PROGRESS IN PEDIATRICS

RÉSUMÉ OF LITERATURE ON TUBERCULOSIS IN CHILDREN, 1917 *

MAY MICHAEL, M.D.

CHICAGO

MODE OF INFECTION

1. Weber, F. P.: Congenital Tuberculosis. *Brit. Jour. Child. Dis.*, 1916, **13**, 321 and 359.
2. Park, W. H.: Channels of Infection and Methods of Transmission of Tuberculosis, *New York Med. Jour.*, 1917, **105**, 777.
3. Klotz, O.: Portal of Entry and Route of Infection in Tuberculosis in Children. *Pennsylvania Med. Jour.*, 1917, **20**, 811.
4. Opie, E. L.: Relation of Apical Tuberculosis of Adults to Focal Tuberculosis of Children and Adults. *Jour. Exper. Med.*, 1917, **26**, 263.
5. Opie, E. L.: Focal Pulmonary Tuberculosis of Children and Adults. *Jour. Exper. Med.*, 1917, **25**, 855.

F. Parkes Weber¹ reviews the literature on congenital tuberculosis, due to intrauterine infection by way of the placenta and fetal membranes. He says that genuine cases of congenital tuberculosis in human beings are undoubtedly rare, and it has been thought that they occurred only when the mother was in an advanced stage of tuberculosis, but more recent observations seem to show that placental tuberculosis may likewise develop when the mother's tuberculosis is not far advanced or is even latent or quiescent. The author's review includes thirty-three cases of true congenital tuberculosis, but he quotes the analysis of the subject by Pehu and Chalier who admit fifty-one cases as conclusively genuine and satisfying all critical demands. According to Pehu and Chalier, in cases of congenital tuberculosis in the infected fetus or infant there are generally tuberculous lesions to be seen in the organs, but in some cases, in spite of no pathologic-anatomic changes having been found, the fetal blood contains virulent tubercle bacilli. This latter condition is the status bacillaris of Honl and is to be distinguished from the actual presence of tuberculous lesions in the fetus.

Weber finds a difference of opinion as to the time of infection in these congenital cases. Pehu and Chalier say placental tuberculosis apparently does not occur until the fourth month of pregnancy. In this connection Pankow's work is of special interest. In twenty pregnant tuberculous women artificial abortion was brought about in the

* Submitted for publication Jan. 15, 1918.

third or fourth month of pregnancy, and from all these cases fetal pulp was injected into guinea-pigs without giving rise to tuberculosis. Dufour and Thiers, however, report the instance of a young woman who died of tuberculosis in the third or the fourth month of pregnancy. The placenta appeared to be healthy, and examination for tubercle bacilli in it gave negative results; but the peritoneum of the fetus contained fluid, animal inoculation with which gave rise to tuberculosis.

W. H. Park,² discussing the channels and methods of transmission of tuberculous infection, says two types of tubercle bacillus cause the disease in man, the human and the bovine. In New York City during the four or five years that pasteurized milk has been more generally used there has been a marked reduction in the percentage of bovine infection among children, and on occurrence it has been found among children fed raw milk. Park thinks droplet infection is more important than that from dried sputum, and the dust of the rooms inhabited by tuberculous persons is only slightly or moderately infected with tubercle bacilli. However, when the sputum clings to lips, fingers or clothing of the patient, there is danger of the bacilli being conveyed to another person. When the contact is close, as when the mother nurses her infant, the danger is very great; when limited, as shaking hands, handling furniture or clothing, it is slight. Although living tubercle bacilli are found more or less abundantly in the feces of all patients with human or bovine open tuberculosis and although many reach the water supply, the danger from the water supply is slight.

O. Klotz³ says that in spite of the tremendous amount of work done on all phases of the tuberculosis problem, there is no agreement on the question of the mode of infection. In order to throw more light on this subject he has searched for the tuberculous focus at 477 necropsies. A tuberculous process was met with in 170 cases of these 477, giving a percentage of 35. From his observations on these cases the author thinks there is no gainsaying the fact that the greatest incidence of tuberculosis is within the thorax, as compared with other parts of the body. This is true of all periods of life, even though in early childhood apparently a greater frequency of tuberculosis has been found in the bowel and its appendages. The closer analysis of the statistics of tuberculosis in childhood has recently indicated that the greater incidence of abdominal tuberculosis is not correct, when an impartial search is given to other parts of the body.

E. L. Opie⁴ has attempted to show the relation of phthisis in adults to tuberculous infection in childhood. In order to do this he has studied the pathology of tuberculosis in children and adults and obtained data as to the frequency of infection among them. During

the first two years of life massive tuberculous lesions sometimes implicate a considerable part of one lung, but do not affect the apex more frequently than other parts. Lesions at this time exhibit no tendency to heal. After the end of the second year tuberculous lesions are usually small, seldom more than 1.5 mm. in diameter, and may be situated in any part of the lung substance. They may be designated as focal lesions and differ from the lesions of infancy only in size. They show, however, a tendency to heal, which is indicated by encapsulation of the caseous focus with fibrous tissue. The caseous material may undergo calcification and become surrounded by a fibrous capsule. The author found that nearly two thirds of all these tuberculous foci have been in contact with the pleural surface of the lung. The lesions are scattered impartially throughout the lungs. The most conspicuous characteristic of tuberculosis in children is the extent of involvement of the regional lymph nodes, but the author agrees with Ghon that the pulmonary lesion is primary and the lymphatic foci are secondary. Masses of greatly enlarged caseous lymphatic glands may occupy the hilus of the lung, in which is located the primary focus, and similar masses fill the spaces between the trachea and lungs or lie in the angle at the bifurcation of the trachea. As the age of the child increases there is less enlargement and caseation, and between the ages of 10 and 18 it is not uncommon to find small or calcified nodules in only one or two lymph nodes.

In adults tuberculous lesions of the lungs may be separated into two sharply defined groups: (1) lesions occupying the apexes of the lungs, tending to spread diffusely through the tissue of the apex and unaccompanied by caseation of the regional lymphatic nodes; (2) circumscribed lesions situated in any part of the lungs and accompanied by similar lesions of the regional lymph glands. In the lungs of adults who have died of disease other than tuberculosis this is the commonest type of tuberculous lesion. They have the distribution and characters of the circumscribed tuberculous lesions, which begin to appear after the second year of life and during later childhood and may be designated as focal tuberculosis. It is noteworthy that the incidence of focal tuberculosis increases continuously after the second year of life, and that at least 92 per cent. of all adults possess focal lesions. Focal tuberculosis is frequently fatal in early childhood, but after the tenth year it is rarely the cause of death. The existence of focal lesions does not preclude the occurrence of apical tuberculosis. Primary infection in almost all individuals who reach adult life occurs in childhood and has the characters of primary infection in animals, since it tends to implicate the regional lymph nodes. Koch showed that a secondary infection of an animal already tuberculous has a greater tendency to heal and does not extend to the regional lymph nodes, and this has

been confirmed by numerous observers. Apical tuberculosis usually exhibits the characteristics of secondary infection, since it pursues a chronic course and is usually unaccompanied by tuberculosis of the regional lymph glands.

Opie concludes, then, that focal tuberculosis of adults is identical with tuberculosis of childhood. It occurs in at least 92 per cent. of all adults. It may be acquired between the ages of 2 and 10, but in more than half of all individuals (in St. Louis) it makes its appearance between the ages of 10 and 18 years. Tuberculosis of childhood does not select the apexes of the lungs, is accompanied by massive tuberculosis of the regional lymph nodes, and exhibits the characteristics of tuberculosis in a freshly infected animal, while the tuberculosis which occurs in the pulmonary apexes of adults has the characters of a secondary infection. Almost all human beings are spontaneously "vaccinated" with tuberculosis before they reach adult life.

The following observations, E. L. Opie⁶ believes, also indicate that apical tuberculosis of adults is not the result of infantile tuberculosis, but is caused by subsequent infection: (a) Apical tuberculosis does not have its highest incidence, in accordance with common belief, in early adult life when focal infections acquired in childhood are relatively fresh and active, but is more common in later life, when the focal lesions of childhood have in most instances completely healed. Most of these apical lesions of later life pursue a chronic course and are discovered at necropsy in individuals who have died from other causes; (b) the well characterized lesions of tuberculosis acquired in childhood and found in adults with apical lesions are almost invariably calcified and healed. The apical lesion is in most instances relatively fresh and caseous, while the focal pulmonary lesion and associated lesions of regional lymphatic nodes exhibit no evidence of activity; (c) in a large proportion of instances of associated focal and apical tuberculosis the focal lesion is in one lung, but the apical lesion is limited to the opposite apex. This relation affords no support to the view that tuberculous lesions may be transmitted to the apex by way of the lymphatics.

BACTERIOLOGY

6. Wang, C. Y.: Incidence of Bovine Tuberculosis in Man. *Jour. Path. and Bacteriol.*, 1917, **21**, 131. *Ibid.* Bovine Infection in Tuberculosis of Children. *Edinburg Med. Jour.*, 1917, **18**, 178.

7. Griffith, A. S.: Human Type of Tubercle Bacilli in Tuberculosis. *Brit. Jour. Tuberc.*, 1917, **11**, 160.

8. Ravenel, M. P.: The Transmission of Bovine Tuberculosis to Human Beings. *Arch. Pediat.*, 1917, **34**, 137.

9. Mitchell, A. P.: Primary Tuberculosis of Faucial Tonsil. *Jour. Path. and Bacteriol.*, 1917, **21**, 248.

10. Griffith, A. S.: Types of Tubercle Bacilli in Cervical and Axillary Adenitis. *Lancet*, London, 1917, **1**, 216.

11. Shimer, W.: Relation of Cow's Milk to Human Tuberculosis. *Indiana State Med. Assn. Jour.*, 1917, **10**, 193.

12. Wang, S. L., and Coonley, F.: Tubercle Bacilli in Breast Milk of Tuberculous Women. *Jour. Am. Med. Assn.*, 1917, **69**, 531.

C. Y. Wang⁶ has undertaken a study with the object of obtaining information as to the relative incidence of the human and bovine types of tubercle bacilli in the infection of man, irrespective of age and the nature of the tuberculous disease. The material was obtained from the pathologic department of the Royal Infirmary and Edinburgh Royal Hospital for sick children. One hundred and twenty-three strains of tubercle bacilli from 88 cases of tuberculosis were studied. All strains were found to conform in important respects to either the human or the bovine type of tubercle bacillus. In no instance was an atypical strain found. Of 68 cases of tuberculosis in adults, bovine tubercle bacilli were found in 7 instances, namely, from 1, of 29 cases of pulmonary tuberculosis, from 2 of 4 cases of abdominal tuberculosis, from 2 of 7 cases of generalized tuberculosis, and from 2 of 28 cases in which the only signs of tuberculosis were calcareous or caseous lesions. Three of the cases of bovine infection gave indication on postmortem examination that the path of infection was by way of the intestine. Of 20 cases of tuberculosis in children, bovine tubercle bacilli were isolated in 11 instances, namely, from 3 of 4 cases of abdominal tuberculosis, from 3 of 5 cases of tuberculous meningitis, and from 2 of 8 cases showing at necropsy no other evidence of tuberculosis than calcareous or caseous glands. In 9 of these cases of bovine infection the primary site of infection was in the intestine, as determined by postmortem examination. These bacteriologic findings confirm those of Fraser and Mitchell and emphasize again the great prevalence of bovine tuberculous infection in Edinburgh, especially among children.

Wang thinks the finding of a large percentage of tuberculous milk in Edinburgh explains only in part this high incidence of bovine tuberculosis there. He thinks the consumption of unboiled milk by the infant population is another very important factor. Investigation has shown that the diet of most children belonging to the working class consisted partly or wholly of cow's milk, and in only a small percentage was the milk boiled. Moreover, it was found that more children who were fed on raw milk gave a positive tuberculin test than those fed boiled milk.

In view of these facts Wang asserts that any measure resorted to in combating the disease should be directed not only against human spread of infection, but also against bovine source of infection. An adequate supervision of milk supply failing, the most efficient way of

safeguarding against the bovine type of tubercle bacillus is to subject all cow's milk for consumption to the process of boiling.

A. S. Griffith⁷ in summarizing the work of the British Commission on Tuberculosis found that in 930 cases of tuberculosis occurring at all ages the bovine bacillus was the infecting organism in 18.17 per cent. One hundred and ninety-six, or 34.2 per cent., of these cases occurred in children up to 5 years; 265, or 26.8 per cent., in children between 5 and 10 years; 127, or 12.6 per cent., in children between 10 and 16 years, and 341, or 5.9 per cent., in individuals above 16 years.

M. P. Ravenel⁸ reviews the work done in the matter of transmission of bovine tubercle bacilli to human beings and regards it as a mistake to emphasize too strongly that the danger from bovine infection is greater in early life. He has been forced to the conclusion that infection of adults with the human tubercle bacillus is much less common than was formerly believed and thinks it possible that further studies, considering the relative proportion of human and bovine infection, will show that adults are infected with the bovine tubercle bacillus relatively as frequently as with the human. Moreover, Ravenel does not believe that the portal of entry of the tubercle bacillus can be told from what is considered the oldest lesion—for example, that cases are of inhalation origin when the pulmonary lesions are the most advanced in the body. In animals it has been conclusively shown that pulmonary tuberculosis can be easily produced both by feeding and by injection of tubercle bacilli directly into the stomach, and the oldest lesions are found in the lungs after infection of known intestinal origin. It seems almost certain that the same thing may take place in children.

A. Philip Mitchell⁹ has attempted to ascertain the frequency of primary tuberculosis of the faucial tonsils and its relation to other tuberculous affections, especially to tuberculosis of the cervical lymph nodes. His study has consisted of examination of tonsils removed from children affected with tuberculosis of the upper deep cervical glands, and of hypertrophied tonsils removed from children with no clinical evidence of tuberculosis of the lymph nodes or other structures. The methods employed were histologic examination of the tonsils and inoculation of tonsillar tissue into guinea-pigs. The author thinks that histologic examination of the entire tonsil is a reliable diagnostic method, but he employs animal inoculations, also, to meet the criticism of those who maintain that foreign substances in the tonsils are frequently the cause of lesions identical with those produced by tuberculosis. Moreover, animal inoculations were necessary to determine the relative frequency of the human and bovine type of tubercle bacillus present in tuberculous tonsils.

There were 106 cases in which the tonsils were removed at operation for tuberculosis of the cervical glands. Of these, 51 cases were in children under 5 years, 49 cases in children between 5 and 15 years, and 6 cases were in adults. In 41 cases there were undoubtedly tuberculous lesions in the tonsils and 38 of these were in children. Inoculation tests were made in 92 of the 106 cases and positive results obtained in 20 cases. In 16 cases the bovine bacillus was obtained and in 4 the human type of tubercle bacillus was obtained.

There were 100 cases in which the faucial tonsils were removed for chronic hypertrophy and 9, or 9 per cent., yielded positive results when inoculated into guinea-pigs. The bovine bacillus was present in 4 cases, and the human in 2 cases, and in the other 3 cases the type was not determined.

Mitchell thinks the interpretation of these bacteriologic findings impossible without considering the source of infection. In a previous investigation he examined 406 samples of milk and in 82, or 20 per cent., he found tubercle bacilli. Children being large consumers of milk, it is quite clear how contaminated milk may be to them a frequent source of infection. In this connection it must be mentioned that 90 per cent. of the children under 5 years of age were bottle fed infants. Among children with tuberculous cervical adenitis, human source of infection seems very frequently absent. In not a single instance of bovine tonsillar infection in this series was there a history of pulmonary tuberculosis in other members of the household.

Mitchell draws the following conclusions from his study: 1. Tuberculosis of the upper deep cervical glands develops from a primary focus in the faucial tonsils much more frequently than is generally supposed. 2. Primary tuberculosis of the tonsils can be recognized only by the aid of the microscope and by inoculation experiments. The lesions are found immediately under the surface epithelium and near the mouth of the lacunae and in relation to the deeper portions of crypts or deep in the tonsils close to the capsule. The first mentioned site furnishes the greatest number of examples. 3. Hypertrophied faucial tonsils are the seat of primary tuberculosis, though rarely, as compared with tonsils from cases of tuberculous cervical adenitis. 4. Experimental results indicated that in Scotland primary tuberculosis of the faucial tonsils must be attributed to the drinking of milk from tuberculous cows, rather than to the inhalation of the tubercle bacillus conveyed by dried sputum or moist spray of a consumptive patient. 5. Bovine and human types of tubercle bacilli are present in the crypts of a small percentage of children without demonstrable tuberculous lesions either in the tonsils or elsewhere. 6. Tonsillectomy is essential in all cases of tuberculous cervical adenitis in chil-

dren. 7. The prognosis is very slightly influenced in children in whom the faucial tonsils and cervical glands are simultaneously affected with tuberculosis. 8. The difficulties associated with the reform of the milk supply and the lengthened period which must elapse before it becomes possible to obtain milk free from tubercle bacilli demand some means of rendering milk safe. The only safeguard is to be had in sterilization by boiling.

Since his last report on bacteriologic findings in cervical adenitis, A. S. Griffith¹⁰ has studied fifty-two additional cases in order to ascertain the type of infecting organism. In seventeen of the cases no tubercle bacilli were found and inoculations into guinea-pigs were negative. In thirty-five cases cultures of tubercle bacilli were isolated either from the original material or from material obtained after the inoculation of guinea-pigs. In fifteen of the thirty-five cases the cultures showed the bovine tubercle bacillus. In nineteen cases the human bacillus was isolated and in three the strain was atypical. The author's figures show that in children under 10 years cervical gland tuberculosis is caused more frequently by the bovine than by the human type of tubercle bacillus, for three fourths of the cases in children under 10 years yielded the bovine type of organism. In persons over 10 years infection of human origin is more common, for in only one third of the individuals from 10 to 20 years was the bovine organism obtained, and in rather less than one fifth of the cases in persons over 20 years.

W. Shimer¹¹ has studied the relation of cow's milk to human tuberculosis. According to the author's statistics, one dairy cow of every ten has tuberculosis (i. e., in Indiana). Hence, if every dairy man kept ten or more cows and mixed the milk, all of the milk would contain tubercle bacilli. Cows rarely suffer from tuberculosis of the udders, and Shimer thinks the chief source of the tubercle bacilli is the feces. Most market milk contains manure, and there are always tubercle bacilli in the manure of cows with tuberculosis, as they invariably swallow their sputum. Cream is one of the greatest sources of danger. Cream contains a concentration of tubercle bacilli and is made into butter. The interval of time which elapses between the production and use of cream and cream products is so short that the bacilli retain their virulence. As long as raw milk from tuberculous cows, or its products, continues to be used, living organisms will find entrance into the human organism. The bovine type of bacillus is responsible for about 1 per cent. of infection in man and 5 per cent. of infection in children under 15 years of age.

S. J. Wang and F. Cooley, during the last year and a half at Sea View Hospital, Staten Island, N. Y., examined the breast milk of

twenty-eight tuberculous women for tubercle bacilli. There was no apparent mammary disease or suspicion of such in any case. The specimens of milk were obtained from these women twice each week, from 3 to 5 c. c. being gathered by breast massage, under aseptic precautions, for each test. All specimens were examined within two hours after they were withdrawn from the breast. An ordinary smear was first stained for tubercle bacilli, then the remainder of the specimen was reduced with weak antiformin solution, and the resulting sediment was examined for tubercle bacilli. Specimens from each of the last fifteen of the series were injected into guinea-pigs intraperitoneally; the guinea-pigs were killed six weeks later and tuberculous changes sought.

All the specimens injected into guinea-pigs were negative. No tuberculous changes were found, and no effects of any kind from the milk injections occurred in the animals.

Altogether there were about 450 microscopic examinations of specimens taken bi-weekly from the whole series of twenty-eight cases. These were all negative except one, which the writers think was questionable.

Some observations were also made on two guinea-pigs that were fed breast milk from two tuberculous women. The milk from these women, both of whom had normal, full-term deliveries in the hospital, was fed to the animals three times a day for one month. As much milk as possible was obtained for each feeding, the amounts varying from 10 to 40 c.c. A small amount of lettuce and bread also was fed them. This experiment was carried out to ascertain whether the animals became tuberculous and, if they did not, whether they gained weight and thrived on these feedings. If these specimens of milk contained toxic substances, it was thought that the guinea-pigs might show some effects from the daily ingestion of such relatively large amounts. Both guinea-pigs had lost weight at the end of the thirty days. Soon after necropsy was performed on the guinea-pigs and no evidence of tuberculosis was found in either animal.

The authors feel that the negative results of these experiments seem to indicate that tubercle bacilli are infrequently found in the breast milk of tuberculous women who have no mammary disease. The possibility of infection from such milk is probably slight, but it is very likely best to inderdict nursing in every instance, because of the additional dangers, that of infection during the intimate relationship of the mother and the nursing child, the possibility of toxic substance in the milk, and the bad effects of nursing on the mother. An exception might be made in the instance of a mother with a closed case of tuberculosis, although it is often difficult to distinguish between a closed and open case after pregnancy and labor. The tuberculous

woman undergoes a profound strain before and during childbirth, and it frequently takes a long period of observation to ascertain whether her disease has been activated.

SYMPTOMATOLOGY

13. Barbier, H.: Tuberculosis in Infants Under Two. *Paris méd.*, 1917, **7**, 109.
14. Reuben, M. S.: Tuberculosis following Ritual Circumcision. *Arch. Pediat.*, 1917, **34**, 186.
15. Comby, J.: Addison's Disease in a Girl of Thirteen. *Arch. de méd. d. enf.*, 1917, **20**, 28.
16. Commarata: Tuberculous Meningitis Simulating Multiple Sclerosis, *Abstr. Am. Rev. Tuberc.*, 1917, **1**, 121.
17. Bonaba, J.: Tuberculosis of the Cerebellum. *Abstr. Arch. de méd. d. enf.*, 1916, **19**, 649.
18. D'Espine, A., and Demole, V.: Tubercles of the Pons. *Arch. de méd. d. enf.*, 1917, **20**, 355.
19. Ash, R. L.: A Contribution to the Diagnosis of Spinal Cord Tumors in Childhood. *AM. JOUR. DIS. CHILD.*, 1917, **13**, 487.
20. Ladd, W. E.: Tuberculous Cervical Adenitis in Children. *Surg., Gynec. and Obst.*, 1917, **24**, 467.
21. Harbitz, F.: Tuberculosis of the Lymph Nodes. *Jour. Infec. Dis.*, 1917, **21**, 196.
22. Jones, A. T.: Tuberculous Glands of the Mesentery. *Am. Jour. Obst.*, 1917, **75**, 417.
23. Du Pan, C. M.: Large Tuberculoma of the Mesentery in a Child of Eight. *Rev. méd. de la Suisse romande*, 1917, **27**, 222.
- Canelli, A.: Miliary Tuberculosis During the First Weeks of Life. *Abstr. Arch. de méd. d. enf.*, 1917, **20**, 375.
- Porter, L.: Tuberculosis in Childhood with Unusual Manifestations. *California State Jour. Med.*, 1917, **15**, 303.
- Bordet, E., and Ovidio, R.: Tuberculous Meningitis in Infants. *Semana méd.*, 1917, **24**, 385.
- Morrison, J. R.: Tuberculous Meningitis. *Kentucky Med. Jour.*, 1917, **15**, 277.
- Bernstein, H. S.: A Case of Tuberculous Meningitis. *Rhode Island Med. Jour.*, 1917, **1**, 68.

For ten years H. Barbier¹³ has been interested in the question of tuberculosis in infants and has sought for this disease at all necropsies. One of his interns found a proportion of 32 per cent. of deaths from tuberculosis in infants under 2 years of age. Another statistical report showed tuberculosis in 39 per cent. of children dying from all causes. But Barbier thinks statistics furnished by necropsy reports are lower than those which represent the morbidity of tuberculosis in infants, for he thinks that all infants below 2 years inoculated with tuberculosis do not die, as is proved by finding among older children lesions which evidently originated at a very early date.

As to the frequency of ulcerative forms, the author found eighty-four cases at 194 necropsies, and adding these personal observations to those published by different authors, Barbier found in a total of 766 necropsies on tuberculous infants 220 cases of cavities, or 29 per cent. Cavities rarely form before the third month and they usually

occur between the sixth and eighteenth month. The frequency of these ulcerative lesions goes to prove the great morbidity of tuberculosis in infants, and Barbier thinks that often symptoms like dyspnea, febrile attacks and cough in so-called atrophic infants are but manifestations of the evolution of a tuberculosis.

M. S. Reuben¹⁴ reports a case of tuberculosis in a nine weeks old baby following ritual circumcision. On the eighth day the child had been circumcised by a mohel, who aspirated the wound by means of a glass tube. Within a week the wound of the circumcision had healed. Five weeks later the mother noticed a swelling in the right groin and brought the child to the writer for treatment. Physical examination showed that the inguinal glands in the right groin were enlarged, the mass being about the size of the small finger; there was also swelling of the left inguinal glands, but not to the same extent as on the right side. Examination of the penis revealed four small tuberculous masses on the anterior surface of the circumcision scar. On palpation of these masses one obtained the feeling not unlike that of shot under the skin; they felt hard and indurated. The largest of these tuberculous masses was excised and microscopic examination showed the tissue was infiltrated with numerous tubercles and diffuse tuberculous inflammatory material. The von Pirquet reaction of the infant was positive. The mohel was found to be suffering from advanced tuberculosis and his sputum was loaded with tubercle bacilli.

Reuben reviewed the literature on this subject and found reports of forty-two cases of tuberculous infection following circumcision. He thinks the incidence of this infection is much greater, as many cases have probably not been reported. The treatment is early excision of the tuberculous tissue of the penis and of the inguinal glands on both sides.

The rarity of Addison's disease among children makes a case reported by J. Comby¹⁵ of especial interest. The case was that of a 13 year old girl whose father had died of pulmonary tuberculosis eight years before. The necropsy showed old pleuritic adhesions, but no tubercles in the lungs or tracheo-bronchial glands. The right suprarenal capsule was much enlarged, nodular and softened. On section a caseous fluid escaped and it was impossible to distinguish any normal tissue. The kidney of the same side showed several yellow tubercles. The left suprarenal was enlarged, but less so than the right, and contained a number of tubercles. The liver and spleen were increased in size and also contained tubercles.

Commarata¹⁶ describes a case of tuberculous meningitis simulating multiple sclerosis in a 3 year old boy. Six months before consultation he developed a tremor of the right hand, which was worse during the

day. Three months later the boy walked with a tremulous, spastic gait and sensation was found to be lost in the right leg. There was an intention tremor so marked that he could not raise a glass to the lips. No evidence of meningitis was present and a diagnosis of multiple sclerosis was made. Some weeks later he was seized with fever, headache, vomiting, stiff neck and a convergent strabismus, which in a few days terminated in convulsions. Lumbar puncture gave a fluid under increased pressure containing tubercle bacilli. There was some temporary improvement after the puncture, but death occurred shortly.

J. Bonaba¹⁷ discusses three cases of tuberculoma of the cerebellum in children. He describes symptoms and gives the necropsy report in each case.

A. D'Espine and V. Demole¹⁸ report a case of tubercles of the pons in a 7 year old boy. From the symptoms a diagnosis was made of a tubercle in the eminentia teres of the right side of the pons. Necropsy showed tracheobronchitis, caseous pulmonary tuberculosis, caseated tracheobronchial glands, ulcerative intestinal tuberculosis, multiple conglomerate tubercles of the brain, cerebellum, and bulb, recent miliary tuberculosis and acute tuberculous meningitis. The findings in the pons were especially interesting. Two tubercles were situated in the right eminentia teres, one in the center of the pyramidal tract, which had almost destroyed the point of origin of the right oculomotor nerve and greatly injured the facial. This lesion explained the paralysis of these two nerves. The second tubercle was situated in the center of the right pyramidal bundle, but only separated the fibers and did not destroy them, a fact which explained the exaggerated reflexes and clonus and the absence of hemiplegia.

R. L. Ash¹⁹ reports an unusual case of tuberculoma of the spinal cord in a 19 months old baby, giving it as a contribution to the study and diagnosis of spinal tumors in childhood. The clinical diagnosis was intramedullary or extramedullary tumor of the spinal cord, compression myelitis and meningitis, probably of tuberculous origin. The child died and necropsy confirmed the diagnosis. There was a general tuberculosis, a tuberculoma of the cerebrum and a tuberculoma of the spinal cord. This latter was olive-shaped, 2.5 by 1.2 cm. in size, and was situated extramedullary in the cervical enlargement of the spinal cord. It was grayish-white and caseous in appearance and microscopically was composed of typical tuberculous tissue. Of special interest in this case is the fact that a tumor of the spinal meninges, which was diagnosed during life, was the first manifestation of a generalized tuberculosis in a child of 19 months. Xanthochromia with massive spontaneous coagulation and pleocytosis was an attending syndrome.

W. E. Ladd²⁰ discusses the subject of tuberculous cervical adenitis

in children. He says the commonest portal of entrance of the infection is the tonsil, though occasionally the adenoids, teeth, ear or skin of the face and scalp are the source, and that further investigation should be undertaken to give a more definite answer to the question of the disease originating from bovine or human type of tubercle bacillus. If it becomes firmly established that milk is responsible for the majority of infections, it would seem possible greatly to reduce their frequency by securing nontuberculous milk supplies.

F. Harbitz,²¹ since his last article in 1905, has investigated further the question of tuberculosis of the lymph nodes and has paid particular attention to the general form of the disease, its frequency in children and adults, its origin and its importance as a cause of death. He says that it is not well known that tuberculosis of the lymph nodes may be a general disease, that is, one which affects the entire lymphatic glandular system. It may be encountered incidentally in postmortem examinations or, as is more commonly the case, it may occur with extensive and, as a rule, eventually fatal cases of tuberculosis, when it is the older and primary lesion and thus indirectly the cause of death. The author's observations were based on 2,906 necropsies, 2,489 of adults and 417 of children. He divides tuberculosis of the lymph glands into seven groups, which include tuberculosis of the bronchial, cervical and abdominal glands, combinations of these three groups, and last and most important, general lymph gland tuberculosis. In this important group were included sixty-one cases, thirty-two of adults and twenty-nine of children. Of the cases in children twenty occurred during the first year of life and in almost all there was a history of tuberculosis in the immediate relatives, usually in the parents. In all these, extensive tuberculous processes were found in the internal organs, as well as in the glands, so that it was impossible to trace the connection between the two processes, but the process in the lymph nodes was clearly the most marked and oldest. The lymph nodes of the neck, of the thorax and of the abdomen were extensively affected, occasionally also those of the axillary and inguinal regions. The process in the neck was a descending one, most marked above and extending down to the supraclavicular space, where the glands were smallest. In the thorax the process was an ascending one, the glands were smallest above around the trachea, while around the bifurcation and pulmonary hilus they were largest. In the abdomen the tuberculosis was usually limited to the mesenteric nodes, or retroperitoneal nodes, where they formed large masses around the aorta, celiac axis or in the hilus of the liver or spleen. In general it did not appear that there was a continuous extension from one group of glands to another, but the impression was rather that a repeated infection had taken place by different paths,

especially as the process appeared to be of different ages, old in some glands, recent in others which had no direct connection with the first. This could be explained by exposure to infection at different times, both by inhalation and swallowing, and the possibility of reinfection was often established by obtaining a history of contact with a phthisical patient. As to the mode of extension, Harbitz thinks that after one or more infections of different groups there is extension along the lymph vessels and then a dissemination through the blood to all groups of glands, until it is impossible to trace the route or mode of infection. Pulmonary tuberculosis appears to be the cause of death in about one-half the cases of general lymph gland tuberculosis. Particularly in older children, but not rarely in the first years of childhood and in infancy, the tuberculosis in the lungs assumes the form of phthisis in adults with cavity formation. Less frequently there is an apical tuberculosis due to extension to the lungs from the nodes in the upper part of the mediastinum or supraclavicular regions. Tuberculosis of the intestinal tract is the cause of death in about one fourth of the cases. In these instances the primary lesion developed presumably in the abdominal lymph nodes. Miliary tuberculosis, or tuberculous meningitis is also the cause in about one fourth of the cases, especially in instances of tuberculosis of isolated groups of glands.

A. T. Jones²² reports nine cases of tuberculous glands of the mesentery, three in children. Operation was performed to relieve surgical symptoms and at the operation the primary cause of the trouble was found to be disease of the mesenteric glands. Jones believes that the tuberculous mesenteric gland is often a primary disease of the true tuberculous type, but the bovine type is undoubtedly present in many children without producing symptoms, the glands remaining quiescent or having a tendency to subside. As a rule, it is impossible to make a correct diagnosis before operation, unless there are glands which can be felt through the abdominal wall or by the finger in the rectum. There are two clinical types: (a) a slightly progressive one, generally with palpable glands; (b) an acute fulminating type, frequently simulating, and impossible to differentiate from, appendicitis. The prognosis in the subacute stage is good without operation. In the acute stage exploratory laparotomy should be performed, but the glands not removed, unless there are definite indications of adhesions or ulceration, or unless the large size of the mass produces much pain or obstruction. From Jones' experience tuberculous glands of the mesentery may present no symptoms until breaking down begins in the glands, and after that there are symptoms of tuberculous peritonitis, intestinal obstruction, or acute appendicitis. He says that in children and young adults with a history of right sided abdominal pain with or

without palpable masses, inflamed mesenteric glands should be considered a possibility.

C. M. Du Pan²³ describes an unusual case of tuberculosis of the mesentery in an 8 year old boy.

TUBERCULOSIS OF THE TRACHEOBRONCHIAL GLANDS

24. Floyd, C., Boutwell, H. K., and George, A. W.: The Diagnosis of Thoracic Adenitis. *Internat. Clin.*, 1916, **3**, 130.

25. Lapham, M. E.: Tuberculosis of Infants. *Southern Med. Jour.*, 1917, **10**, 465.

26. Rich, H. M.: Diagnosis and Significance of Tuberculous Lymph Nodes. *Jour. Michigan Med. Soc.*, 1917, **16**, 7.

27. Bloom, C. J.: D'Espine's Sign, A Valuable Aid in the Diagnosis of Pulmonary and Tracheobronchial Tuberculosis in Childhood. *New Orleans Med. and Surg. Jour.*, 1917, **59**, 748.

McMillan, D. W.: Glandular Tuberculosis in Children. *Florida Med. Assn. Jour.*, 1917, **3**, 212.

C. Floyd, H. K. Boutwell and A. W. George²⁴ discuss the pathology, symptoms and diagnosis of enlarged thoracic glands, a term they prefer to bronchial glands, the one now in use, as it includes the groups of glands not only about the root of the lungs, but also on either side of the trachea. Enlargement of thoracic glands has been noted in many infections, not only in tuberculosis and Hodgkin's disease, but also in the acute contagious diseases of children, as measles, scarlet fever, pertussis, and still more recently in the common acute bronchial colds. Most observers, however, are of the opinion that tuberculosis is the most common cause of enlargement of these glands. The writers believe that the symptomatology of enlarged thoracic glands is still one of considerable uncertainty and obscurity. Lassitude, slight elevation of temperature, more or less constant thoracic pain, especially in the interscapular region, and a brassy cough are the symptoms most often noted. But the writers have failed to detect any constant symptoms in this condition. When, however, there occur persistent elevated temperature and pulse and harsh, dry cough, anemia and lack of normal development, without other explanatory condition, the possibility of thoracic adenitis should be considered. The diagnosis has given rise to a great variety of opinions as to the value of certain signs commonly associated with its presence. The most important ones are enlargement of the superficial thoracic veins, irregularity of the pupils, the so-called Eustace Smith sign, an increase in normal area of dullness, extending outward on either side of the sternum, D'Espine's sign, vertebral dullness or resistance, or both, below the first dorsal spine, which does not change with full inspiration. One or more of these signs, supplemented by positive evidence of fluoroscopic examination and roentgenograms, are generally considered pathognomonic of tracheobronchial adenitis.

The authors' observations have led them to believe that in children whose bronchial glands on the right side are considerably enlarged, there not infrequently occur at the right apex definite signs of consolidation, such as dulness, increased resistance, limited expansion and bronchovesicular breathing. Prolonged observation, clinical and by means of the roentgen ray, have shown in these cases no apical lesion and, with subsidence of the bronchial nodes, there is entire disappearance of these signs. The condition seems to be due to a retraction of the apex, together with a reflex limitation of its function. The authors think that no single sign should be depended on, but in the majority of instances, where parasternal or paravertebral dulness occurs, the diagnosis is correct. D'Espine's sign is of importance, but to a slighter degree than formerly thought. It may, however, be the first clinical sign to appear and may be the only one in acute respiratory infections. The other signs, while they occasionally occur in extensive involvement of the thoracic glands, are too infrequently present to be relied on. No study of bronchial or hilus region is complete without repeated roentgen ray examination, but even here the shadows present may be confused or accompany other conditions, and reliance should not be placed on roentgen-ray examination alone. The authors believe far too little stress has been laid on thoracic adenopathy and that with the advent of more exact methods of study of diseases of the chest the importance of enlarged thoracic glands will be recognized.

M. E. Lapham²⁵ divides the symptoms of tuberculosis of the bronchial glands in infants into those due to pressure and those due to absorption of the toxins. Death may occur if the caseating glands perforate the air passages and fill them with caseous material, or if the infectious material is carried to other parts of the lung and induces caseous or bronchopneumonia, acute miliary tuberculosis, typhobacilemia of Landouzy, or meningitis. The symptoms of pressure are due either to irritation of the pulmonary nerves lying on the surface of the trachea and bronchi or to obstruction to the passage of air. Symptoms suggestive of enlarged bronchial glands are high-pitched, explosive paroxysmal attacks of coughing or a cough resembling the bellowing of a young hound. Often the cough is the first and only symptom for a long time; again it is preceded or overshadowed by the expiratory dyspnea. The expiratory dyspnea is the most constant and reliable symptom of obstruction of the air passages. Frequently there is a bitonal cough, due to pressure on one recurrent nerve and lack of symmetrical functioning of the vocal cords. Vomiting may prove a distressing symptom. Bronchial râles are very common and characteristic.

Symptoms caused by absorption of the toxins are vague; the vaso-

motor, gastrointestinal and hematopoietic systems are chiefly affected. It is possible that the vasomotor system may show the first effect of the toxins, which cause a fall in blood pressure and relaxation of the vessel walls, resulting in sluggish circulation in the gastro-intestinal and hematopoietic systems. Spasmophilia and chorea, which frequently precede tuberculosis, may be manifestations of vasomotor disturbances. The functional activities of the gastro-intestinal tract may be stimulated or depressed by the tuberculotoxins. Hyperacidity is a result of overstimulation. The child regurgitates food, is restless and fretful, but does not lose appetite. Anacidity, on the other hand, causes lack of appetite, constipation and apathy. There is loss of weight and, finally, marked atrophy. There is, however, nothing specific or suggestive of tuberculosis in the disturbances of nutrition resulting from tuberculous toxemia. This is true also of the disturbances of the hematopoietic system. There is hardly a disease of this system, from simple chlorosis to pernicious anemia, which cannot be simulated by tuberculous toxemia.

Tuberculosis of the bronchial glands is not necessarily a wasting or cachectic disease. Fatal perforation and such consequences of perforation as meningitis occur invariably in well-nourished infants.

H. M. Rich²⁶ says the diagnosis of tuberculous bronchial glands is made by considering four groups of facts: (1) history of exposure; (2) presence of symptoms otherwise unexplained; (3) physical signs, including the roentgen-ray findings, and (4) the specific reaction to tuberculin.

An infant living in contact with an open case of tuberculosis practically never escapes infection. A history of exposure is strong predisposing evidence in favor of tuberculous infection having taken place. The symptoms are somewhat indefinite. The earliest symptom is the decline of customary activity, with increased irritability. Loss of appetite and failure to gain weight follow. Many times the writer has noted repeated fleeting attacks of pallor. The temperature range is but slightly disturbed. Cough may or may not be present. It is usually brassy, paroxysmal and ineffective. Change of voice, hoarseness, and attacks of paroxysmal dyspnea may be noted. In the early stage none of the usual signs of phthisis are observed. The findings point to increased mediastinal activity, shown by the presence of D'Espine's sign and of dullness on direct percussion over the vertebrae. A third sign is a variation in the intensity of inspiration in the lower interscapular spaces. It may be heard on either side and is usually quite marked. The findings should always be substantiated by roentgen-ray examination, by which the increased density of the mediastinum can be easily demonstrated. Specific reactions may be

obtained by the von Pirquet test for the first three years of life, by the Calmette test in later life, if no contraindications exist. A positive result with either test means an active tuberculous process. A negative test may be disregarded in the presence of other strong evidence of bronchial gland tuberculosis. The early stage of a mediastinal tumor is perhaps the most difficult condition to differentiate from bronchial gland tuberculosis. The symptoms and physical signs are at first the same, but gradually change as the tumor grows larger. More frequently, however, a distinction must be made between bronchial gland tuberculosis and convalescence from pneumonia. Physical signs of mediastinal density may persist after the signs in the lungs have cleared and fever and malaise may continue for a considerable period. A tuberculin test here is of considerable value. Measles followed by enlarged bronchial glands may also offer difficulty in differential diagnosis.

C. J. Bloom's²⁷ experience with D'Espine's sign covers a series of seventeen cases, in which the sign was positive and a diagnosis of enlarged tracheobronchial glands was made before the roentgen-ray examination. From his study, Bloom wishes to impress the following facts: In infancy the anteroposterior diameter of the chest is relatively small and the glands are normally enlarged, so alteration in their size can be detected and is an aid in diagnosis. D'Espine's sign is a valuable aid in the diagnosis of tracheobronchial tuberculosis, but a positive D'Espine sign only shows an enlargement and does not signify that it is due to a tuberculosis. The sign is most significant under 10 years of age.

DIAGNOSIS

28. Miller, J. A., and Walters, B. H.: Outline for the Diagnosis of Tuberculosis in Children, Formulated by the National Association for the Study and Prevention of Tuberculosis. Tr. Nat. Assn. for Study and Prevention of Tuberc., 1916, **12**, 37.

29. Chadwick, H. D., and Morgan, R.: Diagnosis of Tuberculosis in Children. Boston Med. and Surg. Jour., 1917, **177**, 138.

30. Fishberg, M.: Diagnosis of Tuberculosis in Children of School Age. Med. Rec., New York, 1917, **92**, 406.

31. Signorelli, J.: Frequency of Infection and Early Diagnosis of Tuberculosis in Children. New Orleans Med. and Surg. Jour., 1917, **70**, 338.

32. Lankester, A.: The Gland Index in Tuberculosis. Indiana Jour. Med. Research, 1916, **4**, 285.

33. Knox, J. H. M., Jr.: The Value of the von Pirquet Test as Controlled by Necropsy Findings. AM. JOUR. DIS. CHILD., 1917, **14**, 47.

34. Lindberg, G.: Modification of the Skin Tuberculin Reaction after Repeated Application. Hygiea, Stockholm, 1916, **78**, 1553.

35. Pisani, S.: Regional Cutaneous Reaction. Arch. de méd. d. enf., 1916, **19**, 632.

36. Gauvain, H. J.: Reaction to Human and Bovine Tuberculin, Applied by the Method of v. Pirquet, in Cases of Tuberculous Disease of Bones and Joints. Lancet, London, 1917, **2**, 519.

37. Brocq, M. L.: The Development of Lichen Scrofulosorum around an Intradermal Tuberculin Reaction. *Arch. de méd. d. enf.*, 1917, **20**, 590.
38. Kashara, M.: The Specific Diagnosis of Tuberculous Meningitis. *Am. Jour. Dis. Child.*, 1917, **13**, 141.
39. Golay, J.: Chemical Reactions of the Cerebrospinal Fluid in Differentiation of Tuberculous Meningitis. *Arch. de méd. d. enf.*, 1917, **20**, 169.
40. Leffler, J.: Tubercle Bacilli in the Feces of Children with Tuberculosis of the Air Passages. *Hygiea*, Stockholm, 1916, **78**, 1809.

The following outline for the diagnosis of tuberculosis in children is formulated by J. A. Miller and B. H. Waters²⁸ for the National Association for the Study and Prevention of Tuberculosis.

In the history record should be made of exposure to infection (especially if prolonged), delayed convalescence from any illness, malnutrition, underweight or loss of weight, cough, expectoration, hemorrhage, pain, pleurisy, dyspnea, night sweats, digestive disturbances and ear discharge.

Important physical signs are persistent and persistently localized râles, additional abnormal signs elicited by the usual methods of examination, any gland, joint, bone, muscular, cutaneous, ocular or aural abnormalities. Essential for diagnosis of pulmonary tuberculosis are distinct persistent or persistently localized adventitious sounds in the chest. Temperature over 99 F. by mouth recorded twice a week for a month and not otherwise to be explained. A positive tuberculin test. Exceptionally, in the absence of adventitious signs, a diagnosis of tuberculosis can be made in the following instances: (1) A positive tuberculin reaction with an unquestioned and otherwise unexplained hemoptysis, with or without a positive roentgenogram; (2) a positive tuberculin reaction in children under 3 or 4 years of age without constitutional symptoms, and in older children with frequent cough or rapid pulse or fever, and a roentgenogram which shows unmistakable mottling in the pulmonic field. No patient with fever and persistent physical signs should be considered free from tuberculosis until the tuberculin test has given a negative reaction three successive times. Examiners are reminded that undue importance should not be ascribed to slight vocal and respiratory modifications or to slight alterations in the percussion note so frequently present in children, especially at the apexes.

For the diagnosis of forms of tuberculosis other than pulmonary there must exist suggestive physical signs or constitutional symptoms or both, a negative Wassermann and a positive tuberculin test.

On a study of the case records of 200 children in a sanitarium for tuberculosis, H. D. Chadwick and R. Morgan²⁹ summarize the essentials in the diagnosis of this disease. They emphasize the importance of symptoms indicating tuberculin absorption, namely, weakness, undue fatigue, fever, poor appetite, failure to gain, or loss of weight

and nervous irritability. Symptoms of local involvement are cough, hoarseness and occasionally streaked sputum. The usual physical signs are dulness in the interscapular region radiating into the apexes at the back, frequently not elicited in front. There may or may not be changes in the respiratory sounds. Râles may or may not be present. Symptoms, both constitutional and local, together with a history of exposure, are to be given greater weight in making a diagnosis of active tuberculosis than the presence or absence of physical signs. Percussion is more important than auscultation. A thickened area in the lung or region of the bronchial glands does not in itself mean active tuberculosis. It may be a healed lesion that needs no treatment. Such thickening may also be caused by other diseases than tuberculosis. The child showing constitutional symptoms, even without local signs of disease in the chest, should be considered suspicious, kept under careful observation, and subjected to hygienic treatment in the home. Signs in the chest without constitutional symptoms indicate an old inactive infection that needs no treatment. Individualization and common sense must be used, all the factors in the case weighed and, with experience as a guide, few errors in diagnosis will be made.

M. Fishberg³⁰ discusses the diagnosis of pulmonary tuberculosis in children of school age. He believes it exceedingly rare at this age, and that when it does occur it is of the same type as in adults. Moreover, the physical findings and symptoms are practically the same as when the disease occurs in adults. Thus, children with pulmonary tuberculosis (if the disease is active) have cough, fever, night sweats, tachycardia, and emaciation. The cough may be mild or severe, may be paroxysmal or croupy, or not unlike whooping cough. The fever may be of any type, but it must not be forgotten that instability of temperature is very common and that fever alone is not to be considered pathognomonic of tuberculosis. Excitement, excessive exercise, or a slight gastric disturbance may elevate it. Also moderate elevation of temperature is very frequently due to focal infections of the nose and throat. Night sweats are only significant when they occur during the early morning hours. The pulse rate is an important diagnostic criterion. Active tuberculosis of the lungs may be excluded, when a child under 10 years has a pulse rate of less than eighty per minute. Tachycardia is almost invariably the rule in phthisis of children. Enlargement of the supraclavicular glands is also of great diagnostic significance. It is nearly always due to tuberculosis of the apex of the lung of the affected side. With any or all of the above symptoms pulmonary tuberculosis should be suspected, but no diagnosis made unless the lesion is localized by physical exploration of the chest. In pulmonary tuberculosis of children the lesion is almost invariably

localized at the apex, and statements made by some authors to the effect that it is found at the base or in the region of the hilus result from a confusion of disease of the tracheobronchial glands with disease of the pulmonary parenchyma. Pulmonary tuberculosis should be diagnosed in a child with lesions in the lower lobes, only when tubercle bacilli are found in the sputum, or when all other possible causes have been excluded. Bronchiectasis and multiple abscesses of the lung may give signs similar to those of tuberculosis. In many children suffering from adenoid vegetations of the nasopharynx there is impaired resonance in one of the apexes, usually the right, with bronchial or bronchovesicular breathing. Inasmuch as there is cough and often fever or loss of weight, the diagnosis of tuberculosis is likely to be made. Similar physical signs occur also in children with valvular heart disease. The roentgen ray is of immense value in diagnosis, if properly interpreted. In pulmonary tuberculosis in children the opacities will be found in the parenchyma of the apex, as in adults. Roentgen-ray findings, however, without constitutional symptoms do not justify a diagnosis of pulmonary tuberculosis. As regards the findings of tubercle bacilli in the sputum of children with pulmonary tuberculosis, Fishberg has found them in nearly all his cases. The tuberculin test he says is of no value in children over 4 years, as it only indicates tuberculous infection, not tuberculous disease.

In J. Signorelli's³¹ experience the physical signs were the most important factor in the diagnosis of pulmonary tuberculosis in children. Next was the roentgen-ray examination, which has never failed to corroborate a lesion found clinically, while in obscure cases it has often pointed the way to a conclusion. The von Pirquet test applied three consecutive times, he found, gave a positive reaction in 85 per cent. of children with tuberculosis, while children with nontuberculous lesions always failed to react. D'Espine's sign he found present in 80 per cent. of tuberculous and in 15 per cent. of nontuberculous patients. The finding of tubercle bacilli in the sputum was an absolutely indisputable sign. Signorelli emphasizes the importance of not depending on one mode of examination or on one single examination in making a diagnosis, even though it might appear conclusive.

A. Lankester³² has attempted to find some physical test, easy of application to schoolchildren on a large scale, which could be relied on to give an indication of the extent and prevalence of tuberculosis in the environment from which the children come. He thought that as a very large percentage of enlarged cervical glands are due to tuberculous infection, he might be able to determine a true correlation between the percentage of children showing enlargement of these glands and the number of cases of phthisis in the community to which

they belong. After compiling and studying statistics, however, he has come to the conclusion that the gland index method needs to be further safeguarded before it can be regarded as suitable for general adoption as a measure for tuberculous prevalence. The reasons for this conclusion are the element of possible variation due to a personal factor in the examiner, and to the fact that tuberculosis is only one among several causes of glandular enlargement.

J. H. Mason Knox, Jr.,⁴⁰ reports the results of a study of the von Pirquet cutaneous test for tuberculosis in a series of children on whom careful necropsies were performed. The test was made as a routine measure with Koch's old tuberculin. During the period of investigation, from November, 1912, to April, 1917, there were 2,940 children admitted to the hospital and there were 750 deaths. Necropsies were performed on 324 children. Two hundred and fifty-six, or 80 per cent., were found free of tuberculosis, and sixty-eight, or 20 per cent., were found to have tuberculous lesions. Of the 256 cases having no tuberculous lesion, the tuberculin test had been made in 172 instances and was negative without exception. Of the sixty-eight cases in which tuberculous lesions were found, the von Pirquet test had been performed in sixty-one. Of these it was positive in forty-five and negative in sixteen. The negative cases were carefully analyzed. In twelve instances the patients had a rapidly advancing, widespread miliary tuberculosis, in two instances a tuberculous meningitis, in two, advanced pulmonary tuberculosis, and in one, a tuberculous peritonitis. Knox concludes from these results that the cutaneous tuberculin test as described by von Pirquet is a most reliable aid in the detection of tuberculosis in children; that a positive reaction invariably indicates a tuberculous focus in the body, and that a persistently negative reaction establishes the fact that there is no lesion except in those extremely sick patients, where the presence of tuberculosis can be readily established by physical examination.

G. Lindberg³⁴ has applied repeated skin tuberculin tests to 129 children from 1 to 12 years in the hospital and sanatorium with which he is connected. The tuberculin skin test was applied to each arm and repeated after a week's interval. The reaction was measured in both the axial and transverse diameters twenty-four hours after the test and a week later. When neither diameter was over 5 mm. the reaction was recorded as negative. Of the 129 children, 33.3 per cent. showed a much more pronounced response to the second test than to the first. In 60 per cent. the response was weaker in the second than in the first; in 6.7 per cent. there was but slight difference.

Lindberg divides the patients into three groups—those with active, those with probable and those with nontuberculous lesions. Intensifi-

cation of the reaction, or positive sensitization, occurred in only 5.3 per cent. of the thirty-six cases in the first group; in 28.5 per cent. of sixteen in the probable group, and in 78 per cent. of the last group.

The results of the research testify that with inactive tuberculosis the response to the repetition of the tuberculin skin test is more pronounced than at the first test, while the reverse is the rule with active tuberculosis. The attenuation of the response to a second application of the test has thus a favorable instead of an unfavorable significance.

S. Pisani³⁵ reports his results with the cutaneous tuberculin test, when the injection is made in the skin over the affected viscera. In patients having unilateral renal tuberculosis without other active lesions he has observed that the cutaneous reaction is markedly positive in the lumbar region on the side corresponding to the affected kidney and negative on the other side. The reaction in the skin of the arm may be positive or negative.

In patients suffering from tuberculous peritonitis and in those with tuberculosis of the adnexa, the cutaneous reaction in the skin of the abdomen is very marked, while on the arm it is negative or only slightly positive.

In patients with incipient pulmonary tuberculosis, localized in the apex, with no fever the cutaneous reaction is more precocious and intense in the neighborhood of the affected part. The opposite is true with advanced lesions and in patients with high temperatures.

In patients with a bilateral pulmonary tuberculosis, recent or old, febrile or apyretic, the cutaneous reaction is more intense on the side of the less advanced lesion, a true paradoxical reaction.

In patients suffering from pulmonary tuberculosis with a therapeutic pneumothorax, the cutaneous reaction diminishes without becoming completely negative on the side of the pneumothorax; on the other hand, it becomes positive on the opposite side. If therapeutic intervention, however, has been performed early for a purely unilateral lesion, the reaction usually disappears on both sides.

In patients affected with pleurisy with effusion, the cutaneous reaction varies; usually the fluid hinders the manifestation of the cutaneous reaction.

Pisani concludes that the regional cutaneous reaction is merely a phenomenon of reaction in a region containing lymphatics which drain a tuberculous lesion. Its diagnostic significance is identical with that of the ordinary cutaneous reaction. Its essential characteristic is its greater sensitiveness.

H. J. Gauvain³⁶ applied the von Pirquet test with human and bovine tuberculin to children suffering from tuberculosis of the bones and joints. He wished to ascertain whether the reaction was constantly

present in this form of tuberculous disease; if not present, under what circumstances the reaction would not appear; whether it could be decided by using both human and bovine tuberculin for the test that the patient was suffering from tuberculosis of human or bovine origin; whether the degree of reaction would be an indication of the severity of the infection. The author employed Koch's old tuberculin prepared from the human type of bacilli, and his tuberculin prepared in the identical way from bacilli of bovine origin. The tuberculins were applied to suitable skin scarifications in dilutions of 1:64, 1:16, 1:14, and in full strength, each in approximately equal bulk and controlled by inoculation of the same quantity of sterile normal saline solution. In all, eighty cases were investigated. Local reactions to both human and bovine tuberculin were invariably present in patients from whom tubercle bacilli were isolated from the local lesions. The local reactions to human and bovine tuberculin, however, were found to be essentially similar. In twenty-three the reactions were so nearly equal that it was impossible to decide which was greater. In twenty-one cases the reaction to human tuberculin was somewhat greater than to bovine, and in twenty-five the reaction to bovine was slightly more marked than to human. In four cases the reaction to human tuberculin was markedly greater than to the bovine, and in seven the bovine was markedly greater than to the human. It was therefore impossible by the nature of the reaction to the tuberculin employed to differentiate the type of tubercle bacilli with which the patient was attacked. Gauvain found that patients who were weakly and cachectic, irrespective of the severity of the local tuberculous lesion, reacted feebly, while patients who were strong showed an intense or mild reaction, irrespective of the local lesion. No guide to prognosis could be found by comparing the reactions produced by the weaker and stronger solutions of tuberculin.

M. L. Brocq⁸⁷ reports an instance of lichen scrofulosorum developing around an intradermal tuberculin reaction. The patient, a 13½-year-old girl, entered the hospital April 19, 1917. For five years she had been frail and delicate and had suffered from enlarged cervical and submaxillary glands. During the last two years these had greatly enlarged, and, when the child entered the hospital, had formed voluminous masses on either side of the neck. There was also evidence of enlargement of the tracheobronchial glands. A month before entrance there had appeared on the anterior part of the thorax, the abdomen, in the hypogastric region on the lower part of the back, in the sacrolumbar region and in the region of the deltoids, lesions typical of lichen scrofulosorum. At the same time on the anterior surfaces of both legs were discrete, larger lesions, which were diagnosed as papu-

lonecrotic tuberculids. On entrance to the hospital an intradermal tuberculin test was made with one drop of a 1 to 10,000 solution of tuberculin. In forty-eight hours there was a strong local reaction and an elevation of temperature to 38 C. The center of the reaction was of an opaline tint, at least 1 cm. in diameter; the periphery was swollen and bright red. The following day there was a bulla in the center and two days later there formed a small superficial scab, which dropped off in fifteen days. Ten days after the formation of the scab there appeared around the intradermal reaction a bright red eruption having all the characteristics of a lichen scrofulosorum. Between the central scar and the eruption was a zone free of lesions, corresponding to the erythematous zone area which surrounded the central scar the first few days of the reaction. On the twenty-third of May a second intradermal reaction was made in the left thigh, which was followed by a reaction as strong as the first, although no eruption appeared. Following this second test the eruption on the arm seemed to fade. The two points to which the writer calls particular attention are the appearance of the lichen scrofulosorum around an intradermal tuberculin reaction and the development of a zone 2.5 cm. in diameter around the reaction where no eruption formed. He quotes several reports of eruptions following injection of tuberculin, but none which resembled this.

M. Kashara³⁸ believes he has discovered a specific diagnosis of tuberculous meningitis, by a focal reaction to tuberculin. After the removal of a certain quantity of cerebrospinal fluid by lumbar puncture for cytologic examination an intradural injection is made of from 0.01 to 0.002 mg. of Koch's old tuberculin diluted with 0.5 to 1 c.c. of physiologic salt solution. After six, twelve or twenty-four hours a cytologic examination is again made of the fluid, which is obtained by lumbar puncture, and a comparison made with that previously obtained. In this way the author examined nine cases and found that after the tuberculin injection there was an increase in the number of cells in general, and chiefly a remarkable appearance of red blood cells, a considerable increase in the lymphocytes, and a moderate increase in the polymorphonuclear cells. Moreover, in cases of tuberculous meningitis the cerebrospinal fluid after the injection is turbid and occasionally yellow in color. Kashara found no change in the cerebrospinal fluid after the injection of tuberculin in cases of epidemic meningitis and of chronic hydrocephalus.

J. Golay³⁹ has observed in the Children's Clinic at Geneva many cases of meningismus and of meningitis with a lymphocytosis which simulated tuberculous meningitis, and he has found that by a chemical examination a diagnosis can be made with more certainty than by a

cytologic examination, and more rapidly than by a bacteriologic examination. He emphasizes the importance of differentiating these conditions, especially in view of the benign character of meningismus and of the fatal outcome of tuberculous meningitis. Golay studied the spinal fluid in twenty-six cases of tuberculous meningitis and found in twenty-three a high albumin content, that is, ranging between 1 or 2 gm. per thousand, instead of the normal 0.1 or 0.2 gm. per thousand. In other forms of meningitis and meningismus it ranges between 0.1 and 0.3 gm. per thousand. For determining the amount of albumin the author used either the silver nitrate or neutral chromate of potassium test. Moreover, Golay found that the determination of the amount of chlorids was of great value in making the diagnosis. In the cases of tuberculous meningitis the chlorids ran very low. Instead of the normal 7.25 to 7.40 gm. per thousand they ranged between 5.5 to 6.5 gm., while in cases of meningismus and meningitis they remained within the normal limits.

J. Leffler⁴⁰ has made a study of the feces of 100 tuberculous children and has analyzed the literature on the finding of tubercle bacilli in the stools of children with tuberculous processes of the respiratory tract. Examination of the feces by the Reh method gave positive results in 16.4 per cent. of the cases, most of these being children of 11 to 14 years or infants under 1 year. The author believes that the examination of the feces should be undertaken as a routine procedure along with other diagnostic methods. He thinks it is especially valuable in infiltrating pulmonary tuberculosis of young children, where sputum containing tubercle bacilli is obtained only with difficulty, if at all.

PROGNOSIS

41. Hemplemann, T. C.: Prognosis of Tuberculosis in Infancy. *Am. Rev. of Tuberc.*, 1917, **1**, 99.

42. Hemplemann, T. C.: Frequency of Tuberculids in Infancy and Childhood and their Relation to Prognosis. *Arch. Pédat.*, 1917, **34**, 362.

43. Schwab, J. B.: The Diazo Reaction No Guide in the Prognosis of Tuberculosis in Children. *Nederl. Tijdschr. v. Geneesk.*, 1917, **1**, 1010.

In regard to the prognosis of tuberculosis in children, T. C. Hemplemann⁴¹ says that evidence is accumulating which proves that a certain number of children with pulmonary tuberculosis even in the first year of life do recover, and that this number could be increased if as much effort and care were expended on them as on those who contract it later. The author has studied the mortality of 130 cases of pulmonary tuberculosis in the first two years of life and has arranged the cases in three tables. Table 1 shows the number of children known to have died, the age at the time the diagnosis was made, and the interval elapsing between this and death. In this group

were sixty-four, of whom thirty-seven were less than 1 year old at the time of diagnosis, and twenty-seven were in the second year of life. Forty-six, or 72 per cent., died within three months after diagnosis. As many of these infants were brought to the hospital moribund, these figures give no reliable indication of the rate of progress of the disease. Eighteen infants lived at least three months after the diagnosis was made, nine lived over six months, seven over nine months, three more than a year, and one a year and a half.

Table 2 shows the number of children living at the time of the last note on the history sheet, their ages at the time of the diagnosis of tuberculosis and the length of time they were under observation. There were sixty-six cases in all. Thirty-one were followed less than six months, thirty-five more than six months. Thirty infants were observed for one year or longer, and some observed for periods of four to five years. Only two of these showed symptoms referable to the lungs when last seen, while seven gave other evidence of tuberculosis. Of these thirty, ten were under 1 year of age, when the diagnosis was made, and only one showed active tuberculosis at the time of this report. The other twenty infants were between the ages of 12 and 24 months when the diagnosis was made, and only one showed evidence of pulmonary disease at the time of the report, although six others showed other evidence of tuberculous disease.

Table 3 gives the mortality statistics of children who lived for at least one year. Under 1 year of age the mortality was 78.7 per cent.; from 1 to 2 years it was 57.4 per cent., and for 2 years, 68 per cent.

T. C. Hemplemann⁴² has made an effort to ascertain the relation of tuberculids to prognosis in children. Here and there in the literature he has found the statement that tuberculids are of very grave prognostic import in the tuberculosis of childhood, and that their presence is an indication of general miliary tuberculosis. Hemplemann's material consisted of 130 cases of pulmonary tuberculosis in infants under 2 years of age, thirty of whom showed papulonecrotic tuberculids, and ten cases of tuberculids in children between 2 and 12 years. In all but one of the forty cases there was evidence of lung or tracheobronchial lymph node involvement in addition to the tuberculids. Of the forty children, thirteen are known to have died, eleven of these being in the first year of life and the other two in the second. Eleven children were observed for a period of at least one year after the occurrence of the tuberculids and were doing well when last heard from. Five of these were in the first year of life, five in the second, and one in the fourth. Of the five under 1 year, three were observed for two years or longer, two for three or longer, and one for five years. Of the five in the second year of life, two were observed for three

years and one for four years. One other child, 3½ years old when the tuberculids were discovered, was living at the time of the last note on the history, over two years later. In addition to these children there were sixteen more living, but they were observed for less than a year, and are classified in a separate group because of the uncertainty of their fate. From these statistics the author concludes that tuberculids bear no direct relation to prognosis, as some of the children under observation had showed tuberculids four or five years.

J. B. Schwab⁴³ comments on the difficulty of deciding the prognosis of tuberculosis in children. She studied the diazo and urochromogen reactions in the urine to see whether any light could be thrown on the subject. The children studied were under observation for various periods of time, some only a few days, others as long as seven years. Among them there were 23 with tuberculous meningitis; 15 with generalized tuberculosis; 5 with pulmonary and peritoneal tuberculosis; 10 with tuberculous peritonitis; 33 with pulmonary tuberculosis, and a number with tuberculous pleurisy and glands. The diazo reaction was constantly negative in 55, including 35 progressive and fatal cases, and constantly positive in 27, of which 23 have since proved fatal. The urochromogen reaction ran parallel to the diazo with a few exceptions and did not seem more sensitive than the latter. In 7 cases the diazo varied from positive to negative and clinically the prognosis in this group was always dubious or grave. In short, the article may be summarized by the statement that the diazo reaction is not a reliable guide for the prognosis of tuberculosis in children.

PROPHYLAXIS

44. Combe: Prophylaxis and Prevention of Generalization of Tuberculosis in Infants. *Le Nourrisson*, 1916, **4**, 347.

45. Moor, F. C.: Tuberculous Disease of Children. *Southern Med. Jour.*, 1917, **10**, 300.

46. Kirkwood, R. M.: The Child and the Tuberculosis Problem. *Pediatrics*, 1917, **29**, 46.

47. Kerr, J.: Phthisis and School Children. *Pediatrics*, 1917, **29**, 184.

48. Quimby, J. P.: The Preventorium for Children at Farmington, New Jersey. *Modern Hosp.*, 1917, **8**, 177.

Minor, C. L.: Importance of Control of Childhood Infection in the Crusade for the Eradication of Tuberculosis. *Southern Med. Jour.*, 1917, **10**, 122.

Combe⁴⁴ discusses at length the prophylaxis of tuberculosis in infancy. He says that infection during the first 18 months means death within six or eight months, and so must be prevented at any cost. Prophylactic measures include prevention of infection both by the bovine and human bacillus. To prevent bovine infection milk must be obtained from healthy, tuberculin-tested cows; otherwise it must be boiled or pasteurized. The greatest danger to the infant comes

from human infection — from some tuberculous member of the family — and measures to prevent this kind of infection are expensive and difficult to carry out in the homes of the poor and middle class, since the child must be kept from contact with the tuberculous individual and with objects contaminated by the bacilli. Phthisical mothers are the chief source of infection. They must not nurse their infants, not only because of the toxins the milk contains, but because of the great danger of multiple reinfection from the intimate contact of mother and babe. Tuberculous parents should never kiss their infants, and should limit contact to strict necessity, and that never without washing and disinfecting their hands. They should disinfect their mouths many times a day and hold a handkerchief before the mouth when talking, coughing or sneezing. To prevent infection from contaminated objects, all toilet and table articles should be boiled regularly after use. Soiled linen and clothes should be thrown into boiling water and pressed with a very hot iron. Floors should never be swept, but dusted with a cloth dipped in turpentine. Walls and floors should be washed frequently with antiseptics. The infant should never be allowed to crawl on the floor, or only on a freshly laundered sheet in a railed space. All toys, rubber nipples, etc., should be boiled each time they are given to the child. For the most part prophylaxis in the home is inapplicable and not efficacious and resort must be had to removal of either the patient or the infant. The author is of the opinion that the only means of preventing tuberculosis in infants is to found asylums where infants of tuberculous parents can be placed directly after birth. In France, Germany and Switzerland institutions of this kind are already established.

In case the infant has become infected, prophylactic measures must be taken to prevent generalization of the disease. This can best be done by increasing the resistance of the infant, by change of climate, by proper diet and heliotherapy. The author prefers subalpine to alpine climates for these infants and is not quite sure of the advisability of sending them to the seashore. He thinks heliotherapy is a great aid in raising the resistance, and uses not only sun baths but artificial rays (actinic), declaring the results with the artificial ultraviolet rays to be identical with those obtained with the sun's rays. As to diet, he believes that a great many tuberculous infants suffer from a toxic dyspepsia, with inability to digest fats, so they should be fed a fat-free milk to which has been added malt, farina and Soxhlet's sugar. In some instances they thrive better on albumin milk. A wet-nurse should be procured if possible.

In a paper on tuberculous disease of children, F. C. Moor⁴⁵ discusses first the frequency, the symptoms and the signs of the disease

and then emphasizes the importance of prophylaxis. He says the first decade of life is the period of greatest susceptibility to the infection, and the prophylaxis of tuberculosis in childhood is the most important proposition confronting the medical profession. Moor thinks the first requisite for the proper institution of preventive measures is a complete census of cases of tuberculosis and the enforcing of a law that all new cases be reported. In connection with these reports there should be collected data as to the home conditions of the patients, the number of rooms available for occupancy, the size of the family, and especially the number and ages of the children. These data should be arranged on a unit basis, and with such an arrangement one district nurse to each unit could make the rounds often enough to keep in touch with conditions in each family and to a certain extent combine the duties of a visiting tuberculosis nurse and child welfare worker. Other points to be emphasized are ample protection of all children under 5 and prevention of massive infection, which is sure to occur when there is active disease in either parents or some other member of the household. In families in which ignorance and poverty or a bedridden mother makes home conditions hopeless, there is nothing to be considered but the removal of the younger children to a preventorium, the establishment of which is one of the first problems.

A second and less important requirement in preventing infection is the control of bovine tuberculosis. This can be done by uniform state laws or, better still, by federal laws.

In addition, the author touches on the importance of improving the general physical condition of the child, especially during school age, and he suggests a school medical adviser as well as a school medical inspector. Every child who is anemic, under weight, scrofulous, or otherwise below par should be given the advantage of open air schools and receive especial care from the medical supervisor.

To the end of preventing tuberculosis in the child, R. M. Kirkwood⁴⁶ suggests a number of measures. Very important is the establishment in existing sanatoriums of maternity departments properly equipped and in charge of competent obstetricians, or the establishment of especial maternity sanatoriums or open-air pavillions in existing maternity hospitals, where pregnant women approaching term can be cared for under ideal conditions for a pulmonary invalid; where they can be delivered by a technic most careful to conserve strength, and where the new-born babe can be immediately removed from the tuberculous mother and fed by a nontuberculous wetnurse or by artificial means.

Other measures suggested by the author are the examination for tuberculosis of midwives, obstetric nurses and nurse maids; the sys-

tematic performance of the von Pirquet test on all children; the establishment of preventoriums for children in the pretuberculous stage; the passing of laws prohibiting the marriage of the tuberculous; careful hygiene of homes and schools; proper feeding of children; instruction of school teachers in regard to facts about tuberculosis and its prevention.

According to J. Kerr,⁴⁷ statistics in England show that in the five years before school age and in the years after school age the mortality rate from phthisis among females is continually decreasing, as compared with that of males, while at school age the mortality among boys goes down progressively faster than among girls. Similar statistics have been collected on the continent. The writer thinks this difference in the phthisis mortality between the two sexes represents a difference in vitality and preventable illness, and he emphasizes the necessity of a more natural life for both boys and girls, instead of the cloistered life of the old schoolroom.

J. Palmer Quimby⁴⁸ describes the Tuberculosis Preventorium for Children at Farmingdale, New Jersey. He says that this institution was organized primarily for the care of poorly nourished, underfed children, exposed to tuberculous infection in their homes, who had already contracted tuberculosis, as a positive tuberculin reaction showed, but who had no open lesion. At the preventorium over 100 children are accommodated. They are kept for an average period of four and a half months, so that the institution provides annually for nearly 600 children. In addition to a reception pavilion where all children are quarantined for three weeks in order to prevent infection of the large group, there are four open air shacks, each accommodating thirty-two children, a small infirmary, school buildings, a large administration building, with a dining room which seats all of the children, and, last but not least, 170 acres of land in the sandy pine belt, over which the children roam and play. As children are accepted between the ages of four and fourteen years, it is necessary to give school instruction. There are three teachers, and the two-hour school period provided has proved sufficient to keep the children up to their public school grades.

During the stay of the children at the preventorium the condition of their homes is looked into and improvements instigated. Every six months after discharge the children are visited in their homes and their physical condition and the surroundings noted.

The executive committee of the preventorium determined to help the general tuberculosis campaign by giving employment to tuberculous patients with arrested disease. At the time of writing this article there were fifteen people of this class there and the plan as a whole has proved successful. Also in connection with the preventorium there

has been built a nursery for the care of infants under 2 years of age of tuberculous mothers. Infants remain in the institution for a period of one year, practically living in the open air, and their resisting power is materially increased.

TREATMENT

49. Combe: Treatment of Tuberculosis in Infancy with Tuberculin. *Le Nourrisson*, 1917, **5**, 17.

50. Blumenau, N. R.: Pretuberculosis in Children and Treatment with Tuberculin. *Russk. Vrach.*, 1917, **16**, 289.

51. Hollos, J.: Detection and Treatment of Tuberculosis in Children. *Ztschr. f. Tuberk.*, 1916, **26**, 321.

52. Lasserre, C.: Heliotherapy at Seashore Sanitarium in Southern France. *Jour. de méd. de Bordeaux*, 1917, **88**, 103.

53. Hyde, C. L., and Grasso, H. L.: Rollier Treatment of Tuberculosis. *New York Med. Jour.*, 1917, **105**, 11.

54. White, W. C., Stewart, A. E., and Shuey, P. F.: New Children's Hospital of the Tuberculosis League of Pittsburgh. *Modern Hosp.*, 1917, **8**, 312.

55. Tilli, P.: Autoserotherapy of Tuberculous Meningitis. *Policlinico*, Rome, 1916, **23**, 1357.

56. Weil, P. E., and Loiseleur: Treatment of Tuberculous Pericarditis with Insufflation of Air into the Pericardial Sac. *Arch. de méd. d. enf.*, 1917, **20**, 601.

Becker, H. E.: Treatment of Tuberculosis in Children in North Sea Sanitarium. *Med. Klin*, 1916, **12**, 1353.

Combe⁴⁹ believes that tuberculin therapy is only justified in (1) children afflicted with closed tuberculosis or with limited lesions producing a minimum amount of tuberculin; (2) children who produce an insufficient quantity of antibodies, as those with tracheobronchial tuberculosis, and (3) infants whose organisms are not yet adapted to the formation of antibodies. As regards administering the tuberculin, Combe tried the subcutaneous method, but has discarded it because of disastrous results; but he has been very successful with the intercutaneous method. He begins the treatment with an intercutaneous injection of 0.01 mg. of old tuberculin. If the reaction following this amount is less than 5 mm. in diameter, he uses it for the initial therapeutic dose. If the reaction is larger, he commences with 0.002 or 0.001 mg. The injections are given twice a week and the dose doubled at each injection, if conditions warrant. The increase, however, is gaged by the local reaction and the behavior of the eosinophil cells. Progressive diminution in size of the local reaction, as the therapeutic dose of tuberculin is increased, indicates that antibodies are being produced and immunity established, and speaks favorably for the treatment. On the other hand, if the local reaction increases as the dose of tuberculin is increased, the treatment is harmful and should be discontinued. Moreover, in favorable cases there is an increase in the eosinophil cells, which begins two hours after treatment and lasts until the tuberculin is decomposed, so that forty-eight hours after the injection the count becomes normal again. If too large a dose of tuberculin

has been injected, the eosinophilia persists several days, until all the tuberculin is decomposed.

In ten years of experience the author has become convinced of the value of this method, and he has never known an accident to follow the injections. If begun while the disease is still localized, the temperature drops, the appetite improves, the patient takes on weight, and the course, often fatally progressive, is arrested. The method is of no value if the disease has become generalized.

Combe has lately used another agent with apparent success in the treatment of tuberculosis of infants, namely, roentgenography. In the year he treated fifty children suffering from glandular and pulmonary tuberculosis and observed an improvement in their general condition and in the pulmonary lesions as shown by the roentgenograms. The roentgen ray stimulates the formation of connective tissue around the tuberculous lesions. This was proved in one patient who came to necropsy. The child had a tuberculous peritonitis and a lesion in the apex of the lung. The apical lesion had been exposed to the roentgen ray three times at intervals of eight days, and at necropsy it was found arrested and walled in with connective tissue. The thymus gland was found atrophied, and if this was the result of the treatment a word of warning must be sounded, as early atrophy of gland may result in retardation of development.

N. R. Blumenau⁵⁰ believes that pretuberculous children should be treated with inunctions of tuberculin. He reports experiments on guinea-pigs which apparently prove that toxins rubbed into the uninjured skin, after it has been shaved and cleansed of grease, pass through the skin as through a special filter and induce the production of antibodies in the organism. The animals kept well and even increased in weight, although they were given inunctions of diphtheria toxin in a 50 per cent. ointment. They then survived the subcutaneous injection of four times the fatal dose of diphtheria toxin. The author's experiments on animals were not numerous, but the results were so convincing that he applied the method at once to seventy children. The most effectual technic was to apply a drop of pure tuberculin to the forearm and then shave off a scrap of skin through it. The mixture of the superficial layer of the epidermis and the tuberculin formed a thin salve-like mixture, which was then rubbed into the skin until dry. Adhesive plaster was applied over the spot. When this was removed twenty-four or forty-eight hours later, the skin underneath displayed a strong, or weak reaction, and the inunction was repeated after an interval corresponding to the strength of the reaction. The dose of tuberculin was also progressively increased to a total of four drops. At first the intervals were usually three or five days, but, when the 4-drop dose was reached, the intervals were a week. The results in

the cases of well defined tuberculosis, especially of the lungs, were, as might be expected, scarcely amenable to treatment, but in incipient or occult tuberculosis the therapeutic results were prompt and striking. Blumenau gives a brief summary of eighteen cases. Some of the children were 9 or 10 months old, but the majority were between 2 and 11 years. Parents usually brought the children to the dispensary because of lassitude, drowsiness and apathy, or the reverse, excessive nervousness and irritability. There was frequently loss of appetite, restless sleep, persistent headache, palpitation, cough, pain in the side or chest and in the bones of the arms and legs. The majority were frail and undernourished. In order to arrive at a diagnosis it is not sufficient only to examine the child, but careful inquiry must be made as to the health of the parents and other relatives to ascertain whether any of them may have had pleurisy or chronic pulmonary disease, or whether any child in the family may have died of meningitis, or any one in the building had a chronic cough. None of the symptoms described are pathognomonic of tuberculosis, but when a possible source of infection is known, Blumenau thinks the tuberculin test will often reveal that they are the results of autointoxication from some tuberculous focus.

J. Hollos⁵¹ emphasizes the importance of detecting latent tuberculosis in children, because he believes that with specific treatment it is in that stage completely curable in a comparatively short time. The symptoms of latent tuberculosis are the result of the toxins on various organs. Especially developmental defects are the result of this tuberculous toxemia. A child who has previously developed normally grows thin and pale, the skin loses its elasticity, the muscles become flabby, the bones are inclined to soften and bend. Digestive disturbances and loss of appetite develop. The child becomes nervous and excitable. He cries easily or is always sleepy. Tuberculous toxins either excite or inhibit the functions of the thyroid gland, so that there may be, on the one hand, vasomotor excitability, rapid pulse, tendency to sweating, and, on the other, stunted growth and mental backwardness. Vasomotor disturbances are very common in children with latent tuberculosis. There is headache, dizziness, irregular pulse, pallor or flushing of the face, cold hands and feet. These children catch cold easily, frequently have eczema and pruritus, pains in the muscles, joints or abdomen. Mental development, however, is usually unaffected. The tuberculous toxins also depress or excite the sexual organs, so that a latent tuberculosis at puberty gives a varied picture. Sometimes there is an early sexual development with profuse menstruation, dysmenorrhea, headache and palpitation. Sometimes menstruation is retarded until the sixteenth or eighteenth year, and then is scant and intermittent. The child grows rapidly but remains pale and weak, and

finally develops the characteristic tuberculous habitus. In boys early and repeated pollutions and sexual nervousness should arouse the suspicion of tuberculosis.

Childhood is the most favorable time to effect a cure of tuberculosis. The process is comparatively recent, retrograde changes and mixed infections have not occurred and lowered the vitality of the organism. Treatment must include (1) prevention of repeated infections; (2) establishment of increased resistance; (3) specific treatment. Under the present social upheaval it is almost impossible to improve social or hygienic conditions and so fulfill the first two requirements. All the more important is the specific treatment, which, according to Hollos, is a positive cure even in poor hygienic surroundings. He regards every infant and every child who lives in a tuberculous environment as infected and advises a course of tuberculin treatment. After eight years' experience with Spengler's I. K. (immune bodies) he is even more satisfied with the results obtained in the treatment of tuberculosis in children than in adults, and not only in latent cases, but in advanced and seemingly hopeless ones. But he has obtained the most beneficial effects from the I. K. in children who have no manifest lesion, only subjective and functional disturbances. Moreover, in these cases the I. K. is a great diagnostic aid, for improvement after injection of small doses (vi to vii dilutions) or after inunctions of medium strength (1:20,000, 1:40,000) establishes their tuberculous nature. A few months' treatment brings about a complete cure. Although individualization in treatment is necessary and close watching is advantageous, Hollos has been able to obtain results by giving injections every three or six weeks and depending on the patient's family to use the inunctions every two or three days. He thinks there is no contraindication for the use of I. K. in the treatment of tuberculosis.

C. Lassarre⁵² describes the heliomarine treatment of tuberculosis in children at the Wallenstein foundation. He thinks the wonderful climate of Arcachon associated with heliotherapy is a remarkable therapeutic combination. The foundation has two buildings, the sanatorium and the open air pavilion. The sanatorium is built 500 meters from the water's edge and accommodates forty patients. It has two operating rooms, hydrotherapeutic room, and means for complete radioscopic examination. The open air pavilion has forty beds, twenty for boys between the ages of 4 and 12 years, and twenty for girls between 4 and 18. It is located at the water's edge and is surrounded with pine woods. The routine of treatment is as follows: The children sleep eleven hours, are dressed and exercise in the sand until 8 o'clock, when they have their first meal, of milk or vegetable soup and stew. This is followed by the sun cure and the method of exposure is

practically the same as that of Rollier. At 10 o'clock there are gymnastics; at 11:30 rest in the open air for five hours, interrupted by the midday meal. The evening meal is at 6:30 and consists chiefly of farinaceous foods. Lassarre thinks that the sea baths are an important factor in the treatment. The first bath is given eight or ten days after the child's arrival and they are continued until December, when they are replaced by tepid sprays.

The physiologic effect of the treatment was studied on seventy patients. The pulse is accelerated but always remains full and strong. The blood pressure is diminished during exposure but becomes normal after the treatment. The respiration slightly accelerated. The weight curve always increases. As to the general therapeutic action, the children arrive pale, emaciated and asthenic, and in two months they are completely transformed. The appetite returns, the skin becomes pink, and the children are happy and contented. As regards the local effect of the treatment, the author's experience confirms the opinion of other observers that all local tuberculous lesions are favorably influenced by heliotherapy.

C. L. Hyde and H. L. Grasso⁵³ describe the Adams Memorial Hospital and the results of the Rollier treatment of tuberculosis obtained there. The plant consists of two pavilions one story high with terraces on all sides 21 feet wide, 12 feet covered and 9 feet uncovered. Each pavilion has a central administration building with a kitchen and dining room in the rear and a wing on either side containing two large wards and four private rooms. For the education of the children two teachers are assigned from the school department. There is a large open air school room used for certain class work and when the weather is inclement. The success of treatment has exceeded the writers' expectation. The effect on the general condition of the patient is most remarkable. There is a rapid disappearance of pain, fever and chills; there is a return of appetite and an increase in body weight and strength and an improvement in the blood conditions. The most characteristic local result in the treatment of tuberculous joints by heliotherapy is the return of motion. There is separation and painless spontaneous expulsion of sequestra and intense recalcification. Sinuses and ulcers discharge more freely at first, sloughing follows and the formation of healthy granulations, and finally, healing. Abscesses are often completely absorbed, as are effusions into the joints, peritoneum and pleurae. Up to date ninety patients have been discharged and there are at present 150 under treatment. The average length of stay at the hospital of all patients discharged was 8.4 months, while the average length of stay for those discharged as apparently recovered was 13.5 months. Of the patients who stayed three months or longer, 67 per cent. were discharged apparently cured or with the disease arrested.

Of those who remained six months or longer, 77 per cent. were discharged apparently recovered, and of those who remained nine months or longer, 82 per cent. were discharged apparently recovered. This shows the importance the length of stay has on the results in surgical tuberculosis. As far as the authors have been able to ascertain, there has been no recurrence of the disease in patients apparently recovered at the time of discharge.

W. G. White, A. E. Stewart and P. F. Shuey⁵⁴ describe the new children's building of the Tuberculosis League of Pittsburgh. As one of the chief functions of the Tuberculosis League is teaching undergraduate medical students and nurses, it was necessary to house in this one building many phases of the work. On the ground floor is a ward for fourteen girls and on the second floor a similar ward for boys. On the subbasement floor are the open-air school and toilet rooms, while dining and sewing rooms are on the floor above this. On the dining room floor are the roentgen-ray department and four isolation rooms. On the ground floor with the girls' ward is a small complete operating department, also a students' laboratory, while on the boys' floor is another isolation unit.

P. Tilli⁵⁵ reinjected subcutaneously the cerebrospinal fluid obtained by lumbar puncture in three cases of tuberculous meningitis, in children 3 months, 18 months, and 8 years old. In the youngest child the disease subsided and there was an interval of health, but the meningitis returned ten months later and proved fatal. The 8-year-old child recovered and has had no return of the trouble during the three years to date, but the meningitis has caused blindness and the head is much enlarged. The other child recovered completely under the subcutaneous injections of 1, 2 and 3 c.c. of spinal fluid injected every third day. The cure was complete and has been permanent during the two years to date. This is the only case, however, in which no bacteriologic tests were made.

P. E. Weil and Loiseleur,⁵⁶ with apparently good results, tried the injection of air into the pericardial sac in a case of pericarditis with effusion. The patient was a boy of 14 years, who in March, 1915, had had an infection called grip, complicated with bronchopneumonia and cardiac weakness. There had been edema of the lower extremities, cyanosis, enlargement of the liver, and ascites. When the writers saw the patient in June, they found signs of pericarditis with effusion and of cardiotuberculous cirrhosis, and a generally precarious condition. On June 2 a pericardial puncture was made and a liter of hemorrhagic fluid withdrawn. This was followed by temporary amelioration of the general condition. On July 11 a second puncture was made, 900 c.c. of seropurulent fluid removed and replaced by 500 c.c. of air. All symptoms quickly disappeared. Again, on the 19th, after the

removal of 300 c.c. of fluid, 300 c.c. of air were injected. The radioscopic examination then showed that the pericarditis had cleared up, but at the upper part of the right border of the heart was a pocket of pus. So a fourth puncture was made under control of the screen and 40 c.c. of fluid withdrawn and the same amount of air injected. On July 26 the child was doing well, had no fever since the second puncture, and could sleep lying down; the pulse was 120, of good quality and the respirations were 32. On August 3 another puncture was made and 300 c.c. of yellow fluid withdrawn and the same quantity of air injected. Then, for an entire month the general condition improved and the fluid did not return. On September 5, however, it was again abundant and a sixth puncture was decided on, when 800 c.c. of fluid were removed and 400 c.c. of air injected. On October 25, in spite of the general good condition of the child, the fluid reappeared, and 750 c.c. of fluid were removed and the same amount of air injected.

The authors insist on the advantage of this method of treatment, which is not painful and does not cause dyspnea or discomfort. The operation is not difficult when the effusion is large, and though very difficult when it is small, it can be performed under fluoroscopic examination with comparative ease. These advantages make it preferable to any surgical procedure for pericarditis with effusion.

4744 Prairie Avenue.