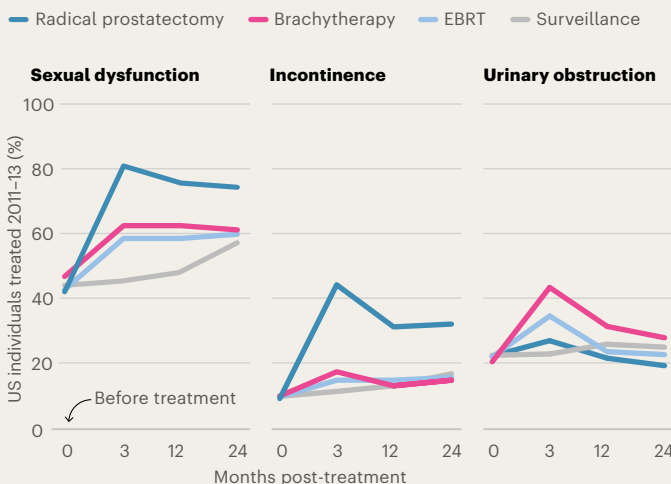
The cost of brachytherapy in US hospitals compares favourably with that of cutting-edge treatments such as advanced forms of beam therapy and robot-assisted surgery⁴. In Europe, treatment costs are more closely matched.

Cost per patient, after five years of follow up (US\$, thousands)



Side-effect selection

Compared with surgery, brachytherapy tends to carry a lower risk of causing sexual dysfunction and incontinence. But it is associated with greater rates of urinary-tract obstruction than are other treatments⁵.

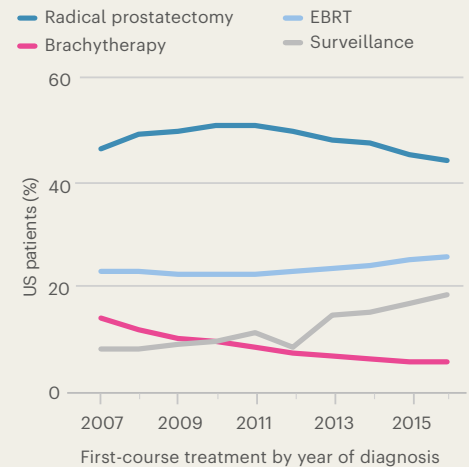


SLIDE AWAY

Despite its apparent benefits, brachytherapy is struggling to compete with a growing clinical armamentarium. Worldwide, dwindling training opportunities put the future of this technique in jeopardy.

Decreasing use

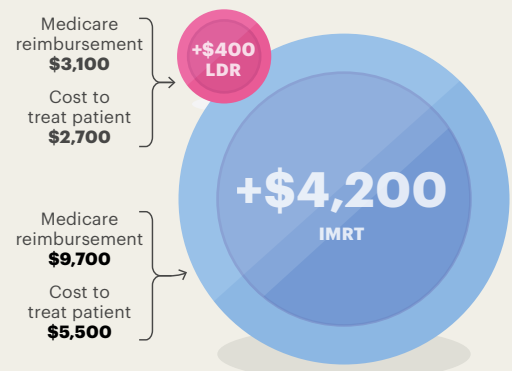
The proportion of US medical facilities performing brachytherapy has been falling each year since 2007, partly because clinicians are delaying treatment for low-risk malignancies in favour of active surveillance. But brachytherapy's use is also sliding compared EBRT and surgery⁶.



Funding issues

In the United States, reimbursement rates by health insurer Medicare for brachytherapy (profit for LDR shown) are closer to the true cost than for other, more costly therapies, such as intensity-modulated radiation therapy (IMRT). This means the other therapies are more profitable⁷. In Europe, the reimbursement received by some hospitals doesn't always cover the cost of brachytherapy.

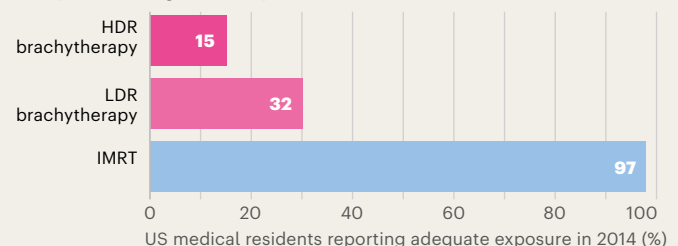
Profit per patient to hospital (US\$)



Opportunity cost

As brachytherapy's popularity declines, so do the opportunities for clinicians early in their career to observe and learn the technique. US medical residents increasingly report insufficient opportunity for training in brachytherapy relative to newer therapies⁸. This could lead to further reductions in access.

Adequate training in technique



SOURCES 1. GLOBOCAN 2018. 2. G. Claudio *et al.* *Can. J. Urol.* **24**, 8728-8733 (2017). 3. W. J. Morris *et al.* *Int. J. Rad. Oncol.* **98**, 275-285 (2017). 4. A. A. Laviana *et al.* *Cancer* **122**, 447-455 (2016). 5. R. C. Chen *et al.* *J. Am. Med. Assoc.* **317**, 1141-1150 (2017). 6. National Cancer Data Base. 7. S. W. Dutta *et al.* *Brachytherapy* **17**, 556-563 (2018). 8. N. Nabavizadeh *et al.* *Int. J. Radiat. Oncol. Biol. Phys.* **94**, 228-234 (2016).