

Original Research Article

IMPACT OF RADIOTHERAPY-INDUCED FIBROSIS ON DIFFICULT AIRWAY PREDICTORS IN ORAL CANCER SURGERY: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Radiotherapy is an essential component of multimodal treatment for oral cavity malignancies. However, radiation exposure frequently leads to progressive fibrosis of soft tissues in the head and neck region, which may alter airway anatomy and complicate airway management during anaesthesia. The present study aimed to evaluate the effect of radiotherapy-related fibrosis on commonly used predictors of difficult airway in patients undergoing surgery for oral cancer.

Materials and Methods: This prospective observational study included 80 adult patients scheduled for elective oral cancer surgery under general anaesthesia. Patients were divided into two groups: those who had previously received radiotherapy (RT group, n=40) and those without prior radiotherapy (Non-RT group, n=40). Preoperative airway assessment included Mallampati classification, thyromental distance, inter-incisor distance, sternomental distance, and neck extension. Laryngoscopic view during intubation was graded using the Cormack–Lehane classification. The incidence of difficult laryngoscopy was compared between groups.

Results: Patients who had undergone radiotherapy demonstrated significantly higher Mallampati grades, decreased mouth opening, shorter thyromental distance, and restricted neck mobility compared with those without previous radiation exposure ($p < 0.05$). Difficult laryngoscopy (Cormack–Lehane grade III or IV) occurred in 35% of patients in the RT group compared with 10% in the Non-RT group. Reduced thyromental distance and limited cervical mobility showed the strongest association with difficult laryngoscopy.

Conclusion: Radiotherapy-related fibrosis significantly influences airway anatomy and increases the frequency of predictors associated with difficult airway. Careful airway evaluation and preparation for advanced airway management techniques are essential when anaesthetising oral cancer patients with prior radiation exposure.

Keywords: Oral cancer, radiotherapy fibrosis, difficult airway, airway predictors, anaesthesia.

INTRODUCTION

Malignancies of the oral cavity represent a major health burden in many developing countries, particularly in regions with widespread tobacco and betel nut consumption. Surgery remains the primary treatment modality for most oral cancers, frequently combined with radiotherapy to improve local disease control.^[1,2]

While radiotherapy contributes significantly to improved survival outcomes, it can also produce long-term structural changes within the irradiated tissues. Radiation-induced fibrosis develops as a consequence of chronic inflammation, collagen deposition, and reduced tissue elasticity in the affected region.^[3]

Fibrotic changes in the head and neck can lead to several anatomical alterations, including trismus,

reduced mandibular mobility, and limited cervical spine movement. These changes may substantially affect airway anatomy and complicate endotracheal intubation during anaesthesia.^[4]

Preoperative airway assessment plays a crucial role in predicting potential difficulties during intubation. Commonly used bedside tests include Mallampati classification, thyromental distance measurement, mouth opening assessment, and evaluation of neck mobility.^[5,6] However, the reliability of these predictors may be altered in patients who have undergone radiotherapy due to structural distortion and tissue contracture.^[7]

Difficult airway management continues to be a significant contributor to peri-operative morbidity and mortality. Early identification of patients at risk enables appropriate preparation and selection of airway management techniques, thereby improving patient safety.^[8]

The present study was designed to evaluate the impact of radiotherapy-induced fibrosis on commonly used difficult airway predictors in patients undergoing oral cancer surgery.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational study was conducted in the Department of Anaesthesiology of a tertiary care centre after approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants.

Study Population: Eighty adult patients scheduled for elective surgery for oral cavity malignancy under general anaesthesia were included in the study.

Inclusion Criteria

- Age between 18 and 70 years
- Diagnosed oral cavity carcinoma
- Scheduled for elective surgical resection
- ASA physical status I–III

Exclusion Criteria

- Patients requiring emergency surgery

- Presence of tracheostomy
- Congenital airway abnormalities
- Previous maxillofacial surgery affecting airway anatomy
- Refusal to participate

Study Groups

Patients were categorized into two groups:

- RT Group (n = 40): Patients who had previously received radiotherapy to the head and neck region
- Non-RT Group (n = 40): Patients without prior radiotherapy

Preoperative Airway Evaluation

Airway assessment was performed during the pre-anaesthetic visit using standard techniques:

- Mallampati classification
- Thyromental distance (TMD)
- Inter-incisor distance (mouth opening)
- Sternomental distance
- Neck extension

The following criteria were considered predictors of difficult airway:

- Mallampati grade III or IV
- Thyromental distance < 6 cm
- Mouth opening < 3 cm
- Restricted neck extension

Intraoperative Assessment: Following induction of general anaesthesia, direct laryngoscopy was performed using a Macintosh laryngoscope blade. The laryngoscopic view was graded according to the Cormack–Lehane classification.^[9]

Difficult laryngoscopy was defined as Cormack–Lehane grade III or IV.

Statistical Analysis

Data were analysed using SPSS software.

- Continuous variables expressed as mean ± standard deviation
- Categorical variables expressed as frequency and percentage
- Student’s t-test used for continuous variables
- Chi-square test used for categorical variables

A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic Characteristics

Table 1: Demographic profile of patients

| Variable | RT Group (n=40) | Non-RT Group (n=40) | p value |
|-------------|-----------------|---------------------|---------|
| Age (years) | 54.3 ± 9.1 | 52.6 ± 10.2 | 0.48 |
| Male (%) | 72.5 | 70 | 0.81 |
| BMI | 21.4 ± 3.2 | 22.1 ± 3.4 | 0.32 |

Both groups were comparable with respect to baseline demographic characteristics.

Airway Assessment

Table 2: Preoperative airway predictors

| Predictor | RT Group (%) | Non-RT Group (%) | p value |
|---------------------------|--------------|------------------|---------|
| Mallampati III–IV | 45 | 20 | 0.02 |
| TMD < 6 cm | 40 | 12.5 | 0.01 |
| Mouth opening < 3 cm | 37.5 | 10 | 0.005 |
| Restricted neck extension | 42.5 | 15 | 0.01 |

Patients with previous radiotherapy showed significantly greater incidence of predictors associated with difficult airway.

Laryngoscopic View

Table 3: Cormack–Lehane grading during intubation

| Grade | RT Group (%) | Non-RT Group (%) |
|-----------|--------------|------------------|
| Grade I | 35 | 55 |
| Grade II | 30 | 35 |
| Grade III | 25 | 10 |
| Grade IV | 10 | 0 |

The incidence of difficult laryngoscopy was significantly higher among patients with previous radiotherapy exposure.

DISCUSSION

Radiotherapy-related fibrosis is a well-recognized late complication in patients treated for head and neck malignancies. Fibrotic changes occur due to progressive collagen deposition and vascular damage within irradiated tissues, resulting in decreased elasticity and contracture.^[10]

In the present study, patients who had received radiotherapy demonstrated significantly higher Mallampati grades and reduced mouth opening compared with those without radiation exposure. These findings may be attributed to fibrosis involving the muscles of mastication and temporomandibular joint structures, leading to trismus.^[11]

Thyromental distance was also significantly shorter in the radiotherapy group. Reduced thyromental distance may reflect restricted mandibular displacement and altered submandibular tissue compliance, which can limit optimal positioning during laryngoscopy.^[6]

Restricted neck extension was another common finding among irradiated patients. Radiation-induced fibrosis affecting cervical fascia and paraspinal muscles may impair neck mobility, making alignment of airway axes more difficult during laryngoscopy.^[12]

Our results also demonstrated a higher incidence of difficult laryngoscopy among irradiated patients, which is consistent with previously published observations in head and neck cancer populations.^[13] These findings highlight the importance of thorough preoperative airway assessment in patients with previous radiotherapy. Advanced airway techniques such as fibre-optic intubation or video laryngoscopy should be readily available when managing these patients.^[8]

CONCLUSION

Radiotherapy-induced fibrosis significantly alters airway anatomy in patients undergoing surgery for oral cancer. These patients demonstrate a higher

incidence of predictors associated with difficult airway, including higher Mallampati grades, reduced thyromental distance, limited mouth opening, and restricted neck mobility.

Careful airway evaluation and appropriate preparation for difficult airway management are essential to ensure safe anaesthetic care in this patient population.

Limitations

- Relatively small sample size
 - Single-centre study
 - Severity of fibrosis was not objectively quantified
- Future multicentre studies with larger populations may further clarify the relationship between radiotherapy-induced fibrosis and airway difficulty.

REFERENCES

1. Gupta B, Johnson NW. Global epidemiology of oral cancer. *Oral Oncol.* 2017;65:13-20.
2. Shah JP, Gil Z. Current concepts in management of oral cancer. *CA Cancer J Clin.* 2009;59:225-246.
3. Bentzen SM. Preventing or reducing late side effects of radiation therapy. *Lancet Oncol.* 2006;7:103-112.
4. Rosenblatt WH. Airway management in head and neck cancer patients. *Anesthesiol Clin.* 2015;33:311-322.
5. Mallampati SR, Gatt SP, Gugino LD. A clinical sign to predict difficult tracheal intubation. *Can Anaesth Soc J.* 1985;32:429-434.
6. Khan ZH, Kashfi A, Ebrahimkhani E. Comparison of airway predictors of difficult intubation. *Anesth Analg.* 2003;96:595-599.
7. Pracy JP, Brennan L, Cook TM. Difficult airway management in head and neck cancer surgery. *Clin Otolaryngol.* 2011;36:321-327.
8. Apfelbaum JL, Hagberg CA, Caplan RA. Practice guidelines for management of the difficult airway. *Anesthesiology.* 2022;136:31-81.
9. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia.* 1984;39:1105-1111.
10. Delanian S, Lefaix JL. The radiation-induced fibroatrophic process. *Radiother Oncol.* 2004;73:119-131.
11. Bensadoun RJ, Riesenbeck D. Radiation-induced trismus. *Support Care Cancer.* 2010;18:1033-1038.
12. Vissink A, Jansma J, Spijkervet FK. Oral sequelae of head and neck radiotherapy. *Crit Rev Oral Biol Med.* 2003;14:199-212.
13. Wong DT, Mehta A. Airway management in patients with head and neck malignancy. *Anesth Analg.* 2011;113:126-134.