Brachytherapy in Head and Neck Cancers: “Are We Doing It or Are We Done with It”

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Abstract

We performed an e-Survey and reviewed the literature on the prevalence of use of brachytherapy in head and neck cancers in order to understand the patterns of care and probable application of this modality. A five-point questionnaire was prepared and sent to 300 oncologists through a web-based survey engine. This was done in preparation for my lecture on “Ongoing Research and Potential Research Avenues” in IBSCON held in Chennai in August 2016. SPSS software was used for the statistical analysis. Of a total of 300 emails that were sent out for the survey, 120 replies were received, which is 40%. Among the results of various questions, (i) 65% of the oncologists felt that there were > 300 ongoing studies in brachytherapy and out of them only 10–20 were on head and neck brachytherapy; (ii) 58% of the responders felt that external beam radiotherapy (EBRT) advances followed by lack of training and experience are the reasons for declining role of brachytherapy; (iii) among the responders, numbers of head and neck brachytherapy performed stand third after gynecological and breast brachytherapy. This survey shows that brachytherapy in head and neck cancers is an essential tool, but seldom practiced. If no path-breaking event happens, we may be dealing with it as a dying art.

Keywords Brachytherapy · Head and neck cancer · Web survey

Introduction

Brachytherapy means short-distance therapy and involves placement of radioactive sources within or in close relation to tissue/tumor. It is a branch of oncology which is an amalgamation of surgical skills and clinical acumen. It brings great joy to say that brachytherapy has completed its centenary and started out as the only source to test the effects of radiation on normal as well as tumor tissue.

Head and neck cancer management is always a challenge as all three modalities, in the form of surgery, radiation therapy, and chemotherapy, have a significant role to play. It is always a

debate between the surgeon and the radiation oncologist on who gets to tackle this disease. Optimal management of head and neck cancers varies based on many factors like site, size, stage, histology, and host factors to name a few. Radio-chemotherapy has emerged as a standard of care in many of these tumors due to its inherent advantage of being non-surgical, cosmetically good, and having similar results to that of surgery. However, one needs to plan the radiation so as to give appropriate doses while respecting the tolerance doses of normal tissues, and in this endeavor, brachytherapy will play a pivotal role.

Brachytherapy in head and neck cancers has a history of more than a century, when Regaud at Curie foundation implanted platinum needles with radium for 6–10 h in 1920 and this was later adopted by Maurice Lenz in 1925 in the USA [1]. Evolution of brachytherapy has followed a sigmoid-shaped curve, where it has reached its golden age between 1970 and 1990. Over the last decade, however, it has reached a situation which is alarming and this is supported by the recent SEER data published by Orton and colleagues, which elaborates on the steady decline in the utilization of brachytherapy in these cancers [2]. There have been various reasons that have been attributed to this decline like availability, accessibility, training, and selection of cases to name a few.

Key Messages: As the theme of the conference goes: “Brachytherapy – An Immortal Art” needs to be achieved then some drastic steps have to be taken. This point was reiterated by our survey and also the review of literature. The future of head and neck brachytherapy could depend on the positive amalgamation of these following factors.

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In order to understand the reasons for decline so that further research can be suggested, we did a literature analysis on ongoing research with future trials and also a five-point questionnaire-based web survey of practicing radiation oncologists.

Subjects and Methods

The whole conceptualization of the present article started with an invitation to deliver a lecture on ongoing research and potential research avenues in head and neck cancers in the recently held IBSCON (Annual Conference of Indian Brachytherapy Society) at Chennai in the month of August 2016. The scientific program was designed to make the delegates understand that brachytherapy is an immortal art and with the objectives of:

- Understanding the basics of physics and radiobiology in brachytherapy
- Indications and also modifications of techniques involved in brachytherapy
- Future perspectives

As with any conference, IBSCON was held over a period of 4 days which included live demonstrations, didactic lectures, panel discussions, and debates. As I was assigned to speak on “Ongoing Research and Potential Research Avenues” in head and neck cancers, I felt it appropriate to know what my colleagues felt on this topic. Hence, we designed a 5-point questionnaire-based web survey along with literature review on the same topic.

Results

Of the total 300 emails that were sent out to oncologists of the web-based survey, 120 took up the survey which accounted for a 40% response. A Web survey form with its five questions and the responses received is elaborated in Table 1 and Graphs 1, 2, 3, and 4.

Discussion

Brachytherapy practice, especially when it comes to head and neck cancer, needs to be looked at in a serious way if you want it to remain as an immortal art. Brachytherapy offers a unique advantage in terms of:

1. Possessing robust historical data
2. Having a dosimetric and radiobiological advantage

Table 1 Questionnaire and responses

Question	Choices and response
What according to your knowledge is the number of ongoing studies in brachytherapy in the world? [GRAPH-1]	1—> 300 = 12% 2—200–300 = 15% 3—100–200 = 8% 4—< 100 = 65%
Out of the total number of ongoing studies how many are in Head and Neck cancer Brachytherapy? [GRAPH-2]	1—0 = 8% 2—1–9 = 30% 3—10–20 = 38% 4—> 20 = 24%
What in your opinion is the reason for decreasing role of Brachytherapy in Head and neck cancer? [GRAPH-3]	1—EBRT advances = 56% 2—Training and experience = 39% 3—Reduced remuneration = 4% 4—Others = 1%
At present the number and type of Brachytherapy procedures you do in a year? [GRAPH-4]	Gynaec: 140 Breast: 45 Head and neck: 24 STS: 5 Others: 20
Future or scope of Research Trials in Brachytherapy-	1—Surgery vs radiation in the form of EBRT + brachytherapy in early stage Ca. tongue 2—Ca. buccal mucosa: brachytherapy boost vs surgery 3—Comparison of brachytherapy alone vs EBRT in early stage post op Ca tongue.

3. Recent technological advancements

If we need to use the abovementioned advantages, then there is an urgent need for clinical research and comparative data collection with other modalities to ascertain supremacy. In this paper, we have tried to review the current situation of brachytherapy and recommend methods to re-establish its role under the following headings.

1. Clinical Trials

We tried to search the number of clinical trials that are active and the number in www.clinicaltrials.gov was 223,375, and when we filtered it to radiotherapy trials, then the result was 10,994. When we further advanced the search to

What according to your knowledge is the number of ongoing studies in brachytherapy in the world?

Graph 1 Responses for query number 1

Graph 2 Responses for query number 2

see how many head and neck cancer trials with brachytherapy were registered, the number became a dismal figure of one. The trial that is active is on inoperable salivary gland tumor and registered as NCT 02048254-2014 [3]. There is one more trial on brachytherapy boost being done at Tata Memorial Hospital (TMH), Mumbai, which is active, but not registered under the www.clinicaltrials.gov website.

As per our survey, the response was better than the reality as more than 50% of the respondents felt that there were more than 10 ongoing studies.

2. Training in Brachytherapy

If one needs to practice a technique, he/she needs to be adequately trained for it and this is where different forms of learning methods come in to vogue:

- Live workshops: Even though many things are taught it is not going to change the way people practice, because at the end of the day it is a teacher performing and students watching—however it is better than didactic lectures. Another limitation would be that cases may not be available at the time of planned workshops
- Mannequin based: this can be a good alternative, but it is expensive and not available in India. Although it gives an idea about the basic aspects of brachytherapy, it needs to be supplemented with additional training.
- Cadaveric hands-on training: one of its kind in the world done by us in M.S. Ramaiah Medical College. It is almost equivalent to live patients and has helped a few participants to start doing brachytherapy after the

Graph 3 Responses for query number 3

Graph 4 Responses for query number 4

training as they become confident of the intricacies of the procedure.

- Live patients: best to have this exposure directly, but due to lack of training and fear of complications, it is rarely possible. Also, experts who are doing them regularly should be inclined to teach.

This may be the answer as oncologist's response in our survey showed that 39% of the oncologists felt lack of training as the main reason for decline in brachytherapy usage. Probably, a combination of cadaveric training coupled with getting trained by experts on live patients would go a long way in preserving this science and art of brachytherapy

3. Technical

- Dose: there have been lots of speculations on what the ideal tumoricidal dose which needs to be delivered. But as per the consensus, a dose less than 60 Gy LDR equivalent is not beneficial in controlling disease. There are no trials that are going on as far as comparing different doses is concerned.
- Dose rate/dose per fraction: dose rate is a contentious issue; however, an agreed upon consensus is that a dose >4.5 Gy per fraction is not advisable in head and neck cancers. Dose rate is not being tested presently in any clinical trial.
- Planning algorithms: there are two types of algorithms, one employing TG43 [task group-43] which is the most common one and the other MBDA [model-based dose calculation] which is the one being tested.
- Delivery systems: lots of advancements have happened in this area in the last decade, following which we have reached a plateau where further research is not going on. However, there seems to be no necessity as the present delivery systems are able to deliver high dose and at the same time personnel are not exposed.

4. Applicator Based

- Template: there has been considerable research that has happened in gynecological malignancies, but head and

neck area is not far behind with the development of PIPARD tongue template. However, the alternative argument is that when freehand technique can do the job then why is there a need for a template. The only reason can be for ease and reproducibility of implant.

- Mold: this seems to be most relevant in head and neck cancers in areas which are superficial like the nose, ear, hard palate, and buccal mucosa.
5. Collaborations: There is a need for collaborations in research, because most of the data published will draw the following conclusions:
 1. Limited sample size
 2. Requires further validation
 3. Multicenter randomized data is the need of the hour
 4. Expertise is lacking or patient number is an issue
 6. Indications: most of our research is limited by the researcher's mind, and when he/she decides that these four walls cannot be breached, then it stops being researched and ends up more like an improvisation. One area where we can recommend further data is newer indications like:
 - Eyelid tumors [4]
 - Keloid
 - Brachytherapy boost
 - Ear tumors

There are a few questionnaire-based surveys on the topic of brachytherapy in general like that published in 2015 by Gandhi and his colleagues [5] on Attitude and Practice of Brachytherapy in India and Nuances of Brachytherapy published by Ram Alva and colleagues [6]. The present survey is a bit different in terms of being a web-based survey and only addressing head and neck brachytherapy in particular. As with any survey, there are a few drawbacks in the present one too like:

1. Representative sample may not be an accurate measure of type of practice prevalent.
2. Sample of 120 out of more than 1000 radiation oncologists in India may be an issue.
3. We limited the questionnaire to a simple five-point one which may be a strength as well as weakness of the study as its not assessing the complete spectrum.
4. Web-based survey was not only done at the outset with the intention of publication but also to understand the trends that are prevalent to aid in preparation of the talk.

Conclusion And Summary

It is very clear that brachytherapy for head and neck cancer has its own place and it is just that there is a lack of training. It

Table 2 Summary

Logistics	Lacking as many centers with no brachytherapy facility are coming up.
Economics	Brachytherapy is economical
Training	Needs a lot of innovation
Treatment time	Very short
Relevance	Relevant especially in the present era of organ conservation and screening.
Advancements	Some are going on; still lot remaining
Evidence	Robust data available.

is definitely going to be used for selected patients and will contribute to a better therapeutic outcome with lesser side-effects. Change in the mindset and willingness to consider brachytherapy for required patients coupled with training will surely sustain this modality of radiation.

As the theme of the conference goes, “Brachytherapy –An Immortal Art” needs to be achieved then some drastic steps have to be taken. This point was reiterated by our survey and also the review of literature. The future of head and neck brachytherapy could depend on the positive amalgamation of these following factors (Table 2).

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