Science Press Publishing Ltd. TUDOMÁNY KIADÓ

MINIREVIEW

Lung Cancer: A Bronchoscopic Approach

János STRAUSZ

6th Department of Pulmonology, Korányi National Institute of Pulmonology, Budapest, Hungary

The unfavourable epidemiological data of lung cancer has not been changed during the past ten years. The only possibility to cure this malignancy is surgical resection. The five year survival rate after surgery is highly dependent on early discovery of the tumor. Today, bronchoscopy plays a central role in the diagnosis, staging and therapy of lung cancer. The main indications of diagnostic bronchoscopy are the identification of the tumor and the determination of its extent. The aim of therapeutic bronchoscopy – laser photocoagulation, high dose rate afterloading irradiation and stent implantation – is to provide an acceptable quality of life and to manage symptoms such as bleeding, cough and dyspnea. (Pathology Oncology Research Vol 2, No1–2, 11–15, 1996)

Key words: lung cancer, bronchoscopy, diagnosis, therapy

Bronchogenic carcinoma is still one of the major health problems in developed western countries. In 1990, 175,400 new cases were discovered in the European Union.[5,24] In Hungary the number of the new cases increases continuously; the incidence was 5,700 patients in 1994 (*Fig. 1*).[38]

The most effective method of managing this tumor is surgical resection. Unfortunately, only 20-30% of patients are suitable for surgery at the time of diagnosis. The most frequent causes of inoperability are either the advanced stage of the tumor and/or the histological type, or the poor general condition of the patient. Despite surgical intervention, the overall survival rate is 8-15% at five years. The survival rate could approach 70% with intervention at the early localized stage. However, only 24% of new cases belong to this "favourable" oncological stage. These figures have not changed over the past decade.[8]

The diagnosis of lung cancer must be based on cytopathological data. Without exact pathomorphological diagnosis neither chemotherapy, nor irradiation should be performed (the only exception is the vena cava superior syndrome). The possibility of surgical interventions (resecability, radicality) can also be influenced by histological type of the tumor.

Received Dec 12, 1995; accepted Jan 18, 1996

Correspondence: János STRAUSZ, MD, PhD, DSc; Korányi National Institute of Pulmonology; Pihenő u. 1, H-1529 Budapest, Hungary. Tel/Fax (36) (1) 156-6412, E mail: str12196@helka.iif.hu

Recently, we celebrated the 100th anniversary of the discovery of the bronchoscope. Endoscopic examination of the bronchial system has continuously improved during the past hundred years. An important cornerstone was the introduction of the flexible bronchoscope in 1964, which contributed to the widespread use of airway endoscopy, mainly among pulmonologists. Currently, more than 90% of bronchoscopies are performed with flexible endoscopes,[29,36] however, in certain cases (mainly laser photocoagulation and prevention of certain life threatening complications) the use of a rigid bronchoscope is indis-

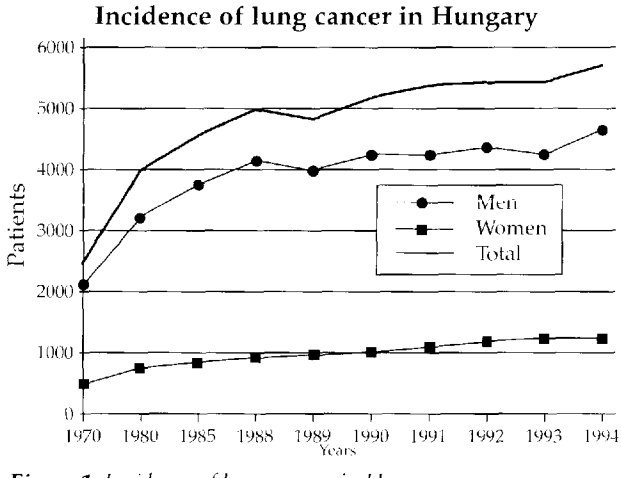

Figure 1. *Incidence of lung cancer in Hungary.*

pensable in a bronchoscopic unit. Today, bronchoscopic examinations are fundamental to the diagnosis, staging and therapy of lung cancer.[1]

Bronchoscopic diagnosis of lung cancer

Bronchoscopically visible tumors

If the tumor can be well visualized in the bronchial system, (*Figs.2,3,4*) the overlying mucous, blood or necrotic material should be removed from the surface before performing the biopsy. A maximum diagnostic yield can be achieved with three or four forceps biopsies, however a combination of different sorts of biopsies can increase also the accuracy of bronchoscopic procedures. The combined method, application of brush-, forceps- and transbronchial fine needle techniques and bronchoalveolar lavage, increase the diagnostic yield over 90%.[34,47]

Peripheral tumor – invisible with bronchoscope

Solitary pulmonary nodules or peripheral coin lesions are defined as circumscribed lesions completely surrounded by normal lung tissue. Diagnostic yields are affected by the size and location of lesions, probability of malignancy, as well as the sampling techniques. The brush biopsy, bronchoalveolar lavage and bronchoscopic lung biopsy are the most effective techniques to achieve a diagnosis. The combination of these techniques can also improve the efficacy of the intervention.[14,19,26,28,31,32,45] Reviewing the data concerning the diagnostic yield of peripheral nodules, bronchoscopy has a significant role only in those cases where the diameter of the lesion is over 2 cm.[21,27,42] It is recommended that five forceps biopsies be taken in patients with peripheral lesions to reach optimal diagnostic accuracy.[15,19]

Bronchoscopy for peripheral lung lesions is generally performed under biplane (or "C" arm) fluoroscopic guidance (*Fig.5*). The CT scan also contributes to increased diagnostic efficacy of bronchoscopy by showing the relation of the bronchus to the lesion.[23] Diagnostic accuracy is significantly higher in those cases where the bronchus leads directly into the nodule (positive bronchus sign).

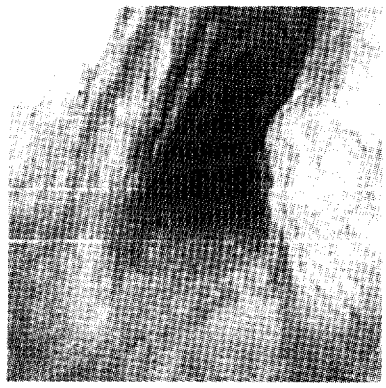

Figure 3. *Small cell carcinoma in the trachea. The tracheal wall is compressed from right, the mucosa is roughly infiltrated.*

Staging lung cancer with bronchoscope

The aim of the staging procedure is to determine operability of the lung tumor.[22] This procedure comprises establishment of the resection line for the surgeon (definitely non-tumorous bronchial structure proximally from the primary lesion and its distance from the proximal carina). There are certain methods concerning biopsies from macroscopically normal bronchial mucosa in the "planned" resection line, but these techniques are not generally accepted because of their inconsistent results.[18,44,46,47]

The other reason for preoperative staging bronchoscopy is to map the hilus and mediastinum to disclose metastatic lymph nodes which can modify and/or preclude the operation. The bronchoscopist can detect airway compression by lymph nodes (or by the tumor itself) without the need to perform a biopsy under direct visual control. The trans-

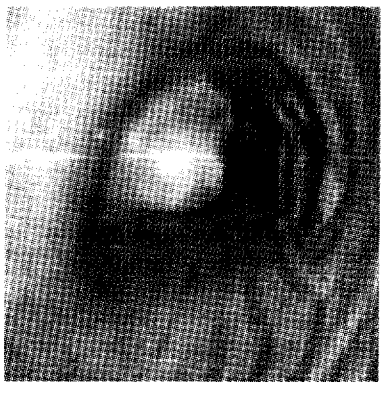

Figure 2. *Adenocarcinoma derived from the left upper lobe breaking through the trachea.*

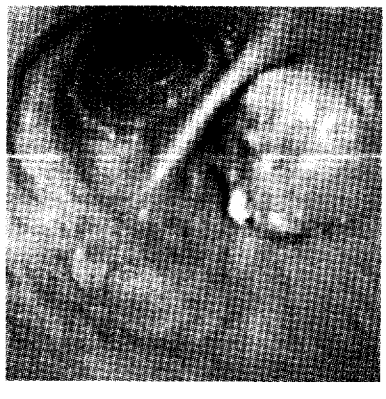

Figure 4. *Squamous cell carcinoma in the right bronchus 10.*

Table 1. **Therapeutic bronchological interventions in lung cancer**

	Laser	*Afterloading*	*Stent*
Indication	intrabronchial processes with length < 4 cm	extra- and intrabronchial tumors	extra- and intrabronchial tumors
Localization		proximally from segmental bronchial tumor	
Bronchoscope	rigid and/or flexible	flexible	rigid and/or flexible
Anaesthesia	local or general	local	local or general
Effect	immediate	late	immediate
Complication	bleeding, perforation, fire	bleeding, perforation, irradiation, bronchitis	displacement, obstruction by secretion

bronchial needle biopsy developed for rigid bronchoscopes is applied for flexible bronchoscope as well, with considerable diagnostic accuracy.[43,44,47,48]

Endobronchial sonography is a newly developed technique for mapping extrabronchial tumors and enlarged lymph nodes located near the airways. This structure is echo-poor and can be distinguished from the echo-rich bronchial wall. The pulmonary vessels can also be separated from tumor tissue designated for biopsy.[17] Another new diagnostic technique is differential laser application with and without photosensitising compound to distinguish normal bronchial epithelium from lesions like metaplasia or dysplasia. The main advantage of this method is the capability to mark that pathological region which would otherwise be invisible with conventional bronchoscope.[11,18,46]

Therapeutic bronchoscopy in lung cancer

Endoluminal obstruction or compression of the central airways commonly cause dyspnea, cough, hemoptysis, obstructive pneumonia and respiratory failure. The most frequent cause is lung cancer discovered generally in an inoperable, advanced stage. Therapeutic possibilities depend on the nature of the disease, extent of the malignancy and prognosis. In these cases, the use of the airways can be maintained by mechanical dilatation, laser photocoagulation, stent implantation, local or external beam radiation, intubation, tracheotomy with cannula, electro- or cryotherapy, etc. These techniques can be combined one with another. It should be understood that all these procedures can be applied only with the expectation of palliation and, importantly, improving the quality of life, not prolonging it.

Endobronchial laser therapy

In endobronchial therapy, most commonly the Nd-YAG laser is applied through a rigid bronchoscope under general anaesthesia (*Fig.6*). The mechanical removal of the coagulated-carbonized tumor tissue follows. The indications and complications of the laser photocoagulation are shown on *Table 1*.[2,6,7,37]

Endobronchial irradiation

Endobronchial irradiation (brachytherapy, afterloading therapy) can be applied in case of intrabronchial obstruction, as well as in extrinsic compression. The radioactive

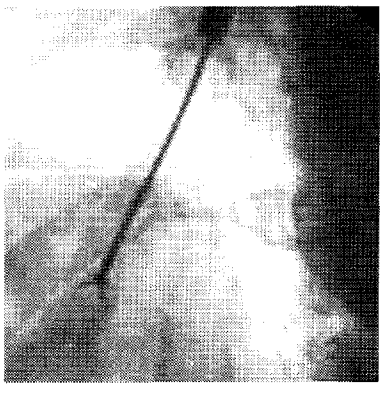

Figure 5. *Fluoroscopy guided biopsy from a bronchoscopically undetectable tumor.*

Figure 6. *Nd-YAG photocoagulation of a squamous cell carcinoma in the right main bronchus.*

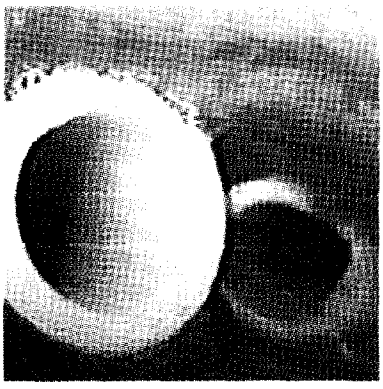

Figure 7. Simultaneous stented left and right main bronchi due to the obstruction of adenocarcinoma.

source (generally ^{192}Ir) afterloaded into a catheter is placed intrabronchially adjacent to the tumor by bronchoscope. The procedure is generally combined with external beam irradiation. Reduction of tumor size and improvement of symptoms can be observed in 60-90% of cases.[4,12,13,16,20,25,33,40,41]

Endobronchial prosthesis (stent) implantation

After opening the airway by laser, or any other method, reobstruction can occur because of rapidly proliferating tumor tissue. Several types of tracheobronchial stents have been developed to splint open the airway segment (*Fig.7*). The Montgomery silicone T stents require tracheostomy, although straight silicone stents may be placed endoscopically and these and different metal-reinforced silicone stents can be tailored to fit most anatomical situations. Nowadays, a variety of stents can be inserted without a bronchoscope (Strecker, Palmaz, Wall) under fluoroscopic control. These endoprotheses are much more preferable for the patient because of the possibility of avoiding a tracheostomy.[3,9,10,30,35,39]

Finally, it should be emphasized again, that most patients with inoperable lung cancer can be offered only palliation. The above discussed methods (main characteristics are described on *Table 1*) can contribute to the improvement of the major symptoms (breathlessness, hemoptysis, refractory cough) without prolonging life span.

References

1. *Arroliga A and Mathay R:* The role of bronchoscopy in lung cancer. Clin Chest Med 14:87-98,1993.
2. *Beamis JF, Vergos K, Rebeiz EE and Shapshay SM:* Endoscopic laser therapy for obstructing tracheobronchial lesions. Ann Otol Rhinol Laryngol 100:413-419, 1991.
3. *Becker H:* Stenting of the central airways. Bronchology 2:98-106, 1995.
4. *Bedwinek J, Petty A, Bruton C, Sofield J and Lee L:* The use of high dose rate endobronchial brachytherapy to palliate symptomatic endobronchial recurrence of previously irradiated bronchogenic carcinoma. Int J Radiat Oncol Biol Phys 22:23-30, 1992.
5. *Boyle P:* The revised european code against cancer. Oncology in Practice 3:4-8, 1995.
6. *Brutinel WM, Cortese DA, McDougall JC, Gillio RG and Bergstralh EJ:* A two-year experience with the neodymium-YAG laser in endobronchial obstruction. Chest 91:159-165, 1987.
7. *Cavaliere S, Foccoli P and Farina PL:* Nd:YAG laser bronchoscopy. A five-year experience with 1,396 applications in 1,000 patients. Chest 94:15-21, 1988.
8. *Connolly CK, Jones WG, Thorogood J, Head C and Muers MF:* Investigation, treatment and prognosis of bronchial carcinoma in the Yorkshire Region of England 1976-1983. Br J Cancer 61:579-583, 1990.
9. *de Souza AC, Keal R, Hudson NM, Leverment JN and Spyt TJ:* Use of expandable wire stents for malignant airway obstruction. Ann Thorac Surg 57:1573-7, 1994.
10. *Dumon J:* A dedicated tracheobronchial stent. Chest 97:328-332, 1990.
11. *Edell ES and Cortese DA:* Bronchoscopic localization and treatment of occult lung cancer. Chest 96:919-921, 1989.
12. *Gauwitz M, Ellerbroek N, Komaki R, Putnam JB, Ryan MB, DeCaro L, Davis, M and Cundiff J:* High dose endobronchial irradiation in recurrent bronchogenic carcinoma. Int J Radiat Oncol Biol Phys 23:397-400, 1992.
13. *Gollins SW, Burt PA, Barber PV and Stout R:* High dose rate intraluminal radiotherapy for carcinoma of the bronchus: outcome of treatment of 406 patients. Radiother Oncol 33:31-40, 1994.
14. *Harrow E, Halber M, Hardy S and Halteman W:* Bronchoscopic and roentgenographic correlates of a positive transbronchial needle aspiration in the staging of lung cancer. Chest 100:1592-1596, 1991.
15. *Harrow EM, Oldenburg FA, Lingenfelter MS and Smith AM:* Transbronchial needle aspiration in clinical practice. A five-year experience. Chest 96:1268-1272, 1989.
16. *Hilaris BS:* Lung brachytherapy. An overview and current indications. Chest Surg Clin N Am 4:45-53, 1994.
17. *Hürter T and Hanrath P:* Endobronchial sonography: feasibility and preliminary results. Thorax 47:565-567, 1992.
18. *Lam S, MacAulay C, Hung J, leRiche J, Profio AE and Palcic B:* Detection of dysplasia and carcinoma in situ with a lung imaging fluorescence endoscope device. J Thorac Cardiovasc Surg 105:1035-1040, 1993.
19. *Mak VH, Johnston ID, Hetzel MR and Grubb C:* Value of washings and brushings at fibreoptic bronchoscopy in the diagnosis of lung cancer. Thorax 45:373-376, 1990.
20. *Marsh BR:* Bronchoscopic brachytherapy. Laryngoscope 99:1-13, 1989.
21. *Mehta A, Kathawalla S, Chan C and Arroliga A:* Role of bronchoscopy in the evaluation of solitary pulmonary nodule. Bronchology 2:315-322, 1995.
22. *Miller JD, Gorenstein LA and Patterson GA:* Staging: the key to rational management of lung cancer. Ann Thorac Surg 53:170-178, 1992.
23. *Naidich DP, Funt S, Ettenger NA and Arranda C:* Hemoptysis: CT-bronchoscopic correlations in 58 cases. Radiology 177:357-362, 1990.
24. *Negri E and La Vecchia C:* Epidemiology of lung cancer: recent trends in mortalitiy with emphasis on Europe. Lung Cancer 12 (Suppl:1) S3-S11, 1995.

25. *Paradelo JC, Waxman MJ, Throne BJ, Beller TA and Kopecky WJ:* Endobronchial irradiation with 192Ir in the treatment of malignant endobronchial obstruction. Chest 102:1072-1074, 1992.
26. *Pirozynski M:* Bronchoalveolar lavage in the diagnosis of peripheral, primary lung cancer. Chest 102:372-374, 1992.
27. *Poe RH, Levy PC, Israel RH, Ortiz CR and Kallay MC:* Use of fiberoptic bronchoscopy in the diagnosis of bronchogenic carcinoma. A study in patients with idiopathic pleural effusions. Chest 105:1663-1667, 1994.
28. *Popp W, Rauscher H, Ritschka L, Redtenbacher S, Zwick H and Dutz W:* Diagnostic sensitivity of different techniques in the diagnosis of lung tumors with the flexible fiberoptic bronchoscope. Comparison of brush biopsy, imprint cytology of forceps biopsy, and histology of forceps biopsy. Cancer 67:72-75, 1991.
29. *Prakash U, Offord K and Stubbs S:* Bronchoscopy in North America: the ACCP survey. Chest 100:1668-1665, 1991.
30. *Putnam J:* Palliation of central airway stenosis with the Dumon silicone stent. Chest 104:1651-1652, 1993.
31. *Rennard SI and Spurzem JR:* Bronchoalveolar lavage in the diagnosis of lung cancer. Chest 102:331-332, 1992.
32. *Salathé M, Soler M, Bolliger C, Dalquen P and Perruchoud A:* Transbronchial needle aspiration in routine fiberoptic bronchoscopy. Respiration 59:5-8, 1992.
33. *Schray MF, McDougall JC, Martinez A, Cortese DA and Brutinel WM:* Management of malignant airway compromise with laser and low dose rate brachytherapy. The Mayo Clinic experience. Chest 93:264-269, 1988.
34. *Shure D, and Astarita R:* Bronchogenic carcinoma presenting as an endobronchial mass. Optimal number of biopsy specimens for diagnosis. Chest 83:865-867, 1983.
35. *Simonds A, Irving J, Clarke S and Dick R:* Use of expandable metal stents in the treatment of bronchial obstruction. Thorax 44:680-681, 1989.
36. *Simpson F, Arnold A, Pulvis A, Belfield P, Muers M and Cooke N:* Postal survey of bronchoscopic practice by physicians in the United Kingdom. Thorax 41:311-317, 1986.
37. *Stanopoulos IT, Beamis JF, Jr., Martinez FJ, Vergos K and Shapshay SM:* Laser bronchoscopy in respiratory failure from malignant airway obstruction. Crit Care Med 21:386-391, 1993.
38. National statistical data on pulmonology. Korányi National Institute of Pulmonology, Budapest/Hungary, 1994.
39. *Strausz J, Kis S, Pápai Z, Szima B, Juhász J and Bölcskei P:* Tracheobronchial silicone stent implantation with flexible bronchoscope. Bronchoscopy 1:123-125, 1994.
40. *Suh JH, Dass KK, Pagliaccio L, Taylor ME, Saxton JP, Tan M and Mehta AC:* Endobronchial radiation therapy with or without neodymium yttrium aluminum garnet laser resection for managing malignant airway obstruction. Cancer 73:2583-2588, 1994.
41. *Sutedja G, Baris G, Schaake Koning C and van Zandwijk N:* High dose rate brachytherapy in patients with local recurrences after radiotherapy of non-small cell lung cancer. Int J Radiat Oncol Biol Phys 24:551-553, 1992.
42. *Torrington K and Kern J:* The utility of fiberoptic bronchoscopy in the evaulation of the solitary pulmonary nodules. Chest 104:1021-1024, 1993.
43. *Utz J, Patel A and Edell E:* The role of transcarinal needle aspiration in the staging of bronchogenic carcinoma. Chest 104:1012-1016, 1993.
44. *Vansteenkiste J, Lacquet L, Demeds M, Deneffe G and Verbeken E:* Transcarinal needle aspiration biopsy in the staging of lung cancer. Eur Respir J 7:265-268, 1994.
45. *Viggiano R, Swensen S and Rosenow E:* Evaluation and management of solitary and multiple pulmonary nodules. Clin Chest Med 13:83-95, 1992.
46. *Walsh GL:* Lasers for the early detection of lung cancer. Semin Thorac Cardiovasc Surg 5:194-200, 1993.
47. *Wang K:* Staging of bronchogenic carcinoma by bronchoscopy. Chest 106:588-593, 1994.
48. *York E, Jones R, King E, Chaput M and Nguyen G:* The value of submucous needle aspiration in the prediction of surgical resection line of bronchogenic carcinoma. Chest 100:1028-1029, 1991.