

## Original Research Article

# Incidence of dry eye after radiotherapy for head and neck tumours: a tertiary Care Hospital North West Rajasthan

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### ABSTRACT

**Background:** Radiotherapy plays a critical role in the management of many patients with head-and-neck (H&N) cancer. To study the incidence of dry eye associated with radiotherapy and correlate them with dose of radiation.

**Methods:** This Hospital based prospective study comprises of 100 patients of head and neck tumors who received radiotherapy by linear accelerator from 2015 to 2017. Ocular examination was done prior to the start of therapy, 1st follow up at 15th day of therapy, 2nd at last day of therapy (23-35 fraction), 3rd at 3 months after completion of therapy for side effects, 4th at 6 months, 5th at 12 month and 6th at 18 months after completion of therapy for assessing dry eye.

**Results:** 59% patients developed dry eye. 44 patients received dose 45-55 Gy and out from these 13 (29.50%) patients developed dry eye, 40 patients received dose 56-65 Gy and out from these 33 (78.00%) patients developed dry eye and 16 patients received dose 66-70 Gy and out from these 13 (95.00%) patients developed dry eye.

**Conclusions:** We concluded that the incidence of dry eye increased with increased total radiation dose. The current study suggests the importance of total dose as well as dose per fraction despite advancement of radiotherapy techniques and using protective mechanisms for eye complications developed.

### INTRODUCTION

Cancers figure among the leading causes of morbidity and mortality worldwide, with approximately 14 million new cases and 8.2 million cancer related deaths in 2012.<sup>1</sup> The projected numbers for the year 2030 are 20-26 million new cases and 13-17 million deaths due to malignancies. On the Indian scene, 1.1 million new cancer cases were estimated, indicating India as a single country (of the 184 countries) contributing to 7.8% of the global cancer burden; mortality figures were 682830, contributing to 8.33% of global cancer deaths in 2012.

Head and neck malignancies are the sixth most common malignancies, worldwide with an annual incidence of head and neck cancers worldwide is more than 550,000 cases

with around 300,000 deaths each year.<sup>2,3</sup> These are the third most common malignancy in India (second most common in males while fourth most common in females).<sup>4</sup>

Radiotherapy plays a critical role in the management of many patients with head-and-neck (H&N) cancer. In recent decades, the treatment for H&N cancer has moved from two-dimensional radiotherapy to three-dimensional conformal radiotherapy (3D-CRT) and recently also to intensity-modulated radiotherapy (IMRT). High rates of local tumor control can be achieved with 5-year survival greater than 80% for stage I and II and 60-70% for stage III and IV tumors; however, long-term sequelae of radiotherapy are highly prevalent and have severe adverse effects on quality of life.<sup>5,6</sup>

Dry Eye is one of the common ophthalmic complications after radiotherapy in head neck tumor. Our institute was largest tertiary level cancer institute. From Punjab, Haryana, Rajasthan maximum cancer patients were treated. So in this study present our experienced regarding dry eye in head neck tumor after radiotherapy.

**METHODS**

This prospective hospital based study was done on 100 patients of head and neck tumours receiving radiation by linear accelerator machine (Figure 1) from 2015 to 2017. The inclusion criteria were Patients who received radiotherapy for head and neck tumours by linear accelerator and given informed consent. The exclusion criteria were Patients who received radiotherapy other than by linear accelerator, radiation not reaching up to ocular structures, systemic illness like diabetes mellitus, hypertension and AIDS, pre existing ocular diseases like dry eye, retinal and neuro-ophthalmic diseases.

**Radiation protocol**

Radiation dose comprised of 30-70 Gray (Gy) delivered in 20-35 fractions (usually 1.8-2 Gy), delivered over a period of 3-6 weeks by linear acceleration, five days per week. The eye was shielded by protective shields.



**Figure 1: External beam radiotherapy by linear accelerator.**

**Methods of evaluation**

After permission of Institutional ethics committee and obtaining informed consent from the patients, ophthalmic examination was done prior to the start of radiation therapy. First follow-up was done at 15th day of radiation therapy, second at last day of radiation therapy (23-35 fraction), third follow up was done 3 months after completion of therapy for monitoring the acute effect. The fourth follow-up was at 6 months, fifth and six follow ups were done at one and one and a half year respectively after completion of therapy for assessing chronic complications of radiation therapy.

**Data analysis**

All data were analyzed by Epi-info software.

**RESULTS**

This study comprised of 100 patients of head and neck tumours, out of which 71 were males and 29 were females. The head and neck tumours were astrocytoma (35%), ganglioma (1%), glioblastoma multiforme (GBM) (21%), glioma (1%), medulloblastoma (1%), oligodendrioglioma (10%) and nasopharyngeal carcinoma (31%). Total dose of radiation given was 45-70 Gy. Most of the head tumors received 50-60 Gy. Nasopharyngeal carcinomas received maximum dose of radiation 60-70 Gy.

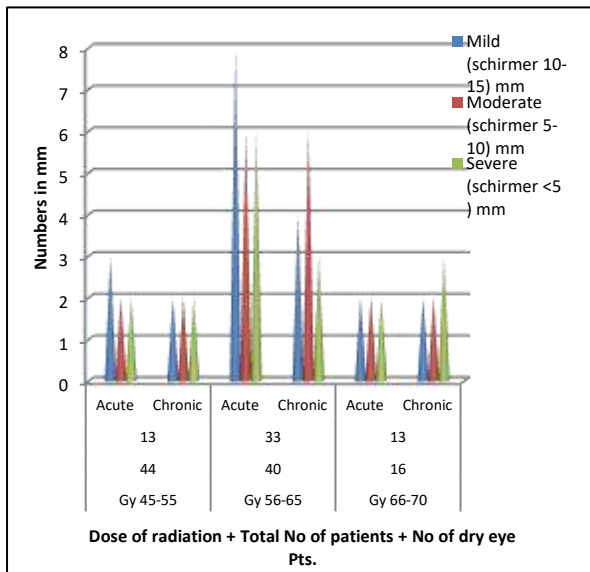
**Table 1: Socio-demographic profile.**

Variables	
Mean age	42.31±16.39 years
Male:female	71:29

Fifty-nine patients developed dry eye. 44 patients received dose 45-55 Gy and out from these 13 (29.50%) patients developed dry eye, 40 patients received dose 56-65 Gy and out from these 33 (78.00%) patients developed dry eye and 16 patients received dose 66-70 Gy and out from these 13 (95.00%) patients developed dry eye. The incidence of dry eye increased with increased total radiation dose. (Table 2, Figure 2) The association between total dose effect and duration of effect was found statistically insignificant.

**Table 2: Dry eye in patients in accordance with total dose of radiation.**

Total dose of radiation	Total no of patients	No of dry eye patients	Duration of effect	Mild (schirmer 10-15) mm	Moderate (schirmer 5-10) mm	Severe (schirmer <5) mm	P value
Gy 45-55	44	13	Acute	3	2	2	0.399
			Chronic	2	2	2	
Gy 56-65	40	33	Acute	8	6	6	0.641
			Chronic	4	6	3	
Gy 66-70	16	13	Acute	2	2	2	0.399
			Chronic	2	2	3	
<b>Total</b>	<b>100</b>	<b>59</b>		<b>21</b>	<b>20</b>	<b>18</b>	



**Figure 2: Dry eye in patients in accordance with total dose with duration of radiation.**

## DISCUSSION

Radiation exerts its greatest impact on rapidly proliferating cells, as found in hair follicles, sebaceous glands and the basal layer of the epidermis that causes acute radiation side effects.

Dry eye occurred due to effects of radiation on the conjunctival epithelium, goblet cells, corneal surface and lacrimal glands. Changes in quality and quantity of tear production lead to the impairment of the dynamic stability of the tear film resulting in chronic dry eye. For doses >45 Gy, symptoms of dry eye developed within 1 month after radiation.<sup>7</sup> In our study, we also found that the symptoms of dry eye occurred at first follow-up. Karp et al demonstrated, on histological analysis, meibomian glands atrophy due to radiation therapy.<sup>8</sup> It exhibits an acute inflammatory response to radiation therapy and causes complete loss of meibomian glands and ducts. The dilated duct filled with keratin and squamous metaplasia predisposes to dry eye. Takeda et al reported that the incidence of dry eye was increases with dose of radiation.<sup>9</sup> In our study, similar result were observed.

There was limited availability of literature on ocular complications of radiotherapy.

### Limitations

We had done only schirmer test for dry eye assessment, other tests of dry eye like ocular surface staining should also done, less sample size and follow-up period was limited in our study. Further research with more patients

and longer follow-up is necessary to determine other late complications of radiation therapy.

## CONCLUSION

We concluded that the incidence of dry eye increased with increased total radiation dose.

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*Ethical approval: The study was approved by the Institutional Ethics Committee*

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