THYROID FUNCTION IN ACCIDENTAL HYPOTHERMIA

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THE clinical state of patients with accidental hypothermia may closely resemble that of severely hypothyroid patients. Moreover laboratory investigations fail to differentiate the two states with certainty. Six cases of hypothermia are described in this paper; the serum carotene and cholesterol levels have been estimated in the hope of establishing a precise diagnosis, and their values and that of the electrocardiogram are considered.

Introduction

Hypothermia has been defined by a Special Committee appointed by the Committee on Medical Science, Education and Research of the BMA (*Brit. med. J.*, 1964) as a body temperature below 95°F (35°C). When the cause is exposure to low external temperatures or derangement of the heat-regulating mechanisms by drugs or disease, the condition is termed accidental hypothermia. When due to lowered heat production consequent upon depressed thyroid function, the state is known as hypothyroid hypothermia.

Accidental hypothermia has been increasingly reported in the last few years, the majority of cases being in the British Isles. The diagnostic problem arises in the elderly in whom the clinical features show considerable overlap with hypothyroid hypothermia. Accidental and hypothyroid hypothermia share certain important clinical features—namely oedema, reflexes with a slow relaxation phase, bradycardia and a croaking voice (Duguid, Simpson and Stavers, 1961; Rosin and Exton-Smith, 1964). Junction (“J”) waves in the electrocardiogram were considered by Elmslie-Smith (1958) to be characteristic of accidental hypothermia, but their occurrence in hypothyroid patients also has been described. The serum cholesterol level might be expected to help in differentiating the two states. The value of the “J” wave and of the serum cholesterol level will be discussed, and the possible use of the serum carotene level considered.

Material

During the two winters 1962-3 and 1963-4 six patients with hypothermia were admitted as emergencies to St. Peter's Hospital, Chertsey, and personally seen. Their clinical features are charted below, (Table 1.).

It is of interest to note that case 6 tripped following a haematemesis, overturning an electric fire. She was found in a burning room engulfed in smoke. Case 5 had had a ureteric transplantation.

Of the clinical features noted in these patients, it was that of classical myxoedema which most closely correlated with our final opinion of the state of thyroid function. This was based in the two hypothyroid patients on post-mortem findings. All patients were elderly and hypothermic, with bradycardia in five and marked hypotension in three. Dysphonia and reflex delay were not confirmed to hypothyroid subjects, nor “J” waves to those with accidental hypothermia.

Thyroid studies have been made in accidental hypothermia. Prescott, Peard and Wallace (1962) and Rosin and Exton-Smith (1964) have recorded serum protein-bound iodine levels above and below the normal range in accidental hypothermia, and the latter record almost invariably high readings for the red cell uptake of ¹³¹I-labelled triiodothyronine.

Many cases of accidental hypothermia have been described in the English literature, and since January 1961 in 52 the serum cholesterol level and/or the ECG findings are recorded. The present 6 make a total of 58 and are included in Table 1. Of these 58 cases, 10 were finally thought to be primarily hypothyroid. In an attempt to assess the value of the cholesterol level and “J” waves as a guide to thyroid function, the findings are tabulated (Table 2.).

Discussion

Analysis of Table 2 reveals that ECG's are recorded on 47 of the 48 patients thought to be previously euthyroid. Of these 47, “J” waves are recorded in 28. ECG's are recorded in 9 of the 10 hypothyroid patients and “J” waves found in 4. Serum cholesterol levels are known

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TABLE 1

patient case no. and initials	age	sex	T ₀ F	pulse	"myx-oedema"	speech slurred or croaky	reflex delay	serum cholesterol mg %	serum carotene μ g %	serum vit. A μ g %	fate and autopsy report	"J" waves
1. DT.	71	F	84	55	+	+	+	433	200	40	Died: thyroid small and fibrous	0
2. EC	73	F	78	40	+	+	+	388	300	60	Died: thyroid small, mainly fibrous	+
3. IC	78	F	81	42	0	+	+	250	250	22	Recovered	+
4. EF	73	M	85	52	0	+	+	200	40	26	Died: no autopsy	0
5. HS	63	M	79	50	0	0	0	160	150	30	Died: thyroid normal	+
6. MW	87	F	89	70	0	0	0	180	150	60	Recovered	0

Normal values for above table: Serum carotene = 50-200 μ g/100ml.
Vitamin A levels = 20-45 μ g/100ml.

for 29 of the 48 euthyroid patients, and 2 of these are above 300 mg./100ml. In the ten hypothyroid patients cholesterol levels are known for each case, and 7 are above 300 mg./100 ml. A cholesterol level above 300mg./100ml. is thus strong evidence of reduced thyroid function. It is only by taking serum cholesterol results of above 350 mg./100ml. that previously euthyroid patients are entirely excluded, as two patients with levels of 300 mg./100ml. and one each of 317 and 348 mg./100ml. were not thought to be previously hypothyroid.

The Ministry of Health Memorandum (*Brit. med. J.* 1964) recommends giving triiodothyronine to patients with hypothermia only if the cause is hypothyroidism. By withholding thyroid in other instances the deleterious effects on the elderly myocardium are avoided. On the other hand, Paulley, Jones, Hughes and Porter (1964), who have achieved a survival rate rather higher than average administer triiodothyronine to all their patients. Three explanations of Paulley's results seem plausible: 1. the ancillary care of his patients is above average; 2. that hypothyroidism is being overlooked by some physicians in hypothermic patients; or 3. that hypothermia in itself leads to some suppression of thyroid function.

The overlap of clinical features also offers similar possible explanations: hypothyroidism is being under-diagnosed, hypothermia leads to hypothyroidism, or hypothermia is directly responsible for metabolic changes giving the

clinical and ECG features seen in frank hypothyroidism.

A raised level of serum carotene has previously been related to depressed thyroid function (Escamilla, 1942), and Wayne (1960) reports levels above 120 μ g/100ml. in 57% of cases of myxoedema. The results in the six patients described in this paper do not hold great hope of the serum carotene level being a useful test of thyroid function under circumstances of hypothermia, although neither hypothyroid

Fig. 1

TABLE 2

Author and Case No.	Cholesterol	J	Final Diagnosis	Author and Case No.	Cholesterol	J	Final Diagnosis
Dugiud age sex				Ferriman age sex			
1 84 F	180	0		1 70 F	348	0	
2 73 F	258	0		2 64 F	168	0	
3 68 F	143	0		Pledger 1 30 M	...	+	
4 75 F	100	0		Taxay 1 46 M	...	+	
5 82 F	241	+		Murphy 2 90 M	...	+	
6 81 F	164	...		3 80 F	185	+	
7 68 M	...	+		4 81 M	300	0	
9 73 M	159	+		6 77 F	130	0	
10 75 F	108	+		7 70 F	175	0	
11 75 F	550	+	M	8 64 F	295	0	
12 83 F	195	+	M	Roe 1 60 F	336	0	M
13 63 F	235	...	M	2 75 M	182	+	
14 72 F	185	+	M	3 43 F	300	0	
15 56 F	356	0	M	McNicol 6 80 M	...	+	
16 82 F	...	+		Ree 1 77 M	225	+	
17 75 M	...	+		Duckworth 1 32 F	...	+	
18 81 F	...	+		2 30 M	...	+	
20 80 M	...	+		3 29 F	...	+	
21 75 M	165	0		4 42 F	...	+	
22 80 M	...	0		5 30 M	...	+	
23 82 F	...	0		Mathews 1 71 F	433	0	M
Read 1 85 F	...	+		2 73 F	388	+	M
2 51 M	...	+		3 78 F	250	+	
Prestcott 1 69 F	641	0	M	4 73 M	200	0	
2 75 F	426	0	M	5 63 M	160	+	
3 76 F	278	+		6 87 F	180	0	
4 44 F	317	+					
5 56 F	256	0					
6 79 F	...	0					
7 82 M	91	+					
8 71 F	244	+					
9 75 F	250	0					

Key: M = Myxoedema. J = Junction waves on ECG

patient had a level below 200mg./100ml. It is likely that although lack of thyroid activity elevates the carotene level, the frequent lack of food in these patients restrains the rise.

Differing values for the normal cholesterol in the elderly have been reported. Hurxthal and Simpson (1941) suggest an upper limit to normal of 280 mg./100ml. at the age of 70 years, whereas Hobson, Jordan and Roseman (1953) record that 90% of elderly men have values below 335 mg./100ml. and women below 395 mg./100ml. However Wayne (1960) has found that a diagnosis of hypothyroidism

based on a serum cholesterol over 300 mg./100ml. agrees with his final diagnosis in 81% of hypothyroid patients. These results may indicate population or laboratory inconsistencies, but none of these studies was performed on elderly hypothermic patients in which the raised level appears to be significant (Fig. 1.)

Summary

Six new cases of hypothermia are described. The value of ECG's, serum cholesterol levels and serum carotene levels in detecting hypo-

thyroidism is discussed, and the literature reviewed.

The problem of differentiating accidental and hypothyroid hypothermia has not been resolved. The finding of a serum cholesterol level above 350 mg./100ml. is the best single aid to clinical detection of hypothyroidism in hypothermic patients.

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