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Evaluation of Feasibility and Toxicity of Intensity Modulated Radiotherapy in Post-Operative Cases of Oral Cavity Cancer

Himanshu Mishra[1], Ritusha Mishra[1], Anupam K Asthana[2]

[1]Assistant Professor, Department of Radiotherapy and Radiation Medicine, IMS, BHU, Varanasi.

[2]Professor, Department of Radiotherapy and Radiation Medicine, IMS, BHU, Varanasi.

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ABSTRACT

Background: The combined modality approach incorporating surgery, radiotherapy(RT) and chemotherapy (CT) forms the corner-stone of management of locally advanced head and neck squamous cell carcinoma(HNSCC). Intensity modulated radiotherapy (IMRT) is an advanced RT technique where large dose of radiation could be delivered to precisely defined target volumes while reducing dose to surrounding OARs It can be delivered in sequential manner or as simultaneous integrated boost(SIB). Aim – The aim of this study was to evaluate the feasibility and toxicity of of IMRT-SIB in post-operative cases of head and neck squamous cell carcinoma (HNSCC). **Methods:** This was a retrospective study done on 20 patients of HNSCC who received adjuvant RT with IMRT-SIB. Data was analysed for various dosimetric parameters and toxicity profile of patients. Toxicities were recorded using RTOG acute radiation morbidity scoring criteria. Toxicities were evaluated weekly during RT and monthly up to 3 months after RT completion. **Results:** The median age was 40.5 years WITH 80% patients having locally advanced disease (stage III and IV). Eleven patients received concurrent cisplatin weekly. Majority (60%) of patients developed Gr 1 mucositis with maximum being grade 3 seen in 1 patient. Maximum skin toxicity that appeared was Grade 2; found in 10% patients. Xerostomia was Grade 2 in 75% patients . Sixty percent of patients experienced Grade 2 dysphagia while 15% grade 3. Seventy five percent patients were treated with dose schedule of 66/60/54 Gy in 33# while remaining with 60/54 in 30#.the dose received by organ at risk(OAR) were within normal limits in all the patients. **Conclusions:** IMRT with SIB can be safely delivered in post-operative squamous cell carcinoma of oral cavity with acceptable toxicity.

Keywords: IMRT, oral cavity, post-operative.

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INTRODUCTION

Squamous cell carcinoma of head and neck is common in India with frequently involving oral cavity.[1] Surgery followed by adjuvant RT (with or without concomitant CT) is strategy of choice for squamous cell carcinoma of oral cavity of advanced stages and with poor prognostic features.[2-4] Addition of concomitant CT to post-operative radiation has shown to be associated with better loco-regional control as compared to radiation alone in presence of certain adverse prognostic factors.[5-7] One of the ways of delivering radiation is IMRT. It can be delivered as sequential or as SIB. With IMRT large dose of radiation could be delivered to target volumes while reducing dose to surrounding OARs as it augments sharp dose gradients. It has shown to be associated with improvement in loco- regional control and decreased toxicity to normal structures.[8-12]

Name & Address of Corresponding Author
Dr. Ritusha Mishra,
154 Janki Nagar,
P.O. Bazardeeha,
Varanasi -
221106.

AIM

This is a retrospective study and the aim is to evaluate feasibility and toxicity of IMRT-SIB in post-operative cases of oral cavity cancer in Indian scenario.

MATERIALS & METHODS

Case files and Planning CT scan data of 20 patients of squamous cell carcinoma of oral cavity treated with post-operative IMRT-SIB were retrieved. Data was analysed for dosimetric parameters (doses to target volumes and critical structures) and toxicity profile of patients. All patients were simulated in supine position with thermoplastic cast (for immobilization). CT scans were done using 3 mm slice thickness. Various target volumes were contoured using ICRU. Volumes having post-operative residual disease and extra nodal extension were contoured as CTV HR. Post-operative bed with clear margins and pathologically positive lymph

node stations without ENE were considered as CTV IR while areas for elective irradiation were considered as CTV LR. PTV was drawn by giving 7 mm margin to CTV. OARs were contoured using RTOG guidelines. Spinal cord, PRV cord, Brainstem and bilateral parotids were important OARs contoured. Toxicities were recorded using RTOG/ CTC criteria. All techniques were generated using the ECLIPSE Planning System and treatment was delivered with 6-MV linear accelerator. Patients were treated with IMRT- SIB technique. Toxicities were evaluated weekly during RT and monthly up to 3 months after RT completion.

RESULTS

Table 1: Patient characteristics (n=20)

Factors	n (%)
Age(yrs)	
<40	10 (n=50)
> 40	10 (n=50)
Gender	
Male	18(n=90)
Female	2(n=10)
KPS	
90	14(n=70)
80	06(n=3)
T stage	
T1	4(n=20)
T2	8(n=40)
T3	4(n=20)
T4	4(n=20)
N stage	
N0	6(n=30)
N1	2(n=10)
N2	12(n=60)
TNM stage	
I	0(n=0)
II	4(n=20)
III	2(n=10)
IV	14(n=70)

Table 2: Dosimetric parameters for organ at risk

Organ at risk	Dose constraints given	Constraints achieved
Spinal Cord	Dmax < 45 Gy	Median Dmax- 41Gy Range Dmax: 35-44Gy
PRV Cord	Dmax < 50 Gy	Median Dmax-44.5Gy Range Dmax:38-48Gy
Brainstem	Dmax < 54 Gy	Median Dmax-33.5Gy Range Dmax:6-50Gy
Rt Parotid	Dmean < 26 Gy	Median Dmean- 26 Gy Range Dmean: 15Gy-53Gy
Lt Parotid	Dmean< 26 Gy	Median Dmean-26Gy Range Dmean:14-62Gy

The median age was 40.5 years and half of the patients were having age less than 40 years. Majority (90%) were male. Seventy percent of patients were having Karnofsky Performance Status (KPS) 90 and 80% patients had locally advanced disease (stage III and IV). Various patient and tumour related characteristics are explained in [Table 1]. Two different IMRT-SIB dose schedules were used for RT delivery. Seventy five percent patients were treated with dose schedule of PTV HR receiving 66Gy/33#, PTV IR 60Gy/33# and PTV LR 54Gy/33# while others (25%) with PTV HR receiving 60Gy/30# and PTV LR 54Gy/30#. Ninety five percent of all the PTVs were covered by 95% isodose atleast. The maximum dose received by each OAR was within the limit of its constraint prescribed [Table 2]. Eleven patients received concurrent chemotherapy (Inj cisplatin 35-40mg/m2). There was no toxicity related treatment interruption during RT. Regarding toxicities, no Grade 4 toxicity was recorded. The toxicity profile of patients is summarized in [Table 3]. Majority (60%) of patients developed Gr 1 mucositis. Grade 3 was maximum observed mucositis and found in only one patient (developed during 5th week of treatment) while grade 2 mucositis developed in 35% patients.. Maximum skin toxicity appeared was Grade 2; found in 10% patients. Grade 2 skin toxicity developed in 6th week of treatment in both the patients. Maximum developed xerostomia was Grade 2 (75% patients); developed in 5th week of RT. Sixty percent of patients experienced Grade 2 dysphagia while 15% grade 3. Grade 3 was maximum seen dysphagia which occurred during 4th week of treatment.

Table 3: Toxicity profile of patients

Toxicity	n(%)
Mucositis	
Grade 3	1(5%)
Grade 2	7(35%)
Grade 1	12(60%)
Skin Reactions	
Grade 2	2(10)
Grade 1	18(90)
Xerostomia	
Grade 2	15(n=75)
Grade 1	5(n=25)
Dysphagia	
Grade 3	3(15)
Grade 2	12(60)
Grade 1	5(25)

DISCUSSION

Radiotherapy planning in head and neck region is challenging as tumour may lie close to various critical structures whose radiation tolerance has to be respected without compromising adequate tumour coverage. With standard conventional RT it is very difficult to meet this challenge, however with the use of IMRT these goals can be achieved in most of the clinical scenarios. It is a well known fact in HNSCC that there is decreased probability of tumour control with increase in overall treatment time. This phenomenon occurs due to accelerated repopulation of tumour cells. Therefore it is imperative to complete the treatment in the stipulated time so as to avoid this tumour repopulation. So it is very important to avoid treatment interruptions during a

course of fractionated radiotherapy. With the use of conformal techniques like IMRT the acute severe toxicities which may lead to treatment interruptions can be minimized. This is evident in our study also as there was no planned treatment interruption. The present study aims to assess the toxicity of IMRT-SIB in post- operative HNSCC in Indian set-up. Extensive literature search shows that there is a paucity of data regarding IMRT-SIB worldwide and this is first Indian study reporting toxicity profile of IMRT-SIB in post- operative cases of oral cavity in best of our knowledge. In our study no Grade 4 reaction was observed. Study by Studer et al which evaluated results of post –operative IMRT in head and neck cancer also reported no grade 4 reaction.[13] Similar study by Ooishi et al also reported no grade 4 reaction.[14] The study reported Grade 3 mucositis, skin toxicity, xerostomia and dysphagia in 30%, 2%, 0% and 4% respectively. However in our study grade 3 mucositis was seen in 5% and dysphagia in 15% cases. There was no grade 3 skin toxicity. No reconstruction flap related toxicity was observed. Barrett et al also found similar thing.[15]

So the findings of the present study are similar to the data available in literature however sample size is small, Small sample size is major limitation of this study.

CONCLUSION

IMRT- SIB with concurrent CT is well tolerated in adjuvant setting in our clinical scenario, the result being in concurrence with that reported in literature.

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