GASTRIC AND INTESTINAL BIOPSY: EXPERIENCE WITH THE CROSBY CAPSULE

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Since its introduction in 1957, the intestinal biopsy capsule (Crosby and Kugler, 1957) has gained wide acceptance as a relatively safe method of obtaining specimens of gastric and small intestinal mucosa perorally. It has been used in this Unit for the past 3 years and 10 gastric and 150 jejunal biopsies have been carried out on 90 subjects. The gastric biopsies were carried out on patients considered to be suffering from Addisonian pernicious anaemia. The jejunal biopsies were performed on either control subjects or on patients considered to be suffering from intestinal malabsorption. All the subjects were adults and their ages varied from 16 years to 72 years. In this paper we review our experience with this instrument and the complications encountered both by us as well as by other workers.

The biopsy capsule (Fig. 1) is an ovoid hollow metal chamber 18.5 mm. long and 9.5 mm. in diameter, with an opening or port 3.0 mm. in diameter on one side. It contains a spring activated cutting blade, an air chamber and a rubber diaphragm. Polyethylene tubing enters the capsule at one end and serves as a means of triggering the knife as well as a means of recovering the instrument after the specimen has been taken. Suction applied by a syringe to the free end of the tubing is transmitted to the capsule, causing intestinal mucosa to be sucked into the instrument, thus occluding the biopsy port. Air in the chamber expands and moves the diaphragm which causes the knife to be tripped and the mucosal specimen to be cut free.

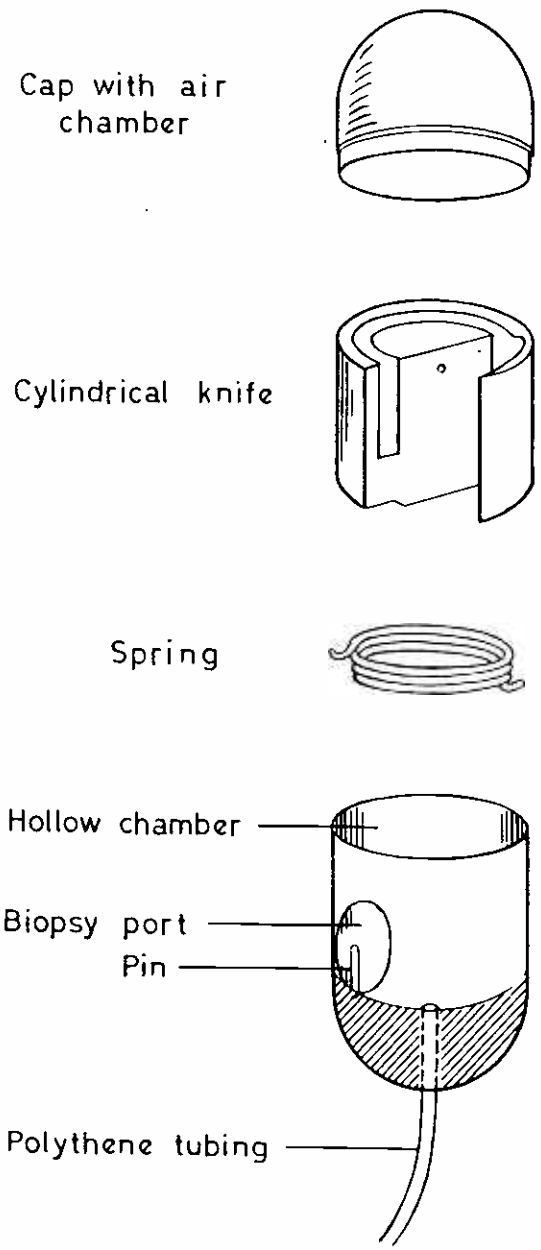

Fig. 1. The Crosby intestinal biopsy capsule.

BIOPSY TECHNIQUE

(a) Jejunal Biopsy

The procedure is explained to the patient prior to the biopsy. Vitamin K_1, 10 mg. intramuscularly, is given routinely to any patient suspected of suffering from a malabsorption syndrome. An abnormal bleeding tendency is detected from the history, physical examination and by carrying out a partial thromboplastin time. Anaemic patients are transfused with blood until the haemoglobin is at least 9 grams %. A pint of blood is reserved and the patient is fasted overnight, the biopsy being carried out the next morning. The tubing is inspected for kinks and is hung up for 12 hours prior to the biopsy in order to remove any tendency to coil up in the stomach. The capsule is assembled and a fingercot containing 2 to 3 c.c. of water is attached by a thread about 6 cms. long to the

wireclip which keeps the assembled capsule together.

The patient's throat is anaesthetised by spraying with 2% amethocaine. A minimal amount of amethocaine is used, as liberal spraying in the first few patients resulted in bronchospasm in one patient who had to be given adrenaline and hydrocortisone for relief. In patients with a history of bronchial asthma, no local anaesthetic is used. Davis (1963) found that proper positioning of the patient was of the utmost importance and his procedure has been followed with some modifications. The capsule and attached balloon fashioned from the fingercot are placed together at the back of the tongue and the patient is instructed to swallow it in one swift motion without chewing the tubing. He then swallows enough tubing, usually 50 cms. in the average adult, to enable the capsule to reach a point midway down the greater curvature of the stomach. He then has a drink of water and lies on his left side for 5 minutes. Thereafter he stands up, bends forward, takes 3 to 4 deep breaths and then swallows an additional 10 to 12 cms. of tubing before lying down again, on his right side with the buttocks elevated on a pillow. These manoeuvres are intended to position the tubing along the greater curvature of the stomach with the capsule lying in the pyloric antrum. In the next 20 minutes no further tubing is swallowed and it is hoped that during this period the capsule will pass by peristalsis into the first part of the duodenum. Thereafter the patient is instructed to swallow about 12 cms. of the tubing at 20 minute intervals, 20 c.c. of water being injected down the tubing each time in order to stimulate peristalsis. When a total length of approximately 100 cms. of tubing has been swallowed, the capsule is usually in the proximal jejunum. The tubing is then outlined with radio-opaque fluid and a plain radiograph of the abdomen is taken to confirm that the capsule is lying in the proximal jejunum (Fig. 2). 20 c.c. of water is injected down the tubing to wash out the capsule and to clear the area near the port followed by 20 c.c. of air since the instrument works better in air than in a fluid medium. The instrument is then fired by applying suction with a syringe. Suction is applied with a quick hard pull, the piston being completely withdrawn from the barrel of the syringe. Resistance to the reintroduction of air or fluid into the tubing usually indicates that the instrument has fired. The capsule is then withdrawn by exerting steady traction to the end of the tubing. The capsule is occasionally held up at the pylorus

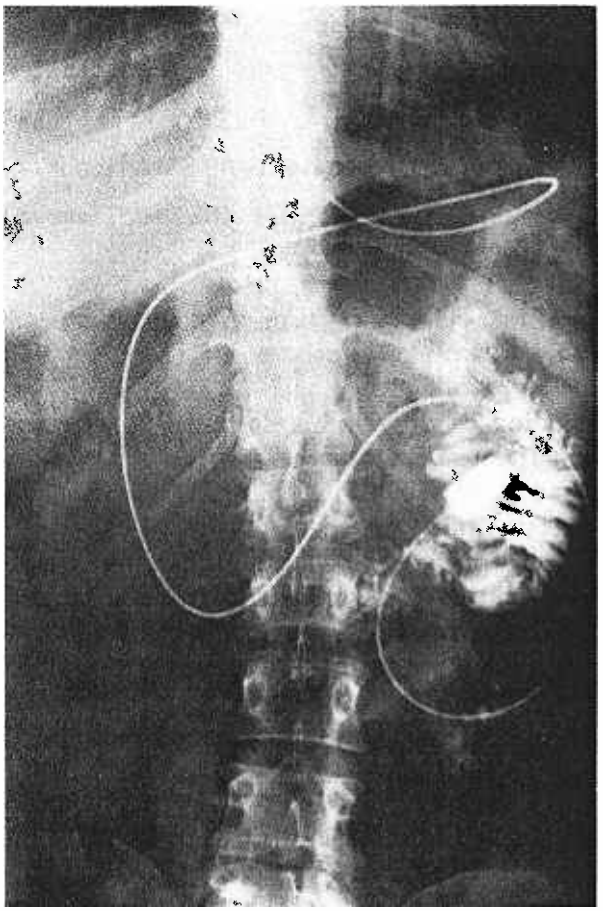

Fig. 2. The capsule is in the proximal jejunum with the tubing and the mucosal pattern of the jejunum outlined by radio-opaque fluid.

and intravenous propantheline has been used by some workers to relax the pylorus. However we found that exerting traction on the tubing after giving the patient a large glass of water to drink, will usually free the capsule. The capsule is opened and the tissue is stretched flat on the operator's palm with the cut surface uppermost. Gel foam is applied to the cut surface and the specimen is placed in 10% formalin in saline. It is later examined and photographed through a dissecting microscope and then serially sectioned for histological examination.

(b) **Gastric Biopsy**

In carrying out gastric biopsies, the procedure of Floch and Sheehy (1962) has been followed. The capsule is prepared for use as described above but the balloon containing water is omitted. The patient fasts overnight and a Ryle's tube is passed into the stomach and the fasting contents are aspirated before the capsule is swallowed. The patient then swallows 40 to 50 cms. of the tubing, enabling the capsule to reach the stomach. The approximate position of the capsule can be ascertained by injecting air down the tubing and listening over the epigastrium with a

stethoscope. We were investigating patients with Addisonian anaemia and were interested in biopsies from the body and fundus of the stomach. Our patients were therefore placed on their backs with the right side elevated as this position would bring the capsule into contact with the body of the stomach. The exact position of the capsule was visualised by injecting radio-opaque fluid down the tubing and taking a plain radiograph of the abdomen. The capsule is then fired and withdrawn. Failure to aspirate the fasting contents of the stomach before swallowing the capsule often results in considerable amounts of fluid being aspirated through the tubing before the capsule fires. This is a disadvantage as the exact time when the capsule fires is uncertain and the amount of tissue sucked into the port of the instrument cannot be minimised by using a quick hard pull on the piston of the syringe.

After the biopsy the patient is placed on an hourly pulse chart and requested to report the presence of abdominal pain, haematemesis or melaena. Only fluids are allowed orally for the first 8 hours after the biopsy; a semisolid diet is given for the next 24 hours and a normal diet thereafter.

RESULTS

No serious complications were seen in this group of patients. One patient was repeatedly unable to swallow the capsule and the procedure was abandoned. In 3 patients the tubing coiled inside the stomach and the capsule failed to pass beyond the pylorus. The capsule was withdrawn and a kink was found in the tubing, presumably due to accidental chewing by the patient. Replacement of the tubing resulted in a successful biopsy. In 2 other patients, after suction was applied, there was resistance to the passage of air reintroduced into the tubing and it was considered that the instrument had fired. However on withdrawing the capsule, it was found that the port was still open and the instrument had not fired. Presumably the port had been occluded by mucus or intestinal food particles, and this had given the impression that the capsule had fired.

DISCUSSION

Complications associated with the use of the intestinal biopsy capsule have been reviewed by Sheehy (1964) and McDonald (1966). The major complications have consisted of gross haemorrhage, intestinal perforation, peritonitis without obvious perforation, and the need for surgical retrieval of the capsule.

4 cases of post biopsy haemorrhage were reported by McDonald, and Sheehy describes two of these patients in some detail. One patient, a 19 year old male with infective hepatitis, developed melaena and shock 5 hours after biopsy and at laparotomy was found to have a spurting artery at the site of the biopsy in the jejunum. The other patient was a 48 year old male with steatorrhoea who developed melaena 9 hours after biopsy. Melaena continued for the next 3 days. Patient was treated with blood transfusions and recovered.

McDonald (1966) found 18 cases of perforation and 3 cases of peritonitis without obvious perforation in the literature. 13 of the patients with perforation and all those with peritonitis without obvious perforation were children. Shackleton and Haas (1962) reported the only fatality after intestinal biopsy. Their patient was an 18 month old child with gluten enteropathy who developed a fever and later collapsed and died 27 hours after biopsy and on necropsy was found to have a jejunal perforation and peritonitis. McDonald emphasized that the adult capsule should never be used on children. Partin and Schubert (1966) found that in infants under the age of 24 months or below 10 Kg. in weight, biopsy should be carried out using a capsule with a port 1.5 mm. or 2 mm. in diameter. Children should be hospitalised and observed for at least 5 days after the biopsy. Although in some centres, biopsy with the capsule has been carried out in adults on an outpatient basis, it is evident that the procedure should be confined to hospitalised patients. Crosby (1963, *a*) advises that the rubber diaphragm of the capsule should not be stretched tightly as this would result in a large amount of tissue being sucked into the biopsy port. He also recommends (1963, *b*) quick hard suction with the syringe on firing the capsule so that a thin superficial specimen is obtained. When perforation has occurred, the initial symptom is usually abdominal pain, followed later by the symptoms and signs of peritonitis. The pain can occur immediately after the biopsy (Baker, 1962) or may be delayed for periods varying from 30 minutes to several hours (Clarke, 1964). The delayed onset of pain has been ascribed either to auto digestion of the visceral peritoneum or to a rise in intraluminal pressure. Indeed one adult patient (Struthers *et al*, 1963) was given a full meal within 45 minutes of the biopsy and immediately developed severe abdominal pain and signs of

peritonitis. We have therefore administered only fluids orally for about 8 hours after the biopsy, before going on to semisolid food. Hubble (1963) recommends treating all patients with post biopsy pain as if perforation has occurred. A plain abdominal radiograph with the patient erect to demonstrate subdiaphragmatic gas will help to establish the diagnosis. Such patients should be placed on antibiotics, gastric aspiration and intravenous fluids and on this regime, the perforation if any, should close. If however, symptoms and signs of peritonitis supervene and advance, laparotomy should not be delayed.

The final major complication which may occur is failure of the knife to cut through the mucosa so that the capsule remains adherent to the intestinal wall and cannot be withdrawn. The capsule should be left in situ for the next 24 hours in the hope that auto digestion of the mucosa will release it. If this fails to happen, the polyethylene tube should be cut at the mouth and the capsule and tubing will usually be passed out within a week. However, when the distal gut is abnormal, the capsule may be retained indefinitely as in the patient reported by Cox (1961) where the capsule was held up by intestinal strictures due to Crohn's disease and had to be retrieved by laparotomy after a period of 4 months.

In the method we have utilised, a small balloon fashioned from a fingercot and containing water has been attached to the capsule. Although the capsule can be used by itself, we found that the attached balloon speeded up the passage of the capsule and decreased the incidence of coiling of the tubing in the stomach. Fluoroscopic screening has been omitted and a single radiograph of the abdomen has been taken after a sufficient length of tubing has been swallowed by the patient. Radio-opaque fluid has been used to outline the tubing, although this is unnecessary if radio-opaque tubing (Cox, 1963) is used. With this procedure it takes approximately 1½ hours from the time of swallowing the capsule for it to reach the proximal jejunum, and approximately 2 to 2½ hours for the entire procedure. This length of time was not entirely disadvantageous as the biopsy procedure was usually combined with other work in the ward. Once the capsule is swallowed, only intermittent attention is required until the appropriate length of tubing has been swallowed. Other workers who have used fluoroscopic control to assist the passage of the capsule have suggested two modifications of the procedure. Bolin (1969) has used metoclopramide ("Maxolon"), a chlorbenzamide derivative which facilitates gastric motility to hasten the passage of the capsule through the pylorus into the duodenum. He finds that the mean time taken by the capsule to pass from the mouth to the first part of the duodenum was 30 minutes without the administration of metoclopramide and 14 minutes after the administration of the drug. Another modification has been suggested by Salem *et al* (1965) who found that replacing the polyethylene tubing by an Odman-Ledin red arterial catheter was an advantage when fluoroscopic control was being used since the catheter was rigid enough to help introduction into the throat and would not coil up in the oesophagus. It would not kink in the alimentary tract and if indented by the patient's teeth, the marks could be removed by immersing the tube in water at 70°C for one minute and hanging the tube vertically until cool.

SUMMARY

10 gastric and 150 jejunal biopsies have been carried out on 90 subjects in the past 3 years, using the intestinal biopsy capsule of Crosby and Kugler. The instrument and the procedure are described. No serious complications were encountered in this series. Complications encountered by other investigators are briefly reviewed.

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