COMPARISON BETWEEN COMPUTED TOMOGRAPHY AND MEDIASTINOSCOPY IN THE ASSESSMENT OF MEDIASTINAL NODAL INVOLVEMENT IN NON-SMALL CELL BRONCHIAL CARCINOMA*

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Abstract **OBJECTIVE: To evaluate the yielding of chest computed tomography in comparison with mediastinoscopy for detection of mediastinal nodal metastases in patients with bronchial carcinoma, and identifying the most problematic regions. MATERIALS AND METHODS: We have analyzed 195 patients with bronchial carcinoma, comparing the findings of chest computed tomography and mediastinoscopy with biopsy. RESULTS: As regards mediastinal nodal metastasis, 33.9% of patients presented peribronchial and/or ipsilateral hilar nodal metastases, 46.1% ipsilateral and/or subcarinal mediastinal metastases, and 20% contralateral mediastinal and/or hilar, scalenic or supraclavicular metastatic disease. Higher sensitivity values were found in the following regions: right tracheobronchial, right upper paratracheal, and left upper paratracheal. Higher specificity values were found in the following nodal regions: left upper paratracheal, right upper paratracheal and tracheobronchial. CONCLUSION: Chest computed tomography has shown to be an important diagnostic tool for detection of mediastinal lymph nodes abnormalities. However, the neoplastic nature of such mediastinal nodes should be confirmed by means of mediastinoscopy or even thoracotomy, aiming at making the correct decision regarding the treatment of patients with non-small cell lung cancer.**

Keywords: Lung cancer – diagnosis. Computed tomography – methods. Mediastinoscopy – methods.

Resumo *Comparação entre tomografia computadorizada e mediastinoscopia na avaliação do envolvimento ganglionar mediastínico no carcinoma brônquico não de pequenas células.*

OBJETIVO: Avaliar o rendimento da tomografia computadorizada torácica, em relação à mediastinoscopia, na detecção de metástases ganglionares mediastinais em pacientes portadores de carcinoma brônquico analisando o rendimento dessa e identificando as regiões mais problemáticas. MATERIAIS E MÉTODOS: Analisamos 195 pacientes portadores de carcinoma brônquico, buscando-se comparar os achados entre tomografia computadorizada torácica e mediastinoscopia com biópsia. RESULTADOS: Em relação às metástases nodais mediastinais, 33,9% tinham doença metastática ganglionar peribrônquica e/ou hilar ipsilateral, 46,1% possuíam metástases mediastinais ipsilaterais e/ou subcarinais e 20% apresentavam doença metastática mediastinal e/ou hilar contralateral, escalênica ou supraclavicular. As regiões com melhores valores de sensibilidade foram traqueobrônquica direita, paratraqueal direita alta e paratraqueal esquerda alta. As regiões nodais com melhores resultados de especificidade foram paratraqueal esquerda alta, paratraqueal direita alta e regiões traqueobrônquicas. CONCLUSÃO: A tomografia computadorizada torácica mostrou-se importante ferramenta diagnóstica na detecção de anormalidades em gânglios mediastinais; entretanto, a natureza neoplásica desses gânglios deve ser conferida por mediastinoscopia, ou até mesmo por toracotomia, a fim de que a correta decisão quanto ao tratamento possa ser tomada.

Unitermos: Câncer de pulmão – diagnóstico; Tomografia computadorizada – métodos; Mediastinoscopia – métodos.

INTRODUCTION

Since the second decade of the twenty century, the incidence of lung cancer has been alarmingly increasing in all over the world, the surgical resection being the most effective treatment for non-small cell lung carcinoma. The clinical stage of the tumor as well as functional condition of the patient, determine the feasibility and applicability of surgical resection as a primary method of treatment. The patients who are candidates to surgery are those with tumors in stages I or II, and a small number with tumors in stage III. Only in exceptional situations, patients with tumors in stages IIIB or IV may be considered as potentially surgical.

In 1959, Carlens[1] described the mediastinoscopy procedure. This technique has been rapidly diffused, representing a significant progress in the lung cancer management, since, for the first time, it provided an accurate presurgical evaluation of

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the existence and extent of mediastinal metastatic disease. The mediastinoscopy has established a practical way to determine the "N" of the TNM classification, and still remains as the golden-standard in the diagnosis of mediastinal involvement.

Early in the nineties, the development of the thoracoscopy has triggered a series of procedures for evaluation of primary neoplastic lesions and mediastinal nodes. Besides being satisfactory for evaluation of mediastinal nodes, this technique allows the performance of maneuvers for surgical dissection in the suspect of contact, compression or invasion of hilar or mediastinal structures by the tumor.

Computed tomography (CT) and magnetic resonance imaging (MRI) have shown 60% accuracy in relation to the nature of intrathoracic lesions. Therefore, depending on the involvement degree, the patient should not be deprived of a surgical treatment only with basis on such imaging findings. Imaging studies, however, might guide a more limited surgical exploration to prevent that patients with unresectable diseases are submitted to more extensive surgeries.

MATERIALS AND METHODS

In the period between April/2001 and December/2002, all the patients diagnosed with lung cancer in our service were prospectively studied. Of the initial 412 patients, 195 were included in the present study, with basis on the following inclusion criteria: chest CT performed previously to invasive procedures for staging and/or definite surgical treatment; confirmed histological diagnosis of bronchial carcinoma; performance of mediastinoscopy, and absence of previous oncologic therapy. Of these 195 patients, 124 (63.6%) were men, and 71 (36.4%) were women. Ages ranged between 36 and 96 years (mean = 64.2, median = 67 years). The histological types of tumors identified in the present series were the following: 112 (57.4%) patients with squamous carcinoma, 59 (30.3%) with adenocarcinoma and subtypes, and 24 (12.3%) patients with undifferentiated large cell carcinoma; cases of small cell bronchial carcinoma were excluded. The most frequent site of lesions was the right lung in 121 (62.0%) cases, and 74 (38.0%) cases in the left lung, the anatomical distribution being shown on Table 1.

CT scans were performed in a Siemens Somatom AR.SP equipment, with the patient in dorsal decubitus, during maximum inspiration. For the mediastinum evaluation, there was a soft tissue filter; and during pulmonary parenchyma evaluation, a bone filter was employed. Scan time was 1.7 second. Wide, medium and narrow fields of view were utilized. Slices thickness for pulmonary and mediastinal tissues were, respectively, 10 mm and 5 mm or 10 mm, with helical technique and 1.5 pitch. Intravenous contrast agent Hypaque 50% (Sanofi Winthrop Farmacêutica; Brazil) was employed; except for patients with contraindications.

Mediastinal nodes classification followed the American Thoracic Society, 1983 criteria. The definition of the localization of lymph nodes visualized on CT and mediastinoscopy was based on this classification.

The mediastinoscope utilized was a Storz 10970 model, 17 cm in length (Karl Storz Endoscopy; Germany) coupled with a 250 W halogen light source. The patients underwent cervical mediastinoscopy as recommended by Carlens[1] under general anesthesia.

The patients with lesion in the left upper lobe and negative results for neoplasm in mediastinal node freezing biopsies were submitted to paraesternal mediastinotomy — with the Chamberlain[2] technique. The main objective of this procedure was the histological study of the region in the aortopulmonary window (region 5).

The ganglions were separated according to the nodal region, as previously described. The frozen biopsied specimens of nodal regions were included in paraffin blocks allowing histology.

The findings of chest CT and mediastinoscopy were compared with the anatomopathological results of nodal biopsy with mediastinoscopy as the golden standard.

The normality criterion as to the mediastinal nodes size was based on the study developed by Glazer et al.[3], where chest CT studies defined ganglions with > 1.0 cm in diameter in their shortest axis as metastatic.

Table 1 Anatomical neoplasm distribution in the series.

Site	N	%
Right upper lobe	48	24.6
Left upper lobe	38	19.9
Middle lobe	34	17.4
Righ lower lobe	39	20.0
Left lower lobe	36	18.1
Total	195	100.0

All the tomographic evaluations were considered as "positive" or "negative", according to criteria as to the presence of neoplasm in mediastinal nodes and compared with the golden standard provided by anatomopathological studies of these same nodes biopsied by means of mediastinoscopy.

So, the measurements of diagnostic performance (sensitivity, specificity, positive and negative predictive values with their respective confidence intervals) were calculates for chest CT.

RESULTS

Results concerning mediastinal nodal involvement were the following: 66 (33.9%) patients with N1, 90 (46.1%) patients with N2, and 39 (20%) patients with N3. Sensitivity, specificity, positive and negative predictive values for detection of nodal metastasis by CT were calculated (Table 2).

Nodal regions presenting lower sensitivity values were: lower aortopulmonary window, 5 (65.6%), left peribronchial, 10L (87.8%), and upper aortopulmonary window, 5 (89.1%). Best results were found in the following regions: left upper paratracheal 2L (89.5%), right peribronchial 10R (92.4%) and right upper paratracheal 2R (91.1%) (Table 2).

Staples et al.[4] have found similar results in their study, also evaluating CT accuracy as per regions. The region of the aortopulmonary window is problematic because of the vascular confluence interfering in the evaluation. This situation is particularly significant in cases of tumor at left, where frequently the upper portion of the pulmonary artery might be confused with a ganglion. Also, the transverse pericardial sinus might be erroneously con-

Table 2 Computed tomography sensitivity (Sen.), specificity (Spe.), positive predictive value (PPV) and negative predictive value (NPV) distributed according to the nodal region.

Nodal region	Sen. (%)	Spe. (%)	PPV (%)	NPV (%)
Right upper paratracheal (2R)	91.1	100.0	100.0	97.4
Left upper paratracheal (2L)	89.5	100.0	100.0	98.9
Right lower paratracheal (4R)	87.9	97.5	98.1	84.6
Left lower paratracheal (4L)	85.4	99.3	97.6	95.4
Aortopulmonary window (5)	89.1	95.0	87.5	95.7
Low aortopulmonary window (6)	65.6	98.2	87.5	93.6
Subcarinal (7)	88.6	99.4	96.9	97.5
Periesophageal (8)	100.0	100.0	100.0	100.0
Right tracheobronchial (10R)	92.4	100.0	100.0	93.6
Left tracheobronchial (10L)	87.8	100.0	100.0	96.1

fused with a lymph node. The regions along the main bronchi, right tracheobronchial, and left peribronchial present vascular confluence which, for a correct tomographic evaluation, must be correctly contrast enhanced, and is investigates with thin slices, to avoid that CT results are affected. The upper right paratracheal region is surrounded by large vessel involved in fat. The misinterpretation of the node density might confuse the findings in this site.

DISCUSSION

Determining the mediastinal nodes involvement is essential for definition of the therapy and prognosis. Although there is a great number of studies on the chest CT appropriateness for determining mediastinal involvement in patients with non-small cell bronchial carcinoma, there is not a precise rule to be applied in these cases, and this investigation remains controversial.

One of the greatest problems in staging tumors with chest CT is the poor standardization of nodes in certain anatomical regions. Many studies suggest the normality criterion for mediastinal lymph nodes is 1.0 cm in diameter in its longest axis; with high sensitivity (79% to 91%)[4–11]. Although this diameter has high sensitivity, its specificity is low. Considering up to 0.5 cm in diameter in its longest axis, sensitivity achieves 95%, but specificity may decrease to 69%, with an increase in the number of false-positive results, reinforcing the necessity of mediastinoscopy. Even so, 5%–10% of mediastinal nodal metastases are not detected by chest CT[4]. Glazer et al.[12] have determined that the node diameter in the shortest axis is more accurate than the node diameter in the longest axis, since the latest is highly dependent on the spatial orientation of lymph nodes. Generally, the greater the size of the node to be considered as involved, the greater the loss of sensitivity of the method.

Our results related to mediastinal involvement, reinforce the current consensus that all the patients with abnormal mediastinal findings on chest CT should undergo an invasive investigation of lymph nodes. Two review series[3,13] on this matter show that one third of patients with enlarged mediastinal nodes detected on CT, do not present tumor dissemination. Additionally, a recent metanalysis[14] has demonstrated that 29% of chest CTs presenting enlarged nodes corresponded to false-positive results. Therefore, enlarged mediastinal nodes detected on tomographic studies are an absolute indication for mediastinoscopy.

Cases where CT does not demonstrate mediastinal involvement remain controversial. Many studies[4,6,13,15] have reported high negative predictive values in the determination of mediastinal metastases, suggesting the a negative chest CT could avoid a mediastinoscopy and that these patients should directly undergo thoracotomy, considering that a small number of unnecessary thoracotomies would be balanced by a great number of avoided mediastinoscopies.

In contrast, Pearson[16] recommends that mediastinoscopy must be performed in every T2 and T3 tumors and in T1 tumors with diagnosis of adenocarcinoma and large cell carcinoma, even with negative findings on chest CT.

It is our understanding that the main objective of the presurgical staging is to avoid an unnecessary thoracotomy. Considering this procedure inherent morbimortality, a high sensitivity is essential in the presurgical investigation. In terms of CT, this does not seem to be the reality yet.

Additionally, the identification of patients with stage IIIA disease before pulmonary resection has gained significance. In the past, patients diagnosed with stage N2 by mediastinoscopy, many times used to be submitted to non-surgical therapeutic modalities. Although the surgery was technically feasible, several series[17–26] have shown a very poor survival in patients for whom pulmonary resection was the modality of choice. However, new studies suggest that neoadjuvant chemotherapy improves the resectability and results, downgrading the pathological stage IIIA, and changing the mediastinoscopy objective. Instead of just diagnosing the unresectable mediastinal disease, presently, the mediastinoscopy defines the patients with minimal N2 disease who might be included in protocols with chemotherapy as a neoadjuvant treatment, with or without radiotherapy, and, later, surgical resection.

In summary, based on our findings, and supported by the current literature, we believe that it is not possible yet to utilize chest CT as a mean to avoid unnecessary mediastinoscopies, however, chest CT remains as an important tool for mediastinal mapping, selecting and guiding the surgical intervention which will yield the definite anatomopathological diagnosis.

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