



Double-stapled Colorectal Anastomosis with Bean-shaped Rectal Doughnut Eliminating Dog Ears

Çift Stapler Kolorektal Anostomozda Rektal Halkanın Fasülye Formunda Çıkarılması ile Kulak Oluşumunun Engellenmesi

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ABSTRACT

The double-stapling technique defined by Knight and Griffen in 1980 has found widespread use in colorectal surgery. However, theoretically, the remaining dog ears on each side of the intersecting line between linear and circular stapler lines may have decreased blood supply and may contain tumor cells. Various modifications have been published in the literature to overcome these disadvantages of the double stapling technique. In this article, a modified technique that provides to excise the whole linear stapling line and to not leave the dog ears behind was introduced.

Keywords: Colorectal anastomosis, dog ears, double-stapling technique

ÖZ

Knight ve Griffen tarafından 1980 yılında tanımlanan çift stapler tekniği kolorektal cerrahide yaygın kullanım alanı bulmuştur. Bununla birlikte, teorik olarak, linear ve sirküler stapler hatlarının kesiştiği hattın her iki tarafında kalan kulakların (dog ears), kanlanmasının bozulabileceği gibi tümör hücreleri de içerebileceği hakkında tereddütler belirtilmektedir. Çift stapler tekniğinin bu dezavantajlarının üstesinden gelmek için tanımlanan çeşitli modifikasyonların yayınlandığı çalışmalara literatürde rastlanmaktadır. Bu makalede, dog ears oluşmasını engellemek üzere rektal linear stapler hattının tamamının çıkarılmasını sağlayan modifiye bir teknik tanıtıldı.

Anahtar Kelimeler: Kolorektal anostomoz, dog ears, çift stapler tekniği

Introduction

After Ravitch and Steichen performed end-to-end low rectal anastomosis with the end-to-end anastomosis instrument (EEA), and Nance defined to use the EEA together with a linear stapler on the upper gastrointestinal system in 1979, Knight and Griffen reported a modified stapler technique using linear and circular staplers together for colorectal anastomosis in 1980.^{1,2,3} In this double-stapling technique (DST), a horizontal closure of the lower rectal segment with a linear stapler was made. Then, an anastomosis with a circular stapler across the horizontal line was performed. DST provided some advantages compared with the traditional hand-sewn technique or single-stapled anastomosis technique (SST), such as significantly less contamination, being easily

performed and the ability to anastomose the bowel segments with different diameters.

However, DST technique has at least two crossing staple lines and causes two corners called “dog ears” on each side. There were some concerns in literature that this technique may be complicated with anastomotic leakage from those “ears” because of weak blood circulation in these regions. This concern seems logical. However, some experimental studies opposing this concern were reported. Julian and Ravitch⁴ reported, in a dog model, that there were no leakages, even though the linear staples were usually removed with the doughnuts deformed, crushed or cut. Zilling showed, in a pig model, that the intersecting staple lines in the colonic and small bowel anastomoses did not reduce the anastomotic



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blood flow to a dangerous ischaemic level.⁵ On the contrary, Roumen reported, in another experimental study on pigs, that double-stapled intersecting anastomoses could resist lower pressure compared with well-organised staple lines performed by a single circular stapler.⁶ Nevertheless, Kawada suggested that resection of dog ears is not required because of technical difficulties and similar clinical results, especially if the intersecting line is placed close to the edge of the rectal stump.⁷ In conclusion of these contradictory results, although there is no exact evidence on the higher rate of anastomotic leakage caused by DST, the dog ears on each side of the intersecting line between the linear and circular staple lines may have a decreased blood flow theoretically, and therefore, they may be the soft belly of this technique.

Because of these contradictory results, some authors have defined new techniques that had the advantages of DST but did not cause crossing lines and dog ears. They aimed to reduce the rate of anastomotic leakage and provide a well-organised complete linear staple line of the rectal stump that does not leave behind dog ears, to provide an accurate oncological diagnosis without suspicion, because dog ears may contain tumour cells.

Method

The colon is prepared according to the planned resection. The proximal segment is transected and closed in such a manner that a bulky cylinder, which does not cause eversion around the anvil shaft, is left behind by over-and-over purse-string suture technique. If required, an “O” suture may be applied over the purse-string suture.

An approximately 1.5 cm segment of the rectum is cleaned from the surrounding fat tissue and cut in either a transverse, oblique or vertical manner by the linear stapler (GIA8048S, Covidien) at the border of the planned resection site.

After digital dilatation, the circular stapler (CDH33, Ethicon Endo-Surgery Inc.) is gently introduced into the anal canal and driven on the staple line. The bowel is perforated by the spike of the stapler at just above the central part of the linear staple line, if it is transverse, or just its right side, if it is vertical or oblique (Figure 1 and 2).

The tightness of the rectal stump is lessened by drawing back the stapler in the rectum slightly. Then, the linear staple line is shaped as a tennis racket by using two 2-0 monofilament sutures around the spike. Care should be taken to leave sufficient space around the spike (Figure 3 and 4). During this procedure, the spike does not cause tissue disruption or laceration because it leans on the staple line.

The anvil shaft is attached to the stapler. When the stapler is closed, it is drawn back slightly, which helps lessen the

tightness of rectal stump, and the tennis racket formed by the linear line can be pushed into the retainer. The handle of the racket is moved into the deepest part of the retainer (Figure 5). By firing the stapler, the procedure is terminated, and a slightly oblique inverting end-to-end colorectal anastomosis is performed.

Discussion

The authors, suggesting that the dog ears are a problem in DST, tried new techniques combining the advantages of DST and the anastomosis ability with inversion characteristics of SST without causing dog ears, such as suturing in the linear staple line, modified DST eliminating one dog ear



Figure 1. The linear staple line and dog ears on each side in the model. A longer staple line causes more prominent dog ears

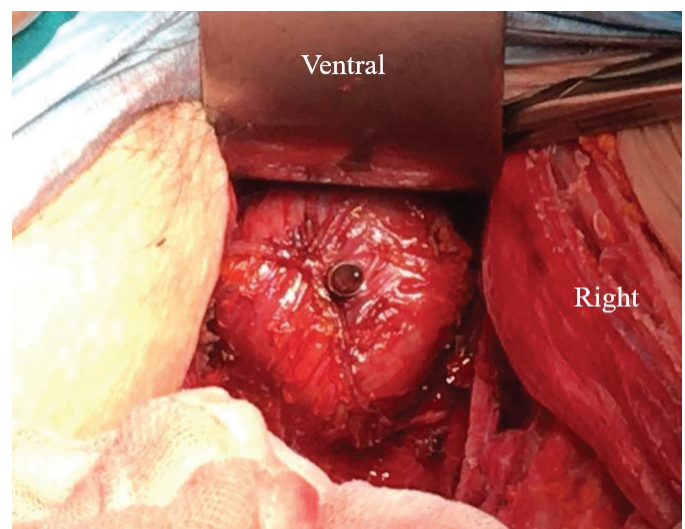


Figure 2. An operation view showing perforation of the rectal stump by the spike of the staple. Note that the perforation site is just ventral to the centre of the linear staple line

and transanal invagination or eversion methods by KOL™ circular stapler.

In this study, the author introduced a technique that he used in his clinical practice. This technique had small differences from the suture techniques described previously. Hazama sutured the staple line between two corners over the trocar

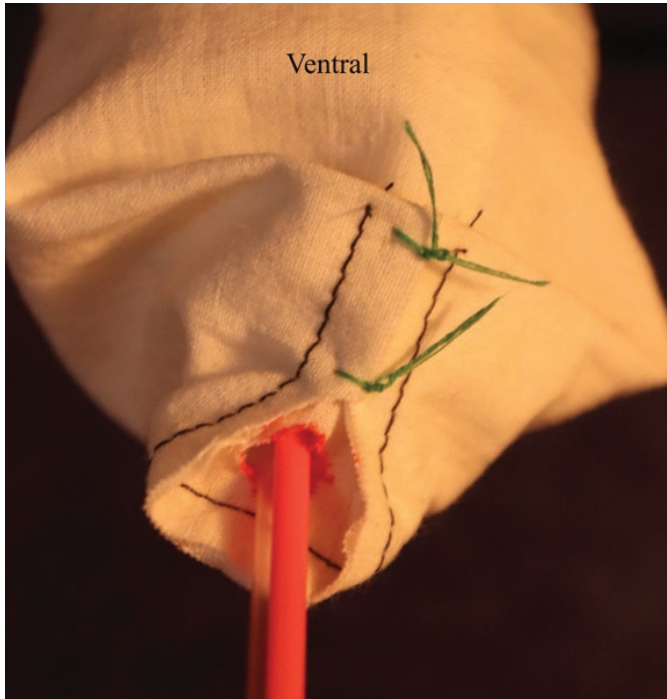


Figure 3. Forming a tennis racket shape by two sutures in the model. Note that sufficient space is left around the spike

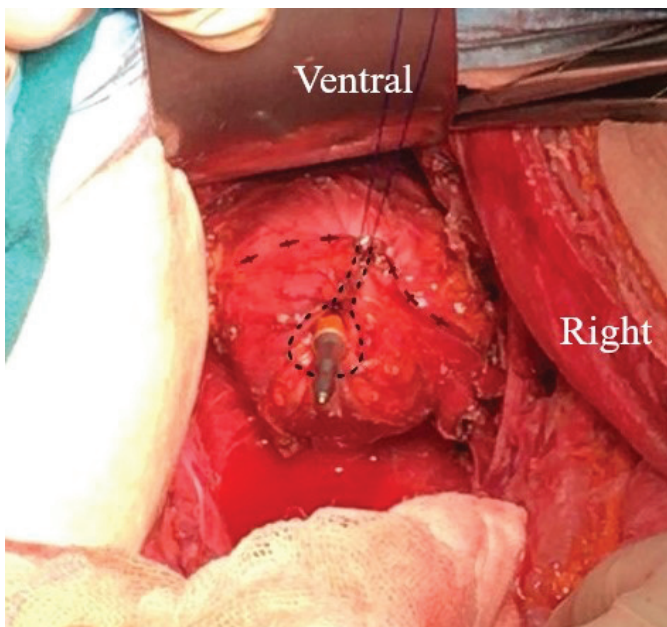


Figure 4. An operation view of the tennis racket shape. The dotted line marked the staple line, and the dashed line marked the rectal wall folding in the handle of the racket

by one suture.⁸ Roumen performed a similar technique by two sutures.⁶ Asao used a mattress suture creating an omega form and suggested usage of a second suture if required.⁹ Kang used a simple running suture, and Chen banded the two corners together with a suture around the trocar laparoscopically.^{10,11} Contrary to those authors, Foppa did not use a suture in the technique of “reverse smile”.¹²

In the technique reported in this study, the author suggested forming a bulky cylinder around the anvil shaft to take out the spike of the stapler. The perforation site was just ventral to the centre of the staple line on the rectal stump. A tennis racket shape was formed using the staple line.

In the completed anastomosis, the size of the site of the distal doughnut perforated by the spike is larger, and the remaining rectum is in a truncated cylinder shape instead of a whole cylinder (Figure 6). The oblique surface of this truncated cylinder was anterior or on the right side. The dorsal side of the rectal stump is slightly longer than the ventral side, and thanks to this, the tightness of the dorsal staple line may be lesser. It is shown that the doughnuts are in different sizes and the rectal doughnut including the linear staple line is bean-shaped instead of circular (Figure 7).

This technique was performed in various clinics and periods by only one trained surgeon, and therefore, a comparative series to evaluate the clinical results of this technique could not be provided, and the specific rate of the anastomotic leakage of this technique was not identified yet.

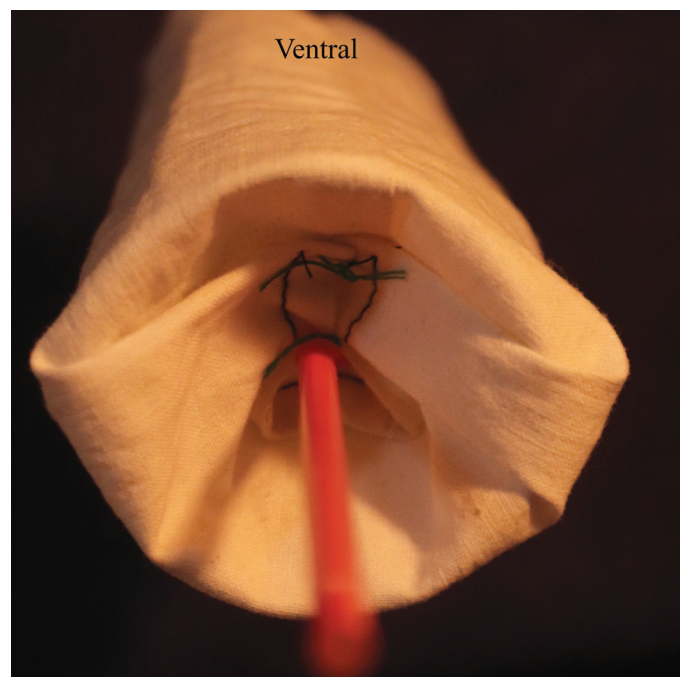


Figure 5. Pulling the tennis racket into the retainer of the stapler in the model. Note that the handle of the racket contains three folds of the wall, and it moves into the deepest part of the retainer

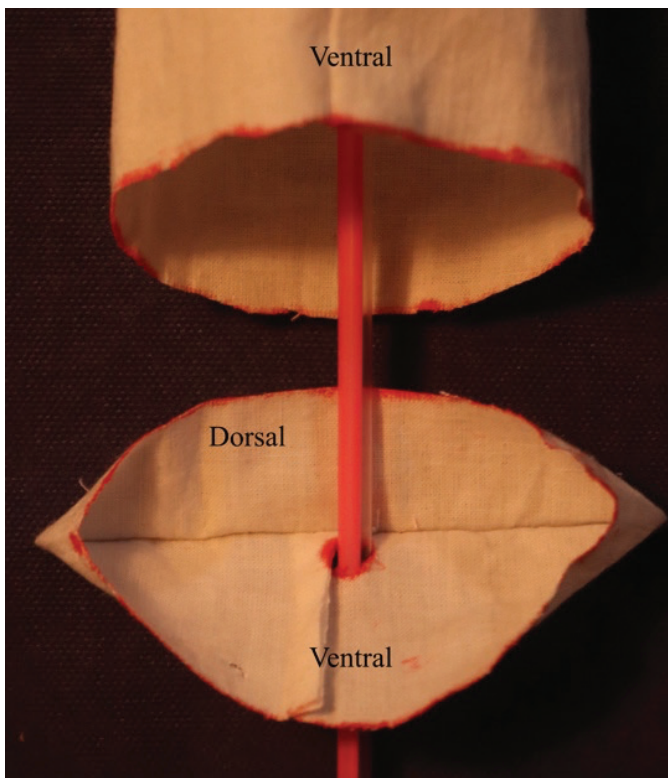


Figure 6. Forming the bean-shaped doughnut and the truncated cylinder in the model

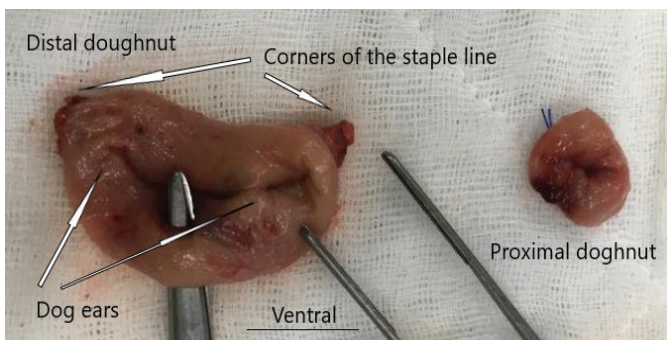


Figure 7. The proximal and distal doughnuts in an operation. Note the differences in diameters and shapes. The proximal doughnut is circular and small. The distal one is bigger and bean-shaped and contains all the linear staple line, including dog ears

This technique may be used in both open and laparoscopic operations in all segments, and it may provide an anastomosis eliminating dog ears even in the wide rectal stumps with long staple lines after anterior resections or sigmoidectomies.

The factor determining the resectable length of the staple line is the volume of the stapler's retainer.

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Ethics

Informed Consent: For this type of study, formal consent is not required.

Peer-review: Internally peer reviewed.

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