RESECTION AND ANASTOMOSIS OF THE INTRATHORACIC TRACHEA FOR PRIMARY NEOPLASMS*

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INTRODUCTION

PRIMARY TUMORS of the trachea are admittedly rare, and when one considers the difficulties of successfully eradicating neoplasms in this region, it is indeed fortunate that they appear so infrequently. However, when we are confronted with a lesion of this type, an ideally successful outcome can scarcely be expected unless we are able both to completely eradicate the local disease and to restore continuity of the tracheal walls by anastomosis. It is the purpose of the authors to demonstrate that surprisingly large segments of the trachea can be resected with primary anastomosis, and that on both pathologic and technical grounds this should and can be more frequently used than has been believed in the past.

In 1947 Tinney, Moersch and MacDonald[9] reported 27 cases of tracheal tumors from the Mayo Clinic. Five hundred and seven cases had been previously reported in the World Literature.[5] A review of the available material reveals a gradual increase in the number of reports of partial resections performed with or without the use of various adjuvants such as various types of rigid tubes,[3] wire mesh supporting fascia lata,[2] or the ingenious method of Belsey,[1] using stainless steel wire to support a fascia lata graft. Most of these methods, however, have been conceived to meet individaul technical problems in far advanced cases where the extent of the lesion seemed to preclude the possibility of re-establishment of continuity of the trachea by any other means.

Gebauer[6] has become increasingly successful in the use of split thickness skin grafts supported by wire in the reconstruction of portions of the bronchus and trachea previously deformed by an inflammatory process. The margins of the defect in these cases were fibrotic and rigid. It remains to be seen whether the suture of dermal grafts to the normal delicate membranous portion of the trachea after adequate sleeve resection would heal as kindly. The work of Taffel,[8] Daniel,[4] Clagett,[3] and Belsey,[1] have made it clear that remarkable reparative processes will assist the reconstruction of segments of the trachea and bronchi with, on the whole, excellent function. It is not clear, however, whether the long term outcome of these prosthetic methods will be entirely satisfactory, viz: one can observe from Belsey's report that one of his cases developed contraction of the scar tissue in the graft, resulting in a 50 per cent loss of cross sectional area of the lumen of the trachea over a period of nine months.

While one must continue to develop plastic methods of various sorts to fit individual cases, the primary purpose should be to establish end to end continuity of the trachea where possible. A sleeve resection seems in principle to be preferred in the

* Submitted for publication August, 1953.

case of a neoplasm for as Rouviere[7] has shown the collecting lymph channels run laterally between the cartilaginous rings and subsequently drain into the paratracheal recurrent lymph node chain from where the drainage continues upwards toward the thoracic inlet. A resection involving only a part of the tracheal wall is a serious compromise with a malignant process, and should and does often result in an early recurrence.

There has been a natural reluctance on the part of surgeons to do radical sleeve resection of the trachea, not only because of the absence until recently of a reliable method of artificial reconstruction, but because the lesions, when seen, have been so far advanced and attended by such a degree of hilar fixation that mobilization of the trachea for an end to end suture seemed out of the question.

The authors present here a case history of a patient with a primary tumor of the trachea uncomplicated by metastases, in which a sleeve resection was employed successfully, with an end to end anastomosis supported by a fascial graft. Excellent healing was evident by bronchoscopy in 17 days. It was felt at the time of resection that a much larger area of the trachea could have been resected with satisfactory end to end anastomosis in this case.

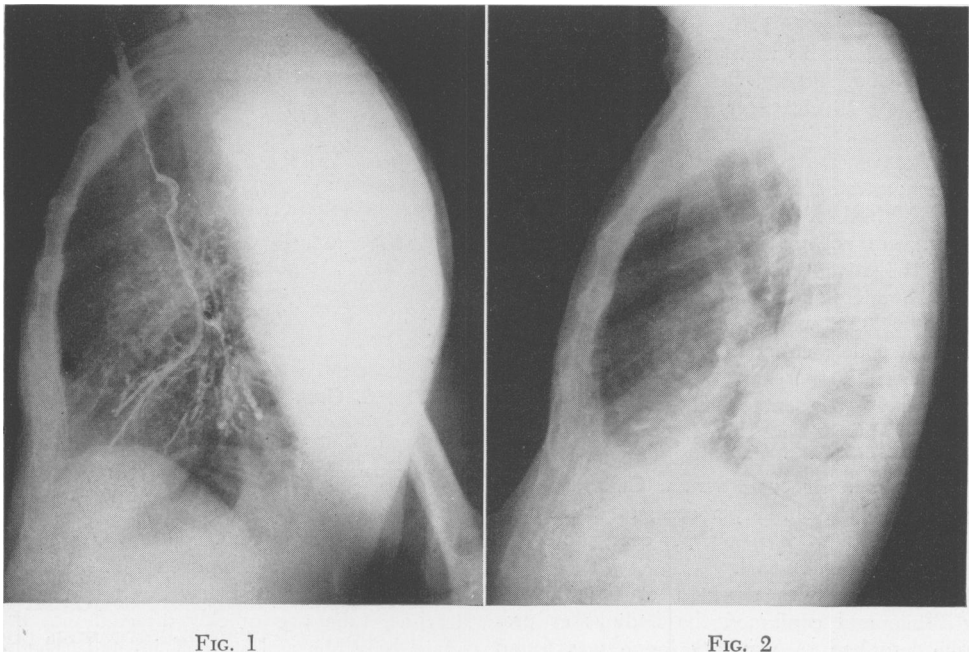

FIG. 1 FIG. 2

FIG. 1. Lateral film of chest after lipiodol installation sharply outlines the tumor projecting from the anterior wall of the trachea.

FIG. 2. Lateral film after resection shows smooth anterior tracheal wall with no narrowing apparent.

CASE REPORT

L. B., a 61-year-old white male, an electrician by occupation, was admitted to the clinic on January 16, 1952. He gave a history of having suffered repeated colds in the fall of 1951, most of which responded to parenteral penicillin. On two occasions, however, hemoptysis had been noted during these attacks of coryza. He denied any weight loss, anorexia, fever, chills or night sweats, but complained of some generalized weakness. Roentgenograms of the chest, taken at the Ithaca, N. Y., hospital, revealed no significant findings.

Bronchoscopy, however, had disclosed a mass on the anterior tracheal wall 2 cm. above the carina. Its apparent base measured approximately 2.5 cm. The mass was irregular, soft, and did not significantly occlude the trachea. It did not bleed easily. A biopsy was taken and interpreted histologically as a section from a primary carcinoma of the trachea. The past history was essentially noncontributory. He had had pneumonia and influenza in 1918, but otherwise had experienced no serious illness throughout his lifetime. There was no history of previous surgery. He admitted to smoking approximately 10 cigarettes daily.

Physical examination on admission was essentially negative. Posteroanterior and lateral chest films demonstrated a small intraluminal mass in the lower third of the trachea. The laboratory findings were not particularly significant. *Urine:* albumin, negative; sugar, negative; specific gravity, 1.021; microscopic, negative. Red blood cell count, 5,000,000; white blood cell count, 9,500; differential count: eosin, 2 per cent; baso, 3 per cent; lymphs, 30 per cent; monos, 13 per cent; seg. polys, 44 per cent; stab. polys, 8 per cent. Hematocrit, 47 per cent; blood proteins; albumin, 4.80 mg. per cent; globulin, 2.28 mg. per cent; N.P.N., 36 mg. per cent; Serum: Chlorides, 435 mg.; free cholesterol, 46 per cent; total 187 mg. per cent; potassium, 21.6 mg. per cent, prothrombin, 58 per cent of normal.

Bronchoscopy was repeated at the Roswell Park Clinic and confirmed the findings as previously described. A papillary lesion was found approximately 2 cm. in diameter on the anterior tracheal wall, 2 cm. above the carina. A biopsy was repeated with the confirmatory diagnosis of mature columnar cell papillary carcinoma. A lipiodol study of the trachea demonstrated the tumor easily (Figs. 1-4).

Operation: February 26, 1952, operation was performed. A long incision was made, para-scapular in type, and the 5th rib resected. The chest was opened widely and the lung packed downward. The azygos vein was divided between silk ligatures and the mediastinal pleura opened to the apex of the chest. A careful dissection of the posterior mediastinal lymph nodes were made from the level of the subclavian artery downward, including the great cardiac nerve on the right side with the lateral recurrent chain. The lymph nodes on the left side of the trachea were dissected free with considerable difficulty. Both of these lymph node masses, accompanied by the areolar tissue, were carried down over the anterior aspect of the carina and removed. They did not appear to be involved with tumor. Only a moderate amount of bleeding was encountered from the superficial vessels entering the anterior wall of the trachea. This extensive dissection left a rather naked and surprisingly mobile trachea. Tapes were then placed around both the right and left main bronchus at the carina. Another tape was passed about the trachea at the level of the inlet. The cleavage plane between the trachea and esophagus had been well developed, and with the

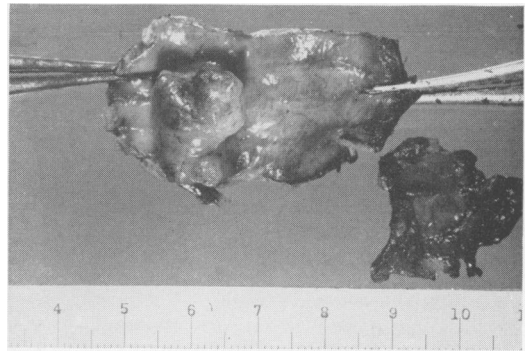

FIG. 3. Gross specimen with trachea opened. Vertical measurement represents length of segment removed. Cut cartilaginous rings may be seen along left lateral margin of trachea.

trachea completely mobilized, it was easily turned 180° to the left and opened through the membraneous portion just below the tumor. The intratracheal tube was quickly directed into the left main bronchus and its cuff inflated. The respiratory exchange was thereafter established easily. Under direct visualization a sleeve resection of the trachea was performed. The specimen involved 3 rings anteriorly, measuring a vertical distance of 3.5 cm. When the resection had been accomplished it was obvious that the trachea could easily be brought together without undue tension. Interrupted 3-0 silk sutures were used to unite the tracheal walls. At this level of the trachea there was very little fibro-elastic tissue between the tracheal cartilages, especially anterolaterally, where they bifurcate so that the sutures were, in some places of necessity, passed around the cartilage rings. Because sufficient care had not been used in fashioning the edges of the trachea it was somewhat difficult to close the left lateral portion of the anastomosis. Consequently, there was a small air leak in this position. In order to secure the anastomosis and protect it, a section of fascia lata, which had been taken in preparation for the Belsey type of plastic repair, was used very satisfactorily. The fascia was passed about the anastomosis, carried up on the trachea to the inlet and down to the bifurcation of the main bronchi. It

was snugly sutured about the trachea, a few interrupted sutures being used to attach the cephalad and caudad margins to the tracheal walls. By tightly closing this fascia, it was possible to secure an air-tight support of the suture line. Anatomical studies indicate that the entire trachea in the average patient is 10.5 cm. long; therefore, we can assume that approximately one-third of the trachea had been resected. The mediastinum was carefully closed and extra-pleural drainage provided for the mediastinum with the use of a rubber catheter. A large drainage tube was led out through the 8th interspace for any fluid that might collect in the pleural cavity. After the lung was re-expanded, the chest wall was closed with continuous chromic catgut on the pleural and inter-costal layers, interrupted fine silk on the muscle layers and skin. The patient tolerated the procedure very well. At the termination of the operation the cervical region was prepared and a tracheotomy done.

Postoperative Course. The postoperative course was relatively uneventful except for the development of a loculated pleural effusion which responded nicely to repeated aspiration. Cultures of this fluid were sterile. The patient ran a low-grade temperature for approximately two weeks, which gradually subsided with continuous use of penicillin and streptomycin in moderate doses. The tracheotomy tube was occluded on the 14th day and since he tolerated this well, it was finally removed entirely on the 17th day without noticeable reaction. A bronchoscopy performed later that day showed almost complete epithelialization at the site of anastomosis. There was no apparent narrowing, but one silk suture was visualized on the anterior tracheal wall. He was discharged one month after operation.

Follow-up. The patient has remained completely asymptomatic, except for some residual weakness. Frequent bronchoscopies have been performed since his discharge, the last one on May 19, 1953. This showed a granuloma in a small area a few millimeters in size on the anterior wall of the trachea at the site of the suture line. This was biopsied and proved to be inflammatory tissue in no way representing the original cylindroma. When seen on November 5, 1953, 20 months after operation, he was entirely well.

Pathology. Gross: Specimen consisted of resected portion of trachea measuring 3 to 4 cm. in length and 4 cm. in diameter. A soft, fleshy tumor, reddish-gray in color, was found arising from the mucosa, measuring 2.5 x 1.5 cm. Along with the specimen were several small soft lymph nodes, the largest of which measured 1 cm. in diameter and contained no gross tumor.

Microscopic: Sections from the trachea show an epithelial tumor covered by columnar epithelium with areas of squamous metaplasia. The tumor was found growing in solid masses and in many areas showing a tubular arrangement surrounding pink staining material, apparently mucus. In the main growth there are also areas of squamous metaplasia. The tumor grows down to, but does not invade, the cartilage and is characteristic of the group of tumors called cylindromas.

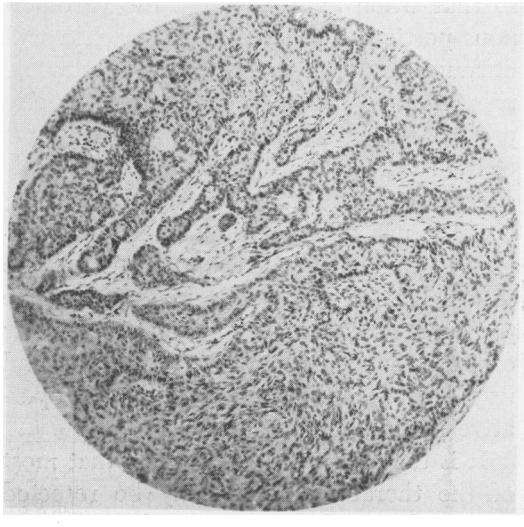

FIG. 4. Epithelial tumor growing in solid masses extending down to cartilage with some attempt at gland formation. Diagnosis: cylindroma of trachea.

COMMENT

A review of the sections from the surgical specimen indicated that the two previous diagnoses of primary mature carcinoma were incorrect and that we had, in fact, resected a primary cylindroma of the trachea. Since the malignant characteristics of this lesion are largely accepted today, it is clear that radical resection is indicated for this type of tumor.

This case demonstrates the feasibility of sleeve resection of the trachea with end to end anastomosis. The important features to stress in this type of procedure are (1) adequate mobilization of the trachea up to the apex of the chest and well down over the carina; (2) adequate control of the

anesthesia by directing either a separate tube through the chest into the carina and dependent lung or using the intra-tracheal tube as a closed circuit by delivering it directly into the dependent main bronchus in order to have adequate control of the respiration of at least one lung during the procedure; (3) sharp, accurate section of the segment of the trachea to be removed so that when approximated, the cartilaginous portion of the semi-rigid trachea will fit snugly and give natural apposition to the proximal and distal segments, and thereby prevent troublesome air-leaks; (4) support of the suture line with a large fascial graft sleeve to insure its stability and integrity; (5) the use of a complimentary tracheotomy to reduce the tidal air, to protect the suture line in the trachea from excessive pressure during coughing, and to allow easier aspiration of the lower trachea and upper bronchi during the early postoperative period.

It is the feeling of the authors that most of the thoracic trachea may be resected with end to end anastomosis if proper mobilization of the trachea and carina are effected before the anastomosis is attempted. In addition, the authors believe that for primary tumors of the trachea, a sleeve resection is the only sound method of surgical treatment to be used when such surgery is at all feasible. Where this seems impossible, even after extensive mobilization, the prosthetic methods described in the literature may be used. In view of the success of this method it should be used electively at an early time in tracheal tumors before they reach the stage of acute respiratory emergencies.

SUMMARY

This is a report of a segmental sleeve resection of the trachea for a primary cylindroma, with end to end anastomosis and a successful early result, and demonstrates the logic and availability of this procedure.

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