PAPERS AND SHORT REPORTS

Role of computed tomography in assessing "operability" of bronchial carcinoma

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Abstract

To try to assess the accuracy of predicting "operability" (as defined by local policy) of bronchial carcinoma 300 patients underwent computed tomography of the thorax in a prospective study. The results of 141 patients showed an agreement between computed tomographic and surgical (including pathological) findings in those patients who had received operations. Most of the other patients had more advanced disease than suggested by the findings of computed tomography.

A total of 118 patients did not receive operations: in 47 their disease was considered to be inoperable on the basis of computed tomographic findings alone, and this was accepted by the cardiothoracic surgeons after consultation. Thirty two other patients had further evidence of metastatic disease on other investigations.

Computed tomography of the thorax should be performed early in the assessment of operability of patients with bronchial carcinoma and before the start of an extensive search for metastatic disease.

Introduction

An improved method of staging patients with known carcinoma of the lung was sought to detect those patients with lesions in whom thoracotomy would be of little or no benefit. Several studies have previously been performed to assess the role of computed tomography in the staging of lung tumours with variable results.¹⁻⁷ Chapman has advocated computed tomography of the upper abdomen to assess secondary disease, particularly in the adrenal glands.⁸ Since the advent of the computed tomographic scanner in

Aberdeen Royal Infirmary in December 1981 patients with bronchial carcinoma have routinely undergone computed tomography of the thorax before proposed thoracotomy. It is the policy in the thoracic surgical unit in Aberdeen to resect all operable carcinomas in the absence of any contraindications and exclude from operation those patients with secondary mediastinal nodal disease whose prognosis is poor.⁹

Patients and methods

Three hundred patients with bronchial carcinoma were studied. In all patients computed tomography of the thorax had been performed as routine assessment of their tumour, and adequate records were available for all. The thorax was scanned at a slice thickness of 12 mm, a slice width of 12 mm, and a scan speed of roughly 10 seconds from the apex of the lungs to the most inferior aspect of the posterior costophrenic recess. Intravenous contrast was used only when definition of mediastinal structures needed to be enhanced and clarified. The assessment of "inoperability" was made on the position and extent of the primary tumour, evidence of local invasion or distant spread, mediastinal nodes greater than 2 cm in any diameter, or obstruction of the superior vena cava. The computed tomograms were examined prospectively on the same day by one of three experienced radiologists. Data were taken only from this initial report and not directly from the scans to enable the results to include observer error. In all patients conventional chest radiography, bronchoscopy, pulmonary function tests, computed tomography of the head, and an isotope bone scan had been performed. If abnormal results were yielded from liver function tests of blood samples an ultrasound liver scan was also performed.

Results

Thoracotomy was performed in 182 of the 300 patients. In 141 of these 182 patients there was agreement between the computed tomographic and surgical (including pathological) findings. In 25 of these 141 patients computed tomographic findings had suggested that the lesions were inoperable but surgery had, nevertheless, been attempted. Sixteen of the 25 patients had thoracotomy without resection, confirming the computed tomographic findings. In the remaining nine patients the computed tomographic finding of mediastinal disease was confirmed but palliative resections were performed.

In 41 patients there was some disagreement between the computed tomographic report and the operative findings. In one of these 41 patients hilar invasion had been noted on computed tomography but not at

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operation, in one enlarged paratracheal nodes were seen at operation but not on computed tomography, and in three enlarged mediastinal nodes were present on computed tomography but not at operation. Disease of hilar nodes and pleural effusion had been incorrectly diagnosed from computed tomographic results in one patient, enlarged hilar nodes in one, positive hilar nodes of less than 2 cm diameter in 11 and more than 2 cm in one, positive subaortic nodes of less than 2 cm in three, positive subcarinal nodes of less than 2 cm in five and more than 2 cm in two, and alveolar cell carcinoma in one. Ten of the 41 patients had direct invasion of the adjacent tissues, and in three of these 10 only thoracotomy without resection was possible. One patient in whom opacities in the contralateral lung were noted on the computed tomographic report was initially declared inoperable, but a repeat computed tomogram one month later showed resolution of the shadows. The lesions were presumed to be resolving inflammation, and the patient had an uneventful thoracotomy with resection. Thus out of 41 patients in whom surgical findings disagreed with computed tomographic findings one patient had thoracotomy delayed for one month and three had unnecessary thoracotomies.

Only six out of 41 patients had less advanced disease at operation than was stated from the findings of computed tomography (false positives). The remaining 35 patients had more advanced disease at operation and on pathological examination (false negatives). The proportion of false positives has decreased since the series began as our interpretation and experience has increased: only one false positive was recorded in the last 100 patients analysed. The proportion of false positives is six out of 182 patients.

Thoracotomy was not performed in 118 patients. The disease in 47 of these patients was assessed as inoperable from computed tomographic findings alone. Thirty two other patients had evidence of metastatic disease and inoperability recorded on their computed tomographic report. In nine patients mediastinal nodal spread was noted on the computed tomographic report, indicating inoperability, and this was confirmed in all nine by mediastinoscopy and histological examination. Thirty patients in whom disease was considered to be operable on computed tomography did not receive thoracotomies for the following reasons: 14 were considered to be medically unfit for thoracotomy, one had associated carcinoma of the larynx, six had positive isotope bone scans, three had positive computed tomograms of the brain, and six refused operation.

Adrenal masses were detected in five patients, but all five patients had other features of disseminated malignancy. No patient was refused an operation by the finding of an isolated adrenal mass. Adrenal biopsy was therefore unnecessary in any patient.

Discussion

Figure 1 shows the number of patients who received operations and the results of computed tomography compared with surgical

FIG 1—Number of patients who received operations and results of computed tomography compared with surgical and pathological staging.

FIG 2—Comparison of the sequelae of operable and inoperable disease as assessed by computed tomography.

and pathological staging for the 300 patients. Figure 2 compares the sequelae of operable and inoperable disease as assessed by computed tomography.

Twenty five patients had a thoracotomy despite their disease being assessed as inoperable on computed tomography. Nine of these patients had only palliative resection, and in the remaining 16 disease was too advanced for any operation to be performed. Most of the patients received operations early in the series when operative proof of the computed tomographic report was necessary. The computed tomographic report of inoperability was thus correct for all 25 patients. Subsequently, only a few thoracotomies were performed in patients with an adverse computed tomographic report.

Earlier studies, often based on small numbers, suggested an accuracy of 33%, though this has improved. The results of our series confirm that computed tomography cannot predict microscopic nodal invasion that occurs without nodal enlargement. Twenty one of the 182 patients who received operations had microscopic mediastinal nodal disease, in which all nodes were less than 2 cm in length. Similarly, nodes enlarged because of reactive hyperplasia cannot be distinguished by computed tomography from those caused by tumours. Pugatch *et al* advise caution in assessing nodal enlargement when there is evidence of postobstructive pneumonia or atelectasis.⁷ This did not, however, appear to be a problem in our series. Several authors have stated that assessment of the hilum and carinal areas is difficult,^{1 3 10-12} but in only 27 out of 182 patients was there disagreement in the diagnosis of nodal disease on computed tomography and at operation. Sones *et al* described 168 cases and concluded that computed tomography should be performed after plain radiography instead of conventional tomography in investigation of an intrathoracic lesion.¹

A correct diagnosis was made from computed tomographic findings in 141 out of 182 patients who had thoracotomy. Of the 41 patients in whom disagreement occurred, 21 had microscopic invasion of nodes that were not visible by computed tomography and 10 had invasion of the local chest wall or mediastinum that again could not be predicted by computed tomography. It may be impossible to distinguish between an invaded structure and an abutting structure of comparable radiographic density.

Thus only 10 patients had a true inaccurate computed tomographic assessment. In six of these 10 patients the computed tomographic report suggested more advanced disease than was found at operation (a 3.2% rate of false positives). Ideally, the number of false positives should be reduced to zero; five of the six false positive cases occurred early in our series, and only one false positive occurred in the last 100 patients analysed. The number of false negatives (35 patients, 19%) was much higher, as expected, as we had aimed at underestimating disease that was present so that no patient was denied thoracotomy for a resectable tumour.

The disease in 113 patients was considered to be inoperable on computed tomography. Mediastinoscopy was performed in nine patients, and all had evidence of mediastinal spread as predicted by computed tomographic findings. In 47 patients disease was assessed as inoperable on computed tomography of the thorax alone, and this was accepted by the thoracic surgeons after careful and full discussion. Thirty two other patients whose disease was assessed as inoperable on computed tomography also had evidence of metastatic spread. The remaining group of 30 patients did not have an operation, although their disease was assessed as operable on computed tomography.

Computed tomography of the thorax is now performed early, before any other investigation for secondary spread, and is used routinely to help to assess suitability for thoracotomy. We recommend that a report of inoperability based on computed tomographic

findings is reliable and accurate but accept that metastatic spread to nodes may be impossible to visualise and computed tomography may underestimate the extent of the disease present.

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Retinal changes in malignant hypertension

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Abstract

To assess the diagnostic and prognostic importance of papilloedema in malignant hypertension a two part study was undertaken. Four observers reviewed 56 photographs of fundi from patients with grade 3 or 4 hypertensive retinopathy. Complete agreement on the presence or absence of haemorrhages was recorded in 52 cases and on exudates in 53 cases. Opinion on papilloedema, however, was divided, all four observers agreeing in only 34 cases. In the second part of the study survival in 139 consecutive hypertensive patients with bilateral retinal haemorrhages and exudates was examined by life tables. Ten year survival was 46% in patients with bilateral haemorrhages and exudates alone (n=43) and 48% when papilloedema was also present (n=96). Multivariate analysis confirmed that papilloedema was not related to survival.

These results suggest that papilloedema is an unreliable

physical sign and does not adversely influence prognosis in hypertensive patients who already have bilateral retinal haemorrhages and exudates when effective treatment is available. Papilloedema should no longer be regarded as a necessary feature of malignant hypertension.

Introduction

Despite recommendations by the World Health Organisation that the criteria for malignant hypertension should include hypertensive patients with bilateral retinal haemorrhages and exudates alone¹ some clinicians insist that papilloedema should also be present.² To try to resolve this issue we assessed the importance of papilloedema in severe hypertension in a two part study.

Patients and methods

In the first part of the study four observers (a senior physician, two junior physicians and a senior ophthalmologist) assessed 56 transparencies of fundi (28 pairs) showing grade 3 or 4 hypertensive retinopathy. The slides were selected from files of the Medical Research Council unit provided that a minimum of one haemorrhage or one exudate was present in at least one of the pair of fundi and each could be sharply focused. Thirty six slides were from patients described in the second part of the study. Photographs of normal fundi were not included as our test was of the extent that clinicians agreed on the presence of retinal changes when the diagnosis of malignant hypertension was suspected. The transparencies were projected singly, and each observer was asked to record whether haemorrhages, exudates, and papilloedema were present or absent. The degree of consensus among observers was then determined.

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