fruit and vegetables. This is consistent with the idea that a low intake of raw fruit and vegetables is a causal factor. It has been reported that patients with Crohn's disease eat significantly more cornflakes at breakfast than controls.[26] In common with three other studies,[27-29] our study could not confirm this finding.

How eating habits, such as those identified in this study, predispose to Crohn's disease is uncertain and will remain so until the pathogenesis of the disease is understood. A role for diet does not exclude the involvement of a virus or bacterium. Dietary influences may alter the milieu of the intestinal lumen or modify the intestinal flora and so promote the growth of an infective agent or its invasion of the gut wall.

The dietary tendencies shown in our study may help to explain the recent emergence of the disease and its rarity in communities eating simple, traditional diets. At a practical level, reversing these eating habits might be helpful in the management of this intractable condition (see accompanying paper).

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Treatment of Crohn's disease with an unrefined-carbohydrate, fibre-rich diet

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Summary and conclusions

Thirty-two patients with Crohn's disease were treated with a fibre-rich, unrefined-carbohydrate diet in addition to conventional management and followed for a mean of four years and four months. Their clinical course was compared retrospectively with that of 32 matched patients who had received no dietary instruction. Hospital admissions were significantly fewer and shorter in the diet-treated patients, who spent a total of 111 days in hospital compared with 533 days in the non-diet-treated control group. Whereas five of the controls required intestinal operation, only one diet-treated patient needed surgery. This is in strong contrast to general experience with this disease.

Treatment with a fibre-rich, unrefined-carbohydrate diet appears to have a favourable effect on the course of Crohn's disease and does not lead to intestinal obstruction.

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Introduction

The traditional attitude to diet in the treatment of Crohn's disease is summed up in the following quotation from a respected gastroenterology textbook: "There is no evidence that what the patient eats in any way affects the symptoms or course of Crohn's disease. . . . Beyond the elimination of "roughage" from the diet in order to reduce the chances of partial or complete intestinal obstruction, the kinds of food eaten by the patient should not be a matter of concern for the physician."[1]

Some years ago one of us, impressed by Cleave's hypothesis[2] that many diseases of civilisation are attributable to the habitual consumption of refined carbohydrate, suspected that refined carbohydrates might promote the development of Crohn's disease.[3] On the basis that removing a promoting factor might help in treatment, a diet which excludes refined carbohydrates was introduced as part of the routine management of Crohn's disease in one clinic of the Bristol Royal Infirmary. After some time the diet-treated patients seemed to be faring unusually well. To test this impression, we decided to compare their progress with that of a matched group of patients who had been given no dietary instruction.

Patients and methods

From April 1972 to July 1977 32 patients with Crohn's disease were prescribed an unrefined-carbohydrate diet in addition to usual forms of treatment. The diet was not advised to a mentally handicapped

man, to a woman about to leave the area, or to elderly patients (over 70). Otherwise, instruction in the diet was given to all patients with Crohn's disease referred to the clinic, including those with intestinal strictures. The diet was begun within three months of diagnosis in 22 patients (69%) and between four and 150 months in the remainder. By January 1979, when the present analysis was begun, dietary treatment had lasted for 18-80 months (mean 52).

Each diet-treated patient was characterised for certain factors said to affect prognosis: age,[4] site of disease at diagnosis,[4-6] previous resections,[7] and duration of diagnosed disease.[8 9] Each patient was matched for these factors with a patient who had been given no dietary instruction (see table). These controls were obtained from a specially compiled register of patients with Crohn's disease being managed in three other medical clinics of the Bristol Royal Infirmary or Frenchay Hospital, Bristol. The controls were the first on the register to fulfil the matching criteria. In all patients the diagnosis was supported by typical radiological changes or inspection of the bowel at operation.

Details of the two patient groups

	Diet-treated patients	Controls
Sex (M:F)	17:15	14:18
Mean age (range) (years)	35 (19–61)	37 (19–62)
Site of disease:		
Ileal	4	4
Colonic	7	7
Ileocolonic	20	20
No with previous resection	9	9

Histological confirmation was available in about half the patients and in all those with disease limited to the colon.

Apart from the diet, the medical treatment of both groups was conventional, with corticosteroids, azathioprine, and sulphasalazine being used as appropriate. Indications for surgical treatment were also conventional—namely, persistent severe symptoms despite full medical treatment and development of surgical complications such as obstruction, fistula, and abscess.

The case record of each diet-treated patient was examined to determine his or her clinical course since dietary treatment began. With the controls, an equivalent follow-up period was identified between 1968 and 1978, in most cases after 1972. Since the study was retrospective the information extracted from the case notes was limited to clearcut events: admission to hospital, intestinal operation (resection or bypass), development of an extraintestinal complication, and treatment with corticosteroids, azathioprine, or sulphasalazine. The documentation in the case notes did not allow us to calculate the amount of drug treatment given, so we noted only whether a drug had been prescribed during the study period.

Each diet-treated patient was given a booklet which advised how to reduce consumption of refined sugar (in the sense of fibre-depleted sugar, which includes brown sugar) and foods containing it. Other refined carbohydrates—white flour, brown flour of less than 100% extraction, and white rice—were replaced with wholemeal flour and unpolished rice. The consumption of fruit and vegetables was encouraged. No attempt was made to increase dietary fibre intake above a set amount and additional wheat bran was not suggested. Dietary advice was strengthened at most clinic visits.

Towards the end of the study period, a single dietitian interviewed each patient to assess compliance. She used the dietary history method,[10] which assesses the habitual diet. The 32 controls were sent a postal questionnaire to assess their refined sugar intake. Completed questionnaires were received from 29, a response rate of 91%; two patients had recently died of causes unrelated to Crohn's disease and another could not be traced. Dietary data were analysed using the recent edition of McCance and Widdowson's food tables.[11]

The statistical significance of differences was calculated by the χ^2 test with Yates's correction, Student's t test, and the Wilcoxon rank sum test as appropriate.

Results

The number of hospital admissions required in the diet-treated patients was 11, compared with 34 in the controls ($P < 0.01$). In the diet group admissions were not only fewer but shorter (median 6 versus 15 days, $P < 0.02$). Consequently, diet-treated patients spent a total of 111 days in hospital, compared with the controls' 533 days ($P < 0.005$). Overall, 11 of the diet-treated patients and 18 of the control group were admitted to hospital. Excluding time spent in hospital for surgery, the diet group still required fewer days in hospital (80 *v* 414 days; $P < 0.01$).

Intestinal operations were performed on only one diet-treated patient but on five controls. In the latter, the indications for surgery were obstruction (1), perforation (1), and persistent, severe symptoms despite full medical treatment (3). In each case the operation was an intestinal resection. The single operation required by a diet-treated patient was a bypass procedure for stricturing pyloroduodenal disease affecting the common bile duct, which was already far advanced when the diet was started.

One diet-treated patient developed sacroiliitis and two controls developed arthritis. At least one period of treatment with either corticosteroids, azathioprine, or sulphasalazine was prescribed in 21 of the patients on the diet and 22 of the controls.

The diet-treated patients ate 33.4 ± 1.8 g/day of dietary fibre, of which 2.9 ± 0.3 g/day was from raw fruit and vegetables. As expected, they ate much less refined sugar (39 ± 4 g/day) than the controls (90 ± 7 g/day; $P < 0.001$). All but one of the controls took more than 45 g of sugar a day, so in assessing compliance to the diet, a daily intake of less than 45 g sugar was taken as evidence of good compliance. On this criterion, 21 patients complied well, but even the "poor compliers" had considerably modified their eating habits. Twenty-one patients preferred the diet to their previous one.

Discussion

In a mean follow-up of 52 months only one of the 32 diet-treated patients required major surgery (and in him the indication was present before starting the diet), which contrasts with the usual tendency for patients with Crohn's disease to need operations. In a large American study with a mean follow-up of 42 months[5] operations were needed by over half the patients. The risk of reoperation varies in different series between 5·5 and 16·5% per year.[7 12-14] In the nine diet-treated patients who had had a resection, no reoperations were required during a mean follow-up period of 55 months.

It is unlikely that the controls had unusually severe disease since only 16% underwent surgery (4% per year). Nevertheless, they received five times as much hospital treatment as the diet-treated patients. The latter seldom needed treatment in hospital, spending on average less than one day per year in hospital.

Our data challenge the traditional recommendation of a low-residue diet in the treatment of Crohn's disease. On the unrefined-carbohydrate diet the mean intake of dietary fibre was 61% more than the estimated national average of 20·4 g/day.[15] In our experience with this diet, which totals 150 patient-years, no patient has suffered intestinal obstruction, though many already had intestinal strictures. Nevertheless, when patients with Crohn's disease are asked to increase their intake of fibre-rich foods it seems prudent to advise them to do it gradually and to chew their food thoroughly. Maintaining weight has not been a problem with this low-sugar diet, except in a young man who had been treated for psychiatric anorexia.

An unrefined-carbohydrate diet appears to improve the prognosis of patients with Crohn's disease, lessening the need for hospital treatment and surgery. A randomised, prospective trial is desirable to confirm these findings.

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Requests for reprints should be addressed to JRT. Copies of the unrefined-carbohydrate diet booklet are available on request.

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Fibreoptic injection of oesophageal varices

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Summary and conclusions

A new technique for injecting sclerosant into oesophageal varices uses a flexible gastroscope. Once the gastroscope has been inserted a flexible tube with a window cut into its distal end is pushed down over the gastroscope until a varix protrudes through the window. The varix can then be injected with a needle passed down the biopsy channel of the gastroscope. Once the varices have all been injected in this way the tube is advanced to compress the injection sites and so help control bleeding.

This method, using a flexible gastroscope, has proved easier and safer than the traditional method using a rigid gastroscope.

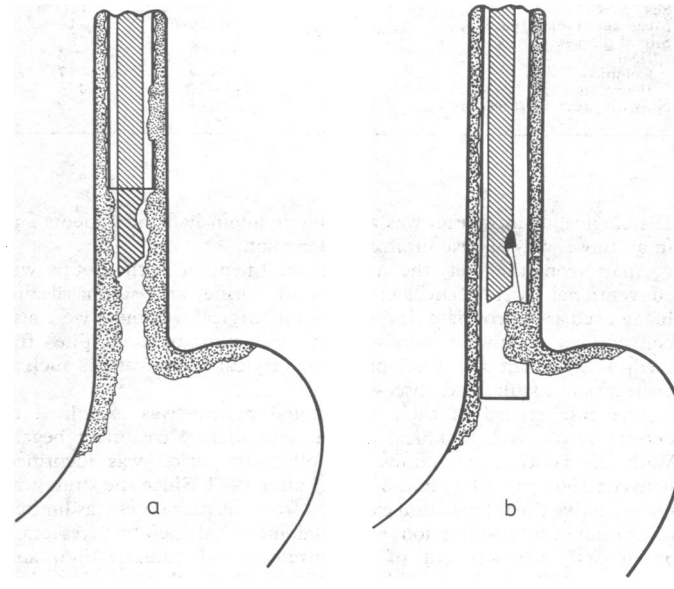
Introduction

The injection of a sclerosant into oesophageal varices is now well established in both emergency and elective cases.[1-3] The rigid oesophagoscope is usually used for such procedures,[1-4] but we describe here a new technique using a flexible gastroscope.

Instruments and technique

The instruments used are (*a*) a GIF K Olympus gastroscope, (*b*) a flexible 50-cm tube, and (*c*) a long flexible needle. The 50-cm tube has an internal diameter of 2 cm, and a window measuring 3 cm × 0·5 cm is cut 2 cm from the distal end of the tube. The tube is graduated at 5 cm intervals. The needle is a retractable oesophageal varices injection needle.

Technique—Before the gastroscope is inserted the tube is threaded over the instrument to its proximal end. Under general anaesthesia the gastroscope is inserted to the lower end of the oesophagus and the positions of the varices are noted (see figure, *a*). The tube is then gently slid down the outside of the gastroscope to the lower end of the oesophagus. When the tube is in the correct position a varix will protrude through the window. The varix is seen through the gastroscope projecting into the lower end of the tube. The guarded needle is passed through the biopsy channel of the gastroscope, and up to 5 ml of ethanolamine oleate is injected into the varix (see figure, *b*). As the needle is withdrawn from the varix the tube is rotated until the adjacent varix protrudes. This procedure is repeated until all the varices have been injected. On completion of the injections the tube is advanced 5 cm to compress the injection sites. At this stage any residual blood in the stomach may be aspirated. It may occasionally be necessary to insert a Sengstaken-Blakemore tube at the completion of the procedure.



(*a*) Tube ready to be pushed down gastroscope.

(*b*) Varix projecting through window ready for injection.

Discussion

There are two methods available for injecting oesophageal varices. The older technique uses a Negus oesophagoscope and the newer method a flexible gastroscope with an outer tube. Dissatisfaction with the former method led us to develop the latter.

The injection of varices with a flexible gastroscope but without an outer tube has several disadvantages. The main problem is bleeding, which tends to obscure vision. The outer sheath has eliminated this problem. It is now possible to isolate and see each varix clearly before injecting the sclerosant. Rotation of the

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