gress to the point of abscess formation he would have had the condition known as Bezold's abscess, which appears actually in the upper part of the neck.

Another variety which is not infrequently encountered is the zygomatic mastoid. The mastoid air cells are prolonged to a greater or less degree into the zygoma, and may extend actually in front of the ear. In such cases the suppuration is superficial and the condition easily diagnosed, but in those cases where the zygoma alone is affected a pre-auricular abscess may be confusing if the possibility of a mastoiditis is not borne in mind. The treatment differs only in that the incision must be prolonged above and in front of the ear, and care must be taken not to enter the temporo-mandibular joint.

CASE V

I was asked to see a boy at Wisbech who, after several months' otorrhoea, developed a painless fluctuating swelling behind the ear. I opened his mastoid and found the whole bone was excavated by the disease to such an extent that all I had to do was to round off a few corners and establish a drainage down to all the important structures. This case illustrates very well the quiet necrosis which sometimes takes the place of the most commonly occurring acute osteomyelitis.

CASE VI

The last case is one that is most commonly met with, and approximates most nearly to the so-called normal. The patient was a child—and this group occurs chiefly in children—who had earache following a sore throat. The day before admission to hospital she had a myringotomy, but in spite of adequate drainage the temperature remained up, and there was oedema and tenderness behind the ear. Pus was found immediately beneath the surface, and the operation completed on the usual lines.

DIAGNOSTIC FEATURES

As already stated, it is not possible to make a logical grouping of the various symptoms which may occur in mastoiditis, but it may be helpful to tabulate a few of the points which come out in the above cases, and which may be of assistance in establishing a diagnosis.

(a) It is never too early in the course of an acute otitis media to suspect mastoiditis.

(b) Persistent pyrexia, in spite of adequate drainage of the middle ear, suggests mastoid involvement, and is itself an indication for operation.

(c) Absence of tenderness and signs of inflammation over the mastoid do not negative a diagnosis of mastoiditis.

(d) Involvement of important structures, such as the dura mater and the facial nerve, are often the first indications of mastoiditis, and must be constantly watched for.

(e) To await oedema behind the ear and pushing forward of the auricle is to allow the disease to progress unduly. These signs only indicate that the suppuration has come right through to the periosteum.

(f) Early diagnosis and operation spell less danger and less possibility of continued suppuration later on.

There are many cases sent to hospital wrongly diagnosed as mastoiditis on the strength of oedema and displacement of the auricle, and there are two conditions which commonly give rise to them. The first is inflammation and suppuration in the post-auricular gland, which is usually secondary to scalp infections or pediculi. The absence of otorrhoea or any form of otitis media should give the clue to the correct diagnosis. The second is meatal boil. Boils occur only in the outer hair-bearing area of the meatus, and the lining here is so closely adherent to the underlying cartilage that the pus is always in the early stages under considerable tension and causes excruciating pain. The infection may pass backwards and give rise to oedema and tenderness over the mastoid. The presence of a discharge from the ear further suggests the possibility of mastoiditis. There is no real excuse, however, for an error of diagnosis, as a meatal boil can always be seen on inspection. Even if its core cannot be distinguished the swelling and obstruction to the meatus are beyond anything seen in an acute otitis. The intensity of the pain is also characteristic.

I shall not go into any detail about the operation for acute mastoiditis beyond stressing the importance of a prompt and complete clearance of all infected bone. I also make a point of exposing the lateral sinus and the dura of the middle fossa almost as a routine. There is no doubt that many subsequent radical operations could be avoided, as well as permanent damage to hearing, by a more thorough technique in the operation for the acute condition. One last point. It is frequently necessary to do a second operation at a later stage for the removal of tonsils and adenoids. Even with the mastoid healed, otorrhoea may, and often does persist, and it is essential to remove all the causative infective foci. It would be only a slight exaggeration to say that this measure should be carried out in every case.

SUMMARY

1. Mastoiditis is extremely varied and uncertain in its manifestations.
2. It may appear very early or very late in relation to an otitis media.
3. To await mastoid oedema and displacement of the auricle is unnecessary and harmful to the patient.
4. Complete clearance of all infected bone is essential for permanent cure.
5. Removal of tonsils and adenoids is often necessary at a later stage.

A COMPARATIVE STUDY OF CHEST RADIOGRAMS AND THE MANTOUX TEST IN CHILDREN

BY

DOROTHY J. DOW, M.A., M.B., CH.B.

AND

W. ERNEST LLOYD, M.D., M.R.C.P.

This paper is the third of a series reporting our investigations on the subject of tuberculosis in children. Our first paper¹ dealt with the mortality in the average child population as contrasted with that in contact children; our second paper² compared the incidence of tuberculous infection in these two classes; the present paper is an attempt to estimate the value of radiological examination of the chest in the diagnosis of tuberculosis in childhood.*

Five hundred children up to the age of 15 were included in our present series. They were attending the Brompton Hospital as out-patients, either as contacts and apparently in good health, or as patients with symptoms referable to the respiratory system; thus they are not representative of the general population of that age. No selection of cases was made, all children being included in the order they attended the out-patient department. Each patient was tested with tuberculin by the intracutaneous method of Mantoux, the technique described in our previous paper² being used. We consider that a positive reaction to tuberculin signifies that the child is infected by the tubercle bacillus. It may be argued that, even when a child has been infected the reaction is not necessarily positive—as, for example, in a child suffering from miliary tuberculosis, or recovering from one of the infectious diseases. As all the children were well enough to attend the out-patient department of the hospital, and the previous history was carefully investigated, this does not affect the conclusion drawn from our series. Each child

* The investigation was carried out by means of a grant from the Halley Stewart Trustees to the research department of Brompton Hospital. The radiographs on which it is based were very kindly taken for us in the radiological department of the hospital, but the responsibility for their interpretation rests entirely on a sub-committee of the medical staff, consisting of Drs. G. E. Beaumont, Maurice Davidson, E. Atkin, R. C. Wingfield, and ourselves. It may thus be that in the employment of special terms we have departed from the usage of radiology, but we have endeavoured to define in every case the exact meaning which we attach to such expressions as "infiltration," "fibrosis," and so forth.

was, at the same time, examined radiologically. The radiograms were interpreted according to a scheme in which certain definite criteria were laid down. This scheme is given later in the paper; it will be seen that we have taken certain pathological conditions, and opposite each we have described the appearance which such a condition should show on the radiogram. The radiogram was in each case read quite independently of the tuberculin reaction—in fact, the result of the latter was not then known. We have classified our results according to the relation between the radiogram and the tuberculin reaction, and in this way have tried to ascertain the value and significance in diagnosis of an abnormal radiogram, considered in conjunction with the tuberculin reaction.

X-RAY CRITERIA IN THIS SERIES OF CASES

Pathological Conditions	X-Ray Appearances
A. Abnormal Tracheo-Bronchial Glands:	
1. Enlarged. }	No abnormal shadows seen unless the glands sufficiently large to project beyond normal mediastinal shadow.
2. Caseous. }	
3. Calcified.	Shadows must be (a) sharp in outline, (b) of great density, and usually (c) irregular in shape.
B. In the Lung Parenchyma:	
1. <i>Infiltration</i> .—An invasion of lung parenchyma by any abnormal tissue which alters its structure; the term is not, therefore, limited to infiltration due to tuberculosis.	Normal lung appearance is altered by presence of localized areas of diminished translucency, outlines of which are generally ill defined.
1A. <i>Fibrosis</i> . — Infiltration with fibrous tissue.	Evidence of infiltration is accompanied by definite homolateral visceral displacement.
2.— <i>Healed Primary Focus</i> of tuberculous infection, as described by Ghon ³ and Canti. ⁴	Small calcified focus in lung parenchyma, with or without calcification of corresponding tracheo-bronchial gland (for calcification, see above).
C. Pleura:	
1. <i>Pleural Effusion</i> .	Homogeneous shadow, usually with contralateral cardiac displacement, possibly showing definite margin.
2. <i>Thickened Pleura</i> .	This may appear as (a) homogeneous shadow resembling that seen in pleural effusion, but without contralateral cardiac displacement; (b) obliteration of the costo-phrenic angle; or (c) peaking of diaphragm.

It will be observed from the above table of definitions that we have not attempted to diagnose any infiltration of the lung as being tuberculous, since the term "infiltration" has a wider significance.

RESULTS OF INVESTIGATION

We have referred in the text to any radiogram fulfilling one or more of the above criteria as an abnormal or positive radiogram. Of the 500 children, 285, or 57 per cent., were considered to have a normal radiogram, and 215, or 43 per cent., an abnormal radiogram. The 500 cases were further subdivided into the following four groups, which show the relation of the radiograms to the tuberculin reaction (T.R. in table).

	No. of Cases	Percentage of Total Cases	Percentage of Total Negative Radiograms	Percentage of Total Positive Radiograms
Negative radiogram with negative T.R.	155	33	57.8	—
Negative radiogram with positive T.R.	123	24	42.1	—
Positive radiogram with negative T.R.	90	18	—	41.8
Positive radiogram with positive T.R.	125	25	—	58.1

Age Incidence

Fifty-seven of the children were under 5 years of age, 269 were between 5 and 10 years, and 174 between 10 and 15 years. In these three age groups the number of positive radiograms was respectively 19, or 33.3 per cent., 114, or 42.3 per cent., and 82, or 47.7 per cent. We thus see that abnormal radiograms of the chest in children increase in frequency with the age of the child.

Relation to the Tuberculin Reaction

Two hundred and fifty-five children reacted negatively to tuberculin, and 245 gave a positive reaction. Of the non-reactors, 90, or 35.3 per cent., had an abnormal chest radiogram. Of the reactors, 125, or 51 per cent., had an abnormal radiogram. From these figures it appears that children who react positively to tuberculin show a higher percentage of intrathoracic lesions as seen by the x-ray photograph than do those giving a negative reaction. The lesions seen in the 90, or 35.3 per cent., of the non-reactors are presumably non-tuberculous, while if we assume that the focus of tuberculous infection in children is extrapulmonary in many cases—for example, in glands, cervical or mesenteric, or in bones—it is probable that a large number of the intrathoracic lesions seen radiologically in the 125 children who gave a positive reaction are non-tuberculous also.

Type of Lesion

The lesions found in the 215 positive radiograms are given in the following table:

Type of Lesion	No. of Cases	Percentage of Total Cases	Percentage with Positive Radiograms
Infiltration	100	20.0	46.5
Calcified tracheo-bronchial glands...	51	10.2	23.7
Primary focus of tuberculosis ...	29	4.0	9.3
Fibrosis	30	6.0	13.9
Pleural effusion	11	2.2	5.1
Pleural thickening	3	0.5	1.3

These lesions will now be considered more in detail.

Infiltration.—In 100 of the 215 positive radiograms the lesion present in the chest was an infiltration according to our previous description. The tuberculin reaction was negative in 43 and positive in 57 of these cases. It follows, therefore, that a very large percentage of the infiltrations seen in chest radiograms of children is non-tuberculous. The distribution of the lesions appears to be much the same in children infected with tuberculosis and in children not so infected. In the 43 non-reactors in this group, the lesion was present in the upper zone of the lung in 10, or 23.2 per cent., in the middle zone in 9, or 20.9 per cent., and in the lower zone in 24, or 55.8 per cent. In the 57 reactors the corresponding figures were 15, or 26.3 per cent., 13, or 22.8 per cent., and 29, or 50.8 per cent. It should be noted that the majority of these infiltrations are in the lower zone. Tubercle bacilli were found in the sputum of 9 of these children, and they reacted positively to tuberculin. In all of these cases the upper zone of one or both lungs was affected. We may therefore assume that in children who react to tuberculin the lesion is more likely to be tuberculous when it is situated in the upper zone than when it is confined to the lower.

Calcification.—Of the 215 children who had positive radiograms, 51 were considered to have calcified tracheo-bronchial glands. Of these, 22, or 43 per cent., gave no reaction to tuberculin, while 29, or 57 per cent., gave a positive reaction. In view of the former figure it would appear that our radiological criteria of calcification were not sufficiently strict. McPhedran,⁵ in dealing with calci-

fied tracheo-bronchial glands in children, says that if the tuberculin reaction is negative to 1 in 100 tuberculin, the lesion is probably obsolete. In our opinion cases with definite calcification of the tracheo-bronchial glands do give a positive tuberculin reaction. The explanation of this is that in almost all such instances tuberculous lesions are still present somewhere in the body. That calcification of those glands is more rare than is generally supposed is borne out by some figures kindly supplied to us by Dr. Atkin, pathologist to the Brompton Hospital. In a series of 200 post-mortem examinations in adults, he found obviously calcified tracheo-bronchial glands in only 14, or 7 per cent., calcified mesenteric glands in 42, or 21 per cent., and no calcification in 144, or 72 per cent. One hundred and twenty-four of the 200 were cases of pulmonary tuberculosis, and the corresponding figures were 11, or 8.9 per cent., 32, or 25.8 per cent., and 81, or 65.3 per cent. In the remaining 76 patients, who had suffered from diseases other than pulmonary tuberculosis, the figures were 3, or 3.9 per cent., 10, or 13.1 per cent., and 63, or 82.9 per cent.

Primary Tuberculous Focus.—Twenty of the 215 positive radiograms showed primary foci to be present. Of these, 7, or 35 per cent., did not react to tuberculin, while 13, or 65 per cent., did react. We think that, as in the case of calcified glands, our criteria were not sufficiently strict, although McPhedran⁵ states that "even in the event of large calcified foci, the tuberculin reaction is often negative to 1 in 100 tuberculin."

Fibrosis.—Fibrosis was present in 30 of the 215 positive radiograms. Fourteen, or 47 per cent. of the cases, did not react to tuberculin, while 16, or 53 per cent., gave a positive reaction. The remainder of the 215 positive radiograms consisted of 11 cases of pleural effusion and 3 cases of pleural thickening. Taking these cases together, we found that 10 out of the 14 cases gave a positive tuberculin reaction.

CONCLUSIONS

1. Abnormal radiograms of the chest in children become more frequent as the age of the child increases.
2. Children who react positively to tuberculin show a higher percentage of intrathoracic lesions as seen radiologically than do those who give a negative reaction.
3. Since 35 per cent. of the non-reactors to tuberculin had positive radiograms, the lesions found in these cases are presumably non-tuberculous.
4. In view of conclusion No. 3, it follows that of the 51 per cent. of the reactors who show a positive radiogram, a considerable number must be discounted in estimating the radiological incidence of intrathoracic tuberculous lesions. In other words, in children infected by the tubercle bacillus, intrathoracic tuberculous lesions radiologically demonstrable are very few.
5. A very large number of infiltrations seen in children are non-tuberculous. The distribution of the infiltration appears to be much the same in all children, whether they are infected with the tubercle bacillus or free of infection, a little over 50 per cent. being in the lower zone, and the remaining 50 per cent. being equally distributed in the upper and middle zones of the lung. We suggest that upper zone infiltrations are more likely to be tuberculous than lower zone infiltrations.
6. In view of the fact that 22 of the 51 children who were considered to have radiological evidence of calcified tracheo-bronchial glands did not react to tuberculin, it would appear that our radiological criteria in this respect were not sufficiently strict. In every case where there is any doubt about the presence of calcified glands, an oblique radiogram should be taken, so as to exclude the possibility of mistaking a blood vessel or other structure viewed "end on" as being a calcified nodule.

7. The same conclusion applies to those cases of primary calcified foci in which the tuberculin reaction was negative.

8. Fibrosis appears to be as common in non-reactors as in reactors.

9. Intrathoracic tuberculosis is comparatively uncommon in children under 15.

It would appear that, in attempting to localize the lesion in children who are shown to be tuberculous by a positive Mantoux reaction, the chest radiogram is not so helpful as might have been supposed. The lesions, if glandular, are invisible unless calcified, and Dr. Atkin's figures suggest that the majority of such lesions may be extrathoracic. Further, our experience in this series of cases shows that non-tuberculous infiltration and fibrosis are more common than tuberculous, from which they cannot be differentiated with certainty. Therefore, while the chest radiogram in children is of great clinical value, it has in this respect these definite limitations, and its interpretation in the "Mantoux-positive" child needs the greatest care.

REFERENCES

- ¹ Tuberculosis Mortality in Children. Brompton Hospital Research Department, Report No. 1, 1930.
- ² Incidence of Tuberculous Infection. Report No. 2, *British Medical Journal*, 1931, ii, 183.
- ³ Ghon: *Die Primäre Lungenherd bei der Tuberkulose der Kinder*. (English edition, Barty King, London, 1916.)
- ⁴ Canti: *Quart. Journ. Med.*, October, 1919.
- ⁵ McPhedran, F. M.: *Pulmonary Tuberculosis in Childhood*. Henry L. Phipps Institute Report, 1929, p. 532.

THE TRUE PLACE OF SERUM IN PROPHYLAXIS OF MEASLES

BY

J. I. COLLIER, PH.D., B.Sc.LOND., M.R.C.S.

FORMERLY ASSISTANT CHEMICAL PATHOLOGIST, MIDDLESEX HOSPITAL

Measles, although endemic in this country, tends to assume epidemic proportions every two or three years. The anticipation, according to statistics, of an epidemic of measles in the autumn and winter of 1931-32 has again brought into prominence the serious complications of this illness and the importance of prophylactic treatment. The gravity of this disease is shown in the report of the medical officer of health and school medical officer on the measles epidemic of 1929-30 (London County Council, 1931). During the past four years in London measles has caused eight times as many deaths as scarlet fever, and one and a half times as many as diphtheria. The average death rate from measles is 6 to 10 per cent., depending on the severity of the epidemic.

It is intended here to deal with the possibilities of immunity in the prophylaxis of measles. Opinion has definitely turned to immunity as the method of control of the epidemic of measles, and the consequent reduction in the death rate. Stocks,¹ among others, expressed this view, and stated that the only hope of preventing these epidemics altogether was through the immunity factor, and that we must hope for either a simple method of inoculation which will produce a more or less permanent immunity, or else a simple method of rendering an attack abortive and harmless.

SCOPE OF SERUM PROPHYLAXIS

Both animal serum and that of convalescent measles cases have been used. The animal serum is obtained by injecting goats with a green-producing diplococcus isolated from measles patients and claimed to be the causal organism of the disease. The consistently good results of human serum have overshadowed those of the animal serum. Of the animal serums Tunncliffe's² has been shown to give the best results with a protection of 43 per cent. of cases treated, whereas with human convalescent serum