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Is interventional bronchoscopy the first-line solution for mediastinal compression syndrome?

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Abstract

English:

The mediastinum is known as the anatomical structure connecting the two pleural sacs. A variety of anatomical structures, from organs to veins and arteries, make mediastinal pathology extremely adventurous. We submit the case of a 67-year-old female patient, a former smoker, who presented to our clinic with dyspnoea on slight exertion, anterior chest pain and ineffective cough. The alarming aspect of the case is the stridor present at regular intervals and the patient's dependence on oxygen. The CT scan reveals a compression syndrome caused by a tumour located in the upper and middle mediastinum that encompasses mediastinal venous and arterial structures and exerts an extrinsic stress effect on the oesophagus and tracheal. An emergency fibrobronchoscopy is performed and it is placed on a Y-shaped tracheal stent; additionally, two biopsies are also taken from different places. The point of debate of the case was related to the coexistence of two simultaneous histopathological types. The medical team's swift intervention has given this patient a fighting chance to continue oncological and radiotherapy treatment.

Keywords

mediastinum • stenosis • stent • corticosteroids therapy

Este bronhoscopia intervențională soluția de primă intenție pentru sindromul de compresiune mediastinală?

Rezumat

Romanian:

Mediastinul este cunoscut ca structura anatomică de legătură dintre cei doi saci pleurali. O varietate de structuri anatomice, de la organe la vene și artere, face ca patologia mediastinului să fie extrem de aventuroasă. Submit cazul unei paciente de 67 ani, fostă fumătoare care se prezintă în serviciul nostru acuzând dispnee la eforturi mici, durere toracică anterioară și tuse ineficientă. Aspectul alarmant al cazului o reprezintă stridorul prezent la intervale regulate de timp și dependența pacientei față de oxigen. Imagistica relevă un sindrom de compresie cauzat de prezența unei tumori localizată la nivelul mediastinului superior și mijlociu care înglobează structurile venoase și arteriale mediastinale și exercită un efect de solicitare extrinsecă asupra esofagului și peretelui traheal. Se efectuează în urgență fibrobronhoscopie și se montează un stent traheal în formă de Y, cu preluarea biopsiilor din zone anatomice diferite. Punctul de dezbatere al cazului a fost legat de coexistența a două tipuri histopatologice simultane. Intervenția rapidă a echipei medicale a făcut ca această pacientă să aibă o sanșă, în lupta sa, pentru a continua un tratament oncologic și radioterapic de specialitate.

Cuvinte-cheie

mediastin • stenoză • stent • corticoterapie

† Authors that have equal contribution as first author (2)

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Introduction

The mediastinum is defined as the anatomical element located within the thoracic cavity between the two lungs. It has a divided structure and contains all the organs within the thoracic cavity, except for the two lungs and the pulmonary pleurae. The variety of anatomical structures present in the mediastinum makes mediastinal diseases extremely complex. The most common mediastinal diseases are infectious and tumoural in nature. The most common tumours occurring in adulthood, in the fifth and sixth decades of age, emerge in the anterior mediastinum. The symptoms of this pathology are given by the compression of the anatomical structures present in that mediastinal compartment. Computed tomography (CT) examination is the gold standard in the diagnosis of mediastinal tumours.

Case description

We place on record the case of a 67-year-old patient, smoker with withdrawal symptoms, with exposure to occupational respiratory toxic emissions (chalk, dust; approximately 40 years) and with no significant personal medical history, who presented to our service claiming various symptoms. Thus, the patient has complaints in (1):

– *the pneumological area*: dyspnoea on minimal exertion, ineffective cough, recurrent feeling of suffocation and occasional wheezing;
– *the ENT area*: dysphonia and frontal headache, without signs of meningitis; and
– *the gastroenterological area*: solid food dysphagia, loss of appetite and weight loss.

Other non-associated symptoms reported by the patient are non-specific anterior chest pain and insomnia. The symptoms have been present for about 2 months with a drastic worsening in the past 5 days.
Clinical examination on admission reveals a patient with a mediocre general condition, overweight, pale skin and mucous membranes, swelling of the face, of the base of the neck and of the anterior upper part of the chest and arms, suggestive of 'cape-like' oedema, jugular veins distension, collateral circulation in the anterior thorax, palpable superficial right supraclavicular lymphadenopathy with a 2 mm diameter, poorly circumscribed and moving from the bone plane, mild thoracic kyphosis, without bronchial breath sounds and no additional murmurs, and minimal leg swelling, with SaO_2 = 88% aa at rest, which under oxygen therapy 3–4 L/min undergoes correction to 94%.

We begin investigating the patient

From a biological perspective, the patient's profile is as follows: no leukocytosis, no inflammatory syndrome, negative procalcitonin, hypochloraemia, mild nitrogen retention, liver cytolysis syndrome, D-dimer, creatine kinase, creatine kinase – MB values within normal limits, negative troponin. The performed electrocardiogram does not detect any acute cardiac event.
From an imaging perspective, the chest X-ray in posteroanterior projection shows the presence of a bilaterally widened mediastinum, predominantly right, right latero-tracheal opacity, with sizes of 3/2 cm, subcostal intensity, clear margins, bilaterally accentuated basal broncho-vascular marking, and free costophrenic recesses (Figure 1).
Since the patient complains of symptoms pertaining to the pneumological and ENT areas, we decided to perform a head and chest CT with and without the use of a contrast agent for detection, as shown in Figures 2A–2G:

– *Cervical level*: thrombosis of the internal jugular vein;
– *Chest level*:
  – a space-occupying mass located at the level of the upper and middle mediastinum, in the axial plane with sizes of approximately 9/8 cm, with lobulated, relatively well-defined margins, hypodense without administering contrast agents and heterogeneous structure after intravenous administration of contrast agent, with

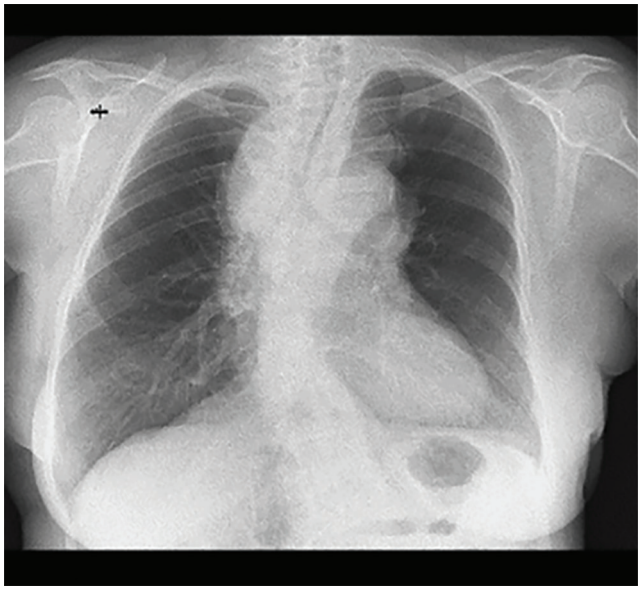


Figure 1. Chest X-ray.

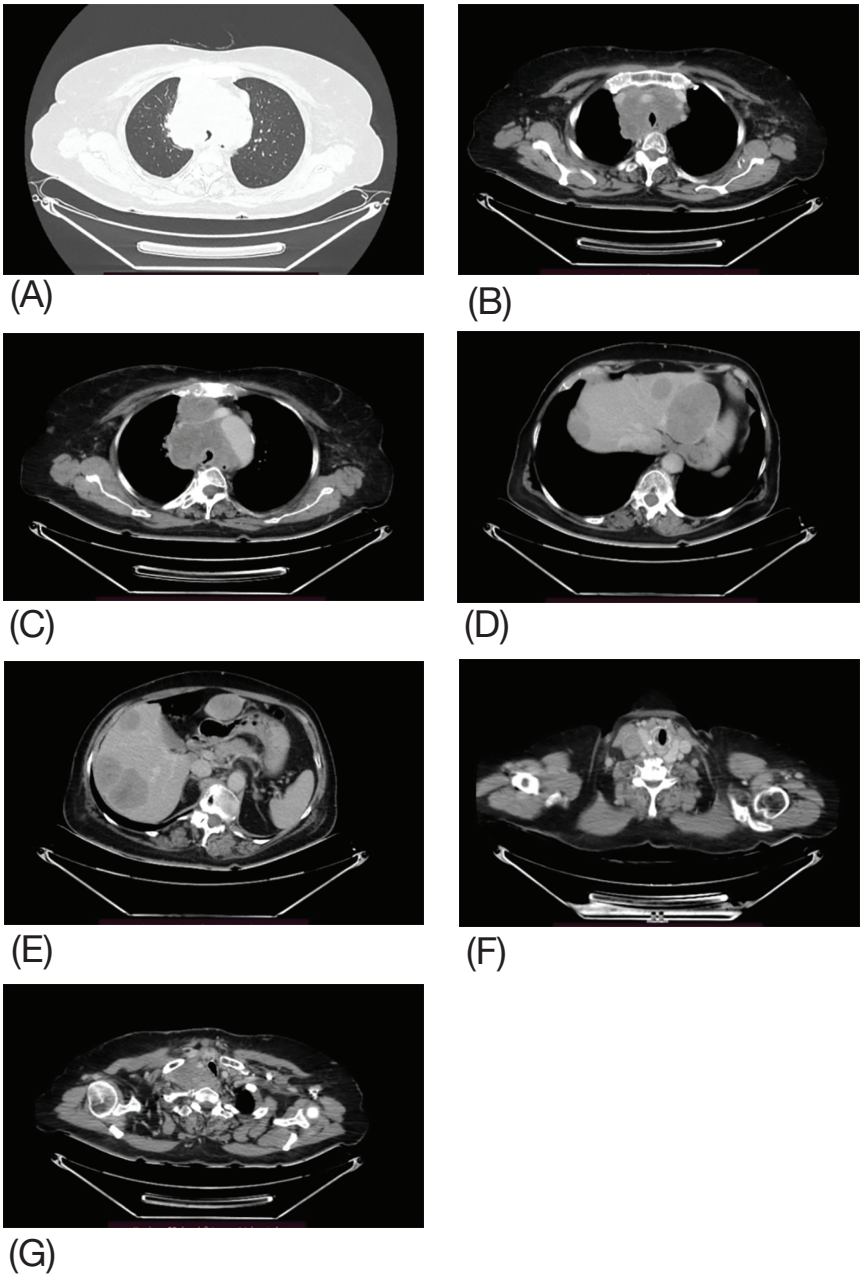
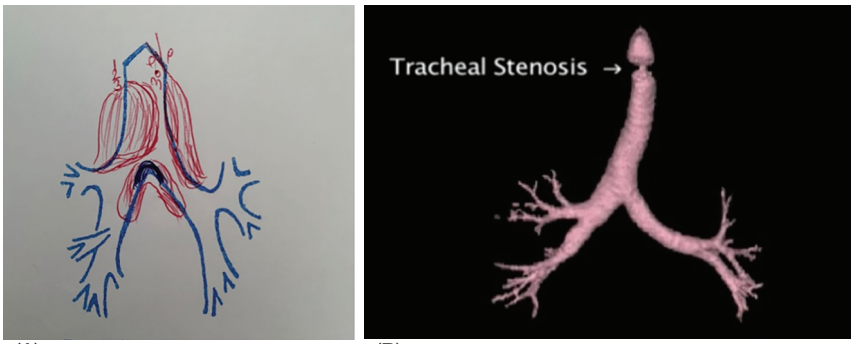


Figure 2. (A–G) CT imaging of the chest with and without contrast agent. CT, computed tomography.

fine moderate iodophilic interior septa, incorporating the mediastinal venous (superior vena cava, brachiocephalic veins, azygos vein), arterial structures (right brachiocephalic trunk with right subclavian artery, right common carotid artery) and the trachea whose gauge is reduced;

– also, this mass compatible with a mediastinal tumour exerts an extrinsic compression effect on the oesophagus (mainly in the cervical segment), as well as on the tracheal wall, invading the right side wall and moderate endoluminal bulge at this level;
– multiple mediastinal lymphadenopathies with maximum sizes of the long axis of approximately 12 mm located at the level of the aortopulmonary window, 17 mm in the perivascular space and approximately 22 mm para-aortic are also found.
– The CT scan managed to capture the upper abdomen as well, where the suspicion of liver metastases is raised.



(A) (B)

Figure 3. (A) Endobronchial appearance. **(B)** 3D tracheal stenosis appearance (4).



Figure 4. Y-shaped tracheal stent.

Given the situation, the absence of images of endoluminal thrombi at the level of the pulmonary trunk and main pulmonary arteries as well as of metastases at the level of the pulmonary parenchyma, together with an absence of pericardial effusion and pleural effusions, is promising.

The next step was to carry out emergency fibrobronchoscopy, adding valuable information to the medical investigation.

From an endobronchial perspective, significant tracheal stenosis (Figure 3A) was observed starting from the 3rd cartilage, up to the level of the carina of trachea (Figure 3B), by extrinsic compression – predominantly at the level of the right tracheal wall and mucosal infiltration, predominantly in the distal trachea, with moderate necrosis on the surface. The carina of the trachea is significantly widened and both main bronchi show proximal moderate stenosis, through the same mechanisms. The remaining tracheal diameter is approximately 30% of normal (2). In the rest, the bilateral bronchial tree has a bronchitic appearance and normal gauges. A biopsy sample from the tracheal level and cytological examination of bronchial aspirate are decided (3).

Due to the current situation (Figures 5A and 5B), we decided to discuss with the bronchoscopist. The anaesthesiologist and the thoracic surgeon joined the discussion. The purpose of this meeting was to make the best decision for the patient given the current situation. It is decided to mount a Y-shaped tracheal stent (Figure 4) in the intensive care unit under general anaesthesia and jet ventilation aiming to restore the appropriate gauge of this elastic, fibrous and cartilaginous tube that connects the larynx to the bronchi and through which the air necessary for breathing circulates from the oral or nasal cavities to the bronchi. Malignant stenoses are difficult to operate upon (5–7). No stent 'cures' the neoplasm (8–10). However, there are a large number of studies recommending the implantation of stents in the case of malignant airway obstruction by extrinsic compression, not only for palliative purposes, but also to gain the time required for obtaining the effect of other treatments.

Also, with the help of electrocautery, the tumour tissue is removed, so that the stent is placed on healthy tissue, thus preventing the possible complications of placing such a stent (Figures 5C and 5D). A second biopsy is sampled, this time at the level of the right main bronchus.

Postoperatively, a bronchoscopy re-examination takes place, finding that the stent is normally placed, with a free lumen, the posterior tracheal wall showing moderate hypotonia above

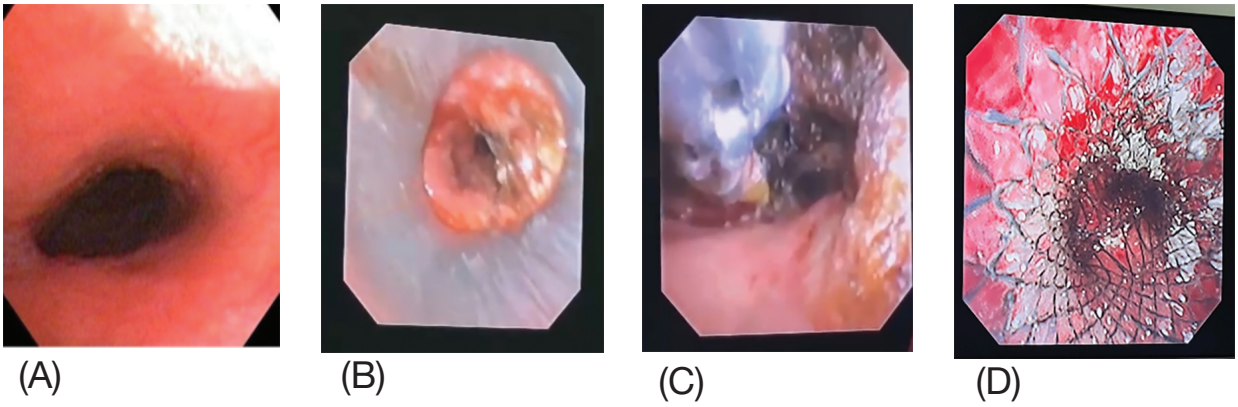


Figure 5. Collection of intraoperative images before and after tracheal stent installation. **(A,B)** Before stent installation. **(C,D)** After stent installation.

Specialty	Diagnoses	Recommendations
ENT	Left vocal cord paralysis fixed in adduction	Radiotherapy initiation
Oncology	Mediastinal tumour Mediastinal compression syndrome Superior vena cava syndrome Liver metastases under observation	IHC testing and initiation of radiotherapy treatment
Cardiology	Excludes the existence of an acute event. The anterior chest pain associated with mediastinal compression syndrome is considered.	

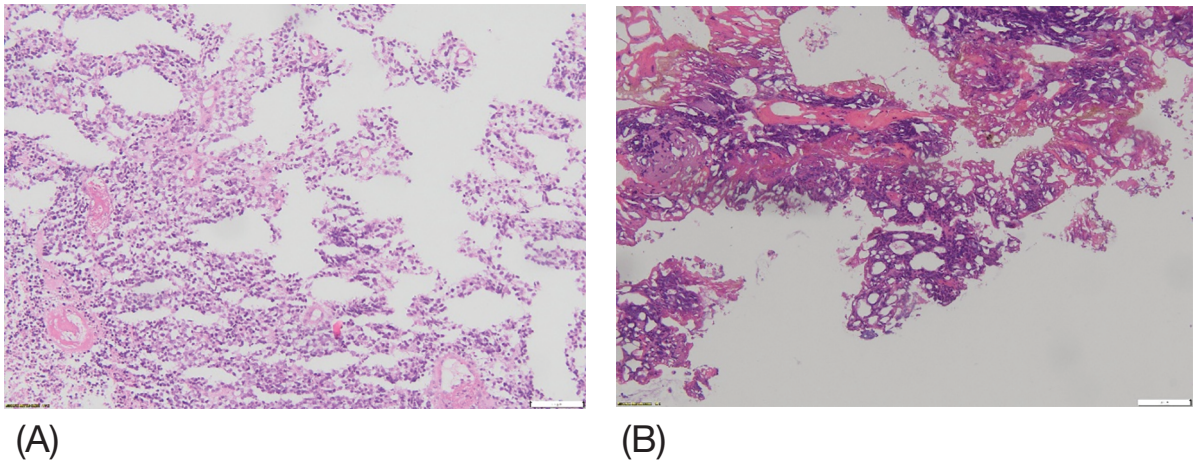
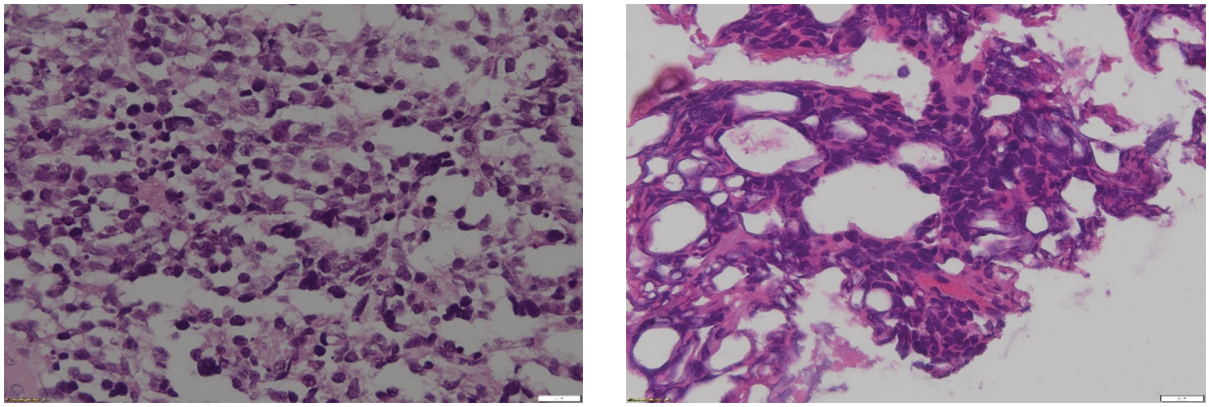


Figure 6. (A) Tracheal biopsy, 10× lens. **(B)** Right primitive bronchial biopsy, 10× lens.

the proximal end of the stent and the segmental bronchi remaining free up to distal bilateral. A new bronchoalveolar lavage is performed. Approximately 3 hr after the completion of the surgical intervention, the patient exhibits an episode of severe laryngospasm, which is remitted under specific medication (11,12).

The surprise of this case comes from the anatomical pathology department, which offers us two different results of the sampled biopsies.

Tracheal biopsy raises the suspicion of a possible small-cell neuroendocrine carcinoma that requires immunohistochemical (IHC) testing of 'specimen collected via bronchoscopy, with



(A) (B)

Figure 7. (A) Tracheal biopsy, 40× lens. **(B)** Right primitive bronchial biopsy, 40× lens.

complete inclusion, fragments of bronchial mucosa with neoplastic infiltrates consisting of solid areas of *small and medium-sized carcinomatous elements* with vesicular and hyperchromatic nuclei, with lightly eosinophilic cytoplasm' and the bronchial biopsy sampled from the right primitive and the distal tracheal region, by electrocautery resection, indicates the presence of a non-small cell lung cancer (NSCLC), advocating for a squamous cell carcinoma 'specimen collected via bronchoscopy, with complete inclusion, crushed fragments of superficial bronchial mucosa, exposed, with tumour cell infiltrates, with elements with relatively large undifferentiated nuclei, alongside blood clots, cellular debris, bronchial epithelia and plaques of squamous metaplasia with lesions of severe intraepithelial dysplasia'.

The specimen (bronchial aspirate) collected via fibrobronchoscopy and sent for the cytological examination is not very useful as no neoplastic cells are found.

We also carry out a series of interdisciplinary consultations.

During hospital admission, the patient received corticosteroid treatment ± rapid insulin if the glycaemic values exceeded the upper threshold, antacid, anti-emetics, antitussives, anticoagulant, hepatoprotector, loop diuretic, beta blocker and rehydration solutions.

After the initiation of corticosteroid medication, the wheezing and the feeling of suffocation were partially abolished, and after the placement of the stent the respiratory status was greatly improved.

On the day of discharge, a final bronchoscopy re-examination was performed, finding that the tracheal stent is normally placed, with a free lumen, and that the vocal cords show dyskinesia; and a bronchoalveolar lavage was performed, absorbing secretions, reassuring that the segmental bronchi are free up to the distal end.

Thus, the evolution of the patient was favourable, improving the quality of life.

Discussion

The topics of debate in this case presented themselves at every turn. We started from the symptoms and proceeded to discuss the histopathological type of the patient's pathology.

1. At the time of taking over the case, we were concerned with the recurrent wheezing, at regular time intervals, and the patient's dependence on both oxygen and systemic corticotherapy. After performing the clinical and imaging examination, things started to become clear regarding the patient's pathology.

2. After viewing the endobronchial appearance, the idea of mounting a metallic tracheal stent to keep the airways free emerged. We also considered that this stent would bring a significant benefit and facilitate the initiation of palliative treatment; however, we still faced several questions: 'Do the patient's anatomical conditions allow safe insertion of the prosthesis? Do the benefits outweigh the complications? Will the mucostasis emerge? Will it be possible to remove the entire tumour tissue? Will it be necessary to place the stent on tumour or granulation tissue? Is the stent safe enough (mechanical failure, perforation of a part of the stent)?' (13).

We have decided to take these risks, and the result was positive; the stent was placed on healthy tissue, and the patient was rebalanced from a respiratory perspective, with a decrease in the dose of corticosteroid medication.

3. Another point of debate was related to the possibility of the coexistence of two simultaneous histopathological types, an issue constituting a particular defining aspect of the case's

uniqueness. The tracheal biopsy (Figures 6A and 7A) (14) argued in favour of a possible small-cell neuroendocrine carcinoma; on the other hand, the bronchial biopsy at the level of the right main bronchus (Figures 6B and 7B) (15) led the medical investigation towards a small squamous cell carcinoma. The reluctance of the anatomical pathology department concerning the histopathological type of certainty was represented by the presence of 'small and medium-sized, poorly differentiated' carcinomatous elements from the tracheal biopsy. Relying on the literature, the coexistence of carcinoid tumours with NSCLC is very rare. The pathogenesis and origin of the combination of the two types of tumour are still unknown. So far, only nine such cases have been reported worldwide, these being predominantly in the Asian region.

In Figures 6 and 7, the descriptions are similar, the differences being given by the lens magnifying power. Small and medium-sized round-oval and fusiform cells are observed, which have either hyperchromic or vesicular nuclei, with scarce, pale cytoplasm. More medium-sized elements are observed, less often small-sized elements, with hyperchromic nuclei, but with more cytoplasm, which leans towards the non-small cell diagnosis. Another issue related to this biopsy is that it has a lot of sampling/crush artefacts, which makes it difficult to interpret.

Without IHC tests, the differential diagnoses are small cell neuroendocrine carcinoma, squamous cell carcinoma – basaloid type, combined small cell neuroendocrine carcinoma or synchronous carcinoma. If we are to be completely fair, any other type of poorly differentiated lung carcinoma should be included in the differential diagnosis, such as solid adenocarcinoma (16,17).

IHC testing was mandatory. Within 10 days we have received the answer. The results of the samples sent for IHC testing revealed that we are dealing with a *small cell neuroendocrine carcinoma* (18,19).

If we are to talk in terms of quantitative data on neuroendocrine tumours, we find that they represent 25% of primary pulmonary neoplasms, and the most common neuroendocrine carcinoma is the small cell carcinoma in a percentage of 20% (20,21). In the past 30 years, there has been an increase in the incidence rate of this histopathological type (22). The lung is considered the most common place of origin of small cell carcinoma in the body, only 5% having an extrapulmonary location. Therefore, the differential diagnosis of metastatic small cell carcinoma of unknown primary site should include pulmonary origin as the first consideration.

4. The prognosis of this case was also debated (23). Although oncological treatment has improved following the emergence of IHC tests, the survival rate of patients confirmed with small cell neuroendocrine carcinoma at 5 years is under 5% (24,25). The present case is characterised by the association of liver metastases, which means that the life expectancy is reduced to approximately several months, and the case is proposed for palliation (26).

Conclusions

For this case, the placement of an airway stent was an important step for respiratory rebalancing of the patient. Not only was the remaining tracheal diameter dilated by approximately 30% of normal but also the tumour tissue was removed at this level, which allowed a proper implantation of the metallic airway stent (27). The fast intervention of the medical team gave this patient a chance in her struggle, so that she can continue a specialty palliative treatment (28).

Funding

None.

Conflicts of interest

The authors declare no conflict of interest.

Institutional review board statement

Not Applicable.

Informed consent statement

Informed consent was obtained from all subjects involved in the study.

Data availability statement

Data used to support the findings of this study are available from the corresponding author upon request.

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