

digesting fluid. Either artificial gastric juice (Jousset's formula is most satisfactory³) or 20 per cent. antiformin has been employed by me. The former appears to digest more completely. A useful modification is to digest the clot *partially* with antiformin (a 20 per cent. solution for an hour at 37° C. will usually suffice), wash for a few seconds in water, and, finally, tease out on a slide. Various more elaborate methods of examination for tubercle bacilli have been suggested, such as passing the fluid through a collodion filter⁴ or a Chamberland candle, hardening the clot and cutting sections,⁵ or by electrolysis,⁶ but they appear to have no advantage over the ordinary methods.

Cultural examinations for tubercle bacilli in pleural fluids are not very useful and are only occasionally made.⁷ Animal inoculation is probably the most reliable test of all, but unfortunately it cannot be practised in every laboratory, and, moreover, does not yield sufficiently rapid results to satisfy the clinician. The bacterial findings obtained with 25 serous fluids are shown in the following table:—

Method.	No. of cases.	No. of positive findings.	Percentage.
Films made direct from deposit...	7	2	28·6
Teased clot	9	2	22·2
Antiformin	7	2	28·6
Artificial gastric juice	16	4	25·0

Unfortunately, owing to small amounts of material obtained, it was not possible to employ every method in each of the 25 fluids, so that the results are not strictly comparable. Altogether bacilli were found in 10 cases out of the 25—i.e., 40 per cent. Cultures were made on ordinary media (both aerobic and anaerobic) in these cases, but no secondary infections were noted.

B. Purulent Fluids.

Purulent tuberculous pleural fluids are apparently not so common as serous. Seven only were collected, as against 25 serous ones. These 7 were all cases of pyopneumothorax. In the case of pus physical, chemical, and cytological examinations are not so important. The search for the tubercle bacillus, moreover, is easier. Out of these 7 cases bacilli were found in ordinary film preparations (without previous digestion) in 5 instances. In the 2 negative cases repeated examinations on several occasions failed to reveal bacilli in the one instance, whilst in the other a secondary infection with *B. pyocyaneus* took place.

Conclusions.

1. The finding of tubercle bacilli is the only conclusive evidence of tuberculous infection. In this series of cases bacilli were found in 40 per cent. of the serous and 71·43 per cent. of the purulent fluids. Ordinary film preparations are satisfactory in purulent fluids, but in serous more careful measures are often necessary. In large effusions without clot sedimentation and centrifugation of the fluid may be sufficient. When present, the examination of clot offers the best hope of finding bacilli.

2. In serous effusions the next best test is the lymphocyte count. Failing this, the tests in order of value are (a) protein content (usually 4–5 per cent.) and (b) specific gravity (about 1018).

3. Sterility on ordinary culture media is suggestive of tubercle in purulent fluids. It is not of much value in serous exudates, since some other effusions and most transfusions are also sterile.

4. Secondary infection was only noted in one instance.

I am deeply indebted to the members of the hospital staff for placing these puncture fluids at my disposal.

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TUBERCULOUS MENINGITIS (BOVINE INFECTION) IN AN INFANT AGED 12 WEEKS.

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THIS case is of special interest on account of the early age at which the disease occurred and of the type of organism found. While it is recognised that a child may in rare cases be born tuberculous and harbour the tubercle bacillus without any obvious sign of its presence for some time, yet as a clinical fact one does not meet with manifestations of the disease, as a rule, within the first three months of extra-uterine life. But in the present instance there is a difficulty in accepting even this explanation of the case in so far that neither father nor mother presents any suspicion of tuberculosis, and the organism was found to be of the bovine type.

A *résumé* of the case was presented to the Glasgow Medico-Chirurgical Society on Feb. 21st of this year, the facts being as follows:—

The child was delivered with the aid of forceps on Jan. 3rd, 1912, evidently healthy and of average weight. One or two superficial abscesses which developed round the areola of one of the mother's breasts were evacuated and healed rapidly, otherwise the confinement was uneventful. For six weeks the child appeared to thrive, but from about this time he did not progress, and the mother on that account supplemented the breast-feeding with two feeds daily of diluted cow's milk. When he was eight weeks old I was called in because of a cough which had developed. There were a few moist râles in the chest, but these cleared up with simple treatment in a few days and did not recur. The mother had plenty of milk and the feeds of cow's milk were stopped. When 11 weeks old his condition began to give serious concern. He was pale, irritable, and seemed little more than his weight at birth. There was no vomiting and the bowels were regular. On the limbs there was an eruption resembling lichen. Two days later the head became retracted and the child cried most of the day. Kernig's sign was not present. At night he had a convulsion. Next day Dr. Leonard Findlay saw the patient along with me and the following points were agreed upon:—Temperature 97° F., pulse rapid; respirations irregular, being occasionally very fast; no vomiting and motions natural four times daily; pupils equal and active, but squint occasionally present; head retracted, but Kernig's sign absent; abdomen flaccid, no glandular masses felt, but liver slightly and spleen markedly enlarged; child fed with difficulty, but not comatose. Lumbar puncture was performed and some cerebro-spinal fluid was withdrawn. It was fairly clear, flowed easily, but could not be said to be under pressure. By evening the child became stuporose, refused food, and had several general convulsions. On March 26th (next day) the stupor deepened and he died that night barely 12 weeks old.

Permission was granted for a very limited post-mortem examination. The enlarged spleen measuring 4 inches by 2½ inches and riddled with small tubercles was removed, along

³ S. R. Gloyne, THE LANCET, Sept. 21st, 1912, p. 827.

⁴ A. Dumpt, Comptes Rendus de la Société de Biologie, vol. lxxiv., 1913.

⁵ D'Este Emery, Clinical Bacteriology and Hematology.

⁶ C. Russ, THE LANCET, July 3rd, 1909, p. 2.

⁷ Bezançon and Griffon: Comptes Rendus de la Société de Biologie, February, 1899.

with a small piece of the liver which also contained tubercles. The peritoneal coat of the intestines was also partially examined but no tubercles were seen. The cerebro-spinal fluid had been handed to Dr. Carl H. Browning, director of the Clinical Laboratory, Western Infirmary, to be examined for Wassermann reaction and for tubercle bacilli. The former he reported negative, but found abundant tubercle bacilli with an exudate chiefly of polymorphs. Dr. J. Cruickshank, who made further examination of the organism for him, reported to the society that he obtained cultures directly from the fluid. These he considered conformed more to the human type of organism, but on careful inoculation tests were shown to be of the bovine type.

Dr. W. Blair M. Martin, University lecturer on bacteriology, kindly examined the spleen for me, and his report is as follows:—

The spleen was much enlarged and firm in consistence. Its maximum dimensions were 4 inches \times 2½ inches \times 1¼ inches, and it weighed 6¼ oz. Its surface was studded with numerous greyish-white tubercles, for the most part discrete and of the size of large pin-heads, but at places confluent, forming areas about one-quarter of an inch in diameter. As seen on section, it was studded throughout with caseous tubercles which quite obscured the normal markings of the organ. In stained microscopical preparations the striking features are the absence of normal Malpighian bodies and their replacement by cario-necrotic zones of varying size which correspond with the greyish-white areas seen on naked-eye inspection. Giant-cell formation is scanty, the few that are present being apparently derived from the hyperplastic connective tissue of the sinuses. Very little lymphoid tissue remains in the spleen.

Only a small portion of liver was obtained. It showed numerous tubercles both beneath the capsule and throughout the organ. The liver tubercles are smaller than those in the spleen and on section are less necrotic, but in preparations stained by the Ziehl-Neelsen method they show more numerous tubercle bacilli, which are of the long, beaded type. Much's method of staining did not reveal a notably larger number of organisms in the lesions.

A tube of Dorset's medium was inoculated with a selected portion of spleen tissue. A scanty moist growth, which did not become luxuriant even after three months' incubation, slowly appeared. A subculture on a second tube of Dorset's medium gave a similar moist unheaped growth, well-grown within five weeks and not apparently increasing beyond that time. In films both cultures were proven to be pure cultures of acid-fast bacilli.

A small portion of spleen was emulsified with normal saline solution and injected subcutaneously into the groin of a guinea-pig. The animal died in 16 days. On examination an extensive "cold abscess" was found at the site of inoculation; the axillary, the inguinal, the mediastinal, and the retroperitoneal lymphatic glands were enlarged, and all contained minute tuberculous foci; the spleen was slightly enlarged, but no tubercles were visible in it; and there were no obvious lesions elsewhere in the body. Films made from the groin pus showed fairly well-preserved cellular elements, chiefly polymorphonuclear leucocytes, and numerous tubercle bacilli, many being intracellular. A rabbit intravenously injected with 1 minim of this groin pus died in 24 days from acute miliary tuberculosis. Tubes containing agar, Dorset's and Lubenau's media, were inoculated with the groin pus. No growth resulted on agar; three isolated colonies of acid-fast bacilli alone developed on Lubenau's medium; but on Dorset's medium an extensive moist growth slowly developed and attained its maximum within two months. Subcultures from this latter culture were made on both Dorset's medium and on Lubenau's medium, but Dorset's medium uniformly yielded the better growths. The strain was maintained in subcultures on Dorset's medium, the type of growth persisting as dysgonic. After nine months' artificial cultivation the pathogenicity was again tested on rabbits. 1 mgm. of moist culture from a two months' growth on Dorset's medium was weighed out and emulsified in 50 minims of normal saline solution. 5 minims of this bacillary emulsion (equivalent to 0.1 mgm. of moist culture) were injected intravenously into a rabbit. It died in 20 days with the lesions of acute miliary tuberculosis. 2 minims of the same bacillary emulsion were injected into the left knee-joint of another rabbit

(Fraser's procedure). The animal was killed 39 days later. Save for a swollen and permanently flexed left knee-joint it appeared in good condition. On examination there was found to be a marked tuberculous arthritis of the left knee-joint with much peri-articular infiltration. The left inguinal glands were slightly enlarged. The lungs were studded with medium-sized centrally caseated tubercles. The spleen and kidneys also showed a few small tubercles, but the liver and mesenteric glands were free.

The foregoing data regarding growth on culture media and pathogenicity all indicate that the infecting agent in this case was the bovine type of tubercle bacillus. (The expenses of this pathological investigation were defrayed by a grant from the Carnegie Trustees.)

There is thus no doubt, then, that we are dealing with a bovine infection at this unusually early age. There remains to be considered the source of the infection. The father, mother, and only other child in the family have always been, and still are, perfectly healthy. An adopted boy, however, is not strong, and shortly after the death of the child had to have tuberculous glands removed from his neck. The operation, however, was performed in hospital, and did not come to my knowledge till afterwards. The infant was really breast-fed. Only after it had begun to show signs of malnutrition was that augmented by cow's milk, and then only for about a fortnight. There seem no sufficient grounds for supposing that the milk was the direct source of infection. The mother was suspicious of something being wrong before the milk was tried, and one must presuppose a very virulent infection to have caused death in six weeks after that event.

One can only speculate. Lymphatic gland infection is known to be frequently due to the bovine type, and presumably the entrance was from some part of the oral cavity. Koplik, in an article in the *Johns Hopkins Hospital Bulletin*, April, 1912, reviews the subject of tuberculosis in infancy and gives his "unreserved support to the contention," put forward by Escherich and his school, "that in a great percentage of cases infection can be traced to a person infected with tuberculosis who had been in the immediate vicinity of the infected child." It seems reasonable to suppose, though incapable of proof, that the adopted child was the source of infection in this case, he being the subject of a bovine infection of his cervical lymphatic glands, with a focus somewhere in his oral cavity.

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THE FREE AIR TREATMENT OF SKIN GRAFTS.

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THE annotation which appeared in THE LANCET of June 14th last, p. 1682, with reference to a recent article upon Skin Grafting Without Dressings in the *Journal of the American Medical Association* and the subsequent letter of Mr. G. Lenthal Cheatele¹ are of interest. In 1907 a similar method, based on a short description by Nélaton and Ombrédanne,² was adopted by Mr. E. Muirhead Little at the Royal National Orthopædic Hospital. For some years previous to this he had applied dry dressing upon the grafts, but for the last six years a different technique has been carried out in all the cases where it has been found necessary to perform skin grafting.

The following is an account of the procedure.