EMERGENCY RESUSCITATION

BY

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An accident or sudden illness which impairs respiration and/or circulation may result in potentially reversible death, when the victim's heart is too good to die. Respiratory obstruction or apnoea may complicate the unconscious state resulting from an accident or acute illness. The most common site of upper airway obstruction is the oropharynx. The most common cause of upper airway obstruction is the toneless tongue. Cessation of effective circulation, commonly referred to as cardiac arrest, may be due to ventricular fibrillation or asystole. This condition may complicate ischaemic heart disease, hypoxia due to asphyxia, shock, anaesthetic overdose, or other drug reactions, electric shock, etc.

Cardio-pulmonary resuscitation in the operating-theatre is performed under ideal conditions by a well-equipped, well-qualified team of anaesthetists and surgeons. When collapse with asphyxia occurs outside the operating-room the patient's life may depend on appropriate resuscitative measures being taken by the first person at the scene. It is important, therefore, that all medical and paramedical personnel, including trained first-aiders, be taught to perform emergency (heart-lung) resuscitation without delay, "on the spot."

The need for judicious inactivity is recognized when death comes not as an enemy but as a friend. Under other circumstances, however, when there may be a flicker of life left in the patient, medical and first-aid personnel must be prepared to take effective means to save a life.

The immediate first-aid requirement if the victim is not breathing is artificial respiration. It is of prime importance to provide a clear upper airway by hyperextension of the head. The victim's lungs are then ventilated by intermittent positive-pressure breathing. In an emergency situation mouth-to-mouth and mouth-to-nose resuscitation are the easiest and most effective methods of applying artificial respiration. If possible, the victim is placed on his back. The neck is then elevated or a pad is placed under his shoulders, the head is tilted back and the chin is raised. This position is maintained throughout the procedure (Fig. 1 a). The mouth and throat are quickly cleared of foreign matter with the fingers. The rescuer opens his own mouth widely and places his lips over the victim's mouth *or* nose in the case of an adult or large child. If artificial respiration is to be undertaken on an infant or small child the lips cover mouth *and* nose. As effective a seal as possible is obtained and the rescuer blows until the chest is seen to rise (Fig. 1 b). Adults require deep breaths, while infants and small children need only small puffs of air. This procedure is repeated every three to four seconds in adults or every two to three seconds in small children.

If the chest fails to rise or if air is not heard to return from the lungs, a check must be made for respiratory obstruction. Mouth and nose are quickly cleared again, and, if it is found that foreign matter is not the cause of obstruction, head and neck are checked for correct positioning. In mouth-to-mouth breathing the victim's mouth is opened by drawing down his lower lip; air leakage from his nose is prevented by application of the rescuer's cheek to the nose or by pinching the nostrils. Between breaths the rescuer's mouth is removed, the victim's mouth kept open, and the head tilted back to permit escape of air from his lungs. In mouth-to-nose breathing the rescuer rests his cheek on the victim's mouth to prevent leakage. The rescuer again removes his mouth between breaths while the head is kept tilted backwards to allow for escape of expired air. This intermittent positive-pressure breathing is maintained until spontaneous respiration is resumed or until expert assistance is obtained.

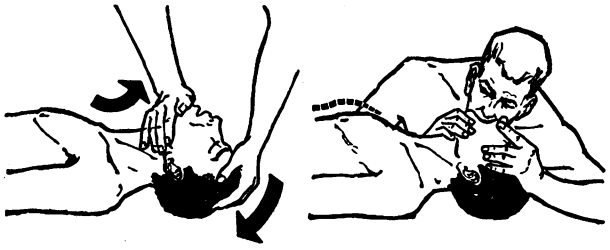

FIG. 1.—Intermittent positive-pressure breathing. (a) Head hyperextended and chin raised. (b) Mouth-to-mouth resuscitation. Look for chest rise with each inflation.

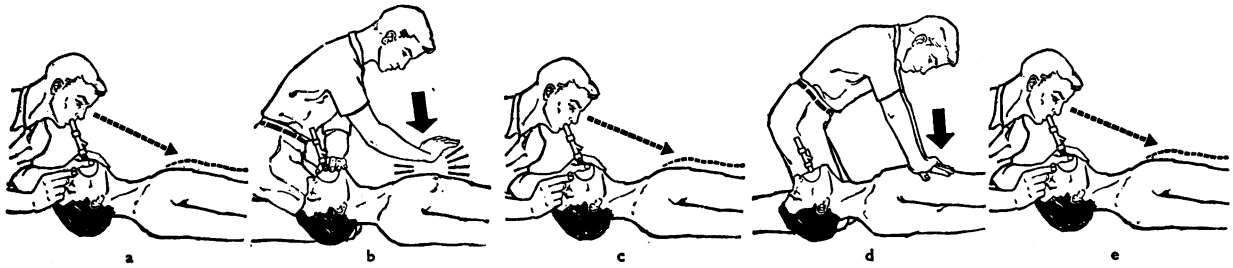

FIG. 2.—Emergency resuscitation. Mouth-to-mouth resuscitation (using the Brook airway when available) plus external cardiac resuscitation. (a) Begin artificial respiration at once. Place victim on back, tilt head fully back, insert airway over tongue. Raise the chin and pinch nostrils closed. Blow every 3–4 seconds. Watch for chest rise, and listen for sound of air returning from victim. (b) If there is no response after 1–2 minutes, as evidenced by no improvement in colour, no spontaneous respirations, no detectable pulse, dilated pupils, in the absence of any chest injury, thump lower third of breast-bone sharply with butt of hand three times. (c) Resume direct artificial respiration. (d) If there is still no response after one minute, begin external cardiac resuscitation. Place heel of hand on lower third of breast-bone. Place other hand over first as illustrated, keep arms straight, press sharply 60–80 times per minute. (e) After one minute, resume direct artificial respiration. If required, alternate 15 chest compressions and 2 airway breaths until assistance arrives or victim is rescued.

If there is no response after two to three minutes, as evidenced by lack of improvement in colour, absence of spontaneous respirations, imperceptible pulse, and dilatation of the pupils, external cardiac resuscitation is infinitely more suitable outside the surgical theatre than thoracotomy with cardiac massage. External cardiac resuscitation does not ventilate the lungs, and should be used only in conjunction with artificial respiration when mouth-to-mouth resuscitation alone fails to revive the victim (Fig. 2).

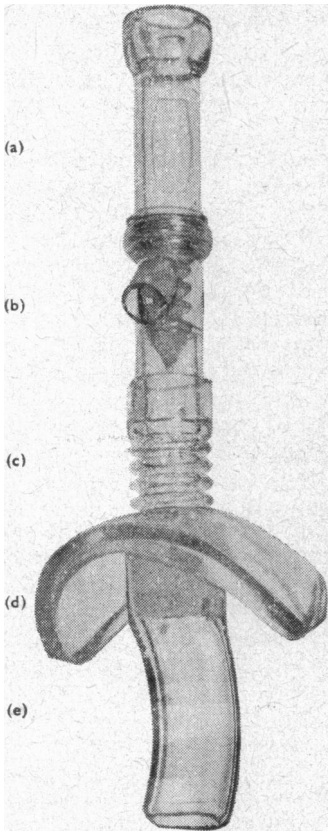

FIG. 3.—Brook airway. (a) Blow-tube. (b) Non-return valve. (c) Flexible neck. (d) Mouth-guard. (e) Oral airway.

Artificial respiration (mouth-to-mouth resuscitation) is designed to provide the victim with the oxygen he needs to survive. Artificial circulation (external cardiac resuscitation) is designed to carry the oxygen he requires to the vital centres. Without oxygen the brain will not survive more than a few minutes. Efforts at sustaining this lifeline of oxygen must be the prime concern of the person applying first aid.

Prognosis depends on the cause of the asphyxia or cardiac arrest, the underlying disease, the age of the patient, and the rapidity of instituting resuscitative measures.

Since mouth-to-mouth resuscitation was rediscovered as the preferred method of artificial respiration about five years ago, international medical scientists have reached unanimous agreement with regard to its superiority. Leading first-aid societies have endorsed the method in the past year or two. The use of adjunctive equipment, however, has remained a controversial subject.

While the first person at the scene may need to apply mouth-to-mouth or mouth-to-nose resuscitation to save a life, physicians, nurses, trained first-aiders, beachguards, firemen, policemen, and others who in the course of their duty may be required to save a life should not be deprived of suitable adjunctive equipment to facilitate the procedure, improve airway patency, remove the repugnancy, and protect the user against the danger of communicable disease.

The Brook airway (Fig. 3) is designed to provide these advantages. A non-traumatic, pliable, short oral airway channels air to and from the victim's lungs. It will neither reach the back of the throat to initiate a vomiting reflex nor impinge on the epiglottis to obstruct the larynx. A nylon bite-block ensures patency. The mouthguard provides an efficient seal against the escape of air and is held in place by the same hand which maintains the victim's head in the optimal position. The flexible neck permits resuscitation even when the victim cannot be ideally positioned. It is designed to accommodate the valve and blow-tube extensions as well as standard resuscitative equipment, air-bags, etc. A new silicone non-return valve deflects the victim's expired air through an escape vent. The technique of mouth-to-mouth resuscitation using the Brook airway is shown in Fig. 4.

Potentially reversible death from electrocution, suffocation, drowning, myocardial infarction, and drug reaction is a daily occurrence. Appropriate training of rescue and first-aid squads in effective methods of first-aid treatment which they can initiate is therefore essential. Coupled with the follow-through therapy applied by the physician, many of the unfortunate victims may be given a second chance to live.

Summary

A relatively recent standard method of emergency "on-the-spot" resuscitation is described. This has been proved to exceed in efficiency all methods of artificial respiration previously recommended. The "Brook airway" has been designed to facilitate mouth-to-mouth direct artificial respiration in the hands of the skilled rescuer. It has the advantage of avoiding direct contact with the patient's mouth, but its non-availability should not deter mouth-to-mouth respiration being carried out. A non-return valve incorporated into the airway protects the rescuer from contamination by the victim's exhaled breath. If no improvement in skin colour occurs after two or three minutes' artificial respiration, circulation must be presumed to be at a standstill and external cardiac resuscitation is then indicated. It is emphasized that external cardiac resuscitation does not ventilate the lungs and *must* be carried out in conjunction with artificial respiration.

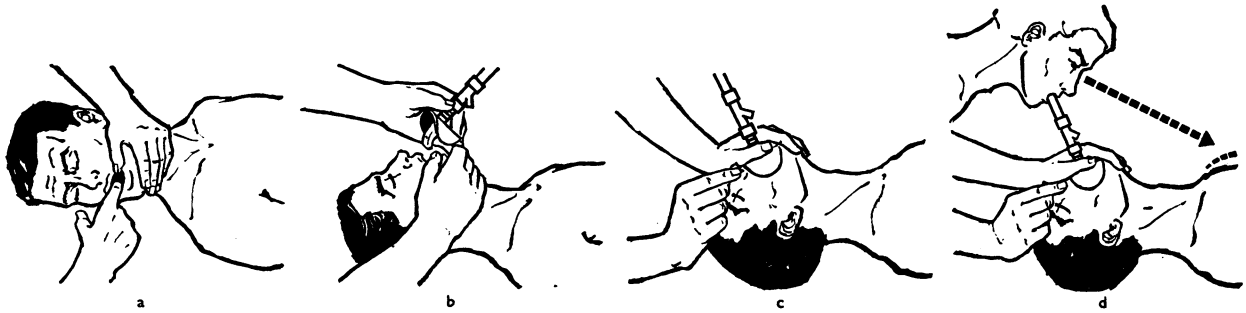

FIG. 4.—Mouth-to-mouth resuscitation using the Brook airway. (a) Place victim on back. Quickly clear mouth and throat of foreign matter with fingers. Tilt head fully back. (b) Insert airway over tongue until mouth-guard covers lips. (c) Raise the chin, and maintain this position with the same hand that holds the airway in place. Pinch nostrils closed to prevent air leakage. (d) Take a deep breath and blow into airway. Watch for chest rise. Between breaths listen for sound of air returning from the victim. Repeat every 3-4 seconds.

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SURGICAL TREATMENT OF CHRONIC LYMPHOEDEMA OF THE LOWER LIMB

WITH PRELIMINARY REPORT OF NEW OPERATION

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The accumulation of excessive amounts of lymph in the subcutaneous tissues of the lower limb may occur from two quite distinct groups of causes. Secondary (" obstructive ") lymphoedema results from the mechanical blocking of proximal lymphatics previously anatomically normal following trauma, surgical excision of inguinal lymph nodes often in association with post-operative infection or deep *x*-ray irradiation, the lymphatic spread of malignant metastases or (in the tropics) the filarial parasite. Primary (" idiopathic ") lymphoedema, whether inherited, congenital, or presenting clinically in later life, is now regarded as the consequence of a structural, developmental defect of the regional lymphatics resulting in functional derangement and lymph stasis (Kinmonth *et al.*, 1957). Radiological lymphangiography following the direct injection of diodone into the peripheral limb lymphatics, in the way described by Kinmonth *et al.* (1955), demonstrates that the defect may take one of three forms: aplasia with absence of lymph vessels, hypoplasia with poorly developed lymphatics in diminished numbers, or hyperplasia with dilated varicose and incompetent lymphatics (Kinmonth *et al.*, 1957).

Such limbs are prone to recurrent attacks of infection in the form of cellulitis and lymphangitis, now considered merely secondary to the pre-existing lymphatic abnormality (Kinmonth *et al.*, 1957 ; Taylor, 1959). In essentially all cases, however, whether primary or secondary in type, the stagnation and accumulation of lymph is limited to those subcutaneous tissues of the limb lying superficial to deep fascia, the muscles being unaffected. Early surgical treatment was directed, therefore, towards establishing drainage of the oedematous subcutaneous tissues of the limb into either the normal subcutaneous tissues of the trunk or the normal deep muscles of the limb itself.

Historical Survey of Operative Treatment

Handley (1909) inserted multiple silk threads subcutaneously throughout the length of the lower limb in the hope that the lymph would ascend by capillary attraction to the level of the iliacus muscle, in which the upper ends of the threads were buried, but confessed to failure a year later (Handley, 1910). No long-term successes have followed the substitution for the silk threads of strips of fascia (Lexer, 1919), or buried tubes whether of rubber (Walther, 1918), " polythene " (Hogeman, 1955), or " portex " (Jantet *et al.*, 1961). Failure was usually attributable to infection, extrusion of the implanted foreign material, and the impossibility of obtaining drainage against the force of gravity by the provision of valveless and inert channels. Gillies and Fraser (1935) introduced the more rational and physiological concept of transferring normal lymphatic vessels in a full-thickness flap of skin and subcutaneous fat taken from the arm to act as a lymphatic bridge across the postulated lymphatic block at the groin and so join the oedematous thigh to the normal tissues of the flank on the same side. Despite ingenious modification (Mowlem, 1948) this remains a procedure of some magnitude which has never repeated the success obtained in the first-reported single case. It has little relevance in cases of primary lymphoedema where the lymphatic maldevelopment is widespread (Mowlem, 1958 ; Taylor and Kinmonth, 1949), any response being more likely to be due to the local implantation of new lymphatics with competent valves than to the successful bridging of a local obstruction (Kinmonth and Taylor, 1954).

The superficial lymphatics draining the skin and subcutaneous tissues communicate so very rarely with the deep lymphatics draining the subfascial compartment of the limb that, as a general proposition, it remains true that the superficial and deep lymphatics are independent of each other until they reach the inguinal region (Poirier *et al.*, 1903 ; Clark, 1958). This view, traditional among anatomists, has received confirmation from modern methods of lymphangiography in human subjects (Blocker *et al.*, 1960). On the assumption that the lymph drainage of deep tissues was unaffected in cases of lower-limb lymphoedema, many surgical efforts have in the past sought to establish drainage of lymph from the oedematous superficial into the normal deep tissues by removing the deep fascia separating superficial from deep lymphatic systems. Lanz (1911) devised a means of communication between the superficial and deep tissues of the lateral thigh by turning pedicled strips of deep fascia into the underlying muscle layer, even inserting them through trephine holes in the femur into the marrow cavity. Kondoléon (1912) later simplified the procedure and extended it to the lower leg by excising in two stages long strips of deep fascia through long medial and lateral incisions. In a late follow-up of his cases Kondoléon (1924) stressed that the greatest improvement in the size and function of the limb occurred where a more radical excision of fascia had been employed in early cases without appreciable subcutaneous fibrosis. Although restoration to