REVIEW

Clinical Efficacy of Ureteroscopy Versus Laparoscopic Ureterolithotomy in the Treatment of Large Proximal Ureteral Stones (>1 cm): A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Purpose: Large proximal ureteral stones (>1 cm) present significant therapeutic challenges due to high complication risks and technical complexities. Current guidelines provide no clear preference between ureteroscopic lithotripsy and laparoscopic ureterolithotomy for large proximal ureteral stones, and the optimal surgical approach remains debated. This meta-analysis therefore compares the clinical efficacy and safety of ureteroscopy versus laparoscopic ureterolithotomy using randomized controlled trial (RCT) data.

Materials and Methods: We systematically searched PubMed, Cochrane Library, Embase, Web of Science, CNKI, Wanfang, VIP, and China Biomedical Literature Database from their inception to July 12, 2026, for RCTs comparing the clinical efficacy of ureteroscopy and laparoscopic ureterolithotomy for large proximal ureteral calculi (>1 cm). Data from the included RCTs were statistically analyzed using Review Manager 5.2 software.

Results: A total of 11 RCTs involving 1300 patients were included. Laparoscopic ureterolithotomy showed significantly higher immediate (odds ratio [OR] = 8.06, $P < .001$) and final (OR = 8.56, $P < .001$) stone-free rates, but longer operative time (standardized mean difference [SMD] = 1.28, $P = .01$), longer hospital stay (SMD = 1.67, $P < .001$), and higher postoperative pain scores (SMD = 0.76, $P < .001$) compared with ureteroscopy. Postoperative complication rates were significantly lower with laparoscopic ureterolithotomy (OR = 0.43, $P < .001$).

Conclusion: Laparoscopic ureterolithotomy provides higher stone-free rates and fewer complications for large proximal ureteral stones, but entails longer operative time, extended hospitalization, and increased postoperative pain. However, the pooled estimates predominantly derive from older trials lacking contemporary ureteroscopic technologies (e.g., high-power lasers, suction access sheaths). Thus, laparoscopic ureterolithotomy represents a viable alternative primarily where modern ureteroscopic equipment is unavailable or contraindicated.

Keywords: ureteral calculi; laparoscopy; ureteroscopy; meta-analysis; randomized controlled trials; lithotripsy

INTRODUCTION

Large proximal ureteral stones (>1 cm) are among the common clinical conditions encountered in urological practice. They may not only cause severe flank or abdominal pain, hematuria, and related symptoms, but also lead to serious complications such as urinary tract obstruction and renal impairment, severely compromising patients' quality of life.[1,2] With the continuous advancement of surgical technology, ureteroscopic lithotripsy (URS) and laparoscopic ureterolithotomy (LU) have emerged as two principal minimally invasive surgical procedures for managing large proximal ureteral stones.[3] However, their comparative clinical efficacy remains a subject of ongoing debate. URS involves transurethral insertion of an endoscope for intracorporeal lithotripsy, offering less surgical trauma and faster postoperative recovery, whereas LU permits direct visualization of calculi and surrounding tissues for precise extraction.[4,5]

Although LU is a minimally invasive procedure, it remains relatively more invasive than URS, and postoperative convalescence may be longer. Significant academic controversy persists regarding the comparative efficacy of URS versus laparoscopy in treating large proximal ureteral stones. Discrepancies have been reported across published studies regarding key clinical indicators such as stone-free rate, operative duration, hospitalization time, and complication rates.[6,7] Therefore, this study aimed to compare the clinical efficacy of URS and LU in the treatment of large proximal ureteral stones (>1 cm) by performing a systematic review and meta-analysis. Unlike prior meta-analyses that included mixed stone sizes, the present study exclusively evaluates calculi >1 cm and incorporates recent randomized controlled trials (RCTs), providing updated evidence on modern LU and URS techniques. The primary objective is to provide clinicians with accurate and reliable evidence to guide treatment planning, optimize surgical approaches, and improve clinical outcomes and patient quality of life.

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Received October 2025 & Accepted August 2026

Table 1. Baseline characteristics of included randomized controlled trials.

Author and Year	Country	Age (years) LU	Age (years) URS	Sample Size (n) LU	Sample Size (n) URS	Stone Size (cm) LU	Stone Size (cm) URS	Initial SFR (%) LU	Initial SFR (%) URS	Final SFR (%) LU	Final SFR (%) URS	Operative Time (min) LU	Operative Time (min) URS	Complication Rate (%) LU	Complication Rate (%) URS	LU Approach	Outcomes Evaluated
Zoeir 2024(9)	Egypt	42.54 ± 10.09	41.14 ± 10.06	35	35	1.74 ± 0.18	1.82 ± 0.24	100.0	68.60	100.0	80.00	85.0 ± 7.57	61.0 ± 8.21	14.30	25.71	Transperitoneal	ΦΧΨΩαβ
Shao 2015(10)	China	—	—	139	136	1.38 ± 0.19	1.36 ± 0.14	—	—	89.90	97.10	48.5 ± 7.7	65.6 ± 8.8	5.03	8.09	Retroperitoneal	ΧΨΩβ
Lopes Neto 2012(11)	Brazil	46.00 ± 13.60	49.60 ± 15.50	15	15	1.59 ± 0.41	1.44 ± 0.41	35.70	62.50	—	—	114.0	132.0	—	—	Transperitoneal / Retroperitoneal	ΦΨΩα
Basiri 2008(12)	Iran	44.00 ± 13.00	39.00 ± 15.00	50	50	2.24 ± 3.20	1.78 ± 0.24	88.0	56.0	90.0	76.0	127.8 ± 41.8	42.7 ± 17.9	—	—	Transperitoneal	ΦΧ
Tugcu 2016(13)	Turkey	39.90 ± 12.02	40.71 ± 10.22	103	80	2.11 ± 0.45	1.85 ± 0.34	—	—	100.0	87.0	65.47 ± 10.92	75.00 ± 11.56	10.60	23.75	Retroperitoneal	ΧΨΩαβ
Kumar 2015(14)	India	36.70 ± 2.40	35.60 ± 2.10	50	50	2.30 ± 0.20	2.20 ± 0.10	—	—	100.0	76.0	49.1 ± 9.2	47.3 ± 8.1	12.0	26.0	Transperitoneal	ΧΨΩβ
Torricelli 2024(15)	Brazil	55.0 (46.5–65.0)	55.0 (42.2–62.5)	32	32	1.6	1.6	—	—	96.80 (1.5–1.9)	93.70 (1.5–1.9)	82.0	80.0	3.10	25.0	Retroperitoneal	Χαβ
Chen 2012(16)	China	41.72 ± 12.70	40.42 ± 14.60	77	76	1.63 ± 0.34	1.61 ± 0.37	—	—	100.0	82.09	90.10 ± 19.00	41.72 ± 15.60	—	—	Retroperitoneal	ΧΨΩ
Chen 2014(17)	China	—	—	85	73	—	—	—	—	100.0	84.93	48.0.0 ± 24	43.0 ± 18.0	—	—	Retroperitoneal	ΧΨΩ
Li 2021(18)	China	43.97 ± 6.09	44.12 ± 6.12	36	30	1.72 ± 0.41	1.70 ± 0.42	—	—	100.0	86.70	68.8 ± 12.4	47.3 ± 7.8	11.10	10.0	Retroperitoneal	ΧΨΩβ
Wei 2015(19)	China	—	—	50	50	1.50 ± 0.50	1.60 ± 0.60	—	—	100.0	84.0	120.2 ± 21.0	62.0 ± 21.7	—	—	Retroperitoneal	ΧΨΩ

Abbreviations: LU, laparoscopic ureterolithotomy; URS, ureteroscopy; SFR, stone-free rate.
Outcomes evaluated: Φ, initial stone-free rate; Χ, final stone-free rate; Ψ, operative time; Ω, hospitalization time; α, postoperative pain score; β, postoperative complications.

MATERIALS AND METHODS

Study Population

The study population comprised patients with proximal ureteral stones (≥1 cm) confirmed by radiographic imaging. This systematic review was restricted to RCTs, with no limitations placed on the implementation of blinding protocols.

Inclusion and Exclusion Criteria

Inclusion criteria were structured according to the PICOS framework: (1) Patients (P): patients with proximal ureteral stones (≥1 cm); (2) Intervention (I): patients undergoing LU via direct-vision stone extraction without intracorporeal lithotripters; (3) Comparison (C): patients undergoing semirigid or rigid ureteroscopic holmium laser lithotripsy for proximal ureteral stones. Studies utilizing flexible ureteroscopy or retrograde intrarenal surgery (RIRS) exclusively for renal pelvic calculi were not considered eligible. We restricted the URS intervention to holmium laser lithotripsy, as this represents the standard of care for endoscopic management of proximal ureteral stones according to contemporary European Association of Urology (EAU) and American Urological Association (AUA) guidelines. Studies utilizing pneumatic lithotripters were excluded to minimize clinical heterogeneity, as pneumatic devices differ substantially from laser systems in fragmentation efficiency, stone retropulsion, and tissue injury profiles. Incorporating pneumatic series would introduce confounding variability and reduce applicability to current clinical practice; (4) Outcomes (O): studies reporting at least one outcome categorized into perioperative, postoperative, or adjunctive procedure measures; (5) Study design: RCTs published in Chinese or English, without restriction regarding blinding implementation.

Exclusion criteria consisted of: (1) Methodological limitations: non-randomized designs (cohort, case-control, or case reports), conference abstracts without extractable datasets, and animal experiments; (2) Data inadequacy: insufficient reporting of numerical outcomes (e.g., absent standard deviations) or duplicate publications (for which only the most complete dataset was retained); (3) Clinical irrelevance: combined surgical

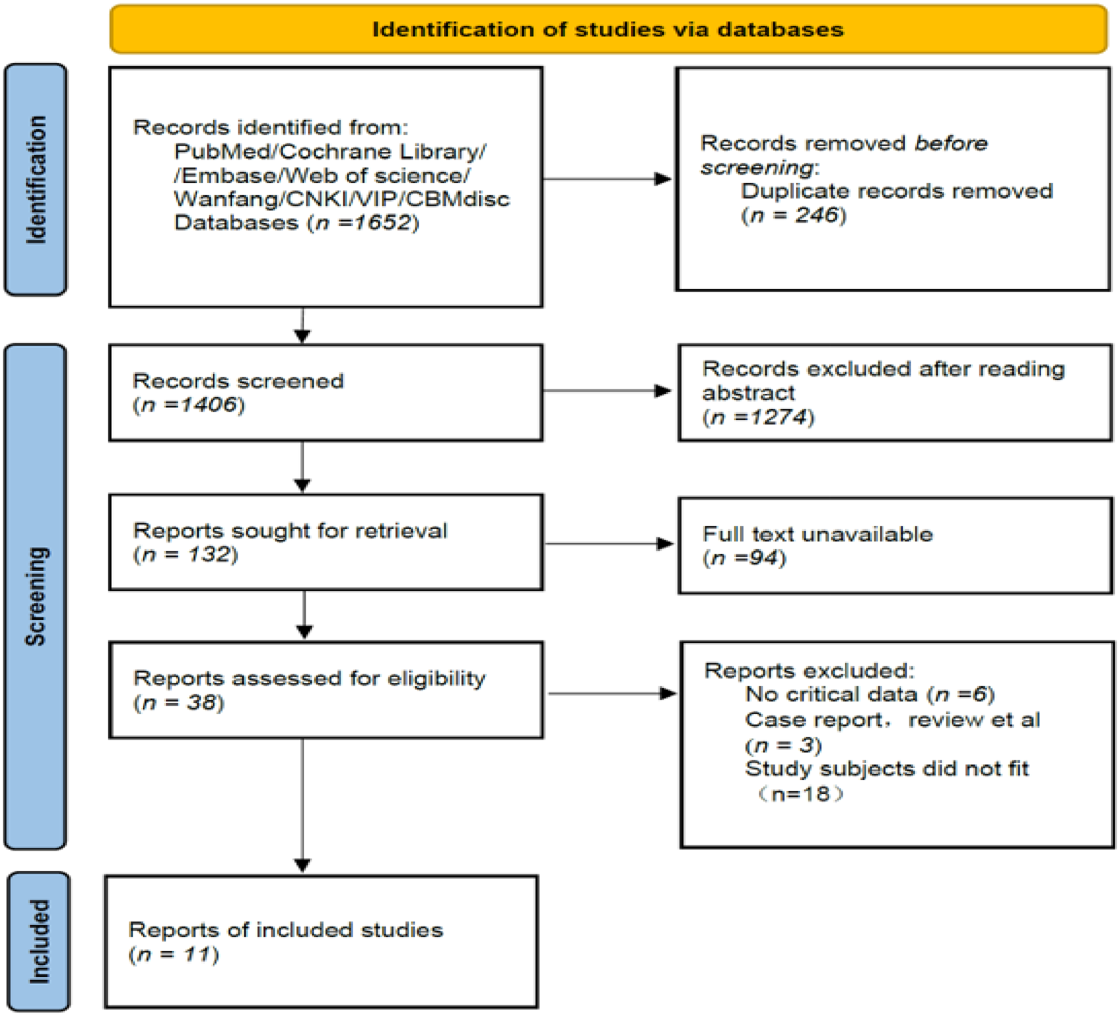

Figure 1. Flowchart of the literature screening and selection process according to the PRISMA 2020 guidelines.

procedures (e.g., LU with concomitant renal surgery) or non-laser URS modalities (e.g., pneumatic lithotripsy); (4) Accessibility issues: inaccessible full texts despite interlibrary requests, or publications in languages other than English or Chinese.

Procedures

We systematically searched PubMed, Cochrane Library, Embase, Web of Science, CNKI, Wanfang, VIP, and the China Biomedical Literature Database from their inception to July 12, 2026, with language restricted to Chinese and English. The search strategy combined MeSH terms and free-text words related to laparoscopy, ureteroscopy, and ureteral calculi (e.g., "Laparoscop", "Ureteroscop", "RIRS", "Ureteral Calculi"). The complete search syntax, exemplified by the PubMed strategy, is detailed in the Appendix. This systematic review followed a predefined protocol prospectively registered with PROSPERO (CRD420251079724).

Of note, the search syntax integrated terms such as "RIRS" and "retrograde intrarenal surgery" to maximize bibliographic sensitivity and capture all potentially relevant investigations. However, our eligibility criteria explicitly restricted stone location to proximal ureteral calculi. Because RIRS is predominantly indicated for intrarenal caliceal and pelvic stones, studies utilizing this technique were excluded during full-text screening if they did not evaluate proximal ureteral calculi. All included RCTs utilized semirigid or rigid ureteroscopes for laser lithotripsy, consistent with our predefined comparator.

Literature screening was conducted using NoteExpress software. Titles and abstracts were screened first, followed by independent full-text appraisal to exclude ineligible articles. Data extraction was conducted independently by two investigators according to NERC criteria, with disagreements resolved through adjudication by a third investigator. Extracted parameters included first author, year of publication, country of origin, recipient age, sample size, stone size, surgical approach, and clinical outcome metrics. For multi-arm studies (e.g., trials containing an extracorporeal shock wave lithotripsy [ESWL] arm alongside LU and URS), data were extracted solely from the LU and URS arms, as the ESWL comparison was beyond the scope of this meta-analysis. This strategy complies with Cochrane recommendations for multi-arm trials, permitting pairwise extraction of relevant intervention groups without requiring multiple-testing adjustments. Risk of bias

Figure 2. Risk of bias assessment summary of the included randomized controlled trials according to the Cochrane ROB 2.0 tool.

was assessed independently by two reviewers using the Cochrane Risk of Bias tool (ROB 2.0)[8] across six domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, selection of reported results, and overall bias. Consensus was reached with a third reviewer in cases of disagreement.

Evaluations

Evaluated endpoints were categorized as follows: (1) perioperative outcomes: operative time, length of hospital stay, 24-hour postoperative pain scores (visual analogue scale [VAS] or numerical rating scale [NRS]), and initial stone-free rate (immediate postoperative clearance); (2) postoperative outcomes: final stone-free rate (assessed at ≥3 weeks postoperatively) and complication rates; and (3) adjunctive procedures: requirement for repeat URS or shock wave lithotripsy to achieve complete stone clearance.

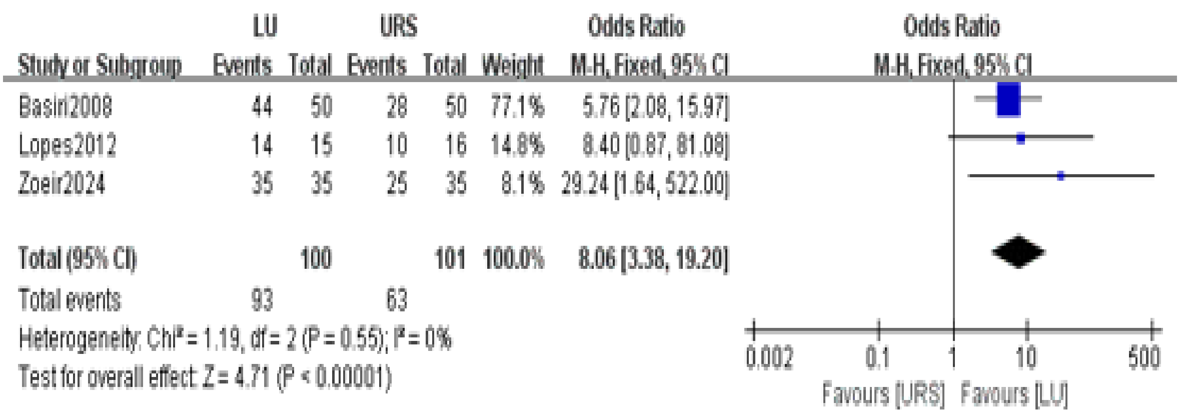

Figure 3. Forest plot comparing initial stone-free rate between laparoscopic ureterolithotomy and ureteroscopic lithotripsy.

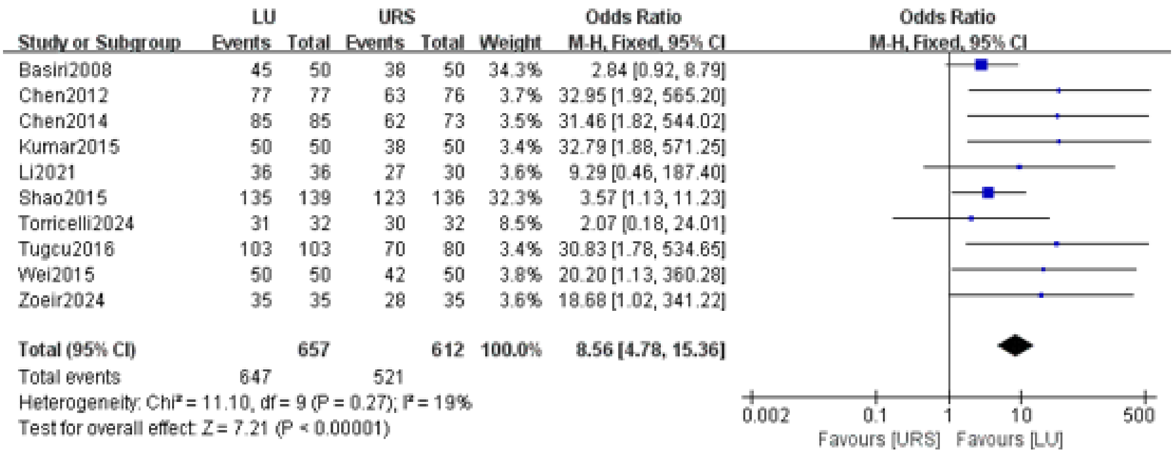

Figure 4. Forest plot comparing final stone-free rate between laparoscopic ureterolithotomy and ureteroscopic lithotripsy.

Statistical Analysis

Statistical heterogeneity among studies was evaluated using the I2 statistic and chi-squared test. Model selection was guided by both clinical and statistical homogeneity: fixed-effects models were applied when low heterogeneity was observed ($P \geq .05$, $I^2 < 50\%$); otherwise, random-effects models were employed. For continuous outcomes (operative time, hospital stay, pain scores), the standardized mean difference (SMD) with 95% confidence intervals (CI) was calculated. Although measurement units were identical, substantial across-study variations in standard deviations justified using SMD over weighted mean difference to standardize effect sizes and account for variability in institutional scoring scales. For dichotomous outcomes, the odds ratio (OR) with 95% CI was calculated. Statistical analyses were performed using Review Manager (RevMan, version 5.2; The Cochrane Collaboration).

RESULTS

Basic Characteristics of Included Studies and Quality Evaluation

The initial database query yielded 1652 records. Following duplicate removal, 1406 records underwent title and abstract screening, resulting in the exclusion of 1274 irrelevant studies. Full texts of the remaining 132 reports were sought, but 94 were unavailable. Of the 38 full-text reports assessed for eligibility, 27 were excluded (3 non-RCT designs, 18 due to stone size <1 cm or lack of segregated >1 cm subgroup data, and 6 due to insufficient outcome reporting). Ultimately, 11 RCTs met all eligibility criteria and were included in the quantitative meta-analysis (**Figure 1**).

The 11 included RCTs[9-19] (7 published in English and 4 in Chinese[16-19]) enrolled a total of 1300 patients with large proximal ureteral stones, including 672 patients in the LU group and 628 patients in the URS group. Baseline characteristics are detailed in Table 1, and the methodological risk of bias assessment based on the ROB 2.0 tool is depicted in **Figure 2**.

Meta-Analysis Results

Stone-Free Rate: Three trials[9,11,12] reported the initial stone-free rate, demonstrating absence of statistical heterogeneity ($P = .55$, $I^2 = 0\%$). For the final stone-free rate reported across 10 trials[9,10,12-19] with low heterogeneity ($P = .27$, $I^2 = 19\%$), a fixed-effects model was utilized. Pooled analysis demonstrated that LU was associated with significantly higher immediate stone-free rates (OR = 8.06, 95% CI: 3.38–19.20, $P < .001$; Figure 3) and final stone-free rates (OR = 8.56, 95% CI: 4.78–15.36, $P < .001$; Figure 4) compared with URS.

Operative Time: Nine studies[9-11,13,14,16-19] evaluated operative duration, exhibiting substantial statistical heterogeneity ($P < .001$, $I^2 = 98\%$). Under a random-effects model, operative time was significantly longer in the LU group than in the URS group (SMD = 1.28, 95% CI:

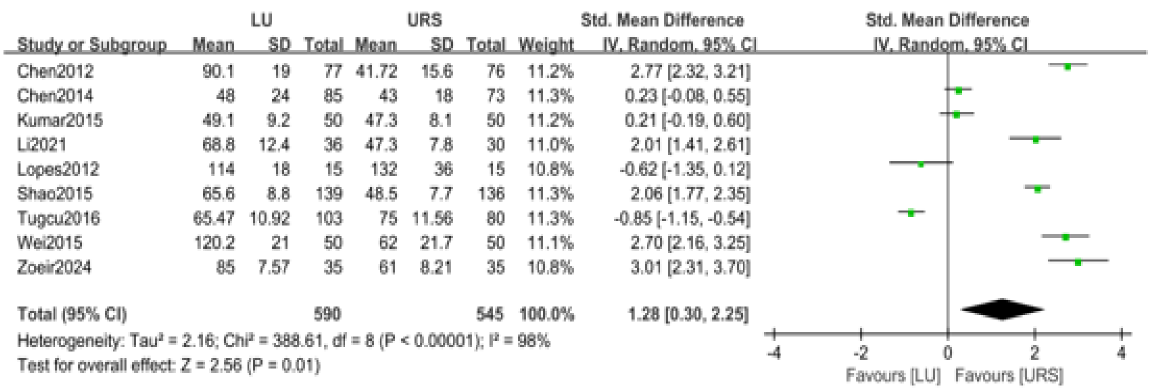

Figure 5. Forest plot comparing operative time between laparoscopic ureterolithotomy and ureteroscopic lithotripsy

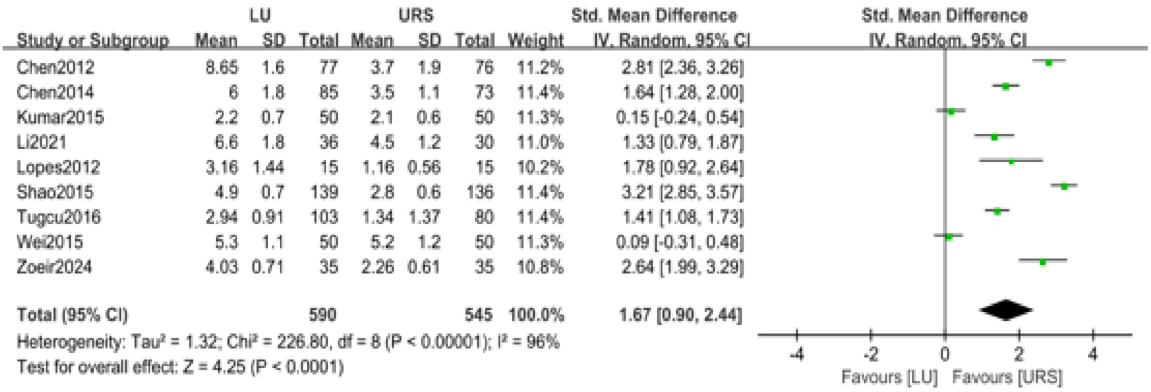

Figure 6. Forest plot comparing length of hospital stay between laparoscopic ureterolithotomy and ureteroscopic lithotripsy

0.30–2.25, P = .01; **Figure 5**).

Duration of Hospitalization: Nine studies[9-11,13,14,16-19] reported length of hospital stay, with marked statistical heterogeneity (P < .001, I^2 = 96%). Analysis using a random-effects model demonstrated that patients undergoing LU experienced a significantly longer hospital stay compared with those receiving URS (SMD = 1.67, 95% CI: 0.90–2.44, P < .001; **Figure 6**).

Postoperative Pain Level: Four studies[9,11,13,15] evaluated postoperative pain scores, showing moderate heterogeneity (P = .10, I^2 = 52%; **Figure 7A**). Following sensitivity analysis with the exclusion of the trial by Zoeir et al.[9] statistical heterogeneity resolved completely (P = .74, I^2 = 0%). Using a fixed-effects model, patients in the URS group exhibited significantly lower pain levels than those in the LU group (SMD = 0.76, 95% CI: 0.52–1.01, P < .001; **Figure 7B**).

Postoperative Complications: Seven studies[9,10,13-15,17,18] evaluated overall complication rates, with no statistical heterogeneity observed (P = .67, I^2 = 0%). Using a fixed-effects model, the overall complication rate was significantly lower in the LU group compared with the URS group (OR = 0.43, 95% CI: 0.27–0.66, P < .001; **Figure 8**).

DISCUSSION

Complete stone clearance remains the primary objective of both URS and LU. Our pooled analysis demonstrated that LU was significantly superior to URS regarding both immediate and final stone-free rates, consistent with observations reported by Choi et al.[20] This clear therapeutic advantage is largely attributable to the direct surgical exposure provided by laparoscopy, which allows precise stone localization, incision, and complete extraction under direct vision, thereby minimizing stone retropulsion.[21] Our findings also corroborate the meta-analysis by Lai et al.,[22] which confirmed superior stone-free rates and reduced ureteral injury risks with LU compared with ureteroscopy for large proximal ureteral calculi. A higher stone-free rate reduces the burden of residual fragments, decreases recurrence, and minimizes the need for ancillary reoperations. These observations indicate that LU represents an effective approach for large or complex proximal ureteral stones,

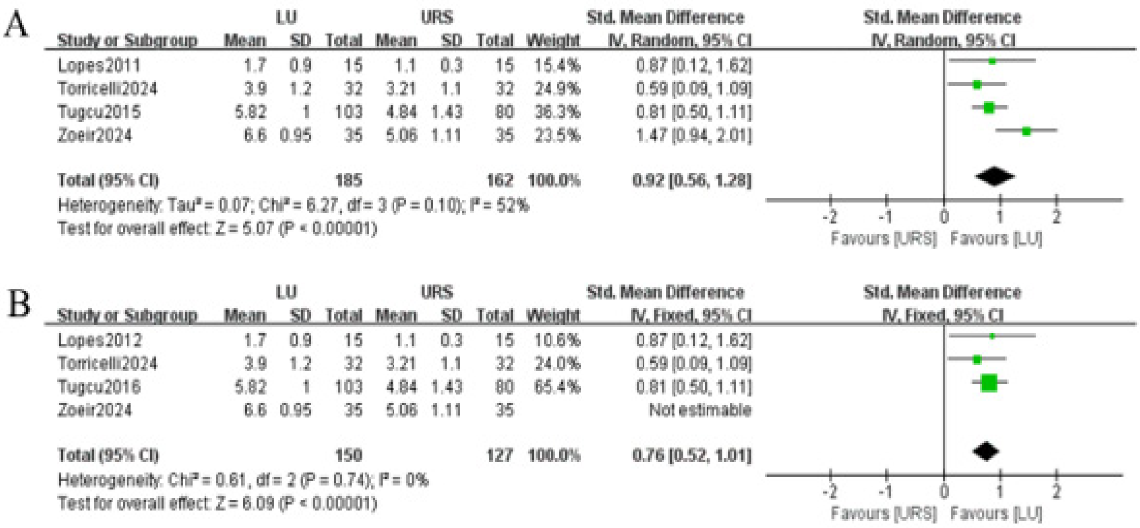

Figure 7. Forest plots comparing postoperative pain scores between laparoscopic ureterolithotomy and ureteroscopic lithotripsy: overall analysis across all reporting studies **(A)** and sensitivity analysis excluding the study by Zoeir et al. **(B).**

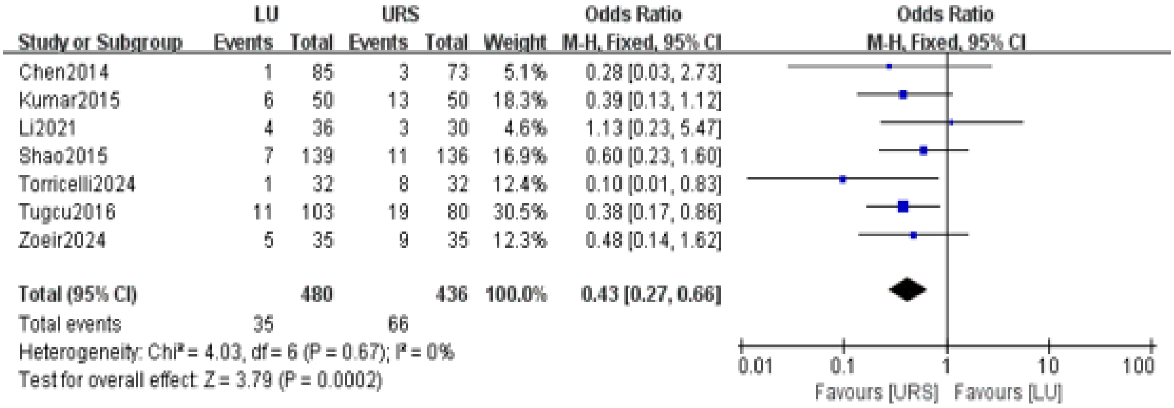

Figure 8. Forest plot comparing overall complication rates between laparoscopic ureterolithotomy and ureteroscopic lithotripsy.

although it entails longer operative duration and extended hospital convalescence compared with URS, as similarly observed by Xu et al.[23] The longer operative time is primarily driven by procedural steps inherent to laparoscopy, including port placement, retroperitoneal or peritoneal dissection, ureterotomy, and meticulous intracorporeal suturing.[24] These requirements increase technical complexity and anesthesia exposure. Nevertheless, the reproducible superiority of LU in stone clearance suggests it serves as a viable alternative for patients with large impacted calculi, provided that patients are appropriate candidates for longer operative interventions.

Postoperative pain is a key determinant of early patient convalescence and functional recovery.[25] Our analysis confirmed that URS was associated with significantly lower postoperative pain scores than LU, aligning with the findings of Zoeir et al.[9] URS is performed entirely through the natural urinary tract, resulting in minimal somatic tissue disruption. In contrast, LU requires abdominal or flank wall trocars, peritoneal or retroperitoneal dissection, and pneumoperitoneum, which induce localized somatic and diaphragmatic peritoneal irritation.[26] Consequently, postoperative pain profiles represent an essential clinical factor when counseling patients and selecting the operative approach.

Regarding surgical safety, this meta-analysis demonstrated a lower overall complication rate in the LU cohort than in the URS cohort. While some earlier reports suggested comparable complication rates between techniques,[18] our findings align with studies highlighting specific risks of endoscopic manipulation in large proximal calculi, including thermal or mechanical ureteral injury, mucosal perforation, extravasation, and post-ablation infectious complications.[19] Notably, stone impaction represents an established risk factor for endoscopic failure and complications, but this parameter was inconsistently defined across the included trials, precluding formal subgroup meta-regression. Future clinical trials should systematically stratify outcomes by stone impaction status.

Despite the high clearance rates of LU, URS remains the standard first-line endoscopic intervention in contemporary urology. For small to moderately sized proximal stones without severe impaction or severe anatomical tortuosity, URS provides rapid stone fragmentation with outpatient or single-day recovery. It also serves as an effective option for radiolucent calculi, where direct endoscopic vision facilitates accurate localization and ablation.[27] Furthermore, URS provides an effective salvage modality for patients failing shock wave lithotripsy. According to EAU guidelines, shock wave lithotripsy or URS is recommended for proximal ureteral stones <10 mm, whereas endourological intervention via URS is recommended for stones >10 mm.[28] However, the RCTs included in this synthesis predominantly utilized older semirigid or rigid ureteroscopes with holmium lasers, accompanied by notable variations in fiber caliber, access sheath usage, and laser energy settings. Recent technological innovations, such as flexible navigable suction ureteral access sheaths (FANS) and direct-in-suction sheaths (DISS), have reshaped modern retrograde intrarenal and ureteral surgery. Contemporary investigations demonstrate superior stone-free rates (95% vs. 67%) and shorter operative times with suction access platforms compared with conventional sheaths.[29] Although our meta-analysis focused on traditional semirigid/rigid URS versus LU, modern suction-assisted ureteroscopy may close the efficacy gap for proximal calculi >1 cm. Current literature on suction sheaths has predominantly focused on intrarenal calculi, and future prospective trials should assess whether these benefits extend to large proximal ureteral stones. Regarding laparoscopic technique, the retroperitoneal approach predominated among included studies (7/11, 64%), while the transperitoneal route was utilized in 27% (3/11). Because no included RCT directly compared retroperitoneal versus transperitoneal routes, dedicated comparative trials remain necessary. In the wider management landscape, percutaneous nephrolithotomy (PCNL) represents another established modality. Previous evidence comparing PCNL with URS for proximal ureteral stones >15 mm demonstrated superior stone-free rates with PCNL, particularly for calculi located above the fourth lumbar vertebra.[30] Network meta-analyses have similarly observed that PCNL and LU achieve comparable stone clearance superior to conventional URS.[31] Direct comparisons between LU and PCNL were outside the scope of this meta-analysis, and our findings should not be extrapolated to comparative performance between these two invasive modalities.

Substantial statistical heterogeneity was observed for operative time ($I^2 = 98\%$) and hospitalization duration ($I^2 = 96\%$). Several factors account for this variance. First, included trials spanned publication dates from 2008 to 2024, during which surgical instruments and

surgeon proficiency evolved substantially. Second, surgeon experience varied across institutions, ranging from high-volume single-surgeon series to multi-operator academic units. Third, the proportion of chronically impacted calculi was inconsistently documented. Fourth, technical variations in laparoscopic access (retroperitoneal vs. transperitoneal) and suturing methods influenced operative time. Fifth, local discharge criteria, drainage policies, and healthcare delivery models varied widely across countries, directly confounding length of stay. Limited reporting of these granular factors precluded formal meta-regression.
Methodological appraisal via the ROB 2.0 tool indicated that while most trials exhibited low risk regarding intervention deviations and missing data, several trials had unclear risk in sequence generation or allocation concealment, and performance blinding was unfeasible given the distinct surgical incisions. These methodological constraints warrant consideration when interpreting secondary endpoints.

Study Limitations

This meta-analysis has several limitations. First, the total number of included RCTs was relatively small (n = 11), with several studies lacking formal power calculations. Second, included trials reported only short-term follow-up (1–12 months) and lacked systematic data regarding long-term ureteral strictures or late functional stenosis. Third, extreme statistical heterogeneity was present for operative time and hospital stay ($I^2 > 90\%$), rendering these pooled metrics hypothesis-generating. Fourth, a substantial chronological and technology-related bias exists: 9 of the 11 trials utilized older-generation URS equipment (low-power holmium lasers, rigid scopes, non-suction sheaths), while modern suction-assisted systems and high-power pulse-modulation lasers were not evaluated. Consequently, the observed advantages of LU likely underestimate the performance of modern endourological suites. Fifth, mini-PCNL was not evaluated as an active comparator arm. Sixth, geographic concentration was present, with nearly half of the included studies originating from China, which may reflect regional practice patterns favoring laparoscopic reconstruction. Seventh, outcomes reported by fewer trials (such as pain, n = 4) require cautious interpretation. Finally, robotic-assisted laparoscopic ureterolithotomy was not evaluated. Future RCTs evaluating modern suction-assisted flexible ureteroscopic platforms against laparoscopic and percutaneous approaches are warranted.

CONCLUSIONS

Within the evidence base of the included randomized trials—which predominantly reflect endourological practice from earlier eras lacking suction access platforms—laparoscopic ureterolithotomy provides significantly higher stone-free rates and lower overall complication rates for large proximal ureteral stones (>1 cm) compared with semirigid or rigid ureteroscopy. However, laparoscopy entails significantly longer operative duration, extended hospital stay, and increased early postoperative pain. Given chronological technology bias, absence of suction-assisted flexible ureteroscopy arms, and unexplained statistical heterogeneity, our findings should not be considered practice-changing. Laparoscopic ureterolithotomy remains a viable therapeutic alternative primarily in clinical settings where modern ureteroscopic technologies or mini-PCNL platforms are unavailable, or for refractory impacted calculi where endoscopic access has failed.

SUMMARY

For large upper ureter stones (>1 cm), keyhole surgery clears stones better with fewer complications than scope surgery, but requires longer surgery, hospital stay, and more pain. Newer scope tools may narrow this gap.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

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