Oesophago-antrostomy with and without pyloroplasty — radiological and manometric findings in the chacma baboon

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Summary

Oesophago-antrostomy with and without pyloroplasty, and with preservation of Latarjet's anterior nerve with an intact pylorus, was studied in chacma baboons. Radiological and manometric studies showed that pyloroplasty is unnecessary after oesophago-antrostomy with an incidental vagotomy and that pyloroplasty in fact interferes with the muscular rhythm of the pyloric sphincteric cylinder.

Materials and methods

The experimental animal was the adult baboon (Papio ursinus ursinus) and subjects were divided into three groups: group A — oesophago-antrostomy without pyloroplasty (4 animals) (Fig. 1); group B — oesophago-antrostomy with pyloroplasty (4 animals) (Fig. 2); and group C — oesophago-antrostomy without pyloroplasty and with preservation of Latarjet’s anterior nerve (3 animals) (Fig. 3).

The baboons, of either sex and weighing ± 17 kg, underwent the operation after a period of conditioning. The operative procedure was performed under general anaesthesia. Ketamine hydrochloride 100 mg was injected intramuscularly to subdue the animal so that anaesthesia could be induced by an intravenous injection of pentobarbitone sodium 20 mg/kg body weight. Thereafter pentobarbitone 4 mg/kg was given intravenously every hour during the operation.

An upper midline incision was used to open the abdomen. The oesophagus was mobilized to obtain an adequate length for anastomosis. The upper part of the stomach and distal oesophagus was resected, leaving a distal gastric segment 7 cm long on the greater curvature side and 5 cm long on the lesser curvature side. The spleen was not removed. The upper part of the gastric remnant was closed with a continuous 3/0 chromic catgut suture. The oesophagus was anastomosed to the anterior wall of the stomach just below the gastric closure in two layers. An interrupted posterior layer of 3/0 black silk was inserted in such a manner that the oesophageal muscle was anastomosed to the seromuscular part of the stomach before the gastrotomy was performed. On completion of this layer the stomach was opened to insert a layer of a continuous 3/0 chromic catgut suture between the oesophageal mucosa and the gastric mucosa. The anterior suture line was then completed with interrupted 3/0
black sutures between the oesophageal musculature and the seromuscular part of the stomach. The pyloroplasty was of the Heineke-Mikulicz type employing a single interrupted layer of 3/0 chromic catgut sutures. Complete truncal vagotomy was established in all animals in groups A and B. In group C the proximal gastrectomy was performed as described, carefully preserving Latarjet’s anterior nerve and severing the posterior vagus nerve. For the first 48 hours after the operation the animals received intravenous feeding and then small sips of water, and within 5 days they were eating their normal pellet diet.

Three months after the procedure cine fluoroscopy was performed. Each animal received a dose of ketamine 10 mg/kg, which was enough to produce sedation but not interfere with the swallowing reflex. A mixture of thick barium paste and the usual solid pellet diet, having the consistency of thick porridge, was administered with a spoon and swallowed without difficulty.

Results

It is proposed to interpret the results according to the descriptions of the anatomy of the distal part of the stomach by Cunningham2 (in man and the anthropoid ape), Forssell3 and Torgersen4 (in comparative anatomical studies) and others.5,6 According to these authors the circular muscularis externa forms a tube-like thickening, 3 - 4 cm in length, in the distal stomach, called the pyloric sphincteric cylinder (‘canalis egestorius’). The pyloric ring (sphincteric ring or ‘right canalis loop’) is not a separate structure, but merely a localized, annular thickening of the aboral part of the cylinder. While the circular fibres of the ring are sharply demarcated from those of the duodenum by a fibrous septum, no such division exists on the gastric side where the fibres of the ring merge imperceptibly into those of the cylinder. Anatomically and functionally the ring forms an inherent part of the cylinder.1–5 The various parts of the cylinder do not function separately, but act as a unit. The movements of the cylinder in the living human stomach as seen radiographically have been fully documented.7 Our previous cine radiographic experience showed that the movements in P. urinum urinum were identical to those in humans. (The abovementioned authors indicated that the concept ‘antrum’ could not be defined anatomically, and advocated the abolition of this term.)

Group A (Fig. 4). The usual finding was that the barium-filled oesophagus emptied rapidly into the remaining stomach,
the stomach started emptying within 2 minutes, and active con­
tractions of the pyloric sphincteric cylinder were observed. Within a period of 7 minutes half the barium had left the sto­
mach. No reverse peristalsis was observed and no duodenogas­
tric reflux occurred. Oesophageal reflux was observed occasion­
ally. Within 5 minutes the proximal small bowel was filled with barium.

**Group B** (Fig. 5). The oesophagus emptied well into the stomach and barium began to leave the stomach after 3 minutes. Weak, irregular contractions were observed in the remaining stomach, but no normal contractions of the pyloric sphincteric cylinder were seen. The typical radiographic appearances of the pyloroplasty were evident, viz. temporary bulges (out­pouchings?) of the lesser and greater curvatures, lack of maximal contraction of the cylinder, and failure of the pyloric aperture to close. There was no duodenogastric reflux, but occasional gastro-oesophageal reflux occurred. The overall impression was that the barium left the stomach by gravity, and within 10 minutes 50% of the barium had left the stomach. Barium was noted in the small bowel within a period of 10 minutes.

**Group C** (Fig. 6). The pyloric sphincteric cylinder showed fairly normal-looking contraction waves, the barium leaving the stomach within 1 minute with a 50% emptying noted at 5 minutes. There was no duodenogastric or gastro-oesophageal reflux.

**Manometric studies**

A water-filled gastric balloon was inserted during the original operative procedure to test its size and accuracy for later mano­metric studies. Three months after the original procedure manometric studies were performed under the influence of ketamine 10 mg/kg. The baboon tolerated the insertion of the gastric tube and balloon and was fed the usual barium and pellet mixture. A transducer connected to a Hewlett Model W788A monitoring machine was used for recording contractions in mil­limetres of mercury. Fig. 7 demonstrates fairly normal-looking
contractions of the pyloric sphincteric cylinder in the group A model. In contrast the manometric findings in group B (Fig. 8) show irregular disorganized contractions varying in intensity. Fig. 9 demonstrates the manometric findings in group C. This model was developed to compare the radiological and manometric findings with those in the two previous models. It should be noted that the contraction waves were smooth, of high amplitude and fairly regular.

![Fig. 8. Group B. The contractions are irregular and disorganised, varying in intensity (measured in mmHg).](image)

![Fig. 9. Group C. The contractions are smooth and fairly regular with a high amplitude (measured in mmHg).](image)

**Discussion**

There are advocates for and against pyloroplasty or pyloromyotomy in patients who undergo oesophago-antrostomy. From these experimental findings it became obvious that a pyloroplasty was not necessary after oesophago-antrostomy; in fact, pyloroplasty may be undesirable because of the unusual irregular contractions of the pyloric sphincteric cylinder.

![Graph showing manometric findings](image)

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We feel that these experiments adequately prove that pyloroplasty is not necessary after oesophago-antrostomy; in fact, pyloroplasty may be undesirable because of the unusual irregular contractions of the pyloric sphincteric cylinder.

**REFERENCES**

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