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Anesthesia Management in Thyroid Tumors

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ABSTRACT

Thyroid nodules as discrete lesions within the thyroid gland. Nodules in the thyroid gland are detected in approximately 5% to 7% of the adult population by physical examination alone. Thyroid nodules are approximately 4 times more common in women than men Thyroid nodules can be classified as neoplastic and non-neoplastic. The initial evaluation of a patient with a thyroid nodule should include a history, physical examination, thyroid stimulating hormone (TSH) measurement, and thyroid ultrasonography to characterize the nodule. TSH measurement by itself may detect subtle thyroid dysfunction. Diagnostic tests include serum markers, fine needle aspiration (FNA) cytology, genetic markers, immunohistochemical markers, and several imaging modalities, most commonly ultrasonography, but also elastography, MRI, CT, and 18FDG-PET scanning. Thyroidectomy is the most common endocrine surgery. Due to compression on the trachea, airway management can be difficult.[1] Preoperative evaluation and management are critical when planning elective thyroidectomy, where changes in the anatomical location are expected because of a large or substernal goiter. Anatomical changes, laryngeal edema and an inexperienced team can all contribute to difficulty in intubation. The incidence of difficult tracheal intubation (DTI) in the patient population undergoing thyroid surgery varies. Several studies found a similar value for the incidence of DTI (5.3% to 6.8%). Previous studies have evaluated risk factors for DTI in patients undergoing thyroid surgery. Increasing age, high Mallampati score, Grade III or IV Cormack score, reduced mouth opening (<4.4 cm), goiter cancer and tracheal stenosis (≥30%) are independent predictors of DTI. Neck circumference (NC) appears to be an important predictor of DTI.

INTRODUCTION

Thyroid nodules are discrete lesions within the thyroid gland (Haugen, 2015). Thyroid nodules can be classified as neoplastic and non-neoplastic (Pemayun, 2016). Although more than 90% of detected nodules are benign lesions that are not clinically significant, thyroid nodules are clinically important because they can represent thyroid cancer in about 4.0% to 6.5% of cases (Durante, 2016). In the adult population, physical examination alone can show a prevalence of 5% to 7% of thyroid nodules. Ultrasound shows a prevalence of 20% to 76% in the same population (Popoveniuc, 2012).

Most patients will come with large palpable nodules in the anterior neck, or incidental nodules found in imaging studies done for other reasons. Most thyroid nodules are asymptomatic, and most individuals with thyroid nodules are eutioid, with less than 1% of nodules causing thyroid disease. Some patients may complain of neck pressure or pain, especially when spontaneous bleeding occurs (Zamora, 2022).

Initial evaluation for patients with thyroid nodules should include an anamnesis, physical examination, measurement of thyroid-stimulating hormone (TSH), and thyroid ultrasound to characterize the nodule. TSH measurements on their own may be able to detect subtle thyroid dysfunction. (Zamora, 2022).

Diagnostic examinations include serum markers, cytology with fine needle aspiration (FNA), genetic markers, immunohistochemical markers, and several imaging modalities, most often ultrasound, but also elastography, MRI, CT, and 18FDG-PET scans (Popoveniuc, 2012).

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The incidence of Difficult Tracheal Intubation (DTI) in the population of patients undergoing thyroid surgery varies. Several studies found similar values for the incidence of DTI (5.3% to 6.8%) (de Cassai, 2019).

Large thyroid mass with excessive tracheal shifts, larynx opening is usually in a normal position and intubation may not be easy. These patients usually have to be intubated with a small endotracheal tube to prevent intraoperative surgical trauma. Intubation must be performed by an experienced anesthesiologist (Shaha AR, 2015).

METHOD

This study is a descriptive study with a retrospective approach. Data was obtained through a review of the medical records of patients undergoing anesthesia management in thyroid tumor surgery at certain hospitals within a predetermined period of time. The population in this study was all patients who underwent thyroid tumor surgery with general anesthesia. The research sample was selected by purposive sampling with the following inclusion and exclusion criteria:

Inclusion criteria:

a. Patients undergoing thyroid tumor surgery under general anesthesia.
b. Patients with complete medical record data.
c. Patients who undergo a tracheal intubation procedure.

Exclusion criteria:

a. Patients with incomplete medical records.
b. Patients with comorbidities that can significantly affect the management of anesthesia.

Data collection was carried out by reviewing the patient's medical records, which included:

a. Patient characteristics (age, gender, general health status).
b. Pre-anesthesia evaluation, including TSH, ultrasound, and physical examination results.
c. The anesthesia technique used, including the type of anesthetic drug and the intubation technique applied.
d. Difficulties in tracheal intubation, including parameters such as the duration of intubation, the use of intubation aids, and the presence of complications during the intubation process.
e. Post-anesthesia evaluation, including intraoperative and postoperative complications associated with anesthesia management.

Data Analysis

The data obtained were analyzed descriptively to get an overview of the management of anesthesia in patients with thyroid tumors. The analysis was carried out using descriptive statistics such as frequency and percentage distributions for categorical variables, as well as mean and standard deviations for numerical variables. The results of the analysis are presented in the form of tables and graphs to facilitate interpretation. Research EthicsThis research has received approval from the Research Ethics Committee at the hospital where the data was obtained. The patient data used is kept confidential, and no personal identity will be published in the results of this study.

RESULTS AND DISCUSSION

Result

The 48-year-old female patient came with complaints of a lump in the neck that was experienced since 5 years ago. Patients also complain of coughing, getting tired quickly, decreased appetite and weight loss. Palpitations and tremors are denied. Fever denied. The patient has no history of allergies. No prior surgical history exists. No history of diabetes mellitus, hypertension, asthma was found. No

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family member has experienced the same complaints as os. The patient is planned surgery for a total thyroidectomy. After the surgery, the patient is planned to be admitted to the ICU.

In the physical examination, the consciousness of the mentis composite was obtained, with a blood pressure of 95/76 mmHg, a pulse of 62 times per minute, a respiratory rate of 20 times per minute, a temperature of 36.5^{0}C, and oxygen saturation of 99%. Examination of the head was found, both pupils were isocorre, no anemis and icteric were found, two-finger mouth opening, ASA II, difficult airway mass ar colli and tracheal deviation. Neck examination found a thyroid nodule measuring 10.3 x 7.6 cm. Vesicular thoracic examination in both pulmonary fields, no retraction was seen, and the sound of ronkhi and wheezing breath was not found. Heart sound I is more dominant than heart sound II, regular and noiseless. The abdomen is soepel, there is no distension, peristalsis is within normal limits and no abdominal tenderness is found. The upper and lower extremities are devoid of edema, warm akral. There were no defecation and mixization disorders.

Figure 1. Physical examination of the patient

Pada pemeriksaan laboratorium didapatkan Hemoglobin: 13,8 mg/dL, Hematokrit : 42%, leukosit: 7.090 / mm3, LED : 42mm/jam, FT3 : 5,91 pmol/L, FT4 : 11,33 pmol/L, TSHs : 0,510 µIU/ml. GDS : 106 mg/dL , Ur: 22 mg/dL, Cr: 0.62 mg/dL, Natrium : 143 mmol/L , Kalium: 3,90 mmol/L, Klorida : 110 mmol/L. INR: 1,10 mmol/L, PT ; 1,11 mmol/L, APTT: 0,98 mmol/l.

Electrocardiography shows the rhythmic sinuses with a heart rate of 97 times per minute. MSCT scan laryng axial, coronal, and sagittal incisions without and with contrast: mass in the thyroid lobe of the sinistra is solid, and cystic with calcification inside, measuring 16.8 x 15.6 x 14.8 cm compressing the carotid artery and jugular vein of the sinistra.

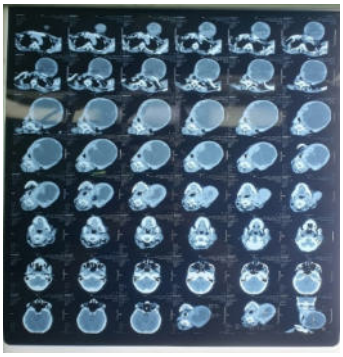

Figure 2. Thorax Photo Examination

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In the patient, a photo examination of the PA thorax was also carried out, and the results did not appear to be abnormal in the cast and pulmo, and a mass of soft tissue density appeared in the colli region, dd/struma. The patient was also examined for thyroid ultrasound and found a lesion in the left thyroid that pushed the trachea to the right. In the FNAB examination of the mass on the patient's neck, 10cc of orange yellow color was obtained. In the smear preparation, there is a distribution of 1-2 cells with a relatively enlarged cell nucleus, hyperchromatic, with the smear background consisting of eosinophilic amorphous masses.

The patient was diagnosed with thyroid tumor Management includes airway, breathing and circulation management. The patient underwent a total thyroidectomy.

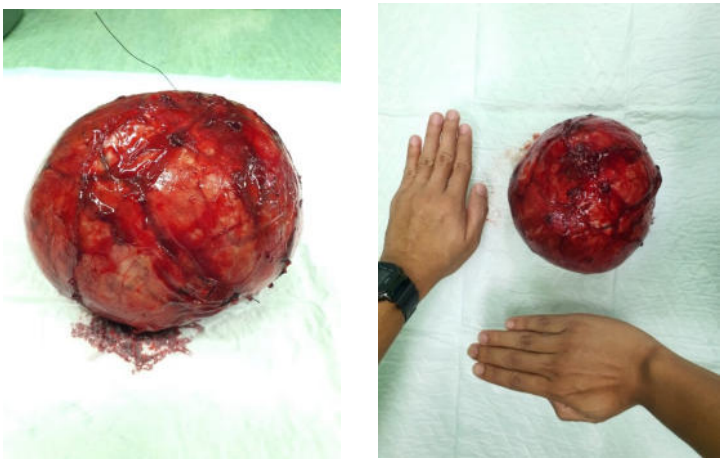

Figure 3. Total thyroidectomy procedure

In the operating room, patients are fitted with a sphygmomanometer and oxygen saturation for evaluation of pulse, blood pressure, and oxygen saturation. In this patient, a pulse of 79 times/minute, blood pressure of 122/74mmHg, and oxygen saturation of 99% were obtained. The patient was intubated using a videolaryngoscope and ETT number 6.5 with a non-apneu intubation technique.

Discussion

The American Thyroid Association (ATA) defines a thyroid nodule as a discrete lesion within the thyroid gland. Radiologically different from the surrounding thyroid parenchyma. Nodules may be solitary, multiple, cystic, or solid. [3] Nodules in the thyroid gland are detected in about 5% to 7% of the adult population by physical examination alone. Nodules are found with increased frequency, likely due to the widespread use of modern imaging modalities, especially ultrasound (US), but also computed tomography (CT), magnetic resonance imaging (MRI), and positron emission tomography. Although more than 90% of detected nodules are benign lesions that are not clinically significant, thyroid nodules are clinically important because they can represent thyroid cancer in about 4.0% to 6.5% of cases.

Ionizing radiation is a known risk factor for benign and malignant thyroid nodules. Other factors that lead to an increased risk of thyroid nodules and goiters include smoking, obesity, metabolic syndrome, alcohol consumption, increased levels of growth factors such as insulin-1, and uterine fibroids

Thyroid nodules can be classified as neoplastic and non-neoplastic. Neoplastic nodules may be benign or malignant, with benign neoplastics including dysfunctional and non-functional nodules. Non-neoplastic nodules include hyperplastic and inflammatory nodules. Thyroid nodules are approximately 4 times more common in women than men and more common in individuals living in geographical areas that are deficient in iodine. In the adult population, physical examination alone can show a prevalence of 5% to 7% of thyroid nodules. Ultrasound shows a prevalence of 20% to 76% in the same population.

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Pathophysiology

The pathophysiology of thyroid nodules varies depending on the type of lesion, with benign macrofollicular nodules being the most common form, which can be monoclonal adenomas or colloidal nodules in multinodular goiter due to nodular replication of monoclonal cells. Thyroid irradiation has been known to play a role in tumorigenesis by causing somatic mutations that increase the risk of cancer, especially in thyroid tissue that is more sensitive to radiation, especially in children who have higher proliferation activity than adults. In addition, proto-oncogene translocations of RET have been found in thyroid malignancies due to exposure to ionizing radiation, including RET/PCT translocations identified in post-radiation follicular adenomas.

Clinical Manifestations

The clinical manifestations of thyroid nodules are generally large palpable nodules in the anterior neck or incidental nodules found through imaging studies for other reasons. Most nodules are asymptomatic, and the majority of individuals with thyroid nodules remain eutioid, with less than 1% of cases causing thyroid disease. However, some patients may experience neck pressure or pain, especially if spontaneous bleeding occurs. Thyroid palpation is the easiest but less sensitive detection method, with a prevalence of 4% to 7%. Physical examination signs that indicate potential malignancy include nodules larger than 4 cm in size (with a risk of malignancy of about 19%), firmness in palpation, fixation to surrounding tissues, cervical lymphadenopathy, and vocal cord paralysis.

Diagnosis

Initial evaluation of thyroid nodules involves anamnesis, physical examination, measurement of thyroid-stimulating hormone (TSH), and thyroid ultrasound (US) to characterize the nodule. TSH measurements can help detect clinically invisible thyroid dysfunction. Further diagnostic examinations include analysis of serum markers, cytology with fine needle aspiration (FNA), genetic markers, immunohistochemical markers, as well as various imaging modalities such as elastography, MRI, CT, and 18FDG-PET scans. In patients with thyroid nodules, TSH should be examined as a first step because high or normal TSH levels can increase suspicion of malignancy, while low TSH is more often indicative of benign nodules. If the TSH is low, an iodine-123 (123-I) or pertechnetate scintigraphic scan is performed to evaluate the possibility of autonomously functioning nodules, which are usually benign and do not require further examination.

Thyroid ultrasound is the primary imaging modality used to evaluate thyroid nodules, provide information on size, structure, and changes in the parenchyma, and detect lesions as small as 2 mm. This examination helps distinguish benign lesions from malignant lesions to avoid unnecessary invasive procedures. Some of the ultrasonography features associated with malignancies include microcalcification, irregular margins, hypoecogenicity, shape higher than width, and increased vascularization. US-FNA is recommended in patients with unpalpable thyroid nodules of more than 1 cm, palpable nodules smaller than 1.5 cm, nodules located very deep in or near blood vessels, as well as nodules that remain undiagnosed after previous conventional FNA.

Governance

The initial management of thyroid nodules depends on the type of lesion, ultrasound (US) characteristics, and whether the nodule is functional or not, with fine needle aspiration (FNA) results as the main guide in determining treatment. The cytology of FNA is classified into six Bethesda categories, each with a different risk of cancer, ranging from non-diagnostic (Bethesda I) with a risk of 5–10%, benign (Bethesda II) with a risk of 0–3%, to malignant (Bethesda VI) with a risk of 97–99%. Non-diagnostic biopsies are considered cytologically inadequate, so FNA is usually repeated in 4–6 weeks. Patients with benign nodules such as macrofollicular adenoma, colloidal adenoma, nodular goiter, and Hashimoto's thyroiditis are generally monitored only through the US periodically every 12–24 months.

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If suspicious findings are found, FNA is repeated within 12 months even if the initial biopsy results are benign.

For nodules with indeterminate cytology (Bethesda III and IV), the approach varies depending on the institution's policy, with some performing molecular testing on additional FNA samples, while others repeating FNA in 6–12 weeks or performing radionuclide scans if architectural atypia is present. In nodules with suspected malignancy (Bethesda V), surgery is the main option without the need for molecular markers. The Bethesda VI category includes a wide range of malignancies such as papillary cancer, medullary thyroid carcinoma (MTC), thyroid lymphoma, anaplastic cancer, as well as metastatic cancer to the thyroid, which generally requires surgical intervention and follow-up therapy.

Anesthesia Management in Thyroid Tumors

The management of anesthesia in patients with thyroid tumors requires a special approach, especially in intubation techniques. Videolaringoscopes are used to facilitate intubation with non-apneu techniques using small ETTs to reduce the risk of trauma. In this procedure, neuromuscular blockade is avoided to maintain laryngeal nerve function during intraoperative neuromonitoring (IONM), which aims to prevent recurrent laryngeal nerve injury (RLN). Intubation without muscle relaxation requires a greater depth of anesthesia, and the choice of anesthesia should consider its effect on neuromonitoring.

The principle of anesthesia in thyroidectomy follows the ABCDE (Airway, Breathing, Circulation, Disability, Exposure) approach. Airway management is carried out by using a flexible ETT or a special tube such as a Neural Integrity Monitor (NIM) to detect and prevent RLN injury. Laryngeal Mask Airway (LMA) is rarely used except for postoperative evaluation of vocal cord function. Ventilation is done with positive pressure, and blood loss during surgery is usually minimal. Intraoperative analgesia is given through an infusion of remifentanil to control blood pressure and reduce laryngeal reflexes.

Postoperative complications include hypocalcemia, hematoma, RLN injury, and post-thyroidectomy tracheomalacia (PTTM), although these events are relatively rare. Risk factors for PTTM include prolonged goiter, significant tracheal deviations, and thyroid malignancy. Intubation of patients with narrowed tracheas is often easier than expected based on CT scans, as the trachea can still expand under certain conditions.

Airway management in patients with large goiter requires careful preoperative evaluation, including assessment of Mallampati scores, thyromental distance, and neck movement. Preoxygenation with 100% oxygen is recommended before anesthesia to increase functional residual capacity and prolong tolerance to hypoxia. There is no single consensus in the airway management of patients with large thyroid masses, so methods such as awake fiberoptic intubation or tracheostomy may be considered in certain cases.

Although fibrooptical bronchoscopy is often used in cases of difficult airway, videolaryngoscopy has also been shown to be effective. Airway occlusion can occur during induction of anesthesia, surgical resection, or extubation in patients with large goiter pressing on the trachea. Techniques such as awake fiberoptic intubation (AFOI) are often used in such cases, although they have limitations such as discomfort for the patient and longer procedure times. Therefore, the selection of the intubation method must be adjusted to the patient's condition and the experience of the anesthesia team.

CONCLUSION

Thyroid nodules are discrete lesions within the thyroid gland. Thyroid nodules can be classified as neoplastic and non-neoplastic. Initial evaluation for patients with thyroid nodules should include an anamnesis, physical examination, measurement of thyroid-stimulating hormone (TSH), and thyroid ultrasound to characterize the nodule. Diagnostic examinations include serum markers, cytology with fine needle aspiration (FNA), genetic markers, immunohistochemical markers, and several imaging modalities, most often ultrasound, but also elastography, MRI, CT, and 18FDG-PET scans. Thyroidectomy is the most common endocrine surgery. Due to the compression on the trachea, airway

management can be difficult. Evaluation and preoperative management are critical when planning an elective thyroidectomy, where there is a change in the anatomical location due to a large goiter. Anatomical changes, laryngeal edema and an inexperienced team can all cause difficulties in intubation.

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