SWEAT TEST FOR THE DIAGNOSIS OF FIBROCYSTIC DISEASE OF THE PANCREAS

REPORT OF A FATALITY

BY

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The recognition of the electrolyte disturbance in the sweat of patients with fibrocystic disease by Darling, diSant' Agnese, Perera and Andersen (1953) led Shwachman, Leubner and Catzel (1955) to devise a simplified method of obtaining sweat for biochemical assay.

In this method the patient is placed in a plastic bag up to the neck and covered with a blanket, the sweat being collected in a weighed square of gauze which is covered with a piece of impermeable sheeting and strapped to the back. The recommended time is 30-90 min., depending on the rate of sweating.

The test is now widely used. In spite of the theoretical risks no serious ill effects from it have been reported. We have had the unfortunate experience of a death following its use, which we record as a reminder of its potential danger.

Case Report

A boy, aged 13 months, was admitted to hospital on account of failure to thrive, backwardness and diarrhoea with bulky and offensive stools, for an unknown period. Delivery and the neonatal period had been normal but he sat up late, and was unable to get into a sitting position at the time of admission. He appeared in a neglected condition and the home conditions were bad. Apart from his low weight, flabby musculature and slight ichthyosis of the skin, physical examination revealed no abnormality.

The Wassermann reaction, chest radiograph and Mantoux test were negative, and the blood count was normal. The stools were pale, bulky, greasy and offensive; no pathogens were isolated. The duodenal fluid was slightly alkaline and showed tryptic activity to a titre of 1:32 (gelatin film method of Harrison, 1947). As this suggested pancreatic impairment, pancreatic granules were given with each meal. There was a rapid general improvement with increase in weight (5 lb. (2.25 g.) in four weeks) and he started to walk.

Although the child was now well, because of the apparent pancreatic impairment a Shwachman test was performed (after sedation with 1 ml. of paraldehyde) by the method described above but using hot water bottles to promote sweating. The test lasted two hours. The result, an increase in the weight of the gauze by 0.2 g., with complete absence of chloride and sodium, was equivocal, and it was decided to repeat the test a week later. The patient was sedated with chloral hydrate gr. 3 (0.05 g.) and, as this had no effect, paraldehyde 0.75 ml. As little sweat had been obtained in the previous test, the period of collection was extended to three hours under the same conditions as before. Throughout the patient's general condition appeared satisfactory, though on removal from the bag he appeared anxious and restless. This was attributed to the discomforts of the test. Half an hour later he vomited copiously. On examination then he was unconscious and pale with a hot, moist skin, and a temperature of 104° F. (40.3° C.) in the axilla. Respirations were irregular; pupils equal and reacting to light; deep reflexes normal. Under treatment with tepid sponging, subcutaneous and intravenous fluids and a mega unit of penicillin the temperature fell to 100° F. (37.6° C.) but the general condition deteriorated; the pupils became temporarily unequal and deep reflexes were absent. The pulse rate rose to 160-200 per minute. Death occurred in coma 14 hours after conclusion of the test.

Necropsy

This was performed five and a half hours after death and showed a well-developed boy with a somewhat rough skin, but without external abnormalities. Throughout the body there were scattered small and some larger flame-shaped haemorrhages mainly involving skeletal muscle and internal organs, especially marked on the pericardial and left septal surfaces of the heart, the omentum and the kidneys, and there were patches of haemorrhage in the well-pigmented adrenals. The lungs were uniformly and extremely congested, firm, and deep red. The gastro-intestinal tract, liver, bile passages, pancreas and ducts were macroscopically normal. The spleen

was slightly enlarged (45 g.), firm, and of a deep red with sharply demarcated large Malpighian corpuscles. Generalized mild but not abnormal lymphoid tissue hyperplasia was noted with enlarged tonsils and adenoids and a generalized mild lymphadenopathy. The thymus was normal (24 g.).

Examination of the skull showed the meninges tense but not congested, the brain bulging with flattened convolutions and a pressure cone of the cerebellum. A small grey nodule, 3-4 mm. in diameter, was noted projecting from the tuber cinereum close to the infundibulum to the left of the midline.

Sectioning of the brain (1,200 g.) showed dry, pale, bulging surfaces suggesting interstitial oedema. A small petechial haemorrhage was seen in the floor of the fourth ventricle. No further nodules were found.

Histology

Sections of the pancreas revealed no evidence of fibrocystic disease, and serial blocks of the terminal centimetre of the main duct showed no obstruction. The acinar cells were filled with secreting granules. The lungs showed extreme congestion only, with no abnormality of structure. The liver was normal apart from very scant round-cell infiltration of the portal tracts. Tonsils, cervical and abdominal lymph nodes, spleen and intestine confirmed slight generalized non-specific hyperplasia of the lymphoid tissue. No sign of an inflammatory reaction was seen in brain and meninges. Sections of cerebral cortex, corpus striatum and hypothalamus confirmed the oedema and showed a few small scattered capillary haemorrhages. The nodule on the tuber cinereum was a small lipoma of the pia mater. The abdominal skin showed hyperkeratosis, deficiency of the stratum granulosum and normal but inactive sweat glands (lumina closed).

Bacteriology

Films and cultures of the cerebrospinal fluid and spleen revealed no micro-organisms.

Pathological Summary

Heat stroke. Mild ichthyosis. Incidental finding: lipoma of meninges.

Comment

The necropsy findings, cerebral oedema and scattered body haemorrhages, taken in conjunction with the sequence of events, bears out the diagnosis of heat stroke, although the highest body temperature recorded, the first to be taken, and when the collapse had already occurred, was only 104° F. (40·3° C.) in the groin.

The method of obtaining sweat as devised by Shwachman is a simple and most useful diagnostic procedure but the potential danger of interference with the normal heat regulation of the body ought

to be clearly recognized. At an external temperature of over 90° F. (32·2° C.) evaporation of sweat is almost the sole means of maintaining the normal body temperature (Best and Taylor, 1955). In the original experiments by Darling *et al.* (1953) a room heated to 90° F. was used to promote sweating, but in the Shwachman test the enclosure of the body by a plastic bag prevents any evaporation and permits a dangerous hyperpyrexia to occur. Patients with fibrocystic disease are known to sweat excessively and the danger of heat exhaustion due to excessive loss of electrolytes has been recorded by Kessler and Andersen (1951). This, however, need not be considered here as it bears no relation to hyperthermia. It is of interest though that the only fatality in their series occurred in an infant which was brought to the hospital during a heat wave wrapped up in a thick woollen blanket, thus preventing heat loss, and having a temperature of 106° F. (41° C.).

The simple screening test of Shwachman and Gahn (1956) which merely requires the placing of a hand on an agar plate incorporating silver chloride and an indicator, might be used more widely to demonstrate the increase of chloride in sweat of patients with fibrocystic disease. In its interpretation the possibility of a doubtful result ought to be borne in mind. We have found one false negative in a severely ill child in which fibrocystic disease of the pancreas was confirmed at necropsy. The polythene bag test should be limited to doubtful cases and when performed due regard must be given to the possibility of hyperthermia, and frequent recordings must be made of the body temperature. The duration of the test should be limited to the time specified by Shwachman and additional heat by hot water bottles or electric blankets should be avoided.

Summary

A fatality due to heat stroke following Shwachman's test involving the collection of sweat for the diagnosis of fibrocystic disease is reported. The potential danger of the test is emphasized.

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