ASPECTS OF TREATMENT*

Complications of rectal anastomoses with end-to-end anastomosis (EEA) stapling instrument

Clinical and radiological leak rates and some practical hints

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Summary
The complications and results of rectal anastomoses carried out with the end-to-end anastomosis (EEA) stapling instrument on 50 patients by 5 consultant surgeons are recorded. There was a clinical leakage rate of 6% and a radiological leakage rate of 20% assessed by water-soluble contrast enema. The technique has advantages compared with hand-suture by allowing low anastomoses and preservation of sphincters and is accompanied by an acceptably low leakage rate. Despite the cost of disposable cartridges these advantages make the technique economical because of the avoidance of colostomies and reduction in hospital stay.

Introduction
In the United Kingdom there is increasing use of circular stapling devices to perform rectal anastomoses, particularly after anterior resection for carcinoma of the mid-rectum. Heald (1) believes that with the use of circular stapling devices it is now possible to deal with most rectal cancers by restorative resection but stresses that careful attention to operative detail is important for success.

In this paper we present the early experience of 5 consultant surgeons using the end-to-end anastomosis (EEA) stapling instrument and report the clinical and radiological leak rates in the first 50 patients undergoing rectal anastomoses with this device. We believe that similar early experience may occur in other groups of surgeons and hope that the article will help them to avoid some of the problems that we experienced and produce better results.

The Editor would welcome any comments on this paper by readers

Material and methods
All the 50 patients underwent preoperative orthograde bowel clearance either by whole-gut irrigation with physiological saline (8–12 l) or with oral mannitol (1–2 l of 5–10% solution) until the effluent was clear.

Most patients had a short course of parenteral antibiotics 1 h before operation — for example, 1 g of cephazolin intramuscularly and a metronidazole suppository, with 500 mg of metronidazole intravenously at the beginning of the operation. Some patients received a 24-h course of oral neomycin (1 g thrice) before operation and all patients received antibiotics for 24–72 h after the operation.

In this series we used the end-to-end anastomosis (EEA) circular stapling device with disposable cartridges. The 31-mm diameter cartridge was the only one we had available for this series. The types of operation performed before rectal anastomosis were: anterior resection of the rectum (28 cases), sigmoid colectomy (11), left hemicolectomy (3), total colectomy (6), and reconnection after Hartmann’s procedure (2). All 28 anterior resections were for carcinoma of the rectum, but the other operations were for carcinoma, complications of diverticular disease, or inflammatory bowel disease. Proximal diversions were not used routinely, but 3 colostomies had already been established at previous emergency operations and 1 loop ileostomy was performed to protect an ileorectal anastomosis.

TECHNIQUE
All operations were performed with the patient in the
Lloyd-Davies position, which allowed an abdomino-perineal approach. After division of the rectum and excision of part or whole of the colon the two ends of bowel were prepared for anastomosis by inserting purse-string sutures near the ends of the bowel. We used Size 0 Prolene (polypropylene) sutures inserted into the proximal bowel with the aid of the modified Furness clamp, but this was often difficult to use across the rectal stump, especially in the small male pelvis, and the purse-string was inserted by hand. In most of the operations included in the series the rectal stump was completely divided before the purse-string was inserted, but later we found it better to insert the purse-string in the anterior layer before dividing the posterior layer of rectum, as recommended by Heald (1). Details of wash-out procedure of the rectal stump were not recorded in all operations, but this was usually done with a Size 26 Foley catheter in the rectum, which was washed out with distilled water or perchlorate solution to clean the rectum and destroy exfoliated tumour cells. It is important to clean the rectal stump of all faecal material since the rectal contents can be pushed into the pelvis when the stapling device is introduced via the anus.

The well-lubricated stapling device was introduced carefully by a second operator until the closed cartridge appeared through the divided rectum and the cartridge was then opened. The distal purse-string suture was usually gathered first around the body of the cartridge and the gun was then pushed farther into the patient before the colonic or ileal end was gathered around the anvil of the cartridge. The cartridge was closed to anastomose the two severed ends by turning the screw at the handle of the instrument until the indicator marks were in line. The gun was then fired to anastomose the bowel with two rings of closed staples. The cartridge was gently opened approximately 0.5 cm and withdrawn through the anastomosis and out via the anus. The anastomosis was examined externally by direct vision and palpation and also internally with a sigmoidoscope or proctoscope. Later we tested the anastomosis by filling the pelvis with saline, introducing air into the rectum through a Foley catheter introduced into the anus, and checking for air bubbles from the suture line.

PROBLEMS
In 2 patients too much tissue was included in the purse-string and this was extruded when the cartridge was closed, resulting in an inadequate anastomosis which was completed by hand.

In 1 patient with diverticular disease the colon was too small to admit the 31-mm instrument and the anastomosis was performed by hand; probably there had been inadequate excision of diseased bowel.

On 1 occasion the instrument was not opened before withdrawal and the anastomosis was torn and was completed by hand.

In only 1 patient was there a probable mechanical failure of the instrument when the staples failed to close properly at two attempts; the procedure was abandoned and the anastomosis completed by hand.

In 4 other patients the surgeon was not completely happy with the anastomosis and reinforced it with interrupted seromuscular sutures.

There were no postoperative haemorrhages from the stapled anastomoses.

Results
DEATHS
There were 3 postoperative deaths, only 1 directly related to leakage from the anastomosis after ante-
Complications of rectal anastomoses with end-to-end anastomosis (EEA) stapling instrument

An assessment of clinical leakage was made in all cases — that is, a leak was diagnosed if there was evidence of intra-abdominal sepsis associated with faeces from a fistula or drain or if disruption of the anastomosis was found at reoperation or post-mortem examination.

Radiological assessment of anastomotic integrity was made in 47 out of our first 50 patients on the 9th or 10th day after operation by watersoluble Urografin (sodium and meglumine diatrizoates) contrast enema. Figure 1 shows the X-ray appearances of an intact staple ring and the passage of contrast medium through the anastomosis without a leak. Figure 2 shows a disrupted staple ring on plain film and a leak of contrast medium from the anastomosis. The clinical and radiological leakage rates for the operations performed are shown in the table.

<table>
<thead>
<tr>
<th>Type of operation</th>
<th>No of operations</th>
<th>Clinical leaks</th>
<th>Radiological leaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior resection</td>
<td>28</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Sigmoid colectomy</td>
<td>11</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Left hemicolectomy</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total colectomy</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reconnection after Hartmann's procedure</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>50</strong></td>
<td><strong>3 (6%)</strong></td>
<td><strong>10 (20%)</strong></td>
</tr>
</tbody>
</table>

**Discussion**

The EEA stapling gun was most commonly used in this series after anterior resection of the rectum for carcinoma (28 patients; 56%) and it is in difficult low anterior resection that the instrument is most valuable in allowing adequate clearance below the tumour and preservation of the sphincters. The clinical and radiological leakage rates were greatest in the anterior resection group, being 11% and 32% respectively in the patients treated by

![FIG 2 Plain X-ray (left) demonstrates a disrupted staple ring and contrast enema (right) shows leakage from the anastomosis.](image-url)
this operation, but since there was only one radiological leak in all of the other operations overall clinical and radiological leakage rates of 6% and 20% respectively were recorded. These results are better than those achieved after a series of hand-sewn rectal anastomoses recorded in this hospital by 2 of the surgeons and their senior registrar and lecturing staff in the same unit. In a consecutive series of 57 patients with hand-sewn anastomoses there were 8 clinical leaks (14%) and 28 leaks detected radiologically (49%).

The recorded leakage rates in our hospital after both stapled and hand-sewn anastomoses are not good and perhaps reflect the large number of surgeons using the stapling instrument for the first time and the number of surgeons with differing experience and ability who performed the hand-sewn anastomoses in the series quoted. The results of our stapled anastomoses are not as good as those of Goligher (2), who in 1979 published a clinical leakage rate of 3.2% and a radiological leakage rate of 6.5% using the Russian stapling gun for 62 anastomoses performed by himself after anterior resection. Goligher compared this with a clinical leakage rate of 6.7% and radiological leakage rate of 28.9% for his own hand-sewn anastomoses after anterior resection in 135 patients; our results after stapled anastomoses (6% and 20% respectively) show a slightly lower leakage rate than from Goligher’s hand-sewn anastomoses.

We did not record any significant differences in leakage rates between the first and second groups of 25 patients, but there was a lower incidence of problems in the latter group. In the first 25 patients there were 3 anastomoses which had to be hand-sewn after complete instrumental failure and 3 anastomoses which were partially hand-sewn or reinforced by sutures. In the next 25 patients there were 2 complete failures and 1 partial failure completed by hand suture.

The surgeons, who were all consultants in this series, felt that technique and speed improved with the experience gained during the relatively few operations that each surgeon contributed to the study and we observed that as each surgeon increased his experience the problems decreased. The clinical leakage rate of another 50 consecutive stapled rectal anastomoses by the same 5 surgeons has been assessed and it remains the same (6%), but radiological leakage rates cannot be given because Urografin enemas were not performed on all patients.

From our experience with the EEA stapling device we recommend the following technical hints:

1) Clear the fat for about 1.5 cm from the ends of the bowel to be anastomosed.
2) Use Size 0 Prolene for the purse-string sutures for adequate strength combined with good sliding qualities.
3) The Furness clamp (or ‘rake’) is not recommended, particularly for the rectal stump in a narrow pelvis.
4) Take approximately 12 bites with each purse-string suture, including no more than 2 mm of tissue in each bite.
5) Leave the purse-string suture long and allow the knife blade of the gun to cut the sutures, which demonstrates that the knife blade has functioned properly.
6) Do not use ‘sizers’ to dilate the bowel but dilate gently with the fingers.
7) Use the surgeon’s hand behind the rectum to guide the cartridge up through it.
8) Use the surgeon’s finger and thumb to encircle the gap between cartridge and anvil when these are closed.
9) Check carefully that two complete rings of bowel (‘doughnuts’) are retrieved from the cartridge at the end of the procedure.
10) Check the anastomosis by insufflating air into the rectum with a Foley catheter with the pelvis full of saline and look for air bubbles.

Conclusion

We feel that the EEA stapling device offers considerable advantages over hand-sewn techniques for rectal anastomosis because of its speed and the possibility of very low anastomoses with sphincter preservation and the avoidance of a colostomy. Despite the high cost of disposable cartridges the technique is economical when one takes into account the avoidance of colostomies and reduction in hospital stay since the technique appears to be accompanied by an acceptably low leakage rate. We believe that increased experience by one or a group of surgeons would be accompanied by a decrease in problems and probably a lower leakage rate from rectal anastomoses.

References