



## TO STUDY THE IMPLICATIONS OF ADVANCED EXTERNAL BEAM RADIOTHERAPY (EBRT) TECHNIQUES ON CURRENT BRACHY THERAPY (BT) PRACTICES IN INDIA

**Dr. Vinod Pandey**

Medical Physicist & RSO, Swami Rama cancer Hospital and Research Institute Rampur Road Haldwani UK - 263139

**Mr. Chhape Ram\***

Asst. Prof. Medical Physicist, Swami Rama cancer Hospital and Research Institute Rampur Road Haldwani UK - 263139 \*Corresponding Author

**Dr. Kailash Chandra Pandey**

Associate Prof. Swami Rama cancer Hospital and Research Institute Rampur Road Haldwani UK - 263139,

### ABSTRACT

**Purpose:** To study the implications of advanced external beam radiotherapy (EBRT) techniques on current brachytherapy (BT) practices in India. **Material And Methods:** The role of BT in the treatment of cancer is well recognized either as a solo radiotherapy modality or in combination with EBRT. We performed a survey on the practice of brachytherapy in India covering various cancer sites namely head and neck, lung, esophagus, breast, cervix-uteri, prostate, anal canal, and some soft-tissue malignancies to ascertain the current scenario. In this study we have included both Government and private institutions which are using brachytherapy. **Results:** Our e-survey found that the site-wise break-up of different brachytherapy centers is as follows: head and neck over all 26.98% (eye 4.6%, tongue 48.84%, cheek 41.86%, nasopharynx 13.95%, lip 25.58%); lung 11.63%; esophagus 53.59%; breast 37.21%; cervix (intracavitary radiotherapy 100%, interstitial implant 44.19%); prostate 6.98%; rectum and anal canal 20.93%; soft tissue 46.51%; and skin 25.58%. **Conclusion:** It was found that all the centers in India having brachytherapy were performing intra-cavitary brachytherapy for cervical cancer. The premier academic centers were practicing brachytherapy for many more sites as compared to smaller and private centers. From the responses received in the survey it was observed that there was a decline in use of BT for sites such as eye, nasopharynx, lung and prostate mainly due to the availability of advanced EBRT techniques such as Intensity Modulated Radiotherapy (IMRT) and Volumetric Arc Therapy (VMAT) along with lack of infrastructure, unavailability of skilled manpower, treatment cost (private centers). In addition, due to invasiveness of BT many patients preferred EBRT over BT.

**KEYWORDS :** Brachytherapy Practice, Indian Scenario, Survey.

### INTRODUCTION

In India, brachytherapy (BT) practice commenced very early in Kolkata in 1926 [1, 2]. It was further developed at Tata Memorial Hospital (TMH), Mumbai in the early 1940s with the efforts of Dr. Ramaiah Naidu who introduced the radon seed extraction technique and established its plant there [1,2,3]. Brachytherapy continued with radium till early seventies and thereafter a decline in the use of radium for brachytherapy was noted due to the emergence of telecobalt units in India and radiation hazards associated in use of radium. Since late 1960 till 1990s brachytherapy was re-developed and practiced with Cs-137 Low Dose Rate (LDR), Medium Dose Rate (MDR) machines and after 1994 High Dose rate BT(HDR) system made brachytherapy popular in India [1,2,4]. As per IAEA (The International Atomic Energy Agency), DIRAC (directory of radiotherapy centres) there are 401 radiotherapy centers, equipped with 639 teletherapy units (MV/MeV) and 314 brachytherapy units available in different hospitals across the country in the year 2020 [5]. It is indicative of the fact that brachytherapy continues to be an important modality for the treatment of cancer with or without external beam radiotherapy (EBRT). Relatively poor treatment results have been reported when radiotherapy is given with EBRT alone as compared to treatment with EBRT + BT for cancers of the head and neck, breast, and cervix [6,7].

Due to technological advancement in EBRT, a decline in the practice of brachytherapy was observed at many centers in USA, Canada and other countries [8, 9]. The rate of brachytherapy in US clinic has declined from 75%-80% during 1980s and 1990s to less than 60% after 2003 as per the study conducted by Han et al [5]. However, the effect of emerging EBRT treatment modalities on current brachytherapy practice in India is not well documented. Survey regarding patterns of care of brachytherapy and its related details does not exist mentioned by Susovan

Banerjee et al. It was, therefore, imperative to conduct a survey to know the current status of brachytherapy practice in India. With advancement in EBRT in terms of precision and conformal dose delivery capabilities using technologies such as Intensity Modulated Radiotherapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT), the role of EBRT has expanded for some sites in place of brachytherapy [9]. However, brachytherapy continues to be in reckoning for treatment for certain sites due to its unique dosimetric and radiobiological advantages. The purpose of this study was also to find the implications of advanced EBRT techniques on the brachytherapy (BT) practice in India.

### MATERIALS AND METHODS

We randomly selected 60 cancer institute's (40 government and 20 private), having brachytherapy and IMRT/VMAT capable linac facilities at their centers and e-mailed the questionnaire to get information about their current brachytherapy practices. Out of 60, only forty three centres responded to us. A part of survey was also conducted by telephonic enquiry. We classified the participating cancer institutes in three categories namely A, B and C depending upon the availability of infrastructure, skilled manpower and workload.

**Category A:** Central government funded premier/academic institutes having adequate infrastructure in terms of trained manpower and financial resources.

**Category B:** Well equipped/academic institutes funded by respective state governments/union territories.

**Category C:** Well equipped private institutes and medical colleges.

The questionnaire was e-mailed to Physicists/ Radiation Oncologists of the chosen centers. Questions were asked

whether they were practicing brachytherapy for the following sites: Eye, tongue, cheek, nasopharynx, lip, lung, esophagus, breast, cervix-ICRT, cervix-implant, prostate, rectum and anal canal, soft tissue, and skin. About 99% of the responses were to be in yes or no form. We also asked for the reason(s) if they had reduced or stopped certain type(s) of brachytherapy practices.

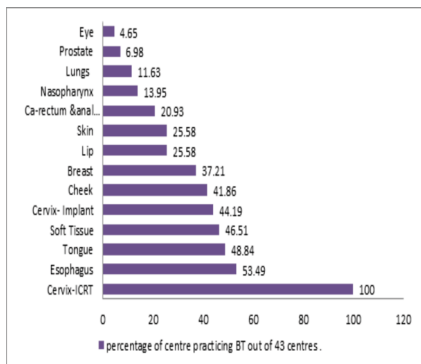
**RESULTS**

Out of the total sixty emails that were sent out to physicists and oncologists of the e-survey, forty three responded to survey which accounted 71.66 % response rate, survey form with its questions and responses received are shown in table 1

**Table 1: Institute-wise Details Of Brachytherapy Practice Of Different Sites**

Sr.No	Tumorsites	CentralGovernment	StateGovernment	Private Institutes-16	No.ofInstitutes Practicing(%)
		Institutes-12	Institutes-15	Institutes-16	
		CategoryA	CategoryB	CategoryC	
1	Eye	2	0	0	2(4.7)
2	Tongue	9	6	6	21(48.8)
3	Cheek	7	6	5	18(41.9)
4	Nasopharynx	2	1	3	6(14)
5	Lip	5	4	2	11(25.6)
6	Lung	3	1	1	5(11.6)
7	Esophagus	9	9	5	23(53.5)
8	Breast	9	4	3	16(37.2)
9	Cervix-ICRT	12	15	16	43(100)
10	Cervix-Implant	10	4	5	19(44.2)
11	Prostate	3	0	0	3(7)
12	RectumandAnalCanal	7	2	0	9(20.9)
13	SoftTissue	8	7	5	20(46.5)
14	Skin	5	4	2	11(25.6)

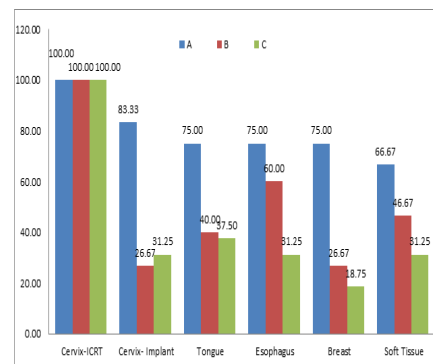
Bar-graph shown in Fig 1 shows the site-wise pattern of brachytherapy practice of various institutes/centers out of a total of 43 centers who responded to the survey.



**Figure 1: Chart Showing Percentage Of Centers (out Of 43 Centers) Practicing Brachytherapy For Different Sites.**

Figure 2 shows the relative BT practices among the three categories of institutes. It is evident that category A institutions were practicing more diverse form of brachytherapy as compared to category B and category C institutes. The use of intracavitary radiotherapy (ICRT) for cervix was 100% for all the practicing brachytherapy centers. A considerably decreasing trend was observed for the cervix implant by categories B and C as compare to category A. From the figure2 it is evident that the six common sites for BT practice in all the three categories of institutes were cervix-ICRT, cervix-implant, tongue, esophagus, breast and soft tissue. The state government and private institutes more or less equally practiced BT in cervix-implant and tongue cases. However, there was a large variation for esophagus, breast and soft tissue among state government and private institutes. Fig 2 also shows

considerably smaller proportion of BT in cervix-implant, tongue, esophagus, breast and soft tissues among category B and C as compared to category A institutes.



**Figure 2: Chart Showing The Relative Percentage Of Bt Practice For Six Common Sites Among The Three Categories Of Institutes (A, B And C).**

The reasons for less active brachytherapy practice reported by the centers are shown in Table-2. Out of the forty three responding centers, 27.9% believed that advancement in EBRT techniques was the main reason for decline in BT for certain sites. 18.6 % believed that non-availability of trained clinicians was the other reason for decline in BT for certain sites. Sixteen percent believed that need for extra manpower, functioning BT operation theatre (OT), and support of anesthesiology along with the fact that brachytherapy was an invasive treatment were some of the reasons of the decline in BT. This problem was more pronounced in private centers where the cost of IMRT/VMAT was high and if BT was also added with EBRT the treatment cost would be further escalated.

**Table 2: Institute Category-wise Reasons For Reduction In Brachytherapy Practice**

Sr.No.	Reason for reduction in brachy therapy practice	A	B	C	total	Percentage
1.	Advancement in EBRT techniques	2	4	7	12	27.9
2.	Expert not available/clinician interestis lacking	3	2	3	8	18.6
3.	Cost, time, extraman power, invasive treatment	0	2	5	7	16
4	Anesthetical and surgical support	0	2	5	7	16

## DISCUSSION

As evident from table 1, eye brachytherapy was being practiced only 02 institutes which were category A premier institutes. In India probably indications for ocular brachytherapy were less or it was not popular among concerned specialists such as ophthalmologists. Hence the investment for such applicators is not justified. This is despite the fact that ocular BT has an important role in treating ocular cancers with I-125 and Sr-90 sources. [4, 24, 25]. All the three categories of institutes were practicing BT for tongue and cheek. The results of EBRT and BT for these sites have been better than EBRT alone as reported by Bhalavat et al. [7] Even for these sites percentage of category A is 75% as compared to 60% and 40% for categories B and C, respectively. Nasopharyngeal cancer (NPC) BT is practiced more in private institutes (category C) as compared to categories A and B. Small difference and small sample size prevented us from making any definitive conclusion on this finding. Overall, NPC BT practicing centers are less in all three categories of institutes. Maybe because of improved efficacy of IMRT/VMAT in such cases or lesser incidents of NPC in India as compared to South East Asia, Southern China and North Africa [10,11]. Or lesser number of early stage NPCs diagnosed in India which are more suitable for BT. Hsing-Lung Chao et al has demonstrated that dose escalation with intraluminal BT for NPC can improve local control of the primary tumor for NPC patients with T1 disease treated with IMRT, even without chemotherapy. BT has been reported as an effective treatment for recurrent NPC cases [12]. The lack of training in brachytherapy has also been reported by many authors [8, 9, 14,17] as reason for decline in BT practice. Han K et al has also reported similar findings for the USA [6]. Another survey based study by Koushik et al [15] about the BT application in Head and Neck cases confirmed that there was decline in BT practice, and the main reason was advancement in EBRT and lack of training and experienced staff in India. Out of 120 respondents, 56% accepted that EBRT advancement and 39 % believed the lack of training and experienced staff is the reasons for decline in BT practices in India as per their studies. Though they took a large sample of 120 centers yet categories of the centers was not mentioned in the study. As per our results the 27.9% respondent accepted EBRT advancement is the main cause of decline in BT practices. Majority number of 7(43.75%) respondent were from private institutes. Gandhi et al [14] also conducted a survey in year 2015 regarding attitude and practice of BT in India after a workshop in brachytherapy. The survey concluded that 93% of the respondents believed lack of training as one of the main causes for decrease of BT practices in India. However, they did not study the effect of advance EBRT techniques on BT for various common treatment sites. Our results are in close agreement with the study conducted by Banerjee et al in 2014. They reported that BT in India was being practiced in a few premier institutes [Group A] and most of the other state government hospitals and medical colleges lacked the dedicated infrastructure such as dedicated OT, anesthetists and equipment. Our study has certain limitations such as a small sample size for only 43 responding institutes. Also, the questionnaire did not cover include information related to work load, training programs, seminars and workshops conducted by various institutions during the last 5 years to get a more accurate picture. Further research needs to be done to collect state-wise data in terms of existing facilities, training program and academic activities conducted by the various government and private medical colleges and institutes in India.

## CONCLUSION

Our survey indicated that all centers practicing brachytherapy in India were performing ICRT for cervical cancer. Academic institutes in category A were far more

active than the other two categories in performing diverse forms of BT. Overall; there was a decline in the use of BT for sites such as eye, nasopharynx, lung and prostates over the years. The primary reasons brought out by the survey for this decline was introduction of advanced EBRT technology namely IMRT and VMAT. Lack of resources in terms of specifically trained manpower, patient preference for EBRT due to invasiveness of BT was some of the other reasons attributed for the decline of BT. The government of India initiative of establishing a National Cancer Institute, 50 regional cancer centres (RCCs) and 20 state cancer institutes (SCIs)[29] are likely to strengthen the teaching and training programmes in cancer treatment including BT. This raises hopes for strengthening BT practice in the coming few years.

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