Dissecting Microscope Appearance of Small Bowel Mucosa in Children

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The technique of small bowel biopsy is now well established in childhood, but reports have largely concentrated on the histological appearances and enzyme activity of the biopsied mucosa (Anderson and Townley, 1962; Burke, Kerry, and Anderson, 1965; Kerpel-Fronius, Jáni, and Fekete, 1966; Kuitunen, 1966; Launiala, Kuitunen, and Visakorpi, 1966; Nordio, Lamedica, Berio, and Vignola, 1966; Townley, Khaw, and Shwachman, 1965). While the value of examination of the biopsied mucosa with the dissecting microscope has been demonstrated in adult patients, few paediatric papers have stressed its value (Burman, 1965; Sheldon and Tempny, 1966; Shmerling, 1965; Stanfield, Hutt, and Tunncliffe, 1965). The purpose of this paper is to record the dissecting microscope appearances of 36 duodenal or jejunal biopsies from Australian children with the malabsorption syndrome or chronic diarrhoea.

Material and Method

The small bowel biopsies were performed using the paediatric Crosby capsule (Crosby and Kugler, 1957).

The site of the capsule at the time of biopsy was assessed by taking an x-ray film of the abdomen shortly after the injection of 5 ml. 'Urografin' through the biopsy tubing. The biopsies were taken from the distal duodenum or the proximal jejunum. Within five minutes of obtaining the biopsy, the mucosa was placed in 10% formol saline and examined under the dissecting microscope. For purposes of record, black-and-white and colour photographs were taken. The mucosa was then sectioned for histological study.

Examinations were made of 36 biopsies from 32 children. The indications for biopsy were the presence of malabsorption or a history of chronic diarrhoea. The ages of the children at the time of biopsy ranged from 3 months to 13 years. 27 children were of European stock, 5 were Aboriginal or part-Aboriginal. Repeat biopsies to assess progress were performed in 4 children. Control biopsies from normal children were not obtained.

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Dissecting Microscope Appearances

The mucosa, when viewed under the dissecting microscope, was assessed and placed in one of three descriptive categories, modified from Booth, Stewart, Holmes, and Brackenbury (1962).

Group I. The mucosal surface was flat and no villi were seen. Two types of appearance were observed: *Type 1:* The mucosa was absolutely flat and barren with no pits or grooves. In some biopsies, blood vessels could be seen beneath the surface (Fig. 1 and colour plate A). *Type 2:* The mucosa was flat but divided by grooves into irregular areas. These areas were pitted with the openings of crypts. This appearance has been described as a 'mosaic' pattern (Fig. 2 and colour plate B).

Group II. The mucosa showed thickened blunt ridges, but no villi were seen. This appearance has been described as 'convoluted' and 'brain-like' (Fig. 3 and colour plate C). In one biopsy the mucosa was, in addition, divided into irregular areas by grooves similar to Group I.

Group III. The mucosa was made up of leaf-like villi. These villi had broad bases which varied considerably in width (Fig. 4 and 5 and colour plate D and E). In some biopsies, occasional finger-like villi were seen.

Results

Thirteen children (Table I) had a flat mucosa, 5 being completely flat and the remaining 8 conforming to Group I (Type 2). Each biopsy had the histological appearance of subtotal villous atrophy. All these children had untreated coeliac disease.

Seven specimens from 6 children (Table II) were characterized by thickened ridges. All showed the histological appearance of partial villous atrophy. One child (Case 14) had been treated for coeliac disease with a gluten-free diet for one month at the time of the initial biopsy. The biopsy was still abnormal four months later. In 4 of the remaining children, gastro-enteritis had preceded the develop-

TABLE I

Cases in which Pattern of Small Intestine Biopsy was Flat Mucosa

Case No.	Age (yr.)	Histology	Biopsy Site	Diagnosis
<i>Type 1</i>				
1	5½	SVA	Jejunum	Coeliac disease
2	2 7/12	SVA	Jejunum	Coeliac disease
3	7 8/12	SVA	Duodenum	Coeliac disease
4	1 11/12	SVA	Jejunum	Coeliac disease
5	2½	SVA	Jejunum	Coeliac disease
<i>Type 2</i>				
6	13	SVA	Jejunum	Coeliac disease
7	3 5/12	SVA	Jejunum	Coeliac disease
8	13/12	SVA	Jejunum	Coeliac disease
9	4 7/12	SVA	Jejunum	Coeliac disease
10	5½	SVA	Duodenum	Coeliac disease
11	1½	SVA	Duodenum	Coeliac disease
12	7 2/12	SVA	Duodenum	Coeliac disease
13	8 5/12	SVA	Duodenum	Coeliac disease

SVA = Subtotal villous atrophy.

TABLE II

Cases in Which Pattern of Small Intestine Biopsy was Thickened Ridges

Case No.	Age (yr.)	Histology	Biopsy Site	Diagnosis
14*	2	PVA	Jejunum	Coeliac disease
14	2 4/12	PVA	Duodeno-jejunal flexure	Coeliac disease
15	1 7/12	PVA	Jejunum	Post-gastro-enteritis malabsorption
16*	2	PVA	Jejunum	Post-gastro-enteritis malabsorption
17	2½	PVA	Jejunum	Post-gastro-enteritis malabsorption
18	14/12	PVA	Jejunum	Post-gastro-enteritis malabsorption
19*	13/12	PVA	Duodeno-jejunal flexure	Giardiasis; malabsorption syndrome

PVA = Partial villous atrophy.

*Cases 14, 16, and 19 were Aboriginal or part-Aboriginal.

ment of malabsorption. In one, there was infestation with *Giardia lamblia*.

In Group III were placed 16 biopsies from 13 children (Table III). 14 of these biopsies were assessed as being within normal limits histologically, i.e. the mucosa showed villi of normal height without increased depths of crypts, the epithelium of the villi was columnar in appearance, with basal nuclei, and there was no increase in inflammatory cells in the lamina propria and no oedema. 2 biopsies had normal villous architecture, but there was infiltration of the lamina propria with inflammatory cells. 4 children had chronic diarrhoea, and the remainder had evidence of malabsorption (fatty acid crystals in stool, sugar in stool, etc.). 4 of these had a clear-cut history of antecedent gastro-enteritis. One child was infested with

TABLE III

Cases in Which Small Intestine Pattern was Leaf-shaped Villi

Case No.	Age (yr.)	Histology	Biopsy Site	Diagnosis
20	2½	Normal	Jejunum	Malabsorption syndrome
21	2½	Normal	Jejunum	Giardiasis; post-gastro-enteritis malabsorption
22*	2	Normal architecture, but increase in inflammatory cells	Jejunum	Post-gastro-enteritis malabsorption
23*	3/12	Normal	Jejunum	Post-gastro-enteritis malabsorption
17	2 8/12	Normal	Duodenum	Post-gastro-enteritis malabsorption
21	2 8/12	Normal	Duodenum	Malabsorption syndrome
24	2	Normal	Duodenum	Post-gastro-enteritis malabsorption
23	5/12	Normal	Jejunum	Post-gastro-enteritis malabsorption
25	3	Normal	Jejunum	Chronic diarrhoea
26	13/12	Normal	Jejunum	Chronic diarrhoea
27	10/12	Normal	Jejunum	Salmonellosis; malabsorption syndrome
28	13/12	Normal architecture, but increase in inflammatory cells	Jejunum	Malabsorption syndrome
29	1 7/12	Normal	Duodenum	Malabsorption syndrome
30	8	Normal	Jejunum	Malabsorption syndrome
31	3 4/12	Normal	Jejunum	Chronic diarrhoea
32	1 11/12	Normal	Jejunum	Chronic diarrhoea

* Cases 22 and 23 were part-Aboriginal.

Giardia lamblia, and another grew salmonella from stool culture at time of biopsy.

In this series, no biopsy had the dissecting microscope appearance which has been said to be characteristic of the jejunal mucosa of normal adults and neonates, i.e. mucosa where finger-like villi are the principal feature (Baker, Ignatius, Mathan, Vaish, and Chacko, 1962; Booth *et al.*, 1962).

Discussion

The presence of a flat mucosa in coeliac disease is well known, but the significance, if any, of the two patterns observed remains obscure. The appearance of 'partial villous atrophy' on histological section in patients with a thick-ridged convoluted mucosa has been demonstrated in adults. However, the significance of leaf-shaped villi remains uncertain.

While leaf-like villi may be seen in the duodenum of healthy adults, Booth *et al.* (1962) have suggested that leaf-like villi in the jejunum may represent a transition from the finger-like villi seen in normal

FIG. 1.—*Flat mucosa, type 1.*

FIG. 2.—*Flat mucosa, type 2.*

FIG. 3.—*Thickened ridges.*

FIG. 4.—*Leaf-like villi.*

FIG. 5.—*Leaf-like villi.*

COLOUR PLATE.

A—Flat mucosa, type 1. B—Flat mucosa, type 2. C—thickened ridges. D and E—Leaf-like villi.

adults to the abnormal mucosa of coeliac disease. Creamer (1964) has postulated that the shape of the villi is related to the size of the epithelial cell population which may be diminished from various causes. When this diminution in mature epithelial cell population occurs, the appearance of leaf-like villi is the first change to be apparent in the mucosa. This appearance has been described in children with kwashiorkor, where villi in the shape of ridges and leaves with an increased cellular infiltrate of the lamina propria have been described by Burman (1965). He has also described the mucosal appearance of 15 biopsy specimens from English children with a variety of gastro-intestinal symptoms: 48% of the villi seen were leaf-like. However, whether or not this appearance is abnormal remains uncertain.

The lack of biopsies from normal controls is regrettable, but at present it seems unethical to take biopsy specimens of the mucosa of normal healthy children. It is of interest, however, that leaf-like villi were seen in 16 children in this series, all of whom had evidence of malabsorption or had chronic diarrhoea. 4 biopsies were duodenal and, by adult standards, may be within normal limits, but the significance of leaf-shaped villi in jejunal biopsies from the remaining patients is still uncertain.

Summary

The dissecting microscopical appearances of 36 duodenal or jejunal biopsies from Australian children with the malabsorption syndrome or chronic diarrhoea are described. Three patterns

were observed: flat mucosa, thick-ridged mucosa, and mucosa characterized by leaf-like villi. The significance of leaf-like villi remains uncertain.

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