



SPRING 2019

# ASTRO news

## BRACHYTHERAPY: TAKING IT FORWARD

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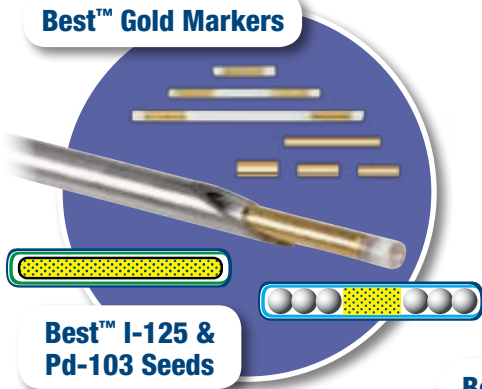
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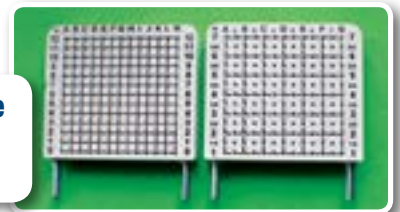


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# ASTRO news

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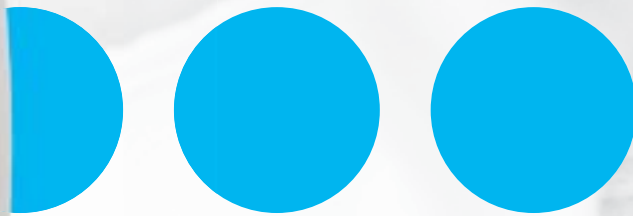
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## EDITOR'S *notes*

BY NAJEEB MOHIDEEN, MD, FASTRO  
SENIOR EDITOR, *ASTROnews*

### "CURES OF A SURPRISING CHARACTER"

**SCIENCE SAVES LIVES.** Oncology is undoubtedly a discipline in which technological and biological advances result in a significant improvement in patient outcomes. On occasion, we may ignore some of the older, time-tested methods that have proven highly effective. That's why the theme of the Spring *ASTROnews* issue is Brachytherapy. In recent years, there has been a decline in brachytherapy utilization rates in the U.S. That's alarming because not only is it the best method to accurately deliver a highly conformal dose of radiation to tumors with lower doses to surrounding healthy tissue but also omitting brachytherapy leads to worse cancer-specific outcomes. This issue provides a global perspective with contributions from thought leaders in the field, defining the problem and outlining solutions.

Why has brachytherapy utilization declined? Among the reasons are training and reimbursement, say Akila Viswanathan and Peter Orio in their overview (page 10). Cate Yashar and Sushil Beriwal argue that this trend is hurting cancer care. It's not just a worry for ASTRO as a professional society but a matter of public concern (page 13).

Dan Petereit, the incoming president of the American Brachytherapy Society, lays out a 10-year plan embodying a multifaceted approach with strategic initiatives to correct the situation (page 17). Jenna Kahn and Sam Marcrom – the lead authors of a recent ARRO survey – offer a fascinating residents' perspective. Their findings show that U.S. radiation oncology residents consider the brachytherapy caseload as the greatest perceived professional barrier to training and achieving independence in practice (page 15).

Outside the U.S., the picture is brighter. Juanita Crook notes that brachytherapy is thriving in Canada as both an economical and highly effective means of delivering radiation. Training and quality assurance

through accreditation are essential components north of the border (page 23).

Europe has a similar policy, spearheaded by the efforts of the Groupe European de Curiethérapie (GEC) - European Society for Therapeutic Radiology and Oncology (ESTRO), a standing committee of ESTRO. The organization is pioneering innovation, research and the dissemination of scientific knowledge in brachytherapy, writes Alina Sturdza (page 25). There are lessons to be learned, particularly the overall structural approach countries take toward care and prioritizing brachytherapy as an option within that framework.

Supriya Chopra focuses on the challenges in low- and middle-income countries (LMICs), posing the question whether – amid advances in image-based brachytherapy – care can be equitably delivered, and can we ensure that the “cure for many” is not lost in our zest to provide “advanced care to a few” (page 24). It is important to consider this perspective in our efforts to assess attempts at improving the global quality of care.

A new generation of novel malignancy-specific radiopharmaceuticals has reached the clinic, with others in the pipeline. These new agents have the potential to offer new treatment options and potentially improve outcomes for oncologic patients. The NETTER-1 trial<sup>1</sup> demonstrating the therapeutic efficacy of Lu-177 DOTATATE (Lutathera®) for treating somatostatin receptor-positive midgut neuroendocrine tumors is a good example of the kind of study that is necessary to advance these agents into routine clinical use. Promising Phase II results have also been reported in castrate-resistant metastatic prostate cancer using tumor-specific radioligand therapy that binds to the prostate-specific membrane antigen (PSMA). Commercial entities that manufacture or supply therapeutic radiopharmaceuticals suggest that there is

a shortage of Authorized Users (AUs) fueling access concerns. The U.S. Nuclear Regulatory Commission (NRC) is currently considering a proposal to reduce training and experience (T&E) requirements for physicians authorized to use therapeutic radiopharmaceuticals regulated under 10 C.F.R. Part 35, Subpart E (“Unsealed Byproduct Material — Written Directive Required”). As Paul Wallner writes in his piece on Systemic Radionuclide therapy (page 19) and in his blog,<sup>2</sup> with 1,000 trainees coming through the traditional pipelines of nuclear medicine, radiation oncology and nuclear/diagnostic radiology, the prospective demand for radionuclide therapy AUs will be adequately covered for the foreseeable future. Further, relaxing training requirements will lead to lower standards, undermining best practices and cancer care while fostering an environment of financially-motivated utilization, thereby reducing the quality and safety of radiopharmaceutical therapy.

However, there may be another issue: As Paul states, “Systemic radionuclides are perhaps the purest form of brachytherapy but have rarely attained a position of importance within radiation oncology.” In fact, even today most of the scientific literature on systemic radionuclide therapy appears in nuclear medicine journals rather than radiation oncology journals. So, are we training radiation oncologists and our residents in treating and managing patients with emerging agents, such as Lutathera®, which are significantly more complex than Radium-223, or is this modality going to be provided exclusively by Nuclear Medicine and Nuclear Radiology providers? If radiation oncologists are to retain a role in this increasingly important modality, we must be knowledgeable about indications, contraindications and logistics, and be able to manage appropriate patients.

Several articles in this issue cite reimbursements in the U.S. as a major challenge for domestic brachytherapy. As you may be aware, changes will likely be coming to radiation oncology Medicare reimbursements (as I alluded to in my last Editor’s note), and CMS gave us some clues to its structure in an accidental release this February on the Radiation Oncology Alternative Payment Model (RO-APM),

for more on this, please read ASTRO Health Policy Director Anne Hubbard’s blog).<sup>3</sup> There are studies<sup>4</sup> that show brachytherapy is the most cost-effective form of radiotherapy treatment for common cancers and in my opinion, it’s poised to do well in an APM.

The origins of brachytherapy date back to the early years of the last century. Shortly after the discovery of radium in 1901, Pierre Curie suggested to Henri Danlos at St. Louis Hospital in Paris that a small tube of the element be applied to treat skin lesions, heralding the birth of the discipline. During a visit to Paris in the spring of 1907, prominent Toronto physician and medical editor William H.B. Aikins marveled at radium’s ability to produce changes in tissues that could not be achieved by any other known substance and which resulted in “cures of a very surprising character.”

Despite great interest and adoption in North America and Europe, its use declined in the middle of the 20th century due to concerns over radiation exposure from the manual application of radioactive sources. Its resurgence was preceded by advances in technology and science, the development of remote after-loading systems, new radioactive sources, advancements in three-dimensional imaging modalities, computerized treatment planning systems and clinical trials. As Christine Fisher writes, we have to embrace technology to help create customized solutions for challenging treatment scenarios so that we can improve the quality of brachytherapy, which will ultimately aid our patients’ cause (page 18). This, alongside innovations in payment policy, strategic initiatives and high-quality research should foster another resurgence of this invaluable treatment option. 🚀

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## ABOUT THE COVER

Dr. Michael Zelefsky, MD, performing brachytherapy treatment.  
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## BRACHYTHERAPY: CALL TO ARMS

**THIS ISSUE OF ASTRONEWS HIGHLIGHTS** a critically important challenge for the discipline of radiation oncology. **The Problem:** declining use of brachytherapy. **The Reason:** multifactorial but substituting IMRT or SBRT boosting for brachytherapy looms as a major contributor. **The Pipeline:** in serious jeopardy since a majority of residents in training identify low institutional caseload as the greatest barrier to achieving independent expertise in brachytherapy practice. **The Result:** diminished cure rates for patients with cervix and prostate cancer treated with radiation. Is this concerning and significant? Absolutely!

Many of the highest impact papers published in the history of oncology demonstrate a survival advantage of five to 10 percent over standard of care therapy. These are the stuff of *The New England Journal of Medicine* publications with accompanying press releases. There is markedly less visibility and press interest when a gradual erosion of expert cancer care results in a five to 10 percent decrease in patient survival over time. Yet this is precisely what is happening for patients with cervix cancer, for example, who may not be availed of brachytherapy boost expertise as an integral component of their cancer treatment regimen.

Superb articles in this issue illuminate the background and challenge in very clear terms. The commentary from Dr. Dan Petereit sets forth a Brachytherapy Call to Arms. The 300 in 10 Strategy (train 30 competent brachytherapists per year over each of the next 10 years) offers a golden opportunity to provide your active support and participation. This 10-year strategy proposed by the American Brachytherapy Society outlines a multi-pronged approach to combat the brachytherapy decline and resultant reduction in survival for curative cancer cases where brachytherapy plays a pivotal role. The strategy is multi-faceted including raising public awareness, establishing centers of excellence to augment brachytherapy training,

fostering advances in simulation training, partnering with ASTRO and other industry partners to support the indispensable role of brachytherapy, to name just a few.

Oncology is a remarkably special calling. We have the unique opportunity to impact the lives of cancer patients and families in a powerful way that few other medical disciplines experience. With U.S. cancer death rates gradually decreasing over the last two decades in large part due to declining tobacco use, increased cancer screening and improved cancer treatments, it is imperative that we protect the critical advances already brought forth by the profession of radiation oncology over recent decades.

We are fortunate to serve as important stewards of high-quality cancer care. This is a pivotal time to step forth and ensure the very best treatments for the cancer patients we serve.

I hereby salute the many dedicated brachytherapy experts and programs around the world who have contributed to the care and cure of hundreds of thousands of cancer patients over the years. The expert training and mentoring that has been passed forward enables us to optimize outcomes for cancer patients of today.

I also wish to express a personalized thank you to several generations of providers within the University of Wisconsin Brachytherapy Program, leaders in the field for many decades. This is the team that delivered world class brachytherapy to a member of my own family for cancer in 2014. We celebrate a five-year cancer free anniversary this summer. My family is forever thankful for the talent, precision and compassion of radiation oncology brachytherapy experts – past, present and future.

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# SOCIETY NEWS

## Shaping the ASTRO Board of Directors and Committees with the support of volunteers

**EACH YEAR, ASTRO'S NOMINATING COMMITTEE**, made up of the five Council Chairs from the Board of Directors, six elected volunteers and chaired by the Board's Immediate Past Chair, works to present a slate of candidates for open seats on the Board. The Nominating Committee welcomes candidate suggestions from the Board, committee chairs and the membership at large. To fill these important seats, the Committee looks at potential candidates' service to ASTRO, including involvement within ASTRO committees, as editors of ASTRO's journals, involvement in ASTRO's accreditation program and other volunteer-supported efforts. Many factors are taken into consideration, including diversity. The final slate is then presented to ASTRO's members, and elections take place during the summer. Voting is conducted through a secure, online system that ensures the authenticity and secrecy of each ballot. The elected candidates officially take their seats at the Business Meeting of the Annual Meeting following elections.

Volunteering for a committee is the perfect opportunity for members to get involved with ASTRO. Every spring the Call for Volunteers goes out to the membership at large, to fill open vacancies on an

average of 25 committees each year. It is the charge of the Board's president-elect to work with committee chairs and staff liaisons to populate each committee with volunteers willing to offer their time and expertise to help advance ASTRO's mission. With diversity and inclusion as one of its core values, it is important to ASTRO that each committee is a balance of not only expertise, but gender, race, location, subspecialty and all the attributes that make up the general ASTRO membership that it represents. Within each committee, volunteers' appointments are renewed annually, for up to five years. The goal is to allow as many interested members as possible the chance to serve on an ASTRO committee of their choice. During the Call for Volunteers, members are asked to select up to two committees, in order of their preference. The internal committee process works to give as many volunteers as possible the opportunity for ASTRO service.

These volunteer opportunities, and others like them, are presented to the general membership through ASTROgrams, the *ASTROnews* and posted on ASTRO's website. It's up to you to get involved by voting for ASTRO leadership and responding to the Call for Volunteers. 



### *In Memoriam*

ASTRO has learned that the following members have passed away.  
Our thoughts go out to their family and friends.


**Karl L. Prado, PhD, Annapolis, Maryland**  
**Michael A. Myers, MD, Camas, Washington**  
**Karen D. Schupak, MD, Basking Ridge, New Jersey**  
**Carl R. Bogardus, Jr., MD, FASTRO, Oklahoma City, Oklahoma**

The Radiation Oncology Institute (ROI) graciously accepts gifts in memory of or in tribute to individuals.  
For more information, visit [www.roinstitute.org](http://www.roinstitute.org).

## Join the conversation

BY LAURA HINELY, ASTRO ONLINE COMMUNICATIONS COORDINATOR

**HAVE YOU BEEN RECEIVING** the ASTRO Daily Digest and are wondering what it is? The Daily Digest is a collection of conversations taking place in the ASTRO *ROhub*, ASTRO's official online community platform. We invite you to network, collaborate and join engaging discussions pertaining to your profession on the *ROhub*. *ROhub* is an exclusive ASTRO member benefit that brings together ASTRO members in a collaborative environment. *ROhub* is also home to the ASTRO Member Directory, where you can search for other members by name, location, specialty and more. In December 2018, *ROhub* launched its first all-member community, the Open Forum, and since has seen tremendous growth covering a wide range of topics from work life balance to addressing the gender gap within radiation oncology. In addition, a dedicated Student Community and special interest communities such as the Locum Tenens Community have been launched with more to follow.

*ROhub* is a secure environment to interact with other ASTRO members and ASTRO staff. Stay tuned for more exciting *ROhub* features in the coming months. Start exploring *ROhub* today by joining a community, participating in a "introduce yourself thread," or starting a discussion. 



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For further assistance, please contact [ROhub@astro.org](mailto:ROhub@astro.org).

## Keeping you informed

### ASTRO HAS A DIVERSE ARRAY OF CHANNELS


to communicate relevant news to members, industry stakeholders, media, patients and the general public. In this brief review, we highlight a few member communication vehicles.

ASTROgram is our weekly round-up of relevant news including announcements of ASTRO initiatives, meetings or products; health policy and legislative updates; and calls to action. The ASTROgram is emailed to all members each Wednesday. If you aren't receiving it, please check with your IT department to be sure ASTRO is designated as a safe sender.

ASTRO Blog is an increasingly popular medium for timely, short news stories for the radiation oncology specialty. Members and staff are invited to submit blog posts. ASTRO Blog posts range from summaries of recent journal articles, to what's trending on Twitter, to insights into session content and networking opportunities at ASTRO meetings, to

what's happening in Washington. Blog posts are often featured in the ASTROgram and can also be found in the News and Publications section of

ASTRO.org. Your comments on blog posts are encouraged.

ASTRO.org homepage is getting a facelift. By the time of publication, the homepage will display content curated into four categories: Latest News, Resources, Publications and Affiliates, providing up-to-date information about the most commonly searched for topics at your fingertips. The new design will make it easier for visitors to navigate the ASTRO website and keep abreast of current events and initiatives. 



## Five Companies Elected to ASTRO's Corporate Advisory Council


**ASTRO'S CORPORATE MEMBERSHIP HAS ELECTED** the following companies to serve on the 2019 Corporate Advisory Council (CAC): Blue Earth Diagnostics; Lap Laser; Nanobiotix; all newly elected, and Elekta, re-elected for another term. In addition, Cumberland Pharmaceuticals will serve a term of one year. The addition of a pharmaceutical company was designed to help bring perspective and contribution to the work of the Council.

The CAC is a smaller, representative group of the Corporate membership-at-large, with a proportional mix of large and small companies from the Corporate membership base. Seats on the Council are held by high-level decision makers within the corporations and represent a broad cross section of the industry.

The CAC allows for collaboration between ASTRO and its Corporate members by focusing on issues and initiatives of mutual concern in radiation oncology. Priorities include increasing awareness of radiation therapy and advancing the science and practice of



cancer treatment and patient care. In cooperation with ASTRO leadership, the Council convenes several times a year via conference call and holds an in-person meeting at ASTRO's Annual Meeting. In 2018, the following topics were brought to the forefront: industry support for new approaches to patient treatment; ASTRO's research agenda; advancing the field of radiation oncology and making a greater impact on science; the Radiation Oncology Incident Learning System® (RO-ILS) and its continued growth; and changes in health care legislation including coding and payment reform.

Nominations for seats on the CAC are accepted every fall with elections conducted during the winter. For more information about the Council and/or Corporate membership, please contact Joanne DiCesare at [joanne.dicesare@astro.org](mailto:joanne.dicesare@astro.org) or 703-502-1550. 

### 2019 CAC Membership

COMPANY	REPRESENTATIVE	TERM EXPIRES
Cumberland Pharmaceuticals	Marty E. Cearnal	2019
IBA (Ion Beam Applications SA)	Frédéric Genin	2019
Qfix	Dan Coppens	2019
RaySearch Laboratories	Marc Mlyn	2019
Xstrahl	Adrian Treverton	2019
Standard Imaging, Inc.	Eric DeWerd	2020
Accuray	Robin Famiglietti	2020
Varian Medical Systems	Chris Toth	2020
ViewRay, Inc.	Shar Matin	2020
Blue Earth Diagnostics	Mike Helsop	2021
Elekta	Peter J. Gaccione	2021
Lap Laser	Trent van Arkel	2021
Nanobiotix	Monica Sukhatme	2021



# SUSTAINING THE ART AND OUTCOMES OF BRACHYTHERAPY

BY PETER F. ORIO III, DO, MS, AND AKILA N. VISWANATHAN, MD, MPH

**BRACHYTHERAPY HAS BEEN A PART** of the curative management of cervical and prostate cancer patients for more than 100 years. In brachytherapy, the precise placement of radioactive sources in or near the tumor ensures significant ablative doses of radiation are delivered to a tumor while ideally sparing the adjacent normal tissues. External beam techniques such as intensity-modulated radiation therapy (IMRT), stereotactic body radiation therapy (SBRT) and proton therapy are unable to match the dose distribution and purposeful dose escalation achieved by brachytherapy. Despite these limitations, external beam technologies are increasingly being used as a way to replace brachytherapy. Given the proven efficacy and outcomes associated with brachytherapy, why has utilization significantly declined over the past two decades?

In a cohort of cervical cancer patients reviewed through the Surveillance, Epidemiology and End Results (SEER) database (1988 to 2009), a 12 percent reduction in overall survival was observed after 2003, concomitant with a 25 percent decrease in utilization of brachytherapy in treating the disease. A similar decrease in the utilization of brachytherapy for cervical cancer has also been reported worldwide. Global reports have shown that the proportion of patients receiving brachytherapy has decreased due to: insufficient equipment, clinical trials that substitute brachytherapy with intensity-modulated radiation therapy (IMRT), stereotactic body radiation therapy (SBRT) or heavy particle therapy, and institutional preferences.

In the United States, the National Cancer Database (NCDB) data shows that 64 percent of Caucasian, 17 percent of Black, and 14 percent of Hispanic patients received a brachytherapy boost for cervical cancer, indicating racial disparities in the receipt of treatment. Possible reasons for underutilization of brachytherapy for cervical cancer include a transition to high-dose-rate (HDR) brachytherapy requiring increased time and use of advanced imaging technologies for safe practice, higher reimbursement rates with IMRT and SBRT, fewer patients having access to brachytherapy due to referral patterns, insufficient training of radiation oncology residents, correlated with inadequate maintenance of brachytherapy skills among practicing radiation oncologists.

Similarly, despite evidence showing its efficacy in the treatment of prostate cancer at any stage of disease, trends mirroring the decreased utilization of brachytherapy for cervical cancer have been observed in the last decade. The declining use of brachytherapy is likely secondary to many societal and economic factors, including the decrease in prostate-specific antigen (PSA) screening, a greater emphasis on active surveillance for appropriate patients, increasing use of robotic prostatectomy and the greater sophistication of external beam technologies. The negative press associated with poor brachytherapy implants, decreasing reimbursement for brachytherapy and increasing disparity between reimbursement for brachytherapy compared with competing treatment modalities, such as IMRT and SBRT, have negatively affected the utilization of brachytherapy. The lack of knowledge of brachytherapy's efficacy, self-referral patterns of physicians with financial interest in external beam technologies and decreased training opportunities, particularly at academic practices, are also factors in the decreased utilization of prostate brachytherapy.

A noticeable decline in the number of men diagnosed with prostate cancer has been observed due to the decreased practice of PSA screening for the disease. The European Randomized Study of Screening for Prostate Cancer (ERSPC) and the flawed United States Prostate, Lung, Colorectal and Ovarian Cancer

Screening Trials (USPLCO), with a median follow up of eleven years, found that 1,055 men needed to be screened to prevent one death. Radiation oncology patient volume has decreased as a result, with patients diagnosed with prostate cancer often counseled by urologists to receive treatment under their care without the benefit of a consultation with a radiation oncologist to hear all of their treatment options.

Level 1 evidence, such as the Canadian Androgen Suppression Combined with Elective Nodal and Dose Escalated Radiation Therapy (ASCENDE-RT) randomized trial, has shown that brachytherapy boost reduces PSA recurrence by 50 percent compared to dose-escalated radiation (PSA nadir <0.2 ng/ml to demonstrate consistency with the surgical definition of failure). Despite this evidence and evidence from several other studies, both academic and nonacademic radiation oncology practices have demonstrated a significant reduction in the use of prostate brachytherapy as monotherapy or as a boost in conjunction with external beam between 2004 and 2012. Of the programs still performing brachytherapy, a significant increase has occurred in those performing

less than 12 cases per year. Recent analysis of the NCDB also showed that 73.7 percent of academic practices perform less than 12 brachytherapy cases, 24.8 percent perform 13 to 53 cases and only 1.5 percent perform greater than 53 cases per year. This has resulted in a decline in residents' exposure to brachytherapy, compounding the problem as our physicians of the future are not adequately trained in the modality.

Unintentional changes in the United States government's reimbursement of the procedure provided a financial disincentive to both hospitals and physicians to provide prostate brachytherapy to patients. Unfortunately, patient outcomes are not factored into the reimbursement strategy for medical procedures. Alternative Payment Models may allow for the equalization of reimbursement levels which may eradicate the selection of one modality over any other as brachytherapy remains the most cost-effective approach amongst all treatment options. This will, in turn, potentially lead to greater demand for resident training of brachytherapy




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in academic programs and through efforts of the American Brachytherapy Society (ABS) and ASTRO.

Regardless of trends in utilization, brachytherapy remains the most cost-effective approach for treating many kinds of cancer and is highly effective. Therefore, it is imperative for us to continue to advocate for the use of brachytherapy for our patients. In health care, knowledge is power. To foster knowledge and empowerment amongst practitioners and patients alike, organizations such as the ABS and ASTRO are creating outreach efforts to address the utilization and efficacy of brachytherapy for all types of cancer. These efforts include direct to patient awareness campaigns, advocacy for residency training guidelines, maintenance of certification standards and efforts to educate physicians in the organizations' memberships. For long-term sustainability of brachytherapy, it is paramount that we create policies and regulations that ensure that cancer patients receive the best possible care, including consultation on the role of brachytherapy in their treatment. Economic incentives cannot be allowed to drive treatments offered to patients. As a field, we are obligated to support the appropriate training of our young practitioners to increase access to all appropriate radiation oncology treatment options. We must ensure that we are arming our patients with both the knowledge and the power to make informed treatment decisions. 

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## ASTRO ADVOCATES FOR BRACHYTHERAPY PAYMENT AND COVERAGE

ASTRO recognizes that brachytherapy, a highly cost-effective radiation treatment, often faces regulatory barriers that can limit patient access to care. ASTRO's advocacy teams commit significant resources working to combat the coverage and payment challenges facing brachytherapy.

In February, ASTRO issued an update to its brachytherapy model policy — one of five modality-specific model policies that provides recommendations for medical insurance coverage. Please refer to the ASTRO website ([www.astro.org/brachymodelpolicy](http://www.astro.org/brachymodelpolicy)) to read the Brachytherapy Model Policy, which reflects current evidence, such as clarification confirming the inclusion of the brain in head and neck cancers, as well as the addition of diagnosis codes associated with medical necessity and a statement on electronic brachytherapy. The Brachytherapy Model Policy exhibits what ASTRO believes are the correct coverage policies for brachytherapy and does not serve as a clinical guideline.

ASTRO health policy leaders also met with Medicare officials recently as part of an ongoing effort to confront a gross undervaluation of brachytherapy reimbursement in the hospital outpatient setting. ASTRO is asking the Centers for Medicare and Medicaid Services to dramatically revise how they pay for brachytherapy, specifically noting how brachytherapy for cervical cancer is often reimbursed at a level \$16,000 below cost.

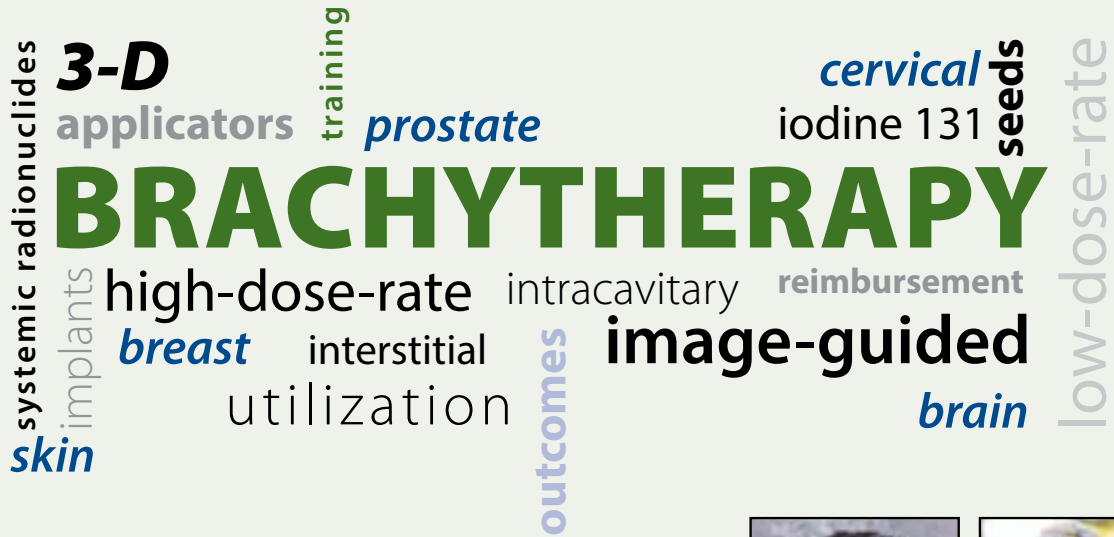
In addition, ASTRO successfully advocated for the Nuclear Regulatory Commission to reform the way it defines medical events for prostate brachytherapy, which had been contributing to a chilling effect among practitioners. Early in 2019, the Commission published a new rule changing the definition to one based on activity, rather than dose.

ASTRO continues to support health policies and payment that ensure patient access to all radiation therapy services and advocating for better treatment of brachytherapy remains a high priority. 

### SUBMIT YOUR NEWS TO ASTRO

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## Declining Use of Brachytherapy *is negatively affecting cancer care*

BY SUSHIL BERIWAL, MD, MBA, AND CATHERYN YASHAR, MD



Sushil Beriwal,  
MD, MBA



Catheryn Yashar,  
MD

### BRACHYTHERAPY HAS BEEN ON A DECLINE

nationally over the past decade. Unfortunately, this has occurred despite evidence that brachytherapy is associated with improved outcomes in multiple disease sites such as prostate cancer and cervical cancer. Numerous studies have demonstrated the detriment in cancer control and survival associated with omitting or substituting brachytherapy with other options.


Population-based studies have offered some sobering insight into the impact of brachytherapy, or the lack of utilization thereof, on prostate cancer outcomes. Two Surveillance, Epidemiology and End Results (SEER) studies have identified a significant association of brachytherapy boost with reduced prostate cancer-specific mortality in men with high-risk disease<sup>1,2</sup>, and a National Cancer Database (NCDB) analysis recently identified a statistically significant difference in overall survival for both intermediate-risk and high-risk patients.<sup>3</sup> In the NCDB analysis, 10-year overall survival was improved from 55 percent with external beam radiation alone to 63 percent for combination therapy incorporating brachytherapy boost, whereas the corresponding numbers for intermediate-risk disease were 58 percent and 72 percent. The recently published ASCENDE-RT trial identified a 21 percent improvement in biochemical disease-free survival at nine years, from 62 percent to 83 percent, with the use of low-dose-rate prostate brachytherapy boost in combination with external beam radiation therapy as opposed to dose-escalated external beam radiation alone.<sup>4</sup> Yet, despite

this association with improved outcome, there was a concerning decline in utilization of brachytherapy boost, with utilization for high-risk patients dropping from 27.6 percent in 2004 to 10.8 percent in 2013.<sup>3</sup>

A similar trend has been observed in population-based studies on cervical cancer. Treatment for locally advanced cervical cancer routinely consists of definitive concurrent chemoradiation with cisplatin and pelvic external beam radiation therapy followed by a brachytherapy boost to the cervix. Yet, according to a NCDB analysis of 7,654 patients, the utilization of brachytherapy decreased from 96.7 percent to 86.1 percent between 2004 and 2011, whereas delivering the boost with intensity-modulated radiation therapy (IMRT) or stereotactic body radiation therapy (SBRT) use increased from 3.3 percent to 13.9 percent during the same period.<sup>5</sup> Alarming, the substitution of brachytherapy with an IMRT or SBRT boost was associated with inferior overall survival, and this survival detriment was stronger than that associated with omitting chemotherapy.

The incorporation of 3-D image-based (CT or MRI) guidance and real-time brachytherapy planning has allowed improved accuracy of applicator positioning and target delineation. With these advances in modern brachytherapy technique, the role and importance of brachytherapy should only be expected to increase. As radiation oncologists, we should be

*Continued on following page*

worried about the trend in declining brachytherapy use, as it directly impacts the well-being of our patients. Concern about the decline in use of brachytherapy prompted the American Brachytherapy Society and the Society of Gynecologic Oncology to pen a joint paper outlining the importance of brachytherapy for the definitive treatment of primary cervical carcinoma.<sup>6</sup> In addition, the American Society for Radiation Oncology has formed a brachytherapy task group to evaluate the issue and inform the board about potential solutions to reverse the concerning trend. The interest is clearly there, but without adequate learning opportunities there will continue to be a shortage of trained physicians who are willing and able to incorporate brachytherapy into their practice. A recent survey of current radiation oncology residents by the Association of Residents in Radiation Oncology revealed that the majority of residents (95 percent) felt that being able to independently perform brachytherapy by the end of residency was either “very important” or “somewhat important.”<sup>7</sup> While it is a positive sign that current trainees are aware of the importance of brachytherapy and are keen to master it, 59 percent of survey respondents believed that low institutional case load was the greatest barrier to learning brachytherapy. As the interest among trainees is not lacking, it is the role of professional societies to seek out ways to provide dedicated training opportunities for residents to complete prior to graduation. 

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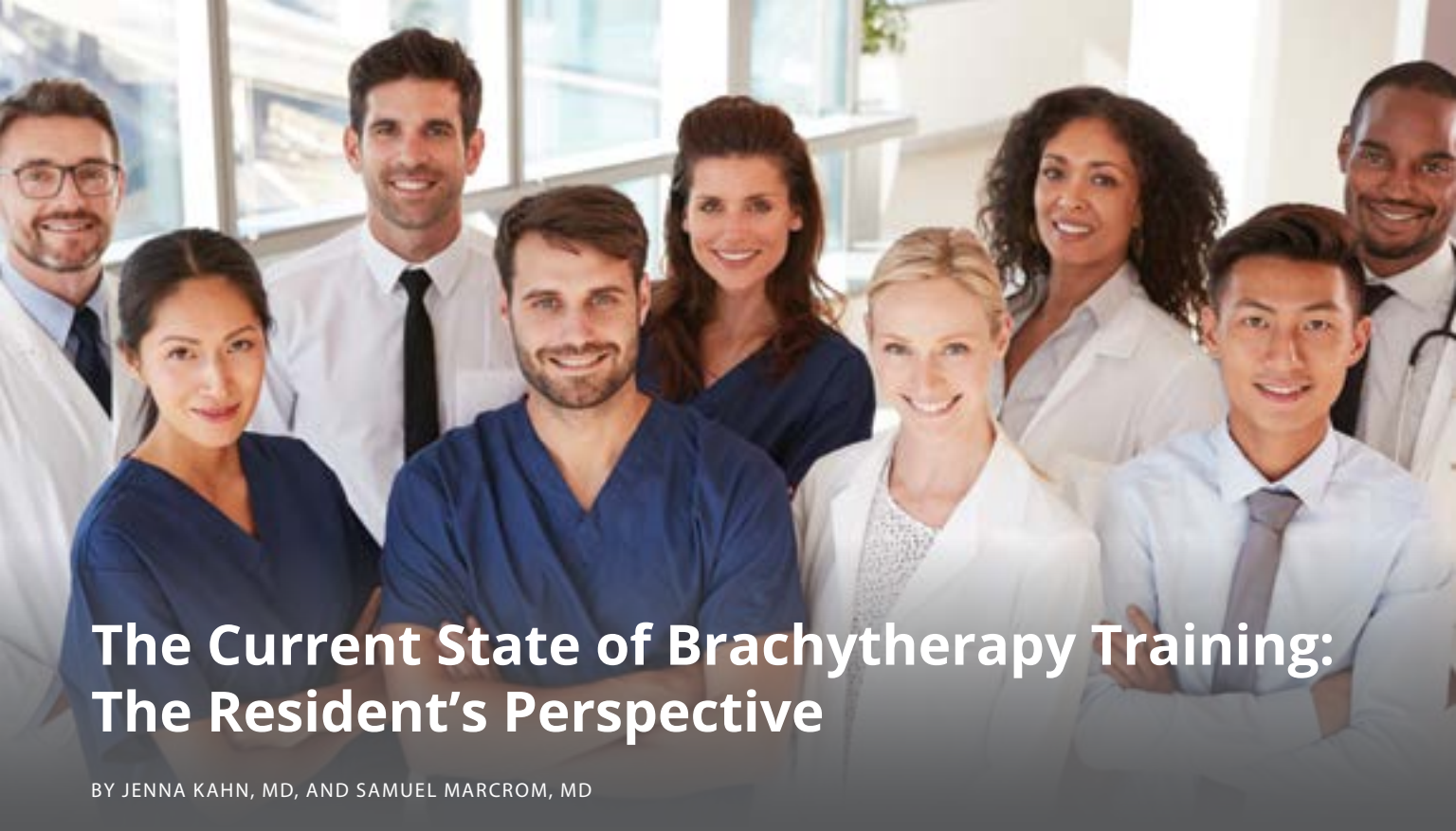
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## 2019 CORPORATE AMBASSADORS

ASTRO PROUDLY RECOGNIZES THE ONGOING COMMITMENT OF OUR CORPORATE AMBASSADORS FOR THEIR OUTSTANDING YEAR-ROUND LEADERSHIP AND PROMOTIONAL SPONSORSHIP OF RADIATION ONCOLOGY.







# The Current State of Brachytherapy Training: The Resident's Perspective

BY JENNA KAHN, MD, AND SAMUEL MARCROM, MD

**RADIATION ONCOLOGY HAS EVOLVED** over the last 25 years with technological advances and increasing complexity in cases, imaging, treatment planning and radiation delivery. This has resulted in physicians evolving toward sub-specialization of both site and technology, including stereotactic radiosurgery (SRS), stereotactic body radiation therapy (SBRT), particle therapy and brachytherapy. One challenge that radiation oncology faces is finding the appropriate balance of broad-spectrum education for trainees in an environment of increased specialization amongst practitioners. The use of brachytherapy is known to improve outcomes in certain cancers but its application has not been uniform with variable practice patterns seen across both academic and community centers.<sup>1</sup> The heterogeneity in the volume of brachytherapy training in radiation oncology has been highlighted in surveys in the United States as well as in Canada over the last decade. Multiple publications have described a declining brachytherapy utilization rate in the U.S. over time.<sup>2-4</sup> Additionally, there appears to be a decrease in trainee brachytherapy exposure to certain brachytherapy modalities with a dramatic decline in the number of chief residents feeling they had adequate exposure to brachytherapy from 2005 to 2015 (example: low-dose-rate prostate brachytherapy, 93 percent vs 32 percent), based on the annual Association

of Residents in Radiation Oncology (ARRO) surveys.<sup>2</sup> Overall, the average number of interstitial cases performed by radiation oncology trainees in residency has decreased by 25 percent between 2006 and 2011 per the Accreditation Council for Graduate Medical Education (ACGME) data.<sup>3</sup>

A recent survey conducted by ARRO assessing brachytherapy training in U.S. radiation oncology residents found that caseload is the greatest perceived barrier to achieving independence in brachytherapy practice.<sup>5</sup> ACGME requirements state that each resident must perform five interstitial and 15 intracavitary brachytherapy procedures. The ARRO survey showed that 97 percent and 83 percent of residents felt comfortable with intracavitary endometrial cylinders and intracavitary cervix cases, respectively. Significantly fewer residents felt comfortable with interstitial cervix (66 percent), prostate (46 percent), breast (38 percent) and skin (15 percent) cases. On the other hand, the ACGME requires 20 SBRT cases and 20 SRS cases during residency. Despite the similarity in required case numbers, a significantly higher number of residents felt comfortable starting an SRS/SBRT practice upon completion of residency (97 percent) as compared to starting a brachytherapy practice (54 percent).

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The enthusiasm of recently surveyed residents to pursue a dedicated one-year brachytherapy fellowship after residency was low (2 percent) although other training opportunities have more enthusiasm.<sup>5</sup> Trainees who felt unprepared to practice brachytherapy independently were more open to the idea of participating in an American Brachytherapy Society (ABS) observership or ABS brachytherapy school to enhance their training. As these training opportunities already exist and provide high-quality experiences in a more compact timeframe, increased utilization of these opportunities by residents may be a tangible way to improve brachytherapy training that doesn't depend on every institution having adequate expertise and caseload. Limitations to an observership during residency would be time out of residency, potentially limited hands-on experience and funding.

Residents value brachytherapy training although only a minority have a formal brachytherapy curriculum or have their brachytherapy skills formally evaluated. The traditional method to teach procedural training is using a repetition-based approach with expert guidance and feedback. As many residents may have a limited opportunity for repetition in brachytherapy given variable institutional caseload, this is an opportunity to increase the utilization of brachytherapy simulation training. Although only a limited number of publications on brachytherapy simulation training exist, the initial reports appear to be encouraging with seemingly consistent improvement in participant competency.<sup>6-9</sup> Additionally, simulation courses would provide the opportunity for training to be directed at specific knowledge/experience gaps in a resident's training. We believe that current radiation oncology trainees are intelligent, highly motivated and capable of learning new skillsets. Brachytherapy is an important and highly valuable component of radiation oncology practice. This belief is widely held by current residents, despite the trend of decreased utilization across multiple disease sites. As the major barrier to

independence in brachytherapy practice appears to be caseload, we should take this opportunity to carefully reflect on reasonable ways to expand opportunities for dedicated training experiences in brachytherapy, such as simulation training, if we want to continue to offer this highly specialized radiation modality.

*Dr. Jenna Kahn is a radiation oncologist resident at the Virginia Commonwealth University Health System and Chair of the Association of Residents in Radiation Oncology (ARRO).*

*Dr. Samuel Marcrom is a radiation oncologist resident at the University of Alabama Birmingham School of Medicine.*

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Jenna Kahn, MD

“Brachytherapy is an important and highly valuable component of radiation oncology practice. This belief is widely held by current residents, despite the trend of decreased utilization across multiple disease sites.”



Samuel Marcrom, MD



BY DANIEL PETEREIT, MD, FASTRO



Daniel Petereit,  
MD, FASTRO

**I RECENTLY HAD THE PRIVILEGE** of describing our cancer disparity program, *Walking Forward*, in the journal *Practical Radiation Oncology*.<sup>1</sup> While implementing strategies to reduce cancer mortality rates for the Northern Plains American Indians (NPAI)

would appear far removed from

the world of brachytherapy, this treatment modality has actually provided substantial benefit for this disparate population. Since many native and non-native patients live 100-150 miles from the cancer center in Rapid City, South Dakota, brachytherapy plays a critical role in the management of these malignancies. Patients frequently choose low-dose-rate (LDR) prostate brachytherapy for treatment rather than surgery or two months of intensity-modulated radiation therapy (IMRT). We have demonstrated increased rates of breast preservation through patient navigation and breast brachytherapy since treatment times are reduced to five days.<sup>2</sup> Although our program facilitates cancer education, screening and early detection, the majority of AI women present with advanced cervical cancer who benefit from image-guided brachytherapy utilizing a hybrid applicator resulting in improved pelvic control and a reduction in toxicities, as discussed in the editorial by Dr. Christine Fisher, found on the following page.

There are multiple publications and editorials detailing the reasons for the national decline in brachytherapy.<sup>3</sup> The decline in brachytherapy is multifactorial and related to the intensive time and resources needed, the technically challenging nature of brachytherapy, less emphasis in training radiation oncology residents, compensation, inadequate maintenance of brachytherapy skills, and competition from alternative radiation treatment techniques.

The recent Association of Residents in Radiation Oncology (ARRO) survey, as discussed by Drs. Jenna Kahn and Samuel Marcrom in “The Current State of

Brachytherapy: A Resident’s Perspective,” identifies low caseload as the primary barrier for residents achieving brachytherapy independence.<sup>4</sup> The number of cases performed by residents positively correlated with the likelihood of starting a brachytherapy practice. While nearly 50 percent of the residents indicated they were likely or highly likely to perform prostate brachytherapy, 22 percent never performed a prostate implant and 66 percent performed less than 10 implants. Also of significance, nearly 75 percent of residents had performed five or fewer definitive cervix hybrid or interstitial implants, and 38 percent performed less than five cervical intracavitary brachytherapy procedures.

The data is irrefutable that when brachytherapy is inadequately performed or replaced with stereotactic body radiation therapy (SBRT) in the management of cervical cancer, cure rates are dramatically

compromised.<sup>5</sup> Per the ARRO survey, residents have limited experience in cervical brachytherapy, and extremely limited experience in the use of hybrid applicators which are becoming a standard in the management of advanced cervical cancer. Moreover, prostate brachytherapy has the highest biochemical control rates as monotherapy for low-to-favorable intermediate risk patients, much better biochemical control rates for unfavorable intermediate-risk and high-risk patients when combined with external beam

radiation therapy (EBRT) compared to EBRT alone from the ASCENDE-RT Trial,<sup>6</sup> and lowest cost and convenience when used as monotherapy. To quote Dr. Steven J. Frank, chair of the American Brachytherapy Society (ABS), “there is no greater value for the treatment of localized prostate cancer than brachytherapy.”

To tackle this head-on, the ABS is implementing a 10-year strategy called 300 in 10. The goal is to ensure the training of 30 competent brachytherapists per year over the next 10 years through a multifaceted approach that includes the following: 1) Increasing public awareness on the value of brachytherapy for cervical, breast and prostate cancer; 2) Partnering with institutions for three-month brachytherapy fellowships; 3) Working to change the Accreditation Council for Graduate Medical Education (ACGME) requirements for brachytherapy (the current ACGME requirements of five interstitial cases and 15 intracavitary cases are

“  
There is no  
greater value for  
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# Recent Advances in Brachytherapy

BY CHRISTINE M. FISHER, MD, MPH



Christine M. Fisher,  
MD, MPH

**CANCER CARE HAS EVOLVED** into highly personalized care, and no treatment modality offers more targeted, escalated therapy than brachytherapy. Patient outcomes are better with brachytherapy in a number of cancers, including improved cancer survival and fewer side effects, than with other treatment

modalities. Brachytherapy can be done with a number of different techniques or applicators, and is applied to a broad array of cancers, both common and rare, including breast, prostate, uterine and cervical cancers, among others. The utilization of brachytherapy is declining, despite incredible data on effectiveness, and shortchanging our patients of the full array of treatment options. Cautious optimism is appropriate, in my opinion, as developments in the fields of industrial design, virtual and augmented reality, and increasing imaging quality across a number of platforms should help to make future brachytherapists more comfortable with the modality.

Our group and others have pioneered 3-D printing custom computer aided design (CAD) applicators as a way to increase the flexibility of the commercially available brachytherapy solutions. We designed, 3-D printed and field tested an external adapter design. The device was easy to use and resulted in seamless, robust positioning of existing gynecological applicators, delivering accurate and valid radiation doses with minimal toxicity. 3-D printing medical device companies are also available to help create customized solutions to challenging oncologic scenarios. The relative ease to produce and modest cost of such endeavors allows for disposable solutions to ease the concerns radiation oncologists might have about customized brachytherapy.


Multiple commercial vendors have designed simulation products for brachytherapy that allow radiation oncology and medical physics residents, fellows and new attendings to practice and advance their skills. These advances include the use of immersive virtual reality-based headsets and are just starting



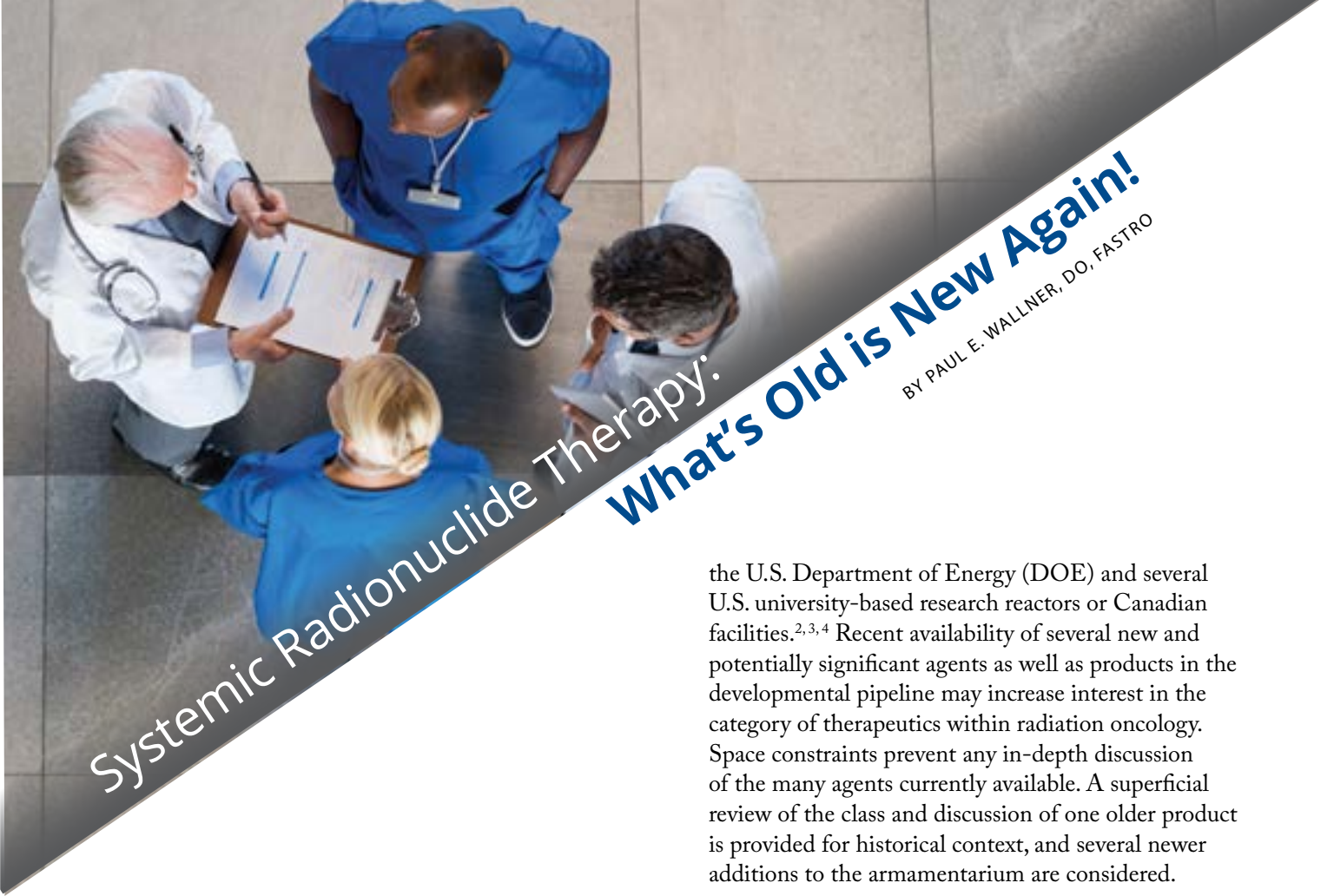
to incorporate augmented reality blending into the surrounding environment.

Finally, imaging quality has improved across relevant modalities, including CT, ultrasound and MRI, allowing optimal visualization of tumor and normal anatomy for preplanning, intraoperative guidance and image-guided brachytherapy (IGBT). IGBT employs cross sectional imaging to create 3-D or even 4-D maps of tumors and normal tissue anatomy, allowing optimal dose delivery. Indeed, IGBT is one of a select few examples in all of radiation oncology where overall survival increased and toxicity decreased with its introduction and testing in randomized phase III clinical trials.

Expertise and comfort with brachytherapy techniques is thriving in low- and middle-income countries (LMIC). Our current chief resident, Tyler Robin, was able to help launch Chartrounds India along with Patricia Hardenbergh (founder of Chartrounds). Once the wide adoption across India had occurred, a brachytherapy-focused session was initiated, led by Dr. Umesh Mahantshetty and supported by our large international collaborative group. Using pre- and post-surveys, increased expertise and comfort was noted by participants across India, who can apply the principles of IGBT to their large cervix cancer population. Similar projects are occurring across Africa, China and the rest of the world that apply creative solutions to local cancer conundrums.

I encourage my residents to participate in as many brachytherapy cases as they are able to and now routinely graduate a brachytherapist annually with well over 100 cases. They are equally facile with high-dose external beam techniques such as SRS and SBRT/SABR, and their fresh eyes see incredible potential for both approaches in the future. It is in harnessing the new world in which we live and embracing the increased opportunities technology brings that brachytherapy will survive and thrive as a part of oncologic care. 

*Dr. Fisher is an associate professor of radiation oncology and residency program director at the University of Colorado School of Medicine in Aurora, Colorado.*



# Systemic Radionuclide Therapy:

## What's Old is New Again!

BY PAUL E. WALLNER, DO, FASTRO

**Systemic radionuclides are perhaps the purest form of brachytherapy but have rarely attained a position of importance within radiation oncology.<sup>1</sup>**

In 2003, ASTRO created a Systemic Targeted Radiation Therapy (STaRT) task force intended to stimulate clinical interest and research in the modality but enthusiasm ebbed and the effort was ultimately abandoned in 2007. Clinical application of the agents has waxed and waned depending on many factors, including: availability of agents for specific clinical indications; introduction of non-radiation emitting products with similar therapeutic efficacy; fear of radiation exposure within the lay community; lack of knowledge regarding appropriateness and availability of the agents within the referral base; and modest levels of reimbursement. Clinical research and development has sometimes been hampered by a lack of novel candidate radionuclides, often available only through

the U.S. Department of Energy (DOE) and several U.S. university-based research reactors or Canadian facilities.<sup>2,3,4</sup> Recent availability of several new and potentially significant agents as well as products in the developmental pipeline may increase interest in the category of therapeutics within radiation oncology. Space constraints prevent any in-depth discussion of the many agents currently available. A superficial review of the class and discussion of one older product is provided for historical context, and several newer additions to the armamentarium are considered.

Nomenclature related to these agents has varied, is often confusing and sometimes technically inaccurate. A frequently employed descriptive terminology is radioimmunotherapy, although only a limited number of available agents are actually immune modulators. Alternatively, the terminology targeted radionuclide therapy may be used, but is also often imprecise. Perhaps the most appropriate, all-encompassing and timely term of reference for the category of products is simply radiopharmaceuticals, or essentially a “category of pharmaceutical agents having radioactive properties.”<sup>5</sup>

Further classification may be based on how the specific agent is delivered, whether it is a free isotope or conjugated to another substance, and the actual chemical or physical properties of the radionuclide.<sup>6,7,8,9</sup> Critical issues in selection of radionuclides for therapeutic intent include the specific half-life ( $T_{1/2}$ ), decay scheme (alpha, beta, gamma or mixed), decay energy levels and chemical properties.  $T_{1/2}$  should ideally be sufficient to enable shipping, handling and possible administration delay without unacceptable degradation of radiation emission or post-treatment risk.

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Decay pattern should be appropriate for the anticipated clinical use. The presence of a gamma component may provide an advantage in greater depth of penetration for therapeutic efficacy and the ability to image for isotope/lesion localization and/or dosimetry but may be problematic for handling and safety purposes. Chemical properties of the isotope may determine its ability to target specific tissues without the need for conjugation to a carrier molecule, or alternatively, may determine the ability to attach carrier molecules without degradation of the isotope.<sup>6,7</sup> The over-arching clinical advantage of the entire class is delivery of the radioactive agent directly or in microscopic proximity to its cellular target, ideally with limited exposure to non-target tissues.

More than 70 years after it was first employed for ablation and treatment of well-differentiated thyroid cancer, iodine-131 (I-131) remains a first-line therapeutic agent.<sup>10</sup> The isotope localizes almost entirely in functioning thyroid tissue, and its  $T_{1/2}$  of 8.04 days and combined beta and gamma emission are therapeutically beneficial and enable imaging localization and dosimetry. Presence of the energetic gamma component does offer some patient management and radiation safety challenges.<sup>10</sup> I-131 has also proven to be an effective agent bound (conjugated) to carriers such as meta-iodobenzylguanidine (MIBG) for both imaging and treatment of certain types of neuroendocrine tumors including neuroblastomas, paragangliomas and pheochromocytomas. In this instance, it is the chemical properties of the carrier molecule which enable it to be used to treat these neuroendocrine tumors. MIBG is similar to norepinephrine/noradrenaline, a neurotransmitter chemical that is selectively taken up by certain neuroendocrine cells.<sup>11</sup>

Yttrium-90 (Y-90) ibritumomab tiuxetan (Zevalin<sup>®</sup>) was the first radioimmunotherapy approved by the U.S. Food and Drug Administration (FDA). Commercially available since 2002, the agent is approved for treatment of low-grade or follicular B-cell non-Hodgkin lymphoma (NHL) that has relapsed during or after treatment with other anticancer drugs, and newly diagnosed follicular NHL following a response to initial anticancer therapy.<sup>12,13</sup> The antibody carrier directly attacks CD20-expressing B-cells delivering the attached isotope with a  $T_{1/2}$  of 64.6 hours and an energetic beta emission directly to the malignant cell.

As is often the case with clinically useful radioisotopes, Y-90 has been attached to other carrier agents for additional clinical indications. The isotope has been embedded in biocompatible resin microspheres (SirSpheres<sup>®</sup>) and glass microspheres (TheraSpheres<sup>®</sup>) for Selective Internal Radiation Therapy (SIRT) of unresectable hepatocellular carcinomas, delivered via percutaneous intrahepatic catheterization.<sup>14,15,16</sup>

In May 2013, the FDA approved radium-223 (Ra-223) dichloride (Xofigo<sup>®</sup>) injection for the treatment of patients with symptomatic bone metastasis from castration-resistant prostate cancer and no known visceral metastatic disease. The Phase III trial submitted for FDA approval demonstrated not only an improvement in bone pain, but also a delay in time-to-first symptomatic skeletal event and overall survival for the Ra-223 arm. Ra-223 acts primarily as a high-energy alpha emitter that selectively binds to areas of increased bone turnover in bone metastases. As a bone-seeking calcium mimetic, Ra-223 is bound into newly formed bone stroma, especially within the microenvironment of osteoblastic metastases.<sup>17,18,19,20</sup>

In the early 2000s, scientists at the University of Missouri's Research Reactor (MURR) recognized the promising clinical properties of lutetium-177 (Lu-177), but it was not until February 2018 that the FDA approved a commercial product utilizing the agent. Lutathera<sup>®</sup> (lutetium-177 dototate) has demonstrated benefit for treatment of gastrointestinal neuroendocrine tumors. Data presented at the 2018 meeting of the American Society of Clinical Oncology (ASCO) indicated that the agent improved progression-free survival, quality of life and overall survival in responsive lesions.<sup>21,22</sup>

Following publication of positive results of a German multicenter Phase II/III trial of Lu-177 prostate-specific membrane antigen-617 (PSMA)

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for metastatic castrate-resistant prostate cancer, an industry-sponsored Phase III randomized trial was opened to global accrual with a 750 patient target. The “VISION” trial will compare the radiopharmaceutical plus best supportive care/best standard care (BSC/BSC) to BSC/BSC alone. Primary endpoint of the study is overall survival.<sup>23,24</sup>

As noted above, commercial availability of useful radiopharmaceuticals has not always translated into sales and revenue figures sufficient to meet vendor projections. Additional negative factors for the two newer agents include significant cost and the reluctance of many facilities to provide products for which reimbursement is uncertain. In an attempt to deal with this presumed underutilization, vendors have approached the U.S. Nuclear Regulatory Commission (NRC) with a request to amend certain regulations governing use of the agents, with an intended result that medical oncologists, urologists and other interested specialists could qualify for limited, category-specific authorized user (AU) licensure (presumably, for alpha- and beta-emitting agents). The regulations detailing training and experience (T&E) requirements for use of these agents are located in Title 10 of the Code of Federal Regulations, Part 35 (10 C.F.R. § 35.390). Section 390 lists the T&E requirements for AUs of the agents, which can generally be met by specialty or subspecialty certification from the American Board of Radiology (ABR) in radiation oncology or nuclear radiology, the American Board of Nuclear Medicine (ABNM), or the American Osteopathic Board of Radiology (AOBR). 10 C.F.R. § 35.390 also defines an alternate pathway to AU-eligibility for practitioners lacking these certificates, but with requisite training and experience. ASTRO and the American College of Radiology (ACR) have been actively involved in these discussions, and vigorously support maintenance of the current T&E requirements as being appropriate, non-burdensome, and having withstood the test of time for the best interests of patients and the public.<sup>25</sup> 

*Dr. Wallner is senior vice president for medical affairs at 21st Century Oncology, Inc. and associate executive director for radiation oncology at The American Board of Radiology.*

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Pitch at 10 (chin up)





# Brachytherapy North of the Border

BY JUANITA CROOK, MD



Juanita Crook, MD

**THE CANADIAN HEALTH CARE SYSTEM** focuses on quality medical care for all citizens but aims to deliver this service as economically as possible. Health care is under provincial jurisdiction, so there are some differences amongst the provinces but in general,

cancer centers are distributed regionally, are affiliated with a university or medical school, and have a budget to provide the required care to their catchment area. As brachytherapy is an economical form of delivering radiation compared to extended courses of image-guided intensity-modulated external beam, this has been an underlying positive force in brachytherapy utilization in Canada.

Intracavitary brachytherapy is an essential component of curative radiation treatment of cervical cancer and is associated with improved overall survival compared to exclusive external radiotherapy.<sup>1</sup> The transition to afterloading high-dose-rate (HDR) from the traditional low-dose-rate Cesium insertions meant that every cancer center required an HDR afterloader and treatment bunker.

Mounting evidence suggests that brachytherapy is also an essential component of curative treatment for prostate cancer, especially high-risk cancers.<sup>2,3,4</sup> Granted, not all men require curative treatment. Because of advancing age and comorbidities, a five to 10 year efficacy window with external beam and androgen deprivation may be sufficient for many, but those who require cure have a much better chance if brachytherapy is incorporated into their treatment plan, a statement supported by the Level One evidence from the ASCENDE trial.<sup>5</sup> However, the nuances of LDR brachytherapy, and the finesse and attention to detail required to ensure optimal results, are not for everyone. This is where HDR brachytherapy comes back into the picture. Initially, HDR could not compete with LDR. LDR is performed in a single one hour outpatient procedure whereas HDR required multiple fractions, hospital admission and pain control for perineal needles in place overnight.

Recent developments, however, allow HDR brachytherapy to be completed in a single two-hour outpatient procedure, ultrasound-guided and ultrasound-planned with treatment delivered while the patient is still under anesthesia. In Canada, the bunkers and the afterloaders are already in place.

A successful program requires more than just equipment. Training and mentorship are essential. Because of regionalization of cancer care and association of cancer centers with universities, brachytherapy training in residency has generally not been lacking in Canada. For those interested in brachytherapy as a focus of their career, post graduate fellowships (six to 12 months) are encouraged. Furthermore, the Royal College of Physicians and Surgeons of Canada (responsible for examination, qualification and licensing of all specialties across Canada) has developed an accreditation program for brachytherapy, recognizing this as a unique skill set within the fundamental practice of radiation oncology. The Area of Focused Competence Diploma in Brachytherapy includes a scholarly project in brachytherapy as well as requiring a portfolio of cases demonstrating competence in two clinical disease sites or techniques, one of which must be either prostate or gynecologic brachytherapy. This program encourages residents to commit to this aspect of their training early in their program.

In British Columbia, brachytherapy is offered in five of the six regional centers. There is a province-wide quality assurance program for review of cases and mentorship. Post-graduate fellows train at two of the centers. Province-wide, there were 375 prostate brachytherapy procedures in 2009. In 2011, HDR prostate brachytherapy was introduced and case volume increased to 520 in 2012. This was followed by a decline of 30 percent over the next two years, largely due to increased active surveillance and decreased PSA screening. Current statistics for 2018 show resurgence to the 2012 peak. Similarly, in the province of Ontario, there has also been a steady increase since 2012 with over 650 cases per year divided amongst eight regional centers.

*Continued on page 27*



# Cervical Cancer Brachytherapy: Can the advances in care be equitably delivered?

BY SUPRIYA CHOPRA, MD



Supriya Chopra,  
MD

## BRACHYTHERAPY IS AN INTEGRAL AND ESSENTIAL COMPONENT

for radical treatment of cervical cancer. Advances in the last two decades in image-guided treatment delivery, magnetic resonance image (MRI) guidance and applicator development have

facilitated dose escalation. Prospective image-guided studies have demonstrated the potential of improved local control and favorable toxicity profile. Observations from retrospective and large phase II prospective studies have led to recommendations for change in clinical practice from point A to advanced imaging and volume-based brachytherapy.<sup>1,2</sup> Unlike concurrent chemo radiation and intensity-modulated radiation therapy, recommendations for image-guided volume-based brachytherapy have evolved without rigorous phase III trials with survival or toxicity endpoints. Modeling studies suggest that advanced brachytherapy techniques are associated with improved local control, lower toxicity and improved cost efficacy. However, recent clinical studies report lack of survival advantage in patients who have advanced disease and poor response to chemoradiation wherein distant metastasis continues to be the dominant pattern of failure.<sup>3</sup> A recent large clinical series that employed X-ray or computed tomography (CT)-guided point A-based brachytherapy with selective use of advanced brachytherapy procedures reported equivalent outcomes to MR-guided series. Within this series, only a small proportion of patients needed combined intracavitary-interstitial brachytherapy.<sup>4</sup>

While transitioning from point A to volume-based brachytherapy may be feasible in clinical environments with adequate resources, the evolving advocacy for volume-based brachytherapy may create distinct implementation challenges within low- and middle-income countries (LMICs). A recent survey from the International Atomic

Energy Agency reported a shortfall of 133 brachytherapy units within LMICs. Assuming that each existing brachytherapy unit can treat 300 women with cervical cancer per year, it is estimated that annually nearly 40,000 women within LMIC's will not have timely access to care.<sup>5</sup>

High volume clinical programs within LMICs perform four to eight procedures per day with a waiting list to accommodate patients needing brachytherapy. A 2018 survey reported that a vast majority of practitioners within high incidence regions for cervical cancer still use X-ray or CT-based point A prescription for cervical brachytherapy.<sup>6</sup> Despite active research in MR based brachytherapy by international groups including LMICs, the transition towards advanced brachytherapy has been slow. Developing a robust image-based program needs investment in new sets of expensive brachytherapy applicators (at least five to eight sets in high volume centers), additional manpower, team training and time. As LMICs have less scanners (0.6-3/ million population) than high-income countries (24-101/ million population),<sup>7</sup> negotiating appointments for image-based brachytherapy within busy diagnostic scanners poses a distinct challenge. LMICs also have a substantial shortfall of human resources with most facilities needing 100-200 percent augmentation of available human resources.<sup>8</sup> It is highly likely that attempts to implement advanced image-guided brachytherapy for all patients may risk increase in patient waiting lists and deterioration in local control due to prolonged overall treatment time. In the current scenario, it's extremely important to identify through clinical trials the patient cohorts that will derive maximum benefit in terms of overall survival or reduced toxicity and triage limited resources accordingly.

While it may be worthwhile to generate level I evidence to test superiority of one brachytherapy technique (point A or volume-based) over the other in a clinical trial, it'll be most imperative to have research programs focusing on clinical

*Continued on page 27*



# European Perspective on Brachytherapy Utilization and Latest Advancements



Alina Sturdza, MD, FRCPC

BY ALINA STURDZA, MD, FRCPC

## EUROPE HAS A VERY OLD TRADITION WITH BRACHYTHERAPY (BT)

starting in 1902 when Dominici performed the first intracavitary intrauterine application for a cervical cancer patient at St.

Louis hospital in Paris.

In the mid-1960s, an independent group of experts founded the Groupe Européen de Curiethérapie (GEC). Their main focus was brachytherapy in all aspects including innovation, research and dissemination of science through congresses, special meetings, educational courses and publications. In 1990, GEC merged with the European Society for Therapeutic Radiology and Oncology (ESTRO) creating the GEC-ESTRO group. This fusion has enabled brachytherapy to strengthen its impact in Europe and to facilitate the administrative aspects of education, collaboration and research in brachytherapy.

The impact of GEC-ESTRO on the acknowledgement of brachytherapy as a feasible and important tool within the multimodality treatment of cancer was clearly demonstrated in a survey that compared the changes in the use of BT in Europe in the years 2002 and 2007. In general, the number of patients in whom BT was performed increased by almost 20 percent. More importantly, the use of 3-D guided BT increased substantially by the use of computed tomography (CT), ultrasound, magnetic resonance imaging (MRI) and positron emission tomography. The most common tumors treated by BT in all groups, in descending order of frequency were: gynecological (59 percent), prostate (17 percent), breast (9 percent), lung/bronchus (3 percent) and esophagus (2 percent).

Over the years, GEC-ESTRO has substantially increased its work, initiating new activities such as organ-related working groups, an executive committee, teaching courses and publications. Currently there are seven brachytherapy working groups which are leading the development of site

recommendations and research: breast, head and neck and skin, gynecology, urology, gastrointestinal, physics (BRAPHYQS) and health economics (Brachy-HERO). The first three have already published target delineation and dose reporting recommendations.

Gynecological BT has encountered maybe the most rapid and successful development in the last two decades in Europe since CT/MRI-guided planning is systematically used. In 2005, the GEC-ESTRO GYN Working Group founded a network to promote collaboration between the increasing number of institutions with research and development activities in image-guided adaptive brachytherapy (IGABT). The focus was on joint research and development as well as on education and dissemination. As a result, the prospective EMBRACE I study (International MRI-guided BRachytherapy in CERvical cancer) and the retrospective RetroEMBRACE study were initiated. These multi-institutional studies confirmed the excellent outcome results from mono-institutional experiences published throughout the world. Furthermore, dose prescription to target volumes and dose constraints for rectum, bladder and rectovaginal point were established. These important findings are integrated in the publication of ICRU Report 89: Prescribing, recording and reporting brachytherapy for cancer of the cervix, a collaborative work between GEC-ESTRO and ABS. The contribution of the GEC-ESTRO Gyn group was of paramount importance in establishing the joint ESGO-ESTRO-ESP guidelines for the treatment of cervical cancer and later of endometrial cancer, in which brachytherapy has an essential role.


The same group designed and launched the EMBRACE II study in which 50 institutions worldwide participate. The goal is to benchmark a high level of local, nodal and systemic control while limiting morbidity, using state of the art external beam radiation therapy (EBRT) and brachytherapy.

*Continued on next page*

The EMBRACE studies portray a clear tendency to perform state of the art IGABT in cervical cancer not only in Europe, but worldwide. This also applies to other gynecological malignancies including vaginal cancer, vulvar cancer and recurrent endometrial cancer. Comprehensive gynecological brachytherapy courses are organized at least twice a year by ESTRO, while contouring and planning workshops with this focus continue to grow in number. This speaks to an increase in brachytherapy utilization for gynecological malignancies in general and of IGABT in cervical cancer specifically. Not only that, but we noticed a revival of the interest in young trainees who attend in higher number of basic and more comprehensive practical brachytherapy courses organized by the GEC-ESTRO subgroups. However, due to a heterogeneous reimbursement, we tend to see large variations in the number of trainees in radiation oncology throughout different European countries.

In spite of the growing popularity of IGABT in gynecological malignancies and brachytherapy in general, there are some shortcomings related to the complex infrastructure required to perform state of the art brachytherapy. This infrastructure is usually available

in large academic centers, which enjoy government financial support and attract most of the trainees in radiation oncology. In peripheral centers and in smaller communities not attached to teaching hospitals, brachytherapy is usually not even offered as an option to patients. Therefore, at the national level, in many European countries there is a tendency to advocate for centralizing brachytherapy cases to tertiary care centers that benefit from the appropriate infrastructure and human expertise.

Overall, in Europe the tradition of brachytherapy continues especially through the effort of the GEC-ESTRO subgroups. Nevertheless, advocacy of brachytherapy should be further sustained at the referee level, among radiation oncology trainees and through patient awareness campaigns. We are looking forward to the World Congress of Brachytherapy in Vienna, Austria, April 2020, where ABS and GEC-ESTRO can join their forces again and promote a strong image of brachytherapy within the world of radiation oncology. 

*Dr. Sturdza is a radiation oncologist at the Medical University of Vienna in Vienna, Austria.*

The logo for ASTRO Academy. The word "ASTRO" is in white serif font on a green rectangular background. To its right is a circular icon with a white infinity symbol on a blue background. To the right of the icon, the word "ACADEMY" is in white sans-serif font on a blue rectangular background.

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The ASTRO logo, featuring the word "ASTRO" in a large, white, serif font. Below it, in a smaller, white, sans-serif font, is the text "AMERICAN SOCIETY FOR RADIATION ONCOLOGY".


HDR is now eclipsing LDR about 3:1, with one academic center in Toronto performing more than 400 prostate brachytherapy procedures last year.

Brachytherapy is thriving in Canada as both an economical and highly effective means of delivering radiation. Availability of training and quality assurance through accreditation are essential components of success. The American Brachytherapy Society recognizes this need and is addressing it through a program of workshops, schools and observerships. 

*Dr. Crook is a professor and radiation oncologist at the British Columbia Cancer Agency Sini Abuwalia Hawkins Centre for the Southern Interior.*

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implementation of brachytherapy in high incidence regions within LMICs. A robust road map is therefore needed at the global level to ensure advocacy for financing brachytherapy with an aim to provide equitable care to all women with cervical cancer. A need for an international joint initiative was recently discussed at the World Cancer Congress for mapping brachytherapy resources in different world regions.<sup>5</sup> Global and regional case studies in brachytherapy availability and financial investment are needed world over to ensure that the opportunity for “cure for many” is not lost in our zest to provide “advanced care to a few.” 

*Dr. Chopra is a professor in the department of radiation oncology at the Advanced Centre for Treatment Education and Research in Cancer (ACTREC), Tata Memorial Centre in Homi Bhabha National Institute, Navi Mumbai, India.*

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## EVOLUTION OF SPATIALLY FRACTIONATED RADIATION THERAPY: PAST, PRESENT AND FUTURE DIRECTIONS

**SPATIALLY FRACTIONATED RADIATION THERAPY (SFRT)** has a history of over 100 years. The concept and its applications are regaining avid clinical interest at many centers in the U.S. and internationally at the current time.

SFRT or GRID therapy was introduced in 1909 and commonly used through the 1930s. SFRT was commonly delivered using a special block called a GRID. The GRID blocks part of the treatment field and delivers the radiation through a specially designed small diameter cylinder-shaped open field to spare the skin dose while allowing a higher dose of radiation to be delivered than would otherwise be possible. In the 1950s, SFRT was widely used with orthovoltage X-rays to treat advanced bulky tumors. With the development of megavoltage radiation, with its skin sparing and better depth dose distribution, GRID therapy has become less commonly used as a clinical method for delivering high-dose radiation. In the 1990s, principles of GRID therapy were applied to megavoltage photon beams again to treat patients with massive tumors or recurrent tumors.

The principle of SFRT is distinctive from the standard radiation approaches, as it does not attempt to treat the total tumor volume with a uniform dose. Instead, it allows the delivery of high doses of radiation in clusters of small areas within the target tissue, especially bulky tumors, without producing prohibitive normal tissue damage in structures close to the tumor. Interestingly, this principle is similar to interstitial brachytherapy with some experts labeling this technique as stereotactic virtual brachytherapy. Thus it is not surprising to see the dosimetry of SFRT inside the tumor volume similar to interstitial brachytherapy with the major difference with SFRT being external beam delivery.

SFRT has produced dramatic relief of severe symptoms, significant objective regression, above average local control rate and minimal toxicity in palliative care. Despite limited resources and research efforts dedicated to SFRT, studies have suggested that SFRT works mainly via bystander effects, intra-tumoral vascular damage, and immune system stimulation. Besides the known useful local effects of SFRT, preclinical data suggest that SFRT can trigger an abscopal response, enhancing metastatic/distant tumor control through modulation of tumor immune microenvironment.

The advancement of physics and technology has provided more techniques to deliver SFRT, such as Tomo GRID, Lattice Radiotherapy (LRT), Proton GRID, Microbeam Radiation Therapy (MRT) and ultra-high-dose-rate irradiation (FLASH). LRT is a three dimensional (3-D) version of SFRT in that it creates 3-D high-dose regions concentrated inside the tumor volume without the limitation of high-dose and related toxicity in the peripheral regions. MRT is a narrow beam of radiation of micrometer or sub-micrometer dimensions. MRT can generate peak entrance doses of several hundreds of Gy well tolerated by adjacent normal tissues, preferentially damaging the target volume. Furthermore, FLASH can deliver large doses of radiation (>50Gy/second) which can be easily incorporated with SFRT. Due to novel advances in image-guided radiation therapy, either via MRI or PET guided Linac, we expect to see more utilization of SFRT in the near future. 



Weisi Yan, MD



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## ASSESSMENT OF KNOWLEDGE AND SKILLS IN BRACHYTHERAPY



Paul E. Wallner,  
DO, FASTRO

**FOR MORE THAN A CENTURY**, sealed-source brachytherapy has been a foundational element of radiation oncology. Somewhat later in the evolution of the field, unsealed sources became available. Despite a recent decline in training and clinical utilization of both modalities, they remain

a critical and powerful tool in the armamentarium of the specialty.<sup>1,2</sup> The importance of brachytherapy in radiation oncology practice is exemplified by the precise nature of residency training requirements as defined by the Accreditation Council for Graduate Medical Education (ACGME).<sup>3</sup> The Radiation Oncology Review Committee (RO RC) program requirements for graduate medical education in radiation oncology specify that program/institutional didactic sessions “must document that residents acquire knowledge and skills through instruction in the following areas,” including “high- and low-dose-rate brachytherapy,” and “must demonstrate competence in performing interstitial and intracavitary brachytherapy procedures.” The requirements further specify that “each resident must perform at least five interstitial and 15 intracavitary brachytherapy procedures,” and that “each resident must demonstrate the requisite knowledge and skills in the administration of at least six procedures using radioimmunotherapy, other targeted therapeutic radiopharmaceuticals, or unsealed sources,” and that “of the six procedures: a minimum of three procedures must include the oral administration of Sodium Iodide (131I) with administered activity equal to or in excess of 1.22 gigabecquerels (33 mCi) for either benign or malignant [conditions] but the counted administrations must be for therapeutic intent.” Requisite experiences in unsealed sources include “a minimum of three

procedures [that] must include parenteral administration with therapeutic intent for a diagnosis of malignancy.”

The precise nature of the ACGME program requirements necessitate that the American Board of Radiology (ABR) include assessment of that knowledge and skills in its qualifying (written) and certifying (oral) initial certification (IC) instruments. Because of the importance of the modalities in radiation oncology practice, continued levels of knowledge and skills must be assessed in the Board’s Maintenance of Certification (MOC) tools.

To assist IC candidates in preparation for the ABR qualifying exams in radiation physics, cancer and radiation biology, and clinical radiation oncology, the ABR has provided study guides that specify areas of assessment.<sup>4,5,6</sup> The IC Certifying Exam is entirely case management-based and where appropriate, includes material related to both sealed and unsealed source brachytherapy. A study guide is also provided for this exam.<sup>7</sup> The study guide for MOC assessment, which in 2020 will become the ABR Online Longitudinal Assessment (ABR OLA), provides similar guidance, but is more oriented to knowledge and skills necessary for day-to-day practice, and at a level expected for all active clinicians, regardless of area of expertise.<sup>8</sup>


The ABR has long recognized the importance of sealed source brachytherapy in the clinical practice of radiation oncology and in 2013, as evidence of this importance, developed a focused practice recognition in brachytherapy (FPRB) program designed to identify volume-based, high-quality providers.<sup>9,10</sup> An important element of the FPRB was a national brachytherapy registry, designed to serve as a focal point for education,



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*Continued on following page*


training and clinical research.<sup>9</sup> Regrettably, because of lower than anticipated diplomate participation, the program was terminated in 2015.<sup>11</sup>

The ABR employs periodic clinical practice analysis surveys to inform development of its IC and MOC assessment instruments.<sup>12</sup> Over the past decade, these surveys have led to some reduction in brachytherapy exam content to parallel what appeared to be a reduction in clinical use of the modalities. The Board is cognizant of evolving practices, especially with some new unsealed agents, and will likely add assessment material regarding these agents to exam instruments in the future. 

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inadequate to establish competency); 4) Reinforcing the need for academic brachytherapy programs (all department chairs and residency directors need to make it a top priority); 5) Supporting comprehensive simulator and didactic training (ABS brachytherapy schools); 6) Proctorship; and 7) Partnership with ASTRO, academic programs and industry. A grant for the AMA initiative, Reimagining Residency, was submitted to address these issues: Collaborative Development of a Novel Brachytherapy Procedural Competency Evaluation Method for Radiation Oncology Residents Entering Clinical Practice. If funded, ABS will have additional resources to implement the 300 in 10 strategy.

The time for discussing the decline in brachytherapy is over, and the time to act is now as the viability of brachytherapy is at a crossroads. Otherwise, brachytherapy will be a point of interest in the timeline of radiation oncology, and our patients will have fewer options and suffer from lower cure rates. We should all step up and work together to solve this problem. 

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# JOURNALS

# HIGHLIGHTS



## HIGHLIGHTS FROM *INTERNATIONAL JOURNAL OF RADIATION ONCOLOGY • BIOLOGY • PHYSICS*

January 1, 2019

### Initial Results of a Multicenter Phase 2 Trial of Stereotactic Ablative Radiation Therapy for Oligometastatic Cancer

*Sutera et al.*

This study explores how SABR may affect oncologic outcomes for patients with oligometastatic disease. One hundred forty-seven patients were enrolled, and following treatment, 84 percent of patients survived at least one year and 43 percent survived five years or longer. Patients reported a statistically significant improvement in quality of life at six and 12 months. A press release for this article is available at the [astro.org](http://astro.org) [News and Media Center](#).

### Timing of Lymphedema After Treatment for Breast Cancer

*McDuff et al.*

The authors sought to determine when the risk of lymphedema is highest after breast cancer treatment, and which factors influence the time course of lymphedema development. Between 2005 and 2017, 2,171 women who received surgery for unilateral or bilateral breast cancer were enrolled in the study. Axillary lymph node dissection (ALND) was found to be associated with early-onset lymphedema, and regional lymph node radiation (RLNR) with late-onset lymphedema.

February 1, 2019

### Validation of Effective Dose as a Better Predictor of Radiation Pneumonitis Risk Than Mean Lung Dose

*Tucker et al.*

This article sought to confirm the superiority of effective dose (Deff) over mean lung dose (MLD) for predicting risk of radiation pneumonitis (RP). Using data from a randomized trial, the authors confirmed that Deff with  $n = 0.5$  (corresponding to root mean squared dose) is a better predictor of RP than is MLD. Additionally, differences between Deff and MLD indicate that delivering higher doses to smaller lung volumes (versus lower doses to larger volumes) increases RP risk.

### A Prospective Phase 2 Trial of TRUS-Guided Brachytherapy for Locally Recurrent Prostate Cancer After External Beam Radiation Therapy

*Crook et al.*

Aiming to evaluate late gastrointestinal and genitourinary adverse events (AEs) after salvage low-dose-rate (LDR) prostate brachytherapy, the researchers registered 100 patients across 20 centers between 2007 and 2014. The trial found that the rate of late grade 3 AEs did not exceed the unacceptable threshold. The only factor predictive of late AEs was implant dosimetry reflected by V100.

March 1, 2019

### Toxicity and Patient-reported Outcomes of a Phase 2 Randomized Trial of Prostate and Pelvic Lymph Node Versus Prostate only Radiotherapy in Advanced Localised Prostate Cancer (PIVOTAL)

*Dearnaley et al.*

Looking to establish the toxicity profile of high-dose pelvic lymph node intensity-modulated radiation therapy (IMRT) and to assess whether it is safely deliverable at multiple centers, this study randomized 124 patients with locally advanced, high-risk prostate cancer between prostate-only IMRT (PO) (74 Gy/37 fractions) and prostate and pelvic lymph node IMRT (P&P; 74 Gy/37 fractions to prostate, 60 Gy/37 fractions to pelvis). The authors note PIVOTAL demonstrated that high-dose pelvic lymph node IMRT can be delivered at multiple centers with a modest side effect profile, though the impact of P&P IMRT on disease control remains to be established.

### Single versus Multifraction SRS for Large Brain Metastases: An International Meta-analysis of 24 Trials

*Lehrer et al.*

This study compared local control (LC) and radionecrosis rates of SF-SRS and MF-SRS in the definitive (SF-SRSD and MF-SRSD) and postoperative (SF-SRSP and MF-SRSP) settings. Twenty-four studies involving 1,887 brain metastases, published between 2008 and 2017, were included. The authors found that treatment for large brain metastases with MF-SRS regimens may offer a relative reduction of radionecrosis while maintaining or improving relative rates of one-year LC compared with SF-SRS.

For more journal articles, visit the new Article Spotlight feature on [www.astro.org](http://www.astro.org).

## HIGHLIGHTS FROM PRACTICAL RADIATION ONCOLOGY

### Robustness Analysis For Radiation Therapy Treatment Plans: Describing Uncertainty Scenarios And Reporting Their Dosimetric Consequences

*Yock et al.*

The ICRU Report 50 was a fundamental change in treatment planning and the evaluation of treatment plans. In proton therapy, robust treatment planning has been used as a more rigorous technique. However, robust treatment planning is also applicable to photon planning. This paper may be considered a foreshadowing of the next major change in treatment planning and evaluation of those plans. The robustness analysis approach described by the authors is presented to promote reliable plan evaluation and dose reporting, particularly during clinical trials conducted across institutions and treatment modalities.

### Standardizing Normal Tissue Contouring for Radiation Therapy Treatment Planning: An ASTRO Consensus Paper

*Wright et al.*

This work represents a consensus professional society recommendation that is relevant to the radiation oncology community and has been endorsed by the American Association of Medical Dosimetrists. Comprehensive identification and delineation of organs at risk (OARs) are vital to the quality of treatment planning and safety of delivery. To improve consistency, a standardized resource for OAR contouring in external beam radiation treatment by disease site has been organized into tables and explained in this publication. The tables offered as a quality assurance resource contain two designations for anatomic sites in the EBRT setting: recommended (structures that are recommended for adult definitive cases and may inform palliative cases) and considered (structures that may be considered depending on the specific clinical scenario).

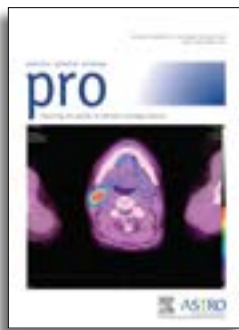
Practical Radiation Oncology has published a podcast further exploring this topic with several of the authors.

The article and podcast are available for free at <https://doi.org/10.1016/j.prro.2018.12.003>.

### Clinical Intensity-modulated Proton Therapy for Hodgkin Lymphoma: Which Patients Benefit the Most?

*Ntentas et al.*

This paper provides value to lymphoma radiation oncologists at photon centers by providing a way to determine which patients with mediastinal lymphomas



should be referred for proton therapy. The authors build on the recently published International Lymphoma Radiation Oncology Group (ILROG) recommendations, offering additional data to assist with decision-making. In particular, their analyses show that of the patient subgroups studied, those with mediastinal lymphoma at or below the level of T7 derived the largest benefit from proton therapy.

## HIGHLIGHTS FROM ADVANCES IN RADIATION ONCOLOGY

### Machine Learning Methods Uncover Radio-morphologic Dose Patterns in Salivary Glands that Predict Xerostomia in Head and Neck Cancer Patients

*Jiang et al.*

Considering machine learning to derive insights? Here the authors used machine learning methods to better understand how the pattern of dose in salivary glands affect long term salivary function in head and neck patients. They found that radio-morphology combined with machine learning methods can suggest patterns of dose in parotid glands and submandibular glands that are most influential to xerostomia. For example, the superior, anterior portion of the contralateral parotid gland and the medial portion of the ipsilateral parotid gland were determined to be the most influential regions regarding dose effect on xerostomia.

Advances in Radiation Oncology has published a podcast further exploring this topic with an author and handling editor from this paper. The article and podcast are available for free at <https://doi.org/10.1016/j.adro.2018.11.008>.

### First Reported Case of Pediatric Radiation Treatment with Magnetic Resonance Image-guided Radiotherapy

*Henke et al.*

Excitement around the use of magnetic resonance image-guided radiation therapy (MRgRT) for multiple patient types is growing. Pediatric patients in particular may benefit because of the reduction in doses from imaging, and optimization of motion management may afford better daily imaging for treatment localization – via MRgRT compared to standard cone-beam CT based image guidance. In the case of a 3-year-old child with IRS Stage III, Group I embryonal rhabdomyosarcoma of the diaphragm, the authors reported successful treatment fractions with MRgRT, without observed acute toxicity. Post-radiation observations (28 months) showed zero evidence of disease recurrence and zero evidence of late toxicity.



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