Facilitating Intracorporeal Colorectal Anastomoses

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ABSTRACT

Background and Objectives: An experimental study was undertaken to evaluate whether a previously described technique for laparoscopic sigmoid resection with intracorporeal resection-anastomosis and specimen removal via a suprapubic incision could be facilitated and applied to the rectum.

Methods: Ten domestic pigs (median weight 41 kg) underwent low anterior resection of the rectum, which was transected with an articulating endoscopic stapler. Pursestring sutures were fashioned intracorporeally with a laparoscopic pursestring clamp. The anvil of a circular stapler was inserted through a 33 mm port into the colon and pursestring tied intracorporeally. A circular gun with a spike fixed to its shaft was introduced per anum and a double-stapled anastomosis performed.

Results: Complete doughnuts were obtained in all cases and anastomoses were all methylene blue tight. All porcine subjects had an uneventful 5-week postoperative course. The median anastomotic level from the anal verge was 5.2 cm. Histology of colorectal anastomoses revealed healing mucosa.

Conclusions: The use of articulating endoscopic stapler, laparoscopic pursestring clamp, and circular stapler with a spike fixed to its shaft seems to facilitate a previously described intracorporeal approach to sigmoid resection which was safely applied to the rectum in a porcine model.

Key Words: Anastomosis, Colorectal surgery, Laparoscopy, Surgical technique.

INTRODUCTION

Intracorporeal colorectal anastomosing techniques have been the topic of considerable experimental research since the original description by Jacobs et al. Nevertheless, completely laparoscopic colorectal procedures have been adopted in clinical practice by a limited number of surgeons. This is possibly due to increased operating time and costs, to the fact that their relative benefit is as yet unclear, and that these procedures are technically demanding. The latter reason prompted this experimental study, which was carried out to evaluate whether a previously described intracorporeal approach to sigmoid resection could be facilitated and applied to the rectum in a porcine model.

MATERIALS AND METHODS

Ten domestic pigs with a median weight of 40.7 kg (range 38.5-43 kg) were anesthetized with intubation and ventilation with halothane. Prior to surgery, the animals were fasted for 48 hours and kept on fluids ad libitum and received a 2-liter enema. Pneumoperitoneum was induced using carbon dioxide insufflated to a pressure of 10 mm Hg by placement of a trocar in the infraumbilical skin using a cut-down technique. A 0° forward-viewing telescope was employed. Two 12 mm ports were then inserted in the left hypochondrium and in the midline cephalad to the umbilicus. Due to porcine anatomy, a 33 mm cannula (Endopath®, Ethicon Endosurgery, Cincinnati, OH) was inserted in the right iliac fossa rather than suprapubically. All subjects were turned into a steep head-down position in addition to a right lateral tilt until no small bowel was seen in the field.

A surgical technique previously described for laparoscopic sigmoid resection with intracorporeal colorectal anastomosis and specimen removal via a suprapubic incision was modified as follows. Once the proximal site of bowel division was identified, a laparoscopic pursestring clamp (Ethicon Endosurgery, Cincinnati, OH) (Figure 1) was applied to the colon, and two straight needles (placed at opposite ends of a monofilament suture and held in position against the clamp by an endoloop) were passed through the clamp and retrieved through a port, as previously described. The colon was divided with scissors against the pursestring clamp after having been ligated with an intracorporeally knotted suture. The lower third of the
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Figure 1. Laparoscopic pursestring suture clamp.

Figure 2. Circular stapler with spike fixed to its shaft is advanced behind the staple line of the rectal stump.

Figure 3. Circular stapler with spike not fixed to its shaft is disconnected and removed.

rectum was transected with an articulating endoscopic stapler (ETS FLEX 35, Ethicon Endosurgery, Cincinnati, OH). A plastic bag allowed temporary intra-abdominal storage of the specimen. The rectal stump was irrigated by luminal wash-out in order to verify that the linear staple row was tight. The anvil of a circular stapler (ECS 25 Ethicon Endosurgery, Cincinnati, OH) held by a modified Allis-clamp was inserted through the 33 mm port into the colon and the pursestring was tied intracorporeally around the anvil notch. The same circular gun with a spike fixed to its shaft was introduced per anum (Figure 2), and a double-stapled colorectal anastomosis was performed according to a previously-described technique. The integrity of the anastomosis was checked by irrigation with methylene blue after the application of a noncrushing intestinal clamp just proximal to the circular staple line. The anastomotic level from the anal verge was evaluated by intraoperative rigid proctoscopy. The specimen, in a plastic bag, was delivered through the 33 mm port.

RESULTS

The procedure described above was reiterated exactly in the same fashion in ten pigs. No perioperative deaths occurred. Median operating time was 75 mins. (range 50-105 mins.). The linear staple row was water-tight in all cases. Complete proximal and distal doughnuts were obtained in all cases and anastomoses were all methylene blue tight. The mean anastomotic level from the anal verge was 5.2 cm (range 4-6 cm). There were no intraoperative complications. All porcine subjects had an uneventful 5-week postoperative course at the end of which both celioscopy and rigid proctoscopy were carried out. At celioscopy there were no adhesions or other abnormalities at the anastomotic site, while endoscopy revealed normal suture lines. Histology of colorectal anastomoses revealed healing mucosa with neither foreign body reactions nor thickening of bowel wall at anastomotic site.

DISCUSSION

Endoscopic linear staplers allow bowel division at the rectosigmoid junction. Transection of the rectum at a lower level can be achieved inserting an open-surgery articulating stapler through a suprapubic incision. However, this approach requires a third stapler (in addition to endoscopic linear and circular staplers), re-establishing pneumoperitoneum twice, and manipulation of an open-surgery stapling device with laparoscopic graspers. The results of the present experimental study show that the use of a laparoscopic articulating stapling device helps to overcome these downsides and allows secure division of the low rectum. Intracorporeally hand-sewn pursestring sutures are usually fashioned with curved or ski-shaped needles on the proxi-
nal colon,\textsuperscript{15} but this is a time-consuming procedure. The introduction of the T-needle technique (Endo-Stitch\textsuperscript{\textregistered}, USSC, Norwalk, CT) failed to facilitate this procedure.\textsuperscript{9} In fact, since the T-needle should not be detached from the instrument’s jaws (unless for reloading), the anvil shaft must, at a certain point, be loosened from the Allis-clamp to allow 360\textdegree sutiing and tying around the pursestring notch of the anvil.\textsuperscript{9} Data from the present study confirm, in accordance with K"{o}ckerling et al.,\textsuperscript{12} that the use of a laparoscopic pursestring suture clamp seems to facilitate the construction of intracorporeal pursestring sutures and results in a safe colorectal anastomosis.

According to previously described techniques,\textsuperscript{9,14} once the circular stapling gun’s central spike (Auto Suture\textsuperscript{\textregistered}, PCEAT\textsuperscript{\textregistered}, USSC, Norwalk, Connecticut) is advanced behind the staple line of the rectal stump, the spike must be disconnected and removed through a port (Figure 3). The use of a gun adapted for laparoscopy (with a spike fixed to its shaft) (Figure 2) eliminates the need for retrieval of the spike.

CONCLUSIONS

The present study shows that a previously described intracorporeal approach to sigmoid resection\textsuperscript{9} can be facilitated and applied safely to the rectum in a porcine model. However, further experimental and clinical comparative studies are needed with regard to safety, time-frame and costs of the construction of intracorporeal pursestring sutures.

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