



Brachytherapy training in India: Results from the GEC-ESTRO-India survey

Prachi Mittal¹, Supriya Chopra^{2,*}, Mitchell Kamrava³, Rajesh Vashistha⁴, Stefan Konrad⁵, Surendra Senapati⁶, Satyajit Pradhan⁷, Vijay Anand Reddy⁸, Daya Nand Sharma⁹, Reena Engineer¹, Rajiv Sarin², Ashwini Budrukhar¹, Sushmita Ghoshal¹⁰, Shyam Kishore Shrivastava¹¹, Jai Prakash Agarwal¹, Alina Emiliana Sturdza^{5,**}

¹ Department of Radiation Oncology and Medical Physics, Tata Memorial Hospital, Tata Memorial Centre, Homi Bhabha National Institute, Mumbai, Maharashtra, India

² Department of Radiation Oncology, Advanced Centre for Treatment Research and Education in Cancer, Tata Memorial Centre, Homi Bhabha National Institute, Mumbai, Maharashtra, India

³ Department of Radiation Oncology, Cedars-Sinai Medical Center, Los Angeles, CA, USA

⁴ Department of Radiation Oncology, Max Super-Specialty Hospital, Bathinda, India

⁵ Department of Radiation Oncology, Comprehensive Cancer Center, Medical University of Vienna, Vienna, Austria

⁶ Department of Radiation Oncology, Acharya Harihar Regional Cancer Centre, Cuttack, Odisha, India

⁷ Homi Bhabha Cancer Hospital and Mahamana Pandit Madan Mohan Malaviya Cancer Centre, Varanasi, India

⁸ Department of Radiation Oncology, Apollo Hospitals, Hyderabad, India

⁹ Department of Radiation Oncology, All India Institute of Medical Sciences, New Delhi, India

¹⁰ Department of Radiotherapy and Oncology, Postgraduate Institute of Medical Education and Research, Chandigarh, India

¹¹ Department of Radiation Oncology, HCG-ICH Khubchandani Cancer Centre, Mumbai, India

ABSTRACT

INTRODUCTION: Brachytherapy (BT) is integral in treatment of gynecological malignancies and is also an option for many other cancers. Data on training and proficiency levels of early career oncologists is limited. Like other continents a survey was conducted for early career oncologists in India.

METHODS AND MATERIALS: An online survey was conducted from November 2019 to February 2020, through Association of Radiation Oncologists of India (AROI) for early career radiation oncologists expected to be within 6 years of training. The survey used a 22 item questionnaire that was also used for European survey. Responses to individual statements were recorded on a 1–5 Likert-type scale. Descriptive statistics were used to describe proportions.

RESULTS: One-hundred twenty-four (17%) of 700 recipients responded to the survey. Majority of the respondents (88%) stated that being able to perform BT at the end of their training was important. Two-thirds of the respondents (81/124) had performed >10 intracavitary procedure and 22.5% had performed >10 intracavitary-interstitial implants. Many respondents had not performed nongynecological procedure- breast (64%), prostate(82%), gastro-intestinal (47%). Respondents predicted that in next 10 years, the role of BT is likely to increase. Lack of dedicated curriculum and training was perceived as the greatest barriers to achieving independence in BT (58%). Respondents suggested that BT training should be prioritized during conferences (73%) and online teaching modules (56%), along with development of BT skills labs (65%).

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* Corresponding author: Department of Radiation Oncology, Advanced Centre for Treatment, Research and Education in Cancer, Tata Memorial Centre, Homi Bhabha National Institute, Kharghar, Navi Mumbai, Maharashtra, India. Tel.: +91-22-27405113; fax: +91-24-146747.

E-mail addresses: schopra@actrec.gov.in (S. Chopra), alina.sturdza@akhwien.at (A.E. Sturdza).

** Author responsible for statistical analysis

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CONCLUSION: This survey identified a lack of proficiency in gynecological intracavitary-interstitial brachytherapy and non-gynecological brachytherapy, despite BT training being regarded as highly important. Dedicated programs, including standardized curriculum and assessment need to be developed for training early-career radiation oncologists in BT. © 2023 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords: Brachytherapy; Education; Survey; Indian early career oncologists

Introduction

The global incidence of cancer in 2020 was 19.3 million, and it is estimated that over 50% of patients will need radiation for the treatment of their cancer (1). Radiotherapy treatment in some solid tumors (e.g., cervical cancer) within low- and middle-income countries is frequently recommended as patients present in a locally advanced stage (2). In some cancer types, brachytherapy (BT) is essential in addition to external radiation to improve local control and survival (3). Omission of BT or use of external radiation for boost for cervical cancer is associated with reduced cancer specific survival and overall survival (4–6). In some tumor sites, BT alone in the radical or adjuvant setting may be curative (e.g., prostate, endometrial) (7,8) or facilitate organ and function preservation (e.g., rectum, breast, bladder, and oropharyngeal cancer) (9–12). Brachytherapy also provides excellent palliation in some cancer sites (esophageal or biliary cancer) (13,14). Despite being an important treatment modality, there is an overall decrease in the utilization of BT procedures (15,16). This decline has been further augmented with increasing popularity of hypo-fractionated regimens for some cancer types (e.g., prostate and breast cancer) (17–19). A national cancer database study that included 1,500,000 prostate cancer patients reported reduction in BT utilization in the United States from 17% to 8% between 2002 to 2010 (20). Similarly, in head and neck malignancies, there has been decreasing trends of BT utilization (16). While BT is a very effective treatment approach, it is highly skill dependent and also needs dedicated training and mentorship. With international trends demonstrating reduced utilization of BT, it is likely that a significant number of radiation oncologists worldwide may lose an important skill. Dedicated efforts are therefore needed for training and mentorship. With an aim to identify existing expertise in early-stage radiation oncologists and their perceptions on the future of BT, a survey was designed by the education task force of GEC-ESTRO and was undertaken in Europe, India, Brazil and Japan. The results of the survey in 21 European countries have recently been published (21) and the present manuscript reports the results of this survey amongst early career radiation oncologists in India (residents and post graduate junior radiation oncologists).

Methods and materials

An online survey was prepared to assess the status of brachytherapy among early-stage radiation oncologists in Europe, India, Brazil, and Japan. (https://wumarketing.eu.qualtrics.com/jfe/form/SV_2g8RFFIYJpqsNL). This was based on the survey performed by the American Association of Radiation Oncology Residents (ARRO) in 2017 (22). The survey consisted of 22 questions, addressing various brachytherapy topics, including interest and confidence in performing brachytherapy, disease site specific questions, barriers in training and preference for future training. Site specific questions were asked pertaining to gynecological (cervix and post-operative endometrial), breast, prostate, rectal and non-melanoma skin cancers. Responses to individual statements were given on a 1–5 Likert-type scale. There were 5 trainee demographic questions and 17 questions that were related to training. The survey addressed several BT topics, including site-specific training (prostate, gynecologic, breast, gastro-intestinal and skin), barriers to training, opinion regarding future role of BT, and preferences for further training. The digital survey was electronically mailed between November 2019 to February 2020 to Association of Radiation Oncologists of India (AROI) members who were within 6 years of the society membership and therefore expected to be in an early stage of training or radiation oncology career. As the society database does not capture the year of initiating specialty training therefore the last 700 registrations were expected to represent early career radiation oncologists. Additionally, the introductory email requested recipients to respond only if they were within 6 years of joining the specialty of radiation oncology as a trainee. After the main survey was circulated, two reminders were sent over email to respond to the survey within a period of 21 days. The survey was subsequently closed to further responses. The responses were summarized using descriptive statistics.

Results

Overall, 124 AROI members (17%) responded to the survey. Ninety-seven percent of the respondents were radiation oncologists and 3% were clinical oncologists. Of the 124 respondents, 61 (49%) were female and 63 (51%) were male. Of these, 88 (71%) were within 3 years of

Table 1

Number of cases performed during training according to disease site and technique.

Current number of cases you have performed in your training:	None N (%)	0–5 N (%)	6–10 N (%)	11–20 N (%)	21–30 N (%)	>30 N (%)	Not answered N (%)
Definitive Cervix Intracavitary	5 (4.0)	19 (15.3)	18 (14.5)	19 (15.3)	13 (10.5)	49 (39.5)	1 (0.8)
Definitive Cervix Intracavitary+Interstitial	44 (35.5)	35 (28.2)	17 (13.7)	15 (12.1)	5 4.0)	8 (6.5)	0
Postoperative Vaginal cylinder	8 (6.5)	19 (15.3)	16 (12.9)	15 (12.1)	17 (13.7)	48 (38.7)	1 (0.8)
Adjuvant breast treatment after lumpectomy (SAVI ^a , Contura, Mammosite)	107 (86.3)	15 (12.1)	2 (1.6)	0 (0.0)	0 (0.0)	0 (0.0)	0
Adjuvant breast treatment after lumpectomy (Interstitial tube and button)	79 (63.7)	35 (28.2)	8 (6.5)	1 (0.8)	0 (0.0)	0 (0.0)	1 (0.8)
Definitive Prostate (LDR ^b or HDR ^c)	102 (82.3)	10 (8.1)	1 (0.8)	8 (6.5)	1 (0.8)	2 (1.6)	0
Gastrointestinal (esophageal/Rectal cancer)	58 (46.8)	42 (33.9)	18 (14.5)	2 (1.6)	1 (0.8)	2 (1.6)	1 (0.8)
Nonmelanoma skin cancer (applicator like Valencia/Leipzig/Xoft/Esteya)	101 (81.5)	16 (12.9)	7 (5.6)	0 (0.0)	0 (0.0)	0 0.0)	0

^a Strut Adjusted Volume Implant^b Low-dose-rate^c High-dose-rate

training, and 26 (21%) belonged to year > 4 of training. Year of training was not available for 10 respondents (8%). Mean age of the respondents was 30 years. Of the 124 responders, 109 (88%) stated that being able to perform brachytherapy at the end of their residency was important, while 12 (10%) stated it was unimportant and 3 (2%) could not come to a decision. Ninety-two respondents (74%) stated that they placed high value on being able to perform BT independently at the end of residency.

Site-specific brachytherapy proficiency

Gynecological brachytherapy

Definite intracavitary and interstitial cervical brachytherapy. On assessing responses to the direct questions related to gynecological BT, two-thirds (65%, 81/124) of respondents reported to have performed >10 intracavitary procedures independently of which 50% (62/124) of respondents had performed > 20 procedures independently (Table 1). Four percent (5/124) of respondents had not performed even a single procedure independently in their residency. For intracavitary-interstitial implants, 22.5% (28/124) of respondents had performed >10 intracavitary-interstitial procedures, 14% (17/124) had performed 6–10 procedures, 28% (35/124) had performed 1–5 procedures and 35% (44/125) had not performed any hybrid procedure. (Table 1) Ninety percent (112/124) of trainees affirmed that after performing 15 intracavitary procedures in residency, they would be able to perform these procedures independently. A vast majority of respondents (57%, 71/124) also felt that performing 5 or more interstitial implants during residency would give them the confidence of performing the implants independently in the future, while 15.3% (19/124) did not agree to the same. Another 27.7% (34) were undecided. Sixty-five percent (81/124) of respondents expressed that the role of BT in the treatment of cervical cancer would increase in the next decade while 33% (41/124) felt it would remain the same. Only 1.6%

(2) believed that use of BT would decrease for cervical cancer (Table 2).

Postoperative gynecological brachytherapy. Seventy-eight percent (97/124) of respondents were likely or highly likely to be able to perform postoperative endometrial vaginal cylinder-based BT at the end of their residency, while 5% (6/124) were unlikely to do so (Table 3). Sixty-five percent (80/124) of respondents had performed >10 such procedures, with 39% (48/124) having performed >30 procedures. Twenty-two percent (27/124) of respondents had performed <5 procedures (Table 1). Also, 58% (72/124) of residents stated that the role of postoperative endometrial BT is likely to increase in the next decade, while 33% (41/124) felt that it is going to remain the same (Table 2).

Breast brachytherapy

A separate question was included for single channel BT implants (Strut Adjusted Volume Implant (SAVI), Contura or Mammosite) and multichannel BT implant for treating breast cancer with adjuvant radiation. A vast majority of respondents had not performed any breast BT implants, which included 86% (107/124) not having performed single channel implant (SAVI, Contura or Mammosite), and 64% (79/124) not having performed a multichannel interstitial implant. Of the respondents, 12% (15/124) had performed 1–5 single channel breast implants and 28% (35/124) had performed 1–5 interstitial tube and button breast implants. Only 1 respondent had performed >10 interstitial tube and button BT implants (Table 1). Nineteen percent (23/124) of respondents stated that they will be able to perform single channel BT and 31% (39/124) stated that they will be able to perform multichannel interstitial implant BT for delivery of adjuvant radiation for breast cancer independently after completion of training (Table 3).

Seventy percent (87/124) of respondents stated that the role of BT is likely to increase in the next 10 years,

Table 2

Response on the predictive role of brachytherapy in various disease sites in the future.

Estimation of future role of BT for following disease sites in the next 10 y.	Likely increase N (%)	Stay about the same N (%)	Likely decrease N (%)
Definitive cervix	81 (65.3)	41 (33.1)	2 (1.6)
Postoperative endometrial	72 (58.1)	46 (37.1)	6 (4.8)
Adjuvant breast treatment after lumpectomy	87 (70.2)	24 (19.4)	13 (10.5)
Definitive prostate	43 (34.7)	40 (32.3)	41 (33.1)
Gastrointestinal (esophageal/Rectal cancer)	65 (52.4)	36 (29.0)	23 (18.5)
Nonmelanoma skin cancer	57 (46.0)	52 (41.9)	14 (11.3)

BT = Brachytherapy.

Please note that 1 respondent had not replied to the role of BT in nonmelanoma skin cancer.

Table 3

Percentage of responders “Highly Likely” or “Likely” to feel comfortable performing brachytherapy independently by the end of residency according to disease site, across different countries.

Brachytherapy technique	India % (N out of 124)	Europe % (N out of 437) ²¹	United States of America % (N out of 90) ²²	RANZCR % (N out of 29) ³²
Intracavitary cervix	81% (100)	46% (203)	83% (75)	31% (9)
Cervix hybrid or interstitial	36% (45)	38% (165)	66% (59)	24% (7)
Intracavitary endometrial (cylinder)	92% (114)	57% (251)	97% (87)	48% (14)
Breast single entry devices (SAVI [®] /Contura/Mammosite)	19% (23)	11% (50)	38% (38)	Breast cancer: 3%
Breast multiple entry (interstitial tube and button)	31% (39)	16% (68)	8% (7)	(1)
Prostate (LDR ^b or HDR ^c)	16% (20)	20% (88)	46% (41)	10% (3)
Skin (applicator such as Valencia/Leipzig/Xoft/Esteya)	19% (24)	18% (77)	15% (13)	7% (2)

RANZCR = Royal Australian and New Zealand College of Radiologists.

^a Strut adjusted volume implant^b Low-dose-rate^c High-dose-rate.

10% (13/124) stated that it is going to decrease and 19% (24/124) stated it is likely to remain the same (Table 2).

Prostate brachytherapy

Sixteen percent (20/124) of respondents stated that they were likely or highly likely to be able to independently perform definitive BT for prostate cancer at the end of their training (Table 3). A vast majority, that is, 82.2% (102/124) had not seen or performed any BT procedures, while only 9% (11/124) had performed >10 procedures (Table 1). According to 35% (43/124) of respondents, the role of BT for prostate cancer would increase in the next 10 years, while 33% (41/124) responded that it is likely to decrease and 32% (40/124) responded that it is going to remain the same (Table 2).

Gastrointestinal brachytherapy

Thirty-four percent (42/124) of respondents had performed 1–5 procedures for gastrointestinal malignancies, including esophageal and rectal malignancies, while 18.5% (23/124) had performed >5 such procedures (Table 1). The majority of the respondents, that is, 52.4% (65/124) stated that the role of BT is likely to increase for gastrointestinal malignancies in the next decade, 29% (36/124) stated that it will stay the same and 18.6% (23/124) stated that the role of brachytherapy is going to decrease (Table 2).

Nonmelanoma skin cancer brachytherapy

Eighty-one percent (101/124) of respondents had not performed a single case of BT for skin cancer, and 18.5% (23/124) had performed 1–10 cases in their residency (Table 1). Nineteen percent (24/124) believed that would be likely/highly likely to be able to perform BT for non-melanoma skin malignancies by the end of their residency (Table 3).

Forty-six percent (57/124) of respondents felt that the role of BT is going to increase in the following years while 42% (52/124) felt is going to remain the same (Table 2).

Learning: impediments and opportunities

The majority of the respondents (58%, 72/124) perceived that the greatest barrier towards achieving independence in brachytherapy was the lack of appropriate didactic or procedural training, while the second most cited reason was the procedure case load in residency (33%, 41/124) followed by lack of interest in learning BT (9%, 11/124) (Table 4). Sixty percent (75/124) responded that their institute had a formal process of BT teaching in their residency, while 22% (27/124) did not have any formal process of BT training. A vast majority of respondents (80%, 100/124), agreed that BT should be its own sub-speciality with formalized training while 6% (7/124) disagreed and 14% (17/124) did not have an opinion.

Table 4

Responses regarding the brachytherapy training in India.

Question	India response % (N of 124)	Europe response % (N of 437) ²¹
Percentage of residents who think performing brachytherapy independently is “very or somewhat” important	88% (109)	59% (260)
Percentage of residents who think performing brachytherapy independently is valued by residency program	74% (91)	36% (159)
Percentage of residents who think 15 case intracavitary requirement sufficient	90% (112)	49% (216)
Percentage of residents who think 5 cases interstitial requirement sufficient	57% (71)	12% (53)
Percentage of residents who strongly agree or agree to having a formal brachy curriculum	44% (55)	32% (142)
Residents who have formal brachytherapy evaluation	58% (72)	21% (93)
Greatest barrier to achieving brachytherapy independence at the end of residency	58% (71)	49% (216)
-Lack of training		
Greatest barrier to achieving brachytherapy independence - low volume of cases	33% (41)	31% (135)
Greatest barrier to achieving brachytherapy independence -lack of interest	9% (11)	17% (73)
High or somewhat high confidence to start a brachytherapy practice	47% (58)	35% (152)
High or somewhat high confidence to start a SBRT ^a practice	45% (56)	62% (270)
Total responders	100% (124)	100% (437)

^a Stereotactic Body Radiotherapy.

The questionnaire also asked how confident respondents would be to practice advanced techniques like BT or stereotactic body radiotherapy (SBRT) after training. Fifty-eight (46.7%) residents stated that they were confident in being able to develop a BT practice in the future. A similar number of residents (45%, 56/124) also stated that they were confident in being able to develop a SBRT or stereotactic radiosurgery (SRS) practice in the future. Respondents were also asked about the ways in which BT training could be improved. Respondents more often preferred educational sessions in BT at conferences (73%, 91/124), followed by development of a skill lab (65%, 80/124) and 56% (70/124) of respondents preferred online teaching modules.

On being asked which additional BT activities they attended during their training, 43% (54) stated conferences, of whom 22% (28) had attended national teaching courses, 17% (21) respondents had attended ESTRO teaching courses and 16 respondents (13%) had attended a GEC ESTRO workshop. Respondents were asked as to which was the most important method of acquiring BT skills, maximum emphasis was laid on national teaching courses (32%) and skills lab (31%).

Discussion

India has 752 teletherapy units and 321 brachytherapy units with heterogeneous distribution of these resources in different states (23). Perhaps there is greater interest in external radiation techniques such as IM-IGRT, Stereotactic radiation therapy compared to brachytherapy, which is more labor intense procedure. Furthermore, not all centers with external radiation facilities have access to BT. Therefore, brachytherapy education and practice can be heterogeneous based on the infrastructure and skill availability. Also, in centers with BT access, a vast majority of BT is utilized essentially for gynecological cancers, es-

pecially intracavitary BT (24). In recent years, there has been emerging evidence showing the impact of quality BT on survival outcomes (25). There has also been increasing evidence for the need of advanced combined intracavitary BT to maximize clinical outcomes in patients with locally advanced cervical cancer (3). This has also been demonstrated in the mono-institutional series from India within the framework of collaborative studies (26,27). It is estimated from the published results that 30%–50% of patients may need advanced BT (3). Based on earlier estimates of women needing radiation for cervical cancer, this number is expected to be 24–40,000 women at the national level per year. Hence, highest priority needs to be given towards skill expansion for advanced gynecological BT (2).

In the present survey, 81% of residents in India were comfortable in performing intracavitary BT as compared to 46% of European counterparts (Table 3) (21). Most respondents (92%) were also very comfortable in performing postoperative cylinder BT. This could possibly be due to the higher incidence of cervical cancer in India and as a consequence, 50% of respondents had already performed > 20 intracavitary procedures (Table 1). This number was higher than that within the European trainees (57%) who may lack the case load in their training facilities. The comfort level in performing intracavitary-interstitial BT dropped significantly as compared to intracavitary alone. However, this proportion was almost similar to that observed in the European trainees (38% vs. 36%) suggesting a need to improve training of advanced procedures across training programs. As advanced techniques have become more available in the last decade, there is an obvious need to set up centers for mentorship and advanced gynecological BT training programs.

For nongynecological sites, very few Indian residents had performed BT. Less than 10% (12/124) of Indian residents had assisted in >5 prostate implants, 7% (9/124) in >5 breast implants and 19% (23/124) in gastrointestinal

procedures. Consequently, residents were least comfortable performing BT for prostate, head and neck, breast and skin malignancies. Among all disease sites, breast cancer was the site where residents felt that the role of BT is going to increase the most in the next decade. The survey was conducted in 2019, where the early career oncologists felt an increasing role of brachytherapy in breast and prostate cancer. This is a perception which may have changed over the last few years with increasing uptake of hypofractionated radiation in breast and prostate. Having said that, 64% of the residents had not performed even a single breast implant. Even then, 31% (39/124) stated that they were confident in being able to perform breast BT after completion of their residency (Table 3). Although this compares favorably with European colleagues, it does highlight the need for further training of residents across training systems in non-gynecological BT(21). Respondents also reported that role of BT is likely to increase (52.5%, 65/124 respondents) for rectal cancer with increase in the popularity of organ preservation approaches (11,12).

Like the present survey, multiple surveys across the globe have clearly demonstrated that a significant number of practitioners lack confidence in performing procedures and attribute it to either not having enough cases or lack of structured training (22,28–33). A higher proportion of Australian and New Zealand trainees and the American trainees felt that the greatest barrier to achieving independence in BT was the low number of patients (70% and 59% respectively) attending their centers. This was much higher as compared to the trainees in Europe and India, where 31% and 33% respectively felt that the greatest barrier to achieving independence in BT was lack of adequate number of patients (21,22,32). The Indian and European residents felt that the greatest barrier to achieving BT independence was lack of formal training (58% and 49% respectively). Less than 20% of residents attributed the reason as “lack of interest in performing BT.” Though different educational and training approaches may be needed across different continents, there is an overall clear need to augment BT education and training. In the last decade, multiple educational courses familiarizing participants with essentials of standard and advanced BT practice have been initiated by the ESTRO school of Brachytherapy and the ABS. Similar initiatives are also in place by AROI in collaboration with ESTRO for cervix cancer. Additionally, the Indian Brachytherapy Society and Elekta Brachyacademy cooperate with Tata Memorial Hospital with the focus on training for both gynecological and nongynecological BT, including live workshops (34–36). It is likely that further augmentation of training is needed using a hands-on approach using cadaver (37), and simulated labs (CTRI/2021/12/039028) (38). A workshop using a simulated approach was conducted in a United States conference for performing select procedures (fiducial placement, applicator selection, suturing and pelvic examination and applicator placements) related to gynecological BT. Of

the 13 attendees who answered the survey, 9 (69%) reported an improvement in confidence in applicator choice, 3 (23%) improvement in comfort with tandem placement, 4 (30%) improvement in comfort with ovoid/ring placement and 5 (38%) increase in comfort in vaginal packing. Eight (62%) reported improved confidence in the management of complications (39). The American Brachytherapy Society (ABS) has also conducted 3 prostate BT workshops from 2017 – 2019. The workshop was aimed at addressing the gap in existing courses and lack of resident training and consisted of lectures and practical demonstration on prostate phantoms and included 111 physician/physicist teams. On a 6 months post workshop survey, 87 (78%) were actively performing prostate BT (40). In India, the incidence of prostate cancer is much lower than in the United States, and very few centers perform prostate BT at present. Recently, prostate BT workshops have also been initiated by the Indian Brachytherapy Society (35).

Apart from training workshops, access to structured imaging and target delineation guidelines can also serve as good training material. Guidelines have been published by GEC ESTRO for performance of BT in different disease sites. However, limited workshops are being conducted across indications to improve skills (41–44). The ESTRO group has developed guidelines on patient eligibility for partial breast irradiation in breast BT and how to perform multicatheter implants. The group also conducts annual scientific meetings to promote BT in ano-rectal cancer and runs regular BT courses including gastro-intestinal BT (45). Need for broader access solutions for training in procedures and learning curve establishment is needed so that training and evaluation of competence could be more objective. With a high emphasis on the use of BT in India, overall Indian radiation oncologists are actively involved in multiple BT collaborative research and educational initiatives (3,27,46–48).

The present survey provides a broad overview of current training and status and potential areas of improvement. However, there are a few limitations. First of all, though the absolute number of responses were high, the proportionate response rate was on the lower side (17%). This low percentage could also be a result of the choice of denominator, that is, the survey being sent to last 700 members rather than selecting mailing list by actual characteristics and experience of trainees. Furthermore, the additional email text also requested not to respond if the recipients were not within 6 years of training. While a response rate of 17% is on the lower side, this is not outside of the more recent expected range for online survey and the results were considered to represent the in-training residents (49,50). Secondly, the survey discusses BT as a whole. It has not captured details on the different steps in brachytherapy procedure, that is, case selection, applicator selection, implantation technique, contouring and plan finalization. Career development from being a trainee to a staff radiation oncologist and a BT specialist

needs multiple skill sets which may need a more formal objective assessment. Furthermore, skills are also dependent on size of the program and clinical case load and quality of training program. These aspects have not been specifically captured. An ongoing initiative in gynecological BT skill assessment in India has led to the development of an assessment scale in a structured format which in future will allow objective assessment of practitioner's skill with an ability to describe learning curve in reference to many of these parameters (CTRI/2021/12/039028) (38). Additionally, relevant in India is whether the respondent belongs to academic or private hospital setup, where case load of patients can vary enormously. Furthermore, details of in-house brachytherapy availability were presumed to be existing whereas that may not necessarily be the case amongst all respondents.

As BT can be safely executed through excellence of a multidisciplinary team procedure, such a survey in future could be extended for skill assessment of medical physicists and radiotherapy technicians in the future, as they play an important part in multidisciplinary team for treatment planning and delivery.

Conclusions

This survey reports on the perception of the BT training of early career radiation oncologists. It also provides a snapshot into existing practices in Indian centers. With a majority respondents stating lack of training as the greatest barrier to independently performing brachytherapy, structured training and skill evaluation programmes are needed. Formal accreditation should be envisioned for improved proficiency in future.

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