

showed before the American Ophthalmological Society a new form of ophthalmoscope, and in the following year suggested additional lens series for it (*Transactions American Ophthalmological Society*, Vol. iv, pp. 111-361) which, with the arrangement of lenses in two slides moving vertically behind the mirror, allowed of the combination of lenses, and of a sufficient lens series completely available, without removal of the instrument from the eye. This form of instrument has since been widely used, and is still, in most respects, entirely satisfactory. But the lens series, the focal distance of the mirror and the size of its sight-hole then adopted, conformed closely to those of other standard ophthalmoscopes, and experience has shown more and more clearly that these were capable of considerable improvement. I, therefore, recently had made by Queen & Co., of Philadelphia, the instrument shown in the accompanying cut, upon the mechanical plan of the earlier instrument, with a mirror of four inches focal distance, having a sight-hole two millimeters in diameter, and with the following lens series:

Convex, 1, 2, 4, 6 and 15 diopters.

Concave, 1, 4, 7, 10 and 30 diopters.

These, by combinations, furnish the following lens series, every number of which is available without the instrument being taken from the eye:

Convex, 1, 2, 3, 4, 5, 6, 8, 11 and 15 diopters.

Concave, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 and 30 diopters.

As to the advantages of this lens series, we have already discussed the worthlessness of a shorter interval than 1 D. for the weaker lenses. The convex series furnishes each diopter to six, then skips to eight, and so on. It should be remembered that hyperopia of over six diopters is rare. Among 4,000 eyes I found only eighteen having more than this amount of hyperopia (*Trans. Am. Ophthalmol. Soc.*, 1889, p. 438). Then, too, by withdrawing the six diopter lens one and five-eighths inches from the eye it measures eight diopters of hyperopia, and at intermediate points measures all intermediate amounts. Really, for the measurement of refraction, no stronger convex than ten diopters is required in the ophthalmoscope, but it is convenient to have a stronger lens for the ophthalmoscopic examination of opacities in the cornea, crystalline lens and vitreous.

It will be noticed that the series of concave lenses gives each diopter up to ten. In the 4,000 eyes above referred to, 24 presented myopia of over ten diopters. But here again the variation of the distance of the lens from the eye enables a few strong concave lenses to measure every degree of myopia; thus the thirty diopter concave held one and one-fourth inches from the cornea measures but fifteen diopters of myopia, and at shorter distances from the eye measures intermediate amounts. If one wishes to be even approximately accurate in the estimation of high degrees of hyperopia and myopia with the ophthalmoscope, he must always measure the distance of the ophthalmoscope lens from the patient's eye, and allow for it; and this process is simplified by having a few well-chosen strong lenses.

It is doubtful if a more extended lens series than this was ever of practical advantage to the mass of ophthalmoscopists, and the accurate measurement of refraction with the ophthalmoscope by the direct method is of far less importance since the introduction of skiascopy. Every lens in a series that is not

needed is a source of possible inaccuracy and a nuisance. It is just as important to have no useless lenses that must be run over in finding the right one, as it is to have at command all that are really needed.

## TUBERCULAR PERITONITIS.

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At this time experiments are rife in every direction. Even the laity demand cause and effect and ask the question: "What is the practical effect of trial?" Peritoneal tuberculosis has interested me for years, and of late the apparent cure by abdominal incision and drainage.

After considerable observation for the past eight years in tubercular peritonitis, I must say that the so-called surgical therapeutics lack an essential base of explanation. I have posted about twenty cases of tubercular peritonitis, operated on some eight to ten patients and made some careful observations on three cases in Professor Senn's clinic, having therefore over thirty cases of quite careful observation.

To be short, in regard to the cases of abdominal section to relieve peritoneal tuberculosis, I will say that all recovered, except the sixth case, after the operation, and became so well that they left the hospital and passed into the unknown field outside the hospital, from which few report, and I have lost all trace of them. They regained a very large part of their health before leaving the hospital. The sixth case died, I think between two and three weeks after the operation, not from the surgical procedure, but from extension of the peritonitis due to tuberculosis. I unhesitatingly say that the tubercular peritonitis in the stages at which I operated appeared to be benefited in all, and at least temporarily improved all but the one case too far advanced.

The present state of the subject of peritoneal tuberculosis is entirely unsettled. Opinions have a wide swing, an extreme swing among surgeons, gynecologists and internal medical men. But so do all subjects until natural experiments force a more rigid standard of decision. It requires many experiments to learn a small number of natural laws. The more wild and varied opinions on any subject, the rarer the opportunities one has for testing his experiments. Ten years ago we relatively knew nothing of the subject in regard to its therapeutics. If I remember rightly it was an old veteran, the methodic and abdominal surgeon, Spencer Wells, who opened the abdomen of a patient possessing a tubercular peritonitis in 1865. In 1885, it seems to me, she was reported alive, twenty years after. This, of course, was a long forgotten circumstance and experiment. But people easily forget matters. It requires a tenacious grip to remember the long-continued effects of good and bad result.

The condition of some cases of peritoneal tuberculosis precludes any possibility of recovery by any known therapeutic agent. There are two forms which we meet in tubercular peritonitis, viz. (a) the dry form, and (b) the moist variety. The dry form appears quite red, congested, and presents large, thick, swollen diseased parts. The ligamentum peritonei is dense, but friable. In cases in which Dr. Lucy Waite and I performed laparotomy the disease had progressed very extensively, showing enormous pathologic products, and yet a year afterward present fair appearances.

The broad ligament with the tube may be thick and twelve to fifteen times their original size. The peritoneum was studded with large and small tubercles. Three weeks' drainage improved the patient very much. Some of the patients presented the most formidable conditions of callosal nodules, and yet were wonderfully improved. It would seem the dry form is amenable to treatment. The second variety is the hydrops peritonei tuberculosis, the moist variety. Ascites slowly arises and the abdominal cavity gradually swells. It is quite likely that it is the chief one of destruction.

In opening the abdomen one may not be able to see the innumerable small, fine miliary tubercles, but one can feel them. When large enough to see they look like small blisters studding over the omentum majus, mesentery and visceral peritoneum. After a certain time or size of the tubercle, degeneration occurs at its center and its caseous degeneration may result in an ulcer; when more advanced bowel perforation results.

On opening the abdominal cavity the first organ, in general, is the omentum majus, for it seems that the business of the omentum majus is to meet emergencies in the abdomen. It seems to be prepossessed of attempting to defend the abdominal cavity by meeting and monopolizing the invading disease. By tracing the omentum majus one is very liable to discover the primary tuberculosis, which in woman is so often from the Fallopian tubes. The omentum is like a man-of-war, it guards the ports against hostile entrance, it is the great peritoneal protector against infectious invasion and the surgeon's good friend to cover up the mischief his hands have wrought. It is asserted by Senn that we meet with peritoneal tuberculosis in the female the most frequently. This is not in accord with the peritoneal tuberculosis I found in 350 personal autopsies, for we found it more frequent in males. From the appearance of the subject it seems that they have other organs than the peritoneum affected.

The present trend in tubercular peritonitis is to perform an abdominal section; yet the very reason against such procedure is that we still know nothing about the real method of cure. And in truth, do we really know whether the section actually cured, or would the patient have done as well without the section? Pibram undertook the tedious labor of finding out how many died of tubercular peritonitis in the pathologic institute of the University of Prague, according to Vierordt, and he found that 165 out of 3,500 died of tubercular peritonitis, *i. e.*, about 5 per cent. A mortality of 5 per cent. from tubercular peritonitis is about what agrees with some other estimates. It seems that in one series of one hundred autopsies which the pathologists and internes of Cook County Hospital were kind enough to allow me to carefully examine during the autopsy, some six died of tubercular peritonitis and several others possessed peritoneums which suggested the same pathologic process, but died from other causes or from tubercles in some other viscus. Differences of opinion arise among physicians from differences of circumstance in life. The surgeon sees one kind of tubercular peritonitis, especially two forms, *e. g.*, large ascitic abdomen, not only enlarged by fluid, but by boggy masses arising from exudates or inflammation in the omentum or mesentery, both stiffening the mesenterium and omentum so that through emaciated abdominal walls

the surgeon distinctly maps out the tumor. Now, just in these cases the surgeon operates, and it may be that this surgical cure which we do not understand is in just such cases. The gynecologist, to a certain extent, may be classed with the surgeon, but he is generally better able to understand the conditions from his more extensive experience in the abdominal cavity (in this country at least, where gynecology and surgery are becoming so widely separated).

Some of the cases reported in this paper appeared simply hopeless from tubercular invasion of the peritoneum. The most advanced cases and the most profoundly affected were those of the dry variety. They were all women but one; two of them, operated on by Dr. Lucy Waite and myself, showed the parts perhaps fifteen times thicker than normal. In one of them it is a year after the operation and in another some ten months; and reports are good. The tubes, broad ligaments and lower omental border presented immense shapeless masses with scarcely any ascites. One case is about three years old, in which Dr. Bertha Van Hoosen assisted. A point of some interest is that the omentum is frequently found at the primary seat of the tubercular peritonitis. It is not easy to explain the predilection of the omentum for the primary seat of peritoneal inflammation. It is absolutely astounding how a human being can live so long with such vast and serious lesions as tubercular peritonitis produces. The peritoneum may become an inch thick. Small and large ulcers beyond count with large tubercles stud the ligamentum peritonei, visceral and parietal peritoneum almost beyond conception. The mesenteric gland may become the size of a hen's egg, and one is amazed at the innumerable mesenteric glands which suddenly come into view in tubercular peritonitis, which normally attract little or no attention from size or number. Tubercular peritonitis is one of the best of nature's experiments to demonstrate the lymph node and the effort of the lymph nodes or glands to check the bacillary invasion. I have noted several large bowel perforations screened and protected by vast deposits of adhesions. It may be noted that these patients generally have other tubercular lesions, as pleuritis, pulmonitis and joint affections. They generally have a tubercular habit or shape and show to the clinician that they are subjects in which to suspect tuberculosis. It is well understood that lupus is a skin, or surface tuberculosis, and that it is quite amenable to surgical treatment, *i. e.*, a thorough curettement or application of the Paquelin cautery will relieve them for eight to twelve months. It may be that the surface serous tuberculosis which is so amenable to treatment is of a similar nature. It is not clear what drainage accomplishes. Does it relieve intra-abdominal pressure? Does it initiate changes in the stomata vera, the fluid regulators of the peritoneum? It may induce rapid multiplication of leucocytes, which swarm to the peritoneal surface and destroy the bacilli. I have injected the rabbit's peritoneum with Berlin blue suspended in fluid, and found that in ten hours the leucocytes have swarmed out on the surface and seized particles of Berlin blue and hastened back through the stomata into the lymphatics of the diaphragm. The leucocytes surround the particles of blue or coloring matter and it then becomes a foreign body no more. It is encapsulated in protoplasm. Of course these leucocytes may be out into the peritoneal cavity for something to eat, but they have not the discriminating powers to

decide what is food and what is not, so they seize any foreign body invading the peritoneum, whether it be in soluble coloring matter or vegetable microbes. The microbes the leucocytes may digest, englobe or destroy. Some leucocytes carry back into the diaphragmatic subserous lymph channels many particles equal to the 100 tubercle bacilli. Scores of leucocytes may be found loaded with particles of coloring matter lying in both straight, superficial and deep channels of the diaphragm.

It seems to me that the cure of tubercular peritonitis, if it be recognized as such, by incision and drainage (and iodoform) must rest back on the power of the leucocytes to fight the battle against invading microbes. In some cases there will be a deposit on the peritoneum sufficient to make it an inch thick. In other cases the adhesions are so dense and so extensive that several bowel perforations will be entirely protected by the adhesions. Surely no incision or drainage will benefit such; they are beyond the art of surgery.

The man who practices internal medicine sees the patient in another and very different condition. He is visited by patients with peritoneal tuberculosis of lighter grade. They are simply slightly ill, constipated, weak, sweat, have no appetite; occasionally sharp diarrhea attacks them. Examination of the abdomen reveals very little, no palpable tumors, omental and mesenteric thickening. In short, they are in a transitional stage between being compelled to stop labor and going to a surgeon. The different stages in which internal medical men and the surgeon find the cases of tubercular peritonitis in cities, cause different opinions as to the course of the disease and the results of therapeutics on the disease. My view is that the claim that abdominal section is a cure-all for tubercular peritonitis is not founded on facts, but founded on imagination. We do not understand how section cures it, nor has any one offered a satisfactory explanation. They claim that air passing into the peritoneal cavity produces the cure. Could they settle the fact by injecting air into the cases where microscopic examination had proved the presence of the tubercular bacillus? But we think we know to-day that tuberculosis is a curable disease, *i. e.*, it may be arrested and not kill a patient. Again, I think that many cases diagnosed and operated on as tuberculosis of the peritoneum are simply chronic peritonitis, and the drainage is the cause of the mystic cure. How many are injured by the abdominal section? Many are born to die unreported. How many cases are really tubercular peritonitis which are operated on and reported on in the ordinary journal?

Finally, what about the newer treatment of iodoform? Senn uses in the abdominal cavity two drams of a 10 per cent. iodoform-glycerin emulsion and claims it has curative effects. This emulsion is smeared over the affected portions of the peritoneum. It may be noted that others believe this valueless for treatment. It seems to do good work as an interosseous and parenchymatous injection, and if so, why not apply iodoform-glycerin emulsion to the peritoneum? Tubercular peritonitis is a surface tuberculosis and it yields the most readily to surgical treatment. Is it because it is a surface tuberculosis? We must not forget that the peritoneum is a great lymph sac and the endothelial layer rests on a bed of lymphatics. Has this anything to do with the curative effect of incision and drainage? What has vis-

ceral trauma to do with it? But there is no doubt that our observations are very defective in tubercular peritonitis, for doubtless many patients recover from it of whom we know nothing, and simply because we accidentally find one and operate, we think we have discovered a therapeutic agent. The month's rest in bed deceives us by its curative effect also; we are apt to overlook that. I call attention to the view that leucocytes may help the surgical procedure to fight the battle against the invading germs. For, really, tuberculosis is a benign disease and requires but a slight shock to check its progress. It, in this respect, resembles a growing uterine myoma whose existence is easily checked by a slight shock. Inflammation seems to be, from my experiments on the peritoneum, a production of leucocytes. It is a fight of the leucocytes against the invader, whether it be Berlin blue or microbes. The object of the leucocyte, a defender of invasion, is to digest or imprison the invader. Now, since the Berlin blue can not be digested, it is encysted, surrounded. Again, when the tubercle bacilli invade the peritoneum, the leucocytes surround it, forming what are known as tubercles, *i. e.*, the tubercles of the peritoneum are composed of leucocytes which endeavor to defend the organism. If the leucocytes are well fed or sufficiently numerous they will come off conquerors. Now, when the abdomen is opened in peritonitis a reaction arises from the trauma and the peritoneum is supplied for a season with much more blood than usual. This fresh supply of blood over-feeds the leucocytes or tubercles of the peritoneum, and the leucocytes with their renewed vigor digest or englobe the tubercle bacilli, hence the recovery from tubercular peritonitis; we may be able to do this same object by a simpler surgical procedure later. However, it seems that the recovery of the tubercular peritonitis with or without surgery must be credited to the leucocytes, the defenders of animal organisms against microbial invasion or inflammation.

## BOVINE TUBERCULOSIS.

Read before the Chicago Pathological Society, March 9, 1896.

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Tuberculosis in cattle has become a recognized factor in the production of tuberculosis in the human family.

The weight of evidence is rapidly accumulating to show that tuberculous food is directly responsible for the transmission of this disease in many individual cases. It is stated that of the mortality of the race 7 per cent. is due to tuberculosis, but the casual observer will readily see that this is but a partial statement of facts, for we all know that many cases with sufficiently pronounced lesions to produce death, are not classed in this category. The nature of many infantile diseases and lesions of important viscera in adults are only too frequently unrecognized. They are treated as inflammations of some sort, when in fact they are nothing more nor less than genuine tubercular affections. The prevalence and fatality of the disease makes it all the more important that we should discover and if possible prevent the causes and conditions which are active in its dissemination.

It is now admitted that food from a tuberculous animal, whether milk or meat which has been infected, may produce tuberculosis, and especially is this true in infants, in those greatly prostrated from some