

(b) *Tongue*.—The disease begins by an aggregation of small granular bodies on the edge or dorsum. Ulceration proceeds, leaving an irregular sore with a distinct but uneven margin, and a rough, often caseous base. The disease extends slowly and may form an ulcer of considerable size. I have known it to be mistaken for epithelioma and the tongue to be excised. It is rarely met with except when other organs are involved. The glands of the angle of the jaw are not enlarged and the sore does not yield to iodide of potassium, which are points of distinction between the tuberculous and the syphilitic ulcer. In doubtful cases the inoculation test should be made, or a portion excised for microscopical examination.

(c) Tubercles may develop on the hard or soft *palate*. In a recent case under the care of my colleague Halsted there was a rough, irregular patch on the roof of the mouth, grayish in spots, and fissured.

(d) Tuberculosis of the *tonsil* has been recorded in a few cases, either in the form of the miliary granules or as caseous foci. Ulceration may occur. In the acute cases the submaxillary glands may be enlarged.

(e) *Pharynx*.—In extensive laryngeal tuberculosis an eruption of miliary granules on the posterior wall of the pharynx is not very uncommon. In chronic phthisis an ulcerative pharyngitis, due to extension of the disease from the epiglottis and larynx, is one of the most distressing of complications, rendering deglutition acutely painful.

(f) A few instances occur in literature of tuberculosis of the *œsophagus*. The condition is a pathological curiosity, except in the slight extension from the larynx, which is not infrequent.

(g) *Stomach*.—Many cases are reported which are doubtful. Primary disease is unknown. Marfan* was able to collect only about a dozen authentic cases. Perforation of stomach occurred six times, thrice by a tuberculous gland. In Oppolzer's case an ulcer of the colon perforated the organ. In Musser's case there was a large tuberculous ulcer three by one and a half inches in extent.

(h) *Intestines*.—The tubercles may be (1) primary in the mucous membrane, or more commonly (2) secondary to disease of the lungs, or in rare cases the affection may (3) pass from the peritonæum.

(1) Primary intestinal tuberculosis occurs most frequently in children, in whom it may be associated with enlargement and caseation of the mesenteric glands, or with peritonitis. It may be difficult to say at the time of the autopsy whether the primary lesion has been intestinal or peritoneal. I have already referred to Woodhead's statistics showing the remarkable frequency of infection through the bowel. In adults primary intestinal tuberculosis is rare; but now and then cases occur in which the disease sets in with irregular diarrhoea, moderate fever, and colicky pains. In a few cases hæmorrhage has been the initial symptom. Regarded at first as a chronic catarrh, it is not until the emaciation becomes marked or

the signs of disease appear in the lungs that the true nature is apparent. Still more deceptive are the cases in which the tuberculosis begins in the cæcum and there are symptoms of typhlitis—tenderness in the right iliac fossa, constipation, or an irregular diarrhoea and fever. These signs may gradually disappear, to recur again in a few weeks, and still further complicate the diagnosis. Perforation may occur with the formation of a pericæcal abscess, or perforation into the peritonæum may take place, or in very rare instances there is partial healing with great thickening of the walls and narrowing of the lumen.

(2) Secondary involvement of the bowels is very common in chronic pulmonary tuberculosis. The lesions are chiefly in the ileum, cæcum, and colon. The affection begins in the solitary and agminated glands or on the surface of or within the mucosa. The caseation and necrosis lead to ulceration, which may be very extensive and involve the greater portion of the mucosa of the large and small bowels. In the ileum the Peyer's patches are chiefly involved and the ulcer may be ovoid, but in the jejunum and colon the ulcers are usually round or transverse to the long axis. The tuberculous ulcer has the following characters: (a) It is irregular, rarely ovoid or in the long axis, more frequently girdling the bowel. (b) The edges and base are infiltrated, often caseous. (c) The submucosa and muscularis are usually involved; and (d) on the serosa may be seen colonies of young tubercles or a well-marked tuberculous lymphangitis. Perforation and peritonitis are not uncommon events in the secondary ulceration. Stenosis of the bowel from cicatrization may occur; the strictures may be multiple.

Tuberculosis of the *rectum* has a special interest in connection with *fistula in ano*, which, according to Spillman's statistics, occurs in about 3.5 per cent of cases of pulmonary disease. In many instances the lesion has been shown to be tuberculous. It is very rarely primary, but if the tissue on removal contains bacilli and is infective the lungs are almost invariably found to be involved. It is a common opinion that the pulmonary symptoms may develop rapidly after the fistula is cut. This may have some basis if the operation consists in laying the tract open, and not in a free excision.

(3) Extension from the peritonæum may excite tuberculous disease in the bowels. The affection may be primary in the peritonæum or extend from the tubes in women or the mesenteric glands in children. The coils of intestines become matted together, caseous and suppurating foci develop between the folds, and perforation may take place between the coils at several different places.

* Paris Thesis, 1887.

VII. TUBERCULOSIS OF THE LIVER.

This organ is very constantly involved in (a) general tuberculosis. The miliary granulation may be very small and in acute cases scarcely perceptible. The liver is pale and often fatty.

(b) A remarkable condition of the organ is produced by the development of the tubercles in the finer bile-vessels. They may attain a considerable size and are almost always softened in the centre, resembling small abscesses. The contents are always bile-stained. The organ may be honeycombed with these tuberculous abscesses.

(c) Large, coarse caseous masses are occasionally found, sometimes in association with perihepatitis or tuberculous peritonitis. They may attain the size of an orange or larger.

(d) Tuberculous cirrhosis. With the eruption of miliary tubercles there may be slight increase in the connective tissue, which is overshadowed by the fatty change. In all the chronic forms of tubercle in this organ there may be fibrous overgrowth. Hanot, who has described several varieties, states that the condition may be primary. Practically it is very rare, except in connection with chronic tuberculous peritonitis and perihepatitis, when the organ may be much deformed by a sclerosis involving the portal canals.

In this last group there may be symptoms of ascites; as a rule, tuberculosis of the liver has a purely anatomical interest.

VIII. TUBERCULOSIS OF THE BRAIN AND CORD.

Tuberculosis of the *brain* occurs as (a) an acute miliary infection causing meningitis and acute hydrocephalus; (b) as a chronic meningo-encephalitis, usually localized, and containing small nodular tubercles; and (c) as the so-called solitary tubercle. Between the last two forms there are all gradations, and it is rare to see the meninges uninvolved. The acute variety has already been considered. I shall here consider the chronic form, which develops slowly and has the clinical characters of a tumor.

It is most common in the young. Of 148 cases collected by Pribram 118 were under fifteen years of age. Other organs are usually involved, particularly the lungs, the bronchial glands, or the bones. In rare instances no tubercles are found elsewhere. They occur most frequently in the cerebellum; next in the cerebrum and then in the pons. The growths are often multiple, in 100 out of 183 cases (Gowers). They range in size from a pea to a walnut; larger tumors occasionally occur, and sometimes an entire lobe of the cerebellum is affected. On section the tubercle presents a grayish-yellow, caseous appearance, usually firm and hard, and encircled by a translucent, softer tissue. The centre of the growth may be semi-diffuent. As in other localities the tubercle may calcify. The tu-

mors are as a rule attached to the meninges, often to the pia at the bottom of a sulcus so that they look imbedded in the brain-substance. About the longitudinal fissure there may be an aggregation of the growths, with compression of the sinus, and the formation of a thrombus. The tuberculous tumor not infrequently excites acute meningitis. In localized meningo-encephalitis the pia is thickened, tubercles are adherent to the under surface and grow about the arteries. It is often combined with cerebral softening from interference with the circulation. Several of the most characteristic instances which I have seen were on the meninges covering the insula. This form may develop in pulmonary tuberculosis, causing hemiplegia or aphasia which may persist for months.

The symptoms of tuberculous growths in the brain are those of tumor, and will be considered in the section on the brain.

In the *spinal cord* the same forms are found. The acute tuberculous meningitis has been considered and is almost always cerebro-spinal. The solitary tubercle of the cord is rare. Herter has reported three cases and collected twenty-four instances from the literature. It was secondary in all save one case. The symptoms are those of spinal tumor or meningitis.

IX. TUBERCULOSIS OF THE GENITO-URINARY SYSTEM.

(a) *Tuberculosis of the Kidneys (Phthisis renum).*—In general tuberculosis the kidneys frequently present scattered miliary tubercles. In pulmonary tuberculosis it is common to find a few nodules in the substance of the organ, or there may be pyelitis. Primary tuberculosis of the kidneys is not very rare. In a majority of the cases the process involves the pelvis and the ureter as well, sometimes the bladder and prostate. In only one of eight cases was the prostate involved. It may be difficult to say in advanced cases whether the disease has started in the bladder, prostate, or vesicles, and crept up the ureters, or whether it started in the kidneys and proceeded downward. In a majority of cases it is, I believe, the latter, and the infection is through the blood. One kidney alone may be involved, and the disease creeps down the ureter and may only extend a few millimetres on the vesical mucosa. In a recent instance a man with aortic insufficiency, who had no lesions in the lungs, presented a localized patch in the pelvis, involving a pyramid, while the ureter, five centimetres from the bladder and at its orifice, was thickened and tuberculous. The prostate showed an area of caseation. It is most common in the middle period of life, but it may occur at the extremes of age. It is more frequent in men than in women. In the earliest stage, which may be met with accidentally, the disease is seen to begin in the pyramids and calyces. Necrosis and caseation proceed rapidly, and the colonies of tubercles start throughout the pyramids and extend upon the mucous membrane of the pelvis. As a rule, from the outset, it is a tuberculous pyo-nephrosis. The disease may be confined to one kidney, or progress more extensively in

one than in the other. At autopsy both organs are usually found enlarged. One organ may be completely destroyed and converted into a series of cysts containing cheesy substance; a form of kidney which the older writers called scrofulous. In the putty-like contents of these cysts lime salts may be deposited. In other instances the walls of the pelvis are thickened and cheesy, the pyramids eroded, and caseous nodules are scattered through the organ, even to the capsule, which may be thickened and adherent. The other organ is usually less affected, and shows only pyelitis or a superficial necrosis of one or two pyramids. The ureters are usually thickened and the mucous membrane ulcerated and caseous. Involvement of the bladder, vesiculæ seminales, and testes is not uncommon in males.

The *symptoms* are those of pyelitis. The urine may be purulent for years, and there may be little or no distress. When the bladder becomes involved micturition is frequent, and many instances are mistaken for cystitis. The condition is for many years compatible with fair health. The curability is shown by the accidental discovery of the so-called scrofulous kidney, converted into cysts containing a putty-like substance. In cases in which the disease becomes advanced and both organs are affected, constitutional symptoms are more marked. There is irregular fever, with chills, and loss of weight and strength. General tuberculosis is common. In only one of my cases were the lungs uninvolved. In a case at the Montreal General Hospital a cyst perforated and caused fatal peritonitis.

Physical examination may detect special tenderness on one side, or the kidney may be palpable in front on deep pressure; but tuberculous pyelonephritis seldom causes a large tumor. Occasionally the pelvis becomes enormously distended; but this is rare in comparison with calculous pyelitis. The urine presents changes similar to those of ordinary calculous pyelitis—pus-cells, epithelium, and occasionally definite caseous masses. Albumen is, of course, present. Tubercle bacilli may be demonstrated by the ordinary methods. Tube-casts are not often seen.

To distinguish the condition from calculous pyelitis is often difficult. Hæmorrhage may be present in both, though not nearly so frequently in the tuberculous disease. Careful examination of the pus for tubercle bacilli gives most important information. The lungs or other organs may be tuberculous.

The incidence of renal in uro-genital tuberculosis may be gathered from Orth's Göttingen material, analyzed by Oppenheim. Of 60 cases there were 34 in which the kidneys were involved.

(b) *Tuberculosis of the Ureters and Bladder.*—This rarely occurs as a primary affection, but is nearly always secondary to involvement of other parts, particularly the pelvis of the kidney. In the case of uro-genital tuberculosis, above mentioned, in a patient who died of heart disease, the ureter, just where it enters the bladder, showed a fresh patch of tuberculosis.

Protracted cystitis, which has come on without apparent cause, is

always suggestive of tuberculosis. The renal regions, the testes, and the prostate should be examined with care. It may follow a pyelo-nephritis or be associated with primary disease of the prostate or vesiculæ seminales.

(c) *Tuberculosis of the Prostate and Vesiculæ Seminales.*—The prostate is frequently involved in tuberculosis of the uro-genital tract. In Krzywicki's cases, of 15 males the prostate was involved in 14 and the vesiculæ seminales in 11. In Orth's cases the prostate was involved in 18 of the 37 cases in males. These parts are much more frequently involved than ordinary post-mortem statistics indicate.

(d) *Tuberculosis of the Testes.*—This somewhat common affection may be primary, or, more frequently, is secondary to tuberculous disease elsewhere. Many cases occur before the second year, and it is stated to have been met with in the foetus. In infants it is serious and usually associated with tuberculous disease in other parts. In nine cases recently reported by Hutinel and Deschamps* in every one there was a general affection. In 20 cases reported by Jullien† 6 were under one year, and 6 between one and two years old. In five of the cases both testicles were affected. Koplik holds that most of the cases of this kind are congenital, in Baumgarten's sense. In the adult the tubercles begin within the substance of the gland, but in children the tunica albuginea is first affected. The tubercle does not always undergo caseation, but it may present a number of embryonic cells, not unlike a sarcoma.

Tubercle of the testes is most likely to be confounded with syphilis. In the latter the body of the organ is most often affected, there is less pain, and the outlines of the growth are more nodular and irregular. In obscure peritoneal disease the detection of tubercle in a testis has not infrequently led to a correct diagnosis. The association of the two conditions is not uncommon. The lesion in the testis may heal completely, or the disease may become generalized. General infection has followed operation.

(e) *Tuberculosis of the Fallopian Tubes, Ovaries, and Uterus.*—The special attention which has been paid to local affections of these parts by gynaecologists has taught us that primary tuberculosis of the tubes is not at all uncommon. Within a year my colleague, Kelly, has operated upon five or six cases. The disease may be primary and produce a most characteristic form of salpingitis, in which the tubes are enlarged, the walls thickened and infiltrated, and the contents cheesy. Adhesion takes place between the fimbriæ and the ovaries, or the uterus may be invaded. The condition is usually bilateral. It may occur in young children. Although, as a rule, very evident to the naked eye, there are specimens resembling ordinary salpingitis, which show on microscopical examination numerous miliary tubercles (Welch and Williams). Tuberculous salpingitis may

* Archives Générales de Médecine, 1891.

† Ibid., 1890.

cause serious local disease with abscess formation, and it may be the starting-point of peritonitis.

Tuberculosis of the uterus is very rare. Only three examples have come under my observation, all in connection with pulmonary phthisis. It may be primary. The mucosa of the fundus is thickened and caseous, and tubercles may be seen in the muscular tissue. Occasionally the process extends to the vagina.

X. ARTERIES.

Primary tuberculosis of the larger blood-vessels is unknown. The disease may, however, occur in a large artery and not result from external invasion. In a case of chronic phthisis from my ward Councilman found a fresh tuberculous growth in the aorta, which had no connection with cheesy masses outside the vessel.

In the lungs and other organs attacked by tuberculosis the arteries are involved in an acute infiltration which usually leads to thrombosis, or tubercles may develop in the walls and proceed to caseation and softening frequently with the result of hæmorrhage. By extension into vessels, particularly veins, the bacilli are widely distributed. In meningitis tuberculosis of the arteries plays an important rôle.

XI. THE PROGNOSIS IN TUBERCULOSIS.

Not all persons in whose bodies the bacilli gain a foothold present marked signs of tuberculosis. As will be stated in the next section, local disease is found in a considerable number of all cadavers. Infection does not necessarily mean the establishment of a progressive and fatal disease. In my autopsies, excluding cases dead of pulmonary phthisis, 7.5 per cent presented tuberculous lesions of the lungs—a low percentage in comparison with other records, as I carefully excluded the simple fibroid puckering at the apex and the solitary cheesy nodule, unless surrounded by colonies of tubercles.

In many cases a natural or spontaneous cure is effected, for the conditions favorable to the development of the disease are not present—in other words, the tissue-soil is unsuitable. Apart from this group, a majority of which probably do not show any sign of disease, there may be spontaneous arrest after the symptoms have become decided. Many years ago Flint called attention to the self-limitation and intrinsic tendency to recovery in well-marked pulmonary tuberculosis. Of his 670 cases, 44 recovered, and in 31 the disease was arrested, spontaneously in 23 of the first group and in 15 of the second. This natural tendency to cure is still more strikingly shown in lymphatic and bone tuberculosis.

The following may be considered favorable circumstances in the prognosis of pulmonary tuberculosis: A good family history, previous good health, a strong digestion, a suitable environment, and an insidious onset,

without high fever, and without extensive pneumonic consolidation. Cases beginning with pleurisy seem to run a more protracted and more favorable course. Repeated attacks of hæmoptysis are unfavorable. When well established the course of tuberculosis in any organ is marked by intervals of weeks or months in which the fever lessens, the symptoms subside, and there is improvement in the general health.

In pulmonary cases the duration is extremely variable. Laennec placed the average duration at two years, and for the majority of cases this is perhaps a correct estimate. Pollock's large statistics of over 3,500 cases shows a mean duration of the disease of over two years and a half. Williams's analysis of 1,000 cases in private practice shows a much more protracted course, as the average duration was over seven years.

Under the subject of prognosis comes the question of the marriage of persons who have had tuberculosis, or in whose family the disease prevails. The following brief statements may be made with reference to it:

(a) Subjects with healed lymphatic or bone tuberculosis marry with personal impunity and may beget healthy children. It is undeniable, however, that in such families, scrofula, caries of the bone, arthritis, cerebral and pulmonary tuberculosis are more common. Which is it, "*hérédité de graine ou hérédité de terrain*," as the French have it, the seed or the soil, or both? We cannot yet say. The risks, however, are such as may properly be taken.

(b) The question of marriage of a person who has arrested or cured lung tuberculosis is more difficult to decide. If a male, the personal risk is not so great; and when the health and strength are good, the external environment favorable, and the family history not extremely bad, the experiment—for it is such—is often successful, and many healthy and happy families are begotten under these circumstances. In women the question is complicated with that of child-bearing, which increases the risks enormously. With a localized lesion, absence of hereditary taint, good physique, and favorable environment, marriage might be permitted. When tuberculosis has existed, however, in a girl whose family history is bad, whose chest expansion is slight, and whose physique is below the standard, the physician should, if possible, place his veto upon marriage.

(c) With existing disease, fever, bacilli, etc., marriage should be absolutely prohibited. Pregnancy and parturition hasten the process in almost every case. There is much truth, indeed, in the remark of Dubois: "If a woman threatened with phthisis marries, she may bear the first accouchement well; a second, with difficulty; a third, never."

XII. PROPHYLAXIS IN TUBERCULOSIS.

(a) *General*.—The sputa of phthisical patients should be carefully collected and destroyed. Patients should be urged not to spit about carelessly, but always to use a spit-cup. Several forms of portable flasks have