The Incidence, Distribution and Morphology of Lymphadenogenous Perforative Bronchial Scars in Adults

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The interest which is shown in the more recent European literature in perforative bronchial lesions is mainly the result of two factors: the more frequent application of radiologic\textsuperscript{1, 2} bronchoscopic \textsuperscript{3-5} and bronchographic\textsuperscript{6} technics in the evaluation of bronchial lesions, and the increased emphasis on the importance of the lymphatic system in the pathogenesis of pulmonary tuberculosis. The latter factor is further brought into prominence by the relative resistance of tuberculous lymph nodes to the effect of modern antituberculosis therapy.\textsuperscript{2, 3} Over 1,000 references on perforations of tuberculous lymph nodes into the bronchial tree are now available.\textsuperscript{6}

Fresh lymphadenogenous bronchial perforations result in characteristic, localized, circumscribed bronchial lesions which differ morphologically and pathogenetically from the caseous, ulcerative bronchial lesions which originate from implantation and spread of tuberculous infection by continuity.\textsuperscript{7} They can be observed in all the phases of pulmonary tuberculosis.\textsuperscript{1, 8-10} Although a large percentage of them heal without sequelae,\textsuperscript{11} localized residual scars at typical sites frequently remain and can often be detected many years later at autopsy.

The relative scarcity of reports on perforative bronchial lesions in the American literature suggested the possibility that perforative bronchial lesions and scars might be less common in the United States than in Europe. Hence the following study.

Materials and Methods

The study is based on material which came to routine autopsy between 1953 and 1955 at a hospital for patients with mental disease, the Warren State Hospital, Pennsylvania. There were 197 available autopsies during these years, all of which were performed by the Chief Pathologist, Dr. P. Schwartz.

After removing the lungs and the tracheobronchial lymph nodes in toto, the bronchi were opened through their dorsal walls and examined macroscopically for the presence of perforative bronchial lesions and scars. Specimens with positive findings were nailed to a wooden block so as to display the opened bronchial tree and preserved in 10 per cent solution of formalin.

Findings

1. Incidence and distribution:

In the 197 autopsies, 54 (27.4 per cent) cases showed perforative bronchial lesions and scars in the lungs. Twenty-nine were men and 25 women.
Their ages ranged from 24 to 92, and from 39 to 86 years respectively. Seventy-eight per cent of both men and women were over the age of 60.

In 41 of the 54 cases, the lesions were confined to the bronchi of a single lung: in 25 to the right and in 16 to the left lung. The remaining 13 showed multiple, bilateral bronchial lesions.

The distribution of the total of 92 perforative bronchial lesions and scars is shown in Figure 1.

2. Morphology:

The bronchial scars were classified according to their appearance in the following order of frequency:

1. Circular, flat scars 24
2. Circular, depressed 24
3. Trough-shaped 13
4. Diverticular 11
5. Long, suture-like 11
6. Pinhead sized and star-shaped 8
7. Funnel-shaped 8

Figures 2, 3 and 4 illustrate examples of circular-flat, circular-depressed, and diverticular scars respectively: they were present in identical sites in the right lower lobe bronchus, and show increasing degrees of depth of the lesions. The diverticular scar (Figure 4) closely resembles in appearance a bronchial orifice, for which it might well be mistaken on bronchoscopy.

FIGURE 1: Frequency and distribution of perforative lesions and scars in the bronchial tree.
FIGURE 2: Flat circular scar in the right lower lobe bronchus.

FIGURE 3: Depressed, flat circular scar in right lower lobe bronchus.
3. Association of bronchial scars with calcified hilar lymph nodes, gross distortion of the major bronchi, and lobar atelectasis:

Radiographs of removed lungs offer a useful technique for investigation of the relationship between bronchial scars and calcified hilar lymph nodes. For technical reasons, this approach could not be carried out at the time the material was under study. The findings reported here are therefore limited to gross macroscopical examinations of the specimen.

Calcified paratrachial, hilar and parabronchial lymph nodes were present on the same side as the scar in 31 cases. In 19, the calcified lymph node was either attached to the scar or in its immediate proximity.

In eight cases, the local damage to the bronchus resulted in a definite palpable loss of bronchial cartilage. Some distortion of the bronchus at the site of the lesion was present in the majority of the autopsies although its degree and extent was difficult to evaluate without previous bronchograms. In seven cases, however, stenosis of the bronchus was most marked, and in four of which the lobe supplied by the stenosed bronchus was found to be atelectatic and fibrosed: twice the middle lobe, and once each the right upper lobe and the lingula.

Figures 5A and 5B illustrate the association between a perforative bronchial scar, calcified hilar lymph nodes and lobar atelectasis. The superior interlobar space of the right lung is seen to be greatly contracted. The main stem of the right pulmonary artery is a strikingly narrow tube surrounded by calcified hilar lymph nodes. The main bronchus of the middle lobe is similarly narrowed, with calcified lymph nodes in immediate proximity. A trough-shaped, bronchial scar 15 mm. long is seen obliquely to extend from the middle lobe orifice towards the carina. The bronchial wall

FIGURE 4: Diverticular scar in right lower lobe bronchus.
FIGURE 5A: Association between a perforative bronchial scar, calcified hilar lymph nodes and lobar atelectasis: hilar aspect.

FIGURE 5B: Association between a perforative bronchial scar, calcified hilar lymph nodes and lobar atelectasis: bronchial aspect.
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is distorted, the lumen narrowed, and the middle lobe distal to it airless, fibrotic and contracted.

The large calcified lymph node complex which produced the perforative bronchial lesion and scar is seen from the hilar aspect (Figure 5A) to be a conglomeration of bifurcation lymph nodes, inferior hilum angle lymph nodes, and lymph nodes of the anterior wall of the proximal part of the middle lobe bronchus.

In another example in this series, published as a separate case study, an even more striking bronchial defect due to a perforative bronchial scar was found: the perforative bronchial lesion on the right upper lobe bronchus produced a complete bronchial amputation, with resulting separation, atelectasis, fibrosis, and shrinkage of the right upper lobe.

DISCUSSION

The literature on perforative bronchial lesions and scars has been reviewed in a number of fairly recent publications. The reported incidence of such lesions reflects disagreement with regard to the incidence of tracheobronchial tuberculosis generally: among tuberculous patients this is estimated to vary from 10 per cent to 66 per cent on bronchoscopy and from 3 per cent to 90 per cent at autopsy. The incidence of perforative bronchial lesions in primary tuberculosis is generally stated to vary between 10 and 60 per cent, with a conservative estimate of between 10 and 20 per cent. Here racial and regional differences in susceptibility to severe lymphadenogenous reactions may be an important factor. A similar range of incidence, however, is observed by different workers also in postprimary tuberculosis. The highest reported frequency of perforative bronchial lesions and scars as detected at autopsy on tuberculous subjects of all ages is 90 per cent.

Among routine autopsies on the general population at least three independent European centers report an incidence of perforative lesions and scars in over 20 per cent of the cases. The evidence for considering these bronchial scars to be the result of perforative lesions is discussed by Wyss. In this series the criteria for considering the bronchial scars to be of perforative origin rests largely in their typical appearance as described in publications referred to in this paper, their characteristic location, and the presence of calcified lymph nodes in close proximity in 35 per cent of the cases. Using radiographs of removed lungs, Wyss found calcified lymph nodes in close proximity to 66.1 per cent of the scars. Voegtli attributes a tuberculous origin to 77.9 per cent of the scars in his series of routine autopsy material.

Most authors agree that perforative bronchial lesions occur more often on the right side than on the left, although their ratios vary widely on different estimations. The preponderance of right sided scars is influenced by the anatomy of the lymphatic drainage of the lungs. Lung fields on the left side often drain directly into the lymph nodes situated on the right side, while the lymphatic drainage of the right side is almost exclusively confined to lymph nodes on that side.

The morphology of perforative bronchial lesions and scars is influenced by their age, size and location. Since perforative bronchial lesions heal rapidly, it is not surprising that examinations undertaken at different stages of the perforative defect should produce widely different findings. Also, it has been estimated that only about 50 per cent of the perforative bronchial lesions are accessible to bronchoscopic examination. A large number are found not to be associated with any marked clinical symptoms or radiologic findings and are thus discovered by chance on routine examination. The more serious sequelae include bronchiectasis, and bronchial stenosis of varying degrees of severity: the latter impair drainage and cause disturbances in pulmonary ventilation. In extreme instances, they are associated with lobar atelectasis and fibrosis. A possible causative relationship between bronchial scars and the development of bronchial carcinoma has been suggested, but not satisfactorily established.

SUMMARY

The relative scarcity of reports on perforative bronchial lesions and scars in the American literature suggested the possibility that such lesions and scars might be less common in the United States than in Europe. A study of the bronchial trees of 197 routine autopsy specimens showed the presence of typical perforative bronchial lesions and scars in 84 (27.4 per cent), an incidence which is comparable to the results obtained by workers in Europe. In 25 cases, the lesions were confined to the bronchi of the right lung; in 16 cases, to the bronchi of the left lung. The remaining 13 cases showed multiple, bilateral bronchial lesions. The lesions are believed to originate in perforations of tuberculous lymph nodes into the bronchial tree.

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RESUME

La rareté relative des fistules bronchiques et des cicatrices de perforations bronchiques relevées dans la littérature américaine ont amené à penser que de telles lésions et cicatrices seraient moins communes aux États-Unis qu'en Europe. Une étude de l'appareil bronchique de 197 autopsies courantes montra la présence de lésions bronchiques perforatives typiques, et de leurs cicatrices dans 54 cas (27,4%), fréquence qui est comparable aux résultats obtenus par les chercheurs en Europe. Dans 25 cas, les lésions étaient limitées aux bronches du poumon droit; dans 16 cas, aux bronches du poumon gauche. Les 13 autres cas montrèrent des lésions bronchiques multiples, bila-

ZUSAMMENFASSUNG

Die relative Spärlichkeit von Berichten über perforierende Bronchialveränderungen und Narben in der amerikanischen Literatur lassen die Möglichkeit vermuten, dass solche Veränderungen und Narben in den Vereinigten Staaten weniger häufig sind als in Europa. Eine Untersuchung der Bronchialbäume bei 197 routinemäßig gewonnenen Sektionspräparaten ergab das Vorliegen von typischen perforierenden Bronchialver-

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