Busey (S.G)

The Effusion of Chyle and of Chyle-like, Milky, Fatty, and Oily Fluids into the Serous Cavities.

BY

SAMUEL C. BUSEY, M. D., LL. D.,

Of Washington, D. C.

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THE EFFUSION OF CHYLE AND OF CHYLE-LIKE, MILKY, FATTY, AND OILY FLUIDS INTO THE SEROUS CAVITIES.[1]

By Samuel C. Busey, M.D., LL.D.,
of Washington, D. C.

The object of this paper is to present the subject of effusion of chyle, chyle-like and fatty fluids into the serous cavities. It will be limited to the consideration of the effusion of such fluids into the cavities of the pleuræ, peritoneum, and tunica vaginalis.

Traumatic injuries of the absorbent vessels seem to have been a subject peculiarly attractive to many of the older authors. Ruysch, as early as 1665, drew attention to wounds of the lymphatic vessels, and refers to a certain surgeon "who had, unfortunately, cut a lymphatic vessel in incising a venereal bubo not completely developed, from which flowed daily a great quantity of lymph." Solingen, in 1693, reported two cases of "lymph fistulæ situated at the head of the soleus muscle, one consequent upon a wound, the other produced by contortion of the limb." Muys, in 1695, saw a young man who had been wounded in the left external malleolus, and from the wound "there flowed every day a vast quantity of water." Nuck, in 1733, wrote of wounds of the lymphatic vessels. "Very often," he says, "in venesection performed on the arm, and especially when performed on the foot, the absorbent vessels are injured; by carelessness in regard to these vessels the lancet has proved fatal." Van Swieten, in 1764, recorded the observation that frequently most abundant discharges of lymph followed venesection; and Haller, a few years later (1773), stated that he had known a "flux of lymph of such long continuance, and so difficult to arrest, that he could explain its existence only upon the supposition that a large vessel" had been severed in bloodletting. Mascagni and Assalini, in 1787, cited cases of lymphorrhagia following venesection; the latter mentions the case "of a boy, eleven years old, who lost five pints of lymph in three days from a slight wound located upon the internal part of the thigh." Soemmerring (1795) and Monro also recorded observations of discharges of lymph following slight wounds; and Schreger (1799) mentions an instance of lymph fistula following bloodletting in the foot.

[1] Read before the Association of American Physicians, Washington, September, 1889.

Soemmerring remarks that the healing of wounds on the instep, near the ankles and knees, on the back of the hands, near the bend of the elbows, and near all joints, is impeded by the continual dripping of lymph, and offers the explanation that, as the "absorbents about the joints are protected only by very thin skin and very little fat," the swelling and inflammation which ensue prevent contraction and compression of the incised vessels. In 1817, Nasse recorded several instances of lymph fistulæ caused by traumatic lesions of lymph vessels; in some of the cases he analyzed the fluid discharged and proved it to be lymph.[1] Since then lymph fistulæ from traumatism seem to have attracted but little attention, though quite a large number of cases of lymphorrhœa and lymphorrhagia, occurring in consequence of diseased conditions of some portion of the lymphatic system, have been carefully recorded.

Subsequent to the discovery of the chyliferæ of the dog by Aselli; of the lymphatics in the intestines of man by Gassendi; of the receptaculum and thoracic duct by Pecquet; and of the lymphatic trunks of the extremities by Rudbeck, and about the time when the works of Ruysch, Meckel, Hewson, Mascagni, Cruikshank, and Hunter appeared, there were reported very many cases of chronic ulcers with fistulous openings, from which a fluid was discharged which the observers believed to be lymph. Even as late as 1859, Binet maintained that neglected lesions of lymph vessels would give rise "to ulcers of the most rebellious character," and suggests that ulcers of the lower extremities very frequently owe their origin "to alterations of the lymphatic vessels." Such ulcers may be recognized, says Binet, "by the abundance of the matter excreted, compared to the extent of the ulcer; by the increase of the excreted fluid when gentle pressure is made from the extremity toward the lesion; by the exceptional difficulty in cicatrization, and by the nature of the excretion." During the same period—previous, however, to the publication of the investigations of Mascagni, Cruikshank, Hunter, and Hewson—there were also a number of cases of "milky discharges" recorded. These were evidently cases of copious, and, perhaps, somewhat modified, purulent secretions. The instance of "milky saliva" reported by Antonio Nuck,[2] and the case of "milky

[1] M. Nélaton has three times met with dilatation of lymph vessels at the fold of the elbow, on a level with the cicatrices of bleeding.

[2] "Practicus observed saliva evidently milky. For a woman, he says, nursing a child, again became pregnant, and therefore weaned the child. The right breast, from neglect, became like a large tumor, and on a certain night subsequently, while suffering much pain, she had an abundant discharge of milk from the mouth, with a corresponding decrease of the swelling in her breast. She swallowed the milk as it came into her mouth (without any inconvenience), which continued for four months."

"But it may be asked, how came the decrease in the breast? In my judgment in no other way than this, that the masses of the blood were laden with chyle, the particles of which could not permeate the lactiferous tubules of the mammæ on account of their

discharge from the cutaneous surface of the abdomen" reported by Rommel,[1] are the most authentic of these curious cases. Among these dubious cases may also be enumerated the case of Schurig,[2] of a milky discharge from a wound; the case of fistulous communication with cold abscesses or deep-seated suppurating glands;[3] from the uterus, by Dolæus;[4] from the tunica vaginalis;[5] and from the mucous membrane of the nose, by Richter.[6]

Assalini relates (Binet) having seen, during many months, discharged from the neighborhood of the umbilicus, in two women recently delivered, a fluid which he believed to be of lymphatic nature. Both women succumbed to puerperal accidents. When Assalini wrote (1787), the lymphatics were being studied, and it is probable that he accepted conclusions without verification, as did Soemmerring after him, who, perhaps, mistook various collections of pus for metastases of milk. Puzos,[7] whose conception of the pathology of puerperal diseases seems to have been limited to the supposed formation of depots of milk in various parts and tissues, reports several cases in which collections of milk were found in the abdominal cavity. In one instance he found a "gallon of coagulated milk," the patient having died of fever five days after delivery of a dead fœtus.

The view held by Puzos, and by others previous to his time, that milk was formed from the food of pregnant women and passed commingled with the blood throughout the system, being determined, during gestation, to the uterus to nourish the fœtus, and to the breast, after delivery, to nourish the infant, led very naturally to the conclusion that a superabundant supply or deficient consumption would eventuate in the formation of depots of milk in other localities.

collapsed condition, but formed a tumor in those nearest the mammary gland, especially since their arteries were filled and were not capable of removing any more. Indeed, the chylous and milky particles were abundantly distributed through the blood mass, and permeated the glandular structures, especially the salivary, which offered the least resistance. In the meantime, the blood, on account of its freer and quieter motion, propelled the chylous particles remaining in the breast toward the veins, and thus to the heart; hence it followed the breast was emptied." Sialographia, etc., Ductuum Aquosorum Anat. Nova. Lugduni Batavorum, 1695, p. 49.

[1] "A woman who was nursing twins began to complain, a few days after the death of one of them, of a sense of dull pain and tension beneath the ribs of the right side of the abdomen and over the umbilicus. This feeling was succeeded by stretching, the stretching by itching, and the itching by an exudation of fluid from the skin, the color, taste, and consistence of which were identical with milk, and which yielded a true butter on agitation." Ephemerides Germaniæ, decur ii., ann. viii.

[2] Parthenolopia, Dresden or Leipsig, 1729.

[3] Med. Essays and Obser., by a Society in Edinburgh, vol. 5, part 1, p, 328. 1747.

[4] Ephem. Germ., decur ij., ann. vj., obs. 76.

[5] Madras Quarterly Journ. Med. Sci., vol. 1, p. 180.

[6] Med. and Surg. Obser., Transl. Ed., 1744.

[7] Memoirs sur le lait ripander, on depots laiteux. New edition, Paris, 1801. P. 141.

It is probable that the cases of Bossu, Martin, and Milleret (7, 8, and 10) belong to this class of reports; nevertheless the case of "particular dropsy" first observed by Poncy in 1699, was undoubtedly a case of hydrops chylosus. The description of the morbid appearances presents so many conditions so closely analogous to those found in the case reported by Marshall Hughes in 1841 (17) that the apparent vague statements must be attributed to the imperfect knowledge of the reporter, rather than to his fancy.

Frequency.—The reported cases of effusion of chyle and milk-like fluids into the pleural and peritoneal cavities, including the doubtful cases, may not exceed sixty-three, and these reports cover a period beginning with Poncy's case in 1699 and terminating with the reports of the cases of Drs. Smith and Newcomb, of New York—one hundred and ninety years. Their infrequency relegates them to the category of pathological curiosities. Nevertheless, thirty-nine of the cases of effusion and collection of chyle and chyle-like fluids in the abdominal cavity have been observed during the present century; thirty-four of these cases since 1850, and twenty-seven during the last and present decades. The increasing frequency of occurrence is thus clearly shown. For whilst the more numerous reports during these decades may, in some measure, be due to more accurate observation and careful study of morbid anatomy, yet it is not probable that such remarkable cases would have escaped the observation of intelligent physicians at any period since the time of Poncy, Morton, Monro, Scherb, Percival, and Sandifort.

The increasing occurrence of the cases of effusion of milk-like and fatty fluids into serous cavities is more clearly shown by the numerous recent reports of cases of lymphocele by Manson, Lewis, and Sonsino and in this country by Mastin, Sr. and Jr., and Guitéras. Whether or not this fact is attributable to the more extended habitation and fruitful propagation of the intermediate host of the filaria sanguinis hominis now known to be constantly associated with, if not the cause of lymphuria and lymphocele, is a problem of great interest and graver import.

Effusion into the Pleural Cavities, Chylo-thorax.

There have been, including the doubtful cases, ten reports of cases of injury produced either by disease or accident, either of the thoracic duct or some of its larger affluent branches, in the thorax, sufficient to emit fluid in quantities incompatible with vigorous health, and certainly endangering life, if not causing death. In five of these cases, the chyle poured directly from the duct, in one of which (Bassius) the aperture in the walls of the vessel was not suspected until discovered at the autopsy In the cases of Hoffman, Guiffart, Bonet, and Quincke the rupture of the duct was the result of external violence. The case of the learned mathematician, reported by Hoffman, was probably a case of empyema,

and the case of the Baron de Heinden, reported by Bonet, who was injured by a missile in the battle of Fionensis, is doubtful, though Bartholinus, to whom the details of the case were communicated, expressed the opinion that the thoracic duct was injured. In Curling's case the lymph concretion, which occupied the right pleural cavity, was discovered in the body of a patient whose right lower extremity had been amputated at the hip-joint, ten months before his death, for malignant disease of the thigh. The concretion consisted of "softened and degenerated lymph." There was no evidence of malignant disease or "secondary deposits in any of the organs." In the cases of Rokitansky and Ormerod (see 23 and 25 of tabulated statement) chyle was found in the pleural and peritoneal cavities; in the former the effusion was the result of obstructed heart circulation, and in the latter the result of the interruption of the blood current in the left subclavian vein. In two of the cases reported by Quincke (28 and 29) chylous fluid was found in the pleural and peritoneal cavities, though the post-mortem examination determines the cases as one of "effusion of chyle into the peritoneal cavity," and the other an "effusion of chyle into the right pleural cavity." In both cases the anatomical lesions were clearly made out; in one the duct was lacerated within the thorax, and in the other, chyle retention was caused by inflammatory thickening of both folds of the mesentery. Some of the lacteals were completely, others partially occluded. The chyle vessels were injected exactly to the union of the intestines with the mesentery. The flow of chyle was impeded, engorgement of the vessels ensued, and rupture occurred. But how explain the presence of chyle in the peritoneal cavity in Case 29 and in the pleural cavity in Case 28? In each instance the phenomenon is perhaps partially explicable upon the hypothesis that portions of the effused fluid traversed the lymph vessels of the diaphragm. In the case of Pelletier, the chylothorax and chylous ascites were associated with a milky diarrhœa and the vomiting of a milky fluid.

The cases in which fatty and oily fluids, other than chyle, have been found in the pleural cavities have not been included in this collection of cases of chylothorax. A number of such cases have been reported by Herard, Bacelli, Guéneau de Mussy, Quincke, Debove, and others. Quincke characterizes such fluids as effusions of chyle; Guéneau de Mussy as altered pus; and Debove as chyliform fluids, but specific effusions distinct from serous, purulent, or serofibrinous exudations. The clinical histories and morbid appearances associate such cases with tuberculosis and cancer, and determine the inflammatory nature of the exudate. In none of these cases has there been discovered any solution of continuity of chyle or lymph vessels.

With the exception of the cases of Rokitansky, Ormerod, and one of Quincke, all the cases of effusion of chyle into the pleural cavities belong

to a class of casualties which do not admit of any generalization, and are only instructive in suggesting the occurrence of an improbable contingency, which may happen under circumstances very various.

The diagnosis of chylothorax cannot be made except by evacuation and examination of the fluid. In Quincke's case of injury by crushing of the chest wall, the effusion was not suspected until discovered by aspiration of the fluid. The prominent symptoms in such cases are dyspnœa and the accumulation of fluid in one or both cavities. In a single instance chyle was discharged drop by drop through a puncture in the chest wall. The prognosis is unfavorable and the treatment expectant.

Effusion of Chyle-like or Milky Fluid into the Cavity of the Tunica Vaginalis Testis: Galactocele, Chylous Hydrocele, Chylocele, Lymphocele, Milky Hydrocele, Lymphous Hydrocele, Filarial Hydrocele.

The case of galactocele reported by Vidal (de Cassis) seems to have been the first observation of this class of effusions. Ruthnum's case of hydrocele, "with contents simulating chylous urine," was published in 1864; and Ferguson's case of "milky fluid from the tunica vaginalis" in 1865. Neither of these cases attracted any special attention, and their reporters seem to have regarded them as curiosities. In Vidal's case the fluid consisted of water, a substance resembling albumen, sugar, chloride of sodium, traces of lime, and numerous globules having the appearance of the globules of butter. In Ruthnum's the fluid looked like milk, and in Ferguson's case it consisted of a colorless fluid in which floated very many globules and a number of minute and large cells not unlike colostrum corpuscles. In each case the fluid coagulated spontaneously. Neither Ruthnum nor Ferguson refers to the case of Vidal, and probably did not know that Lebert, as early as 1855, had suggested that the case of Vidal was nothing more than the rupture of a "lymphatic varix into the cavity of the tunica vaginalis."

Previous to these reports varices had been frequently observed in the superficial and deep-seated integumentary lymphatic vessels and plexuses, but very rarely, if at all, in the capillaries and plexuses of the serous membranes. Morton, in 1689, and Mascagni, in 1787, observed varices of the pulmonary lymphatics; Caldani, in 1761, described a varix of the lymph vessels of the heart; Wathen, in 1787, and Sandifort, in 1780, recorded cases of dilatation of the lymph vessels of the small intestine. In the latter case the varix resulted from obstruction of the lacteals, caused by intussusception. Soemmerring observed the dilatation of the lymphatics of the duodenum and of the intestines in herniæ. He also refers to instances in which he had seen the lymphatic vessels of the liver and spleen "filled with a whitish material," and Lebert asserts

that he had frequently observed dilated lymphatics on the surfaces of the liver and lungs. Schreger and Tilesius saw a case of dilatation of the lymph vessels of the conjunctivæ.

The fourth case in chronological order was reported by C. H. Mastin (1874), of Mobile, and to him is due the credit of verifying the suggestions of Lebert. After an examination of a specimen of the fluid obtained at the first tapping, I called the attention of Dr. Mastin to this suggestion, and in his second operation in April, 1875, he "opened the sac freely for a distance of two or three inches" and discovered, at the upper portion of the membrane, where it begins to be reflected over the testis, "a granular-looking mass," which having been snipped off was recognized by him to be the "patulous mouths of three or four small vessels," which he believed were "portions of lymph vessels." In 1881, in a similar case, Dr. W. M. Mastin practised the same procedure and discovered a varix similarly located, but when cut off showed the patulous orifice of only a single vessel, from which lymph exuded. Specimens of fluid from both of these cases were carefully examined by Dr. James Tyson, who described them as comparable to chyle in their chemical and physical characters, and expressed the belief that they found exit into the sac through rupture of a lymph vessel.

These two observations made by our own countrymen, in the city of Mobile, seemed to have established the nature of lymphocele. But, in the meantime, Lewis had discovered the filaria sanguinis hominis, and quite a number of cases of lymphocele, lymphuria, and elephantoid diseases had been reported by Manson, Lewis, Sonsino, and others, in which this parasite was recognized as the probable, if not the constant and positive cause. In this country, since the beginning of 1885, there have been reported thirteen cases in which the filaria were found, two of which were cases of lymphocele. The first in 1886 by Guitéras, in the city of Charleston, and the other in 1888 by Mastin, in the city of Mobile. Manson ascribes elephantoid diseases to embolism of lymphatic glands by the ova of the filaria, stasis, and consequent regurgitation of lymph. If this be true, it is not improbable that the varicose and ruptured lymph vessels of the tunica vaginalis in cases of lymphocele are the result of gland obstruction produced by similar emboli. It has not been shown, however, that filaria are present in every case of lymphocele. It is conceivable that adenitis, gonorrhœal lymphangitis, or other conditions which obliterate the permeability of neighboring and connecting glands might cause stasis of lymph and dilatation and rupture of lymph capillaries and plexuses, with which the serous membranes are so richly supplied. Vidal vaguely hinted that a previous gonorrhœa was the cause in his case; and Mastin, in a review of the previous cases, assumed, in 1883, that chylocele was due to "obstructed gonorrhœal lymphangitis." Since the discovery of the filaria in the third

case occurring in Mobile, he has modified his opinion, and hints at a classification of causes into filarial and inflammatory obstruction of lymph-glands. Sonsino asserts that the theory of mechanical obstruction caused by the adult worm in the lymphatic channels, with all its consequences, as lymphangitis, lymphatic dilatations, rupture, and consequent lymph extravasation or external lymphorrhagia "is sufficient to explain all the morbid disorders or diseases which have been associated with the worm, and may be originated by it, as lymphuria and lymphocele." The matured opinion of those who have had the best opportunities of studying the relation of the filaria to diseases in general seems to accept the statement of Sir Joseph Fayrer that "it has been shown that disorders of the lymphatic system are most frequently associated with, if not caused by, the filaria." Guitéras asserts that "manifestations of filarial disease may all be included under the head of disturbances of the lymphatic circulation." This view meets with opposition from Rake, who failed to find filaria in cases of elephantiasis and chyluria examined by him in Trinidad.

The chemical and physical properties of the fluid emitted in lymphocele characterize it as a pathological product. Simple dilatation and rupture of a lymph channel, plexus, or space would not necessarily give exit to a fluid so rich in fat and other products.

The recent invasion of portions of the sub-tropical belt of this country by the filaria, and reports of cases of disease with which the parasite has been so uniformly associated, together with the fact that the mosquito has been proven to be its intermediate host, present considerations of the highest importance to the profession and general public.

The diagnosis of lymphocele depends upon the ordinary symptoms of hydrocele and opacity of the tumor, but the character of the fluid can only be ascertained by observation and chemical and microscopical examination. Vidal noted the absence of translucency. It may be that the general symptomatology of filarial disease coexisting with the collection of fluid in the tunica vaginalis might suffice to determine the presence of parasitic lymphocele, but neither of the cases observed in Mobile seems to have presented such a clinical picture and history. The case cited by Guitéras was associated with commencing elephantiasis of the scrotum.

Ruthnum cured his case by injections of iodine. Mastin dissected back the varix for a short distance and "tied the bundle *en masse*, with a small and very strong silk ligature." Mastin, Jr., practised the same procedure. In both cases the cure was complete.

CHYLOUS, CHYLIFORM, AND OILY ASCITES. [HYDROPS CHYLOSUS: HYDROPS ADIPOSUS.]

The accompanying tabulated statement, arranged chronologically, presents a brief and condensed summary of the reports of the cases of chylous and oily ascites. A rigid analysis would exclude many from the category of chylous ascites. The cases of Bossu, Martin, Milleret, and Sandifort, which occurred in puerperal women, are so closely allied to the views of Puzos, previously referred to, that they must be accepted *cum grano salis*. In two of the cases there was no extravasation into the peritoneal cavity, one of which was a chylous cyst of the mesentery, and the other a case of chyle retention in the chyle vessels of the mesentery. In several of the cases (18, 19, 21, 27, and 34) the fluid was more oily than chylous and coexisted with tuberculous peritonitis, which would more properly characterize the fluid as a morbid exudation than an effusion of chyle. In three of these five cases the ascites was ascribed to obstructed pulmonary circulation, one of which (18) had suffered for a long time with chronic bronchitis, with "purulent expectoration containing tuberculous concretions;" another (27) suffered for several years with scrofulous affections and died of pulmonary tuberculosis; and the third (21) died of pulmonary and peritoneal tuberculosis. Excluding the puerperal and tuberculous cases, together with the two in which no extravasation was found in the peritoneal cavity (50 and 53), the cases of chylous ascites proper will not exceed twenty-eight. In Case 37, Prof. Winiwarter ascribed the intra-abdominal effusion to "congenital occlusion of the thoracic duct, formation of a compound cystic tumor through distention of the lacteals at the root of the mesentery by obstructed chyle, rupture of one of the cysts before or during birth, persistency of this solution of continuity, and increasing effusion of chyle." In twenty-seven cases the rupture of some chyle-conveying vessels seems to be clearly established.

Etiology.—Age is an unimportant element of causation. The ages of the twenty-eight cases vary between birth and sixty-two years. Fifteen were females, the oldest sixty-two and the youngest at birth. The ages of the eleven males ranged between two and sixty-one years. If the puerperal and tubercular cases be included, sex assumes a more important etiological relation, and the proportion would be two females to one male. Race, climate, occupation, and circumstances of life are without influence. Hereditary and acquired tendency to diseases of the lymphatic system, and especially disease of the walls of the thoracic duct and receptaculum chyli, which are very rare and mainly limited to tuberculous infiltrations and ossific changes, demand mention as primary conditions which may facilitate the rupture of the walls of chyle-conveying vessels; syphilis may also. Primary rupture occurred in but five of the cases. In one

Cases of Chylous, Chyliform, and Oily Ascites arranged Chronologically.

No.	Reporter.	Date.	Where reported.	Sex.	Age.	Causative conditions.	Treatment.	Results.
1	Poncy, Jr.[1]	1699	Saviard, Observations in Surgery, trans. by Surgion, p. 247 Lond.	F.	18	Obstruction of lymph glands and vessels.	Medicines and tapping,	Died.
2	R. Morton,[2]	1705	Morton's Phthisiologia, Lib. i., chap. x.	M.	2	Compression of duct, near subclavian vein, by large tumors behind "trachea arteria," producing rupture of lacteals.	Tapping.	Died.
3	Littré,	1710	Mém. de l'Acad. des Sci.	F.	7	Enlarged and chalky mesenteric glands.	Not stated.	Died.
4	Chomel,	1728	Mém. de l'Acad. des Sci.	F.	24	Rupture at umbilicus third day after confinement, with discharge of five pints of milky fluid; supposed rupture of abdominal lymphatics.	Counter-opening.	Recovered.
5	J. G. Scherb,	1729	Haller, Dissertatio Abmorborum, vol. iii. p, 237.	M.	39	Calculus in receptaculum chyli.	Tapping.	Died.
6	Donald Monro,[2]	1765	Essay on Dropsy.	F.	...	Effort to "raise a burthen."	Tapping.	
7	Bossu,	1770	Journ. de Méd. Chir. Pharm., xxxiv. p. 283.	F.	...	Metastasis of mammary secretion during first week of puerperium.	Tapping, purgatives, and resolvent applications to abdomen.	Recovered.
8	Martin,	1770	Journ. de Méd. Chir. Pharm., xxx. p 555.	F.	...	Metrorrhagia; miscarriage; unusual exercise.	Tapping	Recovered.
9	Targioni, cited by Bianchi,[3]	1771	Lo Sperimentale, lvii. p. 78, 1886.	F.	21	Obstinate chlorosis; imperfect chylification due to pressure of lymphatics by enlarged spleen.	Tapping, purgatives, deobstruents, corroborants, diuretics, cardiac tonics, mercury.	Recovered.
10	Milleret,	1774	Journ. de Méd. Chir. Pharm., xlii. p. 237.	F.	39	Arrest of secretion from mammary glands and intestinal canal.	Spontaneous discharge at umbilicus, and tonics.	Recovered.
11	Joseph Lieutard,	1779	Historia Anatomica Medica, t. i. p. 257.	...	7	Mesentery cirrhosed and filled with a whitish, chalky substance; large quantity of milky or chylous fluid in abdominal cavity.	Not stated.	Died
12	Lossium, cited by Lieutard,	1779	Historia Anatomica Medica, t. i. p. 257.	...	Child	"Abdominal cavity filled with a milky fluid, evidently derived from ruptured chyliferous vessels."	Not stated.	Died.
13	Ed. Sandifort,	1781	Observ. Anat. Patholog., Ludg. Bat., iv. 1–21, 3 pl.	F.	...	Following premature birth of twins at seven months. Sandifort reports another case of lacteal metastasis to abdominal cavity.	Effusion only discovered at autopsy.	Died.
14	Percival,[2]	1788	Essays, Med., Physiol., and Exp., ii. p. 177.	F.	8	Rupture of lacteals.	Tapping.	Recovered.
15	Weaver,	1814	Med., Surg., and Pharm. Repos., ii. p. 377.	M.	...	Protracted illness, supposed to be liver disease,	Mercurials and other medicines.	Died.
16	Truman Abell,	1833	Boston Medical and Surgical Journal, vii. p. 13.	F.	...	Abdominal tumor following pregnancy with twins.	Spontaneous rupture at umbilicus with discharge.	Died.

[1] First tapped by Poncy July 2, 1699. Died in 1770, after twenty-second tapping; amount of fluid withdrawn 285 French pints.
[2] Essay on Dropsy and its Species, by Monro, third ed., p. 22. London, 1765.
[3] Bianchi cites three cases from Méhu, but without details; probably cases of chyliform ascites.

No.	Reporter.	Date.	Where reported.	Sex.	Age.	Causative conditions.	Treatment.	Results.
17	Hughes,	1841	Guy's Hospital Reports, v. p. 297.	M.	30	Tumor of agglomerated mesenteric glands; numerous lacteals were large, tortuous, varicose, and distended with milky or clear fluid.	Not stated.	Died.
18	Van Camp,	1843	Ann. Soc. de Méd. de Anvers, ii. p. 86.	M.	59	Chronic bronchitis, asthma, tuberculosis.	Not stated.	Died.
19	J. Popham,	1854	Dublin Quarterly Journal of Medicine, xvii. p. 467.	F.	28	Chronic peritonitis, with fat in the effusion; fatty degeneration of liver; free fat in blood; fatty contents of both ovaries combined with hair and bony matter.	Not stated.	Died.
20	M. Lorain,	1859	Compt. Rend. Soc. de Biol., Par 2, s. v. 162.	F.	8	Symptoms analogous to those of tubercular peritonitis; numerous tubercles in lungs.	Not stated	Died.
21	T. Stevenson,	1860	Guy's Hospital Reports, 3 s., xvii. p. 231.	...	...	Report refers only to the composition of two specimens of milky fluid obtained from abdomen in two cases.	Not stated.	
22	Oppolzer,	1861	Allg. Wien. med. Zeitung, S. 149.	F.	42	Mitral and tricuspid insufficiency; thoracic duct plugged at outlet with pale and red fibrous coagula; walls thickened; lumen dilated with thrombi.	Not stated.	Died.
23	Rokitansky,	1861	Patholog. Anatomy, Bd. ii. S. 388.	F.	6	Dilatation of heart; thickening and shortening of mitral valve; occlusion of thoracic duct with soapy material.	Not stated.	Died.
24	W. Cayley,	1866	Trans. Path. Soc. Lond., xvii. p. 163.	M.	19	Fibrinous vegetations attached to intima of subclavian vein; partial obliteration of thoracic duct near its outlet; rupture of receptaculum.	Not stated.	Died.
25	Ormerod,	1868	Trans. Path. Soc. Lond., xix. p. 199.	M.	24	Left subclavian and its affluent branches plugged with a light colored and ragged clot.	Tapping.	Died.
26	Hoppe-Seyler,	1873	Arch. Gesammte Phys., vii. p. 407.	...	...	Rupture of chyle vessels from pressure of a tumor.	Not stated.	
27	Bergeret,	1873	Journ. d'Anatomie, t. ix. p. 585.	F.	27	Scrofula; pulmonary tubercle; oily ascites.	Not stated.	Died.
28	Quincke,	1875	Archiv f. klin. Med., Bd. xvi. S. 128.	F.	30	Flow of chyle obstructed by inflammatory thickening of folds of mesentery and transformation of adipose into connective tissue	Tapping.	Died.
29	Quincke,	1875	Archiv f. klin. Med., Bd. xvi. S. 121.	M.	50	Run over by a wagon. Rupture of thoracic duct; effusion into peritoneal and pleural cavities.	Tapping.	Died.
30	Quincke,	1875	Archiv f. klin. Med., Bd. xvi. S. 121.	F.	33	Primary cancer of peritoneum; fluid containing fat globules and fat cells; hydrops adiposus.	Not stated.	Died.
31	Quincke,	1875	Archiv f. klin. Med., Bd. xvi. S. 121.	F.	10	Scrofulous glands, and tuberculosis; fluid milky and fatty; hydrops adiposus.	Not stated.	Died
32	Friedreich, cited by Quincke,	1875	Archiv f. klin. Med., Bd. xvi S. 121.	F.	12	Scrofula and miliary tubercle; milky fluid, with fat and fatty cells; hydrops adiposus	Not stated	Died.
33	Pelletier,	1875	Journ. de Méd. Chir. Pharm., lxiii p. 496.	F.	...	Chylous fluid vomited; also found in peritoneal and pleural cavities.	Tapping.	Recovered.
34	Wilhelm,	1875	Corres.-Blat. d. Aerztlichen Vereine d. Rhen prov., No. 14, p 13.	...	2 mos.	Abdominal tumor firmly attached to spinal column in umbilical region; rupture of thoracic duct.	Tapping, first at two months.	Died.
35	Ballman,	1876	Centralbl. f. d. med. Wissensch., xiv., p. 274.	F.	39	Peritoneum closely studded with tubercle.	Tapping.	

No.	Reporter.	Date.	Where reported.	Sex.	Age.	Causative conditions.	Treatment.	Results.
36	F. Winckel,	1876	Archiv f. klin. Med., Bd. xvii. S 303.	F.	39	Puncture of chyle vessels by parasites. Had lived in Surinam.	Tapping; lived four years.	
37	Winiwarter,	1877	Jahrbuch. f. d. Kinderheilkunde, v. xi. Nos. 1, 2, and 3.	F.	Birth	Rupture of chylous cyst; probable occlusion of thoracic duct and dilatation of lacteals.	Careful alimentation and tapping.	
38	Kein,	1881–2	Mém. Soc. de Méd. de Strassburg, xix. 2, 52, 57.	F.	50	Rupture of mesenteric and intestinal lacteals.	Tapping, each time four gallons of milky fluid.	
39	Smidt, with permission of Guttman,	1881–2	Zeitschrift f. klin. Med., p. 199	M.	11	Chronic idiopathic peritonitis.	Tapping.	Died.
40	Veil,	1882	Paris Thèse, 21.	F.	25	Syphilitic gummata of liver; fluid chylous and rich in fat globules with few leucocytes.	Not stated.	Died.
41	Gaucher, cited by Veil,	1882	Paris Thèse, 21.	M.	47	Cirrhosis of liver; milky and containing fat.	Not stated.	Died
42	Gaucher, cited by Veil,	1882	Paris Thèse, 21.	M.	39	Hard drinker; cirrhosis of liver; fluid first two tappings ordinary, afterward milky and fatty.	Not stated.	Died.
43	Gaucher, cited by Veil,	1882	Paris Thèse, 21.	...	11	Sarcoma of omentum and mesentery; enlarged and degenerated mesenteric glands. Thoracic duct normal.	Not stated.	Died.
44	Whitla,	1883	Brit. Med. Journ., vol. i. p. 1089, 1885.	M.	13	Peritoneum and pleuræ studded with miliary tubercle; liver and lungs infiltrated with miliary granulations; mesenteric gland enlarged, forming tumor; thoracic duct occluded at middle third, dilated at lower third, with perforation at lowest part; receptaculum dilated and perforated.	Tapping; 117½ pints withdrawn in three months	Died.
45	F. Nickerson,	1884	Mass. Med. Soc., June, 1884.	M.	56	Chylous cyst; probably continuous hard labor.	Tapping.	Recovered.
46	Lettule,	1884	Revue de Méd., iv. p. 723.	M.	3 mos.	Congenital cardiopathy and chronic peritonitis, with cough; probably syphilis.	Tapping and digitalis.	Improved.
47	Lettule,	1885	Revue de Méd., iv. p. 900.	M.	8	Rheumatism involving heart; enlarged liver and spleen; fluid milky, containing granules, leucocytes, and fat globules.	Not stated.	Died.
48	Strauss,	1886	Arch. de Physiolog. et Patholog.	M.	61	Peritoneal cancer, perforation of chyle vessels on anterior surface of mesentery.	Tapping; diet of milk and butter.	Died.
49	P. J. Murphy,	1886	Pamphlet.	F.	19	Violence; long and fatiguing walks and dancing.	Laparotomy.	Recovered.
50	N B. Carson,	1889	Medical News, lv. p. 52.	M.	39	Chylous cyst of mesentery.	Laparotomy and removal of cyst	Recovered.
51	Stephen Smith,	1889	Personal communication.	M.	9	General health fair; no cause discovered, 28 pints of fluid evacuated in 21 days; rich in lymph cells, few blood corpuscles, slightly acid; specific gravity 1015.	Tapping and drainage tube.	Under observation
52	J. E. Newcomb,	1889	Personal communication.	M	2	Previous health good; no cause discovered; fluid milky, containing lymph cells.	Tapping.	Under observation.
53	Weichselbaum,[1]	.....	Virch. Archiv, lxiv. p. 145.	M.	89	No extravasation, but stasis of chyle in the chyle vessels of the mesentery and hypertrophy of the interposed adipose tissue.	Discovered at autopsy.	Died.

[1] Case of chylangioma cavernosum.

(6) the cause was "an effort to raise a burthen;" in two (45 and 49) muscular effort; one vomiting; and one violence inflicted upon the chest. In eleven cases the rupture or perforation was demonstrated, and in sixteen others the character of the fluid left no doubt of its escape from a chyle-conveying vessel.

Chylous ascites may be the secondary result of a variety of morbid conditions which directly or remotely obstruct the flow of the chyle through the lacteals, receptaculum, or thoracic duct, impede its exit into the left subclavian vein, or retard the current of blood in the left subclavian vein, right side of the heart, or lesser circulation. Such obstruction may be caused by anatomical defects and anomalies of position and distribution of the chyle vessels, by dilatation or stenosis, and such disease of the coats of these channels as would lessen their expansibility and tensile strength; by disease of the mesentery, hypertrophy, cavernous and fibroid transformation of its adipose tissue; by indurated, degenerated, and impermeable mesenteric glands, embolism, and deposits of bony, chalky, gelatinous, and soapy material in the channels; compression by inflammatory adhesion or by thoracic, abdominal, and aneurismal tumors. In one case it was ascribed to the presence of the filaria.

Dilated chyliferous lymphatics are quite often observed in the mesentery. The usual cause (Zeigler) is obstruction due to inflammatory or neoplastic growths located in the mesentery or thoracic duct. Sometimes the obstruction is due to lymph thrombosis. The dilated vessels look like straight cylindrical ridges, or convoluted, saccular, or beaded cords; their contents are either white and limpid or pulpy and caseous.

In three cases (5, 24, and 43) the aperture through which the chyle escaped was found in the wall of the receptaculum; in one the perforation resulted from ossification of its wall and filling of the cavity with a bony concretion; and in No. 24, in consequence of stenosis of the thoracic duct, near its outlet. In five cases (1, 2, 14, 17, and 28), and probably in 23 and 26, the rupture took place in the lacteals. In four of these cases, and in the cases of Hoppe-Seyler, Abell, and Wilhelm (16, 26, and 34)—in which no post-mortem examination was made, abdominal tumors were discovered, either by inspection of the cadaver or by palpation during life. In two cases the thoracic duct was compressed by tumors located near its entrance into the left subclavian vein. These tumors were usually glandular, and consisted of hypertrophied and degenerated bronchial or mesenteric glands coexisting, in two instances, with cancerous formations.

In Cases 23 and 25, the chylous effusion into the peritoneal cavity was attributed to interrupted venous blood current in the subclavian and innominate veins; and in Cases 2, 17, and 24 to stenosis of the thoracic duct at or near its entrance into the left subclavian vein.

Clinical[1] observations seem to have established the causal relation of interrupted blood current in the large veins near the heart to lymph stasis and effusion of chyle into the peritoneal cavity, and the experiments of Cooper, Morton, Dupuytren, and others demonstrate that complete arrest or interruption of the current of the fluid in the thoracic duct, at or near its terminal extremity, will, if the anastomotic circulation is not speedily and sufficiently established, produce distention, dilatation, and repletion sufficient to cause rupture, which most frequently takes place in the receptaculum or lacteals. Clinical and post-mortem observations are even more conclusive than experimentation, for they connect directly the process of gradual occlusion of the duct by disease with the concurrent development of a diffuse area of lymphangiectasia, which in some cases terminated in rupture and extravasation. In this connection may be cited the cases of Rokitansky, Ormerod, Morton, Hughes, and Cayley enumerated in the tabulated statement, and other cases which I have collated in a contribution to the AMERICAN JOURNAL OF THE MEDICAL SCIENCES, vol. xc. p. 373.

The force exerted upon the contents of the thoracic duct by the passing current of blood in the subclavian vein is nothing more than an illustration of the hydraulic principle of Venturi, but the explanation of the relation of cause and effect between cardiac disturbances and lymph stasis and chyle effusion must, in a general way, be sought in the varying conditions of blood pressure. Niemeyer[2] asserts that "obstructive engorgement of the great veins extends to the thoracic duct," and Hertz says an over-distended left subclavian vein will not permit the adequate emptying of the thoracic duct.[3]

The relation of the puerperal conditions to the effusion of chyle are not susceptible of explanation. The theory of metastasis of the secretion of the mammary glands is untenable. In Sandifort's case the uterus and vagina were lined by a pseudo-membrane, which was not detachable; in Martin's case the evacuated fluid resembled whey; in Milleret's case the fluid was at first white, "of the consistency of clear bouillon," afterward gelatinous and offensive, and, finally, soap-like and odorless. Subsequently the patient suffered with lymphatic engorgement of the lower extremities and lumbar region, but finally regained her health. In the case reported by Bossu the secretion of milk was so abundant that applications were made to suppress it, which were entirely successful; then followed the accumulation of milky fluid in the abdomen, which having been evacuated, "the milk returned to the breast," and no reaccumulation followed. Three of these four patients recovered. The occurrence

[1] Busey: The Causal Relation of Obstructed Cardiac Circulation to Lymph Stasis. AMERICAN JOURNAL OF THE MEDICAL SCIENCES, vol. xc. p. 373.

[2] Text-book of Practical Medicine, vol. i. p. 120.

[3] Ziemssen's Cyclop., vol. v. p. 382.

of lymphatic œdema in Case 10 is the only circumstance in the clinical reports of these cases suggestive of such a diagnosis, but it is insufficient to justify the classification of the case in the category of chylous ascites. The case reported by Chomel is analogous to the case of Truman Abell, and is worthy of a more favorable consideration. "A puerperal woman, aged twenty-four years, after suffering for several days with a swelled, tender, and painful abdomen, was suddenly awakened during the night by the pouring out of a milky fluid through a rupture of the umbilicus. Five pints of fluid were lost." Chomel ascribed the accumulation of fluid in the abdominal cavity to rupture of lymphatic vessels.

Pelletier's patient (33) was seized with chylous vomiting and diarrhœa, and a chylous fluid was withdrawn by tapping from the pleural and peritoneal cavities. This case was reported in 1875, at a period when a mistake in diagnosis ought not to have been made; nevertheless, the causal relation of the vomiting and diarrhœa to the extravasation of a similar fluid into the serous cavities is not apparent. Sprague reports a "fatal case of vomiting of a chyle-like fluid," but there was no effusion into either of the serous cavities. Chyle may be vomited and discharged *per anum*, and it is not impossible that in rare instances the effort at vomiting might rupture some chyle-conveying vessel.

In nine cases the fluid found in the peritoneal cavity was associated with tuberculosis, in four of which it is distinctly stated that the peritoneum was more or less studded with tubercle. The fluid in these cases was very rich in fat, albumen, and chlorides. Perforation or rupture of a chyle-conveying vessel was discovered in two of the cases. They were reported as cases of milky or oily ascites, and their clinical histories picture the ordinary symptomatology of either pulmonary or peritoneal tuberculosis.

In some of the cases of chyliform ascites, in which no solution of continuity of chyle and lymph channels could be discovered, the fluid consisted of an inflammatory product mixed with lymph and chyle. In such cases the chyle and lymph must have escaped by transudation. This conclusion is the more probable in view of the facts that in some of these cases the changed condition of the coats of the vessels was such, together with the partial or complete obliteration of the lumen of the thoracic duct or smaller channels, either by the thickening of their walls or by the lodgement of morbid products, that transudation of lymph and chyle might take place in quantities sufficient to impart to the coexisting inflammatory product characteristics easily distinguished by the ordinary methods of physical, chemical, and microscopical examinations.

In another form of chyliform ascites, as for instance the cases of Whitla and Straus, in which the fluid was not unlike that found in the cases above referred to, but containing a larger proportion of chyle and lymph, the admixture of chyle and an inflammatory product was clearly

demonstrated by the coexistence of tuberculous peritonitis or cancer, and the discovery of one or more perforations in the walls of the chyle or lymph vessels, through which chyle and lymph escaped. In several of such cases there was also discovered more or less obstruction to the flow of chyle through the thoracic duct, and, consequently, increased pressure in the receptaculum, lacteals, and lower part of the duct, where rupture almost always take place.

In that form of chyliform ascites more properly and usually denominated adipose or oily ascites, in which the lymph and chyle channels, lymph-glands, lacteals, and mesentery are intact and free from disease, distention, pressure, or obstruction, and normal in structure, size, and position, which must exclude the effusion of lymph or chyle by transudation or escape through solution of continuity in any part of the lymph system, the milky, fatty, chyle-like, and opalescent fluid must necessarily be a morbid product. The fluid in this class of cases varies somewhat in appearance, but more markedly in the proportions of fatty matter. Guéneau de Mussy asserts that all such cases are simply cases of chronic tuberculous, cancerous, or neo-membranous peritonitis, which is probably true, with, perhaps, a single exception. That exception refers to the case of Guttman, reported by Smidt, in which the cause is ascribed to a "chronic idiopathic peritonitis."

Whilst, therefore, in most cases of chylous and in some cases of chyliform ascites, there is either rupture or perforation of a chyle-conveying channel, transudation through attenuated, diseased, and degenerated walls cannot be excluded as a cause. In the chyliform varieties transudation is the most frequent and important element of causation, because of the more constant presence of morbid conditions of the walls of such channels.

It must, then, be admitted that these forms of ascites are more frequently due to some lesion of the lymphatics than to any other cause. Nevertheless it is true that ascitic fluid may be milky or chylous in appearance without containing any chyle or lymph. Letulle and Guéneau de Mussy believe that the lactescent color of such fluids is due to the fatty degeneration of the white blood-corpuscles.

Symptomatology and Diagnosis.—The symptomatology of effusion of chyle into the peritoneal cavity is not sufficiently distinctive to differentiate such cases from those of ordinary ascites. Wounds of chyle-conveying channels might be diagnosticated by the location and direction of a stab or puncture, in connection with the escape of chyle into the pleural or peritoneal cavities or externally through the aperture, or its evacuation. As such effusion can only occur through transudation or solution of continuity, its escape externally, or presence in either cavity, must be essential for differential diagnosis. If no fluid escapes externally, then only the symptoms of a fluid accumulation in the cavity are present,

the character of which must be ascertained by evacuation and examination.

The quantity of chyle which may escape by transudation through the walls of normal vessels is small, and the accumulation is neither rapid nor continuous. When it escapes through an aperture in the walls of some channel the opposite conditions are present. Hence an effusion of chyle might be suspected when a rapid accumulation of fluid in the peritoneal cavity should be associated with sudden loss of appetite, acute emaciation and anæmia, rapid prostration, diminished secretion of urine, and the presence of such conditions as would suggest occlusion, stenosis, or compression of the thoracic duct, or arrest of the exit of the chyle into the subclavian vein. The gradual, partial, and progressive compression of the thoracic duct has been frequently determined by the location of a tumor, associated with evidence of blood impoverishment. In uncomplicated cases due to rupture (Cases 6, 48, 49), "the patient, usually after exertion (Murphy), is suddenly seized with sharp, localized pain, followed by swelling of the abdomen," anuria, anorexia, nausea, and, possibly, vomiting. In most cases the symptoms are complicated with those of the causative condition, and a diagnosis is only possible by an examination of the evacuated fluid. In no instance has a diagnosis been made previous to observation of the fluid.

In the chyliform varieties the symptomatology is even more variable, because of the presence of the symptoms of the concomitant visceral lesion.

In some cases of suspected leakage of chyle the diagnosis may be verified by experimental feeding. In Poncy's case the odor of some articles of diet was recognized in the evacuated fluid; and in the case reported by Straus the proportion of fat in the fluid more than doubled during the exclusive milk and butter diet.

Prognosis.—Of the 53 tabulated cases, 33 died, 10 recovered, and in 7 cases the result is not stated. 3 of the puerperal cases recovered, and all the tubercular cases died. Of the 10 recoveries, 8 were females and 2 were males. Of the 28 cases of chylous ascites proper, 15 died, 6 recovered, and in 5 cases the result is not stated. Of the 5 recoveries, 4 were females and 2 males. In whatever aspect the cases may be considered, the prognosis is unfavorable. The larger number of cases were females, and the larger proportion of recoveries were of the same sex. The female sex, therefore, exhibits greater liability to, and a greater probability of recovery from, chylous ascites than the male. In view, however, of the nature of the causative lesions—perforation or rupture of a chyle-conveying channel—the proportion of recoveries is remarkable.

Bianchi says the prognosis is more grave when the extravasation is due to some chronic lesion of the chyliferous vessels than when it is due

to a rupture of the thoracic duct, for the escape of lymph favors the union of the edges of the wound and the closure of the latter by thrombi. It is even more grave when the rupture of the vessel is due to abnormal distention caused by some obstacle because the process of healing is interfered with. The gravity of the prognosis is increased when there are concomitant visceral lesions. The immediate prognosis is perhaps more grave in chylous ascites than in the chyliform. The more extensive the lesion of chyliferous vessels, and the larger the wounded or diseased vessel, the greater the facility of the reproduction of the ascites, and the more rapid and progressive the emaciation.

There is no instance of the preservation of the life of an animal beyond a limited number of days, in which the communication of the lymphatic with the venous system had been completely and permanently obliterated. The wound inflicted by ligation of the thoracic duct could not have caused the death of the animal experimented upon, for in a number of cases it healed by the first intention; neither could death be attributed to the rupture, either of the thoracic duct, lacteals, or receptaculum, nor to the extravasation of chyle or lymph into the pleural or peritoneal cavities, or into the cellular tissue about the abdominal viscera, for death took place in those cases in which neither of these conditions complicated the ligation of the duct, as it did in those in which one or more of these conditions supervened. When the animals, in cases of experimental ligation of the duct, recovered, the current of chyle and lymph was reëstablished through anastomosis. Monro inflicted a wound in the receptaculum chyli of a pig, from which it apparently recovered, but effusion was arrested by a coagulum. Lower ruptured the thoracic duct of a dog; the animal died after languishing a few days, and two pounds of chyle were found in the right pleural cavity. Bartholini mentions a case in which the thoracic duct was wounded, and the patient lived a long time —"longa fuit tabes." Goodlad refers to the case of a man who was wounded in the duct, who seemed nearly cured, but finally died.

The clinical and post-mortem cases, in which the communication between the venous and lymphatic systems was either partially obstructed or wholly obliterated, are not very numerous; and many of the reports are simple statements of bare facts, wanting in the particulars necessary to demonstrate the effect of obstructed conditions of the duct and lacteals upon the duration of life. Meagre and unsatisfactory as these clinical details are, they, nevertheless, point to two conclusions: 1st, that a free and unobstructed channel of communication between the venous system and chyle-conveying vessels is essential to the proper nutrition of the body and preservation of life; and 2d, that death following the partial or complete obliteration of this communication is the result of inanition. The gradual wasting of the body and progressive debility which so markedly characterize the clinical cases in which the flow of chyle, either through

the duct or anastomosing connections, was insufficient for the maintenance of the normal standard of nutrition, more decisively point to innutrition as the cause of death than the sudden exhaustion which follows the abrupt arrest of the flow of chyle and lymph toward the blood. In the experimental and traumatic cases there may be the superadded element of violence, but this cannot be a potential influence, for it has been proven that in every instance of experimental obliteration of the communication in which death occurred, no anastomosing connection could be discovered, and in every case in which life was preserved, where proper methods were adopted to eliminate all doubt, such anastomosing connections were found. The causative condition must, undoubtedly, influence the duration of life, but without the loss of chyle it would, as, for instance, in cases of compression of the channel by a benign tumor, not be very significant.

Clinical reports furnish many cases which illustrate the direct relation, as cause and effect, which subsists between copious losses of lymph and chyle and the marked depression, dulness, and exhaustion which invariably succeed abundant lymphorrhagiæ; and which, likewise, follow artificial occlusion of the thoracic duct, and so distinctly characterize the brief after-life of the animal thus permanently deprived of nutritive material. With but rare exceptions, the cases of copious loss of lymph have been attended with great exhaustion. The latter class may by rest, arrest of the lymphorrhagiæ, and proper alimentation recuperate, to suffer again and, perhaps, many recurrences, similar in course, duration, and effect; but copious and continuous loss of chyle is inevitably fatal.

Cooper records the observation that young dogs experimented on by him lived longer than the old, and the lean much longer than the fat. In the clinical cases the average age of the fatal cases was thirty-one years, and in those who recovered it was twenty-four years, but the cases are too few, in which the ages are given, to attach any value, as an element of prognosis, to a difference of seven years.

It is not possible to establish any constant and direct relation between the appetite and the obliteration, perforation, or rupture of the chyle-conveying channels. It lacks uniformity—sometimes diminished, sometimes variable, and again voracious, even in the same patient, but is uniformly associated with progressive emaciation, quite often with fever of the hectic type, and gastro-intestinal disorder with white and chalky stools. In the case of chylous ascites reported by Poncy, from July 16, 1699, to March 4, 1700, the date of his death, 289 French pints of fluid had been drawn in twenty-two tappings. The evacuated fluid was always chylous, and frequently emitted the odor of articles of diet. In this patient there were progressive emaciation and waste of all the tissues of the body.

Nature of the Effused Fluid.

In most of the cases of effusion into the pleural and peritoneal cavities the fluid was chyle, which had escaped from chyle-conveying channels. In the cases of lymphocele, it was altered lymph, consequent upon pathological processes affecting primarily the lymph vascular system. In the cases of milk-like, fatty, and oily fluid found in the peritoneal cavity the character of the fluid was the result of coexisting degenerative processes. Quincke, Friedreich, and Klebs have reported cases of adipose or fatty dropsy connected with peritoneal and mesenteric cancer. In some of the cases, especially so in the puerperal, the naked-eye observation of the milky appearance of the fluid was the only circumstance upon which its chylous nature was based. In several of the tubercular cases the analysis established its fatty and oily character, but did not prove it to be chyle. Bergeret's case of oily ascites was associated with suppurating glands; in Hughes's case "cerebriform cancer" was present; and in one of Quincke's cases a cancerous nodule developed in the subcutaneous tissue at the point where the puncture was made to evacuate the fluid. In several of the cases abdominal tumors were found, but their nature was not determined.

The fluid in lymphocele is lymph, in rare instances but slightly altered, containing more water and less corpuscular element, but usually, and especially in the parasitic variety, so changed as to be comparable to chyle. It varies in color from that of ordinary lymph to a canary-yellow, but most frequently is a milky, chylous, opalescent fluid, and always possessing the property of spontaneous coagulation.

In either of the classes of effusion the fluid may contain blood, cholesterine, more or less of the common serous exudation, and some inflammatory product. The chylous effusions are rich in solid matter, albumen, fatty matters, chloride of sodium, and sometimes contain bile, sugar, phosphoric acid, lime, and other undetermined substances, also pus and blood. They are either chyle with moderate admixture of extraneous elements, or chyle-like with more or less chyle dilution with peritoneal effusion and lymph.

The appearance and chemical and microscopical composition of the fluid in chyle and chylous effusions are easily understood, but why the fluid in lymphocele and other lymphorrhagiæ, or found contained, either in a fluid or partially coagulated condition, in lymph-cysts, sacs, or developments, should so uniformly exhibit the appearances and physical and chemical properties of chyle, is not so susceptible of explanation. Numerous observations and analyses have been made of the fluids emitted in cases of lymphorrhœa and lymphorrhagia, and, with rare exceptions, it has been characterized as an opalescent, lacteous, or chylous fluid, rich in lymph-cells, albumin, and fatty matters, coagulating quickly and spontaneously. In all such cases lymph-stasis was the single condition

uniformly present, and the alterations in the constitution of the lymph consisted chiefly in an increased proportion of fibrin, the addition of numerous cell elements, not unlike endothelial cells, white blood-corpuscles, occasionally red blood-corpuscles, lymphoid cells, granular matters, a varying quantity of albumen, and fat.

Various theories have been suggested in explanation of this transformation of lymph. The theory of chyle regurgitation is altogether untenable. Buchanan maintains that the explanation of the white fibro-serous discharges must be sought "in the morbid activity of the multitude of epithelial cells, the function of which had become perverted," by which the fatty matter was eliminated from the blood. Petters offers the theory that the chyle-like fluids are due to fatty degeneration of the endothelium and other formed elements, and in the decomposition of protein substances, which processes are brought about by lymph-stasis. Carter insists that the fluid was chyle flowing in a retrograde current from the lacteals through vessels defective in anatomical construction and directly connected with enlarged lymph glands. Fetzer suggested the absorption by the lymph vessels of the fat tissue of contiguous parts. Roberts held that the structures which produced these discharges "were anatomically related to the lacteal and lymphatic tissues, which, in consequence of hypertrophic development, had acquired "the property and functions of the cells lining the lacteal ducts and glands." Sédillot attributed the milky appearance of the fluid in Vidal's case to the presence of an infinite number of zoösperms, but their presence has been disproven; and Gosselin expressed the belief that it was produced by a combination of the cholesterine and fatty constituents, but cholesterine has been but rarely found in such discharges. In view of the fact that the collections and discharges of such milk-like or chyle-like lymphous fluids are so generally, if not always, associated with thrombosis, narrowing, dilatation, or occlusion of lymph channels, and lymph-stasis, the conclusion seems inevitable that they are pathological products.

The fluid in cases of fatty and oily ascites, associated with cancerous or tubercular diseases of the peritoneum or other abdominal viscera, is not necessarily a product of such morbid conditions, for in such cases the disease may invade the lymph and chyle vessels, and cause rupture or perforation. Perforations were found in the cases reported by Whitla and Straus; in the former the peritoneum was studded with tubercles, and in the latter it was cancerous. In Guttman's case the oily fluid was apparently the product of a chronic idiopathic peritonitis. In all cases in which the thoracic duct, lacteals, or lymph vessels are diseased the presumption is in favor of perforation and escape of chyle and lymph into the cavity. In a few cases complicated with peritoneal or visceral tuberculosis or carcinoma, the lymph and chyle vessels were normal. In such cases Debove maintains that fat is formed in the peritoneal cavity.

Treatment of Chylous Ascites.

In twenty-three of the fifty-three tabulated cases tapping was practised, and, in most of the cases, repeated several times. Six of these recovered. In two cases laparotomy was resorted to, with recovery of both patients. One was a case of an intact retention-cyst, and the other was, probably, a ruptured cyst. In the case of congenital cyst recovery took place after several tappings. In two of the cases of recovery, rupture of the umbilicus occurred with spontaneous evacuation of the fluid. The frequent resort to paracentesis was manifestly due to mistaken diagnosis. As a medical resource its value is questionable. The peritoneum is an enormous absorbing surface, which, in cases of moderate effusion unaccompanied with tension of the abdominal walls, might prove adequate for the reabsorption of the effused chyle and lymph. In cases of large accumulation, with its consecutive disturbances of the circulation and respiration, relief of the distention by the evacuation of fluid would be imperative, but it does not seem wise to empty the cavity completely of a nutritive fluid absorbable through such a vast area of lymphatic apparatus.

The treatment has mainly been directed to the prolongation of life, and Murphy suggests that in "cases due to rupture of a chyle-duct it should be rest in bed, with light diet of such foods as are digested and absorbed by the stomach, . . . given in small quantities at short intervals, and a restricted quantity of water and other liquids, the object being to prevent distention of the ruptured ends of the lacteals and the formation of a coagulum." This, together with a general tonic plan of treatment, has, apparently, proven successful in at least two cases, and has certainly prolonged life in other cases.

The causative condition may, in some cases, be amenable to medicinal treatment; but in most cases, especially in those in which the effusion is attributable to the pressure of a benign tumor, some surgical procedure might offer a prospect of cure. In case of chylous cyst (50) removal is certainly justifiable.

In filarial cases the treatment applicable to such would be admissible. Guitéras asserts that patients "with filaria can hope for no permanent relief, except in the death of the adult worm. This happens occasionally, but cannot be brought about by treatment." Sonsino thinks some good may be accomplished in filarial diseases by the employment of astringents, such as gallic acid and the tincture of the chloride of iron, together with rest, tonics, and proper alimentation, but that alimentation must not be pushed to the point of repletion and distention of the lymphatic vessels.

Lancereaux asserts that filariosis, a term which he applies to the parasitic forms of lymphatic diseases, is curable, though it may last for some

time. He has found mercurial inunction in the region of the affected glands of service, in connection with hydropathy, and suggests the injection of parasiticides into the affected lymphatic ganglia to destroy the female adult worm. He, as do others, asserts that removal from the source of infection may result in spontaneous cure.

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