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A Comparative Study of Xerostomia during Treatment with 3D CRT vs. IMRT in Loco Regionally Advanced Head & Neck Carcinoma

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Abstract – The aim of this study is to compare xerostomia during treatment with 3D CRT Vs IMRT in locally loco regionally advanced Head & Neck carcinoma. This study was done at department of Radiotherapy ATRCT&RI, Bikaner Rajasthan. A Total 60 cases of locally advanced carcinoma of head & neck was taken in study. All patients was histological proven case of SCC. Result found that the 3 DCRT group demonstrate significant (grade II) less toxicity (Acute toxicity) at the follow up of 6 month and IMRT group demonstrate significant (grade III) less toxicity (late toxicity) at the follow up of 12 month. It is concluded that Tissue sparing is better by IMRT might lead to better quality of life in long run.

Keywords – Xerostomia, Carcinoma, Head & Neck, 3D CRT, IMRT, Locally Advanced

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INTRODUCTION

Cancer is a major causes of illness and mortality globally, In 2012, there were approx. 14 million latest cases and 8.2 million death from cancer. It is anticipated that by 2030 cancer causes 20–26 million new cases, killing 13–17 million. In the Indian context, 1.1 million new cases of cancer were projected, indicating that India was responsible for 7.8% of world cancer burden in 2012 (out of 184 nations); mortality statistics were 682830, accounting for 8.33 percent of global cancer fatalities. Malignancies of the head and neck are the sixth most common malignancies worldwide, and the third most common in India (2nd most common in males while 4th most common in females). The malignancies that arise from the base of the skull to the thoracic inlet are called head and neck cancers (HNC). According to the GLOBOCON, head and neck cancers account for nearly 166,708 new cases in females and 477,161 new cases in males each year. The mortality rate is staggering, with nearly 262,242 males and 89,498 females worldwide dying from the disease each year.

Every year, India registers over 200,000 head and neck cancer cases were new.

In 2018, our institute, Acharya Tulsi Regional Cancer Training and Research Institute, registered 3002 (total 11299) new head and neck cases.

The RT reactions can be severe enough to necessitate treatment interruptions, which can have a negative impact on the treatment outcome. With the advancement of modern radiotherapy techniques, we can now precisely deliver radiation to tumor-sparing organs at risk (OAR), resulting in fewer side effects. However, as we advance in technology, the treatment cost rises as well. In this research, we evaluated the incidence of xerostomia in patients who had head and neck cancers and received 3DCRT vs IMRT.

According to Ghosh et al., aim was to assess OCC following IMRT result. 40 patients underwent post-operative definitive (21) radiation therapy or IMRT (19) between 2013 January to 2015 January with carcinoma buccal and carcinoma alveolus. A locally progressed T3/4 tumor or a recurrent tumor was found in 28 individuals (70 percent). Total radiation doses given varied between 60 and 70 Gray at 2 Gray/fraction. Cisplatin-based chemotherapy was given to a total of 31 patients (78%) at the same time. Over the same time period, another group of 42 patients got 3D-CRT as a definitive or postoperative adjuvant therapy. Comparisons were

conducted between these two groups. The 95% confidence interval was computed using an unpaired t-test after data was input into an Excel spreadsheet and represented as standard deviation and mean. To investigate local control, the Kaplan-Meier curve was employed (LC). Patients treated with postoperative IMRT had the high LC rate (89 percent LC at 2 years), followed by postoperative 3D-CRT patients (79 percent LC at 2 years), and finally definitively irradiated patients with IMRT and 3D-CRT had the lowest LC rates (43 percent and 32 percent at 2 years, respectively). As estimated, the LC rate for the T1 stage (83 percent, n = 6) were significant high than that for the T2-4 stage (55 percent, n = 76). Due to the high LC rate of all the treatment subgroups examined after the post-operative IMRT of the alveolum cancer and buccal silk, it should be strongly recommended in such cases, particularly those with adverse features like close resection margins, nodal involvement, locally advanced tumor (>T1N0), or recurrent disease.

DeFelice, et al., 2020 The goal of the meta-analysis research was to assess grade 2 incidence differences in grade 2 xerostomia and clinical outcomes with the 3DCRT in terms of its efficacy and toxicity. For systemic reviews and meta-analysis (PRISMA), the specified reporting elements were used. The researchers used random-effects models. The primary result was grade II or poorer xerostomia. Overall survival (OS) and local regional control were the secondary goals (LRC). Three randomized clinical trials were perform with a total of 213 people. The I MRT technology reduced the total acute xerostomia, grade 2 and late xerostomia (RR=0.71.95 per cent CI=0.59-0.86.95) at 1 and 2 years after the treatment (RR=0.71, 95 per cent CI=0.59-0.86, RR=0.45, and 95 percent CI=0.31-0.65 and RR=0.26, 95 per cent CI=0.15-0.46, respectively) with no significant improvements in OS or LRC as compared to 3D-CRT. with IMRT techniques reduced the number, grade 2 and grade 2 of the acute xerostomia and late xerostomiasis This meta-analytic compares the efficacy of IMRT with that of 3D-CRT, and finds that IMRT is above 3D-CRT, not in clinical results, in grade 2 xerostomia rates. It has yet to establish its efficacy as regards tumor control and survival.

Gupta et al. indicated that in the head and neck carcinoma treatment with a purpose to cure cancer, study aims to compare conformal three-dimensional radiotherapy to intensity module radiotherapy. The incidence of the physician evaluated RTOG grade 2 or a worse acute salivary-glucose toxicity was allocated randomly to patients with a biopsy of squamous Oropharynx, Larynx or Hypopharynx (N0-2b, T1-3) disease with either 3D-CRT or IMRT. The random allocation of 60 patients (n = 28) to 3D-CRT or IMRT (n = 32) has been carried out between 2005 and 2008, with an intentional evaluation. The proportion of RTOG grades 2 or less patients with acute salivary gland toxicity was much lower for IMRT [19 of the 32 patients than for 3D-CRT (25 of the 28 patients) [25%, 95% CI: 72%–97%; p=0,009%]. Subcutaneous fibrosis and late xerostomia have also significantly reduced using IMRT. The salivary role in IMRT persons (p(59%, 95% CI: 42%–75%)] -value for trend = 0.0036) has grown significantly over time. In 3 years the two locoregional control or survival groups showed no significant differences. Compared with3D-CRT, the incidence and severity of xerostomia decreased significantly when the HNSCC is irradiated with curative intention.

MATERIAL AND METHODS:

On patients with locally advanced head and neck carcinoma treated with definitive radiotherapy with curative intent either with 3DCRT or IMRT over linear accelerator and completed the prescribed dose of radiation, the current study was conducted at the Radiotherapy ATRCT&RI department, Bikaner Rajasthan, India. The research excluded patients with early stage cancer, non-squamous histology, primary site other than the oral cavity or oropharynx, previous history of radiation, non-compliance with radiotherapy, and palliative care.

The researchers looked at a total of 20 cases of locally advanced carcinoma of the head and neck. All of the patients had SCC that was histologically proven.

Group A – 30 previously untreated patients were chosen randomly and treated with 3D Conformal Radiotherapy.

Group B – 30 previously untreated patients, who were randomly selected and administered IMRT.

All the selected patient were treated on a Seimens Oncor Expression dual energy linear accelerator machine with a 6 megavoltage photon energy beam and supine immobilization using a thermoplastic device. All patients receive 70 Gy in 35 minutes, with 2 Gy per minute for 5 weeks. Weekly cisplatin 40 mg/m2I.V. is given to all patients, along with concurrent radiotherapy. Both groups showed signs of xerostomia toxicity.

Every week, all patients received a 40 mg/m2 intravenous injection of cisplatin, which was given concurrently with radiotherapy. The RTOG Acute and Late Radiation Morbidity Scoring Criteria were used to evaluate acute toxicities including mucositis, dermatitis, xerostomia, and dysphagia, with the worst grade being recorded.

For statistical analyses, version 20.0 of the Statistics Package was utilized. The Chi-square has been used to verify every category data. To determine the statistical significance a two-tailed p-value report and alpha level 0.05 were utilized.

RESULT AND DISCUSSION:

Tables 1 and 2 show the treatment-related acute and late toxicities. The average time between follow-ups was 6 and 12 months. At the 6-month follow-up, the three DCRT groups showed significantly (grade II) less toxicity (acute toxicity). At the 12-month follow-up, the IMRT group showed significantly less toxicity (late toxicity) (grade III).

Table 1 Treatment related acute toxicities

At 6 month xerostomia		
	3 DCRT	IMRT
Grade - I	1 (3.3%)	2 (6.6%)
Grade - II	10 (33.3%)	19 (63.3%)
Grade - III	19 (63.3%)	9 (30%)

Table 2 Treatment related late toxicities

At 12 month xerostomia		
	3 DCRT	IMRT
Grade - I	0	4 (13%)
Grade - II	12 (40%)	20 (66.6%)
Grade - III	18 (60%)	6 (20%)

DISCUSSION:

Traditional radiotherapy, which is widely used, has been linked to serious acute and late side effects. To resolve this problem new techniques like as MRT and 3DCRT have been developed, to precisely provide radiation to the tumor and reduce exposure to the normal tissues around it. The evolution of modern radiation methods is describe in details by Bucci and Ling et al. These advanced methods have the benefit of adapting the unevenly formed target volumetric radiation beam in the case of head and neck cancer, minimizing radiation to surrounding healthy vital tissues like the brain stem, spinal cord, larynx, parotid glands, and so on. The most frequent late adverse effect of head and neck radiation is xerostomia. IMRT may decrease parotid gland irradiation when compared to traditional treatment. Nutting et al. performed a randomized controlled study (RCT) comparing conventional radiation to parotid-sparing IMRT (47 patients in each group) between 2003 and 2007, with the main endpoint being the percentage of patients having grade II or worse xerostomia. P = 0.003 showed that the IMRT group had substantially fewer grade II or worse xerostomia at 12 months than the conventional radiation group. In terms of grade II or worse xerostomia, IMRT was shown to be substantially less frequent than conventional radiation at 24 months; P 0.001. At 12 to 24 months, IMRT demonstrated substantial improvements in saliva secretion recovery as compared to conventional radiation. In Non-xerostomy late toxicity, locoregional control or overall survivors At 24 months there were no major differences between the two groups. In 245 patients who have had primary radiations for stage III and stage IV of squamous cellular carcinoma, Lambrecht and his colleagues have compared 3DCRT to IMRT between 2003 and 2010. Three DCRT treatments were given in 135 out of 245 patients and IMRT in 110. After three years, no significant difference in locoregional control or overall survival rate was observed between the IMRT and the three DCRT.

In addition to xerostomia, we discovered that IMRT decreased the occurrence of moderate to severe subcutaneous fibrosis when compared to 3D-CRT, and that the reduction was mostly maintained over time. Even though doseconstraints were not applied individually, reduced doses to subcutaneous tissue using IMRT may have resulted in improved long-term restoration of vascularity in the dermal and subdermal layers. The biochemical hypothyroidism of both methods had no significant difference and the average thyroid doses in both (dose-volume constraints were not applied separately). Additional late toxicity is too rare to compare statistics. High dosages of TR in the bilateral carotid arteries, leading to stenosis and decreased brain supply, may cause three cases of cerebrovascular accidents. Non-cancer fatalities, such as stroke and aspiration pneumonia, were somewhat higher in the 3D-CRT arm, but the precise reason of death in four patients was unclear. Newer dose-volume restrictions and consensus recommendations for additional OARs, like carotid arteries and dysphagia-aspiration related structures (DARS), will require to be evaluate in prospective trials to minimize late morbidities and non-cancer related mortality like head and neck cancer survival improves (Hall and Wuu, 2003). The frequency of second new primary was almost similar in both hands of our research, throwing doubt on the notion that IMRT is associated with an increased risk of second malignant neoplasms due to greater volumes of low-dose spillage and, as a consequence, higher integral doses.

Previous IMRT investigations have shown marginal recurrence rates of 5–15 percent in the region of the spared parotid gland, generating genuine safety concerns. In all armed areas of our study, the long-term results linked to diseases (LRC and OS) were reassuringly similar, indicating that parotid sparing did not cost the treatment of diseases. To ensure the safety of IMRT, we followed standard target volume delineation and contouring guidelines, as well as stringent quality control in treatment planning and delivery. However, our study lacked sufficient power to show equivalence or non-inferiority of IMRT over 3D-CRT in terms of disease-related outcomes (LRC or OS), which would necessitate the randomization of over a thousand patients (Cannon and Lee, 2008; Chen et al., 2017).

CONCLUSION:

Patients with local advanced head and neck SCC who were treated with modern radiotherapy techniques in a single institute were included in this study. According to the findings, IMRT is linked to a significant decrease in late and severe (grade-III) toxicity. Acute and moderate (grade-II) toxicity are less common with 3DCRT than with IMRT. In the long run, IMRT's better normal tissue sparing may lead to a higher quality of life.

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