SUCCESSFUL CARDIAC MASSAGE FOR CARDIAC ARREST FOLLOWING CORONARY THROMBOSIS

BY

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Cardiac massage is commonly and successfully performed for cardiac arrest during and immediately after anaesthesia. In the following case cardiac arrest was successfully performed in a hospital ward bed on a patient who developed cardiac arrest following a coronary thrombosis. A summary of the procedure is given and several features of interest are discussed.

Case Report

On the late afternoon of March 24, 1959, a labourer aged 54 was admitted to hospital with a history of having suddenly experienced, three hours previously, a severe upper retrosternal pain with radiations across the upper chest, down the left arm, and into the neck. He described it as the worst pain he had ever had. It was still present on admission, but had been eased slightly by ¼ gr. (16 mg.) of morphine given two hours after the onset by the patient's own doctor.

For the previous 14 months he had been having episodes of high retrosternal pain, radiating down the left arm, lasting up to 15 minutes, and bearing no relation to food, posture, exertion, or breathing. No definite diagnosis had been made concerning this pain.

On admission he was shocked, the skin being cold and moist, with some slight cyanosis of the lips. He was not dyspnoeic. All pulses were palpable but weak. His blood-pressure was 110/60, pulse 64 and regular. The heart sounds were normal. All other systems were normal. A clinical diagnosis of coronary thrombosis was made and 12,500 units of heparin were given intramuscularly.

Fifteen minutes after the physical examination was completed he collapsed. Respirations ceased, pulses were not palpable, no heart sounds were audible, and corneal reflexes were absent. Artificial respiration and oxygen under pressure via a face-mask was given for a period of three minutes, at the end of which his condition was unchanged and he was thought to be dead.

On the ward bed, without aseptic precautions, thoracotomy was performed through the left sixth intercostal space and the ribs were forced apart manually. No bleeding occurred. The heart was palpably and visibly immobile and was distended. The pericardium was not opened. Cardiac massage was started, the heart being compressed between the hand and the anterior chest wall. After five minutes there was still no spontaneous movement of the myocardium, so massage was continued.

Meanwhile an endotracheal tube had been passed by a member of the resident staff and the patient was adequately oxygenated under positive pressure from a Boyle machine. There was still no spontaneous respiration at this point. Towards the end of the 10th minute of massage, small localized movements could be felt in the left ventricle. The frequency and site of these increased until by the 15th minute since opening the chest both ventricles were fibrillating. By the 19th minute 5 ml. of 2% procaine hydrochloride was injected intravenously in the arm and massage of the fibrillating ventricle continued. Within 30 seconds of the injection normal heart contractions could be felt. A further 10 ml. of 2% procaine was given, by which time the fibrillation had stopped and the heart was beating normally. Spontaneous respirations had begun.

For a further five minutes normal heart action was observed through the chest wall, a blood-pressure of 110/70 and a pulse of 100 being recorded. During this period an intravenous drip of dextrose–saline containing 50 ml. of 1% procaine, 0.5 g. of oxytetracycline, and 4 ml. of "levophed" was set up. An underwater seal drain was fixed through a stab incision in the left lower chest and the chest closed with a continuous suture.

Half an hour later the patient's blood-pressure was 140/70, pulse 98 and regular, colour good, and respirations 22. He was very restless. *The endotracheal tube was removed* and he was given 20 ml. of paraldehyde intramuscularly. Further progress during the night was uneventful. After eight hours the intravenous drip was discontinued.

Next morning, 13 hours after the operation, his condition remained satisfactory. He was awake, somewhat drowsy, and complained of pain in the region of the wound. Mentally he appeared normal. He was able to take fluids by mouth. That same morning an electrocardiogram (Fig. 1) showed a posterior infarction.

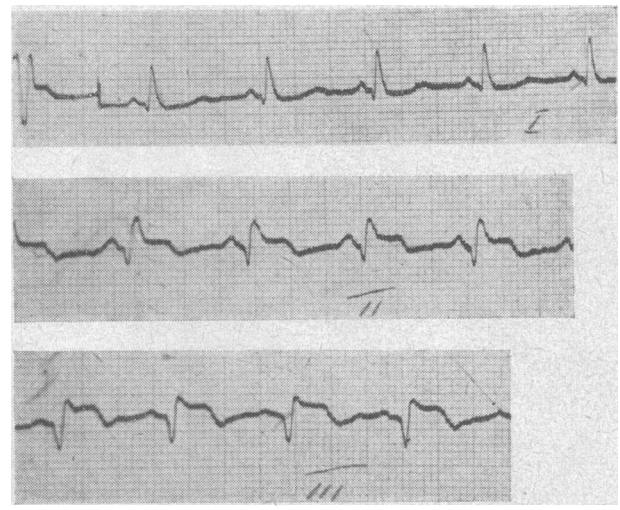

FIG. 1.—Standard leads taken the day after operation.

Except for a small area of sepsis at the top end of his wound, the post-operative course was uneventful. Heparin, 12,500 units b.d., was changed to phenindione in the usual way. He also received 1 mega unit of penicillin b.d. for eight days, and tetracycline 250 mg. q.i.d. for 10 days.

The chest drain was removed and the suture was taken out on the 10th day. An electrocardiogram taken on the 15th day is shown (Fig. 2).

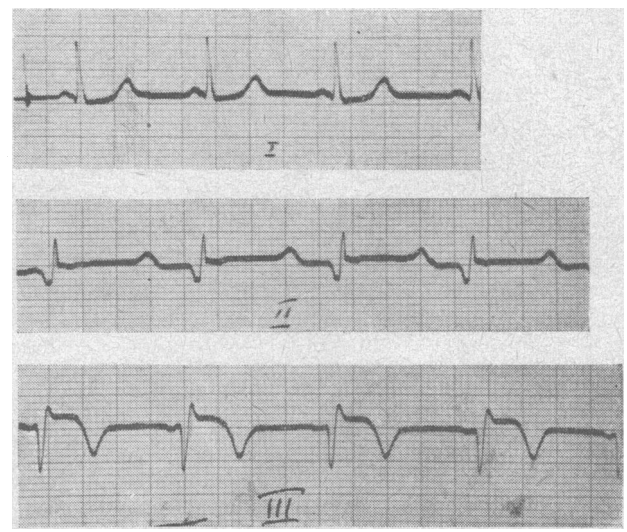

FIG. 2.—Standard leads taken 15 days after operation.

X-ray examination of chest on April 27 showed that the cardiac shadow was within normal limits. There were slight basal congestive changes only and no gross pulmonary lesion was noted.

Four weeks after admission the patient was allowed out of bed, and two weeks later he was walking about the ward and appeared normal in every way. Neither we nor his relatives could detect any mental abnormality. He showed no residual neurological signs of cerebral anoxic damage (Fig. 3). After seven weeks he was discharged home.

When seen on July 23, he was well and his exercise tolerance was quite fair. He complained of some tenderness at the wound site. Clinically his chest was clear. An electrocardiogram (Fig. 4) was done on that date. He was told that there was no reason why he should not be able to take a light job in two months' time.

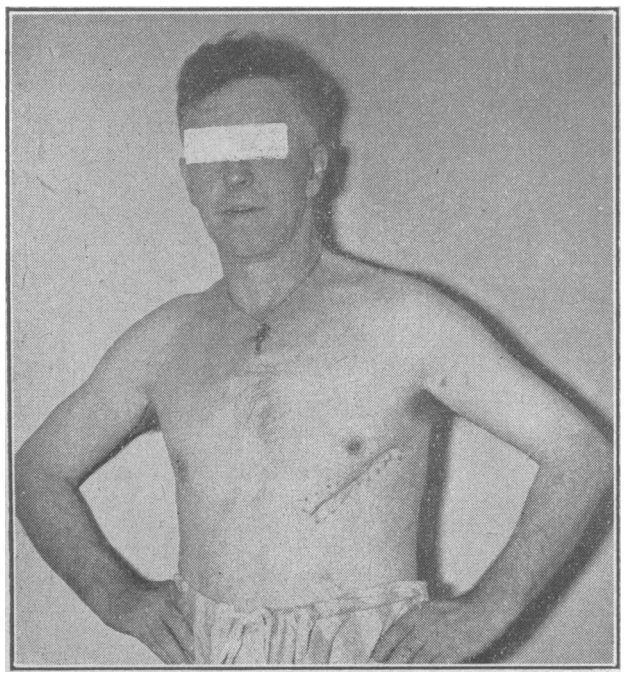

FIG. 3.—Photograph taken six weeks after operation.

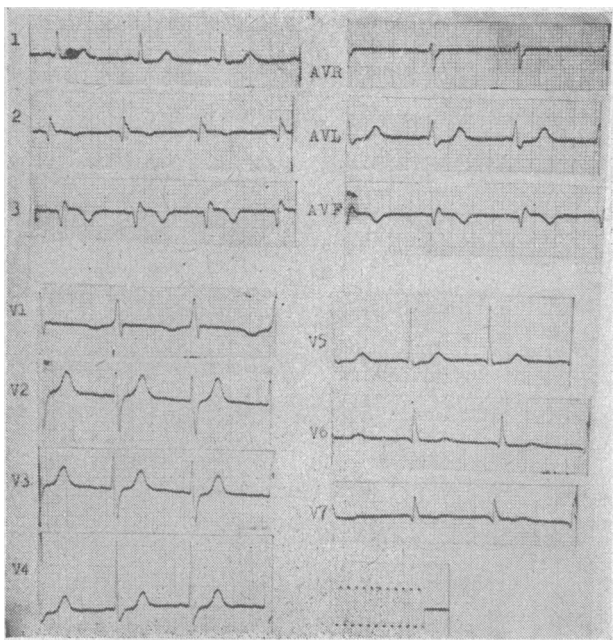

FIG. 4.—Standard and V leads taken four months after operation.

Discussion

So far as can be ascertained there is no record in this country of complete cardiac asystole from coronary thrombosis being resuscitated with uneventful recovery and well-being four months later. Nor is there any record of ventricular fibrillation following asystole being arrested by procaine hydrochloride without the use of electrical defibrillation.

Several other successful cases of resuscitation following coronary thrombosis have been described (Beck, Weckesser, and Barry, 1956). The usual finding at thoracotomy, however, was ventricular fibrillation, normal rhythm being restored by cardiac massage and electrical defibrillation. Resuscitation in cases where there has been complete cardiac standstill is less common (Hannon, Brainard and Flom, 1957) and prolonged survival rare.

Consideration of the history and clinical condition of this patient undoubtedly shows that he had a coronary occlusion on the day of admission. Cases are described where cardiac massage has been performed for cardiac arrest due to conditions other than coronary artery disease or thrombosis, and electrocardiographic changes remotely suggestive of coronary thrombosis have not been found (Celio, 1956). Therefore, though electrocardiography was delayed 24 hours, we can accept the abnormalities with the history as being diagnostic of coronary occlusion and nothing else.

Cardiac arrest is a death-dealing complication of coronary artery disease, and a large proportion (up to 90%) of these deaths are due to disturbances of conductivity or "electrical instability" rather than the primary failure of the heart muscle. In the former group it is estimated that about one-third of the victims die without damage to heart muscle, the other two-thirds having muscle damage but not to such an extent as to be incompatible with normal heart action (Beck *et al.*, 1956). Therefore all the heart needs is to be given another chance to beat.

The action of procaine in reducing irritability of the myocardium is well known, and in this case it appeared to work satisfactorily. Other reports of its use in experimental animal ventricular fibrillation are conflicting (Dodds and Ashmore, 1959). However, it would appear to be the best drug for reducing "irritability" of the myocardium, and if one can accept the fact that a large proportion of deaths from coronary thrombosis are due to conductive or electrical instability within the myocardium, it might be reasonable to consider the prophylactic use of drugs of the procaine type in suitable cases of coronary artery disease, including thrombosis.

The whole of the procedure described was done in the ward of a small hospital containing 80 general beds. There is no specialized cardiac unit. The versatility shown and the speed at which equipment and drugs were obtained, throw great credit on the nursing staff.

Resuscitation from cardiac arrest following coronary thrombosis can be done successfully with a minimum of equipment. The onus of carrying out this procedure will almost certainly fall on junior hospital staff. The

procedure is not difficult. There is nothing to lose and a life to gain. Time is the important factor. Cerebral anoxia of 3½ to 5 minutes can produce irreversible anoxic damage to the brain. A defibrillating apparatus may or may not be to hand. Electrocardiograms take time, and the decision whether there is ventricular fibrillation or asystole is not an easy one. It has been suggested that where there is doubt an incision should be made in the chest wall. If it bleeds the patient will most certainly be fibrillating. Absence of bleeding indicates asystole. With the former one may have time to wait and try the effects of electrical or chemical defibrillation.

On August 20, five months after the incident, the patient was alive and well. There had been no recurrence of his retrosternal pain.

Summary

This is a case where a patient collapsed for a period of approximately 3 minutes, shortly after admission to hospital with a coronary thrombosis. Simple measures of resuscitation were attempted without effect, and he was presumed to be dead. Through a left sixth intercostal incision the asystolic heart was massaged manually for 10 minutes. At the end of this period the ventricles began to fibrillate spontaneously: this was converted to normal rhythms by an intravenous injection of procaine 2%.

The patient made an uneventful recovery without evidence of cerebral anoxic damage, and was alive and well at the time of writing, nine months later.

A short discussion of the problems and management of cardiac arrest following coronary thrombosis is given.

I thank Dr. B. F. Brearley for allowing me to publish this case, Dr. D. M. Anderson for his helpful criticism and suggestions in preparing the script, and Dr. E. Milne for his rapid intubation of the patient and assistance during the procedure.

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During this twenty-first anniversary year, the National Marriage Guidance Council (*Annual Report, 1959–60*) says that 12,000 couples were helped in marriage difficulties; over 1,000 counsellors have now been accepted, and are either trained or in course of training; about 45 marriage guidance councils provided group preparation for marriage for engaged couples; and about 100,000 booklets published by the council were sold during the year under review. The council are buying a long lease of 58, Queen Anne Street, the present headquarters of the Royal College of Obstetricians and Gynaecologists, and finding the money for this, as well as for higher salary scales, "presents a formidable task." The council welcome the increase in their Government grant from £10,000 a year to £15,000 from April 1 this year, but they add: "The Government would have to give us similar increases every year for 197 years before their grant equalled the present cost to public funds of legal aid for divorce."

TWO EPISODES OF CARDIAC ARREST IN ONE WEEK

FULL RECOVERY AFTER CARDIAC MASSAGE

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Complete recovery from one episode of cardiac arrest is no longer unusual. Most surgeons and anaesthetists have had personal experience of the treatment of this emergency, and the pooling of their experience in isolated cases has led to a gradual understanding of the causes, prevention, and management of cardiac arrest. Apart from cardiac surgeons, few have had the opportunity to study and compare the causes of repeated episodes of cardiac arrest in one patient. This paper records the history of a severely burned child whose heart stopped during the induction of general anaesthesia for skin-grafting operations on two separate occasions. This case closely resembles one described by Finer and Nylen (1959) from Sweden. In both cases cardiac arrest occurred twice within a week during the induction of endotracheal anaesthesia, and in both another general anaesthetic without intubation had been given successfully the day before the second episode of arrest. While in the Swedish case the patient recovered from the first arrest without massage, in the present case cardiac massage was required on each occasion.

Case History

A girl aged 6 years was admitted to the Footscray and District Hospital on May 28, 1957, with severe burns from the ignition of clothes soaked with kerosene. There was full-thickness skin-loss from the whole of the lower half of the body from the level of the iliac crests to the ankles, except for the anus and the labia majora. The circumferential burns were treated by the closed-dressing method combined with frequent changes of position to try to prevent additional loss of tissue from pressure necrosis. Despite unavoidable faecal and urinary contamination the burns remained reasonably clean, but the child ran a hectic temperature and required frequent small blood transfusions and continuous intragastric feeding of high-protein fluids during the night to prevent rapid deterioration of her condition.

The dressings were changed six times under general anaesthesia between June 4 and 25, inclusive, without any anxiety. Then, on June 26, under endotracheal anaesthesia, split skin was cut from both arms and from the back and successfully applied as "postage stamp" grafts to the whole of the right leg and the back of the left leg. When dressed under general anaesthesia on June 30, all grafts were seen to have taken. However, the child still had a high temperature and was losing weight rapidly. It was decided that skin-grafting should proceed at once before her condition became critical.

First Cardiac Arrest

On July 2 further grafting was proposed. Immediately before operation the child's temperature was 99.4° F. (37.4° C.), pulse rate 140/min., and respiration rate 28/min.