

Carinal resection, left pneumonectomy, and right lung anastomosis for adenocystic basal cell carcinoma (cylindroma)

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The surgical approach to, and resection of, a cylindroma of the left main bronchus involving the trachea and right main bronchus is described. The literature on bronchial adenoma and cylindroma is reviewed, both the pathogenesis and surgery being discussed. A plea for a more aggressive approach is made.

In a review of the literature on the subject of surgery for cylindroma of the bronchus no reference to an operation of this nature was found. The surgical procedures used in this condition have been pneumonectomy, carinal resection with left and right lung anastomosis, lobectomy, or bronchoscopic 'biopsy' resection of the tumour in an attempt to maintain an airway.

Three problems face the surgeon undertaking a resection of this magnitude: (a) to maintain adequate gaseous exchange while the anastomosis of the single lung is proceeding; (b) to achieve an 'airtight' and adequate anastomosis—a tension pneumothorax would be rapidly fatal; and (c) to ensure total expansion of the lung until complete healing has been achieved.

CASE REPORT

In September 1961 the patient, a sailor aged 46 years, first noticed blood in his sputum and this was associated with cough and some shortness of breath. The physical findings were those of an acute pneumonia and he was treated accordingly and recovered. He had no further trouble until November 1963, when he presented with the same symptoms. Examination for tuberculosis was negative and a chest radiograph was considered to be normal. A year later, a radiograph following a further episode of haemoptysis demonstrated a retrocardiac shadow. Bronchoscopy was advised but refused.

Four years later, in August 1967, further examination and chest radiography showed collapse of the left lung. Bronchoscopy was accepted and a tumour mass occluding the left main bronchus was seen; this

extended up the left side of the trachea and into the right main bronchus.

A specimen taken for examination proved to be from a cylindroma of the adenocystic variety.

From August 1967 to February 1968 repeated bronchoscopies with partial resections of tumour and an attempt to establish an air passage and an aeration of the lung were not successful after initial re-expansion in October.

It was decided that surgical treatment should be attempted, and the patient was seen by the surgeon (D. T. T.) in April 1968. Bronchoscopy confirmed the above findings, there being extension up the trachea for about 2 cm., the carina was almost obliterated by tumour, and involvement of the right main bronchus for about 1.0–1.5 cm. was seen. It was decided to submit the patient to operation.

SURGICAL TECHNIQUE A left thoracotomy was carried out first to assess the surgical situation and to ascertain whether spread beyond the bronchial wall had taken place. A tumour, approx. 4 cm. in size (Figure 1) was seen extending the left main bronchus and carinal region and extending up to the trachea, was felt. The inferior carinal and paratracheal lymph nodes were not involved by tumour, and there was no obvious extension outside the bronchial or tracheal lumen. The left lung was collapsed and airless. A pneumonectomy was performed, the left main bronchus being divided below the tumour.

On completion of the left pneumonectomy the patient was submitted to right thoracotomy. Following division of the azygos vein a dissection of the right main bronchus involved by the tumour was required to avoid damage to the branch of the pulmonary artery to the apical segment of the upper lobe, the expanded bronchus being closely applied and adherent

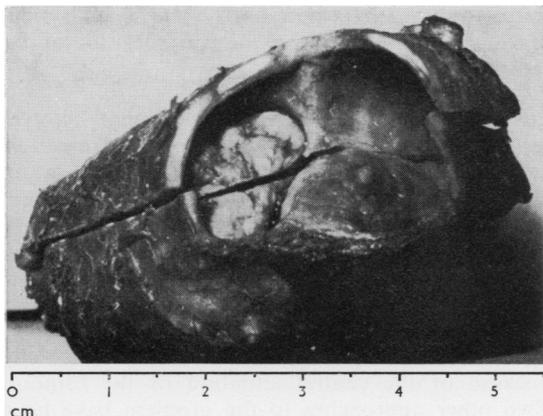


FIGURE 'Bronchoscopic' view of resected specimen showing involvement of right main bronchus and carina.

to it. The carina, the lower end of the trachea, and the stump of the left main bronchus were mobilized. The intratracheal anaesthetic tube was withdrawn proximally, the trachea, about 2-2.5 cm. above the carina, followed by the right main bronchus, about 1.5-2 cm. distal to the carina, were divided, and the tumour-bearing portion of the bronchial tree was removed.

Lymph nodes lying to the right of the trachea were not involved by tumour nor had it extended outside the wall of the right main bronchus.

A triangular wedge of the cartilaginous portion of the trachea was then excised, the amount taken being judged to allow accurate end-to-end anastomosis between the trachea and the right main bronchus after reconstruction of the tracheal lumen. Rather less than required was removed at first, thus allowing a finer tailoring of diameters at the stage of anastomosis.

By impacting the endotracheal tube into the right main bronchus, inflating for one minute, and then withdrawing the tube into the trachea for one and a half minutes, the inferior (with reference to the surgeon and not anatomically) stitches of interrupted catgut were placed between the cut ends and tied with the knot lying externally to the lumen. The one and a half minutes allowed one suture to be placed and tied.

Once these 'inferior' hemicircumferential stitches had been inserted, the endotracheal tube was left in the right main bronchus and the 'superior' half stitches were inserted. There was some difficulty with this procedure as the inflated lung impaired vision.

The stitches in the reconstructed trachea were the last to be inserted as the space thus gained allowed a more accurate placing of the anastomotic sutures.

Acridine was poured into the chest cavity to test for air leak from the anastomosis; a small leak was demonstrated and controlled with a single stitch.

Mediastinal pleura was then stitched over the anastomosis. Antibiotic powder was sprinkled around

the anastomosis, and, after insertion of a single intercostal tube drain, the chest was closed in layers.

A post-operative aspiration and inspection bronchoscopy were carried out.

POST-OPERATIVE CARE The patient was kept under continuous oxygen therapy for three days. His post-operative course was (apart from an episode of auricular fibrillation during the first 24 hours, controlled by digitalis and quinidine) singularly free from complications.

Constant monitoring of the blood gases and bicarbonate levels showed no serious deviation from normal, though, on breathing air only, 24 hours post-operatively there was some oxygen desaturation (PaO_2 79 mm. Hg).

There was no leak of air from the anastomotic site and the intercostal tubes were removed on the third post-operative day. Lung complications did not develop. The patient was discharged from hospital on the 21st post-operative day and he remained well; lung function studies five months later were as shown in Table I.

TABLE I
LUNG FUNCTION STUDIES

| | Actual | Predicted | % |
|--|-------------|-----------|------|
| Vital capacity | 2-250 | 3-720 | 60.5 |
| Functional residual capacity | 1-700 | 3-230 | 52.5 |
| Expiratory reserve volume | 0-870 | 1-360 | 63.5 |
| Residual volume (RV) | 0-830 | 1-870 | 44.5 |
| Total lung capacity (TLC) | 3-080 | 5-590 | 55.0 |
| RV/TLC (%) | 27 | 33 | — |
| FEV _{1.0} (%) | 82 | 81-87 | — |
| Maximum mid-expiratory flow rate | 2.1 l./sec. | 3.3 | — |
| Mixing efficiency (%) | 48 | 55 | — |

TABLE II
PRIMARY TUMOURS OF THE LUNG

| |
|---|
| A. Tumours of bronchial epithelium |
| 1. Bronchogenic carcinoma |
| (a) Squamous-cell carcinoma |
| (b) Adenocarcinoma |
| (c) Large-cell carcinoma |
| (d) Small-cell carcinoma |
| 2. Alveolar-cell carcinoma |
| B. Tumours of mucous gland origin ('adenoma') |
| (a) Carcinoid |
| (b) Cylindroma (adenocystic basal-cell carcinoma) |
| (c) Muco-epidermoid tumour |
| C. Tumours of mesenchymal origin |
| (a) Lymphosarcoma |
| (b) Fibrosarcoma |

A bronchoscopy carried out five months after operation was reported on as follows: 'At the level of the anastomosis there is a ring that does not reduce the lumen of the trachea.'

DISCUSSION

Cylindroma is a rare tumour and has been included under the heading of bronchial adenoma

in a classification of primary tumours of the lung, as indicated in Table II.

In a series reported from the University of Michigan, Markel, Abell, Haight, and French (1964) reviewed all bronchogenic tumours seen in a 28-year period. In all, there were 3,000 tumours, of which 61 (2%) were classified as 'adenoma', and this figure is higher than the generally accepted incidence of 1% adenoma among bronchial tumours. Of the 61 patients, five were of the adenocystic variety, *i.e.*, an incidence of 0.16%.

The group 'adenoma' is a heterogeneous one and there is evidence to view the carcinoid as a tumour arising from cells in the bronchus that resemble intestinal argentaffin cells, and not from mucus-secreting cells.

The cylindroma and the muco-epidermoid tumour may be viewed as the malignant and benign varieties of mucous gland tumours, the adenocystic basal cell carcinoma (cylindroma) being slowly evolving, but undoubtedly malignant.

In the cases reported, and to which the present one is added, symptoms, chiefly haemoptysis, dyspnoea, or recurrent infections, extended over a period of six months to three or more years before advice was sought.

The cylindroma is often situated in the major bronchi and commonly at the carina, and there appears to be a predilection for the left main bronchus, as was the case in our patient. The tumour will eventually invade the surrounding mediastinal tissue and lymph nodes, and secondary tumour deposits occur.

Toomey (1967), in a review of the literature of adenocarcinoma of the larynx, has given an excellent account of this tumour and its clinical features, and it would appear that this form of cylindroma, probably related to that of the bronchus, is a more malignant variety, producing distant metastases in 20% of cases.

The 'cylindroma' is so designated because it resembles salivary gland cylindroma; the cells being small with little basophilic cytoplasm, mitotic figures are uncommon, and the cells are characteristically arranged in irregular clumps containing cysts and 'glands' ('pseudoglands' according to Smout and French (1961)). Hyaline stroma may be a feature and may surround columns (cylinders—hence the name) of epithelial cells.

Intra- and extra-cellular mucin is a commoner feature in these tumours than in the carcinoids, being further supporting evidence that these tumours have differing histological origins.

MANAGEMENT AND TREATMENT The management of these cases may be palliative, surgical, or by radiotherapy.

Palliative This method of management involves repeated bronchoscopies with 'snippet' resection of the tumour in an attempt to maintain an adequate airway. This method of treatment cannot be satisfactory as the tumour is slowly malignant and hence the ultimate death of the patient is to be expected.

Surgical In the reported literature, treatment has been almost entirely by pneumonectomy, chiefly because of the central situation of the tumour. Two other approaches to the problem have been reported—resection of the trachea during cardio-pulmonary bypass (Adkins and Izawa, 1964) and resection of the carina with re-implantation of both lungs (Grillo, Bendixen, and Gephart, 1963; Grillo, Dignan, and Miura, 1964). Involvement of the carina and/or the other main bronchus generally has been considered as an inoperable condition, and hence resection has been eschewed.

The case reported here indicates that these patients should be explored surgically even in the presence of carinal and contralateral main bronchus involvement seen at bronchoscopy, and in our opinion that, in view of the slow evolution of the disease in spite of local spread to lymph nodes and surrounding tissues, a thorough exploration to assess the possibility of resection should be carried out before a decision of inoperability is made.

Radiotherapy Although placed under a separate heading, radiotherapy is essentially palliative, and—it would appear from the literature—of little value. This is perhaps to be expected, bearing in mind the histology of the tumour.

Hence the only real hope that can be afforded to these patients is surgical, and a more aggressive attitude to the tumour is here advocated.

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