7 mm. Except for a pause in the respiration for about twenty seconds immediately after the chloroform was removed, the animal continued to breathe for the whole of this time, its brain being of course supplied with blood from the feeder. After the natural respiration had ceased, artificial respiration was put on for four minutes, but there was no recovery in the blood pressure, and a needle placed in the heart showed no sign of movement.

Again, in the experiment on February 20th, when the blood pressure was 131 mm., the trachea of the fed animal was connected with the chloroform bottle, and in one minute the pressure had fallen to 107 mm. (Fig. 10, Tracing *b*), and when the chloroform was taken off thirty seconds later was 84 mm.; the pressure was then falling rapidly (Fig. 10,

FIG. 10.—February 20th, 1891. Cross Circulation between Two Rabbits. (Leech Extract Injected into Jugular Vein of Fed at 1 p.m.; of Feeder at 1.20 p.m.)

In fed rabbit right carotis, right vertebral, and left subclavian were ligatured, so that animal only had left carotis open to supply the brain region.

In feeder the carotids on both sides were prepared, but not tied.

Time.	Mean Blood Pressure in Feeder.	Mean Blood Pressure in Fed.	Chloroform to Fed.	Remarks.
H. M. S.				
2 0 0	60	87	—	Leech extract injected into feeder. Pressure in both animals remained very constant, with heart beats showing plainly on both tracings. Leech extract injected into fed at 2 h. 7 m. 30 s. This injection produced no effect on the tracing.
2 8 0	62	87	—	Tracing <i>a</i> . The cross circulation was now begun to be established, but by mistake the connection between the left carotis of the fed and the right carotis of the feeder was begun first; in consequence, immediately upon the ligature of the left carotis of the fed the brain of the latter was for the moment deprived of all blood, with the result of causing Kussmaul-Tenner convulsions and a threatening of cessation of respiration. Artificial respiration was at once put on, and the cross circulation as quickly as possible established by connecting together the right carotis of the fed with the left carotis of the feeder and the right jugular vein of the fed to the left jugular of the feeder. When the cross circulation was well established the artificial respiration was removed, and the fed animal was found to be breathing spontaneously without any sign of convulsions. The effects produced by this accidental ligature of the only remaining brain artery of the fed is very instructive, as it demonstrates in the clearest way the efficiency of the cross circulation; without cross circulation ligature of the four brain arteries produces convulsions and quickly cessation of respiration; with cross circulation ligature of the four brain arteries causes no convulsions, no threatening of cessation of respiration.
2 33 30	—	—	—	Artificial respiration off.
2 34 30	60	131	Chloroform to fed	The pressure on fed had been constant for half a minute before the chloroform was given, and heart beats were very visible on the tracing.
2 35 30	58	107	—	Tracing <i>b</i> .
2 36 0	60	84	Chloroform off	Tracing <i>c</i> . Heart beats difficult to see in tracing of fed, pressure falling very rapidly.
2 36 15	61	62	—	Tracing <i>d</i> .
2 36 30	62	36	—	Tracing <i>e</i> . Heart beats quite imperceptible in tracing of fed.
2 37 30	62	34	—	Respirations of fed, 14 per minute. The respirations of the fed animal became shallower and shallower, and finally ceased at 3.40, that is, four minutes after the end of the chloroform administration. Before the respirations had ceased the slowed heart beats of the fed animal reappeared on the tracing for a time and caused the mean blood pressure to rise to 56 mm. at 3.36.

Tracing *e*), and thirty seconds later the pressure had sunk to 36 mm., and there were no longer indications on the tracing of heart beats. The respiration continued for three minutes and a-half after the indication of heart beat was lost. The heart was not permanently arrested, as, after an apparent cessation of beat for about two minutes, it commenced to beat again, and continued to beat slowly for about three minutes, and then gradually stopped.

These cross-circulation experiments confirm absolutely the previous experiments in which chloroform was injected directly into the circulation. In both cases the blood containing chloroform excites the vasomotor centre and raises the blood pressure when it reaches the medulla oblongata, while it depresses the heart's action and lowers the blood pressure when it reaches the heart.

It is, then, clearly proved that the primary fall of blood pressure seen during chloroform administration is not due to paralysis of the vasomotor centre. We must, then, look beyond the central nervous system for an explanation of this fall—that is, to a direct paralysing action of the drug upon the vascular system—a direct action, therefore, upon the heart and blood vessels.

[To be continued.]

VENESECTION IN CERTAIN HÆMORRHAGIC FORMS OF PHTHISIS.

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THE value of venesection in suitable cases is now beginning to be recognised. Most of the writers dealing with the subject recently have named pulmonary tubercle as a contra-indication. For example, Dr. Samuel West, in his valuable remarks on venesection,¹ though stating ably the conditions in which bleeding is called for, says that in hæmoptysis it must ever remain a matter of theory rather than of practice.

I record two cases which go very far towards proving that in certain instances of pulmonary tubercle venesection can be performed with great advantage. As a rule in hæmoptysis, the loss of blood, when amounting to 8 or 10 ounces, or even more, does not seem to have a harmful effect on the general condition of the patient. On the contrary, a distinct improvement is often noticed to follow the loss of blood. But an aggravation of the disease usually occurs when a portion of the lung becomes blocked by the blood; and many cases have come under my notice in which I believe that the damage to the lung by the effused blood has been mainly responsible for the extension or for the more rapid advance of the disease. This thought had been frequently in my mind when a case exemplifying the point in question came under my observation. The clinical history is briefly as follows:—

CASE 1.—A young man of good physique but not very good family history, had a copious hæmorrhage in April and again in November, 1890. In the beginning of 1891 he came to Davos. The physical signs were slight flattening over the upper portion of the right lung, and considerable dullness shading off towards the nipple. Respiration under the clavicle was broncho-vesicular, but with a slightly amphoric character over a small area. No *râles* were present, and the expectoration was small in quantity, but contained elastic fibres and a moderate number of tubercle bacilli. There was a slight afternoon rise of temperature, and some night sweating; the pulse was quick. In the course of a few months all evidence of active disease had passed away. The dullness was hardly perceptible; and the breathing was less bronchial. The temperature regained its normal level, the expectoration almost disappeared, and for a time was free from bacilli, which however reappeared again later on. The patient in the mean time had become very plethoric. One evening after running round his room (in chase of a mouse) he felt something "give way" in his chest between the right nipple and sternum, and after a few moments a mouthful of blood came up. In the part indicated by the patient moist sticky *râles* of medium size were to be heard over an area of about a couple of square inches. The tension and rate of the pulse were nearly as usual, the tension being high and the rate about 96. A hypodermic injection of morphine was given, and the patient was kept in bed. Two mornings later all signs of the bleeding had disappeared; there was no cough and no *râles*. In the evening I was sent for to see the patient again. He had brought up a couple of mouthfuls of blood, having previously had the same sensation of something "having given way." When I looked at the plethoric face of the patient and felt the high tension of the pulse, I was convinced that the only rational treatment was to get rid of the excessive quantity of blood, but by some other channel than the lung. I explained my view to the patient. He readily consented to be bled. He then told me that on a former occasion

¹ BRITISH MEDICAL JOURNAL, November 5th, 1892.

at home hæmorrhage went on every day till his doctor (Dr. Faris, of Ennis, co. Clare) bled him. The hæmoptysis then stopped and did not return till the present occasion. He was further warned by Dr. Faris that he ought to get bled from time to time; but not being anxious to be bled, he had said nothing about the matter. I opened a vein in the arm and allowed a litre and a half (48 ounces) of blood to flow. The patient sat in a chair during the whole time; he showed no sign of faintness or weakness, on the contrary he said that he felt better and better. The face gradually assumed a more healthy hue, and the pulse fell to 80. By the following morning the pulse rate had sunk to 68, and in a few days the *râles* had quite disappeared from the chest, and the very small amount of expectoration procurable a couple of months later was entirely free from tubercle bacilli and elastic fibres. A couple of days after the venesection the patient was going about as usual but feeling much stronger, and from that time he made an uninterrupted recovery. The patient left Davos in the spring of 1892, not having had any return of lung trouble. I have recently heard that he still continues in good health. In this case the amount of blood removed was extremely large; but I do not think that an equally good result would have been secured by a smaller quantity.

CASE II.—The second case is not less interesting. A young man who had influenza and pleurisy in 1890 had a large hæmorrhage (about a pint according to his own statement) in May, 1891, and again in June another hæmorrhage, about a teacupful. These hæmorrhages were quite unexpected, and came on when the patient was seemingly in good health. In the autumn of 1891 the patient came to Davos. The physical signs showed slight flattening and dullness over the upper portion of the right lung, and under the clavicle the breathing had a somewhat cavernous character. Hardly any *râles* were present; the temperature was normal; the pulse quick, about 112, small, but of very high tension. In October, 1891, that is, a month after the patient came to Davos, a small quantity of blood, about a tablespoonful, came up. The pulse had increased in frequency, ranging between 116 and 124, and was always small and hard.

On October 13th again a small quantity of blood appeared, the patient having at the same time a very plethoric aspect. I then removed 16 ounces of blood from the arm. The pulse at once fell from 120 to 88. The patient was a little faint during the bleeding, but very shortly after it was over he said that he felt a great deal better, the chest feeling freer, and that in every respect he was more comfortable than before the bleeding. Later, he said that in going up and downstairs and in going about he was stronger, and that he had more breath. About a month after the venesection, November 9th, the patient again coughed up $\frac{1}{2}$ ounce of pure blood.

On November 26th, the pulse had gradually risen in frequency to about 108, and had again become hard and of high tension, while the patient's face had regained its plethoric look. I told the patient that in all probability he would before long have another hæmorrhage. As he was not particularly anxious to be bled, I kept the bowels freely moved by sulphate of magnesia. There was no material change till the middle of December, when from 2 to 4 ounces of blood came up regularly every morning for five days, the temperature being normal for the first three days, and then rising to about 100 or 101 without sinking at all to the normal. I then removed 6 ounces of blood from the arm, and, except for a very small quantity of blood in the sputum two days later, there was absolutely no recurrence of hæmoptysis.

During this attack moist *râles* became widely diffused over the whole of the upper lobe of the right lung, and appeared also about the second and third interspaces on the left side. The temperature only gradually fell to normal, and the *râles* persisted also for a couple of months. About the middle of February the high tension pulse and the plethoric look foretold a probable return of the hæmoptysis, and, with the patient's consent, I again removed some blood from the arm; this time 4 ounces. The quick hard pulse fell from 120 to 96, and, as on previous occasions, became full and soft. From this time on the patient continued to improve, and, though the disease had not become quiescent, it continued steadily to diminish in activity until the patient left Davos in the spring, since which time I have not heard of him.

Now in both of these cases the bleeding into the lungs was in all probability responsible for the most serious part of the damage. In the first case, in which 48 ounces of blood were removed to the manifest benefit of the patient, there can be little doubt that if the blood had not been drawn from the arm, it would soon have found for itself a channel out of the overfilled vessels. A rupture would have occurred at the weakest point—namely, in the damaged lung, and a series of copious hæmorrhages would have taken place until the vessels had been sufficiently relieved; but in this process a considerable amount of mischief would inevitably have been done. The bronchial tubes would almost certainly have become filled with blood clots, and the result would have been an inflammation favourable to the extension of the tuberculous process. The pyrexia accompanying such a condition has a prejudicial effect on the organism; and the anæmia consecutive to fever is by no means so transient as the anæmia due to a direct hæmorrhage.

Many interesting points are suggested by the record of these two cases. I refrain from discussing them, but would draw special attention to the fall in the pulse rate, which, in every instance, followed the blood-letting. In conclusion, I would enumerate the chief conditions that must be present in a tuberculous patient before venesection can be considered advisable:

1. The patient must be plethoric. 2. The pulse must be marked by high tension. 3. The general health must be

good, and the patient free from marked constitutional symptoms of tuberculous disease, such as night sweats, high temperature, and debility. The presence of inflammatory pyrexia would not, however, contraindicate bleeding. 4. The case is usually marked by recurrent hæmorrhage. 5. The disease is usually, but not necessarily, in an early stage.

I may further mention that in the type of case I have in view the hæmorrhage is generally preceded either by a sense of fulness in the head and general feeling of heaviness, or by a feeling of unusual well-being. In the first of these conditions the hæmorrhage is likely to be followed by a sense of relief, in the second case by prostration. Where a sense of heaviness precedes the hæmorrhage, there is probably a high degree of plethora. Where the hæmorrhage is preceded by a sense of well-being, the plethora is probably only relative—that is to say, the blood pressure is only what could easily be resisted by healthy vessels, but is too great a strain for vessels weakened by disease.

TYRING THE PATELLA FOR FRACTURE OF THAT BONE.

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OF the various methods of dealing with fractured patella, the simplest and the one that most nearly fulfils the requirements laid down by Mr. Barker in his lecture is one the results of which, at any rate, have not been made known. Eighteen months previous to Mr. H. A. Butcher's proposal of passing a wire round the two fragments,¹ I had already operated by that method.

CASE I.—In this case there was a skin wound across the joint with transverse fracture of the patella. I used a large perineum needle fixed to the handle at right angles. The point was entered unarmoured through the wound on the outer side of the upper fragment and passed round it, keeping as close to the bone as possible. The quadriceps tendon was traversed from side to side, and the point of the needle brought out at the angle of the wound on the inner side of the joint. It was threaded with stout silver wire and withdrawn. The lower fragment was then dealt with similarly, the ligamentum patellæ being pierced from side to side. The needle was then threaded with the other end of the silver wire and withdrawn, thus surrounding the fragments with the wire. The joint was cleansed and all blood clot washed out; the fragments were pressed together and the wire was drawn tight, twisted off, and the end hammered to the outer side of the upper fragment. The leg was put on a back splint and slung at an angle of 60°. It healed perfectly without a rise of temperature, bony union taking place. She left the hospital in five weeks with the leg in plaster. She returned to have the plaster removed, but never reappeared until I wrote to her. When seen in May, 1892, about sixteen months after the operation, the leg was straight and absolutely stiff, but the line of fracture could not be detected. I determined to break down the adhesions under chloroform, which I did completely after using a very great deal of force, but the patella remained intact. Since then passive motion has been kept up, and she can bend the leg to more than a right angle and kneel on it without any pain when scrubbing.

CASE II.—A man fractured his patella, and was treated in the old way by strapping and splints, with the result that he had one inch separation of the fragments. He went to Melbourne to have the bone wired, but operation was refused because the lower fragment was so small. He slipped and tore the pieces asunder on August 18th, 1892. The swelling was allowed to go down and then the fragments were brought together as in the previous case; two small nicks being made in the skin for the needle to enter. The operation was done on August 31st; all support was taken off on September 9th, and he was advised to bend the knee gently. He was moving about the ward by September 13th, but as the wire caused a little irritation he had to rest in bed for a few days. He was walking about the ward by October 1st, and left hospital on October 12th, walking better than he could ever do before he slipped the second time. In this case the fragments were drawn as close together as the intervening fibrous tissue would allow, and at the time of operation it could be felt puckered up between them, but when he left it had smoothed down. It will be interesting to see whether it may eventually ossify now that it can no longer be stretched.

CASE III.—A stout woman who fractured her patella by muscular action. In this case I operated before some of the members of the Medical Congress, who gave the operation the above name. The procedure was just the same, but one of the possible troubles was shown. The wire was not passed deep enough through the ligamentum patellæ, so that when the ends were pulled on it tore up on to the front of the lower fragment. It was repassed, and then the fragments were in good apposition. All support was taken off on the eighth day; she sat up in the ward on the eleventh day. She left the hospital, walking easily without any support, on the twenty-first day. She has since shown herself with a perfectly good joint, for she can put the foot under the chair while sitting, and goes about her household duties.

CASE IV.—The patella was fractured by muscular action, but the line of fracture was irregular. It started from the upper and outer angle in-

¹ BRITISH MEDICAL JOURNAL, April 30th, 1892.