Radiation Dose Reduction Through the Development of a Novel Paediatric Low-Dose CT Protocol for Urolithiasis Assessment

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Disclosure: The authors have received support for attending meetings and/or travel from Dalhousie University.

Keywords: CT, paediatric urology, radiation, reduced-dose, stone, urolithiasis.

Citation: EMJ Urol. 2026;14[1]:50-51. https://doi.org/10.33590/emjurol/8P9L6Q1S

BACKGROUND AND AIMS

Ultrasonography is the recommended first-line investigation for the diagnosis of paediatric urolithiasis.[1] Despite higher sensitivity and specificity for urolithiasis detection, CT is reserved for more complex cases to limit paediatric radiation exposure.[2] Although there is an increasing stone prevalence in the paediatric population, there is a lack of low-dose CT urolithiasis protocols to reduce radiation exposure in this vulnerable patient group.[3] Furthermore, descriptions of low-dose protocols are sparse and often not reported in the literature. Herein, the authors report the development and implementation of a low-dose protocol to reduce radiation exposure while diagnosing and assessing paediatric stone disease.

METHODS

A novel low-dose CT protocol to detect urolithiasis was designed through literature review, multidisciplinary collaboration, and experimental phantom trials. Two separate protocols were developed based on patient body mass (<45 kg and ≥45 kg). Prospective patients undergoing CT for urolithiasis assessment were evaluated using the low-dose protocol and were compared to a retrospective cohort at a single institution. Radiation reduction was characterised using descriptive statistics and comparative analysis.

RESULTS

Mean (±SD) age for the low-dose group was 12.6±4.2 years (n=26) compared to 12.4±3.7 years for the standard-dose group (n=15). The mean stone number detected in the <45 kg group was 4.2±3.6 (standard-dose) and 1.3±0.5 (low-dose), and in the ≥45 kg group it was 4.5±4.0 (standard-dose) and 2.6±1.5 (low-dose). There were no differences between groups with respect to stone size determined by ultrasonography and/or CT. Prior history of stone disease was higher in the standard-dose group (53.3%, n=8/15) when compared to the low-dose group (38.5%, n=10/26; p=0.03), highlighting the natural history of stone recurrence over time within this population. Treatment approach based on CT-findings did not differ between groups, with the majority of patients being managed with observation (standard-dose: 60.0%, n=9/15 versus low-dose: 61.5%, n=16/26; p=0.92). Of patients who underwent ureteroscopic or percutaneous management (standard-dose: 33.3%, n=5/15; low-dose: 26.9%, n=7/26), stones were reliably encountered intra-operatively and were treated fully without complication. The low-dose protocol reduced radiation dose when compared to the standard-dose group by 55.5% (≥45 kg; p=0.02) and 27.8% (<45 kg; p=0.03). The low-dose protocol visualised stones seen on ultrasound with 100% accuracy (n=6), and in 61.5% (n=16/26) of patients. Although there was an increase in noise and lower contrast detectability, spatial resolution and detection accuracy were preserved in the low-dose patient groups.

CONCLUSION

Low-dose CT protocols are effective for assessing paediatric urolithiasis while reducing radiation exposure. Implementation of low-dose CT protocols in cases of suspected urolithiasis with ambiguous ultrasound findings or for surgical planning is advised to limit radiation exposure in the paediatric population while maintaining diagnostic accuracy.

References

1. MacNevin W et al. Radiation dose reduction through the development of a novel pediatric low-dose computed tomography protocol for urolithiasis assessment. Abstract A0420. EAU Congress, 13-16 March, 2026.
2. Tasian GE et al. Use of and regional variation in initial CT imaging for kidney stones. Pediatrics. 2014;134(5):909-15.
3. MacNevin W et al. Radiation exposure associated with computed tomography for pediatric urolithiasis evaluation: a scoping review of the literature. J Pediatr Urol. 2024;20(3):386-94.