PROGRESS IN PEDIATRICS

RÉSUMÉ OF WORK ON TUBERCULOSIS IN CHILDREN
FOR 1914

MAY MICHAEL, M.D.
CHICAGO

PORTALS OF ENTRY


Von Pirquet discusses the portals of entry of the tubercle bacillus in infancy. He finds fetal transmission very rare. Sometimes infection takes place through the placental blood-vessels and sometimes by aspiration of the amniotic fluid. Placentogenous infection causes no primary lesion. Post mortem the lymphatic nodules in the liver and adjacent parts show the most advanced lesions. Clinically, new-born infants infected with tuberculosis are under weight and begin to waste away. Fever and meteorism develop and sometimes tuberculids on the skin. The lungs remain free of symptoms. The prognosis is absolutely bad.

Primary infection of the intestinal canal in infants has been much overestimated. Intestinal lesions are a common finding post mortem, but are as a rule secondary, because of the deglutition of tuberculous mucus from the lungs. There is no characteristic clinical picture of primary intestinal tuberculosis. General atrophy with a large abdomen has been found, but the cases with post-mortem proof of primary intestinal infection are not numerous enough to permit any statement as to the symptoms.

Primary infection of the mucous membranes is also rare. Against the view of those who held that the tonsils were a frequent portal of entrance are the statistics of Albrechts, who found only three instances...
of primary tonsillar infection in 1,060, about 0.3 per cent., and those of Ghon, who found one instance in 189 cases, or 0.5 per cent. The primary lesion shows ulceration and the regional lymphatics are intensely swollen.

A few cases of primary infection of the skin are reported; one of these is that of Chancellor, who cared for a 2-months-old baby with a lesion on the cheek, where she was bitten by a tuberculous nurse.

In the first years of life there is no doubt that the bronchogenous mode of infection is the most frequent. Von Pirquet estimates that in 95 per cent. of the cases this is the route of infection.

A. Jousset is of the opinion that the chief portals of entry for the tubercle bacilli are the upper parts of the digestive and respiratory tracts, namely, the mucous membrane of the nose, throat and tonsils. He thinks it probable, however, that the tubercle bacilli can enter through the mucous membrane of the genitalia and that the greater frequency of tuberculous peritonitis in the female sex bears a relation to vulvovaginitis, caused by the tubercle bacillus.

Of interest also is the report of the writer infecting himself with virulent tubercle bacilli of the bovine type through a small wound on the finger. A few days afterward there appeared a small tuberculous nodule with swelling of the axillary lymph-glands. Later there was swelling of the bronchial glands and mild pulmonary disease.

Scheltema emphasizes the great danger for infants of tuberculous infection and reports two cases in which it is his opinion that the infection took place through the skin. The first child was admitted to the hospital at the age of 8 weeks with a tuberculous ulcer on the forehead. He had had a small wound on the forehead and had been cared for by his tuberculous father who expectorated a great deal. The regional lymph-glands were swollen. The child died one year later of a generalized tuberculosis.

The second child had three tuberculous skin ulcers on different parts of the body. For two weeks he had been cared for by a tuberculous woman. Necropsy showed pulmonary involvement with cavity formation.

M. Wollstein and F. H. Bartlett have made a study of the tuberculous lesions found post mortem in 178 infants and young children. The children varied in age from 2½ months to 5 years, and 75 per cent. were under 2 years. The classification was made whether the lesions in the lungs and bronchial lymph-nodes predominated, or whether the ones in the intestinal tract and mesenteric nodes were more marked. In five cases of the first or pulmonary group the tuberculosis was found limited to the bronchial lymph-nodes, and in all five the lesion was an active one; in two cases the tuberculosis was limited to one
lung and adjacent lymph-nodes, in one case to the bronchial lymph-nodes and pia mater, in one to the bronchial nodes and fingers (dactyilitis). In the greatest number of cases (135) the tuberculous lesion of the lungs and bronchial nodes were the oldest lesions of a generalized infection.

In one case of the second or intestinal group, the lesion was limited to the mesenteric lymph-nodes, in one to the intestine and the mesenteric and cervical lymph-nodes. In fifteen cases the tuberculous lesions of the intestines and mesenteric glands were the most advanced lesions of a more or less generalized infection.

There were only fourteen cases in which the lungs were not involved, and only nine in which the bronchial lymph-nodes contained no evidence of tuberculosis. The mesenteric glands were less frequently involved than the bronchial glands. Tuberculous meningitis occurred in sixty-nine cases, in fifty of which the children were below 2 years of age.

A study of the lesions showed that there was a marked tendency to rapid and general dissemination of the tuberculous lesions throughout the body in infants less than a year old. In the entire series not a single healed tuberculous lesion was encountered, and attempts at healing, shown by calcified areas, were found only five times in the lung and thirteen times in lymph-nodes.

The largest number of cases was evidently of inhalation origin, as in most instances the pulmonary lesions were the most advanced in the body. The presence of tuberculous areas in the bronchial glands in seven instances, when there was no pulmonary involvement, seems to show that it is possible for the tubercle bacilli to pass through the lungs without localizing there. Wollstein and Bartlett prefer this explanation of the absence of the pulmonary lesion in the presence of a bronchial gland tuberculosis to that of Ghon, who believes that the pulmonary lesion is always present and, where not found, is merely overlooked.

The smaller proportion of cases of tuberculous meningitis among children who acquire tuberculosis by ingestion, as compared with those who become infected by inhalation, is in keeping with the fact that the deglutition cases show rather less tendency to generalization than do the respiratory cases.

BACTERIOLOGY

17. Auché, M. B.: Passage of the Bacillus of Koch into the Milk of Tuberculous Nurses, Jour. de méd. de Bordeaux, 1914, lixxxv, 93.

A. Philip Mitchell has made a study of cervical gland tuberculosis among the children of Edinburgh because the disease is frequent in this locality and because little attention has been paid to it.

His investigations included seventy-two consecutive cases. Cervical glands excised at operation were received in sterile gauze and inoculated into guinea-pigs and the lesions which subsequently developed were the immediate source of culture. Mitchell also attempted to find a relation between clinical data and milk-supply. He found that in 90 per cent. of the cases the bacillus was of the bovine type and that milk containing the bovine tubercle bacillus was clearly the source of infection. A very important fact brought out by the study was that 84 per cent. of the children, 2 years of age and under, had since birth been fed unsterilized cow's milk. Mitchell thinks that emphasis on the human sources of infection has blinded us to the fact that the drinking of milk is an important factor in the infection of children with tuberculosis. He feels that the tonsils are the most important portal of entry for the tubercle bacillus. The high percentage of tonsils in which the bovine virus was present is further proof of the frequency of tuberculous cow's milk as a source of infection.

N. Raw, after making an extensive study of the subject of human and bovine tuberculosis, adheres to the view he previously published, that man is attacked by two distinct types of tuberculous infection, one conveyed by a tuberculous person, the human type, and the other by infected milk or meat, the bovine type. Primary pulmonary phthisis seems to result from inhalation of the human bacillus and tuberculous ulceration of the intestine to result secondarily from the swallowed sputum. Tuberculous cervical adenitis, peritonitis, joint disease, and probably meningitis and lupus are caused by the bovine bacillus, absorbed from the digestive tract. While the human bacillus produces ulceration of the intestine, the bovine type passes through the intestinal wall and attacks the mesenteric glands, whence the infection spreads
to the lungs. The cervical glands may become infected from the tonsils, the bacillus being conveyed to them directly by the milk. The infection may remain limited to the glands, or spread downward and cause an extensive bovine infection of the lungs.

Raw has instituted inquiries in a number of foreign countries where there are no tuberculous cattle or where cow's milk is not drunk by children and has ascertained that in these countries surgical forms of tuberculosis do not exist, while phthisis is frequent. He ascertained also that in England during the last fifty years there is a marked diminution of phthisis (45 per cent.), while abdominal tuberculosis in children has increased and, what is more significant, tuberculosis in English cattle has rapidly increased. During the last five years Raw has never seen a case of tabes mesenterica in which cow's milk had not been given for several weeks or months.

Raw has also come to the conclusion that the two forms of tuberculosis are antagonistic in the human body and that children who suffer from the surgical forms are rarely attacked by phthisis. This belief has been substantiated by his necropsy findings.

M. P. Ravenel11 quotes statistics which show that bovine infection is much commoner in younger children than in older ones, and commoner in older children than in adults. He cannot explain the apparent immunity of adults to infection with the bovine germ. He is, however, of the opinion that prolonged residence in the human body can so change the morphology and characteristics of the bovine germ as to make its origin unrecognizable. The type of bacillus, then, which is often isolated from human beings and which presents only the characteristics of the human germ, may in reality be the bovine germ.

Ravenel does not think there exist facts enough to show the relative importance of infection from bovine sources and infection from human sources; still, while it must be conceded that infection from fellow men is the more common source, in children bovine infection is quite frequent. The lesson, he says, to be learned from these facts is that our communities must be served with milk which comes from cows known to be healthy.

H. Beitzke12 reports in a 14-year-old boy a fatal case of tuberculosis due to the bovine tubercle bacillus. The boy was accustomed to play in the cow-stable and to drink freely of raw milk from infected cows. When seen by Beitzke, the patient had been sick for a number of weeks with indefinite symptoms. He emaciated rapidly and died within six months of the first examination. A necropsy was obtained and a generalized tuberculosis of unusual form and severity was revealed. Beitzke had never before seen such marked caseation of the glands or such large caseated nodules as were found in the spleen and lungs.
The chief seat of the disease was the mesenteric glands and the mediastinal and supraclavicular glands were evidently involved secondarily from these. Animal experiments showed the infecting organism to be the bovine tubercle bacillus.

The case was chiefly reported because of the alleged mildness of infection with bovine tubercle bacillus. From a pathologic anatomic standpoint the case was the most extensive ever seen by Beitzke.

H. Brooks' gives his experience, extending over a period of ten years, with tuberculosis in a herd of 425 Holstein cows. During this time all tuberculous cows were isolated and treated with injections of tuberculin. In the tuberculous herd were born 200 calves, which were taken from the mothers and fed on the pasteurized milk of healthy cows. None of these calves developed tuberculosis; rather they showed a resistance to the disease. Moreover, their development did not suffer.

Brooks deduces from his observations that tuberculosis in the parent has no detrimental effect on the progeny.

T. A. Ossinin adds the following to the subject of latent tuberculosis. Pathologic anatomists declare that latent tuberculosis frequently occurs. Former statistics considered latent only those cases which clinically gave no evidence of tuberculosis, but in which at autopsy tuberculous lesions were found microscopically. There is, however, another form of latent tuberculosis, namely, that in which no lesions can be found macroscopically, but in which injection of the lymphatic glands into guinea-pigs gives rise to a tuberculosis.

Ossinin examined 100 cadavers of children who had shown no evidence of tuberculosis during life. In 97 per cent. there was also at necropsy no evidence of the disease macroscopically; no tubercle bacilli were found in the lymphatic glands, and tuberculosis did not develop in guinea-pigs injected with the glands. In three cases, in spite of the fact that no gross tuberculous lesions could be found, tubercle bacilli were found in the glands by the antiformin method and tuberculosis developed in guinea-pigs injected with the glands. In two of these three cases the tubercle bacilli seemed non-virulent, as only local lesions developed; in one there was a generalized tuberculosis. In all three cases the tracheobronchial glands were the ones affected, and Ossinin thinks that this perhaps substantiates the theory that the respiratory organs are the chief portal of entry for the tubercle bacilli.

The great difference in the reports of various authors regarding the presence of tubercle bacilli in the blood-stream led P. Lehmann to make a study of the subject. Thinking that reliable results could not be obtained from blood-smears, he limited himself to animal experiments. The blood of 140 children was studied, but the results in thirty-
six cases were excluded because of the possibility of error. The blood
was obtained from the vein at the elbow, diluted with normal salt
solution, and injected into the peritoneal cavity of guinea-pigs. In only
six instances did the animal develop tuberculosis.

Lehnmann does not believe that the acid-fast bacilli so often found
in blood-smears of patients suffering from tuberculosis are tubercle bacilli, or that any diagnostic or prognostic significance can be attached
to their presence, because, in the first place, the animal experiments
showed them so seldom (six out of 104 cases) and, in the second, in
meningitis and generalized tuberculosis in which the bacilli might be
expected, the experiments were negative.

Mandelbaum18 found that in tuberculous meningitis the lumbar
fluid, which before death is clear and transparent, becomes decidedly cloudy. This cloudiness is due to large mononuclear cells which are
macrophages and probably originate in the endothelium of the meninges. They contain lymphocytes, polymorphonuclear cells, and often
 tubercle bacilli. They are also the bearers of a proteolytic ferment,
which accounts for the increase after death in the proteolytic index of
the lumbar fluid.

DIAGNOSIS

19. Hawes, J. B.: Under What Conditions is the Diagnosis of Tuberculosis
20. Bailey, W. C.: Diagnosis and Treatment of Tuberculosis in Children,
22. Lees, D. B.: Diagnosis of Pulmonary Tuberculosis in Infancy and Child¬
24. Rach, E.: The Recognition of Anatomic Types of Tuberculosis with
25. Northrup, W. P.: Disseminated Miliary Tuberculosis of Lungs and Skin,
26. Bruce, W. I.: Diagnosis of Pulmonary Tuberculosis with the Roent¬
27. Dodd, W. J.: Roentgen Rays in Diagnosis of Tuberculosis in Children,
28. Pfender, C. A.: Miliary Tuberculosis of the Lungs Diagnosed by Roent¬
Repeated Local Tuberculin Reactions, Jahrb. f. Kinderh., 1914, lxxix, 123.
Kinderh., 1914, lxxix, 71.
31. Küchenhoff, N. F.: Prognostic and Diagnostic Value of the Cutaneous
Tuberculin Test in Childhood, Deutsch. med. Wchnschr., 1914, xl, 229.
(orig.), 1913, ix, 72.
33. Robertson, L. B.: The Significance of the von Pirquet Test in Surgical
J. B. Hawes discusses the conditions under which the diagnosis of tuberculosis in children is justified. A bad family history and history of exposure are important factors, but the absence of both does not preclude a positive diagnosis. Length and intimacy of exposure are important. A diagnosis of tuberculosis is rarely justifiable, unless constitutional signs and symptoms are present, in spite of what the Roentgen ray shows. As regards local signs and symptoms, cough and expectoration have many causes besides tuberculosis. Marked dulness and râles are significant. The detection of finer shades of dulness, the significance of harsh or puerile breathing, prolonged high-pitched expiratory sounds, bronchial whisper voice, and paravertebral dulness require long experience to interpret properly. D'Espine's sign simply suggests that something is present which transmits the whispered voice sounds from the trachea through the dorsal vertebrae at a lower level than in normal children.

Roentgen ray is of value only in conjunction with other features. A negative tuberculin test, if carefully performed and confirmed by a subsequent negative test, is as good evidence as possible that tuberculosis can be ruled out. A positive test is not so conclusive, but is confirmatory evidence.

P. Van Péé thinks that the so-called orthopercussion of Goldschneider is one of the most valuable aids for diagnosing tuberculosis in infants. To obtain results percussion should be practiced as lightly and over as limited a space as possible, by placing the finger vertically on the chest and percussing the distal phalanx. Practiced in this way, percussion shows that the two lungs react differently to microbic infections. The left lung reacts first and returns more quickly to normal. Signs in the right lung appear later and have a tendency to persist.
This difference is explained by the greater vascularity of the left lung caused by the proximity of heart and large blood-vessels.

According to Van Pée, most pediatricians believe that tuberculosis in the infant is a latent process, which progresses rapidly toward a fatal termination. He, however, believes that it can in the majority of cases be detected and that it runs a chronic course as in the adult.

D. B. Lees\textsuperscript{22} believes that it is not only possible but even easy to establish a diagnosis of chronic pulmonary tuberculosis in children by inspection, palpation, percussion and auscultation, provided these procedures are carefully and methodically carried out. In order properly to percuss the chest, all muscles must be relaxed and adequate counter-resistance provided for, and this can be obtained for the front of the chest only when the patient is lying down. For examination of the back of the chest the sitting, slightly stooping posture should be assumed with the hands on the anterior aspect of the opposite shoulders and the elbows near to each other. Careful percussion will then reveal small areas of incipient tuberculosis in children, even when the Roentgen-ray photographs show little or nothing. Percussion will also demonstrate large areas in cases in which there are few or no morbid sounds audible.

It appears to Lees that accurate percussion is of primary importance in the diagnosis of pulmonary tuberculosis both in children and in adults, and that it is capable of revealing the disease at a much earlier period than is possible by any other method of investigation.

E. Rach\textsuperscript{24} describes the Roentgen-ray pictures which correspond to the various anatomic types of tuberculosis in children.

Ghon's Primary Lesion: A diagnosis of Ghon's primary lesion can be made with all probability in children giving a positive von Pirquet reaction, if a sharply defined bean-sized shadow is found isolated and free in the pulmonary field and if at the same time the picture shows enlargement of the bronchial glands draining this area. If Ghon's lesion lies near the hilum, it cannot with certainty be differentiated from hilum glands.

Intumescent Tubercular Bronchial Glands: By intumescent glands, Rach means those sufficiently large to cause pressure on the neighboring lung tissue. The right upper bronchial glands show most frequently in Roentgen-ray pictures. They produce a shadow to the right of the median shadow, the convexity extending upward, then running parallel to the median shadow, finally turning backward, and again joining the median shadow.

Intrapulmonary Hilum Tuberculosis: Anatomically, this form consists of caseated intrapulmonary glands in the neighborhood of the hilum and caseated areas, extending laterally from the hilum in streaks.
The caseated areas often break down and form cavities. The Roentgen ray gives a definite shadow extending from the median shadow, more often to the right than to the left, into the pulmonary field. It becomes less thick and loses its sharp outline at its periphery. Its upper and lower borders show pointed processes.

Miliary Tuberculosis: Often Roentgen-ray findings give evidence of disease weeks before there are clinical symptoms.

Phthisis of Infants: Anatomically, this type is characterized by numerous areas of caseous pneumonia, often with cavity formation. The Roentgen-ray picture shows wide-spread shadows whose borders are limited by the borders of the lobes. Within these shadows are sharply defined light areas (cavities). Enlarged glands are also seen.

Apical Tuberculosis: Roentgen pictures of this form are identical with those of apical tuberculosis in adults.

According to W. P. Northrup, two reliable aids in the diagnosis of miliary tuberculosis are the Roentgen-ray apparatus and the presence of skin eruptions. Cases of miliary tuberculosis present to the experienced observer the mental picture of pneumonia but the physical signs of bronchitis, and at this point the physician may be unable to procure any reliable testimony for exact diagnosis until a good Roentgen-ray picture has been procured. Next to necropsy, Northrup thinks the Roentgen ray gives the most intimate knowledge of the lesions in the child's lungs.

Eruption of miliary tubercles furnishes a pathognomonic sign for diagnosis and a valuable, almost conclusive, point for prognosis; that is, the lesion is nearly always associated with a fatal form of tuberculosis in the young child. Among the characteristics of the individual lesions may be mentioned that in size it is like a rose spot in typhoid fever, topped by a tiny vesicle, surrounded sooner or later by a congested or hemorrhagic zone with the formation of a crust, which when removed, leaves a little pit.

According to W. I. Bruce, fine detail is absolutely necessary for the recognition of tuberculous infiltration by the Roentgen ray, and this can be obtained only by employing photographic methods. In Roentgen-ray screens there can be seen limitation of movement of the diaphragm on the affected side, increased opacity and general elongation of the cardiac opacity. Skiagrams show increased opacity of the affected lung, somewhat striated in arrangement and also made up of small rounded opacities arranged in groups. In cases of chronic tuberculosis of the lungs when the infiltration is dense, the small rounded opacities overlap and larger patches result. When lung tissue has been destroyed and cavity formation has occurred, there occur areas of great translucency, usually surrounded by densely infiltrated lung tissue.
W. J. Dodd, in discussing the value of the Roentgen ray in the
diagnosis of tuberculosis, says that, if a pathologic lesion is present,
the Roentgen ray will always reveal it. But it must be clearly under-
stood that a lesion is not necessarily a tuberculous one because revealed
by the Roentgen picture. The Roentgen picture is a projection picture
and a record of density, and any lesion that will cause increased density
will present a departure from the normal.

Recently Dodd made Roentgen-ray examinations of the chests of
100 children. A careful physical examination and every effort to
determine the presence of tuberculosis had been made by the pediatri-
cians before the patient was referred for a Roentgen-ray picture. In
all instances in which there was clinical evidence of a lesion this was
confirmed by the Roentgen picture. In several instances lesions were
found which were not made evident by clinical examination. In only
seven cases was there evidence of active disease, yet eighty-nine showed
some pathologic lesion in the Roentgen picture. The report in the
great majority of the cases was enlarged hilum and peribronchial
glands. The results in this series show that other conditions besides
 tuberculosis will reveal evidence of enlarged hilum and bronchial
glands, and emphasize the great importance of a complete examination
before a diagnosis of tuberculosis is made. A diagnosis of tuberculosis
should not be made until positive clinical evidence is obtained. Repeated
Roentgen examinations at intervals of a month or less are
advisable. By this means it is frequently shown that the lesion has
cleared up, and this would not be the case if lesions were tuberculous.

G. Bessau and J. Schwenke wished to ascertain whether an
increase or decrease of sensitiveness to repeated doses of tuberculin
has diagnostic or prognostic significance. One hundred and fifty-three
children of the polyclinic were used for the tests, but twenty-four were
excluded because in them the tests were always negative. Three
strengths of tuberculin were used: 1:10,000, 1:1,000 and 1:100. In
the first test 0.1 c.c. of the weakest solution was injected intracutane-
ously into the extensor surface of the thigh. The size of the reaction
was noted after twenty-four, forty-eight and seventy-two hours. Eight
days after the first injection the second was given in the corresponding
place on the other thigh. If the first reaction was positive, the weakest
solution was used again; if negative the next strongest solution was
injected. If the second reaction was negative, a third injection of
0.1 c.c. of the 1:100 solution of tuberculin was given.

The results show that in clinically manifest tuberculosis there is no
tendency to an increase of the local tuberculin sensitiveness, while in
individuals in whom tuberculosis is latent this always occurs. An
increase of local sensitiveness in cases of active tuberculosis means that the prognosis is favorable.

Bessau and Schwenke also make the following observations from their tests: In childhood a marked local tuberculin reaction following an injection of 0.1 c.c. of a 1:10,000 solution usually indicates an active process; a very marked reaction is usually a good prognostic sign. Weak reactions may signify the presence of a progressive or a latent process. In these cases a repetition of the test is of especial value. Marked increase in the reaction excludes a progressive process.

J. Cronquist30 made some interesting observations on the von Pirquet test in children with exudative diathesis and in children without this taint. He vaccinated forty-two children daily for from two to four weeks. After twenty-four hours he measured the size of the papule and made a curve of the results. In children not suffering from an exudative diathesis the papules were at first irregular, increased in size for ten or twelve days, then decreased slightly, so that at the end of two weeks they were all practically 10 mm. in diameter. In children with an exudative diathesis, the papules were always larger than in those of the first group. There was decided variation in their size from day to day and this lasted as long as the children were revaccinated.

Cronquist also performed experiments to ascertain whether the blood-serum of children who had been treated with tuberculin, when mixed with tuberculin, had any effect on the von Pirquet reaction. In some instances he inactivated the serum before mixing it with the tuberculin. These experiments showed that no marked difference existed between active and inactivated serum; that no difference in the von Pirquet test was obtained, when serum from children receiving less than 0.059 gm. of tuberculin was used, but that when the blood-serum came from children receiving more than 0.20 gm. of tuberculin, there was a decided diminution in the size of the papule. The effect increased with the size of the dose of tuberculin, so that a negative reaction was obtained with blood-serum of children receiving 0.2 to 0.5 gm. This prohibitory effect disappeared only after the tuberculin treatment had been discontinued for some weeks or months.

M. Kasahara32 has made histologic examinations of the papules produced by vaccinating with tuberculin, diphtheria toxin and atoxyl. Macroscopically, these skin reactions are very similar, but histologically, Kasahara found decided differences. The papule resulting from the tuberculin test showed giant cells and infiltration of lymphocytes around the blood-vessels. The giant cells were due to irritation by the tuberculin. The diphtheria toxin papules showed decided changes in the vessel walls. There was thickening of the intima, dilatation and
engorgement of the vessels, and a fibrinous inflammation of the corium.

Kasahara thinks that this histologic study is proof that the tuberculin reaction is a specific one.

L. Bruce Robertson studied the von Pirquet test in surgical tuberculosis of children, taking his material from 350 cases noted in hospital records of the last four years. Of those showing clinical evidence of tuberculosis, all but 2.9 per cent. gave a positive reaction. In the clinically non-tuberculous cases the reactions were mostly negative. The von Pirquet test, then, may be regarded as specific in cases of surgical tuberculosis; and the fact that it is positive in a moderately small percentage of clinically non-tuberculous children does not outweigh its value as a diagnostic test. There is a much greater proportion of positive reactions in apparently non-tuberculous cases than of negative reactions in those clinically tuberculous.

H. Koch and W. Schiller substantiated the findings of a number of observers who found that tuberculous areas in the skin react more violently to the von Pirquet test than normal areas. As tuberculous areas, Koch and Schiller used the sites of former cutaneous or intercutaneous vaccinations. They chose the artificial tuberculous areas because they could control the site of application and apply the test at any stage. Three series of tests were made. In the first the second vaccination was performed during the acute inflammatory process of the first vaccination, and was termed the intrafocal reaction; in the second it was done after the first vaccination had run its course and was termed a scar reaction. In the third series the test was made in the tissues around the primary vaccination area and was designated as a parafocal reaction. The results were interesting. Different results were obtained according to the site of application and stage of primary vaccination. Intrafocal reactions showed no uniform relation to a control vaccination, but it was always observed that the longer the time between the two vaccinations the more marked was the second test. Scar reactions were always more marked than controls made in normal skin areas. The parafocal reactions were only stronger than the controls if the vaccination site was within the area of primary vaccination.

Koch and Schiller give the following explanation of these observations: The specific tuberculin inflammation is an allergic process caused by a reaction between antigen and antibodies. Variation and the quantitative relation of antigen and antibodies cause variation in the intensity of the tuberculin reaction. In the newly inflamed areas there are no free antibodies which can combine with the antigen, but after subsidence of the inflammation there remains an accumulation
of the antibodies so that a second vaccination in this area results in a stronger reaction.

H. Nothmann\textsuperscript{28} vaccinated a number of children with human and bovine tuberculin. He wished to see whether it could be ascertained in this way which is the infecting organism. Two hundred and seven children from 1 to 16 years of age were tested. Fifty-six, or 27 per cent., did not react to either. In 145 the test was positive, and in 133, or 91.7 per cent., of these it was positive to both tuberculins; in two, or 1.4 per cent., to bovine tuberculin alone; in nine, or 6.2 per cent., to human alone. As the negative test frequently became positive after two or more applications of tuberculin, deductions were never made from one vaccination.

Nothmann does not think this method of any value in determining the variety of the infecting organism. He thinks that only one fact can be gleaned from the tests, namely, that the majority of tuberculous patients react to both human and bovine tuberculin. His explanation is that in both tuberculins are similar groups of reaction bodies, and that the homologous group is stronger than the specific group, therefore, no matter what the variety of infection, a double reaction occurs.

W. Egert\textsuperscript{36} obtained in children who were suffering from pulmonary tuberculosis or in whom tuberculosis was suspected a strongly positive cutaneous reaction and a negative subcutaneous reaction, when the tests were performed simultaneously. As the children's condition improved he obtained a marked subcutaneous reaction and only a very slight cutaneous reaction. Egert believes that a positive "contrast" phenomenon, as he calls this positive subcutaneous and negative cutaneous reaction, may be of prognostic value, but more observations must be made before this point can be determined.

N. Blumenau\textsuperscript{29} described a new tuberculin test, which he calls the "plaster test." He cleanses the skin of the forearm with ether, puts a drop of tuberculin on the flexor surface near the fold of the elbow, and covers it with a piece of adhesive plaster, 3 cm. square. The tuberculin must not run over the edge of the plaster and the plaster should be pressed down only around the edge. Sometimes in twenty-four hours, more often in forty-eight, a characteristic eruption appears beneath the plaster. If the reaction is slight the eruption resembles a tuberculid; if marked, it consists of bright rose-red papules, capped with small nodules or vesicles. Blumenau used this test on 227 children and found it very satisfactory, equal to the von Pirquet test in sensitiveness.

J. Müller\textsuperscript{40} reports an instance of gangrene of the nose and other severe results following a diagnostic tuberculin test. The patient was a boy of 15 who suffered from a generalized glandular enlargement.
One drop of a 1 per cent. tuberculin was given intercutaneously for diagnostic purposes. After twenty-four hours there was vomiting, diarrhea and fever. The following day the face was a livid color, and the face, lips nose and neck were swollen. There was a spotted eruption on the trunk. The fourth toe of the right foot and the third toe of the left became gangrenous, as did also the tip of the nose. The mucous membrane of the throat was red and the tonsils were very much swollen. The intercutaneous test was markedly positive.

Müller says that this experience teaches that care must be taken in giving the intercutaneous test when there is a wide-spread glandular tuberculosis.

S. Maggiore⁴¹ bases the following conclusions on many examinations of the blood of children in the various stages of tuberculosis. No stage or form of tuberculosis offers a typical blood-picture. The cases present normal blood findings, diminution of the hemoglobin content and of the red blood-cells; the number of white cells is usually normal or increased, only exceptionally decreased. In infants as well as in older children is found a relative increase in the monocellular element and transitional forms. The basophilic cells are usually decreased or present in normal numbers; the eosinophils are only exceptionally increased. When the hemoglobin and number of red cells are markedly diminished, a polychromatosis and anisocytosis can be demonstrated and exceptionally myelocytes are found.

The changes are undoubtedly due to a specific toxin, but this cannot always be demonstrated. The increase in the mononuclear cells is an expression of reaction on the part of the bone-marrow.

**SYMPTOMATOLOGY**

49. Froelich: Evolution of Surgical Tuberculosis in Infants, Arch. de méd. d. enf., 1914, xvii, 164.
50. Benard, L.: Primary Tuberculosis in the Child, Presse méd., 1914, 293.
56. Hutinéel: A Rare Form of Tuberculous Pericarditis, Rev. internat. de méd. et de chir., 1914, xxv, 97.
75. D'Espine: Cerebellar Ataxia in Cases of Tuberculous Meningitis, Arch. d. méd. d. enf., 1914, xvii, 367.

R. Cruchet describes the clinical course of tuberculosis in infants. The acute miliary form is rare during infancy. Usually after an indefinite period of anemia, emaciation, vague respiratory signs and persistent cough, suddenly a meningitis develops and death occurs in the course of from eight to fifteen days.

Under the heading of subacute and chronic forms, Cruchet describes several types: the anemic, characterized by marked pallor
and emaciation; the abdominal, with symptoms of a persistent dyspepsia or those of an athrepsia; the respiratory, with persistent dry cough and paroxysms of cough, as in whooping-cough; the glandular, characterized by enlargement of either the mesenteric or the tracheobronchial glands, or by a generalized peripheral adenopathy; the cutaneous, with hard nodules in the skin which roll under the examining finger, and over which the skin is brown or violet color (in the later stages these nodules break down and small fistulas persist) and the nervous, characterized by irritability.

With any of these forms it is almost impossible, clinically, to make a correct diagnosis at the onset. Laboratory tests, with perhaps the exception of the tuberculin test, are also discouraging. As the disease advances, however, the symptoms become more characteristic and laboratory tests more useful.

The prognosis of tuberculosis in infants is very grave. Cure is possible, but rarely occurs.

M. Péhu and Mouret\textsuperscript{44} report in a 3-months-old baby a case of generalized tuberculosis, which was interesting not only because of the age of the child, but because of the rapidity of its course and widespread dissemination of the lesions.

The child was born of healthy parents but, when 3 weeks old was given for three weeks in charge of a woman with open tuberculosis. The child began coughing shortly after returning to the parents and, when examined at six weeks, showed symptoms not only of extensive pulmonary involvement, but of meningitis. The face was pale, the head thrown back in position of opisthotonos, there was conjugate deviation of the eyes, the anterior fontanelle bulged, there was marked dyspnea with rapid respirations, 56 to the minute, and cyanosis. Auscultation of the chest revealed scattered mucous râles and tubular breathing at the right apex, where there was also impaired resonance. The liver extended two fingers' breadth below the costal arch and the spleen to the anterior superior spine of the ilium. A small nodular mass could be felt in the epigastrium, a little to the right of the median line. The child died two days after entrance to the hospital.

Necropsy revealed a wide-spread tuberculous process. There were only twenty-four days between the time the child was returned to his parents and the hour of death, and in this interval the bacilli invaded all the organs, lungs, liver, spleen, heart and meninges. In the small intestines were small ulcerations contiguous to the arteries and proving that the infection was hematogenous in origin.

In discussing the mode of infection of infants, Péhu and Mouret mention infection through the placenta, in cases of advanced tuberculosis of the mother (congenital tuberculosis) infection through inhala-
tion of dried sputum from tuberculous parents or, what was evidently the mode of infection in this instance, from a tuberculous caretaker. Careful examination of both parents showed no evidence of infection and the child had never been fed raw milk, so that infection from this source has to be excluded.

J. S. Leopold\(^45\) reports a case in a 7-year-old child of tuberculosis of the lungs, liver and spleen, with general glandular enlargement. The points of chief interest in the physical examination were the great enlargement of the spleen, the ascites, and the anemia with leukopenia. At necropsy there was found a chronic miliary tuberculosis of lungs, liver and spleen.

Leopold's chief object in reporting the case was to call attention to the difficulty of classification of tuberculosis combined with atypical changes in the lymphatic system. He thinks that there can be no satisfactory classification until the etiology of the affections of the lymphatic system has been determined.

Ribadeau-Dumas\(^46\) says that cavity formation is not so very rare among children. Among sixty-eight autopsies on children 1 and 2 years old he has found cavities twenty-two times. In eleven cases the cavity was as large as a nut or larger. Clinically, the diagnosis is difficult to make. Ribadeau-Dumas reported the case of a 6-month-old infant who died of a caseous tuberculosis involving the upper left lobe. Clinically, the cavity could not be detected, but in a series of Roentgen-ray pictures, one taken each week, its development could easily be followed.

J. D. Rolleston and J. E. Robertson-Ross\(^47\) report a case of fatal hemoptysis in a child of 4 years. The child was admitted to the hospital with a paroxysmal cough, which resembled whooping-cough. On examination rhonchi and râles could be heard, but no areas of dulness could be marked out. The abdomen was distended and the superficial veins dilated. Both liver and spleen were enlarged. For two months there was very little change in the child's condition; then dulness was noted below the ninth rib on the left side, extending around into the left axilla. The following week a little blood-stained sputum was expectorated and on the day after a sudden copious hemoptysis occurred, when death almost immediately followed.

At necropsy there were found enlarged and tuberculous tracheobronchial glands; the left pleura was thickened and adherent to the chest wall. The upper lobe of the left lung was studded with tuberculous deposits. The lower lobe was solid and presented a cavity about the size of a walnut completely filled with blood-clot. Liver and spleen contained tuberculous nodules. Tubercles were also found in the kidneys, basal meninges and gray matter of the cerebral cortex.
E. Sluka\textsuperscript{52} believes that the diagnosis of apical tuberculosis in children is often a mistaken one. It is based on a picture resembling that of apical tuberculosis in adults, the presence of the tuberculous habitus, and of a pulmonary catarrh. Roentgen-ray pictures are a great help in clearing up the difficulty. They show apical tuberculosis to be exceedingly rare in childhood and the clinical picture to be the results of a thoracic deformity, either scoliosis or a cervical rib.

C. McNeil\textsuperscript{55} believes that scrofula is more than a variety of tuberculous and that it is the tuberculous infection in children who have lymphatic constitution. In an industrial school near Edinburgh, McNeil has had children with clinical manifestations of scrofula, who gave intense tuberculin reactions and in whom post mortem was discovered evidence of lymphatic constitution. Scrofula, due to a pyogenic infection in children with a lymphatic diathesis, however, is not unknown and has been described by Cornet.

Just what the lymphatic constitution is, is not clear, but McNeil thinks that the thyroid gland is involved in this condition.

Hutinel\textsuperscript{56} reports a case of tuberculous pericarditis in a 13-year-old boy. The child was brought to the hospital for a fever of eight days' standing. On entrance the most prominent symptoms were marked dyspnea, slight cyanosis, and a temperature ranging between 39 and 40°C. Examination showed numerous râles over both lungs, an area of diminished resonance at the left apex with a rough inspiration and expiration and a few subcrepitant râles. The heart-sounds were diminished and the pulse rapid and small. A few days later signs of fluid appeared at the left base and 250 gm. of pus were removed by puncture. The heart-sounds became more dull and distant; dyspnea and cyanosis were intense. A pericardial puncture was made, but no fluid obtained. A second puncture yielded 40 gm. of bloody fluid. The temperature fell and the dyspnea was relieved after puncture. The cyanosis persisted and the liver enlarged until it occupied nearly the entire abdomen. A diagnosis of tuberculous pericarditis was made.

Hutinel describes three forms of tuberculous pericarditis: (a) the latent form; (b) the fibrinous form; (c) pericarditis with effusion. The latent form is not very rare and is often discovered at necropsy. In this form miliary tubercles, either discrete or conglomerate, are scattered over the pericardium. Fibrinous pericarditis is only exceptionally of tuberculous origin. The pericardium is obliterated and the tubercles are found beneath the fibrinous plaques. Hutinel's case illustrates the third form.

A. L. Goodman\textsuperscript{59} reports a case of tuberculosis of the testicle in a 2-year-old child. The swelling had been apparent for a few months and had steadily increased. There was no pain or tenderness. The
patient was operated on and a tuberculous epididymitis found. Goodman says that tuberculosis of the testicle in children is either a primary isolated manifestation or a secondary complication of a visceral tuberculosis. Primary tuberculosis is usually unilateral and does not extend above the inguinal ring. Usually the tuberculous mass remains encysted, but sometimes it suppurates and causes fistulas. Secondary tuberculosis of the testicle is more extensive. Clinically, the symptoms may be acute or chronic, and the second condition is revealed accidentally or by the appearance of abscess or fistula.

The prognosis of the primary forms is good, but that of the secondary unfavorable.

F. C. Pybus\(^6\) reports the following case of tuberculosis of the tunica vaginalis in a 3-year-old child. According to the history, a swelling had been noted in the left side of the scrotum soon after birth. The only abnormality found by Pybus was a swelling in the left scrotum, which was evidently of the testicle, globular in shape, hard and non-translucent. It was impossible to distinguish testicle from epididymis. The cord was slightly thickened. A diagnosis of tuberculosis of the testicle was made and operation advised. At the operation an incision was made on the anterior surface of the swelling. After going through new tissue a quarter of an inch thick, the tunica vaginalis was opened. As it was impossible to dissect off the thickened tunica vaginalis, castration was performed. The specimen showed a remarkable swelling of the tunica vaginalis, whose inner surface was slightly granular. Testicle and epididymis appeared normal. Microscopic examination of the tunica vaginalis showed that it consisted of hyperplastic tuberculous tissue containing many giant cells. Pybus thinks that infection took place from the abdominal cavity, although there was no evidence of abdominal tuberculosis.

S. Boyde\(^6\) reports a case of tuberculosis of the kidney in a 3-year-old child, who was admitted to the hospital because of bronchopneumonia and pyuria. The left kidney gradually increased in size and tubercle bacilli were isolated from the urine. The cystoscope showed the orifice of the left ureter to be reddened and ulcerated. The child was operated on. She recovered from the operation, but died six months later from phthisis. At necropsy the right kidney was found normal, an unusual occurrence, as in most instances tuberculosis of the kidney in children affects both organs.

A. Fischer\(^6\) reports a case of tuberculous duodenal stenosis in a 10-year-old child. Clinically, the picture was one of pyloric stenosis. The child was operated on, and it was found that the stenosis was caused by a circular scar, 2.5 cm. wide, located 1 cm. below the pylorus within the duodenum. The diagnosis of tuberculosis was based on the
circular character of the scar and the presence of other tuberculous lesions. Gastro-enterostomy was performed and the child recovered.

A. Tietze reports two instances of tuberculosis of the liver in boys of 5 years. Marked enlargement of the liver and spleen developed in the course of a pulmonary tuberculosis which had lasted for months. There was no fever or tenderness, but a large amount of ascites. Lues and alcoholism were excluded; the von Pirquet tests were positive. Talma’s operation was performed, and in one case a small piece of the liver excised. This showed undoubted tuberculous changes. The operation had no effect on the course of the disease.

F. W. Schlutz has studied the subject of absorption of fat from the intestinal tract of the actively tuberculous child. He thinks the subject important, because it is an almost universal custom to give the tuberculous child a diet especially rich in fat.

Schlutz first calls attention to Weigert’s experiments, which proved that the tissues of animals fed on protein and fat-rich food showed the largest amount of fat-free residual substance and were low in water content, while, conversely, those fed on food low in protein and fat, but rich in carbohydrates, showed a small percentage of fat-free residual content, but retained much fluid. Weigert has further demonstrated that animals fed on carbohydrates and with pronounced water retention in their tissues are the least resistant to tuberculous infections, while those fed on fat-rich mixtures, resulting in low water retention, succumbed much less readily to the inroads of this disease.

Schlutz’ series of twenty cases comprised all the common forms of tuberculosis. An exclusively fat-rich diet, consisting of milk, cream, butter and eggs, with a small addition of carbohydrate, was given in fifteen cases and the same diet with a larger addition of carbohydrate in five cases. The fat absorption was distinctly diminished only in the glandular type of tuberculosis. In all other forms it very nearly approached the normal. The additional amount of carbohydrate as given in the five cases seemed to improve the fat absorption. From these experiments Schlutz concludes that if it were a question of fat absorption only, high fat feeding would not be contra-indicated in most forms of tuberculosis. He says that experimental and clinical evidence both seem to show that a diet which insures the largest amount of fat deposit in the tissues with the least retention of water is the one most beneficial to the tuberculous child.

B. Marfan discusses the subject of tuberculous peritonitis in infancy. Below the age of 2 years, he says, the disease is rare, the clinical picture is not clear and diagnosis remains obscure for a long time—often, in fact, until some acute tuberculous process, like bronchopneumonia, reveals it; or the child dies and the tuberculous peri-
tonitis is found at necropsy. Intermittent abdominal pain, slight digestive disorders, constipation alternating with diarrhea may be the only symptoms, or marked abdominal distention may be the only symptom. The temperature is usually subnormal, although occasionally there is an irregular intermittent fever.

Tuberculous peritonitis among infants is more grave than among older children and is always fatal among infants below 1 year of age.

Marfan reports a case of tuberculous peritonitis in a 14-month-old baby, and, from the study of this case and others, concludes that chronic typanites without diarrhea or constipation in very young children usually indicates a tuberculous peritonitis or tuberculous mesenteric glands without involvement of the intestine.

E. Bruusgaard\textsuperscript{67} discusses acute disseminated tuberculosis of the skin in children. He says that in most instances the acute lesions which develop at the close of acute infectious diseases in children are of tuberculous nature. The forms which occur are the disseminated miliary lupus, \textit{gommes scrofulae}, lichen scrofulosorum, the hemorrhagic miliary tuberculid and various combinations of these lesions.

Bruusgaard reports a case of tuberculidosis of the skin following an attack of measles in a 4-year-old girl. When examined six months after the measles, she had on the forearms, in the gluteal regions and on the lower extremities millet-seed to pea-sized nodules, extending into the subcutaneous tissue, and above the surface of the skin, which was red or bluish red in color. Some of the lesions fluctuated, others had broken on to the surface of the skin and gave a typical picture of \textit{gommes scrofulae}. Besides these multiple subcutaneous lesions were many small, round or oval verrucose papillary lesions. Guinea-pigs inoculated with the puriform content of the nodular and with excised portions of the papular lesions died of tuberculosis. The child died of tuberculous meningitis.

M. Bourgeois\textsuperscript{68} says that lately the subject of metastatic hematogenous tuberculosis of the skin has received considerable attention in medical literature, and lesions not having the classical structure of tubercle are now regarded as tuberculous.

Bourgeois reports two cases of metastatic hematogenous tuberculosis of the skin in children of 7 and 3 years, neither of whom had previously shown any evidence of tuberculosis. Shortly after measles in one instance and scarlet fever in the other there developed rapidly and simultaneously in several locations on the skin lesions partly characteristic of lichen scrofulosorum and partly of the papulonecrotic tuberculid, but to the greater extent characteristic of tuberculosis verrucosa cutis. The lesions consisted of hard verrucose papules, unequal in size and irregularly grouped. They were covered by a thick
adherent horny layer with a livid red sharply defined edge; were principally on the extremities (hands and feet), but also on the elbows and knees, buttocks and face. They appeared in crops, ran a chronic course and gradually more and more resembled a verrucose lupus vulgaris.

From a study of these two cases and others reported in the literature, Bourgeois comes to the conclusion that besides the usual form of tuberculosis verrucosa cutis due to exogenous infection, there exists a second disseminated hematogenous form. This form usually occurs in children after an acute infectious disease. Associated with the lesions typical of tuberculosis verrucosa cutis are those of other hematogenous tuberculids as the papulonecrotic tuberculid and lichen scrofulosorum. The clinical picture is that of the exogenous form.

S. T. Champtaloup reports an unusual case of multiple subcutaneous tuberculosis following circumcision. The baby was circumcised when 7 weeks old. The wound suppurated and three weeks later abscesses formed in the groins. One week later a measles-like eruption developed on the face, body and limbs. This all faded except several small areas, which indurated and suppurated. As each indurated area softened it was incised, but failed to heal after several months' treatment. Chamtaloup saw the patient eight months after the circumcision. The child was emaciated and hectic. There were numerous subcutaneous suppurating foci. On the outer margin and sole of the right foot and on the left instep were several discharging sinuses. On the inner surface of the right upper arm were recently healed scars surrounded by indurated tissue of a purplish color. On each buttock and on the right cheek and over the right lower jaw were superficial ulcerations. In the right inguinal region a small abscess was pointing. This was aspirated and the pus inoculated into two guinea-pigs. Both showed well-marked tuberculosis when examined four weeks later. Smears and cultures from the aspirated pus failed to show the tubercle bacilli.

The child was treated with tuberculin and eight months later all lesions were healed.

Champtaloup learned that the physician who operated on the baby was suffering at the time from a tuberculous laryngitis; hence the infection.

J. von Bokay has collected reports of thirty-four cases of healed tuberculous meningitis from medical literature and reports three of his own. In twenty-nine of the thirty-four cases the diagnosis was substantiated by finding the tubercle bacilli in the lumbar fluid either by direct examination or by inoculation into animals.
Von Bokay's three cases follow: The first patient was a 12-year-old boy who developed the symptoms of a diffuse meningitis directly after an attack of measles. Lumbar puncture gave 45 cm. of clear fluid, which was evidently under pressure. After a few hours a coagulum formed. Microscopic examination showed only a few lymphocytes. The symptoms remained unchanged and lumbar puncture was again performed. The fluid this time contained many lymphocytes and a few tubercle bacilli. Two days later improvement set in and continued. Lumbar puncture was performed in all four times. The fluid injected into guinea-pigs caused tuberculous lesions. At the time of this report, two and one-half years after the disease, the child is in good condition, there is no sign of paralysis, and mental development is progressing favorably.

The second patient was an 11-year-old boy whom von Bokay was treating for tuberculous peritonitis. On the twelfth day after admission to the hospital the boy became somnolent and complained of headache. Lumbar puncture gave 25 c.c. of clear fluid under high pressure. Meningitis was suspected and seemed probable because of arhythmia of the pulse and positive Trousseau and Kernig signs. The symptoms did not subside, so lumbar puncture was repeated, in all, eight times. After the seventh puncture, improvement set in and continued, and the child was discharged from the hospital six weeks after admission. The lumbar fluid was inoculated into two guinea-pigs, and in this case also gave rise to tuberculous lesions.

The third patient was a 7-year-old boy who entered the hospital with symptoms of meningitis. Lumbar puncture gave 20 cm. of clear fluid, which contained many lymphocytes, but no tubercle bacilli. There was no change in the child's condition and lumbar puncture was repeated. This time tubercle bacilli were found in the fluid. The child was taken home by his parents and so improved as to be able to get out of bed. Five weeks later he died. He was examined just before death by von Bokay, who found an advanced lesion of the left lung.

No recovery occurred in children under 2 years of age; the proportion of recoveries increased after 5 years, although only 10 per cent. of the cases of tuberculous meningitis occur in children over 7. The recoveries occurred, in general, when the tuberculous process was limited to the meninges or did not to any extent involve other organs.

As regards the lesions, von Bokay thinks they can be healed, even when specific changes, as congestion, hemorrhage and formation of miliary tubercles, have taken place. He quotes Ziehen, who says that in tuberculous meningitis in children wide-spread tubercle formation is absent, and there occur collections of only epithelial cells and
lymphocytes, but no giant cells. Also from anatomic-pathologic experience it is to be noted that a tuberculous serofibrinous meningitis without the formation of tubercles occurs, and it is these forms that are more likely to heal, as also those in which the tubercle bacillus causes only a simple hyperemia.

The only method of treatment to consider is operative. Von Bokay mentions reports by several writers of cure by trephining the skull and draining the subarachnoidean space. He thinks that this method is indicated in some cases. In cases in which the pathologic changes are such as will allow of cure, systematic lumbar puncture is indicated, but von Bokay thinks that an important factor is the natural resistance of the organism to the tuberculous infection.

Barbier reports the instance of a child of 8 years who had had several transitory attacks of meningitis. Nov. 20, 1912, he was admitted to the hospital with a pleural effusion. He coughed, and tubercle bacilli were found in the sputum. He gradually improved except for a slight exacerbation in December, but in March, 1913, meningeal symptoms developed. Improvement again set in, but in April there was an exaggeration of the meningeal symptoms. Headache, vomiting and somnolence appeared; there were exaggerated reflexes, irregular pupils and pulse, and tubercle bacilli were again found in the sputum. These gradually disappeared, but new areas of involvement were found in the lungs. In May and June there were again attacks of vomiting and headache.

The child was last examined Jan. 24, 1914, and showed signs of congestion at the right apex, and a small new area in the left axilla. He had increased reflexes — all that remained of the meningeal attacks.

P. A. Potter and F. W. Blakely report the recovery from tuberculous meningitis of a 3-year-old boy who had entered the hospital, April 16, 1913, with the clinical symptoms of a meningitis. Lumbar puncture was performed and a clear fluid which was found to contain tubercle bacilli was withdrawn. Improvement followed the puncture. On April 20 lumbar puncture was again performed and 25 c.c. of rather cloudy fluid obtained. Relief of pressure seemed again to cause amelioration of the child's condition. During the following two weeks the fluid was removed eight times, and at the end of this time the signs of the disease were unmistakably less. Improvement continued; June 12 the lumbar fluid showed no tubercle bacilli and the child was discharged from the hospital, cured.

H. Finkelstein says that lately recovery from tuberculous meningitis has rather frequently been reported, but that some cannot be proved not to be cases of serous meningitis, for the diagnosis was not substantiated by finding the tubercle bacilli in the lumbar fluid or by
animal experimentation. Even if tubercle bacilli were found, it cannot be proved that there was not a circumscribed tuberculosis of the meninges and not a true tuberculous meningitis, that is, a miliary tuberculosis of the pia mater.

Finkelstein reports a case in which necropsy proved the process to be a serous meningitis, resulting from the irritation of a localized tubercle. The patient was an 8-months-old boy with a spina ventosa of two fingers. For five weeks after admittance to the hospital he improved. Then he developed a pneumonia which had its crisis on the sixteenth day. Just before the crisis symptoms suggesting meningitis appeared. The child was restless and vomited occasionally; he put his hand to his head, as if in pain. There was stiffness of the neck, strabismus, facial paresis, irregular pulse. Then the child became soporous and the fontanelle was tense and bulging. The possibility of the process being a serous meningitis complicating a pneumonia was disregarded on obtaining under pressure 360 mg. clear fluid containing many lymphocytes, not polymorphonuclear cells, as occur in pneumonia. The further course of the disease proved the pulmonary lesion to be tuberculosis. After remaining normal for two days the temperature rose again. The signs of pneumonia did not clear up, the bronchial breathing became amphoric. The signs of meningitis, however, gradually disappeared so that none existed by the nineteenth day. The child died of a caseous pneumonia the thirteenth week of illness.

Necropsy showed no tuberculosis of the pia. The left ventricle was slightly distended; the ependyma was unchanged except for a thickened area over the caudate nucleus. A cross-section of the area revealed a pea-sized, caseated tubercle. Finkelstein offers the following explanation of the symptoms: During the course of a febrile tuberculous process in the lungs a few tubercle bacilli were liberated and localized in the brain beneath the floor of the left lateral ventricle. These bacilli caused a local inflammatory reaction and a serous meningitis of the ventricles. Encapsulation of the tubercle and subsidence of the meningitis caused the symptoms to disappear.

In a former report, D'Espine called attention in cases of tuberculous meningitis to disturbances in equilibrium due to localization of the lesions in the superior vermiform process. He now reports a case in which the early appearance of the ataxia made the diagnosis of tuberculous meningitis possible.

The patient was a 2½-year-old boy. He came under D'Espine's observation with the diagnosis of acute gastritis. For two weeks he had had attacks of vomiting, headache and slight fever. On examination the tongue was found coated, the pulse slow (60-68), with slight arhythmia. There was no Kernig's sign and the eyes were normal.
When the child stood up, there was an ataxia with a tendency to fall backward. The diagnosis of tuberculous meningitis was based on this symptom. The diagnosis was corroborated the next day, when strabismus and Kernig's sign developed. Lumbar puncture gave a clear fluid with an increase in lymphocytes. The symptoms of cerebral pressure became more marked and the child died. At necropsy, besides the usual findings of tuberculous meningitis, a greenish gelatinous exudate was found covering the anterior half of the superior vermiiform process, and on the posterior half was a tuberculous nodule, about the size of a pea, which extended a little more to the left than to the right. The lungs showed a miliary tuberculosis, with a large yellow caseating nodule in the base of the right lung.

P. S. Chancellor reports hemiaraesis and hemiplegia as early symptoms in a case of tuberculous meningitis. His patient was a 3-year-old girl, whose mother had died of tuberculosis. Five days before admission to the hospital the child was constipated, complained of feeling tired, and the next day vomited. Two days before admission attacks of convulsions occurred. Twitching of the left eye and of the left side of the body was noted during the attacks. The following day the left arm and left leg were partially paralyzed. There was no rigidity. On admission, March 22, the child was drowsy and did not move left arm or left leg. A Babinski reflex was present on the left side. The von Pirquet reaction was positive and tuberculids developed on the fourth day after admittance. The lumbar fluid was clear and escaped under some pressure. There was a choked disk noted on the thirteenth day. Meningeal symptoms became more marked and the child died on the seventeenth day.

This case, according to Chancellor, belongs to the type of tuberculous meningitis characterized by an early onset of more or less pronounced paralysis limited to one side of the body, rapidly developing into a general paralysis.

TUBERCULOSIS OF THE TRACHEOBRONCHIAL GLANDS

77. Warneke: Diagnosis of Tuberculosis of the Bronchial Glands, Deutsch. med. Wchnschr., 1914, xi, 126.
Warnecke 77 discusses the symptoms which he considers of greatest value for diagnosis of bronchial gland tuberculosis. The presence of the combination of symptoms regarded as "lymphatic diathesis" are of importance. In adults as well as children are observed the pasty look, the swollen lips, thick nose, rhagades, swelling of the lymphatic tissues, inflammations of cornea, phlyctenular conjunctivitis, and catarrh of the upper air-passages. An important symptom is the brassy cough which becomes more pronounced after injection of tuberculin.

Among the objective symptoms which Warnecke deems significant are changes in percussion note over the sternum at the level of the second and third rib, as well as a change in the note in the interscapular space and over the spinous processes.

Auscultatory findings are confirmatory. Characteristic is an expiratory note, almost like a muscular sound, which is heard in the interscapular region and which is more marked after an injection of tuberculin. D'Espine's sign serves good purpose in children, but not in adults.

The blood examination is valuable. In active tuberculosis of the thoracic glands there is a relative lymphocytosis which can be increased by injection of tuberculin.

As regards Roentgen-ray findings, there is no doubt that Roentgen-ray plates show enlarged glands as well as inflammatory infiltrations, peribronchial and perilymphatic processes at the hilum and interlobular exudates. Shadows of interlobular exudate indicate the presence of a Ghon's primary lesion, as this is always accompanied by a pleurisy.

W. Gölz 80 discusses the value of the various symptoms of enlarged bronchial glands after following and examining the history of sixty-eight patients. Frequently in instances of enlarged bronchial glands a history of hereditary or family tuberculous taint is obtained, although this can never be sufficient reason for making the diagnosis. First must be considered the symptoms. Failure to develop, pallor, loss of weight and cough are suspicious. There is no characteristic type of
fever. Many of Götz's patients were free from fever; a number had a slight rise; a few had at times a marked elevation, a few long febrile periods, due to the action of the tuberculo-toxins. Evidence of scrofula is frequent, Götz finding it in forty-three of his patients. Symptoms due to direct pressure on the nerves are less frequent than those due to pressure on the veins.

As to physical findings, Götz believes the difference in the percussion note over the apices to be of great value. This is not due to pulmonary involvement, as is shown by the Roentgen ray, but to changes resulting from pressure of the enlarged glands. The most important area of dulness due directly to the enlarged glands is found over and to both sides of the sternum. Dulness over the vertebra is less important, but Götz found it over the third and fourth vertebra in fifty-three of sixty-five cases and that is lower than occurs normally.

The most valuable of the auscultatory signs is that of d'Espine, namely, bronchophony over the spinous processes at a lower level than normal—the seventh cervical vertebra in small children, the first thoracic in children of 8 years, and the second in children of 12 years.

Götz was surprised to see how seldom the Roentgen-ray pictures conformed with the clinical findings. There occurred, however, in most of his cases on both sides of the median shadow and especially on the right side, streaks and round shadows which were not found in pictures of normal chests and were undoubtedly enlarged bronchial glands.

Of value in diagnosis is a marked diazo reaction, if other causes of the reaction can be ruled out.

C. Riviere\(^1\) discusses the diagnosis of enlarged bronchial glands and phthisis. He lays particular stress in the diagnosis of enlarged bronchial glands on the finding of dulness by percussion in the right interscapular region. He says he was the first to call attention to this finding and thinks it due to pressure on the right pulmonary artery, as it passes in front of the bifurcation glands. Normally, there exists on each side of the spine, between the first and fifth dorsal vertebra, extending one inch from the middle line, an area of slightly impaired resonance elicited by gentle percussion. In enlarged bronchial glands the impairment on the right side becomes more marked and extends out 2 or 3 inches from the middle line and downward to the sixth, seventh or even eighth vertebral spine. Almost always there is also an impairment of resonance over the apices, and this often leads to an erroneous diagnosis of phthisis.

The diagnosis of phthisis in children is but little removed from the diagnosis in adults. The most valuable of all physical signs are those obtained by gentle percussion.
S. Maggiore examined with the Roentgen ray 131 children with enlarged thoracic veins. In but twenty-four cases was this the only symptom besides the enlarged glands in the Roentgen-ray plates. In most cases the size of the glands corresponded to the degree of venous enlargement. Maggiore believes that enlarged veins are pathognomonic of enlarged bronchial glands only when they are limited to the upper part of the chest. In most cases he found them in the second intercostal space, between the border of the sternum and the inner half of the clavicle. Less often they were in the first and third intercostal spaces. He found them more frequently on the right than on the left side or bilateral. He is of the opinion that enlarged thoracic veins are a valuable sign in the diagnosis of enlarged tracheobronchial glands.

E. Rist agrees with Kusz, Albrecht and Ghon that enlargement and caseation of the bronchial and mediastinal glands are caused by and follow an initial pulmonary lesion. In tuberculosis in children caseous degeneration of glands is commonly observed. It may affect only a part of the gland, but in the greater number of cases, when tuberculosis is the cause of death, the whole of the enlarged gland is caseated. The caseous mass is surrounded by fibrous tissue, which adheres firmly to neighboring organs, as esophagus, trachea, bronchi, blood-vessels, and especially to neighboring lymph-glands. Compared to the findings in tuberculosis in adults the difference is very striking. In adults, extensive ulceration of the lungs is found post mortem in cases of long-standing tuberculosis, and the bronchial glands are of normal size or hardly enlarged. Instead of being fixed to the surrounding tissues by fibrous adhesions, they are easily enucleated, and — most important — they are rarely caseated. Rist quotes Koehler, who explains the difference by the fact that in adults the lymphatic channels become obliterated by chronic inflammation and scar tissue. Another explanation is that, in children who recover, the glands are changed into fibrous-antharcotic nodules, incapable of reacting to further tuberculous changes in the lungs. The difficulty in accepting this explanation is that the glands are not found post mortem to be antharcotic.

Rist thinks that the fact that the glands do not react in adults is simply another explanation of allergy of von Pirquet. They would react to any other inflammatory process but tuberculosis, which goes to show that tuberculosis in the adult is not a primary infection.

M. Paunz article on rupture of tuberculous tracheobronchial glands is abstracted at length, not only because it is a valuable contribution to the subject of tuberculous tracheobronchial glands, but because the results obtained by Paunz' methods of treatment are important.
The tracheobronchial lymph-glands is the most frequent localization of tuberculosis in childhood. Even if tuberculosis of these glands cannot be diagnosed clinically, it is the usual accompaniment of pulmonary tuberculosis, miliary tuberculosis, tuberculous meningitis, osseous tuberculosis and intestinal tuberculosis. Necropsy findings have shown that tuberculosis of the tracheobronchial glands is almost always a secondary infection, that is, the result of a primary infection in the lungs. According to Küss, inhalation tuberculosis causes an especial form of tuberculosis in children, which clinically cannot be diagnosed, but can be revealed by careful examination at necropsy. The form is characterized by a small nodule, sharply defined from the surrounding pulmonary parenchyma and situated beneath the pleura. Here it remains in this condition for years, or it may soften and empty its contents into a bronchus. The regional lymph-glands show constant tuberculous changes, but the lymph-passages between the primary pulmonary lesion and the regional lymph-glands remain unaffected. It is possible, however, according to Küss, that the tubercle bacilli, which reach the finest bronchioles, can be taken up into the lymphatics and deposited in the glands without producing a primary lesion in the lungs.

In his article Paunz defines as tracheobronchial glands those located in the angles of division of trachea, the bronchi and collateral branches of the bronchi, besides the chains of glands surrounding trachea and bronchi. The position of these glands presupposes that pathologic changes in them are accompanied by changes in the trachea and bronchi—the two most important being compression of and rupture into them. As regards the pathology of tuberculous tracheobronchial glands, it has been proved by inoculation experiments that the glands can contain bacilli without any tuberculous lesions. Usually, however, shortly after infection they contain small tubercles, which later become confluent, caseate and soften, so that the whole gland consists of a softened mass surrounded by a thickened capsule. The gland may not be entirely softened, but may contain smaller or larger glandular sequestrae. These changes are accompanied by a periadenitis which causes pressure on the walls of the trachea and bronchi. Rupture into the air-passages usually begins slowly and with a small perforation, hardly as large as a pin-head, often with multiple sieve-like openings, or suddenly, with a large opening. The immediate effect of rupture is obstruction of the trachea and bronchi, which, if the sequestrae are large enough, will lead to suffocation. In gradual perforation the small softened masses are aspirated into the finest bronchioles and cause a caseous bronchopneumonia. The gland may at the same time perforate a large blood-vessel and cause death from suffocation and
loss of blood. The pericardium, esophagus, or pleura can also be broken into.

Tuberculous tracheobronchial glands in children can heal. Then there is absorption of the caseated masses, with calcification and encapsulation. Later, following whooping-cough or measles, the apparently inactive lesion can awaken and give rise to tuberculous bronchopneumonia, meningitis, or to a miliary tuberculosis.

In older reports the diagnosis of rupture of tuberculous tracheobronchial glands was made only post mortem. Lately, in medical literature appear reports in which the diagnosis was made before death. In these cases, for the most part, a foreign body was suspected, and the diagnosis of tuberculous lymph-gland made only after the gland was removed, or coughed up after a tracheotomy. Spontaneous cure of rupture occurs, as is evidenced by the finding of old scars post mortem.

Clinically, the manifestations of ruptured glands are overlooked or recognized too late, but direct tracheobronchoscopy offers, according to Paunz, great aid in making the diagnosis. He adds to a previous report of four cases of ruptured tracheobronchial glands, four more in which the diagnosis was made by tracheobronchoscopy. His first case was that of an 8-year-old child who was brought to the hospital with great dyspnea and hoarse voice. She had after entrance repeated suffocative attacks and there was a weakened respiratory murmur on the right side. A foreign body in the respiratory passages or ruptured tuberculous glands was suspected. Tracheobronchoscopy was performed with the patient in the upright position. Two cm. above the bifurcation soft flocculent masses floated before the field of vision, and when the patient lay down these were partly coughed out through the tube and partly removed by forceps. After the debris was sponged out, the right wall of the trachea above the bifurcation bulged markedly, and on the outer and anterior wall of the principal bronchus the point of rupture could be seen. After the operation the symptoms of tracheobronchial stenosis disappeared and the child was dismissed cured.

The second case was that of a 4-year-old child brought to the hospital with a diagnosis of enlarged bronchial glands with compression. Roentgen-ray pictures substantiated the diagnosis. Symptoms of suffocation appeared suddenly and operation was decided on. Tracheobronchoscopy showed that the principal bronchus was obstructed 1 cm. above the bifurcation by a bulging mass covered by mucous membrane. Paunz seized this with forceps and brought out first a pea-sized, then a bean-sized piece of gland. After this the bulging partly disappeared and the tube was farther inserted. A caseated piece of gland was pushed into the tube and afterward was removed by forceps; there then could be seen on the inner-anterior wall a round perforation.
Bronchitis and caseous pneumonia followed the operation, but the child finally recovered.

The third case was that of a 20-month-old baby. Tracheobronchoscopy confirmed the diagnosis of compression of the trachea and bronchi by tuberculous glands. The point of compression could plainly be seen, but no point of perforation could be found, although the tube filled with caseous matter. The child died five days after entrance with symptoms of suffocation. Necropsy showed, besides tuberculosis of the tracheobronchial glands, a wide-spread miliary tuberculosis.

The fourth case was that of a child of 3 admitted to the hospital because a foreign body in the air passages was suspected. Bronchoscopy showed stenosis due to pressure of the bifurcation glands. Suffocation symptoms following bronchoscopy necessitated tracheotomy, and tracheobronchoscopy revealed a small mass in the bronchus leading to the right lower lobe. The mass was not removed and the symptoms slowly subsided.

The two chief symptoms, according to Paunz, on which the diagnosis of enlarged bronchial glands is made are cough and dyspnea. The cough is spasmodic and has a metallic sound, and is non-productive. The dyspnea is inspiratory as well as expiratory. In infants it is chiefly expiratory. A point of importance is that, in spite of the severe dyspnea, the voice is clear, which shows that the obstruction is not in the larynx, but in the lower air-passages. Weakened respiration limited to one side is an important sign. The picture changes, when rupture of the gland begins. If a large caseous gland ruptures suddenly, a severe suffocative attack occurs just as in cases of aspiration of a foreign body. Suffocative attacks occur also with the entrance of a small amount of caseous débris into the air-passages and, as there usually exists first a small opening, which gradually becomes larger, these suffocative attacks are often the first symptom of rupture. Usually, too, there intervenes between the first attack of suffocation and the final catastrophe a few days or at least hours, so time is given for surgical interference. In each of Paunz’ cases a number of days intervened between the first suffocative attack and the one which threatened life.

The appearance of subcutaneous emphysema is another evidence of ruptured tuberculous glands.

Paunz also discusses other signs, which have been designated as signs of enlarged tracheobronchial glands: multilateral enlargement of veins in the neck, changes in percussion note over manubrium and vertebrae, the Roentgen-ray findings; but as most important he regards direct tracheobronchoscopy. He says that to be of any value this must be performed under deep narcosis. Bulging of the wall can then be
made out, and this occurs more regularly on the lower part of the right lateral tracheal wall and the "mediale" wall of the right principal bronchus. The positions correspond to the locations where the tracheobronchial glands are found in large numbers. Direct tracheobronchoscopy also reveals a granulating or fresh point of perforation. It is evident then that tracheobronchoscopy is not only a valuable diagnostic aid, but is a means of determining the exact point of compression and rupture and allows of watching the development of the case.

As to therapy of these condition, therapy of rupture or beginning rupture must be sharply separated from that of compression. There is no doubt that good results can be obtained in cases of slight compression by the general hygienic and dietetic measures recommended in tuberculosis. Severe grades of compression need hospital care, for the condition must be closely watched, as rupture can be expected at any time.

In case of rupture, tracheotomy followed by bronchoscopy is indicated. Tracheotomy alone helps in many cases, as it facilitates expectoration of the pieces of gland. Tracheotomy must always be performed before attempt is made to remove the gland, otherwise the free sequestrae will cause suffocative attacks. With Paunz' cases, in all ten cases of ruptured tracheobronchial glands treated by tracheobronchoscopy have been reported; seven patients were cured. The three deaths occurred among Paunz' patients. One was a 6-months-old girl, one a 20-months-old boy, both with miliary tuberculosis; the third was a 4-year-old child with a foreign body besides the enlarged glands. From these results it is evident that direct tracheobronchoscopy is a method by which the suffocative attacks of glandular rupture can be warded off. The method, however, is limited to removal of the free glandular sequestrae and contents of the glandular abscess. Abscesses clearly showing through the mucous membrane could be incised, but this is not recommended, for it cannot be determined whether these are connected with a pulmonary abscess or with the esophagus, which, when opened, would result in hemorrhage or produce a communication between the air-passages and esophagus.

Recovery from tuberculosis of the tracheobronchial glands has been shown to take place. Necropsies on children dying from other causes have shown this, and usually in tuberculous abscesses rupture is often the last process before spontaneous healing. So Paunz believes it is the duty of physicians in all cases of rupture to perform tracheotomy at once and tracheobronchoscopy, and to try to prevent death by suffocation.

A. Ghon reports a case of rupture of a tuberculous bronchial lymph-gland into the bronchus. A child a year and a half old was
brought to the hospital because of symptoms of stenosis. Intubation was performed, but the patient died the following day. Necropsy showed that a softened lymph-node on the anterior surface of the right hilum had ruptured into the main bronchus of the right upper lobe. In the tracheobronchial and bronchopulmonary glands were extensive tuberculous changes. There was also a tuberculous pleuritis on the right side and a confluent pneumonia with miliary tuberculosis of the right upper lobe as well as a lobular pneumonia of the left lower lobe and a recent tuberculous ulcer in the small intestine with enlargement of the regional mesenteric glands.

G. Caronia reports a case in a 7-year-old boy of suffocation due to the rupture of a caseated lymph-gland into the trachea. Intubation was performed when the patient entered the hospital, but two hours later he coughed up to the tube. As a foreign body was thought to have entered the trachea, tracheotomy was performed, but the child died shortly afterward. Necropsy showed that a caseated gland had ruptured into the trachea and obstructed the bronchi.

According to Hutinel various conditions influence the prognosis of tuberculosis of the mediastinal glands. Their gravity is not in proportion to their size. Often large masses of glands sclerose and heal, while small ones are the source of a rapidly fatal miliary tuberculosis or of tuberculous meningitis. Age is an important factor in prognosis, for the younger the child the more serious the case is. In infants the lesions show no tendency to heal; they spread rapidly and become disseminated, and at necropsy there is found the same pathologic picture as in rabbits and guinea-pigs which have been inoculated with tuberculosis. In children from 3 to 5 years the prognosis is less grave, but experience teaches that most children of this age who develop a meningitis or generalized tuberculosis have caseated areas in their mediastinal glands. Older children living in favorable hygienic surroundings usually recover, but often suffer relapse and are in danger of a generalized tuberculosis after acute infections or exaggerated fatigue.

The prognosis is influenced by the presence of pulmonary lesions. If one finds associated with the mediastinal adenopathy unmistakable lesions at the apex then the prognosis is frankly bad. Impaired resonance and modification of the respiratory sounds have been found at the apices, without tuberculous involvement of these areas, and are due to pressure of the enlarged glands on the bronchi, veins or pulmonary tissue.

In infants the appearance of subcrepitant râles at the hilum is disquieting. It usually indicates a diffusion of the process into the parenchyma of the lung.
The prognosis is always grave when pulmonary lesions develop in subjects who have very large mediastinal glands.

Slight elevations of temperature do not unfavorably influence the prognosis, but marked prolonged elevations are of serious import. Tachycardia with or without arhythmia is always a bad prognostic sign.

Secondary infections play an important rôle in the prognosis of tuberculosis of the mediastinal glands. Necropsies of children who die of miliary tuberculosis following whooping-cough, measles or influenza frequently reveal in the mediastinum a gland which has softened the influence of the infective process or ruptured into a blood-vessel and given rise to the generalized tuberculous process.

Nutritional disorders, which diminish the resistance of the organism, also have an unfavorable influence on the prognosis.

**PROPHYLAXIS**

98. Thiele: Schoolchildren with Open Tuberculosis, Ztschr. f. Schulsgndhkpfl., 1914, xxvii, 73.
From the study of the register and death certificates of Stuttgart, W. Weinberg compiled the following statistics: (1) the mortality among tuberculous women in the first year after confinement was only 15 per cent. above that from tuberculosis in other women of the same age; (2) among 4,000 marriages of tuberculous persons the death-rate of husbands showed 100 per cent. higher than that of the general population of equal age; (3) the fecundity of tuberculous women was sub-normal; (4) the death-rate from tuberculosis was higher in families with a hereditary taint than in other families, but infection from the parents during the first year of life did not seem considerable; (5) among 16,000 children of tuberculous parents, observed from birth to the end of the twentieth year, the death-rate was 46.8 and 48.1 per cent., while that of the offspring of people who had died from other causes was 40.2 to 40.5 per cent. The death-rate of children who had lost both parents from tuberculosis was 52.4 per cent. The death-rate depended on the time which elapsed between the birth of the children and death of the parents. With children born twenty years before the death of the parents the death-rate was from 42.8 to 45.72 per cent.; with those born in the last year, 65.59 to 75.09 per cent.; of those born in the last four weeks of life, 16.7 per cent. were still-born, and 83.4 per cent. died before they were 20 years old. The death-rate of children of tuberculous parents was greater in the first and fourth decade of life.

In order to study the child reared in a tuberculous environment, M. Fishberg observed all the children of tuberculous applicants for relief to the United Hebrew Charities of New York City. He investigated social, economic and hygienic conditions of the family, examined all children under 15 years of age, and applied the cutaneous tuberculin test. The investigation was carried out in 217 families who were found living in conditions favorable to the dissemination of the disease. Of 274 consumptives found among these people, only 112 slept in a separate room and 136 slept in beds by themselves; the rest shared their rooms or beds or both with other persons.

Of 1,129 persons comprised in this group of families, 792 were under 15 years of age. Nearly all of these children were reared on breast-milk, only 5.5 per cent. having been brought up on artificial food. Some mothers suffering from active tuberculosis were found suckling their infants, who apparently thrived as well as others of their class; many, however, became infected with active tuberculosis.
The weight of the infants was fairly normal, but that of the children over 4 years of age was deplorably short.

The examination of hyperplastic conditions of the nose, throat and pharynx confirmed the opinion that these, as well as scrofula, have nothing to do with tuberculosis.

The results of the tuberculin test showed that the tuberculous milieu did not materially increase the number of tuberculous children over 6 years of age, but that among the infants under 4 years of age the proportion infected was considerably higher than among children living in a better environment.

The mortality of children under 14 among these children was rather high. The opinion entertained by many authors that infants less than a year old, when infected by tuberculosis, do not survive the disease was only partly confirmed by this investigation, for Fishberg has seen among these children many who were undoubtedly infected during the first few months of life and who yet survived and even presented a healthy appearance. It appears, however, that the prognosis depends largely on the age at which infection takes place, and that the danger of fatality is in inverse ratio to the age at which the children are infected.

Massive infection, such as Fishberg found among these children, is the most potent factor in the propagation of tuberculosis. To be effective, prophylactic measures taken against the spread of tuberculosis must be directed to preventing contact with individuals suffering from the disease.

P. Nobécourt and G. Schreiber97 emphasize the necessity of removing the child from tuberculous surroundings at birth. They say that the infant is not born tuberculous, that tuberculosis only exceptionally is hereditary, that it is nearly always contracted after birth and that the contagion is from the family. Nobécourt and Schreiber urge that the work founded by Grancher for the preservation of infants should be furthered by a society. This society should remove infants from their infected surroundings, place them in the country, and exercise constant surveillance over them. The nurses must be selected with great care and be under strict medical inspection. Better than private boarding places, these writers think, are crèches located in the country, mountains or at the seashore.

C. Riviere99 says that infection with the tubercle bacillus is inevitable for those living in crowded communities; that a mild infection is protective against further disease or against acute fatal forms; that a primary infection is always dangerous, but that the younger the infant the more serious is the outlook. Since infection is inevitable, the question has to be considered whether infection with the dangerous
human organism and through the more susceptible respiratory channel should be risked or whether there should be substituted alimentary infection with the comparatively innocuous bovine tubercle bacillus. Massive dosage, such as may occur from a single cow or small infected herd, is to be carefully avoided. Dilution of organisms in a well-mixed milk-supply reduces the risk of a gross infection to a minimum, and the matter may be still further elaborated by feeding only small quantities of unboiled milk at first and postponing its administration until the more dangerous early months are passed. Riviere then contends that complete extermination of bovine tuberculosis is not to be wished for so long as the human tubercle bacillus is rife. The aim should be a clean milk-supply and adequate inspection of small byres, and of single cows; through these measures the danger of massive bovine infection may be eliminated and the use of raw milk be more safely and confidently recommended.

T. C. McCleave emphasizes the fact that while all recognize that infection in a very large measure results from contact with infected people, it is now also well established that in a certain smaller proportion of cases the disease is derived from tuberculous cattle. As bovine bacilli practically always gain access to the human body through the ingestion of contaminated milk or milk products, methods of prophylaxis must be directed toward the eradication of the disease from dairy herds, but more especially measures must be devised to render milk from even tuberculous animals suitable for dietetic use. Certified milk is the only commercial milk which affords reasonable assurance of safety, and it should be obtained for little children whenever possible. Commercial pasteurization should be considered adequate only when carried out under conditions which assure a fresh and not excessively contaminated supply, heated to a requisite temperature of 60 C. for a period of twenty minutes, quickly cooled and kept iced, delivered early and consumed without delay, for such milk is likely to undergo rapid fermentative changes. Such conditions, according to McCleave, can be enforced only by a system of strict and energetic official control, and, as carried out at present, are often worse than useless. He is of the opinion that the only absolutely safe milk is that which is heated in the home of the consumer. Milk which is brought to just below the boiling-point in the family kitchen will never transmit bovine tuberculosis to the babies.

W. C. White draws attention to a number of points in prevention of tuberculosis in children, which interest both the tuberculosis worker and the pediatrician. First he deplores the practice of midwife or obstetrician of removing mucus from the mouth of the new-born by direct mouth-to-mouth aspiration. He cites the report of Reich, who
collected ten cases of tuberculous meningitis in the practice of a midwife who suffered from pulmonary tuberculosis and who practiced this method of resuscitation.

Second, he mentions the danger of infection from nurses and nurse-maids and emphasizes the importance of examination of all persons who are to be intrusted with the care of babies and children.

The third point is the prevention of illness from the use of milk. White thinks that this can be effected only by a carefully supervised, municipally controlled milk-supply.

Another point is forbidding tuberculous mothers to nurse their babies. The danger is not so much that the child will become tuberculous from the mother’s milk as that the mother may cough over it.

The next point discussed is that of the value of tonsillectomy in the prevention of tuberculosis. White suggests that careful records of cases in which the tonsils are removed should in the future be kept to give information of the value of this procedure in the prevention of tuberculosis.

Finally, White calls attention to statistics compiled by Frederick Hoffman, which show that in the last ten years the mortality of children under 5 years has dropped, but not that of children between 5 and 15. The figures suggest necessity for work of pediatricians and tuberculosis organizations during this period along the lines of such activities as open-air schools, school lunches, better home conditions, child labor, better workshops. While tuberculosis organizations have taken part in these activities, they belong no more to them than to the various other groups of workers who are interested in child life and health.

Mary E. Lapham106 maintains that medical inspection of schools will protect children from exposure to infection with the tubercle bacilli; will promote their resistance by all hygienic measures available and will put children below par into out-of-door schools, or even under a tuberculosis régime.

J. V. Van Pelt,168 discussing open-air schools in their relation to pulmonary tuberculosis, says that from a theoretical joint of view they have the following advantages: The rapid flow and change of air is far more beneficial than the ordinary or even the best forms of so-called ventilation. Sunlight and strongly diffused light act as disinfecting agents. Fresh air is Nature’s tonic and the vitality of individual is fortified. It must not be forgotten that, when discomfort is felt from the cold, the cold becomes a menace which counteracts the value of the fresh air.

Another advantage of the open-air school is that the nourishment of the children is supervised.
M. M. Vinton\textsuperscript{111} says that a fresh-air class of the open-window type can be organized in any ordinary schoolroom. The ordinary window-sashes must be displaced by sashes swinging on pivots, four sashes in each window, and the entering air directed toward the ceiling. There should be seats fixed on small platforms, which can be moved about the room and allow space for reclining chairs, an addition to the ordinary equipment of a schoolroom. There should be a gas stove for heating milk, and scales for weighing the children.

This is practically the arrangement of the fresh-air schoolrooms in New York with which Vinton is associated. The classes there are ungraded and limited to twenty-five pupils. At 10:30 a.m. a luncheon is served and, after the children return from home at 1 o'clock they don sleeping bags and rest for an hour in reclining chairs. At 2 p.m. another lunch of crackers and milk is served.

Vinton says that the fresh-air class has solved the question of how pretuberculous children may profitably enjoy the benefits of outdoor air and be prevented from acquiring a tuberculous lesion of the lungs.

M. Solis-Cohen\textsuperscript{112} says sanatorium treatment is incomplete unless the patients are instructed and drilled in the life they should lead after their discharge. With class instruction the good results obtained would undoubtedly be more lasting and relapses less frequent.

At the Jewish Sanatorium at Eagleville, Pa., Solis-Cohen gives such instruction to the children. These talks deal with the nature of tuberculosis, the avenues of infection, the ways to avoid communicating the disease, and the hygienic measures necessary to regain and retain health.

\textit{TREATMENT}

\textsuperscript{113} Müller, E.: Treatment and Prophylaxis of Tuberculosis in Childhood, Med. Klin., 1914, x, 138.


\textsuperscript{115} Nobel, E.: Unilateral Pulmonary Tuberculosis Treated with Pneumothorax, Ztschr. f. Kinderh. (Ref.), 1914, viii, 83.


\textsuperscript{117} Stommel, A.: Experience with Rosenbach's Tuberculin, Arch. f. Kinderh., 1914, lxii, 337.


\textsuperscript{119} McMichael, O. W.: Diagnosis and Treatment of Tuberculosis, Michigan State Med. Soc. Jour., 1914, xiii, 1.

\textsuperscript{120} Treplin: Treatment at the Seashore of Tuberculosis in Children, Med. Klin., 1914, x, 765.


\textsuperscript{122} Treves, A.: Heliotherapy in Surgical Tuberculosis, Ann. de méd. et chir. inf., 1914, xviii, 415.

E. Müller\textsuperscript{113} discusses the treatment of tuberculosis in childhood under the following heads: (1) medicinal treatment; (2) general dietetic and hygiene measures; (3) surgical measures.

Among the chemical remedies, Müller believes creosote valuable because of its antidiarrheal and appetite-producing properties.

Müller thinks that there is a tendency to overfeed tuberculous children. A rapid increase in weight after a diet rich in starch and sugar is injurious. Experiments seem to show that a tissue rich in water, such as is produced by feeding carbohydrates, favors the development of the tubercle bacillus. Fats, on the other hand, are useful. Müller does not give much milk because of the large amounts of salts it contains, but 200 to 300 c.c. of cream daily, also abundant butter.

Fresh air and sunshine are important in the treatment of tuberculosis. The efficacy of sunshine in the treatment of surgical tuberculosis has been demonstrated in the last few years. Müller believes, however, that the moderate heat of the sun as experienced in his climate (Berlin) is more effective than the intense heat of mountainous regions. He thinks that with fresh air and sunshine a cure of surgical tuberculosis in children can be effected without operative interference. Müller thinks that salt-water baths are especially useful in the treatment of scrofula. The salt is gradually increased in strength from 3 to 8 per cent., and given three times a week for six weeks. The salt must be boiled for two hours, then the salt-lake poured through cheesecloth into the bath.

Müller also discusses the subject of prophylaxis of tuberculosis in children. Infection with the bovine bacillus is comparatively small, as milk in Germany is always boiled. Ninety per cent. of the children are infected from their tuberculous families. Sanatoriums which only care for early cases and leave behind the advanced ones do not fulfil their true object and further progress in prophylaxis will not be made until advanced cases are segregated.

H. Vogt\textsuperscript{114} directs attention to dietary treatment and the use of pneumothorax and of tuberculin in tuberculosis of children. He does not believe in excessive use of carbohydrates and fat, for carbohy-
drates increase the body weight, but do not increase resistance against
the disease. Vogt uses a moderate amount of milk and vegetables, and
meat twice a day. Fat is given in form of cod-liver oil. With this diet
the children do not gain weight too rapidly, but their color improves
and their muscles harden.

Vogt believes that artificial pneumothorax is effectual for young
children, even when both lungs are involved, provided one is not too
extensively diseased. He regards this measure as the most important
and reliable at hand for severe cases. It is really applicable to infants,
because the disease spreads too rapidly to other organs. Time, how¬
ever, must tell whether cures obtained by this treatment are permanent.

Vogt is not in favor of the tuberculin treatment, agreeing with
Czerny that the results obtained with its use are no greater than
obtained without it.

E. Nobel\textsuperscript{115} reports a case of unilateral pulmonary tuberculosis in
a 7-year-old girl who was treated with artificial pneumothorax. In the
upper lobe was a tuberculous infiltration which could be demonstrated
clinically and with the Roentgen rays. Artificial pneumothorax was
produced and maintained for three months. After the lung was again
inflated it was found to be normal.

K. Bähr\textsuperscript{116} warns against judging the results of therapeutic agents
in tuberculosis. He cites five cases of scrofuloderma in children under
a year old, in four of which the healing was spontaneous. Cure was
complete and not followed by any other manifestation of tuberculosis.
The fifth patient was treated with Rosenbach's tuberculin. These
cases show that scrofuloderma in the first year of life is often a benign
condition and that cure of such cases is no test for the value of any
tuberculin.

A. Stommel\textsuperscript{117} treated 22 children with tuberculosis with Rosen¬
bach's tuberculin. Eighteen suffered from pulmonary and bronchial
gland tuberculosis and 4 from tubercular peritonitis. Of the 18 chil¬
dren with pulmonary and bronchial gland tuberculosis, 6 showed a
decided, 4 a slight improvement, 5 showed no change or slight aggra¬
vation of symptoms, 3 showed a decided aggravation of symptoms,
with 2 deaths. Three of the 4 children with peritonitis improved
under treatment.

From the results, Stommel came to the conclusion that Rosenbach's
tuberculin did not produce a particularly favorable effect. There was
no opportunity to observe a complete cure, and the improvement
observed could not be ascribed unconditionally to the tuberculin, as
similar and even better results have been obtained when children have
been taken away from their unfavorable surroundings and given
plenty of fresh air, sunshine and good food. Moreover, in the two
cases which came to necropsy the lesions showed no tendency to heal. Stommel, therefore, though he does not regard the remedy as dangerous, thinks it is therapeutically inert.

During the last year C. Beck has treated 45 infants and children with Rosenbach's tuberculin. The youngest child was 2 months old, the oldest 13½ years. Seventeen of the children had glandular tuberculosis, 11 osseous caries, 6 pulmonary tuberculosis, 5 peritonitis, 4 meningitis and 2 generalized tuberculosis. Enlarged bronchial glands were demonstrated by the Roentgen rays in all. In the cases of meningitis there was a fall in temperature, the children became quieter and had no further convulsions. Cases of generalized tuberculosis were influenced by the treatment. Beck thinks early cases of bronchial gland tuberculosis are best fitted for the treatment, but advanced ones can be cured. He thinks that Rosenbach's tuberculin should invariably be given a trial in tuberculosis in children.

D. W. McMichael speaks highly of K. von Ruck's vaccine, with which he obtained convincing results in treating more than 200 children and adults. While it is not, he says, a completely certain agent, it does all that any of the known specific products do to check the disease.

Treplin thinks that a sojourn at the seashore favorably affects any form of tuberculosis. There is an increase in appetite and a corresponding gain in weight. Scrofulous children are especially benefited, and often wonderful results are obtained for children with open pulmonary tuberculosis. Children with surgical tuberculosis are benefited if they are in a hospital under the care of a skilful surgeon. Treplin urges that children with surgical as well as pulmonary tuberculosis should not be kept long in city hospitals, but should be sent to the seashore as soon as possible.

Discussing the treatment of surgical tuberculosis, P. Redard says that heliotherapy is not advantageous in all cases. It is dangerous without proper immobilization, especially for children difficult to control. For severe forms, the classical methods, chiefly rigorous immobilization with orthopedic apparatus, ought to be the basis of treatment. In mild forms it is often advantageous to combine heliotherapy and immobilization with simple orthopedic apparatus. By this combination not only is a favorable effect on the general health obtained, but also the local disease heals without deformity and with functional integrity.

W. E. Ladd discusses the treatment of tuberculous cervical adenitis in children. He says that the methods which demand attention are the open air and hygienic treatment alone or combined with tuberculin and palliative surgery, and the Roentgen-ray treatment. He is rather disappointed in the results obtained by palliative surgery and
tuberculin. With the Roentgen ray he has had limited experience, but, in the instance of superficial broken-down glands, which are slow to heal, three or four exposures will sometimes cause them to heal. The Roentgen ray will also sometimes close a sinus and make possible a clean dissection of underlying glands.

Heliotherapy has apparently yielded many good results, but is available only for patients who have sufficient means to go to high altitudes.

Ladd is of the opinion that thorough extirpation of all infected glands with the primary focus yields by far the highest percentage of cures, and requires far less time than any other means. He thinks, moreover, that tuberculosis of the tonsils is more common in cases of tuberculosis of the cervical glands than has been surmised. To avoid unsightly scars, the operation should be performed early before the glands have broken down. Hygienic measures play an important part in the postoperative treatment.

O. H. Peterson discusses the Roentgen-ray treatment of tuberculous lymph-glands. He divides tuberculous lymph-glands into three groups: (1) simple hyperemic glands; (2) caseated and suppurative glands; (3) ulcerated glands with fistula formation.

In the first group the Roentgen rays cause a gradual diminution in the size of the glands, and separation of masses so that the individual glands can be made out. After a long time they become quite small, but never disappear entirely.

In the second group the Roentgen rays hasten the softening process. When the gland is softened, nothing further can be accomplished without surgical interference. A small incision should be made and the pus evacuated and the Roentgen-ray treatment continued, only after the wound has healed. Sometimes repetition of the procedure is necessary.

The third form is difficult to treat because secondary infection is always present. Closure of the fistulas sometimes follows the use of the Roentgen rays.

Comparing the results obtained by Roentgen rays with those of radical surgical procedures, Peterson says that in the former cosmetic effects, which are very important, are better and that all the tissue can be affected, while with surgical measures there is always a chance of overlooking a small infected gland. On the other hand, Roentgen rays only encapsulate the bacilli and the infection may flare up again. The length of time necessary for the Roentgen treatment is also a drawback.

G. Jefferson says that the radical removal of cervical glands is not unfraught with danger. Two children, aged 7 years and 3 years, operated on by him, died of a fulminating streptococcal infection, one
twelve hours, the other twenty hours after the operation. The source of the infection was probably the walls of the sinus, and Jefferson advises that the sinus be swabbed with iodin for a few days before the operation and that at the time of operation the wound should be washed out with saline solution and that drainage be employed, preferably through a separate stab wound.

4744 Prairie Avenue.