

blood pressure. These injections may be made in large or small repeated doses.

Small repeated doses (250 c. c. maximum) are preferable in genuine cases of shock without an important loss of blood. The effect upon the blood pressure is more lasting when the injection is made at the end of the operation. Later injections should be administered in accordance with the curve for the blood pressure, which should be determined by half-hourly observations. A new injection should be made every time the curve assumes an unfavorable bend.<sup>1</sup>

6. Is shock an indication or a counterindication for operation?

<sup>1</sup>As an isotonic solution to be injected the Locke solution is preferable.

	gm.		gm.
Chloride of sodium-----	8.0	Chloride of calcium-----	0.1
Chloride of potassium---	0.2	Glucose -----	1
Bicarbonate of soda-----	0.2	Water -----	1,000

The injection should be made slowly, lasting about 10 minutes. If a second injection is necessary, a solution with a larger proportion of calcium than Locke's solution (hypertonic solution) may be employed.

If the blood pressure falls a great deal, a third injection should contain adrenalin (added at the time of using). Just as the injection is to be made the following ingredients may be mixed: 0.5 c. c. of the solution 1 to 1,000 adrenalin; and 50 c. c. of isotonic solution of the first formula. The injection should always be made slowly, never in less than 10 minutes. Only completely colorless adrenalin should be used. The action of the adrenalin and of the pituitary extract is short lived. The transfusion of blood seems also to give results as in the case of hemorrhage.

The answer to this question depends upon the seriousness of the shock and the nature of the operation.

If the shock itself—aside from the hemorrhage—is serious, if the patient is cold and without a pulse, the shock must be treated first. The same is true if the operation to be performed is long or complex, as in the case of abdominal operations. Any considerable injury to the members calling for amputation is, nevertheless, an indication for operation.

Local anesthesia combined with general anesthesia by means of nitrous oxide is the best. Next to this ether appears to be the least harmful. Spinal injections have produced varying results according to the surgeons employing them, especially in amputations of the lower limbs. The use of chloroform is dangerous.

7. A condition of shock calls for the quickest possible process of operation—the simpler the better—with complete hemostasis (preventive, temporary, and permanent).<sup>1</sup>

## VII. AMPUTATIONS.

1. Amputation is desirable only when the preservation of the limb would result in death or when its loss is certain.

2. The two chief indications for amputation are extensive traumatism and infections.

<sup>1</sup> Compare with conclusions of the third session, p. 50.

3. Amputations for complicating infections are always very serious. Statistics based upon 29,139 amputations show a mortality of 28 per cent in cases of infection against the usual mortality of 6 per cent. Statistics drawn from 3,633 disarticulations lead to the same conclusions.

4. Amputation is called for less frequently in injuries to the upper limbs than is the case with the lower limbs. Less serious and less frequent infection, the favorable results of resection, and the unsatisfactory nature of substitutes for the upper limbs are the chief reasons for this difference.

5. Indication for primary amputation is extensive traumatism; such as laceration, crushing, and incomplete separation of the limb, especially if there is a rupture of the great veins and arteries.

6. An indication for secondary amputation is dry or seriously infectious gangrene. Other ascending infections (superficial gangrene) are amenable to conservative treatment.

7. Late amputations are indicated in chronic infections by cachexia, which is not amenable to treatment.

Primary amputations, or that within 24 to 48 hours, should be effected as nearly in the region of the fracture as the seriousness of the lesions will permit. The operation should be by simple section of the soft parts or with rectification of the bones.

Amputation for infection should be flapless or with short flaps held apart. If there is need it can be revised when the wound has been disinfected and the soft parts have been given all the elongation possible.

The technique of a delayed amputation should be determined largely by the requirements of an artificial limb.

In cases of fracture complicated by extended fissures of the bone, amputation may be performed in the region of the wound, thus preserving the fissured bone, provided sufficient disinfection of the wound is possible.

1. In the case of serious shock the use of nitrous oxide and oxygen is desirable; ether is the next best anesthetic.

2. In general, except in extreme cases, shock is not a counterindication for amputation.

3. Preventive hemostasis is necessary; it should be complete.

4. The periosteum should be neatly cut without causing separation.

5. In primary amputations, especially for infection, the wound ought to be left wide open. The operator should be on his guard against interstitial separations. English surgeons even advise leaving the blood vessels ligatured and the nerves exposed at the surface of the wound.

6. After the operation, the chief precautions should be: 1. The disinfection of the wound against osteomyelitis; 2. The control of the healing of the flaps.

7. More attention should be paid to the length of the stump than to the amount of remaining flesh.

*Amputations of the lower limbs.*—The disarticulation of the hip even by the raquet process, with preventative ligature of the vessels, is more serious than an intertrochanteric amputation.

A thigh stump ought to be at least 12 to 1+ cm. in length below the great trochanter in order to permit of a successful artificial limb.

The amputation of the thigh in the upper region makes it difficult to provide a substitute because of the removal of the femur.

An amputation in the middle or lower region gives good results. The sciatic nerve must be cut above the flap.

The Gritti operation should not be practiced except in delayed amputation.

The disarticulation of the knee is effective as a preliminary operation.

Amputation in the plateau of the tibia gives good results, as it permits walking with the stump of the knee.

Amputation of the leg should be as low as possible; the posterior flap is preferable; the fibula should be cut about an inch above the tibia.

Excellent results may also be obtained by tibio-tarsal disarticulation with section of the malleoli, subastra-

galus disarticulation, Lisfranc, osteoplastic amputations, Syme, Pirogoff.

The Chopart operation may be practiced in secondary and delayed amputation.

Any resection of the bones of the foot which leaves a good plantar sole with normal axis of the leg should be preferred to amputation. (Further discussion at fourth conference, see p. 70.)

*Amputations of the upper limbs.*—In amputations at the shoulder it is well to preserve the head of the humerus.

Amputations of the arm should be as low as possible—10 cm. of bone are needed for a stump. The method may be either circular or with flaps.

In amputations of the forearm leave, whenever possible, 10 cm. of bone below the elbow for leverage. The movements of pronation and supination should be maintained.

On the hand only primary rectifications should be made, unless more complete operations are necessary, because of the service value of every segment preserved.

Treatment of joints above the place of amputation, as well as the exercise of the muscles, should be continued during the entire period of healing.

The artificial limb should be applied as soon as possible. The use of a temporary apparatus is often called for, especially in the case of the lower limbs.