# Bladder infusion versus standard catheter removal in urinary retention: a systematic review

SYSTEMATIC REVIEW

**ORIGINAL ARTICLE BY**

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## ABSTRACT

### BACKGROUND

To compare the outcomes of bladder infusion and standard catheter removal in patients with urinary retention.

### METHODS

We searched for the studies through Trip Database, MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL) and Scopus without any language restriction. We checked the references of included studies and manually searched for additional studies which were relevant. Criteria for inclusion in our meta-analysis included participants with urinary retention who were assigned randomly to remove the indwelling catheter by bladder infusion or standard catheter removal and the outcome was the time to discharge.

### RESULTS

We identified four trials that met our inclusion criteria involving a total of 294 participants, who removed indwelling catheter by infusion bladder (132 patients) and standard catheter removal (162 patients). There was a statistically significant shorter time to discharge in the bladder infusion group than in the standard group (mean difference (MD) -5.6 hours; 95% confidence interval (CI), -9.06 to -2.21). In the inpatient's subgroup, there was no statistically significant difference in time to discharge between the bladder infusion group and the standard group (MD -9.06 hours; 95% CI, -19.36 to 1.23). In the dawn TOV subgroup, there was no statistically significant difference time to discharge between the bladder infusion group and the standard group (MD -6.41 hours; 95% CI -20.69 to 7.86). According to the time to decide to TOV, there was a statistically significant shorter time to decision to TOV in the bladder infusion group than the standard group (standard MD -0.69 hours; 95% CI, -1.02 to 0.37).

### CONCLUSION

The bladder infusion method can reduce the time to discharge in the patients with urinary retention compared to the standard method.

## INTRODUCTION

Urinary retention is an inability to empty the bladder completely, which can be acute urinary retention (AUR) or chronic urinary retention (CUR).[1,2] AUR is common in men.[3,4] The incidence of AUR dramatically increases with age, approximately 10 percent of men older than 70 and one-third of men in their 80s will develop AUR.[2] The initial management of AUR is immediate and complete bladder decompression by catheterization.[2,5-7] There are no uniform guidelines for bladder decompression.[8] Most patients will have an initial attempt at urethral catheterization.[8] The indwelling catheter should be inserted as first-line therapy and it was important because that effected to time to discharge, returning to normal voiding and rate of re-catheterization.[9-15] In addition, many techniques had been modified by various authors for shorter hospital stay such as early catheter removal, clamping before removal catheter and bladder infusion.[10,11,16-22] The previous studies have shown that the bladder infusion method before removing the catheter was found to be effective and patients could be discharged earlier once satisfactory voiding was attained.[10] Bladder infusion procedure was attaching an intravenous administration set to irrigating channels of the catheter then infused normal saline 300 to 500 cc until the patient had sensation of fullness and the catheter was then removed.[10]

There have been four randomized controlled trials (RCTs) comparing the bladder infusion method and the standard method regarding the outcomes in the patients with urinary intention published since 1996. Two RCTs in 1996 and 2010 showed that the bladder infusion method gives a significant result about the time to discharge when comparing to the standard method.[10,23] And the study in 1996 recommended applying this method for all patients.[23] One study in 2000 showed the significant difference in the timing of readiness to discharge including the ability to control and pass void in adequate volume but the day of discharge in this study was not statistically significant.[24] One study in 2012 showed no statistically significant relationship between bladder infusion and time to discharge even if it could decrease the time to discharge in practical.[25] It still has a controversy about the advantages of bladder infusion that it can apply in the patients or not that why the systematic review of this knowledge should be concerned.

## METHODS

### SEARCH STRATEGY

We searched for studies through Trip Database, MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL) and Scopus without any language restriction. We used keyword standard catheter removal OR trial of void catheter removal OR "urinary retention AND foley catheter" and the asterisk for the synonyms searching in Trip Database, MEDLINE, Scopus, and CENTRAL. We checked the references of included studies and manually searched for additional studies which were relevant. Three authors have been performed by the individual and independently.

## INCLUSION CRITERIA

### *PARTICIPANTS*

Studies in the participants with urinary retention who were assigned randomly to remove the indwelling catheter.

### *INTERVENTIONS*

Indwelling catheter removal by bladder infusion compared to standard catheter removal.

### *OUTCOMES*

The primary outcome was the time to discharge from the hospital. Secondary outcomes included time to reach a decision to a trial of void (TOV) and adverse events measures according to failure to void within 24 hours and urinary tract infection.

## EXCLUSION CRITERIA

None

## DATA EXTRACTION

Data were extracted and recorded from three authors by individual and independently as the number of participants, interventions, and outcomes. Disagreements resolved by discussion and consensus.

## QUALITY OF REPORTING AND RISK OF BIAS

Three authors evaluated the quality and risk of bias of the included studies with Jadad scale and Cochrane risk of bias tool to assess the quality of selected studies (table 2, figure 2, 3). Moreover, we used the domain based-evaluation following The Cochrane Handbook for Systematic Reviews of Interventions version 5.3.0 (the programme provided by the Cochrane Collaboration). The domain based-evaluation evaluated in random sequence generation (selection bias), allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias) and selective reporting (reporting bias) and others bias. They classified the study into low risk, high risk and unclear risk for each bias tool. Potential publication bias was assessed by using a funnel plot (Figure 4).

## DATA ANALYSIS

To standardize the reporting of our results. The primary outcome and some secondary outcomes, we calculated the mean difference (MD) and standard MD where appropriate with 95% confidence interval (CI) from continuous data in each group for three trials. All analyses were performed with Revman 5.3.0 statistical software using random effect model meta-analyses to assess time to discharge, time to decide to TOV of bladder infusion compared with standard catheter removal in patients with urinary retention and applied indwelling urinary catheter. The secondary outcome, the rate of failure to void within 24 hours, we calculated relative risk (RR) with 95% CI from dichotomous data. The chi-square and $I^2$ statistics were used to evaluate statistical heterogeneity across trials. The statistical test of heterogeneity was significant if $P<0.05$ and heterogeneity was considered high if the $I^2$ statistic was more than 50%. We used a random effect model for the meta-analysis when heterogeneity was of statistical significance.

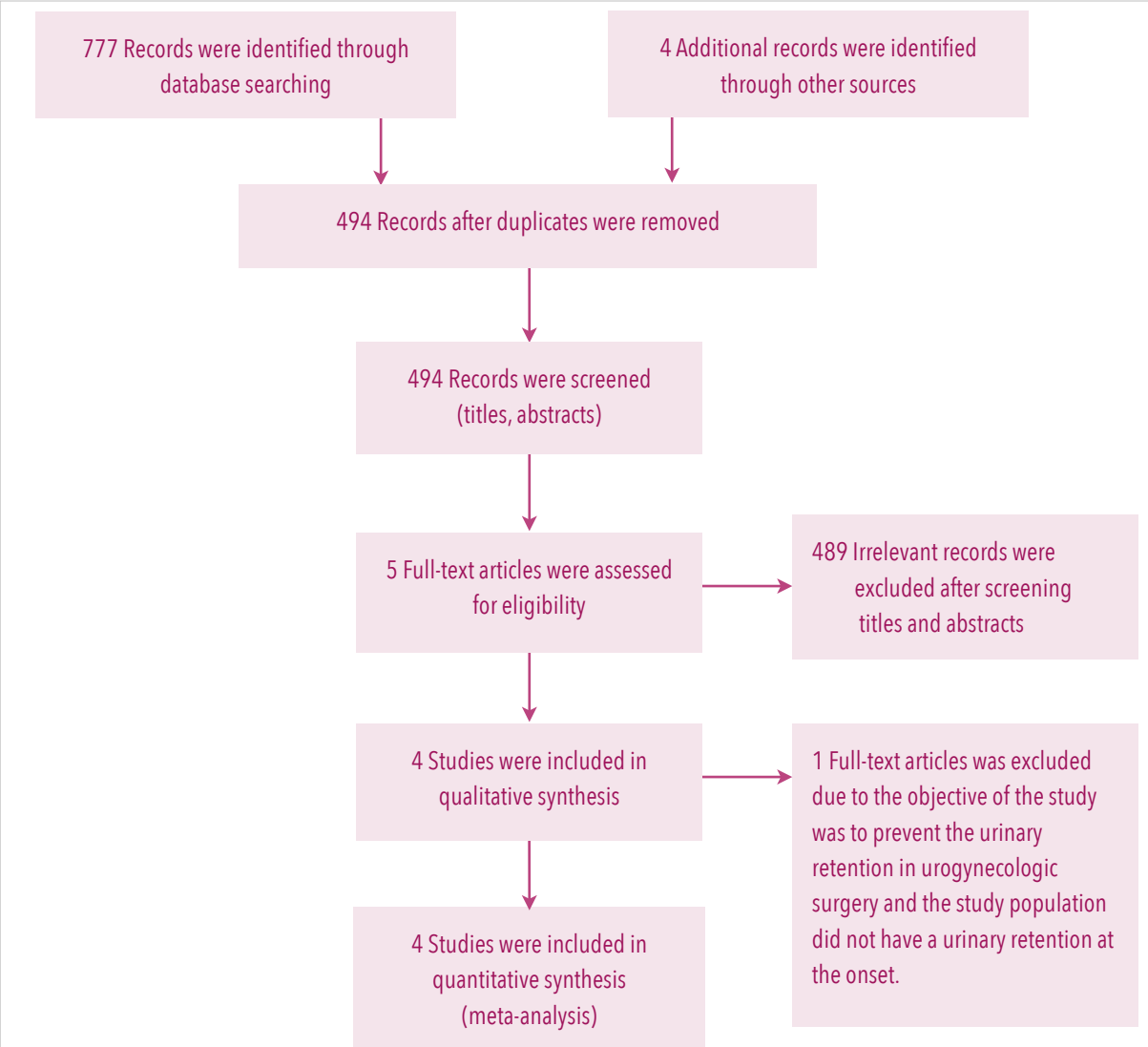


**Figure 1. Process of study selection**

## RESULTS

The literature search retrieved 781 citations (Figure 1). Of these, after duplicates removed 494 citations were identified. All studies were RCTs. After screened the title and abstracts, 489 citations were excluded and then five full-text articles assessed for eligibility according to inclusion and exclusion criteria. Finally, four studies were included. The included studies assigned 294 participants, who were treated by bladder infusion method (n=131) and standard method (n=163).

### STUDY CHARACTERISTICS

Table 1 summarizes the characteristics of the selected RCTs. All trials compared the outcomes between the bladder infusion and the standard method in patients with urinary retention.

**Table 1. Characteristics of studies included**

| Study | Year | Population | Intervention | Control | Outcome |
|---|---|---|---|---|---|
| Lyth | 1996 | 107 consecutive patients with postoperative TURP or BNI. Divided into 3 groups A midnight TOM group (n=39) A dawn TOM group (n=33) Bladder infusion group (n=35) | Fast drip rate of NSS with IV administration set infused to IDC by nursing staff | Standard catheter removal at midnight and dawn | Bladder infusion could reduce in time to decision to TOV and time to discharge but four patients in infusion group failed to void |
| I.D.Wilson | 2000 | 75 consecutive patients undergoing TURP Divided into 2 groups Bladder infusion group (n=37) Standard catheter removal group (n=38) | Nursing staff used IV giving set to infuse NSS into the irrigating channel of IDC | Standard catheter removal at 06.00 hours by nursing staff | No significant in the day of discharge but significant increasing readiness for discharge |
| Mark A.Boccola | 2010 | 60 participants who discharged after failing their operative and came to ED with AUR were recruited Divided into 2 groups Bladder infusion group (n=32) Control group (n=28) | Infusion of warm NSS 300-500 mL into urinary bladder | Standard catheter removal | Significant shortening time to discharge and time to decision to TOV and no significant in failure to void within 24 hours |
| Jason Du | 2012 | 52 participants who underwent TURP, BNI or went the hospital with UR were recruited. Divided into 2 groups Bladder infusion group (n=27) Control group (n=25) | Infusion of NSS to IDC at 06.00 hours | Removing of IDC without infusion at 06.00 hours | No significant in time to discharge but increasing risk of failure to void within 24 hours |

TURP, transurethral resection of prostate; BNI, bladder neck incision; NSS,normal saline solution; IV, intravenous; IDC, indwelling catheter; ED,emergency department

## BIAS RISK ASSESSMENT

Four trials were assessed using the Jadad scale and Cochrane risk of bias tool (Table 2).

## COCHRANE RISK OF BIAS TOOL

Figure 2A and 2B summarised the assessment of the risk of bias for individual trials (domain based-evaluation) using Cochrane Collaboration's tool.

## SEQUENCE GENERATION, ALLOCATION CONCEALMENT AND BLINDING

All were randomized, open-labeled and compared between the bladder infusion method and the standard method with no blinding.[10,23-25] One study did not described randomization.[10] Two studies described inadequately about the allocation concealment.[23,25]

**Table 2. Jadad Scale**

| Questions | Lyth 1996 | I.D.Wilson 2000 | I.D.Wilson 2000 | Jason Du 2012 |
|---|---|---|---|---|
| 1. Was the study described as randomized? | 1 | 1 | 1 | 1 |
| 2. Was the method used to generate the sequence of randomization described and appropriate? | 0 | | 1 | 1 |
| 3. Was the study described as double blind? | 0 | 0 | 0 | 0 |
| 4. Was the method of double blinding described and appropriate? | 0 | 0 | 0 | 0 |
| 5. Was there a description of withdrawals and dropouts? | 1 | 1 | 1 | 1 |
| **Summary** | 2 | 2 | 2 | 3 |

TURP, transurethral resection of prostate; BNI, bladder neck incision; NSS,normal saline solution; IV, intravenous; IDC, indwelling catheter; ED,emergency department

## INCOMPLETE OUTCOME DATA

All studies had no reports according to the incomplete outcome data or drop out of patients .[10,23-25]

## SELECTIVE OUTCOME REPORTING

One of the studies had the selective outcome reporting because it showed the secondary outcome, the catheter-free rate at 4 weeks in the method but it was not reported in the result.[24]

## OTHER POTENTIAL SOURCES OF BIAS

There were not the other potential sources of bias due to the study design that the intervention had to be done by the personnel. According to our funnel plot which constructed from the four trials included in the analysis appeared to be asymmetrical and suggested potential publication bias in this review.

## CLINICAL OUTCOME

For the primary outcome, Figure 3 shows the results of the time to discharge, the primary outcome was MD of timing to discharge from the hospital. The meta-analysis of the three studies, there was a statistically significant shorter time to discharge in the bladder infusion group than in the standard group (MD -3.86 hours; 95% CI, -7.04 to -0.68; heterogeneity: $\chi^2=25.76$, $I^2=92\%$).[10,24,25] Two trials compared the time to discharge in the inpatients subgroup and outpatient subgroup, there was no statistically significant difference in time to discharge between the bladder infusion group and the standard group in the inpatients subgroup (MD -6.89 hours; 95% CI, -19.43 to 5.62; heterogeneity: $\chi^2=25.73$, $I^2=96\%$).[10,25] There was a statistically significant difference in time to discharge between the bladder infusion group and the standard group in the outpatients'

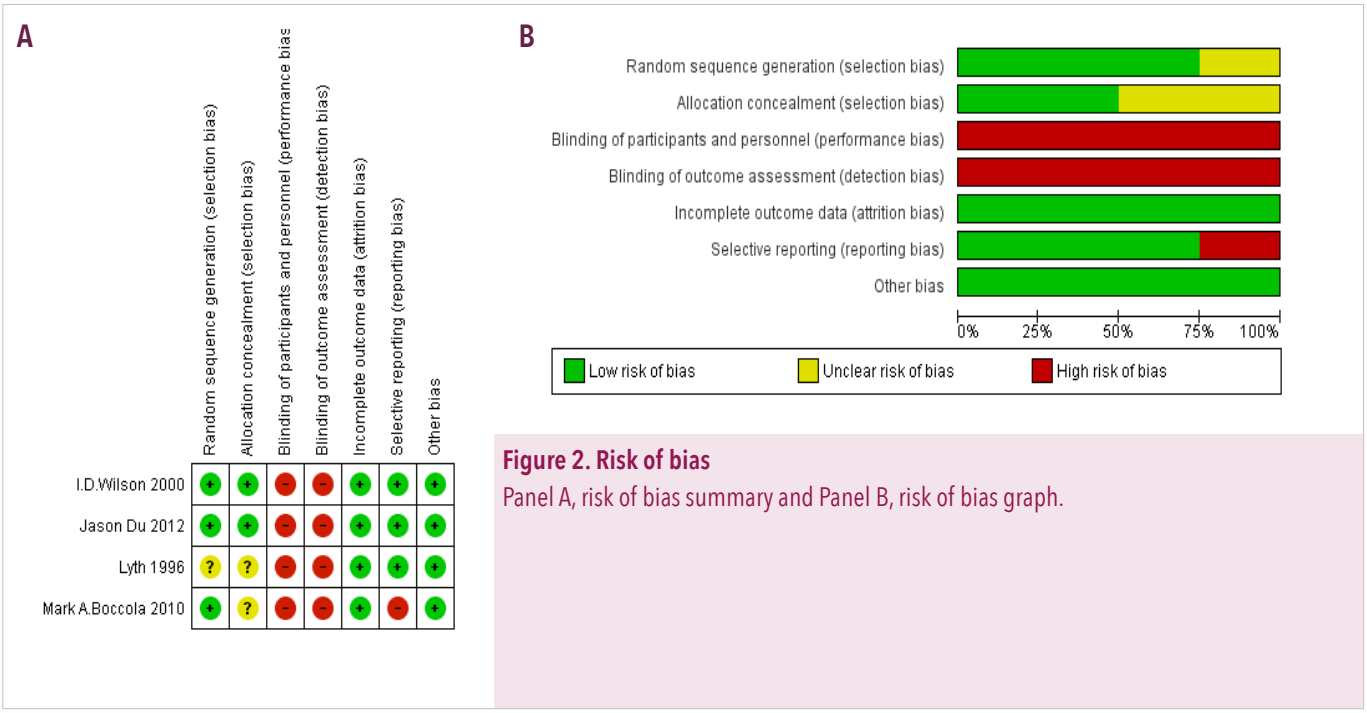


**Figure 2. Risk of bias**
Panel A, risk of bias summary and Panel B, risk of bias graph.

subgroup (MD -1.70 hours; 95% CI, -2.08 to -.132).[24] In the high-quality studies subgroup, there was a significant shorter time to discharge in the bladder infusion group than in the standard group (MD -1.46 hours; 95% CI, -2.30 to -0.62; heterogeneity: $\chi^2$=1.69, $I^2$=41%).[24,25] In the low-quality studies subgroup, there was a statistically significant shorter time to discharge in the bladder infusion group than in the standard group (MD -13.50 hours; 95% CI, -18.23 to -8.77).[10]

For the secondary outcome, Figure 4 shows the results of the time to decide to TOV, there was no statistically significant shorter time to decision to TOV in the bladder infusion group than the standard group (standard MD -1.19 hours; 95% CI, -2.46 to 0.08; heterogeneity: $\chi^2$=11.86, $I^2$=92%).[10,24] Figure 5 shows the results of the rate of failure to void within 24 hours and the urinary tract infection, There was no statistically significant difference in the rate of failure to void within 24 hours between the bladder infusion group and the standard group (RR 0.99; 95% CI, 0.32 to 3.12; heterogeneity: $\chi^2$=6.22, $I^2$=52%).[10,23-25] In the inpatient subgroup, there was no statistically significant difference in the rate of failure to void within 24 hours between the bladder infusion group and the standard group (RR 1.90, 95% CI, 0.61 to 5.87; heterogeneity: $\chi^2$=1.6, $I^2$=0%).[10,23,25] In the outpatient subgroup, there was a statistically significant difference in the rate of failure to void within 24 hours between the bladder infusion group and the standard group (RR 0.44, 95% CI, 0.21 to 0.93).[24] In the low-quality studies subgroup, there was no statistically significant difference in the rate of failure to void within 24 hours between the bladder infusion

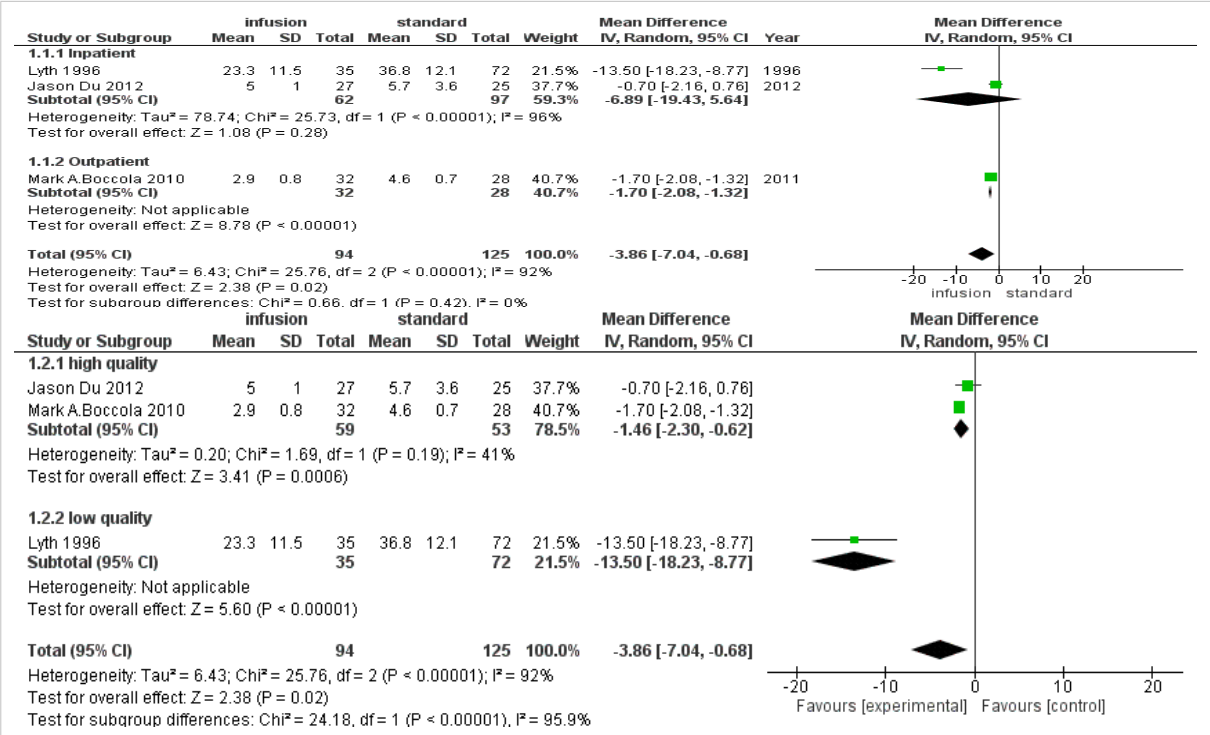


**Figure 3. The forest plot of comparison: The time to discharge between the bladder infusion group and the standard group**

group and the standard group (RR 2.84; 95% CI, 0.69 to 11.66; heterogeneity: $\chi^2$=0.73, $I^2$=0%).[10,23] In the high-quality studies subgroup, there was a statistically significant difference in the rate of failure to void within 24 hours between the bladder infusion group and the standard group (RR 0.49; 95% CI, 0.24 to 0.98; heterogeneity: $\chi^2$=0.53, $I^2$=0%).[24,25] There were no reports of urinary tract infection in all studies.*+

## DISCUSSION

In this systematic review, a meta-analysis indicates that the infusion bladder method might reduce the time to discharge in the patients with urinary retention compared to the standard method. The heterogeneity is 92% that means it had a lot of variations either clinical heterogeneity or statistical heterogeneity such as the patient's conditions, the method to apply interventions, the measurement of outcomes and the assessor. In high-quality subgroup analysis, it indicates that the infusion bladder method might reduce the time to discharge in the patients with urinary retention compared to the standard method and the heterogeneity is 92%. Even if the result from a meta-analysis indicates the advantages of the infusion bladder method but the reliability could

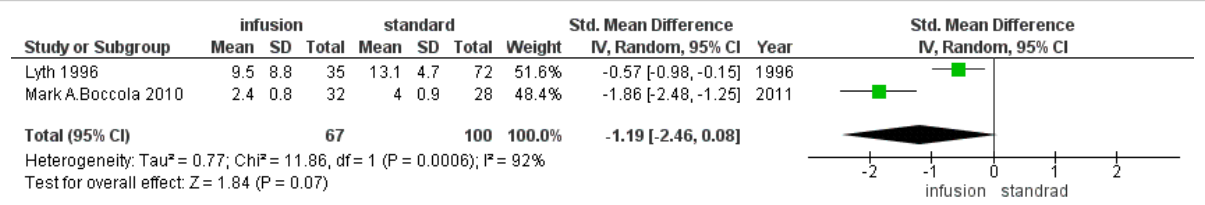


**Figure 4. The forest plot of comparison: The time to decision to TOV between the bladder infusion group and the standard group**

be reduced by the significant statistical heterogeneity between the trials. However, the primary outcome in this systematic review, the time to discharge could give the wrong information and make the statistics changed because almost patients would be discharged in the late afternoon of the first day after removing catheter but they could not come back due to the distance between their house and the hospital.[23] So if it has a further study, the measurement of this outcome should be the time of the first void after removing the catheter.

According to the secondary outcomes in this systematic review, a meta-analysis indicates that the infusion bladder method could not reduce the time to TOV in the patient with urinary retention compared to the standard method. To analyze the time to decide to TOV, the reviewers use the standard MD because of the various ways that two studies assessed the same outcome. One study made the decision according to when the TOV should commence and confirmed by the medical staff.[10] Meanwhile, another study decided and measured by monitoring with two-hourly bladder ultrasonography.[24]

In this systematic review, a meta-analysis indicates that the bladder infusion method might not increase the rate of failure to void in 24 hours compared to the standard method. However, in the high-quality subgroup and the outpatients' subgroup, a meta-analysis indicates that the bladder infusion method increased the rate of failure to void in 24 hours compared to the standard method. The reason for this result could occur from the outpatient with AUR who needed the intermittent indwelling catheter for initial management.[24] The patients in that group relieved symptoms but the underlying disease was still remaining. When the assessors applied the interventions and recorded the adverse events. It would not classify that the adverse events were from the interventions or their own underlying.

## STRENGTH AND LIMITATION OF THE REVIEW

The strength in this systematic review is three authors searched for eligible RCTs by screening all titles and abstracts and reading the full-text articles to assess relevant studies, so we got eligible studies and assured not to miss the important data. The data extraction had been performed by individual reviewers and independently.

The limitation in this systematic review is the risk of bias thoroughly using Jadad scale and Cochrane risk bias tool. Only two studies were high

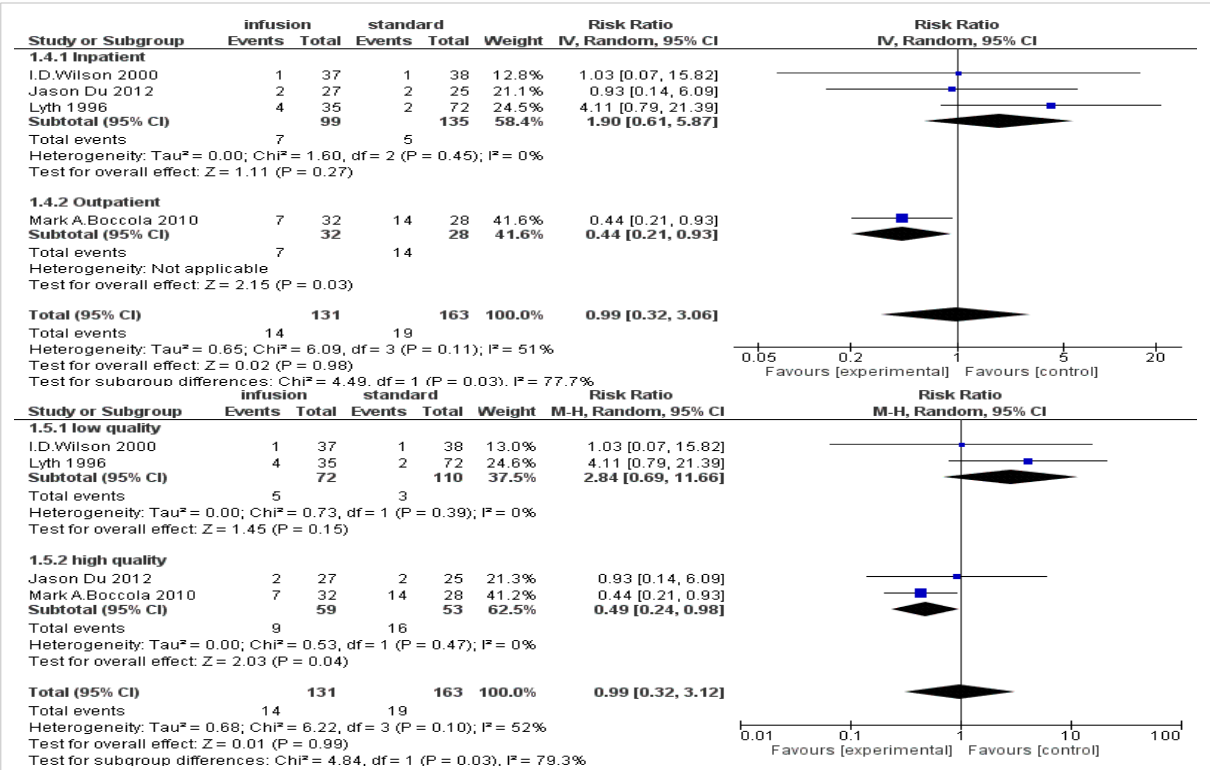


**Figure 5. The forest plot of comparison: the rate of failure to void within 24 hours between the bladder infusion group and the standard group**

methodological quality with a low risk of bias and the blinding method did not apply in all RCTs.[24,25] According to the primary outcome; Time to discharge, It had a lot of factors that affected the result such as the variation of an individual decision of the doctors and the readiness of patients including the distance between a house and a hospital, caregiver and poor financial support.

Each study had different methods to assess the same outcomes such as the assessment of the time to decide to TOV, One study made the decision according to when the TOV should commence and confirmed by the medical staff.[10] Meanwhile, another study decided and measured by monitoring with two-hourly bladder ultrasonography.[24]

## COMPARISON WITH OTHER STUDIES

The primary outcome of this systematic review was the time to discharge that compared between bladder infusion method and standard catheter removal. There was one systematic review in 2007 that studied in the advantage of the bladder infusion method compared to the standard catheter removal in the patients with urinary retention and the primary outcome was the length of hospitalization.[11] The results indicate that the

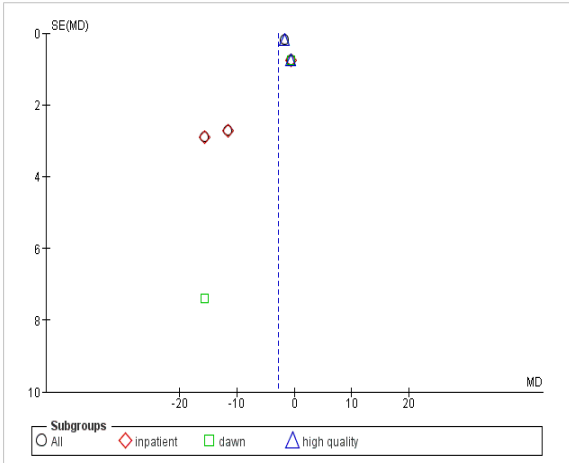


**Figure 6. Funnel plot of overall catheter removal outcomes**

midnight catheter removal method decreased the length of hospitalization of the patients with urinary retention compared to the morning catheter removal method with significant statistical heterogeneity similar to our systematic review.[11] Another outcome was the duration of catheterization, the results indicate that the early catheter removal did not decrease the length of hospitalization of the patients with urinary retention compared to the late catheter removal.[11]

There were two systematic reviews in 2009 and 2015 that reported the successful rate of spontaneous voiding in the patients with urinary retention by taking the alpha-blocker prior to catheter removal compared between the alpha-blocker group and the placebo group.[26,27] Both of the results indicate that taking the alpha-blocker prior to catheter removal increased the success rate of spontaneous voiding compared to the placebo in the patients with urinary retention.[26,27]

## CONCLUSION

A meta-analysis of four RCTs indicates that the bladder infusion method might decrease the time to discharge in the patients with urinary retention compared to the standard method. However, this result should apply to the individual patient due to the various factors including the patient's conditions, the method to apply interventions, the measurement of outcomes and the assessor. Even though this systematic review concluded that there were no the adverse events in the bladder infusion method. For further studies, the RCTs should be performed with the larger number of sample studies and blinding method.

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## REFERENCES


1. Verhamme KMC, Sturkenboom MCJM, Stricker BHC, Bosch R. Drug-induced urinary retention: incidence, management and prevention. Drug Saf. 2008;31(5):373–88.

2. Selius BA, Subedi R. Urinary retention in adults: diagnosis and initial management. Am Fam Physician. 2008 Mar 1;77(5):643–50.

3. Binder Z, Iwata K, Mojica M, Ginsburg HB, Henning J, Strubel N, et al. Acute Urinary Retention Caused by an Ovarian Teratoma-A Unique Pediatric Presentation and Review. J Emerg Med. 2015 Nov; 49(5):e139–42.

4. Jacobsen SJ, Jacobson DJ, Girman CJ, Roberts RO, Rhodes T, Guess HA, et al. Natural history of prostatism: risk factors for acute urinary retention. J Urol. 1997 Aug; 158(2):481–7.

5. Sliwinski A, D'Arcy FT, Sultana R, Lawrentschuk N. Acute urinary retention and the difficult catheterization: current emergency management. Eur J Emerg Med Off J Eur Soc Emerg Med. 2015 Oct 16;

6. Brouwer TA, Rosier PFWM, Moons KGM, Zuithoff NPA, van Roon EN, Kalkman CJ. Postoperative bladder catheterization based on individual bladder capacity: a randomized trial. Anesthesiology. 2015 Jan; 122(1):46–54.

7. Lau H, Lam B. Management of postoperative urinary retention: a randomized trial of in-out versus overnight catheterization. ANZ J Surg. 2004 Aug; 74(8):658–61.

8. Acute urinary retention [Internet]. [cited 2015 Dec 23]. Available from: http://www.uptodate.com/contents/acute-urinary-retention/contributors?utdPopup=true

9. Curtis LA, Dolan TS, Cespedes RD. Acute urinary retention and urinary incontinence. Emerg Med Clin North Am. 2001 Aug;19(3): 591–619.

10. Lyth DR, Braslis K, Iacovou JW. The infusion trial of micturition. Br J Urol. 1997 Jan;79(1):94–5.

11.Griffiths R, Fernandez R. Strategies for the removal of short-term indwelling urethral catheters in adults. Cochrane Database Syst Rev. 2007;(2):CD004011.

12.Alessandri F, Mistrangelo E, Lijoi D, Ferrero S, Ragni N. A prospective, randomized trial comparing immediate versus delayed catheter removal following hysterectomy. Acta Obstet Gynecol Scand. 2006;85(6):716–20.

13. Kidd EA, Stewart F, Kassis NC, Hom E, Omar MI. Urethral (indwelling or intermittent) or suprapubic routes for short-term catheterisation in hospitalised adults. Cochrane Database Syst Rev. 2015 Dec 10;12:CD004203.

14. Skelly JM, Guyatt GH, Kalbfleisch R, Singer J, Winter L. Management of urinary retention after surgical repair of hip fracture. CMAJ Can Med Assoc J J Assoc Medicale Can. 1992 Apr 1;146(7):1185–9.

15. Knight RM, Pellegrini VD. Bladder management after total joint arthroplasty. J Arthroplasty. 1996 Dec;11(8):882–8.

16. Durrani SN, Khan S, Ur Rehman A. Transurethral resection of prostate: early versus delayed removal of catheter. J Ayub Med Coll Abbottabad JAMC. 2014 Mar; 26(1):38–41.

17. Perera ND, Nandasena ACN. Early catheter removal after transurethral resection of the prostate. Ceylon Med J. 2002 Mar;47(1):11–2.

18. Li S-X, Liu C-X. [Early removal of the urethral catheter after transurethral plasma kinetic resection of the prostate in the treatment of BPH]. Zhonghua Nan Ke Xue Natl J Androl. 2014 Mar;20(3):249–52.

19. Liu YS, Wei S, Elliott M. The effects of a catheter clamping protocol on bladder function in neurosurgical patients: a controlled trial. Int J Nurs Pract. 2015 Feb; 21(1):29–36.

20. Fernandez RS, Griffiths RD. Clamping short-term indwelling catheters: a systematic review of the evidence. J Wound Ostomy Cont Nurs Off Publ Wound Ostomy Cont Nurses Soc WOCN. 2005 Oct;32(5): 329–36.

21. Street P, Thompson J, Bailey M. Management of urinary catheters following hip fracture. Australas J Ageing. 2015 Dec; 34(4):241–6.

22. Pavlin DJ, Pavlin EG, Fitzgibbon DR, Koerschgen ME, Plitt TM. Management of bladder function after outpatient surgery. Anesthesiology. 1999 Jul;91(1):42–50.

23. Wilson ID, Bramwell SP, Hollins GW. A randomized trial comparing bladder infusion with standard catheter removal after transurethral resection of the prostate. BJU Int. 2000 Dec;86(9):993–5.

24. Boccola MA, Sharma A, Taylor C, Wong L-M, Travis D, Chan S. The infusion method trial of void vs standard catheter removal in the outpatient setting: a prospective randomized trial. BJU Int. 2011 Apr;107 Suppl 3:43–6.

25. Du J, Marshall D, Leyland J, Shaw L, Broome KE, Mason DFC. Prospective, multicentre, randomized controlled trial of bladder filling prior to trial of void on the timing of discharge. ANZ J Surg. 2013 Apr; 83(4):239–42.

26. Zeif H-J, Subramonian K. Alpha blockers prior to removal of a catheter for acute urinary retention in adult men. Cochrane Database Syst Rev. 2009;(4):CD006744.

27. Yoon PD, Chalasani V, Woo HH. Systematic review and meta-analysis on management of acute urinary retention. Prostate Cancer Prostatic Dis. 2015 Dec; 18(4):297–302.