volume of the blood being normal or even diminished; a plethora in which the plasma is to some extent hydraemic and the percentage of corpuscles diminished; a true plethora in which the plasma is normal in composition and the percentage of corpuscles has also reached the normal. The proteins of the blood are thus made up much more rapidly than the corpuscles, so that one cannot say that hydraemic plethora exists merely because the corpuscles are diminished in percentage. Were it not for the constant absorption of water and output of protein, tending to keep the blood hydraemic, the proteins of the blood would, no doubt, be found normal in quantity from an early date. We have already seen how the organism attempts to compensate for the anaemic condition of certain portions of its vascular system by vaso-constriction, whereby it ensures that the maximum amount of blood possible reaches the tissues. It has only a certain quantity of available blood at its disposal, and with this it is unable to supply the tissues with their normal amount. A further series of events is therefore initiated whereby the blood is first increased in quantity, and then becomes normal in quality.

SUMMARY. *

1.

The increased output of lymph giving rise to cardiac dropsy is one of a very definite series of events following the occurrence of failure of the heart in its capacity as a pump. These events may be grouped into the following stages:

Stage I.—Accumulation of blood in the veins, with a moderate rise of venous and capillary pressure in all parts. Abstraction of blood from the arterial system with a fall of arterial blood pressure.

Stage II.—Dilatation of the veins and capillaries of the central parts of the body, with a fall of venous and capillary pressure to normal or thereabouts. This leads to increased congestion of the central parts and anaemia of the peripheral parts of the body, in which the venous and capillary pressures fall below normal. Increased output of lymph in the congested area giving rise to dropsy. Increased absorption of water in the anaemic areas, which balances the loss of fluid by the blood. Simple hydraemia results.

Stage III.—Vasomotor constriction resulting from anaemia of the medulla causing:

1. A rise of arterial pressure to the normal.
2. A moderate rise of venous and capillary pressure in the central parts of the trunk.

The venous and capillary pressures of the peripheral parts remain subnormal, or may become normal.

Stage IV.—Hydraemic plethora is established and raises the venous and capillary pressures in the central portions of the body to a great height. There is still a relative anaemia of the peripheral portions, although to an increasingly limited extent, as the congested area spreads peripherally.

Stage V.—The ascites and hydrothorax increase in degree and the oedema spreads in the areolar tissues peripherally, as the congested area encroaches upon the anaemic regions. True plethora is established.

2.

The abnormal output of lymph leading to dropsy is primarily conditioned by the nutritive state of the capillary wall, and is increased by the general plethora and consequent high capillary pressure.

3.

In uncompensated heart disease in man the central portions of the trunk are relieved by gravity at the expense of the legs, which become included in the congested area. The dropsical area spreads up the legs to the abdominal wall, thus encroaching upon the anaemic area from below upwards.

BIBLIOGRAPHY.

- Bayliss and Starling: *Journ. Physiol.*, 1894, vol. xvi, p. 171.
 Bolton: *Journ. Path. and Bact.*, 1903, vol. ix, p. 67. *Proc. Roy. Soc. London*, 1907, B, vol. lxxix, p. 267. *Journ. Path. and Bact.*, 1909, vol. xiv, p. 49. *Ibid.*, 1916, vol. xx, p. 290.
 Cohnheim: *Lect. Gen. Path.*, New Syd. Soc. Trans., London, 1889, vol. i, pp. 21, 513, 423.
 Hammerschlag: *Zeit. f. klin. Med.*, Berlin, 1892, Bd. xxi, S. 475.
 Lazarus-Barlow: *Phil. Trans.*, B, 1894, vol. clxxxv, p. 779.
 Lorrain Smith: *Trans. Path. Soc. London*, 1902, vol. liii, p. 136.
 Lower: *Tract. de Cordis*, etc. Edit. sex., London, 1728, p. 127.
 Starling, E.: *Arris and Gale Lectures, Lancet*, 1896, vol. i, pp. 1267, 1407. *Ibid.*, 1897, vol. i, pp. 569, 723.
 Starling, H. J.: *Lancet*, 1906, vol. ii, p. 846.

APPARATUS FOR TREATMENT OF FRACTURES OF THE FEMUR AND OF THE LEG.

BY

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THE apparatus which I am now describing permits the treatment of fractures of the femur and of the leg in a position of extension as well as of flexion of the hip and knee-joint. In the flexed position the action of certain muscles often becomes less disturbing, while the relaxation of these muscles decreases the force required for successful traction. Especially for certain cases of high and low fractures of the femur, the treatment by flexion offers real advantages. I have therefore devised an apparatus for the treatment

FIG. 1.

of fractures of the femur in extension or in flexion, which permits a change of position when required, without the necessity of first removing or displacing the apparatus, which, moreover, allows the simultaneous treatment of fractures of the femur and of the leg. It is made of metal, and consists of two lateral splints, united above by a posterior arc, which has, in its internal part, a special

FIG. 2.

curve similar to that in M. Delbet's apparatus. This special curve provides a good leaning on the ischium, a point well adapted to sustain a certain amount of pressure. At the further end the two splints are united by a transverse bar, in the middle of which is applied a dynamometer, which regulates the strength of the traction exercised by means of diachylon, network, plasters

FIG. 3.

Finochietto's stirrup, etc. The dynamometer can be replaced by elastic tubes or other springs, etc. The apparatus consists of two parts, articulating in a special manner corresponding to the knee-joint; the upper part supporting the femur, and the lower part the leg. In order to give the appliance more rigidity, two transverse arcs unite the two splints, and a large support at each end gives additional stability to the apparatus, which should be placed upon a firm base. Linen or metal straps form the hammock which carries the limb.

A number of holes in the splints facilitates the suspension of the apparatus, the femoral part of which can be

elongated as required. With the apparatus in rectilinear position (Fig. 1), it is possible to put the limb in extension, and to exercise upon it graduated traction with counter-pressure upon the ischium—as may also be obtained, of course, with other apparatus. For flexion, the appliance has an articulation corresponding to the knee-joint in such a manner that it may be easily transformed into a double-inclined plane (Fig. 2). The distance from the tuberosity of the ischium to the popliteal hollow becomes appreciably longer as the leg passes from the position of extension to that of flexion. In the medical literature of such appliances this fact has, so far as I am aware, not yet been noted, when it is necessary to accommodate the length of the appliance to the varying distance of the tuberosity of the ischium from the popliteal hollow.

The lateral splints supporting the femur and the leg, under the knee, are each semi-elliptically curved back below, and at the point of their lower junction is placed the axis around which the bending movement in adaptation to the knee-joint is produced. By means of this arrangement an elongation of the femoral part of the apparatus follows automatically the process of flexion.

When, as a consequence of flexion, the upper posterior arc, on being lowered, loses contact with its point of pressure upon the ischium, it is necessary, in order to maintain this contact, that the upper support of the apparatus should be capable of being either lengthened or shortened, at will, according to the degree of flexion. Of course, in case of fractures necessitating the abduction of the limb the apparatus must be placed in this position. By transverse tractors attached to the splints, it is possible to modify, when required, the position of the fragments.

If when the limb is in flexion traction is to be exercised upon the femur, another arc may be added to the apparatus, securely fixed in axial prolongation on the two femoral splints (Fig. 3). In applying elastic traction (dynamometer), which in the flexed position of the limb can be moderated, the counter-pressure is always upon the tuberosity of the ischium. Different tractions can also be simultaneously applied on the leg. With this apparatus it is possible to treat fractures in suspension and in different positions of the limb. Free access to wounds and adjacent regions is given; movement of the knee and massage of soft parts are also possible, the fracture remaining fixed. Removal of the patient also is rendered easier. For longer journeys a better immobilization can be obtained by applying a long splint from the armpit to the foot, and by securing the splint to the apparatus and to the thorax.

The application of this apparatus is not possible when there are lesions in the region of the ischium.

GLYCERINE AND ANTISEPTICS.

BY

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AN interesting note in the BRITISH MEDICAL JOURNAL of May 5th, pointing out the possibility of using substitutes for glycerine for some purposes, in view of the great scarcity of this drug, makes it desirable to publish some of my recent experimental results, which show that its presence more or less completely destroys the antiseptic power of such useful substances as thymol, phenol, boracic acid, mercuric chloride, etc., in aqueous solution.

It is a well-known fact that many antiseptics, inorganic as well as organic, are much more soluble in glycerine than in water.

Approximate Solubility at Ordinary Temperatures.

Thymol: 0.06 per cent. in water; 0.526 per cent. in glycerine.

Phenol: 7.7 per cent. in water; 350 per cent. in glycerine.

Mercuric chloride: 5.26 per cent. in water; 61.5 per cent. in glycerine.

Boracic acid: 4 per cent. in water; 25 per cent. in glycerine.

There is therefore no doubt that in a mixture of water and glycerine more of the above substances will dissolve than in pure water; for example, in a mixture of equal volumes of water and glycerine about five times as much thymol will dissolve as in pure water. However, the

resulting solution has no better antiseptic power than the aqueous solution containing only a fraction of the amount of thymol, as already recorded in my recent paper on mouth-washes. The same is the case with boracic acid: a saturated solution in water will kill all the organisms in a thin film of *Staphylococcus pyogenes aureus* in just over one hour, whereas a saturated solution in water and glycerine containing more than four times as much boracic acid requires about six hours.

Hitherto it appears to have been assumed by pharmacologists that solutions in glycerine were necessarily more antiseptic than the more dilute aqueous solution, and further, statements such as the following, are liable to be misleading: "Glycerine is largely used in pharmaceutical preparations as a solvent, and, being an antiseptic, it also acts as a preservative." (Squire, 1916, p. 658.) It was Sternberg who included glycerine, up to 1 in 4 dilutions, among feeble antiseptics, but, as shown below, even water compares well in disinfecting power with 50 per cent. glycerine. Pure glycerine easily kills protozoa and other animals, but here it acts by osmosis, for it is well known to extract water from tissues. Many bacteria are much less susceptible to fatal effects from drying, and may consequently remain alive in glycerine for hours. Dilute solutions are not even preservative; in fact, up to 8 per cent. glycerine is so beneficial to certain bacteria as to be added to media for growing them.

The experiments mentioned below were carried out in the same way as those described in my recent paper in this JOURNAL (April 14th), but with a standard culture of *S. pyogenes aureus*. The glycerine used was in the liquid form (specific gravity 1.26), pure and perfectly sterile.

To destroy all the organisms on a cover-slip film pure glycerine required approximately eight hours; mixed with water in equal volume it required more than twenty-four hours, after these hours giving considerably more growth than the control which had been in tap-water for the same time. For the following experiments a stock solution of the antiseptic was made in water, and this was diluted as required with an equal volume of water or glycerine:

Times required to Destroy all the Individuals from a Standard Culture of S. pyogenes aureus Contained on a Thin Film on a Coverglass.

Phenol:

3.3 per cent. solution in water required less than $\frac{1}{4}$ minute.
3.3 per cent. solution in water and glycerine required more than 1 minute (between 1 and 5).

Mercuric Chloride:

0.005 per cent. solution in water required approximately $\frac{1}{4}$ minute.
0.005 per cent. solution in water and glycerine required more than $\frac{1}{4}$ minute.

Boracic Acid:

A saturated solution (4 per cent.) in water required approximately 65 minutes.
A half-saturated solution (2 per cent.) in water required approximately 285 minutes.
A 2 per cent. solution in water and glycerine required more than 480 minutes.

Thymol:

A saturated solution (0.06 per cent.) in water required $\frac{1}{4}$ minute.
A half-saturated solution (0.03 per cent.) in water required 12 $\frac{1}{2}$ minutes.
A 0.03 per cent. solution in water and glycerine required more than 300 minutes.

In the case of thymol and *S. pyogenes aureus* the value of the constant in the logarithmic relation existing between the time required for disinfection and concentration, as given by H. E. Watson, is 5.6. This is almost exactly the same as that for phenol and *S. pyogenes aureus*, calculated from H. Chick's results, obtained in an entirely different way. However, the discussion of methods, etc., must be deferred and published with the graphs representing the variations in times required for disinfection with concentrations of these antiseptics; especially interesting are those showing the interference of glycerine and other solvents.

The theory underlying the action of glycerine is most interesting; possibly the glycerine merely acts as oil is supposed to act in the case of carbolic acid—that is, being a better solvent for the antiseptic, the latter does not diffuse so easily from the solution into the watery protoplasm. However, in some ways this explanation is unsatisfactory, and the fact that glycerine diminishes the