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Original Article

Totally Transanal Laparo-Endoscopic Single-Site ProctoColectomy-Ileoanal J-Pouch (TLPC-J): An Experimental Study of a Novel Approach

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Abstract

Background: The natural orifice transluminal endoscopic surgery (NOTES) has become a commonly considered novel approach in the surgical field. The NOTES provide possibility of operation through the natural orifice and decreases the intentional puncture of the systemic organ and subsequent complications. Totally transanal laparo-endoscopic single-site proctoColectomy-Ileoanal J-Pouch (TLPC-J) is a novel method in minimally invasive surgery for total colectomy. The main goal of this study is to perform this new method on an animal model, to assess probable complication and to resolve probable issues by using patients that are candidate for total colectomy.

Method: Five dogs were prepared in lithotomy position. The TLPC-I procedure consists of endorectal technique with full thickness rectal dissection starting 1 cm orally from the dentate line above the peritoneal reflection and the proximal bowel was replaced into the abdominal cavity. Afterwards, the TriPort system was inserted in the anal canal and mesentrial resection of the total colon, mobilization of a distal ileal segment and intracorporeal suture of an ileal J-loop was accomplished by this system. An incision in the J-loop was conducted transanally. The J-pouch was created with an Endo-GIA® and sutured to the rectal wall.

Results: All animals survived and passed stool with clear post operation situation. There was no infection in site of anastomosis.

Conclusion: The TLPC-I provides the possibility of surgery without abdominal wall incision and decreases post operation complication such as pain, abdominal wound infection and wound dehiscence. This technique increases the quality of life and surgeons can discharge the patients early.

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Keywords ● Natural orifice transluminal endoscopic surgery ● Minimally invasive surgical procedures

Introduction

Total colectomy is a common surgical procedure, which is being performed in patients with intractable ulcerative colitis and those who have familial forms of colorectal cancer such as familial adenomatous polyposis. Few disadvantages of total colectomy with ileal J-pouch anastomosis by open surgery or laparoscopic surgery via the abdominal wall include adhesive

small bowel obstruction and adhesion-related infertility in women. The risk of adhesive small bowel obstruction after (sub) total colectomy is 11% within 1 year, increasing to 30% at 10 years.[1] In the past two decades, with the first laparoscopic cholecystectomy in 1987, the field of minimally invasive surgery has seen great growth.[2] Although laparoscopic surgery has been considered as a great revolution in the minimally invasive surgery, in recent years, natural orifice transluminal endoscopic surgery (NOTES), has become a novel minimal invasive approach in surgical field worldwide. Considering that a NOTES procedure could prevent the intentional puncture of the viscera (e.g., stomach, rectum, vagina, urinary bladder) and subsequent wound complications, operation-related pain and scarring, provides a possibility that traditional surgical procedures can be performed through the natural orifices.[3] Therefore, many surgeons and endoscopists have been interested to use this new method in their study.[2,4,5] TLPC-I is a novel method for avoiding abdominal wall incision for total colectomy. Consequently, we decided to introduce this as a new approach that would initially be done on an animal model and to assess its feasibility, patient safety, and possible complications. We trust that this new method may result in a fewer complications than open surgery or laparoscopy via abdominal wall.

Materials and Methods

Our study is a descriptive investigation that was conducted in five dogs (crossbreed), which were prepared from Laparoscopic and Minimal Invasive Surgery Research Center, Shiraz University of Medical Sciences, Shiraz, Iran. The aim was to determine the feasibility of TLPC-I as a new surgical technique, to assess the incidence and type of probable complications as well as evaluating the safety and efficacy of TLPC-I. The rectal preparation was performed by normal saline before the surgery and the prophylactic antibiotic therapy was started for 5 days. The antibiotic regimen, including cefuroxime and metronidazole was administrated intravenously as a standard protocol that is used in our animal research center. The dogs were placed in lithotomy position. The rectal mucosa was pulled out and fixed above the dentate line by stay sutures.

The TLPC instruments consisted of one 5 mm optic, one 5 mm LigaSure device and a 3 mm grasper. The TLPC-I procedure consisted of an endorectal technique with full thickness rectal dissection starting 1 cm orally from the dentate line to above the peritoneal reflection, where the rectal muscle is divided circumferentially.Then, the proximal bowel was replaced into the abdominal cavity and a TriPort system (Olympus Surgical Technologies Europe, Hamburg, Germany) was inserted into the anal canal. In order to provide a pneumopritoneum, the blue elastic ring of the TriPort was unfolded in the peritoneum without CO2 leakage. Mesenterial resection of the total colon, mobilization of a distal ileal segment and intracorporeal suture of an ileal J-loop was accomplished via transanal LESS. Thus, there was the risk of visceral innervation damage during the use of LigaSureTM (Covidien, Mansfield, MA, USA) because the dissection was continued very close to the bowel wall. The bowel perfusion was determined under direct laparoscopic observation during the division of the vessels. The mobilized ileum was reached and pulled down to the site of anastomosis. After the removal of the port, an incision in the J-loop was accomplished transanally. The J-pouch was created with an Endo-GIA® (Covidien, Mansfield, MA, USA) and sutured to the rectal wall. Then the dogs were monitored and their ability to pass stool and complication were reported.

Result

The duration of the surgical procedure was 65 minutes. The dogs were followed at one month after the procedure. All dogs survived and passed stool normally, with clear post operation situation. No surgical site infection was seen at the site of anastomosis.

Discussion

Considering the technical and ethical challenges that may occur in transgastric and transvaginal open surgery and subsequent perforation and closure of the healthy organ,[6] transanal endoscopic surgery approach is a practically favorable alternative to transgastric or transvaginal approaches for intraperitoneal surgery.[7] Left sided laparoscopic hemi colectomy through the natural orifice specimen extraction (NOSE) is conducted in adult patients to avoid a larger abdominal wall incision and the creation of an anastomosis.[8] The open colectomy has been performed for intestinal neuronal dysplasia type B due to its feasibility and low morbidity rate. One complication of sphincteromyectomy and

classic radical correction for Hirschsprung's disease is constipation as a result of misjudgment of the length of affected bowel, leaving a dysganglionic segment in place.[9] In 1995, laparoscopic-assisted transanal Soave pull-through was introduced as a feasible and safe technique for long segment disease or total aganglionosis.[10] For the first time in 1995, laparoscopic-assisted pull-through technique was conducted by using abdominal ports through multiple incisions. The transanal endorectal pull-through (TEPT) was introduced by De La Torre et al. in 1998.[11] Mucosectomy, aganlionic segment colectomy and normoaganlionic colon pull-through was performed by this approach, but long-segment bowel aganglionosis were not resectable by this technique.[12] As described by De La Torre et al., in patients that the transition zone is located in proximal rather than the mid-sigmoid colon, there is a need to mobilize at least descending colon, and in some cases, splenic flexure in order to bring the ganglionic bowel down. For these patients, the TEPT combined with laparoscopic procedure through umbilical incision is needed.[13] The most important indications for total colectomy are basically mucosa-related diseases, including inflammatory bowel diseases or familial cancer syndromes. In cases that rectum is preserved, the mucosectomy was done so that the abnormal mucosa from the retained rectal segment must be removed and this may further increase the associated complications.[1] Although, the transanal approach is proper for many investigations, the main challenges in transluminal surgery are sterile and safe access. Few authors believe that the transluminal surgery is a risky method because of contamination and secondary leakage.[14] Similar to mucosectomy and coloplasty, the colectomy involves retaining part of rectum to preserve continency that could effect on post-surgery quality of life. The colectomy as well as mucosectomy and coloplasty involve the preservation of continency by retained part of the rectum.[15]

Transumbilical single-port colectomy in an experimental model was a one-step in improvement of micro invasive surgery as described by Leroy et al. in 2008.[16] In one study, the transanal trocar procedure was conducted for correction of sigmoid colon in Hirschsprung's disease. Thus, three trocars were inserted transanally in prone position in one case with a transitional zone in the lower sigmoid and described as a feasible approach.[17] The totally transanal LESS pull-through colectomy (TLPC) was described as a first successful management in extraction of long-segment aganglionosis in pediatric patients with Hirschsprung. The TLPC provided a possibility to better visualize the position of the transition zone and gave us the opportunity to continue the transanal pull-through without abdominal wall incision. In addition, this approach can be performed in patients that aganglionic segment is located more proximal than the sigmoid.[12] The pediatric patients with transition zone in the rectum or the sigmoid colon can be treated by a conventional TEPT without a compelling need to proximal mobilization and laparoscopic visualization. The special procedures must be performed in splenic flexure and middle colic vessels when the transition zone is located at splenic flexure or proximal to it (long segment aganglionosis). In order to ensure the preservation of marginal vessels, the safe intra-abdominal visualization is needed.

The TLPC is a challenging method, which has limitations for surgeons compared with the conventional laparoscopic approach. The instruments pass through a single entry point with approximate parallel direction that causes crashing and crossing of instruments and because of the unchangeable camera position, the cranial and posterior aspects of the bowel are difficult to visualize. However, the surgeon could visualize the area around the splenic flexure completely. The length of instruments is 3 mm. There is no problem in pediatric patients with Hirschsprung that aganglionic segment is located in colonic flexure while, the elderly patients may have limitations in this situation.

The TLPC instruments consist of one 5 mm optic, one 5 mm LigaSure device and a 3 mm grasper. Operating such devices by unskilled users could be cumbersome and the surgeons are recommended to gain experience to overcome possible issues during LESS procedure.[12]

The quality of life is considered as an important measure in assessing outcome of interventions. This would allow colonic pouch to be compared with straight anastomosis or coloplasty in order to achieve tangible advantages in functions and quality of life.[15] In TLPC-I, we used the same instruments such as TLPC in addition Endo-GIA® to perform Ileal J-pouch.

More studies are required to assay feasibility of this technique on humans and a long-term follow up for assessment of small bowel adhesions after this procedure.

Conclusion

The TLPC-I technique allows the surgeons to proceed total proctocolectomy and ileoanal J-pouch anastomosis without abdominal incision. The technique provides decreased post operation complication such as pain, abdominal wound infection, and wound dehiscence. It clearly increases quality of life and permits the surgeons for an early discharge of patients after operation.

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Conflict of Interest: None declared.

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