

RESEARCH

Open Access



Incidence of post-procedure symptomatic urinary tract infection in children undergoing micturition cystourethrogram in the absence of antibiotic cover

Suresh Kumar Thanneeru¹, Avinash Sriramapura Ravindra¹, Ann Sumin Toms², Tarun John Jacob¹ and Jujju Jacob Kurian^{1*}

Abstract

Context: Prophylactic antibiotics are usually not recommended for an in and out catheterization. However procedures involving similar catheterizations like micturition cystourethrogram (MCUG) and cystometrogram are being performed under prophylactic antibiotic cover.

Aims: We aim to find the incidence of symptomatic urinary tract infections following MCUG done in children without antibiotic cover.

Settings and design: A retrospective cross sectional study was conducted on 398 patients who underwent MCUG from January 2015 to January 2016. The median age was 24 months and here were 272 males and 126 females, with 102 of them being infants.

Methods and material: Urine microscopy or culture was checked before performing the MCUG and only those without UTI were included in the study. Those with symptomatic and culture proven UTI within 2 weeks post-MCUG were defined as having post-procedure UTI (ppUTI). The incidence of post-procedure UTI was calculated and was compared with other studies.

Statistical analysis used: Data was entered in Microsoft Excel and analyzed using SPSS. Categorical variables were summarized as percentage and continuous variables were summarized as mean with standard deviation.

Results: Symptomatic procedure induced UTI were seen in only 3 of the 398 (0.75%) patients with a 95% CI of 0.02–0.008.

Conclusions: Strict adherence to aseptic precautions while performing an MCUG and prompt initiation of appropriate therapy when indicated may help obviate the need for routine administration of pre procedure antibiotics before MCUG.

Keywords: Micturition cystourethrogram, ppUTI, Post-procedure urinary tract infection, HUN, Hydro uretero nephrosis

Key message

Pre-existing urological abnormalities in children undergoing MCU may be a harbinger for ppUTI. Strict adherence to aseptic precautions and prompt initiation of appropriate measures on finding abnormalities may help

*Correspondence: jujjujacobkurian@gmail.com

¹ Department of Paediatric Surgery, Christian Medical College, Vellore, Tamil Nadu 632004, India

Full list of author information is available at the end of the article

obviate the need for routine administration of antibiotic prophylaxis for ppUTI prevention.

Introduction

Pre-procedure antibiotics are usually not administered for a routine in and out urethral catheterization, except in those with associated co-morbidities [1]. Various guidelines however suggest using antibiotics prior to performing a MCU which is akin to in and out catheterization. The risk of post-procedure UTI (ppUTI) following MCU varies widely in literature. Studies have documented a ppUTI incidence of 7–42% without antibiotic prophylaxis and 0–13% with antibiotic prophylaxis [2]. Routine use of pre-procedure antibiotics in turn may have deleterious effects either in the form of adverse drug reactions or contributing to the ever increasing burden of antibiotic resistance [3].

Subjects and methods

A retrospective cross sectional analysis was conducted on 398 consecutive patients who underwent a MCU in the Department of Pediatric surgery, Christian Medical College Hospital, Vellore from January 2015 to January 2016. Ethics committee approval has been taken from the Institutional Review Board (IRB number 11884). Data and follow up information was obtained from the medical records, imaging and out-patient records. As per institutional protocol for children undergoing an MCU, only those who underwent a pre-procedure urine microscopy/culture and without symptomatic or investigation proven UTI at the time of performing the MCU were included in the study. Patients who were on treatment for UTI at the time of performing the MCU, those with urinary diversion and clean intermittent catheterization was excluded from the study. Routine antibiotic prophylaxis was not recommended in our institute, unless there is an evidence of reflux on MCUG or documented history of UTI. Patients who were on prophylaxis because of immediate post-treatment of UTI and referral patients from outside were excluded from the study. (query—any patients who were on prophylaxis before MCUG).

The catheterization was performed under strict aseptic precautions by a pediatric surgeon. No attempt was made to pull the preputial foreskin back. After cleansing the skin with an antiseptic solution, catheters were introduced (6 Fr feeding tubes for infants and 8 Fr tubes for older children). The catheterization was aided by using a sterile local anesthetic lubricant. Urograffin contrast media diluted with sterile normal saline in 1:5 ratio, was loaded in a disposable syringe and injected gently till the bladder capacity was reached or till the bladder neck opened. The bladder shape, capacity, and presence of bladder or urethral anomalies were noted. Vesico ureteric

reflux (VUR) if present was classified according to the international VUR classification. After the MCU procedure, all patients were followed up within 2 weeks in the out-patient department.

A ppUTI was defined as (a) the presence of clinical symptoms like dysuria or fever and (b) a positive urine culture characterized by > 100,000 CFU/ml [4] of a single urinary pathogen, occurring within 2 weeks post-MCU. Symptomatic children were started on empirical antibiotics while awaiting the culture report.

Results

Over the study period, 398 cases fulfilled our inclusion criteria. The median age of undergoing the procedure was 24 months (range 0–15 years). There were 272 males and 126 females, with 102 of them being infants. The indications for which MCU were done included febrile UTI 156 (39%), evaluation of bilateral hydronephrosis or unilateral/ bilateral hydro-ureteronephrosis 116 (29%), and evaluation of children with voiding dysfunction (dribbling of urine, nocturnal enuresis) 126(32%). The MCU was abnormal in 128 of the 398 children (32%). The most common anomalies were vesicoureteric reflux (primary and secondary)—103 (26%), lower urinary tract abnormality without VUR (posterior urethral valve, neurogenic bladder)—25 (6%). Urinary tract obstruction above the bladder level (pelvi-ureteric junction and vesico-ureteric junction obstruction, ureterocoele) was diagnosed in 10 of these children (2.5%).

Post-procedures UTI were seen in 3 of the 398 (0.75%) patients. All had febrile illness with two of them requiring hospitalization. These children also had some common characteristics—male sex, infants, uncircumcised and a pre-procedure diagnosis of a urological anomaly (moderate to severe hydroureteronephrosis). The first 2 cases of ppUTI were in infants with antenatal detected hydroureteronephrosis which subsequently was diagnosed as vesico-ureteric junction obstruction. Symptoms in the first child started on the 4th day post-MCU, with urine growing *Klebsiella* that was treated with intravenous Cefotaxime. Post-treatment of UTI, double J ureteric stenting was done cystoscopically, which was replaced after 6 months and kept for a total duration of 1 year. Follow-up investigations have shown improvement and the child is presently asymptomatic.

The second child, also with vesico-ureteric junction obstruction, became symptomatic on the 10th day post-MCU. His urine culture grew *E. coli* which was treated with oral Augmentin. However, as his symptoms were mild, and his renograms were normal, he was kept on follow-up. Presently he is asymptomatic with stable sonographic findings. The third was a 4-month-old with an antenatal diagnosis of right HUN. He presented to us

following an episode of culture positive UTI which was treated with appropriate antibiotics. MCU done post-resolution of infection revealed right grade 5 primary vesico-ureteric reflux, for which he was started on Septran prophylaxis. He became symptomatic on the 3rd day post-MCU despite septran prophylaxis with urine culture growing *Enterobacter* and was treated with intravenous meropenem. This child was advised surgical intervention, which was denied by the parents.

Discussion

MCU is an important and commonly performed diagnostic study for a number of pediatric urological problems. This involves bladder catheterization, which in turn can be a source of infection if not done under strict aseptic precautions. This in turn prompted the advent of performing the procedure under antibiotic cover.

Over the years, there have been various studies advocating both for and against the use of antibiotics. Initial studies by McAlister et al. [5] where MCU was done without antibiotic cover showed a ppUTI rate of 16%. While the 1978 paper by Maskell et al. [2] found a definite benefit in undertaking VCUG with prophylactic antibiotics (10% ppUTI among the antibiotic group versus 42% among the non-antibiotic group), this was in sharp contrast to the 1992 study by Zerlin and Shulkin [6] where irrespective of the antibiotic status none developed UTIs. It however should be mentioned that these older studies were limited by small sample size and used bacteriuria alone as a diagnostic criterion for UTI. Recently, Rachmeil et al. showed a ppUTI rate of 1.7% when prophylactic antibiotics were administered before doing a MCU [7]. A similar study done by Rajiv Sinha et al. showed ppUTI rate of 1.4% in antibiotic group compared to 17% in non-antibiotic group [8]. However, Moorthy et al. could find no significant difference between the prophylactic antibiotic and non-antibiotic group with regards to ppUTI rates [9].

This lack of consensus is present even in the guidelines. While the NICE [4] and IAP [10] guidelines recommend prophylactic antibiotics before doing a MCU to prevent procedure related infections, the American College of Radiology-Society for Pediatric Radiology is silent on its use. As per the CDC guidelines, the duration of catheterization rather than the number of times a catheter gets inserted was the most important risk factor for the development of catheter associated bacteriuria. Also, CDC guidelines for CAUTI 2009 (catheter-associated UTI) suggested no benefit of antimicrobial prophylaxis in patients undergoing short-term catheterization and for those on Clean intermittent catheterization (CIC) [1].

As catheterization in MCU is similar to sterile catheterization, we felt the need to find the incidence of ppUTI

in children where MCU was done without antibiotic cover. In our study, post-procedure UTI was seen in 3 of the 398 (0.75%) patients. This study adds considerably to the previous literature by providing the ppUTI rates in MCU done without antibiotic cover in children. The risk factors we identified for the development of ppUTI were uncircumcised male infants with a pre-existing urological diagnosis which in our cohort was moderate to severe hydroureteronephrosis. However, due to the low incidence of ppUTI in our cohort, none of the identified risk factors could gain statistical significance.

We feel this low rate of ppUTI may be due to the strict asepsis maintained in the procedure room and immediate approach to the pathology post-MCUG. While patients with VUR were started on prophylactic antibiotics, patients with PUV were taken up for immediate surgery under antibiotic cover and children with suspected neurogenic bladders were put on CIC and medications. A significant point noted was that of the 4 children with vesico-ureteric junction obstruction, 2 developed ppUTI. These children were not kept on post-procedure antibiotic prophylaxis as their MCUs were normal and the diagnosis was made by a renogram. We feel that it may be prudent to initiate post-MCU antibiotic prophylaxis in children with significant hydroureteronephrosis due to lower ureteric obstruction [11].

In our cohort, more than 60% of the MCUs were normal. Routine administration of pre procedure antibiotics in those with normal MCUs has no particular advantage other than exposing them to adverse drug effects and contributing to antibiotic resistance. The main limitation of our study was that it was retrospective in nature. Also, as the study was performed in a single center, the results may vary in a different center as well as in a different population sub group. Another limitation was that we could not find any statistically significant risk factor that may act as a predictor for ppUTI due to lesser number of the same. Keeping this study as a pilot, we intent to perform a prospective study which may help us formulate a definite guideline on the use of antibiotics before procedures requiring a single in and out bladder catheterization.

Conclusion

Strict adherence to aseptic precautions and prompt initiation of appropriate measures on finding abnormalities may help obviate the need for routine administration of pre-procedure antibiotics before MCU. Antibiotic prophylaxis maybe required only in those with significant hydroureteronephrosis, either due to vesico-urezeric reflux or due to lower ureteric obstruction.

Acknowledgements

None.

Authors' contributions

SKT was in the conceptualization, data acquisition, and preparation of initial draft. ASR was involved in data acquisition and data analysis. AST was involved with data interpretation and correction of the draft document. TJJ was involved with planning, data analysis and interpretation. JJK was involved in the planning, conceptualization, and final revision of the article. All authors have read and have approved the final manuscript.

Funding

None.

Availability of data and materials

The datasets used and analyzed during the current study will be made available by the corresponding author on reasonable request.

Declarations**Ethics approval and consent to participate**

This study was approved by the ethics committee of Christian Medical College, Vellore, India, vide IRB No: 11884. Written consent from all patients or their guardians was obtained prior to undertaking any procedure and the consent includes the consent to publish.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹Department of Paediatric Surgery, Christian Medical College, Vellore, Tamil Nadu 632004, India. ²Department of Anaesthesiology, Christian Medical College, Vellore, Tamil Nadu 632004, India.

Received: 25 October 2020 Accepted: 4 April 2022

Published online: 02 May 2022

References

- Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA, Healthcare Infection Control Practices Advisory Committee (2010) Guideline for prevention of catheter-associated urinary tract infections 2009. *Infect Control Hosp Epidemiol* 31(4):319–326. <https://doi.org/10.1086/651091>
- Maskell R, Pead L, Vinnicombe J (1978) Urinary infection after micturating cystography. *Lancet* 2(8101):1191–1192
- Bryce A, Hay AD, Lane IF, Thornton HV, Wootton M, Costelloe C (2016) Global prevalence of antibiotic resistance in paediatric urinary tract infections caused by *Escherichia coli* and association with routine use of antibiotics in primary care: systematic review and meta-analysis. *BMJ* 352:i939. <https://doi.org/10.1136/bmj.i939>
- National Collaborating Centre for Women's and Children's Health (UK) (2007) Urinary tract infection in children: diagnosis, treatment and long-term management. RCOG Press, London (NICE Clinical Guidelines, No. 54.) Available from: <https://www.ncbi.nlm.nih.gov/books/NBK50606/>
- McAlister WH, Cacciarelli A, Shackelford GD (1974) Complications associated with Cystography in children. *Pediatr Radiol* 111:167–172
- Zerin JM, Shulkin BL (1992) Post procedural symptoms in children who undergo imaging studies of the urinary tract: is it the contrast material or the catheter? *Radiology* 182:727–730
- Rachmiel M, Aladjem M, Starinsky R, Strauss S, Villa Y, Goldman M (2005) Symptomatic urinary tract infections following voiding cystourethrography. *Pediatr Nephrol* 20(10):1449–1452. <https://doi.org/10.1007/s00467-005-1942-5>
- Sinha R, Saha S, Maji B, Tse Y (2017) Antibiotics for performing voiding cystourethrogram: a randomised control trial. *Arch Dis Child:archdischild-2017-313266*. <https://doi.org/10.1136/archdischild-2017-313266>
- Moorthy I, Crook D, Bale M, Cubbon M, Kenney I (2010) Is antibiotic prophylaxis necessary for voiding cystourethrography? *Arch Dis Child*. <https://doi.org/10.1136/adc.2009.174169>
- indianpediatrics.net (2001) Indian Pediatric Nephrology Group Indian Academy of Pediatrics. Consensus statement on management of urinary tract infections. *Indian Pediatr* 38:1106–1115 Available from <https://www.indianpediatrics.net/oct2001/oct-1106-1115.htm>
- Johnson EK, Malhotra NR, Shannon R et al (2017) Urinary tract infection after voiding cystourethrogram. *J Pediatr Urol* 13(4):384.e1–384.e7. <https://doi.org/10.1016/j.jpuro.2017.04.018>

Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Submit your manuscript to a SpringerOpen[®] journal and benefit from:

- Convenient online submission
- Rigorous peer review
- Open access: articles freely available online
- High visibility within the field
- Retaining the copyright to your article

Submit your next manuscript at ► [springeropen.com](https://www.springeropen.com)