LOCALIZED EMPHYSEMA AS A SIGN OF INCOMPLETE BRONCHIAL OBSTRUCTION

BY

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(WITH SPECIAL PLATE)

Physical examination of the chest has recently tended to recede in importance: the auxiliary methods of investigation are so helpful, and in many cases so conclusive, that it seems almost a waste of time to expend effort in elaborating and in attempting to interpret physical signs. It must be admitted that if, for instance, the value of physical examination is compared with that of radiography in the average case of lung disease, physical examination yields decidedly less accurate information. The plain radiograph cannot, however, give much information as to the state of the bronchi in cases of early bronchial disease unless secondary changes have already occurred in the lungs; and careful consideration of the physical signs may draw attention to a lesion which might be overlooked if too much reliance were placed on the film alone.

Types of Bronchial Obstruction

Bronchial obstruction has been much studied of late years, and the information thus gained has led to radical revision of views once held to be well established. A comparatively large area of the bronchial tract is now open to direct inspection, and even deeper parts of the bronchial tree can be accurately outlined by means of lipiodol. Chevalier Jackson (1934) has described three chief types of bronchial obstruction. The first, which he terms "bypass valve," is the result of a partial obstruction which allows air to enter and to leave the bronchus, and which therefore does not cause either emphysema or collapse. The chief sign is a wheeze that is audible when the patient has his mouth open. The second, termed "check-valve," is the one illustrated by this series of cases. The lumen of the bronchus enlarges on inspiration, admitting air, but it decreases on expiration and refuses exit to the air, which gradually accumulates in the affected part of the lung and causes localized emphysema. The third type, the "stop-valve," is the reverse of the check-valve and is the one usually recognized clinically. In this type air cannot get into the lobe supplied by the obstructed bronchus, while it might or might not be able to escape, with the result that air is absorbed from the alveoli, with resulting collapse of the lobe. As partial bronchial obstruction, with consequent emphysema, must be a common precursor of complete obstruction with massive collapse of the lung, it seems to follow that realization of the significance of the signs of obstructive emphysema must lead to the earlier recognition of local disease in a bronchus.

Causal Conditions

The conditions which give rise to obstructive emphysema are foreign body, tumour, and accumulated secretion. The physical signs are those of emphysema in general, poor movement, resonant percussion note, and weak or absent air entry; but they are localized to one side, or even to one part of the lung. When a complete lung is involved the affected part of the chest may be expanded as compared with the sound side. It usually moves much less. The heart is commonly in its usual position when the condition

is localized, but in extreme cases it may be shifted towards the sound side (Plate, Fig. 1). The percussion note may correspond with that of the sound side, or it may be hyper-resonant: this increased resonance may on occasion be found over the whole of one side of the chest. The breath sounds are weak and frequently are absent; this is the most significant physical sign of all.

It will be seen that these physical signs are precisely similar to those which may be found when a pneumothorax is present, and a not uncommon clinical diagnosis is spontaneous pneumothorax. It may be quite impossible to differentiate the two conditions clinically when the signs are extensive, but a positive coin sound would be conclusive evidence in favour of pneumothorax and against localized emphysema. The only certain method of distinguishing the two conditions is by means of skiagrams, which must always be taken when physical signs of this sort are detected.

The cardinal signs of obstructive emphysema on the skiagram are: (1) greater transparency of the lung field on the affected side; (2) there may be displacement of the heart towards the free side; (3) it may be noted on screening that the displacement of the heart varies with respiration; and (4) the dome of the diaphragm on the affected side may be depressed and flattened, and on screening its excursion may be found to be limited. The signs of emphysema are most obvious at the end of expiration, and in all cases of doubt a film should be exposed at this phase.

The following six cases are described to illustrate the types of condition in which localized emphysema may be found. In most of these cases a clinical diagnosis of spontaneous pneumothorax was made, and the correct diagnosis of localized emphysema was reached on further investigation. The cases may be divided into two groups. The first consists of those in which the emphysema is transient and commonly resolves spontaneously, the condition apparently being due to a temporary obstruction of a bronchus by a plug of mucus or muco-pus. It may happen, however, that this obstruction becomes complete, and massive collapse of the lung may result in cases of bronchitis and asthma, as previously described by me (Maxwell, 1937), or following major operations, as in the condition termed "post-operative massive collapse of the lung." The second group consists of cases in which the obstruction is permanent, the usual cause being a tumour. In this latter group the emphysema is nearly always a temporary event and proves to be the precursor of massive collapse of the lung. There is a third group in which an identical state results from the inhalation of a foreign body; but no cases of this type are included in this series, and reference may be made to Jackson's work, already quoted, for full details.

Case I

A female child aged 2½ was taken ill suddenly on the night of August 3, 1937, with fever, cough, and dyspnoea. On the following morning her breathing was much easier, but the temperature was raised and continued so for three days. The illness then seemed to have passed off, but the irritative cough persisted. No sputum and no haemoptysis were seen at any time. The attacks of coughing were quite severe and often caused her to wake at night; they also occurred regularly every morning on waking. She had not been heard to whoop and there was no vomiting.

The child was brought to the out-patient department of St. Bartholomew's Hospital on September 29, 1937, and was found to be well developed. She was in no distress and seemed quite comfortable whether sitting up or lying down,

but there was slight cyanosis. Inspection of the chest showed a few dilated veins in front and it was noticed that the left side was not moving so well as the other; the heart and trachea were displaced to the right. The percussion note was slightly higher in pitch, but very resonant over the whole of the left side. Loud puerile breath sounds were heard over the whole of the right side of the chest, but on the left side there were no breath sounds at all from the apex to the base. The coin sound could not be elicited. On examination of the abdomen the tip of the spleen could be felt two fingerbreadths below the costal margin. There were no other abnormal findings.

On consideration of the physical signs it seemed almost certain that the condition was a spontaneous pneumothorax. A radiograph, however, showed that the left lung was in a state of extreme emphysema (Fig. 1). The reason for this was not at all apparent on the film, so admission was advised.

The patient was admitted on October 7, when her condition was unchanged. There was no fever, but the respirations were raised, averaging 30 per minute. The radiograph was repeated on October 11. The report stated: "The appearances still favour an intermittent obstruction in the left main bronchus, allowing air to enter the left lung but not to pass out. ? foreign body in left main bronchus." On October 12 the temperature rose to 101° for a few hours and there was slight exacerbation of cough, but nothing was coughed out of the bronchus.

At this stage the opinion was that there must be a foreign body in the left main bronchus, so bronchoscopy was advised. It so happened that on October 14, before this could be done, the physical signs changed completely. It was found that within a few hours the left side of the chest had begun to move quite well, the trachea returned to the middle line, the apex beat could be determined in its normal situation, and the breath sounds were good and equal on both sides of the chest. A radiograph taken on October 16 showed a complete return to normal (Fig. 2).

At no time was there any evidence that the child had coughed up a foreign body, and the only possible conclusion appeared to be that there had been an obstruction of the left main bronchus which had spontaneously resolved. The only material that could have caused such an obstruction appeared to have been mucus. In a way it was unfortunate that the change in the physical signs occurred on the day before the bronchoscopy was planned, for final proof of the nature of the obstruction was not obtained.

Case II

A woman aged 38 came to the out-patient department of the Royal Chest Hospital on February 27, 1934, complaining of pain in the left side of the chest. Two years previously removal of an ovarian cyst had been followed by pneumonia and pleurisy on the left side. Six months later she developed bronchitis, with shortness of breath, loss of voice, and much sputum. The bronchitis had persisted since that time. She had never coughed blood, but had lost a stone in weight during the previous two years. On examination it was noted that the left side of the chest was not moving at all well, the percussion note was hyperresonant, and there was slight weakening of the breath sounds over the upper lobe but complete absence of breath sounds over the lower lobe.

On the following day she was admitted to hospital for observation. The physical signs persisted unchanged, and a radiograph taken on March 6 showed emphysema of the left lower lobe (Fig. 3). A lipiodol examination was attempted on two occasions, but was unsuccessful on account of intense laryngeal spasm. A bronchoscopy was therefore performed, and a plug of mucus was seen which almost entirely obstructed the left main bronchus. This mucus was removed so far as possible. The physical signs remained unchanged during the next three days, but after this the breath sounds gradually improved until they were practically equal on the two sides. The patient has been under observation for the past five years, and she has followed the same course as the average patient with secondary asthma. In November, 1934, she had a similar

attack, with identical physical signs, and gelatinous masses of mucus were again removed through the bronchoscope. On this occasion a successful attempt was made to introduce lipiodol (Fig. 4), and it could be seen that the larger bronchi in the left lower lobe were a little dilated and that the oil did not enter the smaller bronchi at all. It would appear that the obstruction was not confined to a single part of a large bronchus, but that a considerable area of the bronchial tree was affected either by catarrhal swelling of the mucous membrane or by an extensive layer of mucus. In either case the obstruction would have the same effect on the lung.

Case III

A man aged 30 came to the out-patient department of the Royal Chest Hospital on April 22, 1935. He had been quite well until three weeks previously, when he experienced sudden pain in the left side of the chest. He became short of breath, but did not have any cough or sputum at that time. A few days later he was noted to have a slight irritative cough, but there was still no sputum. On examination he appeared to be toxic and had a temperature of 100.2°. The left side was moving distinctly less than the right, the percussion note was equal on the two sides, but there were no breath sounds over the left upper lobe. A diagnosis of spontaneous pneumothorax was made, but the radiograph showed increased translucency in the left upper half of the chest, with lung markings extending to the periphery. In view of these findings the original clinical diagnosis was obviously untenable, and that of obstructive emphysema was substituted. The desirability of bronchoscopy was considered, but it so happened that within the next four days, and before a decision had been reached, the physical signs disappeared fairly quickly and the chest became normal. A radiograph taken on May 9 showed equal translucency on the two sides. From the history it was elicited that this patient had had pneumonia at the age of 6 and had suffered from a mild degree of catarrh since that time. In the light of the experience gained from the other cases in this series there would seem to be no doubt that a temporary obstruction due to mucus was responsible for the physical signs.

Case IV

A woman aged 50 attended the out-patient department of St. Bartholomew's Hospital on June 10, 1931, complaining of pain in the left side of the chest, weakness, and loss of weight. She had been in her usual health until December, 1930, when a cough began, with a considerable quantity of yellow sputum. The cough was not severe, and it had almost disappeared in the next four months. In March, 1931, she experienced stabbing pain in the left side of the chest which was increased by taking food; there was gradually increasing dysphagia.

On examination she was pale and thin. The signs in the chest were not regarded as being conclusive, but the left side was moving poorly and the percussion note was unduly resonant over the upper lobe and impaired at the base; the breath sounds were weak over the whole of that side. The mediastinum was not displaced at this time. A skiagram taken on the same day showed a mass in the left hilum and veiling of the left lower lobe; the increased translucency of the left upper lobe, due to emphysema, was very apparent. The patient entered hospital on July 15, by which time the physical signs were entirely altered, being now the classical signs of complete collapse of the left lung. It was established that the collapse was due to a carcinoma in the lumen of the left main bronchus.

Case V

The patient, a man aged 64, was seen in consultation on February 28, 1939. He had suffered from winter bronchitis for some years and had been treated with an autogenous vaccine. After one of his usual injections in the middle of February he experienced a rigor and the temperature was raised for two days. One week later he had a further injection of vaccine, after which the temperature remained persistently raised, reaching 102°. There was an irritating cough with practically no sputum; he had not coughed any blood.

On examination on the morning of February 28 he was stated to have signs of either consolidation or fluid at the left base, but the breath sounds in the two upper lobes were equal. In the late afternoon of the same day it was found that the left side was not moving; the percussion note was hyperresonant over the left upper lobe, but there were no breath sounds. At the base the percussion note was much impaired and there was bronchial breathing. In view of the apparent change in the physical signs over the upper lobe it was felt that the patient might have developed a spontaneous pneumothorax during the day. The condition in this case might have been a hydropneumothorax or pyopneumothorax, but a succussion splash could not be obtained. The chest was explored with a needle, and a very little turbid fluid was obtained; this contained polymorphs, but remained sterile on culture. The opinion at the time was that the patient had an acute inflammation in the left lower lobe—a pleural reaction surrounding the inflamed part—and that a spontaneous pneumothorax had occurred above the diseased area. A skiagram taken on the following day showed translucency of the upper lobe, but the markings extended to the periphery. There was therefore no pneumothorax, but a condition of emphysema in the upper lobe. In view of this finding it was thought that there must be some obstruction in the bronchus. While this obstruction might be mucus, it was possible that it might be a tumour. Bronchoscopy was advised; this was later carried out at the Radcliffe Infirmary, where a bronchial carcinoma was found.

This case illustrates very well the fact that an apparent pneumonia in an elderly man should not be accepted at its face value. In a considerable proportion of cases of this type the inflammation is found to have occurred in the region of a previously unsuspected growth.

Case VI

A man aged 44 was referred to the out-patient department of St. Bartholomew's Hospital on May 10, 1939, complaining of shortness of breath and pain in the chest. He had been perfectly well until six weeks previously, when he had a sudden attack of "indigestion," which consisted of pain under the heart and much wind. The pain continued, but the indigestion improved. There was practically no cough or sputum, but he had recently coughed up an occasional streak of blood. On physical examination it was found that the left chest was not moving well, the percussion note was a little more resonant on the left than on the right, but no breath sounds were heard on the left side. The mediastinum was not displaced. The sudden onset of symptoms made it appear probable that the patient had had a spontaneous pneumothorax, and, with this provisional diagnosis, he was radiographed. The film showed that the left lung was somewhat more translucent than normal, and that the lung markings extended to the periphery. A small circumscribed mass was apparent in the left hilum. In view of this finding the patient was advised to come into hospital. He was not admitted until May 29, and during the interval he developed severe pain in the back and across the shoulders, but there were no other respiratory symptoms. It was considered that this new pain, which had the characters of a root pain, was due to a secondary deposit in the spine.

On examination it was apparent that a change had occurred in the chest. The left lower ribs were immobile, the heart had moved a little towards the left, the percussion note at the left base was slightly impaired, and the breath sounds were weak in this area. A skiagram taken on the following day showed that the heart was considerably displaced to the left and there was collapse of the left lower lobe. The appearances in the upper mediastinum on the right side were suggestive of glandular enlargement. Bronchoscopy revealed a carcinoma at the bifurcation of the left main bronchus.

Discussion

It is apparent that obstructive emphysema can at least be suspected from a consideration of the physical signs in the chest. The signs, however, closely simulate those of

pneumothorax, and it is therefore not possible to be certain of the diagnosis without seeing the x-ray film. On the other hand, the film alone sometimes shows comparatively slight evidence of emphysema, and it would be possible to overlook the condition unless the physical signs and the radiographic appearances were considered together. As this type of emphysema is an early event in certain cases of organic bronchial disease it follows that the ability to recognize the presence of obstructive emphysema is likely to draw attention to an underlying lesion earlier than would otherwise be the case.

The early diagnosis of malignant disease of the bronchus is obviously important if the promising results obtained from surgery are to be improved upon, and therefore the detection of obstructive emphysema should lead at once to the consideration of bronchoscopy and lipiodol bronchography as additional diagnostic measures. The group of cases in which obstructive emphysema occurs as the result of partial blockage of a large bronchus by a plug of mucus or muco-pus is fairly common and is of considerable clinical importance. Massive collapse of the lung has been reported in cases of bronchitis and asthma (Maxwell, 1937), and massive collapse of the lung which follows major surgery is a well-known and troublesome complication, especially of abdominal operations. It is thought that the collapse in these cases is due to an obstructive plug of mucus, and this view can be held to be well established. It will, however, be seen from the records of the first three cases in this series that there must often be a stage of obstructive emphysema as a precursor to the final state of collapse. In many of these cases the plug is probably localized, but a study of Case II and of Figs. 3 and 4 suggests that obstructive emphysema, and consequent massive collapse, may be due to extensive exudation of mucus throughout a considerable region of the bronchial tree. The early recognition of the signs of obstructive emphysema, where the obstruction is due to mucus, should suggest the adoption of immediate measures to relieve the obstruction in the bronchus before it becomes fully established. Such measures as the administration of carbon dioxide are much more likely to be useful at this stage than when the lung has completely collapsed. The physical signs of obstructive emphysema should be looked for carefully in every case in which there is the slightest respiratory distress following a major operation, for in this way many cases of threatened massive collapse could probably be averted.

REFERENCES

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Maxwell, J. (1937). *St. Bart's Hosp. Rep.*, 70, 183.

The committee on workers' holidays set up by the Industrial Welfare Society, under the chairmanship of Lord Amulree, having considered the desirability of encouraging holidays in wartime, has come to the following conclusions: That an annual holiday contributes to the workpeople's happiness, health, and efficiency. That if the workers are to meet the demands for wartime production without undue strain a holiday, except in sudden or grave emergency, is more vital than in peacetime. That, owing to the use of normal holiday accommodation for various wartime purposes, and the limitation on transport by road and rail, it is essential that holidays should be spread over the months of May to October if beneficial holidays are to be enjoyed. The committee therefore appeals to local authorities, to employers and their representatives, to workpeople and their representatives, in the industrial districts, to arrange meetings at an early date to discuss local arrangements for bringing about a spread-over of the holiday period.

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FIG. 1.—Gross emphysema of left lung with displacement of mediastinum to the right.

FIG. 2.—Return to normal of left lung; no evidence of disease in the chest.

FIG. 3.—Emphysema of the left lower lobe; obstruction due to mucus.

FIG. 4.—Lipiodol filling, showing that the bronchial obstruction appears to be diffuse rather than local.