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Original research article

Airway management in retrosternal goiter surgery, retrospective study

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Abbreviations

ASA – American Society of Anesthesiologists
BMI – body mass index
CT – computerized tomography
DL – direct laryngoscopy
ET tube – endotracheal tube
ICU – intensive care unit
RSG – retrosternal goiter
RTG – roentgenograph
VL – video laryngoscopy

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Abstract

Background and purpose: *Retrosternal goiter refers to thyroid enlargement in which the lower pole of the thyroid is not palpable with the neck in a hyperextended position. The presence of a mass in the anterior mediastinum and displacement of the trachea are the risk factors for a difficult airway. The aim of this study was to present our experience with airway management in patients with retrosternal goiter.*

Materials and methods: *We conducted a retrospective observational study of patients undergoing elective retrosternal goiter surgery in a tertiary center over one year. We analyzed the preoperative evaluation data and the planning, techniques and outcome of airway management.*

Results: *From January 1st to December 31st, 2024, a total of 349 patients underwent thyroid surgery at our center. Among 72 patients admitted for goiter surgery, 26 patients were diagnosed with retrosternal goiter. A preoperative computerized tomography scan was performed in most patients and revealed 11 patients with massive retrosternal goiter. Intravenous induction to anesthesia with direct or video laryngoscopy was the preferred method of intubation. No significant complications were recorded.*

Conclusion*: If there are no additional risk factors, intravenous induction of anesthesia and intubation with direct or video laryngoscopy are acceptable methods of airway management in patients with retrosternal goiter. Flexible nasendoscopy and virtual bronchoscopy are valuable methods for airway assessment and may reduce the need for awake fiberoptic intubation in complex cases. However, multicentric studies with larger sample sizes are needed to confirm our findings.*

INTRODUCTION

Thyroid goiter (thyromegaly, struma) is a swelling of the neck resulting from enlargement of the thyroid gland. The retrosternal goiter (RSG) can be defined in numerous ways. The most widely accepted definition is that goiter can be considered mediastinal if the lower pole of the thyroid gland is not palpable during neck hyperextension *(1).* Goiter is one of the most common causes of mid-tracheal obstruction, including other retrosternal processes *(2).* Symptoms of RSG develop gradually and are the result of the pressure on the trachea and great neurovascular structures. Patients commonly complain of dysphagia, dyspnea, or hoarseness, indicating compression of cervical organs. Superior vena cava syndrome (which can be complicated by thrombosis), reduction of cerebral perfusion due to arterial compression and thyrocervical steal syndrome, chylothorax and pleural or pericardial effusions

can also occur *(3,4)*. The presence of a mass in the anterior mediastinum and tracheal displacement are the risk factors for a difficult airway. There is no consensus on the ideal approach to airway management in patients with RSG and compression syndrome. Awake fiberoptic intubation in patients with pre-existing tracheal stenosis can be demanding and stressful for the patient *(5,6,7,8)*. This study aimed to present our experience in the anesthetic management of patients with RSG in our center with an emphasis on an airway management technique and the frequency of intubation complications.

MATERIALS AND METHODS

We conducted a retrospective observational study, with ethics and confidentiality taken into account in extracting and recording the data. All thyroid surgeries performed from January 1st to December 31st, 2024, in the Department of Otolaryngology, Head and Neck Surgery of the University Hospital Centre Zagreb were identified using the operating room protocol archive. Patients with diagnosed goiter were selected for detailed analysis. We examined clinical records and preoperative diagnostic imaging methods (neck ultrasound and computerized tomography scans of the neck and thorax) to single out patients with retrosternal goiter, defined as thyroid enlargement in which the lower pole of the thyroid gland is not palpable with the patient in the surgical position. Patients with malignant tumors within the RSG were excluded from the study.

Data collected included the patient characteristics (age, sex), significant comorbidities, and ASA status. We focused on the presenting symptoms, e.g. dyspnea, dysphagia, hoarseness, dizziness, or other. Preoperative surgical and anesthesiologic evaluation, preoperative flexible nasendoscopy description, and the extent of the thyroid enlargement as well as the tracheal deviation and narrowing on RTG or CT scan findings were analyzed and recorded.

In the anesthetic documentation, we collected information about the technique of the induction of general anesthesia (intravenous with or without the use of the neuromuscular blocking agent), tracheal intubation (awake or post-induction), type of airway management device/technique used (DL, VL or other), as well as the size of reinforced endotracheal tube used.

Operative data included the type of procedure performed and the need for sternotomy. Postoperative data included the need for reoperation and the rate of postoperative admission to the ICU. In addition, perioperative complications such as wound dehiscence, postoperative hematoma, or others were recorded.

RESULTS

In this retrospective observational study, in one year, a total of three hundred and forty-nine patients underwent thyroid surgery in our Center. Among 72 patients admitted for goiter surgery, 26 (36%) were documented as having an RSG defined above. A review of each patient's preoperative CT imaging records identified 11 out of 26 RSG patients (42%) in which the thyroid gland descended to the aortic arch or below, defined as massive RSG according to the Huins classification (9,10).

The median age was 68.5 years (range 32-79), with 14 female and 12 male patients. The major presenting clinical features of our patients are detailed in Table 1. Significant comorbidities were found in five patients: four had coronary artery disease, and one presented with extreme obesity (BMI 50 kg/m^2).

Tracheal deviation on RTG or CT scan was evident in 18 cases, with significant tracheal stenosis described in one patient. In complex cases, virtual bronchoscopy was utilized to define the extent of tracheal narrowing. In Figure 1. one can find an example of tracheal deviation with preserved tracheal lumen visible on the chest radiograph. A widened shadow of the upper mediastinum with tracheal narrowing visible on the chest radiograph is shown in Figure 2.

All the patients underwent intravenous induction of general anesthesia, and only in one case, the patient was intubated without the use of a neuromuscular blocking agent, with remifentanil infusion started during the induction of anesthesia. In one patient, a high-flow nasal cannula was used during the induction of anesthesia for preoxygenation and apneic oxygenation. Direct laryngoscopy, and video laryngoscopy in five patients with significant tracheal deviation, were the preferred methods of intubation. In one case, due to the superposition of soft tissues on the VL camera, the patient was successfully intubated in the second attempt with DL. One patient was intubated with the use of the rigid intubation endoscope. All the patients were intubated with a reinforced ET tube, with a cuffed tube size 7.0 used in most cases.

Table 1. *General Clinical Characteristics of our patients with RSG (n=26)*

Median age	68.5 (32-79)
Sex	
Female	14
Male	12
ASA status	
2	12
3	14
Presenting symptoms	
Dysphagia	7
Dyspnea	6
Feeling of compression in the neck	5
Asymptomatic	5
Non-specified	3

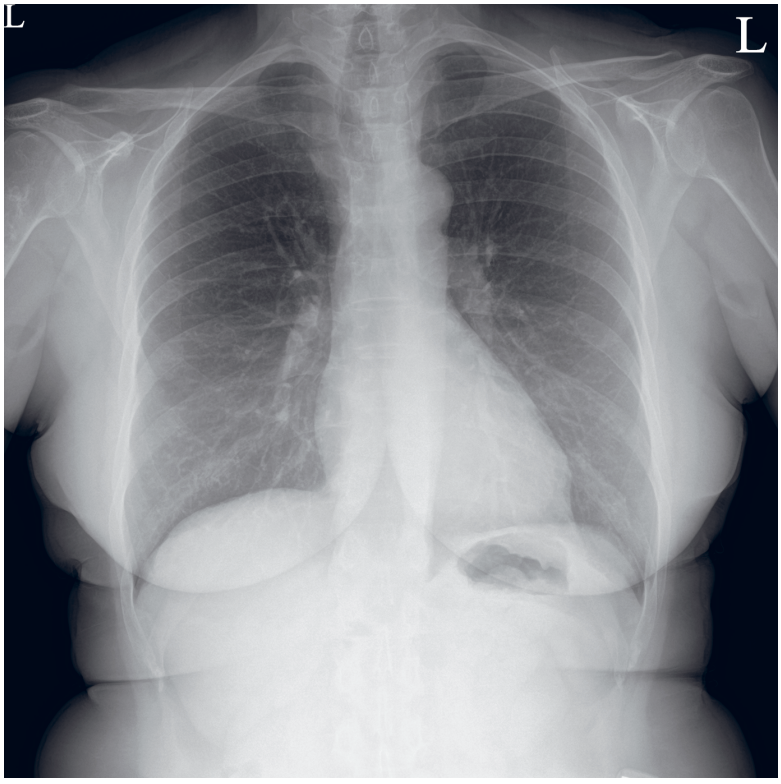

Figure 1. *Chest radiograph. The air column in the trachea is of adequate width, slightly arched and pushed to the right at the level of the cervicothoracic junction.*

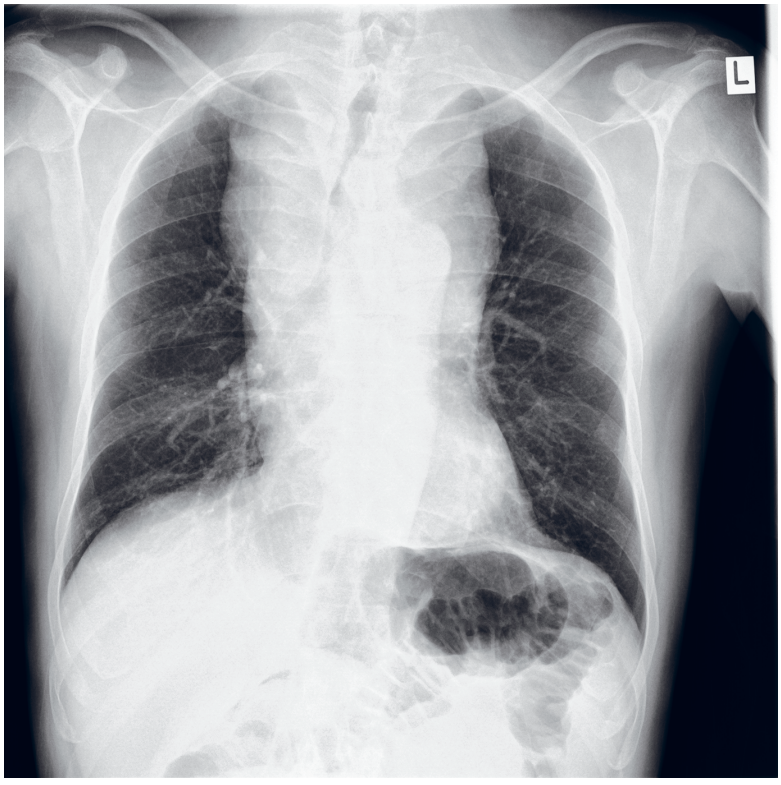

Figure 2. *Chest radiograph. On the summation image of the thoracic organs, the shadow of the upper mediastinum is expanded. The impression of a tracheal stenosis is about 40 mm subcarinal on a 19 mm segment.*

Preoperative endoscopic airway examination had a direct influence on tube size selection in two patients who had edematous larynx and narrowed aryepiglottic folds, in which cases we used reinforced ET tube size 5.5. No significant complications related to airway management were noted. Technique of the awake tracheal intubation and neuromonitoring was not used.

Most of the operations were completed via the cervical approach, with one case of sternotomy. There was no requirement for intraoperative blood transfusion. After operation, no patient developed a post-extubation stridor. Due to the co-morbidities, and because of significant tracheal compression preoperatively in one patient, a total of five patients were admitted to the ICU postoperatively for monitoring. No adverse event was noted.

DISCUSSION

It is a commonly held view among anesthesiologists that patients requiring retrosternal thyroidectomy pose significant airway management risk *(9)*. However, studies of airway management in patients with benign RSG have shown that the incidence of difficult or failed intubation in these cases is 5.3%, which is comparable with the incidence of 5.5%-20% of difficult intubation in thyroid surgery *(2,3)*. With the introduction of VL into everyday clinical practice, the incidence of difficult intubation is even lower. Massive RSG causes tracheal compression and deviation, which may cause a difficult airway and put stress the cardiovascular system, leading to circulatory failure *(3,4,5)*. Potential tracheomalacia due to long-standing tracheal compression by the large goiter mass can be the reason for respiratory failure after thyroidectomy because of the tracheal collapse *(10,11,12,13)*. The incidence of postoperative tracheomalacia in patients with benign goiter is rare but can reach up to 10% in patients with massive RSG *(9)*. Ideally, the surgeon will notice tracheomalacia intraoperatively and alert the anesthesiologist. A cuff release test may be performed before extubation. If tracheomalacia is not detected in time, there may be a need for urgent reintubation, which in this case is risky because the tube can pierce the already softened trachea *(3)*. Some authors advocate delayed extubation, while others believe that postoperative tracheostomy is indicated immediately in such cases *(3,9,11)*.

According to the literature, there were only two predicting factors for difficult airway in RSG: cancerous goiter (especially if compressive signs are present) and Cormack and Lehane grade III/IV. We have excluded patients with malignant tumors within the goiter from this study because invasion of the tumor to the surrounding tissues or trachea is a significant risk factor for difficult intubation. Additionally, due to the malignancy, there is a higher risk for perioperative complications. Tracheal narrowing caused by benign goiters is not fixed and will usually allow the passage of regular-size tubes. In most of the cases, we chose ET tube size according to the patient's body habitus.

Retrosternal extension of the goiter may cause positional dyspnea which is elicited when specific movements force the enlarged thyroid into the thoracic inlet *(6)*. It is important to ask the patient which position suits him/her well, before the induction of the anesthesia. Classical anatomical predictors of difficult intubation, unrelated to the thyroid pathology should also be considered *(14)*.

Before the operation, the anesthesiologist should read the CT scan carefully and discuss it with the surgeon to know whether the tumor is benign or malignant and to get other necessary information. For example, about the position of the larynx and visualization of the vocal cords on preoperative flexible nasoendoscopy. However, flexible nasoendoscopy fails to provide any information on any infraglottic pathology that may exist. Virtual bronchoscopy potentially bridges the gap in airway assessment by providing a non-invasive, anatomically accurate representation of the patient's whole airway and may reduce the need for awake fiberoptic intubation *(15)*.

CONCLUSION

According to the results of our single-center retrospective study, in the absence of additional risk factors for difficult intubation, intravenous induction of anesthesia and classic intubation with DL or VL are acceptable methods of airway management in patients with retrosternal thyroid goiter. Flexible nasoendoscopy, and virtual bronchoscopy in complex cases, are valuable methods of airway assessment and planning and may reduce the need for awake fiberoptic intubation. However, multicentric studies with a larger number of patients with RSG are needed to confirm our findings.

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