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CYTOTOXIC FACTOR IN A PATIENT WITH SUDDEN DEATH OCCURRING DURING EXERCISE

By

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Sudden death unexpectedly occurring in previously healthy persons, is usually given a satisfactory explanation at autopsy. However, in some cases, particularly in young individuals, no underlying mechanism may be found at careful post-mortem examination (1, 2, 3). Not infrequently, death may follow trivial causes such as slight exertion or having a cold bath (4). We have recently observed a 13-year-old girl who, in spite of vigorous medical treatment, died 4½ hours after the onset of a sudden shock appearing when she was swimming. In this case certain observations were made, strongly indicating a non-inflammatory heart lesion and, moreover, the presence of a factor in the patients serum interfering with the metabolism of heart muscle cells.

CASE REPORT

13-year-old girl. Previous history was noncontributory. She had not been recently vaccinated, nor been suffering from respiratory infection of any kind. The physical training in school comprised, among other things, of indoor swimming in a 25 metre pool, which she was used to. On October 10th, 1961, after having swum 25 meters, she became short of breath, but after a short rest of less than one minute, she was able to continue. However, after 25 meters more she had to stop and after coming out of the water, she suddenly collapsed. She was immediately taken to hospital. On admission her general condition was serious with

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a clinical picture of a full-blown shock. She complained of severe retrosternal pain. Physical examination of the heart revealed normal findings, but later on, an accentuated second pulmonary tone was ausculted. The lungs were clear, but about one hour later, râles appeared throughout both lungs. Blood pressure was exceedingly low and not measurable. ECG showed a right bundle branch block of the wide "S wave" type and depressed S-T segments in leads II-III and V₄. The most remarkable objective finding was a high value of GOT (126 units) determined about two hours after admission. The red-cell count and white-cell count was 3.1 million and 13000, respectively. Haemoglobin was 9.4 gm per 100 ml. She was treated with oxygen, morphine and high doses of norarterenol. A fulminating pulmonary oedema appeared after about one hour, because of which only small amounts of macrodex were given intravenously. Her condition gradually deteriorated and she died four and a half hours after the onset of the symptoms. At autopsy, signs of decompensation in various organs were found. There was a moderate hypertrophy of the wall of the left chamber. The coronary vessels and the myocardium were normal at appearance. Microscopical examination (Associate professor Per Lundin, Sahlgrenska sjukhuset, Gothenburg) showed scattered minimal bleedings and necrosis, recently developed, with a moderate number of neutrophils. Dr. Lundin made the following comments: "Most probably these changes have resulted from the patient's long-standing shock and do not appear to be the primary cause of the disease. There were no signs of any present or healed myocarditis".

Serum examination to demonstrate a specific serum factor interfering with the metabolism of heart muscle cells.

In patients with various heart diseases Bengmark and Helander demonstrated a cytotoxic factor interfering with the growth of embryonic heart muscle cell in tissue culture (5).

In the actual case serum was sent to Dr. Bengmark for this special examination.¹ The results clearly showed the presence of such a factor in the patient's serum. Thus, "mean of growth rate" (5) of the patient's serum was 0.167 and of the control serum 0.248, the difference being highly significant ($P < 0.001$).

To eliminate the possibility that a long-standing shock per se could be responsible for the presence of this factor, another patient without clinical signs of severe heart damage served as an additional control. This patient suffering from haematemesis had a profound shock lasting more than 24 hours. No cytotoxic factor could, however, be demonstrated in this case.

The objective findings in this case strongly indicate severe damage to the heart muscle as evidenced by the highly abnormal ECG. The alternations seem to be due to necrosis according to the high value of GOT. The normal appearance of the

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coronary arteries at autopsy suggests that the primary cause of the disease is to be found in the myocardium. Most probably, then, the nature of the shock is "cardiogenic", analogous to the shock commonly occurring in myocardial infarction. The current concept of the nature of hemodynamic disturbance of such types is that reduction of cardiac output is due to loss of contractile strength of the ventricle. The cardiac decompensation noticed in this case may very well fit with this line of view. There is little doubt that the main events in this case occurred primarily at cellular level probably as a disturbance of the normal metabolism of the heart muscle cells and exaggerated during increased demands, *i.e.* strenuous exercise. The rôle of the humoral factor demonstrated remains, however, unexplained. Cases of sudden death at an early age from no obvious cause are obscure from an etiological point of view, but although the causes are probably of heterogenous origin in this group, the finding of such a factor may contribute to the discussion of the pathologic physiology in some cases.

SUMMARY

A 13-year-old girl suddenly collapsed after swimming about 50 meters. She died a few hours later with the clinical picture of a shock on account of myocardial damage. Using the method described by *Bengmark & Helander*, a cytotoxic serum factor against embryonal heart muscle cells could be demonstrated.

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