Personal practice

Small bowel biopsy

A L COLLINS, D S K BROOKFIELD, I HYDE, AND C J ROLLES

Departments of Paediatrics and Paediatric Radiology, Southampton General Hospital

SUMMARY We describe our technique of small bowel biopsy, which has been used on 190 occasions over a four year period. In 77%, the examination was completed within 10 minutes, and fluoroscopy times were less than 10 seconds in 75% of the cases. The technique is easily taught, and it has made the examination a minor procedure.

The technique of small bowel biopsy in childhood has been reviewed previously,¹⁻³ and the importance of minimising radiation exposure has been emphasised.⁴ The procedure can be a time consuming and worrying experience for patients, parents, and medical staff. We had previously used different techniques, but by combining our experience with a modification of the method of Gaze *et al*¹ we have reduced appreciably the total intubation time and radiation exposure, while at the same time making this a less stressful experience for the patient.

Methods

The procedure is explained to parents and older children, and written consent is obtained. The most convenient time for the examination is in the early morning after overnight fasting: most children arrive at the hospital between 8 and 8.30 am and are able to leave in the early afternoon.

Premedication is by diazepam syrup or crushed tablets, given with a little water 30 to 60 minutes before the procedure. The dose given depends on the child's age—under 1 year, 5 mg; over 1 year, 10 mg. Parents accompany the child to the fluoroscopy room but are not present during the actual procedure. The child lies supine on a padded x ray table and a butterfly needle is inserted into a suitable vein. A second dose of diazepam (up to 0.5 mg/kg with a maximum of 10 mg) is slowly injected until signs of adequate sedation occur, after which metaclopramide, in a dose of 0.5 mg/kg with a maximum of 10 mg, is given. The needle is then removed.

Two metered doses (10 mg each) of aerosol

lignocaine spray are applied to the back of the tongue, using the extension tube on the aerosol (Xylocaine, Astra). The child invariably swallows, and thus spreads the lignocaine over the pharynx, facilitating passage of the tube without gagging. Care must be taken not to spray the lignocaine during inspiration. The paediatric biopsy capsule attached to a semi-rigid tube with an outer sleeve (see addendum) is then gently directed into the oesophagus. The outer introducing sleeve is of sufficient length to reach from the lips to the lower half of the oesophagus. We have found exact measurement of the outer sleeve to be unnecessary. We estimate length visually by holding the tubing against the child from mouth to mid-sternum and allowing 5 to 10 cm to protrude from the mouth to be held by the investigator. With the capsule in the lower oesophagus, the child is placed on the right side and the inner semi-rigid tubing is advanced slowly with the outer tube held fixed. As it is advanced the semi-rigid tubing is rolled clockwise and anticlockwise between thumb and fingers to ease the passage of the capsule.

Once sufficient tubing has been inserted to reach beyond the pylorus the child is turned supine and the image intensifier is positioned accurately over the patient. A momentary fluoroscopic exposure shows the anatomical siting of the capsule (see addendum). It is frequently found that the capsule has passed through the pylorus and is already in a satisfactory position for biopsy. If the capsule is directed towards the pylorus but has not passed through, a wait of one to two minutes may be all that is necessary. A second momentary fluoroscopic exposure confirms the position. Most of our biopsies

are taken from the third or fourth part of the duodenum but the second part is acceptable. If the capsule is pointing away from the pylorus and the tubing coiled in the stomach it is withdrawn to the approximate position of the cardia and the manoeuvre is repeated. In the rare event of persistent 'hold up' at the pylorus the following manoeuvres may be tried:

(1) Manual pressure over the left hypochondrium with the patient lying on the right side;

(2) Gentle injection of cold water or metaclopramide syrup down the tube;

(3) Advancement of the outer tube until it is in contact with the capsule, followed by advancement of the inner tube. This prevents deflection of the capsule away from the pylorus.

With the capsule in the desired position a 20 ml syringe is attached to the tube and 2 to 5 ml of air are gently injected to clear any mucus from the capsule. Repeated slow gentle suction is then applied to fire the capsule. Sudden release of suction in the syringe or the complete withdrawal of the plunger from the barrel is to be avoided as this may lead to detachment of the capsule. Successful firing of the capsule is indicated by a resistance felt on attempting to inject a small volume of air down the tube. If this manoeuvre is too vigorous the whole capsule or its cap may become disconnected. The capsule is withdrawn together with the outer tube. If no specimen is present, a second loaded capsule is available and a further attempt is made immediately. After recovery from sedation on the ward the child has a meal and is discharged, usually within three hours.

Biopsy specimen. The capsule is dismantled and the specimen is found within it or attached to the knife blade. A needle is used to transfer it to a moistened finger tip. The specimen rolls up with the mucosa on the outside, and by using the needle the edges are unrolled to produce a flat sheet of tissue with the mucosa in contact with the finger and the muscularis uppermost. It is then transferred directly, muscularis side down, to a small square of nylon mesh and placed in Bouins solution. It is now correctly orientated for examination under the dissecting microscope or for sectioning after further processing. Ordinary filter paper is not a satisfactory substitute for the nylon mesh as fibres may adhere to the sample and cause distortion during sectioning.

Patients and Results

Over a 4 year period 190 consecutive procedures produced 184 satisfactory specimens at the first attempt. The ages of the children ranged from 6

months to 16 years, and all were being investigated for possible coeliac disease, either as a primary investigation or as part of a gluten challenge. Some of the children, therefore, had more than one biopsy. The total intubation time (taken from the introduction of the capsule into the oesophagus until its removal) was recorded, as was the fluoroscopy time. Most of the biopsies were performed by junior staff of the paediatric and radiology departments. The intubation time ranged from 1 to 90 minutes. Seventy seven (42%) of the 184 successful procedures were completed within 5 minutes, and 142 (77%) within 10 minutes (Table 1). Only 11 took longer than 30 minutes. For most of the biopsies the fluoroscopy time was derived from the standard timer on the control panel but this was not accurate to less than 5 seconds. For the latter part of the study the fluoroscopy unit was equipped with an electronic timer with a display on the monitor. This gives an accuracy to 1/100 of a second. In the interests of simplicity, however, all fluoroscopy times below 5 seconds were recorded as 'less than 5 seconds'. Actual screening time ranged from 0.4 to 83 seconds. In 97 examinations (53%) the fluoroscopy time was 5 seconds or less, and in 137 (75%) it was less than 10 seconds (Table 2).

Failures. We experienced 6 failures out of the 190 biopsies attempted. (See Table 3). Satisfactory specimens were easily obtained in each case at the next attempt. It is now our practice that if no specimen has been obtained within 40 minutes we abandon the attempt and try again at a later date.

Table 1 *Intubation times for small bowel biopsies*

Intubation time (mins)	No of patients	(%)
0-5	77	(42)
6-10	65	(35)
11-15	19	(10)
16-20	6	(3)
21-25	5	(3)
26-30	1	(0.5)
31-90	11	(6)

Table 2 *Fluoroscopy times for small bowel biopsy*

Fluoroscopy screening time (secs)	No of patients	(%)
5	97	(53)
6-10	40	(22)
11-15	15	(8)
16-20	8	(4)
21-25	7	(4)
26-30	3	(2)
31-83	14	(8)

Table 3 Biopsy failures

Reason for failure	No of cases
Unable to pass capsule through pylorus	3
Gastric mucosa obtained	1
Specimen considered unsuitable for histology	1
Repeated tracheal intubation	1

Possible dangers

Drug reactions. Diazepam: respiratory depression is the main hazard, especially if the injection is too rapid, but this was not encountered in our series. In one child unusually deep sedation was produced.

Lignocaine: anaphylaxis from the use of the local anaesthetic spray is a theoretical hazard but we have never seen it. Nevertheless full resuscitation facilities should be available during the procedure.

Metaclopramide: we know of no dangerous side effects or complications with its use as we have described.

Tracheal intubation. If this occurs the child is likely to cough vigorously and the capsule should be withdrawn at once. Tracheal intubation may be more likely if the lignocaine is accidentally inhaled.

Aspiration of stomach contents. This is unlikely to occur if the child has been fasted adequately.

Bleeding. We feel that with the use of the paediatric sized capsule, bleeding rarely occurs, and in none of the 190 biopsies attempted was there a case of clinical bleeding. In our combined previous experience of over 1500 biopsies we have not encountered either clinical bleeding or perforation. We do not check clotting times before biopsy unless a bleeding or clotting problem is suspected.

Inexperience. We would strongly advise against small bowel biopsy being attempted without someone present who has had experience of the procedure.

Discussion

By modifying previously described techniques we have developed a more efficient method of small bowel biopsy. The sedation given was similar to that of Gaze *et al*,¹ except that we administered an additional dose of oral diazepam which reduces the stress of travel to the radiography department and of the venepuncture. With the dose of diazepam that

we used, there were no instances of respiratory depression and we were surprised to find that all children had recovered sufficiently to be able to go home within three hours of its administration. Another advantage of this drug is the amnesia that it produces. We now use an emulsion form of diazepam (Diazemuls, Kabi Vitrum) which causes less discomfort when injected.

Having had considerable experience with different types of tubing, we find that the use of the semi-rigid angiography catheter (see addendum) is far more satisfactory than the very soft tubing supplied with the Watson capsule. Initially we assumed that by using the stiffer tube, as described by Townley and Barnes,² metaclopramide would be of little benefit but this has proved to be incorrect, and we feel that their combined use is advantageous. Further vindication of the method is the ready acceptance by children and parents of repeat biopsies. The same technique has been used by one of us (IH) in adults; the only difference found has been a slightly longer fluoroscopy time. The paediatric sized capsule provides a perfectly adequate sample for histology, electronmicroscopy, and enzyme estimation.

We disagree with Law⁵ that it is necessary to manipulate the capsule under fluoroscopic control, as this results in increased radiation exposure. Only one of his patients had a fluoroscopy time of less than one minute. Neither do we feel that a guide wire would aid manipulation of the capsule as suggested by Maki,⁶ who reports a mean fluoroscopy time of one minute.

Meticulous attention to the fluoroscopy technique (see addendum) with momentary exposures only and no tube manipulation under direct vision results in considerable reductions in radiation exposure. Only one other paper⁴ emphasises the use of split second exposures and in that study 92% of biopsies were completed within five seconds of fluoroscopy time. For comparison, in our department, screening time for a barium meal ranges from 30 seconds to one minute.

The technique we describe is learned quickly by the junior paediatric and radiology staff, who performed almost all the biopsies. Even with this large number of investigators we estimate our failure rate to be approximately one in 30, and in all children satisfactory specimens were eventually obtained.

Addendum

Capsule. We use a paediatric size Watson modification of the Crosby capsule (Ferraris Development and Engineering Company). We have had experi-

ence with the more expensive American Crosby capsule which has proved to be entirely satisfactory but in our view offers no real advantages over the English version.

The capsule is supplied with a small metal loading jig and rubber diaphragms. We have never found the loading jig to be of use. After experimentation with different types of latex rubber we found the smooth cuff portion of a surgeons rubber glove (Regent Dispo glove) to be the most satisfactory. After carefully loading the spring blade in the proximal part of the capsule it is covered by a 2 cm, square of rubber. The cap is then screwed down firmly and excess rubber trimmed to leave a small frill which may help peristalsis grip the capsule.

Tubing. The semi-rigid tubing (KIFA cat no 17.887-7. Seimens-Elma, Sweden) is standard angiography catheter that comes in rolls of five metres. This tubing cannot be sterilised using heat but all the equipment may be cleaned with a proprietary sterilising fluid such as Hibitane or glutaraldehyde. To attach the tubing to the capsule it is necessary to draw out a terminal segment after softening in steam. The thinned segment is then trimmed and inserted into the capsule and the end splayed out using any blunt tapered instrument preheated in steam. The outer tube is the same as that described by Gaze *et al*¹ (Portex radio opaque 800/023/300 shore 90), and a fresh piece is cut for each patient.

Fluoroscopy technique. The apparatus consists of a standard fluoroscopy table with image intensification and a television monitor. Careful attention to the details of fluoroscopy substantially reduces the radiation dose to patients. All fluoroscopic exposures are momentary, that is less than one second. It is most important that the image intensifier be carefully positioned over the patient and the diaphragms coned to a suitable size. It is not necessary to identify the stomach, duodenal cap, or duodenal loop. The position of the capsule is determined by the characteristic smooth configuration of the tubing (see Figure). The total fluoroscopic time is the summation of these momentary exposures. On no account should there be panning or hunting for the image. There must be no manipulation of the tube under direct vision. If the tube is found to have looped in the stomach the inner tubing is withdrawn until the capsule is once more positioned at the cardia and the tube manipulation is repeated. It is not necessary to perform any of this repositioning under direct vision. Cases where the fluoroscopy

Figure Characteristic configuration of the biopsy capsule tubing. (A) In the stomach; (B) vertical descent in the second part of the duodenum; and (C) approaching the duodeno-jejunal flexure.

time exceeded 15 seconds were those in which repeated repositioning or replacement of the capsule was required. Exceptionally there may be anomalous looping of the duodenum with the result that the first and second parts are superimposed. Superficially it may then seem that the tube is looped in the stomach, but to confirm the position in the second or third parts of the duodenum requires no more than a further second or so of fluoroscopy.

Video disc storage of the momentary image is a useful recent refinement, and the brevity of the exposure time is now only limited by the reaction time of the operator. The stored image can then be retrieved and reviewed at leisure.

We thank Mrs Brenda Danby for radiographic and other assistance.

References

- 1 Gaze H, Rolles CJ, Signer E, Sagaro E. Premedication for jejunal biopsy in childhood using intravenous diazepam and metaclopramide. *Arch Dis Child* 1974;**49**:322-4.
- 2 Townley RRW, Barnes GL. Intestinal biopsy in childhood. *Arch Dis Child* 1973;**48**:480-2.
- 3 Walker-Smith J. *Diseases of the small intestine in childhood*. Kent: Pitman Medical, 1975:25-7.
- 4 Granditsch G, Deutsch J, Tsarmaklis G, Kletter K. Exposure to x-rays during small bowel biopsies in children. *Eur J Pediatr* 1981;**137**:165-9.
- 5 Law RL. Guide wire manipulation of Crosby jejunal biopsy capsule under fluoroscopic control. *Br Med J* 1984;**288**:286-7.
- 6 Maki M. Guide wire manipulation of Crosby jejunal biopsy capsule (letter). *Br Med J* 1984;**288**:862-3.

Correspondence to Dr C J Rolles, The Paediatric Medical Unit, Southampton General Hospital, Southampton SO9 4XY.