SCANDINAVIAN JOURNAL OF UROLOGY
2023, VOL. 58, 115–119
https://doi.org/10.2340/sju.v58.13392

ORIGINAL RESEARCH ARTICLE

Paediatric percutaneous nephrolithotomy (P-PCNL) reporting checklist

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ABSTRACT

Objective: To develop a reporting checklist that serves to improve and standardise reporting in studies pertaining to paediatric percutaneous nephrolithotomy (PCNL).
Methods: Based on findings from systematic review of literature, a draft list of items was formulated. By process of review and revisions, a finalised version was established and consensus achieved.
Results: The finalised version of the checklist covers four main sections, which include the following areas: study details, pre-operative, operative and post-operative information. There are 18 further sub-items. Recommendations deemed to be of high importance to include are highlighted in bold.
Conclusion: This practical tool can aid clinicians and researchers when undertaking and reviewing studies on paediatric PCNL. This is highly relevant given the current heterogeneity that exists as well as debate in best practice patterns.

ARTICLE HISTORY
Received 26 May 2023
Accepted 06 September 2023

KEYWORDS
Percutaneous nephrolithotomy; urolithiasis; paediatric; checklist

Introduction

Minimally invasive surgeries represent key treatments for paediatric urolithiasis [1]. These include shockwave lithotripsy (SWL), ureteroscopy (URS) and percutaneous nephrolithotomy (PCNL) [2]. Not only has the global volume of such procedures risen but so too has the body of publications reporting outcomes [3–6]. The latter is welcomed as it offers a platform for experiences and techniques to be shared and possibly to learn safety lessons. However, differences in how outcomes are reported as well as missing key information have the potential to result in misleading conclusions when reporting or drawing comparisons between studies. The overall impact of such limitations is the delay of our collective advancement in the surgical treatment of paediatric urolithiasis. While several generic tools exist, which aid in reporting different study types such as the Consolidated Standards of Reporting Trials (CONSORT) and *Standards for QUality Improvement Reporting Excellence (SQUIRE)*, these do not include craft orientated content, which is tailored to the subject field, for example, paediatric endourology [7, 8]. The authors recently developed the paediatric ureteroscopy (P-URS) tool, which serves to support and aid how outcomes are reported in studies on that particular surgical intervention [9].

Reporting of PCNL in the paediatric setting is another area that warrants further attention for the same reasons. This intervention has received increased attention owing to technological advances such as miniaturisation of instruments, novel energy sources for lithotripsy and modifications such as vacuum assisted sheaths [10–14]. To this end, our aim was to develop a similar checklist for paediatric PCNL.

Methods

Studies included in recently published systematic reviews performed by the author group on paediatric PCNL were used to compile a preliminary list of items common to all studies [15, 16]. Each step of the treatment pathway was considered from planning to the operation itself and its subsequent follow up. The list was then reviewed by the author panel to create a summary of key items including practical recommendations for how studies could report them in a more standardised way. This process was repeated until consensus was achieved, and a finalised version was established.

Results

The final version of P-PCNL covers four main sections, which include the following areas: study details, pre-operative, operative and post-operative information (Table 1). There are 18 further sub-items. Recommendations deemed to be of high importance to include are highlighted in bold. Further description and expansion on certain points has been added below.

Study details

This section includes the study aim(s), setting, design and study selection criteria.

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Table 1. Paediatric Percutaneous Nephrolithotomy (P-PCNL) reporting checklist.

Item	Recommendation
Study details	
Study Aim	• **Description of primary and secondary aims of the study**
Study setting	• Hospital setting and volume of cases performed each year
Study design	• **Retrospective (clinical audit), prospective (comparative) study (non-randomised), randomised controlled trial**
Selection criteria	• Description of how patients were enrolled, for example, consecutively • **Inclusion criteria** • **Exclusion criteria** • **Indication for surgery** • **Definition of sheath sizes if using miniaturised equipment**
Pre-operative	
Operating team	• Number of surgeons performing surgery • Surgical team and subspeciality • Experience of surgeon(s), for example, case volume in year or career • State whether resident(s) involved (operating or supervised)
Patient information	• Breakdown demographics and later results by age group: for example, infants/children/pre-puberty/adolescence • Body mass index (BMI) and/or Weight (both can be used to breakdown sample) • Previous treatments, for example, SWL/URS undergone during that stone episode • Comorbidities • **Pre-operative urine culture**
Imaging	• **Breakdown of imaging modalities used** • **Time interval of the imaging prior to surgery**
Pre-operative stone status	• **Stone size and dimensions used** • Stone volume (include formula for calculation) – if available • Stone density (Hounsfield units) – if available • **Stone location** • Stone multiplicity • Preoperative stone obstruction (hydronephrosis/proximal dilatation) • Stone scoring (e.g. Guys stone score)
Operative	
Timing	• **Operative time** • Type of anaesthesia
Renal Access	• **Percentage success at accessing renal unit** • **Number of punctures and location** • Dilatation method • Urologist or radiologist gaining access • Use of ultrasound (Fluoroless) or fluoroscopy or combined
Equipment and description of procedure	• **Patient positioning (prone or supine/modified)** • **Sheath sizes used** • Conversion to larger sheath size(s) • Use of modified sheath, for example, vacuum • Type and dimensions of endoscope (s) • **Energy source for lithotripsy** • **Laser type and power output (if used)** • Start-up settings • Extras: Laser activation time, total laser energy • Any other modifications in surgery (e.g. ECIRS)
Radiation exposure	• Use of radiation protection measures for patient • Fluoroscopy time • Effective dose (mSv)
Complications	• Report any intra operative complications • Use a validated grading tool wherever possible • Estimated blood loss (or pre/post Hb levels) • Renal function (pre/post eGFR)
Exit strategy	• **Breakdown of tubeless/ totally tubeless** • Duration of indwelling tube(s) • Number of patients with indwelling urethral catheter and duration
Post operative	
Follow up	• **Hospital stay duration** • **Timing when follow up performed** • **Imaging modality used for follow-up and when done** • Stone composition (if available)

(Continued)

Table 1 (Continued).

Item	Recommendation
SFR	• **Definition and imaging used to calculate SFR** • Include zero fragment definition • **Give initial SFR after first procedure as well as final SFR after any additional PCNL treatments required**. • Provide total and average number of PCNL procedures each patient required to become stone free.
Auxiliary treatment	• Give details on any further intervention, for example, open/laparoscopic surgery required to become stone free and provide a further SFR result
Complications	• **Use a validated grading tool wherever possible** • Specify if complications were per patient, procedure or renal unit • Include complications occurring during all stages of stone treatment, that is, formal stone surgery and stent removal • Specify if complication rate is for PCNL procedure only or whether it includes additional procedures such as stent removal • Time period covering complications recorded.

URS: ureteroscopy; PCNL: percutaneous nephrolithotomy; MET: medical expulsive therapy; SFR: stone free rate.

There still exists a lack of consensus regarding the exact definitions for different size categories for miniaturised PCNL. General categories are summarised in Table 2 [17]. Therefore, author groups should strive to define early on what they have employed. This can also be placed in brackets in the study title. When considering the reproducibility of the results, it is beneficial to add the hospital setting (university hospital vs. community) as well as the volume of paediatric PCNL cases performed at that centre and/or by the surgeon per year. Providing the geographic catchment or referral area can add more context here too.

Pre-operative

This next section builds on the above foundation and includes information on the operating team, patient sample, imaging, and stone status. The number of surgeons involved in the series should be specified along with the resident involvement. Paediatric stone surgery is performed by adult urologists and paediatric surgeons dependent on location and healthcare setting, so this can be also added. What constitutes as "paediatric" in terms of age varies across nations but the upper limit is usually between 16 and 18 years. The sample should be broken down by ages, but weight and body mass index (BMI) can also be employed. Ideally, results should avoid being pooled as the anatomy and physiology differs significantly between, for example, a 1-year-old and an adolescent. It is appreciated that this is often not done as the sample size in paediatric stone surgery tends to be small, but a compromise can be to split the group into two groups, for example, pre and post pubescent. While PCNL may have been chosen as the first line treatment for a patient, if it comes as an auxiliary treatment after an initial attempt with SWL or URS has failed, this information is relevant to add. Traditionally, this special patient group has a higher comorbidity burden or anatomical and/or physiological abnormalities compared to the adult patients and these can be detailed accordingly. The imaging for determining the stone burden should be included as well as dimensions used to record size.

Table 2. Nomenclature of sheath sizes for PCNL.

Category	Sheath size (Fr)
Standard or Maxi	>22
Mini	16–22
Super-mini	10–14
Ultra-mini	10–13
Micro	4.85

Nomograms are being increasingly applied in the paediatric setting as part of treatment planning [18]. Their role is not yet formally delineated in children and therefore mention to their use helps the urology community assess this. If information on stone density and stone volume is available, this should be included. The latter is arguably a more accurate means to report stone size. While use of computed tomography is less common in children, it is employed in select cases with very large burdens and those of high complexity.

Operative

This section covers timing, renal access, equipment and description of procedure, radiation exposure, complications and exit strategy. Successful puncture is one of the critical steps in PCNL and therefore authors should specify how many punctures were performed, their anatomical location, the method and who performed it. Positioning includes supine and prone as well as modifications to each of these [19]. It is useful to add the exact breakdown of different sheath sizes used rather than stating a range. This can be misleading for example if an author states 13-22Fr. This leaves the reader questioning if the larger sized sheaths were just used in select cases or vice versa. Similarly, if conversion to larger sized sheaths mid procedure, for example, switch to maxi PCNL was done, this should be made clear. Modified sheaths and manufacturer should be mentioned as for the endoscope as well as the energy source used. New technological developments on the latter include combined systems, for example, ballistic and ultrasonic. An early example of this single probe dual energy machine was the ShockPulse-SE (Olympus) [20]. Some newer systems such as the EMS LithoClast® Trilogy also have built in suction [21]. Laser systems can be used, including high power Ho:YAG and Thulium Fiber laser (TFL) [14, 22]. The latter has grown more popular given dusting capabilities [14]. User settings as well as factory settings vary widely; therefore, at least start-up settings should be stated. While irrigation fluid at room temperature is the standard, some groups have reported modifying this and so this can also be stated [10].

One of the main potential advantages of miniaturised technique is reduced blood loss [23]. Blood loss should be quantified, if possible, as well as reporting pre and post operative haemoglobin levels. Complications occurring intra-operative can be reported, including the use of a validated tool [24].

Post-operative

The final section covers follow up, stone free rate (SFR), auxiliary treatment and complications. The latter forms a key part of this and a validated tool such as Clavien-Dindo is recommended [25]. The time period applied for capturing such adverse events should be mentioned. Imaging and follow up schedules vary widely, but it should still be stated clearly as well as breakdown of modalities used to assess residual stone burden. Even in the adult setting where CT has now become a standard follow up imaging type for SFR, consensus on definitions is lacking. This is even more challenging in the paediatric setting where most study samples include a heterogenous combination of ultrasound, plain x ray and rarely CT [26]. Whichever definition for SFR is adopted, it should be made clear to the reader, as well as a separate value after any additional procedures have been performed. While the term "initial SFR" is quite self-explanatory, others such as "final SFR" or "overall SFR" can lead to confusion unless defined clearly. To aid this, the average number of procedures each patient required to gain stone free status can be added here. While minimally invasive techniques such as PCNL yield high clearance rates, there are still occasions when a strategy such as open or laparoscopic stone removal of stone (or even kidney) is required. It is therefore useful to mention this in the results as it helps our understanding of whether these more invasive treatments still have a role or were required [27].

Limitations

This tool serves as a practical tool for researchers, including reviewers when assessing studies to ensure key information is included prior to publication. It is appreciated that studies may not be able to include all information, such as if they are retrospective or if follow up has not been performed. Centres receiving tertiary referrals may have limited availability of follow up data after initial treatment. The use of patient reported outcome measures is very limited in the paediatric setting [28]. It is anticipated that future studies such as the Pediatric KIDney Stone (PKIDS) Care Improvement Network Trial may lead to improvements in this area [29]. Future research should try to gain consensus in SFR definitions for paediatric stone cases. It is a further limitation within the field of paediatric endourology, that classification tools, for example, Clavien-Dindo system for complications are used, which were developed for use in the adult setting [30]. Purpose made paediatric tools are therefore still lacking. When reporting the exit strategy, nomenclature can also be confusing here, for example, tubeless versus totally tubeless and therefore terms used should be avoided.

Conclusion

P-PCNL reporting checklist is a tool that can help improve current reporting standards in PCNL. This could serve to aid researchers when interpreting a study's findings. Furthermore it could help put in context results of a study especially when comparing them with those of another study.

Conflicts of interest

Øyvind Ulvik has acted as a consultant for Olympus. The other authors have nil to declare.

Acknowledgements

Nil.

Financial disclosures

Nil.

Ethical approval

Not required for this research type.

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