pamide or tolbutamide), the output of glucose from the liver is reduced. The hyperglycaemic response to glucagon is usually satisfactory, though glucagon also stimulates the secretion of insulin.

In all cases of hypoglycaemia, once consciousness is regained, adequate carbohydrate must be given by mouth to prevent the development of secondary hypoglycaemia. Any precipitating factor should be excluded and the patient's diet and dose of hypoglycaemic drug should be carefully considered.

CARDIOVASCULAR DISEASE

Probably glucagon will have a limited, though theoretically interesting, place in the treatment of cardiovascular disease. Its value in clinical practice is not yet established and early results have been variable. This may reflect the ability of the drug to influence myocardial cell metabolism at different degrees of cell injury.

A beneficial effect has been reported in a few patients with a first episode of heart failure, and also in patients who had resistant cardiac failure and even cardiogenic shock. The increase in cardiac output without increasing ventricular irritability has even occurred in patients on full doses of digoxin and in patients with depression of myocardial function after treatment with beta-adrenergic blocking drugs. Glucagon has also been advocated in low cardiac output states after operation. In all these cases the drug has been given in an infusion of 5% dextrose (1—7.5 mg/hour).

Further studies are required to assess the antiarrhythmic effects of glucagon, particularly in heart failure associated with arrhythmias induced by digoxin. Work in dogs has shown that glucagon may abolish these arrhythmias without depressing myocardial function, in contrast to alternative drugs such as procaineamide. There is no evidence that glucagon will be useful in the treatment of angina pectoris as the increase in cardiac output is also associated with increased myocardial oxygen requirements.

Uses in Diagnosis

Glycogen Storage Disease.—A reduced hyperglycaemic response to glucagon occurs in fasting patients when the liver is the principal organ involved (types I, III, IV, VI). More specific investigations are available to establish the exact Cori type.

Phaeochromocytoma.—A pressor response may be noted after provocative agents, such as histamine, tyramine, and glucagon. These tests must be carefully supervised and an alpha-blocking agent such as phentolamine should be available. Few false-positive results have been reported after glucagon but further studies are required. Provocative tests should be undertaken only in those patients where the diagnosis remains in doubt after initial screening tests such as measurement of urinary catecholamine excretion.

Insulinoma.—The diagnosis is suggested if after glucagon significant hyperglycaemia fails to develop or if hypoglycaemia occurs in association with raised plasma insulin levels.

Pituitary Deficiency.—The measurement of the peak levels of serum growth hormone after glucagon may prove a further test of pituitary reserve, but further studies are required to compare it with other available tests.

Adverse Effects and Availability

Glucagon is a protein substance and allergy may develop. At low doses side effects are minimal. At doses used in the infusions in the treatment of cardiovascular disease nausea and vomiting are common. There is a tendency for hypokalaemia to develop. The requirements for warfarin may be reduced because of interference with vitamin K synthesis.

Glucagon (Eli Lilly) is available as porcine pancreatic glucagon as the hydrochloride in 1 mg and 10 mg ampoules. Diluting solutions are provided.

New Appliances

Double-cuff Endotracheal Tube

Dr. P. D. SALPEKAR, research medical assistant in orthopaedic and accident surgery, Preston Royal Infirmary, Preston PR1 6PS, writes: Tracheostomy and intermittent positive-pressure ventilation are recognized methods used in the management of respiratory failure and are not free from problems. The prolonged use of a single-cuff rubber endotracheal tube in intermittent positive-pressure ventilation therapy has its own added adverse effects on the larynx and tracheal mucosa. The use of a double-cuff tracheostomy tube has clearly resulted in fewer tracheal complications.¹

Therefore a double-cuff endotracheal tube has been designed (see Fig.) using the same tracheostomy tube cuffs for prolonged periods of intermittent positive-pressure ventilation therapy. In practice the cuffs are inflated with 3–4 ml of air alternately at half-hour intervals. When the tracheostomy is performed after some period of time it is observed at operation that the tracheal mucosa shows hardly any evidence of local irritation or bleeding, as is seen frequently in similar circumstances after a rubber endotracheal tube intubation. This procedure has been successfully carried out on many patients with chest and multiple injuries, and in some cases the operation of tracheostomy has been avoided.

Double-cuff endotracheal tube.

The tube is made by Portland Plastics Ltd., Hythe, Kent.

Reference

- Salpekar, P. D., *British Medical Journal*, 1966, 1, 296.