Updating Cardiopulmonary Resuscitation

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SUMMARY :

Make a diagnosis of cardiopulmonary arrest, palpate carotid pulse, look for chest movement, and associated air movement. Don't freeze, if in doubt begin CPR. Extend head and remove any foreign body to form adequate airway. Thump and then proceed immediately with CPR. When giving artificial ventilation, watch for sternal motion, correct air leaks around nose and mouth, correct airway obstruction. The patient should be placed on a hard surface. When giving a cardiac compression the heel of the hand should be parallel to sternum and not over exiphoid process. See that the compression is 1.5 to 2 inches in adult; place weight of shoulders and torso over extended arms. Compression and relaxing should be timed equally. Promptness of the resuscitative efforts and the expertness with which they are delivered may help salvage many a patients who have had cardiac arrest. Smooth and co-operative performance of CPR needs a lot of education, instruction and practice. Doctors and paramedics working in hospitals especially in Emergency Wards should realise the paramount importance of CPR. As physicians working in different departments it is of utmost importance that we initiate personal training, supervise drills, and conduct review sessions after CPR.

With added awareness and consciousness we may not only be able to save the hearts which are too good to die but we may also be able to salvage some of the extensively damaged ones.

CARDIOPULMONARY RESUSCITATION

Few if any advances have so dramatically altered the area of emergency medical care as the advent and widespread application of mouth to mouth ventilation and closed chest augmentation of the circulation. Knowledge of CPR assumes enormous importance for physicians staffing areas such as intensive care units, emergency wards, and operating rooms, where cardiac arrests are frequently encountered. Doctors throughout the hospital should acquire personal expertise in CPR and should also train medical technicians and nurses, enthusiastically.

First a quick diagnosis of cardiopulmonary arrest should (Fig. 1) be made. This can be done by palpating for carotid or femoral pulse, listening for breath sounds and observing thoracic and abdominal wall motion.

At the start of CPR, the status of the pupils should be (Fig. 2) noted. This may give some indication of the time that has elapsed since cessation of adequate circulation. The pupils begin to dilate between 30 and 45 seconds after effective circulation has stopped. In contrast, it takes 4-5 minutes for cerebral cortical damage to become inrreversible. Therefore, the presence of

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fixed, dilated pupils is not a contraindication to the institution of CPR. The return of pupillary responsiveness or constriction during the resuscitative effort indiates re-establishment of cerebral oxygenation.

Successful resuscitation lies on the realisation that time is of vital importance, and it must be clearly understood that irreversible brain damage may occur as early as 3 1/2 to 4 mins. Once it is determined that the patients respiratory activity and circulation is absent or markedly depressed, immediate application of resuscitation techniques is indicated. The victim should be placed on a hard surface supine and head downwares. If the patient is in bed a hard board should be placed beneath the spine, and the ABC of cardiopulmonary resuscitation begun forthrightly.

A: Airway: Ensure that airway is open. Place one hand beneath the patients neck and the other on his forehead, lift the neck with one hand and tilt the head backward by pressure with the other hand [Fig. 4]. In such a fashion the neck is extended and the tongue is lifted away from the back of the throat, relieving any anatomic obstruction of the airway produced by the tongue lying against the back of the throat (Fig. 3). This simple maneuver may establish a patent airway, and in some arrests this may be all that is necessary for resuscitation. If a broken tooth, artificial denture, or any object is in the way an attempt must be made to clear it.

If an injury to the cervical spine is suspected the neck should not be extended. Alternatively, airway can be opened by means of jaw-lift

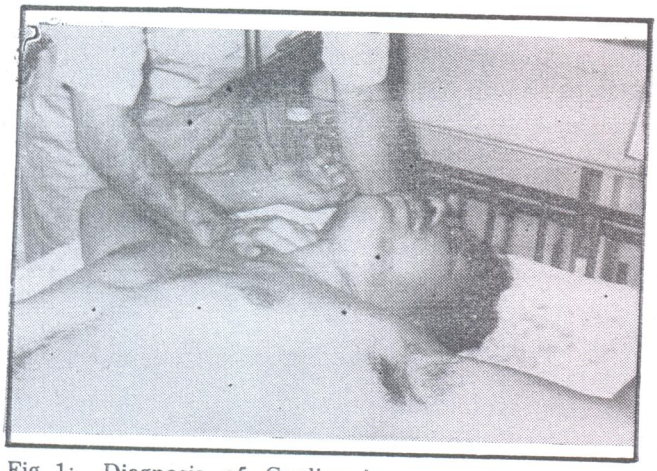


Fig. 1: Diagnosis of Cardiopulmonary arrest is made by extending patients head, palpating for carotid puse, listening for breath sounds, and observing sternal motion.

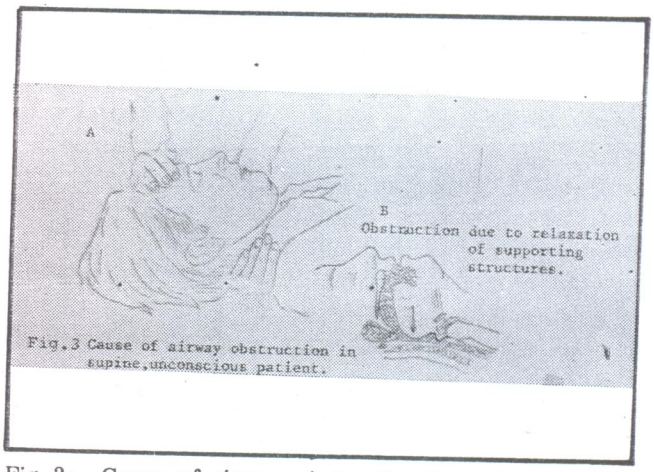


Fig. 3: Cause of airway obstruction in supine, unconscious patient.

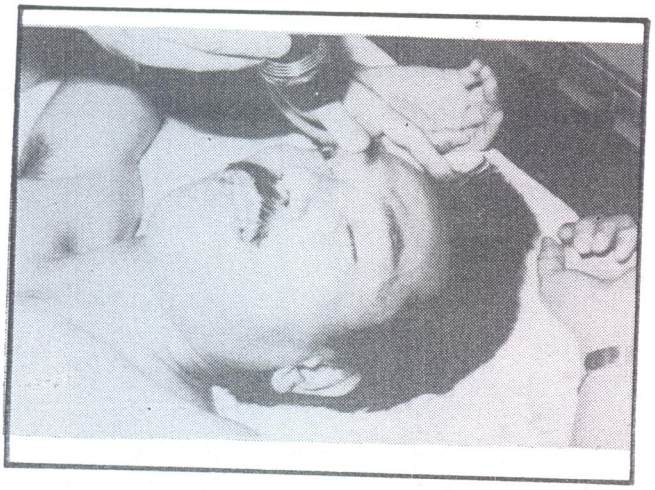


Fig. 2: Observation of pupillary status.

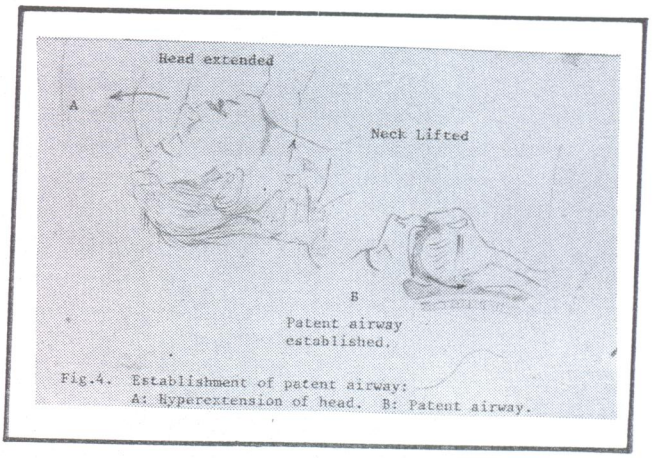


Fig. 4: Establishment of patient airway :
A. Hyperextension of head.
B. Patent airway

method, placing the fingers bilaterally behind the angles of the mandible and displacing the mandible forward, or chin-lift method (Fig. 5).

B: Breathing: Mouth to mouth, or mouth to nose artificial respiration must be started immediately. It is advisable to keep a gauze piece, if handy, otherwise, a "dopatta" can serve the purpose. Take a deep breath and exhale into the patients' mouth, and look for expansion of the victim's chest. When the chest rises, take your mouth away and let him exhale on your own (Fig. 6).

In an emergency ward, however, mechanical devices such as ambu bag are usually employed rather than mouth to mouth technique. When properly used the devices help in effective ventilation and administration of high concentration of oxygen, but their correct use is a skill that must be learned and practised. Repeated and prolonged and unskilled efforts at intubation of the dusky patient which necessitate interruption of closed chest massage and which may traumatise the airway are to be condemned. Usually a rate of 12 respirations per minute.

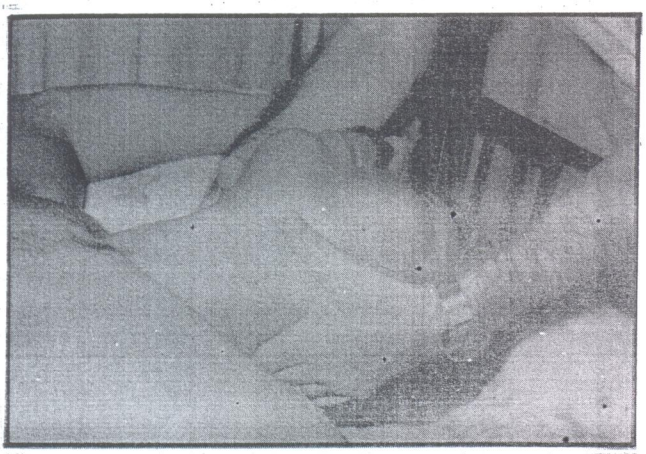
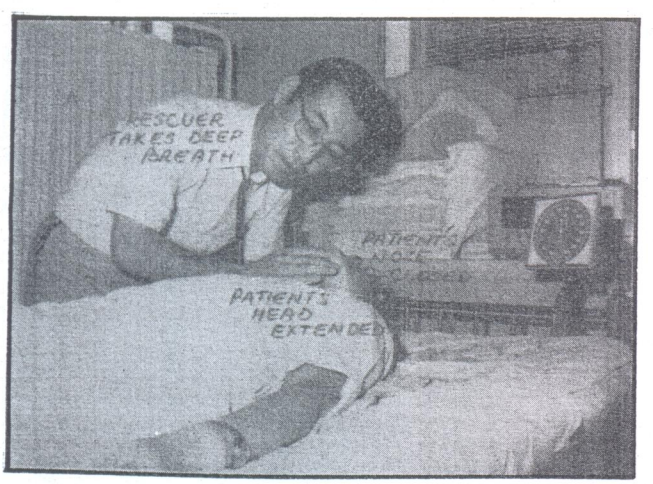


Fig. 5: Alternate methods to open airway if cervical injury is suspected.

C: Circulation: Simultaneously with A&B institute closed chest cardiac resuscitation. A sharp blow to the mid portion of the sternum may be able to restart the heart beats. Thumping should not be continued since the second or third blow is usually not effective. It is ineffective in patients with anoxic arrests. For external cardiac massage, ideally one should be directly over the victim, with elbows extended and with the pressure exerted from the shoulder downwards. The resuscitator should place the heal of one hand parallel to and ove the lower half of the sternum and the heal of the second hand on top of the first (Fig. 7). Be careful to avoid applying pressure on the xiphoid process, otherwise there is danger of lacerating the liver of spleen. Since the early 1960s at the time of development of modern cardiopulmonary resuscitation technique, Jude, Kouvenhouven, and Knickerbrocker proposed that blood flow following sternal displacement resulted from direct compression of the heart. This notion gained universal recognition and acceptance. Recent research findings seem inconsistent with the direct compression hypothesis. It has been shown that for the most part blood flow during sternal compression results from the generalised rise of intrathoracic pressure during chest compression not cardiac massage. Any one of a number of maneuvers which increase intrathoracic pressure moves blood in proportion to the rise of intrathoracic pressure. The compression should be firm and smooth with a



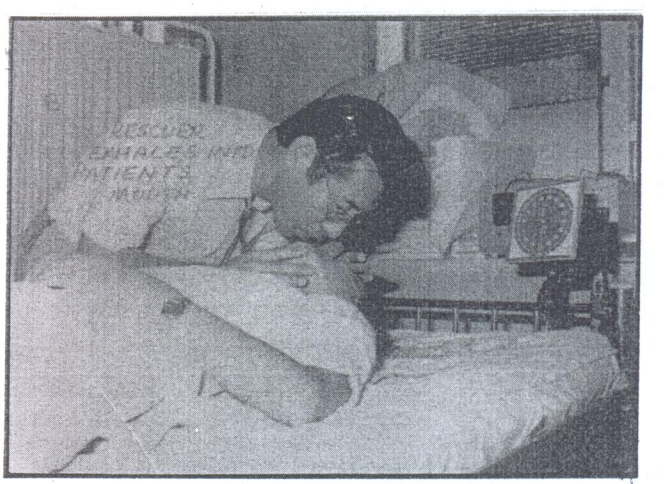


Fig. 6: Techniques of mouth to mouth ventilation.

frequency of 60 to 80 per minute. Care should be taken not to let the fingers rest on the ribs or constrochondral junctions because of the dangers of applying force to one side of the sternum and cracking or dislocating the ribs. Do not remove the heel of the hand from the sternum otherwise the thoracic cage bounce and damage to it may ensue.

The force required to increase the thoracic pressure varies from using the fingers to resuscitate the newborn, to hand and arm weight in the child, to full shoulder and trunk weight in the atheletic heart. Extra care should be exercised in older patients with arthritis and brittle bones.

If there is only one person available for initial CPR and he has to carry out both the procedure together, he should combine 3 ventilations with 15 sternal compresses on the chest. If two persons are available, the ratio can be one breath to four sternal compresses. It should be emphasised that chest compresses should not be interrupted to allow ventilation of the lungs the latter should occur between the fifth and first sternal compression in each cycle. If it is necessary to move a patient or to insert an endotracheal tube, interruption in CPR should not exceed 15 seconds.

To check for effectiveness of CPR palpate the carotid or femoral pulse. There should be an impulse felt with each compression. Check the eyes for return of blink relfex or pupillary responsiveness.

Usual complications of CPR are, costrochondral separations, and fractured ribs, pneumothorax, hemothorax and pulmonary contusions.

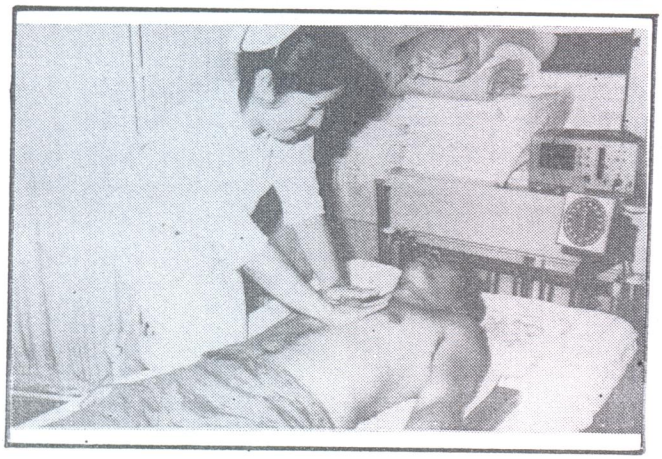


Fig. 7: Correct hand position for closed-chest cardiac compression.

Fig. 8: CPR with two rescuers.

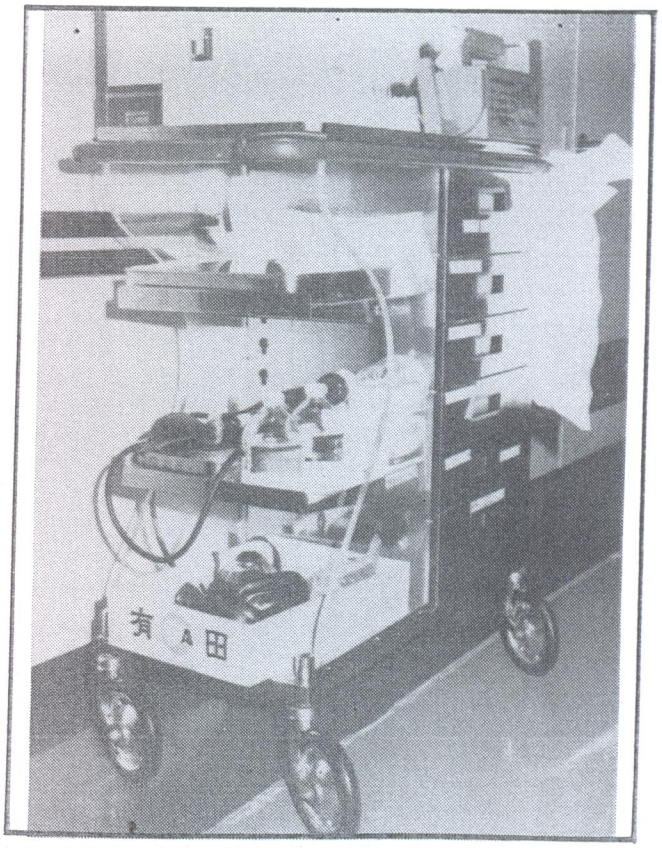


Fig. 9: Crash trolley.

By learning the details and paying careful attention while performing CPR will help reduce complications. Raise lower extremities, this may provoke a heart beat by augmenting the return of blood to the right atrium and thereby stretching cardiac muscle (Starling's Law).

Without stopping CPR attach ECG leads and determine rhythm. If VF is detected, defibrillate with D-C Defibrillator set to deliver approximately 400 watt-second. If the leads have not been attached but VF is suspected blind defibrillation should be performed. The defibrillator paddles should be wrapped with guaze pieces and ample eletrode paste applied on them or on the skin. Correctly, one paddle should be placed to the right of the upper portion of the sternum and the other lateral to the normal position of the cardiac apex in the mid-axillary line.

After defibrilation has been attempted, ventilation and external cardiac compression should be instituted immediately and should be continued until it can be determined by the electrocardiogram that an effective rhythm has been obtained. It is important to believe that all hearts can be defibrillated. If a rate above 60 beats per minute has been achieved the physician should palpate a carotid or femoral pulse. If a pulse is present with adequate blood pressure a close watch is indicated. Check the vital signs frequently if the pulse becomes weak, start CPR again and institute additional therapeutic measures.

DRUG THERAPY :

From the very beginning put in a inravenous catheter, so that drug therapy can be started. The catheter is better placed in a large vein in the neck for example, subclavian, internal jugular or external jugular. Transthoracic or intracardiac administration of drugs is fraught with dangers and is justified only before I.V. line is set up or if an intravenous route cannot be established. Potential complications of transthoracic or intracardiac approach include coronary artery laceration, pericardial hemorrhage and hemopneumothorax.

It is very important to realise that equipment and medication should be immediately available. For this purpose a crash trolley should be prepared and kept uptodate so that valuable time is not lost (Fig. 9). Confusion should not be allowed to prevail. It is best to have two distinct emergency drug trays. The first should contain syringes, intracardiac and regular needles, intravenous sets, fluids, epinephrine, calcium chloride, lidocaine and bicarbonate. The second tray should contain medications such as digoxin, procainamide, is proterenol, atropine, vasopressors, etc.

The two most useful drugs are sodium bicarbonate and epinerphrine. Metabolic acidosis is dangerous to myocardial function because it causes arrhythmias and impairs contractility. Bicarbonate is usually administered in a dose of 1.5 to 2 ampoules containing 44.6 mEQ./ampoule. If arterial pH and Pco2 measurements are not available, one half of the initial dose of sodium bicarbonate may be administered every 10 minutes during resuscitation. Epinephrine increases the myocardial contractile force and raises the heart rate (B-effect). If ventricular fibrillation is present and the fibrillary waves are small they can be made coarse by epinephrine when the heart may become more amenable to defibrillation. With electromechanical dissociation, without a palpable pulse, 0.5 mg. of epinephrine may be administered intravenously at 5-minute intervals to stimulate the heart. Catecholamines such as epinephrine, isoproterenol, norepinephrine, and dopamine work best at a sightly alkaline pH from 7.35 to 7.50, so pH correction with bicarbonate is mandatory.

If a rhythm below 60 beats per minute with a palpable pulse has been established either Atropine 0.5 to 1.0 mg I.V. as a bolus or isoproterenol, 1 mg/250 ml. infused intravenously at a rate adequate to produce the desired effect, may be administered for its chronotropic effect on the heart. If the bradycardia is persistent, a temporary pacemaker should be placed in position.

When defibrillation has successfully been established, lidocaine should be used to suppress venticular irritabilty. It may be given as a bolus or as in infusion of 1 to 4 mg./min. to prevent recurrent ventricular irritability.

Calcium is not one of the first drugs to be administered in cardiac arrest except in one situation, hyperkalemic arrest. It should be used with caution in digitalised patients because it potentiates digitalis toxicity. It should be used as a "second-line" drug in refractory electromechanical dissociation, asystole, or fibrillation refractory to counter-shock. Intervenous administration of 10 ml. of a 10% solution of calcium chloride or gluconate at 10 minutes intervals may be considered appropriate.

If CPR has been successful, the patient should have continuous cardiac monitoring, sequential arterial blood-gas determinations, frequent monitoring of the vital signs, and if indicated, assisted

or controlled ventilation. He should be shifted to I.C.U. or C.C.U. but should not be transported unmonitored or in an unstable condition.

Common errors in basic cardiopulmonary resuscitation include, delay in diagnosis, and in starting CPR, inadequate airway, inadequte ventilation, failure to place patient on hard surface, repeated thumping, poor hand position on the sternum, inadequate sternal compression and lack of smooth compression. Do not interrupt CPR for prolonged period for inexpert attempts at intubation. Do not let lack of preparation catch you offhand. In a team designate a leader and delegate responsibilities to the members.

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