Fiberoptic bronchoscopy findings in patients diagnosed with lung cancer*

Achados de fibrobroncoscopia em pacientes com diagnóstico de neoplasia pulmonar

Marcelo Fouad Rabahi, Andréia Alves Ferreira, Bruno Pereira Reciputti, Thalita de Oliveira Matos, Sebastião Alves Pinto

Abstract

Objective: To compile fiberoptic bronchoscopy findings in patients diagnosed with lung cancer and to correlate those with histopathological findings. **Methods:** This was a retrospective study involving 212 patients with a confirmed diagnosis of lung cancer by cytological evaluation of BAL specimens or by histopathological evaluation of endobronchial or transbronchial biopsy specimens. The data were collected at the Respiratory Endoscopy Section of *Hospital São Salvador*, located in the city of Goiânia, Brazil, between 2005 and 2010. The endoscopic findings were classified as endoscopically visible tumor, endoscopically invisible tumor, and mucosal injury, as well as being classified by the presence/type of secretion. The visible tumors were also classified according to their location in the tracheobronchial tree. **Results:** Endobronchial mass (64%) and mucosal infiltration (35%) were the main endoscopic findings. The histological type was determined in 199 cases, the most prevalent types being squamous carcinoma, in 78 (39%), adenocarcinoma, in 42 (21%), small cell carcinoma, in 24 (12%), and large cell carcinoma, in 2 (1%). More than 45% of the visible tumors were at the upper bronchi. Squamous carcinoma (n = 78) was most commonly visualized as an endobronchial mass (in 74%), mucosal infiltration (in 36%), luminal narrowing (in 10%), or external compression (in 6%). **Conclusions:** Our results show that an endobronchial mass is the most common bronchoscopic finding that is suggestive of malignancy. Proportionally, mucosal infiltration is the most common finding in small cell carcinoma. In adenocarcinoma, luminal narrowing, external compression, mucosal injury, and endobronchial secretion prevail.

Keywords: Lung neoplasms/diagnosis; Lung neoplasms/classification; Bronchoscopy.

Resumo

Objetivo: Catalogar alterações encontradas em imagens obtidas por fibrobroncoscopia em pacientes com diagnóstico de neoplasia pulmonar e correlacionar esses achados com achados histopatológicos. **Métodos:** Estudo retrospectivo envolvendo 212 pacientes com diagnóstico de câncer de pulmão confirmado por citologia obtida por lavado broncoalveolar e/ou histopatologia de biópsia endobrônquica ou transbrônquica. Os dados foram obtidos no Serviço de Endoscopia Respiratória do Hospital São Salvador (Goiânia-GO), entre 2005 e 2010. Os achados endoscópicos foram classificados como tumor endoscopicamente visível, tumor endoscopicamente não visível e lesão na mucosa, assim com quanto à presença/tipo de secreção. Os tumores visíveis também foram classificados de acordo com sua localização na árvore traqueobrônquica. **Resultados:** O principal achado endoscópico foi a presença de massa endobrônquica (64%), seguido por infiltração da mucosa (35%). Quanto aos tipos histológicos (n = 199), os mais prevalentes foram carcinoma escamoso (39%), adenocarcinoma (21%), carcinoma de pequenas células (12%) e carcinoma de grandes células (1%). Mais de 45% dos tumores visíveis estavam localizados nos brônquios superiores. O carcinoma escamoso (n = 78) apresentou-se mais frequentemente como massa tumoral endobrônquica (74%), infiltração da mucosa (36%), estreitamento do lúmen (10%) e compressão extrínseca (6%). **Conclusões:** Nossos resultados indicam que a massa tumoral endobrônquica é o achado endoscópico que mais sugere malignidade. Proporcionalmente, infiltração da mucosa é mais comumente achada em carcinoma de pequenas células. Estreitamento do lúmen, compressão extrínseca, lesão na mucosa e secreção endobrônquica prevalecem no adenocarcinoma.

Descritores: Neoplasias pulmonares/diagnóstico; Neoplasias pulmonares/classificação; Broncoscopia.

* Study carried out in the Department of Pulmonology, *Hospital São Salvador*, Goiás, Brazil.
Correspondence to: Marcelo Fouad Rabahi. Avenida B, 483, Setor Oeste, CEP 74110 030, Goiânia, GO, Brasil.
Tel. 55 62 3521-3333. E-mail: mfrabahi@gmail.com
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Introduction

Lung cancer is the malignancy with the highest mortality worldwide, being the only one whose incidence of death has progressively increased despite improved and more aggressive therapy in recent years. The mean five-year survival ranges from 13% to 21% and from 7% to 10% in developed and in developing countries, respectively.[1]

In the state of Goiás, Brazil, in 2008, the mortality rate of lung cancer as the primary site in the male population was 13.33 per 100,000 men, lung cancer being considered the leading cause of cancer death in this group. In the female population, in that same year, the rate was 7.68 per 100,000 women, lung cancer being therefore the second leading cause of cancer death in women, second only to breast cancer.[2]

Because the prognosis of lung cancer is unfavorable, early diagnosis plays an important role in increasing survival in lung cancer patients.[3] The use of various methods can contribute to early diagnosis. Among the most commonly used methods are imaging tests (chest X-ray and CT), sputum cytology, and fiberoptic bronchoscopy. Fiberoptic bronchoscopy is currently considered the primary method for evaluating the tracheobronchial tree in patients with suspected lung cancer.[4] In addition to allowing visualization of the lesion, the method allows the collection of cytological specimens (by bronchial lavage and bronchial brushing) and histological specimens (by endobronchial biopsy and transbronchial biopsy).

However, bronchoscopists can face difficulties in describing endobronchial lesions. Such lesions range from a devitalized area showing loss of natural luster to gross presentations of large exophytic masses obstructing the bronchial lumen. The description of images as seen under the cold light of the endoscope is subjective, reflecting the variability to which any scientific observation is subject. Fiberoptic bronchoscopy reports show a bias in description: the same lesion can be described with different words, and the cold light of the endoscope can cause artifacts (as it often does). In addition, at best, examiners recognize endoscopic signs of malignancy, but no histopathological diagnosis can be presumed from the results of the test.[5]

The objective of the present study was to compile fiberoptic bronchoscopy findings in patients diagnosed with lung cancer and to determine the relationship between those findings and histopathological findings.

Methods

In the present retrospective study, we analyzed the findings of 376 bronchoscopic procedures (all employing fiberoptic bronchoscopy) performed between January of 2005 and December of 2010 in patients who were clinically and radiologically suspected of having lung cancer, at the Respiratory Endoscopy Section of the Pulmonology Department of *Hospital São Salvador*, located in the city of Goiânia, Brazil.

The patients whose tests were analyzed were guaranteed anonymity, as well as being assured that the study would not cause them any harm or injury at any stage, including treatment. In addition, the patients were assured that the researchers would provide full support in case any harm or injury was directly or indirectly caused by the study. The Directive Council of *Hospital São Salvador* and the Human and Animal Research Ethics Committee of the Federal University of Goiás *Hospital das Clínicas* approved the study.

We reviewed the medical records of the patients (including fiberoptic bronchoscopy reports and photographs) and collected data such as age, gender, indication for the test, cytological findings, and histopathological findings.

The exclusion criteria were as follows: patients with incomplete reports or repeated tests (n = 43); patients for whom cytological or histopathological findings were negative for lung cancer (n = 107); and patients submitted to any surgical procedure involving the lungs (n = 14). On the basis of these criteria, we selected 212 patients (126 males and 86 females).

Endoscopic findings were categorized according to the classification of Ikeda et al.[6] (endoscopically visible and endoscopically invisible tumors), together with some of the criteria used by the Japan Lung Cancer Society[5,7] in order to classify mucosal injury and secretion findings. Endoscopically visible tumors were also classified according to their location in the tracheobronchial tree (trachea, left main bronchus, left upper lobe bronchus, left lower lobe bronchus, right main bronchus, intermediate bronchus, right upper lobe bronchus, middle lobe bronchus, and right lower lobe bronchus).

All bronchoscopic procedures were performed by the same specialist. A Pentax VB-1830T2 fiberoptic bronchoscope (Asahi Optical Co., Tokyo, Japan) was used. Patients received sedation with midazolam and fentanyl, followed by topical anesthesia with 10% lidocaine spray and 2% lidocaine solution (maximum dose, 20 mL). The device was inserted nasally or orally, with the patient in the supine position. During the procedure, BAL specimens were collected for cytology and endobronchial or transbronchial biopsy (without fluoroscopy) specimens were collected for histopathology. After thorough inspection of the bronchial tree, samples were taken from areas showing abnormality. In the BAL procedure, the fiberoptic bronchoscope was inserted into a bronchus as distally as possible, 120 mL of saline solution being administered and approximately 50% of the material being recovered.

Of the 212 patients, 3 did not undergo biopsy and 6 did not undergo BAL. Therefore, 203 patients underwent both procedures.

All specimens collected during the procedures were analyzed by the pathology team of the Goiás State Institute of Oncology and Hematology, located in the city of Goiânia, Brazil.

The cytological and histopathological findings were classified as being negative for, inconclusive for, suggestive of, or positive for malignancy. The findings that were classified as inconclusive were considered negative, whereas those classified as being suggestive of malignancy were considered positive. The histological and cytological classification of tumors was based on the criteria used by the World Health Organization.[8]

Results

Between January of 2005 and December of 2010, we retrospectively followed 212 patients with a confirmed diagnosis of lung cancer. Of those, 59% were male. The mean age was 66 years (range, 34-88 years) for the male patients and 64 years (range, 14-89 years) for the female patients.

The endoscopic findings are presented in Table 1. The most characteristic endoscopic findings can be seen in Figure 1.

In 9 (4%) of the 212 patients diagnosed with lung cancer, the only endoscopic findings were those related to mucosal injury, with or without secretion.

It was possible to determine the location of endoscopically visible tumors in 169 cases. In 48%, the tumor was located in the upper lobe bronchi, 28% being located in the right upper lobe bronchi and 20% being located in the left upper lobe bronchi. Regarding the main bronchi, 17% of the tests showed that the lesion was on the left side, whereas 16% showed that the lesion was on the right side. In the right and left lower lobe bronchi, respectively, tumors were visualized in 10% and 12% of the cases.

Of the 212 patients, 199 were evaluated for tumor histological type, and the results were as follows: squamous carcinoma, in 39%; adenocarcinoma, in 21%; small cell carcinoma, in 12%; and large cell carcinoma, in 1%.

We investigated the distribution of histological types in the group of patients with endoscopically visible tumors and, compiling only the test results for this group, regardless of the presence of mucosal injury or endobronchial secretion, we reviewed a total of 74 patients. Among those, the most prevalent types were squamous carcinoma, in 45%, adenocarcinoma, in 16%, and small cell carcinoma, in 16% (Table 2).

Investigating the distribution of histological types in the group of patients with endoscopically invisible tumors, we reviewed 31 patients; among those, the most prevalent types were adenocarcinoma, in 39%, squamous carcinoma, in 23%, and small cell carcinoma, in 10% (Table 2).

Considering the three main histological types found in the study, we compared the fiberoptic bronchoscopy findings specific to each type.

Of the patients with squamous carcinoma, 58 (74%) had endoscopic findings of an endobronchial mass, 28 (36%) had mucosal infiltration, 8 (10%) had lumen narrowing, and 5 (6%) had external compression (Table 3). Of the 41 patients diagnosed with adenocarcinoma, 20 (49%) had an endobronchial mass, 13 (32%) had mucosal infiltration, 9 (22%) had lumen narrowing, and 10 (24%) had external compression. Of the 25 patients diagnosed with small cell carcinoma, 16 (64%) had an endobronchial mass, 15 (60%) had mucosal infiltration, none (0%) had lumen narrowing, and 6 (24%) had external compression (Table 3).

Discussion

We observed that there was a higher prevalence of lung cancer among males, with a male to female ratio of 1.46:1.00. This is in accordance

Table 1 - Frequency of endoscopic findings in patients with lung cancer.

Endoscopically visible tumor	Patients (n = 212)	
	n	%
Endobronchial mass[a]	135	64
Mucosal infiltration	74	35
Micronodules/macronodules in the mucosa	5	2
Mucosal ulceration (with or without necrosis)	0	0
Endoscopically invisible tumor	n	%
Widening of the main carina	40	19
External compression	37	18
Luminal narrowing/constriction (concentric or otherwise)	28	13
Retraction of the bronchus or carina	23	11
Engorgement of submucosal blood vessels	18	8
Distortion/elevation or torsion of longitudinal folds	15	7
Vocal fold paralysis	7	3
Rigidity of the bronchial wall or carina	2	1
Mucosal injury	n	%
Mucosal hyperemia (localized or generalized)	129	61
Mucosal edema (localized or generalized)	48	23
Mucosal friability (localized or generalized)	4	2
Mucosal hypotrophy/atrophy (localized or generalized)	3	1
Secretion findings	n	%
Serous/seromucous	45	21
Hemorrhagic/clot	34	16
Purulent/mucopurulent	4	2

[a]Exophytic, vegetative, necrotic, lobulated, or polypoid; with or without engorgement of neoplastic blood vessels.

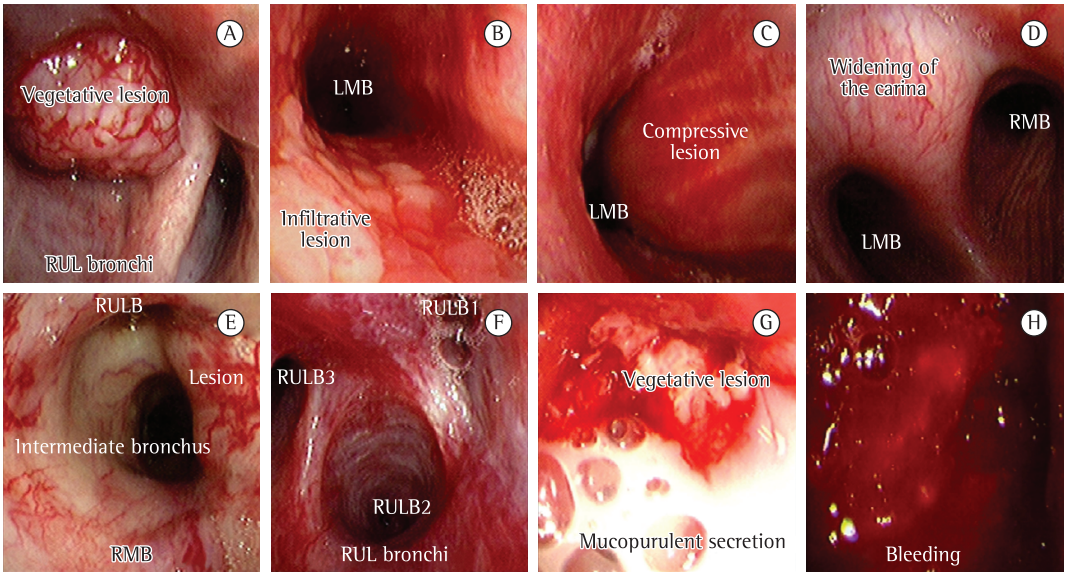

Figure 1 - Fiberoptic bronchoscopy findings. In A, hypervascular vegetative lesion in the right upper lobe (RUL) bronchus (squamous carcinoma). In B, infiltrative lesion in the tracheal mucosa and left main bronchus (LMB; undifferentiated carcinoma). In C, external compression (adenocarcinoma). In D, widening of the main carina. In E, engorgement of submucosal blood vessels (small cell carcinoma). In F, mucosal hyperemia and edema (adenocarcinoma). In G, abundant purulent secretion (squamous carcinoma). In H, active bleeding from the bronchi (undifferentiated carcinoma). RMB: right main bronchus; RULB: right upper lobe bronchus; LB1: lobar bronchus 1; LB2: lobar bronchus 2; and LB3: lobar bronchus 3.

Table 2 - Incidence of histological types in patients with lung tumor classified as endoscopically visible or endoscopically invisible.

Histological type	Visible tumor (n = 74)		Invisible tumor (n = 31)		Total (n = 105)	
	n	%	n	%	n	%
Adenocarcinoma	12	16	12	38	24	23
Squamous carcinoma	33	44	7	23	40	38
Adenoid cystic carcinoma	0	0	1	3	1	1
Neuroendocrine carcinoma	0	0	1	3	1	1
Small cell carcinoma	12	16	3	10	15	14
Hemangioendothelioma	0	0	1	3	1	1
MALT lymphoma	0	0	0	0	0	0
Undifferentiated carcinoma	4	5	2	6	6	6
Carcinoid tumor	2	3	0	0	2	2
Indeterminate	11	15	4	13	15	14

MALT: mucosa-associated lymphoid tissue.

Table 3 - Histological findings compared with fiberoptic bronchoscopy findings.

Endoscopic findings	Histological types					
	SC (n = 78)		AC (n = 41)		SCC (n = 25)	
	n	%	n	%	n	%
Endobronchial mass	58	74	20	49	16	64
Mucosal infiltration	28	36	13	32	15	60
Widening of the main carina	17	22	8	19	6	24
Luminal widening	8	10	9	22	0	0
External compression	5	6	10	24	6	24
Mucosal hyperemia	44	56	26	63	17	68
Mucosal edema	15	19	12	29	6	24
Mucosal hypotrophy	2	26	1	2	0	0
Serous secretion	18	23	10	24	7	28
Hemorrhagic secretion	17	22	9	22	0	0
Purulent secretion	3	4	0	0	0	0

SC: squamous carcinoma; AC: adenocarcinoma; and SCC: small cell carcinoma.

with the literature, which shows a progressive increase in incidence in females when compared with males. In the mid-20th century, the male to female ratio was 10:1.[9]

In the present study, we did not investigate the prevalence of smoking among the selected patients or its role as a risk factor for lung cancer. However, this correlation has been well established by several studies. In 1950, Doll & Hill demonstrated the relationship between smoking and lung cancer. The risk of death is approximately 20-30 times as high in smokers as it is in nonsmokers. Mortality was found to be higher in patients who started smoking during adolescence and in those with higher daily cigarette consumption. Another relevant finding is the age bracket in which the incidence of lung cancer is highest, i.e., the 50-70 year age bracket. In patients younger than 40 years of age, the incidence is lower than 5%[10,11] In the present study, the mean age at diagnosis was 65 years.

Regarding the most prevalent lung cancer location, our findings corroborate the literature: the most commonly affected sites are the upper lobes and the central sites of the right lung, in 28% of the cases analyzed.[12] According to topographic data on malignancies in patients treated at *Hospital Araújo Jorge*, a referral center for the treatment of cancer in the state of Goiás, the most commonly affected lung sites are the upper and lower lobes, as well as the main bronchi.

[13] This distribution corroborates the distribution found in our study.

The value of cytological evaluation in the diagnosis of lung cancer is well established, the proportion of false-positive results being less than 1%.[3,14,15] A definitive diagnosis of cancer was established when cytological or histopathological examination showed neoplastic cells, given that the literature shows that there is a good correlation between these tests, and the cytological diagnosis is unanimously accepted.[3,16]

In the literature, the yields of the two tests are approximately the same. Several studies in the literature have shown that the combination of the two tests results in a higher positivity rate, which ranges from 48% to 95%, depending on whether or not the lesion is endoscopically visible; therefore, we routinely perform lavage and biopsy.[3,17]

In the sample as a whole, the most common histological type was squamous carcinoma (in 39% of the cases), followed by adenocarcinoma (in 21% of the cases), the proportions being similar to those reported in other studies. The least common histological type was large cell carcinoma, a finding that is consistent with the literature.[3,4,9,11,12]

One group of authors reported an increase in adenocarcinoma incidence, which can be higher than the incidence of squamous carcinoma.[18] According to Shields,[19] 30-50% are adenocarcinomas, 20-35% are squamous carcinomas, and 15-35% are small cell carcinomas. However, in our study, we found a predominance of squamous carcinoma, the incidence of which was similar to that of adenocarcinoma; this finding is similar to those reported in other parts of Brazil.[9,11]

One group of authors analyzed three histological types (squamous carcinoma, adenocarcinoma, and large cell carcinoma) and correlated them with their location and endoscopic findings. Squamous carcinoma was most commonly located in the central region, and, on endoscopy, it was most commonly visualized as a tumor mass. Adenocarcinoma was most commonly located in peripheral areas and showed indirect findings, such as bronchial obstruction and external compression, which are endoscopically invisible, or no findings at all.[12]

Analyzing the three most prevalent histological types, we demonstrated that an endobronchial mass is the most common bronchoscopic finding that is suggestive of malignancy. Proportionally, mucosal infiltration is the most common finding in small cell carcinoma. In adenocarcinoma, luminal narrowing, external compression, mucosal injury, and endobronchial secretion prevail.

Division of the sample into two groups (visible tumors and no direct evidence of tumor) has been used in several studies of fiberoptic bronchoscopy, given that the sensitivity of this test is different for each group in the various studies published in Brazil and worldwide.

As can be seen in Table 2, 45% of the endoscopically visible tumors were squamous carcinomas, whereas 39% of the endoscopically invisible tumors were adenocarcinomas. Small cell carcinoma predominated in the group of visible tumors. These findings are in agreement with those reported by other authors.[3]

The findings of the present study, the first of its kind to be conducted in Brazil, are in agreement with those reported in the literature and underscore the importance of a standardized description of fiberoptic bronchoscopy findings as a tool in the diagnosis of lung cancer.

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About the authors

Marcelo Fouad Rabahi
Adjunct Professor. Department of Clinical Medicine, Federal University of Goiás School of Medicine, Goiás, Brazil.

Andréia Alves Ferreira
Medical Student. Federal University of Goiás School of Medicine, Goiás, Brazil.

Bruno Pereira Reciputti
Medical Student. Federal University of Goiás School of Medicine, Goiás, Brazil.

Thalita de Oliveira Matos
Medical Student. Federal University of Goiás School of Medicine, Goiás, Brazil.

Sebastião Alves Pinto
Assistant Professor. Department of Pathology, Federal University of Goiás School of Medicine, Goiás, Brazil.