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Combined Pyeloplasty and Flexible Endoscopic Management in Children with Ureteropelvic Junction Obstruction and Urolithiasis: A Systematic Review

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Abstract

Background: Concurrent ureteropelvic junction obstruction (UPJO) and renal calculi in children remain challenging to manage. This systematic review evaluated the efficacy and safety of simultaneous flexible endoscopic stone extraction during laparoscopic or robot-assisted pyeloplasty in paediatric patients with concurrent UPJO and urolithiasis.

Methods: The study protocol was registered in PROSPERO (CRD420261402551). A systematic search was conducted according to the PRISMA 2020 guidelines. Studies involving paediatric patients who underwent simultaneous laparoscopic or robot-assisted pyeloplasty with flexible endoscopic stone management were included. Study quality was assessed via the Joanna Briggs Institute Critical Appraisal Tool and Newcastle–Ottawa Scale.

Results: Five studies involving 46 paediatric patients (mean age, 7.4 years) were included. Most procedures use an antegrade flexible endoscopic approach with Holmium laser lithotripsy. The mean operative time was 214 minutes. The initial stone-free rate after the primary procedure was 88.1% (37/42), increasing to 97.8% (41/42) following secondary interventions. The overall complication rate was 9.5% (4/42 patients), complications included transient urinary leakage managed with double-J stent placement (Clavien-Dindo IIIa) in three patients (Jia et al.) and residual stone fragments requiring secondary ureterorenoscopy (Clavien-Dindo IIIb) in three patients (Esposito et al.), alongside minor postoperative events, including hematuria and urinary tract infection (Clavien-Dindo II). No major intraoperative complications, postoperative anastomotic strictures, or stone recurrences were documented during a mean follow-up of 16.4 months.

Conclusions: Simultaneous minimally invasive pyeloplasty with flexible endoscopic stone extraction appears to be a safe and effective single-stage approach for paediatric patients with concurrent UPJO and nephrolithiasis. This technique provides high stone clearance rates with low morbidity while avoiding more invasive staged procedures. Further prospective studies with larger cohorts are needed to validate long-term outcomes.

INTRODUCTION

The simultaneous presentation of ureteropelvic junction obstruction (UPJO) and renal urolithiasis is a challenging clinical scenario in paediatric urology. While UPJO remains the most common congenital obstructive nephropathy requiring surgical correction in children, concurrent renal stones are identified in up to 20% of these cases (2,4). The presence of mechanical obstruction leads to urinary stasis, which significantly alters intrarenal urodynamics and accelerates calculus formation.

Open dismembered pyeloplasty coupled with manual pyelolithotomy is the definitive gold standard. However, this approach is limited in terms of surgical trauma and restricted access to lower or peripheral calyces (1,5). Standard endourological procedures such as retrograde intrarenal surgery (RIRS) or percutaneous nephrolithotomy (PCNL) present unique limitations in the paediatric population. PCNL carries risks of parenchymal injury and hemorrhage in a small kidney, whereas isolated RIRS fails to address the anatomical narrowing at the UPJ. Staged operations or shock wave lithotripsy (ESWL) often necessitate multiple episodes of general anaesthesia, exposing paediatric patients to potential neurotoxicity and increased cumulative morbidity (6).

The evolution of minimally invasive surgery (MIS) has fundamentally shifted this paradigm. Conventional laparoscopic pyeloplasty (LP) and robot-assisted laparoscopic pyeloplasty (RALP) have demonstrated success rates comparable to those of open surgery, offering the benefits of reduced postoperative pain, minimal scarring, and rapid recovery. RALP enhances this ability through its 3D high-definition visualisation, tremor filtration, and multiple degrees of freedomassisted instruments, which permit highly precise dissection and suturing within tight anatomical confines (7).

METHODS

2.1 Study registration

This review was conducted in accordance with the PRISMA 2020 statement. The protocol was registered in PROSPERO (CRD420261402551).

2.2 Search strategy

A comprehensive literature search was conducted across electronic databases, including PubMed, ScienceDirect, EuropePMC, Epistemonikos, and Google Scholar, from database inception through April 2026. The search strategy was developed via a combination of Medical Subject Headings (MeSH) and free-text terms related to ureteropelvic junction obstruction, pyeloplasty, renal calculi, flexible endoscopy, and paediatric patients. The search terms included "ureteropelvic junction obstruction", "UPJO", "pyeloplasty", "urolithiasis", "nephrolithiasis", "renal calculi", "kidney stones", "flexible ureteroscopy", "flexible endoscopy", "laparoscopic", "robot-assisted", "robotic", "paediatric", and "children". The search strategies were adapted for each database as appropriate.

The reference lists of the included studies and relevant reviews were examined for additional eligible publications.

2.3 Eligibility criteria (PICOS framework)

Studies were selected according to the PICOS framework.

Population (P)

Paediatric patients (≤ 18 years) diagnosed with ureteropelvic junction obstruction (UPJO) and concomitant urolithiasis.

Intervention (I)

Simultaneous pyeloplasty combined with flexible endoscopy, including flexible ureteroscopy or flexible cystoscopy-assisted stone management performed during the same procedure.

Comparison (C)

No specific comparator was required for study inclusion.

Outcomes (O)

Stone-free rate (SFR), operative time, estimated blood loss (EBL), length of hospital stay (LOS), pyeloplasty success, perioperative outcomes, and postoperative complications.

Study design (S)

Randomised controlled trials, cohort studies, case series, and case reports.

Studies were excluded if they involved adult patients, did not include concomitant UPJO and urolithiasis, did not evaluate combined pyeloplasty and flexible endoscopy, were review articles, editorials, conference abstracts without sufficient data, animal studies, or non-English publications.

2.4 Study selection process

After removing duplicate records via Rayyan, two independent reviewers screened the titles and abstracts of the remaining studies on the basis of the predefined eligibility criteria. Studies deemed relevant underwent a full-text review by the same two authors to confirm final inclusion. Any disagreements during the screening and evaluation phases were resolved through consensus. If a dilemma persisted, a third senior reviewer was consulted to reach a final decision.

The reasons for full-text exclusion were as follows: (1) inappropriate patient population (e.g., adult cohorts or patients without concurrent urolithiasis), (2) absence of the specific combined intervention (pyeloplasty and flexible endoscopy performed simultaneously), (3) insufficient clinical outcome data, and (4) ineligible study designs, including review articles, editorials, or conference abstracts.

2.5 Data extraction

Two reviewers independently extracted data from the included studies via a standardised collection form. Disagreements during data extraction were resolved through discussion and consensus, or by consulting a third senior reviewer if needed.

The extracted variables were divided into baseline characteristics and clinical outcomes to match Table 1 and Table 2. The following data were collected from each study: (1) baseline characteristics, including the primary author, publication year, study design, sample size, patient age, gender, and stone size and location; and (2) surgical and clinical outcomes, including the operative time, stone-free rate (SFR), length of hospital stay, and incidence of postoperative complications.

2.6 Quality assessment risk of bias

Two reviewers independently evaluated the methodological quality and risk of bias of the included studies. The Newcastle-Ottawa Scale (NOS) was utilised to assess the retrospective cohort study by Jia et al. The Joanna Briggs Institute (JBI) Critical Appraisal Tools were applied, using checklists for case series (Masieri et al., Wong et al., Esposito et al.) and case reports (Scarcella et al.). Any disagreements were resolved through discussion and consensus. The complete risk of bias assessment scores for each study are presented in **Table 3 within the Results section.**

2.7 Data Synthesis

A meta-analysis was not performed due to significant clinical and methodological heterogeneity among the included studies, specifically in terms of surgical platforms, patient demographics, endoscopic techniques, and outcome reporting. Instead, the data were subjected to narrative synthesis, with descriptive statistics used where appropriate.

2.8 Use of AI-assisted technologies

Large Language Models (ChatGPT, OpenAI) were utilised solely for language editing, translation support, and manuscript formatting to increase text readability. All scientific content, data extraction, and clinical syntheses were performed, reviewed, and approved entirely by the authors, who maintain full accountability for the manuscript.

RESULTS

3.1 Study Selection

A comprehensive literature search across PubMed, ScienceDirect, EuropePMC, Epistenomikos, and Google Scholar retrieved a total of 338 articles. After the removal of 190 duplicate entries, 148 unique studies underwent title and abstract screening. During this initial phase, 118 records were excluded because they did not meet the predefined inclusion criteria.

The remaining 72 articles were subjected to a rigorous full-text review. Of these, 67 studies were excluded because they failed to meet the eligibility criteria. The primary reasons for exclusion included adult populations, staged surgical interventions, or lack of relevant clinical outcomes. Five distinct studies met all eligibility criteria and were included in this systematic review. The detailed screening and selection process is illustrated in the **PRISMA 2020 flow diagram (Fig. 1).**

3.2 Baseline characteristics of the included studies

The five included studies included a total of 46 paediatric patients with concurrent UPJO and urolithiasis. The majority were single-centre retrospective case series, with the exception of one multicentre case series (Esposito et al., four centres across Italy, France, and the United States) and one case report with a non-systematic literature review (Scarcella et al.). The publication years ranged from 2021–2025, and the studies originated from China, Italy, and Hong Kong (China).

Patient age ranged from 3–16 years, with a pooled mean of 7.4 years across the included cohorts. Male predominance was noted in most studies, although the sex distribution varied. The stone burden was heterogeneous: the median stone size ranged from 4 mm to 28 mm, with locations distributed across the renal pelvis, lower pole, middle calyx, and, in two cases, the urinary bladder. The number of stones per patient ranged from 1–15. The detailed baseline characteristics are presented in Tables 1 and 2.

Table 1
Study Characteristics General Demographics and Design

First Author	Year	Country	Study Design	Study Period	Total N	N (UPJO + Calculi)	Age	Sex Distribution
Jia et al.	2025	China	Single-centre retrospective case series	March 2018 – June 2023	25	25	RALP: mean 9.0 years [4–15]; LP: mean 8.6 years [3–16]	RALP: 6M /5F; LP: 9M/5F
Masieri et al	2022	Italy	Single-centre retrospective case series	April 2013-December 2019	7	7	Median age at 7 years	4 Female, 3 Male
Wong et al .	2022	Hong Kong (China)	Single-centre retrospective case series	NR	2	2	6 and 10 years (range NR)	2 Female, 0 Male
Scarcella et al.	2021	Italy	Single-centre case report with non-systematic literature review	NR	1	1	4 years	1 Male (implied)
Esposito et al.	2021	Italy/France/USA (4 centres)	Multi-centre retrospective case series	January 2015 – January 2020	15	11	Median 8.5 years (range 4–15)	12 Male, 3 Female

Table 2
Study characteristics, stone parameters and follow-up

First Author	Stone Size	Stone Location	Stone Burden/Number	Follow-up Duration	Stone-Free Rate Definition
Jia et al.	RALP: mean 12.7 mm [6–28]; LP: mean 10.6 mm [5–21]	Lower calyces (predominantly); NR for other locations per group	RALP: mean 3.3 [2–7]; LP: mean 2.4 [1–5]	1, 3, 6 months post-operatively then annually (median duration NR)	No documented stone fragments on KUB, renal US, and/or CTU
Masieri et al	NR	Renal pelvis (57.1%) Middle calyx (28.6%) Lower calyx (14.3%)	Median stone area 77.77mm2(range 50.2-148.2)	Median 16 months (10–25)	NR (no recurrence during follow-up; all stones removed intraoperatively)
Wong et al.	4–8 mm	Mid- and lower pole calyces (bilateral patients – left kidney)	Patient 1: 3 stones; Patient 2: 14 stones	9 and 11 months (range NR)	Complete stone clearance on ultrasound and plain X-ray
Scarcella et al.	Pelvic stones: 8 mm and 19 mm; inferior calyx: 10 mm and 16 mm; medium calyx: 16 mm	Renal pelvis (×2) and calyceal (inferior ×2, medium ×1)	5 stones	24 months	Retrograde pyelography negative for residual stones at 60 days; US at 2, 6, 12 months
Esposito et al.	Median 10.8 mm (range 2–30) upper tract; 27 mm (range 21–33) bladder	Renal pelvis 8/15 (53.3%); lower pole 3/15 (20%); pelvis+lower pole 2/15 (13.3%); bladder 2/15 (13.3%); multiple 2/15 (13.3%)	Median 3 (range 1–15)	Median 23.2 months (range 3–54)	No documented stone fragments on postoperative radiographic imaging (KUB, renal US)

3.3 Quality assessment and risk of bias

Given the predominance of case series and single case reports among the included studies, the overall level of evidence was low. The New-Ottawa Scale was applied to the retrospective comparative cohort study by Jia et al. (2025), which received a moderate quality rating, with the main limitations being its single-centre design, retrospective data collection, and relatively small sample size in each surgical group. The remaining four studies were appraised via the JBI Critical Appraisal Checklists for case series and case reports.

All case series demonstrated consistent case ascertainment and appropriate reporting of demographic and operative variables; however, the absence of a comparison group, short follow-up durations, and lack of standardised outcome definitions represented notable methodological limitations. The case report by Scarcella et al. provided detailed procedural documentation but is inherently limited in generalisability. The complete risk of bias scores for each study are presented in **Table 3.**

Study	Tool	Selection	Ascertainment/Exposure	Outcome Assessment	Follow-up	Statistical Analysis	Overall Risk
Jia et al., 2025	NOS	✓	✓	✓	✓	✓	✓ Low
Esposito et al., 2021	JBI Case Series	✓	✓	✓	✓	✓	✓ Low
Masieri et al., 2022	JBI Case Series	✓	✓	✓	✓	✓	✓ Low
Wong et al., 2022	JBI Case Series	✓	✓	✓	✓	✓	✓ Moderate
Scarcella et al., 2021	JBI Case Report	✓	✓	✓	✓	N/A	✓ Low

Interpretation

The overall methodological quality was moderate-to-high, with most studies demonstrating clear inclusion criteria, standardised outcome assessment, and adequate follow-up. The main limitations were the retrospective design, small sample size, and lack of control groups in case series studies.

3.4 Surgical approach

Robot-assisted laparoscopic pyeloplasty (RALP) was the predominant surgical platform employed in four of the five studies, whereas Jia et al. (2025) additionally included a conventional laparoscopic pyeloplasty (LP) group, making it the only study providing a direct comparison between the two approaches. All procedures employed the Anderson-Hynes dismembered pyeloplasty technique via a transperitoneal approach.

Flexible endoscopy was performed through various access strategies. The most common approach is antegrade introduction of the flexible ureteroscope through a small incision at the pelviureteric junction prior to reconstruction. Masieri et al. (2022) and Wong et al. (2022) introduced the flexible cystoscope or ureteroscope through the robotic trocar port, whereas Esposito et al. (2021) utilised the assistant port following undocking of one robotic arm. When calyceal access was initially restricted, as documented by Scarcella et al. (2021), a switch from a rigid to a digital disposable flexible ureteroscope was needed.

The lithotripsy modality also varies across studies. Holmium laser lithotripsy was used in Jia et al. and Scarcella et al. for larger or harder fragments, whereas Masieri et al., Wong et al., and Esposito et al. relied solely on basket extraction without lithotripsy. The mean operative time across all studies was 214 minutes, with a wide range reflecting the heterogeneity in surgical complexity and technique. The estimated blood loss and hospital stay data are summarised in Table 4.

Table 4
Surgical Approach and Technique

First Author	Surgical Approach	Pyeloplasty Type	Endoscopic Technique	Lithotripsy Modality	Operative Time (min)	EBL (mL)	Hospital Stay
Jia et al. (RALP group)	RALP; 3 trocars (8.5 mm camera, 8 mm, 5 mm); pneumoperitoneum 6–8 mmHg	Dismembered pyeloplasty (Anderson–Hynes technique implied)	Flexible ureteroscopy via ureteral access sheath introduced through small (~ 0.2 cm) mucosal-preserving incision at pelviureteric junction	Stone retrieval basket for small fragments; holmium laser lithotripsy for larger stones	Mean 212.7 ± 15.4 min [170–263]	Mean 48.2 ± 9.5 mL [20–100]	Mean 6.5 ± 1.2 days [5–9]
Jia et al. (LP group)	Conventional laparoscopic pyeloplasty (LP); same trocar configuration as RALP group	Dismembered pyeloplasty	Flexible ureteroscopy via ureteral access sheath	Stone retrieval basket; holmium laser lithotripsy for larger stones	Mean 185.0 ± 13.8 min [150–250]	Mean 60.2 ± 11.3 mL [30–150]	Mean 7.7 ± 1.6 days [6–10]
Masieri et al.	RALP via transperitoneal approach (da Vinci Xi); 3 robotic arms, 4 trocars	Dismembered Hynes–Anderson pyeloplasty	Flexible cystoscope inserted through 8 mm robotic trocar or 5 mm trocar	Stone basket extraction only; no lithotripsy	Median 110 min (IQR 104–125)	NR	Median 5 days (IQR 4–5)
Wong et al.	RALP via transperitoneal approach (da Vinci Xi); 3 ports, no assistant port	Dismembered Anderson–Hynes pyeloplasty	Flexible nephroscopy: Fr16 flexible cystoscope (primary); Fr8.7/9.3 single-use flexible ureteroscope (when infundibulum too narrow)	Stone basket extraction only; no lithotripsy	225 and 232 min	NR	2 days (both patients)
Scarcella et al.	Robot-assisted laparoscopic pyeloplasty (da Vinci Si); transperitoneal; 4 robotic trocars + 1 Nathanson liver retractor + 1 assistant 5 mm port	Anderson–Hynes dismembered pyeloplasty	Initially, rigid 10 Ch ureteroscope (calyces inaccessible); then digital disposable 7.7/9.5 Ch flexible ureteroscope (Lithovue, Boston Scientific)	Holmium laser lithotripsy (0.27 mm fibre; 1800 J; 9 Hz) + no-tip 2.4 Ch Dormia basket for residual pelvic stone	Flexible renoscopy: 112 min; robotic pyeloplasty: 190 min	NR	Discharged within 48 h (2 days)
Esposito et al.	Robot-assisted laparoscopic surgery (RALS; da Vinci Xi); transperitoneal; 4 ports (3 robotic 8 mm + 1 assistant 5 mm)	Anderson–Hynes dismembered pyeloplasty (6 – 0 or 5 – 0 poliglecaprone 25 suture)	Flexible ureteroscope introduced through assistant/robotic port (one arm undocked)	Flexible grasper or basket; sterile glove finger retrieval bag; saline irrigation; no laser reported for pyeloplasty-stone group	Median 131.8 min (range 60–240)	NR	Median 2.8 days (range 1–4)

3.5 Postoperative Complications and Outcomes

The primary stone-free rate following the index procedure was 88.1% (37/42 patients for whom SFR data were available). After secondary interventions, including second-look ureteroscopy in two patients (Jia et al.) and ureterorenoscopy in three patients (Esposito et al.), the overall SFR increased to 97.6% (41/42). Three studies reported complete stone clearance (100% SFR) following the primary procedure: Masieri et al., Wong et al., and Scarcella et al.

Pyeloplasty success, defined as radiological improvement in drainage on diuretic renography or renal ultrasound, was achieved in 100% of the patients across all the studies. No postoperative anastomotic strictures or stone recurrences were documented during a mean follow-up of 16.4 months.

The overall complication rate was 9.5% (4/42 patients). In the Jia et al. cohort, three cases of transient urinary leakage were reported (one in the RALP group and two in the LP group), all of which were managed conservatively with double-J stent placement and Clavien-Dindo IIIa grade. In the study by Esposito et al., postoperative complications included hematuria in three patients (Clavien II), urinary tract infection in two patients (Clavien II), and residual stone fragments requiring secondary ureterorenoscopy in three patients (Clavien IIIb). No intraoperative complications, open conversions, major vascular injuries, or perioperative deaths were reported in any of the included studies.

Table 5
Clinical Outcomes, Complications, Stone-Free Rate, and Pyeloplasty Success

First Author	Intraop Complications	Postop Complications	Stone-Free Rate (SFR)	Pyeloplasty Success	Hydronephrosis	Secondary Procedures	Renal Function/Other Outcomes
Jia et al. (RALP)	NR	1/11 (9.1%) Clavien Grade IIIa (transient urinary leakage, managed with double-J stent, resolved within 5–10 days)	90.9% (10/11) after initial surgery; 100% after ancillary procedures	100% (improvement in drainage defined as success)	NR (improvement in drainage assessed by diuretic renogram)	1 patient: second-look ureteroscopy	NR
Jia et al. (LP)	None	2/14 (14.3%) Clavien Grade IIIa (transient urinary leakage)	85.7% (12/14) after initial surgery; 100% after ancillary procedures	100%	NR	1 patient: second-look ureteroscopy; 1 patient: ESWL	NR
Masieri et al	NR	NR	100% (7/7)	100% (confirmed by reduction of hydronephrosis on US and absence of symptoms)	Improvement/ reduction on US	None required	NR
Wong et al.	None reported; no conversion; air leak controlled with gauze when flexible ureteroscope used	None (no Clavien–Dindo grading reported)	100% (3/3 stones and 14/14 stones removed, confirmed on US and plain X-ray	100% (confirmed at 9 and 11 months by diuretic radioisotope scan)	APD reduced to 3 mm and 5 mm, respectively (from 17 mm and 28 mm)	None required	Left differential renal function: 45% and 53% postoperatively (preoperative 45% and 46%); diuretic t½: 15 and 12 min (from > 20 min)
Scarcella et al.	Rigid ureteroscope unsuccessful for calyceal access; switched to flexible scope; no intraoperative complications	None reported; no UTI, no haematuria	100% at 60-day retrograde pyelography; confirmed stone-free at 2, 6, 12 months	100% (no UPJO recurrence at 24 months)	NR	None required	NR; radiation exposure minimised (ultrasound-based follow-up); holmium YAG laser used as gold standard
Esposito et al.	None (0% intraoperative complications; no conversions)	Hematuria: 3/15 (20%, Clavien II); UTIs: 2/15 (13.3%, Clavien II); residual stones: 3/15 (20%, Clavien IIIb). No stricture of ureteropelvic anastomosis	80% (12/15) following initial surgery; 100% after secondary treatment (3 patients treated with URS)	100% in UPJO patients (11/11); significant improvement of hydronephrosis and renal excretion at MAG3 renal scan	Median pre-op APD 28.4 mm (range 18–40); median post-op APD 4.1 mm (range 0–8)	3/15 (20%) underwent ureterorenoscopy for residual stones	Renal drainage on MAG3: before surgery 44 min (range 27–78); after surgery 7.7 min (range 8–15)

DISCUSSION

This systematic review evaluated the efficacy and safety of simultaneous flexible endoscopic stone management during minimally invasive pyeloplasty in children with concurrent UPJO and nephrolithiasis. Across five studies involving 46 patients, the technique achieved a final SFR of 97.6%, with a 100% pyeloplasty success rate and an overall complication rate below 10%, with no major intraoperative events or long-term structural sequelae. These findings collectively support the feasibility of a single-stage approach in appropriately selected paediatric patients.

The clinical rationale for combining pyeloplasty with flexible endoscopic stone clearance in a single anaesthetic episode is particularly relevant in the paediatric context (2). Staged procedures, whether sequential pyeloplasty followed by ureteroscopy or the use of ESWL as a separate intervention, carry the cumulative burden of repeated general anaesthesia (1,3). There is ongoing concern regarding the potential neurotoxic effects of anaesthetic exposure during early childhood, and while definitive evidence in humans remains limited, minimising the number of procedures is a broadly accepted principle in paediatric surgical planning. In addition to neurotoxicity, staged approaches also carry the practical disadvantages of prolonged overall treatment duration, additional hospital admissions, and the theoretical risk of stone migration or further calculus formation in the interval between procedures due to persistent urinary obstruction (4).

Standard urological approaches used in adults are not straightforwardly applicable to children. PCNL, while effective for large stone burdens, carries a disproportionate risk of parenchymal haemorrhage in smaller paediatric kidneys and requires prone or modified positioning, increasing procedural complexity (2,4). Retrograde intrarenal surgery alone, without concurrent correction of the anatomical obstruction, addresses the stone burden but leaves the underlying UPJ narrowing untreated, which predisposes patients to stone recurrence given the persistent urinary stasis. Open dismembered pyeloplasty with concurrent pyelolithotomy was historically the definitive approach but is now largely superseded in centres with minimally invasive expertise given its associated morbidity, longer recovery, and restricted access to peripheral calyces (1,3).

Across the included studies, the surgical technique was not uniform, and this heterogeneity is worth examining in some detail. A key distinction lies in the use of holmium laser lithotripsy versus basket extraction alone. In studies where lithotripsy was employed specifically by Jia et al. and Scarcella et al. The stone burden tended to be larger and more complex (multiple fragments, calyceal locations, mean stone size up to 12.7 mm), and the initial SFR was correspondingly lower (85.7% to 90.9%), with residual fragments managed through secondary procedures. In contrast, studies relying solely on basket extraction reported a 100% primary SFR, but these cohorts generally had fewer stones of smaller dimensions. This pattern suggests that the choice of lithotripsy modality should be tailored to preoperative stone characteristics rather than being a fixed component of the technique.

The only study providing a direct comparison between RALP and conventional LP was Jia et al. (2025), who reported that RALP was associated with a longer operative time but lower estimated blood loss than LP was. Pyeloplasty success and the final SFR were equivalent between the groups. While these results are exploratory given the small sample sizes (11 RALP patients vs. 14 LP patients), they are consistent with broader trends in the paediatric minimally invasive surgery literature, where the added precision of the robotic platform appears most beneficial for the suturing steps of pyeloplasty in a narrow operative field rather than for stone extraction per se. Multicentre comparative data with larger cohorts are needed before firm recommendations can be made.

The complication profile observed across the included studies warrants careful interpretation. Three cases of transient urinary leakage in the Jia et al. cohort, classified as Clavien IIIa, were managed with double-J stent placement and resolved without long-term sequelae. Notably, urinary leakage following pyeloplasty, particularly in the early postoperative period, is a recognised and manageable event rather than a marker of technical failure. The three cases of residual stone fragments reported by Esposito et al. and classified as Clavien IIIb reflect the need for secondary ureteroscopy rather than a complication arising from the primary technique itself. No strictures of the ureteropelvic anastomosis were identified during follow-up in any study, which is an important measure of reconstruction quality and suggests that the endoscopic manoeuvres performed during stone extraction do not adversely affect pyeloplasty anastomosis.

Several important limitations of this review must be acknowledged. The total number of patients across all included studies was small (n = 46), and the study designs were predominantly retrospective case series and case reports, representing the lower tiers of the evidence hierarchy. There was substantial heterogeneity in surgical platforms, endoscopic techniques, stone characteristics, follow-up duration, and definitions of stone-free status, which precluded meta-analysis and limits the comparability of outcomes across studies. The absence of control groups in most studies means that it is not possible to directly quantify the benefit of the simultaneous approach over staged procedures. The duration of follow-up was also relatively short across most studies, at a median of 16.4 months, which is insufficient to draw conclusions about long-term stone recurrence rates, which are known to be greater in children than in adults given the underlying metabolic risk factors that frequently coexist with anatomical anomalies.

Despite these limitations, the current evidence is consistent and directionally clear: in experienced centres, simultaneous flexible endoscopic stone management during minimally invasive pyeloplasty appears to be both feasible and safe in selected paediatric patients. The technique is most likely to deliver the highest stone clearance rates when integrated preoperative planning accounts for stone size, number, and location and when the surgical team has access to the full range of endoscopic instruments, including digital flexible ureteroscopes and holmium laser. In the future, prospective multicentre studies with standardised outcome definitions, longer follow-up periods, and metabolic stone workups will be necessary to define the exact patient selection criteria and establish whether this approach should be considered standard of care or reserved for specific clinical scenarios.

CONCLUSION

Simultaneous minimally invasive pyeloplasty with flexible endoscopic stone extraction is a safe and effective single-stage approach for paediatric patients with concurrent UPJO and nephrolithiasis. The technique achieves high stone clearance and pyeloplasty success rates while avoiding the morbidity associated with staged procedures. Further prospective studies with larger cohorts are needed to validate long-term outcomes and refine patient selection criteria.

Declarations

Ethics approval and consent to participate

Not applicable. This study is a systematic review of previously published literature and did not involve any direct primary research on human participants or animals.

Consent for publication

Not applicable. This manuscript does not contain individual patient data, images, or personal details.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

R.A.D., M.A.S., and F.U.D. conceived and designed the study, performed the literature search, data extraction, and quality assessment, synthesized the findings, and drafted the initial manuscript. N.S. contributed to data verification, manuscript editing, and critical revision for important intellectual content. All authors reviewed and approved the final manuscript.

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Data Availability

All data generated or analysed during this study are included in this published article and its supplementary information files. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

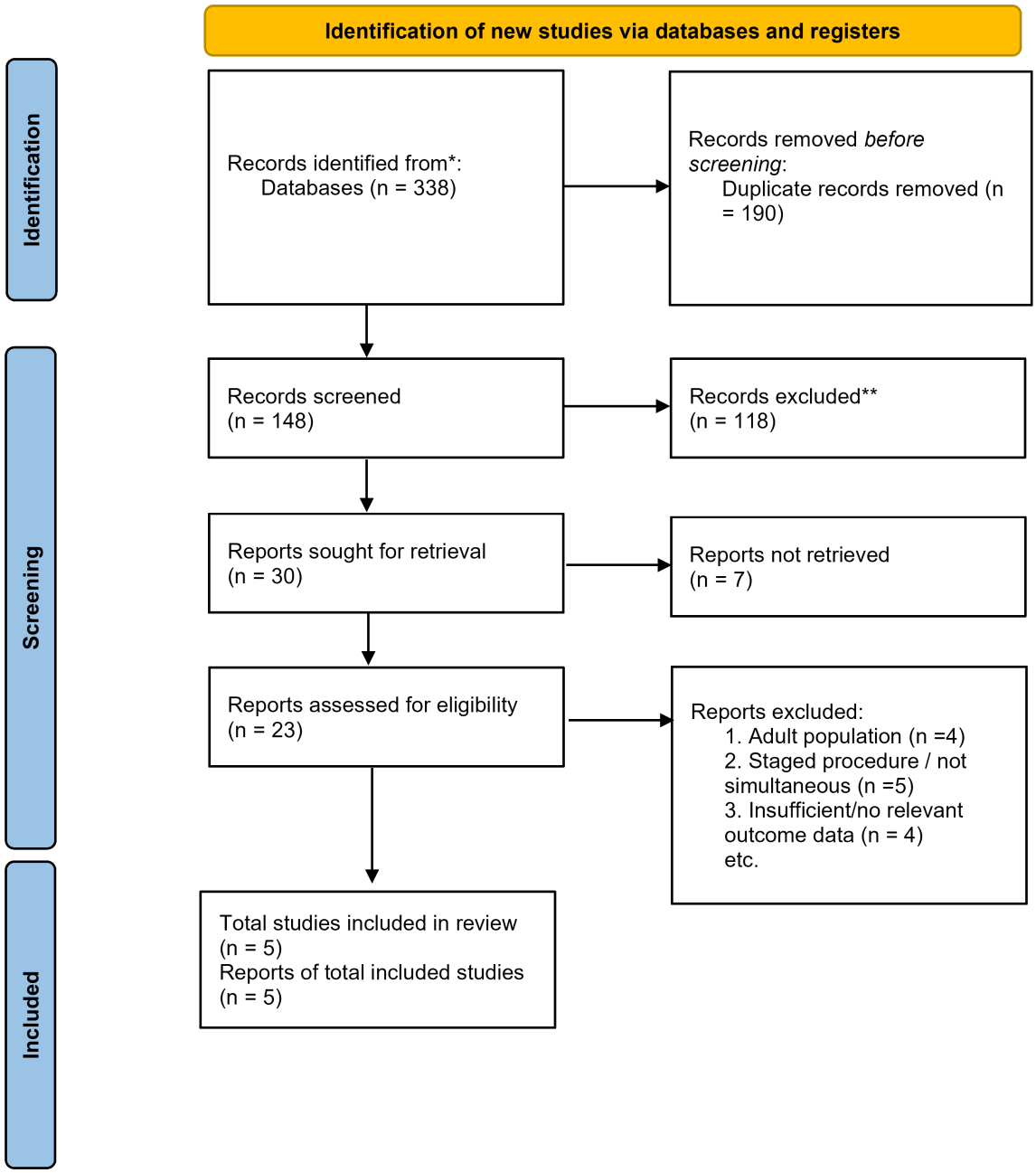


Figure 1

PRISMA 2020 flow diagram