

VOLVULUS OF THE SIGMOID COLON IN RELATION TO THE ANATOMY OF THE PELVIC COLON

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CASE REPORT

A Bantu male aged 40 years presented with an enormously distended abdomen and was diagnosed as recurrent volvulus of the sigmoid colon. Two months before admission he developed acute abdominal distension and was deflated with a rectal tube after 3 days. Distension reappeared in 7 days. He said he had always had a large abdomen. On admission he had very little pain but has had attacks of stomach-ache, constipation and vomiting associated with the distension.

In May 1956 he underwent laparotomy, when a large hypertrophied loop of pelvic colon with a loop of small bowel around the base of the pelvic loop was found. There were also some adhesions. He had had a previous operation before that, but unfortunately he could give no details about it. In 1956 barium enema showed a huge pelvic colon, which was differentiated from Hirschsprung's disease. In 1957 and again in 1958 he was admitted for subacute obstruction, which was relieved by conservative treatment.

In 1961 a diagnosis of megacolon was made and his obstruction was thought to be due to faecal impaction. Sigmoidoscopy and barium enema did not reveal any other abnormality and he was again treated conservatively.

On examination during the present admission his abdomen was found to be enormously distended. The abdomen was resonant except over the lower section. Bowel sounds were present and had a tinkling character (Fig. 1). There was no

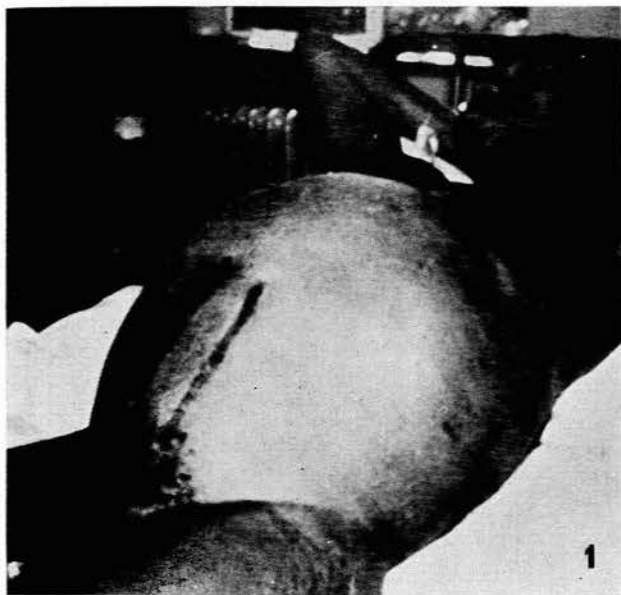


Fig. 1. The patient on admission, showing the enormous distension.

rigidity, guarding or tenderness. Straight X-ray showed enormous dilation of the large bowel, in the flanks as well as centrally. There was a large fluid level running almost entirely across the abdomen in the erect view.

An immediate sigmoidoscopy was performed. The rectum was not ballooned. The colon would not dilate beyond 22 cm., and only a small amount of air was introduced for fear of rupturing the colon, as the air entering seemed to disappear without distending the lumen. A flatus tube was passed through the sigmoidoscope and entered to a depth of 2 feet without any difficulty. A tremendous amount of flatus was



Fig. 2. Showing the ruptures of the abdomen after deflation.

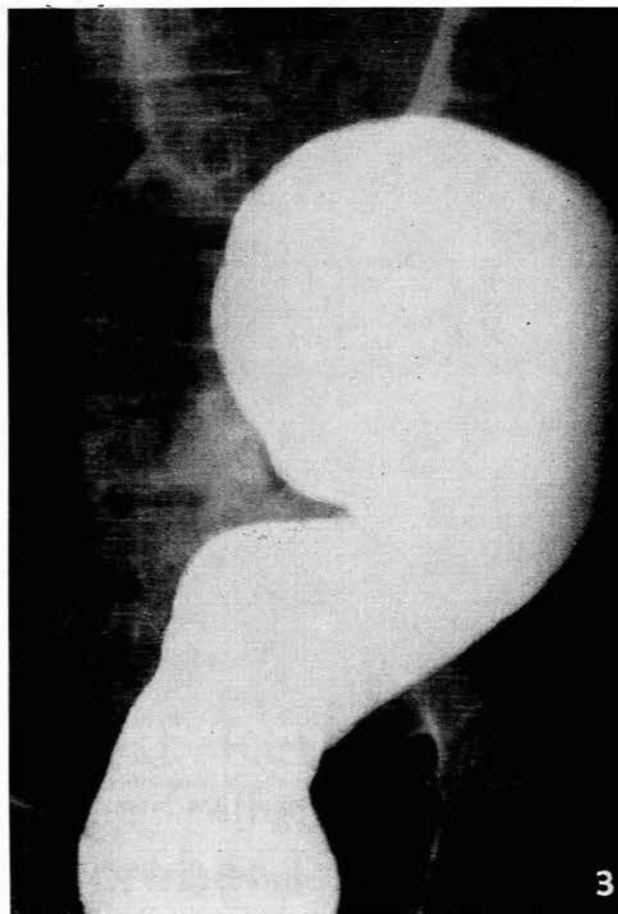


Fig. 3. Barium enema. Note the gaseous distension proximal to the barium.

passed and the abdomen deflated visibly. The tube was left *in situ* and visible peristalsis could be seen through the abdominal wall after deflation (Fig. 2).

The bowel was prepared with 'sulfasuxidine' and 'kantrex' and cleaned with saline enemas. Barium enema showed obstruction in a greatly dilated pelvic colon. The subacute obstruction had recurred once the flatus tube had been removed (Fig. 3).

Operation

Ten days after admission, on the day before that on which the operation was planned to take place, he became acutely distended again and the operation was performed through a left paramedian incision. When the abdomen was opened a huge distended loop of pelvic colon was found, projecting into the right hypochondrium. An assistant passed a rectal tube, which was guided into the dilated loop, as it was thought that the sudden eventration might burst the bowel wall.

The two limbs of the loop were adherent to each other but not to anything else. The volvulus was unwound by rotating the loop in a clockwise direction through somewhat more than 180 degrees. A loop of small bowel wound right around the base of the pelvic loop and was adherent to the abdominal scar. (A similar loop was found in 1956.) This loop of small bowel was not causing the obstruction. It was noted that the posterior parietal peritoneum could be floated away from the posterior wall at the pedicle site.

All the coats of the loop were greatly hypertrophied and the visceral peritoneum was very much thickened. The loop was transected proximal to the 'twist' lest the vascular supply to the distal colon and rectum might be impaired by a larger resection. The proximal lumen had to be narrowed considerably to match the sizes of the distal lumen before end-to-end anastomosis could be performed. A two-layer anastomosis was carried out.

The length of the loop resected was 22 inches along its greater border, the greatest diameter was 7 inches, and the loop could be filled with 9 pints of water (Fig. 4).

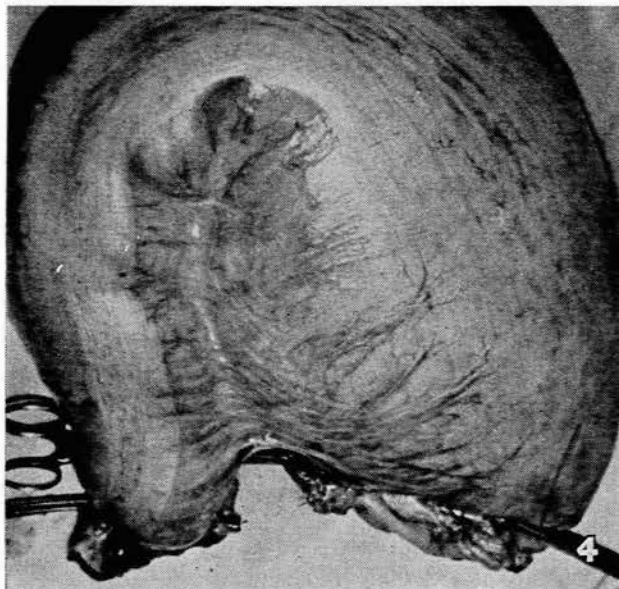


Fig. 4. The resected loop.

A drain was put down to the site of anastomosis and the lax abdominal wall closed in layers. The patient made an uneventful recovery (Figs. 5 and 6).

ANATOMY OF THE PELVIC COLON

Fifty adult cadavers were examined in the Department of Anatomy, University of the Witwatersrand. Five subjects

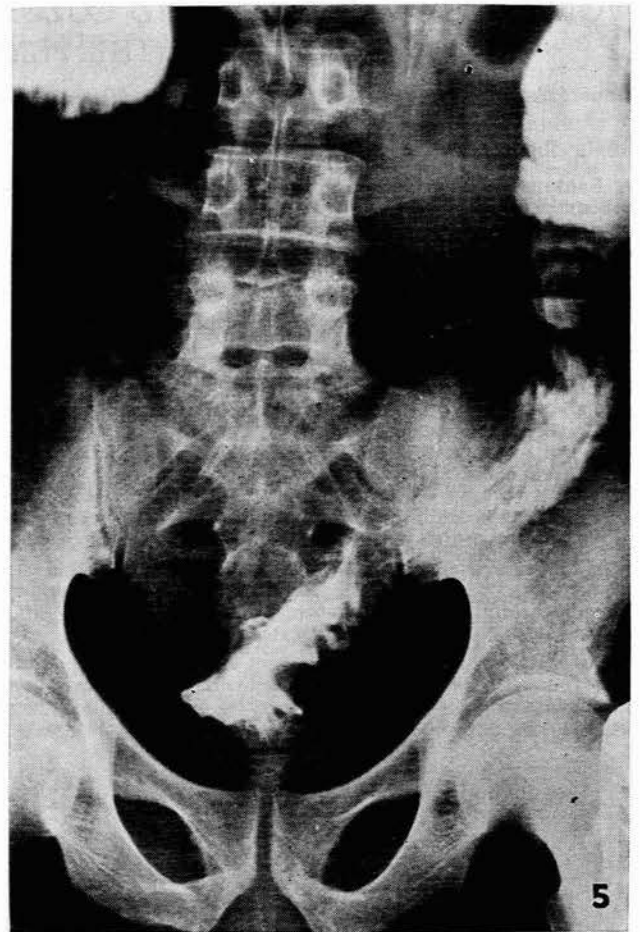


Fig. 5. Postoperative barium enema.

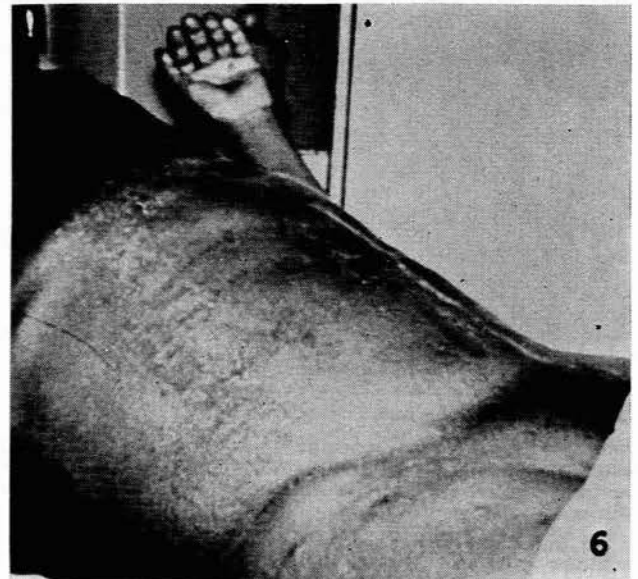


Fig. 6. Postoperative condition.

were Europeans and two were Coloured. (The average figures refer to the Bantu subjects.) Twelve of the subjects

were females. The following measurements and observation were made:

Length of Pelvic Colon

This measurement was taken along the greater circumference of the loop, from the fixed point in the iliac fossa to the fixed point at the level of the second piece of the sacrum where the pelvic colon and rectum meet.

The average length of the pelvic colon was 15 inches in the males and 12 inches in the females, with an average for both sexes of 14.5 inches. The variation was from 26 inches to 7 inches.

The lengths of the pelvic colon in the 5 Europeans were 14, 25, 13, 11 and 13 inches, which is comparable to the Bantu.

Height of Loop

The vertical height of the pelvic loop, which was essentially half of the circumferential length of the pelvic colon, varied from 1 inch, when the pelvic colon had no mesentery, to 13 inches (Fig. 6).

Height of Pelvic Mesocolon

This varied from nil to 4½ inches. Excluding those pelvic colons that tended to be fixed or to have a very short mesocolon, this measurement was essentially half of the length of the inner circumference of the loop of pelvic colon.

It was found that the length of the pelvic colon varied much more in proportion to the diameter of the pelvic colon (and thus the distension) than to the height of the mesocolon (see subject 11, below).

Width of Base of Mesocolon

This measurement, which was the shortest distance between the two fixed points of attachment of the pelvic mesocolon, varied from 1 inch to 5 inches.

Total Length of Colon

This measurement, which excluded the rectum but included the caecum and the ascending, transverse, descending and pelvic colon, varied from 3 feet to 5 feet, with an average of almost 4 feet (34 inches to 63 inches, with an average of 46 inches).

Type of Attachment of Mesocolon

In half the subjects the attachment could be classified into the inverted V or U type with a definite intersigmoid fossa. The other half had a straight-line attachment, horizontal or oblique, with no intersigmoid fossa. In spite of the straight attachment the pelvic colon would still fall into a sigmoid loop in the majority of cases.

Mobility of Pelvic Colon

None of the cases examined had ever developed a volvulus, but an attempt was made to estimate this possibility by estimating the mobility of the pelvic colon, which was assessed by the twisting capacity of the pelvic loop.

Subjects were classified into 4 groups, the first two being 'impossible' and 'unlikely', the third 'possible', and the fourth 'very possible'. 25% fell into the 'very possible' group and 12½% into the 'possible' group. Thus in less than two-thirds of the subjects was it judged that volvulus could be excluded as a possibility according to the anatomical mobility of the colon.

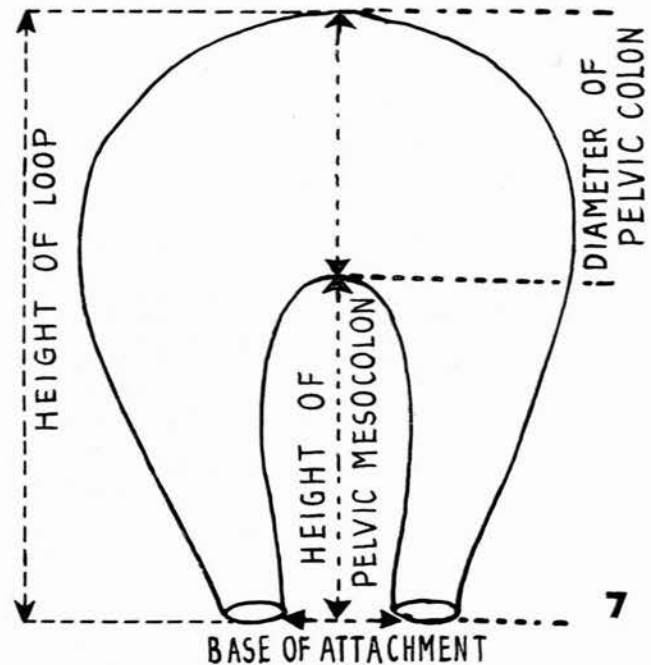


Fig. 7. Measurements of sigmoid loop.

In every case where it was judged that volvulus was possible, the pelvic colon was increased in diameter.

The type of attachment of the pelvic mesocolon had no bearing on the mobility.

The ratio of the height of the mesocolon to the width of the base of attachment had a direct bearing on the mobility of the pelvic colon. A ratio of 1:1 or less fell into the 'unlikely' or 'impossible' class. As this ratio increased the tendency was for the mobility to increase as well. However, there were exceptions. When the ratio increased and mobility did not increase, then the pelvic colon was not distended. Conversely, when the ratio was greater than 1:1 and the diameter of the pelvic colon was increased, the twisting capacity of the loop was invariably increased.

Examples

Three of the subjects are here selected as illustrated examples:

Subject 27: Male Bantu aged 70 years

Length of pelvic colon 16"
 Height of whole loop 8"
 Height of mesocolon 4"
 Diameter of pelvic colon 4"
 Width of base of attachment of mesocolon 1"
 Ratio 4:1 (mesocolon:base); 8:1 (height of loop:base)
 Type of attachment: Straight transverse.
 Mobility: Volvulus extremely possible.

Subject 11: Male Bantu aged 36 years

Length of pelvic colon 22"
 Height of whole loop 11"
 Height of mesocolon 4½"
 Diameter of pelvic colon 6½"
 Width of base of attachment 3"
 Ratio 3:2 (mesocolon:base); 11:3 (height of loop:base)
 Type of attachment: Wide inverted U
 Mobility: Very mobile—volvulus very possible.

Subject 5: Female Bantu aged 46 years

Length of pelvic colon 14"
 Height of whole loop 7"
 Height of mesocolon 1½"
 Diameter of pelvic colon 5½"
 Width of base of attachment 3"
 Ratio 1:2 (mesocolon:base); 7:3 (height of loop:base)
 Type of attachment: Straight oblique
 Mobility: Slight mobility—volvulus unlikely.

Discussion of subjects

In subject 27 the length of the pelvic colon, as measured on the outer circumference, was mainly due to the distension of the lumen. In the preserved state the colon had a diameter of 4 inches. The mesocolon had a greatest height of 4 inches and, as the base was only 1 inch, the ratio of 4:1 was in favour of an increased twisting capacity of the pelvic loop. The ratio of the height of the loop (height of mesocolon + diameter of colon) to the base was still greater, viz. 8:1.

Subject 11 had a very long pelvic loop and this again was extremely mobile, so that volvulus, anatomically, was very possible. This was in spite of a mesocolon ratio of only 3:2 and in spite of a wide inverted U type of attachment. The ratio of the loop to base was 11:3 (nearly 4:1).

In subject 5, in spite of the great distension (5½ inches diameter) of the pelvic colon, volvulus was considered unlikely to occur. The ratio of height of loop to base was 7:3.

Conclusions

1. The distension of the colon to a large extent determines the length and mobility of the pelvic loop.
2. The height of the pelvic mesocolon does not vary to a very large degree (0—4½ inches), but if short it will decrease the twisting capacity of the loop in spite of distension of the lumen (as in subject 5).
3. The ratio of the height of the mesocolon to the width of the base, though important, plays a secondary part, but the ratio of the total height of the loop to the base of attachment, anatomically, is probably the most important factor.
4. The type of attachment of the mesocolon to the posterior wall does not have any bearing on the mobility of the pelvic loop.
5. There must be some other factor or factors that initiate the clinical condition of volvulus of the pelvic colon. These are considered by the author to be dietary distension of the pelvic colon, with elongation of the mesocolon. This elongation is aided by the 'borrowing' of peritoneum from the posterior abdominal wall, which still further increases the ratio of total height to base.

GENERAL DISCUSSION OF SIGMOID VOLVULUS

The case of volvulus presented is of the common recurrent type, which, though subacute, is still surgically urgent.^{1,2} Two-thirds of the cases are of this type, and they tend to be in an older age group.¹ A less common acute type presents as a surgical emergency, and has a very high mortality rate;¹ this is the case with strangulation, which occurs either in a first attack or in one of the later attacks in the recurrent type.

The peak age for volvulus of the sigmoid is 50 years. Mace David,³ however, recorded a case in a boy of 14 years, who had no constipation until 3 years before operation, but thereafter had recurrent episodes of abdominal pain and constipation (probably the early attacks of subacute volvulus). The condition is 4 times commoner in males than females.¹

It is stated that volvulus of the sigmoid is uncommon in the European population of the USA,⁴ though relatively commoner in mental institutions.⁵ Reports from Scandinavia,⁶ India,⁷ and Kampala,⁸ indicate that it is a fairly common cause of sigmoid obstruction. In one Russian clinic 50% of cases of large-bowel obstruction were due to volvulus of the sigmoid.⁹ In some of these countries the inhabitants tend to eat a high-residue diet and also to eat irregularly—a period of starvation being followed by an enormous meal.

Surgical Problems

The surgical problems involved in the condition resolve into the following:

(a) Obstruction with distension of the proximal part of the colon if the ileocaecal valve is competent.

(b) Closed-loop obstruction characterized by a valvular effect, leading to enormous dilatation. Clinically, the great distension of the abdomen with obstruction is characteristic, as well as the previous minor recurrent attacks. Enemata may be harmful by increasing the distension and by causing water intoxication, unless the obstruction is so intense that the valvular mechanism cannot operate. Air insufflation during sigmoidoscopy may also behave in this manner. The distension is mainly gaseous and in many cases perforation is probably prevented only by the hypertrophy of the colonic walls.

(c) Strangulation of the loop. The rotation is always around the mesenteric axis,¹⁰ which contains hypertrophied blood vessels, and sooner or later strangulation must occur if the condition is not relieved.

(d) Recurrence of the volvulus if radical surgery is not employed.

Discussion of Treatment

Firstly the patient is in obstruction, even though vomiting is a late sign, and supportive therapy should be instituted. Abdominal tenderness may indicate strangulation, and blood should then be present.

Straight X-ray of the abdomen in the erect position shows large fluid levels in a hugely dilated colon. Characteristically the curve of the pelvic loop is more convex on the right.¹¹ The 'beak' sign may be seen on barium enema.¹²

Very gentle conservative deflation with a rectal tube through a sigmoidoscope may be attempted if there is no abdominal tenderness. If this is successful the tube should remain *in situ*, for obstruction is likely to occur again. The bowel should then be prepared and cleaned and laparotomy arranged. Ideally, end-to-end anastomosis should be performed at operation.

If rectal deflation is not successful or not attempted, then, ideally, two operations should be performed.² The first operation allows untwisting of the volvulus and introduction of a rectal tube. At the second operation, when the lumen of the proximal limb has become smaller, an end-to-end anastomosis should be performed.

The danger that a patient may not submit to the second operation (about 3 weeks later) is very real in the Bantu and should be borne in mind. Drainage at laparotomy, by a catheter brought out through a stab wound, is a palliative procedure that tends to fix the bowel to the anterior abdominal wall and prevent the recurrence of the volvulus.

If strangulation has occurred then passing a rectal tube may perforate the bowel. The loop should be emptied by aspiration before untwisting. Any serosanguinous fluid in the peritoneal cavity should be removed by aspiration. Opinion differs on the surgical procedure, but exteriorization plus resection, leaving a double-loop colostomy,¹¹ is probably one of the safest.

There is always a risk of recurrence if any lesser procedure than resection of the pelvic loop is adopted.² Plication of the mesocolon and suturing it to the left iliac fossa has been used successfully,⁹ but the weight of the distended and loaded pelvic colon might possibly undo the good work and lead to recurrence.

SUMMARY

1. A case of subacute recurrent volvulus of the colon is presented.

2. The pelvic colon of fifty cadavers were examined and the measurements analysed and reported. The ratio of the height of the mesocolon plus the diameter of the lumen of the bowel to the base of attachment is anatomically the most important factor tending to increase the mobility of the pelvic colon.

3. Sigmoid volvulus and its treatment are discussed.

4. Dietary distension of the pelvic colon is accepted as the most likely aetiological factor in volvulus of the

sigmoid colon. The great gaseous distension depends on a valvular mechanism in the pedicle. The hypertrophy of the tissues depends on the chronicity of the condition and prevents spontaneous rupture. The floating peritoneum increases the height to base ratio, and probably behaves as the 'final straw'.

I wish to acknowledge my indebtedness to Dr. R. Pearson, Chief Medical Officer of the Witwatersrand Native Labour Association Hospital, for allowing me to present the illustrative case, and to Prof. P. V. Tobias of the Department of Anatomy, University of the Witwatersrand, for granting me the facilities to investigate the anatomy of the cadavers in the department.

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