Summary

Urinary calcium excretion has been measured in 13 normal subjects and 24 cases of osteoporosis on a ward diet and after seven full days on a low-calcium diet.

The mean calcium excretion of the two groups did not differ significantly on either diet.

In normal subjects urinary calcium excretion fell significantly after a low-calcium diet; in the patients with osteoporosis the mean excretion did not change.

The data are compatible with the concept that patients with osteoporosis are less able than normal subjects to adapt to a low-calcium diet by reducing calcium excretion.

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TWO CASES OF ACCIDENTAL HYPOTHERMIA

BY

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Accidental hypothermia is an uncommon medical emergency in England, although it is relatively common in North America (Britten, 1930). Cases reported have resulted mainly from exposure following intoxication from alcohol, the most celebrated being that of an American negress reported by Laufman (1951). Mountaineers and long-distance swimmers are at special risk, but most commonly it results from shipwreck. Below are reported two cases of different causation, treated differently, both occurring in the United Kingdom.

Case 1

A 72-year-old woman was admitted to the Royal South Hants Hospital on the evening of January 14, 1959. She was thought to be suffering from mild senile dementia when seen by her doctor three weeks previously. About one week before admission her neighbour, believing her to be unsafe with her gas fire, had switched off the main supply, and unfortunately this act coincided with the onset of cold weather, the mean air temperature in Southampton being 32.5° F. (0.28° C.) for the six days January 9 to 14. On January 14 she was found unconscious in bed, dressed in night attire.

On admission to hospital she was lying curled up, unconscious, emaciated, and dehydrated. Her face, arms, and legs were cold and blue. She responded only to painful stimuli; her muscles were generally stiff and the tendon reflexes absent. Her pulse was regular 60/minute, systolic blood-pressure 130 mm. Hg, and respiration 16/minute. Her abdomen was scaphoid, with boardlike rigidity. The bowel sounds were few but normal and the rectal temperature was 81° F. (27.2° C.). There was no evidence of frost-bite. Haematological and biochemical examinations revealed no gross abnormalities, but a haemoglobin of 108% and a C.S.F. pressure of 80 mm. of water supported signs of dehydration.

She was covered with blankets and given oral triiodothyronine 20 mg. eight-hourly and penicillin 500,000 units twice daily parenterally. External heat was avoided. Her temperature gradually rose to 98° F. (36.7° C.) after 56 hours (Fig. 1). She was then more deeply unconscious, her radial pulse being impalpable, carotid pulse weak, and blood-pressure unrecordable. On this day she was to be transferred to a neurosurgical unit to exclude a diagnosis

FIG. 1.—Rectal and axillary temperature in Case 1 from admission.

of subdural haematoma. Investigation was postponed for two days when her systolic pressure became stabilized at 95 mm. Hg. Bilateral posterior parietal burr-holes were made on January 19; the only abnormality found was a C.S.F. pressure of 30 mm. of water. This was confirmed by lumbar puncture, and after the injection of normal saline into the subarachnoid space, raising the pressure to 120 mm. of water, she regained consciousness. She was given water plentifully by mouth and added salt. There was no evidence of hypothyroidism, which was first considered as a possible factor leading to hypothermia, and she was eventually discharged on February 21 still slightly demented but probably no worse for her hypothermic interlude.

Case 2

This is the case of a long-distance swimmer, Florence Chadwick. Her first attempt to swim the Irish Channel, a distance of just under 21 miles (33.6 km.), was in 1957. She was then taken from the water after 11 hours and 47 minutes, some 2½ miles (4 km.) from the Scottish coast. She resisted rescue, but on reaching the deck of the rescue boat collapsed unconscious. Her temperature was not recorded, but she was pulseless, her blood-pressure was unrecordable, and her heart sounds were slow and faint. Her respiratory rate was also slow. Her body was described by Dr. W. A. Baird as being cold "like a mortuary specimen," and he expressed doubts concerning her recovery. She was wrapped in blankets but supplementary heat was avoided. After four hours her blood-pressure had risen to 90/60 mm. Hg and she had auricular fibrillation, which continued for at least 24 hours. After 48 hours she was fully recovered. Subsequent medical examinations, including E.C.G., have shown no abnormality.

In the autumn of 1960 she returned to England to make three further attempts. The first two were aborted by bad weather after two and six hours respectively. I was asked to accompany her on her third attempt, which eventually took place in good weather on October 15, 1960. Forty-

eight hours before the swim she suffered from a gastric upset, vomiting after her breakfast and lunch. That evening she had a pyrexia of 100° F. (37.8° C.) and her first proper meal was not until the following evening, the day before her swim, when she ate a small steak, potatoes, and vegetables. At 3 a.m. she had another meal of chicken breast and toast, and started the swim at 5.07 a.m.

She had trained to swim at a stroke rate of 60/minute, but soon after entering the sea her stroke rate was reduced to 52/minute because of choppy water, and it continued to drop throughout the swim. Her total food intake was seven jelly sweets (estimated 150 calories) and less than a quarter of a bottle of Coca-cola. The water temperature varied from 57° F. (13.9° C.) to 55° F. (12.8° C.) (Fig. 2).

FIG. 2.—Stroke rate and sea-water temperature during the cross-Channel swim described in Case 2. Arrows and numbers refer to the time and number of jelly sweets taken.

She came out of the water at 12.40 p.m. after 7 hours 33 minutes, approximately 7 miles (11.2 km.) from the Scottish coast. She gave up voluntarily when asked to do so. She was unable to stand and admitted to a feeling of impending loss of consciousness similar to her sensations just before being taken from the water in 1957. She complained of a severe pain in her right thigh, though no abnormality was found. Her skin was pallid, her pulse regular 68/minute, and blood-pressure 130/80 mm. Hg. Her breath smelled strongly of acetone. She was tense, but at no time did she show any signs of shivering. Her five-minute rectal temperature was 90.4° F. (32.4° C.). At 12.50 p.m. she was put into a warm bath at 102° F. (38.9° C.). At 1.05 p.m. her five-minute mouth temperature was 93° F. (33.9° C.) and at 1.30 p.m. it was 97° F. (36.1° C.), and she said she "felt fine." Because she was a bad sailor she remained in the bath until reaching port at 3 p.m. The boat was a 38-ft. (11.6-m.) fishing trawler, in the hold of which was put a wooden bath fitted with a canvas lid. Hot water was kept in ice-cream containers and was reheated on two small calor gas rings.

Discussion

The physiology of Channel swimmers was investigated by Pugh *et al.* (1960), who found heat loss to be dependent upon superficial fat thickness and water temperature. Human superficial fat and lanolin used by Channel swimmers had similar insulating properties, each supporting a temperature gradient of 3° F. (1.67° C.) over 1 mm. at the high rates of heat flow found under Channel-swimming conditions. Miss Chadwick is comparatively thin, height 5 ft. 6 in. (167.5 cm.), and usually weighing just over 130 lb. (59.1 kg.), enabling her to "model" swimming-costumes. For the swim she weighed 150 lb. (68.2 kg.). She spread 6 lb. (2.7 kg.) of lanolin over her body before the swim,

giving a layer depth of about 0.06 in. (1.5 mm.). Oxygen utilization and therefore heat production in any individual swimmer was found to be closely correlated with speed through the water, which, in turn, was related to stroke rate; swimmers with less thickness of superficial fat necessarily being faster swimmers with higher stroke rates (Pugh *et al.*, 1960). Miss Chadwick dropped her stroke rate early in the swim and it continued to drop progressively, leading to hypothermia. Fatigue did not seem to be the cause of her falling stroke rate.

Molnar (1946) estimated survival times for sailors in cold water and found that at 40° F. (4.4° C.) it was one and a half hours; at 60° F. (15.6° C.) it was five and a half hours, but above 70° F. (21.1° C.) heat balance could be maintained indefinitely. In spite of the increased heat production of trained swimmers there must be a time/water-temperature relationship for any individual beyond which survival becomes impossible.

The energy expenditure of fast Channel swimmers has been estimated at approximately 900 cal./hour (Pugh *et al.*, 1960). Most of this energy is probably derived from fat, but an adequate carbohydrate metabolism is clearly important, and was insufficient in the case of Miss Chadwick to prevent acidosis. Her carbohydrate stores were probably partially depleted before the start of the swim and her intake during the swim was negligible. But the reason for her failure was probably due to her slower-than-normal stroke rate, leading to progressive early hypothermia.

Arguments concerning the relative value of rapid against slow reheating have been reviewed by Cooper and Ross (1960). Findings in Case 1 suggest considerable water and salt depletion, which played an important part in the patient's clinical state only when her normal body temperature was restored. Her blood-pressure was maintained in the hypothermic state owing to the increased peripheral vascular tone. On reheating, the peripheral vascular bed dilated and no adequate measures to rehydrate the patient were taken, and a serious drop in blood- and C.S.F. pressure occurred. Adequate rehydration, with rapid rewarming and careful control of blood-pressure, might have been the method of choice even in this case.

In Case 2 resuscitation by the rapid method was complete in 40 minutes. Although in her first hypothermic episode her blood-pressure was unrecordable, owing largely no doubt to the profound peripheral vasoconstriction, rapid reheating would still have been the treatment of choice. After-drop—that is, fall in deep body temperature after reheating has started—occurs to the same degree whether a slow reheating method is used or a rapid method applied externally, but the length of time it lasts is reduced greatly by the rapid method (Cooper and Ross, 1960).

In acute hypothermia rapid reheating is the method of choice, and its feasibility even in the confines of a small ill-equipped boat has been demonstrated and could lead to the saving of many lives.

Summary

Two cases of accidental hypothermia are described. Case 1 is that of an elderly mildly demented woman who suffered from chronic hypothermia, and Case 2 that of an athletic Channel swimmer suffering from acute hypothermia on two occasions. The two

conditions are shown to differ in that dehydration is an important factor in the chronic state needing correction during reheating. The effects of slow and rapid reheating are compared in Case 2, and it is suggested that the rapid method, certainly the choice in acute hypothermia, is probably to be preferred in all cases of hypothermia uncomplicated by frost-bite. A rapid method of reheating, using a warm bath, is shown to be practical even in a small ill-equipped fishing trawler, and if some similar device were fitted to sea-rescue craft many lives might be saved. Some aspects of heat production and heat loss in a Channel swimmer are discussed.

I am indebted to Dr. Kenneth Robertson for permission to publish Case 1, and to Dr. R. Goldsmith, of the Medical Research Council Laboratories, Hampstead, for his generous assistance with the preparation of this article. I am also indebted to Miss Florence Chadwick, without whose co-operation this article would not have been possible.

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"HEDGEHOG RINGWORM"

BY

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Apart from the report of Eddowes (1898), who described the case of a patient who had developed ringworm after contact with a hedgehog, but did not culture the organism, this association does not appear to have been noted until the report of Marples and Smith (1960) from New Zealand. These authors isolated an atypical strain of *Trichophyton mentagrophytes* from two patients, one of whom had been in contact with a pet hedgehog. Twenty-six hedgehogs were then examined and the same type of fungus was isolated from seven of these. The fungus was found to infect a guinea-pig and a human volunteer.

When, during a visit to this country early in 1961, Professor Marples described the fungus to one of us (M. P. E.), it was realized that here was the probable explanation for a number of hitherto unexplained cases of ringworm among our patients. In this paper we present the cases of 13 patients infected with "hedgehog ringworm."

Case Reports

Cases 1 and 2.—In September, 1960, a woman aged 44 (Case 1) attended the Bristol General Hospital with an eruption on the hands, consisting of a mixture of vesicles and pustules having the appearance of a secondarily infected pompholyx (see Fig.). She explained that she had been handling a family of young wild hedgehogs and, although the eruption did not suggest a ringworm infection, a scraping yielded a strain of *T. mentagrophytes* with an

unusual yellow pigmentation. The patient's eruption settled down after four weeks, but one finger-nail became infected: this cleared after four months on oral griseofulvin. Later her husband (Case 2) was also seen. He was said to have had a similar eruption on one finger which had cleared, but two finger-nails were still thickened and discoloured. Scrapings from these yielded the same fungus. The nail infection cleared in response to oral griseofulvin. Six months after the condition began one of the hedgehogs was examined and the same fungus was isolated from scales.

Case 3.—In early February, 1960, a woman was seen at Bristol General Hospital with an infiltrated ringed eruption on the left side of the chin of six weeks' duration. This gradually extended to a diameter of 6 cm. Scaling was minimal and the finding of a fungus in the scrapings was unexpected. In culture, the yellow pigmented strain of *T. mentagrophytes* was obtained. The eruption gradually cleared with the use of ung. acid. benz. co. *B.N.F.* after being present for two to three months. On inquiry in early 1961 it was discovered that she had been feeding a family of hedgehogs prior to the onset of the eruption.

Since 1958 scrapings from 10 patients residing in Cornwall have yielded this same yellow pigmented strain of *T. mentagrophytes*. After the recognition of its association with hedgehogs further inquiries were made in 1961.

Cases 4-13

In April, 1959, a boy aged 8 (Case 4) developed a scaling erythema involving most of the skin of the hands, with a demarcated edge on one thenar eminence: there were also scaling patches on the face and upper lip, and the fungus was isolated from scrapings. The eruption took some four to five months to clear. Just before the onset he had been playing with a dead hedgehog which he had attached to a piece of string. At about the same time the boy's mother (Case 5), aged 33, had scaling over the thumb, first finger, interdigital spaces, and adjacent part of the palm of the right hand, which was very similar to eczema in appearance. The same fungus was isolated. The eruption cleared after two to three months.

In April, 1959, a woman aged 41, living in Truro (Case 6), presented with a large red scaling patch on the right forearm which had been present for three months. It looked like a patch of eczema, but scrapings yielded the yellow strain of *T. mentagrophytes*. The eruption cleared up rapidly with local applications. Inquiries made in 1961 disclosed that this patient was often licked by her boxer dog, which commonly picked up hedgehogs and sometimes brought them home. Two years later, at our request, the patient

Eruption on hands in Case 1.