Over 20,000 Canadians will be diagnosed with lung cancer each year. Unfortunately, less than 15% will be cured of their disease. Curative therapy is available for only one-quarter of such patients, because most patients present with more advanced disease, which is not amenable to curative surgery or radiotherapy.

A small proportion of patients have an early stage of disease (T1N0) if the tumor is less than...
3 cm in diameter. Surgical therapy will cure up to 75% of patients. In most instances, these early tumors are diagnosed in asymptomatic patients when an incidental chest X-ray is performed, usually for other reasons. On very rare occasions, sputum cytology will detect an early primary tumor of the proximal endobronchial tree. Studies in the past have failed to demonstrate an advantage to using these techniques (i.e., chest X-ray and sputum cytology) as a screening tool. Computed tomography (CT) scanning of the chest, however, has demonstrated the ability to identify very tiny lesions, some of which are a tiny carcinoma. Advances in immunohistochemistry also have allowed earlier detection of abnormal malignant cells in the sputum cytology. Centers are now investigating these newer techniques to identify whether or not they will have a role in screening high-risk individuals for lung cancer. It is hoped that identifying these very early tumors will enable physicians to cure patients with regularity. It is also hoped that the technique will prove to be a cost-effective screening method.

Until very recently, lung cancer has rarely been diagnosed in the very earliest stages. With the advent of spiral CT screening and immunofluorescent staining of sputum, however, earlier tumors are being found both in the parenchyma of the lung (usually peripheral) and in the proximal tracheobronchial tree. In medically unfit patients, primary radiotherapy has been used in all stages of lung cancer in an attempt to cure the disease. The success of using local control depends on the size of the primary tumor, the dose of radiotherapy and, possibly, the patient’s histology.

Peripheral Nodules
**Surgery.** For the usual T1N0 tumor (*i.e.*, 3 cm or less), both randomized trials and retrospective analyses have demonstrated that wedge resection is not appropriate, because of local control problems.\textsuperscript{1} Segmental resection is also somewhat of a compromise for the same reason, and the treatment of choice is lobectomy. Until recently, early-diagnosed subcentimeter tumors have been treated similarly. However, in centers where screening has been prospectively assessed, especially in Japan, lesser resections are being considered, including segmentectomy and wedge excision. Only early results are available.\textsuperscript{2,3} Local control, using segmental resection, appears to be effective. It is difficult to assess, at this time, whether this is true for wedge resection. Long-term survival, so far, appears excellent, although effective locoregional control is still of concern.

As yet, spiral CT scanning cannot be recommended for screening high-risk individuals. Many tiny nodules are identified during spiral CT scanning, 10% of which will be malignant. The cost-effectiveness of such screening is still in question, because of the need to investigate all of these other nodules. Furthermore, there have been no definitive studies demonstrating the salutary impact of such an early diagnosis in the management of lung cancer patients. There is a certain subset of early identified tumors (*e.g.*, bronchoalveolar carcinoma), which may not represent a true malignant process, but only pre-neoplasia. Many of these tiny lesions, identified as ground glass opacities, are indolent, and may not require surgical intervention. This group of tumors or pre-malignant lesions appear to benefit most from limited resections, such as wedge resection or segmentectomy. Surgeons may have problems identifying these subcentimeter lesions at the time of surgery. Preoperative identifica-

**Tiny endobronchial tumors, usually discovered by sputum cytology, have been treated by surgical excision in the past, but can be dealt with in a variety of non-surgical ways.**
tion by percutaneous needle localization may be required.

Primary radiotherapy. In medically unfit patients, primary radiotherapy has been used in all stages of lung cancer in an attempt to cure the disease. The success of using local control depends on the size of the primary tumor, the dose of radiotherapy and, possibly, the patient’s histology. More recently, stereotactic radiosurgery and 3D conformal radiotherapy has allowed higher doses to be administered (up to 100 Gray). Although no information is available yet for the use of primary radiotherapy in sub-centimeter lesions, in larger, stage I tumors at higher doses (e.g., 60 to 90 Gray), local control has been achieved in about 50% to 60% of cases — not as good as the local control obtained by surgery. With regard to subcentimeter lesions, however, local control is probably easier to achieve and may rival the results of surgery.

Radiofrequency ablation. Thermal destruction of tumors, by inserting needles and applying a radiofrequency current, is being used with increasing frequency in the management of hepatic metastases. A thermal destruction of 2 cm to 5 cm can occur. Using the newer imaging techniques, needles can be inserted into these tiny pulmonary lesions and a cytologic diagnosis, therefore, can be made without surgical excision. In such cases, it has been proposed that these tiny nodules can be totally ablated (and cured) employing radiofrequency ablation.4

Very little is known about the value of radiofrequency ablation for very tiny lung lesions. This can be performed percutaneously under CT imaging, and prospective studies are beginning, especially in severely compromised individuals who are not considered capable of tolerating a surgical approach. This approach employs thermal coagulation necrosis to destroy the tumor, and has been applied successfully in treating inoperable liver and kidney tumors.

Combined approaches. In order to preserve lung function, combined approaches may be considered (e.g., wedge excision plus post-operative or intraoperative radiotherapy, intraoperative radiofrequency ablation followed by wedge resection, or percutaneous radiofrequency ablation followed by wedge resection). All of these approaches almost certainly will be investigated in the future. In the Noguchi type I lesions (pure ground glass opacities), watchful waiting may be most appropriate.

Endobronchial Tumors

Tiny endobronchial tumors, usually discovered by sputum cytology, have been treated by surgical excision in the past, but can be dealt with in a variety of non-surgical ways, including photodynamic therapy, endobronchial brachytherapy, fulguration and cryotherapy. Localized external beam radiotherapy, using 3D conformal approaches or stereotactic radiosurgery, also can be considered.

Until recently, surgical resection has been the most accepted approach, even for minimally invasive endobronchial tumors — most of these are squamous cell carcinomas. The results of surgical resection yields almost 100% local control. It is not yet known whether primary external beam radiotherapy or brachytherapy can achieve results as good as these.

The greatest non-surgical experience has been the use of photodynamic therapy. This approach is exceptionally good for treating in-situ carcinoma or minimally invasive carcinoma, and achieves local control in almost 90% of patients. The technique employs intravenous administration of a hematoporphyrin derivative, followed by excitation by a laser tuned to 630 nm to 690 nm (e.g., argon beam). Patients must be followed closely with repeated bronchoscopy, and, if the tumor recurs, other forms of treatment, such as endobronchial brachytherapy or surgical resection, should be
considered.

Conclusion
With the advent of spiral CT scanning and immunohistochemical staining of cells, earlier tumors of the lung and tracheobronchial tree are being identified. The traditional methods of treating such tumors has included large resections of the lung (lobectomy or greater) and surgical excision of segments of the tracheobronchial tree when necessary. Thanks to modern technology, subcentimeter tumors now are being identified. As with other malignant lesions, it is possible that less destructive treatments will prove to be successful in managing these very early diagnosed lung cancers.

References

Suggested Readings