

Surgical management of bronchial carcinoma invading the chest wall

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ABSTRACT In a 20-year period (1958-77) 43 patients underwent combined pulmonary and chest wall resection for bronchial carcinoma with local invasion of the thoracic wall. The clinical data, symptoms, surgical procedures, pathology, and results are reviewed. Pain was the usual presenting symptom. The operative mortality was 16%, respiratory complications causing most of the postoperative morbidity and mortality. These complications were less common after pneumonectomy. Long-term survival was achieved in only three cases with a corrected three-year survival rate of 10%. The survivors had certain pathological and operative features in common that may have prognostic significance. Recurrent carcinoma was responsible for most late deaths. Despite the poor overall prognosis, surgical management provided reasonable palliation and occasionally resulted in prolonged disease-free survival.

Surgical management of a peripheral bronchial carcinoma that is invading the thoracic wall by pulmonary resection and excision of the affected chest wall has been established as technically feasible for over 30 years (Coleman, 1947). The value of this treatment in palliating the pain often associated with such lesions has received little attention, and there is considerable variation in the published morbidity and mortality, although prolonged survival has been reported (Grillo *et al*, 1966; Geha *et al*, 1967; Ramsey and Clifton, 1968).

In the regional thoracic surgical unit, Edinburgh, a policy of attempting removal of such lesions has been followed for many years. We review our experience over a 20-year period.

Patients and methods

During 1958-77 2413 patients underwent pulmonary resections for bronchial carcinoma in the City Hospital, Edinburgh. This study is concerned with 43 of these patients (1.8%) who also required resection of an area of chest wall for direct invasion by tumour lateral to the rib angles as seen at operation. Chest wall resection is taken to indicate the excision of portions of one or more ribs. "Pancoast" tumours represent a separate clinical entity and are therefore not included.

Clinical findings

Age and sex—There were 36 male (84%) and seven female patients, whose ages at the time of operation ranged from 39-75 years (mean 62). The women (mean age 53.7) were younger than the men (mean age 63.4), and included three of the four patients aged less than 50.

Smoking habits—the smoking habits of two patients were not recorded, and one patient smoked a pipe. Of the remaining 40 patients all except one smoked more than ten cigarettes a day.

Symptoms (table 1)—Thirty-eight patients (88%) had chest wall pain as a presenting symptom. In 20 the pain was either an isolated complaint (15 cases) or preceded their other symptoms. The average duration of these symptoms was 4.8 months, with a range of three weeks to two years,

Table 1 *Presenting symptoms. Number of patients in whom this was the sole presenting symptom in parentheses*

Chest wall pain	38	(15)
Haemoptysis	15	(1)
Cough	9	
Dyspnoea	2	
Unresolved pneumonia	2	(2)
Non-specific (Anorexia etc)	2	(1)

the latter figure representing a patient with retro-sternal pain repeatedly presumed to be cardiac in origin until the development of a radiological opacity. In three cases the lesion was detected on a routine chest radiograph. One of these patients was asymptomatic, the other two admitting to symptoms on subsequent questioning.

Radiographic findings—All patients had a peripheral radiological opacity consistent with a bronchial carcinoma. In 12 cases (28%) radiological evidence of erosion of one or more ribs was present.

Operative procedures and postoperative course

In 84% of patients the tumour arose in an upper lobe with a predominance of left-sided lesions (58%), and lobectomy was usually practicable (27 patients). Twelve patients required pneumonectomy, while segmental resection (two cases) or wedge excision (two cases) were used in the remainder. Of the 43 resections, 38 were classified as "curative" in that all visible tumour was removed. Residual tumour was either observed or strongly suspected in the remaining five patients, including the two undergoing wedge excision, the operation being considered "palliative."

The chest wall resection involved up to four ribs, segments of two or three ribs being removed in most patients (19 and 16 cases respectively). A prosthesis, usually a moulded acrylic plate, was inserted in 15 patients. This was used for the larger defects, particularly anteriorly and laterally, where there was no scapular cover. In two patients prosthetic material was subsequently removed on account of infection.

Sputum retention, with resultant respiratory infection or ventilatory failure or both, was a frequent complication. In addition to physiotherapy and antibiotics 17 patients (40%) required bronchoscopy, tracheostomy, or mechanical ventilation, or some combination of these procedures. These measures were more often necessary in post-lobectomy patients (45%) than in post-pneumonectomy patients (25%).

Seven patients died within 30 days of operation, an operative mortality of 16%. Respiratory complications were implicated in six of these cases, one of which was compounded by a cerebrovascular accident. The remaining patient died at home of cerebral metastases not recognised before operation. Respiratory complications may account for six of the seven deaths occurring after lobectomy. The operative mortality was 22% after lobectomy and 8.5% after pneumonectomy.

Pathology

Sixty-five per cent of the patients had a squamous cell carcinoma and 28% undifferentiated lesions. In two cases the tumour was an adenocarcinoma, and one exhibited mixed histological features. Hilar or mediastinal nodes were implicated in 11 patients (26%), more so with pneumonectomy (33%) and undifferentiated carcinoma (33%) than with lobectomy (23%) and squamous cell carcinoma (18%).

Results

At the time of follow-up two patients were alive, 13 and 63 months after operation. Fourteen patients survived for one year, and three were alive at three and five years, representing a corrected survival rate among patients who underwent "curative" surgery of 39% at one year and 10% at three years (table 2). Two of the patients alive at five years have since died, one at 80 months after developing spinal metastases and one at 86 months of a myocardial infarction, necropsy showing no evidence of recurrent carcinoma. The mean survival, excluding operative deaths, was 15 months with a median survival of 7.5 months. No patient who underwent pneumonectomy was alive one year after operation.

Table 2 *Survival after operation*

Operation	No of cases	Operative death	Survival (years)			
			<1	1	3	5
Pneumonectomy	12	1	11	—	—	—
Lobectomy	27	6	10	11	3	3
Wedge/segmental	4	—	1	3	—	—
Total	43	7	22	14	3	3

Recurrent disease—Two of the 36 patients who survived operation are alive with no evidence of recurrent tumour. In 27 of the remaining patients (79%) recurrent carcinoma was proved or strongly suspected at the time of death.

Symptomatic relief—An attempt was made to assess pain relief, although it is accepted that this is of limited accuracy in a retrospective analysis of case records. Thirty-one patients who presented with chest wall pain survived long enough to allow some assessment of pain relief. Eleven (35%) of these complained of continuing pain, the remaining 20 having apparently obtained symptomatic relief.

Discussion

Direct invasion of the thoracic wall by a bronchial carcinoma has not been considered an absolute contraindication to surgery since Coleman (1947) first reported long-term survival after en bloc excision of the invaded chest wall structures. Twenty years later Geha *et al* (1967), in a series of 41 similar patients, were able to report a five-year survival rate of 32%, very similar to that expected after pulmonary resection alone. However, only 12% of the cases had affected hilar nodes, and the extent of chest wall resection was not clearly stated.

In the experience of most authors prolonged survival is uncommon after extensive resection, but in most series some long-term survivors are recorded and these provide the rationale for surgical treatment (Abbey Smith, 1964; Ramsey and Clifton, 1968; Burnard *et al*, 1974).

Our results were similar in that there was an increased early and late mortality compared with simple pulmonary resection, but the three long-term survivors represent a corrected three-year survival rate of 10% among patients undergoing curative surgery.

In view of the small numbers concerned, it is difficult to establish accurate prognostic indices, but we did note that the three five-year survivors shared certain features—namely, a “curative” resection; lobectomy; a limited chest wall excision (two ribs or less); and a squamous cell carcinoma with no affected hilar nodes. With the exception of the extent of chest wall resection these are all features known to be associated with improved survival after simple pulmonary resection (Galofré *et al*, 1964; Belcher and Anderson, 1965; Higgins *et al*, 1969) suggesting that similar criteria may apply even in more extensive lesions. Indeed a subgroup of eight patients from the present series who exhibited the above features had no operative deaths, a median survival of 12 months, and a five-year survival rate of 38%.

Another point of interest related to the role of pneumonectomy when excision of thoracic wall is indicated. Pneumonectomy for bronchial carcinoma carries a higher early and late mortality than lobectomy (Kirsch *et al*, 1972; Wilkins *et al*, 1978). This difference reflects the use of a more extensive procedure for lesions at a more advanced stage (Le Roux, 1968). For the same reason no pneumonectomy patients in this series remained alive one year after surgery. In contrast, however, the operative mortality was much lower after pneumonectomy than after lobectomy, suggesting that different factors govern early mor-

talidity and morbidity. After pneumonectomy the effect of paradoxical movement and impaired cough is lessened by the absence of ventilated lung underlying the defect with a corresponding reduction in sputum retention, impaired ventilation, and ventilation-perfusion imbalance. Routine positive-pressure ventilation or splintage with a plaster bandage have been advocated to prevent these complications, but some authors have specifically suggested pneumonectomy as the pulmonary resection of choice when chest wall excision is indicated (Lavenson and Serfas, 1968). Our experience lends support to that argument.

The other feature to emerge from this study, which confirms previous experience with similar patients, is the frequency of pain as a presenting feature. In a review of 4000 cases of bronchial carcinoma Le Roux (1968) described chest pain at the time of presentation in one-third, as compared with 88% in the present series. In half of the patients pain was the first or only symptom. The pain is usually well localised, but may be referred to the shoulder or arm, and appeared to be relieved after operation in most cases.

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