Diagnosis of Early Bronchogenic Carcinoma

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Cytologic examination of sputum has long been used in the diagnosis of bronchogenic carcinoma. Tumors of the segmental and larger bronchi may shed cells detectable in the sputum for many months prior to becoming symptomatic or radiographically apparent.1 During this period of their development, standard endoscopic techniques have frequently proven inadequate to localize the lesion with sufficient accuracy to permit definitive therapy.2 As increasing emphasis is being placed on early diagnosis and as sputum cytology becomes more widely used, we can expect an increasing need to evaluate patients whose diagnosis of cancer is based solely on sputum cytology.

It is the purpose of this paper to summarize the endoscopic techniques and observations we have found useful in discovering the source of malignant cells found in the sputum of patients whose tumor site cannot otherwise be located. This work was performed at The Johns Hopkins Hospital as one aspect of a screening study designed to identify, localize and treat lung cancer discovered in a working population of cigarette smoking men over age 45 years.

PROCEDURE

A detailed evaluation of the upper respiratory tract is made with modern telescopes and sometimes flexible instruments, cytologic smears and biopsies. Malignancies in this area may shed into the sputum cells which cannot be differentiated from those arising in the lung.

The bronchoscopic study which follows is usually conducted under general anesthesia. Radiologically occult bronchogenic carcinomas involving bronchi accessible to fiberoptic examination cover a spectrum from large lesions of the major airways to an invisible patch of carcinoma in situ in a small segmental bronchus. These very small tumors often require a time-consuming, segment-by-segment study for discovery.3,4 General anesthesia provided through a 9 mm ID endotracheal tube provides not only optimum conditions for retrieval of “uncontaminated” brush specimens, but also adequate ventilation for as detailed a procedure as may be required.

A thorough search of all accessible bronchi is completed before specimens are obtained. This usually suggests where the lesion is located and sometimes reveals multifocal disease. Any suspicious areas are both brushed and biopsied. Finally, a biopsy is taken from the lobar spur just proximal to the suspected lesion to aid in determining whether potential surgical margins are tumor free.

Invisible Tumors

When the tumor proves to be completely invisible, its location can usually be determined cytologically by a series of carefully obtained brushings. In order to reduce cytologic “cross-contamination,” these are obtained after excess mucus has been aspirated during the visual study. A few milliliters of balanced salt solution (BSS) are aspirated through the instrument channel to free it of any residual cells and a clean brush is inserted within the lumen. The bronchoscope is then passed through the endotracheal tube and directed to a lobar orifice where the brush is extruded. By a to-and-fro motion, all accessible bronchi of the lobe are brushed before withdrawing the brush back to the tip of the bronchoscope. Both are then removed together before again extruding the brush sufficiently to remove the specimen. The brush is withdrawn from the instrument, a few milliliters of BSS are aspirated through the channel and a new brush is replaced in the lumen. This procedure is repeated for each lobe and the specimens labelled as to their source. Separate brushes may be used for each segment, but this is seldom necessary to provide adequate localization.

Finally, microbiopsy specimens are obtained from the segmental and lobar spurs. These provide important localizing information and rarely result in any significant bleeding.

In these patients where no tumor can be seen, we require either a positive biopsy or two consecutive

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Supported in part by National Cancer Institute, Contract No. 1-CN-45037.
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brush specimens with diagnostic cells obtained from one lobe on two different occasions before surgical intervention is recommended. Even though the brushing technique described has proven extremely reliable, the possibility for cytologic “cross-contamination” makes these precautions necessary. In most cases, a positive biopsy can ultimately be obtained after a brush specimen indicates which lobe is involved.

When the patient awakens from anesthesia, the tracheobronchial tree is lavaged for a cytologic specimen before extubation. This specimen may prove useful in demonstrating a primary lung lesion (as opposed to an upper respiratory tract lesion) in the event that all brushing specimens prove nondiagnostic. Such a possibility occurs when a small tumor of a large bronchus is overlooked or when the involved segmental bronchus either is not, or cannot be brushed.

**RESULTS**

We have studied 33 patients whose sputum cytology revealed squamous carcinoma but whose chest radiograph failed to identify the lesion. In four patients, the source of cells was found in the upper respiratory tract (one nasopharynx, three larynx). In 21 patients, the lesion appeared to originate from a segmental bronchus, while in five, the major involvement was the lobar or main bronchus. In the remaining three patients the site has not yet been localized. Several patients required a second procedure to assure accuracy of findings or to further evaluate extent of disease by additional biopsies. This includes four patients with multifocal disease.

These observations demonstrate the importance of the bronchial segments in discovering early squamous carcinoma. It is here that we find most of the smaller lesions. Those consisting of carcinoma in situ alone may appear as nothing more than an area of slight roughening (Fig 1). Unfortunately, this same effect may also be created by trauma from the fiberscope itself. Therefore, care must be taken in use of the instrument especially in the segmental bronchi.

Any area of localized friability or loss of the characteristic mucosal sheen should also alert the bronchoscopist. Frequently, the first evidence of an early lesion will be found in a thickening and irregularity of a segmental spur. In other cases, one may note the interruption, distortion or obliteration of the normal longitudinal folds.

Later in the course of disease the lesion seems to become nodular and takes on the more characteristic appearance of a tumor mass (Fig 2). Not infrequently these apparently small tumors are associated with a relatively extensive area of carcinoma in situ whose margins may be difficult for the bronchoscopist to recognize. For this reason we obtain marginal biopsies to aid in planning an adequate surgical resection.

This study demonstrates not only the efficacy of these techniques, but also the difficulty still encountered in some endoscopically-invisible tumors. As more effective and economical screening techniques become generally available, the bronchoscopist must prepare himself to apply more sophisticated localizing techniques in patients with early bronchogenic carcinoma.

**REFERENCES**