ctaanA dme.gasaki. 6 : *29—35*

Resuscitation from Cardiac Arrest, Occuring During Cardiac Catheterisation : A Case Report

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Received for publication August 25, 1961

This is the report of a case of successful cardiac resuscitation following cardiac arrest during cardiac catheterisation, treated with brain cooling, 12 minutes having elapsed between the arrest and initiation of cardiac massage.

This is the report of a case of cardiac resuscitation from cardiac arrest which occured recently during cardiac catheterisation.

Cardiac catheterization has been performed by us without accident on more than 200 patients with severe pulmonary and cardiac disease. We believe that resuscitation from cardiac arrest during cardiac catheterisation is a comparatively rare experience and we therefore present this report.

The patient was a twenty three year old sailor. At the age of fifteen he was found to be suffering from congenital heart disease. On admission to hospital on November 4th 1960 he complained of dyspnea and progressive palpitations. There was neither cyanosis nor cardiac arrythmia at this time but a systolic murmur was noted, maximum at the fourth left intercostal space. Chest x-ray also showed enlargement of the left ventricle with congestion of the lung. E.C.G. was normal.

Because of the suspicion of ventricular septal defect, right cardiac catheterisation was performed on 10th November. A F8 catheter was introduced easily into the patient's pulmonary artery from the lateral superficial saphenous vein passing through the right atrium and right ventricle. In the pulmonary artery a reading of the pressure wave (20 mmHg) and a blood sample were taken. Then the catheter was drawn back into the right ventricle and the pressure curve of thc right ventricle was checked. At this point respiratory stondstill occured together with the disappearance of the pressure curve and pulse. The catheter

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was therefore pulled back into the saphenous vein, and Noradrenaline 0.1cc injected through the catheter and artificial respiration started. Intermittent positive presure breathing apparatus was brought from the operating room and an endotracheal tube placed and positive pressure respiration commenced.

The thoracic cavity was opened at the fourth left intercostal space and the heart was found to be at standstill. It was also considerably enlarged. An injection of 10cc calcium was given into the ventricular cavity and cardiac massage was immediately begun. The interval between cardiac arrest and massage had been 12 minutes. As the cardiac impulse did not readily return, 0.1cc adrenalin with normal saline was into the ventricular cavity and massage continued together with intermittent pressure on the descending aorta. By this method, cyanosis of the heart musrle decreased, tone reappeared and fibrillation was noted 3 minutes after the commencement of the massage.

Electric shock was applied 3 times to the heart muscle and normal rhythm returned after 10 minutes. By that time the patient's pupils showed slight contruction and responded slightly to light. 4 hours after the return of the cardiac impulse, the blood pressure was restored to 120-100/60-40. Because of the heavy loss of blood into the thoracic cavity, the patient was taken back to thc operating room and the chest reopened. After stopping the bleeding completely, the chest was washed out with saline and then closed again. After the operation, tracheotomy was performed and intermittent positive pressure breathing continued for three days. At the time the chest was opened, ice bags were applied to the head. This was continued for three days also. On the third day, Nov. 13, the patient recovered consciousness but could not identify any objects at all. He also had retrograde amnesia. From the seventh day, he was able to respond to conversation but could neither recognize his surroundings nor recall events in the immediate past. On the 15th day, he was diagnosed by a paychiatrist as having KORSAKOV's psychosis. His postoperative condition was good with no pulmonary complications. Three months after the operation, February 1961, he found to be able to live his daily life without difficulty although his memory and understanding had decreased slightly.

Postoperative E.C G's taken 18 days (Fig. 2) and 34 days (Fig. 3) after the operation showed an inverted 'T' wave in chest leads 4, 5 and 6. Three months later (Figure 4) the negative "T" wave in lead 6 had disappeared and the negative "T" wave in leads 4 and 5 had decreased. We think that these changes in the E.C.G. were caused by anoxia of heart muscle[1] after receiving electroshock therapy or heart massage. The E.E.G. on the 18th day after the operation (Fig. 5) showed 5-6 cycle low voltage slow waves with irregular and low α waves at the left anterior region, parietal region, temporal region, and all over the

posterior region. This was especially conspicuous at the anterior and parietal regions. On the 35th day after the operation (Fig. 6) α waves were seen generally and the E.E.G. showed an almost normal pattern at the posterior and temporal regions. Three months after the operation (Fig. 7) the E.E.G. showed improvement More α waves were seen in general with low θ waves at the anterior and parietal regions.

COMMENT

In the statistical study of a hundred cases (Table 1) BRIGGS[2] states that most cases of cardiac arrest are caused by over annesthetisation, heart disease or anoxia. The rate of recovery is particularly low if the cardiac arrest is caused by heart disease. According to the report of the American Heart Association,[3] 4 cases of cardiac arrest occured out of 5,691 cases of cardiac catheterisation (less than 0.1%). We have not had case reports in Japan.

Table 1.
Factors Associated with Cardiac Arrest (103 Cases)

Factor	No. of Cases	Recovered	Temporary Restoration	Died
Increasing depth of anesthesia	34	24	2	8
Reflex phenomena	6	6	0	0
Hypoxia	13	4	3	6
Moribund	9	0	1	8
Cardiovascular collapse	9	0	5	4
Heart disease	16*	3	0	13
Unexplained	13	0	2	11

* In 44 cases listed under other factors, heart disease was also present.
(BRIGGS, B.D. et al, J.A.M.A. 160; 1439-1444, 1956).

Concerning signs indicating imminent cardiac arrest is sometimes seen. COOLEY[4] states that bradycardia with a heart rate under 40/min. ZIEGLER[5] thinks that tachycardia and arrythmia are seen. In general, if a cardiac catheter is introduced into the right atrium and right ventricle, the mechanical stimulus of the catheter, easily induce temporary arrythmias such as auricular or ventribular techycardia, or extrasystoles. If the stimulus continues over too long a period, the arrythmia becomes irreversible. It is known that fibrillation terminates cardiac arrest. With regard to cardiac resuscitation, SAKAKIBARA[6] states that he classifies the process of cardiac arrest under normothermia into safe stage (within 3 minutes), dangerous stage (within 7 minutes), and irreversible stage (after 7 minutes), when no response to resuscitation is shown. We think that our case is very interesting because

cardiac resuscitalion was achieved during SAKAKIBARA's "Irreversible Stage", as well as because cardiac arrest occured suddenly during the introduction of the cardiac catheter without warning.

Brain cooling is often applied as an effective method for prolonging the time of possible recovery from cardiac arrest[7)8)9)]. We gave brain cooling since expected that there would be a delay before starting cardiac massage. We think that this treatment was effective in prolonging the length of time before brain damage occured.

Judging from the result of this case, we think that the heart can withstand anoxia for a longer period than we have hitherto believed. Although it is said that the incidence of cardiac arrest duriug cardiac catheterisation is low, it is important to have annaesthetic and electroshock equipment ready for emergency use. JUDE et al[10)] recently reported a new method of resuscitation. This is to apply pressure on the chest over the lower sternum. He succeeded in resuscitating 41 out of 57 cases without opening the chest. This method proved 100% successful in the operating room and 61% even in emergency rooms and wards. Therefore, we consider this method worthy of consideration.

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Fig. 1 (a)

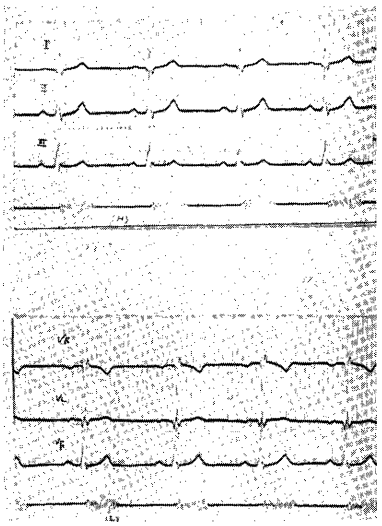

Fig. 1 (b)

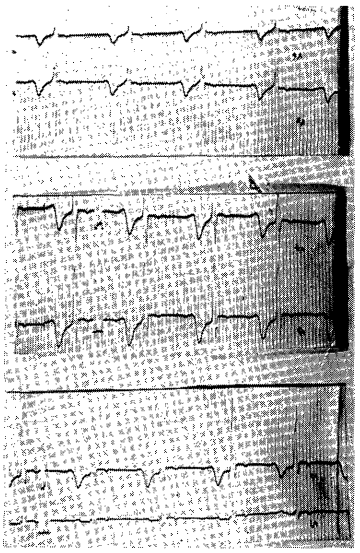

Fig. 1 An electrocardiogram recorded on admission.

Fig. 2 (a)

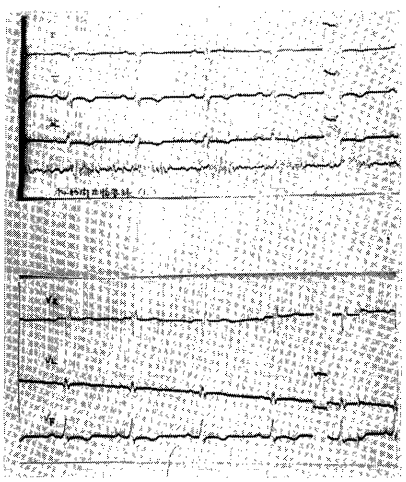

Fig. 2 (b)

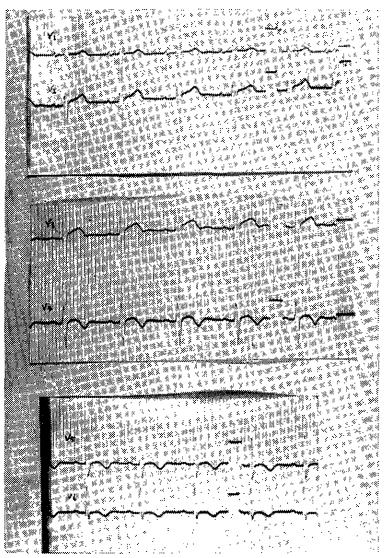

Fig. 2 An electrocardiogram on the 18th day after cardiac arrest.

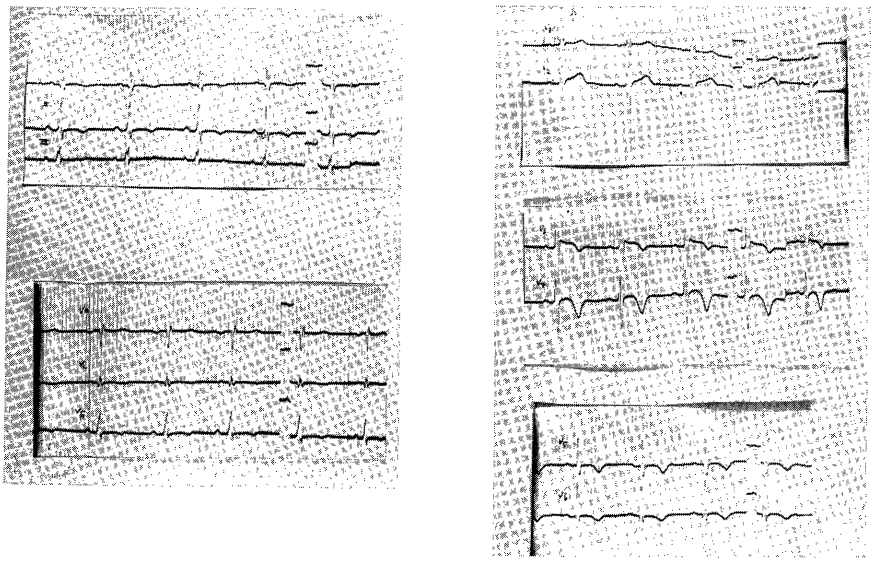

Fig. 3 An electrocardiogram on the 34th day after cariac arrest.

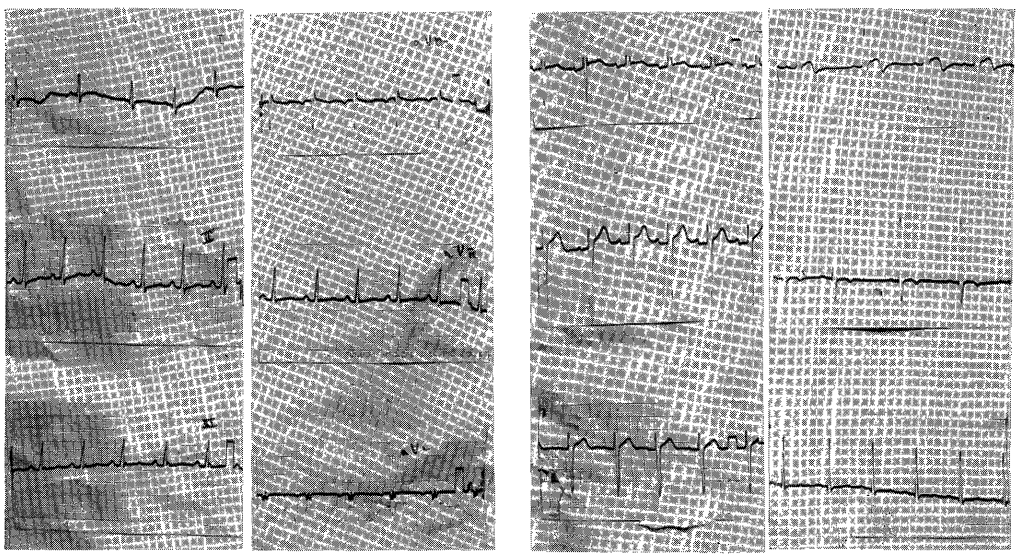

Fig. 4 An electrocardiogram on the 90th day after cardiac arrest.

Fig. 5

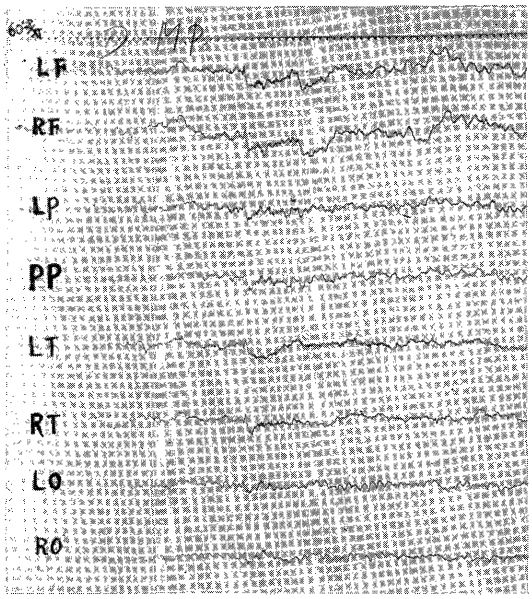

Fig. 6

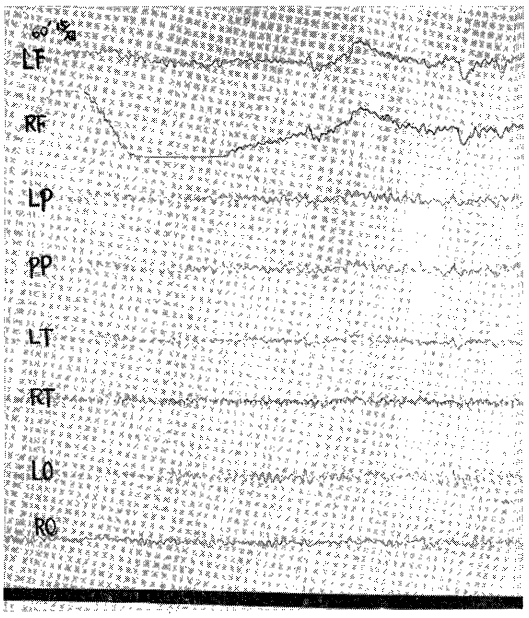

Fig. 5 An electroeoencephalogram on the 18th day after cardiac arrest.

Fig. 6 An electroencephalogram on the 34th day after cardiac arrest.

Fig. 7

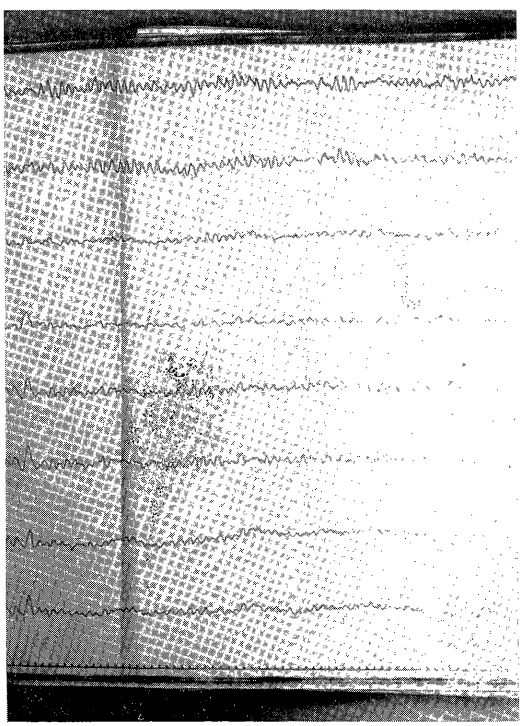

Fig. 7 An electroehcephalogram on the 90th day after cardiac arrest.