



# Long-term follow-up on dusting versus basketing during ureteroscopy: a prospective multicenter trial from the EDGE Research Consortium

Karen L. Stern<sup>1</sup> · Roger L. Sur<sup>2</sup> · Elisabeth S. Lim<sup>6</sup> · Emily Kong<sup>2</sup> · K. F. Victor Wong<sup>3</sup> · Harmenjit Brar<sup>4,7</sup> · Jonathan Moore<sup>5</sup> · Jonathan H. Berger<sup>2</sup> · Seth K. Bechis<sup>2</sup> · Manoj Monga<sup>2</sup> · Sri Sivalingam<sup>4</sup> · Mitchell R. Humphreys<sup>1</sup> · Ben H. Chew<sup>3</sup>

Received: 1 December 2022 / Accepted: 25 March 2023

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2023

## Abstract

In 2018, the Endourology Disease Group for Excellence (EDGE) published a prospective trial comparing dusting versus basketing during ureteroscopy. One hundred fifty-nine patients were included in the original analysis, which found no difference in stone-free rate at 3 months. We report the intermediate and long-term outcomes of patients included in the original trial. Two analyses were performed. At 1-year, a retrospective chart review was performed, and data collected on stone episodes, Emergency Department (ED) visits, hospital admissions and surgical interventions. To obtain long-term outcomes, the four sites with the largest initial accrual were included in a second phase of data collection with updated analyses. The patients from those sites were contacted, re-consented, and data were collected on stone surgical interventions, stone episodes, stone recurrences on imaging, emergency department (ED) visits, and hospital admissions for stone-related care since their original procedure. One-year follow-up data were collected in 111 of the original 159 (69.8%) patients from the nine sites. There were no statistically significant differences in the number of painful episodes, ED visits, hospital admissions, or surgical interventions. 94 patients from four sites were included in the long-term analysis. There were no statistically significant differences in surgical interventions, painful stone episodes, stone recurrence on imaging, ED visits or hospitalizations for stone-related events between the two groups. Long-term outcomes of dusting versus basketing during ureteroscopy indicate that there are no significant differences in clinical outcomes between the two surgical modalities.

**Keywords** Laser lithotripsy · Nephrolithiasis · Ureteroscopy · Urolithiasis

## Introduction

Ureteroscopy is the gold standard option for the surgical management of a significant portion of renal stones and makes up approximately 60% of the surgeries for urinary stones in the United States [1]. There are variations in ureteroscopic treatment of stones which can be generalized into

---

Abstract presented at the annual meeting of the American Urological Association (virtual), September 10–13, 2021; and at the annual meeting of the World Congress of Endourology and Uro-Technology (virtual), September 23–25, 2021.

---

✉ Karen L. Stern  
stern.karen@mayo.edu

<sup>1</sup> Department of Urology, Mayo Clinic Arizona, 5777 E Mayo Blvd, Phoenix, AZ 85054, USA

<sup>2</sup> Department of Urology, University of California-San Diego, San Diego, CA, USA

<sup>3</sup> Department of Urology, University of British Columbia, Vancouver, BC, Canada

<sup>4</sup> Department of Urology, Cleveland Clinic Foundation, Cleveland, OH, Canada

<sup>5</sup> Department of Urology, Dalhousie University, Halifax, NS, Canada

<sup>6</sup> Department of Quantitative Health Sciences, Mayo Clinic Arizona, Phoenix, AZ, USA

<sup>7</sup> Fort Lauderdale, FL, USA

two different approaches: “dusting” and “basketing.” “Dusting” procedures utilize a laser to disintegrate stones into “dust” sized fragments (i.e., fragments one millimeter or smaller which are expected to pass spontaneously). “Basketing” involves active extraction of the stone fragments utilizing an endoscopic basket. Pros and cons of both surgical techniques exist. For example, dusting may obviate the need to place a ureteral access sheath (reducing cost and risks associated with sheath placement). However, concerns remain that residual “dust” fragments may be too large to pass without an increase a patient’s risk for future stone events [2]. Some urologists consider fragmentation with active basket retrieval better as it may have more complete initial stone clearance in situ [3]; however, basketing does most often require ureteral access sheath placement and repetitive passage of the ureteroscope through the ureter/access sheath, which may increase operative time and cost, and has the potential for ureteral injury.

We previously reported equivocal stone-free outcomes after 6 weeks in a prospective, multicenter trial comparing dusting to basketing during ureteroscopy [4]. We now report the intermediate and long-term results of this trial and seek to determine the durability of prior findings.

## Methods

The initial study was performed by members of Endourological Disease Group for Excellence (EDGE) research consortium consisting of 150 patients from nine academic centers [4]. In this updated analysis, follow-up data were obtained at both intermediate time (1-year) and long-term (at least 5 years) time intervals from the date of the original study index surgery. The 1-year follow-up data were obtained from chart reviews—as approved by the initial institutional review board (IRB) protocol. Charts were queried for

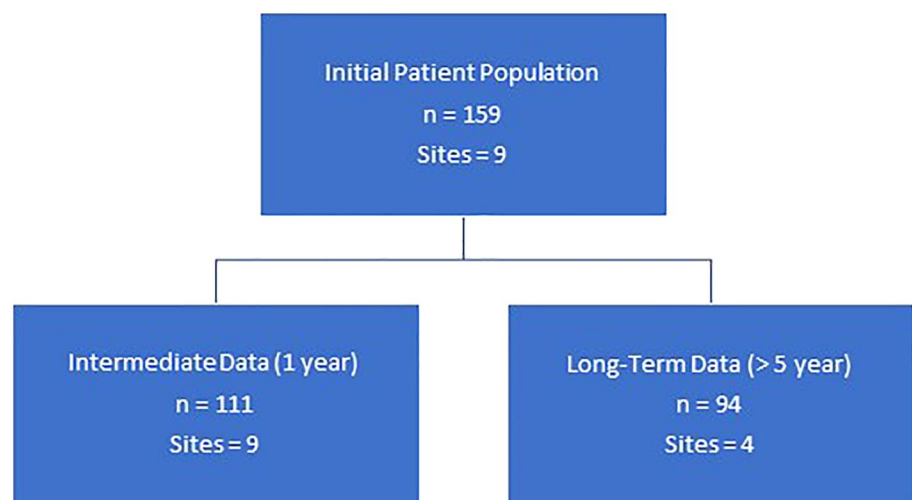
documentation of painful stone episodes in the 12 months following surgery, visits to the Emergency Department (ED) for stone-related care, admissions to the hospital for stone-related care, and future or past surgical interventions for stones since the original study index surgery date.

Furthermore, following an approved IRB protocol update for inclusion of data outside of the original 12-month IRB approval, four of the original study sites with the largest initial accrual were also included in a second phase obtaining long-term data ( $n = 94$ ). Patients enrolled from these four sites in the original study were contacted via phone for re-consenting and surveying. Patients were asked to report about and charts were reviewed for stone surgical interventions, painful stone episodes, stone recurrences on imaging, ED visits for stones, and hospital admissions for stone-related care since their original procedure. Logistical challenges (such as those involving site investigator transfer to other institutions) involving the five remaining original institutions precluded retrieval ( $n = 64$ ) (Fig. 1).

## Results

One-year follow-up data were collected in 111 of the original 159 (69.8%) patients from the nine sites via chart review. There were 61 patients in the dusting group and 50 in the basketing group. Results are seen below in Table 1. Six (13.3%) patients in the dusting group and 10 (23.3%) patients in the basketing group experienced painful episodes secondary to the stones in the 12 months following their initial study ureteroscopy ( $p = 0.23$ ). Of those patients, there was no significant difference in number of painful episodes ( $p = 0.41$ ) or ED visits/hospital admissions for stone-related care ( $p = 0.67$ ). Furthermore, there were no statistically significant differences noted in surgeries (planned or completed). Additional surgical intervention for stone

**Fig. 1** Study enrollment from initial patient population. The intermediate data included 111 patients from 9 sites. The long-term data included 94 patients from the 4 largest sites



**Table 1** One-year data

Outcome	Dusting ( <i>N</i> =61)	Basketing ( <i>N</i> =50)	<i>p</i> value
Painful episodes	6 (13.3%)	10 (23.3%)	0.23
Number of episodes (mean)	2.8	3.2	0.41
Visit to ED	4 (8.9%)	5 (11.6%)	0.67
Number of ED visits (mean)	2.3	1.2	0.38
Hospital admissions	3 (6.7%)	4 (9.3%)	0.65
Number of hospitalizations (mean)	3.5	1.0	0.055
Surgical interventions	8 (17.8%)	4 (9.3%)	0.25
Scheduled/future surgery	7 (15.6%)	2 (4.8%)	0.099

ED emergency department

management was performed in eight (17.8%) of patients in the dusting group and four (9.3%) in the basketing group ( $p=0.25$ ); and planned surgical procedures in the dusting group totaled seven (15.6%) while the basketing group had two (4.8%) procedures yet to occur ( $p=0.099$ ).

Long-term follow-up was completed on the 94 patients identified and able to be contacted from the four largest accrual sites (Mayo Clinic  $n=30$ , University of British Columbia  $n=31$ , Cleveland Clinic  $n=17$ , and the University of California, San Diego  $n=16$ ). Of the 94 patients contacted, there were 34 in the dusting cohort and 60 in the basketing cohort ( $p<0.001$ ). Of the two cohorts, the median follow-up was 6.4 (IQR 5.5–6.6) years in the dusting cohort and 6.6 (IQR 5.9–6.9) years in the basketing group. Nine patients (26.5%) in the dusting cohort were female and 28 (47.5%) of the basketing cohort were female ( $p=0.046$ ). Consistent with the original study, the dusting cohort had a significantly larger mean stone burden (133.5 vs. 73.5 mm<sup>2</sup>,  $p<0.001$ ). Also consistent with the original study, 100% of the basketing cohort used ureteral access sheaths. In the dusting cohort, seven (20.6%) of the 34 patients had ureteral access sheaths used during their procedure. Additional stone and procedural characteristics of included patients are

listed in Table 2. Similar numbers of patients in each cohort underwent additional surgical interventions—12 (35.3%) of the patients in the dusting cohort and 14 (23.3%) of patients in the basketing ( $p=0.213$ ). In addition, there were no statistically significant difference in painful stone episodes, stone recurrence on imaging, ED visits, or hospital admissions for stone-related events between the two groups on long-term follow-up (Table 3). A Kaplan–Meier plot demonstrates similar time intervals before need for repeat surgical procedure for stone with a 5-year-follow-up noting the mean survival-to-surgery for dusting and basketing of 54.2 ( $\pm 2.0$ ) and 56.8 ( $\pm 1.4$ ) months, respectively ( $p=0.109$ , T) (Fig. 2).

## Discussion

Broadly categorized, there are two different surgical techniques used during ureteroscopy to treat urinary tract stones—“dusting” and “basketing.” Per surgeon preference, the surgeon either uses a high-powered laser to “dust” the stone into small, passable fragments without physically removing them; or the surgeon fragments the stone and physically removes the fragments with a basket (hence the

**Table 2** Long-term cohort stone characteristics (initial surgery)

	Dusting ( <i>N</i> =34)	Basketing ( <i>N</i> =60)	<i>p</i> value
Laterality of stone			0.20
Right	15 (44.1%)	27 (45.0%)	
Left	19 (55.9%)	47 (50.0%)	
Both	0 (0.0%)	5 (8.3%)	
Location			
Upper pole	6 (17.6%)	13 (21.7%)	0.64
Mid kidney	4 (11.8%)	17 (28.3%)	0.06
Lower pole	13 (38.2%)	29 (48.3%)	0.34
Renal pelvis	14 (41.2%)	21 (35.0%)	0.55
Pre-stented	7 (20.6%)	7 (11.9%)	0.26
Concomitant ureteral stone	1 (2.9%)	2 (3.8%)	0.84
Preoperative hydronephrosis	11 (32.4%)	12 (20.0%)	0.26
Calculated area (mean)	133.5 mm <sup>2</sup>	73.5 mm <sup>2</sup>	<0.001

**Table 3** Long-term data

Outcome	Dusting ( <i>N</i> =34)	Basketing ( <i>N</i> =60)	<i>p</i> value
Surgical interventions	12 (35.3%)	14 (23.3%)	0.21
Painful stone episodes	14 (41.2%)	21 (42.9%)	0.88
Stone recurrence on imaging	18 (52.9%)	24 (40.0%)	0.23
ED visits	7 (20.6%)	15 (25.0%)	0.63
Hospitalizations	9 (26.5%)	11 (18.3%)	0.35

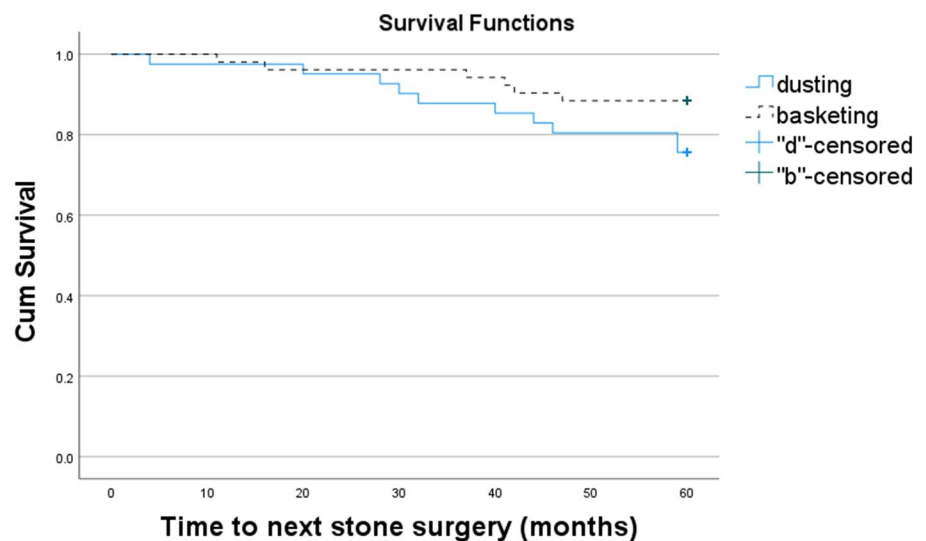
*ED* emergency department

term “basketing”). We previously reported a prospective, multicenter trial comparing patients who underwent ureteroscopy for renal stones measuring five mm to 20 mm in size and were subjected to either “dusting” or “basketing,” per surgeon preference [4]. All patients were treated with a 30 W to 100 W holmium laser. A total of 159 patients were treated, with 84 in the basketing arm and 75 in the dusting arm. Stone-free was defined as no residual fragments. 74.3% of patients in the basketing cohort were stone-free versus 58.2% in the dusting cohort. On multivariate analysis, there was no significant difference in stone-free rate on short-term follow-up. Operative time was longer in the basketing group, but there was no difference in complication rates, hospital readmissions or additional procedures on short-term follow-up.

This updated report presents intermediate (1 year) and long-term (5 years or more) follow-up data from the inception study cohorts. In terms of painful stone episodes, visits to the ED/hospitalizations for stone-related care, or surgical interventions, neither intermediate, nor long-term follow-up,

revealed differences in patients who underwent “basketing” or “dusting” procedures for index surgery. The number of reported surgical interventions and painful stone episodes is consistent with prior data, which shows that intervention-free survival and stone-related-event-free survival decreases over time [5]. It should be noted that follow-up beyond 6 years, as in our study, has not been frequently reported. There are definite possibilities that repeat procedures are secondary to metabolically active stone disease and active or new stone growth versus any residual stone or sequelae of the study index surgery [6].

In addition, the original study was performed with the Holmium:YAG laser (without dual pulse modulation). With the introduction of the Thulium Fiber Laser (TFL), which has been shown to have superior dusting capability, there could be a potential shift in superiority of techniques [7, 8]. Additional trials in the future should aim to see if there is any clinically significant difference in basketing with the Holmium versus dusting with the TFL or Holmium: YAG with dual pulse modulation.

**Fig. 2** Survival time until next stone surgery

Mean survival-time-to-surgery (followed up to five years):

-Dusting 54.2 (+/- 2.0) months

-Basketing 56.8 (+/- 1.4) months

*p* = 0.109 by Log-Rank test, Mantel-Cox

Limitations of our study include the lack of follow-up of several of the centers who participated in the original trial, which was multifactorial (IRB delays secondary to COVID-19, staffing changes, etc.). The decreased number of institutions included in the long-term follow-up contributed to a lower number of patients in the long-term dusting cohort, which potentially could have skewed the results. Also, recall bias of patients must be considered, especially when considering the subjectivity of “painful episodes.” Only unplanned ED visits were captured which may have missed phone calls, primary care provider visits or other unplanned office visits. Additionally, within the participating institutions, follow-up protocols differ likely affecting frequency of stone events—e.g., disparity in timing and use of metabolic evaluations, differences in timing and type of imaging, practice patterns of indications for surgery. Moreover, we recognize that dusting and basketing are not mutually exclusive techniques as one can imagine a surgeon dusting and then utilizing basketing to remove larger fragments that do not adequately fragment into small fragments. These limitations notwithstanding, we present data demonstrating the durability of our initial findings—that there appears to be equivalence between dusting and basketing for ureteroscopy with respect to post-surgical stone events in the intermediate and long-term time periods.

## Conclusion

Through intermediate and long-term follow-up, there are no significant differences in clinical outcomes between patients who underwent dusting versus basketing during ureteroscopy for renal stones. Keeping the above limitations in mind, either technique produces acceptable outcomes when performed by experienced Urologists and can be expected to produce similar results.

**Author contributions** KLS, MD—protocol/project development, data collection, manuscript writing/editing. RLS, MD—protocol/project development, data collection, manuscript writing/editing. EK—data collection, manuscript writing/editing. KFVW—data collection. HB, MD—data collection. JM, MD—data collection, manuscript writing/editing. JB, MD—data analysis, manuscript writing/editing. SKB, MD—protocol/project development, data collection, manuscript writing/editing. MM, MD—protocol/project development, data collection, manuscript writing/editing. SS, MD—protocol/project development, data collection, manuscript writing/editing. MRH, MD—protocol/project development, data collection, manuscript writing/editing. BHC, MD—protocol/project development, data collection, manuscript writing/editing. ESL—data analysis.

**Funding** No funds, grants, or other support was received.

**Data, material and/or code availability** Data available on request from the authors.

## Declarations

**Conflict of interest** The authors have no competing interest to declare that are relevant to the content of this article.

**Ethics approval** Obtained IRB approval.

**Consent** Consent obtained from all patients.

**Consent to participate** Informed consent was obtained from all individual participants included in the study.

**Consent to publish** Participants provided informed consent for publication.

## References

1. Metzler IS, Holt S, Harper JD (2021) Surgical trends in nephrolithiasis: increasing de novo renal access by urologists for percutaneous nephrolithotomy. *J Endourol* 35:769–774. <https://doi.org/10.1089/end.2020.0888>
2. Chew BH, Brotherhood HL, Sur RL, Wang AQ, Knudsen BE, Yong C et al (2016) Natural history, complications and re-intervention rates of asymptomatic residual stone fragments after ureteroscopy: a report from the EDGE Research Consortium. *J Urol* 195:982–986. <https://doi.org/10.1016/j.juro.2015.11.009>
3. Matlaga BR, Chew B, Eisner B, Humphreys M, Knudsen B, Krambeck A et al (2018) Ureteroscopic laser lithotripsy: a review of dusting vs fragmentation with extraction. *J Endourol* 32:1–6. <https://doi.org/10.1089/end.2017.0641>
4. Humphreys MR, Shah OD, Monga M, Chang YH, Krambeck AE, Sur RL et al (2018) Dusting versus basketing during ureteroscopy: which technique is more efficacious? A prospective multicenter trial from the EDGE Research Consortium. *J Urol* 199:1272–1276. <https://doi.org/10.1016/j.juro.2017.11.126>
5. Ito K, Takahashi T, Somiya S, Kanno T, Higashi Y, Yamada H (2021) Predictors of repeat surgery and stone-related events after flexible ureteroscopy for renal stones. *Urology* 154:96–102. <https://doi.org/10.1016/j.urology.2021.02.025>
6. Osman MM, Alfano Y, Kamp S, Haecker A, Alken P, Michel MS et al (2005) 5-year-follow-up of patients with clinically insignificant residual fragments after extracorporeal shockwave lithotripsy. *Eur Urol* 47:860–864. <https://doi.org/10.1016/j.eururo.2005.01.005>
7. Kronenberg P, Traxer O (2019) The laser of the future: reality and expectations about the new thulium fiber laser, a systematic review. *Transl Androl Urol* 8:S398–S417. <https://doi.org/10.21037/tau.2019.08.01>
8. Traxer O, Corrales M (2021) Managing urolithiasis with thulium fiber laser: updated real-life results: a systematic review. *J Clin Med*. <https://doi.org/10.3390/jcm10153390>

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.