third stage, sputum-positive cases not progressing well under the ordinary régime, restoration to a quite full working capacity cannot be expected in all cases, or in the first few years. Occasionally patients soon make a complete recovery. This is especially likely to occur in young persons with sound contralateral lungs. The expectoration of sputum containing tubercle bacilli is usually an early symptom to cease.

The extent of re-expansion of the compressed lung varies, and cannot easily be predicted. In rather more than one-third the re-expansion is fairly complete. The scarring in the lung shows chiefly through cardiac, and, if on the left side, stomach displacement. The heart is pulled over to the affected side. There are no adventitious sounds, but the breath sounds may remain permanently a little weak. When much destruction with excavation of the lung has taken place, a considerable opening up of the lung is usually neither desirable nor often found.

Other figures giving the end-results of pneumothorax treatment can be found in a recent paper by Dr. R. C. Matson and others in *Tubercle* for October, 1925, and in Dr. Gravesen's *Surgical Treatment of Pulmonary Tuberculosis*, 1925, Table I (p. 52). These statistics show from 30 to 40 per cent. of cures.

THE NATURE AND USES OF REFRACTOMETRIC AND VISCOSIMETRIC TESTS.

BY

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DURING the last twenty-five years a great amount of work has been done on viscosity of the blood and serum, most of it since the introduction in 1906 of Hess's viscosimeter. In clinical work, it is the *relative viscosity* which is measured (of blood, serum, oedema fluid, etc.), compared with distilled water. Refractometry gives us the protein content of serum, oedema fluid, etc.—that is, the degree of concentration of the protein.

Viscosity plays an important part in the circulation. That the blood pressure itself is dependent upon the state of the heart and the vessel walls has long been recognized, but it is only recently that the part played by viscosity has received attention, and its importance in pathological conditions has been realized. Allbutt recognized this in his review in 1911,¹ the viscosity of the blood increasing the heart work many times, compared with what it would be if it were water.

Viscosity is a property of the blood, and is subject to variations, slight daily, marked in pathological conditions. The blood carries cells in suspension, salts in solution, and a viscous protein. Viscosimetry and refractometry help to throw light upon the changes in the tissues and the alterations in the water content of the blood in varying conditions.

Viscosity in relation to work becomes an important factor in circulatory and cardiac disturbances. A blood examination cannot be considered complete without a viscosimetric-refractometric examination being undertaken. The value of determining the viscosity has been well summarized by Bircher,⁷ as threefold:

"1. In circulatory questions, viscosity should be considered. Red cells and viscosity are the two opposite factors which have a determining influence on the effect of heart work.

"2. The viscosimetric factor is an excellent check of the normal blood test, because it depends on the different constituents of the blood. It is a delicate indicator for changes in their relation, and on this fact is based some valuable diagnostic information.

"3. The viscosity is an accurate means of analysing the constituents of the blood; the quantity and quality of protein in

plasma may be studied as well as the exact volume of the cellular elements. On these determinations are based the diagnostic applications supported by Naegeli."

Instruments.

The viscosimeter of W. R. Hess of Zürich is used, which is not only very simple and reliable, but the only one which fulfils all the necessary conditions; it is based on the law of Poiseuille, according to which fluids at equal temperature and pressure, passing through capillary tubes of equal calibre, vary in their rate of flow in direct proportion to their internal friction—that is, to their viscosity. The clinical model shown in the diagram is the most generally useful, being compact and portable.

Method.

Only one drop of blood is required, obtained from a stab in the finger after immersing the hand in a basin of warm water for two to three minutes. The blood is collected in a short length of narrow glass tubing, E, specially supplied, which is at once brought into opposition with the end of the blood capillary tube K₂; the tube E is held in position by being pressed into a spring clip F. By means of a bulb the blood is immediately sucked up to the 0 mark. The tap H is now opened and both water and blood columns are drawn along until the blood in tube K₂ reaches the 1 mark. After reading the point reached by the column of water the blood is expelled, and the tap is turned off as soon as the water has been driven back to zero. The blood tube, K₂, is at once cleaned by sucking in and expelling ammonia, water, alcohol, and ether in succession. Although the method is not by any means free from errors, it is sufficiently accurate for clinical purposes.

Blood is then collected in a U-tube, each limb 4 inches long, no pressure being made on the finger; this is centrifuged, and when the supernatant serum is clear one limb is cut off just above the blood clot and the viscosity of the serum is measured, the other being retained for refractometric examination. (A full description of the viscosimeter is given in Bircher's review,⁷ and of the refractometer in the booklet supplied by the makers.) The refractometer of Pulfrich (Zeiss's dipping refractometer) is used, which gives the angle of refraction of the fluid; this reading is converted into grams of protein per cent. by means of E. Reiss's table.

The viscosity of the blood depends upon:

1. The mass (whole volume) of the cells. An increase raises the viscosity, and a fall in number lowers it, but the viscosity is not directly proportional. (Du Pré Denning and Watson,¹⁴ Münzer,¹⁵ Bence.⁵)
2. The haemoglobin content. (Lisbonne and Margat.¹⁶)
3. The number of

the white cells per cubic millimetre. The viscosity is increased in leukaemia, the white cells conducting more, in proportion, to the viscosity than do the reds. (Determann,¹³ Rotky.²²)

4. The carbon dioxide content. The viscosity is raised in cyanosis; venous blood is more viscous than arterial, and oxidation lowers viscosity. (Koranyi and Bence,⁶ Adam,³ Determann,¹² Austrian.⁴)

5. The protein content. Dehydration increases the viscosity, and hydraemia lowers the viscosity. After a severe haemorrhage by the rectum I have observed it to fall from 4.0 to 1.75. (Nicator-Ferro,¹⁹ Lommel.¹⁷)

6. The salt and urea contents—of small influence. (Bottazzi.¹¹)

The average viscosity of the whole blood may be taken as 4.3 to 5.3 in men, 3.9 to 4.9 in women, and of serum as 1.7 to 2.0 in both (Naegeli). The viscosity of the serum depends chiefly upon the protein content.

Considerations of space make it impossible to enter into

The essential part of the apparatus consists of two capillary tubes, K₁, K₂, connected to a single aspirator S, Gb; by the aid of a strong rubber bulb, Gb, distilled water and blood (or serum) are simultaneously drawn through the two capillary tubes K₁, K₂, respectively. If the blood is sucked up tube K₂ from 0 to 1 the column of water reaches a point in the graduated tube K₁, which indicates directly how much further the water has flown in the same time and under the same conditions. The reading is then taken at the point which the water has reached, say 4.3; this reading is the viscosity of the blood. No correction need be made for temperature between 17° and 23° C.

the significance of the viscosimetric-refractometric findings in various diseases, which it is hoped may be dealt with in another paper, but that it has a distinct value in cases of syphilis, cancer, and tuberculosis has been shown by Bircher,^{10 9 8} in secondary anaemias and in peritoneal infections by Oehlecker,²⁰ Simon,²⁴ and Süssenguth,²⁵ in pneumonia by Ch. Achard, Touraine, and St. Girons,² and by Franklin,¹⁵ and in oedema by Shirley.²³

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DELIVERY OF BREECH WITH EXTENDED LEGS.

BY

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WITH the object of discovering the most satisfactory method of treating a breech presentation with extended legs, we have recently investigated the details of 100 cases that have occurred at Queen Charlotte's Maternity Hospital during the last ten years.

Of the 100 cases only 6 were delivered spontaneously with legs extended; with the remainder the legs were brought down before delivery. The average weight of the children born with extended legs was 5 lb. 10 oz.; when the legs were brought down the average weight was 7 lb. 7 oz.

The delay was so considerable that it practically amounted to obstruction in 47 of the cases where the legs had ultimately to be brought down; that is to say, the breech did not advance in spite of good pains, although left as long as two hours in the second stage. Of these 47 cases, 28 were delayed in the cavity of the pelvis and 19 on the perineum; in the latter condition the difficulty in pulling down the legs was much greater.

Of the remaining 47 cases no record was kept of the reason for the bringing down of the legs, but in all the breech was well down in the pelvic cavity or on the perineum before the legs were brought down. The inference is that in the majority of these cases there was some delay at the outlet. In most cases both legs were brought down simultaneously. When only one leg was brought down it was generally necessary to bring down the other at a later stage.

After the extended legs had been brought down the presenting part advanced regularly without further interference. Sometimes this advance was found to be slow, but it was not accompanied by foetal distress. When the child was born as far as the umbilicus the position of the arms was then ascertained. They were found to be extended in 94 cases, 6 of these being instances in which delivery took place spontaneously with legs extended. In the remaining 88 cases the legs had merely been brought down and not

pulled on, nor was fundal pressure used until the arms had been brought down. This, in our opinion, is of great interest, as it appears to show very clearly that the extension of the arms is a primary condition, and not, as generally supposed, the result of the legs being pulled on. In every case the arms were pulled down and the head delivered without delay by various methods (the Prague, Mauriceau-Veit combined with fundal pressure).

In 13 cases great difficulty was encountered in the delivery of the head. Apparently this was due in the majority to extension of the head. In 2 cases forceps, applied to the after-coming head, were used with success, and in 4 perforation through the roof of the mouth was necessary before delivery was possible.

Conclusions.

The conclusions we have drawn from the investigations and from our personal experience of 20 cases are as follows:

1. As a general rule extended legs have to be brought down.
2. In the comparatively few cases where it is not absolutely necessary, it will shorten the labour and lessen the sufferings of the patient if the legs are brought down.
3. The right time for bringing down the legs is as soon as the os is fully dilated. It must be understood that each case must be treated according to the attendant circumstances.
4. When the presenting part is not advancing we consider that the legs should be brought down although the os may not be fully dilated. In these circumstances the os should not be rigid, and it should be at least three-quarters dilated.

5. It was noted that there was greater difficulty in bringing down the legs when the delay was on the perineum.

6. Before the legs are brought down an anaesthetic must be administered. The result is that temporarily the pains either cease or become weaker. In our opinion it is better to bring down the legs and then wait until the pains become stronger, when the patient will be able to deliver the child as far as the umbilicus. No harm will be caused to the child by this delay. Unless there is a definite indication, such as foetal or maternal embarrassment, we consider it better both for mother and child not to pull on the legs at all after they have been brought down.

7. When the child is born as far as the umbilicus a loop of cord can be pulled down and watched. The position of the arms must then be ascertained. If found to be extended (this is usually the case) they must be brought down. Before doing so an anaesthetic must generally be administered. The posterior arm must be found and pulled down, then the anterior. If there be any difficulty the body should be rotated so that the anterior arm becomes posterior. This will give more space by reason of the hollow of the sacrum, and the bringing down will be accomplished with greater ease. At this juncture, and not earlier, the skilled assistant can follow the head from above and endeavour to keep it flexed.

8. As in most cases there are difficulties with the after-coming head, we consider that it is best to use the Mauriceau-Veit method, with fundal pressure from above. In combination with this method and in those cases where the head is not well flexed, it has been found advantageous first to push up the occiput with the fingers of the right hand, thus helping to flex the head, then to get two fingers of the left hand well down over the tongue, not only just inside the mouth. When this has been done both hands should pull in the axis of the pelvic outlet, and fundal pressure should be applied in the same axis. The pushing up of the occiput and the placing of the fingers well inside the mouth instead of just inside the lower jaw are two points which we consider of much importance.

Summary.

We are of the opinion that care should be taken—

(a) In deciding the propitious time for bringing down the legs.

(b) In realizing the importance of not pulling on the legs when once they have been brought down.