

megaly in rabbits in which large amounts of pectin had been injected. . . . Pectin, though inferior to blood or plasma, appears to be of more value than glucose or saline in the prophylaxis of shock in extensive surgical procedures. Pectin is non-toxic and non-antigenic in the quantity 1,000 to 1,500 cc. usually required to maintain blood pressure in the presence of shock producing conditions. Untoward results appeared only after the intravenous injection of amounts in excess of 4,000 cc." 6 references.

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ADAMS, R. C.; LUNDY, J. S., AND SELDON, T. H.: *Shock in Relation to Anesthetic Management*. S. Clin. North America, Mayo Clinic Number 808-813 (Aug.) 1944.

"The treatment of shock by the members of the department of anesthesia in a large surgical hospital has resulted in efficient teamwork between surgeons and anesthetists. This has been mutually beneficial and of definite advantage to the patient. . . . The anesthetist begins before the time of the operation to evaluate the surgical patient and what will happen to him during surgical intervention. . . . Having the general condition of the patient in his mind, together with the operative possibilities, the anesthetist chooses his anesthetic or a combination of them, to suit the case. . . . The attempt must be made to administer the minimal amount of anesthetic agent that is commensurate with the needs of the surgeon. A so-called good anesthetic may not necessarily be one which provides optimal working conditions for the surgeon. Too much anesthetization may instigate, and also aggravate, shock from other causes. On the other hand, too little anesthetization, or the choice of an inadequate agent or method, in the hope of minimizing anesthetic shock, may work

in the reverse manner. Too light surgical anesthesia, poor relaxation, active reflexes, straining and so forth may lead to prolongation of the operation, excessive retraction and manipulation and excessive surgical trauma in general, all of which contribute to production of surgical shock. It is better in the long run to use a method of anesthesia which is adequate for the operative procedure so that the operation may be expedited and the patient returned to his bed as soon as possible. . . . The main causative factors which may throw the surgical patient into a state of shock are: (1) psychic trauma, (2) pain, (3) loss of heat, (4) surgical trauma, (5) oxygen want and (6) loss of blood and other fluid. The first two of these are taken care of by the preliminary medication and the anesthetic itself. Loss of heat can be minimized by application of external heat and minimal exposure of the region of operation. Surgical trauma to a certain degree is inevitable but can be minimized by gentle manipulation by the surgeon and his assistants. . . .

"A continuously patent airway is essential and is best provided by insertion of an intratracheal tube. This permits the efficient oxygenation of the patient which is so vital in combating shock. It also facilitates artificial respiration and resuscitation if the need arises. Apparatus must be at hand for the administration of oxygen under positive pressure, whereby the lungs can be inflated should circulatory and respiratory function become depressed. Facilities for suction-aspiration of the tracheobronchial tree must be provided. . . . Loss of blood and tissue fluid from the site of operation is variable and may depend on many factors. The important thing is that these losses, if extensive, must be compensated for before the patient reaches a profound state of shock. . . . Complicated apparatus and blood chemical

and physical estimations, while interesting and enlightening, are not essential to the gathering of information relative to the onset of shock. One of us (Lundy) has reiterated that a patient who is pink, warm and dry during the course of an operation probably is in reasonably good general condition. This simple information tells the anesthetist that the patient is well oxygenated, that his circulation is adequate and that insensible loss of fluid is at least minimal. This is in contradistinction to a patient who is blue or gray, cold and wet, the typical picture of shock. In addition to knowledge of the rate and character of the patient's pulse, his blood pressure, the capillary filling time (blanching test) and the condition of the skin, the anesthetist should have an approximate idea of loss of blood from the field of operation at all times. This, when added to the estimated insensible loss of fluid and salt, forms a basis for estimating the quantity of fluid necessary for replacement. Although persistent fall in blood pressure during an operation may forecast the onset of shock, the blood pressure alone is not a reliable sign of the presence or absence of shock. If the fall in blood pressure is not accompanied by a rising pulse rate, if the patient is warm and dry and if it is obvious that there has been little loss of blood or other fluid, no need for alarm exists, for the blood pressure probably will return to normal. In such instances, however, use of stimulant drugs such as ephedrine or neosynephrin may be indicated.

"On the other hand, if the fall in blood pressure is progressive and persistent, if it is accompanied by a pulse that is increasing in rate and decreasing in volume, if the patient's skin is cool and moist and if he obviously has been losing blood, shock has set in and probably will be progressive if left untreated. In such an instance,

the elevation in blood pressure resulting from administration of stimulant drugs will be transient and will lead only to a false sense of security. The use of stimulant drugs under these circumstances is permissible only as an interim measure, to sustain the blood pressure until intravenous supportive measures can be instituted. The important thing when a patient shows this combination of symptoms is to start administration of blood or other fluids or both, without delay. When it is obvious that a patient is losing blood and will probably lose more, supportive measures should be begun at once, whether or not signs of approaching shock have begun to appear. For these reasons, if an extensive major operation is to be done, or if the patient constitutes a poor risk for any reason, or if the operation probably will be long and more than the usual amount of blood will be lost, the patient is prepared for administration of supportive therapy at the time the anesthesia is begun. . . . The type of solution necessary in the treatment of shock will vary under different circumstances, as will the amount. . . . The rate at which the infusion can be given will depend on the rapidity of the loss. If the loss has been acute and rapid and the blood pressure is well down, there is no harm in infusing blood and other fluids as rapidly as possible until the symptoms are relieved and the blood pressure approximates normal. After this desirable effect has been attained, slow infusion is essential to prevent overloading the circulation and preventing such effects as pulmonary edema."

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LUNDY, J. S.; TUOHY, E. B.; ADAMS, R. C.; MOUSEL, L. H., AND SELDON, T. H.: *Annual Report for 1943 of the Section on Anesthesiology: Including Data and Remarks Concerning Blood*