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UTILITY OF TUMOUR VOLUME IN DETERMINING MEDIAN SURVIVAL FOR LOCALLY ADVANCED ORAL CANCER: A RETROSPECTIVE ANALYSIS

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Abstract

Background:

Surgical intervention has traditionally served as the primary therapeutic modality for mouth cancer. Patients who are not subjected to surgical intervention are often managed with the administration of concurrent chemoradiotherapy (CCRT). Several variables contribute to the survival of patients, and tumour volume is perhaps one of these aspects. The objective of this research is to investigate the impact of pre-treatment tumour volume on survival outcomes.

Methodology:

A retrospective analysis was carried out on the reports of the patients treated for oral cancer. The tumour volume was estimated by performing a CT scan before treatment. The ideal tumour volume was determined for this study. The statistical analysis was carried out to estimate the effect of various factors on the survival outcome.

Results:

The average total tumors volume among the 40 patients who were treated with radiation was 74 cm^3. The average primary volume of the tumour was 59 cm^3. The average volume of the tumour in the lymph nodes was 6 cm^3. The patients who had a volume of the tumor less than 52 cm^3 had higher survival of 34 months and those who had more than 52 cm^3 had survival of 9 months.

Conclusion:

The volume of the tumour influences the prognosis of oral cancer. The volume above 52 cm^3 resulted in a poor survival outcome. The TTV can be used as a factor to develop a treatment that delivers a favourable outcome.

Recommendation:

Total tumour volume (TTV) should be used by the oncologist to develop a treatment plan that is effective and improves overall survival. Also, prospective studies are required in this domain to confirm the association of various factors with survival outcomes.

Keywords: ***Total tumour volume, survival outcome, oral cancer, chemoradiotherapy***
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Introduction

Head and neck cancers have more than 50% of the mortality rates. The primary treatment for head and neck cancers is surgical resection. However, it is not feasible to perform surgeries in all cases, depending on consent. on the tumor size, location and patient's consent Oncologists have to look for other options, such as radiation therapy or concurrent chemotherapy radiotherapy [1]. Irrespective of the treatment adopted for a patient, the survival rates vary significantly.

Apart from the clinical outcomes, treatment also depends on the current stage of the malignancy and existing comorbidities. The risk factors associated with chemotherapy are the toxicities that occur while treating the patients. The oncologist has to determine the ratio of toxicity

to the survival benefits for the patients. The survival rates in head and neck cancer patients treated with radiotherapy or chemoradiotherapy are only about 30–40% [2]. Also, 50% of the patients experience severe toxicity, such as chronic pain and discomfort [3]. 30–40% of cases of head and neck cancer treated with chemoradiotherapy report death within one to two years of the treatment [4].

Predicting the clinical outcomes helps in determining the risk-to-benefit ratio. The location of the tumour and its size might vary in each case. Therefore, a prognostic tool is required to understand the prognosis of the treatment for patients. Tumor volume, which is determined with a CT scan, helps in determining the prognosis of the disease in patients [5]. A CT scan is conducted before planning the dose and regime of the chemoradiotherapy. In the scan, the area demonstrating tumour hypoxia is measured as tumour volume [6]. This tumour volume is used to plan the treatment regime and target the tumour area. In this study, tumour volume is used as a prognostic tool to determine the prognosis of chemoradiotherapy in patients with head and neck cancer, particularly oral cancer. The prognosis is used in this study to predict the survival rate of patients in the advanced stage of oral cancer. The aim of the study is to investigate the impact of pre-treatment tumour volume on survival outcomes.

Methods

Study design and setting:

A retrospective analysis was carried out on the reports of the patients who were treated for oral cancer at the Department of Radiation Oncology, DMCH Laheriasarai. The analysis was carried out from August 2022 to June 2023.

Participants: The patients who confirmed the presence of squamous cell oral cancer from histopathological findings and received the treatment of concurrent chemoradiotherapy were included in the study. The patients who had metastatic cancer were excluded from the study.

Variables and Data Sources: Patient information, which includes their weight, gender, age, stage of cancer, treatment given, starting date of treatment, and end date of treatment, was studied. The patients who could not undergo surgery due to metastasis, other health conditions, or the risk involved were given concurrent chemoradiotherapy. Radiation at 70 Gy was given in 35 fraction, over the period of 3-4 weeks. To prevent severe weight loss percutaneous wire endoscopy gastrostomy was done on the patients before treatment. Radiation was targeted on the primary area of the tumour three times and the lymph nodes that were affected. Chemotherapy included cisplatin thrice during the whole treatment. If the patient experienced any side effects or toxicity, they were given carboplatin or cisplatin only weekly. The tumour volume was calculated based on the CT scan performed before the treatment. Based on the tumour volume, the clinical outcomes of the regimes were predicted. The survival rate was calculated as the difference between the day from which the treatment was started and the last seen date.

Statistical analysis:

All the data obtained was subjected to statistical analysis, and each factor was compared to determine its effect on the survival rate, and hence the p-value was calculated.

Ethical consideration:

The ethics committee of the Department of Radiation Oncology, DMCH Laheriasarai, approved this study.

Results

In total, there were 1,000 cases of oral cancer at the 3rd and the 4th stages, out of which 200 received treatment at the Department of Radiation Oncology, DMCH Laheriasarai. Among the 200 total, reports, 120 showed metastasis, and thus 70 reports were taken for further analysis. The majority of the patients presenting with oral cancer were males. The tumour was found mostly in the tongue. 40 patients were treated with radiation, and the rest 30 underwent surgical resection or chemotherapy.

Table 1 illustrates the findings of the tumour volume and survival rate of the patients. The average total tumour volume among the 40 patients who were treated with radiation was 74 cm^3. The average primary volume of the tumour was 59 cm^3. The average volume of the tumour in the lymph nodes was 6 cm^3. The patients followed up after the treatment for an average of 13 months, and the average survival rate was also 13 months. The cancer was fully cleared in 20 patients who received concurrent chemoradiotherapy, but nine 9 of them had relapsed in the same region. The ideal total tumour volume in this study, according to statistics, was 52 cm^3. The patients who had a tumour volume less than that had a higher survival rate of 34 months, and those who had a tumour volume greater than that had a survival rate of 9 months.

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Table no. 1 Findings of the study

Parameters	Average values
Total tumor volume	74 cm^3
Primary volume of the tumor	59 cm^3
Tumor in the lymph node	6 cm^3
Follow up	13 months
Survival rate	13 months
Survival for patients with tumor volume greater than 52 cm^3	9 months
Survival for patients with tumor volume less than 52 cm^3	34 months

Factors that affected the overall survival and had a p-value of less than 0.05 were the total tumour volume and the technique of radiation. Other factors such as smoking drinking, gender weight, site of tumor, treatment received, age, and existing comorbidity did not affect the survival of the patients. The overall survival was analyzed using Kaplan-Meier overall survival, in this total tumour volume was taken as the primary factor. The tumour volume of less than 52 m^3 decreased the overall survival significantly and similarly the radiation given by image-modulated radiation therapy also decreased the survival. The decrease in survival due to both these factors was found to be statistically significant.

Discussion

From the present study, it is found that total tumour volume influences the prognosis of oral cancer. This finding is consistent with other studies conducted in the area of head and neck cancer [7, 8]. A study reported that the risk of mortality and morbidity increases with an increase in 10 cm^3 of the tumour volume [9]. Another study demonstrated that the tumour volume before the treatment dictated the prognosis and survival outcome of the patients [10]. Hence, tumour volume plays a significant role in predicting the survival outcome, particularly in patients treated with concurrent chemoradiotherapy.

This study also reported the influence of radiation technique on overall survival. The patients treated with image-modulated radiation therapy had lower overall survival. Although this technique lowers the occurrence of side effects and also decreases their severity compared to the dimensional radiation technique it has much lower survival. However, such finding is not reported in any of the studies conducted. This finding has to be confirmed by performing a comparative study on both techniques.

The present study reported an overall average survival of 13 months which is not consistent with other studies. The overall survival time in our study is much less than the other studies, this is because the sample size in our study was smaller comparatively [11, 12]. Also, the survival time was calculated from the day of treatment and not from the day of diagnosis.

Chemotherapy given to the patients also influenced the survival time but unlike other studies present study did not consider the cumulative dose of platinum therapy. A study reported that 200 mg of cumulative therapy with cisplatin increased the survival time of the patients [13]. All the patients who received concurrent chemoradiotherapy at least had a cumulative dose of 300 mg at the end of total treatment which might have contributed to the overall survival. The difference in the efficacy of weekly cisplatin and thrice-a-week cisplatin could not be estimated because the rationale behind the different regimes could not be determined.

Conclusion

The volume of the tumour influences the prognosis of oral cancer. The volume above 52cm^3 resulted in poor survival outcomes. The TTV can be used as a factor to develop a treatment that delivers favourable outcomes.

Limitations

As the sample size of this study was small. The association between radiation technique and overall survival could not be determined. This study was a retrospective analysis and thus the selection bias could not be avoided.

Recommendation

Total tumour volume (TTV) should be used by oncologists to develop a treatment plan that is effective and improves overall survival. Also, prospective studies are required in this domain to confirm the association of various factors with survival outcomes.

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List of abbreviation

CT- Computed tomography
TTV- Total Tumor Volume

Source of funding:

The study was not funded

Conflict of interest:

We declare no conflict of interest

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