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Robotic Resection of Ectopic Thyroid Tissue of the Mediastinum - Case Report and Literature Review

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Rezumat

Rezecție asistată robotic a unei tiroide ectopice mediastinale – prezentare de caz și review de literature

Introducere: Țesutul tiroidian ectopic (TTE) este o cauză rară a maselor mediastinale, reprezentând mai puțin de 1% din toate tumorile mediastinale (1). TTE ar putea fi detectat oriunde de-a lungul traseului primei coborâri embriologice a glandei tiroide de la podeaua primordială a intestinului anterior până la poziția sa obişnuită pretraheală. Localizarea mediastinală TTE reprezintă mai puțin de 1% din toate cazurile de tiroide ectopice (2,3). Diverse metode chirurgicale pentru abordarea maselor mediastinale au fost documentate în literatură sternotomia mediană, toracotomia posterolaterală şi, chirurgie toracică video-asistată (VATS) (4). Abordul toracoscopic asistat robotic pentru TTE a fost doar recent raportat si iar prezentarea tehnicii operatorii face obiectul acestui articol (RATS).

Prezentare caz: Prezentăm cazul unui bărbat de 40 de ani, fără antecedente medicale semnificative, care a descoperit o masă mediastinală la o tomografie toracică în urma infecției cu COVID-19. Simptomele au fost disfagie şi durere toracică anterioară cu extensie cervicală. Scintigrafia a confirmat prezența țesutului tiroidian ectopic în mediastin dar şi a unei tiroide cervicale normale. TTE a fost, de asemenea, confirmată histologic prin biopsie ecoendoscopică. Chirurgia asistată robotic a fost opțiunea pentru tratamentul chirurgical. Detaliile abordului toracoscopic asistat robotic în acest caz rar de TTE mediastinal sunt prezentate pe larg. Timpul operator a fost de 230 minute iar pierderea da sânge 60 ml. Evoluția post-operatorie a fost fără complicații pacientul fiind externat la 48 de ore.

Concluzii: Țesutul tiroidian ectopic (TTE) este o cauză rară a maselor mediastinale iar stabilirea diagnosticului este de multe ori

o provocare. Abordul toracoscopic asistat robotic demonstrează beneficiile chirurgiei minim invazive, într-un caz rar de TTE present în mediastinul superior.

Cuvinte cheie: tiroidă ectopică, chirurgie toracică asistată robotic

Abstract

Introduction: Ectopic thyroid tissue (ETT) is a rare cause of mediastinal masses, representing less than 1% of all mediastinal tumors (1). ETT could be detected anywhere along the path of the first embryonic descent of the thyroid gland from the primordial foregut floor to its usual pre-tracheal position. ETT mediastinal localization accounts for fewer than 1% of all ectopic thyroid cases (2,3). Various surgical methods for approaching mediastinal masses have been documented in the literature, including median sternotomy, posterolateral thoracotomy, and, video-assisted thoracoscopic surgery (VATS) (4). More recently, robotic-assisted thoracoscopic surgery (RATS) has been proposed for these masses. The aim of this article is to present the use of robotic-assisted thoracoscopic surgery (RATS) for a rare case of a mediastinal ETT.

Case presentation: We present the case of a 40-year-old male with no significant medical history who discovered a mediastinal mass on a thoracic CT scan following COVID-19 infection. Symptoms were dysphagia and anterior thoracic pain with cervical extension. Scintigraphy confirmed the presence of ectopic thyroid tissue in the mediastinum as well as a normal cervical thyroid gland. ETT was histologically confirmed by endoscopic ultrasound guided biopsy. Robotic assisted surgery was the chosen approach to surgically treat this mass and the technical details are presented. The mass was extracted through the cervical incision. Total surgical time was 230 minutes, and the blood loss was 60 ml. The patient was discharged after 48 hours with follow up showing a full recovery with no residual pain or respiratory symptoms.

Conclusion: Ectopic thyroid tissue (ETT) is a rare cause of mediastinal masses, and the diagnosis is always a challenge. Robotic assisted thoracoscopic surgery was proved to be safe and efficient in this rare case of ETT developed in the superior mediastinum.

Key words: ectopic thyroid tissue, robotic assisted thoracoscopy

Introduction

Ectopic thyroid tissue (ETT) is a rare cause of mediastinal masses, representing less than 1% of all mediastinal tumors (1). ETT could be detected anywhere along the path of the first embryologic descent of the thyroid gland from the primordial foregut floor to its normal pre-tracheal position. The majority of ETTs are discovered along this line of descent, while only around 10% of them are discovered in other anatomical regions. The mediastinal localization of ETT accounts for less than 1% of all ectopic thyroid cases (2,3).

There have been few case reports of mediastinal ETT published in literature so far. The majority of mediastinal ETTs were found in the anterior or middle mediastinum. ETTs can be rarely found in the posterior mediastinum, and in the three published reports sternotomy and thoracotomy were the favored surgical approaches (4,5).

Mediastinal ETT presents with typical symptoms of a mediastinal mass such as hemoptysis, dyspnea, and a dry cough. Less frequently, patients may appear with dysphagia or superior vena cava syndrome. Orthotopic tissue frequently coexists with mediastinal ectopic thyroid, and the patients are euthyroid. ETT was found in the anterior

mediastinum in the majority of the few occurrences that have been documented in the literature (6).

The differential diagnosis of an anterior mediastinal mass is critical, since it encompasses diseases such as lymphomas, thymic tumors, dermoid cysts, and mediastinal ectopic thyroid, each of which requires a unique management and treatment plan (7).

It is crucial to note that the mediastinum contains numerous pluripotent cells, which accounts for the wide range of cancers observed in this anatomical region, including lymphomas, endocrine or neuroendocrine carcinomas, primary thymic carcinomas, and mesenchymal tumors. The most common mediastinal lymphomas are Hodgkin lymphoma, large B cell lymphoma, and lymphoblastic lymphoma, while thymic and neuroendocrine carcinomas are rare but very aggressive. Moreover, lymphomas and neuroendocrine carcinomas are typically detected in the anterior mediastinum, whereas neurogenic tumors are more commonly discovered on the posterior side. The presence of mesenchymal tumors in the mediastinum is extremely unusual and usually goes unnoticed (8).

Since ETT represent only 1% of mediastinal masses the histology is paramount. There are several techniques, such as fine needle aspiration (US or CT-guided) or endobronchial ultrasound-guided transbronchial needle aspiration that can be used to clarify the diagnosis. Although while the aforementioned procedures do not normally alter the surgical course, they do assist in obtaining information about the nature of the mass (9).

Various surgical methods for approaching mediastinal masses have been documented in the literature, including median sternotomy, posterolateral thoracotomy, and, more recently, video-assisted thoracoscopic surgery (VATS) (10).

Over the last decades, robotic-assisted surgery has been introduced for the surgical approach of mediastinal masses, demonstrating its advantages of high-definition, three-dimensional image and articulating endo-wristed instruments (11). The technique was proved very efficient for anterior mediastinal masses, too (12). However, reports about the use of robotic-assisted surgery for ETT are scarce (13).

The aim of our paper is to present the rare case of ETT developed in the superior mediastinum for which robotic-assisted surgery was the chosen approach.

Case Presentation

A 40-year-old patient with no significant medical history with the exception of COVID-19 infection in January 2022 after which he underwent a thoracic CT scan that discovered a large mass in the superior mediastinum 6.1/7/6.1 cm in size, with multiple calcifications, which displaced the trachea to the left. Other symptoms were dysphagia, and anterior thoracic pain extending towards the cervical area. There were no CT signs of invasion of the esophagus, traches or mediastinal blood vessels (*Fig. 1*).

We continued investigations by performing a scintigraphy with 131-Iodine which revealed normal thyroid tissue in the cervical area as well as a completely separate area of ectopic thyroid tissue in the mediastinum. Diagnosis was confirmed by an endoscopic ultrasound for both visualization of the esophagus as well as a tumor biopsy. Echo-endoscopy confirmed no esophageal infiltration and also the presence of the 6.9/5.1 cm mass with irregular margins and rich vascularization confirmed through Doppler. Three biopsies were

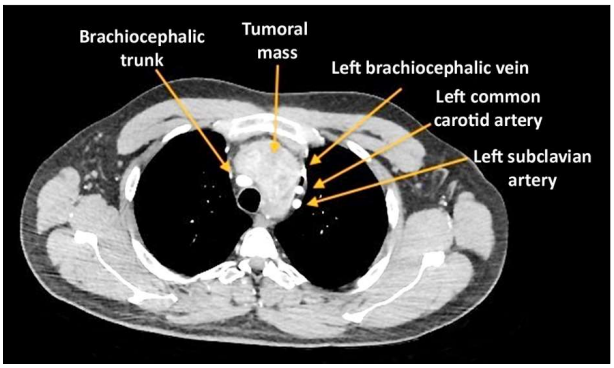

Figure 1. CT view of lesion and surrounding anatomy

performed which confirmed the presence of thyroid tissue. CT and endoscopy both confirmed this as ectopic thyroid tissue (ETT) and not goiter. Cervical thyroid gland is normal, with no nodules, masses or hypertrophy with normal thyroid function.

Given the size of the tumor as well as the displacement of the trachea, the chosen course of treatment was surgical. We opted for a robotic assisted resection that would offer us a very stable image, better visualization of the anatomy and most importantly in order to avoid a median sternotomy. Robotic assisted surgery was associated with a small cervicotomy in order to free the upper part of the mass and remove it.

Surgery was performed under general anesthesia with selective oro-tracheal intubation, excluding the left lung. The patient was placed in dorsal decubitus with the left side slightly elevated. We used four robotic ports for 30-degree camera, tip-up grasper, Cadiere forceps and Maryland bipolar forceps as well as one assistant port. Three robotic ports were mounted on the left hemithorax, through the VII intercostal space and one was placed later on during surgery in the right hemithorax. We prepared and docked the Da Vinci-Xi Surgical System (Intuitive Surgical, Sunnyvalle, CA, USA) from the left side of the patient. After targeting, the instruments described above were each placed in their proper port. The assistant port was on the left hemithorax right above the diaphragm. Inspection of the thoracic cavity revealed no abnormalities of the parietal or mediastinal pleura or of the lung (*Fig. 2*).

We identified the mediastinal mass and started by dissecting and exposing the anatomical structures adjacent to the lesion: aortic arch, left subclavian and common carotid arteries, left brachiocephalic vein as well as the phrenic and vagus nerves. The magnified view offered by the robotic assisted platform as well the EndoWrist® articulated instruments supported an accurate dissection of the anatomical structures (*Fig. 3*).

After finishing the intrathoracic dissection of the lesion, a cervicotomy was performed in order to free the superior and posterior sides of the tumor. The mass was extracted through the cervical incision. A final inspection of the chest cavity after removal confirmed complete removal of the mass (*Fig. 4*). After this a 28CH drain was placed and the cervicotomy and robotic ports were closed. Postoperative recovery was uneventful with the chest drain being removed after 24 hours after confirming complete lung expansion through chest radiography (*Fig. 5*). Total surgical time was 230 minutes and, the blood loss was 60 ml. The patient was discharged after 48 hours with follow up showing a full recovery with no residual pain or respiratory symptoms.

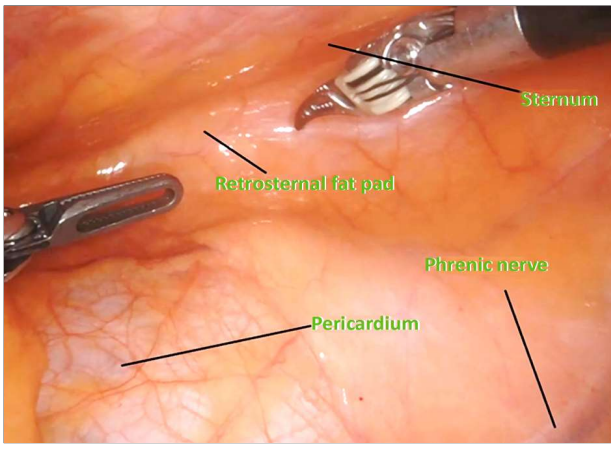

Figure 2. Intraoperative view – point of mediastinal pleura incision

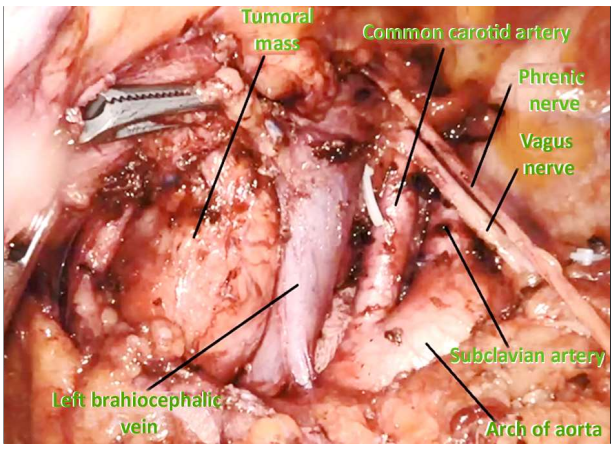

Figure 3. Intraoperative view – tumor and surrounding anatomy after dissection

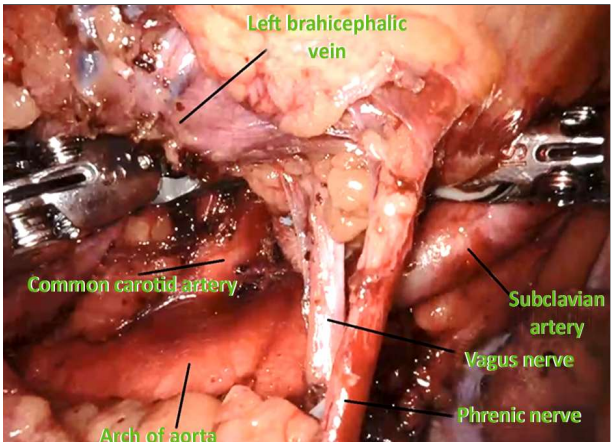

Figure 4. Intraoperative view – mediastinal anatomy after tumor removal

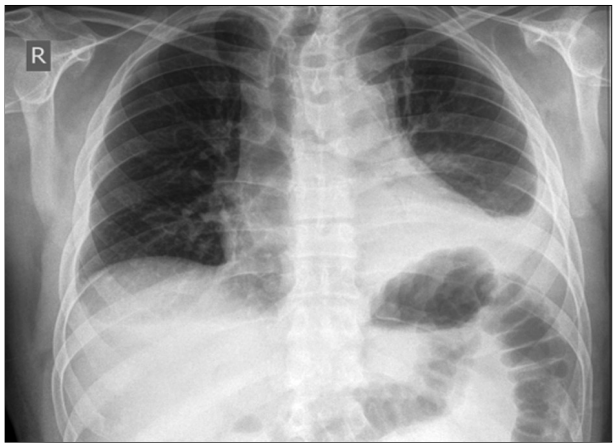

Figure 5. Postoperative chest radiography after drain removal

Discussion

Intrathoracic ectopic thyroid has been reported in the mediastinum, lungs, and heart, presenting with a dry cough, dyspnea, and hemoptysis. Patients with dysphagia or superior vena cava syndrome are less common. Intrathoracic thyroid may also be discovered inadvertently on a chest scan or at an autopsy. Orthotopic tissue generally coexists with mediastinal ectopic thyroid, and individuals are euthyroid (14,15). Similar findings were identified in our patient who was diagnosed through a follow-up chest CT after COVID-19 infection. The mass was discovered in its most frequent position, the anterior mediastinum, however, the main symptom was dysphagia.

Ectopic thyroid can cause clinically evident thyroid dysfunction or cause a goiter (16). It is possible to develop hypofunction or hyperfunction (17). Ectopic thyroid tissue has occasionally been characterized as having benign or malignant neoplastic alterations (18). Several incidences of thyroiditis in ectopic thyroid tissue have also been reported (19). Even so, none of these findings applied to our patient that presented with normal thyroid function, no goiter, no signs of thyroiditis and pathology revealed the mass as normal thyroid tissue with small signs of benign degeneration.

Fine needle aspiration cytology (FNAC) is very useful in verifying the diagnosis of ectopic thyroid. It is the most effective method for distinguishing between benign and malignant lesions. FNAC is one of the most accurate procedures for detecting neck masses, providing a correct diagnosis in 95-97% of instances. However, FNAC results can be deceptive or non-diagnostic in rare cases, particularly in cystic masses. It can aid in the preoperative identification of ectopic thyroid tissue, which helps the surgeon decide whether to request more radioisotope imaging to determine whether the mass is the only functioning thyroid tissue (20). If ultrasounds show the presence of a normal cervical thyroid with no signs of inflammation or nodules, we can remove the ectopic gland without risk of hypothyroidism (21).

Most cases of ectopic mediastinal thyroid tissue are treated through open surgery or thoracoscopically. The upper mediastinum is a sensitive and difficult-to-reach anatomic location for thoracoscopy. Working thoracoscopically in an anatomic region with vulnerable large vessels and nerves certainly poses a risk: the image of the operating field on the monitor is flat because it is only 2-dimensional, the thoracoscopic instruments amplify a surgeon's tremor, and the surgeon's hand movements must be counteractive to the intended direction that the instruments take inside the

pleural cavity (22).

To address the methodological and technical limitations of traditional endoscopic surgery, surgical robots were developed. When compared to traditional thoracoscopy, the da Vinci robotic system provides improved ocular control and surgical instrument agility. The robotic camera platform is stable and offers the surgeon at the console a realistic 3D image. The movement of the tool tips provides 7 degrees of freedom, allowing for gentle and precise dissection in a small and remote region. When compared to prior attempts at conventional thoracoscopic surgeries, the robot allows for better preservation of neighboring veins or nerves (23).

The reasons we chose to perform robotic assisted surgery combined with a minimal cervicotomy, apart from the esthetic one, were better visualization of the mediastinum (blood vessels and nervous structures), faster recovery time, lower postoperative pain, lower risk of bleeding and lower overall blood-loss.

Conclusions

Ectopic thyroid tissue (ETT) is a rare cause of mediastinal masses, representing less than 1% of all mediastinal tumors, however they usually present with normal thyroid function, are asymptomatic and are mostly discovered accidentally during routine imaging investigations. Computed tomography, scintigraphy, echography and endoscopic or bronhoscopic ultrasound guided biopsy are the main methods for the diagnosis of ETT. Although most cases are resolved using open surgery, the increasing availability of robotic technology may offer the minimally invasive benefits for mediastinal masses.

In our experience, robotic assisted thoracoscopic surgery was proved to be safe and efficient in this rare case of ETT developed in the superior mediastinum.

Conflicts of Interests

The authors have no conflict of interest.

Ethical Statement

All procedures performed were in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments. Informed consent was obtained.

Author's Contributions

All authors have contributed equally in the making of this paper.

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