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Introduction & Objectives: The miniaturization of PCNL instrumentation led to a reduction of complications despite posing other problems, e.g. lengthened operative time (OT), decreased stone-free rate (SFR) and increased risk of infections, which may be overcome by novel Mini-PCNL systems. The aim of our study was to assess safety and efficacy of a semi-closed-circuit vacuum-assisted Mini-PCNL (svMini-PCNL) system in pediatric patients.

Materials & Methods: From January 2017 to December 2018, we prospectively collected data from our pediatric patients with a weight > 20 Kg who underwent a svMini-PCNL using a nephrostomy sheath, equipped with a lateral arm connected to an aspiration system. Lapaxy was performed by slowly drawing back the nephroscope inside the sheath until the opening of the lateral aspiration arm. Pre-, intra- and post-operative data were evaluated. For continuous variables, we estimated the median and inter-quartile range (IQR). We enrolled 13 children (Table 1) with a median age of 119 months (IQR: 97-160) and a median weight of 29 Kg (IQR: 25-40). Eighteen svMini-PCNLs were performed in 15 renal units with a median OT of 128 min (IQR: 99-167). Neither intra-operative complications nor blood transfusions occurred.

Results: The SFR was 73.3% (11/15) and raised up to 86.7% (13/15) after different ancillary procedures. Among post-operative complications, fever was observed in 27.8% cases and in one case a double J ureteral stent was placed for concomitant hydronephrosis.

Table 1. Pre-, intra- and post-operative data of our enrolled patients.

Parameters	Values
No. patients	13 - 8 Milan (61.5%) - 5 Barcelona (38.5%)
No. renal units	15
No. svMini-PCNLs	18
Sex	- Males: 8 (61.5%) - Females: 5 (38.5%)
Age (months) median (IQR)	119 (97-160)
Weight (Kg) median (IQR)	29 (25-40)
Type of stone	- Staghorn: 8 (44.4%) - Multiple: 15 (83.3%)
Stone side	- Right: 10 (55.6%) - Left: 8 (44.4%)
Cumulative stone size (mm) median (IQR)	32 (22-46)
No. patients with comorbidities	7 (53.8%) - Primary hyperoxaluria type 1 (7.7%) - Cystinuria: 2 (15.4%) - Bladder exstrophy: 1 (7.7%) - Distal renal tubular acidosis: 1 (7.7%) - Bilateral ureteral reimplantation according to Cohen: 1 (7.7%) - Kabuki syndrome: 1 (7.7%) - Posterior urethral valves: 1 (7.7%) - Gastroschisis: 1 (7.7%)
Pre-operative condition	- Ureteral DJ stent: 6 (33.3%) - Nephrostomy tube: 2 (11.1%) - Ureteral DJ stent + nephrostomy tube: 2 (11.1%)
Positive pre-operative urine culture	5.6% (1/18) - Pseudomonas aeruginosa
Operative time (min) median (IQR)	128 (99-167)
Tract number median (range)	1 (1-4)
Lithotripsy mode	Holmium laser: 94.4% (17/18) ShockPulse-SE lithotripter: 5.6% (1/18)
Intra-operative complications	None
Exit strategy	- Nephrostomy tube: 15 (83.3%) [in one case: two nephrostomy tubes] - Tubeless: 3 (16.7%) - double-J ureteral stent: 3 (16.7%) - single-J ureteral catheter: 5 (27.8%)
Stone composition	- Calcium oxalate monohydrate: 3 (23.1%) - Calcium oxalate monohydrate and calcium carbonate: 3 (23.1%) - Cystine: 2 (15.4%) - Phosphate-based infectious stones (e.g. struvite, carboapatite): 5 (38.5%)
Fever	27.8% (5/18)
Blood transfusion	None
Complications according to Clavien-Dindo classification	- Grade I-II - Grade III
	- 33.3% (6/18) - 5.6% (1/18)
Hospital stay (days) median (IQR)	3 (3-6)
Stone-free rate after 1st svMini-PCNL	73.3% (11/15)
Stone-free rate after ancillary procedures	86.7% (13/15)

Acronyms: BMI = body mass index; IQR = inter-quartile range; svMini-PCNL = semi-closed-circuit vacuum-assisted Mini-PCNL.

Conclusions: To our knowledge, this study reports the first use of a svMini-PCNL system in pediatric patients. The svMini-PCNL system proved to be a safe and effective approach to treat complex kidney stones in pediatric patients. According to our preliminary experience, the svMini-PCNL may potentially be associated with low intra-renal pressures, easy litholapaxy, decreased OT, increased SFR, and low need of disposable devices. All these issues should be investigated through further well-designed studies.