ment of the ciliary arteries always, or, at least, so frequently found, we must admit that this condition is not an improbable one.

What, then, is the agent by whose pressure the ciliary folds are advanced? Not the swollen lens, since, as before said, demonstration of such swelling is rare; and, admitting it to be more frequent than I think, its effect would be principally, as in the early stage of some forms of cataract, to render shallow the more central parts of the anterior chamber. Moreover, the advance of the ciliary folds takes place as readily after the lens has been removed by extraction, whether in its capsule or not; but a swelling of the lens would doubtless predispose to glaucoma by its simple encroachment on the space included within the ocular tunics. Nor is an accumulation of fluid in front of the vitreous body, that is, between it and the ciliary body or lens, the agent; for such, if it had existed, would give some microscopical evidence of its presence by distension of the region of the so-called canal of Potit, or otherwise. Therefore, the parts posterior to the lens and ciliary folds, and between these and the secreting parts, must be the agents in question. Such might be the vitreous body itself, the retina, or fluid accumulated between the vitreous body and retina, or between the retina and choroid.

It is difficult to demonstrate an enlargement of the vitreous body, and impossible to measure such; but I take it that, if the lens and ciliary folds be advanced, and the optic disc pressed backwards into a concave shape, and if there be, at the same time, no detachment of the vitreous body to be found, then this body must be enlarged. Such a condition is probable in glaucoma on other grounds, since, in most cases of this disease, the vitreous body is firmer, and contains more cell-elements than normal.¹ Enlargement of the vitreous body occurs undoubtedly in the early and acute stages of suppurative hyalitis, and there produces an advance of the lens, ciliary folds, and iris, as well as increased tension.

The retina is extremely frequently thickened in glaucoma by cystic oedema of its substance. This thickening affects most commonly the front part, and occasionally, especially in the glaucoma accompanying Bright's disease or embolism of the central vessels of the nerve, at the posterior part of the retina. It is occasionally found in isolated patches, and in such the thickening may be very great, even amounting to ten times the normal; but such thickenings, even the greatest of them, can have no very great effect in pushing the vitreous body forwards, and, therefore, may be simply taken as indications either that more fluid passes from the surrounding vessels, or that there is some obstruction to the outflow of this fluid from the retina. *Post mortem* examinations sometimes demonstrate the existence of fluid just behind the detached retina, or between it and the choroid. We must then ask why this fluid, whether it be in the vitreous body or elsewhere, is detained there, and if it be normal in constitution, and in the amount secreted.

I judge it to be normal in constitution, in the absence of direct evidence to the contrary, and inasmuch as, under the mechanical influence of eserine, it can escape *via* Schlemm's canal; also, that it is beyond the normal in amount, since, Schlemm's canal and the entrance to it remaining normal, there is sufficient fluid still retained within the eye to keep it hard. The demonstration of an increased flow through Schlemm's canal in glaucoma is convincing, when the instillation of eserine rapidly brings about a restoration of the tension to normal; and that of an increased secretion depends upon the rapidity with which the tension is re-established after paracentesis in glaucoma, and, perhaps, also on the slowness with which the anterior chamber is re-filled after more extensive operations for the same disease.

But why should this application of the iris take place only in the later stage of glaucoma? It is, as many specimens in which sarcoma of the choroid co-exists with still normal tension show, preceded by a somewhat advanced position of the base of the iris, such advance being sufficient to narrow but not to close the peripheral part of the anterior chamber of the aqueous. The ciliary folds are, of course, the agents in this case, but their action is opposed by that of the muscles of the iris, especially the sphincter. But when, as in the later stages of glaucoma, the motor-nerves to the iris are paralysed, then this structure is impelled forwards to within the influence of the suction towards the ligamentum pectinatum, and immediately close apposition is brought about.

It is worthy of note that pressure on the posterior pole of the eye, as by sarcoma of the optic nerve or orbit, produces some advance of the periphery of the iris, just as in the earlier stage of glaucoma. This commends itself to me as a fact by the microscopic evidence of numerous cases of intra-orbital tumour.

The lens regains its position in the later stages of glaucoma by the tension of the zonula, which becomes greater as the atrophy of the ciliary body progresses. This tension is now free to act with effect, since, supposing the vitreous body to be now of the normal size, the pressure in front of and behind the lens becomes equalised on the closure of the exits from the anterior chamber. The iris tends to regain its position from the same cause, but its attempts are frustrated by the inflammatory adhesion which is speedily developed between it and the peripheral part of the cornea.

CHYLOUS ASCITES.

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CASES where large quantities of chyle have been removed from the body are sufficiently uncommon, and of such physiological importance, as to warrant me in bringing the following under notice.¹

The following is an abstract of the case, taken by my clinical clerk, Mr. Thomas.

A. C., aged 13, was admitted to hospital on November 10th, 1883, complaining of abdominal swelling.

Family History.—His mother was alive and well; his father suffered from phthisis (and had since died); he had one sister who died in infancy.

Personal History.—The patient stated that he enjoyed good health until last spring. He had been an inmate of a reformatory for over two years. In May, 1883, whilst at work, he got a severe wetting, which was followed by bronchial catarrh, accompanied with pain in the left side. After he had got rid of the catarrh, the pain remained, catching him on breathing deeply. In August, the pain became more severe, due, he thought, to getting overheated, and he was sent to hospital. The following is Dr. Lindsay's account of his condition at that time. He was suffering acute pain in the left side, and had a cough; a loud friction-sound was audible in the sixth space, on the left side in front. There were some dullness and faint crepitus over the corresponding part of the same lung behind. His temperature did not rise beyond 100°, and the constitutional symptoms were slight. He remained in hospital five weeks, and his illness ran a slow but mild course. He was confined to bed for only four or five days; and convalescence was gradual, and apparently complete.

Present Illness.—He thought that his present illness began about four weeks after (about the middle of October), when he had a shivering fit, followed by pain on the left side, in the axillary line above the level of the last rib. Owing to this, he was placed in the sick-ward of the reformatory.

On October 31st, the patient first noticed that his abdomen was swollen. The swelling was always uniform; there was no oedema of the face, feet, or legs. The swelling increased rapidly; it was unaccompanied by pain. The appetite became poor, and he suffered much from thirst. The bowels were a few times irregular, some days confined; diarrhoea lasting three or four days following; a confined state again supervening. The patient stated that he passed urine more frequently than in health, not a great quantity at a time, and thought that, altogether, he passed less than usual; he stated that it was sometimes reddish and darker than normal.

Condition on Admission.—The patient was fairly well nourished; intelligent; he ate moderately, and slept well. His tongue was slightly furred. The abdomen was uniformly distended. On palpation, there was increased resistance, with slight pain on pressure over the left hypochondriac region. The percussion-note was tympanitic over the epigastric and umbilical regions, but became duller towards the pubes and flanks; this dullness changed with position. Fluctuation was well marked, and could be easily made out. His bowels were now regular, and his appetite good. The region of hepatic dullness could not be clearly made out on account of the distension. Pressure close to the costal arch in this region caused slight pain. The heart-sounds were normal, and the pulse was 90.

On examination of the lungs, the percussion-note was somewhat dull, over a limited area, at the inferior angle of the right scapula, over which region the breath-sounds appeared feeble, and there was some loss of vocal resonance. At the base of the right lung, a few crepitations were audible on deep inspiration; there were also a few

¹ "On the Vitreous Body in its Relation to Various Diseases of the Eye." *Guy's Hospital Reports*, 1882.

² Specimens of the chylous fluid, and morbid specimens, were exhibited before the Ulster Medical Society and the last annual meeting of the British Medical Association.

crepitations in the axillary region of the left side; but the examination did not reveal anything except what pressure would account for; and these physical signs were entirely absent upon a subsequent examination.

December 2nd. The abdomen measured thirty-three inches in circumference at the umbilicus. The abdominal wall was tense and resisting, with enlargement of the superficial veins. The percussion-note was clear over the epigastric region to within four inches of the umbilicus, but became dull in the hypochondriac regions. The dullness extended all over the abdomen, except in the above-mentioned parts. In the flanks, there was a line of clearer note along the colon. In the erect position, percussion over the whole abdomen was dull, including the epigastric region. Fluctuation was distinctly felt. The apex-beat of the heart was visible, and could be felt at the left nipple. The first sound was normal; the second sound was accentuated; pulse 100. Over the lungs, the percussion-note seemed slightly clearer on the right than on the left side in the infraclavicular region in front. On the right side, this clearness extended as low as the nipple. A few *râles* were audible over the left lung, at the anterior border of the axilla. Behind, there was dullness extending downwards on both sides, from the inferior angle of the scapula, more marked on the right side (liver). Over this latter region, the breath-sounds were feeble. On the left, an occasional *râle* might be heard. The patient complained of slight cough; no expectoration. The urine was of specific gravity 1023; no albumen; no sugar.

December 3rd.—Five small circular blisters were applied to the abdominal wall. The abdomen measured 32½ inches over the umbilicus, and the patient complained a good deal of the distension and discomfort of the accumulated fluid.

December 7th.—The patient was tapped, and twelve pints of fluid came away. The fluid closely resembled milk in appearance; it was albuminous, slightly alkaline, had a sweetish saline taste, and a faintly pleasant smell. The density was 1020. It did not coagulate spontaneously, but coagulated on the addition of nitric acid, and became almost solid on the application of heat. A small portion of the fluid shaken up with ether became nearly transparent after the ether had risen to the top. On evaporation of the ethereal liquid, the residue consisted of almost pure oil. After standing for some time, the liquid separated into two layers; the upper was an opaque pearly-white fluid, resembling so closely the cream which rises on a good sample of cow's milk, that it could not possibly be distinguished from it; this stratum was about one-eighth of the entire mass. The lower stratum was of a very faint yellow colour; it was opalescent, but decidedly milky in appearance. Several to whom the samples were shown were positive that the liquid was milk, and that it had a milky odour.

Under the microscope, the liquid was seen to contain corpuscular elements. The corpuscles were not very numerous; they presented all the characteristics of white blood-corpuscles, were distinctly nucleated, and some appeared as if about to divide. There were a few red blood-discs, which were larger and more rounded than normal, and some of them appeared to approach the white cells in character. They presented most unusual changes of shape on being watched for a moment, becoming crescent-shaped, and gradually flattening out again (these changes were only noticed when the specimen was observed fresh). Acetic acid did not cause the nuclei of the white cells to become tripartite. There were a few large exudation-corpuscles. The remainder of the field was occupied by a fluid consisting of numerous small molecular bodies, hardly capable of being measured, but

apparently all of about the same size. After the slide upon which the liquid was being examined was allowed to remain for a few minutes under observation, the molecules congregated into little cylindrical masses, and then presented an appearance not unlike some specimens of amorphous urates. Though congregating into masses, each molecule remained distinct, and did not run into the neighbouring ones, or become in any way continuous. In the fresh specimen, they were so numerous, and so uniform in size, as to be but faintly distinguishable from the surrounding fluid. The entire appearances resembled those presented by the molecular base of chyle. There were no oil-globules, and a few small spherical bodies might be seen, like the enlarged nuclei of the larger lymphoid cells.

The accompanying woodcut gives a fair idea of the microscopic characters of the fluid, after about twenty-four hours' removal from the body. The minute molecular base (for the sake of clearness) is not so abundantly represented as it should be.

Six days after removal from the body, the fluid was examined again by the microscope, and the innumerable uniform molecules presented identically the same appearance. If a drop were taken from the upper layer, the molecules were so numerous as to obscure everything else; oil-drops might be seen in this layer; the lower layer did not contain any appearance of oil-drops, but exhibited the molecular base, just as when removed from the body. There were only a few corpuscles to be seen, and they were indistinct. No crystals were noticeable in this lower stratum; a few were noticed in the previous examination.

The abdomen was carefully examined after the tapping, and a tumour was found lying across the front of the spine about the level of the umbilicus; it was about the size of two small bantam's eggs. It was firm, elastic, smooth in outline, and conveyed the feeling to the touch as if one were palpating a small horse-shoe kidney. This tumour was conjectured to consist of enlarged lymphatic glands lying on the front of the spine, and occluding the thoracic duct in the abdomen.

December 20th.—There had been little to report since the tapping; a day or two after it, he was able to sit up, and move about the ward. His appetite had remained fairly good, and he had not been thirsty. His diet consisted of chicken-soup for dinner, and two pints of extra milk through the day, with bread and butter, tea, etc. His bowels had been slightly relaxed, but nothing abnormal was noticed in the stools. He was apparently somewhat more emaciated than he had been; his temperature had been about normal, and he slept pretty well. The swelling in the abdomen had increased since tapping; it appeared to increase uniformly.

December 29th.—There had been no change in the condition of the patient, except that the swelling had continued to increase, and he now measured 36½ inches, and had considerable dyspnoea from the ascent of the diaphragm. The physical characters of the abdomen in no way differed from those seen in a typical case of ascites. At his own request, he was tapped in the middle line (as before), midway between the pubes and umbilicus, and eighteen pints of milky fluid were drawn off. This in no way differed from that previously removed. On the examination of the abdomen immediately after tapping, the tumour previously mentioned was only to be vaguely felt by the side of the spine in the right hypochondriac region. It appeared to be slightly movable. Deep in the abdomen, to the left of the umbilicus, a small and movable tumour, about the size and shape of a large filbert, could be felt; it was smooth and doughy, and easily slipped away from under the fingers; it was probably a small scybalum.

December 30th. The temperature rose, after the tapping, to 100.2° Fahr.; the abdomen was slightly tender; otherwise, the patient was much relieved. On examining the chest posteriorly, the breathing was natural from apex to base. In front, about the border of the cardiac region, submucous crepitation was to be heard. At a spot above and to the left of the nipple, very fine crepitation was heard on inspiration; this disappeared after a few deep respirations. There was no tubular breathing, but a faint degree of dullness could probably be appreciated under the left clavicle. The patient was carefully weighed yesterday after tapping, and found to be 5 st. 9½ lbs. with two shirts on. The liquid, after standing since yesterday in a large bottle, had a most unmistakably milky odour in the opinion of the many members of the clinical class who examined it.

January 13th, 1884. There was little change in the aspect of the patient. His fingers were beginning to club at the extremities; if anything, he was more *apparently* emaciated, but not markedly anæmic. His tongue was slightly furred, and his hair was peculiarly dry; it had not been washed. The skin over the body was not unusually dry or harsh, but it was so on the legs. The veins on the abdomen were prominent, but not more so than when first reported upon. He had been on his ordinary diet for the last week or so, consisting of—breakfast, one pint of tea, with sugar, milk, and

bread and butter; dinner, half a chicken broiled, one potato, and one or two pieces of bread; supper, same as breakfast; besides which, he had about two pints of milk during the twenty-four hours. Temperature, 98.9° Fahr. The abdomen was very prominent; it measured 38 inches; the sense of fluctuation was very distinct. There was only a small tympanic area at the bottom of the sternum, not larger than the palm of the hand. This area did not become dull when the patient lay on his left side, but became clear towards his right flank.

January 14th. The patient was tapped, giving 22 pints of fluid, differing in no way from that drawn off before. The abdomen now measured 25 inches, and through the relaxed walls a tumour could be felt in front of the spine; it was movable, and appeared to be as large as a small hen's egg, and slipped easily into the groove on the left side of the spine. In the right hypochondriac region, a more uneven and larger mass could be obscurely felt; it also appeared to be movable. There was not much tenderness over the abdomen. Weight, after tapping, 6 st. 2 lbs., with exactly the same clothing upon him as when previously weighed (gain, 6½ lbs. in sixteen days). He was probably not so completely emptied by this tapping. I forwarded 12 ounces of the fluid obtained by this third tapping to Professor Matthew Hay of Aberdeen. He received it next day (January 15th), and commenced a chemical examination of it upon the following day. I am much indebted to him for his able and careful analysis; the following is his report.

"The fluid was received by post on January 15th, 1884, and its examination was commenced on the day following. The whole fluid measured about 12 ounces.

"It presented to the eye all the appearances of milk, being white and opaque and limpid. Although it had been allowed to stand for twenty hours in a tall jar, it showed no signs of separating into two layers, as is the case with milk. It had no odour; its specific gravity was 1014; and its reaction was moderately alkaline. A portion of it was heated without showing signs of coagulation; a fresh portion was diluted with water until distinctly translucent, and then heated, but the opacity of the fluid was not visibly increased. Acidulated with acetic acid and heated, the fluid yielded flaky coagula, just as milk does when similarly treated. The amount of coagulation was not such as to render the fluid semi-solid. Heated with excess of caustic potash, the fluid quickly became of a dark olive-green colour, without losing its opacity.

"Twenty grammes of the chylous fluid evaporated to dryness over the water-bath, and afterwards heated in an air-bath, at 100° Cent., until it ceased to lose weight, yielded a residue weighing 1.183 grammes (after prolonged combustion the residue was reduced to 0.199 grammes). The fluid, therefore, contains 5.915 per cent. of solids, of which 4.920 is organic, and 0.995 inorganic.

"In order to ascertain the amount of albumen, 50 cubic centimetres of the fluid were slightly acidulated by means of dilute acetic acid, and boiled. The flaky precipitate, after repeated exhaustion with ether, was collected on a filter and well washed, and then dried at 100° Cent. Deducting the weight of the filter, the precipitate weighed 1.439 grammes, which is equivalent to 2.878 per cent. of albumen in the fluid.

"The amount of fat was obtained by evaporating 50 cubic centimetres of the fluid to dryness, and thoroughly exhausting the residue by means of ether. The ethereal solution was then shaken with acidulated water, poured off and evaporated; the residue weighed 0.515 gramme, equal to 1.030 per cent., of not perfectly pure fat.

"As regards sugar, the fluid, either in its original state or diluted with water, gave no reaction with Fehling's solution; although it yielded, as already mentioned, a dark olive colour, on heating with excess of caustic potash. However, after previous removal of the albumen and greater part of the fat, by means of acetic acid and heat, a colourless and almost perfectly transparent filtrate was obtained, which readily reduced Fehling's solution. For the purpose of estimating the amount of sugar, 25 cubic centimetres of the fluid were, therefore, acidulated and boiled, and the albuminous coagulum filtered off, and the filtrate was triturated with a standard solution of Fehling. In this manner the fluid was found to contain 0.210 per cent. of sugar.

"The analysis was not carried further. I now give the quantitative results, in a tabular form.

Water...	94.085 per cent.	
Solids...	5.915 "	
Inorganic...	0.995 per cent.	
Organic	4.920 "	
Albumen	2.878 per cent.	
Fat	1.030 "	
Sugar	0.210 "	
Other organic matter	.802 "	

"I may mention that, by diluting the chylous fluid with definite quantities of water, and comparing it with skimmed cow's milk (specific gravity, 1035.2) similarly diluted, both fluids being placed in glass tubes of equal diameter, I ascertained that the chylous fluid was slightly more opaque than the milk, the relative degree of opacity being as 102:100.

"I should also remark that I never observed, even after the fluid had stood for some days, any creamy scum form on its surface. This was probably due to the fact that the specific gravity of the suspending liquid was low, and that the particles of fat were remarkably fine, much finer as shown by the microscope, than the fatty globules of milk.

"The aseptic property of the fluid was noteworthy. A portion of it kept in an open bottle in a warm room showed no signs of undergoing decomposition, as judged by the odour and the appearance, for more than a fortnight. It may be well to state that the fluid received contained no trace of spontaneous coagulum, as ordinary chyle sometimes does.

"This chylous fluid would appear, therefore, from its chemical examination, to consist almost entirely of pure chyle, and has evidently been poured out into the peritoneal sac through some rupture in the walls of the thoracic duct, or the receptaculum. Owing to the lowness of the percentage of albumen, the chyle is apparently not much mixed with serum from the peritoneum."

One very interesting physiological fact is brought out in the chemical analysis—namely, that the chyle contains sugar. Although this long remained in doubt, and has only comparatively recently been shown to be the case, as regards the chyle of some of the lower animals, it has not yet, so far as I know, been demonstrated in man. There is no question here of the chylous fluid having obtained the sugar from its admixture with peritoneal exudation, since serous exudations are well known to contain at most a trace of sugar. The sugar has been absorbed from the intestines by the lacteals.

The absence of separation of the fluid into two layers, in Dr. Hays's specimen, might possibly be caused by changes produced by the shaking of the bottle during the long journey from Belfast to Aberdeen.

January 17th. The abdomen measured thirty inches in circumference one inch above the umbilicus. On this day, the chest was examined, and nothing abnormal was found.

January 27th. There was no alteration in the appearance of the patient; the abdomen was much distended, and the veins were very prominent over the entire surface. He complained of great inconvenience from accumulation of the fluid. In the sitting posture, there was dulness on percussion, from the symphysis pubis to the xiphoid cartilage.

January 28th. The patient was tapped in a sitting posture in the usual place, and twenty-two pints were removed, differing in no way from that obtained at former tapplings. He had been taking three pints of milk daily in addition to his ordinary diet of chicken, bread, tea, etc. A sample of the fluid in a tall urine-glass, taken as it flowed from the trocar, on being compared with a sample of milk of the same size, presented a faintly yellow trace of colour as compared with the milk. The entire amount of fluids taken by the patient averaged about four pints and a half daily, notwithstanding which he passed under twenty ounces of urine. His bowels were moved regularly every day, and he had a natural soft motion (sometimes two were passed).

After tapping, the parietes appeared to be thickened and slightly oedematous, and he was very tender, and did not permit a thorough examination. A small tumour, like an enlarged gland, not bigger than a walnut, could be felt on the left side, below the umbilicus. On firm pressure at the level of the umbilicus, the finger was able to come down on the spine, and there did not appear to be anything between it and the bodies of the vertebrae. His weight, half an hour after tapping, was 5 st. 13 lbs.

Temperature.—This was normal in the morning, with slight rise in the evening. This rise was greatest on the evenings after tapping, the highest temperature reached being 100.8°. The following is a week's temperature, from January 21st to 28th.

	M.	E.
January 21st	98.4°	100.2°
" 22nd	98.8°	98.8°
" 23rd	98.4°	100.2°
" 24th	98.4°	100.6°
" 25th	99°	100°
" 26th	98.4°	99.4°
" 27th	99°	100.2°
" 28th	99°	100.8° after tapping.

Urine. November 10th.—Clear in colour, acid in reaction, specific gravity 1020. Albumen present about 1%; no sugar, no deposit.

November 21st. Clear, acid; specific gravity 1012; no albumen, no sugar.

December 8th. Clear, neutral; specific gravity 1023; no albumen, no sugar.

January 24th, 1884. Yellow, acid; specific gravity 1030; no albumen, no sugar.

Quantity of Urine passed Daily since December 8th.

	Oz.		Oz.
December 8th	19	January 7th	22
" 9th	22	" 8th	20
" 10th	17	" 9th	21
" 11th	17	" 10th	18
" 12th	18	" 11th	20
" 13th	23	" 12th	21
" 14th	22	" 13th	19
" 15th	19	" 14th	21
" 16th	18	" 15th	19
" 17th	17	" 16th	20
" 18th	15	" 17th	18
" 19th	17	" 18th	20½
" 20th	23	" 19th	23
" 21st	20	" 20th	17
" 22nd	18	" 21st	22
" 23rd	22	" 22nd	19
" 24th	13	" 23rd	16
" 25th	17	" 24th	20
" 26th	18	" 25th	16
" 27th	16	" 26th	18
" 28th	19	" 27th	17½
" 29th	18	" 28th	14
" 30th	17	" 29th	18
" 31st	17	" 30th	16½
January 1st	18	" 31st	18
" 2nd	19	February 1st	20
" 3rd	17	" 2nd	21
" 4th	14	" 3rd	23
" 5th	17	" 4th	18
" 6th	19		

February 5th. The abdomen was much distended, apparently more than it had been yet, and the veins were very distinctly visible. The general aspect now would not strike one as being marked by any great emaciation or wasting. He was tapped in the usual position, and twenty-one and a half pints were withdrawn. The fluid appeared thinner than before; its gross physical characters were the same as on previous tapplings, with this exception, that it was only very faintly alkaline. A sample taken and moderately heated became thick, but became more fluid again on cooling; the addition of heat and nitric acid caused thorough coagulation.

On examination immediately after tapping, there was a good deal of tenderness over the relaxed abdomen. A smooth, soft, elastic elongated tumour, occupying the position, and apparently having the same dimensions as the pancreas, lay across the spine at a level of about two inches above the umbilicus. On manipulation, this partially disappeared from below the fingers, receding into the left vertebral groove, but could still be obscurely felt deep in the left hypochondrium. On deep pressure in the left iliac region, a fibrous ridge could be felt occupying the position of the tendon of the psoas muscle. Weight, 5 st. 10 lbs.

February 14th. 10 P.M. The abdomen was very much distended, causing dull dragging pain in the flanks, and general uneasiness to the patient, who sat up in bed unable to rest, and was crying. The superficial veins were plainly visible. He was tapped in the usual manner, and twenty-two pints of fluid were removed. This fluid bore the same general characters as on previous tapplings, but seemed to flow more easily from the cannula, its density being 1008. The tumour could be felt lying in the same position, but appeared firmer to the touch. The patient weighed 5 st. 9½ lbs. after tapping.

February 25th. 10 A.M. Since the last tapping, there had been a considerable change in the patient's aspect and symptoms. His urine had been rising in density and diminishing in amount; he had only passed nine ounces in the last twenty-four hours. The abdomen was moderately distended with fluid, not more, however, than it would have been on the fourth day after previous tapplings. It could scarcely be said to be tender on pressure, except a little below the sternum. He complained for the last week of severe and persistent headache, felt most in the frontal region. During this time, he had been vomiting two or three times a day; these symptoms were accounted for at first by quantities of food and sweetmeats, which had been brought to him by friends, and of which he ate freely. He lay in bed on his back, with a handkerchief tied tightly round his eyes, complaining severely of headache. Admission of light was a positive pain to him; the sound of the voice, or the vibration of footsteps on the floor, were particularly distressing. He had ceased to take any solid food, but still managed to take three pints of milk in the twenty-four hours. His pupils were equal, and readily responded to light; his brows were contracted. His pulse was moderately full, and counted 52 per minute. His temperature was 99.2°. He felt very sick, and had vomited twice

to-day, and complained of a good deal of pain and uneasiness in the stomach, which he called heartburn. His vomit was very acid.

February 26th. 8.30 P.M. The patient had slept very little since last report. His headache had been very severe, and the vomiting frequent, he having vomited about twelve times since yesterday. His temperature was 101°; his pulse 60, unequal, and irregular, some of the beats being imperceptible, others barely full. There was slight dyspnoea, but an examination, which was unsatisfactory and difficult to obtain, revealed no adventitious sounds in the chest. The expiratory murmur was prolonged at the left apex, and the breathing was slightly harsher, and there appeared to be the slightest shade of dulness over this region. Otherwise, there was no physical sign indicative of phthisis. His meningeal symptoms were, upon the whole, not more pronounced than they were on the morning of the previous day.

February 27th. The patient vomited twice during the day, once after breakfast, and again after dinner, the matter vomited being very acid. The headache was not severe during the day, but grew much worse towards night. The pain was chiefly frontal, and most severe on the left side. Wrinkling the skin of the forehead caused pain. Movement of the head was painful, and caused shooting pain along the muscles of the neck posteriorly. Pulse 87. Temperature, morning, 98°; midday, 98.2°; evening, 99°. Quantity of urine passed, eight ounces.

From this date on till his death, which occurred on March 7th, the clinical report details the progressive deepening of tubercular meningeal symptoms—vomiting, irregular pulse, and respiration—and coma alternating with periods of semi-consciousness, and delirium; the temperature never exceeding 102°.

Post Mortem Examination. one hour and a half after death.—The body was not markedly emaciated. An incision was made in the median line, and about a gallon of dirty yellow semi-purulent fluid escaped. The intestines bulged into the wound, and were deeply congested, and covered here and there with shreds of lymph. The bladder was distended, and filled with yellow-coloured urine. The cæcum was very much distended with gas; the ascending colon was moderately dilated; the transverse very much dilated; and the epiploon gathered up into a firm thickened band, resembling a pancreas. It was also deeply congested; and, with the exception of a few milary elevations, it was smooth, and felt like a fetal lung. On tracing this band of the epiploon, it was found to be attached to the abdominal wall, at the splenic flexure, opposite the tenth rib. On tracing the transverse colon in the same direction, it was found still distended, and contained some hard scybala. About two inches below the splenic flexure, the colon was found to be constricted for nearly three inches. Its walls were thickened, and the appendicæ epiploicæ matted together. Towards the sigmoid flexure the bowel was considerably dilated, though empty, as was also the rectum. The presence of faeces was confined to that part of the splenic flexure above the constriction. The peritoneum covering the intestines was everywhere studded with milary tubercle; this was most marked in the mesentery proper, which presented a deeply congested appearance, relieved by myriads of greyish-white granulations. The glands of the mesentery were not very much enlarged, and were somewhat obscured by the presence of so many granulations. The small intestines were deeply congested, and comparatively empty. That portion of the peritoneum which is reflected from the duodenum to the small intestine, as it goes to form the mesentery, was very much thickened, and infiltrated with the same milary granulations; and, together with its glands, which were very considerably enlarged, it formed a tumour, lying on the front of the spine; this was what was felt during life after the tapplings. The liver and the pleura covering both lungs were studded on the surfaces with fine milary granulations. The kidneys were deeply congested; the capsule was easily removed. The connective tissue around was studded with tubercle. On section, the lungs were infiltrated everywhere with fine millet-seed granulations; but in no place in the pulmonary tissue was there any caseation, softening, or excavation, the deposit apparently being of comparatively recent origin, and not yet leading to any destruction of the lung. The costal and pulmonary pleura and diaphragm were adherent, and fused together about the fifth, sixth, and seventh interspaces on the left side below the heart in front; this corresponded to the site of his pleuritis in July, and accounted for the constant pain which he referred to the spot all through his last illness. The structures upon the front of the spine in the abdomen and chest, which lay between the serous covering and the vertebrae, seemed quite healthy, the veins and nerves in the neighbourhood of the thoracic duct glistening through the pleura and peritoneum. I did not think it wise to attempt a dissection of the duct, under the difficulties surrounding the *post mortem* examination, but removed all the structures *in situ*, separating everything clean off from the periosteum of the vertebrae, and removing the mass for a subsequent careful dissection.

To Professor Redfern I am mainly indebted for the beautiful dissection of the thoracic duct; and Dr. Maguire (Manchester) has kindly made a microscopic examination of its walls, and also of the coats of the colon,

which he found ulcerated and infiltrated with tubercle at the narrowed portion previously mentioned.

The lower third of the duct is considerably dilated: its walls are of normal thickness, and its internal surface is smooth and glistening. Near the upper end of this portion of the duct, whilst it is still slightly dilated, its walls are thickened, and upon its internal surface a few minute elevations are noticeable, having the naked-eye characters of exceedingly small miliary tubercles. At the lower end of this dilated portion of the duct is a distinct perforation, reminding one of a minute bullet-wound; its edges are smooth, and they are not infiltrated—indeed, here the coats of this dilated part seem rather attenuated. The accompanying woodcut gives a fair idea of this aperture. It represents the lower third of the duct, slit up in its upper part, and a portion of a No. 2 catheter passed through the slit, and its point brought out through the rounded aperture, out of which the chyle flowed during life. There can be no doubt whatever that this aperture is the result of a rupture some months before the patient's death, and not artificially produced during the dissection. The extreme care taken by Professor Redfern and myself rendered this impossible; and you see the margins are rounded off by some vital action very distinct from *post mortem* violence.

The middle third of the duct at its lower part, for a short distance, admits a fine knitting-needle, and was sealed with a perfect little plug of fibrin, almost half an inch in length; at this spot there are minute miliary elevations to be seen, with difficulty, upon its inner surface; beyond this, the middle third of the duct, is an impervious cord, feeling as hard as a piece of ligature-silk. Its walls are firm, and a transverse section shows, under the microscope, the remains of a lumen, in the form of a transverse mark, around which is seen only the firm fibrous thickened walls.

The upper third of the duct, at its lower end, is also impervious and similar to the middle third; above this, for half an inch, is a portion which still shows a central cavity with thickened walls; above this, again, is a small portion which is impervious; whilst above this the extreme upper part of the duct is perfectly normal.

There are no enlarged glands pressing upon the duct, nor is there any fibrous cicatricial tissue in its neighbourhood.

Dr. Maguire reports that the microscopic examination of the thickened lower part of the duct, shows that the small elevations noticed upon its inner surface are round-celled miliary tubercles, showing no caseation, or giant-cells. The tubercles are all situated towards the inner portion of the duct.

The obliterated middle third of the duct shows, by the microscope, thickening of the walls, which contain minute tubercles surrounded by tuberculous infiltration consisting of fibro-nuclear growth and giant-cells; this tissue is seen to be at the inner part of the duct, and more towards the outer coats is seen a quantity of young fibrous tissue, with a few spindle-cells, whilst surrounding the whole is a layer of ordinary fully formed fibrous tissue.

From these appearances one is forced to conclude that the primary tubercular deposit in the walls of the duct led to its closure, and finally to complete obliteration. The part played by the inflammatory action excited by the deposit which led to the complete *fibrinous* plugging must not be overlooked.

The chyle, flowing from the radicles entering the duct from below, caused the receptaculum to dilate, and finally to burst; and it is evident that all the chyle during life flowed into the receptacle and out through the perforated spot.

An examination of the cranial cavity was not permitted; it would doubtless have proved that the immediate cause of death was tubercular meningitis—part of the general acute tuberculosis which studded over all the serous membranes and infiltrated every organ in the chest and abdomen.

As the details of the case have necessarily occupied so much space, there is, unfortunately, little left for remarks; and it is hoped that the facts are recorded in such a way that valuable deductions may be derived from them which may throw light upon the important and somewhat mysterious processes going on in the lacteal system.

It is probable that the rich fluid obtained from the first tappings was pure chyle in a concentrated form, the more watery portions of which had become to some extent absorbed by the abdominal vessels. It is equally probable that no such absorption had taken place in the intervals between the last two or three tappings, owing to the state of the entire peritoneal surface, which was so studded with minute granulations that the head of a pin could scarcely be laid anywhere upon the peritoneum without impinging upon a miliary elevation.

It will thus appear reasonable to calculate that the bulk of the fluid removed will represent less than the actual amount of chyle passing through the thoracic duct in health, since any peritoneal secretion will be more than balanced by peritoneal absorption. Altogether, 117½ pints, or nearly 15 gallons, of chyle were removed from the body

during life. From the tapping upon December 7th till February 14th, a period of 68 days, 2,110 ounces were removed, or rather more than 31 ounces per day. The extraordinary fact must be noted that though 117½ pints were removed, the patient did not lose weight. He weighed 79½ pounds upon December 29th, and 79½ pounds on February 14th. The weight of chyle secreted amounted to 150 pounds, or nearly double that of the patient's body. It is not possible that there could be any error in the weighing. It should be borne in mind, however, in reviewing the generally accepted doctrine of the importance played by chyle in the maintenance of the nutrition of the body, in the light of these figures, that the presence of the tubercle must be considered.

It may appear absurd to regard miliary tubercle as a possible factor in preventing loss of body-weight; but when one thinks of the millions of little tubercles, there must be some ponderous importance attached to their presence. It appears, therefore, that the general and extensive infiltration might have made up for the wasting which must have been at work. Though the adipose tissue was scanty, it was not so scanty as may sometimes be seen in apparently healthy lean folk. The patient was imbibing 90 ounces of fluids, and passing less than 20 ounces in his urine; of the balance, only 30 ounces went to make chyle. The observation made about the milky odour of the chyle was often verified by numerous members of the clinical class from time to time, and it is probable that the milk passed with little change through the lacteals.

Attention has been drawn recently to the pathology of chylous ascites by Dr. M. Letulle in the *Revue de Médecine*. This observer is strongly of opinion that such cases are always caused by peritonitis, independent of any opening or connection with the lacteals; and he espouses the view which was promulgated by M. Gueneau de Mussy, that the purulent products of the inflammatory action are slowly transformed with the leucocytes into a granulo-fatty emulsion. After a most exhaustive survey of the whole literature of the question, he formulates the following startling propositions. 1. All cases of chyliform ascites known up to the present time, and followed by necropsies, are cases simply of chronic tuberculous, cancerous, or neo-membranous peritonitis. 2. The granulo-fatty retrogression of the inflammatory products is sufficient to hold all the emulsified fat in suspension in the peritoneal serosity.

A glance at these specimens, or a study of the woodcut, answers these fanciful theories for all time to come. Debove maintained, but without any reason, that emulsified fat could be formed in the serous cavities, "qui ne provient ni d'une transformation des globules de plus ni d'un épanchement de chyle."

Having once seen the cause, in a case like this, so clearly demonstrated, one is justified afterwards in assuming that there is probably a small aperture in some of the minute lacteals, which, though not visible, can still permit the direct escape of the chyle.

ON EARLY SYPHILITIC EPIDIDYMITIS.

By ARTHUR COOPER, M.R.C.S.Eng.

WHEN syphilis attacks the testis, it rarely does so during the so-called secondary period; and when this organ does suffer, it is well known that, in nearly all cases, the body of the testis is first affected, and that the epididymis either remains free, or only becomes implicated later on, by extension of the morbid process from the testis itself.

The much rarer affection now to be considered differs from ordinary syphilitic orchitis, in that the epididymis is especially attacked, and that it occurs in the earlier portion of the secondary stage. Syphilitic epididymitis appears to have been first clearly described in 1863, by M. Dron of Lyons, who reported sixteen cases (*Archives Gén. de Médecine*, 1863, vol. ii, pp. 513, 724). In 1869, and again in 1875, M. Fournier (*Annales de Derm. et de Syph.*, 1869; and *Du Sarcocèle Syphilitique*, Paris, 1875) wrote on the subject, and referred to eight cases which had come under his own observation. Since then, most authors have included epididymitis among the consequences of syphilis, and the reality of its occurrence is now generally accepted. It should be mentioned, however, that no less an authority than the late Professor Sigmund, of Vienna, stated that he had never seen such a disease, and doubted its existence. It is worth notice that, during the twenty years which have elapsed since the publication of M. Dron's paper, but little appears to have been written on the subject in England. This is pretty well shown by the fact that, in the *Medical Digest*, the only reference on this matter relates to an abstract, in the *British and Foreign Medico-Chirurgical Review*, of M. Dron's paper mentioned above. It may be well, therefore, before giving the notes

of a case which I believe to be of this kind, to refer very briefly to the chief features of the affection.

First, as to the time of appearance: this seems to be nearly always within the first year, and most commonly within about the first six months. Of five of Dron's cases in which this point was ascertained, the earliest was two months, and the latest five months, after the appearance of the initial lesion, the average being three and a half months. Six of Fournier's eight cases occurred within seven months, one at the ninth, and one at the eleventh month, after the initial lesion. One or both organs may be attacked. In nine of Dron's sixteen cases, both were enlarged at the same time. The degree of swelling is usually unequal on the two sides. The enlargement always begins in the globus major, and hardly ever extends beyond it. Fournier has never seen the whole epididymis affected. In one of Dron's cases, the globus minor, and in two, the body of the testis, was enlarged. The scrotum and cord remain free. Only once in Dron's cases was the scrotum adherent for a short time. The swelling is indolent, usually painless, or nearly so, and rapidly subsides under general antisyphilitic treatment. The significance of the affection is doubtful. Julien (*Maladies Vénériennes*, 1879, p. 776), however, thinks it indicates a severe attack of syphilis. The morbid anatomy is unknown. There appears to be no *post mortem* examination on record, unless a case of gumma of the epididymis mentioned by Dr. Greenfield (*Pathological Transactions*, 1877, p. 225) were of this kind.

CASE.—Mr. P. H., aged 21, came under my care on August 26th, 1882, with two venereal sores of the inner prepuce, which had been first noticed five days previously. The date of contagion could not be ascertained. At this time, the sores were suppurating, and neither induration of the sores nor enlargement of the glands was sufficiently marked to make the diagnosis certain. A week later, both signs were characteristic, and mercury was at once begun. Roséola occurred in due course, and was followed by mucous patches in the throat and small fissures on the tongue. A few days after a visit to me on October 20th, the patient, whilst hunting in one of the midland counties, broke his left forearm; and it was in the early part of November (that is, about two months and a half after the appearance of the initial lesion), while lying up on account of his injury, that he first noticed swelling, with some amount of pain, in both testicles, but especially the left one. He was sure that the organs were not hurt in the accident, and he had no urethral discharge. The next time I saw him was on December 21st, consequently five or six weeks after the testes began to enlarge, and the patient said their condition remained pretty much as at first. He had been taking mercury (one grain and a half of mercurial pill three or four times a day) since I last saw him. On examination, the head of the left epididymis was found to be considerably enlarged. The swelling involved the whole globus major, and the bulk was about equal to that of a quarter of a Tangerine orange; the usual form of the organ was preserved, and the surface was moderately smooth. On the right side, the swelling was similar in every way, except that it was only about half the size. The swelling was strictly limited to the globus major on each side, the body and tail of the epididymis being of natural size and consistence. The scrotum and spermatic cords were unaffected. Only slight discomfort was caused on handling the parts. There was no urethral discharge. Elsewhere, also, there were signs of active syphilitic growth—namely, a prominent tubercle on the glans penis, a considerably raised scaly patch on the abdomen, and a very large and prominent mucous tubercle on the dorsum of the tongue. The pills (four a day) were continued until December 30th, on which date, as there was no improvement in any of the symptoms, the pills were left off, and a mixture containing one-twelfth of a grain of perchloride of mercury and five grains of iodide of potassium, to be taken three times a day, was prescribed. This was taken regularly until February 21st, 1883, when he next came to town. Both epididymes at that time were perfectly natural in size and to the touch, except that the left globus major was perhaps very slightly thickened; this, however, was only perceptible on carefully comparing the two organs, and would not have been noticed under other circumstances. The signs of active growth elsewhere had also disappeared. The patient had remarked that his testicles began to get smaller about a week after his visit to me on December 30th. They had given no further trouble up to the time I last saw him, in December 1883.

REMARKS.—In any case of enlargement of the epididymis, the first thing to be looked for is, of course, urethral irritation of some kind. Here there had been none for a long time; but it should be mentioned that there was a history of swelled testicle on the right side, with gonorrhœa, in 1879, and of a blow on the scrotum from a cricket-ball in 1881. That the affection was due to syphilis, seems