



# ARCHIVOS DE BRONCONEUMOLOGIA

www.archbronconeumol.org



Editorial

## Broncho-Angioplasty Surgery in the Treatment of Lung Cancer

### Cirugía Broncoangioplástica en el Tratamiento del Cáncer de Pulmón

Abel Gómez-Caro\*

Servicio de Cirugía Torácica, Instituto del Tórax, Hospital Clínico y Provincial de Barcelona, Universidad de Barcelona, Barcelona, Spain

Lung cancer is the neoplasia with highest prevalence in the world, with 1,400,000 new cases yearly. In Spain new 20,000 patients are diagnosed every year, with a gross incidence rate of 78.3/10<sup>5</sup> in men and 11.8/10<sup>5</sup> in women,<sup>1</sup> and a total survival estimate of 13-15% to 5 years. Approximately, only 25% of patients diagnosed with lung cancer receive surgical treatment, which is the group with higher survival rate: 40% of the patients survive 5 years. Surgical intervention is, therefore the best available treatment in selected cases from an oncological and functional viewpoint. It is precisely at this point, with candidates at their functioning limits, that lung sparing surgery using broncho-angioplastic techniques provides a surgical treatment oncologically adequate, with acceptable postoperative morbidity and mortality and better quality of life after surgery. Furthermore, these techniques are extremely useful in aged patients with central tumours, in whom pneumonectomy could result in a mortality rate higher than 20%, and specially in patients under induction chemoradiotherapy.

At Brompton Hospital, Thomas<sup>2</sup> published the first sleeve bronchoplasty operation in a carcinoid tumour, and Paulson and Shaw<sup>3</sup> later showed that long survival rates were reached using these procedures. The initial and most frequent localisation is the intermediate bronchus over the right primary bronchus where around 60% of this type of operations are performed, trying to avoid right pneumonectomy.<sup>3</sup>

These broncho-angioplastic techniques were initially described to limit the number of pneumonectomies in patients with compromised pulmonary function. However, it is currently considered the treatment of choice, even in patients with normal pulmonary function. This choice is justified by 2 reasons: reduction of postoperative morbidity and mortality, almost always significantly reduced as complications involved in pneumonectomy are avoided, and a better quality of life for the long term, recorded in studies through specific questionnaires, associated with an extension of resection of pulmonary parenchyma. Sleeve lobectomy techniques to which this article makes reference are especially useful in locally advanced tumours that have been previously treated with chemoradiotherapy for nodal involvement. It is of utmost importance

to avoid pneumonectomy in these patients, and it is certainly advisable to preserve pulmonary remnants to reduce complications related to dehiscence of bronchial suture. The rate of bronchial complications advises against pneumonectomies, mostly over the right lung after neoadjuvant treatment, and any technique that reduces this incidence of complications without altering curing effects is advisable.

However, broncho-angioplastic techniques are technically more demanding and are not without complications of their own. Resection with bronchial reconstruction have a 6-12% rate of bronchial fistulae, and when the reconstruction is combined with pulmonary artery, arterial thrombosis and injury from ischaemia-reperfusion over the re-implanted lobe occur in 2%-4% of the cases. Vascular complications associated with reconstruction, although a few, may diminish if systemic and local heparinization is performed during flow interruption. The rate of bronchial or bronco-vascular complications may increase with prior radiotherapy, although the medical literature does not describe a significant increase in complications. However, deficient healing and a higher rate of bronchial healing complications are to be expected in this type of patients. Higher frequency of sputum retention due to disruption of ciliary clearance secondary to bronchial circular suture also characterises this type of major surgery, requiring energetic respiratory physiotherapy.

Moreover, pneumonectomy involves a higher rate of overall bronchial complications, not counting adult respiratory distress, of sad prognosis, and reduction of cardiopulmonary reserve, which results in worse quality of life for the long term.<sup>4</sup> A difficult decision point lies in the detection of affected interlobar nodes; nowadays the tendency is to apply this type of techniques even for N1 disease, accompanied with exhaustive interlobar and mediastinal lymphadenectomy, in absence of residual disease. Okada et al<sup>5</sup> carried out a study comparing pneumonectomies and sleeve lobectomies; after a statistical adjustment according to nodal involvement, they concluded that pulmonary preservation was more beneficial than pneumonectomy independently of intra-pulmonary or mediastinal nodal involvement. These authors also showed survival increase with sleeve lobectomies against pneumonectomies. However, most institutional studies do not find differences in survival,<sup>6</sup> but they do in later quality of life when this is the object of study.<sup>7-9</sup>

E-mail address: gomezcar@clinic.ub.es

Deslauriers et al<sup>10</sup> have recently published a study showing improved survival with lung sparing surgery than with pneumonectomies, with similar local recurrence rates. Furthermore, these authors champion this type of surgery for all cases when complete resection is possible, regardless of nodal state, based on an increase in survival compared to pneumonectomy. For the long term, the rate of anastomotic complications involves exclusively the bronchus, with minimal incidence.

At the moment, indication favouring either surgical procedure for central bronchial tumours depends on the surgeon. Lung sparing techniques are technically more complicated, and rate of pneumonectomies against sleeve lobectomies might well be regarded as an indicator of service quality for thoracic surgery. Thus, less than 10% of lung sparing surgery annually in resections for bronchogenic carcinoma against over 15% of pneumonectomies clearly indicates that the number of lung sparing surgeries is insufficient or that the pneumonectomy rate is too high.

Martin-Ucar et al<sup>11</sup> showed in a prospective institutional study that as this surgical practice increases the number of pneumonectomies decreases gradually, until the number of pneumonectomies and broncho-angioplasties are practically equalled. As such, the learning curve plays an important role for bronchoplasty to prevail, a practice more frequent in units with long tradition or those performing lung transplants. Morbidity and mortality with these procedures decreases along with the learning curve, the same as the ratio of pneumonectomy against sleeve lobectomy, as much as 1:1 or even less, 1:2, and shows the tendency to decrease even more with time and experience. The highest rate published so far is that of Rendina et al,<sup>12-14</sup> with over 14% broncho-angioplastic lobectomies in resection surgery for bronchogenic carcinoma. This type of interventions reaches 12%–14% annually at our unit in lung resection surgery for bronchogenic carcinoma, with a ratio of pneumonectomy against bronchoplastic surgery closer to 1:1.7. In the last 4 years, the number of bronchoplasties performed at our unit is close to half a hundred, with less than 7% pneumonectomies for the same period of time.

At present any surgical option that is oncologically valid tends to be considered instead of pneumonectomy. Broncho-angioplastic lobar resections accompanied by some anatomically sub-lobar segment are safe and should always be considered to avoid pneumonectomy.<sup>5</sup>

Most advanced tumours usually involve the bronchial carina, which forces to perform pneumonectomies associated with resection of carina. However, in certain selected cases, and almost always over the right side, it is possible to save the lower lobe, or lower and median, which is re-implanted in the main left bronchus or trachea in order to prevent complications in the carina suture or right pneumonectomy.

In patients for whom broncho-angioplastic techniques may be too risky due to extended vascular, arterial or vein involvement,

oncological resection of tumour at bench surgery should be considered, followed by re-implant of remaining lobe with bronchial, arterial or vein reconstruction. Autotransplantation, therefore, orally communicated, should be considered a safe option, although not free from complications.<sup>15</sup> This type of techniques to repair bronchial complications of lobectomy surgery has also been described in the medical literature.

To conclude, lung resections with bronchovascular reconstruction are invaluable for patients with central tumours, although they do demand more skill than pneumonectomies. Pneumonectomy against broncho-angioplastic surgery may be considered a ratio for good surgical practice. Both good results and oncological reliability promote this type of interventions, which always have to be considered for any central tumour in order to avoid pneumonectomy and complications involved in massive extirpation of pulmonary parenchyma.

## References

1. Mortalidad por cáncer en España. Área de Epidemiología Ambiental y Cáncer. Centro Nacional de Epidemiología. Instituto de Salud Carlos III. Ministerio de Sanidad. Available at: <http://cne.isciii.es/cancer/mort2006.txt>
2. Thomas P. Lobectomy with sleeve resection. *Thorax*. 1960;15:9-11.
3. Paulson DL, Shaw RR. Results of bronchoplastic procedures for bronchogenic carcinoma. *Ann Surg*. 1960;151:729-40.
4. Schuchert MJ, Pettiford BL, Luketich JD, Landreneau RJ. Parenchymal-sparing resections: why, when, and how. *Thorac Surg Clin*. 2008;18:93-105.
5. Okada M, Nishio W, Sakamoto T, Uchino K, Yuki T, Nakagawa A, et al. Sleeve segmentectomy for non-small cell lung carcinoma. *J Thorac Cardiovasc Surg*. 2004;128:420-4.
6. Ludwig C, Stoelben E, Olschewski M, Hasse J. Comparison of morbidity, 30-day mortality, and long-term survival after pneumonectomy and sleeve lobectomy for non-small cell lung carcinoma. *Ann Thorac Surg*. 2005;79:968-73.
7. Schulte T, Schniewind B, Dohrmann P, Kuchler T, Kurdow R. The extent of lung parenchyma resection significantly impacts long-term quality of life in patients with non small cell lung cancer. *Chest*. 2009;135:322-9.
8. Yildizeli B, Fadel E, Mussot S, Fabre D, Chataigner O, Darteville PG. Morbidity, mortality, and long-term survival after sleeve lobectomy for non-small cell lung cancer. *Eur J Cardiothorac Surg*. 2007;31:95-102.
9. Bagan P, Le Pimpec-Barthes F, Badia A, Crockett F, Dujon A, Riquet M. Bronchial sleeve resections: lung function resurrecting procedure. *Eur J Cardiothorac Surg*. 2008;34:484-7.
10. Deslauriers J, Gregoire J, Jacques LF, Piroux M, Guojin L, Lacasse Y. Sleeve lobectomy versus pneumonectomy for lung cancer: a comparative analysis of survival and sites or recurrences. *Ann Thorac Surg*. 2004;77:1152-6.
11. Martin-Ucar AE, Chaudhuri N, Edwards JG, Waller DA. Can pneumonectomy for non-small cell lung cancer be avoided? An audit of parenchymal sparing lung surgery. *Eur J Cardiothorac Surg*. 2002;21:601-5.
12. Rendina EA, De Giacomo T, Venuta F, Ciccone AM, Coloni GF. Lung conservation techniques: bronchial sleeve resection and reconstruction of the pulmonary artery. *Semin Surg Oncol*. 2000;18:165-72.
13. Rendina EA, Venuta F, De Giacomo T, Ciccone AM, Moretti M, Ruvolo G, et al. Sleeve resection and prosthetic reconstruction of the pulmonary artery for lung cancer. *Ann Thorac Surg*. 1999;68:995-1001.
14. Rendina EA, Venuta F, De Giacomo T, Rossi M, Coloni GF. Parenchymal sparing operations for bronchogenic carcinoma. *Surg Clin North Am*. 2002;82:589-609.
15. Jiang F, Xu L, Yuan FL, Huang JF, Lu XX. Lung autotransplantation technique in the treatment for central lung cancer of upper lobe. *J Thorac Oncol*. 2008;3:609-11.