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## Clinical Experience Using Biofragmentable Ring for Ileo-Ileo Anastomosis

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**Abstract** The biofragmentable anastomosis ring (BAR) was introduced in 1985. The BAR is made of polyglycolic acid polymer and barium sulfate. It fragments into small pieces after polymer hydrolysis and completely passes out of the body in about 3 weeks. The BAR was originally designed for colonic anastomosis. We have recently used it for ileo-ileal anastomosis in 3 patients who underwent urinary tract diversion with pelvic exenteration (1 case) or with radical cystectomy (2 cases). No complication, such as wound infection, intra-abdominal abscess, anastomotic leak, ileus or intestinal obstruction, was observed. It took about 10 minutes to complete the anastomosis. This is about half as long as that of sutured anastomosis. On the plain abdominal X-ray, the shadow of the BAR disappeared by the 25th. post operative day. Patients felt no discomfort when the fragments were passed out in the stools. Small intestinal anastomosis using the BAR is a safe, easy, swift, and a satisfactory procedure. The BAR maintains the patency of the intestinal lumen until the anastomotic site heals up. There were no residual foreign bodies after the fragments were discharged in the stool.

*key words* : biofragmentable anastomosis ring, bowel anastomosis, urinary diversion

### Introduction

The biofragmentable anastomosis ring (BAR, VALTRACR, Davis and Geck Medical Device Division, American Cynamid Co., Wayne, NJ) was introduced in 1985 by Hardy et al.<sup>1)</sup> The fundamental structure of the BAR is a double segmented ring (Fig.1), and it originated in Murphy's steel button reported in 1892<sup>2)</sup>. The Murphy's button was made of steel, however, the BAR is made of polyglycolic acid polymer (87.5% by weight) and barium sulfate (12.5% by weight). It finally fragments into small pieces after polymer hydrolysis, completely passing out of the body in the stools in about 3 weeks after the anastomosis had been completed<sup>1,4,6-8)</sup>.

The BAR was originally designed for colonic anastomosis<sup>1)</sup>. We have performed several colonic anastomoses using BAR with good results. We recently employed it for ileo-ileal anastomosis in 3 patients who underwent urinary tract diversion with an ileal conduit. We report some advantages of using the BAR in small intestinal anastomosis.

### Patients and methods

The Bar was used for ileo-ileal anastomosis in three cases who underwent pelvic exenteration (1 case) or total cystectomy (2 cases). The patients' data are shown in table 1.

In all cases, urinary diversion was performed with an ileal conduit. A 20cm long ileal

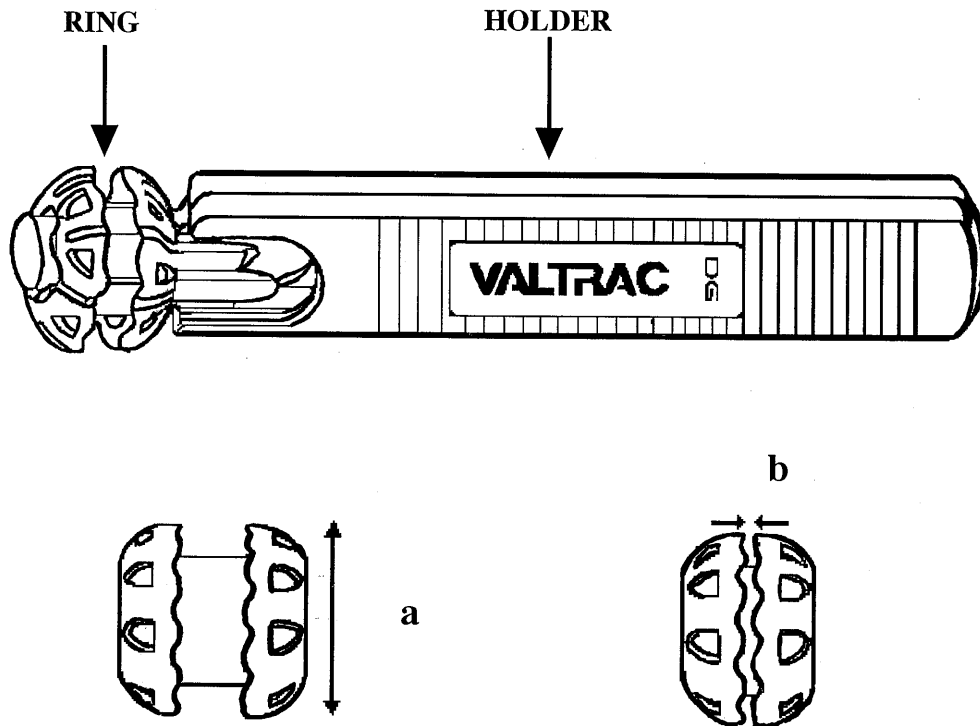


Fig. 1 Diagram of the BAR. a : outer diameter. b : gap size.

Table 1 List of the patients

Name	Sex	Age	Disease	Operative procedures
T.O.	m*	72	Cancer of the urinary bladder	Total cystectomy and Urinary diversion with an ileal conduit
A.I.	m	62	Cancer of the urinary bladder	Total cystectomy and Urinary diversion with an ileal conduit
T.T.	m	74	Cancer of the rectum Invasion to the urinary bladder	Pelvic excenteration and Urinary diversion with an ileal conduit

\*m : male

segment was freed with its mesenteric pedicle for ileal conduit. An end to end ileo-ileal anastomosis was completed using the BAR.

The surgical technique of bowel anastomosis with the BAR has been described in detail elsewhere<sup>1,3-8</sup>. Briefly, 1 ; purse-string sutures were made at both bowel ends with polyglycolic acid monofilament (3-0 Maxon), 2 ; the appropriately sized BAR was chosen by using a steel sizer, 3 ; a ring was inserted into

the bowel and the bowel end was anchored to the center tube of the BAR, 4 ; a holder was released of the ring and the other ring was inserted into the other end of the bowel and anchored to the center tube in the same manner, 5 ; the rings were then closed by hand. One of the most important point in the procedure is the choice of BAR size. There are several choice of devices, depending on the outer diameter and the gap size. Before decid-

ing on the size, we inserted a sizer into the ileal lumen and chose the appropriately sized BAR. In each case the smallest BAR (outer diameter 28mm, gap size 2.0mm) was selected.

All patients were observed for at least 4 weeks after surgery.

## Results

No complication, such as wound infection, intra-abdominal abscess, anastomotic leak, ileus or intestinal obstruction, was observed in any of the cases.

It took about 10 minutes to complete the ileo-ileal anastomosis in an end to end fashion. This is about half as long as that of conventional sutured anastomosis.

As the BAR contains barium sulfate, we can see the ring on the plain abdominal X-ray film

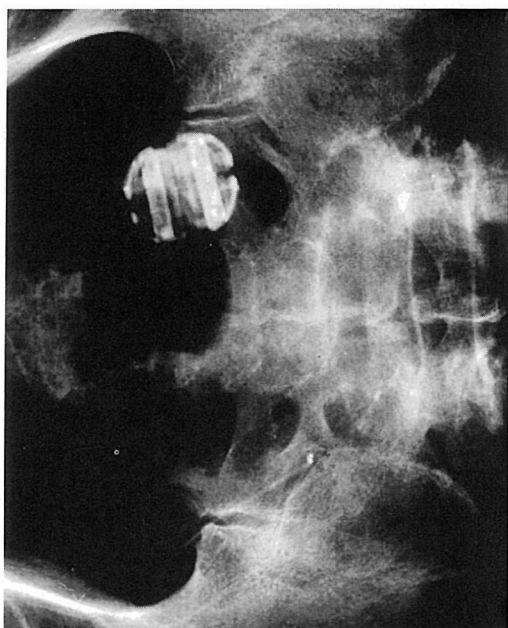


Fig. 2 The BAR presented on the plain abdominal X-ray film after the surgery.

after the surgery (Fig.2) till the ring passes out of the body. The shadow of the BAR had disappeared by 21st. post operative day in 2 cases and by 25th. post operative day in another case. In one case, the fragmented BAR was observed in the rectum on the film before it was discharged. Patients felt no discomfort when the fragments were passed in the stools.

## Discussion

For good bowel anastomosis, the maintenance of an adequate blood supply, accurate serosal apposition, and a water-tight seal are required. Hardy and co-workers introduced a new device, the BAR, to meet these requirements for safe and effective bowel anastomosis in 1985<sup>1)</sup>. Gullichsen et al. (1991) described that the BAR anastomosis was similar in macroscopic and histological appearances to that of hand sutured and stapled anastomoses at 40 days after surgery in dog models<sup>9)</sup>.

The BAR is sort of a compression anastomotic device that originated in Murphy's button. However, the BAR has unique features different from the button ; 1. the BAR does not induce necrosis in the inverted anastomosis ends after ring closure, 2 ; the BAR is biofragmentable after polymer hydrolysis with no residual material in the body.

The inside edge of the ring is waved and there is a gap (1.5mm, 2.0mm or 2.5mm) between the edges of the ring in the completely closed position, therefore it avoids compression of the blood supply and prevents necrosis at the anastomotic site (Fig. 3). On the other hand, the inside edge of the ring is flat and there is no gap between the edges in Murphy's button. Therefore, the inverted bowel end can not maintain enough blood supply. It may also cause stenosis at the anastomotic site because of inverted bowel necrosis<sup>2)</sup>. Hence Murphy's button has not been generally used. The BAR is made of polyglycolic acid polymer and barium sulfate. The polyglycolic acid is hydrated in the bowel lumen, and the ring

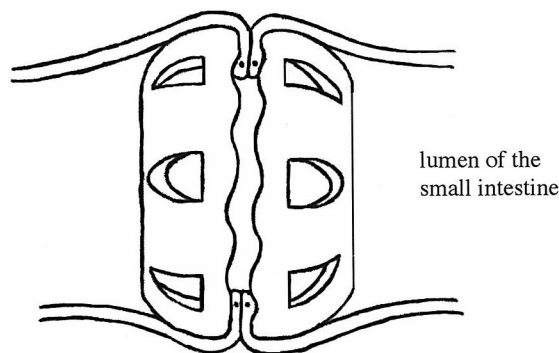


Fig. 3 Diagram of the anastomosis site with the BAR

becomes fragmented in the lumen and completely passes out of the body. After discharge there is no residual foreign material at the anastomotic site. Therefore, there is no risk of preventing anastomotic site from healing. There are no artifacts caused by steel material like staples, at the anastomotic site on computed tomography or magnetic resonance imaging, and there is no worry about hyperheating of staples during hyperthermia therapy. It has been reported that a few patients felt discomfort when the fragments were passed through their anus<sup>8)</sup>. In our cases, no patient felt any discomfort during discharge of the fragmented device.

There have been several complications reported<sup>3,4,6)</sup>. In those series the incidence of leakage was about 3 per cent, intra-abdominal abscess 1 per cent, anastomotic transient obstruction 4 per cent, and stricture 0.5 per cent. Those incidences were comparable to those of sutured anastomosis or stapling method. In this series, no complication was observed.

In the early period after surgery the BAR may cause mechanical obstruction<sup>9)</sup>, because inside diameter of the ring is only 14mm. In our experience with colonic anastomoses, two patients developed abdominal distention postoperatively, however, they improved with semi-liquid meal. No patient reported in this article developed intestinal obstruction. The content in the lumen of the small intestine is liquid, and therefore mechanical obstruction may not be a problem.

This procedure is easy to perform and it takes only about 10 minutes to complete the anastomosis. Most of the time is due to the creation of the purse-string suture. If we use a device, Purstring™ (United States Surgical Co.), the anastomosis can be completed in a shorter time. This ring can revolutionize the way of bowel anastomosis, and a doctor, who is not so familiar with bowel anastomosis, can perform the procedure in a uniform manner.

## Conclusions

1. Small intestinal anastomosis using the BAR is a safe, easy, swift, and satisfactory procedure.
2. The BAR maintains patency of the intesti-

nal lumen until the anastomotic site heals up.

3. There are no residual foreign bodies after the fragments of the ring have passed out of the bowel.

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