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

A meta-analysis of stoma-related complications

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ABSTRACT

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, colorectal 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.
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). 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 complications in patients with a permanent stoma. The incidence ranges from 4-48.1%. In open surgery, several techniques have been reported to prevent parastomal hernia. The extraperitoneal route for stoma construction, which first reported by Goligher 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 al 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. Hamada et al 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. Akamoto used a special retractor to make extraperitoneal laparoscopic sigmoid colostomy easier and more feasible.

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. 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 routes 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.** 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 outcomes 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. $P≤0.05$ 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: \( \chi^2 = 4.84, \ p = 0.36 \)) (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: \( \chi^2 = 0.85, \ p < 0.00001 \)) (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

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**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/I/II/III/IV) | Odds Ratio M-H Fixed, 95% CI |
|--------------------|------------------------------------|----------|--------------|-----------------------|-----------------------------|
| Hamada et al. 2012 | Retrospective controlled study     | 22/15    | 11/11        | 14/1                  | 0.6 (0.4-0.8)               |
| Leroy et al. 2012  | Retrospective controlled study     | 12/10    | 8/4          | 6/4                   | 2.2 (1.6-3.2)               |
| Gong & Hei-Ying 2012 | Retrospective controlled study     | 21/21    | 9/12         | 10/11                 | 0.01 (0.01-1.25)            |
| Yang et al. 2010   | Retrospective controlled study     | 78/43    | -            | -                     | -                           |
| Qu et al. 2008     | Retrospective controlled study     | 30/30    | 18/12        | 17/13                 | 0.4 (0.13-1.3)              |
| Xue-Feng et al. 2013 | Retrospective controlled study     | 28/32    | 19/9         | 19/13                 | 0.2 (0.15-1.01)             |
| Heiying et al. 2014 | Randomized controlled study        | 18/18    | 7/11         | 9/9                   | 0.4 (0.12-1.2)              |

APR - abdominoperineal resection, EPC - extraperitoneal colostomy after laparoscopic APR surgery, TPC - transperitoneal colostomy after laparoscopic APR surgery, Stage (0/I/II/III/IV) - 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](image-url) - 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.
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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. 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 al. 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. 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.

References

1. Heijing J, Yonghong D, Xiaofeng W, Hang Y, Kunlan W, Bei Z, et al. A study of laparoscopic extraperitoneal sigmoid colostomy after abdomino-perineal resection for rectal cancer. *Gastroenterol Rep (Oxf)* 2014; 2: 58-62.

2. Leroy J, Diana M, Callari C, Barry B, D’Agostino J, Wu HS, et al. Laparoscopic extraperitoneal colostomy in elective abdomino-perineal resection for cancer: a single surgeon experience. *Colorectal Dis* 2012; 14: e618-e622.

3. Wijeyekoon SP, Gurusamy K, El-Gendy K, Chan CL. Prevention of parastomal herniation with biologic/composite prosthetic mesh: a systematic review and meta-analysis of randomized controlled trials. *J Am Coll Surg* 2010; 211: 637-645.

4. Goligher JC. Extraperitoneal colostomy or ileostomy. *Br J Surg* 1958; 46: 97-103.

5. Lian L, Wu XR, He XS, Zou YF, Wu XJ, Lan P, et al. Extraperitoneal vs. intraperitoneal route for permanent colostomy: a meta-analysis of 1,071 patients. *Int J Colorectal Dis* 2012; 27: 59-64.

6. Hotta T, Yamaue H. Laparoscopic surgery for rectal cancer: review of published literature 2000-2009. *Surg Today* 2011; 41: 1583-1591.

7. Hamada M, Ozaki K, Muraoka G, Kawakita N, Nishioka Y. Permanent end-sigmoid colostomy through the extraperitoneal route prevents parastomal hernia after laparoscopic abdominoperineal resection. *Dis Colon Rectum* 2012; 55: 963-969.

8. Hamada M, Nishioka Y, Nishimura T, Goto M, Furukita Y, Ozaki K, et al. Laparoscopic permanent sigmoid stoma creation through the extraperitoneal route. *Surg Laparosc Endosc Percutan Tech* 2008; 18: 483-485.

9. Akamoto S, Noge S, Uemura J, Maeda N, Ohshima M, Kashiwagi H, et al. Extraperitoneal colostomy in laparoscopic abdominoperineal resection using a laparoscopic retractor. *Surg Today* 2013; 43: 580-582.

10. Gong-Jian D, Hei-Ying J. [The experience in laparoscopic extraperitoneal sigmoidostomy.] *Journal of Clinical and Experimental Medicine* 2013; 12: 1392-1393. Chinese

11. Yang P, Peng X, Deng J. Analysis of stoma-related complications after laparoscopic-assisted Miles operation. *Hainan Medical Journal* 2010; 16: 607.

12. Qu S, Xie G, Ding S. [Application of the extraperitoneal sigmoidostomy in laparoscopic miles operation]. *Journal of Laparoscopic Surgery* 2008; 13: 15. Chinese

13. Xuefeng J, Baolai X, Xiaowiao H, Qing D, Jianping X, Fu T. [Clinical application of extraperitoneal sigmoid colostomy in laparoscopic miles surgery]. *Journal of Clinical Surgery* 2013; 21: 525-526. Chinese