recommended "from the acromion to the pubes." As, in Mr. Tait's first case of cholecystotomy, the tumour had crossed the middle line, and in my own case it was on the verge of crossing, I do not think this can be so reliable as the one I have given. Both, however, would eliminate the class of tumours just referred to.

Case No. 9 is, of course, a very exceptional one. In this case, if the gall-bladder could have been felt, it must necessarily have been altogether to the right of the line which I have described; and I should wish to be distinctly understood as claiming for my "line" nothing beyond a good indication of the direction in which a distended gall-bladder will "naturally" lie. Neither this nor any other extra-abdominal sign can be more than an aid to diagnosis. In any very doubtful case, the diagnosis should be intra-abdominal.

The liver and kidney may be so displaced, and adhesions may so alter the relations of important viscera, that the expectation of the most careful and experienced may often (and occasionally most fortunately) be found wide of the mark.

ON RE-INFUSION OF BLOOD IN PRIMARY AND OTHER AMPUTATIONS.

By JOHN DUNCAN, M.A., LL.D., ETC.,

Surgeon to the Royal Infirmary, Edinburgh.

ON October 21st, 1885, Dr. Lindsay Porteous, of Kirkcaldy, sent to me a case of railway injury. The left leg had been crushed, and amputation was required in the lower third of the thigh. There had been no hemorrhage at the time of injury; but Dr. Porteous, as a measure of precaution, had placed a tourniquet loosely round the limb, with instructions to tighten it if necessary. Bleeding commenced during the journey; the tourniquet was insufficiently screwed up; and a large quantity of blood was lost before the patient reached the infirmary. When I saw him eight hours after the accident, he was pallid and collapsed, with a pulse, when perceptible, quick, irregular, and fluttering. Alcohol, ether-injection, and elevation of the limbs, had a scarcely appreciable and quite evanescent effect; and I came to the conclusion that it was impossible he should lose his leg and live through the operation. Intravenous injection seemed the only hope, and it occurred to me that I might to a certain extent utilise the patient's own blood for the purpose. In a large school like this, there is no difficulty in finding blood-givers during the day, but at night a saline fluid is the imperfect alternative.

The patient was anaesthetised with chloroform, followed by ether. While I rapidly removed the limb, the blood which fell from it (in all about three ounces) was caught by an assistant in a dish containing solution of phosphate of soda. After the arteries had been tied, it was difficult for a time to say whether the patient was dead or alive; but I proceeded to inject the blood and phosphate of soda, mingled with distilled water in the last syringeful to increase the quantity. In all, about eight ounces were thrown into the femoral vein on the face of the stump. The quantities are not exact, because the graduated dish was necessarily flat to catch the blood, but are correct within a drachm, or at most two.

The patient was then quickly put to bed, placed in front of the fire, and teaspoonfuls of weak brandy and water were given to him frequently. The pulse had become quite perceptible by the time he had been got into bed; it steadily improved during the night, and the man is now perfectly well.

The dominant idea in the procedure is to utilise the blood flowing from the amputated limb, which otherwise must necessarily be lost. Especially in shattered limbs, it is difficult to empty thoroughly before amputating; and both at the moment of incision, and also while ligaturing the arteries, a certain quantity of blood may always be caught. The importance of even a few ounces in cases of collapse can hardly be overestimated. No doubt, a simple saline fluid may for a time supply the means of working to the empty heart and vessels; but, in my experience, the benefit is only temporary—for one reason, because it is essential that the blood-forming organs should act; and they require suitable nourishment, like every other part of the frame.

I am convinced that this little operation, so easily performed, will save many lives in the collapse of primary amputations, and will prove beneficial to wasted and anemic patients in the major amputations for disease. I have now performed it in a sufficient number of cases, one of them an amputation at the hip performed by my colleague, Dr. Miller, to enable me to speak with confidence as to its safety and value.

The idea would probably not have occurred to me had I not, during

the previous six months, had considerable experience in transfusion of blood from one human being to another. My colleague, Dr. Brakenridge, having under his care a case of pernicious anæmia, in which the decadence was so rapid that the end could not be postponed many weeks, came to the conclusion that it would be right to try transfusion of blood, and consulted me on the subject. I had tried myself, or seen tried by others, most of the instruments hitherto in use for direct transfusion, and had arrived at the opinion that all were unsatisfactory, either from the risk attending them, or from liability to failure in attaining the desired end. It appeared to me, therefore, that it was necessary to adopt the method of defibrination, or to delay the coagulation of the blood by some of the saline additions which have already been used for the purpose, in order that a sufficient quantity might be injected with sufficient slowness.

In making inquiry as to the experience of others, I was informed by my colleague, Dr. Catterill, that he had on one occasion performed transfusion of blood mingled with phosphate of soda, as recommended by Dr. Pavy, and that the immediate result of the operation had been all that could be desired. As the power of phosphate of soda to delay coagulation is undoubted, I determined to adopt a plan whose feasibility was thus assured.

It is unnecessary now to go into the history of the pernicious anæmia. Dr. Brakenridge will doubtless give the results of his very careful observation, when the case may be regarded as complete. Suffice it to say that, by four transfusions, the quantity of the red corpuscles and hemoglobin was trebled, and that the improvement has been maintained for two months without further operation.

Before describing the mode of operating, I will merely mention another of our transfusion cases, highly creditable to my last house-surgeon, Dr. Carmichael, which he intends to publish more fully, along with some important experimental investigations on which he is engaged. I had operated in a case of empyema by resection of portions of seven ribs. A certain amount of blood was unavoidably lost during the operation, and through the night slow oozing took place into the thoracic cavity, making little show outside the dressings. Next day the patient seemed moribund; and, as he found that I was from home, Dr. Carmichael, who had admirably assisted me in the other operations, had himself bled to six ounces, and injected that quantity with phosphate solution into the patient's veins. The man immediately rallied, and is now quite well.

An operation of this kind plainly requires attention to detail, but its extreme simplicity renders easy the avoidance of mistakes, some of which I committed in the earlier instances. I attach much importance to the perfect fluidity of the blood, and the aseptic condition of all the instruments. In no case had our patients the slightest fever, rigor, or disturbance of any sort subsequent to the operation. Glass was purified by prolonged immersion in a solution of bichloride of mercury, metal in carbolic acid.

For introduction into the vein of the receiver, I use a short glass-tube, of the size of a No. 6 catheter, having a pen-shaped point. To its other end, made slightly bulbous, about two inches of India-rubber tubing is attached. A simple glass syringe, holding four ounces, whose nozzle fits the tubing, is perfectly effective. I keep up the temperature by surrounding it with boracic lint, wrung out of hot water. A syringe which I had made with an outer glass envelope to hold warm water, I find rather cumbersome. A graduated glass vessel, kept floating in warm water, contains the solution of phosphate of soda, and receives the blood.

All are washed with aseptic water after removal from the antiseptic solution, and before being used.

In amputations, the most convenient vein is selected on the face of the stump, the glass point is inserted, and a catgut ligature put round it. While the process of ligaturing the arteries is going on, the blood is caught by one assistant, who adds the soda-solution as required, and is slowly injected by another. There is no time wasted, and the amount put into the circulation is precisely proportioned to what the patient would otherwise have lost, *plus* what amount of saline solution the surgeon may think right and appropriate to the case.

In the case of pernicious anæmia to which I have referred, a vein in the arm of the blood-receiver was exposed, and under it a double thread of catgut was passed. I then drew the blood from the donor into the dish containing the phosphate of soda, with which it was gently mixed by means of a glass rod. While an assistant filled the syringe, I opened the exposed vein of the receiver, the lower thread of catgut being gently pulled upon to prevent bleeding. The tube was now inserted, the upper thread tied round it with one knot, and the lower definitely secured and cut short. The blood was next slowly injected, the India-rubber tubing being pinched when the syringe re-

quired to be refilled. The upper cut was finally tied and cut short when the operation was completed, and the little wound was stitched up.

There is a limit to the rate of injection on each side. One may possibly take longer to inject than the blood will remain fluid, or one may inject too rapidly for the comfort of the patient. In amputation, neither of these can easily happen; but in this case, I committed both errors. This point of course involves the question as to how much phosphate of soda ought to be added, and as to the coagulating quality of the blood. The solution of phosphate of soda was of 5 per cent., and one part of the solution was added to three parts of blood. A slightly larger proportion is probably advisable, and was frequently used in the amputation cases.

The donors for the pernicious anemia were healthy and powerful young students. One of them, Mr. Hardyman, found before he was bled that his red corpuscles were largely above the average, and on that occasion six ounces and a half of blood were added to two ounces of soda-solution. I was obliged to stop before the last ounce was injected, because it showed signs of thickening in the dish, and it actually coagulated six or eight minutes afterwards.

On the next occasion, with the same donor, I hastened the operation considerably, in order to avoid this coagulation. The patient, however, had only received four ounces when she experienced so much distress from pain in the back and forcible cardiac action, that I ceased injecting. It was annoying to find that, by an error in compounding, the soda-solution had been made of double strength, and that the remaining blood had not coagulated half an hour afterwards.

Experience, in short, shows that, in such a case, and with sufficient phosphate of soda, one may occupy at least twenty or thirty minutes in injecting; and that at a slow rate the patient will experience not the least discomfort. At the same time, the effect will vary with the condition of the patient. In one amputation, I injected eight ounces in five minutes; in the hip, sixteen ounces in about fifteen minutes, without any disturbance. But in the case of pernicious anemia, we had already by previous operations added considerably to the vascular contents, and the quantity of blood in the body was daily increasing, so that it is not astonishing that four ounces added to the blood in five minutes should produce unpleasant though evanescent symptoms. The more complete and rapid depletion has been, the more quickly and largely may repletion be effected.

One other observation has to be made. The process of re-injecting the patient's own blood is incompatible with the use of spray or irrigation during the operation. For myself, I am satisfied by experiment and from clinical experience that the spray does not kill micro-organisms in the air; and that in most cases the application of the germicide may safely be delayed till near the end of the operation. With pure hands and instruments, the risk from the air is trifling, and it is not worth considering when a patient is in imminent danger from hæmorrhage and collapse.

ABDOMINAL SECTION FOR THE REMOVAL OF SMALL INTRAPELVIC TUMOURS OF THE OVARIES AND ADJACENT PARTS: WITH NOTES OF TWO CASES.

Read before the Lancashire and Cheshire Branch.

By CHARLES J. CULLINGWORTH, M.D., M.R.C.P.,
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THE operation for the removal of the ordinary ovarian tumour has now become so general, that it is no longer necessary to plead that it should be recommended early. Medical men are, for the most part, sufficiently alive to the desirability of such a course, knowing how much their patient has to gain by submitting to treatment before the constitution has begun seriously to suffer. But the feasibility of operative interference in the class of cases, of which the two to which I am about to call attention are typical specimens, is not yet established on anything like so firm a basis. We are, indeed, only just beginning to realise the vast fields of usefulness that have been opened up to us by recent advances in abdominal surgery—advances due, in the first instance, to the experience gained by our great ovariologists; in the second place, to the introduction of the various antiseptic methods, whether Listerian or otherwise; and lastly, if not chiefly, to the conspicuous ability and enterprise of a distinguished provincial surgeon; I mean, of course, Mr. Lawson Tait. I confess that, in common with many others, I was somewhat slow to undertake ovarian operations where there was no perceptible tumour in the abdomen. But

I have now for some time been convinced that surgical interference affords us the best, if not the only, means at our disposal of relieving and curing a large number of women, who have hitherto drifted on from year to year, without sensible amelioration of their suffering, and who have long been the opprobria of our gynecological out-patient and consulting rooms.

The operation of abdominal section for the removal of intrapelvic tumours is in several respects a more difficult one than ordinary ovariectomy. The incision in the abdominal walls is more likely to be attended with troublesome hæmorrhage when the tissues are in their normal condition, than when they have been distended and atrophied by the pressure of an underlying tumour. Again, instead of a tumour presenting itself to one's eye the moment the incision is made, one is apt to come upon coils of small intestine, amongst which one has, as it were, to grope for the diseased structures which lie deeply down, out of sight. One has, in short, to rely much more on the sense of touch, and much less on the sense of sight. Further, when the diseased structure is seized, its removal is very often attended with considerable difficulty, owing to its deep situation, and the firm adhesions frequent under these circumstances. But notwithstanding these difficulties, the operation is not only a feasible and justifiable one, but, thanks to the improved methods of operating now practised, is as safe as ordinary ovariectomy.

Without further preface, I proceed to describe, as briefly as possible, two cases upon which I have operated successfully during the present year.¹

The first case was that of a young woman, aged 25, named Annie McC., who presented herself in the out-patient department of St. Mary's Hospital, Manchester, on account of a constant pain and a sensation of weight in the lower part of the abdomen, which rendered her quite unable to continue her calling as a dressmaker. She had married at the age of 17, had never been pregnant, and had now been a widow for three years. The pain commenced six years ago, and had continued ever since with one or two short intervals; it was most severe on the left side. She had consulted several eminent gynecologists in London, and had at one time been a patient at the Chelsea Hospital, where she obtained considerable temporary relief. But the symptoms returned when she resumed her ordinary life, and increased in severity from year to year, until, twelve months ago, she found she was unable to maintain the sitting posture sufficiently long to continue her occupation. During the last six months, she had earned what she could as an artist's model. She had an anæmic and careworn appearance, and her general health was evidently becoming impaired.

On bimanual examination of the pelvis, a firm, rounded, tender swelling was felt to the right of, and slightly behind, the uterus; the uterus itself was normal in size and position. The patient attended in the out-door department for about seven weeks, and, as she did not in any way improve, I suggested an exploratory incision, with a view to removing the disease, if it were found practicable. As her life was a burden to her, and she was unfit for any kind of work, she readily consented to run the risk of the operation; and, accordingly, I admitted her as an in-patient on May 11th, 1885, and explored the abdomen, with antiseptic precautions, on the 13th.

I expected to find a chronically inflamed and enlarged ovary on the right side, and an inflamed and adherent ovary, without marked enlargement, on the left. What I did find was as follows: on the right side, a chronically inflamed and indurated ovary, of the size of a walnut, and, in addition to this, a firm tumour of the broad ligament, of the size of a closed fist, consisting of a compact mass of exceedingly small cysts; on the left side, another broad ligament tumour of similar character to that on the right side, but smaller. The left ovary was apparently healthy. I enucleated both the broad-ligament tumours, and removed the right ovary with part of the Fallopian tube, leaving the left ovary and tube undisturbed. The operation was rendered somewhat difficult, owing to numerous very firm adhesions. The pedicle of the right ovary and tube was secured by a carbolised silk ligature, and left within the abdomen. A glass drainage-tube was inserted, and left in for forty-eight hours. The temperature rose to 102° Fahr. in the evening of the day of operation, but soon fell to 100° Fahr.; and, although it rose on the morning of the fifth day, and again on the morning of the sixth day, to 101° Fahr., it did not again occasion the least anxiety, and the patient made an excellent recovery.

I saw her so recently as yesterday (December 15th, 1885). She has lost her anæmic appearance, and become stout and well. A lady, from whom I removed an ovarian tumour some time ago as a private

¹ The descriptions which follow are condensed from notes kindly taken for me by Dr. Archibald Donald, house-surgeon to the hospital.