

(2) preventing the mattress from sliding on the table:

(1) Placing the patient in the Trendelenburg position is simple, but must be done precisely and in advance. (a) The patient is placed so that the creases at the back of the knees are about 3 to 4 inches below (toward the foot) the line where the foot portion of the table hinges. (b) *Before* turning the table to the Trendelenburg position, the foot of the table (from knee to toe) is lowered. (c) The table proper is then tilted head downward. The patient will slide toward the head end for 1 or 2 inches until the back of the knees catches at the break in the table. (d) When final position has been attained, the foot portion of the table should be depressed at the same angle at which the rest of the table is tilted in the opposite direction.

(2) When patients slide after being placed in tilted positions, almost always it is really the mattress that is slipping. Patients rarely slide on the sheet on which they lie. Most slipping occurs between the sheet and mattress or the mattress and the

table, especially if the rubber covering is smooth or old. This misadventure is prevented by securing the sheet and mattress to the operating table with a few strips of wide adhesive tape *beforehand*, or by replacing the mattress with a newer type which does not slip as much as an old mattress.

These methods have been used successfully without employing braces in hundreds of cases during the past four years. It was necessary to add shoulder braces in only two instances of steep Trendelenburg position for very obese patients, and in these cases the majority of the weight was borne by the legs and body, as already described. There have been no instances of sore legs or paresis of any nerves of the legs, and the incidence of phlebitis of the lower extremities has not increased. Either of these methods will be effective in moderate Trendelenburg position and if both are used, even steep head down postures can be handled easily.

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## AN ELECTRIC SHOCK APPARATUS FOR VENTRICULAR DEFIBRILLATION

We are presenting an adaptation of a conventional type of electric shock apparatus to serve as a ventricular defibrillator. The equipment is a commercially available "shock machine" which was designed for convulsive therapy by the psychiatrist. It incorporates a variable electronic timer of high accuracy and an efficient variable voltage adjustment control which make it a suitable apparatus for defibrillation. This apparatus as adapted has been tested and found to deliver the electric shock necessary for ventricular defibrillation that is, a 60 cycle alternating current with a potential of 110 volts and a current of 1 to 1.5 amperes for one-tenth to five-tenths second.

We have had constructed two flat heart electrodes which are 2 inches square and made of copper heavily plated with silver. The right angled handles are made of a nonconducting plastic material which pro-

tects the operator from accidental leakage of current and they provide a convenient holding angle at which to apply the electrodes to the heart. The electrodes may be sterilized by immersion in alcohol or Bard-Parker solution.

The only alteration which we made in the electrical circuit itself was to install an isolating transformer between the wall outlet and the shock apparatus. This provides an extra measure of protection to the patient by preventing him from getting a "ground shock" should he accidentally become connected to ground by contact with the metal operating table or through the leakage of blood or irrigating fluid.

Several salient physical factors are concerned with the placement of the electrodes and the choice of the current. The voltage used should be roughly proportional to the transverse diameter of the heart. The compression applied to the heart with the electrodes by the operator is an important fac-

\* Manufactured by the Electro-Physical Laboratories, Inc., Rye, N. Y.

tor since increased compression reduces the effective resistance of the heart and allows a lower density of current to be used. Since the highest resistance in the heart is the "contact resistance" at the site where the electrodes touch the heart, we have provided the electrodes with "booties" of cotton fabric which are moistened with saline solution. This insures good contact and tends to prevent burns to the myocardium.

The apparatus itself is grounded but is not sparkproof. All of the exposed electrical circuits are enclosed in a wooden case so that the possibility of explosive mixtures getting into the apparatus is extremely remote. The explosive hazard of a spark occurring at the contact site always exists. The possibility that such a spark would cause an explosion is minimized by the fact that part of any cardiac resuscitation is the halting of administration of the anesthetic agent and the washing out with oxygen. This routine procedure minimizes the explosion hazard by diluting the explosive gases below their explosive range.

The apparatus has been tested on animals and employed for human defibrillation with success. The electrical characteristics advocated are 110 A.C. voltage of one-tenth to two-tenths second.

#### SUMMARY

A method of adapting a commercially available apparatus for use as a cardiac defibrillator is presented. Changes in the mechanism and precautions for use are described.

#### REFERENCES

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### PROBLEMS ENCOUNTERED IN ANESTHESIA FOR CARDIO-PERICARDIOPEXY

Cardio-pericardiopexy is an operation designed to rehabilitate cardiac cripples. With this procedure an attempt is made to overcome the myocardial ischemia by establishing adequate collateral circulation as well as producing myocardial hyperemia. Talcum powder is inserted into the pericardial sac to establish adhesive pericarditis. Anesthesia for this type of surgical intervention entails the development of a regimen that can easily be managed by a badly damaged heart. Extrasystoles, circulatory collapse, ventricular and auricular fibrillations, and cardiac arrest have been encountered during operation.

Thompson and Raisbeck (1) have stated: "The selection of patients for the operation depends on the following: (1) The establishment of a positive diagnosis of coronary artery disease with angina. This may depend upon subjective findings such as a distinct and clearly defined anginal syndrome, pain of the characteristic nature and distribution with a definite relationship to

effort. Or it may depend upon objective evidence of myocardial disease as revealed by electrocardiogram, although this is occasionally absent. (2) The lack of improvement after fairly prolonged medical treatment. (3) An extreme degree of disability, corresponding to at least class three of the Heart Association classification, necessitating greatly limited physical activities.

"A previous coronary occlusion is not a contraindication; however, sufficient time must have elapsed to permit healing of the infarct. The two principal contraindications to the operation are congestive failure and an active infarct. An attempt is made to rule out the presence of an active process by means of serial electrocardiograms, blood sedimentation rates and white blood cell counts. These three tests are performed each day for four or five days immediately preceding the operation. If the electrocardiograms are not stable and the other two tests show an abnormal increase, the operation is postponed" (1).