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Worldwide trends of practice and intervention in paediatric endourology: comparison of European versus Non-European responses

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Introduction The area of paediatric endourology is unique and is recognised to be challenging, and it requires a certain level of focused training and expertise. Our aim was to conduct a worldwide survey in order to gain an overview regarding the current practice patterns for minimally invasive treatments of paediatric upper urinary tract stone patients.

Material and methods The survey was distributed between December 2021 and April 2022 through urology sections and societies in United Kingdom, Latin America and Asia. The survey was made up of 20 questions and it was distributed online using the free online Google Forms (TM).

Results 221 urologists answered the survey with 56 responses each from India, South America and UK and 53 responses from the rest of Europe (15 countries). In total, 163 responders (73.7%)

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managed paediatric stone patients in their daily practice. Of the responders, 60.2% were adult urologists and 39.8% were paediatric urologists. 12.9% adult urologists and 20.4% paediatric urologists run independent clinics while some run combined adult and paediatric clinics sometimes with the support of the nephrologists.
Only 33.9% urologists offered all surgical treatments [extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL), ureteroscopy (URS) and retrograde intrarenal surgery (RIRS)].
Conclusions Treatment of paediatric stones can vary according to country and legislations. Based on the results of this survey, minimally invasive methods such as URS and mini PCNL seem to have become more popular. In most institutions a collaboration exists between adult and paediatric urologists, which is the key for a tailored decision making, counselling and treatment success.

Key Words: paediatric stones ‹› urolithiasis ‹› ureteroscopy ‹› PCNL ‹› SWL ‹› worldwide survey

INTRODUCTION

Endourology is a field of urology that uses minimally invasive techniques to assess the upper and lower urinary tract and treat urinary tract stones [1]. Treatment of kidney stones disease (KSD) in the paediatric population is recognised to be challenging and it requires a certain level of focused training and expertise [2]. KSD has been recognised to be of great importance due to its possible association with a metabolic abnormality as well as increased risks of coronary heart disease, chronic kidney disease and hypertension. This is one of the key reasons why it is so important to diagnose and treat patients with KSD at a young age [3].
In view of the great variability and anatomical differences among children of different ages, stone treatment should be individualized. Furthermore, parents and patients (if age appropriate) should be informed about all available treatment options [4]. Most centres specialising in paediatric endourology can offer extracorporeal shock wave lithotripsy (ESWL), retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotomy (PCNL). Advances in endourological technology have led to the adoption of smaller flexible ureteroscopes when performing RIRS and miniaturised access for PCNL, such as mini- or ultra-mini- or micro-PCNL [5]. However, not all the centres worldwide are able to offer an equal standard of practice and this is due to a variety of reasons [6]. For example, in some centres, the treatment of paediatric urolithiasis is traditionally managed by an adult endourologist, while the paediatric surgeons tend to perform only the open surgical procedures. This may be because of the lack of training or availability of paediatric sized equipment, which can be both more expensive and difficult to procure [7].
Recent evidence shows how the majority of stones in children can be managed using endourological procedures, thus reducing the number of children requiring open surgery [8]. Although the European guidelines do highlight how the latest available technological advancements have allowed minimally invasive surgical techniques to becomes the first line option for KSD treatment [9], the reality in local hospitals is often quite different due to a lack of appropriately sized instruments and specialized dedicated team.
Our aim was to conduct a worldwide survey in order to gain an overview regarding the current practice patterns for minimally invasive treatments of paediatric upper urinary tract stone patients.

MATERIAL AND METHODS

The survey was distributed between December 2021 and April 2022 through the European Association of Urology (EAU) section of Urolithiasis (EULIS), Young academic urology (YAU) section of Urolithiasis and British Association of Urological Surgeons (BAUS) Endourology section board members and other societies of Latin America and Asia. The survey was made up of 20 questions, and it was distributed online using the free online Google Forms (TM) platform. The methodology was created and developed according to the CHERRIES checklist [10]. A total of 221 urologists answered the survey, with at least 50 responses each from Europe, UK, Asia and Latin America respectively. In order to evaluate the practice and intervention trends in paediatric endourology, the questionnaire was addressed to endourologists irrespective of whether they practiced in this specific area. We also wanted to compare European (EU) practice (Europe and UK) with non-European practice (non-EU). Data was then collected in excel sheet and analysed in a descriptive format.

RESULTS

221 urologists answered the survey with 56 responses each from India, South America and United Kingdom and 53 responses from the rest of Europe (15 countries). In total, 163 responders (73.7%) managed paediatric stone patients in their daily practice. The remaining 26.3% of endourologists, although not themselves practicing in the domain of paediatric KSD, were still able to give an insight and opinion on the practice and intervention trends in their geographical area of practice.

Of the responders, 133 (60.2%) were adult urologists and 88 (39.8%) were paediatric urologists. Overall, 79 (35.7%) adult urologists and 84 (38%) paediatric urologists were involved in paediatric stone treatment (Table 1). When it came to dedicated paediatric stone clinics, the responses reflected solo run clinics by 5 (12.9%) adult urologists and 30 (20.4%) paediatric urologists, combined adult and paediatric clinics by 32 (14.4%) and combined paediatric and nephrology clinics by 18 (8.1%). Similarly, the practice of surgical procedure responses reflected solo adult urologists in 72 (32.5%), solo paediatric urologists in 39 (17.6%), and a combined adult and paediatric set up in 60 (27.1%) with a further addition of interventional radiology in 17 (7.7%).

In terms of the surgical procedures offered, only 75 (33.9%) offered all treatments (ESWL, PCNL, semi rigid ureteroscopy (URS) and RIRS with, others offering only URS and RIRS (25, 11.3%), PCNL and flexible ureteroscopy and lasertripsy (FURS) (65, 29.4%), SWL only (14, 6.3%) and no endourological intervention (25, 11.3%).

In term of minimally invasive and innovative treatments (Table 2), mini PCNL (≤24 Fr) was performed in 51–75% of PCNL cases by nearly half of all responders (104, 47%). However, no major difference was noted between the preference of choice with prone or supine PCNL. Endoscopic combined intrarenal surgery (ECIRS) was offered by 61 (27.6%) and simultaneous bilateral endoscopic surgery (SBES) was offered by 47 (21.2%). During RIRS, UAS was never used by 67 (30.3%), whilst the majority only used it select cases only.

While the percentage of patients treated by various modalities differed, SWL was used in 0–25% of cases by 129 respondents, 26–50% of cases by 30 respondents and 75–100% of cases by 13 respondents. PCNL was used in 0–25% of cases by 93 respondents, 26–50% of cases by 53 respondents and 75–100% of cases by 30 respondents. URS/RIRS was used in 0–25% of cases by 82 respondents, 26–50% of cases by 68 respondents and 75–100% of cases by 27 respondents.

European vs Non-European responses

A total of 221 urologists answered our survey. Of them 109 responders were from 16 countries of Europe (EU) including 56 participants from the United Kingdom, while 112 were from non-EU countries with main representation of Latin America and Asia.

All surgical procedures were offered by 42% (n = 46) and 19.6% (n = 22) of EU and non-EU responders respectively. While 11.3% EU (n = 12) and 3.5% non-EU (n = 4) only offered rigid or flexible ureteroscopy, SWL only was offered by 6.3% EU (n = 4) and 3.5% non-EU (n = 4) respondents. While no difference of prone and supine PCNL were noted with both groups, ECIRS was offered by 11% EU (n = 20) and 17.8% non-EU (n = 20) responders.

DISCUSSION

Our survey provides a snapshot of worldwide practice patterns for paediatric KSD. Given the relative low incidence of this disease, the findings give insight into treatment selection and geographical variations based on individual setup in different countries or different regions of the same country.

High volume and academic teaching centres potentially have the advantage of offering different treatment choices as well as the benefit of a multidisciplinary team approach. This has been previously described in the setting a UK high volume centre where the paediatric urologist operates in tandem with an adult endourologist as a part of a twin surgeon model [11]. Similarly, endourology teams are often supported by an interventional radiology (IR) team for complex PCNL or antegrade cases. The opportunity to combine the expertise of adult

Table 1. *Job title and modality of clinic and surgical procedures performed (out of the total responses)*

Job title	Adult urologist n (%)	Paediatric urologist n (%)	Adult + Paediatric n (%)
Number of responses	133 (60.2%)	88 (39.8%)	
Involved in paediatric stone treatment?	79 (35.7%)	84 (38%)	
Who attends Paediatric stone clinic?	5 (12.9%)	30 (20.4%) + nephrologists 18 (8.1%)	32 (14.4%)
Who performs surgical procedures?	72 (32.5%)	39 alone (17.6%)	60 (27.1%) + 17 (7.7%) with Interventional Radiology

Table 2. *Survey results on proportion of stones which are treated by individual modalities if this is offered to patients*

		Available surgical options	Do not treat/ No response	25% of cases	50% of cases	75% of cases	100% (all cases)
EU (109)	No. of responders that treat renal stones with	SWL	71	16	12	6	4
		PCNL	44	38	23	3	1
		URS/FURS	42	28	26	11	2
	No. of responders that treat ureteral stones with	SWL	67	6	25	8	3
		PCNL/anterograde URS	74	18	17	0	0
		URS/FURS	64	6	19	12	8
Non-EU (112)	No. of responders that treat renal stones with	SWL	69	36	14	3	0
		PCNL	14	38	32	20	8
		URS/FURS	19	36	42	13	2
	No. of responders that treat ureteral stones with	SWL	87	18	4	2	1
		PCNL/anterograde URS	55	37	14	3	3
		URS/FURS	9	12	23	43	25

EU – Europe; ROTW – rest of the world; SWL – shock wave lithotripsy; PCNL – percutaneous nephrolithotomy; URS/FURS – ureteroscopy/flexible ureteroscopy

endourologist(s) with the knowledge of paediatric surgeons, allows the treatment to be customised for the specific case and potentially, for superior outcomes to be achieved in terms of stone free rate (SFR) and complications [12].

The last decade has witnessed increased attention towards paediatric KSD and technological evolutions have allowed us to adapt endourological procedures for the paediatric population [13]. Both large cases series and metanalyses [14] have shown how medium and high-volume centres can both achieve good outcomes in endourological procedures. Miniaturization of ureteroscopes and modern laser platforms have supported this advancement. The minimally invasive nature and high SFR have promoted RIRS to a more popular status than SWL as reflected by our survey [15, 16, 17].

A recent original study from Norway showed how paediatric URS and RIRS can also be delivered by adult endourologists in regional cenres without outcomes being compromised [18]. The use of SWL seems to have gradually decreased over time [19], however, it does still serve as a valid option for kidney stones <2 cm and reported SFRS range between 49% and 97% [20]. Given the majority of paediatric SWL cases require general anaesthesia, it represents a less appealing intervention choice for paediatric cases. Furthermore, SWL may require more sessions to achieve stone clearance.

The present status of paediatric urolithiasis sees an increasing adaptation of these surgical techniques to paediatric needs [21]. In our survey, 47% of the respondents used UAS in different proportions. Comparing these results to large data sets, most series are in agreement and favour the usage of UAS in children [22]. However, in adult series, some authors achieved better SFR in the abscens of UAS [23, 24]. Current literature confirms how RIRS has been benefitted by the advent of slimmer flexible ureteroscopes including single use models. Beside URS, miniaturized PCNL is the most effective choice for treating larger paediatric renal stones in a single session but at the cost of a higher morbidity profile [25]. The micro and ultra-mini adaptations have allowed a renewed interest towards the technique in the paediatric population [25, 26, 27]. Smaller sheaths for tract formation not only reduce damage to the renal parenchymal but also reduce the risk of bleeding [28]. New lasers systems have also evolved during the last decade with the introduction of Thulium fiber laser, high power Holmium and novel pulse modulation methods such as Moses technology. Applying these particular innovations to paediatric RIRS in the clinical setting has not yet yielded difference SFR and postoperative complication rate [29, 30], however, at present available clinical evidence is low and long-term data are sparce for paediatric patients.

A large meta-analysis compared micro-PCNL and RIRS in 239 paediatric patients and found the former to be superior to RIRS for kidney stones between 10–20 mm with comparable SFR and reduced need for additional procedures [31]. The need for careful fluid balance and risk of hypothermia during the operation have led to the development of warm irrigation systems as well as suction devices to reduce intrarenal pressure [32]. Despite progress in the field of miniaturization of PCNL that is suitable for treatment of complex stones [33, 34], standard PCNL remains a valuable option in cases

of staghorn stones in children [35, 36]. Despite the safety of the procedure, Samad et al. described incidence of focal scarring in 5% of paediatric patients that underwent PCNL [37]. However, the CROES study described how PCNL in children can be considered equally as safe as in adults [38]. Further minimally invasive surgical treatments such as laparoscopy and robot-assisted laparoscopic approaches have also been developed over the years [39] and go hand in hand with endourological procedures for treatment of more complex stone cases.

Limit of the study and areas of future research

This survey was distributed to endourologists and paediatric urologists in both EU and non-EU countries. The aim was to get a broad view on the landscape of paediatric endourology practice. While the results seem heterogeneous, they illustrate a scenario based on real life practice. The response rate was difficult to estimate due to the sub-specialist area and likely many adult urologists did not complete the survey due to a lack of interest or practice in this area. We also included medium and high-volume centres as previous data shows equivalence of outcomes between medium and high volume centres doing paediatric ureteroscopy [15]. We also included UK and non-UK data together as previous papers published in collaboration shows similar results [40, 41]. This questionnaire has been distributed in a time span where surveys have been the most utilised way of data collection due to the recent pandemic. Our response rate might have therefore been affected by the general lack of novelty related to the timing rather than to the topic. The results of our study are relevant as they highlight the great variability that exists with the management of paediatric endourology. While the survey reflects perceptions of practice, real world data from individual countries is the only way to see the true reality of what is being offered to these patients.

CONCLUSIONS

While minimally invasive methods such as URS and mini PCNL seem to have become more popular, there is a need for dedicated paediatric stone clinics for tailored decision making and counselling. Similarly, more needs to be done in the multidisciplinary nature of management for this vulnerable patient group.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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