

however, be under no apprehension of any inconvenience from this, as the difference of the blood pressure within the pulmonary artery and the aorta is so great (83.3 mm. Hg. in the one and 250 mm. Hg. in the other), that the circulation through the former would be completely blocked long before any appreciable compression could be exerted on the latter. Indeed, in order that the pulmonary artery may be sufficiently constricted to give rise to a murmur during the ventricular systole, it is necessary to suppose that there is a minimum pressure within the left auricle, during its diastole, greater than that within the pulmonary artery at its maximum. But it is so obviously impossible that the circulation could be carried on under these conditions, that I need not say that this hypothetical cause of a pulmonary murmur is absolutely untenable.

To conclude, I may say that I agree with Dr Russell when he says that hæmic bruits, "murmurs of debility," are always due to a dilated heart. I also think it possible that we may now and then meet with cases with a short *appendix auriculi*. In those cases I would, however, expect the primary murmur to be heard in the classic position, in the first place at all events, though no doubt it would be almost simultaneously audible in the pulmonary artery and in the tricuspid area. But I have never seen any case of this kind, and they must be extremely rare. I regret that, for the reasons already stated, I cannot agree with any of the other opinions Dr Russell has advanced. They display, to use his own expression, a flight of imagination which, though it does not transcend, is at least equal to anything of the kind I am acquainted with in connexion with cardiac pathology.

ARTICLE II.—*A Case of Diabetic Coma with Lipæmia*. By Professor THOMAS R. FRASER, M.D., and J. R. LOGAN, M.B. and C.M.
(Read before the Medico-Chirurgical Society of Edinburgh, 1st February 1882).

SINCE the important paper communicated to the *Edinburgh Medical Journal* in July 1879 by Professor Sanders and Dr Hamilton, very few additional facts have been recorded to confirm their theory that the fatal dyspnœa and coma of diabetes are due to lipæmia and fat embolism. With the exception of the cases they have described, the evidence bearing on this termination of diabetes consists of two cases mentioned by Dr Gamgee, and one by Dr Foster of Birmingham, which do not altogether support the theory, and of a case published by Dr Starr of Philadelphia, in which, on the other hand, the theory is amply confirmed by the demonstration of post-mortem appearances very closely resembling those described by Sanders and Hamilton. The statement of Dr Babington in 1836, that the blood in diabetes is at times specially characterized by its milk-like appearance, may also be regarded as

confirmatory evidence. The absence of a greater amount of confirmatory evidence—which has induced one of the most recent writers on diabetes to state that the data in favour of the theory are yet too few to make its acceptance justifiable—may find an explanation in the unusual occurrence of fatal dyspnoea and coma in cases of diabetes, or in the fact that fatal cases of diabetes may present these symptoms unassociated with the concurrence of lipæmia and fatty embolism.

As such cases have been recorded, it becomes of importance to add to the limited evidence now existing in favour of the view that lipæmia and fatty embolism may occur in some of the cases in which diabetes terminates with symptoms of dyspnoea and coma. It is for this purpose that we place on record the following case. It has, besides, a special interest in the fact that a demonstration was made during the life of the patient of the occurrence of an excess of fat in the blood, coinciding with the existence of coma and dyspnoea.

R. M., aged 35, a boot-closer, was admitted into Ward XXIII. of the Infirmary on the 7th of November 1880, with the symptoms of diabetes mellitus. Six months before admission he had noticed that he required to urinate more frequently than before, and very soon afterwards he suffered from thirst, pain in the back, and sleeplessness. He obtained advice at the Richmond Street Dispensary, and improved under the treatment that was prescribed; but a fortnight before his admission to the Infirmary he caught cold, and relapsed into his former condition of weakness.

He is married, and has had seven children, four of whom are alive. There is no history of diabetes in any of his near relations. He has been always steady in his habits, and his occupation required him to be at work for ten or eleven hours daily.

At the detailed examination made on the 12th of November it was noted that the patient is a man 5 ft. 5 inches in height, with a pallid complexion, and somewhat emaciated, as he now weighs 8 stone, whereas his usual weight was 9 stone.

The skin is generally dry, but sometimes moist with perspiration. Teeth in pretty good condition. Tongue with a slight gray fur. Has an acid taste, and on examining the reaction of the buccal fluid it was found to be strongly acid. Has a constant thirst, which leads him to drink about eight pints of liquid daily. His appetite is good, but by no means ravenous, and he suffers from heartburn and flatulence after meals. The bowels are rather constipated. The condition of the abdomen and of the liver and spleen was found to be normal. He did not suffer from cough nor dyspnoea, the respiratory movements occurred about twenty-two times in the minute, and physical examination of the lungs revealed no abnormality. The pulse was small and soft, but not frequent, and the second sound of the heart was reduplicated at the base.

He suffers from slight dimness of vision, the cause of which was

not ascertained further than that the existence of cataract was excluded. The other special senses and the central and peripheral nervous systems were functionally in a healthy state.

Micturition is frequent and unaccompanied with pain or any difficulty. Has recently passed from 200 to 270 ounces of urine in the twenty-four hours, and since his admission it has been of a straw colour, with a slightly sweet odour, an average specific gravity of 1036, containing an average of 21 ounces daily of glucose, and being free from albumen. Deep pressure over the right kidney causes a little pain. For the last six months patient has lost his sexual power.

On the following day (13th of November) patient commenced an ordinary diabetic dietary.

On the 30th of November he took, in addition, five grains of carbonate of lithia twice a day, which was continued until the 6th of March 1881; and during all that time he was, with a few exceptions, able to go about during the day, and frequently left the hospital for some hours to visit his family, who resided in town. The quantity of urine which he voided became considerably lessened, and his weight steadily though slowly increased, so that he regained his former weight of nine stone. The elimination of glucose was materially affected. Under dietetic treatment alone, it became reduced from the previous amount of 21 oz. in the twenty-four hours to 19 oz. on the 9th November, and 18·48 oz. on the 12th of November; and during treatment with carbonate of lithia, it was still further reduced to 12·5 oz. on the 18th of December, and 8·8 oz. on the 6th of March.

On the 6th of March the treatment with carbonate of lithia was stopped, and in its place the patient received three phosphorus pills daily, each containing only 1-50th of a grain of phosphorus. As some diarrhœa occasionally occurred, the administration of phosphorus was every now and then interrupted for a day or two at a time; but with these exceptions it was continued until the 5th of April. During this period the quantity of urine became still further lessened, and occasionally amounted to less than 100 ounces in twenty-four hours.

Early in April the patient was exposed to cold, and on the 6th of that month the feet became œdematous, and the morning temperature rose to 100°·8. The amount of urine passed in the twenty-four hours fell to 82 ounces. It contained a trace of albumen and only 6¼ ounces of sugar. Some bronchitis, also, was found to be present. He was confined to bed and treated with external applications and the subcutaneous injection of 1-6th of a grain of nitrate of pilocarpine. On the 9th of April the œdema had disappeared, and 100 ounces of urine were voided, which, however, still contained albumen.

Early in the morning of the 10th of April—probably at some time between 3 and 5 A.M.—patient suddenly experienced great

difficulty in breathing, with a feeling of so severe oppression that he said "he could have lain down and died." The night-nurse gave him a little whisky; but as his condition did not improve, the house physician, Dr Logan, was sent for at 8 A.M. He found the patient lying in bed in the ordinary recumbent posture, which had been maintained since the urgent symptoms appeared. He was breathing rapidly—34 times in the minute. The face and hands had a dusky, cyanotic hue. The breath had no very distinct odour, but it was somewhat ethereal, its character being marked by the odour of the whisky which had been given to the patient. The pupils were equal and rather small. The patient spoke slowly and a little indistinctly, and appeared to have an imperfect recollection of events that occurred a few hours previously. The pulse was weak, small, easily compressed, and at the rate of 154 per minute.

A little blood was removed from the finger. Its naked-eye appearance was peculiar. It was apparently quite as thick as normal blood, but was whiter in colour, presenting an appearance such as might have resulted from mixing together equal quantities of blood and cream. When examined with the microscope, it appeared totally disorganized, no proper cells being at first visible, but a granular appearance occupied the whole field. In a short time, however, hæmocytes were detected, presenting their usual shape, colour, number, and arrangement; for although many of the hæmocytes lay detached on their sides, there were many well-formed though small rouleaux. In some cases the hæmocytes were marked by clear spots which seemed like nuclei, but were evidently oil globules. The leucocytes appeared more numerous than in normal blood, and a few of them were coarsely granular. Between, and occasionally around, the cells there was an immense number of granules and globules densely packed together, varying in size from a mere speck to bodies as large as a red cell, and presenting the usual refractile appearance of oil globules. There were also a few other bodies of the same size and looking like decolorized red cells. The addition of osmic acid stained the larger refractile granules of a dark green colour, but had no marked effect on the smaller granules.

The patient received, by subcutaneous injection, ℥ss. of ether at 8.15, which was repeated every hour, and also frequent doses of carbonate of ammonia and whisky by the mouth.

At 9 A.M. he was perspiring freely, and in a semi-comatose condition, but was still suffering from dyspnoea.

At 10 A.M. breathing was attended with less effort. The thorax was resonant in front, expiration was prolonged and bronchial in character, and there were no accompaniments. Behind, at both sides, there was dulness on percussion and a few crepitations.

At 10.45 dyspnoea was less urgent; the pulse was slightly stronger, at the rate of 142 per minute; the extremities were cold,

and the patient quite comatose. He died at 11.30 A.M., or about seven hours after the commencement of the urgent symptoms.

Some hours before death an examination was made by Dr Gowers's apparatus of the number of hæmocytes and leucocytes. The former were found to number 5,680,000, and the latter 16,000, in the cubic millimetre.

The post-mortem examination was made on the following day by Dr Hamilton. Height 5 feet 4 inches; circumference at shoulders, $37\frac{3}{4}$ inches. Body well nourished. Rigor well marked, and lividity moderate in amount.

When the heart was exposed the coronary vessels were found to present a remarkable appearance, due to milk-white emboli of large size and considerable length, which gave many of the vessels the appearance of having been injected with plaster of Paris. The organ was flabby and anæmic, but otherwise healthy. The right side was loosely filled with pink blood, which, after removal, presented on its upper surface a thick white stratum. Similar characters were presented by the blood from the left side, though not so decidedly. The blood in both venæ cavæ had the same characters as that in the right side of the heart. Floating in the blood were numbers of white clots. Both pleural cavities were dry.

Between the upper lobes of the left lung there was a round patch, about the size of a five-shilling piece, of a milk-white appearance, and apparently situated in the substance of the pleura. On being incised, a substance like milk escaped from it. The lung contained a large quantity of pink blood, which became brighter pink on exposure. The right lung was in a similar condition.

The liver was not enlarged. Its substance seemed healthy, but the portal and hepatic veins both contained much pink-coloured blood.

The spleen presented a dappled appearance, due to its being anæmic in some parts, and to its containing in other parts the milk-like substance.

The kidneys were anæmic, and the capsule could be easily peeled off.

The vessels of the omentum contained in many places very long white emboli, which were apparently situated in the branches of the portal vein, and similar emboli were present in the inter-costal vessels. The blood in the abdominal vena cava presented the same characters as that removed from the heart.

On raising the scalp, a white patch about the size of a five-shilling piece, and apparently caused by extravasation, was seen on the left side. The vessels of the brain, both arterial and venous, had a milk-white appearance. The brain substance appeared markedly anæmic.

All the viscera possessed an acetone-like odour.

A microscopic examination of the blood and of many of the

viscera was afterwards made. The blood removed after death had much the same characters as that examined during the life of the patient, except that there were a greater number of what have been regarded as decolorized hæmocytes. The application of osmic acid, caustic potash, magenta, and other reagents showed that the blood contained oil granules and particles of albumen or fibrin in addition to the ordinary constituents. The blood-clot was also examined after hardening in Müller's fluid and spirit, and before and after the application of reagents. It was thereby shown to be composed of alternating layers of blood-cells and fatty matter, together probably with some albuminous particles, the whole being bound together by fibrin. The reticulated arrangement of the latter was rendered apparent by the addition of chloroform.

When sections were made of the liver, each lobule was distinctly visible, the centre being darker than the periphery. Microscopic examination with the aid of reagents showed that the vessels were filled with normal blood-elements, along with other unusual constituents, consisting of fat and albumen in the form of granules; and that fatty and pigmentary degenerations had occurred.

When the kidneys were examined, the whole of their blood-vessels—*vasa recta*, and glomeruli vessels—were seen to be distended with blood-cells, globules of fat, and smaller particles, which were dissolved by acetic acid, and were probably, therefore, of albuminous composition.

Sections of the lung, under naked-eye inspection, appeared to have the tissues well filled with blood. Under a high power all the capillaries were found in a state of dilatation and intense congestion. In some parts the red cells were seen closely packed, so as to be distorted in their shape, but their colour was well preserved. In other parts of the vessels a translucent substance, generally in the form of minute globules pressed together, and a few granules, were seen. The globules were larger than those in the liver; indeed, in some of the vessels they had run together to form oily masses of the size of several red blood-cells. The parts of the capillaries containing the globules were occasionally more dilated than the other parts. The parenchyma of the lung presented no peculiarity.

The sclerotic, conjunctiva, iris, and retina all contained vessels filled with contents similar to those in the lung bloodvessels. The sclerotic and cornea were both blackened with osmic acid; and in the meshes of the latter were seen, with a high power, a few globules and granules, apparently fatty. They probably were conveyed there during life; but as similar globules were moving about, having escaped from the bloodvessels, it is impossible to be certain that all those seen in the meshes of the cornea had obtained an entrance during life.

At the post-mortem examination a small quantity of urine was found in the bladder. It was of a light straw colour, had a marked

acetone odour, and was found to contain about 1-7th of albumen. The percentage amount of urea and of glucose present in it was considerably below that discovered in any examination made during the life of the patient. Microscopic examination of the grayish-white sediment which formed after it had stood for a short time revealed the presence of a few tube-casts and of an enormous number of cells of all the forms present in the urinary tract, along with some tessellated epithelial cells that had probably proceeded from the urethra.

To summarize the results of this examination:—In the blood there was found fatty matter, precipitated albumen, and a substance having an odour like that of acetone. The fat seems to have adhered largely to the sides of the bloodvessels, causing an obstruction in the flow of their contents, resulting in congestion and in extravasations of the vascular contents. The lung stasis and in consequence would account for the dyspnœa and cyanosis; and thereby produced would probably cause coma, the production of which might have been aided by defective nutrition and by poisoning resulting from accumulation of effete matter and from the presence of acetone.

These may be regarded as the immediate causes of the fatal termination. The remote cause seems to have been exposure to cold, one of the results of which was an inflammatory change in the kidneys, which interfered with their eliminative function, and hence the marked diminution in the quantity of urea, and probably of glucose, excreted. The evidence appears to point to the fact that the fatty matter so largely present in the blood was universally and equally distributed throughout the body. Its origin may in that case be reasonably assigned to some constituent existing in the blood, which had somewhat rapidly undergone transformation. The blood-corpuses could not have produced it, for their number was not lessened.

The chemical relationship between glucose and fat is a very remote one, nor can albuminous matter be either rapidly or easily transformed into fat. An altogether satisfactory explanation, therefore, of the origin of the abnormal constituents present in this and in similar cases cannot be given from existing data. We can only advance hypotheses; and our contribution to these hypotheses is that from the glucose present in the blood the acetone was mainly derived, while the fatty matter originated from a transformation of the albuminous constituents of the blood-plasma.
