Reversal of an Intestinal Segment in the Long-term Management of the Short-Bowel Syndrome


SUMMARY

A severe case of malabsorption after extensive resection of the small intestine is reported. Striking improvement in nutritional state and general well-being was achieved by reversal of a short segment of the residual jejunum. This procedure results in antiperistalsis which delays the passage of intestinal contents, and thus permits more time for absorption. Surgical procedures designed to increase absorption and improve survival in this condition are discussed.


Malabsorption with its accompanying nutritional deficits, is an inevitable sequel to extensive resection of the small intestine. The degree of malabsorption is related to the site and length of the intestinal resection. When the resection exceeds 70% or more of the small bowel, what results is referred to as the 'short-bowel syndrome'.

Animal studies have shown that long-term survival following extensive small-bowel resection, is possible by reversing a segment of the residual small intestine. The reversal of such a segment brings about antiperistalsis which slows the transit time of the intestinal contents. This significantly augments absorption.

We report the effect of such a procedure in a young man who, after an extensive surgical resection of bowel, was left with only 50 cm of small bowel.

CASE REPORT

A 25-year-old Bantu man was admitted to hospital on 26 October 1965, with a 6 months' history of generalized debility and weight loss. His symptoms dated from April 1965, when he had undergone emergency abdominal surgery for multiple, penetrating stab-wounds of the abdomen, in a rural hospital. He developed severe diarrhoea soon after the operation, having 6-8 bowel actions a day. The stools were pale, large, foul-smelling, but without blood.

This diarrhoea continued for the next 6 months, and then he came under our care. He also complained of considerable weight loss associated with generalized weakness, and lassitude. On his admission to this hospital the nature and extent of the abdominal surgery he had undergone, were not known.

Physical examination showed an emaciated young man (Fig. 1 A) who was weak and apathetic. He was 182.5 cm tall and weighed 41.8 kg. The scalp hair had lost some of its normal 'corkscrew' curliness. The skin showed generalized follicular hyperkeratosis characteristic of vitamin A deficiency. This was most marked on the buttocks and extensor aspects of the forearms (Fig. 2). Perifollicular haemorrhages due to vitamin C deficiency were present on the thighs. There was oedema of the legs and lower back due to hypoproteinaemia. The abdomen was scaphoid with two extensive, old paramedian surgical scars on each side of the midline, as well as several small, healed scars consistent with the history of multiple stabs (Fig. 1 A). There was no abdominal tenderness. Rectal examination showed a pale, semisolid stool, but no other abnormality. The rest of the physical examination was within normal limits.

A provisional diagnosis of malabsorption secondary to intestinal hurry, a sequel to abdominal surgery, was made.

Laboratory data on admission (Table I) showed a moderately severe anaemia with low serum potassium, calcium and iron levels. The serum proteins were also reduced. Apart from the low albumin level and slightly reduced prothrombin index, other liver function tests were normal. Investigations of small-intestinal function

*Date received: 16 April 1972.
TABLE I. LABORATORY DATA BEFORE AND AFTER INTESTINAL REVERSAL

<table>
<thead>
<tr>
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<th>Before reversal</th>
<th>After reversal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haemoglobin (g/100 ml)</td>
<td>8,0</td>
<td>15,7</td>
</tr>
<tr>
<td>Serum electrolytes (mEq/L)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>2,9</td>
<td>4,1</td>
</tr>
<tr>
<td>Sodium</td>
<td>140</td>
<td>138</td>
</tr>
<tr>
<td>Chloride</td>
<td>104</td>
<td>104</td>
</tr>
<tr>
<td>Calcium</td>
<td>3,5</td>
<td>4,4</td>
</tr>
<tr>
<td>Serum iron (µg/100 ml)</td>
<td>56</td>
<td>145</td>
</tr>
<tr>
<td>Serum proteins (g/100 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3,4</td>
<td>7,2</td>
</tr>
<tr>
<td>Albumin</td>
<td>1,88</td>
<td>5,04</td>
</tr>
<tr>
<td>Globulin</td>
<td>1,52</td>
<td>2,16</td>
</tr>
<tr>
<td>Serum vitamin B₁₂ (pg/ml)</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>Serum folic acid (ng/ml)</td>
<td>—</td>
<td>5,8</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>41,8</td>
<td>73,5</td>
</tr>
</tbody>
</table>

(Table II) showed impaired absorption. This was demonstrated by (a) a high faecal fat excretion, (b) a reduced D-xylose excretion, and (c) a flat glucose-tolerance curve.

TABLE II. SMALL-INTESTINE ABSORPTION STUDIES

<table>
<thead>
<tr>
<th></th>
<th>Before reversal</th>
<th>After reversal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily faecal fat excretion</td>
<td>8,58 g</td>
<td>3,41 g</td>
</tr>
<tr>
<td>D-xylose excretion</td>
<td>40%</td>
<td>82%</td>
</tr>
<tr>
<td>Glucose tolerance curve</td>
<td>Flat</td>
<td>Flat</td>
</tr>
<tr>
<td>Vitamin B₁₂ absorption:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without intrinsic factor</td>
<td>—</td>
<td>Nil</td>
</tr>
<tr>
<td>With intrinsic factor</td>
<td>—</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Microscopy and culture of stools failed to show pathogenic bacteria or animal parasites (including E. histolytica). He continued passing 5–10 watery stools a day, uninfluenced by diet or constipating agents. He remained weak, apathetic and failed to gain weight. At this stage it was decided to try and improve intestinal absorption by resorting to surgery.

Operative Management

The abdomen was opened through a right paramedian incision. Only 50 cm of small intestine, mainly jejunum, was identified. The rest of the small bowel had been previously resected. Nine centimetres of the distal jejunum was mobilized, i.e. resected with intact blood supply, reversed 180°, and anastomosed end-to-end between the proximal jejunum and the remnant of the distal ileum (segment a-b of Fig. 3A). After ensuring that the vascular supply of the reversed segment had not undergone torsion, the abdomen was closed.

Intravenous fluids were administered for 72 hours postoperatively, as well as penicillin and streptomycin.

Fig. 2. Photograph of thigh, showing follicular hyperkeratosis and perifollicular haemorrhages.

Fig. 3. Diagrams illustrating simple (A) and complex (B) surgical reversal procedures (see text).
Oral fluids were given on the third postoperative day. Severe diarrhoea again set in as feeding was increased, so he was given daily a bland diet divided into 6 small feeds with protein and vitamin supplements. Codeine phosphate syrup, kaolin, and pectin were added to control the diarrhoea. Stool frequency gradually diminished, and by the sixteenth postoperative day he had gained 2.9 kg, despite a significant diminution of the peripheral oedema. Constipating agents were discontinued, and his stools stabilized at 2-3 per day, but he was troubled by much flatus. His weight continued to improve and by April 1966, 4 months after the surgical procedure, he had gained 22.3 kg. He was discharged from hospital, much stronger and more vigorous (Fig. 1B).

In September 1966, he was readmitted for further study. Laboratory data at this time are reflected in Table I. The haemoglobin, serum potassium, calcium and iron levels had risen to normal. The serum vitamin B₉ was low, while the folic acid level was normal. Repeated absorption studies showed that the faecal fat content was with normal limits and the D-xylose excretion had improved considerably, from 40% to 82%. The glucose tolerance curve, however, remained flat. The Schilling test showed no absorption of vitamin B₁₂ before and after the addition of intrinsic factor. He was discharged from hospital and seen periodically as an outpatient.

One year after the reversal of the segment, his weight had stabilized at 72.7 kg—a gain of 30.9 kg. His stools were now semiformal and he had 1-3 bowel actions a day. The skin lesions of vitamin A and C deficiencies were not evident. He was in excellent health, active, energetic and capable of full-time employment. He failed to attend again.

**DISCUSSION**

Resection of three-quarters or more of the small intestine is usually associated with widespread metabolic disturbances. These include impaired absorption of fat, fat-soluble vitamins, amino acids, and carbohydrates. In addition there may be hypokalaemia, hypocalcaemia and megaloblastic anaemia. When the loss of absorptive surface is significant, chronic diarrhoea ensues with a concomitant loss of weight, strength, and vitality. As a result, long-term survival after massive small-bowel resection is generally poor. To correct the severe metabolic and nutritional deficits of this syndrome, various operative procedures have been designed to improve absorption in the residual bowel.

The first work in this field was done by Mall in 1886.¹ He produced antiperistalsis in dogs by reversing a segment of small intestine. Although he was able to demonstrate delayed transit by this procedure, the animals died of intestinal obstruction, and he concluded that antiperistalsis was fatal.

Almost half a century passed before interest in the construction of antiperistaltic segments was re-awakened. Hammer et al. in 1955² and 1959³ showed that dogs could survive for more than 2 years after resection of 75-90% of small bowel if a small segment of residual bowel were reversed. The length of the reversed segment appears to be critical for its proper functioning and ultimate survival.⁴ Thus, in the dog, segments longer than 60 cm result in death from obstruction, whereas shorter segments improve the chances of survival. The best clinical results are obtained with very short reversed segments of less than 5-7 cm.⁵

The benefits of a reversed segment appear to be due to physiological delay at the site of anastomosis, which significantly enhances absorption. Confirmation that a delay in transit is effected by an antiperistaltic segment, may be obtained by barium studies. Mackay et al.⁶ have noted from experimental studies, that dilatation of bowel occurs proximal to the reversed segment, and they suggest that the oedema and distension of the proximal bowel aggravate malabsorption. Venables and co-workers⁷ were unable to confirm significant proximal distension or oedema of the bowel wall in their patient with a simple reversed segment who came to postmortem, death having been due to congestive cardiac failure.

To lessen possible proximal dilatation and oedema, Mackby et al.⁸ devised the following operation (Fig. 3B). The complete residual small bowel is mobilized, i.e. resected with intact blood supply from a region just distal to the duodenum, to about 5 cm from the ileocaecal junction. This is reversed and the new distal end is looped back and anastomosed, end-to-side, to its new proximal end. The newly constructed loop is now anastomosed, side-to-end, to the ileal stump. This reconstruction functions as a combined recirculating loop and a reversed antiperistaltic segment.

A marked increase in gastric secretion has been noted in some cases after a massive resection of the small bowel. This may be a factor in the pathogenesis of the diarrhoea associated with this condition. Vagotomy and pyloroplasty were done to reduce the gastric hypersecretion and acidity in 2 such patients, by Frederick and Craig⁹ who report longer survival after these procedures.

Our patient benefited considerably from simple intestinal reversal. Improved absorption became evident soon after corrective surgery, as reflected in the reduction of stool frequency, the steady gain in weight, the regression of avitaminous skin lesions, and the striking improvement in general well-being. Biochemical measurements paralleled the satisfactory clinical progress. One notable exception was the impaired absorption of vitamin B₁₂, which was probably due to the very short ileal remnant. Since the reversed segment had been placed proximal to this remnant, the ileal stump had probably failed to benefit from antiperistalsis. Despite the depressed absorption of vitamin B₁₂, there was no evidence of megaloblastic anaemia or neurological disturbances associated with deficiency of this vitamin. This is attributable to hepatic reserves of vitamin B₁₂ which may be sufficiently adequate for body requirements for as long as 3 years, in the presence of malabsorption.¹⁰

Reassessment of intestinal function, after making the antiperistaltic segment, demonstrated that fat absorption had been restored to normal, with a marked improvement in absorption of carbohydrates.
The satisfactory progress of our patient, and the few, though encouraging, reports in the literature, appear to indicate that reversal of an intestinal segment to compensate for extensive small bowel resection could, in selected patients, prove to be important in the long-term management of this syndrome.

We should like to thank Professor H. H. Lawson for his helpful review of the manuscript; and the Photographic Department, Department of Medicine, University of the Witwatersrand, for the photographic reproductions.

REFERENCES

Treatment of Advanced Carcinoma of the Larynx

REVIEW OF 98 CASES

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SUMMARY

The results of treatment of 98 cases of carcinoma of the larynx and pyriform fossa are presented. Ninety of these were advanced carcinomas, i.e. stage 3 or 4. Surgery was a more successful form of therapy for advanced tumours than radical radiotherapy alone. Combined therapy, viz. pre-operative radical radiotherapy followed by surgery after a short interval, is not recommended in the treatment of carcinoma of the larynx in the Bantu population. A trial of radiotherapy, followed by 'salvage surgery' for unsuccessful cases, is not a suitable approach to the treatment of advanced carcinomas of the larynx or pyriform fossa.


Patients with carcinoma of the larynx may be treated surgically, or by irradiation alone, or by a preliminary course of irradiation followed by radical surgery. The choice of therapy is a controversial issue for each stage of the disease. In the Bantu population this condition is usually neglected until a late stage, and most patients have advanced cancer, or are moribund, when first seen. This article reviews the results of treatment of 98 cases of laryngeal carcinoma occurring in South African Bantu who were treated jointly by the Department of Otorhinolaryngology, Baragwanath Hospital, and the Department of Radiation Therapy, Johannesburg Hospital, during the years 1967 - 1970.

INCIDENCE

The incidence of laryngeal carcinoma in the Transvaal has not altered significantly in either the Bantu or the White population during the past 20 years. Of the 98 cases reviewed, 92 were male and 6 were female. The ages varied from 30 to 80 years, with a maximum incidence between 45 and 65 years.

PATHOLOGY

All 98 cases were squamous carcinomas; 44 were well differentiated, 16 were moderately well differentiated, 19 were poorly differentiated, and 18 were reported simply as squamous carcinoma. The histological report was lost in 1 case. The larynx was the primary site of the tumour in...