Conjoined versus separate technique: a meta-analysis of anastomosis techniques for urinary diversion after bladder cancer

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Abstract

Introduction: This was a meta-analysis of studies on conjoined and separate anastomosis for urinary diversion after radical cystectomy due to bladder cancer. **Methods:** We searched databases (PubMed, Embase and the Cochrane Central Register of Controlled Trials) for studies regarding anastomosis for urinary diversion due to bladder cancer. The meta-analysis was designed to determine the difference between conjoined and separate anastomosis. Six studies including 1601 patients were considered in the meta-analysis (654 in the separate group and 947 in the conjoined group). **Results:** There were no significant differences with respect to age, gender or duration of follow-up. There were seven studies that compared the rate of stricture and the rate of hydronephrosis. For overall stricture, there were 186 of 1163 ureters in the separate group and 64 of 1718 ureters in the conjoined group (odds ratio, 4.53; 95% CI, 2.01-10.22; $P = 0.0003$). For overall hydronephrosis patients, there were 55 of 205 ureters in the separate group and 51 of 254 ureters in the conjoined group (odds ratio, 1.48; 95% CI, 0.95-2.29; $P = 0.08$). **Conclusion:** The separate anastomosis had a higher ratio of strictures than did the conjoined group. The separate anastomosis group experienced hydronephrosis more often than did the conjoined anastomosis group. The separate anastomosis is the better choice for surgery during the operation.

Background

Bladder cancer is a common malignant tumor of the urinary bladder. Radical resection may be invasive or confined to the bladder muscle layer for recurrent bladder cancer[1]. Urinary diversion for radical cystectomy is one of the most complicated operations in urology. It has the characteristics of large trauma, complicated operation, long operation time and many postoperative complications. With the continuous improvement of surgical methods in recent years, it has become the gold standard for invasive bladder cancer. Muscle invasive bladder cancer of T2~4a N0~X M0, high-risk non-muscle invasive bladder cancer(NMIBC), BCG-ineffective carcinoma in situ and recurrent non-muscle invasive bladder cancer all should be underwent radical cystectomy. Urinary diversion after bladder cancer refers to ileal conduit surgery and the ileal orthotopic neobladder technique, among others. There are several ways to perform ureteral anastomosis, including reflux and anti-reflux anastomoses with colonic or intestinal anastomosis. Anastomosis techniques can also be broadly divided into two groups: the separate group and the conjoined group.

The separate anastomosis technique, initially described in the early 1950s, involves anastomosing each ureter to the bowel segment separately[2]. This includes Bricker anastomosis and LeDuc technique. In the conjoined anastomosis technique, both ureters are cut to the same length, then the medial walls are joined and the free edges of the newly conjoined ureters are anastomosed to the proximal end of an open bowel segment[3]. This technique includes the Wallace anastomosis.

The selection of the technique for anastomosis depends on surgeon preference and patient characteristics. There are disadvantages to both techniques. The disadvantage of separate anastomosis

is the higher rate of stricture[4], while the disadvantages of conjoined anastomosis are obstruction and tumor recurrence[5].

We performed a meta-analysis to compare the incidence of hydronephrosis and ureteral stricture between the separate anastomosis and conjoined anastomosis in order to determine the efficacy of the two surgical methods.

Methods

Study design

Systematic review of randomized controlled trials(RCTs) was carried out using the referred reporting items for systematic reviews and meta-analyses(PRISMA) checklist[6].

Identification of Studies

We searched PubMed, Embase and the Cochrane Central Register of Controlled Trials by entering the following in the search algorithm: (anastomosis) AND (bladder cancer) AND (cystectomy) OR (urinary diversion). We set English as the language restriction. We examined the titles and the abstracts, and then we obtained the trials for further examination.

Eligibility criteria

Studies with comparative data between separate and conjoined ureteral anastomosis were eligible for inclusion. The subjects of the studies were sufficient and the two groups were matched with rigorous controls. Randomized and nonrandomized trials and prospective and retrospective trials were all examined. Exclusion criteria included articles not consistent with the review, animal experiments, pathological reports, subjects obviously not consistent with single anastomosis, and absence of comparison.

Quality assessment

The Jadad Scale was used to assess the quality of each RCT[7]. Two authors assessed the selected publications. We assessed the patient allocation method, blinding methods, concealment of allocation procedures, reporting, and other factors according to Cochrane Library recommendations. Then, the studies were qualitatively classified according to the guidelines presented in the *Cochrane Handbook for Systematic Reviews of Interventions (version 5.1.0)*[8]. The study was evaluated and classified based on quality assessment criteria: (A) Satisfying almost all of the quality criteria, and it should be considered to have a low probability of bias; (B) Ambiguous about one or more quality criteria and had a moderate risk of bias; or (C) Barely met the quality criteria, the study was considered to have a high probability of bias. All authors participated in the quality assessment of RCTs retrieved, eventually everyone agree with the results of the assessment. All studies were evaluated using quality categories by assessing the criteria of the quality and grading the risk of bias. Discrepancies were resolved by consensus.

Data extraction and outcomes

We recorded the following information regarding each eligible trial: authors' names, year of publication, study type, length of follow-up, total number of patients, technique of ureteral anastomosis, complication and the number of patients.

Statistical analysis

The meta-analysis was conducted using RevMan v.5.1.0 (Cochrane Collaboration, Oxford, UK)[9]. For anastomosis in each study, we estimated the odds ratio (OR) with its variance and 95% confidence interval (CI). The random effects analysis weighted the natural logarithm of each study's OR by the inverse of its variance plus an estimate of the between-study variance in the presence of between-study heterogeneity. The heterogeneity between ORs for the same outcome between different studies was assessed. This was done through the use of the I² inconsistency test and chi-square-based Cochran's Q statistic test[10]. The *p* value was two-tailed and was considered to be statistically significant when *p*<0.10. The I² inconsistency test was used to evaluate heterogeneity between studies in which I²> 50% indicate high heterogeneity, and I²> 75% indicate higher heterogeneity.

Results

Characteristics of the individual studies

There were six eligible studies containing data comparing separate and conjoined ureteral anastomosis (Table 1). We identified 215 potentially eligible studies, and 165 studies were excluded by not comparing separate and conjoined anastomosis, and 44 articles were excluded due to lack of useful data. The flow chart in Fig. 1 describes the selection process. All studies were published in English. All patients underwent urinary diversion after radical cystectomy for bladder cancer. These were all retrospective trials.

Table 1

Fig. 1

Quality of the individual studies

The six studies were cohort studies. The surgical methods were all compared and patient data were all collected retrospectively. The quality of all identified studies was categorized as A or B, though the final Jadad score for each study was low (Table 2), all studies were included in the analysis.

Table 2

Patient demographics

There were 1587 patients in the stricture group, and there were 2881 ureters in all (Fig. 2). The 1163 separate anastomosis ureters included 186 which developed stricture (16.0%), and 1718 conjoined anastomosis ureters had 64 strictures (3.7%). The overall stricture rate for all ureters in this group was 250 of 2881 ureters (odds ratio, 4.53; 95% CI, 2.01-10.22; $P = 0.0003$).

Fig. 2

There were 363 patients in the hydronephrosis group, and there were 459 ureters in all (Fig. 3). There were 55 ureters which developed hydronephrosis of the 205 separate anastomosis ureters (26.8%), and there were 51 ureters which developed the hydronephrosis of the 254 conjoined anastomosis ureters (16.9%). The overall hydronephrosis rate for all ureters in this group was 106 of 459 (odds ratio, 1.48; 95% CI, 0.95-2.29; $P = 0.08$).

Fig. 3

Publication bias

We performed a qualitative estimation of publication bias of the studies using two funnel plots (Fig. 4,5). Both values of hydronephrosis and stricture lay within the scope of the funnel plots and were evenly distributed on both sides of the central lines, suggesting no evidence of bias.

Fig. 4

Fig. 5

Discussion

There is high malignancy, recurrence and distant metastasis in the invasive bladder cancer. The current standard of treatment is still the radical cystectomy combined with urinary diversion, and its surgical procedure is complicated, also there is a high incidence of postoperative complications[16]. The anastomosis of the ureteral stump and free ileal intestinal fistula is the key technical points of the operation, which directly determines the incidence of the ureter stricture and the postoperative hydronephrosis.

Through our meta-analysis, we found that the rates of stricture and hydronephrosis in the separate group were higher than those of the conjoined anastomosis group. And there was no heterogeneity on the basis of the chi-square-based Cochran's Q statistic test[10], in which $p < 0.1$. Stricture is a serious postoperative problem, and the conjoined anastomosis has a lower incidence than the separate anastomosis. Therefore, it become a common technique to handle ureteroileal anastomotic strictures and hydronephrosis[17, 18]. The separate technique requires a surgical closure technique for the end of the ileum in addition to the ureteroileal anastomosis, while the two ureters are combined and connected to the end of the afferent limb by the end-to-end method in the conjoined anastomosis, therefore, there is low rate of stricture complications in neobladder reconstructions[12].

There was no heterogeneity in the hydronephrosis group according to our meta-analysis, and the overall rate of hydronephrosis was 23.1%. The hydronephrosis rate of conjoined anastomosis is lower than that of the separate anastomosis. The separate anastomosis requires the left ureter to travel to the right through the posterior sigmoid mesenteric approach, thus causing compression of the left ureter; while the left ureter needs to travel to the right and anastomosis with the intestinal fistula, which will lead to excessive ureteral distraction, excessive tension, resulting in ischemic stenosis of the left ureter. Studies have shown that the separate anastomosis can lead to postoperative complications due to changes in the anatomical position of the ureter, and it occurs mostly in the ureteral anastomosis[19].

The separate and conjoined anastomosis procedures are the most common techniques used for urinary diversion after bladder cancer[20]. Both techniques have some limitations. The separate technique has a higher rate of stricture and hydronephrosis, with a possibility of upper urinary tract recurrence[21]. Surgeons choose the anastomosis depending on patient characteristics. The limitations of early studies include the lack of classification of complications of the two anastomosis, and there is little data comparison in the early studies[22].

The incidence of complication of conjoined anastomosis is low, which can lead to recurrence of the upper urinary tract tumor and block both ureters, causing uremia from bilateral obstruction[5]. There are several risk factors for upper urinary tract recurrence, including prostatic urethra involvement, ureteral involvement or positive ureteral margin, and recurrent tumor[23]. Therefore, the conjoined technique is not used for patients with recurrent tumor or carcinoma of the ureters[24].

Surgeons choose different techniques according to different situations. Ureteral length after retrosigmoidal tunneling is a factor influencing the choice of anastomosis technique. The conjoined technique is better when the ureteral length is similar on both sides, while the separate technique is preferred when lengths are disparate.

Admittedly, there were also some limitations to our study. First the number of studies included was small: only six studies compared the two types of anastomosis, and there were few randomized trials, therefore clinical heterogeneity was inevitable. Second, the impact of unpublished research was not considered, therefore, there might be some publication bias or selection bias. Third, there are other complications after surgery that were not included in our analysis. Meanwhile, the number of patients was low, introducing possible search bias.

Conclusions

The effect of surgical methods on the quality of life after surgery is increasingly a concern of urological surgeons[25]. If we want to reduce the rate of stricture and hydronephrosis, we can choose conjoined anastomosis. Surgeons should choose the technique according to patients' characteristics.

List Of Abbreviations

OR: Odds ratio; RCTs: Randomized controlled trials; NMIBC: non-muscle invasive bladder cancer; CI: Confidence interval; BCG: Bacillus Calmette-Guerin; PRISMA: Preferred reporting items for systematic reviews and meta-analyses.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

All data and materials in this study are included in this published article.

Competing interests

There is no competing interests in any authors.

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Authors' Contributions

LDQ, and WYH collected the studies, analysed statistics and drafted the manuscript. YXC and ZY helped to extract the data. NHT and WXS designed the study and edited the manuscript. LDQ and WYH Contributed equally. All authors have read and approved the manuscript.

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Tables

Table 1

	Anastomosis	Total/ Available	complication	Lesion ureters/ Separate ureters	Lesion ureters/ Conjoined ureters
]	Bricker/ Wallace anastomosis	99/99	stricture	8/106	4/92
]	LeDuc technique/ Wallace	72/71	Hydronephrosis/ stricture	12/64 9/64	7/78 0/78
	Bricker /Wallace anastomosis	186/186	stricture	7/187	0/184
]	Bricker/ Wallace anastomosis	190/160	Hydronephrosis	43/141	43/176
in]	LeDuc technique/ Wallace	953/953	Stricture	158/714	56/1192
]	Bricker/ Wallace anastomosis	136/132	stricture	4/92	6/172

Table 2

Allocation sequence generation	Allocation concealment	Blinding	Calculation of sample size	Statistical analysis	Level of quality	Jadad Score (5- point)
A	B	B	YES	Student's t-test	B	3
A	B	B	YES	Student's t-test	A	4
B	B	B	YES	Student's t-test	A	4
A	A	B	YES	Student's t-test	B	3
B	A	B	YES	Student's t-test	B	3
B	A	B	YES	Student's t-test	A	4

Figures

Figure 1

A flow diagram of the study selection process.

Figure 2

Forest plots showing differences of two techniques. M-H: mantel haenszel, CI: confidence interval

Figure 3

Forest plots showing differences of two techniques. M-H: mantel haenszel, CI: confidence interval

Figure 4

Funnel plot of the stricture complication in our meta-analysis. OR: odds ratio, SE: standard error

Figure 5

Funnel plot of the hydronephrosis complication in our meta-analysis. OR: odds ratio, SE: standard error