Radiation induced changes in the airway - anaesthetic implications

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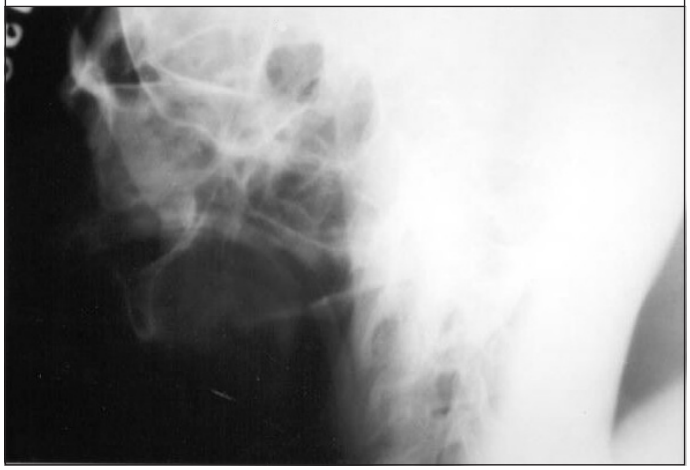
Summary: *Radiation induces a variety of changes in the airway that can potentially lead to difficult intubation. Osteoradionecrosis (ORN) of the mandible, a severe consequence of radiotherapy for head and neck malignancies can cause a reduction of the 'mandibular space' and alteration of the morphometric measurements, viz. thyromental distance, hyomandibular distance, anterior mandibular length and posterior mandibular length, that usually predict difficult intubation. A case of osteoradionecrosis of the mandible presenting for elective surgery under general anaesthesia is presented. The primary intention of this article is to focus awareness amongst anaesthesiologists on the myriad of airway problems to be anticipated in cancer patients who present for surgery after radiotherapy.*

Keywords: *Difficult airway, Predictors, Mandible, Radiation*

A 65 year old, 47 kg male, diagnosed to have carcinoma of the buccal mucosa, was scheduled for wide full thickness excision of the tumour, functional neck dissection and pectoralis major myocutaneous flap reconstruction for lining the oral cavity. When the patient presented to our preanaesthetic clinic for evaluation, he gave a history of having had radiotherapy for carcinoma of the lip, detected 7 years previously. He had received 5000-cgy radiation as 16 fractions over 4 weeks. Six months later, he noticed progressive recession of his lower jaw. He did not have any respiratory symptoms suggestive of obstruction or a history of snoring. His physical examination revealed normal vital signs, stable cardiovascular and respiratory systems. Airway examination revealed the following: (i) receding chin area (ii) mouth opening of 3cm (iii) edentulous (iv) modified Mallampati classification of III (v) normal atlanto-occipital joint extension (vi) an exophytic mass in the oral cavity 3 x 3cms arising from buccal mucosa on the right, extending to the adjacent floor of mouth, 1.5cm behind the oral commissure. The growth was fleshy, friable and bled on touch, and thyromental distance and anterior mandibular length could not be assessed, as the mandible was absent. His haematological, biochemical investigations as well as chest X-ray and electrocardiogram were normal. Lateral view X-rays of the mandibular area revealed a small 2cm shadow on the left side suggestive of calcified periosteum (Figure 1). Premedication was with oral diazepam 10mg the previous night and 5mg the next day. Oral ranitidine 150mg and oral metoclopramide 10mg were given in the morning on day of surgery. One percent xylometazoline drops were instilled in both nostrils. Since the patient had no history of airway compromise during sleep or in the supine position, intramuscular morphine 4.5mg and promethazine 12.5mg were given along with glycopyrollate 0.2mg, 45 minutes before induction. Topical airway anaesthesia was accomplished by nebulisation with 2ml of 2% lignocaine, lignocaine viscus (2%) gargle 6ml, transtracheal injection of 2 ml, 4% xylocaine and 4-5 drops of 4% xylocaine instilled nasally. With

Figure I



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the patient awake, an 8mm cuffed endotracheal tube was introduced nasally under the guidance of a fibreoptic bronchoscope. General anaesthesia was then induced with intravenous thiopentone sodium 5mg/kg and maintained with nitrous oxide, oxygen and halothane. Intravenous morphine 4.5mg was supplemented and muscle relaxation achieved with pancuronium 4mg initially followed by 1mg boluses as required. After securing the airway with the cuffed endotracheal tube (ETT), laryngoscopy was carefully performed with a medium sized Macintosh laryngoscope blade, which revealed the patient's airway to be of Cormack Lehane grade III. The same manoeuvre caused bleeding and dislodgement of a 2x1.5cm piece of tumour tissue into the oral cavity, which was promptly removed with a Magill's forceps. The surgery continued uneventfully for 4 hours at the end of which muscle relaxation was reversed with neostigmine 2mg and atropine 1.2mg intravenously. The ETT was retained overnight and intravenous morphine 3 mg was administered every six hours for postoperative analgesia. The patient was extubated the next day after ascertaining peritubal breathing by performing a cuff leak test.

Discussion

Head and neck malignancy cases presenting for surgery, either primarily or subsequent to radiotherapy and chemotherapy, are common. The latter treatment modalities produce anatomical alterations in the upper and lower airways, posing difficulty to anaesthesiologists in airway management.[1,2] However, the degree of difficulty in tracheal intubation varies from patient to patient depending on the disease per se as well as type, site and changes in airway.[3]

Irradiated patients frequently present for head and neck surgery. Serious consideration needs to be given to the associated airway problems and their management. Radiation induces oedema with subsequent fibrosis or necrosis in the exposed tissues.[4] These changes mainly affect the buccal mucosa, bone and dentition and may contribute towards difficulties at every step of airway management (Table1). Mask holding and ventilation is made difficult by mandibular osteoradionecrosis, orofacial pain due to mucositis, lack of dentition, orocutaneous fistulae with purulent discharge, pathological fractures and oedema caused by radiation. Laryngoscopy in irradiated patients is rendered difficult by fibrosis, and oedema resulting in trismus and restriction of mouth opening and altered consistency of neck tissues causing restriction of neck movements. Glottic and epiglottic oedema secondary to radiation impedes the visualization of the glottic aperture during laryngoscopy.

These changes need to be looked for and recognised in a background of problems produced by the primary lesion in airway management. Thus careful history taking and proper airway evaluation greatly facilitates successful tracheal intubation.

Osteoradionecrosis (ORN), a severe complication of high dose, frequent radiation to vascular bone is reported to occur in 0.4-56%[5,6,7] subjects. The mandible, being highly vascular is more susceptible to ORN than other bones. Although this occurs secondary to impairment of revascularisation in bone tissue, severity of damage depends on total dose of radiation, frequency of exposure and prior trauma.[7,8] In our patient, ORN had occurred to the extent of causing the mandible to be virtually absent. Our literature search failed to find similar cases or information regarding its anaesthetic implications. It is widely

Table 1: Airway changes following radiation

Sl. No.	*Site of malignancy*	*Pathology*	*Disability*		*Anaesthetic implications*
1	Face & buccal mucosa	• Necrosis • Mucositis	*Early* • Oral thrush • Orofacial pain	*Late* • Ulceration • Orocutaneous fistula with purulent discharge	• Difficult mask holding&ventilation • Hemorrhage
2	TM joint	• Fibrosis		• Trismus	Difficult laryngoscopy & intubation
3	Tongue	• Fibrosis • Inflammation	• Glossitis	• Glossomegaly • _ tongue mobility	• Falsely obscures Mallampati classification • Difficult laryngoscopy • Haemorrhage
4	Dentition	• Increased risk of caries	• Increased mobility	• Loss of teeth	• Difficulty in mask holding&ventilation • Dislodgement of teeth during laryngoscopy
5	Floor of mouth	• Fibrosis		• _ mobility of tongue	Difficult laryngoscopy
6	Mandible	• Osteonecrosis or osteomyelitis • Pathological fracture	• Asymptomatic dehiscence of mucosa	• micrognathia/mandibular recession • Extraoral/intraoral fistulae	• Reduction in mandibular space • Difficult mask holding&ventilation • Difficult laryngoscopy
7	Suprahyoid region	• Fibrosis & oedema		• Altered consistency of neck tissue presents as firm or woody mass • Skin tethering	• Limitation of flexion & extension at atlanto occipital joint
8	Lower airway	• Epiglottic oedema • Glottic oedema		• Snoring • Hoarseness of voice • Irritant cough	• Difficult visualization of larynx • Difficult endotracheal intubation

agreed that early recognition and anticipation of airway problems is the key to successful airway management. The three bedside clinical tests viz (a) tongue versus pharyngeal size, (b) size of mandibular space and (c) atlanto occipital extension have great appeal among anaesthesiologists as intubation predictors.[9] In our case, however, their credibility appears questionable. Here mandibular space was absent and all measurements based on mandible viz.thyromental distance, anterior mandibular length and posterior mandibular depth were impossible. Even though gross reduction of mandibular space suggested little space for displacing tongue during laryngoscopy, direct laryngoscopy was possible, probably due to the absence of bony restrictions. However, the view at laryngoscopy was Cormack and Lehane grade III. This could be explained by the presence of the large primary lesion, an ulceroproliferative mass on the dorsum of the tongue, which limited manoeuvring of laryngoscope. This makes one conclude that absence of the mandible does not hinder direct laryngoscopy or intubation. It also emphasizes the need for anaesthetists to be aware of radiation-induced subtle changes in the airways of cancer patients. Use of the fibreoptic bronchoscope (FOB) is warranted in these cases. But in centres in developing countries where the FOB is not available, awake blind nasal intubation could be a safe option. Alternatively, tracheostomy under local anaesthesia may be the only option.

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