THE "FLOWERS" IN BRONCHOGRAPHY

BY

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For many years we have made an extensive bronchographic study of asthma in Groningen. The first results were published by Israels in 1952 and by Israels, Orie, Geelen, Warringa, and Huizinga in 1955. We described seven abnormalities: (1) Spasm (or swelling of the mucosa, which gives the same picture); (2) "flowers"; (3) segmentation; (4) naked filled bronchi; (5) "fringe" (dilatation of the mucous glands); (6) "broken bronchi"; and (7) bronchiectasis. The first three pictures are typical for asthma, the last three for chronic bronchitis. Most of these appearances are now generally recognized, though perhaps the "flowers" are an exception.

Fig. 1 is a good example of this anomaly. This bronchogram is from a patient, aged 38, who had suffered from severe attacks of asthma from 2 to 16 years of age, and in more recent years he had had some slight dyspnoea. The vital capacity was 2,820 ml. (normal ± 4 l.): after the administration of 0.3 ml. 1% adrenaline it rose to 3,074 ml. (+9%), and after 0.02 mg. histamine it fell to 2,480 ml. (–12%). The diagnosis of asthma can be made from this bronchogram, which shows a characteristic picture. The bronchi to both lower lobes show some spasm, but the most striking anomalies are the woolly opacities bilaterally. These shadows are not homogeneous but are more granular and irregular. They are not the result of filling of a dilated bronchus or of a cavity in the lung, but are formed by the superimposition of a number of smaller shadows.

When we called this picture the "flowers" at Groningen, we did not realize that it had already been described several times in the literature, originally by Sparks and Wood (1932). No radiographs were reproduced in their paper, but the drawings distinctly resemble "flowers." In subsequent papers the radiographic appearances show a close similarity to the "flowers" of our patients. The remarkable thing, and this emphasizes the characteristic feature of the picture, is that many authors have independently described this anomaly in botanical terms. Reid

(1955) has done splendid work on this subject and has focused attention on it, as have Simon and Galbraith (1953). Kerley (1936) mentions a "vine tree appearance," Drouet, Herbeuval, and Faivre (1949) and Scarinci (1950) write of "brin de muguet" ("lily of the valley"), and English authors describe "mimosa blossom." The botanical appearance has been stressed in different terms and therefore we repeat our suggestion that the anomaly should be called a "flower," which seems to us a good compromise.

English authors have recently studied the bronchography of chronic bronchitis, especially the abnormalities found at the periphery, and in many patients "pools" are described. Reid proved, by a careful macroscopic and microscopic study of injected specimens obtained at necropsy or operation, that "pools" are caused by dilatation of a bronchiole, the diameter of which is less than 1 mm., and which is usually obliterated beyond the pool. Literature on the subject is still scarce, as it is with regard to "flowers": we could find no report of a patient in whom a histological examination had been carried out as a result of

FIG. 1.—Typical "flowers."

a bronchogram made during life. This investigation was done in the patient whose case report follows.

CASE REPORT

A man, aged 38, had been suffering for years from chronic bronchial asthma. Vital capacity was 5,460 ml. and one-second value 33%; after the administration of isoprenaline the readings were 5,400 ml. and 41%. On the chest film a clearly outlined shadow could be seen below and external to the left hilum (Fig. 2). On the lateral view the shadow appeared to be below and in front of the hilum (Fig. 3).

Tests for tubercle bacilli and tumour cells were repeatedly negative, though with lipiodol bronchography the diagnosis of carcinoma seemed likely, since on the left-hand side of Figs. 2 and 3 there appeared to be occlusion of the lingular bronchus. This failure to fill is a typical example of a bronchus missing on the bronchogram and is the same abnormality as was seen in our first patient. This was seen in the

FIG. 2.—Dorsoventral bronchogram left side.

FIG. 3.—Lateral bronchogram left side.

upper and lower lobes of the left lung (Figs. 2 and 3), but was more obvious in the right upper lobe (see the oblique bronchogram, Fig. 4). There were many small and some large shadows diffusely scattered in the lung. These were not as large as in our first patient, but showed the same characteristics in that they were not homogeneous, were more granular, and had an irregular border.

Bronchoscopy did not produce anything unexpected, and at operation a solid tumour was found in the lingula. The left upper lobe was removed, and microscopic examination confirmed a carcinoma in the lingula. The patient made a good recovery.

Examination of the left upper lobe (Dr. P. de Baan) was reported on as follows: "There is slight general alveolar emphysema. At about 1.5 cm. from the surface there are a number of small vesicles in the lung parenchyma with an average diameter of 2 to 3 cm. These foci of localized emphysema seem to have a smooth wall.

Histology shows slight chronic inflammation of the bronchi and the large bronchioles. There is hypertrophy of the mucous glands with an excessive

FIG. 4.—Oblique bronchogram right side. Typical "flowers" right upper lobe.

amount of mucus and dilatation of some excretory ducts. There is also some infiltration with round cells and moderate fibrosis of the tunica propria. In the terminal bronchioles and the respiratory bronchioles there is some fibrosis of the wall without any distinct cellular inflammation. The vesicles seen macroscopically correspond with dilatation of the terminal and occasionally the respiratory bronchioles, which we can call bronchiectatic emphysema (Fig. 5). The walls of these bronchioles show all the above-mentioned increases of connective tissue. The bronchi and bronchioli proximal to the lesions show no obvious narrowing. The remaining lung tissue is normal."

DISCUSSION

The dilatation of the terminal and respiratory bronchioles does not satisfactorily explain the bronchographic appearances. Filling of these dilatations with contrast medium should produce small round shadows closely resembling "pools."

FIG. 5.—Dilatation of the terminal bronchioles, $\times 20$.

However, a few of these dilatations must have been filled, because on the lateral bronchogram (Fig. 3) in the upper as well as the lower lobe some smaller round shadows with a smooth border are visible, which give the impression of a filling of one cavity. These small round shadows have the same diameter as the dilatations which were found on microscopical examination. One could call them "pools," though they are more peripheral than those found by Reid. However, the "flowers" cannot be explained by the filling of these dilatations.

There is a great difference between a "pool" and a "flower." Though we admire the work of Reid (1955), we cannot agree with her when she writes: "The lily of the valley appearance is probably what has been described here as 'pools.'" The "lilies of the valley" are, like the "mimosa blossoms," identical with "flowers." They are different from the "pools" which Reid has also described and which she found more proximal in a small bronchiole. Leopold and Seal (1961) described a case with pools evidently in the lung tissue, since on microscopy centrilobular emphysematous spaces were found. When

dilatations or small cavities are present and when they are filled during bronchography, we get a picture of a "pool," which looks like a berry on a stem, as can be seen in some places in Fig. 3. It is one outlined shadow, in cross-section 3 to 5 mm., and is "spherical, lobulated, or sausage-shaped, and the edge is always smooth." The "flower" is larger, 0.5 to 2 cm. in cross-section, spotty in appearance, and has an irregular edge or border because the "flower" is made by several smaller shadows. The reason why "flowers" are so conspicuous in typical cases is because they show up sharply against the rest of the lung where there is no peripheral filling.

We have studied the bronchograms of many hundreds of patients with asthma and chronic bronchitis and have seen numerous examples of "flowers," though seldom a single "pool." This does not seem to be the case in England, and it is not easy to account for this geographical difference.

The circumscribed filling of the periphery in the "flowers" can be related to respiration. We know with certainty that, although the large bronchi are mainly filled by gravity, the peripheral filling is chiefly brought about by the suction power of inspiration. It is known that this is poor in patients with emphysema and may vary considerably in different parts of the lung, so giving rise to an unequal distribution of the contrast medium. This association with emphysema has been found in our patients and is described by O'Donoghue (1938), who writes of emphysema as having an "irregular and scattered distribution of the oil-filled alveoli." Kerley (1936) and Drouet *et al.* (1949) also described the "flowers" in cases of emphysema. Di Rienzo (1949) described areas of "foliage" (the same as our acinous filling), which were irregular or dense, or scarce, or were even devoid of foliage, which indicated emphysema. One only has to look at his book (Figs. 204 and 205) to see typical examples of bronchograms showing "flowers" in emphysema. Di Rienzo assumed that only the most diseased parts of the lung were not filled with contrast medium. Theoretically, this seems very plausible to us; it can only be confirmed by further microscopical examination of material obtained at operation or necropsy.

The English authors have devoted special attention to "pools." Reid states that these anomalies in the filling of the periphery of the lung are important and indicative of "serious and scattered disease in the lung." Simon and Galbraith (1953) observed that in a series of patients with chronic bronchitis the dyspnoea was

more severe if "pools" could be seen on the bronchogram, and so they have a highly functional meaning. The same may be said of "flowers": they, too, may point to a "serious and scattered disease in the lung."

According to Israels (1952), "flowers" are dependent not so much on bronchitis as on allergic asthma, and he made a detailed allergic investigation, which is apparently not done in England. Chronic bronchitis is continually mentioned by English authors, but many assume that it arises on the basis of allergy; this is not always easy to decide in practice. Our patients with "flowers" nearly always have a long previous history of emphysema.

Some of our earlier work may explain how "flowers" arise. In experiments on human lungs with filling of the acini of a circumscribed part of the lung, Huizinga (1936) found a pattern with a close resemblance to "flowers." Reid (1955) has since drawn attention to this resemblance and noticed that "the pattern is coarser." This is undoubtedly true for some of the "flowers," but, from several of our own cases and from the pictures in the literature, we have the impression that this pattern of coarseness may be variable. What seems more important, and what is characteristic of the "flowers," is an irregular division of the contrast medium at the periphery, which is presumably due to unequal ventilation.

SUMMARY

The left upper lobe was removed from a patient with lung carcinoma, in whom at bronchography a characteristic pattern was found, known in the Netherlands as "flowers." This is usually described in other countries in botanical terms such as "lily of the valley" or "mimosa blossom." In our patient the histology showed slight emphysema and a dilatation of terminal and respiratory bronchioles. References in the literature to "flowers" and "pools" and the correlation with lung pathology are discussed.

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