Original Article

Flexible Ureteroscopy for Renal Stone Fragmentation: Extraction versus No Extraction

Ali Mahmood Shakir[1], Zahraa Ali Kareem[2], Amna Mohammed Hamza[3], Jihad Talib Obead[4] and Noor Mahmood Mahdi[5]

ABSTRACT

Objective: To compare the operative time and stone-free rates between dusting alone and dusting with basket extraction in patients with 15-20 mm renal calculi.

Study Design: Prospective observational study

Place and Duration of Study: This study was conducted at the Department of Urology, Al-Kafeel Hospital, 56001, Karbala, Iraq from 1st January 2024 to 31st December 2024.

Methods: 164 consecutive patients were enrolled. Seventy-three patients underwent dusting with basket extraction, while 91 patients were treated with dusting alone. Stone burden were assessed using non-contrast computed tomography by measuring maximal axial diameter and calculating ellipsoid stone volume. Patients were followed for 4 weeks postoperatively. Primary outcomes were operative time and stone-free fate, while secondary outcomes included perioperative complications.

Results: Mean operative time was significantly longer in the dusting with extraction group compared with the dusting-only group (72±10 vs 59±8 minutes; mean difference 13 minutes, 95% CI 10–16). The stone-free rates at 4 weeks was 91% in the extraction group and 86% in the dusting group, with an absolute difference of 5% (95% CI –4 to 13), which was not statistically significant. Complications were infrequent and minor, with no major adverse events reported.

Conclusions: In patients with 15–20 mm renal calculi, laser dusting alone achieves stone-free rates comparable to dusting with basket extraction while significantly reducing operative time. The use of standardized non-contrast computed tomography-based volumetric assessment enhances the reliability of stone-burden evaluation and should be considered in future clinical trials and routine practice.

Key Words: Flexible ureteroscopy, Renal stone, Fragmentation

Citation of article: Shakir AM, Kareem ZA, Hamza AM, Obead JT, Mahdi NM. Flexible Ureteroscopy for Renal Stone Fragmentation: Extraction versus No Extraction. Med Forum 2026;37(3):20-23. doi:10.60110/medforum.370304.

INTRODUCTION

Renal stone disease represents a significant global health burden, with increasing prevalence and recurrence rates, leading to substantial morbidity and healthcare costs.[1,2]

[1.] Department of Urology, Al-Kafeel Hospital, 56001, Karbala, Iraq
[2.] College of Education for Pure Sciences, University of Kerbala, 56001, Karbala, Iraq
[3.] College of Nursing, University of Karbala, Karbala, Iraq.
[4.] Department of Microbiology & Parasitology, University of Kerbala, Iraq
[5.] Department of Basic Sciences, College of Dentistry, University of Kerbala, Karbala, 56001, Iraq

Correspondence: Ali Mahmood Shakir, Department of Urology, Al-Kafeel Hospital, 56001, Karbala, Iraq.
Contact No: +9647516639169
Email: nooralshahmani@gmail.com

Received: September, 2025
Reviewed: October-November, 2025
Accepted: December, 2025

Advances in endourological techniques have revolutionized the management of nephrolithiasis, positioning flexible ureteroscopy (fURS) as a cornerstone modality for the treatment of renal calculi, particularly those of small to moderate size.[3,4] The widespread adoption of fURS is attributed to its high efficacy, minimally invasive nature, and favorable safety profile when compared with open or percutaneous surgical approaches.[5]

Flexible ureteroscopy has become a standard treatment for renal calculi ≤20 mm, offering high success rates with minimal morbidity. Advances in laser technology and flexible scopes have widened its role in modern endourology. Although basket extraction ensures immediate removal of fragments, it increases operative time and costs. Dusting is quicker and avoids basket use, but residual fragments may persist. Accurate stone measurement is critical: volumetry is superior to diameter alone. Therefore, we conducted a prospective study to compare dusting and dusting with extraction in 15–20 mm renal stones, employing standardized CT volumetry. Laser lithotripsy, most commonly utilizing the holmium:yttrium-aluminum-garnet (Ho:YAG) laser,

is the standard method for stone fragmentation during fURS.[6] However, optimal management of the resulting stone fragments remains a subject of ongoing debate. Two principal strategies are currently employed: active extraction of fragments using retrieval devices, and fragmentation without extraction (dusting), wherein fine particles are left in situ to pass spontaneously through the urinary tract.[7,8]

Proponents of fragment extraction argue that it maximizes stone-free rates and reduces the likelihood of residual fragments, which are associated with recurrent stone formation, persistent symptoms, and the need for secondary interventions.[9,10] Conversely, advocates of the no-extraction approach emphasize reduced operative time, lower intrarenal pressure, decreased risk of ureteral trauma, and potential cost effectiveness, particularly when residual fragments are sufficiently small to permit spontaneous clearance.[11-13] Despite numerous studies evaluating both techniques, there remains no clear consensus regarding the superiority of one approach over the other.[14,15] Variability in stone characteristics, patient factors, surgical expertise, and definitions of stone-free status further complicate direct comparisons.[16] Therefore, a comprehensive evaluation of extraction versus no-extraction strategies during flexible ureteroscopy is warranted. This study aims to critically compare the clinical outcomes of stone fragment extraction versus no extraction following laser lithotripsy during flexible ureteroscopy for renal stones, focusing on stone-free rates, operative time, perioperative complications, need for auxiliary procedures, and overall patient outcomes.[17]

METHODS

This prospective, single-center observational study at Al-Kafeel Hospital from 1st January 2024 to 31st December 2024 vide letter No. 4545/QM/Approval/3839JFHF dated 21.12.2023 Written informed consent obtained. Adults ≥18, renal stones 15–20 mm confirmed by NCCT were included. Prior PCNL, abnormal renal anatomy, strictures, or anesthesia contraindications were excluded. Group A (dusting with basket extraction, n=73) vs Group B (dusting only, n=91). Performed under GA with flexible ureter scopes and Ho:YAG laser. Double-J stent placed in all patients. Stone measurement: NCCT with maximal diameter and ellipsoid formula ($\pi/6 \times$ length $\times$ width $\times$ depth). Cumulative volume reported for multiple stones. ≤3 mm slice thickness, standardized settings, blinded radiologists. Follow-up: NCCT at 4 weeks. SFR defined as no fragments >2 mm. Complications graded by Clavien-Dindo. Statistics: t-test and χ^2. Effect sizes and 95% CI reported. Sample size determined a priori for ≥10% SFR difference with 80% power.

RESULTS

Groups similar in demographics and stone size (17.1±1.1 mm vs 16.4±1.3 mm, p=0.09) [Table 1]. Mean operative time was 72±10 min (extraction) vs 59±8 min (dusting) [p<0.001]. Mean difference 13 min (95% CI 10–16). Operative time differences are demonstrating significantly (P<0.001) longer duration for extraction group as compared with dusting group (Table 2, Fig. 1). 91% vs 86% (p=0.28), absolute difference 5% (95% CI –4 to 13), the 4-week stone-free rates showing a modest but non-significant advantage of basket extraction (Fig. 2).

Table No. 1: Baseline characteristics

Variable	Extraction (n=73)	Dusting (n=91)	p-value
Age (years)	46.8±11.4	47.2±12.0	0.82
Male	61%	63%	0.74
Stone size (mm)	17.1±1.1	16.4±1.3	0.09

Table No. 2: Operative outcomes

Variable	Extraction (n=73)	Dusting (n=91)	p-value
Operative time (min)	72±10	59±8	<0.001
SFR at 4 weeks	91%	86%	0.28
Complications (major)	-	-	–

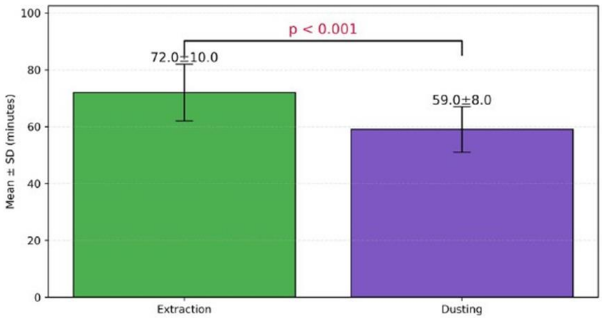

Figure No. 1: Operative time by treatment modality

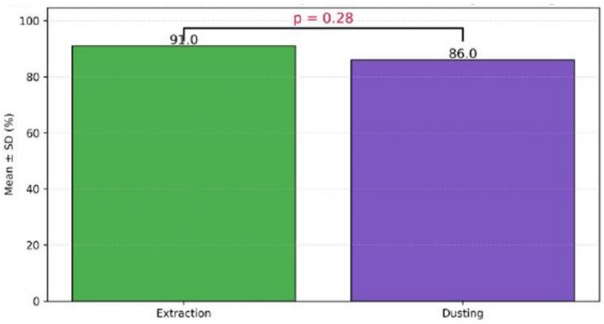

Figure No. 2: Stone-free rate at 4 weeks by treatment modality

DISCUSSION

This study shows that laser dusting alone during fURS for 15-20 mm renal stones gets stone-free rates similar to dusting with basket extraction, while cutting down operative time a lot. Though the extraction group had a bit higher stone-free rate (91% vs 86%), this difference is not statistically significant and probably not clinically meaningful. These results are in line with previous studies which reported equal effectiveness between dusting and extraction techniques for renal stones ≤20 mm.[18] The significantly shorter operative time observed with dusting alone represents a key advantage; mean reduction of 13 minutes is clinically relevant as it reduces anesthesia exposure, operating room utilization, and procedural costs. Similar reductions in operative time with dusting strategies have been consistently reported in the literature.[19] The prolonged duration associated with basket extraction is likely attributable to repeated instrument exchanges and fragment retrieval maneuvers. This prospective study shows dusting provides comparable SFR to extraction while significantly reducing operative time. The small SFR difference was not statistically or clinically significant, consistent with prior reports. The 13-minute reduction in operative time is clinically meaningful. The use of CT volumetry strengthens methodological rigor. Basket extraction may remain valuable in dense stones or lower pole locations. In the present study, the non-significant SFR difference and the clear operative-time reduction confirm that dusting achieves equivalent clearance with shorter procedures.

Both techniques were very safe and had no major complications at all. This matches earlier reports that said there are few complications when fURS are done by skilled surgeons.[19] Even though basket extraction could theoretically raise the risk of ureteral injury, no such injuries happened in this group. The clinical importance of leftover pieces after dusting is still up for debate. Some proof indicates that pieces smaller than or equal to 2 mm usually pass without help and could be thought of as clinically unimportant.[20] In this research, the slightly lower rate of being stone-free in the dusting group did not lead to more complications or reinterventions within the short follow-up period. A major strength of this study is standardized NCCT-based volumetric stone assessment which improves accuracy compared with diameter-only measurements.[17] Limitations include single-center design, modest sample size, and short follow-up duration. Longer-term outcomes such as stone recurrence were not assessed. In general, these results back up laser dusting alone as an efficient and effective strategy for handling 15-20 mm renal stones during fURS, keeping basket extraction reserved for particular cases based on stone characteristics and anatomy.

In this study, stone-free rates at 4 weeks were high in both groups and did not differ statistically between dusting with extraction and dusting alone. These results are consistent with previous studies that have shown comparable clearance rates for the two techniques for renal stones ≤20 mm.[3,11,13] The use of NCCT and a strict fragment threshold (>2 mm) enhances the robustness of these findings.

Operative time was significantly shorter in the dusting-only group, with a mean reduction of 13 minutes. This finding echoes prior reports that omission of basket extraction improves procedural efficiency.[3,6,11] Reduced operative time is clinically relevant as it reduces anesthesia exposure and optimizes operating room utilization.

The techniques were safe with no major complications observed. Minor complications were infrequent and comparable between groups. Although basket extraction has been associated with increased ureteral manipulation, no ureteral injuries occurred in this study consistent with existing literatures.[19,20] Clinical Impact of Residual Fragments The slightly lower stone-free rate observed with dusting alone did not result in increased morbidity or need for secondary interventions since small residual fragments following dusting are often clinically insignificant and may pass spontaneously.[11,18] These findings support a more pragmatic interpretation of stone-free status in the context of dusting techniques.

CONCLUSION

It was effective as extraction for 15‑20 mm renal stones while significantly reducing operative time. CT volumetry should be integrated into clinical research and practice to improve outcome accuracy. Flexible ureteroscopy with laser dusting alone results in comparable stone-free rates to that of dusting followed by basket extraction in patients with renal stones of size 15–20 mm, but offers the added significant advantage of decreased operative time. The major complications are absent in both arms, thus confirming the safety of either intervention performed by a competent surgeon. Although there is a slight enhancement in the stone-free rate with basket extraction, this does not seem to be clinically relevant during the short-term follow-up period. Standardized non-contrast computed tomography with volumetric stone assessment improves outcome evaluation accuracy and increases findings reliability.

Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Ali Mahmood Shakir, Zahraa Ali Kareem, Amna Mohammed Hamza
Drafting or Revising Critically:	Jihad Talib Obead, Noor Mahmood Mahdi

Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

Conflict of Interest: The study has no conflict of interest to declare by any author.

Source of Funding: None

Ethical Approval: No. 4545/QM/Approval/3839JFHF Dated 21.12.2023

REFERENCES

1. Türk C, Petřík A, Sarica K, Seitz C, Skolarikos A, Straub M, Knoll T. EAU guidelines on diagnosis and conservative management of urolithiasis. Eur Urol 2016;69(3):468-74.
2. Smith A. Flexible ureteroscopy: techniques and outcomes. J Endourol 2021;35(5):653-60.
3. Wen Z, Wang L, Liu Y. Outcomes between dusting and fragmentation in RIRS. BMC Urol 2023;23:113.
4. Zeinelabden KM, Abdelhalim E, Galal M, Abdelbaky T, Nabeeh H. Flexible ureteroscopy, extracorporeal shock wave lithotripsy and mini percutaneous nephrolithotomy for management of lower pole renal hard stones ≤ 2 cm: a prospective randomized study. BMC Urol 2024;24(1):288.
5. Wu W, Wan W, Yang J. Flexible vs semirigid ureteroscopy. BMC Urol 2024;24:261.
6. Elshazly M, Assi M. Laser settings in dusting vs fragmentation. J Endourol 2024;38(7):925-33.
7. Yu S. Flexible ureteroscopic management of kidney stones: review. Asian J Urol 2024;11(2): 122-30.
8. Rammah AM. Flexible ureteroscopy for renal stones <20 mm. Arab J Urol 2025;23(1):51-7.
9. Kuo RL. Stone volume vs diameter for URS outcomes. Urology 2018;115:45-50.
10. Cao D. CT slice thickness and stone measurement variability. Radiology 2015;277(3):874-81.
11. Doizi S, Traxer O. Dusting vs fragmentation: considerations. Curr Opin Urol 2019;29(2): 120-26.
12. Fulgham PF. AUA guideline on imaging for urolithiasis. J Urol 2020;203(1):20-28.
13. Breda A. Flexible ureteroscopy outcomes review. Eur Urol Focus 2017;3(2):175-82.
14. Zeng G. Standardized reporting in endourology. World J Urol 2019;37(1):7-13.
15. Aldoukhi A. Advances in laser lithotripsy. J Endourol 2020;34(6):567-74.
16. Schuster TG. Radiation and low-dose CT in urolithiasis. AJR Am J Roentgenol 2012;198(1): W90-95.
17. Assimos D, Krambeck A, Miller NL, Monga M, Murad MH, Nelson CP, et al. Surgical Management of Stones: American Urological Association/ Endourological Society Guideline, PART I. J Urol 2016;196(4):1153-60.
18. Ghani KR, Wolf JS. What is the stone-free rate? World J Urol 2015;33(2):213-5.
19. Traxer O. Complications of ureteroscopy. World J Urol 2017;35(5):675-82.
20. Ibrahim A. Outcomes of flexible ureteroscopy in different populations. Urolithiasis 2021;49(3): 231-8.