Tuberculosis of the tunica vaginalis testis, with a clinical and pathological report of two cases : from the Surgical Out-Patient Department of the Royal Hospital for Sick Children / by Harold J. Stiles.

With the author's compliments

TUBERCULOSIS OF THE TUNICA VAGINALIS TESTIS, WITH A CLINICAL AND PATHOLOGICAL REPORT OF TWO CASES. FROM THE SURGICAL OUT-PATIENT DEPARTMENT OF THE ROYAL HOSPITAL FOR SICK CHILDREN.

By HAROLD J. STILES, M.B., F.R.C.S.Ed.

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Tuberculosis of the Tunica Vaginalis Testis, with a Clinical and Pathological Report of Two Cases. From the Surgical Out-Patient Department of the Royal Hospital for Sick Children.

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Tubercle of the tunica vaginalis testis may occur—(1) as a primary condition; (2) secondary to tubercle of the testis, or epididymis; (3) secondary to abdominal tuberculosis.

The cases which I am about to describe belong to the third group, in which I shall place only those conditions where the disease spreads down a patent funicular peritoneal process into the tunica vaginalis. Practically, therefore, it is to be regarded as a surgical disease of childhood. Judging from the very scanty reference to this variety in literature, it would appear to be an exceedingly rare affection. The few recorded cases which I have been able to discover have been associated with a hydrocele, which, in the absence of concomitant conditions referable to the abdomen, would be difficult to distinguish from ordinary non-tubercular communicating hydrocele. My own cases were not attended with hydrocele, but gave rise to clinical signs which, without a previous knowledge of the pathology and morbid anatomy of the condition, might easily lead to an erroneous diagnosis. With this knowledge, however, we shall find that the clinical signs are fairly characteristic. I am inclined to think that tubercle of the tunica vaginalis is not so rare as surgical literature would have us suppose, and since the affection is altogether ignored in even the largest surgical text-books, I may, before describing my own cases, refer shortly to the various conditions which have been met with. As regards the primary form, Simmonds states that it is exceedingly rare to find a tubercular deposit upon the tunica

vaginalis without the existence also of tubercle in the epididymis or testis. After a long search for such a condition, Simmonds only met with one case, and that at the post-mortem of a man who died of general tuberculosis. The only other reference that I can find to the condition is one by Bulteau, who says that it occurs in the form of small disseminated tubercles, or more rarely as larger nodules, and that it is generally accompanied by hydrocele.

The variety occurring secondarily to tubercle of the testis, or epididymis, has been carefully studied by Simmonds. Out of the 12 cases examined by him, 8 showed tuberculosis of the tunica vaginalis. In those cases in which it was absent, the disease in the testicle was less advanced, and in one of these the two serous layers were firmly united throughout by a simple adhesive inflammation. All the specimens were from adults from 28 to 71 years of age. The form presented by the disease in the tunica vaginalis was that of minute, small, seldom larger nodules, scattered more or less abundantly over both layers. In 6 out of the 8 cases hydrocele was present, the fluid being serous and more or less abundant. In 4 the membrane was covered with a delicate fibrinous layer. In only one case did the disease present the form of a "fungous periorchitis."

The third form—namely, that occurring along with abdominal tuberculosis—was first drawn attention to by M. Phocas, so recently as 1891, at the Congrès de Chirurgie. Last year M. Phocas[1] reported 3 cases which had been under his care, and discussed the pathogenesis of this and also of the non-tubercular form of "congenital" (communicating) hydrocele. The main facts in his cases are as follows:—

Case 1.—Æt. 7; father tubercular. In the right tunica vaginalis there was an ounce or so of transparent fluid, which could be pressed into the abdomen with difficulty. Testicle and epididymis normal; cord thickened and a little tender. Abdomen swollen, but not tender; no positive evidence of tubercle. Absorbent lotions and tapping having produced no benefit, a radical operation was performed. The sac was

[1] *Archiv prov. de chir.* I. 2, No. 6, p. 355.

dissected out, and ligatured at the inguinal canal. It was considerably thickened, and its inner surface was dotted over with tubercles. Three hundred c.c. of a yellow fluid was drawn off preliminary to the operation, only 40 c.c. of which could have come from the tunica vaginalis. Tubercle bacilli were detected in the fluid. The boy died six weeks later from general tubercular peritonitis.

Case 2.—Æt. 6 years; hydrocele with tubercular ascites. No operation.

Case 3.—Æt. 12 years; tubercular family history. The hydrocele, which was moderate, had existed for nine years, and varied in size from time to time. The fluid could generally be reduced without difficulty. There was intermittent diarrhœa, abdominal pain, and distinct evidence of ascites. The cord, as in the first case, was indurated and painful. The operation consisted in excising the sac, the separation of which from the cord was difficult. Microscopic examination showed that the sac was lined by a layer of embryonic tissue, rich in tubercle follicles. A nodule about the size of a pea, which resembled clinically a third testicle, or a cyst, was found to be a large caseous tubercular mass, springing from the floor of the sac. The fluid was of a brown colour. M. Phocas, in the *résumé* of his paper, points out that were it not for the co-existence of the general symptoms, which might easily be overlooked, the condition would probably be mistaken for non-tubercular communicating hydrocele. The abdomen should be carefully examined. Prominence, tenderness, slight tension, evidence of ascites, alternate constipation and diarrhœa, when present in a case of communicating hydrocele, should make the surgeon suspicious of its tubercular nature. The local signs which point to tubercular hydrocele are, some thickening of the sac, thickening and tenderness of the cord, and the possible presence of a palpable nodule, which moves independently of the testicle (a tubercular nodule springing from the parietal layer of the tunica vaginalis). Further, we may add the persistence of the affection, and its resistance to everything short of radical treatment.

A fourth case, operated on by Niehans, is mentioned in Kocher's [1] work, where it is stated that there was a serous communicating hydrocele associated with tubercular peritonitis.

Mr. Alexis Thomson mentions, in the first volume of these *Reports*, a fifth case, in which the sac had become converted into a tubercular abscess. The condition resembled somewhat an inflamed hernia. At the operation it was found impossible to separate the sac from the testicle, so that the latter, although healthy, had to be excised. The cord was infiltrated with caseous tubercle. The child was 2 months old, and had a "large abdomen."

In discussing the pathogenesis of this group, M. Phocas [2] leans to the view that the abdominal tuberculosis is secondary to the disease in the processus vaginalis. I am inclined, however, to favour the converse hypothesis, namely, that the hydrocele is secondary to, or, more correctly perhaps, part of an abdominal tubercular peritonitis. That the hydrocele may be the first, and even the only condition which attracts attention, is not surprising, when we remember how slow and insidious may be the progress, and how ill-marked the symptoms of peritoneal tuberculosis. It is well known, also, that the disease may remain quiescent, or even undergo spontaneous healing. Post-mortem examinations not infrequently reveal the remains of an abdominal tuberculosis, the existence of which, during life, was not even suspected.

While it is beyond the scope of this paper to include the subject of tubercular herniæ, a short reference to it is advantageous, as helping to throw some light upon the pathogenesis of tubercular communicating hydrocele. I have been able to discover only 20 recorded cases of tubercular herniæ. Bruns [3] has described an interesting case, and gives an admirable epitome of 12 others, all collated from French literature. More recently Southam,[4] Remedi,[5] and Bernard Pitts [6] have

[1] *Deutsche Chir.* Lief. 50*b*, s. 151.
[2] *Loc. cit.*
[3] *Beiträge z. klin. Chir.* Bd. xi. s. 209.
[4] *Medical Chronicle*, vol. xvi. p. 19.
[5] *Centralbl. f. Chir.* 1892, No. 15, s. 319.
[6] *Trans. Path. Soc. London*, vol. xlii. p. 77.

each reported 2 cases, and Haegler[1] 1 case. Taking the 20 cases, I find that the sac was tubercular in 17, in 11 of which it was the only part of the hernia involved. The presence of general abdominal tuberculosis was demonstrated in 12 of the cases; of the remaining 8, the tubercle was confined to the hernia in 1 (Cruveilhier's);[2] in 3 (Haegler, 1; Bernard Pitts, 2) this was believed to be the case; and in 4 no mention is made of the abdominal condition. The above statistics show that the greater majority of cases of tubercular hernia are accompanied by general peritoneal tuberculosis. Lejars[3] and Jonnesco[4] agree that the hernia is the primary seat of the disease, and Southam[5] believed that this was so in both his cases. That such may be the order of events, in exceptional cases, must be admitted; I agree, however, with Bruns,[6] that tubercle of a hernia is, as a rule, only a part of the condition of general abdominal tuberculosis, and not the cause of it. The rarity of tubercular herniæ even in tubercular subjects, shows, as pointed out by Bruns, that they have no special tendency to become infected. Albert records two cases in which the herniæ escaped, although the patients who possessed them suffered from general peritoneal tuberculosis.

The form which the tubercle presents when affecting herniæ varies. The tubercles are generally small and scattered, and attended with a serous effusion; but they may be confluent, and form large cheesy nodules, projecting from the sac, or matting together the omentum. More rarely the sac is filled with tubercular pus. The pathogenesis and morbid anatomy, therefore, of tubercular communicating hydrocele is the same.

Let me now pass to my own cases, the special feature of which is, that the tunica vaginalis and funicular process, instead of containing fluid, and thereby constituting a hydrocele, were distended with solid tubercular tissue.

[1] *Correspond.-Bl. f. schweiz. Aerzte*, Jahrg. xxii. 1892.
[2] *Traité d'anat. path. génér.* Tome iv. p. 669.
[3] *Gazette des Hôpitaux*, No. 88, p. 801.
[4] *Revue de chir.* Tome xi. p. 185.
[5] *Loc. cit.*
[6] *Loc. cit.*

Case 1 was transferred to me from the Medical side of the Out-Patient Department of the Royal Hospital for Sick Children by my colleague, Dr. Melville Dunlop. The child had been under treatment for tubercular peritonitis. I was asked to see him on account of what appeared to be an enlargement of the right testicle. Dr. Dunlop has kindly furnished me with the following notes:—"J. S., æt. 2½ years; brought complaining for several weeks of pains in the abdomen, intermittent attacks of diarrhœa, and feverishness at night. Six months previously he had measles, the recovery from which was unsatisfactory. Before this attack he was a strong, healthy child, but subsequently he was constantly ailing and peevish, had a capricious appetite, developed glandular enlargements in the neck, and lost flesh. On examination, he was found to be puny and atrophic. Temperature, 100°·4; pulse quick and shabby; tongue furred in the centre, with angry and irritable tip and edges. Abdomen considerably distended and tympanitic, with a glossy skin and dilated surface veins. The flanks gave a dull note to percussion, and there was resistance and tenderness on pressure." Dr. Dunlop looked upon the case as one of tubercular peritonitis. The patient is the fourth child of a family of five, all the others being very healthy. No family history of tubercle.

With regard to the testicle, the mother states that she first noticed the enlargement quite accidentally, only a few weeks before I saw it. The child had never complained of it being painful. No history of traumatism. On examination, I found the right half of the scrotum contained what at first sight appeared to be the testicle enlarged to three or four times its normal size. The skin was stretched, but otherwise normal. The swelling was smooth, firm, heavy, and distinctly pyriform, its upper end passing almost insensibly into the spermatic cord, which was solid, and about the thickness of an ordinary pencil. An important point to be noted is, that careful palpation under chloroform failed to differentiate either the testis or epididymis. The swelling formed one continuous smooth pyriform mass. There were no indurated nodules or areas of softening. The cord, as far up as could

be reached, was firm and uniformly thickened; the vas deferens could be felt upon its posterior aspect; it did not appear to be thickened. The parts could be freely handled without causing pain, but in consequence of the age of the patient it was difficult to come to any conclusion as to "testicular sensation."

The *diagnosis* appeared to be between simple orchitis, congenital interstitial syphilitic orchitis, sarcoma, and tubercle. The possibility of hæmatocele need not, I think, be entertained in children. Simple orchitis could be excluded by the entire absence of pain and tenderness. Cases of congenital syphilitic orchitis have been recorded by Curling,[1] Bryant,[2] and more especially by Henoch,[3] who has described seven cases occurring in children, aged between three and a half months and two and a half years. In four of the cases both testicles were affected. The organ becomes enlarged, smooth, and firm. In my own case, however, the history was entirely against syphilis. We are left, therefore, with sarcoma and tubercle. According to Butlin[4] and Jacobson,[5] infancy and childhood are periods of life during which sarcoma of the testicle is liable to occur. As regards the testicle itself, the clinical signs were equally, indeed more consistent with one of the more slowly growing forms of sarcoma than with tubercle. The strong suspicion, however, of the presence of abdominal tuberculosis determined the diagnosis in favour of tubercle.

According to Mr. Jacobson's[6] experience—and he believes also to the experience of most English surgeons—it is rare to meet with tuberculosis of the testicle in infancy and childhood. Of 50 cases mentioned by Kocher,[7] only 3 occurred under twenty years of age; and of 69 collected by Simmonds,[8] only one occurred in childhood, viz. at 18 months. According to Hutinel and Deschamps,[9] tubercle of the testicle is met

[1] *Treatise on the Diseases of the Testicle*, 1878.
[2] *Med. Times and Gazette*, 1863, vol. ii. p. 614.
[3] *Berlin. klin. Woch.* 1877, No. 33, p. 483.
[4] *The Operative Surgery of Malignant Disease*, 1887, p. 285.
[5] *Diseases of the Male Organs of Generation*, p. 397.
[6] *Loc. cit.* p. 373.
[7] *Deutsche Chir.* Lief. 50*b*, s. 321.
[8] *Deutsches Archiv f. klin. Med.* Bd. xxxviii. s. 579.
[9] *Archiv. gén. de méd.* 1891, pp. 257, 453.

with almost as frequently in children as in adults. As far as my own experience goes, I am inclined to agree with Hutinel and Deschamps; for, during the single year in which I have had charge of the surgical out-patients at the Children's Hospital, I have had occasion to excise four tubercular testicles in children under 4 years. May it not be, as suggested by these authors, that the condition often escapes notice in early life on account of the functionless condition of the gland, and of the slow and painless character of the disease. Hutinel and Deschamps have shown that, in children, tubercular peritonitis frequently precedes the disease of the testicle. Jacobson[1] regards the connection as "probably reciprocal." In two cases of tuberculosis in infants, with disorganisation of the testis, Jacobson[1] "found the processus funiculo vaginalis open in its whole extent, and in both its inner aspect was shotty with miliary tubercles as high as it was possible to follow it." Hutinel and Deschamps point out that tuberculosis of the testicle in children is usually the result of direct blood infection, since in them tubercle rarely occurs elsewhere in the genito-urinary tract. The tubercle may, however, spread directly from the peritoneum down a patent funicular process, and from thence to the testicle and epididymis. Such, it will be seen, has probably been the order of events in my second case. An ultimate diagnosis, however, between sarcoma and tubercle was of no therapeutic importance, since, in either case, the treatment was to excise the testicle. The presence of tubercular peritonitis, if chronic, is no contra-indication to excision of the testicle, because the disease in the latter organ is almost certain to be progressive, whereas the peritoneal tuberculosis may undergo retrogressive changes, ending in complete recovery.

Before proceeding to excise the testicle, a diagnostic incision was made into the lower part of the swelling. The incised tissue was uniformly pink and fleshy, resembling firm granulation tissue. No caseation could be detected. The diagnosis therefore remained uncertain. The cord was next exposed, clamped, and divided at the external ring.

[1] *Loc. cit.* p. 374.

The cut surface had exactly the same appearance as that exposed by the diagnostic incision. The skin incision was then carried downwards to the bottom of the scrotum, and the testicle shelled out. Returning to the cord, it was found that the new tissue was surrounded by the vessels, and that the vas, which lay posteriorly, appeared to be healthy. Being still in doubt as to the exact nature of the condition, I bisected the testicle, and found, somewhat to my astonishment, that both testis and epididymis were quite healthy, but embedded in what was evidently a mass of tubercular tissue, filling and obliterating the tunica vaginalis. On slitting up the anterior wall of the inguinal canal, the cord was found to be thickened in its whole length. The vessels were secured by transfixing the cord with a double ligature and tying it in two halves. The canal was then closed completely with catgut stitches. A continuous suture was used to close the wound, and no drain was introduced. Primary union followed, and the child was dismissed on the eighteenth day. Dr. Dunlop—under whose care the patient again returned—has kindly given me the following note:—"After recovering from the operation, the patient resumed attendance at the Medical side, where he was treated for four months by the application of iodine ointment to the abdomen, and the internal administration of cod-liver oil and the syrup of the iodide of iron. Under this treatment he gradually improved, and put on flesh. The evening rise of temperature declined, and the abdomen lost its hard tympanitic condition, and became soft and flaccid. The pain and tenderness disappeared, and gradually the boy regained his usual health."

I saw the patient again ten months after the operation. The parts at the seat of operation were quite healthy. There were no signs of abdominal mischief, and the general health appeared to be perfect.

Pathological Report.

On slicing the testicle transversely at various levels, the testis and epididymis both appeared to be normal. The cavity of the tunica vaginalis and its funicular process were filled

and distended with a firm, fleshy, greyish pink, bulging tissue, evidently tubercular, but presenting no macroscopic areas of softening. The vas deferens looked healthy. Occupying the centre of the tubercular mass in the processus vaginalis was a small fissure-like canal, surrounded by soft granulation tissue. Microscopic preparations were made from complete transverse slices of the organ at various levels.

The appearances of a section through the middle of the testicle are well seen in Plate XIII. It will be seen that the testis, epididymis, and vas are all quite healthy, and that the tumefaction was due, so to speak, to a natural injection, obliteration, and distension of the cavity of the tunica vaginalis with a solid tubercular tissue. The following points may be noted regarding the character of the tubercle:—

1. The individual tubercles are well developed and numerous; the giant cells are well formed, and two, three, sometimes more, occupy the same follicle.

2. There is an entire absence of caseous softening.

3. The small-celled or inflammatory zones of the tubercles are poorly represented or entirely absent, their place being taken by a young fibroblastic connective tissue.

It would appear, therefore, that in this case we have to deal with a tubercular tissue that has no tendency to undergo degenerative softening, or to set up any degree of inflammatory reaction around it; indeed, it possesses qualities which characterise a tubercular tissue endowed with the power of spontaneous healing,—such, for example, as that which leads to ankylosis in the natural cure of a tubercular joint. This fact is worthy of mention, now that we know that the abdominal tuberculosis has been recovered from. I do not wish to infer, however, that cure would have resulted spontaneously in the case of the tunica vaginalis, because the various irritations to which the part is liable would favour a slow but certain advance of the disease, ending in the invasion of the testis, epididymis, and cutaneous structures. So far, however, the tunica albuginea has formed a successful barrier against the invasion of the testis. Although the epididymis is, like the testicle, healthy, it would no doubt have become involved earlier than the latter, in consequence of the relative thinness of its capsule.

The relations of the parietal layer of the tunica vaginalis to the epididymis, and the manner in which the latter is surrounded with tubercle, with the exception of its posterior border, is well seen. The epididymis, in fact, bears the same relation to the outer of the two reflected portions of the serous layer that the testis itself does to the entire sac. The epididymis has been pushed away from the testis by the distension with tubercle of the pouch-like diverticulum, known as the digital fossa, which intervenes between the two organs. The vas deferens is seen divided at its somewhat convoluted testicular end. It is quite free from disease, and lies, along with the vessels and nerves, in the supporting fibrous tissue behind the testis and between the two serous reflections, which, when the cavity is distended, present the appearance of a short mesorchium with its two layers widely separated. I have drawn special attention to the anatomical relations of the parts, in order to emphasise and explain the important clinical point already alluded to, viz. that the whole swelling was smooth and pyriform, and that an anatomical differentiation into testis and epididymis was not to be made out. It is this fact which distinguishes the condition clinically from tubercular orchitis and epididymitis, and which gives to it more the physical semblance of a neoplasm, and a still closer resemblance to hæmatocele.

Although the sac of the tunica vaginalis is so distended with tubercle, the coverings external to it, with the exception of the deeper part of the thickened tunica vaginalis communis (from transversalis fascia), are healthy, and easily recognisable anatomically.

The naked-eye appearances of the thickened spermatic cord have already been referred to. Plate XIV. shows the anatomy and microscopic appearances of a transverse section a little below the external abdominal ring. The infundibuliform fascia (fascia transversalis) is thickened, and forms a well-defined fibrous envelope, the anterior segment of which is covered by bundles of the cremaster muscle. Within the fascia, and forming rather more than the anterior half of the substance of the cord, is a crescentic mass of tubercular tissue, and behind it, imbedded in a fibrous stroma, entirely free from

tubercle, are the spermatic vessels and the vas deferens, the latter occupying the posterior part of the section. One or two small fat lobules are seen in the fibrous tissue supporting the vessels: these are derived from the extra-peritoneal fat, and account for the occasional occurrence of lipoma of the cord. The drawing shows also how the healthy vas could be made out clinically at the posterior aspect of the thickened cord. In the smaller horn of the crescentic mass of tubercle is a small irregular cavity, representing the section of a canal which could be traced from the level of the operation section of the cord downwards to the globus major of the epididymis. The wall of this canal is of considerable thickness, and is composed of recent tubercle, whereas the rest of the mass consists of tubercle in every way similar to that we have already examined filling the tunica vaginalis. The recent tubercle consists, from within outwards, of the following layers, which merge the one into the other:—(1) A layer of round-celled granulation tissue covered with a layer of fibrin; (2) An œdematous, less cellular and more vascular layer; (3) A fibro-cellular layer, containing a few embryonic tubercles. A structure closely similar to this is frequently met with in the early stage of synovial tubercle. Limiting the last layer, and separating it from the fibrous tissue supporting the vessels, is a well-developed and continuous stratum of smooth muscle, the bundles of which are cut transversely, and therefore run in the long axis of the cord. These fibres are of special interest, as their relation to the tubercle enables us to say definitely that the disease in the cord occupies the peritoneal funicular process. They are the remains of the muscular fibres of the gubernaculum testis, and have been described under the name *internal cremaster* muscle by Henle.[1]

Before passing to the next case, a few words must be said regarding the appearances presented by a complete transverse section just above the testis. The globus major of the epididymis is perfectly healthy, but embedded in a crescentic mass of tubercle covered anteriorly by the external cremaster and posteriorly by the well-developed internal cremaster, which separates it from the vas and from the spermatic

[1] *Anat. des Menschen*, Bd. ii. s. 441.

vessels, all of which are free from tubercle. Surrounding about two-thirds of the globus major is a fissure-like space in the midst of the tubercle. As in the cord, this space is lined by recent granulation tissue covered with fibrin. It represents the lower end of the remains of the canal of the funicular peritoneal process.

Case 2 was transferred from the Medical side of the Out-Patient Department by my colleague, Dr. John Thomson. The child had what at first sight appeared to be an enlargement of the right testicle. On closer examination, however, the swelling was found to possess characters so closely resembling those of the case just described, that I ventured to diagnose it as a second case of tuberculosis of the tunica vaginalis. As microscopical examination has established the diagnosis, and as the case when compared with the first one very probably represents a further stage in the life-history of the condition, I propose to record it.

History.—Alexander S., æt. 2, was brought to the Medical waiting-room six months ago, complaining of loss of appetite, pain in the abdomen, diarrhœa, and vomiting. The diarrhœa was intermittent, lasted for several weeks, and was attended with a great deal of pain. The motions were somewhat slimy, but free from blood. The testicle had gradually been getting larger for nearly a year, and for the past three months the mother noticed that the skin of the scrotum had begun to be fixed to the swelling, and that during the last three weeks it had become reddened.

On examination, the child was seen to be pale, and somewhat fat and flabby. There was a small deep-seated abscess in the right infraorbital region, which, on being opened, was found to be connected with caries of the infraorbital margin and the malar bone. The abdomen was prominent and somewhat tense. There was no dulness in the flanks. Deep palpation under chloroform revealed, below and to the right of the umbilicus, an oval, movable, and firm swelling, the size of a pigeon's egg. This I took to be a tubercular mesenteric gland.

In the right half of the scrotum, in place of the testicle, was a firm, heavy, oval, smooth swelling, the size of a bantam's

egg. Here, just as in the first case, no differentiation into testis and epididymis could be made out. The upper end of the swelling merged gradually into the cord, which was firm, and almost as thick as the little finger. The vas could be identified posteriorly; it did not appear to be thicker than its fellow. The skin of the scrotum was stretched, and over the anterior part of the swelling it was slightly red and adherent. Palpation over this area revealed softening, and gave a strong suspicion of fluctuation. Rectal examination gave negative signs.

The treatment was evidently to excise the testicle. This I did in the usual way, removing also the area of skin which was involved by the bursting of the abscess through the coverings of the testicle. The cord was thickened as far up the inguinal canal as could be felt. As it was not possible, by slitting up the canal, to get beyond the disease, I contented myself, in this case, with dividing the cord at the external ring. It appears to me that when we have to deal with cases of this kind, in which the tubercle has descended from the abdomen, that no advantage is gained by slitting up the canal, in order to divide the cord close to the internal ring. The patient was dismissed at the end of the third week, with the wound firmly healed.

Pathological Report.

The mass removed was sliced transversely at various levels. To the naked eye the cut surfaces showed, embedded in the centre of a mass of caseating tubercle, a somewhat flattened encapsulated body, the size of a small pea, which was evidently the testis, and close to it, a body corresponding to the epididymis. The former looked healthy, but the latter appeared to be tubercular.

Microscopic preparations were made of sections passing transversely at various levels through the entire mass. As in the first case, the cavity of the tunica vaginalis was filled and so distended with tubercle that its parietal and visceral layers were separated for a distance greater than the diameter of the testis. The digital pouch was widely distended, and

the two reflections of the serous membrane were so stretched and approximated as to constitute a distinct mesorchium. The tubercular tissue differed from that in the first case, in containing, in its central part, large areas of caseous and semi-purulent softening. At the periphery were numerous typical giant-celled tubercle follicles, many of which showed commencing caseation. The largest softened area communicated through a rupture in the coverings with the small abscess to which the skin was adherent. At first sight, the testicle itself appeared to be healthy; but on closer scrutiny, from two to six small embryonic tubercle follicles, in which giant cells had not developed, could be detected in each complete section in the intertubular stroma. There were no tubercles in the mediastinum testis, or in the tunica albuginea.

While the globus minor was free from tubercles, the body and globus major, on the other hand, contained a considerable number. The globus major, although enlarged to twice its natural size, could not be felt clinically, in consequence of the distension of the cavity of the tunica vaginalis.

Sections immediately above the testis proper showed a large and well-defined circumscribed mass of tubercle compressing and invading the adjacent part of the globus major. From the relations which this mass of tubercle bore to the surrounding structures, and from a comparison with sections at a lower level, it was evident that it occupied the upper end of the cavity of the tunica vaginalis, and that it had involved the epididymis secondarily. The tubercle in the cavity of the tunica vaginalis was not due to the rupture into it of a cheesy abscess in the globus major, as sometimes occurs when this organ is the primary seat of the tubercle.

Sections of the cord, while they point to the very strong probability that here again the tubercle had descended from the abdomen, do not, however, afford such conclusive evidence as in the first case. The tubercle, instead of forming one continuous mass, consists of separate foci, all of which, however, are collected into one group, occupying a region of the cord having a relation to its various constituents similar to that which existed in the first case, that is to say, having a

specially close relation to the smooth muscular fibres of the internal cremaster (gubernacular fibres). In this case also the muscular fibres are much more abundant than normal. I believe that here again the tubercle had descended from the abdomen, and had subsequently obliterated the funicular process. Were it not for the knowledge derived from the first case, in which the serous sac was alone involved, one might have been more inclined to look upon the epididymis as the primary focus, which in its turn had infected the tunica vaginalis. I believe, as has already been stated, that the disease in the epididymis is secondary to that in the serous sac. The comparative thinness of the capsule of the epididymis, as compared with the tunica albuginea, is the cause of its earlier invasion.

No tubercle was found in the vas deferens in any of the sections examined from the testicular region. In a section through the cord, however, a single, small, and embryonic tubercle follicle was found in substance of the mucous membrane of the vas under the epithelium. The follicle did not contain a giant cell; nevertheless the arrangement of its cells, and their typically endothelioid character, was sufficient evidence of its tubercular nature. I may here mention that microscopic examination of the vas in several other cases of tubercular testicles, has taught me that, while thickening of the vas is, when present, most valuable evidence in favour of tubercle, the absence of it, on the other hand, cannot be regarded as of much value in negativing that diagnosis. Tubercle spreads from the testicle up the vas, in the first instance, not along its lumen, but along the lymphatics of its mucous membrane, and the disease does not—on account of the great thickness of the muscular wall—give rise to thickening until a comparatively late stage. In this way tubercle bacilli may be conveyed along the lymphatics of the vas as far as the prostate and seminal vesicle, without the duct itself giving any palpable signs of disease. In such a case the disease in the testicle might erroneously be regarded as secondary to disease of the prostate.

It is well known that the epididymis may be extensively tubercular without the testis proper, the vas, or the tunica

vaginalis becoming involved. The cavity of the tunica vaginalis frequently escapes general infection, in consequence of the simple adhesive inflammation which is produced by the disease in its neighbourhood.

It has been pointed out that in both these cases the tubercle in the cord has a very intimate relation to the internal cremaster muscle, and that the muscle itself was unusually well developed. In the first case the muscle surrounded completely the lesser horn of the tubercular mass, and extended over nearly the whole of its posterior surface, that is to say, the opposite surface to that which is covered by the external cremaster. In the second case the muscular bundles were scattered abundantly between the more or less confluent tubercles. It is worth while, I think, to inquire a little more closely into the significance of these fibres and into their relation to the tubercle.

The non-striped fibres found in the spermatic cord are remnants of the gubernaculum testis. Those which lie within and close to the adventitious sheath of the vas deferens are believed to represent those bands of the gubernacular muscle which, before the descent of the testicle, pass from it, and from the vas, to be attached below to the pubic bone and to the region of Poupart's ligament. Later, during the descent of the testicle to the bottom of the scrotum, these bands are pulled down and inverted so as to become constituents of the cord. The main part of the gubernacular muscle, namely that which descends to the bottom of the scrotum, is of course not represented in the cord.

Mr. C. B. Lockwood, in his very able *Hunterian Lectures*, "On the Development and Transition of the Testes,"[1] has shown that, superiorly, the attachments of the gubernaculum are not confined to the testicle, but that some of the fibres are continued upwards in the plica vascularis behind the testicle to be attached to the peritoneum, and probably also to the organs on the posterior abdominal wall with which the plica vascularis is connected. Mr. Lockwood points out the important part which these ascending or peritoneal attachments of the gubernaculum probably play in producing con-

[1] See *Journ. of Anat. and Phys.* 1887, 1888, vols. xxi., xxii.

genital herniæ of the cæcum, and of the sigmoid flexure, and in forming the sacs of infantile herniæ. Professors Bennett and Cunningham [1] describes a case of hernia of the cæcum, in which these ascending fibres were so hypertrophied as to resemble a platysma. From a careful study of Mr. Lockwood's work, it appears to me that the well-developed muscles, so closely related to the tubercle in the spermatic cord in my two cases, are the representatives of the ascending or peritoneal fibres of the gubernaculum.

While the part played by the gubernaculum in the formation of the processus vaginalis, and in the subsequent descent of the testicle into it, has been much discussed and disputed, it would appear that little attention has been directed to the nature of the process which leads to the closure of the funicular peritoneal process, or—what is of still greater practical importance—to the causes which are responsible for its non-closure. From the intimate relation which the peritoneal fibres of the internal cremaster have to the funicular process, it occurred to me that possibly they play an important part in causing or preventing its obliteration. I have examined many spermatic cords in children to ascertain what is to be looked upon as the normal degree of development of the internal cremaster. In all the cases in which the funicular peritoneal process had been obliterated, I found that the gubernacular fibres (which it is to be remembered are longitudinal) were represented only by a few bundles closely related to the vas. This fact, when contrasted with the presence of the marked degree of development of the peritoneal portion of the internal cremaster in the two tubercular cases (where the processes had previously been patent), led me to entertain the hypothesis that possibly these fibres when thus hypertrophied might prevent the obliteration of the process by keeping up a more or less constant movement of the peritoneal surfaces upon each other. This hypothesis, however, fell to the ground, when, on examining the cord of a child, æt. 2½ years, it was discovered that the process was still patent, but that there were only a very few scattered bundles of smooth muscular fibres in its wall; there was nothing approaching

[1] *The Sectional Anatomy of Congenital Cæcal Hernia*, 1888.

the continuous stratum of muscle which existed in the two tubercular cases. The specimen, however, was of value as demonstrating that its patent peritoneal process bore the same relation to the other constituents of the cord as did the tubercular masses in the cords of the two tubercular cases.

The facts above recorded seem to me to justify the following conclusions :—

1. That, in children, tuberculosis of the tunica vaginalis testis is generally the result of the extension of a tubercular peritonitis down a patent funicular process.

2. That sooner or later the testicle becomes invaded.

3. That tuberculosis of the testicle is more common in children than the literature of the subject indicates, and that the above is a common channel through which it becomes infected.

4. That the disease in the tunica vaginalis testis presents itself in one or other of the following forms :—

(*a*) Serous hydrocele.
(*b*) Chronic abscess.
(*c*) Disseminated tubercles and nodules.
(*d*) Solid tubercular tissue, with or without caseation, distending and obliterating the serous cavity.

Of these, the serous form may be mistaken for a simple communicating hydrocele, and the solid form for either congenital syphilitic orchitis or for sarcoma testis.

5. In establishing the diagnosis, attention must be directed to the history; to the general symptoms and condition of the child; to the condition of the abdomen; to the thickening and tenderness of the cord,—at the posterior part of which the vas can be felt unaltered; and, in the solid form, to the fact that the testis and epididymis cannot be differentiated.

In many cases, excision of the tunica vaginalis along with the testicle is the only treatment to be adopted; no advantage is gained, however, by slitting up the inguinal canal in order to divide the cord at the internal ring.

DESCRIPTION OF PLATES XIII. AND XIV.

PLATE XIII.

Transverse section through the middle of the testicle and its inner coverings. × 10.

CASE 1.—J. P. æt. 2½ years.

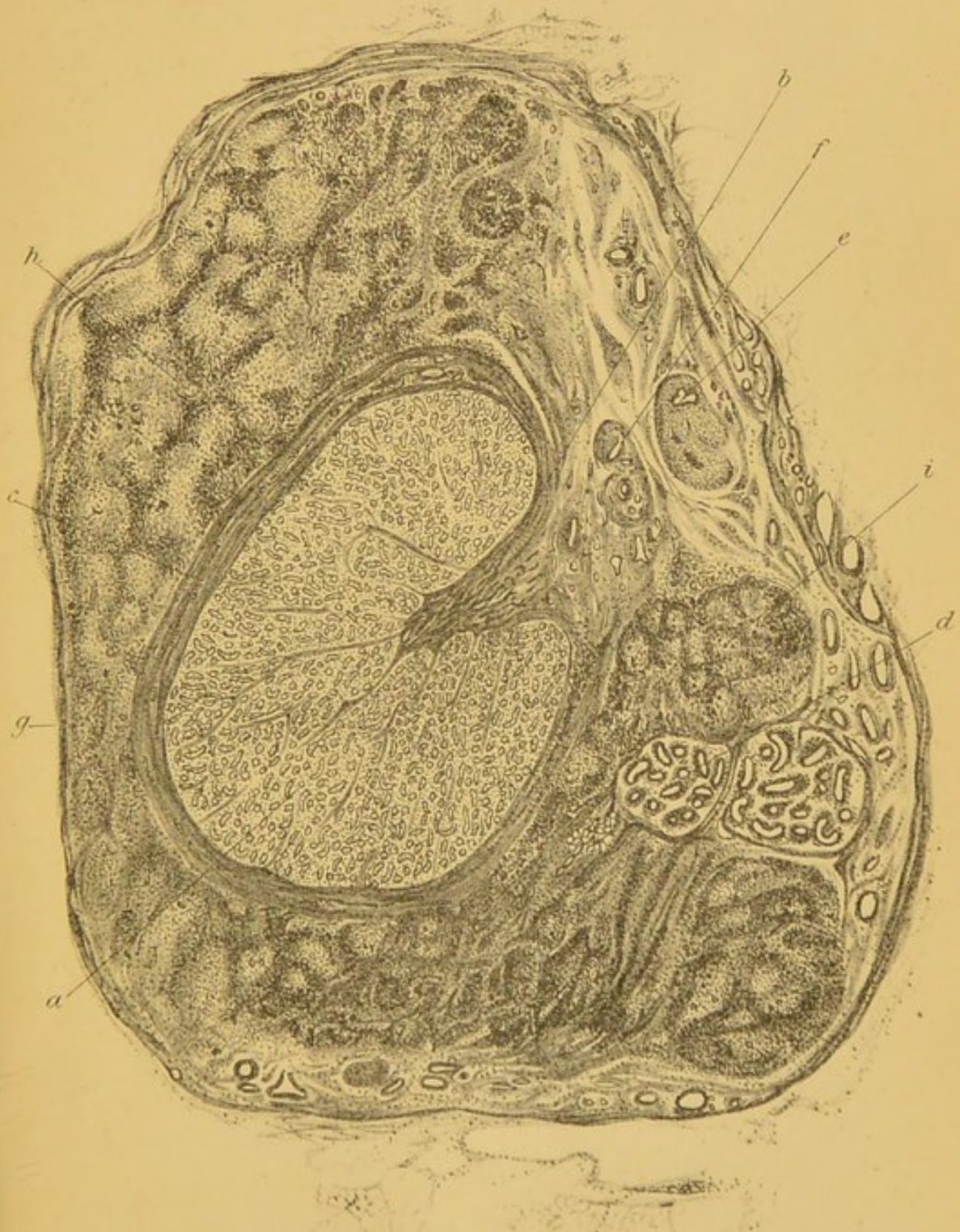
a. Healthy seminal tubules.
b. Mediastinum testis giving off its radiating connective tissue septa.
c. Tunica albuginea.
d. Body of epididymis surrounded by its thin capsule.
e. Vas deferens (convoluted).
f. Spermatic vessels embedded in the fibrous stroma situated behind the testicle and between the reflections of the tunica vaginalis.
g. Infundibuliform fascia.
h. Solid non-caseating tubercular tissue, filling and distending the cavity of the tunica vaginalis testis.
i. Digital pouch filled with tubercle.

PLATE XIV.

(Taken from the same case as Plate XIII.)

Transverse section through the spermatic cord, just below the external abdominal ring. × 15.

a. Healthy vas deferens.
b. Spermatic arteries and pampiniform plexus of veins, occupying, along with the vas, the posterior part of the cord.
c. Bundles of the external cremaster muscle.
d. Thickened infundibuliform fascia.
e. Continuous stratum of non-striped muscle (gubernacular fibres or *internal* cremaster of Henle) cut transversely.
f. Mass of tubercular tissue occupying the anterior half of the cord, and filling and distending the funicular peritoneal process.
g. Remains of the lumen of the funicular process.
h. Recent tubercular tissue.
i. Fat-lobule in the substance of the cord.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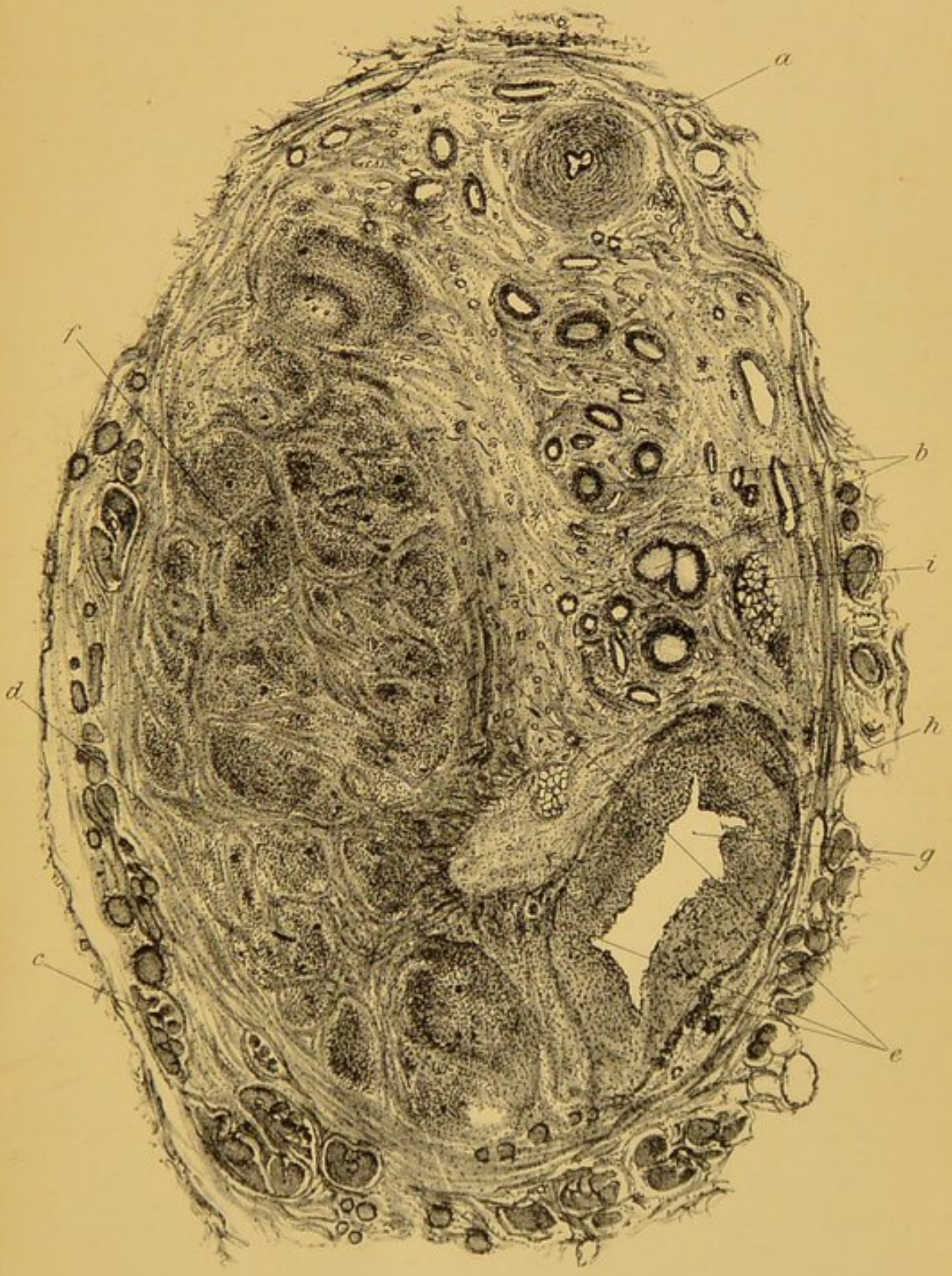
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