methyl dopa given for two to six weeks causes a rise in serum prolactin concentrations in hypertensive patients.

Our studies have confirmed that patients on long-term treatment with methyl dopa have raised serum prolactin concentrations. Furthermore, we have shown that even a single oral dose of methyl dopa will increase serum prolactin concentrations. Basal serum prolactin levels varied considerably in the seven patients who received a single dose of methyl dopa, but they did not correlate with the level of blood pressure. That the rise in prolactin produced by methyl dopa was not merely a result of hypotension is suggested by the results in two patients given bethanidine (which lowers blood pressure by a peripheral adrenergic neurone blocking effect); there was no change in serum prolactin concentrations in spite of a considerable fall in blood pressure.

It is difficult to assess the importance of these drug-induced changes in serum prolactin concentrations. There are considerable species differences in the effects of prolactin itself on blood pressure,^{13 14} and its effect in man is unknown. Whether prolactin is a mediator of the sodium retention produced by methyl dopa is also open to question.¹⁵ Finally, galactorrhoea is seen in a few patients on methyl dopa, but the relation of this to the magnitude of the prolactin response is not clear.

The control of GH secretion is relatively more complex than that of prolactin. GH secretion is modulated by catecholamines, and in man there is evidence that alpha-adrenergic stimulation increases and beta-adrenergic stimulation decreases circulating concentrations.¹⁶ Furthermore, administration of levodopa, the precursor of dopamine, has been reported to increase circulating GH.¹⁷ When GH secretion was measured over 24 hours in a group of Parkinsonian patients given levodopa, however, 79% of the time GH concentrations failed to rise.¹⁸ Using insulin hypoglycaemia as the stimulus for GH secretion, the difference between patients on short-term and long-term methyl dopa therapy may be explicable in terms of the time course of substitution of endogenous catecholamines with metabolites of methyl dopa within the brain. There may be a similar explanation for the greater effect of methyl dopa on serum prolactin levels in

patients on prolonged methyl dopa treatment, since, unlike GH, prolactin secretion is inhibited by catecholamines.¹¹

These data suggest a novel aspect of the effects of long-term hypotensive therapy. As new, more potent, centrally acting antihypertensive drugs become available, hormonally mediated effects may become of considerable importance.

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SHORT REPORTS

Excessive egg consumption, xanthomatosis, and hypercholesterolaemia

We report a case of xanthomatosis and hypercholesterolaemia resulting from eating too many eggs.

Case report

A 30-year-old woman (51 kg, 164 cm) was admitted to hospital in 1969 for a routine check-up. She had had an appendicectomy and tonsillectomy. There was no abnormality apart from a few pinhead-sized xanthomas between the thumb and index finger on the backs of her hands. Among the serum laboratory findings increases in cholesterol (24.4 mmol/l (940 mg/100 ml)) and phospholipids (measured as lipid phosphor) 8.2 mmol/l (635 mg/100 ml) were remarkable. The lipidelectrophoresis was typical for a type IIa hyperlipidaemia according to Fredrickson. Triglyceride concentration was 2.2 mmol/l (198 mg/100 ml).

Careful questioning showed that she had followed the dietary recommendations of a magazine for three and a half years to stay slim. Each day she had consumed eight to 12 eggs, one or two lean steaks or half a small chicken and, half to one litre of milk. Sometimes some cottage cheese or tomatoes enriched the menu and, on rare occasions, fruit. She completely avoided butter, bread, potatoes, rice, noodles, alcohol, or any other food or beverage containing carbohydrate. The daily cholesterol intake, which was mainly derived from the egg yolks, was about 3500 mg. The total calorie

intake was about 8.4 MJ (2000 kcal) (35% protein, 55% fat, and 10% carbohydrates polyunsaturated fat:saturated fat (P:S) ratio=0.26). She was advised to change her diet and in particular to stop eating eggs. The total daily calorie intake remained the same (22% protein, 35% fat, and 43% carbohydrate, P:S ratio=0.30) but eggs were completely avoided. The daily cholesterol intake dropped to 235 mg. After 16 days the serum cholesterol was 19.4 mmol/l (750 mg/100 ml), triglycerides 2.9 mmol/l (261 mg/100 ml), and phospholipids 6.1 mmol/l (474 mg/100 ml). In the following years the serum cholesterol was checked several times by a doctor and reported to be in the normal range. In September 1974 no lipid deposits were found on the skin, cholesterol was 4.9 mmol/l (188 mg/100 ml), triglycerides 1.8 mmol/l (157 mg/100 ml), and phospholipids 4 mmol/l (310 mg/100 ml). The lipidelectrophoresis was normal. The phospholipids were still somewhat above normal, which may have been connected with an oestrogen medication the patient had received.

Comment

Man and Andrus¹ produced high blood cholesterol levels in an adult macacus rhesus monkey fed on a diet rich in egg yolks. After two-and-half years on this regimen the monkey developed xanthomatosis and when killed a year later exhibited extensive atherosclerosis. Similar results were reported by Gresham *et al.*² The chief effect of the atherogenic diet was the increase in the β -lipoproteins and their cholesterol and phospholipid content, but there was no increase in triglycerides. These findings agree with our observations in men. This case report also confirms the observation of Connor *et al.*,³ who showed the single influence of a diet rich in egg yolks on serum cholesterol levels in men under metabolic ward conditions. They

observed an appreciable increase in serum cholesterol at the end of several weeks whereas we measured a serum cholesterol level three times as high as theirs at the end of three-and-a-half years. Population studies,¹ furthermore, clearly show the close correlation between serum cholesterol and the prevalence of ischaemic heart disease.

We therefore concluded that regular consumption of many eggs over a long time is harmful, a fact which doctors should remember when advising people about weight reduction in order to prevent coronary heart disease. This is particularly important as some non-scientific magazines and journals have published slimming diets for overweight people, recommending 10 or more eggs a day.

¹ Mann, G V, Andrus, S B, *Journal of Laboratory and Clinical Medicine*, 1956, **48**, 533.
² Gresham, G A, *et al*, *British Journal of Experimental Pathology*, 1965, **46**, 94.
³ Connor, W E, Hodges, R E, and Bleiler, R E, *Journal of Clinical Investigation*, 1961, **40**, 894.
⁴ Kannel, W B, *et al*, *Annals of Internal Medicine*, 1964, **61**, 888.

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Hydrogen ion infusion for treating severe metabolic alkalosis

Conventional treatment of metabolic alkalosis consists of administering sodium, potassium, and chloride, but the response is slow. Infusions of hydrogen ion produce a rapid improvement, as in the case reported here, and represent a more physiological approach to the condition.

Case report

A 53-year-old woman presented with a 24-hour history of profuse vomiting associated with carpopedal spasm and ensuing drowsiness and dysphagia. Previously she had suffered from intermittent anorexia without indigestion or vomiting and chronic bronchitis with exertional dyspnoea of one year's standing. She had had no antacid treatment.

On admission she was marasmic, dehydrated, and delirious, making choreiform movements. Blood pressure was 100/60 mm Hg and pulse rate 100 beats/min (atrial fibrillation). A succession splash was heard, and residual gastric volume on aspiration was 150 ml. Central venous pressure was - 5 cm H₂O.

Electrolyte and blood gas levels on admission were compatible with severe vomiting secondary to pyloric stenosis (later confirmed by gastrografin meal). She was given 375 mmol (375 mEq) of sodium and chloride and 128 mmol (128 mEq) of potassium over 18 hours without improvement of her alkalosis (see table).

Because of evidence of failing renal function 300 mmol (300 mEq) of hydrogen ion was infused over 18 hours as 0.1-M hydrochloric acid via a central vein, the amount being calculated from her body weight (40 kg) and her chloride deficit (see below). A considerable clinical and biochemical

improvement followed. Involuntary movement ceased, and she became responsive to her name and aware of her surroundings.

Nutrients were given intravenously with the aim of surgical intervention; but she died after 11 days, having developed an overwhelming bronchopneumonia. Necropsy confirmed bronchopneumonia and pyloric stenosis due to benign fibrosis.

Discussion

Conventional treatment of metabolic alkalosis with sodium and potassium chloride relies mainly on renal suppression of acid excretion and enhancement of alkali excretion, as the respiratory response (hypoventilation) is not effective in protecting pH.¹ The renal corrective mechanisms are necessarily slow, and when metabolic alkalosis is likely, as in excessive loss of upper gastrointestinal contents, hepatorenal failure, severe shock states, and marked hypokalaemia from any cause (diuretics, diarrhoea, Conn's syndrome, and Cushing's disease), renal function is likely to be impaired.

A more physiological approach is to administer mineral acid to titrate excessive bicarbonate stores and effectively lower blood pH. This has been given as ammonium chloride, which may cause encephalopathy when given parenterally, or as arginine monohydrochloride, a compound which supplies hydrochloric acid during its metabolism. Recently Abouna *et al*² have successfully reversed severe metabolic alkalosis in a series of cases using intravenous hydrochloric acid. This must, however, be infused into a central vein.

The amount of mineral acid required can be calculated either from the extracellular chloride deficit³:

Cl deficit = (0.2 × body weight in kg) × (103 - Cl observed)

or from the bicarbonate excess⁴:

hydrogen ion deficit = (0.5 × body weight in kg) × (HCO₃ observed - 24)

Abouna *et al* suggest that the amount of mineral acid given should be enough to provide 100% replacement of the chloride deficit and 50% replacement of the hydrogen ion deficit, this being given over 12-24 hours.² The hydrochloric acid is given as an isotonic solution containing 150 ml of 1-M HCl in one litre of sterile water, which gives 300 mmol of H⁺ and Cl⁻ per litre.

Patients with severe metabolic alkalosis are usually considerably volume contracted and will therefore also require isotonic saline with potassium supplements as judged by clinical state and serum electrolyte levels.

Although some workers feel that mineral acid should be used only when conventional treatment has failed, it seems that the use of intravenous hydrochloric acid, if carefully monitored by measurement of electrolytes and blood gases, is both effective and safe and provides a more physiological first-line approach to treating severe metabolic alkalosis; it should not be reserved solely as a "therapy of desperation."⁵

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¹ Goldring, R M, *et al*, *Journal of Clinical Investigation*, 1968, **47**, 188.
² Abouna, G M, Aldrete, J A, and Starzl, T E, *Surgery*, 1974, **75**, 194.
³ Harken, A H, *et al*, *Archives of Surgery*, 1975, **110**, 819.
⁴ Kassirer, J P, *New England Journal of Medicine*, 1974, **291**, 773.
⁵ *Lancet*, 1974, **1**, 720.

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Serum electrolyte concentrations and blood gas analysis during early stage of treatment

	Days after admission and time of estimation									
	1	2		3			4	5	6	7
	2300	1000	1500	0100	1000	1800	0900	0900	0900	0900
HCO ₃ (mmol/l)	>50	60	56	36	30	26	20	23	21	24
Cl (mmol/l)	<70	64	65	74	90	97	107	107	102	107
K (mmol/l)	2.6	6.0	3.4	3.7	4.3	3.6	4.3	3.6	4.3	3.8
Na (mmol/l)	135	141	141	139	137	141	143	143	137	141
Urea (mmol/l)	21.5	25.0	31.0	31.5	30.3	29.5	26.0	21.2	17.3	13.1
pH		7.54		7.51		7.42				
Pco ₂ (kPa)		9.4				6.8				
HCO ₃ (mmol/l)		56.5			30.2					

Conversion: SI to traditional units—Urea: 1 mmol/l ≈ 6 mg/100 ml. Pco₂: 1 kPa ≈ 7.5 mm Hg.