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Transanal tube placement for prevention of anastomotic leakage following low anterior resection for rectal cancer: a systematic review and meta-analysis

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Purpose: Anastomotic leakage following low anterior resection (LAR) for rectal cancer is a serious complication that increases morbidity and mortality rates. Transanal tube placement may reduce postoperative anastomotic leakage rate by reducing intraluminal pressure and preventing fecal extrusion through the staple line. This meta-analysis evaluated the effectiveness of transanal tube placement to prevent anastomotic leakage after LAR for rectal cancer using a stapling technique.
Methods: A systematic review of the literature was consistent with the recommendations of the PRISMA (preferred reporting items for systematic reviews and meta-analyses) statement. Multiple comprehensive databases, including PubMed, Embase, Cochrane Library and KoreaMed, were searched. The main study outcomes were anastomotic leakage.
Results: Two randomized clinical trials and 4 nonrandomized studies involving 1,118 patients were included. Subgroup analyses of randomized clinical trials found that transanal tube placement had no effect on study outcomes. Meta-analysis of nonrandomized studies showed that transanal tube placement was associated with a lower incidence of anastomotic leakage (relative risk, 0.32; 95% CI, 0.15–0.67; I^2 = 0%).
Conclusion: Transanal tube placement may be effective in preventing or reducing the occurrence of anastomotic leakage after LAR for rectal cancer using a stapling technique. Randomized clinical trials with sufficient power are needed to confirm the benefit of transanal tube placement.
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Key Words: Colorectal neoplasm, Colorectal surgery, Anastomotic leak, Transanal tube

INTRODUCTION

Improvements in surgical techniques and perioperative management have increased the use of low anterior resection (LAR) for the treatment of rectal cancer. Although LAR shows good oncologic and functional outcomes, anastomotic leakage following LAR remains a serious complication, increasing patient morbidity and mortality. Anastomotic leakage may prolong hospital stay and have deleterious effects on oncologic outcomes and postoperative quality of life [1-3]. Therefore, prevention of anastomotic leakage is crucial for safe rectal anastomosis. Intraluminal pressure in the anastomotic portion may be associated with anastomotic leakage. Transanal tube placement may reduce postoperative anastomotic leakage rate by reducing intraluminal pressure and preventing fecal extrusion through the staple line. This meta-analysis, which is consistent with the recommendations of the PRISMA (preferred reporting items for systematic reviews and meta-analyses)

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statement [4], was designed to evaluate the effectiveness of transanal tube placement for prevention of anastomotic leakage after LAR using a stapling technique in patients with rectal cancer.

METHODS

Multiple comprehensive databases were searched for studies comparing patients who did and did not undergo transanal tube placement after LAR for rectal cancers. The study protocol was based on Cochrane Review Methods [5].

Data source & literature source

The databases searched were PubMed (January 1, 1976 to October 28, 2014), Embase (January 1, 1985 to October 28, 2014), the Cochrane Central Register of Controlled Trials (January 1, 1987 to October 28, 2014) and KoreaMed (June 1, 1958 to October 28, 2014). There were no restrictions on language or year of publication.

PubMed was searched using the keywords and MeSH terms colorectal neoplasm, colorectal surgery, rectum/surgery, anterior resection, transanal tube, and anastomotic leak in combination with the Boolean operators AND or OR. The same strategy was adopted for searching the other databases. After the initial electronic search, articles were further hand-searched. Articles identified were assessed individually for inclusion.

Study selection

Inclusion of studies was determined independently by two reviewers, G.W.H. and M.R.L., based on the selection criteria. Studies were selected through two levels of screening: first, screening of the titles and abstracts of identified studies; and second, screening of full texts.

Studies were included if they assessed patients with rectal cancer who underwent LAR with the following characteristics: (1) total mesorectal excision (TME), (2) end to end anastomosis using a single or double stapling technique, (3) anastomosis below the peritoneal reflection, and (4) without diverting stoma. Studies were excluded if (1) they used materials other than an ordinary rubber drainage tube that was soft and had a relatively large diameter, such as a Malecot catheter; (2) did not compare patients who did and did not undergo transanal tube placement; and (3) had no extractable data and the authors could not be reached to provide additional information.

Data extraction

The two reviewers independently extracted data from each study using a predefined data extraction form. Any disagreement unresolved by discussion was reviewed by a third reviewer. The following variables were recorded: (1)

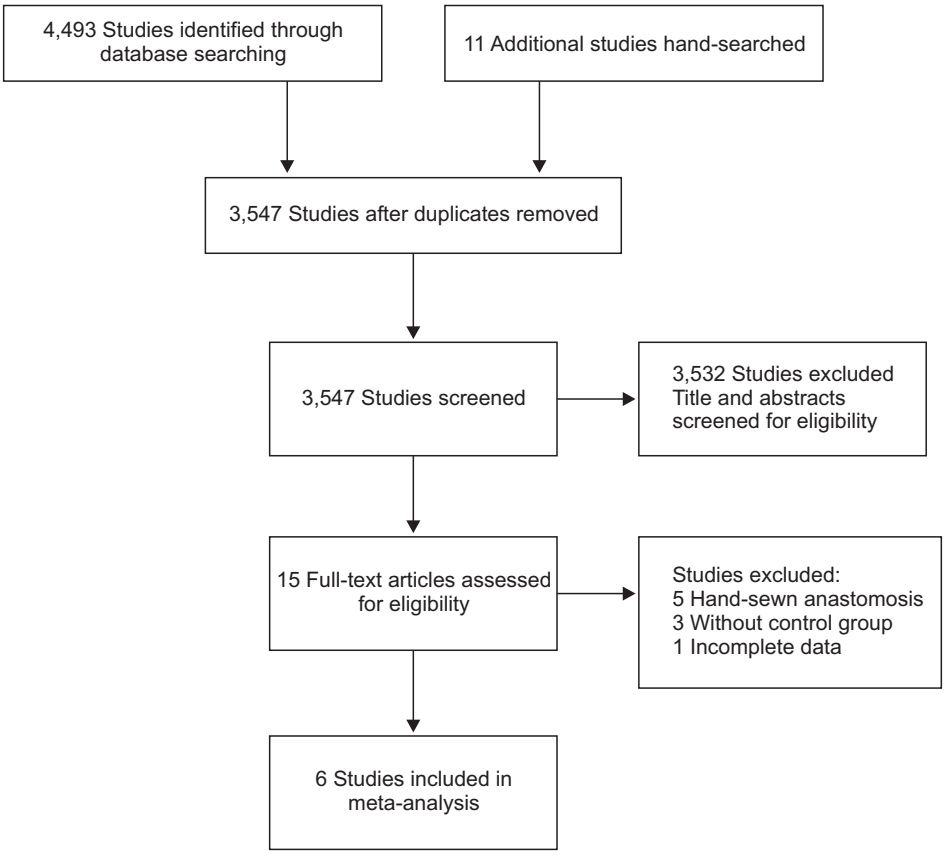

Fig. 1. Flow chart of the literature search according to the PRISMA (preferred reporting items for systematic reviews and meta-analyses) statement.

study information, including name of the first author, year of publication, country, and number of patients in each group; (2) demographic, clinical, and treatment characteristics of the patients; and (3) outcome measures. Outcomes included clinical anastomotic leakage; the occurrence of clinical symptoms such as fever; the discharge of feces, pus or gas from the abdominal drain; and occurrence of peritonitis within 30 days after surgery, leading to a clinical and/or radiological examination or repeat surgery to confirm the leakage. If the above variables were not mentioned in the studies, the data were requested from the study authors via email.

Assessment of methodological quality

Two reviewers (G.W.H. and M.R.L.) independently assessed the methodological quality of the trials. The quality of randomized clinical trials (RCTs) was assessed using the Cochrane Collaboration risk of bias tool [5], and the quality of nonrandomized studies (NRSs) was assessed using the Newcastle-Ottawa quality scale [6]. Any unresolved disagreements between reviewers were resolved through consensus discussions or consultation with a third reviewer.

Publication bias was not assessable in these trials. Tests for funnel plot asymmetry are generally performed only when at least 10 studies are included in the meta-analysis. As this analysis only included 6 studies, tests for asymmetry would be unable to differentiate chance from asymmetry.

Statistical analysis

Dichotomous outcomes were assessed by calculating relative risk (RR) and 95% confidence intervals (CIs). The presence and amount of heterogeneity were assessed with the Q test and I^2 index, with $P < 0.1$ considered statistically significant. I^2 indices of 25%, 50%, and 75% were considered low, moderate, and high, respectively. Planned subgroup analyses were performed for RCTs and NRSs. All data were analyzed using Review Manager software ver. 5.3 (Cochrane Collaboration, Copenhagen, The Nordic Cochrane Centre, Denmark) from the Cochrane Collaboration.

RESULTS

Identification of studies

The initial searches of the databases resulted in 3,547 articles. Of these, 3,532 were excluded because it was clear from their titles and abstracts that they did not fulfil the selection criteria. Full texts of the remaining 15 articles were obtained, with careful scrutiny identifying six potentially relevant studies while excluding the other nine. Therefore, a total of six studies, two RCTs and four NRSs, were included in the review (Fig. 1).

Table 1. Characteristics of the included studies

Study	Year	Design and centres	Sex (M/F)		Age (yr) (mean ± SD)		Study size		Stapling technique	Duration of TAT placement (day)	Follow-up (day)
			TAT	NTAT	TAT	NTAT	TAT	NTAT			
Bulow et al. [8]	2006	RCT, multicentre (11 centres), Denmark	36/18	27/24	69	70	54	51	DST or SST	4	NA
Xiao et al. [18]	2011	RCT, single, China	115/85	121/77	59 ± 11	58 ± 12	188	182	DST	5–7	30
Hidaka et al. [16]	2014	NRS, single, Japan	64/32	65/44	63.4 ± 10.2	64.6 ± 12.3	96	109	DST	7	NA
Jang et al. [19]	2007	NRS, single, South Korea	9/5	NA	59.6	NA	14	90	DST or SST	7	NA
Nishigori et al. [20]	2014	NRS, single, Japan	23/13	88/52	61	63	36	140	DST	5	30
Zhao et al. [7]	2013	NRS, single, China	47/34	43/34	NA	NA	81	77	DST or SST	5–6	NA

SD, standard deviation; TAT, transanal tube placement; NTAT, no tube placement; RCT, randomized clinical trial; DST, double stapling technique; SST, single stapling technique; NA, not available; NRS, nonrandomized study.

Study characteristics and patient populations

The two RCTs and four NRSs included a total of 1,118 patients. The main characteristics of the six studies are summarized in Table 1. All were full length articles, one published in Korean and five in English. All six studies compared patients who did and did not undergo transanal tube placement.

Fig. 2 shows an evaluation of the risk of bias for the included trials. The two RCTs used adequate methods for randomization, employing sealed envelopes for allocation and adequate methods of concealment. In neither of these RCTs were the surgeons or patients blinded to allocation, because of the nature of the interventions being compared. The quality of all four NRSs was level 2 (6–9 stars) on the Newcastle-Ottawa scale.

Outcomes

Outcomes in the RCTs and NRSs were assessed separately. The RCTs involving 475 patients found no differences between groups of patients who did and did not undergo transanal tube placement. In contrast, a meta-analysis of the NRSs involving 643 patients showed that transanal tube placement was

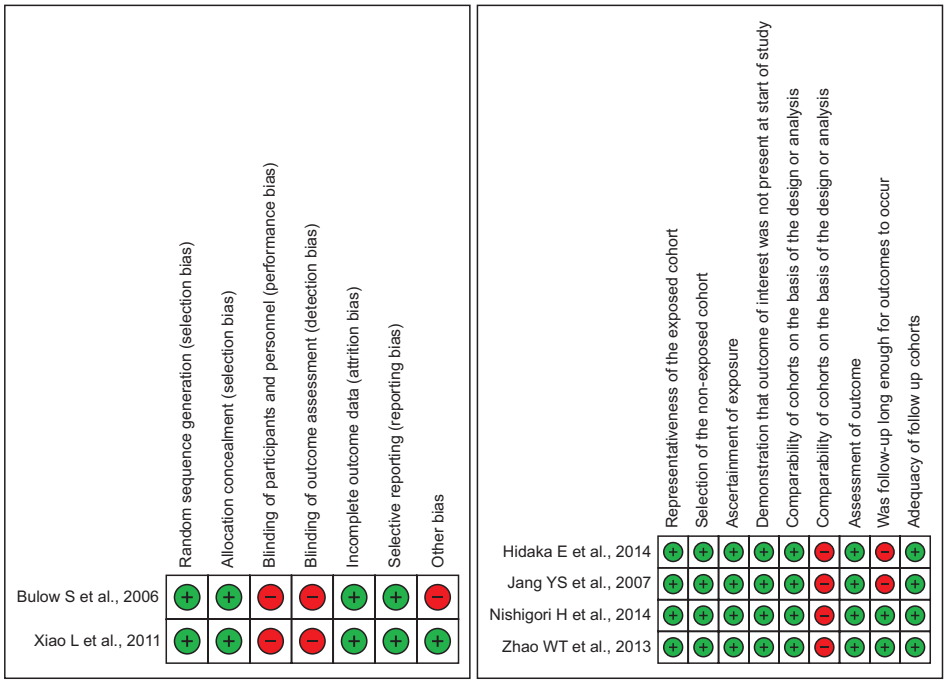

Fig. 2. Assessment of risk of bias in included studies.

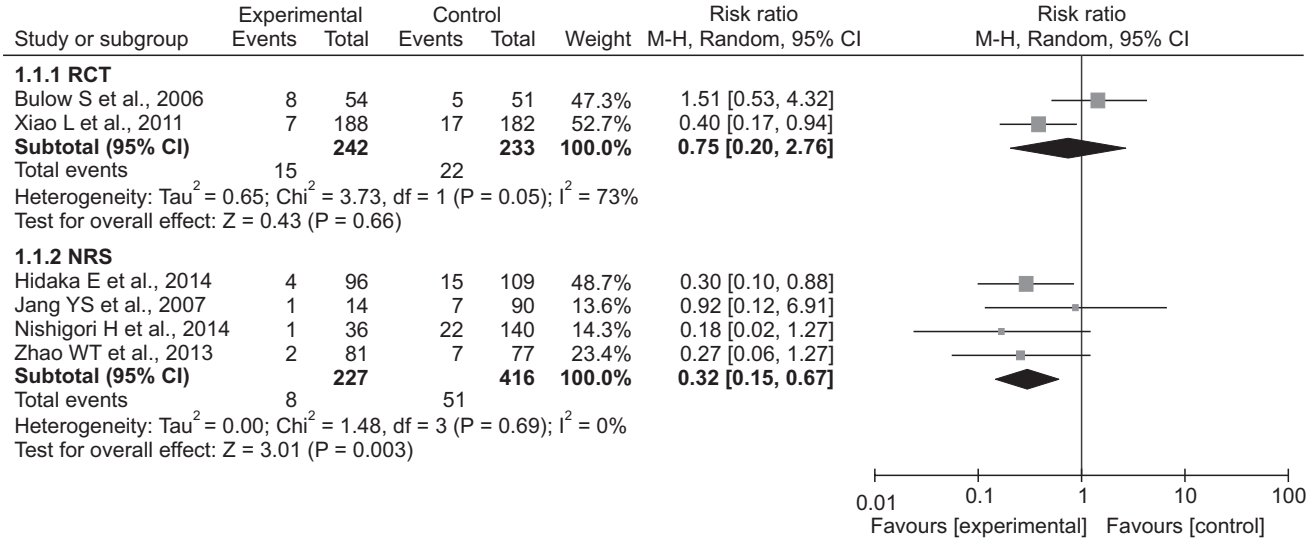

Fig. 3. Forest plot of meta-analysis of anastomotic leakage between transanal tube placement versus no placement groups. M-H, Mantel-Haenszel method; CI, confidence interval; RCT, randomized clinical trial; NRS, nonrandomized study; df, degree of freedom.

associated with a lower rate of anastomotic leakage (RR, 0.32; 95% CI, 0.15–0.67; $I^2 = 0\%$) (Fig. 3).

DISCUSSION

Improvements in perioperative management and surgical techniques such as stapling methods and TME has led to LAR with sphincter preservation becoming the most common surgical method used to treat patients with rectal cancer. Although enhancing oncologic and functional outcomes, anastomotic leakage remains a serious complication. Indicators of anastomotic leakage include the occurrence of clinical symptoms such as fever; discharge of feces, pus or gas from the abdominal drain; and the occurrence of peritonitis within 30 days after surgery. The incidence rate of anastomotic leakage after LAR has been reported to vary from 4% to 12% [7]. Anastomotic leakage increases patient morbidity and mortality rates, prolongs hospital stay, and entails extra costs. Furthermore, leakage has been shown to reduce long-term survival and to increase local tumor recurrence [1-3].

Although transanal tube placement was introduced to overcome the problems associated with anastomotic leakage, the benefits of transanal tube placement remain unclear. In analyzing NRSs, we found that transanal tube placement benefited patients, by reducing the incidence of anastomotic leakage. Analysis of the two RCTs showed no difference in outcomes between patients with and without transanal tube placement. This result can be attributed to one of the RCTs being an underpowered study; because the expected effect size was overestimated, the minimum sample size was underestimated. In addition, the study had been terminated prematurely for ethical reasons and consequently the number of included patients was smaller than planned. Lastly, transanal tube did not remain in situ for the planned days in some patients [8]. This finding suggests the need for additional RCTs involving large enough numbers of patients.

Generally, risk factors for anastomotic leakage following LAR for rectal cancers have been reported to include male gender, preoperative chemoradiation, low anastomosis level, and disturbed microcirculation [9-15]. In addition, a reduction of pressure in the anastomotic portion may prevent anastomotic leakage. During the first few postoperative days, increased intraluminal rectal pressure resulting from a closed anal sphincter may result in fecal extrusion through the staple line, a potential factor in the pathogenesis of anastomotic leakage. Transanal tube placement in these patients may allow passage of flatus on the proximal side of the anastomosis, reducing the endoluminal pressure in the anastomotic portion and potentially reducing the risk of anastomotic leakage [7,8,16-20].

Because most anastomotic leakages occur within 7 days after surgery, early removal of the transanal tube may lead to anastomotic dehiscence. Decompression was reported when measuring rectal resting pressure on postoperative days 3 and 5, with patients with a transanal tube having a lower rectal resting pressure than patients without a tube [18]. Therefore, it is recommended that a transanal tube should be left *in situ* for at least 5 days. Our meta-analysis included studies in which the drainage tube was made of a soft, ordinary rubber and had a relatively large diameter, such as a Malecot catheter. The tube could be adjusted; in five studies, the proximal end of the tube was located above the anastomotic staple line for 5–7 days, whereas, in one RCT, the tube was placed for four days.

Diverting stoma formation has been reported to reduce the incidence of symptomatic anastomotic leakage following LAR [11,21-24]. Diverting stoma formation may reduce the endoluminal pressure and protect the anastomotic site. However, closure of a diverting stoma requires a second hospital stay and additional surgery and is accompanied by patient management costs different from those of transanal tube placement. Therefore, if the two procedures have nearly equal efficacy in the prevention of anastomotic leakage, transanal tube placement is superior to diverting stoma and can be recommended as an alternative technique after anastomosis [16,25,26].

This study had several limitations. First, only two RCTs were included in the meta-analysis, and an underpowered study may have influenced the meta-analysis of the RCT results suggesting the need for confirmation by additional high-quality RCTs. Second, NRSs may have biases; for example, surgeons may avoid transanal tube placement in patients at high risk of anastomotic leakage. Third, the role of transanal tube placement remains unclear in patients with a hand-sewn anastomosis and preoperative chemoradiation.

In conclusion, transanal tube placement may be effective in preventing or reducing the occurrence of anastomotic leakage after LAR for rectal cancer using a stapling technique. RCTs of sufficient power are needed to confirm the benefits of transanal tube placement.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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