a change being made for a short time, in some cases, to chloroform for the purpose of observation. The blood pressure was taken at the time of the connection of the instrument with the vessel and then its variations were recorded as different operations were being performed, until pronounced shock with loss of blood pressure was present. Various drugs were then administered subcutaneously and the effect upon the blood pressure recorded. The cannula connecting with the vessel was occasionally opened for the purpose of noting the effect of hemorrhage. While it must be admitted that the instrument is delicate and easily disturbed, it unquestionably, when working properly, records accurately the blood pressure. With the sphygmograph one must judge of the blood pressure by the height of the stroke, and with this instrument this is reasonably correct, but in the case of the kymograph the height of the stroke and the blood pressure are not at all synonymous. While the height of the

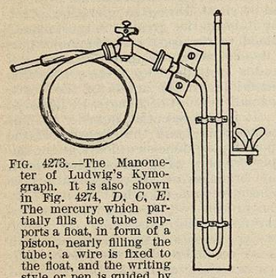

FIG. 4273.—The Manometer of Ludwig's Kymograph. It is also shown in Fig. 4274, *D*, *C*, *E*. The mercury which partially fills the tube supports a float, in form of a piston, nearly filling the tube; a wire is fixed to the float, and the writing style or pen is guided by passing through the brass cap of the tube fixed to the wire; the pressure is communicated to the mercury by means of a flexible metal tube filled with fluid.

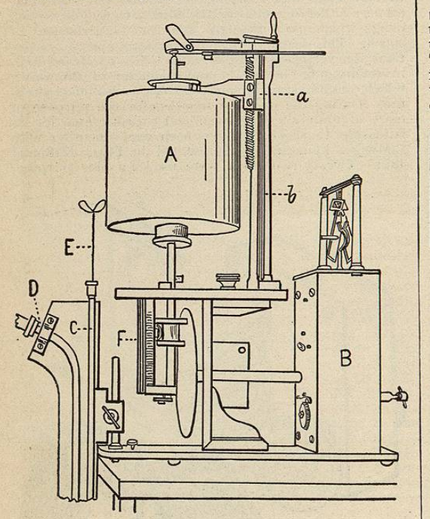

FIG. 4274.—Diagram of Ludwig's Mercurial Kymograph. *A*, Revolving cylinder, worked by a clockwork arrangement contained in the box (*B*), the speed being regulated by a fan above the box; cylinder supported by an upright (*b*), and capable of being raised or lowered by a screw (*a*), by a handle attached to it; *D*, *C*, *E*, represent mercurial manometer.

stroke depends in the kymograph in a measure upon the blood pressure, it also is influenced by the size of the artery with which the instrument is connected, its nearness to the heart, and the size of the cannula used. These conditions always being the same, as they are with the sphygmograph, the height of the stroke in a reasonable degree corresponds with the blood pressure.

Treatment of the Actual Shock.—The treatment of shock may be considered under three heads: (1) The recovery

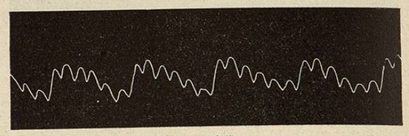

FIG. 4275.

of the normal blood pressure. (2) The re-establishment of the muscular tone; and (3) the restoration of the mental phenomena. The restoration of the blood pressure is at times more quickly affected by an intravenous infusion of the normal salt solution than by any other method, and in cases in which the condition is largely the result of hemorrhage this is the most scientific and satisfactory

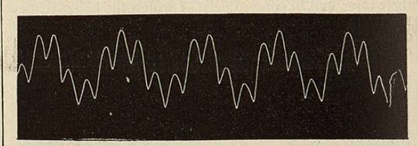

FIG. 4276.

method of treatment. The tracing in Fig. 4275 is from the femoral artery of a dog that had undergone a resection of a portion of the intestine and a gastro-enterostomy. The dog had also lost a large amount of blood. Pressure in the femoral at the time tracing in Fig. 4275 was taken was 13.2 cm. The tracing in Fig. 4276 was taken after one quart of normal salt solution had been infused into a

FIG. 4277.

vein, the pressure now having risen 2.6 cm. Fig. 4277 shows a sphygmographic tracing of a weak pulse during an operation, and Fig. 4278 a tracing of the same pulse after the injection of one pint of normal salt solution beneath the breast.

Hypodermoclysis.—In the writer's clinic at St. Joseph's and Milwaukee County hospitals, as well as in his private practice, it is the rule, when a pulse shows weakness, and especially if this be largely from loss of blood, to inject beneath a breast, at the border of the scapula, in the lumbar or gluteal regions, a pint of normal salt solution, and to repeat this injection in half an hour upon the opposite side if necessary. The apparatus required is an aseptic fountain syringe attached to a large

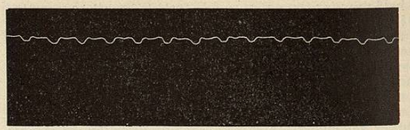

FIG. 4278.

surgically clean aspirating needle. While this method does not act as quickly as the intravenous infusion, it acts promptly enough for ordinary cases and is extremely simple. In cases in which the blood pressure is lowered in consequence of exhaustion of the nervous system from gross injury this treatment may still to a certain extent be advantageous, in that it produces some slight vascular stimulation and also adds to the volume of fluid circulating, and thus assists to a certain extent in compensating for the dilatation of the peripheral vessels. It is, however,

FIG. 4279.

a matter of frequent observation in cases of profound shock with great weakness of the pulse that the introduction into a vein of a quart of normal salt solution does not materially improve the patient's condition. The volume of the pulse in these cases may be restored for a few minutes, but this volume is without tension and soon disappears. This is in consequence of the fact that the vaso-motor system has become partially or completely exhausted. What is desired in these cases is the strengthening of the heart and the restoration of the functions of the vaso-motor system, and of the cerebral cortex. It is,

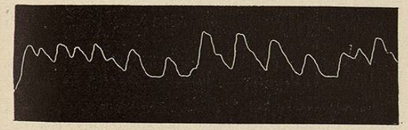

FIG. 4280.

nevertheless, true in some cases of gross injury or of prolonged operation that the exhaustion of the nervous system is so complete that no treatment which we are able to institute will be effectual.

In my experience with shock there is nothing which meets the condition and which sustains the nervous system and holds the ground gained so well as strychnine. Kymographic tracings show that strychnine increases the blood pressure in practically every instance. This pressure is often increased by a single hypodermic injection from 0.5 to 1 or even 1.5 cm. In the administration of strychnine for a serious condition of shock one-fourth of

FIG. 4281.—Before Whiskey.

a grain may be given in divided doses during the course of one hour, and, following this, one-thirtieth of a grain administered every two hours for one or two days, or until the muscles show the influence of the drug.

Nitroglycerin.—The use of nitroglycerin in shock has been criticised by many writers upon the ground that it dilated the superficial capillaries and thereby reduced blood pressure. In my experimental and clinical work nitroglycerin has always increased the height of the stroke and lessened the frequency of a rapid pulse. Gr. $\frac{1}{100}$–$\frac{1}{50}$ of nitroglycerin, injected subcutaneously, has always increased the blood pressure from 0.5 to 1 cm. Its effect, although manifested almost at once and reaching perhaps the same height as that from strychnine, is not so long sustained. The tracing in Fig. 4279 was taken from the femoral artery of a dog where the pulse was scarcely perceptible in consequence of numerous sections of both sciatic nerves, resection of a considerable portion of the small intestine, and of the entire stomach. The tracing in Fig. 4280 was taken one-half a minute after the injection of gr. $\frac{1}{50}$ of nitroglycerin. In four and one-half minutes the blood pressure had risen 1.8 cm.

Caffeine.—Caffeine acts almost as promptly and effectually in restoring blood pressure as does strychnine. Five grains injected subcutaneously in a dog raised the blood pressure from 12.6 cm. to 13.6 cm. This effect is also well sustained.

Adrenalin.—In the writer's experience adrenalin in gr. $\frac{1}{100}$–$\frac{1}{50}$ acts promptly in increasing blood pressure.

FIG. 4282.—Twenty Minutes after Whiskey.

This action seemingly, however, is not well sustained. Adrenalin is certainly deserving of further consideration in the treatment of shock.

Digitalis and Strophanthus.—Both of these substances were used repeatedly. Their immediate action, however, upon blood pressure is not pronounced. With a rapid pulse their use is indicated, as they will assist in controlling this factor and in maintaining blood pressure.

Whiskey.—The advocacy of whiskey or brandy in shock has occasioned more dispute and acrimonious debate than that of all the other remedies combined. That they are capable of raising the blood pressure when injected subcutaneously or taken into the stomach there can be absolutely no doubt. A dog whose sciatic had been sectioned half a dozen times was subjected to an intestinal anastomosis and then to a complete resection of the stomach. During these procedures, which occupied one hour and twenty minutes, the blood pressure fell from 14.2 cm. to 12 cm. At 10:25, 25 c.c. of whiskey in water was injected subcutaneously, and in twelve minutes the blood pressure had risen to 13.3 cm., at 10:39 to

FIG. 4283.—Three-quarters of an Hour after Whiskey.

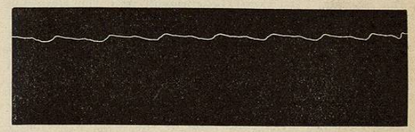

FIG. 4284.—One Hour after Whiskey.

13.6 cm., and at 10:40 to 13.8 cm., at which point it remained until 10:44, when it fell to 13.1 cm., where it stood for a very considerable time. The sphygmographic tracing in Fig. 4281 was taken from a weak patient's radial before giving whiskey, the tracing in Fig.

4282 twenty minutes after one ounce by stomach, that in Fig. 4283 forty-five minutes after, that in Fig. 4284 one hour after, that in Fig. 4285 one and one-half hours after, and that in Fig. 4286 two and one-half hours after.

In the treatment of shock there are conditions to be met besides those of blood pressure. One of these is the loss of muscular tone, and another the practical suspension of the mental faculties. It is probably true that anything which assists in restoring blood pressure will

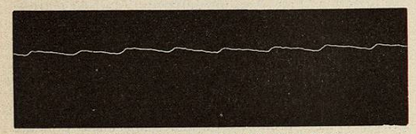

FIG. 4285.—One Hour and a Half after Whiskey.

also assist in re-establishing muscular tone and the vigor of the mental faculties. The normal salt solution, when infused into a vein, acts only mechanically, and is often without decided effect upon the profound depression of the vital functions. Remedies are wanted in shock which will restore not only blood pressure but also all of the vital functions. These conditions are met more perfectly in shock without hemorrhage by the use of strychnine, caffeine, nitroglycerin, whiskey, adrenalin, and normal salt solution than by any other remedies. In

FIG. 4286.—Two Hours and a Quarter after Whiskey.

cases in which hemorrhage has been a prominent factor the normal salt solution should take precedence of all other remedies. *A. H. Levings.*

SHOULDER, THE SURGICAL ANATOMY OF.—The region of the shoulder comprises the bones forming the joint, viz., the scapula and the upper part of the humerus, the clavicle and acromio-clavicular articulation, also the upper and outer part of the thorax, which takes part in forming the axilla. These bony structures, with the softer tissues enveloping them, would be included in the term *shoulder*.

Surface Anatomy.—Beneath the skin can be easily felt the outer end of the clavicle, the acromion process, and the coracoid. Where the clavicle joins the acromion there is a distinct elevation which can be without difficulty detected by running the finger nail over it. The line of this articulation would correspond to a vertical line running up the middle of the front part of the arm. The acromion in the stoutest person may easily be made out by following the spine of the scapula, and the coracoid process is just inside the shoulder joint and below the clavicle. Between the coracoid and the acromion processes is the rounded prominence of the shoulder; this is formed partly by the thick deltoid muscle, but also in part by the upper end of the humerus which lies below it. As the arm is rotated the tuberosities can easily be felt beneath the muscles. In dislocation of the humerus, instead of a prominence there is a flattening, and in pressing with the fingers a well-marked depression is found where the head of the bone is normally felt. If in suspected dislocation the thumb be placed on the coracoid process and one of the fingers of the same hand on the acromion, the space will be found wanting in roundness and the finger can be easily pushed into a hollow; the upper end of the bone can be no more felt on rotation. The portion of the humerus which in normal joints is felt beneath the deltoid is not the head, but the tuberosities. The head can be felt through the axilla if the fingers be well pushed up and the arm be strongly abducted. The head of the humerus faces in the direc-

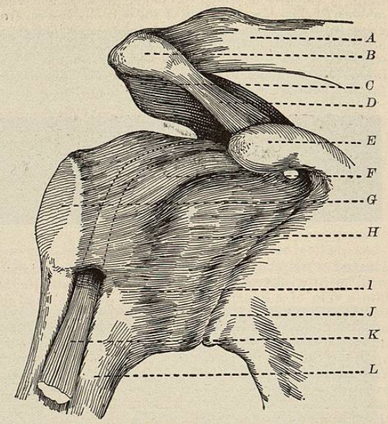

FIG. 4287.—*A*, Clavicle; *B*, *C*, acromion; *D*, coraco-acromial ligament; *E*, coracoid; *F*, coraco-humeral ligament; *G*, great tuberosity of humerus; *H*, capsular ligament; *I*, lesser tuberosity; *J*, scapular neck; *K*, long tendon of biceps; *L*, humerus.

tion of the internal condyle, this latter being always a good guide to the position of the upper end of the humerus.

The adjacent margins of the deltoid and pectoralis muscles cannot be felt below, but above there is a considerable triangular interval which forms the infraclavicular fossa below the clavicle. This fossa is well seen in thin persons, but is obliterated in subcoracoid dislocations, in fracture of the clavicle, and by inflammatory tumors and new growths. In subclavicular dislocations the depression is replaced by an eminence. The space between the two muscles lodges the cephalic vein (Fig. 4288).

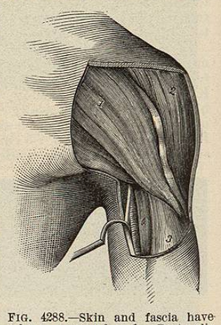

FIG. 4288.—Skin and fascia have been removed. 1, Pectoralis major; 2, deltoid; between these muscles is seen the cephalic vein; 3, biceps; 4, coracobrachialis, close to which lies the brachial artery and the median nerve drawn to one side. (After Roser.)

The back of the shoulder is comparatively flat; here the deltoid muscle is thinner. By abducting the arm the deltoid becomes prominent and various vertical elevations appear which correspond to the muscular tissue between the various tendinous intersections which run down from the acromion through the muscle. The axillary border of the scapula and inferior angle may be brought out by placing the forearm behind the back; to bring the vertebral border and superior angle into evidence, the hand should be placed over the opposite shoulder.

Surface Marking of Axillary Artery.—At a point internal to the coracoid process and below the most convex portion of the clavicle the axillary artery may be compressed against the second rib. The course of this artery can be easily marked out by drawing a line from the most convex portion of the clavicle to the inner border of the elevation formed by the coracobrachialis muscle.

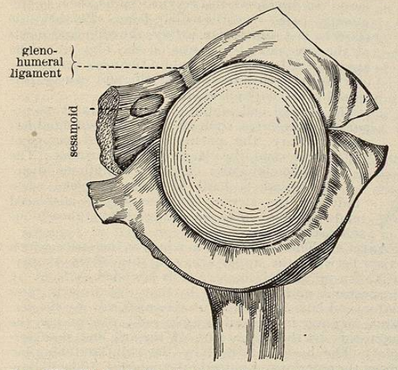

FIG. 4289.—Head of Humerus, with Part of Capsule Attached. (Morris.)

If the arm be raised from the side, the third part of the axillary artery may be felt pulsating as it passes into the arm beneath the anterior fold of the axilla, and in a line corresponding to the outer border of the axillary hair, that is, at the junction of the anterior with the middle third of the space between the axillary folds. At the junction of the upper with the middle third of the deltoid muscle the posterior circumflex vessels and nerves wind round to the back of the humerus under the muscle.

The *deltoid region* comprises the point of the shoulder and is confined to the limits of the deltoid muscles which cover the shoulder-joint and upper end of the humerus. Between the deltoid muscle and the joint is a large bursa, the subdeltoid or subacromion bursa. Owing to the exposed position of the shoulder-joint it is liable to

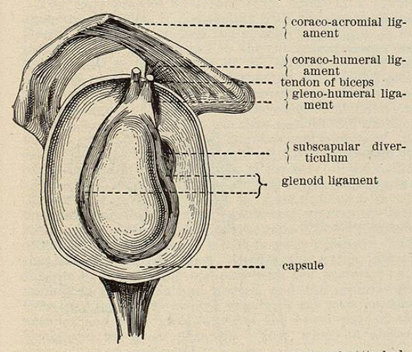

FIG. 4290.—Glenoid Fossa of Scapula, with Part of Capsule Attached.

many injuries and diseases; fatty tumors are not infrequently seen here and may attain to a large size.

The shoulder-joint is of the ball-and-socket variety (enarthrodial), and so is very freely movable; the socket in the scapula is very shallow but is deepened by the glenoid ligament, to which the long head of the biceps is attached. It is small in size compared with the large articular surface of the head of the humerus. This disparity gives greater freedom of movement with lessened security and more liability to displacement in extreme movements.

The circumflex nerve supplies the deltoid, shoulder-joint, and skin over the lower two-thirds of the shoulder and upper part of the triceps. In injuries to the shoulder this nerve is frequently damaged, and paralysis with atrophy of the deltoid may result; marked flattening of the shoulder may as a consequence ensue.

Relations of the Joint.—Muscles of great strength surround the shoulder except inferiorly; above we have the deltoid and supraspinatus, internally and in front the subscapularis, and externally and behind the infraspinatus, both these latter separated from the capsule by a bursa. The capsule of the joint, though strengthened by these muscles, is very loose, so that when the muscles

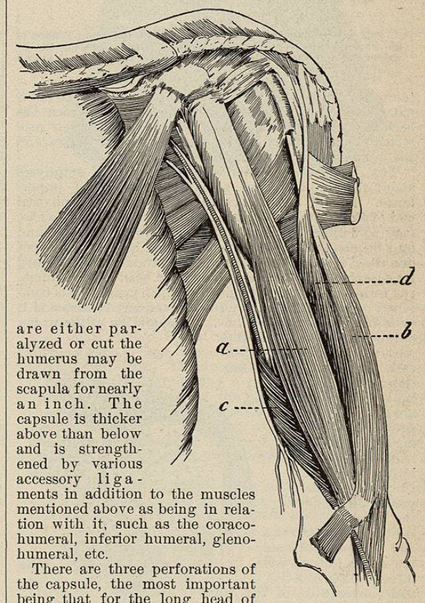

FIG. 4291.—Abnormal Arrangement of the Biceps. *a*, Coracoid head; *b*, glenoid head; *c*, humeral head; *d*, capsular head.

are either paralyzed or cut the humerus may be drawn from the scapula for nearly an inch. The capsule is thicker above than below and is strengthened by various accessory ligaments in addition to the muscles mentioned above as being in relation with it, such as the coraco-humeral, inferior humeral, gleno-humeral, etc.

There are three perforations of the capsule, the most important being that for the long head of the biceps at its lower part; it is also perforated by the supraspinatus and not infrequently by the infraspinatus. *The tendon of the long head of the biceps* has synovial membrane prolonged along it and surrounding it. This tendon keeps the head of the humerus against the glenoid cavity and prevents the bone rising up toward the acromion. This tendon is sometimes ruptured, thus causing weakening of the upper limb and a drawing up of the humerus forward and inward against the coraco-acromial arch. The tendon may be dislocated—that is, it may slip out of its groove to one side or the other. In such cases the head is prominent and drawn up under the acromion; owing to the higher position of the greater tuberosity, abduction is not so free.

Rupture of the tendon is more apt to occur in persons the subjects of rheumatic disease; in them the joint is dry and perhaps the tendon is partially worn. In old cases