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Distinctive radiological aspects of the bronchial carcinoid tumors: an analysis of 24 cases.

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Abstract: *Learning objectives: We report in this article the various radiologic features of bronchial carcinoid tumors, as well as their specific distribution within the lung, which could help distinguishing them from other pulmonary nodules and establishing an appropriate therapeutic strategy. Materials and methods: We reviewed the medical records of all patients with bronchial carcinoid tumors diagnosed by biopsy or surgical resection, and that underwent CT scans in the radiology department of CHU HASSAN II in Fez, during the last 05 years, from January 2015 up to January 2020. Results: The study group included 24 cases of which 16 were women and eight were men. The average age was 41 years old (range: 18–64 years). The clinical presentation was dominated by hemoptysis in 16 cases. However, 04 patients were asymptomatic. Tumors were predominantly proximal (72%). The mean tumor diameter was 22 mm (range: 05–58 mm); the majority (88%) had a lobulated outlinethe lesions were all solid, containing partial calcifications in 26% of cases and significantly enhanced after contrast injection in 61% of cases. 17 of this tumors were typical carcinoids and the seven remaining were atypical. Conclusion : Carcinoid bronchial tumours are known to be low-grade tumors and are classified as lung neuroendocrine tumors. There are two types of carcinoid tumors, typical and atypical, which are different in terms of aggressiveness and prognosis, although they present similar imaging features. the analysis of imaging features allows a better understanding of this type of tumor and a better management*

Keywords: Bronchial tumor, Carcinoid tumor, Radiography, Computed Tomography.

Introduction :

Carcinoid tracheobronchial tumours are known to be low-grade of malignity tumours and are classified as pulmonary neuroendocrine tumours. There are two types of carcinoid tumors, each one of them has its own aggressiveness level and prognosis, although they present similar imaging features.
Surgery is the basic treatment, with an average rate of survival up to 5 years , of 90% for typical carcinoids and 75% for atypical ones.

Materials and methods:

We reviewed the medical records of 24 patients with primary pulmonary carcinoid tumors diagnosed by biopsy or surgical resection, and that underwent CT scans in the radiology department of CHU HASSAN II in Fez, during the last 05 years, from January 2015 up to January 2020.
A Thoracic CT was done for the following reasons: location of lesions; order of the bronchi involved; size, outline and density of lesions; enhancement after contrast; the presence of peripheral atelectasis, as well as pneumonia and bronchiectasis

Results:

Epidemiological and clinical findings:

The average age in our study was 41 years old with a range going from 18 up to 64 years old, 8 of which were males and 16 were females. Only 2 patients were smokers.
The clinical presentation was dominated by hemoptysis found in 16 cases, cough was less frequent, found in 02 cases, dyspnea and chest pain were found in only 01 cases each. On the other hand, 04 patients were asymptomatic and no carcinoid syndrome was revealed.

Radiological findings:

All patients underwent plain radiograph and chest CT scan.

The plain radiography revealed rounded opacity with clear boundaries in 11 patients, while a blurred boundaries mass was found in 5 patients, the presence of calcifications within the mass was only found in 1 patient. The indirect radiological signs were: atelectasis (n = 5), bronchiectasis (n = 3).

At chest CT scan , the majority of lesions had a lobulated outline.

The different locations were as follows:

• Only one tumour was tracheal and was located at the junction of the upper third and middle third of the trachea.

• 17 right carcinoid tumors were found (70%): 2 in the main bronchus, 7 in the intermediate bronchus, 2 in the upper lobe, 3 in the middle lobe and 2 in the lower lobe.

• 6 tumors have been identified in the left side (25%): 2 in the main bronchus, 1 in the upper lobe and 4 in the lower lobe.

* It should be noted that a case of synchronous bilateral typical pulmonary carcinoid tumours was found: one was located in the intermediate bronchus and the other in the left lower lobe

(Figure 1).

Table : Location of tumors on the tracheobronchial tree.

Bronchus (n)	Right	Left	tracheal
Main bronchus	2	2	1
Upper lobe	2	1	
Bronchus intermedius	7		
Middle lobe	3		
Lower lobe	2	4	
Total	16	7	

Table 1 : The different locations of the bronchial carcinoid tumors in our study group.

The average size of the 07 atypical carcinoid tumors was 51 mm (range: 20-110mm), while it was 32 mm (range 15-80 mm) for the 17 typical ones.

All lesions were solid, containing partial calcifications in 26% of cases and having a marked enhancement after contrast injection, with an average of 40 HU (range: 14 to 63 HU). On the other hand, the tumors were associated with indirect signs including atelectasis in 06 cases, bronchiectasis in 05 cases, pneumonia in 03 cases.

The staging was done using a **chest-abdomen-pelvis CT scan** and no further metastasis was found.

Bronchial endoscopy:

All patients had benefited from a flexible bronchial fibroscopy apart from one case of peripheral tumor location. This fibroscopy demonstrated, in all patients, an endobronchial or endotracheal bud, framboised pink, bleeding spontaneously or on contact. It was totally obstructive in 65% of cases (n = 15). Biopsy could be performed in only 26% of cases (n = 6) and allowed the diagnosis in 5 cases (2 typical carcinoids and 3 atypical forms). In the sixth case, the diagnosis was rectified on the surgical specimen (typical and then atypical carcinoid).

Spirometry:

Spirometry was performed in all patients except the case with a peripheral tumor localization. The forced expiratory volume in seconds (FEV1) ranged from 1.40 L to 3.70 L and 3 cases of non-reversible obstructive disorders were identified.

Surgical treatment

All patients were operated on by posterolateral thoracotomy conserving the dorsalis major muscle apart from the single tracheal location where a cervico-manubriotomy was performed. In addition, the patient with a synchronous bilateral tumor benefited, after multidisciplinary consultation, from deferred bilateral surgery, starting with the largest tumor on the right side.

The procedures performed were lobectomy in 9 cases (including middle lobectomy with V-plasty on the inferior lobar bronchus, left inferior lobectomy with bronchoplasty on the left upper lobar), middle and inferior bilobectomy in 7 cases and pneumonectomy in 4 cases.

In addition, for optimal parenchymal preservation, 3 lobectomies with bronchial anastomosis resection (BAR) were necessary.

Concerning the tracheal localization, a terminal anastomosis resection was performed. Radical mediastinal lymph node dissection was performed in 91% of cases (n = 21). It was not performed in the case of the tracheal tumor and the peripheral tumor. The surgery was hemorrhagic in 3 cases, requiring transfusion of 1, 2 and 3 red blood cells.

Anatomopathological examination

All surgical specimens (**Figure 2**) were sent for pathological examination. Macroscopically, they were well-limited, encapsulated tumors with a beige or whitish color. The size ranged from 1.5 cm to 11 cm long axis with a mean of 3.9 cm.

Thus, a typical carcinoid tumor was found in 61% of cases (n = 14) and an atypical tumor in 39% of cases (n = 9). The tracheal and bronchial cuttings were healthy in 95.6% of cases. In one case, a bronchial cut was tumorous. Node dissection was negative in 95.6% of cases, positive in one case. The tumors were classified:
- pT1N0M0 or stage IA in 33.5% of cases (n = 8);
- pT2N0M0 or stage IB in 50% of cases (n = 12);
- pT3N0M0 or stage IIB in 12.5% of cases (n = 3);
- pT3N1M0 or stage IIIA in 4% of cases (n = 1).

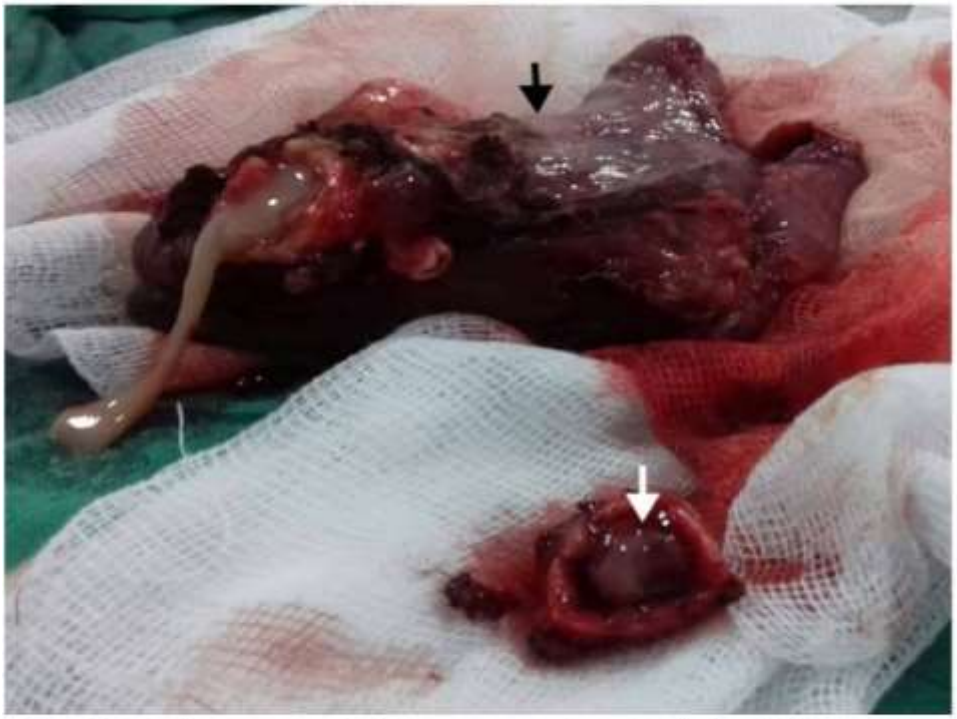

Figure 2. Surgical specimen showing the tumor process obstructing the bronchial lumen (white arrow) with a completely hepatic right upper lobe (black arrow).
References: department of pathological anatomy of the CHU HASSAN II of Fez/MA

Postoperative follow-up

The duration of hospitalization varied between one and six days with an average of three days. All patients stayed in the intensive care unit immediately after surgery. Morbidity was 13% (n = 3).
These were:
- two cases of bronchial congestion after bronchial anastomosis resection (BAR) rapidly resolved by fibroaspiration ;
- and one case of hemopneumothorax on the sixth postoperative day for which the patient benefited from thoracic drainage with a satisfactory outcome.

Adjuvant treatment

Adjuvant chemotherapy was chosen in 17% of cases (n = 4) after discussion in a multidisciplinary consultation meeting.
In all these patients, the main indication for this adjuvant treatment was the risk of local recurrence and distant extension, given that these were atypical carcinoid tumours, thus presenting a potential of locoregional aggressiveness similar to that of non-small cell bronchial cancers, and on the other hand, that the tumor volume was important, with sometimes lymph node extension and enfin the

defect of an R0 resection. Thus, good tumor control was obtained without locoregional recurrence or distant metastasis during the average follow-up time, which was 38 months for these 4 patients. No radiotherapy was administered.

Mortality

Mortality was 9% (n = 2). The first case was a patient who benefited from a left lower lobectomy for aspergilloma and then anastomotic resection for tracheal tumor; he died at D4 postoperatively in a cataclysmic hemothorax setting following a broncho-arterial fistula complicating the left lower lobectomy. The second case was a patient with an altered general condition (WHO at 2) who died at D-18 postoperatively in the intensive care unit in a picture of profound cachexia.

Evolution:

The evolution was favorable in 91% of cases, without recurrence or secondary localization after a mean follow-up of 29 months.

Discussion:

Bronchial carcinoids are rare tumors. According to the American SEER database, this group represent 1 to 2% of primary bronchial tumors [1].

EPIDEMIOLOGICAL PRESENTATION:

In our study, lesions occurred preferentially in young adults (average age of 41 years), in concordance with literature data where the peak incidence is between 40 and 50 years for carcinoids.
The sex ratio is controversial , indeed, while some studies are in favor of a balanced distribution [3], others have shown a preponderance of atypical carcinoids in men [4,5] and a clear predominance, in typical carcinoids, in women [6,7]. This was demonstrated in our study where almost all patients were women in the case of typical carcinoids (16/17) against a slight male predominance for the atypical carcinoid group (5 men versus 3 women).
According to the studies, neither the environmental factors nor smoking were retained for typical carcinoids. Nevertheless, several surveys assume that smoking might be a risk factor for the development of atypical carcinoids. [8] in our series, the 02 smoking patients had atypical carcinoids.

CLINICAL PRESENTATION:

It has been noted in the literature that patients with bronchial carcinoids are often symptomatic and the most common symptoms include cough, hemoptysis, wheezing, and pneumonia as a result of central airway involvement. [9] Rare associations of pulmonary carcinoid tumors include carcinoid syndrome, Cushing disease from ectopic adrenocorticotropic hormone (ACTH) production, and acromegaly from ectopic production of growth hormone [10]
However, about 19-51% of the patients are asymptomatic and bronchial carcinoid is diagnosed because of their abnormal findings on chest radiographs [11]
Our study showed the most frequent symptoms to be hemoptysis (n=16), cough (n=2), dyspnea (n=1), and chest pain cough (n=1). On the other hand, 04 patients were asymptomatic.

IMAGING FINDINGS:

1. CONTRIBUTION OF PLAIN RADIOGRAPHY:

Carcinoid tumors generally present as an isolated, well-defined opacities, sometimes lobulated. Partial calcifications or even excavations are possible [12]. Tumour localization can be hilar or perihilar in 80% of cases, or distal in 20% [13]. The intra-bronchial character is hardly detectable by standard radiography [14].
The lesion is exceptionally multifocal or bilateral **(Figure 3).**

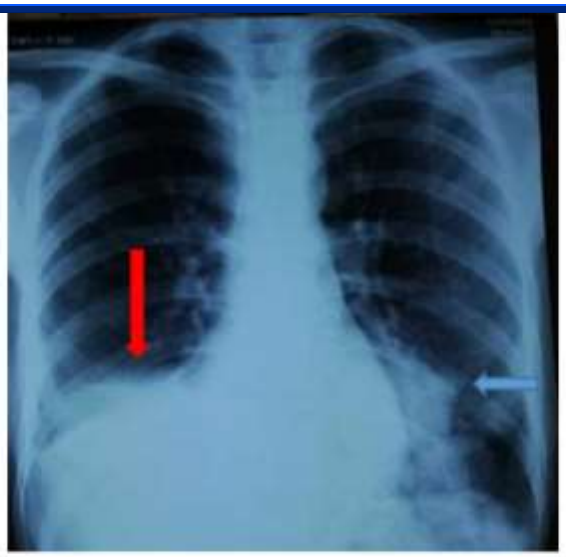

Figure 3 : 36 years old man, 4 months of dyspnea and recurrent high abundance hemoptysis.
Chest X ray shows lower lobe atelectasis erasing the diaphragmatic dome (red arrow) on the right, and at Left, a round opacity of the lower lobe, poorly defined (blue arrow)
References: Department of radiology. University hospital HASSAN II- Fes/MA

The findings of a tumor in a chest X ray is not always obvious and we can sometimes only see the indirect signs due to the bronchial obstruction caused by the tumor, such as atelectasis, air trapping, obstructive pneumonitis, bronchocele or bronchial dilatation **(Figure 4).**

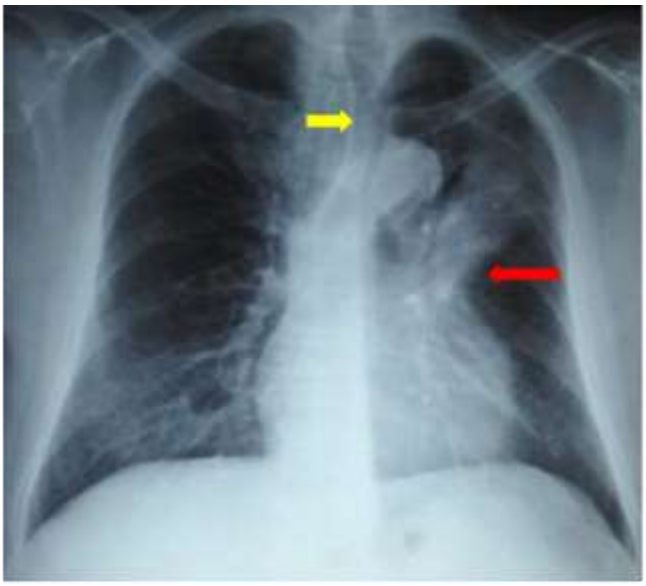

Figure 4 : 64 years old man , who presented with 6 months of cough and dyspnea .
Front chest radiography: Atelectasis of the lingula (red arrow) with attraction of the trachea in its direction (yellow arrow). The cause of collapse is not identified on the image.
References: Department of radiology. University hospital HASSAN II- Fes/MA

On the other hand, chest X ray can be normal in 20% of cases in pure and non-obstructive endobronchial forms [15], hence the need to complete the radiological assessment with a chest CT scan in the event of suggestive carcinoid syndrome, or obstructive parenchymal involvement resistant to treatment, especially in a young patients. [16]

2. CONTRIBUTION OF CHEST CT :

It is more efficient for studying the characteristics of the tumour, it allows to specify the exact location, size, morphology and enhancement of the tumour. Furthermore, it can help to determine the extent of the primary tumor, involvement of mediastinal lymph nodes, and presence of distant metastases.

The main contribution of CT compared to fibroscopy is to show tumours with external-bronchial development, to explore the state of the bronchi and pulmonary complications downstream from obstructive tumors as well as the study of the loco-regional extension. Significant differences in radiological presentation exist between typical and atypical carcinoid tumors, but the diagnosis of certainty remains anatomopathological.

a) LOCATION:

Some authors find a predominance of lesions in the right field (55-75%) [17]. This agrees with our series where 14 cases (66%) , were of right localization.

The predominance of lesions in the proximal bronchial tree is recognized by all [18], this, despite a central topographic versus peripheral differentiation varying from one author to another. Also in our study, all 24 patients presented with central tumors (upstream of a segmental bronchus).

✓ *Hilar or Perihilar masses:*

Central bronchial carcinoids most frequently manifest as a hilar or perihilar mass **(Figure 5 - Figure 6 - Figure 7).**

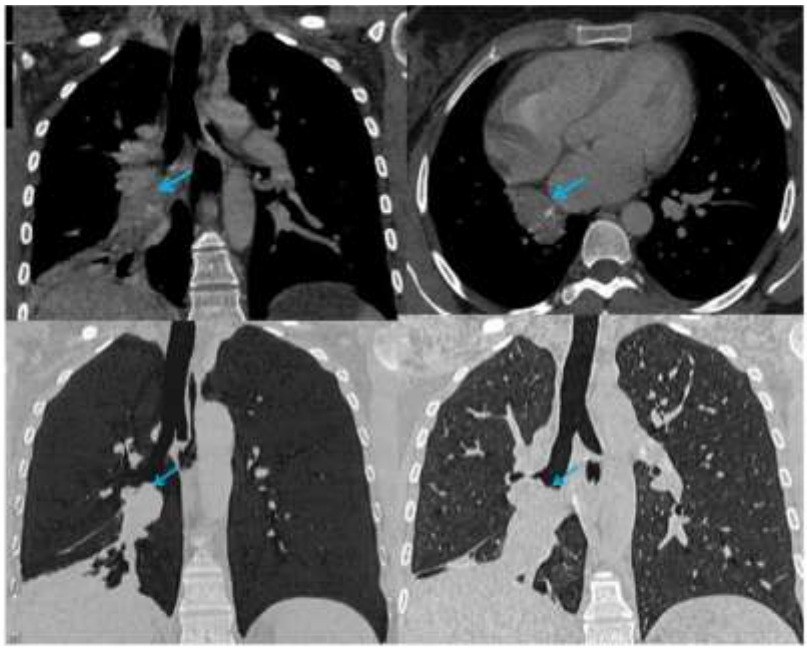

Figure 5: Typical carcinoid in a 36-year-old woman with hemoptysis.
Contrast-enhanced CT scan demonstrates a well-defined ovoid, perihilar mass with narrowing of the intermediate bronchus (arrow).
References: Department of radiology. University hospital HASSAN II- Fes/MA

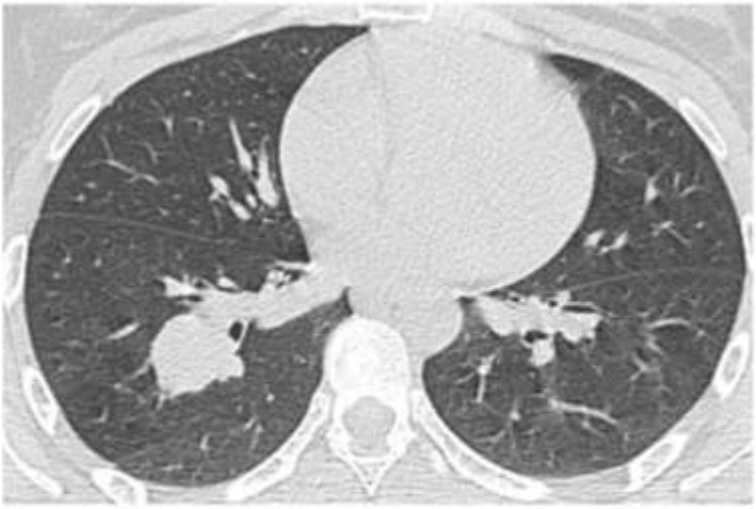

Figure 6 : 34 years old woman; who presented withh hemoptysis for 02 years.
Axial Chest CT: (parenchymal windowing) Peri hilar masse of the lower lobe with regular contour and lobulated shape, classified T1N0M0.
Histological study: typical bronchial carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

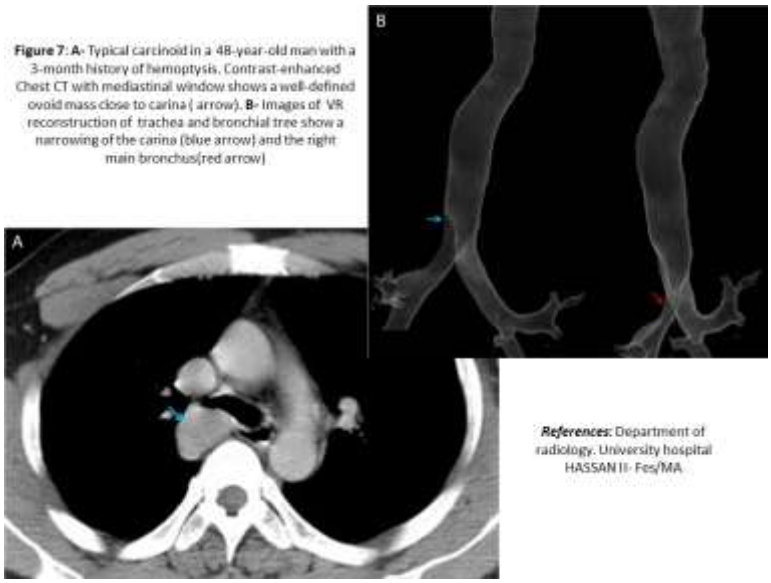

Figure 7: A- Typical carcinoid in a 48-year-old man with a 3-month history of hemoptysis. Contrast-enhanced Chest CT with mediastinal window shows a well-defined ovoid mass close to carina (arrow). **B-** Images of VR reconstruction of trachea and bronchial tree show a narrowing of the carina (blue arrow) and the right main bronchus(red arrow)

References: Department of radiology. University hospital HASSAN II- Fes/MA

Despite the primarily endoluminal origin, it is typically observed on CT that most of the mass extends to the adjacent parenchyma, and the endoluminal component may be minimal. This finding is what is called the "**tip of the iceberg**" sign. [19][21]

- ✓ *Endobronchial nodules:*

Approximately 20% of carcinoid tumors present as endobronchial polyp-like lesion without involvement of lung parenchyma **(Figure 8 - Figure 9) [1].**

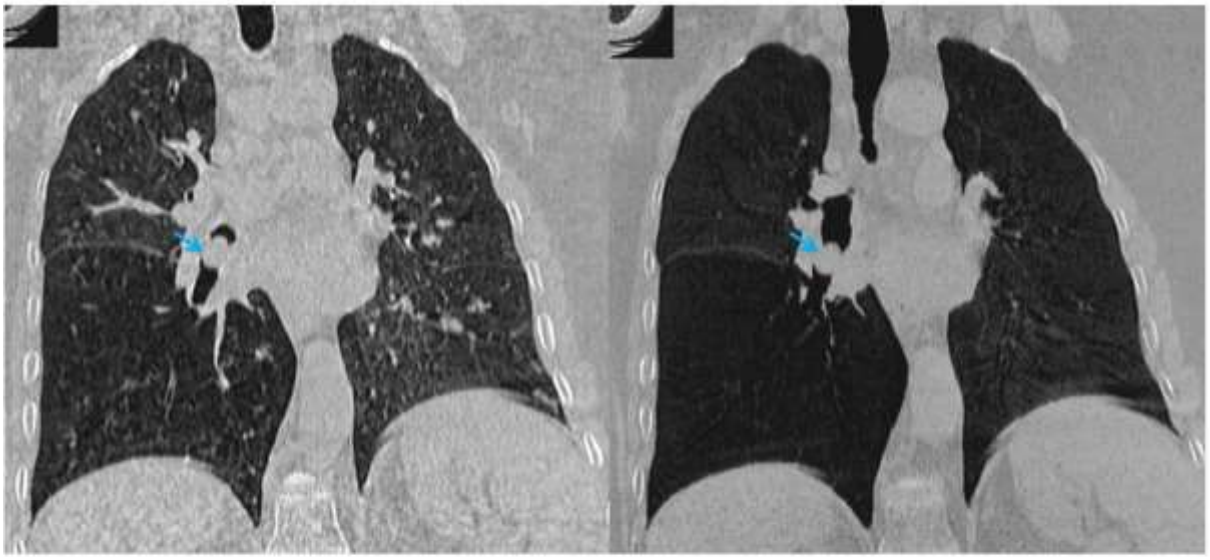

Figure 8 :50 years old woman, who presented with hemoptysis for 01 year.
Chest CT: (Lung windowing) Right main bronchus tumor of size 1.0 cm × 1.5 cm, well-circumscribed, ovoid, entirely endoluminal , classified T1N0M0.
Histological study: typical bronchial carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

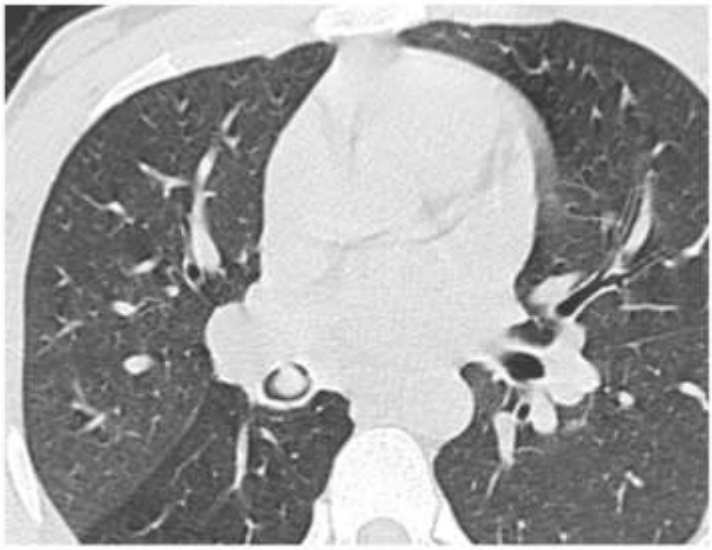

Figure 9: 18 year old man; who presented with hemoptysis for 02 years.
Chest CT: (Lung windowing) endobronchial carcinoid tumor in the bronchus intermedius, classified T1N0M0.
Histological study: Atypical bronchial carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

- ✓ *Peripheral bronchial carcinoids:*

None of our patients had a peripheral tumor (downstream of a segmental bronchus). The peripheral topography does not allow the distinction between typical or atypical carcinoid tumor [22]. Finaly, if the peripheral lesion is a solitary pulmonary nodule, the differential diagnosis of the lesions may include many disorders **(Figure 10)**

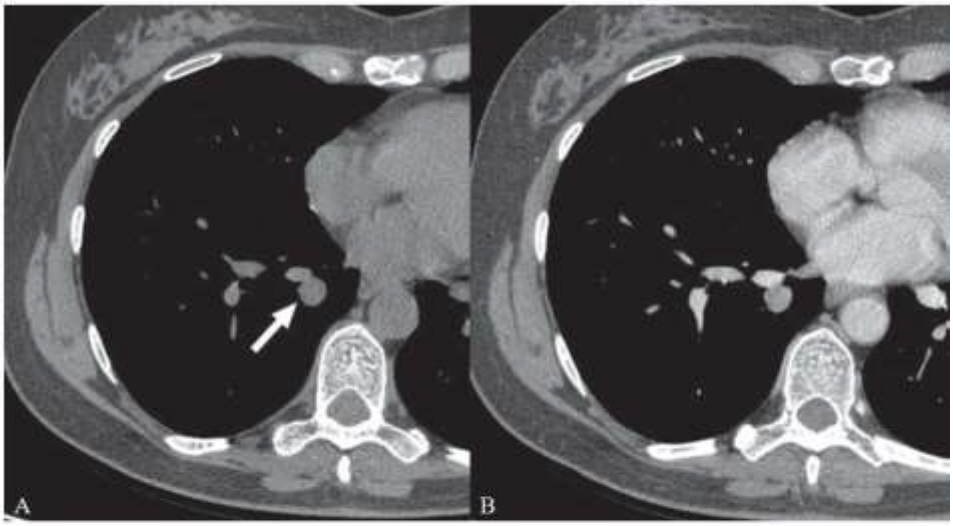

Figure 10: 55-year-old woman with peripheral typical carcinoid tumor at lobectomy. CT contrast enhancement of right lower lobe nodule.
A, Unenhanced CT scan shows density of nodule (arrow) is 5 HU. B, CT scan obtained 60 seconds after contrast administration shows density of nodule is 78 HU.
References: Meisinger et al. CT Features of Peripheral Pulmonary Carcinoid Tumors. AJR:197, November 2011

- ✓ *Tracheal localization:*

This location is rare. Indeed, in the series of Ayadi-kaddour [23], Kyriss [24], Federico [25] and Fink [26], no tracheal localization was found.
Whereas, in our series one patient presented with tracheal localization (**Figure 11**).

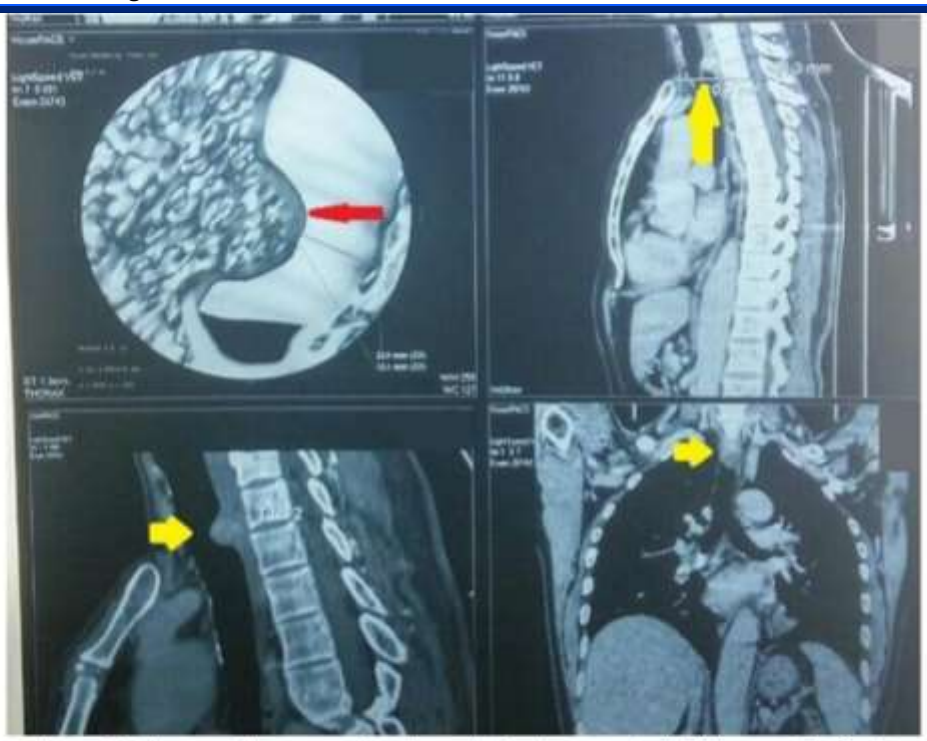

Figure 11 : 62 years old man, smoker, tuberculosis, who presented with hemoptysis for 06 months + cough + dyspnea with a secondary aspergilloma of the LIG .
(a) Virtual endoscopy carcinoid tumor obstructing 40% light (red arrow) &CT reconstruction in sagittal (b.c) and frontal (d) slices: CT (yellow arrows). Histology: atypical carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

- ✓ *Bilateral localization:*

Bilateral localization is very rare, indeed, it was found in the Fink series [21] (n = 8 or 5.7%), in our series (n = 1 or 5%) and in the Ayadi-kaddour series [18], where 2 cases of bifocal tumors were noted as well as a case of multifocal tumors on the left (**Figure 12**).

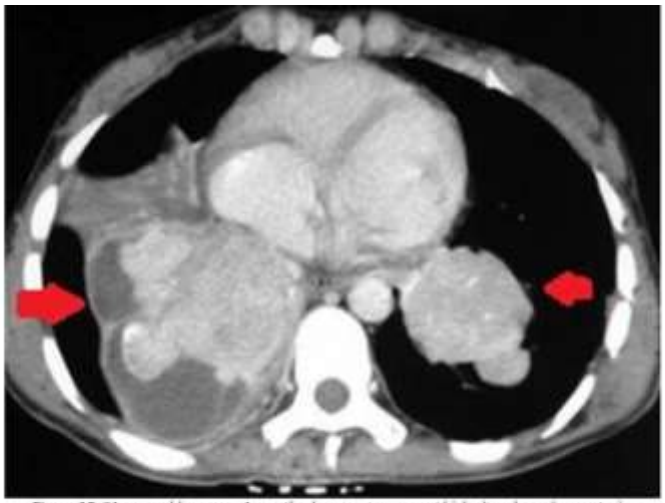

Figure 12: 31 years old woman, 4 months dyspnea + recurrent high abundance hemoptysis.
Contrast-enhanced thorax CT scan (mediastinal windowing): two bilateral parenchymal opacities of the LID and LIG (red arrows).
Histological study: atypical carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

b) TUMOR MORPHOLOGY:

According to the data in the literature one the **size** of the carcinoid tumor, atypical carcinoids are larger in volume than typical carcinoids. This parameter was confirmed in our series, where the average size of atypical carcinoids was 5.1 cm, significantly larger than that of typical CT carcinoids whose average was 3.2 cm.

According to Zwiebel [27], oval tumors with a long axis parallel to the bronchus are in favor of a slow and minimally invasive form of tumor progression. He describes this particular radiological sign under the name of the "sign of parallelism". In fact, this radiological sign is rare and not very sensitive, but very specific of a carcinoid tumor, moreover, it does not allow the distinction between the two histological forms.

Commonly, the lesion is of tissue composition, rounded in shape, sometimes polylobulate, with regular contours, never infiltrating or spiculated edges.

Tumor **calcifications** are better appreciated by CT. They can be diffuse or localized and are more common in proximal tumors. [28] We note, moreover, a predominance of punctiform eccentric calcifications compared to macrocalcifications, which explains the low yield of plain radiography. Some authors have described tumor ossifications: they are unusual and, on the pathological level, these ossifications correspond to spicules of calcified lamellar bone **(Figure 13).**

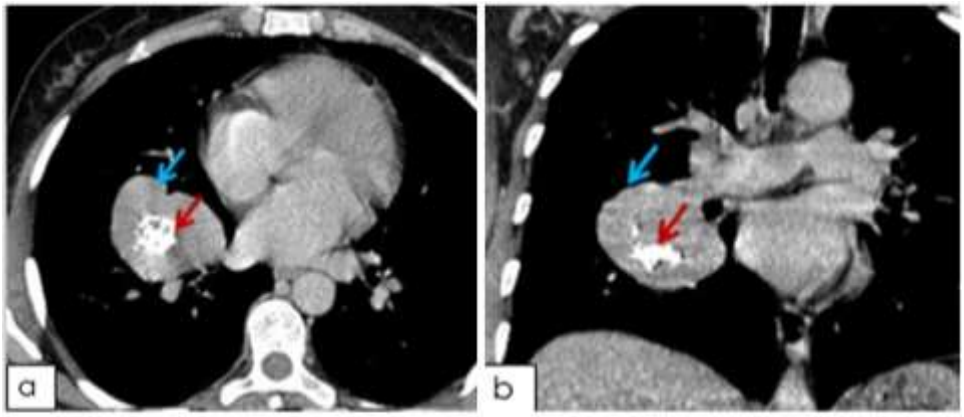

Figure 13: 46 years old man, chronic cough.
Axial (a) & coronal (b) CT scan (mediastinal windowing) shows a right perihilar masse with regular contour (blue arrow) and foci of macrocalcifications within it (red arrow) .
Histological study: : Typical carcinoid tumor.
References: Department of radiology. University hospital HASSAN II- Fes/MA

Endobronchial calcifications can pose a problem of differential diagnosis with broncholithiasis or hamartochondroma. [29]

The **strong enhancement** after contrast injection is explained by the significant stroma characterizing carcinoid tumors. [22] However, this semiological character does not allow to differentiate carcinoid bronchial tumors from other malignant lung lesions. Intense enhancement can wrongly pass a carcinoid tumor for a vascular malformation **(Figure 14).**

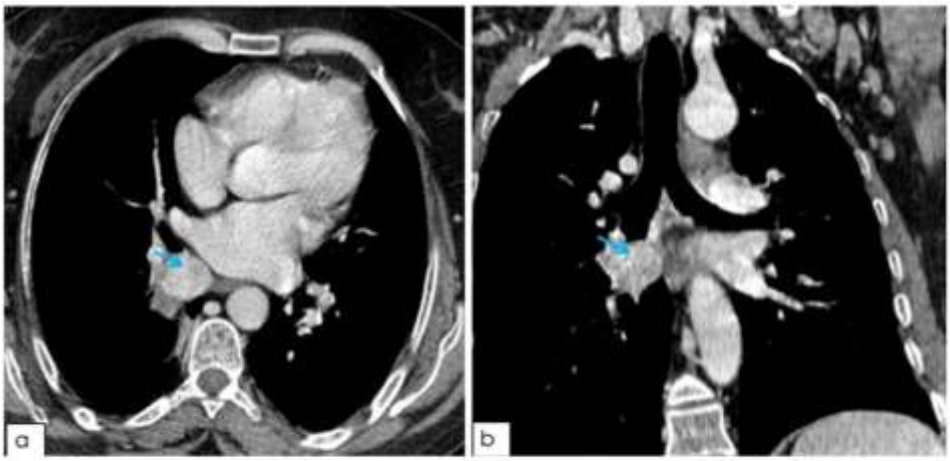

Figure 14: 46 years old man, who presented hemoptysis.
Contrast-enhanced CT scan: (mediastinal windowing):a proximal mass with marked, homogeneous contrast enhancement

Histological study: atypical carcinoid tumor .
References: Department of radiology. University hospital HASSAN II- Fes/MA

a) ASSOCIATED SIGNS RELATED TO BRONCHIAL OBSTRUCTION:

The presence of atelectasis or post obstructive pulmonary pneumonitis on a chest X ray, is usually associated with proximal lesion on CT scan. (**Figure 15 - Figure 16**) [32]

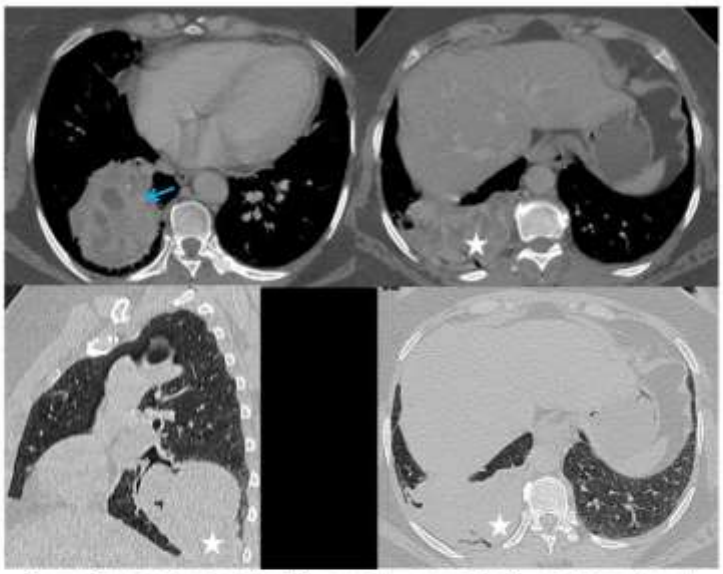

Figure 15: Atypical carcinoid in a 53 -year-old woman with a 3-year history of cough and recurrent pneumonia.
CT scan (lung and mediastinal windowing) shows a well-circumscribed lobular mass with slight enhancement in the lung periphery (arrow) that close the right lower lobar bronchus producing complete atelectasis (asterisk).
References: Department of radiology. University hospital HASSAN II- Fes/MA

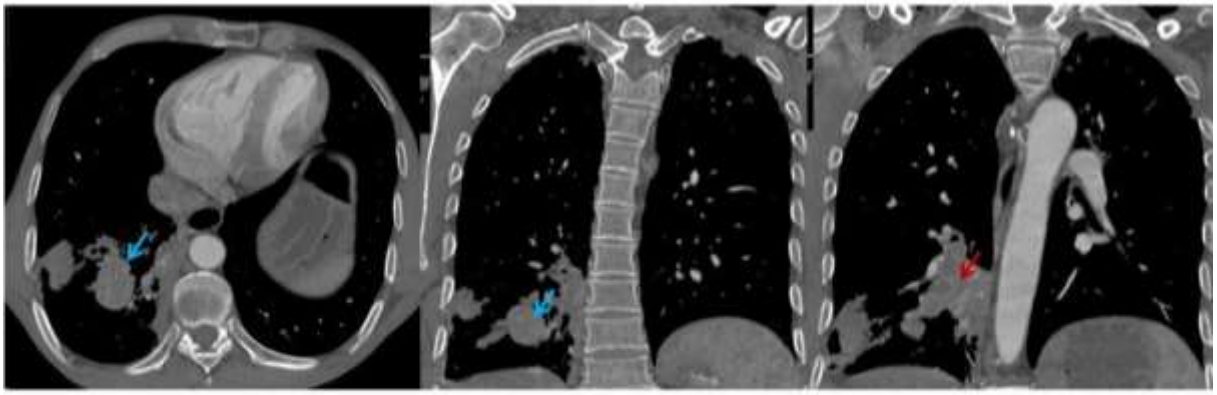

Figure 16: Atypical carcinoid in a 67-year-old man with recurrent pneumonitis.
Contrast-enhanced CT scan (mediastinal windowing) shows a lobulated mass with slight enhancement in the right lower lobe (blue arrow) with distal pneumonitis (red arrow).
References: Department of radiology. University hospital HASSAN II- Fes/MA

The presence of dilation of the bronchi or bronchocele reflects a chronic obstructive nature [22] (**Figure 17 - Figure 18**)

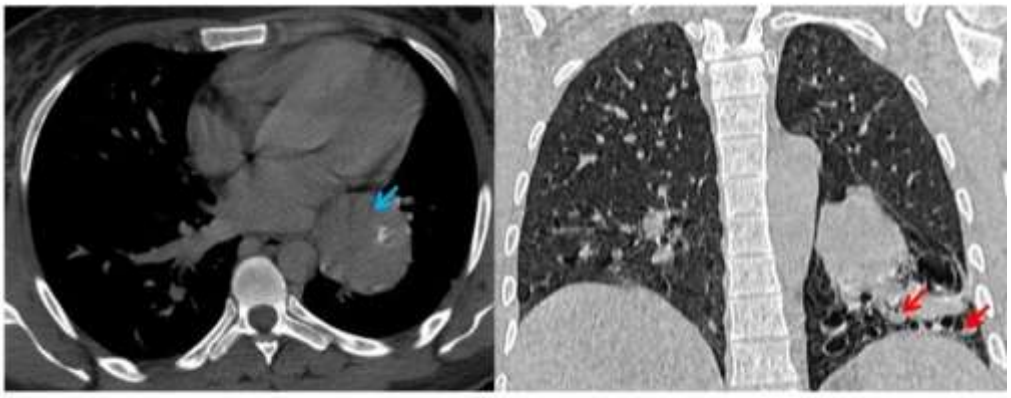

Figure 17: Typical carcinoid in a 36-year-old woman with a 2-year history of cough and recurrent pneumonitis.
Contrast-enhanced Chest CT with mediastinal window demonstrates a single mass in the left lung base (blue arrow) that causes narrowing of the left lower bronchus.
Chest CT with lung window shows a several bronchiectasis distal to the tumor site, some occupied by mucus (red arrow).
References: Department of radiology. University hospital HASSAN II- Fes/MA

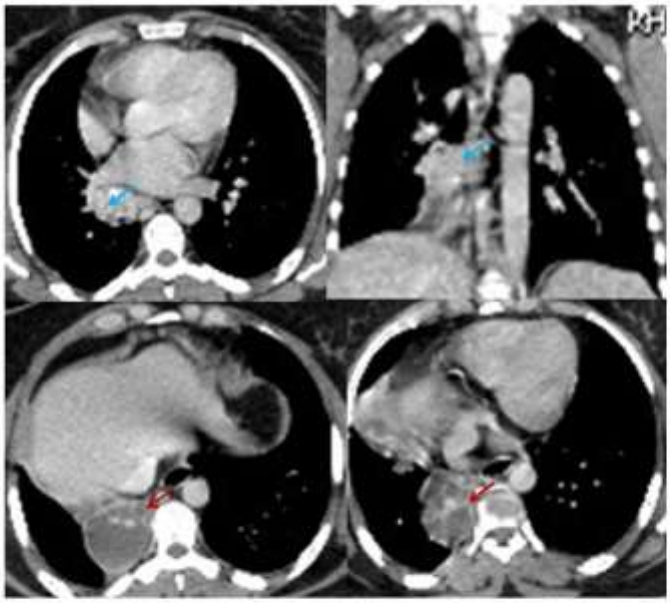

Figure 18: Typical carcinoid in a 32-year-old woman with a 8-months history of recurrent pneumonitis.
Contrast-enhanced Chest CT (mediastinal window) demonstrates a right perihilar mass (blue arrow) with distal bronchocele (red arrow).
References: Department of radiology. University hospital HASSAN II- Fes/MA

b) LYMPH NODE EXTENSION:

Adenomegaly can be associated with carcinoid tumors: they are related to recurrent infections or to metastatic invasion. Lymph node invasion is more frequent in cases of atypical carcinoid. [30,31] (**Figure 19**)

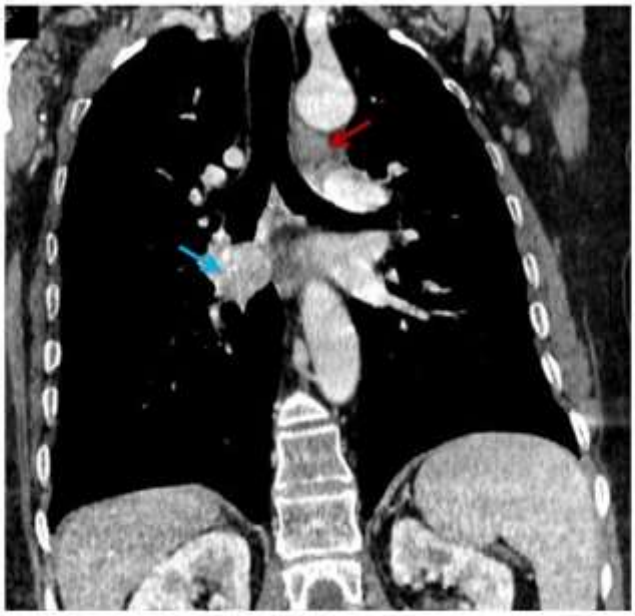

Figure 19: Typical Central carcinoid in a 65-year-old woman with hemoptysis. **Contrast-enhanced chest CT scan** (mediastinal windowing) shows a right hilar ovoid mass (blue arrow) with a left hilar adenopathy (red arrow).
References: Department of radiology. University hospital HASSAN II- Fes/MA

BRONCHOSCOPIC EXAMINATION

Bronchial carcinoids are usually red-brown to bluish-tan endobronchial masses with a smooth surface. They are often highly vascular and in some circumstances have been reported to bleed considerably when biopsied. Care should therefore be exercised and cautery always available **(Figure 20). [33]**

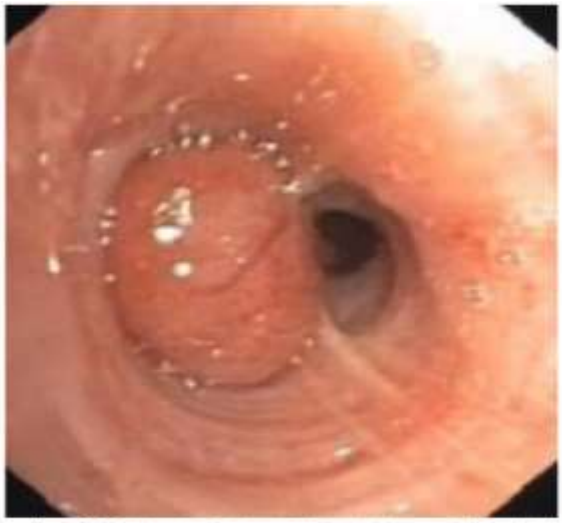

Figure 20: Typical carcinoid obstructing the medial segment of the right middle lobe bronchus
References: Leonardo Fuks et al. Long-TermFollow-Up of Flexible Bronchoscopic Treatment for Bronchial Carcinoids with Curative Intent. Hindawi Publishing Corporation Diagnostic and Therapeutic Endoscopy Journal Volume 2009, Article ID 782961.

HISTOLOGY :

Bronchial carcinoids arise in the bronchial and bronchiolar epithelium and may derive from existing Kulchitsky cells, neuroepithelial bodies or pluripotential bronchial epithelial stem cells [34]
They are categorized into two major groups: About 90% are typical carcinoid tumors. The remaining 10% of the lesions are atypical carcinoid tumors, which tend to have a higher rate of metastasis and are larger at the time of diagnosis [35]
The WHO diagnostic criteria for TC are: a tumor with carcinoid morphology and <2 mitoses/2 mm2 (10 HPH), lacking necrosis, and tumor 0.5 cm or larger. An AC is defined as a tumor with carcinoid morphology with 2 to 10 mitoses/2 mm2 and/or necrosis [36] **(Figure 21).**

Our study shows typical and atypical carcinoids in respectively 85% and 15% of the patients.

Tumor Type	Criteria
Typical carcinoid tumors	Carcinoid morphology and <2 mitoses/2mm2 (10 HPFs), no necrosis and >0.5 cm
Atypical carcinoid tumors	Carcinoid morphology with 2-10 mitoses/2mm2 (10 HPFs) or necrosis (often punctual)

Figure 21 : 2004 WHO Criteria for Diagnosis of Neuroendocrine Tumors
References: Travis W, Brambilla E. Tumours of the lung, pleura, thymus, and heart. In: Anonymoused, ed. Pathology and Genetics. Lyon: IARC Press; 2004

SURGICAL TREATMENT

Surgery can be performed by conventional open or minimally invasive approaches.
The posterolateral thoracotomy, which conserves the dorsalis major muscle, was the preferred approach in our series. This approach was the one adopted in almost 99% of the patients in the multicenter study conducted by Filosso et al. on a series of 260 patients with atypical carcinoid tumor and large cell neuroendocrine carcinoma [37]. Video-assisted thoracoscopic surgery (VATS) was performed in his series in only 3 cases, one reason being the central location of these tumors. In addition, these resections sometimes involve parenchymal sparing procedures that can only be performed by thoracotomy. These procedures involve sleeve lobectomies and bronchoplasties with or without parenchymal resection. In our series, these BARs were performed in 3 patients. But lobectomies remain the parenchymal resections of choice sleeve lobectomies [38] and the most widely performed. In a multicenter series, Fink et al. found 56% of lobectomies. Machuca et al. also found that lobectomy was the most common parenchymal resection [39]. However, in typical carcinoids, wedge resections and segmentectomies can be performed. Thus, in a large series, Fox et al. found no difference in survival between lobectomy and infralobar resection in typical sectionwedger carcinoids [40]. Similarly, Yendamuri et al. concluded that a lobectomy was not mandatory in typical carcinoid tumors, provided that a mediastinal lymph node dissection was performed [41]. In our practice, the latter is systematically performed for any central tumor and only one case of lymph node extension was found. This lymph node extension was found in 12% of typical carcinoids and 37.5% of atypical carcinoids in the series by Fox et al [40]. Some authors propose a mediastinal sampling only for tumor staging while others propose a radical mediastinal lymph node curage in case of central tumor even N0 stagingsampling[42]. However, lymph node involvement has a prognostic value. Cardillo et al. concluded that prognosis was more related to lymph node involvement than to histological type, N2 involvement being associated with a worse prognosis [43]. Thus, the 5- and 10-year survival for N1 and N2 involvement is 90% and 75%, respectively, for typical carcinoids and 60% and 50% for atypical carcinoids [42]. In our series, the prognosis was favorable with a recurrence-free survival at 29 months of 91%; we therefore recommend a systematic mediastinal lymph node curage in case of central tumor. [44]

Conclusion :

Carcinoid bronchial tumours are known to be low-grade tumours and are classified as pulmonary neuroendocrine tumours. There are two types of carcinoid tumours, each one of them has its own aggressiveness level and prognosis, although they present similar imaging features.
In a young or a non-smoking patient who has a central lesion, that is well defined and deforms or obstructs a bronchus, the diagnosis of a bronchial carcinoid tumour should be mentioned. Moreover, the presence of calcifications (usually eccentric) or a recurrent history of pulmonary infections concerning the same topography in the same patient should warn us to this specific tumor. The couple thoracic CT scan and bronchial fibroscopy is undoubtedly the best means for the diagnosis.
Multicentric grouping of imaging data allows a better understanding of this type of tumor and better management.

Disclosure of interest:

The authors declare that they have no competing interest.

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