Medical and non-medical interventions for post-operative urinary retention prevention: network meta-analysis and risk benefit analysis

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### Appendix 1: Systematic review with Direct meta-analysis

**Supplement Table 1. Search terms and results in PubMed, SCOPUS, Thai-Journal Citation Index Centre, ClinicalTrial.gov and Cochrane Central Register of Controlled Trials**

**PubMed**

| Search term                              | Number     |
|------------------------------------------|------------|
| **Population Domain**                    |            |
| #1 operation                             | 3,168,376  |
| #2 surgery                               | 4,513,862  |
| #3 surgical                              | 3,548,614  |
| #4 #1 OR #2 OR #3                       | 4,853,158  |
| **Interventions domain**                 |            |
| **I1 sub-domain: Ambulation**            |            |
| #5 ambulation                            | 100,215    |
| #6 mobility                              | 203,990    |
| #7 "mobilization"                        | 52,456     |
| #8 #5 OR #6 OR #7                        | 343,085    |
| **I2 sub-domain: Fluid adjustment**      |            |
| #8 "fluid adjusting"                     | 1,500      |
| #9 "fluid restriction"                   | 1,334      |
| #10 "fluid adjustment"                   | 8          |
| #11 #8 OR #9 OR #10                      | 2,832      |
| **I3 sub-domain: Neuromodulation**       |            |
| #12 neuromodulation                      | 9,496      |
| #13 transcutaneous electric nerve stimulation[MeSH Terms] | 8,014 |
| #14 “Nerve Stimulation”                  | 91,442     |
| #15 “Bladder stimulation”                | 110        |
| #16 #12 OR #13 OR #14 OR #15             | 27,557     |
| **I4 sub-domain: Acupuncture**           |            |
| #17 Electroacupuncture                   | 5,015      |
| #18 acupuncture                           | 30,293     |
| #19 #17 OR #18                            | 30,584     |
### I5 sub-domain: Cholinergic drug

| #  | Term                                      | Count  |
|----|-------------------------------------------|--------|
| #20| cholinergic agents [MeSH Terms]           | 48,384 |
| #21| "cholinergic agents"                      | 217,889|
| #22| "cholinergic drug"                        | 199    |
| #23| pilocarpine                               | 9,103  |
| #24| urecholine                                | 2,386  |
| #25| neostigmine                               | 6,073  |
| #26| physostigmine                             | 7,274  |
| #27| distigmine                                | 90     |
| #28| carbachol                                 | 18,810 |
| #29| #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 | 241,658|

### I6 sub-domain: Benzodiazepine

| #  | Term                                      | Count  |
|----|-------------------------------------------|--------|
| #30| benzodiazepine                            | 77,983 |
| #31| alprazolam                                | 2,606  |
| #32| clobazam                                  | 945    |
| #33| clonazepam                                | 4,406  |
| #34| clorazepate                               | 469    |
| #35| chlordiazepoxide                          | 4,765  |
| #36| diazepam                                  | 25,566 |
| #37| estazolam                                 | 229    |
| #38| lorazepam                                 | 4,528  |
| #39| oxazepam                                  | 1,918  |
| #40| temazepam                                 | 1,089  |
| #41| triazolam                                 | 1,741  |
| #42| #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 | 86,085 |

### I7 sub-domain: Antispasmodic agents

| #  | Term                                      | Count  |
|----|-------------------------------------------|--------|
| #43| Antispasmodic                             | 48,242 |
| #44| Anti-spasmodic                            | 110    |
| #45| Drotaverine                               | 174    |
|   |   |   |
|---|---|---|
| #46 | buscopan | 716 |
| #47 | Hyoscyamine | 505 |
| #48 | #43 OR #44 OR #45 OR #46 OR #47 | 48,686 |
| **I8 sub-domain : opioid antagonist** |   |   |
| #49 | "narcotic antagonists" | 36,882 |
| #50 | "Methylnaltrexone bromide" | 28 |
| #51 | naloxone | 32,443 |
| #52 | naltrexone | 9,680 |
| #53 | #49 OR #50 OR #52 OR #52 | 45,193 |
| **I9 sub-domain : alpha adrenergic antagonist** |   |   |
| #54 | “alpha adrenergic blocking” | 507 |
| #55 | "alpha adrenergic antagonist" | 614 |
| #56 | "alpha adrenergic blockade" | 673 |
| #57 | adrenergic alpha-antagonists [MeSH Terms] | 16,432 |
| #58 | Phenoxybenzamine | 6,545 |
| #59 | Dibenzyline | 6,586 |
| #60 | Prazosin | 13,559 |
| #61 | Alfuzosin | 571 |
| #62 | Tamsulosin | 1,829 |
| #63 | Silodosin | 389 |
| #64 | #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62 OR #63 | 32,369 |
| **I10 sub-domain : NSAID** |   |   |
| #65 | NSAID | 228,920 |
| #66 | "anti-inflammatory agents, non-steroidal" [MeSH Terms] | 80,078 |
| #67 | aspirin | 64,673 |
| #68 | diclofenac | 12,451 |
| #69 | indomethacin | 44,010 |
| #70 | ibuprofen | 14,084 |
| #71 | naproxen | 6,617 |
| #72 | piroxicam | 3,878 |
|   |   |   |
|---|---|---|
| #73 | mefenamic acid | 1,638 |
| #74 | celecoxib | 6,530 |
| #75 | etoricoxib | 715 |
| #76 | ketorolac | 2,992 |
| #77 | #65 OR #66 OR #67 OR #68 OR #69 OR #70 #71 OR #72 OR #73 OR #74 OR #75 OR #76 | 186,068 |

### All intervention

| #78 | #8 OR #11 OR #16 OR #19 OR #29 OR #42 OR #48 OR #53 OR #64 OR #77 | 967,668 |

### Outcome domain

#### O1 sub-domain : Urinary retention

| #79 | urinary retention [MeSH Terms] | 4,362 |
| #80 | "voiding dysfunction" | 2,249 |
| #81 | "fail spontaneous void" | 4 |
| #82 | OR #79 OR #80 OR #81 | 6,443 |

#### O2 sub-domain : UTI

| #83 | urinary tract infection [MeSH Terms] | 44,996 |
| #84 | “urinary tract infection” | 22,385 |
| #85 | #83 OR #84 | 55,542 |

#### O3 sub-domain : LUTS

| #86 | luts [MeSH Terms] | 38317 |

#### O4 sub-domain Adverse events

| #87 | "Adverse events" | 128931 |
| #88 | "side effect" | 33503 |
| #89 | "adverse drug reaction" | 11012 |
| #90 | Drug-Related Side Effects and Adverse Reactions [MeSH Terms] | 110415 |
| #91 | #87 OR #88 OR #89 OR #90 | 271736 |

### All Outcome

| #92 | #82 OR #85 OR #86 OR #91 | 967,668 |

### Results
SCOPUS

| Search Term | Number |
|-------------|--------|
| TITLE-ABS-KEY (surgery) | 2,154,894 |
| TITLE-ABS-KEY surgical) | 1,683,856 |
| TITLE-ABS-KEY ("surgical procedure") | 364,192 |
| TITLE-ABS-KEY (Operation) | 2,141,790 |
| TITLE-ABS-KEY (operative) | 415,489 |
| #1 OR #2 OR #3 OR #4 OR #5 | 3,041,059 |
| TITLE-ABS-KEY ("early ambulation") | 3,541 |
| TITLE-ABS-KEY (walking) | 155,091 |
| TITLE-ABS-KEY (mobilization) | 118,433 |
| TITLE-ABS-KEY (mobility) | 528,781 |
| #7 OR #8 OR #9 OR #10 | 781,081 |
| TITLE-ABS-KEY ("fluid adjustment") | 24 |
| TITLE-ABS-KEY ("fluid restriction") | 1,749 |
| #12 OR #13 | 1,772 |
| TITLE-ABS-KEY (neuromodulation) | 39,907 |
| TITLE-ABS-KEY ("Transcutaneous Electric Nerve Stimulation") | 4,161 |
| TITLE-ABS-KEY ("Nerve Stimulation") | 57,040 |
| TITLE-ABS-KEY ("bladder Stimulation") | 144 |
| #15 OR #16 OR #17 OR #18 | 180,445 |
| TITLE-ABS-KEY ("acupuncture") | 47,005 |
| Title | Description | Count |
|-------|-------------|-------|
| **I5 cholinergic agent** | | |
| #21  | TITLE-ABS-KEY ( pilocarpine ) | 16,169 |
| #22  | TITLE-ABS-KEY ( bethanechol ) | 4,701 |
| #23  | TITLE-ABS-KEY ( urecholine ) | 510 |
| #24  | TITLE-ABS-KEY ( distigmine ) | 358 |
| #25  | TITLE-ABS-KEY ( neostigmine ) | 14,118 |
| #26  | TITLE-ABS-KEY ( physostigmine ) | 13,589 |
| #27  | TITLE-ABS-KEY ( carbachol ) | 25,900 |
| #28  | #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 | 68,528 |
| **I6 Benzodiazepine** | | |
| #29  | TITLE-ABS-KEY ( alprazolam ) | 12,383 |
| #30  | TITLE-ABS-KEY ( clobazam ) | 6,375 |
| #31  | TITLE-ABS-KEY ( clonazepam ) | 24,329 |
| #32  | TITLE-ABS-KEY ( clorazepate ) | 3,991 |
| #33  | TITLE-ABS-KEY ( chlordiazepoxide ) | 12,826 |
| #34  | TITLE-ABS-KEY ( diazepam ) | 75,862 |
| #35  | TITLE-ABS-KEY ( estazolam ) | 1,304 |
| #36  | TITLE-ABS-KEY ( lorazepam ) | 24,516 |
| #37  | TITLE-ABS-KEY ( oxazepam ) | 8,584 |
| #38  | TITLE-ABS-KEY ( temazepam ) | 5,650 |
| #39  | TITLE-ABS-KEY ( triazolam ) | 6,106 |
| #40  | #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 | 130,287 |
| **I7 antispasmodic agents** | | |
| #41  | TITLE-ABS-KEY ( drotaverine ) | 414 |
| #42  | TITLE-ABS-KEY ( buscopan OR hyoscyamine ) | 3,480 |
| #43  | #41 OR #42 | 3,886 |
| **I8 opioid antagonist** | | |
| #44  | TITLE-ABS-KEY ( naltrexone ) | 16,093 |
| #45  | TITLE-ABS-KEY ( "Methylnaltrexone bromide" ) | 145 |
| #46  | TITLE-ABS-KEY ( naloxone ) | 45,226 |
| #47 | #44 OR #45 OR #46 | 57,172 |
| I9 Alpha blocker | | |
| #48 | TITLE-ABS-KEY ( phenoxybenzamine ) | 13,867 |
| #49 | TITLE-ABS-KEY ( dibenzyline ) | 786 |
| #50 | TITLE-ABS-KEY ( prazosin ) | 24,986 |
| #51 | TITLE-ABS-KEY ( alfuzosin ) | 2,327 |
| #52 | TITLE-ABS-KEY ( tamsulosin ) | 5,068 |
| #53 | TITLE-ABS-KEY ( silodosin ) | 780 |
| #54 | #48 OR #49 OR #50 OR #51 OR #52 OR #53 | 205,011 |
| I10 NSAID | | |
| #55 | TITLE-ABS-KEY ( aspirin ) | 199,735 |
| #56 | TITLE-ABS-KEY ( diclofenac ) | 39,375 |
| #57 | TITLE-ABS-KEY ( indomethacin ) | 47,510 |
| #58 | TITLE-ABS-KEY ( ibuprofen ) | 49,118 |
| #59 | TITLE-ABS-KEY ( naproxen ) | 26,460 |
| #60 | TITLE-ABS-KEY ( piroxicam ) | 11,994 |
| #61 | TITLE-ABS-KEY ( "mefenamic acid" ) | 5,916 |
| #62 | TITLE-ABS-KEY ( celecoxib ) | 19,809 |
| #63 | TITLE-ABS-KEY ( etoricoxib ) | 2,590 |
| #64 | TITLE-ABS-KEY ( ketorolac ) | 10,087 |
| #65 | #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62 OR #63 OR #64 | 336,818 |
| O domain | | |
| O1 POUR | | |
| #66 | TITLE-ABS-KEY ("urinary retention") | 11,762 |
| #67 | TITLE-ABS-KEY ("voiding dysfunction") | 2,992 |
| #68 | TITLE-ABS-KEY ("bladder dysfunction") | 7,630 |
| #69 | #66 OR #67 OR #68 | 21,258 |
| O2 UTI | | |
| #70 | TITLE-ABS-KEY ("urinary tract infection") | 104,131 |
| #71 | TITLE-ABS-KEY ( uti ) | 12,595 |
|   |   |   |
|---|---|---|
| #72 | #70 OR #71 | 105,785 |

**O3 LUTS**

|   |   |   |
|---|---|---|
| #73 | TITLE-ABS-KEY ("lower urinary tract symptoms") | 12,332 |
| #74 | TITLE-ABS-KEY (luts) | 6,457 |
| #75 | #73 OR #74 | 14,516 |

**I4 adverse effect**

|   |   |   |
|---|---|---|
| #76 | TITLE-ABS-KEY ("side effect") | 519,323 |
| #77 | TITLE-ABS-KEY ("adverse drug reaction") | 167,712 |
| #78 | TITLE-ABS-KEY ("Adverse event") | 159,162 |
| #79 | #76 OR #77 OR #78 | 770,319 |

**All Intervention**

|   |   |   |
|---|---|---|
| #80 | #11 OR #14 OR #19 OR #20 OR #28 OR #40 OR #43 OR #47 OR #54 OR #65 | 1,512,941 |

**All Outcome**

|   |   |   |
|---|---|---|
| #81 | #69 OR #72 OR #75 OR #79 | 888,382 |

**Results**

|   |   |   |
|---|---|---|
| #82 | #6 AND #80 AND #81 | 3,479 |

**Thai-Journal Citation Index Centre**

|   |   |   |
|---|---|---|
| #1 | Urinary retention | 13 |

**ClinicalTrial.gov**

|   |   |   |
|---|---|---|
| #1 | Post operative urinary retention | 46 |

**Cochrane Central Register of Controlled Trials**

|   |   |   |
|---|---|---|
| #1 | Post operative urinary retention, RCT | 18 |
## Supplement Table 2. Characteristics of included studies

| Author, Year | Intervention | Regimens of interventions | Definition of POUR | Timing of POUR measurement | Methods of PVRU measurement | Definition of UTI | Collected AE |
|--------------|--------------|----------------------------|--------------------|---------------------------|-----------------------------|-----------------|--------------|
| **AMB vs PLA** |
| Hansen, 2015 | AMB vs PLA   | Walk to the toilet Bedpan | urine >400 ml by bladder scan regardless of whether the patients had passed urine | within 24 hrs | bladder scan within 24 hrs after surgery | N/A | Nausea, Vomiting |
| Kim SB, 1999 | AMB vs PLA   | Walk within 24 hrs Walk after 24 hrs postoperatively | feeling of bladder fullness after urination | within 24 hrs | N/A | N/A | Spinal headache |
| Kim SH, 1999 | AMB vs PLA   | Early ambulation Bed rest | need for catheterization | not define | N/A | N/A | Postdural puncture headache |
| **FLU vs PLA** |
| Bailey, 1976 | FLU vs PLA   | Restrict oral fluid to 250 ml Free access to oral fluids | palpable bladder | not define | N/A | N/A | N/A |
| Kozol, 1992  | FLU vs PLA   | Restrict IV fluid to 500 ml or less No intravenous fluid restriction | suprapubic pain, palpable bladder | 8 hrs after surgery | 8 hrs after surgery | N/A | N/A |
| Lee, 1999    | FLU vs PLA   | Restrict fluid 500 ml or less Hydration | inability to void, suprapubic pain, palpable bladder | not define | N/A | N/A | N/A |
| Orbey, 2009  | FLU vs PLA   | Restrict oral and IV No intervention | unable to void, failed to pass urine, palpable urinary bladder | after surgery, not define time | not define | N/A | Headache, Nausea, Vomiting, Vagal syncope, Postdural puncture headache |
| **NEU vs PLA** |
| Butwick, 2003| NEU vs PLA   | The queen's square external bladder stimulator frequency of 60 Hz for 24 hrs postoperatively, Placebo same schedule | urinary retention requiring catheterization | 24 hrs after surgery | N/A | N/A | N/A |
| Author       | Intervention | Methodology                                                                 | Outcome Measures                                                                 | Time                           | N/A       | N/A       | N/A       |
|--------------|--------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------|-----------|-----------|-----------|
| Li, 2019     | NEU vs PLA   | Electrical stimulation 35 Hz 200 μs and 1 Hz and 270 μs 15 to 30min each time for 3 days | cannot urinate smoothly, urine ≥ 100 ml by bladder scan                           | On day 14 after surgery        | RU by USG | N/A       | N/A       |
|              |              | No intervention                                                            |                                                                                  | (catheter removal on day 14)    |           |           |           |
|              |              |                                                                            |                                                                                  |                                |           |           |           |
| Gao, 2014    | ACU vs PLA   | Han's acupoint nerve stimulation, 2Hz, 30min                               | bladder overdistention can or cannot void, urine > 600 ml by bladder scan       | measure since post surgery     | N/A       | N/A       | Overall adverse events |
|              |              | No intervention                                                            |                                                                                  | every hour until void          |           |           |           |
|              |              |                                                                            |                                                                                  |                                |           |           |           |
| Bimei, 2015  | ACU vs PLA   | Electroacupuncture location at spine, 50 Hz, 30 min                        | inability to void urine, suprapubic pain, palpable bladder                      | At 6-8 hrs after surgery       | N/A       | N/A       | N/A       |
|              |              | No intervention                                                            |                                                                                  |                                |           |           |           |
| Weimin, 2008 | ACU vs PLA   | Electroacupuncture 4 Hz 30 min start 8-12 day before surgery for 5 days    | inability to void urine, urine > 400 ml                                         | not define                     | Cath at day 14 | N/A       | N/A       |
|              |              | No intervention                                                            |                                                                                  |                                |           |           |           |
| Uy, 2011     | CHO vs PLA   | Bethanechol 25 mg oral start 1 hr after surgery and then 4-6 hrs after surgery | inability to void, urine > 400 ml by catheterization                            | 6-8 hrs after surgery          | N/A       | N/A       | Overall adverse events |
|              |              | No intervention                                                            |                                                                                  |                                |           |           |           |
| Bowers, 1987 | CHO vs PLA   | Urecholine, 25 mg orally every 4 hrs for 24hrs* Urecholine, 50 mg orally every 4 hrs for 24 hrs* Urecholine, 5 mg subcutaneously every 4 hrs for 24 hrs* No medication | distended bladder              | not define                     | N/A       | N/A       | Nausea, Vomiting, Sweating |
|              |              |                                                                            |                                                                                  |                                |           |           |           |
| Manchana, 2011 | CHO vs PLA  | Bethanechol 20 mg oral 3 times/day start 3 days before surgery and continue until 7 days after surgery Placebo same schedule | Fail catheter removal at 1 wk after surgery, urine > 30% of bladder capacity     | at 1 wk after surgery          | at 8 days after catheter removal | urine culture at 1 month after surgery | Nausea, Vomiting, Abdominal pain, Abdominal distention |
| Study                        | Intervention                  | Comparator          | Drug/dosage                                                                 | Time point after surgery | Adverse events |
|------------------------------|-------------------------------|---------------------|-----------------------------------------------------------------------------|--------------------------|----------------|
| Walsh, 1972                  | CHO vs PLA Distigmine 0.5 mg IM start post op 10-12 hrs and 24 hrs Placebo same schedule | PLA                  | not define                                                                 | after surgery, not define time | N/A            |
|                              |                               |                     | Urine culture at 5 days post operation                                        |                          |                |
| Hershberger, 2003            | BENZ vs PLA Lorazepam 1 mg start 1 hr after surgery Placebo same schedule | PLA                  | inability to void                                                           | 6-8 hrs after surgery     | N/A            |
|                              |                               |                     |                                                                            |                          |                |
| ASP vs PLA                   | ASP vs PLA Drotaverine 40 mg at the time of anesthesia No intervention | PLA                  | abdominal discomfort                                                        | after surgery, not define time | N/A            |
|                              |                               |                     |                                                                            |                          |                |
| OPI vs PLA                   | OPI vs PLA PCA Morphine 1 mg/ml plus naloxone 0.1 ug/ml Placebo Morphine alone | PLA                  | not define                                                                 | 24 hrs after surgery      | N/A            |
|                              |                               |                     |                                                                            |                          | Nausea, Vomiting, Pruritus |
| Gallo, 2008                  | OPI vs PLA Naloxone 0.1 mg iv 4 hrs with PCA morphine Placebo Morphine alone | PLA                  | suprapubic pain, palpable bladder                                           | 8 hrs after surgery       | N/A            |
|                              |                               |                     |                                                                            |                          |                |
| Zand, 2015                   | OPI vs PLA Methylnaltrexone 12 mg immediate post op NSS subcutaneous same schedule | PLA                  | inability to void, urine >600 ml by catheterization                        | 12 hrs after surgery      | N/A            |
|                              |                               |                     |                                                                            |                          | Overall adverse events, Pruritus, Respiratory distress |
| ALP vs PLA                   | ALP vs PLA Tamsulosin 0.4 mg 14 and 2 hrs before surgery* Placebo 12 and 2 hrs before surgery | PLA                  | inability to void urine, suprapubic pain, palpable bladder, urine >500 ml by catheterization | 12 hrs after surgery      | N/A            |
|                              |                               |                     |                                                                            |                          |                |
| Basheer, 2017                | ALP vs PLA Tamsulosin 0.4mg 48 hrs and the night before surgery then continue until 1 day after surgery or until catheter removal Placebo same schedule | PLA                  | urine >250 ml by bladder scan                                              | 6 hrs after surgery       | N/A            |
|                              |                               |                     |                                                                            |                          |                |
| Author    | Study Design | Treatment 1 | Treatment 2 | N/A 1 | N/A 2 | Adverse Events |
|-----------|--------------|-------------|-------------|-------|-------|----------------|
| Bazzazi, 2014 | ALP vs PLA | Tamsulosin 0.4 mg 7 days before surgery  | Placebo same schedule | inability to void | during 12 hrs after surgery then at 24 and 72 hrs | N/A | N/A | Floppy iris syndrome |
| Cataldo, 1991 | ALP vs PLA | Prazosin 1mg orally at preop surgical unit then every 12 hrs Placebo same schedule | fail to void, bladder distended or uncomfortable | 8 hrs after surgery | N/A | N/A | Dizziness, Nausea, Vomiting, Orthostatic hypotension, Syncope |
| Chung, 2015 | ALP vs PLA | Tamsulosin 0.2 mg start 1 day before surgery until 6 days after surgery Placebo same schedule | not define | 1 and 7 days after biopsy | not define | N/A | N/A |
| Goldman, 1988 | ALP vs PLA | Phenoxybenzamine 10 mg 2 hrs before surgery then twice a day for 3 days after surgery No intervention | not define | not define | N/A | N/A | N/A |
| Gonullu, 1999 | ALP vs PLA | Prazosin 1mg orally at 12 hrs and 2 hrs before surgery then 12, 24 hrs after surgery Placebo same schedule | inability to void urine, suprapubic pain, palpable bladder | within 10 hrs after surgery | N/A | N/A | Overall adverse events |
| Jang, 2012 | ALP vs PLA | Tamsulosin 0.2 mg start on the surgery day then 0.2 mg/day until 7 days after surgery No intervention | inability to void, urine>200 ml by bladder scan | 72 hrs after surgery bladder scan at 7 days after surgery | not define | N/A |
| Jeong, 2014 | ALP vs PLA | Tamsulosin 0.4 mg start 1 day before surgery until 14 days after surgery No intervention | inability to void urine, suprapubic pain, palpable bladder | at 5 days after surgery | not define | not define | N/A |
| Livne, 1983 | ALP vs PLA | Dibenzyline 10 ug start 6-8 hrs before surgery then 18 hrs after first dose No intervention | inability to void | within 24 hrs after surgery | N/A | N/A | N/A |
| Lose, 1985 | ALP vs PLA | Phenoxybenzamine 10 mg start 4 hrs post surgery then 4 hrs later and continue until day 5 post surgery Placebo same schedule | inability to void | at day 1 and day 2 after surgery catheterization at 5 days after surgery | urine culture at 5 days after surgery | Headache, Dizziness, Orthostatic hypotension, Nausea, Vomiting, Urinary incontinence |
| Author                  | Intervention |Dosage and Administration | Inclusion Criteria | Time to Incidence | Follow-up | Adverse Events |
|------------------------|--------------|---------------------------|--------------------|-------------------|-----------|----------------|
| Madani, 2014           | ALP vs PLA   | Tamsulosin 0.4 mg start 14 hrs and 2 hrs before surgery and continue until 10 hrs after Sx Placebo same schedule | inability to void urine, suprapubic pain, palpable bladder, urine >400 ml by catheterization | within 24 hrs after surgery | N/A       | Dizziness, Nausea, Vomiting |
| Schubert, 2019         | ALP vs PLA   | Tamsulosin 0.4 mg start 5 days before surgery continue until 1 day after surgery Placebo same schedule | inability to void urine, suprapubic pain, urine >200 ml by bladder scan | within 6 hrs after surgery | N/A       | Dizziness, Hypotension, Constipation, Calf pain, Alterment status, Floppy iris syndrome, Syncope, Increase joint pain, Delay wound healing, SSI, Viral infection, Pruritus, Shortness of breath, Fatigue, GI bleeding |
| Mohamma di-Fallah, 2012 | ALP vs PLA   | Tamsulosin 0.4 mg start 6 hrs before surgery and 6-12 hr after surgery Placebo same schedule | inability to void urine, suprapubic pain | within 24 hrs after surgery | N/A       | Overall adverse events |
| Peterson, 1991         | ALP vs PLA   | Prazosin start 1 mg at 48 hrs before Sx then 2 mg every 12 hrs until discharge from the hospital No intervention(standard fluid regimen) | inability to void urine, palpable bladder | not define | not define | symptoms, urine test, urine culture at 5 days after surgery |
| Shaw, 2014             | ALP vs PLA   | Tamsulosin 0.4 mg start 7 hrs before surgery continue until 3 days post surgery Placebo same schedule | not define | not define | N/A       | Overall adverse events |
| Watson, 1999           | ALP vs PLA   | Indoramin 20 mg twice daily start 1 day post surgery continue until discharge from the hospital Placebo same schedule | not define | 2 days after surgery | N/A       | sore tongue |
| Woo, 1995              | ALP vs PLA   | Prazosin start 2 days before surgery titrate dose until 2 days post surgery | not define | not define | N/A       | Overall adverse events, Headache, Hypotension, |
| Study             | Intervention 1                  | Medication 1          | Medication 2                  | Medication 3                  | Discharge Criteria                  | Time Points  | Other Events |
|-------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------------------|--------------|--------------|
| Evron, 1984       | ALP vs PLA                      | Phenoxybenzamine 10 mg start 24hrs, 2hrs before surgery then 8 and 16 hrs after surgery | No intervention          | inability to void urine, suprapubic pain, palpable bladder | within 48 hrs after surgery     | N/A          | Hypotension  |
| Jianggao, 2000    | ALP vs PLA                      | Phenoxybenzamine 10 mg three times/day start 1 and 6 hrs before surgery | No intervention          | not define            | not define                          | N/A          | N/A          |
| Khan, 2015        | NSD vs PLA                      | Diclofenac 100 mg rectal suppository immediately post operation for 1 dose | Placebo same schedule    | the first 24 hrs      | the first 24 hrs                    | N/A          | N/A          |
| Galan, 2008       | NSD vs PLA                      | Diclofenac 100 mg rectal suppository immediate post op 1 dose | No intervention          | inability to void urine, suprapubic pain | 8 hrs after surgery            | N/A          | Overall adverse events |
| Burger, 1997      | ALP vs COMB vs PLA              | Alfuzosin 10 mg at 10 and 2 hrs before surgery Carbachol (2 mg)/diazepam (2 mg) Placebo | Placebo                  | no spontaneous micturation within 2 hs after taking the randomly administered medication | 8 hrs after surgery            | N/A          | N/A          |
| Savona-Ventura, 1991 | CHO vs ALP vs PLA              | Distigmine 5 mg oral start 1 day after surgery Phenoxybenzamine 10 mg twice daily start 1 day after surgery | No intervention          | urine >150 ml by catheterization | 3 days after surgery            | N/A          | N/A          |

*Combine same medication group into 1 group for analysis
Supplement Figure 1 Risk of bias assessment using Revised Cochrane risk-of-bias tool for randomized trials (RoB 2)

| Author, Year  | Randomization | deviations from intended interventions | missing outcome data | measurement of the outcome | selection of the reported result | Overall bias |
|---------------|---------------|----------------------------------------|----------------------|----------------------------|---------------------------------|--------------|
| AMB vs PLA    |               |                                        |                      |                            |                                 |              |
| Hansen, 2015  | +             | +                                     | −                    | +                          | ?                               | −            |
| Kim SB, 1999  | ?             | +                                     | +                    | +                          | ?                               | !            |
| Kim SH, 1999  | ?             | +                                     | +                    | −                          | ?                               | −            |
| FLU vs PLA    |               |                                        |                      |                            |                                 |              |
| Bailey, 1976  | −             | ?                                     | +                    | −                          | ?                               | −            |
| Kozol, 1992   | ?             | +                                     | +                    | +                          | ?                               | !            |
| Lee, 1999     | ?             | +                                     | +                    | +                          | ?                               | !            |
| Orbey, 2009   | +             | ?                                     | +                    | +                          | ?                               | !            |
| NEU vs PLA    |               |                                        |                      |                            |                                 |              |
| Butwick, 2003 | ?             | +                                     | +                    | +                          | ?                               | !            |
| Li, 2019      | ?             | +                                     | +                    | −                          | ?                               | −            |
| ACU vs PLA    |               |                                        |                      |                            |                                 |              |
| Gao, 2014     | ?             | +                                     | +                    | +                          | ?                               | !            |
| Bimei, 2015   | ?             | +                                     | +                    | +                          | ?                               | !            |
| Weimin, 2008  | ?             | +                                     | +                    | +                          | ?                               | !            |
| CHO vs PLA    |               |                                        |                      |                            |                                 |              |
| Uy, 2011      | ?             | +                                     | +                    | +                          | ?                               | !            |
| Bowers, 1986  | ?             | +                                     | +                    | +                          | ?                               | !            |
| Manchana, 2011| +             | +                                     | +                    | +                          | +                               | +            |
| Walsh, 1972   | ?             | +                                     | +                    | −                          | ?                               | −            |
| Study                          | BENZ vs PLA | ASP vs PLA | OPI vs PLA | ALP vs PLA |
|-------------------------------|-------------|------------|------------|------------|
| Hershberger, 2003             | ?           |            | +          | ?          |
| Tomaszewski, 2015             | ?           | -          | -          | ?          |
| Cepeda, 2004                  | +           | +          | +          | ?          |
| Gallo, 2008                   | ?           | +          | +          | ?          |
| Zand, 2015                    | ?           |            | +          | +          |
| Akkoc, 2016                   | -           | +          | +          | ?          |
| Basheer, 2017                 | ?           | +          | +          | ?          |
| Bazzazi, 2014                 | ?           | +          | +          | ?          |
| Cataldo, 1997                 | ?           | ?          | +          | ?          |
| Chung, 2015                   | ?           | +          | +          | ?          |
| Goldman, 1988                 | ?           | +          | +          | ?          |
| Gonullu, 1999                 | ?           | +          | +          | ?          |
| Jang, 2012                    | -           | +          | +          | ?          |
| Jeong, 2014                   | ?           | -          | -          | +          |
| Livne, 1983                   | ?           | +          | +          | ?          |
| Lose, 1985                    | ?           | +          | -          | ?          |
| Madani, 2014                  | +           | -          | +          | +          |
| Schubert, 2019                | +           | +          | +          | +          |
| Mohammadi-Fallah, 2012        | ?           | +          | +          | ?          |
| Peterson, 1991                | ?           | +          | +          | ?          |
| Shaw, 2014                    | ?           | +          | +          | ?          |
| Study                  | NSD vs PLA | ALP vs COMB vs PLA | CHO vs ALP vs PLA |
|------------------------|------------|--------------------|-------------------|
| Watson, 1999           | ?          | +                  | +                 |
| Woo, 1995              | -          | +                  | -                 |
| Evron, 1984            | ?          | +                  | -                 |
| Jianggao, 2000         | ?          | +                  | -                 |
| Khan, 2015             | ?          | +                  | +                 |
| Galan, 2008            | ?          | +                  | -                 |
| Burger, 1997           | -          | +                  | +                 |
| Savona-Ventura, 1991   | ?          | +                  | +                 |
Supplement Figure 2. Forest plot of risk ratio in lowering POUR between 2 interventions

A. comparing between AMB vs PLA, B. comparing between FLU vs PLA, C. comparing between ACU vs PLA
Supplement Figure 2. Forest plot of risk ratio in lowering POUR between 2 interventions (cont.)

**D.** Comparing between OPI vs PLA

| Study                       | OPI Yes | OPI No | PLA Yes | PLA No | Risk Ratio with 95% CI | Weight (%) |
|-----------------------------|---------|--------|---------|--------|------------------------|------------|
| M. Soledad Cepeda, 2004     | 6       | 130    | 11      | 118    | 0.52 [0.20, 1.36]      | 19.75      |
| Susan Gallo, 2008           | 6       | 46     | 11      | 34     | 0.47 [0.19, 1.17]      | 22.16      |
| Farid Zand, 2015            | 12      | 21     | 17      | 17     | 0.73 [0.41, 1.28]      | 58.09      |
| **Overall**                 |         |        |         |        | 0.62 [0.40, 0.95]      |        |

Heterogeneity: $I^2 = 0.00\%$, $H^2 = 0.39$

Test of $θ = 0$; $Q(2) = 0.79$, $p = 0.67$

Test of $θ = 0$: $z = -2.20$, $p = 0.03$

Fixed-effects inverse-variance model

**E.** Comparing between CHO vs PLA

| Study                     | CHO Yes | CHO No | PLA Yes | PLA No | Risk Ratio with 95% CI | Weight (%) |
|---------------------------|---------|--------|---------|--------|------------------------|------------|
| Billy James G. Uy, 2011  | 3       | 43     | 14      | 46     | 0.28 [0.09, 0.92]      | 15.18      |
| Fredrick J. Bowers, 1987 | 14      | 67     | 3       | 24     | 1.56 [0.48, 5.00]      | 15.42      |
| Tarinee Manchana, 2011    | 10      | 21     | 19      | 12     | 0.53 [0.29, 0.94]      | 25.32      |
| C. Savona-Ventura, 1991   | 9       | 13     | 3       | 25     | 3.82 [1.17, 12.44]     | 15.25      |
| John Walsh, 1972          | 24      | 26     | 28      | 22     | 0.86 [0.59, 1.25]      | 28.83      |
| **Overall**               |         |        |         |        | 0.88 [0.47, 1.66]      |        |

Heterogeneity: $I^2 = 0.33$, $I^2 = 69.47\%$, $H^2 = 3.28$

Test of $θ = 0$; $Q(4) = 13.10$, $p = 0.01$

Test of $θ = 0$: $z = -0.39$, $p = 0.69$

Random-effects DerSimonian-Laird model
Supplement Figure 2. Forest plot of risk ratio in lowering POUR between 2 interventions (cont.)

| Study                        | ALP | PLA | Risk Ratio with 95% CI | Weight |
|------------------------------|-----|-----|------------------------|--------|
| All Akkoc, 2016              | 7   | 113 | 0.23 [0.10, 0.54]      | 5.33   |
| Azam Basheer, 2017           | 16  | 33  | 1.16 [0.63, 2.13]      | 6.44   |
| Nooshin Bazzazi, 2014        | 1   | 31  | 0.06 [0.01, 0.46]      | 2.04   |
| Destree H.C. Burger, 1997    | 33  | 49  | 1.18 [0.83, 1.68]      | 7.62   |
| Peter A. Cardo, 1997        | 10  | 15  | 0.80 [0.43, 1.49]      | 6.37   |
| Seung J. Chung, 2015         | 0   | 44  | 0.20 [0.01, 0.40]      | 1.01   |
| Gideon Goldman, 1988         | 0   | 58  | 0.01 [0.00, 0.23]      | 1.16   |
| Neset N. Onur, 1999          | 9   | 75  | 0.43 [0.21, 0.89]      | 5.83   |
| Je H. Jang, 2012             | 11  | 36  | 1.10 [0.52, 2.34]      | 5.74   |
| In G Jeong, 2014             | 8   | 101 | 0.42 [0.19, 0.92]      | 5.61   |
| Pinhas M. Livne, 1983        | 10  | 71  | 0.37 [0.19, 0.71]      | 6.19   |
| Gunnar Lose, 1985            | 7   | 13  | 0.73 [0.35, 1.55]      | 5.78   |
| Ali H. Madaani, 2014         | 7   | 111 | 0.28 [0.13, 0.63]      | 5.52   |
| Manuel F. Schubert, 2019     | 18  | 69  | 0.75 [0.44, 1.28]      | 6.81   |
| Mohammadreza Mohammadi-Falah, 2012 | 1   | 39  | 0.17 [0.02, 1.32]      | 1.88   |
| Michael S. Peterson, 1991    | 6   | 22  | 0.36 [0.17, 0.78]      | 5.69   |
| C. Savona-Ventura, 1991      | 8   | 15  | 3.25 [0.97, 10.85]     | 3.85   |
| Manoj K. Shaw, 2014          | 3   | 21  | 0.30 [0.09, 0.96]      | 4.02   |
| H.H. Woo, 1995               | 2   | 34  | 4.73 [0.24, 95.09]     | 1.01   |
| Samuel Evron, 1984           | 3   | 27  | 0.21 [0.07, 0.67]      | 4.09   |
| Tang Jianguo, 2000           | 18  | 2   | 1.06 [0.84, 1.34]      | 8.02   |

F. comparing between ALP vs PLA

Random-effects DerSimonian-Laird model
Supplement Figure 3. Forrest plot of risk ratio in lowering POUR between ALP vs PLA with subgroup analysis

| Study                                | ALP Yes | ALP No | PLA Yes | PLA No | Risk Ratio with 95% CI | Weight (%) |
|--------------------------------------|---------|--------|---------|--------|------------------------|------------|
| Male                                 |         |        |         |        |                        |            |
| Azam Basheer, 2017                    | 16      | 33     | 13      | 33     | 1.16 [0.63, 2.13]      | 6.44       |
| Nooshin Bazzazi, 2014                 | 1       | 31     | 17      | 18     | 0.06 [0.01, 0.46]      | 2.04       |
| Seung Jun Chung, 2015                 | 0       | 44     | 2       | 42     | 0.20 [0.01, 4.05]      | 1.01       |
| Neset Nuri Gonullu, 1999              | 9       | 75     | 18      | 54     | 0.43 [0.21, 0.89]      | 5.83       |
| In Gab Jeong, 2014                    | 8       | 101    | 19      | 90     | 0.42 [0.19, 0.92]      | 5.61       |
| Ali Hamidi Madani, 2014               | 7       | 111    | 24      | 90     | 0.28 [0.13, 0.63]      | 5.52       |
| Manuel F. Schubert, 2019              | 18      | 69     | 24      | 63     | 0.75 [0.44, 1.28]      | 6.81       |
| Mohammadreza Mohammadi-Fallah, 2012   | 1       | 39     | 6       | 34     | 0.17 [0.02, 1.32]      | 1.88       |
| Michael S. Peterson, 1991             | 6       | 22     | 19      | 13     | 0.36 [0.17, 0.78]      | 5.69       |
| Manoj K. Shaw, 2014                   | 3       | 21     | 10      | 14     | 0.30 [0.09, 0.96]      | 4.02       |
| H.H.Woo, 1995                         | 2       | 34     | 0       | 34     | 4.73 [0.24, 95.09]     | 1.01       |
| Heterogeneity: $\tau^2 = 0.23$, $I^2 = 52.12\%$, $H^2 = 2.09$ | | | | | 0.45 [0.29, 0.69] |
| Test of $\theta_i = \theta_j$: $Q(10) = 20.89$, $p = 0.02$ | | | | | |
| Female                               |         |        |         |        |                        |            |
| Pinhas M. Lime, 1983                  | 10      | 71     | 25      | 49     | 0.37 [0.19, 0.71]      | 6.19       |
| Gunnar Lose, 1985                     | 7       | 13     | 10      | 11     | 0.73 [0.35, 1.55]      | 5.78       |
| C.Savona-Ventura, 1991                | 8       | 15     | 3       | 25     | 3.25 [0.97, 10.85]     | 3.85       |
| Samuel Evron, 1984                    | 3       | 27     | 14      | 16     | 0.21 [0.07, 0.67]      | 4.09       |
| Heterogeneity: $\tau^2 = 0.68$, $I^2 = 76.89\%$, $H^2 = 4.33$ | | | | | 0.63 [0.25, 1.60] |
| Test of $\theta_i = \theta_j$: $Q(3) = 12.98$, $p = 0.00$ | | | | | |
| Mixed gender                         |         |        |         |        |                        |            |
| Desiree H.C. Burger, 1997             | 33      | 49     | 47      | 91     | 1.18 [0.83, 1.68]      | 7.62       |
| Je Ho Jang, 2012                      | 11      | 36     | 10      | 37     | 1.10 [0.52, 2.34]      | 5.74       |
| Heterogeneity: $\tau^2 = 0.00$, $I^2 = 0.00\%$, $H^2 = 1.00$ | | | | | 1.17 [0.85, 1.60] |
| Test of $\theta_i = \theta_j$: $Q(1) = 0.03$, $p = 0.87$ | | | | | |
| Overall                              |         |        |         |        |                        |            |
| Heterogeneity: $\tau^2 = 0.34$, $I^2 = 67.73\%$, $H^2 = 3.10$ | | | | | 0.56 [0.39, 0.81] |
| Test of $\theta_i = \theta_j$: $Q(16) = 49.58$, $p = 0.00$ | | | | | |
| Test of group differences: $Q(2) = 12.38$, $p = 0.00$ | | | | | |

Random-effects DerSimonian-Laird model

A. Subgroup analysis by gender
Supplement Figure 3. Forrest plot of risk ratio in lowering POUR between ALP vs PLA with subgroup analysis (cont.)

| Study                                      | ALP Yes | ALP No | PLA Yes | PLA No | Risk Ratio with 95% CI | Weight (%) |
|--------------------------------------------|---------|--------|---------|--------|------------------------|------------|
| Non-neurourological procedure              |         |        |         |        |                        |            |
| Nooshin Bazzazi, 2014                      | 1       | 31     | 17      | 18     | 0.06 [0.01, 0.46]      | 3.93       |
| Neset Nuri Gonullu, 1999                   | 9       | 75     | 18      | 54     | 0.43 [0.21, 0.89]      | 12.96      |
| Ali Hamidi Madani, 2014                     | 7       | 111    | 24      | 90     | 0.28 [0.13, 0.63]      | 12.10      |
| Manuel F. Schubert, 2019                   | 18      | 69     | 24      | 63     | 0.75 [0.44, 1.28]      | 15.78      |
| Mohammadreza Mohammadi-Fallah, 2012        | 1       | 39     | 6       | 34     | 0.17 [0.02, 1.32]      | 3.59       |
| Michael S. Peterson, 1991                  | 6       | 22     | 19      | 13     | 0.36 [0.17, 0.78]      | 12.57      |
| Manoj K. Shaw, 2014                        | 3       | 21     | 10      | 14     | 0.30 [0.09, 0.96]      | 8.31       |
| H.H.Woo, 1995                              | 2       | 34     | 0       | 34     | 4.73 [0.24, 95.09]     | 1.88       |
| Heterogeneity: $\tau^2 = 0.19$, $I^2 = 44.66\%$, $H^2 = 1.81$ |         |        |         |        |                        |            |
| Test of $\theta_i = \theta_j$: $Q(7) = 12.65$, $p = 0.08$ |         |        |         |        |                        |            |

| Neuourological procedure                    |         |        |         |        |                        |            |
| Azam Basheer, 2017                          | 16      | 33     | 13      | 33     | 1.16 [0.63, 2.13]      | 14.67      |
| Seung Jun Chung, 2015                       | 0       | 44     | 2       | 42     | 0.20 [0.01, 4.05]      | 1.87       |
| In Gab Jeong, 2014                          | 8       | 101    | 19      | 90     | 0.42 [0.19, 0.92]      | 12.35      |
| Heterogeneity: $\tau^2 = 0.33$, $I^2 = 57.89\%$, $H^2 = 2.38$ |         |        |         |        |                        |            |
| Test of $\theta_i = \theta_j$: $Q(2) = 4.75$, $p = 0.09$ |         |        |         |        |                        |            |

| Overall                                     |         |        |         |        |                        |            |
| Heterogeneity: $\tau^2 = 0.23$, $I^2 = 52.12\%$, $H^2 = 2.09$ |         |        |         |        |                        |            |
| Test of $\theta_i = \theta_j$: $Q(10) = 20.89$, $p = 0.02$ |         |        |         |        |                        |            |
| Test of group differences: $Q_{10}(1) = 1.00$, $p = 0.32$ |         |        |         |        |                        |            |

| Weight (%)                                  | 0.016   | 0.25   | 4       | 64     |                        |            |

Random-effects DerSimonian-Laird model

B. Subgroup analysis by type of operations in male
Supplement Figure 3. Forrest plot of risk ratio in lowering POUR between ALP vs PLA with subgroup analysis (cont.)

| Study                          | ALP | PLA | Risk Ratio with 95% CI | Weight (%) |
|-------------------------------|-----|-----|------------------------|------------|
| Non-neurourological procedure |     |     |                        |            |
| Pinhas M. Lime, 1983          | 10  | 25  | 0.37 [ 0.19, 0.71]     | 28.63      |
| Samuel Evron, 1984            | 3   | 14  | 0.21 [ 0.07, 0.67]     | 22.34      |
| Heterogeneity: $\tau^2 = 0.00$, $I^2 = 0.00\%$, $H^2 = 1.00$ |     |     | 0.32 [ 0.18, 0.57]     |            |
| Test of $\theta_i = \theta_j$: $Q(1) = 0.63$, $p = 0.43$ |     |     |                        |            |

| Neurourological procedure     |     |     |                        |            |
| Gunnar Lose, 1985             | 7   | 13  | 0.73 [ 0.35, 1.55]     | 27.55      |
| C. Savona-Ventura, 1991       | 8   | 15  | 3.25 [ 0.97, 10.85]    | 21.47      |
| Heterogeneity: $\tau^2 = 0.84$, $I^2 = 76.23\%$, $H^2 = 4.21$ |     |     | 1.43 [ 0.34, 6.07]    |            |
| Test of $\theta_i = \theta_j$: $Q(1) = 4.21$, $p = 0.04$ |     |     |                        |            |

| Overall                       |     |     | 0.63 [ 0.25, 1.60]     |            |
| Heterogeneity: $\tau^2 = 0.68$, $I^2 = 76.89\%$, $H^2 = 4.33$ |     |     |                        |            |
| Test of $\theta_i = \theta_j$: $Q(3) = 12.98$, $p = 0.00$ |     |     |                        |            |
| Test of group differences: $Q_b(1) = 3.56$, $p = 0.06$ |     |     |                        |            |

Random-effects DerSimonian-Laird model

C. Subgroup analysis by type of operations in female
Supplement Figure 4. Forest plot of risk ratio in lowering UTI between 2 interventions

| Study                          | ALP Yes | ALP No | PLA Yes | PLA No | Risk Ratio with 95% CI | Weight (%) |
|-------------------------------|---------|--------|---------|--------|------------------------|------------|
| Je H. Jang, 2012              | 0       | 47     | 2       | 45     | 0.20 [ 0.01, 4.06]     | 7.03       |
| Gunnar Lose, 1985             | 5       | 15     | 9       | 11     | 0.56 [ 0.23, 1.37]     | 78.52      |
| Manuel F. Schubert, 2019      | 2       | 62     | 0       | 67     | 5.23 [ 0.26, 106.89]   | 6.99       |
| Samuel Evron, 1984             | 0       | 30     | 3       | 27     | 0.14 [ 0.01, 2.65]     | 7.46       |
| Overall                       |         |        |         |        | 0.55 [ 0.25, 1.21]     |            |

Heterogeneity: $I^2 = 11.58\%$, $H^2 = 1.13$

Test of $\theta_i = \theta_j$: $Q(3) = 3.39$, $p = 0.33$

Test of $\theta = 0$: $z = -1.48$, $p = 0.14$

Fixed-effects inverse-variance model
Supplement Figure 5. Forest plot of mean difference in lowering PVRU between 2 interventions

| Study                  | ALP N | Mean  | SD   | PLA N | Mean  | SD   | Mean Diff. with 95% CI | Weight (%) |
|------------------------|-------|-------|------|-------|-------|------|------------------------|------------|
| Seung J. Chung, 2015   | 44    | 39.7  | 25.3 | 44    | 78.8  | 75.2 | -39.10 [-62.54, -15.66] | 30.07      |
| Je H. Jang, 2012       | 47    | 53    | 84.8 | 47    | 33.6  | 59.9 | 19.40 [-10.28, 49.08]   | 27.88      |
| In G. Jeong, 2014      | 105   | 22.7  | 29.1 | 102   | 27.1  | 42.4 | -4.40 [-14.28, 5.48]    | 33.68      |
| Gunnar Lose, 1985      | 20    | 70    | 98.2 | 21    | 232   | 307.5| -162.00 [-303.23, -20.77] | 5.37       |
| A. J.S Watson, 1999    | 25    | 251   | 400.8| 24    | 325   | 287.6| -74.00 [-270.04, 122.04] | 3.01       |
| **Overall**            |       |       |      |       |       |      | -18.75 [-54.36, 16.85]  |            |

Heterogeneity: $\tau^2 = 954.32$, $I^2 = 82.15\%$, $H^2 = 5.60$

Test of $\theta = \theta$: $Q(4) = 15.55$, $p = 0.00$

Test of $\theta = 0$: $z = -1.03$, $p = 0.30$

Random-effects REML model
Supplement Figure 6. Forest plot of mean difference in lowering LUTS between 2 interventions

| Study                          | ALP  | PLA  | Cohen's d with 95% CI | Weight (%) |
|-------------------------------|------|------|-----------------------|------------|
|                               | N    | Mean | SD        | N    | Mean | SD        |            |            |
| Seung J. Chung, 2015          | 44   | 12.5 | 8.3       | 44   | 12.8 | 8.7       | -0.04 [-0.45, 0.38] | 26.84 |
| In G. Jeong, 2014             | 105  | 10.4 | 6.4       | 102  | 11.8 | 6.8       | -0.21 [-0.49, 0.06]  | 40.15 |
| Manuel F. Schubert, 2019      | 64   | 7.98 | 5.76      | 67   | 6.48 | 6.3       | 0.25 [-0.10, 0.59]   | 33.01 |
| Overall                       |      |      |           |      |      |           | -0.01 [-0.30, 0.27]  |        |

- Heterogeneity: $\tau^2 = 0.03, I^2 = 52.34\%, H^2 = 2.10$
- Test of $\theta = 0$: $Q(2) = 4.22, p = 0.12$
- Test of $\theta = 0$: $z = -0.09, p = 0.93$

Random-effects REML model
Supplement Figure 7. Forest plot of risk ratio in having AE between 2 interventions

A. comparing between AMB vs PLA, B. comparing between CHO vs PLA
Supplement Figure 7. Forest plot of risk ratio in having AE between 2 interventions (cont.)

C. comparing between ALP vs PLA

| Study                          | ALP | PLA | Risk Ratio with 95% CI | Weight (%) |
|-------------------------------|-----|-----|------------------------|------------|
| Ali A. Khoc, 2016             | 3   | 118 | 3.50 [0.18, 66.69]     | 2.65       |
| Noosheh Bazzazi, 2014         | 0   | 32  | 0.36 [0.02, 8.62]      | 2.30       |
| Peter A. Cataldo, 1997        | 4   | 21  | 1.28 [0.32, 5.13]      | 11.94      |
| Neset N. Goulu, 1999          | 0   | 84  | 0.86 [0.02, 42.74]     | 1.51       |
| Gunnar Lose, 1985             | 4   | 16  | 1.40 [0.36, 5.49]      | 12.34      |
| Ali H. Madani, 2014           | 2   | 116 | 4.83 [0.23, 99.56]     | 2.51       |
| Manuel F. Schubert, 2019      | 22  | 42  | 2.30 [1.19, 4.48]      | 52.15      |
| Mohammadreza Mohammadi-Fallah, | 0   | 40  | 1.00 [0.02, 49.20]     | 1.52       |
| Michael S. Peterson, 1991     | 0   | 28  | 1.14 [0.02, 55.55]     | 1.52       |
| A. J. S. Watson, 1999         | 1   | 24  | 2.68 [0.12, 67.53]     | 2.32       |
| H.H. Woo, 1995                | 2   | 34  | 0.63 [0.11, 3.54]      | 7.72       |
| Samuel Eyront, 1984           | 0   | 30  | 1.00 [0.02, 48.82]     | 1.52       |
| Overall                       |     |     | 1.72 [1.07, 2.76]      |            |

Heterogeneity: I^2 = 0.00%, H^2 = 0.39
Test of ψ = 0; Q(11) = 4.32, p = 0.96
Test of ψ = 0; z = 2.22, p = 0.03

Fixed-effects inverse-variance model
Supplement Figure 8. Funnel plots of studies included in direct meta-analysis for POUR, UTI prevention, PVUR, LUTS lowering and AE outcomes

A. studies included for POUR prevention between AMB vs PLA, B. studies included for POUR prevention between FLU vs PLA, C. studies included for POUR prevention between ACU vs PLA, D. studies included for POUR prevention between CHO vs PLA, E. studies included for POUR prevention between OPI vs PLA, F. studies included for POUR prevention between ALP vs PLA
Supplement Figure 8. Funnel plots of studies included in direct meta-analysis for POUR, UTI prevention, PVUR, LUTS lowering and AE outcomes (cont.)

G. studies included for UTI prevention between ALP vs PLA
Supplement Figure 8. Funnel plots of studies included in direct meta-analysis for POUR, UTI prevention, PVUR, LUTS lowering and AE outcomes (cont.)

![Funnel Plot](image)

H. studies included for PVRU lowering between ALP vs PLA
Supplement Figure 8. Funnel plots of studies included in direct meta-analysis for POUR, UTI prevention, PVUR, LUTS lowering and AE outcomes (cont.)

I. studies included for LUTS lowering between ALP vs PLA
Supplement Figure 8. Funnel plots of studies included in direct meta-analysis for POUR, UTI prevention, PVUR, LUTS lowering and AE outcomes (cont.)

J. AMB vs PLA

K. CHO vs PLA

L. ALP vs PLA

J. studies included for AE risk between AMB vs PLA, K. studies included for AE risk between CHO vs PLA, L. studies included for AE risk between ALP vs PLA
Supplement 2: Network meta-analysis

Supplement Figure 9. Rankogram showing the effect of each intervention in preventing POUR
Supplement Figure 10. Contour-enhanced funnel plots of studies included in NMA for POUR outcome
### Supplement Table 3. Treatment effects of direct and indirect comparison between 2 interventions for UTI, PVRU, LUTS outcomes

| Outcome | Comparator | PLA | OPI | NSD | NEU | CHO | ALP | ACU |
|---------|------------|-----|-----|-----|-----|-----|-----|-----|
| PVRU    | PLA        | 1   | -8.60 | - | -20.16 | -78.00 | -18.24 | -13.30 |
|         | OPI        | 8.60 | 1 | - | -11.56 | -69.40 | -9.64 | -4.70 |
|         | NEU        | 20.16 | 11.56 | - | 1 | -57.84 | 1.93 | 6.86 |
|         | CHO        | 78.00 | 69.40 | - | 57.84 | 1 | 59.76 | 64.70 |
|         | ALP        | 18.24 | 9.64 | - | -1.93 | -59.76 | 1 | 4.94 |
|         | ACU        | 13.30 | 4.70 | - | -6.86 | -64.70 | -4.94 | 1 |
| UTI     | PLA        | 1   | - | 0.38 (0.02,9.15) | - | 1.16 | 0.57 | - |
|         | NSD        | 2.64 | 1 | - | 3.07 | 1.50 | - |
|         | CHO        | 0.86 | 0.33 (0.01,8.20) | - | 1 | 0.49 | - |
|         | ALP        | 1.76 | 0.67 (0.02,17.79) | - | 2.05 | 1 | - |
| LUTS    | PLA        | 1   | - | - | -2.00 | - | -0.03 | - |
|         | NEU        | 2.00 | - | - | 1 | - | 1.97 | - |
|         | ALP        | 0.03 | - | - | -1.97 | - | 1 | - |

PVRU and LUTS reported as mean difference (95% confidence intervals) from network meta-analysis between each pair of treatments.
UTI reported as risk ratio (95% confidence intervals) from network meta-analysis between each pair of treatments.
Bold font indicates statistical significance.

ACU = Acupuncture, ALP = Alpha adrenergic antagonist, AMB = Ambulation, ASP = Antispasmodic agents, BENZ = Benzodiazepine, CHO = Cholinergic agents, FLU = Fluid restriction, NSD = NSAIDS, OPI = Opioid antagonist agent.
Supplement Figure 11. Rankogram showing the effect of each intervention in preventing UTI
Supplement Figure 12. Contour-enhanced funnel plots of studies included in NMA for UTI outcome.
Supplement Figure 13. Rankogram showing the effect of each intervention in reducing PVRU
Supplement Figure 14. Contour-enhanced funnel plots of studies included in NMA for PVRU outcome
Supplement Figure 15. Rankogram showing the effect of each intervention in reducing LUTS
Supplement Figure 16. Contour-enhanced funnel plots of studies included in NMA for LUTS outcome
Supplement Figure 17. Rankogram showing the effect of each intervention in AE occurrence
Supplement Figure 18. Contour-enhanced funnel plots of studies included in NMA for AE outcome
Appendix 3 : Risk-benefit analysis

Supplement Figure 19. Risk-benefit plane between 2 interventions in POUR prevention

Incremental risk benefit curve showed ∆B and ∆R plot of each intervention pair along with risk-benefit acceptability thresholds at 0.2 and 0.3. The scatter plot in the right lower quadrant, corresponding to high benefit with minimal AE.
Supplement Table 4. Estimations of pooled $\Delta R$ and $\Delta B$ for AMB, ACU, CHO, OPI, ALP and NSD versus PLA using NMA with consistency model

| Comparisons | $\Delta R$ (95% CI) | $\Delta B$ (95% CI) | IRBR |
|-------------|---------------------|---------------------|------|
| AMB vs PLA  | -0.0030 (-0.00385 , -0.00241) | -0.2561 (-0.250534 , -0.261725) | 0.0118 |
| ACU vs PLA  | -0.1355 (-0.14281 , -0.1323) | -0.1840 (-0.179877 , -0.1911) | 0.7372 |
| CHO vs PLA  | 0.0076 (0.006936 , 0.008448) | -0.0591 (-0.054043 , -0.062971) | -0.1290 |
| OPI vs PLA  | -0.1325 (-0.13593 , -0.1293) | -0.0940 (-0.08591, -0.09724) | 1.4131 |
| ALP vs PLA  | 0.0089 (.0086708 , 0.146951) | -0.1461 (-0.142305 , -0.146951) | -0.0609 |
| NSD vs PLA  | 0.0009 (-0.00044, 0.001145) | -0.0943 (-0.0791 , -0.091647) | -0.0095 |

$\Delta B$ = the expected incremental probability of benefit, CI=confidence interval, IRBR= An incremental risk-benefit ratio. $\Delta R$ = the expected incremental probability of risk.

ACU = Acupuncture, ALP = Alpha adrenergic antagonist, AMB = Ambulation, CHO = Cholinergic agents, NSD = NSAIDS, OPI = Opioid antagonist agent.
Supplement Figure 20. Acceptability curve plotting between the probability of benefit in Y axis and the clinical threshold in X-axis

A. AMB vs PLA

B. ACU vs PLA

C. CHO vs PLA

D. OPI vs PLA

E. ALP vs PLA

F. NSD vs PLA
**Supplement Table 5. Estimation of percent chance that IRBR of each comparisons were less than risk-benefit acceptability thresholds ranging from 0 to 1.0**

| Threshold | AMB vs PLA | ACU vs PLA | CHO vs PLA | OPI vs PLA | ALP vs PLA | NSD vs PLA |
|-----------|------------|------------|------------|------------|------------|------------|
| 0         | 52.1       | 91.7       | 34.9       | 84.6       | 10.7       | 49.5       |
| 0.1       | 97.2       | 94.9       | 57.7       | 85.0       | 76.3       | 76.9       |
| 0.2       | 98.8       | 95.8       | 72.4       | 85.2       | 97.6       | 87.2       |
| 0.3       | 99.0       | 96.5       | 80.3       | 85.4       | 99.6       | 91.1       |
| 0.4       | 99.1       | 96.9       | 85.4       | 85.5       | 99.9       | 93.4       |
| 0.5       | 99.2       | 97.1       | 89.0       | 85.7       | 1          | 94.6       |
| 0.6       | 99.4       | 97.4       | 91.2       | 85.8       | 1          | 95.8       |
| 0.7       | 99.6       | 97.6       | 92.2       | 86.0       | 1          | 96.4       |
| 0.8       | 99.6       | 97.6       | 93.6       | 86.2       | 1          | 96.8       |
| 0.9       | 99.6       | 97.6       | 94.5       | 86.4       | 1          | 97.3       |
| 1         | 99.7       | 97.8       | 94.8       | 86.7       | 1          | 97.3       |
Supplement Figure 21. Net clinical benefit acceptability curve shows the probability of being the best intervention in terms of net clinical benefit.