TYPES OF ORGANISM FOUND IN A SERIES OF TUBERCULOUS CHILDREN*

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In view of the fact that a determination of the relative frequency with which bovine tuberculosis occurs in children of the same community has a very definite bearing upon the nature of the milk supply of that community, and also that, in some instances, the figures of other investigators have been somewhat too small to deduce final percentages of bovine infection in children, a study of the subject was undertaken in these laboratories. It was our chief object to ascertain the type of infection in each case, rather than to attempt to discuss at any length the morphologic and cultural characteristics of tubercle bacilli from bovine and human sources.

Following the discovery by Theobald Smith,1 in 1898, that two distinct types of tubercle bacilli could be recovered from tuberculous lesions in man, one of which was also pathogenic for cattle, and thus designated "bovine," and the other pathogenic only for human beings and, therefore, designated "human," and his demonstration of the fact that both rabbits and guinea-pigs differ in their susceptibility to these two types of bacilli, numerous workers became interested in the subject. Wolbach and Ernst,2 and others, studied with great care and completeness the cultural characteristics and morphology of the organisms, while the largest series of actual cases of tuberculosis in this country that were classified according to type, age and parts affected appeared in the monograph of Park and Krumwiede,3 in 1910. From a study of a large series of cases in the State of New York, and later4 combining their figures with those of others, they pointed out that the bovine type of tubercle bacillus was the infecting agent in nearly 11 per cent. of all cases, and that of these more than 90 per cent. occurred

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in children under 16 years of age. They also showed that the bovine virus caused somewhat less than 10 per cent. of the total deaths in children.

Much more startling results have been obtained by British investigators. Mitchell, in a study of seventy-two cases of tuberculous adenitis in children, in and about the city of Edinburgh, found that 90 per cent. of the total number were infected with a bovine organism, while Fraser, in a series of seventy cases of bone and joint tuberculosis at the Sick Children's Hospital, Edinburgh, recovered the bovine organism in nearly 60 per cent. of the total. The former emphasized the almost universal practice of feeding Scottish children with unsterilized cow's milk, and the great prevalence of tuberculosis in the dairy cows of Scotland, combined with the inadequate veterinary inspection.

1. TECHNIC

It is generally conceded that in order to establish definitely the identity of the human and bovine types of tubercle bacillus, the organisms must not only show characteristic types of growth on artificial culture mediums, but must also be tested for their virulence. The latter, which is the most conclusive means of differentiation, depends upon the extent of the lesions produced in rabbits inoculated with the bacilli, while the nature of the growth of the organisms upon egg mediums appears to give sufficient contrast to enable one to distinguish the two types culturally. Some workers have, in addition, employed the "Smith reaction," which consists of noting the constant curve of acid reduction which the two types produce when grown upon slightly acid glycerin bouillon; but its practical usefulness appears to be interfered with by the length of time that must elapse before a final reaction is obtained. In the main, the variation in technic used by different workers has existed simply in the method chosen for inoculation of rabbits. Since this fact alone may slightly alter the picture of the findings, we have considered that a somewhat detailed account of the routine procedure that we have employed in each case might not be out of place here.

The material to be tested was ground up with about 10 c.c. of sterile saline in a sterile mortar. After complete disintegration, the supernatant fluid was decanted into another sterile vessel, whence it was drawn up into a 5 c.c. syringe. Two rabbits and two guinea-pigs

of known weight were inoculated with 1 c.c. of this fluid, the injection being made subcutaneously into the groin in the case of one guinea-pig and one rabbit, while the other guinea-pig and rabbit were inoculated intraperitoneally. The animals were then placed in clean cages in a room separate from that in which the inoculations and dissections were made, and their weights recorded weekly. If any marked loss of weight occurred in the guinea-pigs during the two weeks subsequent to inoculation, the animals were killed in order to obviate postmortem contamination, since it is difficult to obtain a sterile culture from an animal after death from tuberculosis. Guinea-pigs that did not show any marked loss of weight were allowed to live, as a maximum, four weeks from the time of inoculation. The weight of these animals is not always a reliable sign of infection, since some showed a gain in weight even when there was generalized tuberculosis. Small guinea-pigs are the least resistant, and lesions appear earlier in them than in the larger ones. The picture of virulence in guinea-pigs is not so marked as to be of value in the differentiation of the two types of bacilli; as a rule, however, the bovine type of organism causes a more generalized tuberculosis than the human. Constant findings in all cases were, in the event of an intraperitoneal inoculation, a tumor of the omentum, and, in the case of subcutaneous inoculation in the groin, caseation of the inguinal and retroperitoneal lymph nodes, while, in both instances, there were gross tubercles in the spleen.

Rabbits were killed within the minimum period of six weeks. Here again the weight of the animals is not always a reliable sign, although a constant gain practically precludes the presence of the bovine virus. In these animals, the contrast in the anatomic picture was particularly striking. Those inoculated subcutaneously in the groin with a suspension of the human type of organism showed, in the majority of cases, no gross evidence of tuberculosis, although occasionally there was a caseous nodule at the site of inoculation; while, in the case of the bovine virus, there was tuberculosis with caseation of the inguinal and retroperitoneal lymph nodes, the lungs and spleen being in most cases riddled with tubercles. Intraperitoneal inoculation of the human virus, in the majority of instances, revealed no gross evidence of tuberculosis, although in many instances a caseous nodule appeared at the site of inoculation, or a small caseous mesenteric lymph node, and, in some instances, a few scattered tubercles in the lungs. In the case of the bovine type of organism, there was a large caseous area at the site of inoculation, a large omental mass, and miliary tubercles in the peritoneum, lungs and spleen.

 Cultures were taken from the killed guinea-pigs in the following manner: The animal was skinned, care being taken not to contaminate the body cavities. It was then strapped or pinned to a board, and,
with a searing knife, a longitudinal sear was made from the top of the sternum to the symphysis pubis, and two diagonal sears, one just above the symphysis pubis and the other just below the costal border. By cutting along these sears with a sterile instrument, the body cavities were exposed aseptically. Pieces of tuberculous tissue were then excised under sterile precautions and placed in a petri dish, where they were thoroughly disintegrated before being transferred to artificial culture mediums. In the choice of tissue for cultural purposes, we have preferred regional lymph nodes, as we have found them less prone to contamination by molds than other organs. In the case of animals inoculated in the groin, two constantly affected and readily accessible nodes are those which are situated behind the peritoneum, in the region of the bifurcation of the iliac vessels.

Small pieces of the disintegrated tissue were rubbed thoroughly over the surface of at least ten tubes of Dorset's egg medium, both with and without glycerin. We found that our most successful cultures were obtained from those tubes from which the pieces of tissue were removed immediately after inoculation, the retention of the tissue seeming to encourage the appearance of molds and to have a slight inhibitory effect on the growth of the tubercle bacillus.

Since we were not concerned with a detailed study of the morphology and physiology of the organisms, we took notice only of such gross characteristics of the cultures as might serve to differentiate the growth of the human and bovine types of tubercle bacillus. In fact, in our primary cultures on the mediums used, the morphology of the two types of bacilli was not distinctive enough to be of diagnostic value, although, in the main, the organisms of the human type took a less heavy stain than those of the bovine type and were inclined to be more curved.

We found that the majority of cultures taken from material that was not virulent for rabbits, and which we, therefore, designated as belonging to the "human" type, showed the following characteristics:

1. The growth on plain egg and on glycerin egg medium was equally luxuriant.
2. This growth was macroscopically apparent in from ten days to three weeks.
3. The colonies were dry and "crumby," and, in some of the older cultures, they showed a slight buff pigment.

On the other hand, the majority of cultures from material which gave a generalized tuberculosis to rabbits, and which we called "bovine," showed these characteristics:

1. This type of organism grew on glycerin egg in only two cases and then very scantily.
2. On plain egg, it grew in almost every case, but with varying degrees of luxuriance. In no case did it grow as heavily as the human type.

3. Growth in these cultures was not, as a rule, macroscopically evident before an incubation period of three weeks.

4. The colonies were moist and flat and tended to be more confluent than those of the human type.

In a few cases we failed to obtain growth in the cultures. This lack of success was quite definitely traced to the use of poor lots of mediums and to the presence of contaminating organisms. Several cultures planted from tuberculous material of the human type, according to the animal tests, showed a moist growth similar to that of the bovine organism. In these instances, it was noticed that the tissue used for inoculation was inclined to be soft and somewhat puriform, as compared with the dry caseous material used for the more heavily growing cultures.

These observations were all made on the primary cultures from infected animal tissue. Later generations of cultures were not suitable for differential diagnosis, since the more robust of the bovine cultures began to assume the dry appearance of the human type even in the second or third generation.

Because of the various environmental factors concerned in the cultivation of the tubercle bacillus, we believe that our cultures, while valuable in checking the results of animal inoculations, were not reliable enough in themselves for determining the type of tuberculous infection.

II. CLINICAL AND PATHOLOGIC DATA AND TYPES OF ORGANISM RECOVERED

Our own series of cases has been selected from material in the wards of the Children's and Infants' hospitals, Boston, and consists of thirty tuberculous children, ranging in age from 4 months to 11 years, all of whom resided in the Boston district. We have given a summary of the history and clinical and pathologic findings, together with the type of organism recovered in each case, in order to attempt to establish a definite relationship between the type of organism and such factors as contact with tuberculous adults, the nature of the child's food and the extent of the lesions.

REPORT OF CASES

Case 1.—A. S., boy, aged 4 months, was admitted to the Infants' Hospital, March 15, 1922, with a history of cough and upper respiratory symptoms for two months previous to admission. Vomiting and diarrhea had been evident for some time since then. There had been retraction of the head for three weeks. The baby was breast fed. The father had a cough and had lost weight for one year; but there was no definite family history of tuberculosis or
exposure to it. Physical examination revealed marked malnutrition, retraction of the head and positive Kernig and Brudzinski signs, and fine râles over both lungs. The Pirquet reaction was positive. The spinal fluid was cloudy, contained 130 cells per cubic millimeter; and acid-fast bacilli. A roentgenogram of the chest revealed marked bilateral infiltration, with a cavity at the left apex. The child died March 19, 1922. Necropsy revealed tuberculous pneumonia and generalized miliary tuberculosis, with involvement of the meninges, the primary focus being the left apex. The human type of organism was recovered.

Case 2.—M. M., girl, aged 4 months, was admitted to the Infants' Hospital, Jan. 12, 1922, with a history of fever, anorexia and failure to gain during the previous three weeks. The family history was negative, and there was no history of exposure to tuberculosis. The baby had been breast fed until the illness began. Physical examination revealed definite evidence of consolidation of the right lung in the axillæ, with scattered râles throughout both sides of the chest. Some meningeal signs were present. The Pirquet reaction was positive. The roentgen ray revealed extensive tuberculous processes throughout both lungs. The spinal fluid contained 100 cells per cubic millimeter; small lymphocytes, 71 per cent., and no micro-organisms were found. The child died, Jan. 18, 1922. Necropsy revealed tuberculous bronchopneumonia with generalized miliary tuberculosis and tuberculous meningitis. The human type of organism was recovered.

Case 3.—J. F., boy, aged 4 months, was admitted to the Infants' Hospital, June 5, 1922, with a history of irritability, refusal to take food, sleeplessness and sighing respirations. Drowsiness and slight cough had been present for eight days previous to admission. The baby was breast fed. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed marked prostration and emaciation, rapid, shallow breathing, a bulging anterior fontanel, and bilateral internal strabismus. The lungs showed signs of consolidation in the left upper lobe, and diffuse pulmonary tuberculosis, confirmed by the roentgen ray. Kernig's sign was positive, as was also the Pirquet reaction. The spinal fluid showed 580 cells; 60 per cent. polymorphonuclears, and numerous acid-fast bacilli. The infant died, June 7, 1922. Necropsy revealed tuberculous pneumonia, tuberculous meningitis and generalized miliary tuberculosis. The human type of organism was recovered.

Case 4.—V. L., girl, aged 5 months, for whom there are no available records as to history or physical examination, was treated with a clinical diagnosis of tuberculosis meningitis. No necropsy was obtained. The human type of organism was recovered.

Case 5.—W. F., boy, aged 6 months, was admitted to the Infants' Hospital, May 23, 1922, with a history of gradual onset of drowsiness, vomiting and convulsions, commencing five days before admission. There was a definite family history of tuberculosis and of exposure to it. The infant was breast fed. Physical examination revealed enlarged cervical glands on both sides and signs of meningitis. The skin showed tuberculid rash. The Pirquet reaction was positive. The roentgen ray revealed diffuse pulmonary tuberculosis, with thickening of the hilum and paratracheal involvement. The spinal fluid contained 359 cells, the majority of which were mononuclears, and positive albumin and globulin. The patient died, June 1, 1922. No necropsy was obtained. Clinical diagnosis was generalized miliary tuberculosis and tuberculous meningitis; type of organism, human.

Case 6.—J. M., boy, aged 8 months, was admitted to the Infants' Hospital, April 7, 1922, with a history of pneumonia complicated by pleurisy, six weeks before admission. The day before admission the child had become very irritable and commenced to vomit. The family history was negative, and there was no history of exposure to tuberculosis. The infant had been bottle
fed since birth. Physical examination revealed signs of meningitis and consolidation of the apex of the left lung, with diffuse râles and impaired resonance throughout. There was a tuberculid rash on the skin. The Pirquet reaction was positive. A roentgenogram of the chest revealed diffuse pulmonary tuberculosis. The spinal fluid was under pressure and contained 46 cells per cubic millimeter, all lymphocytes. The patient was taken home, April 9, 1922. The clinical diagnosis was: generalized miliary tuberculosis and tuberculous meningitis; type of organism, human.

Case 7.—J. G., boy, aged 10 months, was admitted to the Infants’ Hospital, Jan. 5, 1922, with a history of cough and fever for three weeks. There was a definite history of exposure to tuberculosis for two months. Physical examination revealed marked anemia and signs of consolidation in both lungs. The Pirquet reaction was positive. Pulmonary lesions finally involved both lungs to a marked degree. The child died, Jan. 31, 1922. Necropsy revealed tuberculous bronchopneumonia and generalized miliary tuberculosis. The brain and meninges were negative. The human type of organism was recovered.

Case 8.—A. A., boy, aged 10 months, was admitted to the Infants’ Hospital, May 7, 1922, with a history of vomiting for three days. The family history was negative, and there was no history of exposure to tuberculosis. The child was breast fed. Physical examination revealed irritability and marked loss of weight. Râles were heard throughout both lungs. Several scattered erythematous nodules were present on the skin, some of which showed breaking down. An excised nodule showed tuberculosis of the skin, and tubercle bacilli were demonstrated in the tissue. The Pirquet reaction was positive. The roentgen ray revealed diffuse tuberculous involvement of both lungs. The spinal fluid contained 90 cells, the majority of which were mononuclears, positive albumin and globulin and acid-fast bacilli. The patient was taken home, May 9, 1922. The clinical diagnosis was generalized miliary tuberculosis and tuberculous meningitis; type of organism, bovine.

Case 9.—M. F., boy, aged 12 months, was admitted to the Infants’ Hospital, Feb. 21, 1922, with a history of cough, some fever, and loss of weight for three months previous to admission. One month before admission, he had an acute illness lasting ten days, which the physician had said was bronchopneumonia. Since that time, loss of weight, fever and perspiration had been noted. He was breast fed for four months, then he was given a milk mixture. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed consolidation of almost the entire left lung. The roentgen ray revealed consolidation, not typically tuberculous. The Pirquet reaction was positive. The patient died suddenly, March 9, 1922. Necropsy revealed tuberculous bronchopneumonia and generalized miliary tuberculosis. An examination of the head was not permitted. The human type of organism was recovered.

Case 10.—T. F., boy, aged 13 months, was admitted to the Infants’ Hospital, April 29, 1922, with a history of fever and cough, commencing three months previously, and recurrent fever ever since. Three days before admission he became irritable, and jerky movements of the extremities developed. The family history was negative, and there was no history of exposure to tuberculosis. The child was breast fed for eight months, then put on a milk mixture. Physical examination revealed irritability and emaciation. The Pirquet reaction was positive. The spinal fluid contained 95 cells per cubic millimeter, mostly mononuclears and acid-fast bacilli. Tests for albumin and globulin were positive. The patient died, May 14, 1922. Necropsy revealed generalized miliary tuberculosis, including the heart and pancreas, and tuberculous meningitis of alimentary origin. The bovine type of organism was recovered.

Case 11.—C., girl, aged 14 months, was admitted to the Infants’ Hospital, June 2, 1922, with a history of vomiting and listlessness for two months
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previous to admission. The family history was negative, and there was no history of exposure to tuberculosis. She had been fed cow's milk occasionally since 1 year of age. Physical examination revealed marked prostration and drowsiness. The Pirquet reaction was questionable. The spinal fluid contained 87 cells per cubic millimeter, and large numbers of acid-fast bacilli. Tests for albumin and globulin were positive. Roentgenographic examination of the chest revealed miliary tubercles in the lungs. The child died, June 11, 1922. Necropsy revealed generalized miliary tuberculosis and tuberculous meningitis, of respiratory origin. The human type of organism was recovered.

Case 12.—J. T., boy, aged 16 months, was admitted to the Infants' Hospital, March 22, 1922, with a history of cough and fever for three weeks previous to admission. He was breast fed for two months, then he was put on a milk mixture. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed signs of diffuse bronchopneumonia. The Pirquet reaction was positive. Tubercle bacilli were found in the spinal fluid. The patient died, March 25, 1922. Necropsy revealed generalized miliary tuberculosis and tuberculous meningitis, of respiratory origin. The human type of organism was recovered.

Case 13.—M. G., girl, aged 18 months, was admitted to the Infants' Hospital, May 16, 1922. She had developed a cold and cough, ten weeks before admission. The cough had continued, with slight fever at times. Convulsions had occurred four days before admission, followed by drowsiness and rigidity. There was a history of loss of weight, poor appetite and profuse sweating. She had been in close contact with the father who had active pulmonary tuberculosis. Physical examination revealed areas of impaired resonance in the lungs and râles throughout. The Pirquet reaction was positive. The spinal fluid contained 260 cells, mostly mononuclears and acid-fast bacilli. Tests for albumin and globulin were positive. Acid-fast bacilli were found in the sputum. The patient died, May 18, 1922. Necropsy revealed generalized miliary tuberculosis and tuberculous meningitis, of respiratory origin. The human type of organism was recovered.

Case 14.—C. L., boy, aged 18 months, was admitted to the Infants' Hospital, April 15, 1922, with a history of gradual onset of sleepiness, irritability and vomiting, commencing ten days before admission. The family history was negative; but there was a definite history of the patient's having visited a tuberculous family for long periods of time. The child was breast fed for three months. Physical examination revealed bronchial breathing over the left scapula, but no definite signs of meningitis. The Pirquet reaction was positive. The spinal fluid contained 127 cells per cubic millimeter, the majority of which were mononuclears, and acid-fast bacilli. The patient was taken home, April 28, 1922. He died two days later. The clinical diagnosis was: generalized miliary tuberculosis and tuberculous meningitis; type of organism, human.

Case 15.—J. C., boy, aged 2 years and 2 months, was admitted to the Children's Hospital, Oct. 17, 1921. Ten days before admission he had become feverish and drowsy. Four days later he commenced to vomit. Two days before admission, he had a generalized convulsion. Irregular temperature, as high as 101 F., had been noted since the onset. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed definite signs of meningitis. The spinal fluid contained 55 cells, 84 per cent. of which were mononuclears. The child died, Oct. 18, 1921. Necropsy revealed generalized miliary tuberculosis and tuberculous meningitis, of alimentary origin. The bovine type of organism was recovered.

Case 16.—F. G., boy, aged 2 years and 3 months, was admitted to the Children's Hospital, March 20, 1922. He had been treated in the orthopedic service during the previous year for tuberculosis of the spine. One week
before admission, he commenced to vomit and continued to do so up to time of admission. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed definite meningeal signs and evidence of miliary tuberculosis. The spinal fluid was under pressure and contained 500 cells per cubic millimeter, the majority of which were mononuclears, and acid-fast bacilli. The child died, March 26, 1922. No necropsy was obtained. The clinical diagnosis was: generalized miliary tuberculosis and tuberculous meningitis; type of organism, human.

Case 17.—R. G., boy, aged 2 years and 8 months, was admitted to the Children's Hospital, March 13, 1922, with a history of diarrhea lasting for two weeks, five months previous to admission. Since that time, anorexia and marked loss of weight had been noted. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed the typical tuberculous habitus; signs of fluid in the flanks and a questionable mass in the right flank. Roentgenographic examination of the chest revealed miliary tubercles in the lungs. The Pirquet reaction was negative. The child died, March 19, 1922. Necropsy revealed generalized miliary tuberculosis of alimentary origin. An examination of the head was not permitted. The bovine type of organism was recovered.

Case 18.—P. K., boy, aged 3 years and 2 months, was admitted to the Children's Hospital, May 13, 1922, with a history of tonsillectomy in December, 1921. Two weeks before admission he commenced to vomit. This was followed by a headache and drowsiness. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed stiffness of the neck and a positive Brudzinski sign. The spinal fluid was clear, under pressure, and contained 300 cells, all of which were mononuclears. Two days later, the child developed definite signs of meningitis. Tubercle bacilli were found in the spinal fluid. He died, May 9, 1922. Necropsy revealed generalized miliary tuberculosis and tuberculous meningitis, respiratory in origin. The human type of organism was recovered.

Case 19.—K. H., girl, aged 3 years and 2 months, was admitted to the Children's Hospital, March 4, 1922. Two weeks before admission, she became feverish and lost her appetite. During the five days previous to admission she had severe headache, and the temperature ranged from 100 to 102° F. The family history was negative, and there was no history of exposure to tuberculosis. The physical examination revealed stiffness of the neck. The Pirquet reaction was positive. Signs of meningitis gradually developed after admission. The spinal fluid contained 400 cells per cubic millimeter, all lymphocytes, and acid-fast bacilli. The child died, March 14, 1922. No necropsy was obtained. The clinical diagnosis was: tuberculous meningitis; type of organism, human.

Case 20.—A. R., boy, aged 3 years and 5 months, was admitted to the Children's Hospital, March 2, 1922, with a history of sore throat, six weeks before admission, followed by swelling of the glands of the left side of the neck. The mother died when the patient was born, otherwise the family history was negative. There was no history of exposure to tuberculosis. The glands, tonsils and adenoids were excised, March 3, 1922. The glands and both tonsils showed tuberculosis. He was discharged, March 12, 1922. The diagnosis was: tuberculous adenitis and tuberculosis of the tonsils; type of organism, bovine.

Case 21.—K. M., boy, aged 4 years and 4 months, was admitted to the Children's Hospital, April 26, 1922, with a history of loss of weight, loss of appetite and night sweats during the six months previous to admission. During the three weeks before admission he had been coughing, and the temperature had varied between 99 and 100 per cent. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed presence of fluid in the left pleural cavity. The Pirquet
reaction was positive. Fluid was aspirated from the chest. The patient was discharged home improved, May 1, 1922. The clinical diagnosis was: pulmonary tuberculosis; type of organism, human.

Case 22.—T. C., boy, aged 4 years and 5 months, was admitted to the Children's Hospital, Feb. 23, 1922. He had had nasopharyngitis, bronchitis and digestive disturbances since birth. Six days before admission he became feverish and commenced passing bloody urine. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed marked emaciation, enlarged tonsils, and enlarged cervical nodes on both sides. Two weeks after admission he had a convulsion lasting for three hours. Two weeks after this, he became drowsy, and signs of meningitis developed. The Pirquet reaction was positive. The spinal fluid contained 390 cells, chiefly mononuclears, and acid-fast bacilli. The patient was taken home, Feb. 29, 1922. The clinical diagnosis was: tuberculous meningitis; type of organism, human.

Case 23.—W. G., boy, aged 6 years, was admitted to the Children's Hospital, April 24, 1922, with a history of limp, commencing eighteen months before admission. He was treated with a plaster cast and later an abduction splint. Six weeks before admission the hip began to swell. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed flexion and abduction of the left hip, and a large fluctuating swelling in the left upper thigh. The latter was incised and drained, April 28. The clinical diagnosis was: tuberculosis of the hip joint; type of organism, bovine.

Case 24.—E. W., girl, aged 7 years, was readmitted to the Children's Hospital, April 7, 1922, having been treated in this hospital, three years previously, for tuberculosis of the hip-joint. One week before admission, she began to have headache. During the four days previous to admission, she had vomited continuously. Marked irritability and slight rise of temperature had been noted. The family history was negative, and there was no history of exposure to tuberculosis. Physical examination revealed definite signs of meningitis and bilateral choked disks. The spinal fluid was clear, and under pressure. It contained 150 cells per cubic millimeter, and acid-fast bacilli. The patient died, April 14, 1922. No necropsy was obtained. The clinical diagnosis was: tuberculous meningitis; type of organism, human.

Case 25.—A. V., boy, aged 8 years and 4 months, was admitted to the Children's Hospital, Oct. 3, 1921, with a history of tonsillectomy, three weeks before admission, followed by general malaise and dull pain in the left side of the abdomen. A younger sister had been previously treated in this hospital for tuberculosis of the hip-joint. On examination under ether, a fairly large movable mass could be felt in the right lower abdomen. The Pirquet reaction was positive. Operation was performed, October 5, and the appendix and inflammatory tissue removed, the latter being diagnosed as tuberculosis. The patient was sent to a convalescent home. He was readmitted, March 5, 1922, and examination revealed a tense and distended abdomen, with signs of fluid in the flanks. March 20, 1922, signs of meningitis appeared. The patient died, March 31, 1922. No necropsy was obtained. The clinical diagnosis was: tuberculous meningitis and tuberculous peritonitis; type of organism, human.

Case 26.—H. D., girl, aged 10 years and 2 months, was readmitted to the Children's Hospital, Feb. 18, 1922. She had been treated in this hospital for tuberculosis of the hip-joint, off and on, during the previous five years. The younger brother died of tuberculous meningitis in this hospital. The hip-joint was aspirated, April 23, 1922. The clinical diagnosis was: tuberculosis of the hip-joint; type of organism, bovine.

Case 27.—T. H., boy, aged 10 years and 4 months, was first admitted to the Children's Hospital, April 12, 1921, with a history of limp, commencing in August, 1920, followed by pain in right hip-joint. An aunt and grandmother
had died of tuberculosis. The Pirquet reaction was positive. He was readmitted, April 14, 1922. A fluctuating abscess, pointing in the right femoral triangle was incised, May 3, 1922. The clinical diagnosis was: tuberculosis of the hip-joint; type of organism, human.

Case 28.—A. G., boy, aged 11 years, was first admitted to the Children's Hospital, March 23, 1920, with a history of frequency and bloody urination, for seven months, and loss of weight. The glands of the neck had been removed on three different occasions at other hospitals. The family history was negative, and there was no history of exposure to tuberculosis. A catheterized specimen of urine from the left kidney showed acid-fast bacilli. Nephrectomy was performed, April 12, 1920. In January, 1922, frequency of urination commenced again. Acid-fast bacilli were found in a catheterized specimen of urine. The clinical diagnosis was: tuberculosis of the kidney; type of organism, bovine.

Case 29.—M. G., girl, aged 11 years, was admitted to the Children's Hospital, March 26, 1922, with enlarged glands on the left side of the neck. The family history was negative, and there was no history of exposure to tuberculosis. The excised glands showed tuberculosis with caseation. The bovine type of organism was recovered.

In addition to the foregoing series we have studied the following case from the Peter Bent Brigham Hospital, which is interesting because of its clinical history:

Case 30.—P. M., boy, aged 14 months, was admitted to the Peter Bent Brigham Hospital, Nov. 2, 1921, with a history of gradual swelling of the glands of the neck on the left side for six months. The family history was negative, and there was no history of exposure to tuberculosis. The baby was breast fed for four months, then it was fed certified, not pasteurized, milk. The glands when excised showed tuberculosis. The bovine type of organism was recovered.

Comment

In the accompanying table, we have classified these thirty cases according to the method of Park and Krumwiede, which not only contributes toward uniformity but also affords a satisfactory method of grouping the cases in accordance with either the clinical or post-mortem diagnosis. Permission for necropsy in all of the fatal cases was not obtained, and they are classified according to the clinical diagnosis. Among these are the cases grouped under the heading "Tuberculous Meningitis." On the other hand, in the event necropsy was not performed and the point of origin of the infection was in the alimentary tract, the cases are tabulated either under the heading "Generalized Tuberculosis, Alimentary Origin," or "Generalized Tuberculosis Including the Meninges, Alimentary Origin." Those cases classified as "Generalized Tuberculosis" or "Generalized Tuberculosis Including the Meninges" are either grouped according to (1) clinical diagnosis; (2) pathologic diagnosis, when the point of origin was in the respiratory apparatus, or (3) pathologic diagnosis, when the point of origin was in the respiratory apparatus, but when permission to examine the head was not granted.
Summary

In a total of thirty cases of tuberculosis in children under the age of 12 years, the bovine organism was identified in ten instances, or in 33 1/3 per cent. Twenty-three of the total number of patients were less than 5 years of age. In six of these, the organism was of the bovine type (or 25 per cent.). The remaining seven patients were between the ages of 5 and 12 years, and of these there were four instances of bovine infection, or 52 per cent. From these figures, it can be seen that there was a greater actual incidence of bovine infection in the children under 5 years of age, although the number of bovine cases in patients between the ages of 5 and 12 years was relatively greater. Moreover, in the infants under 1 year of age, the bovine organism was identified only in a single instance.

Twenty-two of the total number of cases were known to be fatal. Of these, four, or less than 20 per cent., were of the bovine type. Permission for necropsy was obtained in twelve of the fatal cases. Of this number, the cases in which the point of origin of infection was found in the alimentary tract proved to be, without exception, bovine in type. Only one of the fatal cases (Case 25) would appear to be contradictory to this statement; but no necropsy was obtained to verify the origin of the infection. On the other hand, the human bacillus was recovered from all those cases in which the point of origin, at necropsy, was in the respiratory tract. From these facts, the conclusion is obvious.

In five cases out of the total number, the history indicated that the children were exclusively breast fed. The reliability of this statement on the part of the parents may be regarded as doubtful, for although four of this number showed a human type of infection, the
bovine organism was recovered in one instance. Since in the latter case (Case 8), the patient was 10 months old, it would seem fairly reasonable to assume that, in addition to the breast, there had been supplementary readings of cow's milk, although this has been denied by the mother. In Case 30 there was a very definite and reliable history of the baby's being fed exclusively with "certified," not sterilized, milk, since weaning. This history was verified by tracing the source of the infection to the herd which supplied the milk.

Seven cases of the total number gave a definite history of either familial tuberculosis or contact with tuberculous persons. Six of these proved to be infected with the human and one with the bovine organism. In the latter instance, the patient had been exposed to a younger brother who had previously died of generalized tuberculosis.

In consideration of the fact that the foregoing figures apply to only thirty cases of tuberculosis in infancy and childhood, no general conclusions may be reached other than that, in the Boston district, the percentage of bovine tuberculosis would appear unnecessarily high.8

8. A further study of this subject is being conducted in these laboratories,