A systematic review and meta-analysis of the long-term outcomes of ileal conduit and orthotopic neobladder urinary diversion

Eva Browne[1]; Nathan Lawrentschuk[2]; Niall F. Davis[2]
[1]Royal College of Surgeons, Dublin, Ireland; [2]Department of Urology, The Austin Hospital, Victoria, Australia

Cite as: *Can Urol Assoc J* 2020 July 17; Epub ahead of print.
http://dx.doi.org/10.5489/cuaj.6466

Published online July 17, 2020

***

Abstract

Introduction: We aimed to perform a systematic review and meta-analysis on the long-term durability, incidence of complications, and patient satisfaction outcomes in ileal conduit (IC) and orthotopic neobladder (ONB).
Methods: A systematic electronic literature search was performed in Medline, Embase, Cochrane Library, and Scopus using MeSH and free-text search terms "Urinary diversion" AND "Ileal conduit" AND "Neobladder." The search concluded June 19, 2018. Inclusion criteria were those patients who had a cystectomy and required urinary diversion by either IC or neobladder.
Results: In total, 32 publications met the inclusion criteria. Data were available on 46 787 patients (n=36 719 for IC and n=10 068 for ONB). Meta-analyses showed that IC urinary diversions performed less favorably than ONB in terms of re-operation rates, Clavien-Dindo complications, and mortality rates; odds ratios (ORs) and 95% confidence intervals (CIs) were 1.76 (1.24, 2.50) p<0.01, 1.16 (1.09, 1.22) p<0.01, and 6.29 (5.30, 7.48) p<0.01, respectively. IC urinary diversion performed better than ONB in relation to urinary tract infection rates and ureteric stricture rates, OR and 95% CI 0.67 (0.58, 0.77) p<0.01 and 0.70 (0.55, 0.89) p<0.01, respectively.
Conclusions: Our results show that there is no significantly increased morbidity with ONB compared to IC. Selection of either urinary diversion technique should be based on factors such as tumor stage, comorbidities, surgical experience, and patient acceptance of postoperative sequalae.

Introduction

There are many conditions which necessitate removal of the urinary bladder using cystectomy.[1] The most common indication is cancer of the urinary bladder but in some cases cystectomy is indicated to treat benign disease such as interstitial cystitis.[1] Cystectomy therefore requires replacement of the urinary bladder with a procedure known as urinary diversion.[1] Urinary diversion is a form of urinary reconstruction and most commonly involves the use of a gastrointestinal (GI) segment to replace part or all of the function of the urinary bladder.[1] An optimal bladder replacement should be able to hold large intravesical volumes whilst maintaining low pressure values in order to restore normal function and preserve the upper urinary tracts.[1]

Lifelong postoperative complications are common with any type of urinary diversion.[1] These can be divided into three broad groups, (i) Metabolic complications which are due to the intestinal segment's resorptive capacity, (ii) Neuromechanical aspects which affect storage volume and diversion compliance and (iii) Technical-surgical complications which result in post-operative morbidity.[1]

Ileal conduit has long been considered the gold standard for replacement of the urinary bladder. However, orthotopic neobladder has a superior cosmetic appearance and better preservation of body image.[2] The aim of this systematic review and meta-analysis is to perform a robust comparison of ileal conduit and orthotopic neobladder urinary diversion and to provide practitioners with a summary of the global trends for reconstructive preferences in urinary diversion.

Methods

Search strategy

This review was planned and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[3]

A systematic electronic literature search was carried out in Medline, Embase, Cochrane Library and Scopus. Using MeSH and free text terms, the search strategy was: "Urinary diversion" AND "Ileal conduit" AND "Neobladder". Titles and abstracts retrieved by the June 2018 search were screened independently by two authors (EB and ND), following the removal of duplicates. Where there was any uncertainty regarding inclusion, full texts were retrieved and assessed for inclusion. Excluded studies were listed with reasons given for their exclusion. Disagreements regarding the inclusion or exclusion of an article were resolved by discussion.

Eligibility criteria

Inclusion criteria were those patients who have had a cystectomy for any reason and required urinary diversion by either ileal conduit or orthotopic neobladder. Exclusion criteria were review articles, case reports, commentaries, letters, conference abstracts without sufficient outcome data and failure to meet the inclusion criteria.

Data extraction and outcomes

The following data were extracted from each study: author's name, journal of publication, year of publication, country of origin, study type, total number of patients and patient demographics (age, sex, body mass index [BMI]). Information regarding the following outcomes were recorded from each eligible study. The primary outcome measures were quality of life, measures of long-term durability (including re-operation, urinary tract infections (UTI) and ureteric stricture), post-operative morbidity, post-operative mortality and length of stay. Secondary outcome measures were physiological changes including active reflux, mucous, upper tract dilatation/hydronephrosis, renal scarring, metabolic changes, urinary stones, and health economics.

Statistical analysis

Data were presented as a mean±SD for continuous variables. Differences between outcomes measured were considered significant at p<0.05 (Stata). Meta-analysis was performed with Review Manager Version 5.3 software.[4] The Mantel-Haenszel model was used for meta-analysis of dichotomous data and the inverse variance model for meta-analysis of continuous data.[5]

Results

Eligible studies

In total, 2907 articles were identified. Following the removal of duplicates (n=1458), 1449 articles were screened, of which 1417 were excluded as they did not meet the inclusion criteria. In total, 32 articles were included in the qualitative and quantitative analysis; see the PRISMA diagram in Figure 1 for the flow of studies through the review and the reasons for which studies were excluded.

Data were available for 46,787 patients in the studies included in this review (n=36,719 for ileal conduit and n=10,068 for orthotopic neobladders). Study characteristics are summarised in Table 1. In total there were 16 prospective case-control studies,[6-21] one of which was a prospective case-control study with matched-pair analysis[20] and 16 retrospective case-control studies.[2 22-36]

Patient demographics (including patient age, male to female ratio and patient BMI) were reported, if available; these are outlined in Table 2 and Table 3. The mean patient age between the ileal conduit and orthotopic neobladder groups was significantly different, 69.65 ±5.84 in the ileal conduit group versus 61.07 ±4.47 in the orthotopic neobladder group, 95% Confidence Interval (CI) 8.44, 8.71, p <0.01, with patients undergoing ileal conduit urinary diversion being older overall. The mean BMI of the ileal conduit and orthotopic neobladder groups were significantly different; 25.7 ±4.6 in the ileal conduit group versus 23.7 ±3.3 in the orthotopic neobladder group 95% CI 175, 2.25, p<0.01. The sex ratio in both groups was significantly different (11:2 male:female in the ileal conduit group versus 11:1 male:female in the orthotopic neobladder group, p <0.01).

Primary outcomes

Quality of life

Patient satisfaction, general measures of health status and disease specific measures of quality of life were not reported in a standardised manner across the studies. This precludes meaningful statistical analysis. Of the 32 included publications, 5 compared quality of life in patients with either diversion type.[13 18 24 34 35] Using The European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 questionnaire,[37] Navarro *et al* found a better acceptance in orthotopic neobladders versus ileal conduits.[13] The scale used by the authors rates overall quality of life on a 7 point scale, where 1=Very Poor and 7=Excellent.[37] Sogni *et al.* also used the QLQ-C30 questionnaire as well as the bladder cancer-specific module EORTC QLQ-muscle-invasive bladder cancer module 30 (BLM 30)[38] and found that the quality of life reported in both groups was comparable but with a non-significant higher quality of life rating seen in the orthotopic neobladder group.[34] Erber *et al* also used the QLQ-C30 questionnaire and reported overall quality of life as 58±25.3 in the ileal conduit group and 72.3±19.5 in the neobladder group.[24] Sherwani *et al* used a simple satisfaction scale of "Very Good", "Good", "Poor" to compare quality of life between the two groups and reported higher ratings in the orthotopic neobladder group.[18] Finally, Thulin *et al* had patients rate quality of life as "high", "moderate" or "low".[35] Of these, 68% of patients with an orthotopic neobladder reported their quality of life as "high" compared to 53% of ileal conduit recipients.[35]

Measures of long-term durability

The measures of long-term durability included in this review were re-operation rates, UTI rates and ureteric stricture rates. The meta-analysis of these outcomes are detailed in Figure 2.

Of the 32 studies included in this review, 9 examined re-operation rates. The rate of re-operation was significantly greater in patients with an ileal conduit compared to patients undergoing orthotopic neobladder formation [Odds Ratio (OR) 1.76: 95% Confidence Interval (CI) 1.24, 2.50, $p < 0.01$)]; see Figure 2A.

The incidence of UTI rates was reported in 11 studies. The incidence of UTI was significantly less in patients with an ileal conduit versus patients with an orthotopic neobladder [n = 1048/4013, 26.1% versus n = 433/1425, 30.4% respectively, OR 0.67: 95% CI 0.58, 0.77, $p < 0.01$]. This is reported in Figure 2B.

Ureteric stricture rates in both groups were reported in 9 publications. The incidence of the ureteric stricture was statistically less significant in patients undergoing ileal conduit urinary diversion versus patients with orthotopic neobladder, shown in Figure 2C [n = 249/3533, 7.0% versus n = 109/1241, 8.8% respectively, OR 0.70: 95% CI 0.55, 0.89, $p < 0.01$].

Complications

Post-operative morbidity, reported in 21 publications, was described using the Clavien-Dindo classification in 12 publications. [6 7 10 14 15 19-22 26 28 33 39].

The incidence of post-operative morbidity was significantly higher in patients undergoing ileal conduit urinary diversion versus those undergoing orthotopic neobladder urinary diversion as shown in Figure 3A [n = 15659/25264, 61.9% versus n = 5102/8478, 60.1% respectively; OR 1.16 95% CI 1.09, 1.22, $p < 0.01$]. Subgroup analysis of patients who suffered Clavien-Dindo 1-2 (minor) complications showed that patients undergoing ileal conduits were less likely to suffer a minor complication than those undergoing orthotopic neobladder urinary diversion, as shown in Figure 3B, this was not statistically significant [n = 1016/1802 56.4% versus n = 573/1029, 55.7%; OR 0.89 95% CI 0.75, 1.06, p = 0.21]. Subgroup analysis of those who suffered Clavien-Dindo 3-5 (major) complications showed that patients with ileal conduits were significantly more likely to suffer a major complication than those with orthotopic neobladders, as shown in Figure 3C [n = 375/1802, 20.8% versus n = 184/1029, 17.9%; OR 1.25 95% CI 1.02, 1.53, p = 0.03].

Mortality

Post-operative mortality was reported in 21 publications The mortality rate in patients with ileal conduit urinary diversion is significantly higher than that of patients undergoing orthotopic neobladder [n = 3227/33656, 9.6% versus n = 142/8810, 1.6%; OR 6.29 95% CI 5.30, 7.48, $p < 0.01$] as demonstrated in Figure 4.

Length of stay

Seven publications reported length of stay for ileal conduit and orthotopic neobladder groups as a mean ±SD as outlined in Figure 5. Length of stay was shorter in the ileal conduit group compared to the orthotopic neobladder group 17.56±8.61 days versus 19.93±7.85 days with a mean difference of -0.74 [95% CI -1.30, -0.18, $p < 0.01$].
Eleven other publications reported length of stay as median and range and these are outlined in Table 4.

Secondary outcomes

Physiological changes

For the purpose of this review, physiological changes following urinary diversion were defined as: active reflux, upper tract dilation or hydronephrosis, mucous, metabolic changes urinary stones and renal scarring.

The incidence of active reflux was reported in 2 of the 32 included publications. The forest plot in Figure 6A shows that patients undergoing ileal conduit urinary diversion are at lower risk of active reflux than those undergoing orthotopic neobladder, this was not statistically significant [n = 0/147 versus n = 1/81 respectively; OR 0.17 95% CI 0.01, 4.31 p = 0.28].
The incidence of upper tract dilatation/hydronephrosis was reported in 3 of the 32 included publications. Analysis shows that patients with ileal conduit urinary diversion are more likely to have hydronephrosis than those with orthotopic neobladders, shown in Figure 6B [n = 23/568,

4.0% versus n = 9/297, 3.0% respectively, OR 1.56 95% CI 0.67, 3.62, p = 0.30]; again, not statistically significant.

The incidence of mucous production was less in patients with ileal conduit than those with orthotopic neobladder [n = 1/135, 0.7% versus n = 3/99, 3% respectively; OR 0.58 95% CI 0.08, 3.98, p = 0.58]. This was not statistically significant. This is demonstrated in Figure 6C. The incidence of metabolic change is less in patients with an ileal conduit versus orthotopic neobladder, shown in Figure 6D. [n = 26/280 4.5% versus n = 37/330, 11.2% respectively: OR 0.57 95% CI 0.32, 1.03, p = 0.06]. This finding was not statistically significant

The incidence of urinary stones was lower in patients with ileal conduit urinary diversion compared to orthotopic neobladder [n= 167/4719, 3.5% versus n = 85/1319, 6.4% respectively; OR 0.49 95% CI 0.37, 0.64, p < 0.01]. This is shown in Figure 6E. This was statistically significant.

There were no data reported in any of the included studies regarding the incidence of renal scarring in patients with either urinary diversion.

Health economics

None of the studies included in this review examined or made any comment on the economic impact of either ileal conduit or orthotopic neobladder urinary diversion precluding a comparison of cost of intervention or assessment of cost-benefit relationship.

Discussion

This study is a comprehensive review comparing ileal conduit and orthotopic neobladder urinary diversions. The choice of urinary diversion has significant implications for both the patient in terms of their future health and quality of life and for the surgeon and their methods. The choice of which urinary diversion to use also depends on many factors such as surgical skill, urethral disease or patient acceptance.[1] It is therefore imperative that a thorough comparison is made of the outcomes of IC and ONB to provide practitioners with a comprehensive summary of the data to aid surgical and patient decision making.

It demonstrates that there is an overall preference towards ileal conduit urinary diversion and a tendency for this type of diversion to be performed in older patients. It also showed a higher re-operation rate and rate of post-operative morbidity and mortality in those patients who underwent an ileal conduit urinary diversion. Orthotopic neobladder urinary diversions, however, performed worse in terms of UTI, ureteric stricture, urinary stone rates.

In this study, comparison of patient age in the two groups showed that patients IC urinary diversion were significantly older than those patients undergoing ONB diversion. It can be reliably assumed that older patients have greater comorbidities so interpretation of results may be affected by this finding. Younger patients, likely with fewer comorbidities, tend to have a ONB diversion, possibly due to the widely accepted belief that ONB has a greater risk of perioperative complications due to its technical complexity. [2] This is therefore likely to confound data relating to post-operative complication rates in each group. The larger numbers of ileal conduits performed in these studies compared to orthotopic neobladders demonstrates the preference for ileal conduit as the choice of urinary diversion. This is likely to be multifactorial as addressed previously, including patient preference, surgical skill and other patient factors such as age or comorbidity.

From the included publications there was a better acceptance and quality of life in patients with orthotopic neobladder diversions than those with ileal conduit[40]. However it is worth bearing in mind that each type of urinary diversion has inherently different challenges associated with it.[6] According to meta-analysis there is a higher rate of UTI in the orthotopic neobladder group, potentially as orthotopic neobladders often require self-catheterisation which comes with the associated risk of bacterial inoculation.[35] Meta-analysis also demonstrated a significantly higher risk of ureteroileal stricture in patients with an orthotopic neobladder than those with an ileal conduit urinary diversion, possibly due to the use of an anti-reflux mechanism in ureterointestinal anastomosis, however an antireflux mechanism was only used for ONB in two of the publications included in this review. This highlights the importance of forming a low pressure reservoir.[1]
The studies included for analysis in this review focused predominantly on reporting peri-operative data regarding ileal conduit urinary diversion and orthotopic neobladders, revealing a dearth of information on long-term outcomes of these two types of urinary diversion. This may explain the paucity of evidence relating to the long-term complications of urinary diversion.[1] Meta-analysis of those publications which reported post-operative morbidity using Clavien-Dindo shows a significantly higher morbidity in ileal conduit compared to orthotopic neobladder.[6 7 10 14 15 19-22 26 28 33] This is potentially explained by noting that within this systematic review, patients undergoing ileal conduit tended to be older and have higher grade tumours, which may increase the risk of death independent of diversion type. It must also be considered that minor (CD 1-2) complications may be under reported given that many of the publications included in this review were retrospective case controls.[27]

Meta-analysis of mortality rates between ileal conduit and orthotopic neobladder urinary diversion showed a significantly increased risk of death in those patients undergoing ileal conduit diversion compared to patients with orthotopic neobladders. However, patients undergoing ileal conduit tend to be older and have higher grade tumours, which may increase the risk of death independent of diversion type.[2]

Meta-analysis of mean ±SD of length of stay demonstrated a significantly longer length of stay in patients undergoing orthotopic neobladder. Length of stay is sometimes dependent on the practice of individual institutions and thus it cannot be assumed that orthotopic neobladder urinary diversion always results in an increased length of stay but it is still an important consideration when deciding which type of urinary diversion to use.

With the exception of stones (which were significantly more likely in orthotopic neobladder), meta-analysis of the physiological changes considered in this review showed no statistically significant results. Nonetheless, consideration of physiological changes such as hydronephrosis, vesicoureteric reflux, mucous production, metabolic changes and urinary stones is important when deciding between ileal conduit and orthotopic neobladder, particularly in patients with pre-existing conditions.

A cost-benefit comparison is a crucial aspect of assessing any intervention and there seems to be a complete lack of any such analysis in contemporary literature. This is certainly an aspect of urinary diversion which requires further study. In countries where universal or socialised healthcare does not exist, the type of urinary diversion a patient receives may depend on their ability to pay for this type. [41]

The main limitation of this meta-analysis is that the studies included for analysis consist of retrospective or prospective case-control studies. Other limitations include the small sample sizes contained within most publications, limiting the generalisability of the findings of this review and the non-standard reporting of outcomes. Thirdly, some data points were presented as median and range which precluded any analysis regarding these figures. Lastly, there is the potential for significant selection bias in all publications in that those undergoing orthotopic neobladder have lower stage tumours and would therefore have better postoperative outcomes in terms of recovery and mortality rates. [20]

However, this is a very robust analysis involving large numbers of patients with extensive follow up, using standardised questionnaires, and involves data from multiple institutions. This analysis also includes international publications and so is representative of global trends for reconstructive preferences in urinary diversion.

Conclusions
This systematic review and meta-analysis does not support the widely held perception that orthotopic neobladder is associated with increased risk of post-operative morbidity, however the reason for this may be multifactorial. Our findings demonstrated that orthotopic neobladder was associated with a lower rate of major (Clavien-Dindo 3-5) complications than the ileal conduit. However, larger cohort studies are required to reach a definitive conclusion as to which type of diversion is superior. Our results also reinforce that the selection of which type of urinary diversion to perform should be based on careful pre-operative counselling taking into account patient factors such as tumour stage and comorbidities, surgical skill and patient acceptance of the sequalae of either type of urinary diversion.

References

1. Wein AJ, Kavoussi LR, Partin AW, et al. Campbell-Walsh urology. Philadelphia, PA: Elsevier 2016.
2. Gburek BM, Lieber MM, Blute ML. Comparison of Studer ileal neobladder and ileal conduit urinary diversion with respect to perioperative outcome and late complications. *Journal of Urology* 1998;160(3 I):721-23. doi: 10.1016/S0022-5347(01)62767-8
3. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine* 2009;151(4):264-9, w64. [published Online First: 2009/07/23]
4. Review Manager (RevMan) [program]. 5.3 version. Copenhagen: The Nordic Cochrance Centre: The Cochrane Collaboration, 2014.
5. Davis NF, Quinlan MR, Poyet C, et al. Miniaturised percutaneous nephrolithotomy versus flexible ureteropyeloscopy: a systematic review and meta-analysis comparing clinical efficacy and safety profile. *World journal of urology* 2018;36(7):1127-38. doi: 10.1007/s00345-018-2230-x [published Online First: 2018/02/17]
6. Aboumarzouk OM, Drewa T, Olejniczak P, et al. Laparoscopic radical cystectomy: neobladder or ileal conduit, debate still goes on. *Central European journal of urology* 2014;67(1):9-15. doi: 10.5173/ceju.2014.01.art2 [published Online First: 2014/07/02]
7. Angulo JC, Caceres F, Cabrera PM, et al. Two-port laparoscopic radical cystectomy with reusable umbilical system: a feasibility study. *Urology* 2014;84(5):1088-93. doi: 10.1016/j.urology.2014.07.024 [published Online First: 2014/12/03]
8. Belotti S, Antonelli A, Bastiani N, et al. Role of urinary diversion on complication rate after radical cystectomy: Retrospective study on a single-centre cohort of 407 consecutive patients. *Anticancer Research* 2012;32(5):1917-19.
9. Collins JW, Tyritzis S, Nyberg T, et al. Robot-assisted radical cystectomy: description of an evolved approach to radical cystectomy. *European urology* 2013;64(4):654-63. doi: 10.1016/j.eururo.2013.05.020 [published Online First: 2013/06/19]
10. De Nunzio C, Cindolo L, Leonardo C, et al. Analysis of radical cystectomy and urinary diversion complications with the Clavien classification system in an Italian real life cohort. *European journal of surgical oncology : the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology* 2013;39(7):792-8. doi: 10.1016/j.ejso.2013.03.008 [published Online First: 2013/04/09]
11. Hofer M, Bhalani V, Kundu S, et al. Complications of cystectomy and urinary diversions from the national surgical quality improvement program. *Journal of Urology* 2012;187(4):e712. doi: 10.1016/j.juro.2012.02.1780
12. Jung JU, Sohn DW, Cho YH. Alteration in renal function for patients with ileal conduit and ileal orthotopic neobladder. *Korean Journal of Urology* 2006;47(10):1065-68.
13. Navarro M, Tagle R, Montes C, et al. Comparison of clinical factors, surgical complications, functional results and quality of life between four different urinary diversions. *Urology* 2013;82(3):S324.
14. Nazmy M, Wilson T, Yuh B, et al. Complications of robotic assisted radical cystectomy by diversion type. *Journal of Urology* 2013;189(4):e724. doi: 10.1016/j.juro.2013.02.2890
15. Nieuwenhuijzen JA, de Vries RR, Bex A, et al. Urinary diversions after cystectomy: the association of clinical factors, complications and functional results of four different

diversions. *European urology* 2008;53(4):834-42; discussion 42-4. doi: 10.1016/j.eururo.2007.09.008 [published Online First: 2007/10/02]
16. Prcic A, Begic E. Complications After Ileal Urinary Derivations. *Medical archives (Sarajevo, Bosnia and Herzegovina)* 2017;71(5):320-24. doi: 10.5455/medarh.2017.71.320-324 [published Online First: 2017/12/30]
17. Roghmann F, Von Landenberg N, Schmidt J, et al. Evaluation of postoperative complications after radical cystectomy using the comprehensive complication index. *Journal of Urology* 2017;197(4):e722.
18. Sherwani Afak Y, Wazir BS, Hamid A, et al. Comparative study of various forms of urinary diversion after radical cystectomy in muscle invasive carcinoma urinary bladder. *International journal of health sciences* 2009;3(1):3-11. [published Online First: 2009/01/01]
19. Tan WS, Lamb BW, Tan MY, et al. In-depth Critical Analysis of Complications Following Robot-assisted Radical Cystectomy with Intracorporeal Urinary Diversion. *European urology focus* 2017;3(2-3):273-79. doi: 10.1016/j.euf.2016.06.002 [published Online First: 2017/07/30]
20. Antonelli A, Belotti S, Cristinelli L, et al. Comparison of Perioperative Morbidity of Radical Cystectomy With Neobladder Versus Ileal Conduit: A Matched Pair Analysis of 170 Patients. *Clinical genitourinary cancer* 2016;14(3):244-8. doi: 10.1016/j.clgc.2015.07.011 [published Online First: 2015/09/13]
21. Decaestecker K, Vanmarsnille T, Vandamme E, et al. Neobladder versus ileal conduit in Robot-Assisted Radical Cystectomy (RARC): Results from a high-volume academic centre. *European Urology, Supplements* 2016;15(7):227-28.
22. Abe T, Takada N, Shinohara N, et al. Comparison of 90-day complications between ileal conduit and neobladder reconstruction after radical cystectomy: a retrospective multi-institutional study in Japan. *International journal of urology : official journal of the Japanese Urological Association* 2014;21(6):554-9. doi: 10.1111/iju.12357 [published Online First: 2013/12/07]
23. Cho A, Lee SM, Noh JW, et al. Acid-base disorders after orthotopic bladder replacement: Comparison of an ileal neobladder and an ileal conduit. *Renal Failure* 2017;39(1):379-84. doi: 10.1080/0886022X.2017.1287733
24. Erber B, Schrader M, Miller K, et al. Morbidity and Quality of Life in Bladder Cancer Patients following Cystectomy and Urinary Diversion: A Single-Institution Comparison of Ileal Conduit versus Orthotopic Neobladder. *ISRN urology* 2012;2012:342796. doi: 10.5402/2012/342796 [published Online First: 2012/04/24]
25. Gore JL, Gilbert SM, Lai J, et al. Downstream consequences of urinary diversion. *Journal of Urology* 2010;183(4):e21-e22. doi: 10.1016/j.juro.2010.02.097
26. Kim SH, Yu A, Jung JH, et al. Incidence and risk factors of 30-day early and 90-day late morbidity and mortality of radical cystectomy during a 13-year follow-up: a comparative propensity-score matched analysis of complications between neobladder and ileal conduit. *Japanese journal of clinical oncology* 2014;44(7):677-85. doi: 10.1093/jjco/hyu051 [published Online First: 2014/05/06]
27. Mano R, Goldberg H, Stabholz Y, et al. Urinary Tract Infections After Urinary Diversion-Different Occurrence Patterns in Patients With Ileal Conduit and Orthotopic Neobladder. *Urology* 2018 doi: 10.1016/j.urology.2018.03.042 [published Online First: 2018/04/08]

28. Monn MF, Kaimakliotis HZ, Cary KC, et al. Short-term morbidity and mortality of Indiana pouch, ileal conduit, and neobladder urinary diversion following radical cystectomy. *Urologic Oncology: Seminars and Original Investigations* 2014;32(8):1151-57. doi: 10.1016/j.urolonc.2014.04.009
29. Nahar B, Koru-Sengul T, Prakash NS, et al. Comparison of readmission and short-term mortality rates between different types of urinary diversion in patients undergoing radical cystectomy. *Journal of Urology* 2017;197(4):e726.
30. Parekh DJ, Gilbert WB, Koch MO, et al. Continent urinary reconstruction versus ileal conduit: a contemporary single-institution comparison of perioperative morbidity and mortality. *Urology* 2000;55(6):852-5. [published Online First: 2000/06/07]
31. Popov Z, Stavridis A, Lekovski L, et al. Urinary diversion: 30 years experience of a single centre in Republic of Macedonia. *Acta chirurgica Iugoslavica* 2007;54(4):49-55.
32. Roghmann F, Becker A, Trinh QD, et al. Updated assessment of neobladder utilization and morbidity according to urinary diversion after radical cystectomy: A contemporary US-population-based cohort. *Canadian Urological Association journal = Journal de l'Association des urologues du Canada* 2013;7(9-10):E552-60. doi: 10.5489/cuaj.221 [published Online First: 2013/09/27]
33. Roghmann F, Trinh QD, Braun K, et al. Standardized assessment of complications in a contemporary series of European patients undergoing radical cystectomy. *International journal of urology : official journal of the Japanese Urological Association* 2014;21(2):143-9. doi: 10.1111/iju.12232 [published Online First: 2013/08/03]
34. Sogni F, Brausi M, Frea B, et al. Morbidity and Quality of Life in Elderly Patients Receiving Ileal Conduit or Orthotopic Neobladder After Radical Cystectomy for Invasive Bladder Cancer. *Urology* 2008;71(5):919-23. doi: 10.1016/j.urology.2007.11.125
35. Thulin H, Steineck G, Kreicbergs U, et al. Hygiene and urinary tract infections after cystectomy in 452 Swedish survivors of bladder cancer. *BJU international* 2010;105(8):1107-17. doi: 10.1111/j.1464-410X.2009.08909.x [published Online First: 2009/10/30]
36. van Hemelrijck M, Thorstenson A, Smith P, et al. Risk of in-hospital complications after radical cystectomy for urinary bladder carcinoma: population-based follow-up study of 7608 patients. *BJU international* 2013;112(8):1113-20. doi: 10.1111/bju.12239 [published Online First: 2013/08/03]
37. Aaronson NK, Ahmedzai S, Bergman B, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *Journal of the National Cancer Institute* 1993;85(5):365-76. [published Online First: 1993/03/03]
38. Group EQoLS. EORTC QLQ - BLM30 1994.
39. Dindo D, Demartines N, Clavien P-A. Classification of Surgical Complications: A New Proposal With Evaluation in a Cohort of 6336 Patients and Results of a Survey. *Annals of Surgery* 2004;240(2):205-13. doi: 10.1097/01.sla.0000133083.54934.ae
40. Dutta SC, Chang SC, Coffey CS, et al. Health related quality of life assessment after radical cystectomy: comparison of ileal conduit with continent orthotopic neobladder. *The Journal of urology* 2002;168(1):164-7. [published Online First: 2002/06/07]
41. Moeen AM, Safwat AS, Gadelmoula MM, et al. Health related quality of life after urinary diversion. Which technique is better? *Journal of the Egyptian National Cancer*

Institute 2018;30(3):93-97. doi: 10.1016/j.jnci.2018.08.001 [published Online First: 2018/08/27]

Figures and Tables

Fig 1.

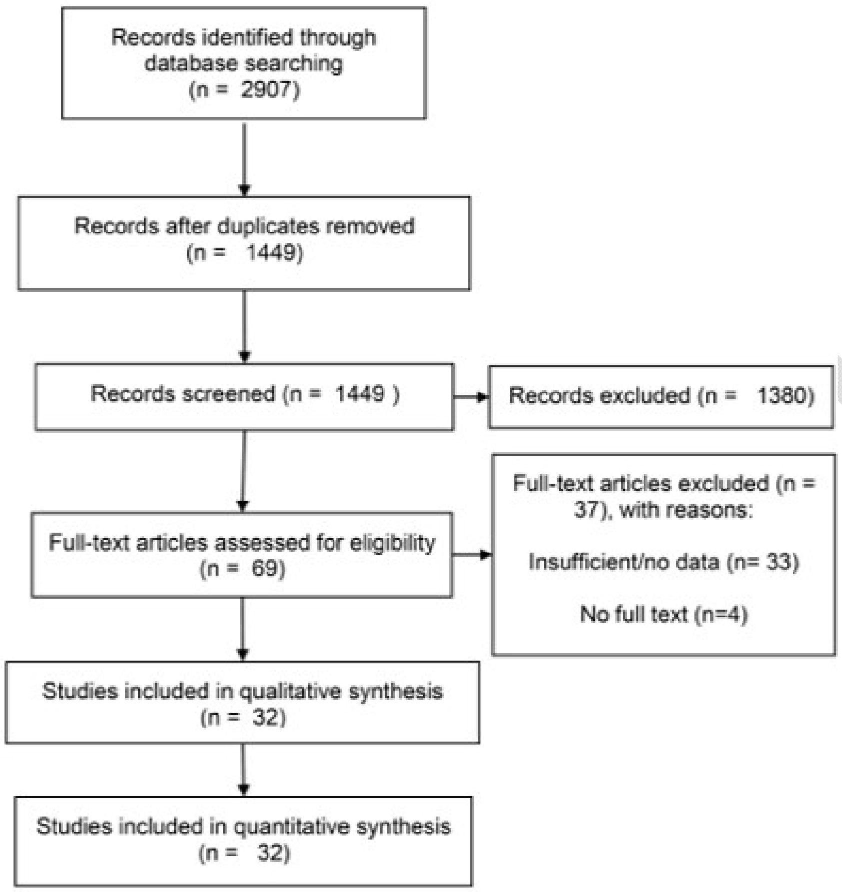


Fig 2.

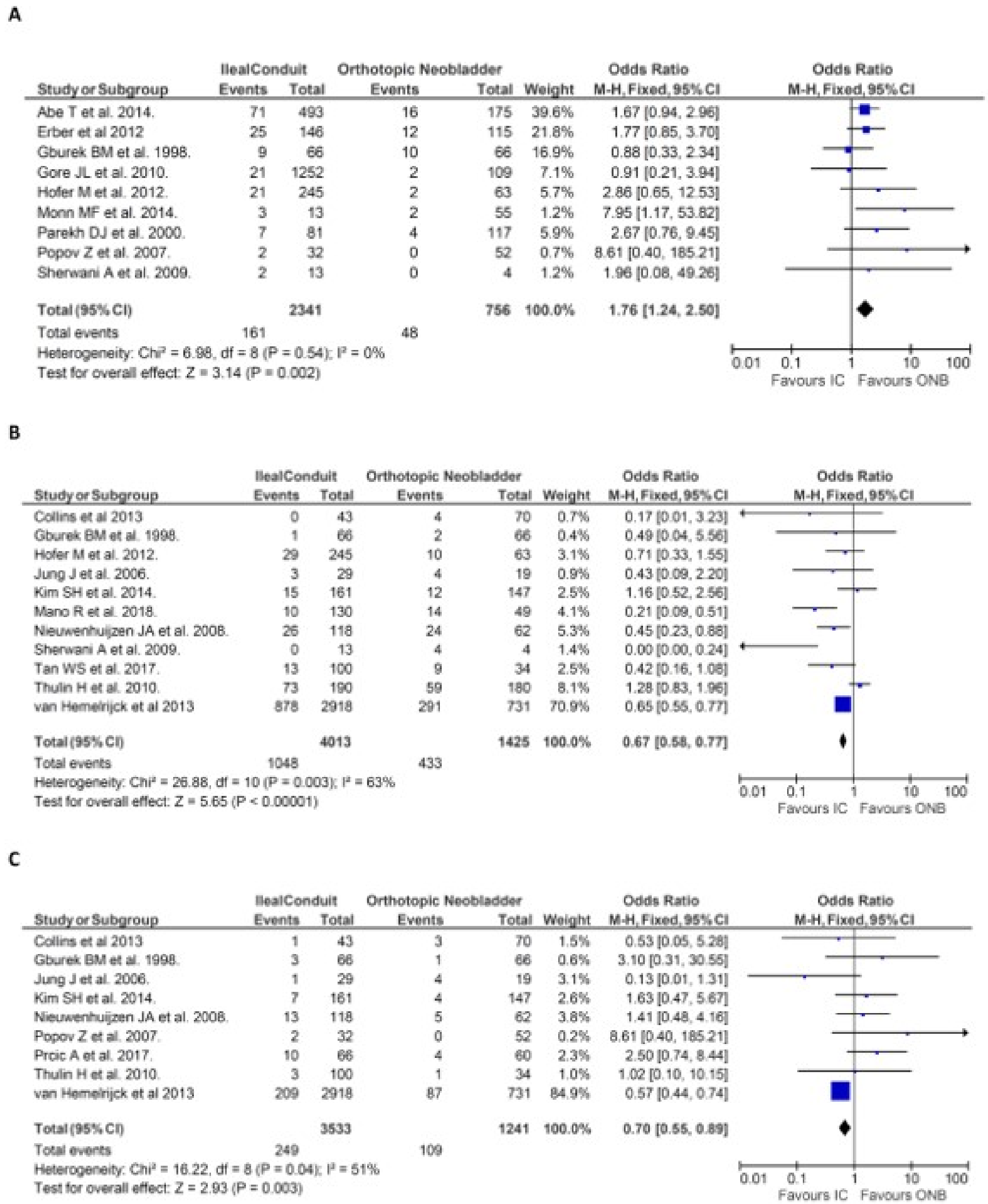
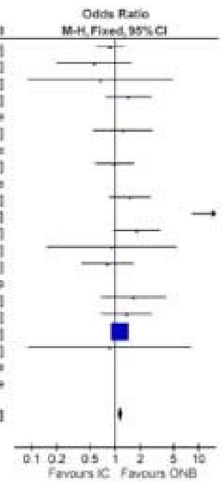

A
IlealConduit
Orthotopic Neobladder
Odds Ratio
Odds Ratio
Study or Subgroup
Events Total
Events Total Weight M-H, Fixed, 95% CI
M-H, Fixed, 95% CI
Abe T et al. 2014. 71 493 16 175 39.6% 1.67 [0.94, 2.96]
Erber et al 2012 25 146 12 115 21.8% 1.77 [0.85, 3.70]
Gburek BM et al. 1998. 9 66 10 66 16.9% 0.88 [0.33, 2.34]
Gore JL et al. 2010. 21 1252 2 109 7.1% 0.91 [0.21, 3.94]
Hofer M et al. 2012. 21 245 2 63 5.7% 2.86 [0.65, 12.53]
Monn MF et al. 2014. 3 13 2 55 1.2% 7.95 [1.17, 53.82]
Parekh DJ et al. 2000. 7 81 4 117 5.9% 2.67 [0.76, 9.45]
Popov Z et al. 2007. 2 32 0 52 0.7% 8.61 [0.40, 185.21]
Sherwani A et al. 2009. 2 13 0 4 1.2% 1.96 [0.08, 49.26]
Total (95% CI) 2341 756 100.0% 1.76 [1.24, 2.50]
Total events 161 48
Heterogeneity: Chi² = 6.98, df = 8 (P = 0.54); I² = 0%
Test for overall effect: Z = 3.14 (P = 0.002)
0.01 0.1 1 10 100
Favours IC Favours ONB
B
IlealConduit
Orthotopic Neobladder
Odds Ratio
Odds Ratio
Study or Subgroup
Events Total
Events Total Weight M-H, Fixed, 95% CI
M-H, Fixed, 95% CI
Collins et al 2013 0 43 4 70 0.7% 0.17 [0.01, 3.23]
Gburek BM et al. 1998. 1 66 2 66 0.4% 0.49 [0.04, 5.56]
Hofer M et al. 2012. 29 245 10 63 3.1% 0.71 [0.33, 1.55]
Jung J et al. 2006. 3 29 4 19 0.9% 0.43 [0.09, 2.20]
Kim SH et al. 2014. 15 161 12 147 2.5% 1.16 [0.52, 2.56]
Mano R et al. 2018. 10 130 14 49 4.1% 0.21 [0.09, 0.51]
Nieuwenhuijzen JA et al. 2008. 26 118 24 62 5.3% 0.45 [0.23, 0.88]
Sherwani A et al. 2009. 0 13 4 4 1.4% 0.00 [0.00, 0.24]
Tan WS et al. 2017. 13 100 9 34 2.5% 0.42 [0.16, 1.08]
Thulin H et al. 2010. 73 190 59 180 8.1% 1.28 [0.83, 1.96]
van Hemelrijck et al 2013 878 2918 291 731 70.9% 0.65 [0.55, 0.77]
Total (95% CI) 4013 1425 100.0% 0.67 [0.58, 0.77]
Total events 1048 433
Heterogeneity: Chi² = 26.88, df = 10 (P = 0.003); I² = 63%
Test for overall effect: Z = 5.65 (P < 0.00001)
0.01 0.1 1 10 100
Favours IC Favours ONB
C
IlealConduit
Orthotopic Neobladder
Odds Ratio
Odds Ratio
Study or Subgroup
Events Total
Events Total Weight M-H, Fixed, 95% CI
M-H, Fixed, 95% CI
Collins et al 2013 1 43 3 70 1.5% 0.53 [0.05, 5.28]
Gburek BM et al. 1998. 3 66 1 66 0.6% 3.10 [0.31, 30.55]
Jung J et al. 2006. 1 29 4 19 3.1% 0.13 [0.01, 1.31]
Kim SH et al. 2014. 7 161 4 147 2.6% 1.63 [0.47, 5.67]
Nieuwenhuijzen JA et al. 2008. 13 118 5 62 3.8% 1.41 [0.48, 4.16]
Popov Z et al. 2007. 2 32 0 52 0.2% 8.61 [0.40, 185.21]
Prcic A et al. 2017. 10 66 4 60 2.3% 2.50 [0.74, 8.44]
Thulin H et al. 2010. 3 100 1 34 1.0% 1.02 [0.10, 10.15]
van Hemelrijck et al 2013 209 2918 87 731 84.9% 0.57 [0.44, 0.74]
Total (95% CI) 3533 1241 100.0% 0.70 [0.55, 0.89]
Total events 249 109
Heterogeneity: Chi² = 16.22, df = 8 (P = 0.04); I² = 51%
Test for overall effect: Z = 2.93 (P = 0.003)
0.01 0.1 1 10 100
Favours IC Favours ONB

Fig 3.

A

Study or Subgroup	IlealConduit Events	IlealConduit Total	Orthotopic Neobladder Events	Orthotopic Neobladder Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Abe T et al. 2014.	350	493	129	175	2.3%	0.87 [0.59, 1.29]
Aboumarzouk OM et al. 2014.	14	39	12	24	0.4%	0.56 [0.20, 1.57]
Angulo et al 2014	2	8	4	12	0.1%	0.67 [0.09, 4.93]
Antonelli A et al. 2016.	59	85	52	85	0.7%	1.44 [0.76, 2.72]
Collins et al 2013	46	43	55	70		Not estimable
De Nunzio C et al. 2013.	201	217	102	112	0.4%	1.23 [0.54, 2.81]
Decaestecker K et al. 2016.	38	40	35	32		Not estimable
Erber et al 2012	101	146	80	115	1.1%	0.98 [0.58, 1.67]
Gore JL et al. 2010.	827	1252	197	109		Not estimable
Hofer M et al. 2012.	167	245	37	63	0.8%	1.50 [0.85, 2.66]
Kim SH et al. 2014.	78	161	7	147	0.2%	18.80 [8.28, 42.66]
Monn MF et al. 2014.	68	139	19	55	0.6%	1.81 [0.95, 3.47]
Navaro M et al. 2013.	15	17	33	37	0.1%	0.91 [0.15, 5.52]
Nazmy M et al. 2013.	48	67	69	91	0.7%	0.81 [0.39, 1.65]
Nieuwenhuijzen JA et al. 2008.	87	118	100	62		Not estimable
Popov Z et al. 2007.	20	32	26	52	0.3%	1.67 [0.68, 4.09]
Roghmann et al 2014	328	349	171	186	0.6%	1.37 [0.69, 2.73]
Roghmann F et al. 2013.	10142	18782	3203	6282	91.8%	1.13 [1.07, 1.19]
Sherwani A et al. 2009.	6	13	2	4	0.1%	0.86 [0.09, 8.07]
Tan WS et al. 2017.	120	100	49	34		Not estimable
van Hemelrijck et al 2013	2942	2918	720	731		Not estimable
Total (95% CI)		**26264**		**8478**	**100.0%**	**1.16 [1.09, 1.22]**
Total events	15659		5102			

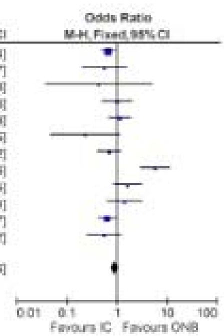
Heterogeneity: $Chi^2 = 54.85$, df = 14 ($P < 0.00001$); $I^2 = 74\%$
Test for overall effect: Z = 5.21 ($P < 0.00001$)



B

Study or Subgroup	IlealConduit Events	IlealConduit Total	Orthotopic Neobladder Events	Orthotopic Neobladder Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Abe T et al. 2014.	249	493	106	175	28.5%	0.66 [0.47, 0.94]
Aboumarzouk OM et al. 2014.	14	39	12	24	3.5%	0.56 [0.20, 1.57]
Angulo et al 2014	1	8	3	12	0.8%	0.43 [0.04, 5.06]
Antonelli A et al. 2016.	66	85	66	85	5.4%	1.00 [0.49, 2.06]
De Nunzio C et al. 2013.	166	217	83	112	9.5%	1.14 [0.67, 1.93]
Decaestecker K et al. 2016.	31	40	30	32	2.6%	0.23 [0.05, 1.15]
Kim SH et al. 2014.	26	147	38	161	11.0%	0.70 [0.40, 1.22]
Monn MF et al. 2014.	115	139	25	55	2.3%	5.75 [2.89, 11.46]
Nazmy M et al. 2013.	32	67	33	91	5.4%	1.61 [0.85, 3.06]
Nieuwenhuijzen JA et al. 2008.	25	118	10	62	3.8%	1.40 [0.62, 3.14]
Roghmann et al 2014	244	349	146	186	21.1%	0.64 [0.42, 0.97]
Tan WS et al. 2017.	47	100	21	34	6.1%	0.55 [0.25, 1.22]
Total (95% CI)		**1802**		**1029**	**100.0%**	**0.89 [0.75, 1.06]**
Total events	1016		573			

Heterogeneity: $Chi^2 = 44.64$, df = 11 ($P < 0.00001$); $I^2 = 75\%$
Test for overall effect: Z = 1.26 ($P = 0.21$)



C

Study or Subgroup	IlealConduit Events	IlealConduit Total	Orthotopic Neobladder Events	Orthotopic Neobladder Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Abe T et al. 2014	101	493	23	175	15.9%	1.70 [1.04, 2.78]
Aboumarzouk OM et al. 2014.	2	39	1	24	0.7%	1.24 [0.11, 14.50]
Angulo et al 2014	1	8	1	12	0.4%	1.57 [0.08, 29.41]
Antonelli A et al. 2016.	11	85	9	85	4.6%	1.26 [0.49, 3.20]
De Nunzio C et al. 2013.	35	217	18	112	12.4%	0.94 [0.51, 1.74]
Decaestecker K et al. 2016.	7	40	5	32	2.7%	1.15 [0.33, 4.02]
Kim SH et al. 2014.	34	147	28	161	12.1%	1.43 [0.82, 2.50]
Monn MF et al. 2014.	31	139	15	55	9.8%	0.77 [0.37, 1.57]
Nazmy M et al. 2013.	16	67	36	91	13.7%	0.48 [0.24, 0.97]
Nieuwenhuijzen JA et al. 2008.	32	118	15	62	8.4%	1.17 [0.57, 2.37]
Roghmann et al 2014	84	349	25	186	14.6%	2.04 [1.25, 3.32]
Tan WS et al. 2017.	21	100	7	34	4.9%	1.03 [0.39, 2.68]
Total (95% CI)		**1802**		**1029**	**100.0%**	**1.26 [1.02, 1.53]**
Total events	375		184			

Heterogeneity: $Chi^2 = 15.68$, df = 11 ($P = 0.15$); $I^2 = 30\%$
Test for overall effect: Z = 2.14 ($P = 0.03$)

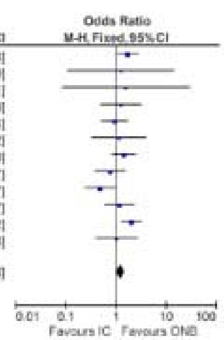
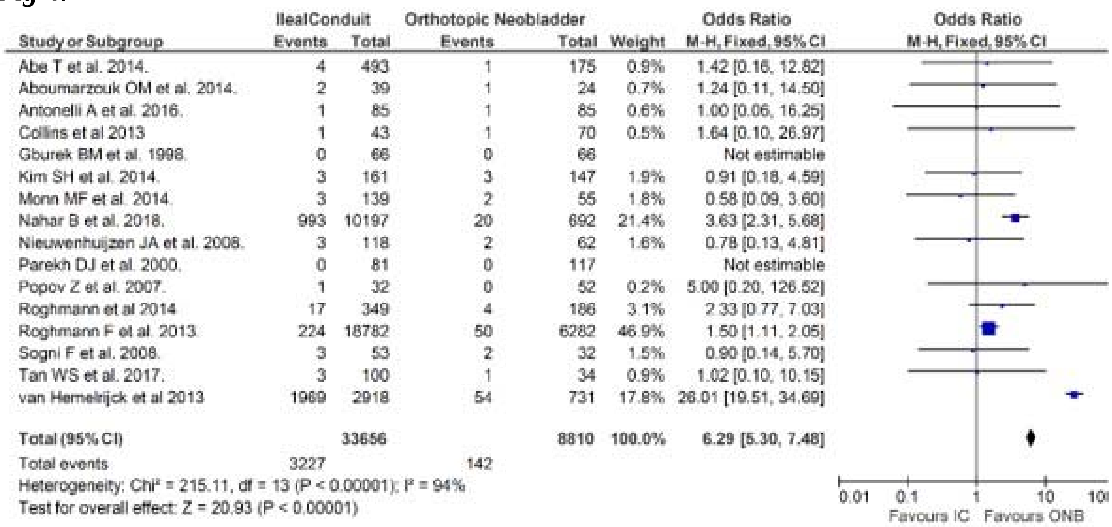


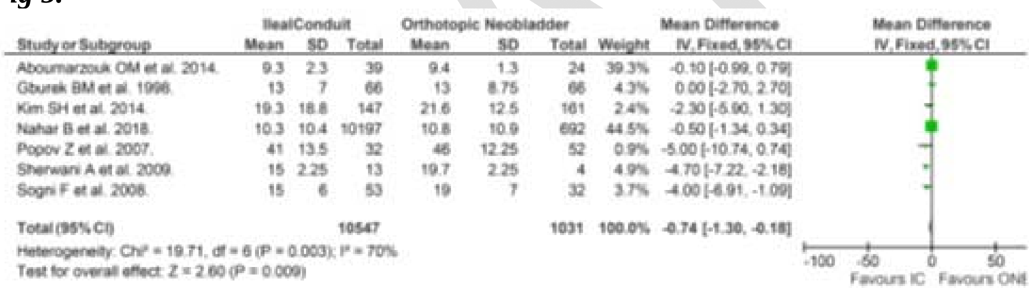
Fig 4.



Study or Subgroup	IlealConduit Events	IlealConduit Total	Orthotopic Neobladder Events	Orthotopic Neobladder Total	Weight	Odds Ratio M-H, Fixed, 95% CI
Abe T et al. 2014.	4	493	1	175	0.9%	1.42 [0.16, 12.82]
Aboumarzouk OM et al. 2014.	2	39	1	24	0.7%	1.24 [0.11, 14.50]
Antonelli A et al. 2016.	1	85	1	85	0.6%	1.00 [0.06, 16.25]
Collins et al 2013	1	43	1	70	0.5%	1.64 [0.10, 26.97]
Gburek BM et al. 1998.	0	66	0	66		Not estimable
Kim SH et al. 2014.	3	161	3	147	1.9%	0.91 [0.18, 4.59]
Monn MF et al. 2014.	3	139	2	55	1.8%	0.58 [0.09, 3.60]
Nahar B et al. 2018.	993	10197	20	692	21.4%	3.63 [2.31, 5.68]
Nieuwenhuijzen JA et al. 2008.	3	118	2	62	1.6%	0.78 [0.13, 4.81]
Parekh DJ et al. 2000.	0	81	0	117		Not estimable
Popov Z et al. 2007.	1	32	0	52	0.2%	5.00 [0.20, 126.52]
Roghmann et al 2014	17	349	4	186	3.1%	2.33 [0.77, 7.03]
Roghmann F et al. 2013.	224	18782	50	6282	46.9%	1.50 [1.11, 2.05]
Sogni F et al. 2008.	3	53	2	32	1.5%	0.90 [0.14, 5.70]
Tan WS et al. 2017.	3	100	1	34	0.9%	1.02 [0.10, 10.15]
van Hemelrijck et al 2013	1969	2918	54	731	17.8%	26.01 [19.51, 34.69]
Total (95% CI)		**33656**		**8810**	**100.0%**	**6.29 [5.30, 7.48]**
Total events	3227		142			

Heterogeneity: $Chi^2 = 215.11$, $df = 13$ ($P < 0.00001$); $I^2 = 94\%$
Test for overall effect: $Z = 20.93$ ($P < 0.00001$)

Fig 5.



Study or Subgroup	IlealConduit Mean	IlealConduit SD	IlealConduit Total	Orthotopic Neobladder Mean	Orthotopic Neobladder SD	Orthotopic Neobladder Total	Weight	Mean Difference IV, Fixed, 95% CI
Aboumarzouk OM et al. 2014.	9.3	2.3	39	9.4	1.3	24	39.3%	-0.10 [-0.99, 0.79]
Gburek BM et al. 1998.	13	7	66	13	8.75	66	4.3%	0.00 [-2.70, 2.70]
Kim SH et al. 2014.	19.3	18.8	147	21.6	12.5	161	2.4%	-2.30 [-5.90, 1.30]
Nahar B et al. 2018.	10.3	10.4	10197	10.8	10.9	692	44.5%	-0.50 [-1.34, 0.34]
Popov Z et al. 2007.	41	13.5	32	46	12.25	52	0.9%	-5.00 [-10.74, 0.74]
Sherwani A et al. 2009.	15	2.25	13	19.7	2.25	4	4.9%	-4.70 [-7.22, -2.18]
Sogni F et al. 2008.	15	6	53	19	7	32	3.7%	-4.00 [-6.91, -1.09]
Total (95% CI)			**10547**			**1031**	**100.0%**	**-0.74 [-1.30, -0.18]**

Heterogeneity: $Chi^2 = 19.71$, $df = 6$ ($P = 0.003$); $I^2 = 70\%$
Test for overall effect: $Z = 2.60$ ($P = 0.009$)

Fig. 6

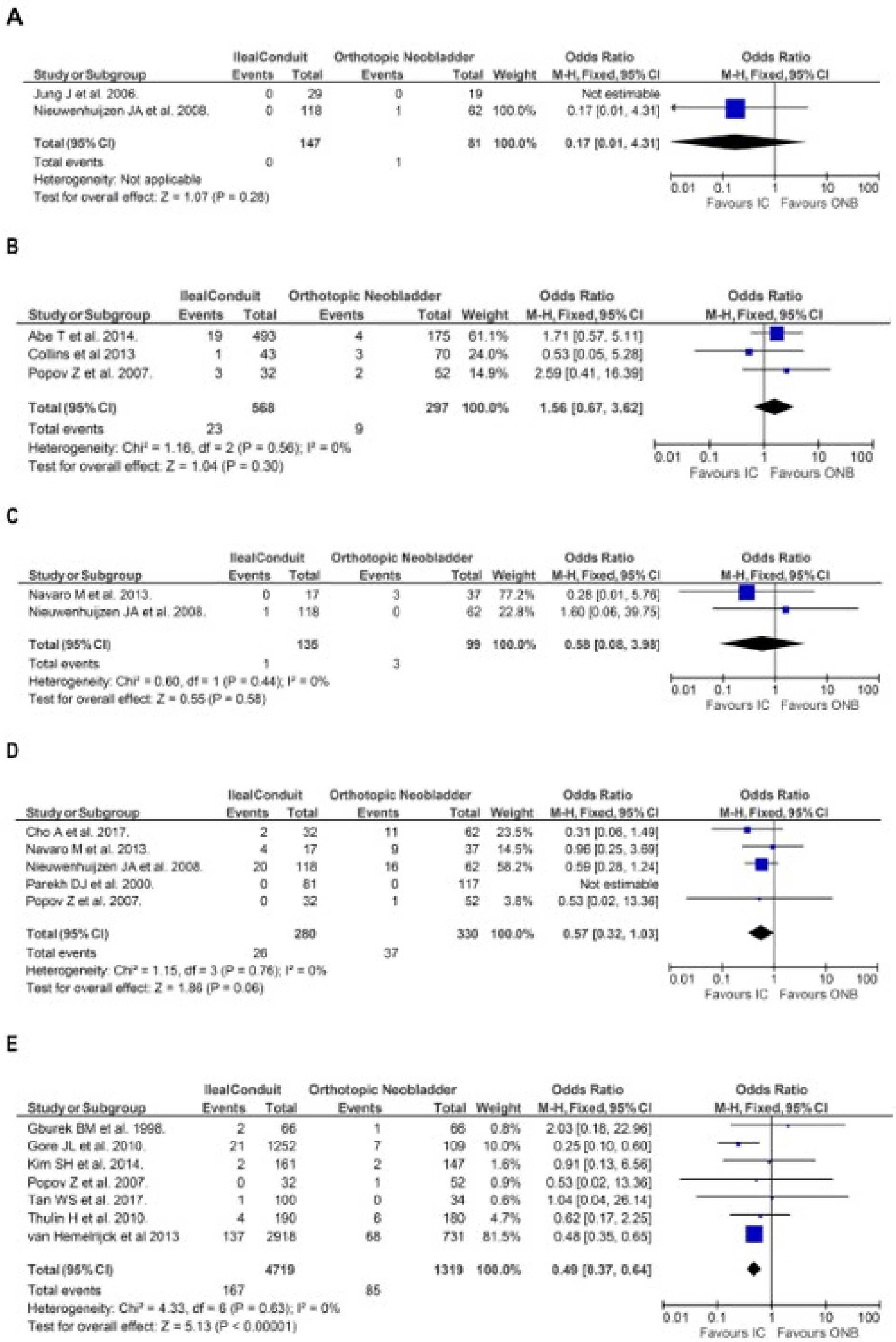

A
IlealConduit
Orthotopic Neobladder
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI M-H, Fixed, 95% CI
Jung J et al. 2006. 0 29 0 19 Not estimable
Nieuwenhuijzen JA et al. 2008. 0 118 1 62 100.0% 0.17 [0.01, 4.31]
Total (95% CI) 147 81 100.0% 0.17 [0.01, 4.31]
Total events 0 1
Heterogeneity: Not applicable
Test for overall effect: Z = 1.07 (P = 0.28)
0.01 0.1 1 10 100
Favours IC Favours ONB
B
IlealConduit
Orthotopic Neobladder
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI M-H, Fixed, 95% CI
Abe T et al. 2014. 19 493 4 175 61.1% 1.71 [0.57, 5.11]
Collins et al 2013 1 43 3 70 24.0% 0.53 [0.05, 5.28]
Popov Z et al. 2007. 3 32 2 52 14.9% 2.59 [0.41, 16.39]
Total (95% CI) 568 297 100.0% 1.56 [0.67, 3.62]
Total events 23 9
Heterogeneity: Chi² = 1.16, df = 2 (P = 0.56); I² = 0%
Test for overall effect: Z = 1.04 (P = 0.30)
0.01 0.1 1 10 100
Favours IC Favours ONB
C
IlealConduit
Orthotopic Neobladder
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI M-H, Fixed, 95% CI
Navaro M et al. 2013. 0 17 3 37 77.2% 0.28 [0.01, 5.76]
Nieuwenhuijzen JA et al. 2008. 1 118 0 62 22.8% 1.60 [0.06, 39.75]
Total (95% CI) 135 99 100.0% 0.58 [0.08, 3.98]
Total events 1 3
Heterogeneity: Chi² = 0.60, df = 1 (P = 0.44); I² = 0%
Test for overall effect: Z = 0.55 (P = 0.58)
0.01 0.1 1 10 100
Favours IC Favours ONB
D
IlealConduit
Orthotopic Neobladder
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI M-H, Fixed, 95% CI
Cho A et al. 2017. 2 32 11 62 23.5% 0.31 [0.06, 1.49]
Navaro M et al. 2013. 4 17 9 37 14.5% 0.96 [0.25, 3.69]
Nieuwenhuijzen JA et al. 2008. 20 118 16 62 58.2% 0.59 [0.28, 1.24]
Parekh DJ et al. 2000. 0 81 0 117 Not estimable
Popov Z et al. 2007. 0 32 1 52 3.8% 0.53 [0.02, 13.36]
Total (95% CI) 280 330 100.0% 0.57 [0.32, 1.03]
Total events 26 37
Heterogeneity: Chi² = 1.15, df = 3 (P = 0.76); I² = 0%
Test for overall effect: Z = 1.86 (P = 0.06)
0.01 0.1 1 10 100
Favours IC Favours ONB
E
IlealConduit
Orthotopic Neobladder
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI M-H, Fixed, 95% CI
Gburek BM et al. 1998. 2 66 1 66 0.8% 2.03 [0.18, 22.96]
Gore JL et al. 2010. 21 1252 7 109 10.0% 0.25 [0.10, 0.60]
Kim SH et al. 2014. 2 161 2 147 1.6% 0.91 [0.13, 6.56]
Popov Z et al. 2007. 0 32 1 52 0.9% 0.53 [0.02, 13.36]
Tan WS et al. 2017. 1 100 0 34 0.6% 1.04 [0.04, 26.14]
Thulin H et al. 2010. 4 190 6 180 4.7% 0.62 [0.17, 2.25]
van Hemelrijck et al 2013 137 2918 68 731 81.5% 0.48 [0.35, 0.65]
Total (95% CI) 4719 1319 100.0% 0.49 [0.37, 0.64]
Total events 167 85
Heterogeneity: Chi² = 4.33, df = 6 (P = 0.63); I² = 0%
Test for overall effect: Z = 5.13 (P < 0.00001)
0.01 0.1 1 10 100
Favours IC Favours ONB

Table 1. Summary of studies included in the meta-analysis for ileal conduit and orthotopic neobladder						
Author (year)	**Origin**	**Journal**	**Type of study**	**Level of evidence**	**IC (N)**	**ONB (N)**
Abe et al, 2014	Japan	*Int J Urol*	RCC	3b	493	175
Aboumarzouk et al, 2014	Poland	*Cent European J Urol*	PCC	3b	39	24
Angulo et al, 2014	Spain	*Urology*	PCC	3b	8	12
Antonelli et al 2016	Italy	*Clin Genitourin Cancer*	PCC	3b	85	85
Belotti et al, 2012	Italy	*Anticancer Research*	PCC	3b	223	111
Cho et al, 2017	Korea	*Renal Failure*	RCC	3b	33	62
Collins et al, 2013	Sweden	*Eur Urol*	PCC	3b	43	70
De Nunzio et al, 2013	Italy	*Eur J Surg Oncol*	PCC	3b	217	112
Decaestecker et al, 2016	Belgium	*European Urology, Supplements*	PCC	3b	40	32
Erber et al, 2012	Germany	*IRSN Urol*	RCC	3b	23	34
Gburek et al, 1998	USA	*Journal of Urology*	RCC	3b	66	66
Gore et al, 2010	USA	*Journal of Urology*	RCC	3b	1252	109
Hofer et al, 2012	USA	*Journal of Urology*	PCC	3b	245	63
Jung et al, 2006	Korea	*Korean Journal of Urology*	PCC	3b	29	19
Kim et al, 2014	Korea	*Jpn J Clin Oncol*	RCC	3b	161	147
Mano et al, 2018	Israel	*Urology*	RCC	3b	130	49
Monn et al, 2014	USA	*Urologic Oncology: Seminars and Original Investigations*	RCC	3b	139	55
Nahar et al, 2018	USA	*Journal of Urology*	RCC	3b	10197	692
Navarro et al, 2008	Chile	*Urology*	PCC	3b	17	37
Nazmy et al, 2013	USA	*Journal of Urology*	PCC	3b	67	91
Nieuwenhuijzen et al, 2008	The Netherlands	*Eur Urol*	PCC	3b	118	62

Parekh et al, 2000	USA	*Urology*	RCC	3b	81	117
Popov et al, 2007	Republic of Macedonia	*Acta chirurgica lugoslavica*	RCC	3b	32	52
Prcic et al, 2017	Bosnia and Herzegovina	*Med Arch*	PCC	3b	66	60
Roghmann et al, 2013	USA	*Can Urol Assoc J*	RCC	3b	18782	6282
Roghmann et al, 2014	Germany	*Int J Urol*	RCC	3b	349	186
Roghmann et al, 2017	Germany	*Journal of Urology*	PCC	3b	510	294
Sherwani et al, 2009	India	*Int J Health Sci (Qassim)*	PCC	3b	13	4
Sogni et al, 2008	Italy	*Urology*	RCC	3b	53	32
Tan et al, 2017	United Kingdom	*Eur Urol Focus*	PCC	3b	100	34
Thulin et al, 2010	Sweden	*BJU Int*	RCC	3b	190	180
van Hemelrijck et al, 2013	Sweden	*BJU Int*	RCC	3b	2918	720

IC: ileal conduit; ONB: orthotopic neobladder; PCC: prospective case-control; RCC: retrospective case-control.

Table 2. Patient demographics from papers where age was reported as a mean ± standard deviation						
Author (year)	**Age (conduit)**	**Age (neobladder)**	**Male/female (conduit)**	**Male/female (neobladder)**	**BMI (conduit)**	**BMI (neobladder)**
Aboumarzouk et al, 2014	60±7.11	57±8.68	34/5	24/0	27.2±2.3	27.96±2
Antonelli A et al 2016	63±8.8	63.5±6.7	69/16	72/13	NR	NR
Belotti et al, 2012	70.4±8.1	60.6±0.9	183/34	90/21	26.3±4.3	26.3±3.6
Cho et al, 2017	69.5±8.1	64.5±8.6	23/10	52/10	NR	NR
Collins et al, 2013	69.9±6.7	59.8±9.0	31/11	62/8	24.8±3.1	26.1±3.4
De Nunzio et al, 2013	71±9.75*	63± 0.25*	NR	NR	26.4±6*	25±3.25*
Decaestecker et al, 2016	71±1.5*	63±1.25*	29/11	27/5	26±4.25*	26 ±3.75*
Gburek B et al, 1998	69±11.75*	62±12.75*	66/0	62/4	NR	NR
Hofer et al, 2012	69.7± 3.75*	59.7±15	NR	NR	NR	NR
Jung et al, 2006	65.6±9.9	60.8±8.3	NR	NR	NR	NR
Kim et al, 2014	67.1±8.9	59.4±9.4	115/32	156/5	23.6±3.3	24±3.1
Monn et al, 2014	72.6±10	59.6±9	107/32	49/6	NR	NR
Nahar et al, 2018	68.8±10.1	62.8±10	8835/1362	663/29	NR	NR
Parekh et al, 2000	68±12.75*	60±13.5*	48/33	97/20	NR	NR
Roghmann et al, 2013	69.6	60.8	81/19	91/9	NR	NR
Sherwani et al, 2009	59	53.3	NR	NR	NR	NR
Thulin et al, 2010	70.1	64.3	134/56	165/15	NR	NR

*Estimated standard deviation based on the Range Rule of Thumb. BMI: body mass index; NR: not reported.

Table 3. Patient demographics from papers where age was reported as a median and range						
Author (year)	**Age (conduit)**	**Age (neobladder)**	**Male/female (conduit)**	**Male/female (neobladder)**	**BMI (conduit)**	**BMI (neobladder)**
Abe et al, 2014	70 (37–89)	63 (25–86)	364/129	164/11	23 (14.6–35.1)	23.3 (16–31.5)
Angulo et al, 2014	74.5 (70–82.2)	66 (61.5–75)	5/3	12/0	27.7 (23.2–31.8)	27.3 (25.5–28.5)
Erber et al, 2012	70 (64–75)	62 (56–66)	98/48	110/5	NR	NR
Mano et al, 2018	72 (65–78)	60 (53–65)	112/18	43/6	NR	NR
Nieuwenhuijzen et al, 2008	70 (46–85)	62 (32–73)	88/30	59/3	NR	NR
Roghmann et al, 2014	72 (67–76)	61 (55–67)	256/93	158/28	27.3 (24.6–29.8)	26.1 (23.8–29.2)
Sogni et al, 2008	78.9 (75–88)	77.5 (75–82)	NR	NR	NR	NR
Tan et al, 2017.	67.4 (60.4–74.3)	54.5 (48.6–61.6)	75/25	28/6	27.2 (23.4–31)	27.3 (23–28.5)

BMI: body mass index; NR: not reported.

Table 4. Studies where length of stay is reported as median and range				
Author (year)	**Ileal conduit**		**Orthotopic neobladder**	
	n	**Median (range)**	**n**	**Median (range)**
Abe et al, 2014	493	39 (3–257)	175	42 (18–364)
Angulo et al, 2014	8	9.5 (8–11)	12	8.5 (7.2–10.7)
Antonelli et al, 2016	85	17	85	21
Belotti et al, 2012	223	20 (16–24)	111	24 (20–29)
Collins et al, 2013	43	9 (6–142)	70	9 (4–78)
Decaestecker et al, 2016	40	10 (5–36)	32	11 (6–39)
Monn et al, 2014	139	8 (6–10)	55	7 (6–8)
Nieuwenhuijzen et al, 2008	118	17 (6–53)	62	15 (8–44)
Parekh et al, 2000	81	8 (5–60)	117	7 (5–28)
Roghmann et al, 2014	349	19 (16–24)	70	9 (17–23)
Tan et al, 2017	100	10 (8–15.5)	34	11 (8.5–14)