oxygen was increased to 30 per cent. This amount of carbonic acid is 6 per cent. more than that found after colliery explosions in which complete combustion has taken place.

THE TREATMENT OF ASCITES BY ABDOMINAL COMPRESSION.

By STEPHEN MACKENZIE, M.D.,

Assistant-Physician to the London Hospital.

THERE are numerous ways of treating the ascites dependent upon contraction of the liver. Alteratives, drastics, diuretics, tonics, compelling the patient to satiate his thirst from his peritoneal cavity, simply keeping the patient at rest in bed, all have their advocates, and are plans under which I, as every other physician, have seen good results in even unpromising cases. Every now and then, however, under any of these plans of treatment, alone or in combination, the peritoneal effusion remains stationary, and its removal becomes tedious. I have found that, in cases where there is any tendency to absorption, this may be greatly accelerated by a simple method—that of abdominal pressure—to be described, and that in cases in which absorption does not appear to be taking place the same plan is often successful in removing the fluid. I have employed this treatment in several cases, with such good results, that it encourages me to hope that others will find it useful. Perhaps I can best illustrate the plan of treatment I have found so successful in some cases of ascites, by narrating the first case in which I put it into operation.

E. S., aged 41, widow, was admitted into the London Hospital under my care on January 16th, 1875. The patient stated that she had not been thoroughly well since her last confinement, nineteen years previously. About one year before admission, in January, she noticed that her waistbands became tight. She attached no importance to the occurrence, however, at first. In February and March, she found that she was passing extremely small quantities of urine. In May, the size of the abdomen was much increased, and its "weight" inconvenienced her when she moved about. The enlargement of the abdomen increased rapidly up to June, when she attended at another hospital as an out-patient. She then measured forty-two inches round the largest part of the abdomen. She attended for three months, and during that time increased in size, and continued to increase in size to the end of September, at about, she thinks, the rate of "an inch a month". Since September, the increase had been less marked, but had slowly continued, until coming under treatment. She had only passed very small quantities of urine. She was the mother of two children, and had miscarried once, owing, she thought, to a strain. There was nothing in her history to support the diagnosis of syphilis; no intemperance could be elicited on close questioning. She had never had jaundice. When admitted, I noted that the patient was much emaciated, but was not decidedly cachectic. The abdomen was greatly distended, of ovoid shape, tense, with extremely distinct fluctuation-wave. The circumference of the abdomen at the umbilicus was forty-six inches, and the same two inches higher. Medium-sized superficial veins were seen coursing over the abdominal walls from below upwards, as could be demonstrated by pressure. There were no veins passing downwards to the thighs; the umbilicus protruded slightly. There was oedema of the lower extremities, from the thighs to the feet, especially on the left side. There was a small patch of discoloration on the inner aspect of the left leg, which, she stated, had been in existence for five years. It came as a small speck of the same colour, and has gradually increased to its present size. There was no history of injury to the part; no nodes. Hepatic dulness in the right mammary line was bounded by the upper border of the fourth rib. Here and in the axilla it was about two inches in extent, and posteriorly on a level with the twelfth dorsal spine, it was four inches deep. The chest organs were pushed up, but presented no noteworthy signs. Vaginal examination showed the uterus and anterior wall of the vagina depressed (cystocele).

On January 22nd, the patient's expression was anxious. She complained of difficulty of breathing, and her respiration was seen to be embarrassed. There was a slight herpetic eruption around the mouth; the patient had not been observed to have a rigor since her admission, but was suffering from catarrh when she came. The bowels had acted daily; the motions were solid and of good colour. She passed about fifty-five ounces of urine *per diem*. It was of an orange colour, free from albumen and bile-pigment. She was ordered to take five-grain doses of iodide of potassium thrice daily.

January 26th. The patient had a less anxious expression, but still looked haggard and as if she were the subject of abdominal disease. The average quantity of urine was about seventy ounces *per diem*.

Her breathing was easier, but entirely thoracic. The measurement of the abdomen at the same point as before was forty-five and a quarter inches. The legs were less swollen than on admission.

February 2nd. Whilst the patient expressed herself as better, and appeared cheerful, she looked more haggard and pinched in the face, and had dark areolæ around the eyes. The sister stated that she began to sleep with her eyes open. The abdomen had considerably diminished in size, was quite lax, and fell over to the side on which she lay. It was forty-two and five-eighths inches in circumference at the level of the umbilicus. The superficial veins were not so distended. She took all the nourishment supplied to her.

February 12th. The patient appeared better. The iodine appeared to be producing toxic effects. She had an acnoid eruption on the face, and had watering and smarting of the conjunctivæ, running at the nose, and soreness of the mouth. She was ordered to discontinue the iodide of potassium, and to take a mixture containing citrate of iron and quinine.

February 23rd. The patient looked and expressed herself as better. She slept and ate well; she passed from fifty to sixty ounces of urine daily, which had a specific gravity of 1,016 to 1,020, and was free from albumen. The largest measurement of the abdomen was now thirty-nine and a half inches. The oedema had wholly disappeared from the legs.

March 30th. The patient's general condition was improved. The abdomen now measured thirty-six inches; its summit was about three-quarters of an inch above the level of the sternum, and it was flat on the surface. The edge of the liver could now be felt three inches below the point of the xiphoid cartilage. No irregularities could be felt on the surface of the liver.

May 11th. The condition of the patient appeared stationary. There was still a considerable amount of fluid in the peritoneal cavity. She passed about forty ounces of urine in the course of the twenty-four hours. *The abdomen was ordered to be tightly bound with a flannel bandage, so as to exercise pressure.*

June 4th. When the bandage was first applied to the abdomen the pressure caused a feeling of sickness, but soon the patient bore it without discomfort; in fact, it appeared to afford her relief. The measurement around the abdomen, at the level of the umbilicus, was now thirty-three inches. She passed about thirty to forty ounces of urine daily, and did not perspire much. I now ordered a properly made abdominal support to be constructed for her by the instrument-maker. It was arranged with straps, so that it could be tightened to a very considerable degree.

June 29th. The patient expressed herself, and appeared to be, in good general health, but she was still much wasted. The abdomen looked much smaller, and measured thirty-one and a half inches at the level of the umbilicus. There was pseudo-fluctuation on percussion, but it did not convey the impression of being due to fluid. The liver could be felt in the same situation as before. Its surface was smooth, its edge firm, sharp, and regular. The spleen was not to be felt in the abdomen. Its dulness reached the seventh rib in the axillary line. She passed, on an average, fifty to sixty ounces of normal urine daily. She ate and slept well. She was now allowed to get up, but was directed to continue wearing the abdominal support. The latter, owing to the diminution of the size of the abdomen, had required to be altered. After being up in the ward for a few days, the patient was allowed to go into the garden; and there then being no reaccumulation of fluid in the abdomen, she was made an out-patient. This was in July 1875. The patient has been continually under my observation from then until now. She has had no recurrence of the ascites. Her general condition of health is feeble, but she is able to do her household work and earn her living. Unusual exertion causes slight oedema of the feet. She has never had albuminuria.

Another case where equally good results followed, is the following. A. T., aged 46, married, was admitted into the London Hospital under my care September 3rd, 1875. She was quite well until two years before admission, when her feet began to swell. The catamenia, hitherto regular, at this time ceased. After the feet had been swollen two or three months, the abdomen began to swell; and it became so large that she came into the hospital eighteen months ago. She remained in the hospital three months, and during this time was twice tapped. On returning home, the swelling increased again, and she was again tapped. After this, the fluid again accumulated; she was readmitted into the hospital and tapped again. She improved, and continued as an out-patient until about eight weeks before her present admission, when her abdomen began to swell again, and it gradually increased, until she came into the hospital. There was nothing in her history to suggest syphilis; no excessive indulgence in alcohol could be elicited. The patient was a stout person, with injected cheeks, puffy face, watery and glistening conjunctivæ. The cardiac dulness could not

be mapped out; the impulse was indistinct; the sounds were natural; the lungs were normal, except for slight emphysema. The abdomen was much distended, of spherical form, rising three or four inches above the level of the sternum, and measured forty-seven and a half inches in circumference at the umbilicus. Fluctuation was distinct; the superficial abdominal veins were somewhat distended. The liver-dulness appeared to reach the lower border of the fourth rib, in the right mammary line. Neither liver nor spleen could be felt in the abdomen. There was slight pitting on pressure over the legs. The urine was scanty, acid, of specific gravity 1.012, free from albumen. The temperature, pulse, and respiration were normal. The abdomen was directed to be bandaged with a wide flannel roller. She was ordered to take *mistura rubra*, one ounce, three times a day.

November 15th. The ascites was considerably diminished. The abdominal walls were quite flaccid and thin. The liver-dulness did not extend two fingers-breadth in the right mammary line. The general condition was improved.

December 6th. The abdomen was greatly diminished in size; it was flaccid and pendulous. There was no distinct fluctuation wave now, but there was dulness in both flanks, whilst the summit of the abdomen was resonant. There was still slight pitting over the feet and legs. She was directed to continue the abdominal pressure.

December 20th. The patient was now up; the abdomen had not enlarged since she had left her bed. There was no oedema of the feet. She still had the kidney look observed on admission. For the last two months, she had passed, on an average, sixty-five ounces of urine daily, of pale colour, specific gravity varying between 1.010 and 1.015, and, though repeatedly examined, it had never contained albumen. The patient was now allowed to go home and attend as an out-patient. Whilst she continued under observation there was no recurrence of the ascites. The only medicine she took throughout her residence in the hospital was the *mistura rubra* of the *London Hospital Pharmacopæia* (burnt sugar and water).

It will be seen that in the first case alluded to the ascites was very great, and the vital condition of the patient brought very low from mal-assimilation. The appearance of the leg, with the absence of any history of intemperance (the latter not a very valuable indication in the case of a woman, it is true), suggested the possibility of syphilis causing the disease of liver which gives rise to the ascites. Without adopting this view, I thought it right to give the patient the advantage of the doubt, and accordingly administered iodide of potassium until the patient was fully under its influence. The ascites certainly diminished during the time the patient was taking the drug, but the diminution continued, it will be observed, when it was replaced by some quinine and iron, given as a general tonic, and was, no doubt, due to the rest in bed. I cannot ascribe any specific action to the iodide of potassium, therefore, and the patient never subsequently had any symptoms suggestive even of syphilis. Between March and May, it will be noticed, the patient made no progress. Her dropsy remained stationary. She passed at this time about forty ounces of urine daily. The idea suggested itself to me, as it had often previously, that the absorption which took place when the patient first came under treatment was due in great measure to the pressure of the greatly distended, tense, abdominal walls opening up the collateral channels of the portal circulation—the previously existing communications between the branches of the portal vein and the tributaries of the superior and inferior venæ cavæ, and the new system of vessels developed in the augmented connective tissue of the liver, and in the adhesions formed by this organ.* When a certain amount of fluid had become absorbed, the abdominal walls became flaccid, and no longer exercised pressure on the portal system sufficient to drive the blood through devious and narrow conduits. It occurred to me to imitate the natural process by which absorption had, it seemed, been brought about in the first instance, and to the failure of which the arrest of the absorption appeared attributable. Hence I endeavoured by a bandage to convert the lax yielding abdominal wall into a tense elastic and resisting one. The employment of a properly constructed abdominal support was only a more convenient and efficacious method of applying the necessary pressure. The result was highly encouraging. The bandage and support certainly squeezed the fluid out of the peritoneal cavity, and it was carried out of the body, without loss to the system of any albumen, by means of the kidneys. The result was a cure of the portal obstruction. It is now nearly three years since the patient left the hospital, and I have had her frequently under my observation. There has been absolutely no recurrence of the ascites. Equally satisfactory was the effect of the same treatment in the second case I have given—a case from its

antecedents far from a promising one—and here the mechanical treatment was uncomplicated by the action of drugs. I may add I have had as good results in other cases.

Hitherto I have not tried abdominal compression in increasing ascitic effusions. It has seemed to me that the abdominal walls offered as much opposition to the pouring out of fluid as it would be safe to call into play, and that a greater strain on the vessels might lead to their rupture—effects we not unfrequently witness in cirrhosis, as hæmatemesis and hæmorrhage from the bowels. It is, however, quite possible that the obstacle offered to the effusion from the portal veins may be safely augmented to such a degree as to force open the anastomoses of the portal vein, and, by thus effectually carrying off the blood brought to the liver, to cure the disease. I use the word cure advisedly, as fibrosis of the liver in the main kills the patient by the secondary effects of the mechanical obstruction of the portal circulation. A person can get along, by management, with half a liver. In contraction of the liver, if the blood which cannot traverse the organ be efficiently carried off by other routes, and is not lost to the system, enough blood may yet pass through the liver to enable this large gland to perform its varied and important functions for all ordinary needs of the body. So far as I know, the plan of abdominal compression has not been recommended for cases of ascites, though I make no claim for its novelty. It has proved useful in my hands, and, I believe, will be found serviceable in causing or accelerating the absorption of an ascites, alone or in conjunction with other methods of treatment.

TWO CASES OF POISONING BY PHOSPHORUS.

By FREDERICK W. WILLMORE, M.R.C.S.Eng., Walsall.

THE recent case of death from this poison, narrated in the JOURNAL by Surgeon-Major Martin, induces me to record two of a similar nature which have been lately under my own observation, and which present several features of interest. Two young girls, L. C. and M. H., aged respectively sixteen and fourteen years, took between them, on the evening of March 25th ult., a small potful of phosphorus-paste, containing about half-an-ounce. Vomiting, with abdominal pain, rapidly came on, yet no advice was sought for until the afternoon of Friday the 29th. I was then asked to see the sufferers, being told "that they had taken poison on Monday, in consequence of slighted affection, and that they were still lingering". In compliance with this quaint request, I at once saw the patients. Both presented symptoms of grave depression; the vomiting still recurred occasionally; there was no diarrhoea, but the whole abdominal region was greatly distended, painful, and tender. The breath and vomited matter smelt strongly of the poison, and the skin and conjunctivæ were both deeply yellow. Severe frontal headache was complained of, and the act of swallowing was attended with considerable difficulty and pain. The pulse was thready and easily compressed—in the elder girl 135; in the younger 98. From the first, the case of the former patient gave most cause for anxiety, and I ascertained that she had taken the larger amount of the poison. A small quantity of food and mucus, obtained from the stomach of M. H., and submitted to Mitscherlich's test, gave distinct evidence of the presence of phosphorus. The bowels having been gently cleared, small doses of morphia were given, with the effect of relieving the pain and vomiting. The case of L. C., however, rapidly became worse, the prostration more marked, and drowsiness and convulsions terminated her life on March 31st, eight days after taking her fatal meal.

On Tuesday, April 2nd, fifty-six hours after death, I made a careful examination of the body, of which the following is an abridged report. The stomach and bowels were greatly distended with flatus; the inner coat showing, over nearly its whole area, traces of recent inflammation, but destitute of any erosion. In the stomach itself was found a small quantity of black grumous material, with a distinct odour of phosphorus. The liver, though normal in size, presented changes of a striking character. It was of a dull yellow colour, its borders quite black, the dark rim varying from the eighth of an inch to nearly an inch in depth. Its under surface also presented black patches, contrasting strangely with the yellow body of the organ. This dark appearance seemed limited to the capsule, and did not extend to the parenchyma. The tissue itself was abnormally yellow, soft, and friable, and under the microscope its ordinary characters were quite indistinguishable. The gall-bladder was almost empty. The spleen contained a small cystic tumour, but was otherwise of the usual size and appearance. The cerebral membranes, and more especially the pia mater, were deeply hyperæmic, and the arachnoid space was filled with a considerable amount of effused fluid. The brain-substance was

* Frerichs, *Disease of the Liver* (New Sydenham Society's translation), vol. ii, page 29.