ANAESTHESIA IN UNTREATED MYXEDEMA
Report of Two Cases

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SUMMARY
General anaesthesia can precipitate cardiovascular collapse in patients with untreated myxoedema. This is illustrated by two case reports. Emergency surgery may be necessary in these patients but should be delayed for a few hours until therapy with triiodothyronine and cortisone has been started. Narcotic analgesics, sedatives, and tranquillizers should be avoided as they may cause marked respiratory depression. Hypothermia may develop but active rewarming is dangerous and unnecessary as the temperature will return to normal as soon as treatment with triiodothyronine is started. General anaesthesia may be satisfactorily carried out with nitrous oxide, oxygen, relaxants and positive pressure ventilation.

Anaesthesia for patients with endocrine disease has recently been reviewed in the volume edited by Jenkins (1963). In this and other anaesthetic books myxoedema is only briefly discussed. The following case reports illustrate the problems which can occur when patients with myxoedema undergo anaesthesia.

CASE NO. 1.
A married woman aged 59 years was admitted to hospital for investigation of dysphagia which was found to be due to a postcricoid carcinoma; a history of dyspnoea and chest pain on exertion was also given. Clinical examination revealed no other abnormality; an electrocardiograph, chest X-ray, full blood count, haemoglobin, blood urea and serum transaminase values were all normal. She underwent a pharyngolaryngectomy and block dissection of the left side of the neck during which three-quarters of the thyroid gland was removed, and she was left with a permanent tracheostomy. Anaesthesia for this operation was induced with methohexitone and maintained by means of oxygen and halothane combined with intermittent positive pressure ventilation to produce hypotension (details not available to the writer). The operation and postoperative course were uneventful and she was transferred to the plastic surgery unit at this hospital for reconstruction of the pharynx.

Three weeks after the first operation the patient appeared healthy and no abnormality was found apart from generalized alopecia which had developed 40 years previously. Her weight was 51 kg, blood pressure 140/80 mm Hg, haemoglobin 12 gm/100 ml and chest X-ray normal. Premedication was not given.

Anaesthesia was induced with thiopentone 2.5 per cent 200 mg and was followed by tubocurarine 35 mg. Pulmonary ventilation was controlled through a cuffed latex trach-rostomy tube, using a Frazierly ventilator.

Anaesthesia lasted for 7 hours.

Twenty minutes after induction, 1 per cent halothane was added for 30 minutes and the arterial pressure fell from 120/70 mm Hg to 80/70 mm Hg and then became unobtainable by the Riva Rocci method. Halothane was discontinued and the pressure returned to 110/85 mm Hg. Bleeding became troublesome and 1 per cent halothane was added for 10 minutes, the pressure again became unrecordable. Halothane was discontinued and the pressure returned to 80/60 mm Hg. At this stage, 2 hours after the operation commenced, blood loss was less than 500 ml. This was estimated by colorimetric measurement of haemoglobin extracted from the swabs in a known volume of water. Rapid blood transfusion failed to raise the arterial pressure above 70/60 mm Hg and marked peripheral cyanosis was present. Capillary oozing developed but repeat blood group, crossmatch, and Coombes test were all normal, and the clotting time was 3 minutes. The arterial blood acid base state was pH 7.48, Pco2, 33 mm Hg, base excess +1 m.equiv/l. Following intravenous injection of methoxamine 5 mg, hydrocortisone 100 mg and further rapid blood transfusion, the pressure rose to 110/90 mm Hg for 30 minutes and then fell to 70/60 mm Hg. It remained at this level in spite of blood replacement which exceeded estimated loss by 1000 ml. It was considered dangerous to continue rapid transfusion in view of her age and history suggesting the possibility of angina. The e.c.g. showed low voltage complexes and sinus rhythm at a rate of 60/min. The rectal temperature was 35°C and fell to 34°C in spite of a theatre temperature of 24°C. Since 1500 ml of blood had been transfused, 20 ml of 10 per cent calcium gluconate was given and the blood
pressure increased to 100/80 mm Hg. Myxoedema was suspected but no specific treatment was given. At the end of the operation, curarization was reversed with atropine 1.2 mg and neostigmine 5.0 mg, given together. Muscle tone returned to normal and the patient quickly regained consciousness. On return of spontaneous respiration the pressure was 110/80 mm Hg. Because the period of severe hypotension had lasted for 4 hours, the patient was admitted to the intensive care unit for observation of renal function.

Postoperatively renal function was satisfactory, and hypothyroidism was confirmed by finding characteristically slow ankle jerks, a low voltage e.c.g. and a serum cholesterol of 260 mg/100 ml (normal upper limit 180 mg/100 ml).

She was treated with 1-thyroxine 0.1 mg daily and 3 weeks later the ankle jerks were brisker and the electrocardiogram showed increased voltage. Six weeks after this operation she underwent further surgery under nitrous oxide, oxygen and halothane anaesthesia, under nitrous oxide, oxygen and halothane anaesthesia. Postoperatively 48 hours elapsed before the body temperature returned to normal. In a similar case, during halothane anaesthesia lasting 8 hours in a 70-year-old man, the temperature only fell to 36°C and returned to normal within 12 hours.

Myxoedema was diagnosed postoperatively and having excluded coronary thrombosis, excess blood loss, transfusion reaction and other endocrine deficiency, it must be considered the most likely cause of resistant hypotension in this case.

**CASE NO. 2.**

A man aged 73 years was admitted with burns of his left arm (total area of burns 1.5 per cent). He appeared to be mentally defective and a coherent history could not be obtained. His general health and nutrition were good. The blood pressure was 160/90 mm Hg, the pulse rate 60 beats/min, and the heart and lungs were normal on clinical examination. The abdomen was distended, his skin was thickened and there was slight pitting oedema over the tibia. Myxoedema was diagnosed and treatment was started with tab. thyroid 60 mg b.d. Eight days later signs of large bowel obstruction developed and a laparotomy was considered necessary. Pre-operative serum electrolyte values were: sodium 126 m.eqiv/l., chloride 95 m.eqiv/l.; urea 47 mg. Premedication consisted of atropine 0.6 mg and pethidine 50 mg, and 1 hour later when the patient was brought to theatre he was observed to be cyanosed. An intravenous transfusion was given and anaesthesia was induced with thio-panone 200 mg, followed by tubocurarine 45 mg. After endotracheal intubation the lungs were ventilated with nitrous oxide (6 l./min) and oxygen (2 l./min). At this stage the patient had become pulseless and cardiac arrest was diagnosed. The operation was postponed. Internal cardiac massage was carried out and the heart was restarted. After 30 minutes, during which the circulation was satisfactory, residual curarization was reversed with atropine 1.2 mg and neostigmine 5.0 mg given together intravenously, and spontaneous respiration returned satisfactorily. Cortisone 100 mg and triiodothyronine (T.I.T.) 15 mg were given intravenously and these drugs were continued over the next 14 days.

Postoperatively the patient showed marked signs of myxoedema. The blood pressure was 105/60 mm Hg and the pulse rate 50 beats/min. The electrocardiogram showed low voltage QRS, widened Q-T segments and low voltage T-waves. His temperature had remained at 36°C since admission. Forty-eight hours after the cardiac arrest he underwent laparotomy for the intestinal obstruction. One hour pre-operatively cortisone 100 mg and T.I.T. 20 mg were given. An endotracheal tube was inserted under topical analgesia. Tubo-
curarine 45 mg was then given and the lungs were ventilated with nitrous oxide and oxygen. The operation was uneventful and curarization was reversed with atropine 1.2 mg and neostigmine 5.0 mg.

At laparotomy no cause for the large bowel obstruction was found, and it was suggested that the gaseous distension and atony of the bowels was due to the myxoedema. Postoperatively intravenous fluids were given for 5 days and the patient became rather "waterlogged". This cleared spontaneously when intravenous fluids were discontinued. Treatment was continued by giving a maintenance dose of 1-thyroxine by mouth; one month later the electrocardiogram was much improved and the other signs of myxoedema were diminishing.

COMMENT

In this case, myxoedema was diagnosed preoperatively and thyroid replacement therapy commenced using thyroid extract by mouth. Oral thyroxine takes up to 10 days to produce its maximum effect (Forrester, 1963) and, since this patient was operated on only 8 days after starting treatment, replacement was obviously insufficient. Also he became cyanosed following premedication with pethidine 50 mg, probably due to severe respiratory depression. Relatively large doses of thiopentone (200 mg) and tubocurarine were given for induction of anaesthesia and these could produce profound hypotension. This combination of hypoxia and hypotension was probably responsible for the cardiac arrest. Following effective replacement therapy with triiodothyronine, further anaesthesia and surgery within 48 hours of the arrest took place without incident.

DISCUSSION

Anaesthesia may have to be undertaken in patients with untreated myxoedema who require emergency surgery. Little has been written on the management of these cases but it is essential to be aware of the problems involved and to have a plan of therapy. This can be divided into specific replacement therapy and supportive measures.

Anaesthesia and operation should be postponed until replacement therapy has commenced. As stated above, thyroxine takes up to 10 days to exert its effect and is therefore not effective for emergency therapy. Triiodothyronine is the drug of choice as it acts within 6 hours and exerts its maximum effect in 48–72 hours (Perlmitter, 1964; Forrester, 1963; Blackburn et al., 1954). Triiodothyronine is given intravenously and McLelland (1963) recommends that 25 μg be given at once, to be followed by 25 μg in the first bottle of intravenous fluid. A more cautious regime is to add 0.1 mg triiodothyronine to 1 litre of 5 per cent dextrose and give it intravenously at a rate of 20 drops/min, whilst observing the electrocardiogram for flattening of the T-wave and depression of the RS–T segment. Too rapid administration of triiodothyronine can cause angina, auricular fibrillation, cardiac failure, ventricular tachycardia and cardiac arrest. Parenteral replacement therapy should be continued, e.g. 15 mg b.d. for 2 weeks until oral thyroxine is acting effectively.

In myxoedema a rapid return to normal metabolism from the hypometabolic state may result in acute adrenocortical insufficiency and shock (Perlmitter, 1963). Cortisone 100 mg should be given intravenously with the triiodothyronine and continued in reducing dosage over the next 5 days.

Hypotension in myxoedema is resistant to vasoressors until thyroid is given but Holvey (1964) describes a case in which ventricular tachycardia and fibrillation developed when using this combination of drugs; therefore it is probably best to avoid vasoressors. Coronary artery disease is common in myxoedema but it may be difficult to obtain a history of angina or dyspnoea because of mental impairment associated with the disease. Blood and fluid loss is tolerated badly and, although replacement is essential, rapid transfusion and overtransfusion are equally dangerous. Rehydration, electrolyte and blood replacement should start pre-operatively, the rate being determined by observing the blood pressure and central venous pressure. A progressive decrease in pulmonary compliance during anaesthesia may be due to pulmonary oedema from overtransfusion or cardiac failure (Masson, 1963).

Catz and Russel (1961) state that hypoglycaemia tends to develop during the treatment of myxoedema with thyroid. Estimations of the blood sugar should be made and an adequate intake of carbohydrate ensured.

Hyponatraemia is also commonly found, due to sodium and water becoming sequestrated into connective tissue, but normal redistribution takes place after thyroid replacement therapy (Curtis, 1956; Holvey, 1964; Aikawa, 1956). Therefore, replacement of apparent sodium deficiency should be undertaken cautiously as it may cause cardiac
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Failure and effusions, as occurred in the second case described.

Hypothermia is a feature of myxoedema and exposure to cold following injury may precipitate myxoedema coma. Attempts at active rewarming are dangerous as this may produce cardiovascular collapse and local burns. In any case, administration of triiodothyronine will restore the body temperature to normal in 24-48 hours (Catz and Russel, 1961). The theatre temperature should be kept high to prevent further cooling.

There are many reports that the respiratory centre does not function normally in myxoedema and that alveolar hypoventilation and carbon dioxide retention is common (Holvey, 1964; Massumi and Winnacker, 1964; Mitchell, Surridge and Willison, 1959; Perlmitter, 1964; Nickel and Frame, 1961; Nordquist et al., 1960). This centre is particularly sensitive to narcotic analgesics, sedatives and tranquillizers, either of which may cause severe respiratory depression. This is illustrated in the second case who became cyanosed following a 50 mg dose of pethidine. The normal respiratory response to carbon dioxide or hypoxia is lost and carbon dioxide retention is readily produced. Carbon dioxide narcosis is important in the genesis of myxoedema coma, and failure to detect and correct it by artificial ventilation may be responsible for the failure of the patient to respond to other forms of treatment.

Gastrointestinal haemorrhage frequently occurs in myxoedema coma. Orr (1962) and Blackburn (1959) state that capillary fragility increases in hypothyroidism. This may have been the cause of the capillary oozing in Case No. 1. The patient with myxoedema may therefore be anaemic and it is important to correct this.

In view of the foregoing discussion the choice of anaesthetic agents is obviously restricted. Narcotic analgesics, sedatives and tranquillizers should be avoided both in the pre-operative and postoperative periods, because they may produce severe respiratory depression and also vasopressor resistant hypotension. Masson (1963) recommends cyclopropane and oxygen with controlled ventilation as it is potent in high concentrations of oxygen and can be rapidly eliminated at the end of the operation. Also it has a minimal effect on the blood pressure in moderate levels of anaesthesia. Induction with nitrous oxide and oxygen, curarization, intubation and controlled ventilation will produce minimal disturbance of the cardiovascular system (Prime and Gray, 1952). The arterial blood pressure in Case No. 1 was easily lowered by positive pressure ventilation and only returned to normal levels when spontaneous respiration returned. It would appear, therefore, that the mean intrathoracic pressure should be kept as low as possible during positive pressure breathing, by allowing an adequate expiratory time with a negative phase if possible. Hyperventilation should be avoided because of the low metabolic rate, because it will lower the Pco₂ to extremely low levels. Total chest compliance is reduced in myxoedema due to myxoedematous involvement of the chest wall structures (Nickel and Frame, 1961).

Muscle relaxants do not appear to be contraindicated. It is advisable to start with a test dose, to keep the total dosage to a minimum, and reverse residual curarization with neostigmine.

Anaesthesia in untreated myxoedema is not often necessary, but it is hoped that the suggestions outlined will prove useful should this emergency arise.

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References


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