

Laparoscopic permanent sigmoid stoma creation through the extraperitoneal route versus transperitoneal route

A meta-analysis of stoma-related complications

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ABSTRACT

الأهداف: عمل مقارنة بين طريقتي إحداث فغرة في القولون خارج الصفاق بواسطة التنظير من جهة وطريقة إحداث الفغرة في القولون بطريق الصفاق من جهة أخرى من أجل إحداث فغرة دائمة وذلك اعتماداً على قياس معدل حدوث الفتق أو المضاعفات الجراحية الأخرى المرتبطة بهذه العملية الجراحية.

الطريقة: أجري هذا التحليل البعدي في قسم الجراحة العامة، المستشفى الثاني التابع لجامعة سوكو، سوجو، مقاطعة جيانغسو، الصين في عام 2014م. لقد قمنا بالبحث في الأدب العلمي المرتبط بالموضوع وذلك في قاعدة بيانات ميديلاين، وإيمبيس، وكوكرين، وقاعدة البيانات الصينية للطب الحيوي وذلك خلال الفترة من 1990م إلى 2014م. لقد قمنا بهذا البحث باستخدام العناوين والكلمات الطبية التالية: إحداث فغرة في القولون خارج الصفاق، إحداث الفغرة في القولون بطريق الصفاق، إحداث فغرة في القولون خارج الصفاق بواسطة التنظير، سرطان القولون، الاستئصال البطني المعجاني باستخدام التنظير، الفتق، المضاعفات المرتبطة بإحداث فغرة في القولون. وقام مراجعين مستقلين بعملية البحث والتقييم.

النتائج: شمل التحليل دراسة محكمة عشوائية محكمة واحدة، و 6 دراسات استرجاعية. وقد تضمنت 378 مريضاً (209 مريضاً أجريت لهم عملية إحداث فغرة في القولون خارج الصفاق، و 169 مريضاً أجريت لهم عملية إحداث الفغرة في القولون بطريق الصفاق). وقد أشارت نتائج الدراسة بأن نسبة حدوث الفتق بين المرضى الذين أجريت لهم عملية إحداث فغرة في القولون خارج الصفاق قد كانت أقل من المجموعة التي أجريت لهم العملية داخل الصفاق وذلك بصورة واضحة من الناحية الإحصائية ($odds\ ratio\ 0.10$); $95\%\ confidence\ interval\ 0.03-0.29$, $p<0.0001$). وبالمقابل لم يكن هناك فرق واضح من الناحية الإحصائية بين المجموعتين فيما يخص المضاعفات المرتبطة بإحداث الفغرة.

الخلاصة: أظهرت الدراسة بأن طريقة إحداث فغرة في القولون خارج الصفاق بواسطة التنظير قد قلل كثيراً من نسبة حدوث الفتق بعد العملية الجراحية. لذلك يمكن اعتماد طريقة التنظير في إحداث الفتق السيني وذلك كخيار أول بعد عملية الاستئصال البطني المعجاني باستخدام التنظير.

Objectives: To compare laparoscopic extraperitoneal colostomy with transperitoneal colostomy for construction of a permanent stoma by measuring the incidence of parastomal hernia, and other postoperative complications related to colostomy.

Methods: The meta-analysis was carried out in the General Surgery Department of the Second Affiliated Hospital of Soochow University, Suzhou, Jiangsu Province, China in 2014. A literature search of Medline, EMBASE, Cochrane database, and the Chinese Biomedical Literature Database (CBM) from the years 1990 to 2014 was performed. The literature searches were carried out using medical subject headings and free-text words: extraperitoneal colostomy, transperitoneal colostomy, laparoscopic extraperitoneal colostomy, rectal cancer, laparoscopic abdominoperineal resection, parastomal hernia, permanent stoma, and colostomy-related complications. Two different reviewers carried out the search and evaluated studies independently.

Results: One randomized controlled trial and 6 retrospective studies were included. A total of 378 patients (209 extraperitoneal colostomy and 169 transperitoneal colostomy) were identified. Our analysis showed that there was a significantly lower rate of parastomal hernia ($odds\ ratio\ 0.10$; $95\%\ confidence\ interval\ 0.03-0.29$, $p<0.0001$) in the extraperitoneal colostomy group. However, the other stoma-related complications were not significantly different between the 2 groups.

Conclusion: Colostomy construction via the extraperitoneal route using a laparoscopic approach can largely reduce the incidence of parastomal hernia. Laparoscopic permanent sigmoid stoma creation through the extraperitoneal route should be the first choice after laparoscopic abdominoperineal resection.

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Although the sphincter-preserving operation is widely used for the treatment of low rectal cancer, approximately 10-20% of patients still need a permanent colostomy after abdominoperineal resection (APR).¹ The stoma relates to the quality of life of patients after APR. The existence of stoma changes the bowel evacuation habits of the patients and puts them under enormous psychological pressure; stoma-related complications make it harder for them. Of all the complications, parastomal hernia is one of the most common troublesome complication in patients with a permanent stoma. The incidence ranges from 4-48.1%.² In open surgery, several techniques have reported to prevent parastomal hernia.³ The extraperitoneal route for stoma construction, which first reported by Goligher⁴ in 1958, has been widely used. Many studies have proved that the extraperitoneal approach for sigmoid colostomy in open surgery presents a lower risk of herniation in comparison with the transperitoneal route. Lian et al⁵ recently revealed a significantly lower rate of parastomal hernia in the extraperitoneal colostomy group in his meta-analysis. Lian's meta-analysis, which compared extraperitoneal colostomy with transperitoneal colostomy, provides guidance for surgeons to choose the route for stoma construction.

With the further development of laparoscopic rectal surgery, a permanent stoma can be constructed using the laparoscopic technique following APR.⁶ Hamada et al⁷ developed a laparoscopic technique to create an end-sigmoid colostomy through the extraperitoneal route and achieved good short-term outcomes. He also compared laparoscopic extraperitoneal colostomy with the transperitoneal colostomy, using the application of CT to follow up, and found that laparoscopic extraperitoneal stoma can reduce the incidence of postoperative parastomal hernia.^{7,8} Akamoto⁹ used a special retractor to make extraperitoneal laparoscopic sigmoid colostomy easier and more feasible.⁹

However, an extraperitoneal colostomy is technically much more difficult in laparoscopic APR than open APR, because the laparoscopic dissection via the extraperitoneal route is a technically demanding procedure.⁸ Because of its difficulty, laparoscopic extraperitoneal colostomy construction is rarely practiced. Although the transperitoneal route for laparoscopic construction of a sigmoid colostomy increases the chance of a parastomal hernia, it still used after laparoscopic APR. The choice of the extraperitoneal or transperitoneal route for permanent stoma is still confusing for many surgeons. Therefore, the aim of this study is to compare these 2 different route in terms of the operation time, and the incidence of stoma-related

complications after laparoscopic APR. This study was designed to address whether an extraperitoneal route for colostomy in laparoscopic APR surgery can reduce the risk of stoma-related complications.

Methods. Search strategy. The meta-analysis was carried out in the General Surgery Department of the Second Affiliated Hospital of Soochow University, Suzhou, Jiangsu Province, China. A literature search of Medline, EMBASE, Cochrane database, and the Chinese Biomedical Literature Database (CBM) for the years 1990 to 2014 was performed. The literature searches were carried out using medical subject headings and free-text words: "extraperitoneal colostomy", "transperitoneal colostomy", "laparoscopic extraperitoneal colostomy", "rectal cancer", "LAPR", "laparoscopic abdominoperineal resection", "parastomal hernia", "PSH", "permanent stoma", and "colostomy-related complications". Two different reviewers carried out the search and evaluated studies independently.

Inclusion criterion. All randomized, and non-randomized controlled clinical trials, which compared extraperitoneal with the transperitoneal route for patients undergoing permanent colostomy using a laparoscopic approach, and which reported the incidence of parastomal hernia or other postoperative complications related to the colostomy were included.

Exclusion criterion. Studies were excluded from the analysis if 1) the out-comes were not clearly reported for the 2 different routes, 2) it was impossible to extract the appropriate data from the published results such as abstracts, comments. Case reports, and conference proceedings were not included in the review. We also excluded studies with small-sized groups (<10 patients), or with no long term follow-up.

Date collection. The search was carried out by 2 investigators independently. All disagreements were resolved through discussion. Publications were included if they compared laparoscopic permanent sigmoid stoma creation through the extraperitoneal route to the transperitoneal route. Non-comparative studies, cases series, and case reports were excluded.

Statistical analysis. We used Review Manager 5.2 (RevMan, The Nordic Cochrane Centre, The Cochrane Collaboration, Copenhagen, Denmark) to conduct the review. The Mantel-Haenszel method was used for the statistical analysis of the operation time, parastomal hernia, and other postoperative complications related to the colostomy. Dichotomous data was analyzed for odds ratio (OR) and 95% effectiveness confidence interval (CI). The results were displayed by forest plot graph. $P \leq 0.05$ was considered statistically significant.

Results. To reduce the chance of small sample events, studies with small-sized groups (<10 patients) were excluded. Many stoma-related complications can still appear several years after the operation; therefore, studies with no long time follow-up were also excluded. Finally, one randomized controlled trial and 6 retrospective studies are included. A total of 386 patients 209 (55.3%) extraperitoneal colostomy, and 169 (44.7%) transperitoneal colostomy) were identified. These studies are detailed in Table 1.

Parastomal hernia. All 7 studies reported a lower rate of parastomal hernia in the extraperitoneal route, including the RCT. In our statistical analysis, among the 378 patients, the extraperitoneal route using a laparoscopic approach had a lower incidence of parastomal hernia when compared with the traditional transperitoneal route. There was a significantly lower rate of parastomal hernia (OR 0.10; 95% CI: 0.03-0.29, $p < 0.0001$) in the extraperitoneal colostomy group (Figure 1).

Other stoma-related complications. Four studies reported on necrosis of the stoma, but the difference

did not reach statistical significance (OR 0.6; 95% CI: 0.17-2.13, $p = 0.43$) (Figure 2). Another 5 studies reported on infection of the stoma, but again this did not reach statistical significance (OR 0.90, 95% CI: 0.29-2.76, $p = 0.85$) (Figure 3).

The operation time. Four studies reported on the operation time, 2 studies focused on the entire operation time, and 2 studies focused on the time for the colostomy construction. Our analysis shows that there is no statistically significant difference regarding the length of the entire operation time (total 34 patients; heterogeneity: $\text{Chi}^2 = 4.84$, $p = 0.36$) (Figure 4). However, the time for colostomy construction via the extraperitoneal route using a laparoscopic approach is longer than the transperitoneal route (total 39 patients; heterogeneity: $\text{Chi}^2 = 0.85$, $p < 0.00001$) (Figure 5).

Discussion. Compared with open surgery, laparoscopic permanent sigmoid stoma creation through the extraperitoneal route has the potential to minimize damage to the abdominal wall, so this route is also worth considering for laparoscopic surgery.⁷ With

Table 1 - Summary of published information from retrospective controlled studies on patients with EPC and patients with TPC.

Reference	Type of study	Patients		Gender (M/F)		Stage (0\1\2\3\4)	
		EPC	TPC	EPC	TPC	EPC	TPC
Hamada et al ⁷ 2012	Retrospective controlled study	22	15	11\11	14\1	0\6\6\8\1	1\2\5\4\3
Leroy et al ² 2012	Retrospective controlled study	12	10	8\4	6\4	2\2\6\2\0	1\4\2\3\0
Gong-Jian & Hei-Ying ¹⁰ 2013	Retrospective controlled study	21	21	9\12	10\11	0\0\1\3\8\0	0\0\1\5\6\0
Yang et al ¹¹ 2010	Retrospective controlled study	78	43	-	-	-	-
Qu et al ¹² 2008	Retrospective controlled study	30	30	18\12	17\13	0\4\1\3\9\0	0\3\1\5\7\0
Xue-Feng et al ¹³ 2013	Retrospective controlled study	28	32	19\9	19\13	0\2\1\5\10\1	0\3\1\2\1\6\1
Heiying et al ¹ 2014	Randomized controlled study	18	18	7\11	9\9	0\4\2\1\2\0	0\4\5\9\0

APR - abdominoperineal resection, EPC - extraperitoneal colostomy after laparoscopic APR surgery, TPC - transperitoneal colostomy after laparoscopic APR surgery, Stage (0\1\2\3\4) - primary tumor depth (T-stage) and regional lymph node status (N-stage) and tumor metastasis status (M-stage) staging of the rectal cancer



Figure 1 - Analysis of controlled studies of EPC versus TPC in patients with rectal cancer. Outcome: parastomal hernia, 95% CI - 95% confidence interval, M-H - Mantel-Haenszel, df - degrees of freedom, OR - odds ratio, EPC - extraperitoneal colostomy after laparoscopic abdominoperineal resection surgery, TPC - transperitoneal colostomy after laparoscopic abdominoperineal resection surgery

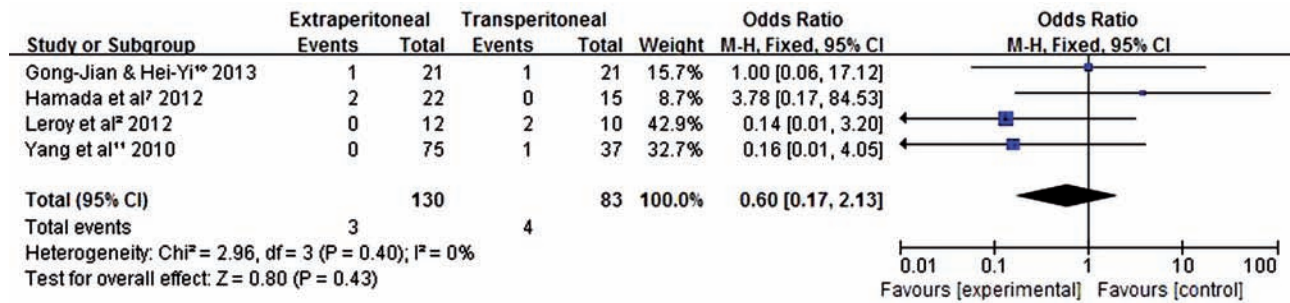


Figure 2 - Analysis of controlled studies of EPC versus TPC in patients with rectal cancer. Outcome: necrosis of the stoma, 95% CI - 95% confidence interval, M-H - Mantel-Haenszel, df - degrees of freedom, OR - odds ratio, EPC - extraperitoneal colostomy after laparoscopic abdominoperineal resection surgery, TPC - transperitoneal colostomy after laparoscopic abdominoperineal resection surgery

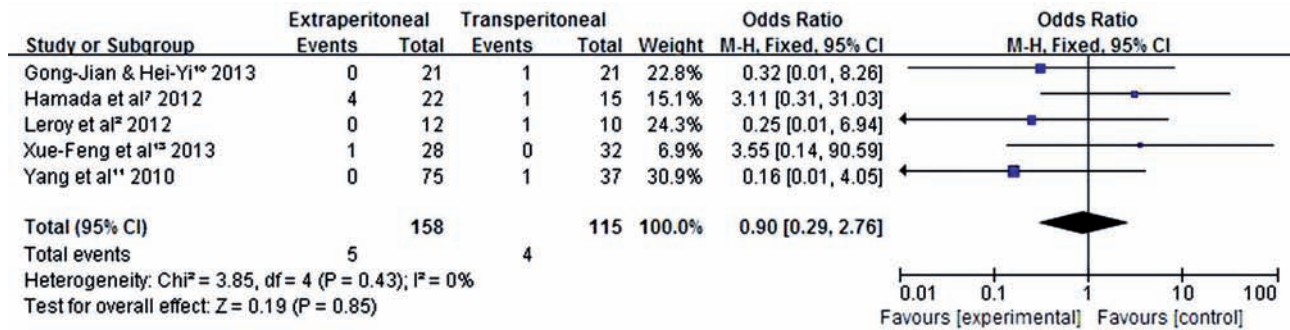


Figure 3 - Analysis of controlled studies of EPC versus TPC in patients with rectal cancer. Outcome: infection of the stoma, 95% CI - 95% confidence interval, M-H - Mantel-Haenszel, df - degrees of freedom, OR - odds ratio, EPC - extraperitoneal colostomy after laparoscopic abdominoperineal resection surgery, TPC - transperitoneal colostomy after laparoscopic abdominoperineal resection surgery

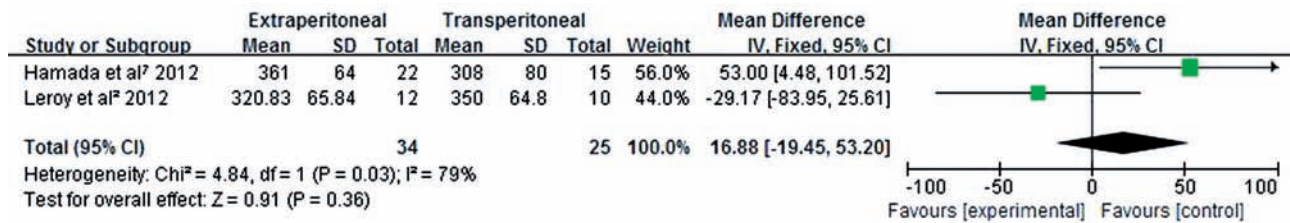


Figure 4 - Analysis of controlled studies of EPC versus TPC in patients with rectal cancer. Outcome: operation time, 95% CI - 95% confidence interval, M-H - Mantel-Haenszel, df - degrees of freedom, OR - odds ratio, EPC - extraperitoneal colostomy after laparoscopic abdominoperineal resection surgery, TPC - transperitoneal colostomy after laparoscopic abdominoperineal resection surgery

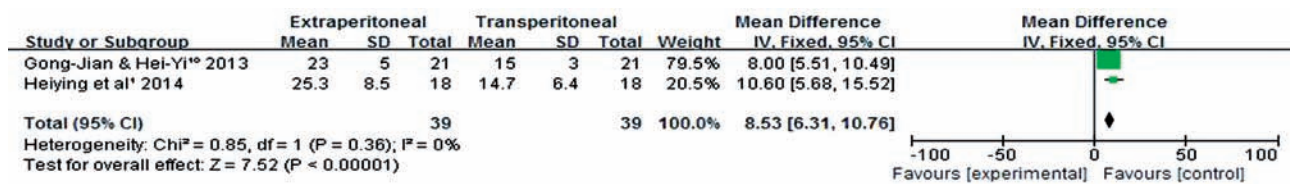


Figure 5 - Analysis of controlled studies of EPC versus TPC in patients with rectal cancer. Outcome: operation time of colostomy construction, 95% CI - 95% confidence interval, M-H - Mantel-Haenszel, df - degrees of freedom, OR - odds ratio, EPC - extraperitoneal colostomy after laparoscopic abdominoperineal resection surgery, TPC - transperitoneal colostomy after laparoscopic abdominoperineal resection surgery

the further development of laparoscopic rectal surgery; permanent stoma creation will be widely used in many cases. This meta-analysis is an assessment of laparoscopic extraperitoneal colostomy with regard to the incidence

of parastomal hernia and other colostomy-related complications.

Our results showed no statistical differences in the whole operation time, the rate of necrosis, or the

occurrence of infection of the stoma. However, the incidence of parastomal hernia was higher using the laparoscopic transperitoneal colostomy compared with the extraperitoneal route (OR 0.10; 95% CI: 0.03-0.29, $p < 0.0001$). The main reason for the occurrence of the parastomal hernia is that the junction between the colon and the abdominal wall is not dense enough.¹⁰ The lateral peritoneum was sutured with the intestinal wall in the transperitoneal route, which will cause a gap between the abdominal cavity and the stoma. What makes it different is that the colon was pulled out through the tunnel of the lateral peritoneum using a laparoscopic approach via the extraperitoneal route, which makes the gap between the abdominal cavity and the stoma disappear compared with open surgery. This may explain the lower incidence of the parastomal hernia after extraperitoneal colostomy. Our analysis showed laparoscopic permanent sigmoid stoma creation through the extraperitoneal route can reduce the incidence of the parastomal hernia.

The time of colostomy construction via the extraperitoneal route using a laparoscopic approach is longer than the transperitoneal route. Compared with the transperitoneal route, extraperitoneal route using a laparoscopic approach required additional procedures. The sigmoid colon is stretched through the extraperitoneal tunnel, and the seromuscular layer of the sigmoid colon is sutured with the side of the peritoneum under laparoscopic. These steps are difficult and time consuming for many young surgeons, and is why the time for colostomy construction via the extraperitoneal route using a laparoscopic approach takes longer than the transperitoneal route.

Regarding other post-operation complications, Hamada et al⁷ reported an 18.2% infection rate in the extraperitoneal route compared with 6.6% in the transperitoneal route, and necrosis of the stoma was 9.1% higher than the transperitoneal route. However, there was no significant difference between the groups.⁷ In our meta-analysis, the chance of infection of the stoma was also not significantly reduced after the extraperitoneal route using a laparoscopic approach, the same as the chance of the necrosis of the stoma.

The main limitation of our study is the small number of RCTs, and we therefore included some retrospective studies in the statistical analysis. A prospective RCT is warranted to further determine the role of the extraperitoneal route in the prevention of stoma-related complications.

In conclusion, colostomy construction via an extraperitoneal route using a laparoscopic approach may take a little more time compared with the

transperitoneal colostomy, but this route can largely reduce the incidence of parastomal hernia without increasing the chances of necrosis or infection of the stoma. With the development of laparoscopic techniques, laparoscopic permanent sigmoid stoma creation through the extraperitoneal route will become the first choice for many surgeons.

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