

# Practice patterns in ordering a voiding cystourethrogram for pediatric patients among different specialties in a Middle Eastern tertiary care center

Mohammad Hout, Bilal Aoun<sup>1</sup>, Lamyia Ann Atweh<sup>2</sup>, Ali Merhe, Yaser El-Hout

Division of Urology, American University of Beirut-Medical Center, <sup>1</sup>Division of Pediatric Nephrology, American University of Beirut-Medical Center, <sup>2</sup>Department of Radiology, American University of Beirut-Medical Center, Beirut, Lebanon

## Abstract

**Introduction:** Voiding cystourethrogram (VCUG) is a very popular test performed to evaluate genitourinary tract anomalies. Nevertheless, this test can be overused and can lead to unnecessary patient discomfort, radiation exposure, and cost. We sought to study the practice patterns in ordering a VCUG in a Middle Eastern tertiary care center.

**Methods:** Over a period of 3 years, a retrospective analysis of all VCUG images done for pediatric patients in a single center was made. Further clinical details were extracted from the electronic health records. The specialty of an ordering physician and the reported indication for the procedure were noted. Indications for VCUG were recorded based on the AAP 2011 guidelines, NICE guidelines 2007, and ACR 2011 guidelines. Based on these criteria, patients were analyzed.

**Results:** A total of 92 VCUGs were evaluated. Of all VCUGs done, pediatricians ordered the most VCUGs (50/92), followed by pediatric infectious disease (16/92), pediatric nephrology (9/92), pediatric urology (7/92), adult urology (5/92), pediatric surgery (3/92), obstetrician-gynecologist (1/92), and emergency medicine (1/92). Properly indicated VCUGs were 50% by general pediatrics, 55% by pediatric infectious disease, 45% by pediatric nephrology, 40% by adult urology, 33% by pediatric surgery, and 100% by pediatric urology.

**Conclusion:** VCUG is utilized differently by different specialties. In some centers, adult specialties may order a pediatric VCUG. General pediatricians order VCUG the most with a tendency for misuse in up to 50%. Pediatric urology is not the most ordering specialty of VCUG; however, it utilizes it most appropriately. The noted practice patterns may be improved with awareness of the indications and limitations of the study and with proper referral.

**Keywords:** Pediatrics, practice patterns, voiding cystourethrogram

**Address for correspondence:** Dr. Yaser El-Hout, Division of Urology, American University of Beirut-Medical Center, Beirut, Lebanon.

E-mail: yelhout@aub.edu.lb

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## INTRODUCTION

Voiding cystourethrogram (VCUG) is a very popular test performed to evaluate genitourinary tract anomalies.

Nevertheless, this test can be overused and can lead to unnecessary patient discomfort, radiation exposure, and cost. We sought to study our practice patterns and dissect

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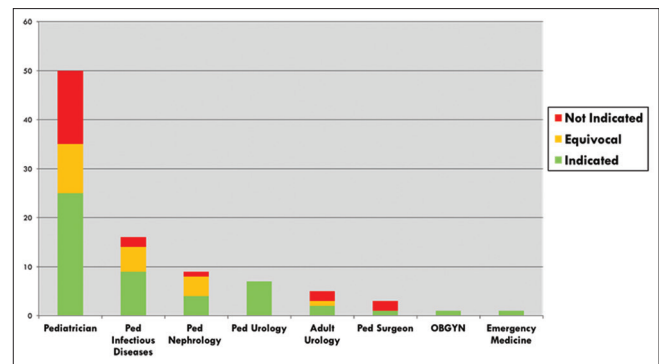
the utilization of VCUGs among our different specialties to interpret its misuse and indications.

## METHODS

Over a period of 3 years, a retrospective analysis of all VCUG images done for pediatric patients in a single center was made. Further clinical details were extracted from the electronic health records. The specialty of an ordering physician and the reported indication for the procedure were noted. Indications for VCUG were categorized as being: (i) indicated if second febrile urinary tract infection (UTI) or evidence of genitourinary anatomic abnormality on imaging, (ii) equivocal if evidence of genitourinary pathology not in the presence of a UTI, or (iii) not indicated if first febrile UTI or normal genitourinary imaging or older than 3 years with no evidence of genitourinary anomalies. This classification was based on the AAP 2011 guidelines, NICE guidelines 2007, and ACR 2011 guidelines. Based on these criteria, patients were classified by an evaluator blinded to the specialty and identity of the ordering physician. The data were entered into SPSS (Statistical package for the social sciences) software version 24 developed by IBM Corporation which was used for data management and analysis. Descriptive statistics were carried out by presenting number and percentage for categorical variables.

## RESULTS

A total of 92 VCUGs were evaluated. Mean age at imaging was 3.75 years (range: 1 month to 16 years). 59/92 (64%) were female. The result was negative for vesicoureteral reflux (VUR) in 63/92 (68%). Seventeen (18%) had unilateral reflux (10 nondilating and 7 dilating renal units). Twelve (13%) had bilateral reflux (3 nondilating and 21 dilating renal units). The specialty and indication for imaging are recorded in Figure 1. Of all VCUGs done, pediatricians ordered the most VCUGs (50/92), followed by pediatric infectious disease (16/92), pediatric nephrology (9/92), pediatric urology (7/92), adult urology (5/92), pediatric surgery (3/92), obstetrician-gynecologist (OBGYN, 1/92), and emergency medicine (1/92). The percentage of properly indicated VCUGs among specialties is shown in Figure 2. Of the ordered VCUGs among specialties, the indicated VCUGs ordered by general pediatricians were 50%, pediatric infectious disease were 55%, pediatric nephrology were 55%, pediatric urology were 100%, adult urology were 40%, and pediatric surgery were 33%. OBGYN and emergency medicine each ordered one VCUG which was indicated.



**Figure 1:** Bar graph showing the distribution of ordered voiding cystourethrograms along with the fraction of indicated, equivocal, and not indicated

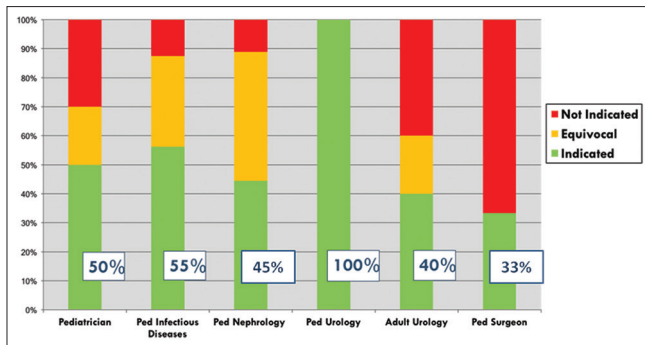
## DISCUSSION

VCUG is a very popular test performed to evaluate genitourinary tract anomalies. Nevertheless, this test can be overused and can lead to unnecessary patient discomfort, radiation exposure, and cost. It is interesting to note that multiple internet forums and sites are created to discuss the psychological abuse that may occur from VCUGs.<sup>[1]</sup>

Efforts to decrease anxiety and discomfort with regard to this testing modality have been explored. One study conducted by Herd, 2008 reports that using midazolam on children reduces anxiety, causes amnesia, and does not interfere with the voiding dynamics,<sup>[2]</sup> highlighting the psychological burden and technical difficulty required to perform it. A study conducted by Thacker *et al.*, 2016 described the stress of children undergoing VCUG using the brief behavioral distress scale and concluded the need for pretest preparation including the need for sedation and parental comforting before performing the procedure.<sup>[3]</sup>

Mussurakis *et al.*, 1995 studied the patterns of integration and clinical value of VCUG in decision-making for children with lower UTI. The study concluded that an increased effort is needed to minimize the overuse of VCUG. The testing modality was mostly either inappropriately integrated or unclear whether it should have been ordered. In addition, the test did not influence decision-making as anticipated.<sup>[4]</sup>

Main indications for performing this test are various, most commonly used in children with febrile UTIs to detect VUR. Detection of VUR in children is crucial to detect renal scarring and to prevent renal injury.<sup>[5]</sup> With regard to children aged between 2 and 24 months, VCUG is no longer recommended after the first febrile UTI unless evidence of severe hydronephrosis, scarring, or renal injury is found.<sup>[5]</sup> Other indications for VCUG include



**Figure 2:** Percentage of properly indicated voiding cystourethrograms among specialties

hydronephrosis, dysuria, hematuria, dysfunctional voiding, bladder outlet obstruction, postoperative urinary tract evaluation, and incontinence.<sup>[6]</sup>

Of all ordered VCUGs done, 68% were negative with 32% positive for either unilateral or bilateral reflux which shows that the low positive yield of this test should propel physicians to be more judicious in ordering it. Of the above ordering physicians, general pediatricians ordered the most amount of VCUGs most likely due to the fact that they are the first line in seeing patients before referral to specialists and may have a tendency to screen for pathologies of organ systems to identify a diagnosis before specialist referral. It is arguable that this testing modality is better utilized under specialist hands with regard to the above data showing that generalists had of the highest percentage of misuse. Despite the fact that adult urology ordered very few VCUGs (5.4%), the degree of misuse was quite high with only 40% indicated. This shows that despite being a specialist of the indicated organ system, a high risk of misuse could occur. Pediatric urology had a relatively very low number of ordered VCUGs (7.6% of total), with all of them being indicated which reveals that this testing modality can be avoided in a lot more scenarios if physicians were more prudent.

Ultrasound and DMSA Renal scan are resourceful modalities that can carry out the diagnostic challenges of VCUG.<sup>[7]</sup> According to the National Institute of Health and Care Excellence, DMSA and ultrasound are recommended instead of VCUG in children above 3 years of age.<sup>[8]</sup> It

is imperative to minimize the overuse of VCUG. This practice pattern may be influenced by the experience and specialty of the ordering physician and by referral dynamics.

## CONCLUSION

VCUG is utilized differently by different specialties. In some centers, adult specialties may order a pediatric VCUG. General pediatricians order VCUG the most with a tendency for misuse in up to 50%. Pediatric urology is not the most ordering specialty of VCUG; however, it utilizes it most appropriately. The noted practice patterns may be improved with awareness of the indications and limitations of the study and with proper referral.

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## Conflicts of interest

There are no conflicts of interest.

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