PEDIATRIC UROLOGY

# *Contemporary practice patterns in the treatment of pediatric stone disease*

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***Introduction:*** *To compare endourology versus pediatric urology exposure to pediatric stone cases during fellowship, comfortability in treating pediatric stone cases, and access to pediatric surgical equipment.*

***Materials and methods:*** *A survey was distributed to all pediatric urology fellowship programs and the Endourological Society. Age was stratified into < 12 months old, 12 months-4 years, 5-12 years, and 13-18 years. Exposure and comfortability performing extracorporeal shock wave lithotripsy (SWL), ureteroscopy (URS) and percutaneous nephrolithotomy (PCNL) were assessed across age groups. Exposure was assessed as "yes/no" and comfortability was scaled from 1-5 ("would not do" to "very comfortable").*

***Results:*** *Seventy-two surveys met inclusion criteria, with 23 (31.9%) from pediatric urologists and 49 (68.1%) by endourologists. During fellowship, pediatric urologists had more exposure to SWL in toddlers (p = 0.03) and school age children (p = 0.045), URS in toddlers (p = 0.012) and school age children (p = 0.002), and PCNL in infants (p = 0.031) and school age children (p = 0.025) compared to endourologists. Pediatric urologists were significantly more comfortable performing SWL in toddlers (p = 0.04), URS in toddlers (p = 0.04) and school age children (p = 0.04), and PCNL in school age children (p = 0.02) compared to endourologists. Endourologists were significantly more uncomfortable than pediatric urologists in performing URS in toddlers (p = 0.03) and PCNL in infants (p = 0.04) and school age children (p = 0.03). There were no differences in availability of pediatric equipment.*

***Conclusions:*** *Pediatric urologists, have significantly more exposure than endourologists during fellowship and are more comfortable performing surgical treatment for urolithiasis in most pediatric ages. Endourology fellowships may benefit from greater exposure to pediatric patients with stones.*

**Key Words:** renal stone, ureteral stones, pediatrics, extracorporeal shock wave lithotripsy, ureteroscopy, percutaneous nephrolithotomy

## Introduction

Urolithiasis is a common urologic condition and is associated with a large healthcare burden, including high morbidity rates and significant healthcare expenditure. Classically, urolithiasis affects the adult population, though recent epidemiological data suggest that urolithiasis is increasingly common in the pediatric population.[1-3] The root cause behind the dramatic rise of urolithiasis in the pediatric population is largely unknown but thought to be influenced by metabolic abnormities that favor stone formation. While medical expulsive therapy (MET) is a frequent and often successful conservative approach to stone disease, a large proportion of patients will ultimately require surgical intervention, including ureteroscopy (URS), extracorporeal shock wave lithotripsy (SWL), or percutaneous nephrolithotomy (PCNL).[4-10]

Despite the growing prevalence of pediatric urolithiasis and the advances in the treatment of pediatric stone disease, the trends in practice patterns have not been well described. As it stands, both pediatric urologists and endourologists encounter and treat pediatric stone disease. The training exposure for various treatment modalities for stone disease is unknown with respect to the pediatric population as is the comfort level in treating this disease. For instance, during their respective subspecialty training, endourologists may have less exposure to a pediatric population, while pediatric trained urologists may

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have less exposure to complex stone disease. We postulate that endourologists may be more comfortable with the techniques whereas the pediatric urologist may be more comfortable with the patient population. Therefore, the aim of this study is to analyze current practice patterns in the treatment of pediatric stone disease through a survey instrument.

## Materials and methods

This study was approved by our Institutional Review Board. A survey was designed to assess surgeon practices in the treatment of pediatric stone disease during fellowship training, current practices in the treatment of pediatric stone disease, availability of pediatric surgical equipment, and comfortability with surgical techniques across various pediatric age groups. Pediatric age group was stratified into infants < 12 months old, toddler age 12 months to 4 years, school age 5 years to 12 years, and adolescents 13 years to 18 years. The comfortability of each surgeon was assessed for each modality ranging from "would not do the procedure," "uncomfortable with the procedure," "neither comfortable nor uncomfortable," "comfortable," and "very comfortable."

The survey was distributed through an email sent to all pediatric urology fellowship programs and a survey distributed via the endourology society. Inclusion criteria included completion of a fellowship in either pediatric urology or endourology. Surgeons were excluded if they had completed both a pediatric and endourology fellowship. Eligible participants were sent the survey via email through SurveyMonkey (https://www.surveymonkey.com). Electronic data were collected anonymously and kept confidential. Microsoft Excel was used for statistical analysis; statistical analysis included Chi square, Fischer's t test and multinomial logistic regression.

## Results

A total of 83 urologists responded to the survey. Nine surveys were excluded as these participants had not completed a pediatric or endourologist fellowship and another two surveys were excluded for completion of both fellowships. A total of 72 surveys met inclusion criteria, with 23 (31.9%) surveys completed by pediatric urologists and 49 (68.1%) surveys by endourologists.

### *Exposure during fellowship training*

During their fellowship training, pediatric urologists had significantly more exposure to SWL in both toddlers (p = 0.03) and school age children (p = 0.045) compared to endourologists, Figure 1. Similarly, pediatric urologists had significantly more exposure to URS in toddlers (p = 0.012) and school age children (p = 0.002) compared to endourologists, Figure 2.

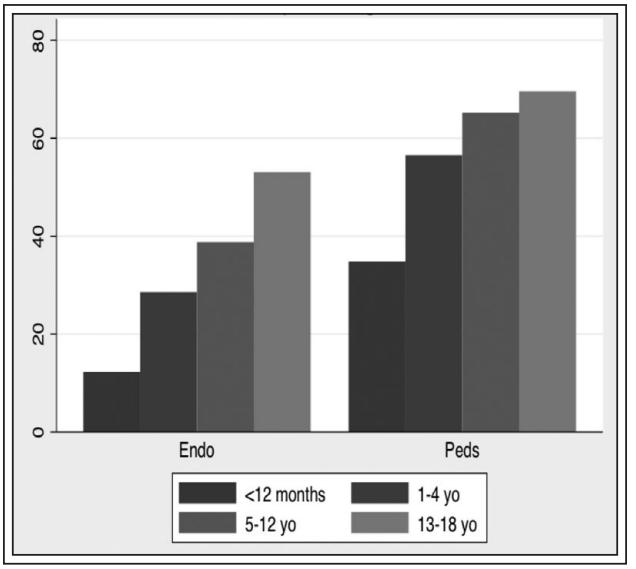


**Figure 1.** Exposure to SWL during fellowship training.

With respect to PCNL exposure, pediatric urologists had significantly more exposure in infants (p = 0.031) and school age children (p = 0.025), Figure 3. See Table 1 for complete exposure rates.

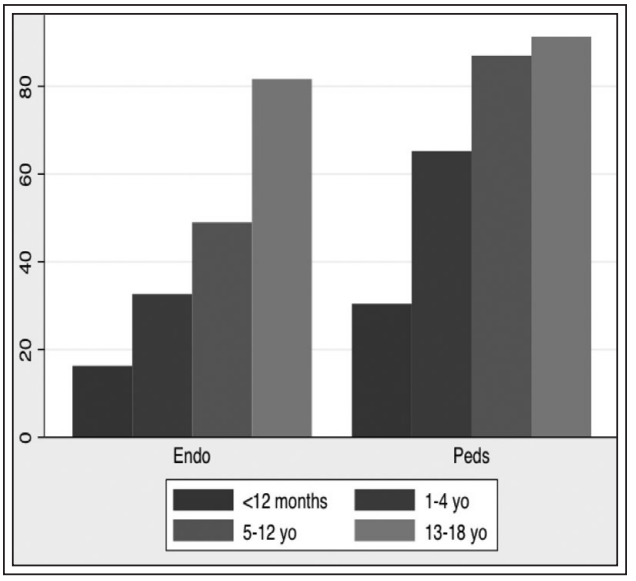


**Figure 2.** Exposure to ureteroscopy during fellowship training.

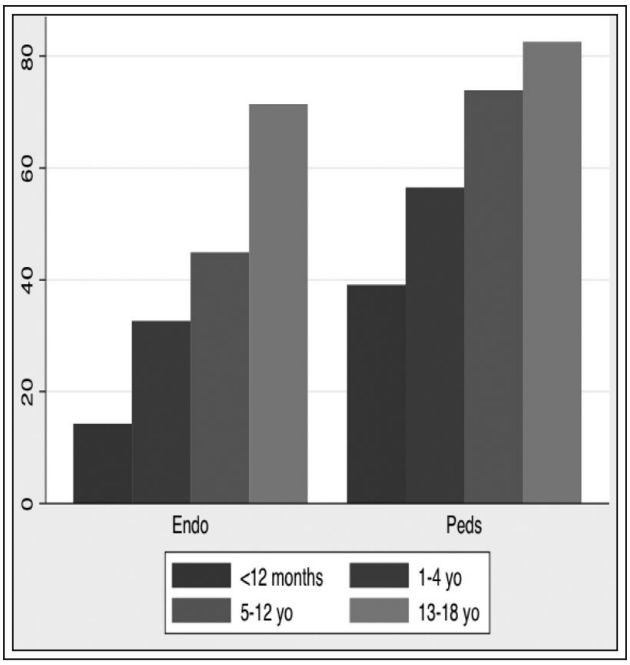


**Figure 3.** Exposure to PCNL during fellowship training.

### *Comfortability in practice*

In regard to comfortability performing various procedures in each age group, responses were grouped into two categories: "comfortable" if answers included "comfortable" or "very comfortable" versus "uncomfortable" if answers included "would not perform procedure" or "uncomfortable." Pediatric urologists were significantly more comfortable performing SWL in toddlers compared to endourologists (p = 0.04). Similarly, pediatric urologists were more comfortable performing URS in toddlers (p = 0.04) and school age children (p = 0.04) compared to endourologists. Endourologists were significantly more uncomfortable performing URS in toddlers compared to pediatric urologists (p = 0.03). Pediatric urologists were also significantly more comfortable performing PCNL in school age children than endourologists (p = 0.02) while endourologists were significantly more uncomfortable performing PCNL in both infants (p = 0.04) and school age children (p = 0.03). See Table 2 for complete comfortability rates.

### *Specialty surgical equipment*

There were no differences in the availability of pediatric surgical equipment for both pediatric urologists and endourologists. Approximately half of pediatric urologists and endourologists had access to a 4.5Fr semirigid ureteroscope (54.5% and 53.2% respectively, p = 1.0), a self-dilating 4.5 to 6.5Fr ureteroscope (54.5% and 48.9% respectively, p = 0.061), and a mini PCNL set (11-13Fr outer sheath with 6F inner sheath) (63.6% and 46.8%, respectively, p = 0.21). Approximately one third of pediatric urologists had access to both an infant brace for SWL and a short and thin pediatric PCNL set (31.8% each) while 19.1% of endourologists had access to both sets of equipment (p = 0.36 for both brace and thin pediatric PCNL set). See Figure 4.

## Discussion

Urolithiasis is commonly thought of as an adult urologic condition. However, recent epidemiologic data demonstrate that the incidence of pediatric urolithiasis is rising.[2,11] Given the increasing number of pediatric stone patients, there is an inevitable overlap in

TABLE 1. **Surgical modality exposure during fellowship training**

| | SWL | | | URS | | | PCNL | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Ped (%)** | **Endo (%)** | **p value** | **Ped (%)** | **Endo (%)** | **p value** | **Ped (%)** | **Endo(%)** | **p value** |
| Infants (0-12 mos) | 34.8 | 12.2 | 0.052 | 30.4 | 16.3 | 0.216 | 39.1 | 14.3 | 0.031 |
| Toddlers (12 mos-4 yrs) | 56.5 | 28.6 | 0.036 | 65.2 | 32.6 | 0.012 | 56.5 | 32.7 | 0.073 |
| School age (5-12 yrs) | 65.2 | 38.8 | 0.045 | 87.0 | 49.0 | 0.002 | 73.9 | 44.5 | 0.025 |
| Adolescent (13-18 yrs) | 69.6 | 54.1 | 0.21 | 91.3 | 81.6 | 0.484 | 82.6 | 71.4 | 0.39 |

SWL = shock wave lithotripsy; URS = ureteroscopy; PCNL = percutaneous nephrolithotomy; ped = pediatric trained; endo = endourologist trained

TABLE 2. **Comfortability rates in practice**

| | Comfortable or very comfortable with surgical modality | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | URS | | | SWL | | | PCNL | | |
| | Ped (%) | Endo (%) | p value | Ped (%) | Endo (%) | p value | Ped (%) | Endo(%) | p value |
| Infants (0-12 mos) | 45 | 30 | 0.29 | 39 | 24 | 0.27 | 48 | 22 | 0.053 |
| Toddlers (12 mos-4 yrs) | 58 | 40 | 0.04 | 65 | 36 | 0.04 | 60 | 35 | 0.08 |
| School age (5-12 yrs) | 91 | 68 | 0.04 | 82 | 64 | 0.11 | 91 | 64 | 0.02 |
| Adolescent (13-18 yrs) | 95 | 91 | 1 | 87 | 79 | 0.55 | 87 | 90 | 0.7 |
| | Would not perform or uncomfortable with surgical modality | | | | | | | | |
| Infants (0-12 mos) | 50 | 55 | 0.8 | 35 | 57 | 0.13 | 43 | 57 | 0.04 |
| Toddlers (12 mos-4 yrs) | 14 | 43 | 0.03 | 21 | 45 | 0.07 | 21 | 45 | 0.07 |
| School age (5-12 yrs) | 5 | 20 | 0.15 | 17 | 28 | 0.39 | 4 | 25 | 0.03 |
| Adolescent (13-18 yrs) | 5 | 4 | 1 | 9 | 10 | 1 | 4 | 5 | 1 |

SWL = shock wave lithotripsy; URS = ureteroscopy; PCNL = percutaneous nephrolithotomy; ped = pediatric trained; endo = endourologist trained

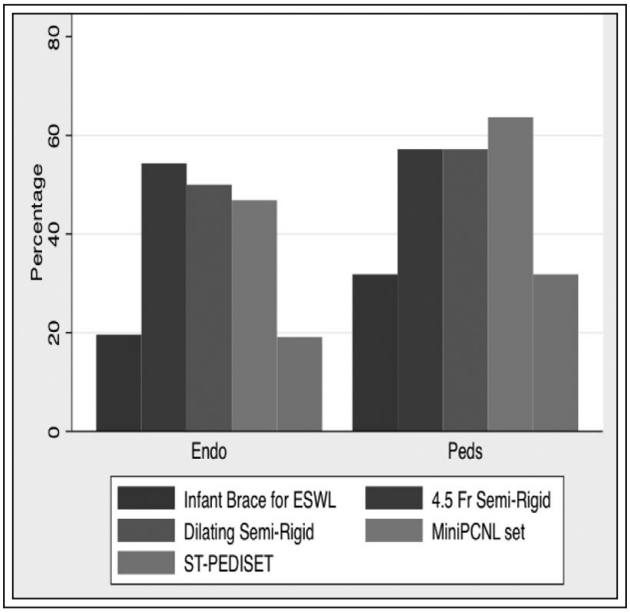


**Figure 4.** Pediatric-specific surgical equipment availability.

treatment of these patients between pediatric urologists and adult endourologists. Pediatric urologists, by default, have a greater exposure to pediatric patients; therefore, we hypothesized that pediatric urologists will have greater exposure during fellowship to all surgical modalities compared to endourologists. However, a common assumption is that endourologists have a greater exposure to complex stone cases during fellowship, and, therefore, we hypothesized they will be more comfortable performing complex URS and PCNL in pediatric patients compared to pediatric urologists. No study to date has confirmed or refuted these practice patterns. Thus, we sought to elucidate the practice patterns of both pediatric urologists and endourologists in the surgical treatment of pediatric urolithiasis.

Our data demonstrate pediatric urologists received greater exposure to all three surgical modalities during fellowship training compared to endourologists. Further, pediatric urologists had greater exposure in the majority of pediatric patient age groups. The one age group for which there was no significant difference in exposure in any modality was adolescents. We posit

that the comparable size of adolescents (13-18 years old) to adults facilitates referrals to "adult" endourologists and increases exposure during fellowship training. Overall, the increased exposure by pediatric urologists is not wholly unsurprising, as endourology fellowships are primarily focused on adults.

With respect to comfortability in performing these procedures, we hypothesized that endourologists would be more comfortable than pediatric urologists performing complex stone procedures, particularly URS and especially PCNL. A competing notion is that endourologists may shy away from operating on the youngest subgroups of patients. Our data agree with the latter hypothesis. We found that pediatric urologists are more comfortable performing SWL and URS on patients between the ages of 12 months and 12 years. This is likely due to their extensive experience across the youngest pediatric age groups, and the comfort that that experience fosters and engenders. Most surprising, however, is the fact that more pediatric urologists were significantly comfortable performing PCNL in school age children while endourologists were significantly uncomfortable performing PCNL in this same age group. This suggests that in the youngest age groups, pediatric urologists feel more comfortable than endourologists performing PCNL, despite the increased surgical complexity of the procedure. One potential reason for this may be a lack of necessary exposure and experience by endourologists to these age groups.

In one study, Bayrak et al retrospectively examined the learning curve for pediatric PCNL by an experienced adult urologist. They demonstrated that pediatric PCNL may be performed safely by an adult urologist given a background with an adult experience of 120 adult PCNLs. They further demonstrated that with continued exposure to pediatric PCNLs (defined as at least 35 pediatric PCNL cases), safe and effective PCNLs could be performed in even younger pediatric patients.[12] Other potential reasons for a lack of endourology comfortability with pediatric patients could be a fear of litigation when operating on the youngest pediatric patients, or referral patterns that favor increased volume and experience by pediatric urologists.

The varying degrees of comfortability in performing these operations could potentially be explained by differential access to surgical equipment. Inadequate access to proper pediatric equipment would certainly limit a surgeon's comfort in performing a procedure. However, our data found no difference in the availability of surgical equipment between pediatric and endourologists. This therefore could not explain the differences seen in the comfort levels between pediatric and endourologists. However, we only assessed the availability of several pediatric items and did not assess how often each piece of equipment was used.

There are several limitations to our study. First, there is inherent reporting bias in any survey study. Second, our survey was sent to recipients through either an academic institution that has a pediatric urology fellowship or through a listserv from the Society of Endourology. Therefore, a large portion of pediatric urologists that work mainly in a community or private practice setting were likely not surveyed, introducing a potential selection bias. Endourologists who do not subscribe to the Society of Endourologist listserv were also not given the opportunity to answer the survey. With a broader survey audience, there may have been more significant differences in both exposure and comfortability in treating pediatric patients. Finally, this survey did not account for surgical complexity (e.g. pelvicaliceal anatomy or stone volume), which may influence comfortability rates. For example, staghorn stones in multiple calyces often necessitate a multi-tract approach, requiring a fluoroscopy guided puncture skillset that is not often taught to pediatric urologists. In fact, Aron et al, a group of adult endourologists, demonstrated excellent outcomes following PCNL for staghorn stones in pre-school children, with the majority of children requiring a multi-tract approach.[13] Overall, these limitations lead the way for further analysis looking at outcomes of stone procedures performed by pediatric versus endourologists across various pediatric age ranges. This would give a more objective analysis to the practice patterns in pediatric urolithiasis. Regardless, this is the first study to address the important issue of who is treating urolithiasis in the pediatric population.

## Conclusions

Pediatric urolithiasis is rapidly increasing and, therefore, so will be the surgical treatment of urolithiasis in these patients. Currently, there is a theoretical and practical overlap between pediatric urologists and endourologists in the treatment of pediatric stones. Our study examined the current practice patterns of both pediatric urologists and endourologists in the treatment of pediatric urolithiasis. Our data demonstrate that not only do pediatric urologists have significantly more exposure during fellowship to the surgical modalities to treat stones in most of the pediatric age groups but they are also more comfortable using the various surgical modalities, including URS and PCNL, in most pediatric patient age groups compared to endourologists. □

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