TRACHEAL DIVERTICULA

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DIVERTICULA of the trachea have been recorded only rarely. While they may occasionally assume clinical significance, for example, by pressure on the recurrent laryngeal nerve, or by becoming infected, the majority have been discovered post-mortem, although some have recently been visualized radiographically during life. The lesions in the case to be described were incidental findings at necropsy in a man of 55 who died a few days after an extensive resection for a carcinoma of the cardia.

Macroscopic Appearances (Figs. 1 and 2)

The larynx was normal. An ovoid cyst measuring $3{\cdot}5 \times 3{\cdot}5 \times 3$ cm. arose by a pedicle 1 cm. in diameter from the right postero-lateral border of the

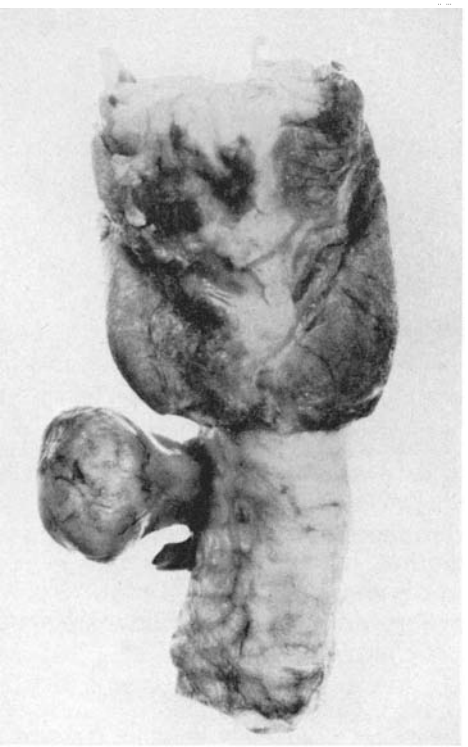


FIG. 1.

Photograph of the gross specimen, after fixation, viewed from the front.

https://doi.org/10.1017/S0022215100057637 Published online by Cambridge University Press

trachea, its upper border 4·5 cm. below the vocal cords and 1·5 cm. below the lower pole of the thyroid gland. Its wall was firm and easily separable from the surrounding tissues, and the cyst communicated with the trachea by an orifice, through which a fine probe could just be passed, situated at the junction of the cartilaginous rings and the trachealis muscle, and between

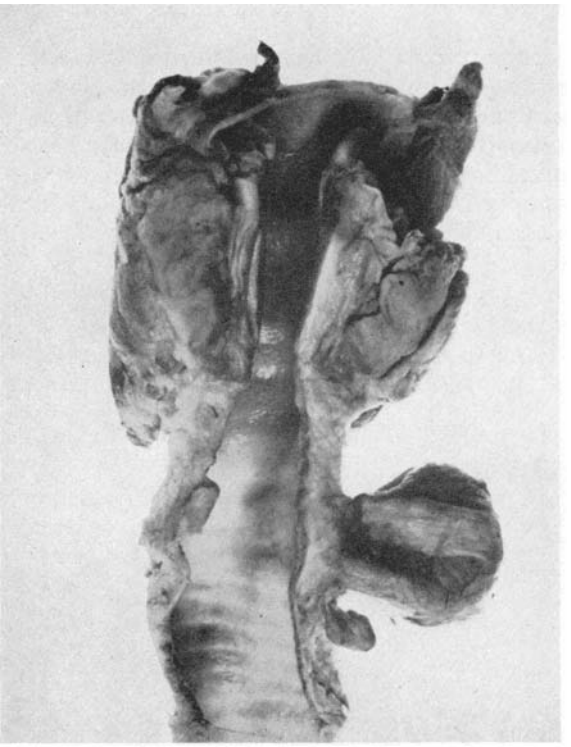


FIG. 2.
Posterior aspect of the same.

two adjacent cartilages. On gross section the cyst was empty and unilocular, and its wall varied in thickness up to 6 mm.

Immediately below this there was a second cyst, measuring 1 × 0·8 × 0·5 cm., which communicated with the trachea by a small opening in line with the previous one, and in the inter-cartilage space next below it.

Apart from these lesions the trachea and bronchi appeared macroscopically normal.

Microscopic appearances

The larger cyst is almost completely lined by a stratified ciliated columnar epithelium which appears healthy (see Fig. 3). Immediately external to this is a layer of loose connective tissue infiltrated by lymphocytes, plasma cells

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and a very occasional polymorph leucocyte. The remainder of the wall is composed of laminated collagen fibres in which a few capillaries and arterioles are present. No cartilage or smooth muscle can be seen. Throughout the thickness of the wall there are many irregular duct-like structures with an epithelial lining similar to that of the main cavity. A few of these spaces contain inspissated mucoid material but the majority are empty, and all are surrounded by

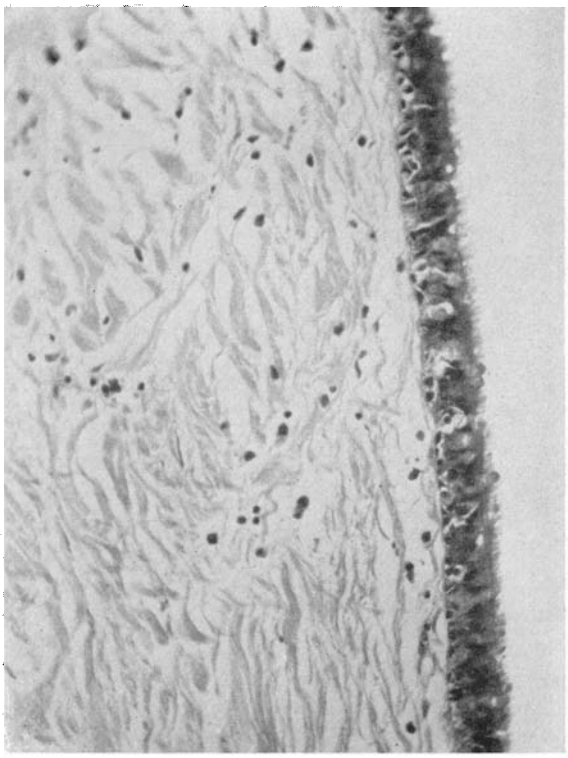


FIG. 3.

Photomicrograph of the wall of the larger diverticulum showing the stratified ciliated columnar epithelium, and part of the fibrous layer. There is a mild inflammatory infiltration beneath the mucous membrane (Hæmatoxylin and Eosin. ×220).

an infiltration of chronic inflammatory cells. No mucous glands are present in the wall.

In the smaller cyst the epithelium is similar to that in the larger, but the fibrous wall is thinner, more vascular and less collagenous. There is a light round-cell infiltration. No cartilage or muscle is seen but several apparently normal mucous glands are present (see Fig. 4).

A tranverse section through the openings into the trachea shows them to be lined by healthy ciliated columnar epithelium. In their immediate vicinity the mucous glands of the tracheal wall have distended ducts filled with inspissated material. Sections from the wall of the trachea at other sites show a

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mild sub-mucosal round-cell infiltration and moderate hyperplasia of mucous glands which are otherwise normal.

Discussion

Very rarely diverticula arise from the anterior wall of the trachea in the median line close to the thyroid gland. These so-called tracheocœles may represent congenital herniae of the mucous membrane, or may result from

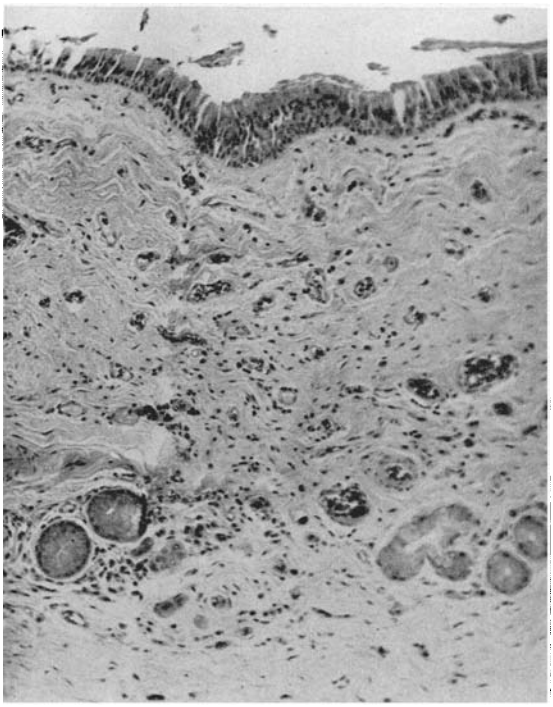


FIG. 4.

A section from the smaller diverticulum showing a similar structure to the previous figure but with mucous glands in the wall (Hæmatoxylin and Eosin. ×120).

chronic inflammation of the trachea with, or without, there being a congenital weakness of the wall. Pouching of the whole or the greater part of the posterior wall in association with emphysema has also been described. Neither of these varieties will be discussed further.

The majority of tracheal diverticula arise from the right side. It is clear from the literature that, ætiologically, two different lesions occur, the one acquired and the other congenital. The number of cases recorded, of both varieties, is very small and a summary of them will be found in the paper by Goldman and Wilson (1957).

The lesions in the present case are examples of the acquired variety. These were probably first described by Rokitansky (1838, quoted by Schwalbe 1912),

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who regarded them as retention cysts of mucous glands. The only series of cases published is that of MacKinnon (1953), who described ten. In three of these there were two cysts, bearing the same relationship to each other as those in the present case, while in the remainder the lesions were single. The cysts varied from 0·5 to 3 cm. in diameter, and all were attached to the right postero-lateral border of the trachea, with which they communicated by a fine opening situated at the junction of the cartilaginous rings and the membranous part. The upper border of the cysts lay just below the lower pole of the thyroid gland in all but one instance where the lower border was 2 cm. above the tracheal bifurcation. In most cases a vertical series of small openings, which histologically were the dilated ducts of mucous glands, was present on the right side of the trachea above and below the orifices of the cysts. The cysts were either unilocular or multilocular, and histologically all were similar in having a stratified ciliated columnar lining, and a wall of fibrous tissue from which cartilage and muscle were absent. A chronic inflammatory infiltration was present in all, and mucous glands were found in the wall in two cases. In this series seven were male, mostly in the older age groups, and all but one had a history of a chronic cough. The exception was a man of 32 with rheumatic valvular disease, who differed also from the others in that the cyst was close to the tracheal bifurcation. MacKinnon considered the diverticula in his series to be acquired lesions, and agreed with Rokitansky's view that they arose by cystic dilatation of the ducts of mucous glands. He thought the earliest stage to consist in dilatation of the ducts with hyperplasia of the glands, which was followed by further cystic distension of the ducts with associated atrophy of the glands, there finally remaining a simple epithelium-lined fibrous-walled cyst.

An alternative explanation for their origin was put forward by Przewoski (1898 quoted by Mathey and Lemoine 1954) who, while accepting their acquired nature, suggested that they were pulsion diverticula resulting from degeneration of the elastic and muscle fibres of the posterior tracheal wall.

MacKinnon's principal reason for believing that the cysts were derived from mucous glands was that he found dilated gland ducts in other parts of the trachea, and assumed that these were the earlier stages in the formation of the cystic lesions. This, however, is purely speculative. The usual cause of distension of a duct system is obstruction of its outlet, but with continuing secretion by its glandular cells. The cysts in question do not give the impression histologically that this is their mode of formation, since there is no obstruction of their outlet or evidence or retained secretion, and since the mucosa is healthy, unlike the flattened, atrophic lining usually found in cysts formed in this manner. Moreover, hyperplasia of tracheal glands with dilatation of their ducts is the rule in chronic bronchitis. The incidence of acquired diverticula is difficult to assess. Very few cases have been reported, but on the other hand eight of MacKinnon's cases when the lesions were being specifically sought, were found in 867 consecutive necropsies. Nevertheless, in view of the high incidence of chronic bronchitis it seems probable that some other mechanism must be operative in the production of the diverticula. A herniation of the tracheal mucosa through a congenital or acquired defect in the tracheal wall seems a more likely explanation of the histological appearances of these lesions. Miller

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(1913) described the trachealis muscle as being composed of transverse bands between which there are relatively amuscular areas which might serve as the site of election for diverticula. The spasmodically high intra-tracheal pressure of a chronic cough might then serve to expose a congenital weakness, or on the other hand the changes of chronic bronchitis might lead to degeneration of the elastic tissue of the tracheal wall. The restriction of acquired diverticula to the right side of the trachea is probably explained by the fact that the œsophagus deviates slightly to the left and thus leaves the right edge of the membranous trachea relatively unsupported. Whatever their mode of production, their acquired nature is suggested by their being found for the most part in elderly men with a chronic cough. The patient in the present case had had a cough for 30 years.

To be distinguished from the lesions already described, on grounds of both ætiology and structure, are those whose congenital nature is undoubted. These were first described by Chiari (1889) in a series of five cases. They too are found on the right side of the trachea and also open into the lumen at the junction of cartilaginous and membranous parts, but often nearer the bifurcation. They are found at all ages and are more common in males. Their principal histological difference from the acquired diverticula is the presence in their wall of cartilage and muscle. Their pathogenesis is in an aberration of that process of tracheal budding in the early embryo which gives rise to the right eparterial bronchus. In its more developed forms the abnormal bud becomes a tracheal bronchus or supplies an accessory lung, but if the process is abortive a diverticulum of the trachea results. If the abnormal bud ends blindly and loses its connection with the trachea, there may result a mediastinal bronchial cyst, also found on the right side, as described by Laippley (1945). Developmental abnormalities of the bones of the thorax or of the great vessels may be associated with congenital tracheal diverticula.

Summary

The gross and microscopic appearances of two tracheal diverticula, found incidentially at necropsy in a man of 55, are described. A distinction is drawn between acquired and congenital diverticula, and the pathogenesis of each discussed. The lesions in the present case are considered to be of the acquired type.

Acknowledgements

I wish to thank Miss Anne Harrison for the histological preparations and Mr. David Andrews for the photographs.

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