AN INQUIRY INTO THE CLINICAL AND RADIOLOGICAL DIAGNOSIS OF INTRATHORACIC TUBERCULOSIS IN CHILDREN OF SCHOOL AGE.

(A *Résumé of an Investigation undertaken for the Local Government Board, with Comments.*)

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THE material of this inquiry was formed by 61 children between the ages of 5 and 10 years, nearly all being resident in the district of Bethnal Green. They belonged to three classes, A, B, and C; the first containing children with no known source of tuberculous infection in the house, the second exposed to infection of slight or limited extent, and the third to severe infection, one or both parents having in many cases died from the disease. The nature of the material was not known to the investigators until the end of the inquiry.

Clinical Examination.

A routine examination was made of each case, but only those points which appeared to give profitable results will be referred to here. The cases fell clinically into four groups:—

1. Those without abnormal physical signs.
2. Those with *right-sided paravertebral dullness* (Fig. 1), and in these, nearly always, there exists some general percussion impairment over the upper part or whole of the right side, and a tendency to blowing breath sounds at the apex. There is reason to believe (from unpublished investigations made by one of us) that right-sided paravertebral dullness is generally caused by pressure of enlarged bifurcation glands on the right pulmonary artery.
3. Those with *double paravertebral dullness* (Fig. 2) due to pressure on lines of communication (? branches of pulmonary artery) on both sides.
4. Those with *parasternal dullness* (Fig. 3) due, apparently, to enlargement of tracheo-bronchial glands. Normally, in

in many cases. Group 2 points to bifurcation glands and is often the earliest disease manifestation; Group 3 suggests in addition the involvement of hilum or pulmonary glands; Group 4, disease of tracheo-bronchial glands.

Lung involvement is notoriously difficult to estimate in cases of central disease spreading from hilum glands, as occurs in the case of children. In but few were signs suggestive of lung infiltration discovered, symptoms were ruled out, and there remained only the reflex areas of percussion impairment (Fig. 4) described by one of us² as present in cases of pulmonary tuberculosis for investigation here as evidence of active lung involvement.

Clinical results.—*Class A.*—Of 23 children from healthy households, 12 (52 per cent.) showed abnormal physical signs in the chest. Of these, 7 cases (58.3 per cent.) came into Group 2, 4 cases (33.3 per cent.) into Group 3, and 4 cases (33.3 per cent.) into Group 4. Three cases came into two groups; 8 showed reflex bands of impairment. (Fig. 4.) In one case there were signs suggestive of tuberculous infiltration of the lung.

Classes B and C.—Of 19 cases with a limited household infection, only 4 were free of signs, while of 19 cases with a severe household infection 5 were free of physical signs of disease. The remaining 29 cases of these classes (76 per cent.) showed signs which brought them into the following groups: 17 cases (60 per cent.) into Group 2, 9 cases (31 per cent.) into Group 3, and 7 cases (24 per cent.) into Group 4. Five cases came into two of these groups; 9 showed reflex bands of impairment (Fig. 4) (in 7 cases this sign was not looked for).

Remarks on clinical results.—Though the incidence of abnormal physical signs is much higher (76 per cent.) in Classes B and C than in Class A (52 per cent.), yet this latter is itself so high as to call for special comment. The children came from a poor and crowded neighbourhood (Bethnal Green); among school-children in a healthy northern suburb (less laboriously examined) one of us found only 1.3 per cent. with signs in Group 2, as against 30 per cent. here. Coincidence operating among a small material may help to swell the numbers, since two of the cases in Class A had been former patients under one of us at the City of London Chest Hospital.

Lung involvement.—It was found that the reflex bands of impairment (Fig. 4) suggestive of active lung involvement showed a notably higher incidence in Classes A and B than in C, suggesting that with longer exposure the active processes have time to die down. Blowing breath sounds at one apex were marked in 6 cases, and in 1 were possibly due to active disease, but in the remainder probably to glandular

FIG. 1.

Right-sided paravertebral dullness.

FIG. 2.

Double paravertebral dullness.

FIG. 3.

Parasternal dullness.

children of this age, there exists about 1 cm. of impairment on each side of the sternum. In conditions of disease this is increased to 2 or 3 up to 5 cm., mainly on the left side curiously enough, since the right glands are those most prone to disease. In these cases, as would be expected, the chest veins commonly form a visible network, from pressure on the vena azygos,¹ and sometimes the external jugulars are full from pressure on the superior vena cava. In some cases these latter signs were present without the discovery of any parasternal dullness.

The signs thus gave evidence of three different localisations of disease, though tending, as would be expected, to overlap

enlargement or healed lung infiltration. Râles and crepitations were present in 12 cases, and in many were obviously of bronchitic origin. In a few there were heard showers of fine crackles, superficial-sounding and often fleeting, generally round the nipples or near the lung bases. These seem somewhat characteristic of these cases, but are perhaps of multiple causation, atelectasis, lung cedema, pleurisy, perhaps tissue sounds, and, more rarely, lung infiltration. Enlarged *supra-clavicular glands* were noted in a few cases, and appear to be of some value where found. *Nutrition* was found to be better among the cases without physical signs than in those showing evidence of disease.

¹ Overend: THE LANCET, August 31st, 1901.

² Riviere: THE LANCET, August 21st, 1915, p. 387.

Radiological Examination.

Each case was screened and a radiogram taken in three positions, supine, prone, and in the oblique posture. The appearances of the pulmonary fields were found to fall into four types: (a) the normal with good illumination and clear pulmonary areas; (b) the *cloudy* and indistinct; (c) the *granular*; and (d) the *cloudy and granular*, a combination of (b) and (c). The oblique position was so selected that the space between spine and pericardium just above the diaphragm was of maximal width, with the leaden disc fixed on the fifth spine as near the external margin of the chest as possible.

Radiological diagnosis.—Tracheo-bronchial opacities.—Outside the sternum a shadow occupying the posterior second, third, and fourth intercostal spaces is frequently noticeable. It lies parallel to the sternum, often with a

FIG. 4.

The upper and lower areas of percussion impairment in pulmonary tuberculosis.

sharp straight or slightly curved border, and sometimes shows definite outline of glands within it. For diagnosis its relation to the trachea and right bronchus must be obvious. Occasionally the opacity is as manifest on the ventro-dorsal plate; the oblique radiogram shows these glands to spread forwards as well as laterally. When an opacity is present on the left edge of the sternum it must be distinguished from (a) the bend of the aorta; (b) an enlarged thymus; (c) a dilated left auricle; (d) pulmonary artery; (e) hilum opacities and infiltration.

An increased *hilum opacity* is generally irregular in shape and contains deeper shadows, but its density is commonly less than that of the heart, and is therefore readily separated from it. If enlarged with an appearance of diffuse cloudiness activity is probably present. The external margin of the opacity may not be quite definite, but may fade gradually into the pulmonary field. Often it has a convex border from which lines radiate in a fan-shaped manner towards the clavicle, axilla, lateral walls, and diaphragm. Peribronchial foci may be present close to the circumference of the hilum opacity.

Enlarged bifurcation glands are practically invisible except on the oblique radiogram. In this an opacity is almost invariably present, though of varying dimension. For a positive diagnosis the right and left bronchi must be discernible, the former passing to the left over the spine, the latter to the right through the cardiac shadow, and the gland shadow must lie between. Its intensity and its uniform character or otherwise will determine whether the glands are merely swollen, caseous, calcareous, or shrivelled into a small oval fibroid residue.

Radiological remarks concerning each class.—Of the 23 members of *Class A* only 3 (13 per cent.) could be pronounced normal to the radiological examination. Of the remaining 20, 12 (52 per cent.) showed no signs of activity, but many exhibited marked evidence of old peribronchial infection with conspicuous striation, arrested caseous or calcareous foci, enlarged hilum opacities, with caseating or calcareous tracheo-bronchial and bifurcation opacities. In one case a small—now calcareous—primary focus was obvious in the lower part of the right upper lobe, and in association with it a double calcareous opacity in the lower part of the right tracheo-bronchial shadow. Many of the cases were markedly

granular on the screen, but some illuminated well during inspiration. Eight of the 23 (35 per cent.) showed radiological evidence of activity.

—In *Class B* not one showed an absolutely normal radiogram. Altogether 9 exhibited no signs of activity in the picture, although the pulmonary fields in each of these cases were filled with numerous small foci, producing a finely granular appearance, with an accompanying striation (old and healed peribronchial tuberculosis). The remaining 9 (47 per cent.) revealed on the radiogram signs of activity.

Of the members of *Class C* 6 (31 per cent.) showed signs suggestive of activity to radiological examination; nearly 60 per cent. had for the time successfully arrested the progress of the disease. All these inactive cases showed generally dull and granular fields to the fluoroscopic screen, permeated on the radiogram by disseminated peribronchial tubercle sometimes to the extreme periphery of the lung. Occasionally the deposition was unilateral, and sometimes restricted to one lobe. In 6 cases the question of activity or arrest could not be settled by the methods at our disposal, and these it is proposed to re-examine periodically.

Correlation of Clinical and Radiological Findings.

These were for the most part closely in accord, and may be considered under three headings.

(a) *Glands.*—1. *Tracheo-bronchial.*—Wherever clinical evidence existed of their involvement this was confirmed by the X rays. In a few cases radiograms showed tracheo-bronchial opacity unnoted at the clinical examination, but parasternal dullness was not carefully looked for among the earlier cases examined.

2. *Bifurcation glands.*—These were visible in nearly all cases on the oblique radiogram—evidently a definite degree of enlargement is necessary to produce the characteristic right paravertebral dullness to clinical examination.

3. *Hilum and pulmonary glands.*—The relation of hilum opacities to double paravertebral impairment could not be clearly established.

(b) *Lung.*—In hilum tuberculosis—the common form of dissemination in childhood—the deep areas of lung affected in the early stages lie quite beyond the reach of clinical examination. Only when the process reaches nearly to the surface are stethoscopic signs present, and only when the disease is markedly unilateral does contrast dullness to percussion make itself evident. When disease is active symptoms may indicate hidden lung disease, and the reflex bands of impairment (Fig. 4) may confirm its presence. Where it is arrested clinical signs may entirely fail. It appears to be in these cases of deeply situated disease that the X rays are particularly of value in giving evidence as to its extent and nature. At the same time, school age is admittedly the period of greatest resistance to tuberculous infection, and active pulmonary disease is far less often seen than at ages above and below this period. For this reason many of the appearances noted in our series of cases may be said to fall short of obvious clinical disease as generally understood. In other words, gross evidences of lung disease were for the most part absent.

Evidences of activity.—With a few exceptions the results of physical and radiological examination were, on this point, in accord. It must be noted, however, that no final appeal to symptoms, temperature, or special tests was available in this investigation, and this was admittedly a grave drawback in slight cases which appeared to be on the borderland between activity and arrest.

Comments.

Some general remarks on the significance of the findings of this investigation may not be out of place. For many years the profession has been familiar with the ubiquity of tubercle “infection,” even at school ages, as exemplified in the results of the von Pirquet and intracutaneous tuberculin tests in the hands of Hamburger and the Vienna school, and subsequently confirmed by others for crowded communities generally. These results received pathological support from the well-known figures of Nägeli, and still more from those of Bollinger and Müller, not to speak of more recent contributions. This pathological confirmation served to demonstrate that tubercle “infection” has a physical basis, and depends in truth on actual, though limited, disease, but nevertheless it has still been convenient in practice to maintain a clear distinction between tuberculous “infection” and tuberculous “disease” from the clinical standpoint. The

results of the present research only serve to increase our sense of the high artificiality of this distinction, since they demonstrate that with modern methods of diagnosis signs of disease can be detected in infected children by clinical methods in the majority and in practically all by means of the X rays. Not only, it appears, is tubercle "infection" widespread, as we have long known, but also actual tuberculous disease of a degree that can be detected clinically. This demonstration marks, in truth, neither more nor less than an extension into the clinical field of the pathological evidence cited, and it seems to call for some readjustment of our clinical concepts.

At the time when Hamburger and Monti's well-known figures showed that some 94 per cent. of children at the age of 12 to 14 years were already infected with tubercle there were some who received the fact with scepticism. But among those who accepted its truth there were not wanting persons who took "scare" views of its significance—the widespread infection which it indicated loomed large in their view! Others, with a saner judgment, were more greatly struck with the high resistance to tubercle infection which the new facts undoubtedly revealed. To them the discovery was rather a matter for encouragement than otherwise, and paved the way towards modern views on the valuable immunity which arises from slight infection among civilised communities. The results of the present investigation seem in a sense to confirm and amplify these latter views. Firstly, we cannot but be struck with the power of recovery which must exist in later childhood, since the majority of these children appear to overcome successfully a disease-process of no limited extent. What proportion of them will relapse as cases of phthisis when the limits of childhood are past can only be matter of conjecture. Secondly, it becomes obvious that, at this age period, the presence of certain physical signs and shadows of disease, apart from clear proof of activity, is not in itself evidence of a need for treatment or even, in many cases, for a change to more hygienic surroundings.

We are presented with evidence of infection and truly of something more—of disease which has spread so far as to modify the normal physical signs and the normal X ray picture. Yet these children for the most part may be said to flourish in spite of this, and attend school and enjoy life. Obviously a wide latitude must be allowed in gauging the gravity of these abnormal physical signs; apart from clear evidence of active disease, the need for medical interference must be based on other grounds. These will usually be supplied on the side of symptoms, of which wasting, or persistent malnutrition, is perhaps the commonest. Among an infected child community the weighing machine will probably be found the most practical means of deciding when the danger point has been reached or overstepped. In addition a proportion may reach the physician on account of cough, fever and sweating, chest pains, and the like; no record of symptoms is available, unfortunately, among the cases which were submitted to us for investigation.

At the conclusion we would discount the obvious criticism that proof of the tuberculous nature of the processes giving rise to the physical signs and X ray shadows described is here based on presumptive evidence alone. This must, of course, be admitted—no other evidence, in the nature of things, could be available. But the presumptive evidence is, we think, of a sufficiently sound and ample nature to support the conclusions based upon it, and is, moreover, reinforced by direct evidence from parallel cases known to us, but not coming within the limits of the present investigation.

THE Bishop of Crediton has dedicated a mortuary chapel erected for the South Devon and East Cornwall Hospital. Dr. Trefusis in his address alluded to the keen interest which the late Mr. W. L. Woolcombe had taken in the building, for he had presented the handsome carved oak altar. By Mr. Woolcombe's desire his body rested in the little sanctuary before burial.

THE ROYAL PORTSMOUTH HOSPITAL: TREATMENT OF VENEREAL DISEASE.—The committee of the Royal Portsmouth Hospital have approved of the suggestions of the Local Government Board in reference to the provision at that hospital of facilities for the diagnosis and treatment of venereal diseases, provided that no part of the cost shall fall on the general funds of that institution, and that resort to the facilities for treatment shall be purely voluntary and open to all, irrespective of means or residence.

ENUCLEATION OF THE TONSILS.

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DURING the past months soldiers have been sent back from France or from the various camps in hundreds to have the tonsils removed on account of tonsillitis, quinsy, acute middle-ear suppuration, or rheumatism. In the large majority of cases enucleation of the tonsil or the complete removal of the tonsil with its capsule intact appears to be indicated, and as there have been many questions as to the best method to adopt it seems advisable to review the various operations at our disposal and to try to estimate their degrees of usefulness. It must, however, be stated that these remarks are intended to apply to the more difficult cases in adults and have no reference to the comparatively simple cases in children, where enucleation may be accomplished by almost any method.

There are two main types of operation: (1) Enucleation by dissection; and (2) enucleation with the blunt guillotine; and of these there are very many modifications, which, however, are chiefly dependent on details of technique or on the use of special instruments for their claims to notice.

Enucleation by dissection was until a few years ago practically the only satisfactory operation at our disposal and owes its popularity in this country mainly to the advocacy of Mr. G. E. Waugh and to the simplified technique introduced by him. For its performance two tonsil-holding forceps, a pair of fine rat-toothed forceps, and a pair of blunt-pointed scissors curved on the flat are the only instruments that are necessary. After the mouth has been widely opened with a gag (Doyen's or better still Denham's) and the tongue drawn forwards by means of a silk ligature through its tip, the tonsil is seized with the holding forceps and pulled forcibly inwards towards the mouth and at the same time a little forwards. (Figs. 1 and 2.) The deeper part of the tonsil which lies against the pharyngeal wall is thus made to bulge the anterior pillar of the fauces and to put it on the stretch. A nick is then made in the tightly stretched mucous membrane just behind the point where it is reflected on to the tonsil near the upper pole and the shining white fibrous capsule of the tonsil comes into view.

When this is seen, a blunt instrument is inserted and swept round the outer surface of the tonsil, keeping close to the capsule. (Fig. 3.) If the sweeping movement is first carried upwards over the top of the tonsil and then down

FIG. 1.

The tonsil is grasped by the forceps.

FIG. 2.

The tonsil pulled inwards and forwards, and thus made to bulge the interior faucial pillar.