

CARDIAC ARREST : RESUSCITATION BY MANUAL MASSAGE A CASE REPORT*

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Unexpected cardiac arrest has been a problem for many years, but in recent years reports of successful resuscitations have been appearing in the literature with increasing frequency. In 1953 it was suggested that all the published cases should be brought under review and the clinical effectiveness of treatment evaluated.¹

Cardiac arrest seems to occur more commonly among very young or very old patients. Some cases have been attributed to organic lesions such as tumor or infectious disease, but among infants and children it is most likely that hypoxia has increased the sensitivity of the myocardium to the vago-vagal reflex.

Any or all of the following factors may play a contributing role in arrest of the heart :

1. *Adrenals.* Increased secretion of adrenalin may be due to surgical manipulation of the adrenal gland, emotional states, hypoglycemia, or adrenergic tumors. Increased vagal tone may further sensitize the myocardium.

2. *Ischemic areas in the myocardium* due to coronary arteriosclerosis.

3. *Serum potassium level,* whether abnormally high or abnormally low.

4. *Reduction of blood pH* due to increased CO₂ tension and hyperpnea. This would increase the irritability and excitability of the vagus nerve.

5. *Hypoxia,* producing an increased sensitivity of the carotid sinus reflex.

6. Anesthetic agents, such chloroform or cyclopropane, which sensitize the heart to the action of epinephrine.

7. Allergic reactions to drugs used intravenously or intrathecally.

8. Transfusions.

9. Bacterial toxins.

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Diagnosis

In one study² of 1200 cases of cardiac arrest it was stated that the time factor for resuscitation was very important. 47 % of all successful cases were massaged within four minutes. If the necessary procedures were delayed for more than this time, the survival rate was only 6 %. Therefore early diagnosis is very important.

If the patient's pulse is not palpable and blood pressure not obtainable, this should be considered sufficient indication for thoracotomy and cardiac massage. If the delay exceeds four minutes, not only is the chance of survival diminished, but most of those who recover will exhibit permanent brain damage due to anoxia.

Who should attempt resuscitation? The time factor just mentioned makes it obvious that the person to attempt cardiac resuscitation is the one who makes the diagnosis, for therein lies the patient's hope of survival. Thus every physician should be familiar with the proper method to be employed.

Treatment

Various techniques of resuscitation have been developed :

1. Manual massage.
2. Chemotherapy.
3. Electrical stimulation.

Differential diagnosis is not important in the treatment of cardiac arrest. Establishment of artificial circulation and oxygenation is the most urgent problem. Usually (if the arrest is due to the vago-vagal reflex), the heart will recommence its own normal rhythmic beat after a few moments of massage. If hypoxia is the main cause, the circulation of well-oxygenated blood will establish spontaneous beats³.

Cardiac massage by itself is not sufficient for resuscitation; proper oxygenation and artificial respiration should be carried out simultaneously. If oxygen and a positive pressure apparatus are not available, then mouth-to-mouth insufflation may be helpful. Difficulty may be caused by prolapse of the tongue posteriorly, leading to airway obstruction. In this case someone must immediately grasp the tongue and pull it forward.

Among chemotherapeutic agents, epinephrine is the most satisfactory drug for increasing the tone of the myocardium. Caffeine, Coramine, and Cardiazol are of no value at all in resuscitation.

Electrical stimulation requires special apparatus such as the external cardiac pacemaker or the defibrillator.

Manual Massage

The most important function of cardiac massage is to keep the tissues well oxygenated, and the most useful criteria of success in this are pupils which remain constricted and a systolic blood pressure maintained at around 60 to 70 mm Hg. The rate should be between 60 and 80 strokes per minute, and the rhythm should be as regular as possible. The right hand should be introduced between the heart and the diaphragm, with the thumb on the anterior superior surface (right ventricle) and the opposed fingers on the posterior inferior aspect (left ventricle); the two ventricles will then be compressed toward each other.

Massage should be continued until the heart begins to beat strongly enough to keep the cerebral cortex well oxygenated. There have been reported cases of successful resuscitation after eight hours of cardiac massage. If it is necessary to continue beyond 20 to 30 minutes the procedure usually becomes very fatiguing, therefore another doctor should always be ready to take over whenever the first is tired.

Cardiac rupture due to massage has been reported.⁴ This usually occurs at the outflow tract of the right ventricle, where the thumb is placed.

Case Report

K. S., protocol number 58/12777. This 4-month-old male infant was admitted to the hospital for an elective herniorrhaphy. Physical examination showed a temperature of 36.8 C, weight 4.500 kg, and length 54 cm. The pulse rate was 128 per minute and respirations 28 per minute. The diameter of the anterior fontanel was 4.5 cm. The occipital bones showed craniotabes. A left inguinal hernia was present.

On the day following admission the patient's temperature was 39.2 C. and two or three maculo-papular lesions appeared on the abdomen, with a few more on the legs. Benadryl was started because the rash was thought to be allergic in origin. In spite of the absence of other abnormal physical findings, crystalline penicillin (100,000 units every three hours) was also administered, and blood drawn for calcium, phosphorus, and alkaline phosphatase determinations. On the third hospital day the temperature fell to normal. That same day at 8:30 AM while the nurse was feeding him the infant stopped taking food and respiration ceased. He became cyanotic. No foam appeared at the mouth. Aspiration was performed. No heart beat nor pulse were perceptible. While the infant was intubated and oxygen administered, the house officer opened the thorax and began massage of the

arrested heart. Intracardiac adrenaline was given, and in a few minutes the heart began to beat again and then respirations recommenced. Massage was discontinued after ten minutes. Intravenous fluids were started by cut-down and tracheotomy done.

At this time blood chemistries were reported : Calcium was 7 mgm %, phosphorus 7 mgm %, and alkaline phosphatase 17 Bodansky units. Calcium gluconate was administered and Benadryl discontinued. Chloromycetin and streptomycin were added to the penicillin and one-sixth molar sodium lactate was administered because the CO₂ was found to be 7 mEq per liter; by evening this value had risen to 26 mEq per liter.

The next morning the infant was catheterized because of urinary retention. He remained continuously semicomatose following thoracotomy. Two small transfusions were given. Digitalisation was begun, but the patient expired three hours later, or 36 hours after thoracotomy.

The first urinalysis was normal. The second revealed 4-5 white blood cells and a trace of protein but was otherwise normal. The post-mortem non-protein nitrogen was 92 mgm%, serum protein 5.8 gm%, albumin 4.5 gm%, globulin 1.3 gm%, CO₂ 15.5 mEq/liter, chloride 101.5 mEq/liter, calcium 7.8 mgm%, and phosphorus 16.2 mgm%. The EKG was within normal limits. Spinal tap yielded normal cerebrospinal fluid.

This infant obviously had clinical rickets with hypocalcemia and acidosis. The myocardium was very sensitive to the vago-vagal reflex; movements of the head and neck might have stimulated the vagus nerve and led to cardiac arrest.

Thoracotomy and cardiac massage were done within five minutes and the baby was successfully resuscitated. Exitus, occurring 36 hours later, was attributed to the undetermined underlying disease, but unfortunately an autopsy permit was not obtainable.

It is believed that this patient's myocardium was hypersensitized by hypocalcemia. He did have rickets. Why he had a severe acidosis without diarrhea, vomiting or high fever is not clear.

Discussion

The purpose in presenting this disappointing case with such an unhappy outcome is to demonstrate that cardiac massage has a place even in hopeless cases. In this infant, cardiac arrest appeared suddenly, completely unexpectedly and without apparent cause. Because it was noticed immediately and thoracotomy and cardiac massage were

done without delay, the infant was given, in effect, a 36 hour reprieve. An evaluation of possible causes and therapeutic measures was attempted *after* the cardiac activity had been restored by the massage. If this had been done initially there would undoubtedly have been no "second chance". That, in the time gained, we were unable to learn exactly what was going on in this infant, and that the outcome was finally fatal, in no way reflects on the procedure itself if our assumption that death was probably due to a disturbance in fluid and electrolyte balance is correct. It seems reasonable to expect that in other similar circumstances the added hours of life might well provide the opportunity for the clinician to establish an accurate diagnosis and treat it adequately.

There is no question that cardiac massage is frequently life-saving. The vast majority of such cases occur in association with another surgical or anesthetic procedure, usually in the operating theater with necessary medical personnel and equipment immediately at hand. Under such circumstances, cardiac massage is a relatively simple procedure. As with this infant, however, that is not always the case and the points brought out earlier regarding who should do the massage and when are clearly illustrated in this case. The house officer, having recognized the problem and having had adequate instruction prior to this accident, was able, under far from ideal circumstances, to deal appropriately with problem. Within the allowable time limit he achieved his goal of restoring the heart beat while others were being summoned to provide oxygen and other supportive therapy. Once the heart was functioning adequately again there was no evidence, either in clinical or electrocardiographic findings, of cardiac injury or malfunction.

S U M M A R Y

1. A brief discussion of the possible causes of cardiac arrest, the importance of prompt recognition and treatment by cardiac massage, and a brief description of the technique of massage have been presented.

2. A brief case history of an infant in which cardiac arrest occurred, followed by prompt cardiac massage, has been presented with a discussion of the role of cardiac massage as a life-prolonging factor.

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New Light on Noah

Professor Arnold Sorsby, Research Professor in Ophthalmology at the Royal College of Surgeons and Royal Eye Hospital, says that an account of Noah's birth given in the Book of Enoch is clearly not that of a miraculous child but of an albino.

In an article in the "British Medical Journal" the professor includes the Dead Sea Scrolls among his sources of information on Noah, whose appearance at birth, described in the Book of Enoch, is "a body white as wool and eyes that are like the rays of the sun."

In a fragment of a particularly badly preserved scroll from the Dead Sea caves the story is told that Lamech, Noah's father, was assured by his wife, who addresses Lamech as "O my brother," and "O my lord," that Noah was his child, not the child of any stranger or of the Sons of Heaven. In the light of this fragment, says the professor, the account of Noah's birth is clearly that of an albino.

The fragment also allows some conclusions on how Noah inherited his albinism. It has been held, says the professor, that Lamech's wife was also his sister. Thus Noah was the offspring of an extreme type of consanguineous marriage. The first recorded case of albinism shows parentage of this nature.

Another authority calls Lamech's wife his cousin—a common type of consanguinity in albinism. If Lamech and his wife were brother and sister, however, it would enable Methuselah, Lamech's father, to claim the additional distinction of being the first authenticated carrier of albinism, unless the distinction belongs to his anonymous wife.

On either reading, says Professor Sorsby, the consanguineous origin of Noah's albinism is beyond question. Lamech and his wife not only produced Noah but also made genetic history.

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