

CARDIAC ARREST — A REPORT OF TWO CASES TREATED SUCCESSFULLY BY EXTERNAL CARDIAC MASSAGE

By Yeoh Kean Seng, F.R.C.S., F.R.C.S.E.

(Department of Surgery, University of Singapore)

It is well known that sudden death occurs under a variety of conditions. It may occur on the operating table, in a medical ward, in the X-ray department, or outside the hospital in a doctor's clinic. When it does occur, it calls for prompt diagnosis and immediate treatment. The purposes of this paper is to describe two cases of cardiac arrest, and to draw attention to a simple and most effective method of non-operative, i.e. external cardiac massage.

Case I

A 7 year old Malay boy was hit by a car and dragged for some distance along the road. He sustained extensive facial lacerations and abrasions on other parts of the body. He was shocked on admission, and after resuscitation he was taken to the operating theatre for toilet and suture of his wounds. A general anaesthetic was administered. During the operation the patient appeared a little pale and cyanosed. Examination of the carotid and radial pulse showed they were absent. There were no heart sounds, the pupils were dilated and non-reactive. Cardiac arrest was diagnosed and external cardiac massage was immediately initiated. After one minute of cardiac massage, the radial and carotid pulses returned, the pupils became smaller and reacted to light. The pulse was 110 per minute and the blood pressure 100/60. The operation was rapidly completed and the patient returned to the ward. When he was examined a few hours later, he was fully conscious. There were no signs of neurological damage. A post-operative electrocardiogram showed a normal pattern. (Fig. 1). The patient was subsequently seen in the follow-up clinic, and has remained well.

Case II

This 3 year old boy was admitted to the General Hospital for repair of bilateral cleft lip. Pre-operative examination showed no abnormality of the cardio-respiratory system. The operation was carried out in the usual manner under general anaesthesia. Towards the end of the operation, the patient appeared a little pale and cyanosed. The carotid and radial pulses were checked and found absent. There were no heart sounds, and the pupils were dilated. External cardiac massage was instantly carried out and within two minutes, spontaneous heart beat returned and the pupils

constricted and reacted to light. The operation was completed and the patient taken back to the ward. On subsequent examination the child was well and before discharge from hospital, the electrocardiogram was found to be normal (Fig. 2).

DISCUSSION

The incidence of cardiac arrest is probably much higher than we realise. In the past, sudden deaths had been labelled with different names, e.g. "apoplexy", "stroke", "status lymphaticus", "pleural shock" and so on. Many of these are, no doubt, deaths due to sudden cardiac arrest. Under general anaesthesia alone, the incidence of cardiac arrest is approximately 1 in 2,384 (3).

It is generally believed that sudden cardiac arrest is mediated through the vaso-vagal reflex. This has an inhibitory effect on the heart. The vaso-vagal centre is stimulated by a number of factors, one of which is cerebral anoxia.

Both sexes are affected, but there seems to be a slight preponderance among the males. All ages are involved. In an analysis of 1,200 cases of cardiac arrest, Stephenson et al show that 20 per cent (or 1 in 5) of the cases occur in the young persons under 10 years of age. This is probably due to their more sensitive reflexes in response to cerebral anoxia.

DIAGNOSIS OF CARDIAC ARREST

The diagnosis of cardiac arrest is straightforward and can be made on clinical findings. The detection of an absent peripheral pulse (radial, carotid or femoral) absent heart beat, and heart sounds is sufficient evidence for a diagnosis of cardiac arrest. Precious moments must not be wasted to confirm the diagnosis of cardiac arrest by ancillary methods such as electrocardiogram and sphygmomanometry. With the diagnosis made IMMEDIATE cardiac massage must be instituted.

METHOD OF CARDIAC MASSAGE

There are two methods of carrying out cardiac massage :—

- (a) Operative method. By this method, the heart is massaged through an incision in the chest or the abdomen. This article is

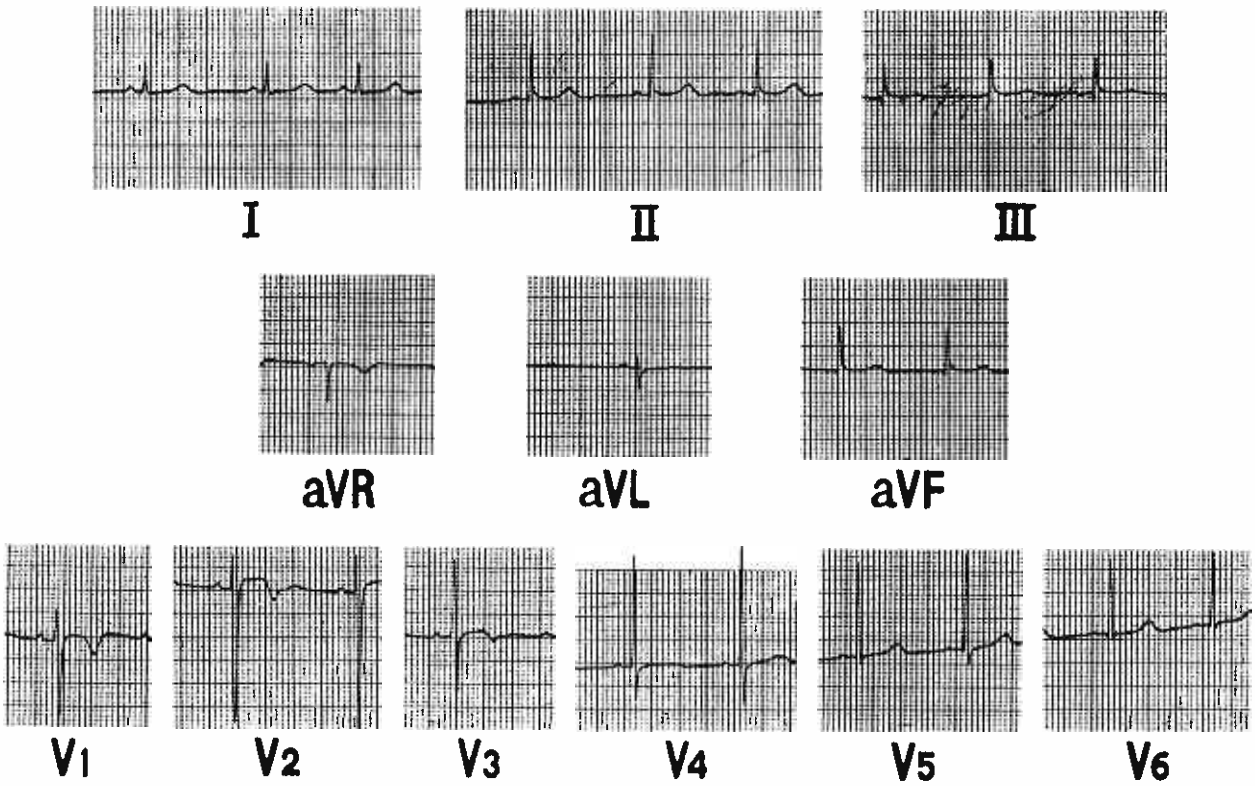


Fig. 1. Electrocardiogram of the first patient taken after resuscitation by external cardiac massage. The tracing is normal.

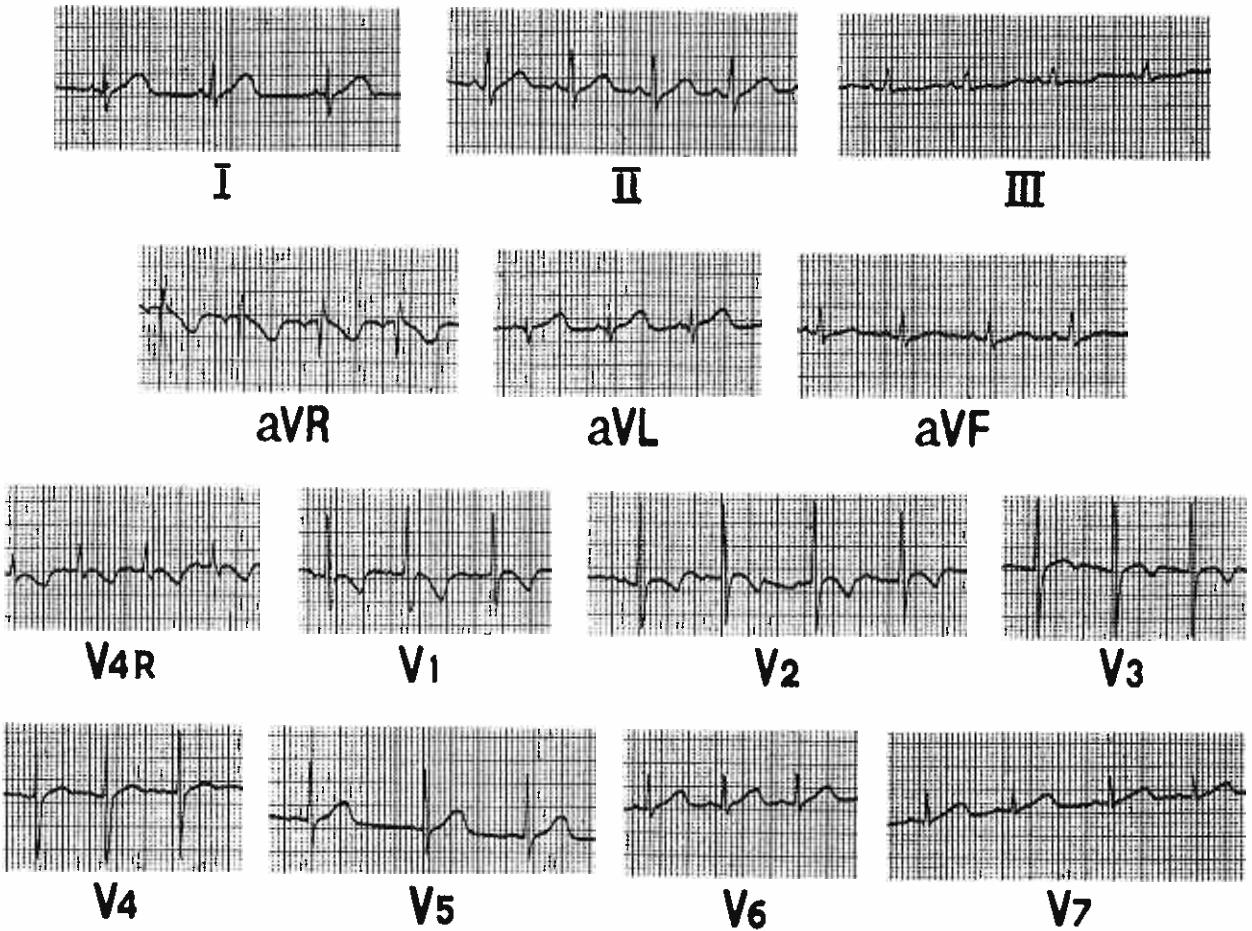


Fig. 2. This E.C.G. is taken of the second patient before his discharge from the hospital. Again the tracing is within normal.

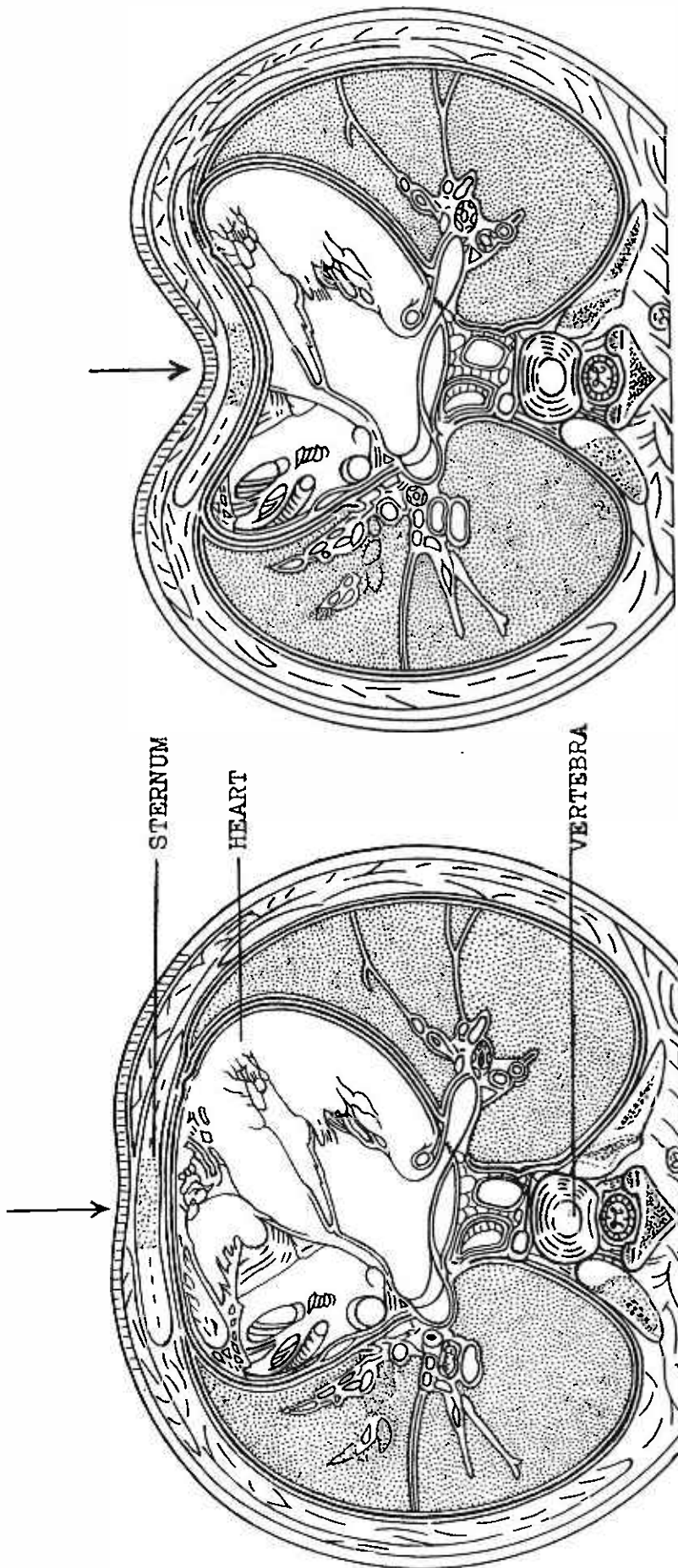


Fig. 3.

Fig. 4.

Figs. 3 and 4. Sketches of cross sections of the chest showing the anatomical relationships of the sternum, the heart and the spine. Compression of the sternum causes the heart to be squeezed between it and the spine. When the pressure is removed from the sternum, the chest wall and the heart spring back to their original positions.

not concerned with this method of cardiac massage, although it is very valuable in patients whose chests or abdomens are already opened.

- (b) **Non-operative or external cardiac massage.** This simple and effective method is based on the fact that the sternum and the chest wall are mobile and elastic. They can be displaced posteriorly to compress the heart against the thoracic vertebrae. When the pressure is released, the chest wall springs back to its original position (Figs. 3 and 4).

Technique of external cardiac massage

Before starting cardiac massage, it is most important to check the airway, and to make sure it is patent. This is essential for the free flow of air into the patient's lungs.

The patient is placed supine, on a hard surface, e.g. floor, operating table, orthopaedic bed, in order to exert effective compression on the chest wall (External cardiac massage cannot be achieved if the patient is lying on a spring mattress bed). The operator may stand or kneel beside the patient.

The palm of one hand is placed over the lower end of the sternum, and the other hand is placed over the first (Fig. 5). The operator then puts his whole weight on the lower end of the sternum. In this way, the sternum can be displaced posteriorly for 4 centimetres or so (Fig. 6). When the pressure is removed from the sternum, the chest wall springs back to its normal position, and air can be heard rushing into the lung.

This method of resuscitation not only effectively establishes cardiac massage, but also induces adequate artificial respiration.

Rate of compression

The aim of cardiac massage is to simulate the normal action of the heart. The rate of compression should therefore approximate the normal heart rate, viz. 60 to 80 times per minute.

When to stop cardiac massage

In principle, cardiac massage should continue until the heart resumes its normal action, but in practice, if the pupils remain fully dilated and fixed, and a good peripheral pulse cannot be maintained, the patient will not recover. As long as the pupil is constricted and a good peripheral pulse present, cardiac massage must go on, until spontaneous cardiac rhythm is re-established.



Fig. 5. The cardiac massage procedure. One hand (using the heel of the palm) is placed on the lower end of the sternum. The other hand is then placed over the first. It is important to check that the airway is clear before cardiac massage begins. The patient must also be lying on a hard surface, which will not sag when pressure is applied to the sternum.

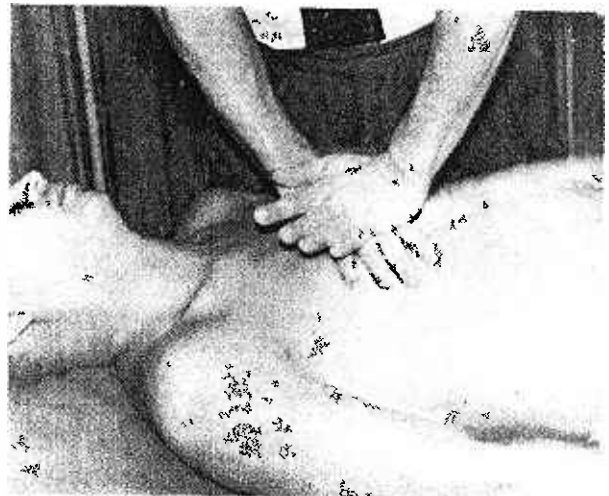


Fig. 6. Pressure is now applied on the sternum, and it can be seen that the chest wall has been pushed back. When the pressure is released, the sternum springs back to its original position. In this way, a massaging effect on the heart is effected.

Results of cardiac massage

The result of cardiac massage depends on the time interval between cardiac arrest and cardiac massage. The longer the interval the higher the incidence of mortality and morbidity.

If cardiac massage is instituted within a minute or two after cardiac arrest, nearly all cases recover. After an interval of 4 minutes or more, less than 4 per cent will survive. Hence it is vitally important to recognise that any delay in cardiac massage may mean losing a patient, or should he survive, it may only be as a decerebrate animal.

Complications of cardiac massage

In operative cardiac massage, contusion of the myocardium is inevitable and sometimes a severe degree of contusion occurs. With external cardiac massage, less trauma is inflicted to the myocardium. However, fractures of ribs may occur if external cardiac massage is too vigorously applied, especially in older patients whose ribs are more rigid. This is, however, not a serious complication.

SUMMARY

Two cases of cardiac arrest treated successfully by external cardiac massage are reported.

The aetiology, diagnosis and treatment of cardiac arrest are briefly discussed. The technique

of external cardiac massage is discussed in some detail and it is stressed that everyone should be familiar with this simple and effective method of cardiac resuscitation. Delay in cardiac massage is the important single factor in the poor result of cardiac resuscitation.

REFERENCES

1. Jude, J.R., Kouwenhoven, W.B. and Knickerbocker, G.G.: A new approach to cardiac resuscitation. *Ann. Surg.*, 154: 311, 1961.
2. Kouwenhoven, W.B., Jude, J.R. and Knickerbocker, G.G.: Closed chest cardiac massage. *J.A.M.A.*, 173: 1064, 1960.
3. Stephenson, H.E., Reid, L.C. and Hinton, J.W.: Some common denominators in 1200 cases of cardiac arrest. *Ann. Surg.*, 137: 731, 1953.