Mangement and Screening of Primary Vesicoureteral Reflux in Children

Published 2010; Reviewed and Validity Confirmed 2017

Unabridged version of this Guideline [pdf]
View Individual Topics for Vesicoureteral Reflux

Panel Members

Craig A. Peters, MD, Chair; Steven J. Skoog, MD, Vice-Chair; Billy S. Arant, Jr., MD; Hillary L. Copp, MD; Jack S. Elder, MD, Facilitator; R. Guy Hudson, MD; Antoine E. Khoury, MD; Armando J. Lorenzo, MD; Hans G. Pohl, MD; Ellen Shapiro, MD; Warren T. Snodgrass, MD

Introduction

In 1997, the American Urological Association (AUA) published the Guideline on the Management of Primary Vesicoureteral Reflux in Children.[1] Since that time there has been an expanding body of literature involving not only the evaluation and the management of vesicoureteral reflux (VUR) but also the role of screening in its management. For this reason, the AUA appointed a Panel of experts to update the 1997 document and elected to expand its scope to include guidelines for the screening of siblings of children with vesicoureteral reflux (VUR) and of neonates/infants with prenatally diagnosed hydronephrosis. A literature search, review of the evidence, and data extraction from the relevant clinical studies and case series were performed. Extracted data underwent meta-analysis to determine the outcomes related to five topics: 1) management of children over one year of age with VUR; 2) evaluation and management of infants with VUR; 3) management of children with VUR and Bladder and Bowel Dysfunction (BBD); 4) screening of siblings and offspring of patients with VUR; and 5) screening of neonates and infants with prenatal hydronephrosis. This document summarizes the guideline statements derived from a meta-analysis. Additional chapters (1-5) provide a detailed summary of each of these topics.

From the evidence and expert opinion, the Panel drafted guideline statements. According to AUA nomenclature, these statements are graded with respect to the degree of flexibility in application. A "standard" is the most rigid treatment policy. A "recommendation" has significantly less rigidity and an "option" the least. These terms are defined as follows:

1. **Standard**: A guideline statement is a standard if (1) the health outcomes of the alternative interventions are sufficiently well-known to permit meaningful decisions and (2) there is virtual unanimity among panel members about which intervention is preferred.

2. **Recommendation**: A guideline statement is a recommendation if (1) the health outcomes of the alternative interventions are sufficiently well-known to permit meaningful decisions and (2) an appreciable, but not unanimous majority of the panel members agrees on which intervention is preferred.

3. **Option**: A guideline statement is an option if (1) the health outcomes of the interventions are not sufficiently well-known to permit meaningful decisions or (2) preferences are unknown or equivocal.

Although the development of a clinical guideline is often limited by the availability of quality data, which is notably true with respect to the VUR literature, recommendations can be based on general principles developed from a formal meta-analysis as well as experience and clinical judgment. These guidelines for management of VUR were based upon risk assessment, considering the probability for spontaneous resolution versus perceived risk for recurrent urinary tract infection (UTI) and renal injury. In the absence of incontrovertible evidence of the advantage of one approach over another, the Panel has elected to include only three Standards in this document. Statements that have been designated as Recommendations are those for which the Panel determined there was sufficient evidence, even if not consistently of the highest quality or proven to the preferred degree of rigor, to advocate for a particular clinical approach. Statements designated as Options are those for which the Panel determined there was evidence of relatively equal strength and quality supporting more than one approach, with any approach being acceptable and justifiable. In the absence of definitive evidence, stronger guidelines cannot appropriately be made and the final decisions regarding clinical care reside with the physician and family.

Initial Evaluation of the Child with VUR

General evaluation

Standard: VUR and urinary tract infections may detrimentally affect the overall health and renal function in affected children. Therefore, on initial presentation the child with VUR should undergo a careful general medical evaluation including measurement of height, weight, blood pressure and serum creatinine if bilateral renal abnormalities are found.

[Based on Panel consensus]

Recommendation: Urinalysis for proteinuria and bacteriuria is recommended. If the urinalysis indicates infection, a urine culture and sensitivity is recommended.

[Based on Panel consensus]

Option: A baseline serum creatinine may be obtained to establish an estimate of glomerular filtration rate (GFR) for future reference.

[Based on Panel consensus]

Recommendation: Because VUR and urinary tract infection may affect renal structure and function, performing renal ultrasound to assess the upper urinary tract is recommended.

[Based on Panel consensus]

Option: DMSA (technetium-99m-labeled dimercaptosuccinic acid) renal imaging can be obtained to assess the status of the kidneys for scarring and function.

[Based on review of the data and Panel consensus]

Discussion

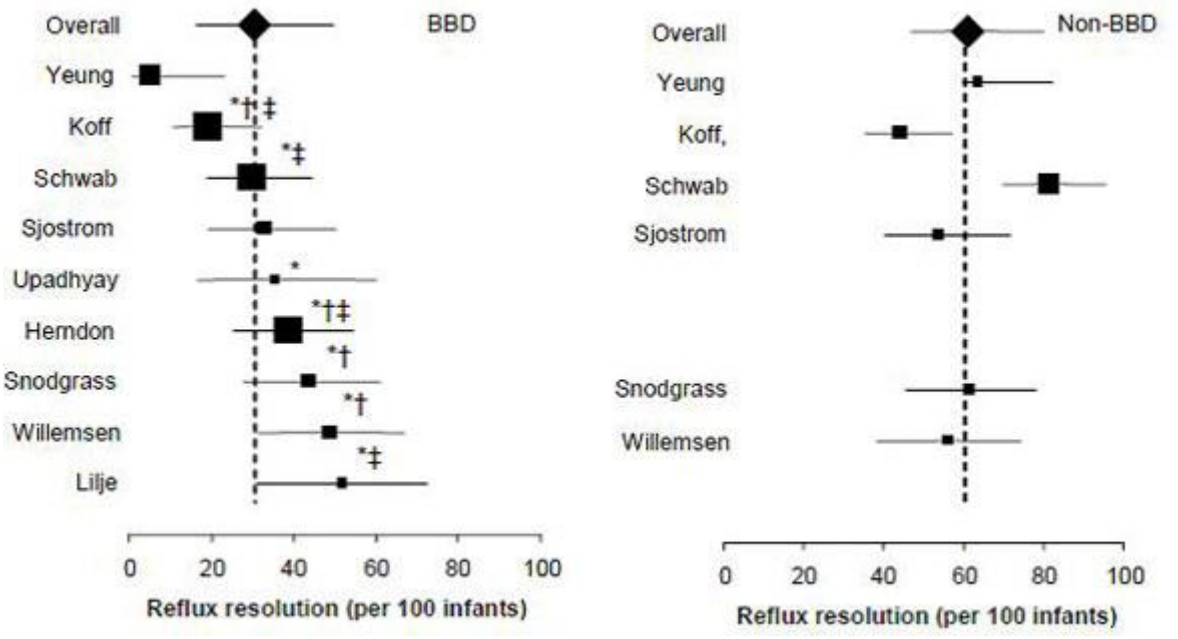
Assessment of voiding patterns

Bladder/bowel dysfunction (BBD), dysfunctional voiding, dysfunctional elimination syndrome and dysfunctional lower urinary tract symptoms refer to a common but poorly characterized complex of symptoms typically including urinary incontinence, dysuria, urinary tract infections (UTI), urinary frequency or infrequent voiding, and constipation. BBD is used to describe children with abnormal lower urinary tract symptoms of storage and/or emptying which include lower urinary tract conditions such as overactive bladder and urge incontinence, voiding postponement, underactive bladder, and voiding dysfunction, and may also include abnormal bowel patterns including constipation and encopresis.

The appropriate approach to the management of the child with VUR and BBD has not been defined, yet the child with this combination of conditions may be at greater risk of renal injury due to infection. The presence of untreated BBD can be shown to affect several aspects of VUR. The incidence of breakthrough UTI in children on continuous antibiotic prophylaxis (see below) is greater in those with BBD than in those without BBD. In children receiving CAP, resolution rates were 31% for those with BBD and 61% for those without BBD (Figure 1).

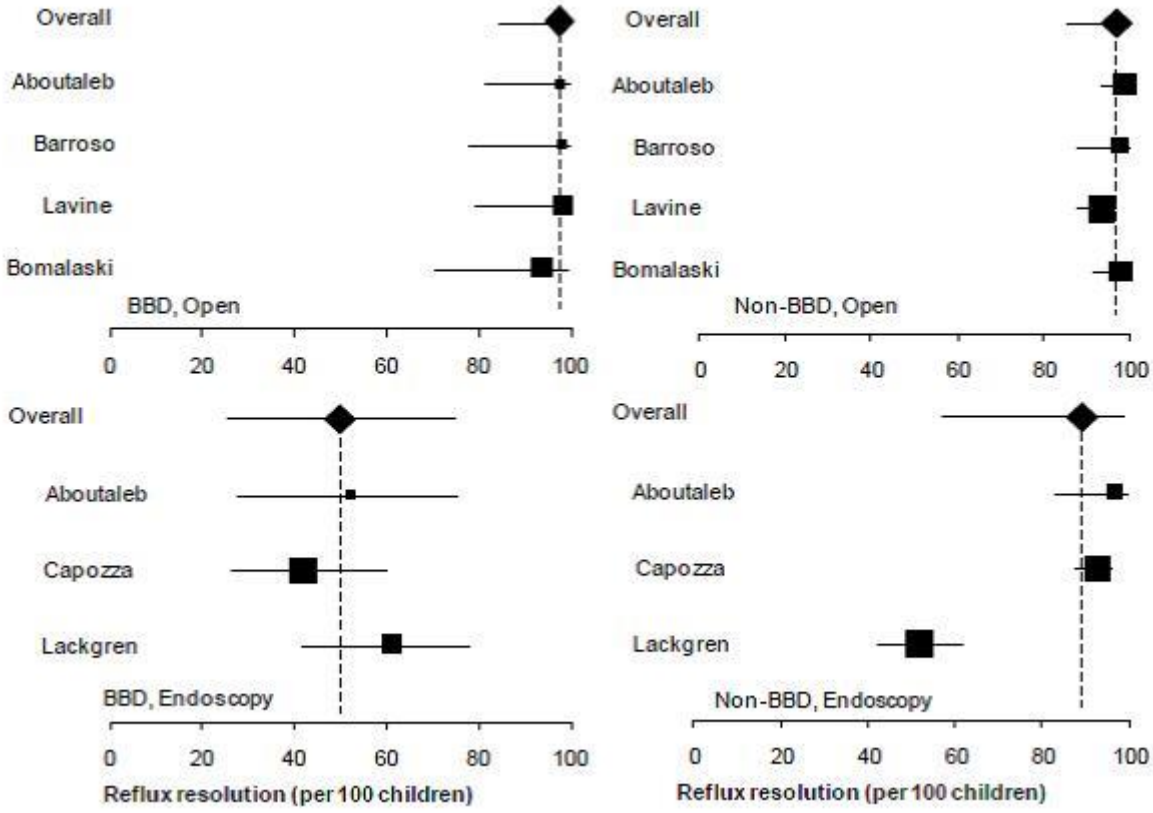
Figure 1. Forest plots of reflux resolution among children receiving continuous antibiotic prophylaxis

(Concurrent/prior use of: *bladder training, †anticholinergics, ‡stool softeners)



In children treated with endoscopic surgery, resolution rates at initial follow-up were 50% for those with BBD and 89% for those without BBD (Figure 2). For children treated with open surgery, the presence of BBD did not appear to alter surgical resolution rates, which were 97% in both groups (Figure 2).

Figure 2: Forest plots of reflux resolution in children undergoing intervention with curative intent (open surgery or endoscopic)



Standard: Symptoms indicative of bladder/bowel dysfunction should be sought in the initial evaluation, including urinary frequency and urgency, prolonged voiding intervals, daytime wetting, perineal/penile pain, holding maneuvers (posturing to prevent wetting), and constipation/encopresis.

[Based on Panel consensus]

Family and patient education

Standard: Family and patient education regarding VUR should include a discussion of the rationale for treating VUR, the potential consequences of untreated VUR, the equivalency of certain treatment approaches, assessment of likely adherence with the care plan, determination of parental concerns and accommodation of parental preferences when treatment choices offer a similar risk-benefit balance.

[Based on Panel consensus]

Initial Management of the Child with VUR

The goals of management of the child with VUR are to 1) prevent recurring febrile UTIs; 2) prevent renal injury; and 3) minimize the morbidity of treatment and follow-up. Separate guidelines are provided for management of VUR for the child less than one year of age and for the child over one year.

It should be noted that several recent publications have questioned the efficacy of continuous antibiotic prophylaxis (CAP) in reducing recurrent UTI and by extension the importance of identifying VUR following urinary tract infection (UTI).[2-5] Until recently, management of VUR without CAP was considered a deviation from standard care, limiting the available data to address questions concerning VUR health risks or the use of CAP. Future studies may identify patient subgroups most likely to benefit from VUR identification and treatment.

The child with VUR less than one year of age

Recommendation: Continuous antibiotic prophylaxis is recommended for the child less than one year of age with VUR with a history of a febrile urinary tract infection. This approach is based on the greater morbidity from recurrent urinary tract infections found in this population.

[Based on review of the data and Panel consensus]

Recommendation: In the absence of a history of febrile urinary tract infections, continuous antibiotic prophylaxis is recommended for the child less than one year of age with VUR grades III–V who is identified through screening.

[Based on review of the data and Panel consensus]

Option: In the absence of a history of febrile urinary tract infections, the child less than one year of age with VUR grades I–II who is identified through screening may be offered continuous antibiotic prophylaxis.

[Based on review of the data and Panel consensus]

Option: Circumcision of the infant male with VUR may be considered based on an increased risk of urinary tract infections in boys who are not circumcised compared to those who are circumcised. Although there are insufficient data to evaluate the degree of this increased risk and its duration, parents need to be made aware of this association to permit informed decision-making.

[Based on review of the data and Panel consensus]

The child with UTI and VUR more than one year of age

Guidelines for management of VUR in the child more than one year of age are somewhat different from those for the child less than one year of age, reflecting several contributing elements that influence clinical outcomes. These include the greater likelihood of BBD, the lower probability of spontaneous resolution of VUR, lower risk of acute morbidity from febrile UTI and the greater ability of the child to verbally complain of symptoms to indicate acute infection. The management decision should be made with recognition of the clinical context, including the presence of BBD, patient age, VUR grade, the presence of scarring, and parental preferences. Given the individuality of each patient and their parental preferences, there can be no uniform guidelines of management.

Recommendation: If clinical evidence of bladder/bowl dysfunction is present (see "Initial evaluation of the child with VUR" above) treatment of bladder/bowel dysfunction is indicated, preferably before any surgical intervention for VUR is undertaken.

There are insufficient data to recommend a specific treatment regimen for bladder/bowel dysfunction, but possible treatment options include behavioral therapy (see Glossary for description), biofeedback (appropriate for children more than age five), anticholinergic medications, alpha blockers, and treatment of constipation. Monitoring the response to bladder/bowel dysfunction treatment is recommended to determine whether treatment should be maintained or modified.

[Based on Panel consensus]

Recommendation: Continuous antibiotic prophylaxis is recommended for the child with bladder/bowel dysfunction and VUR due to the increased risk of urinary tract infection while bladder/bowel dysfunction is present and being treated (Table 1).

[Based on review of the data and Panel consensus]

Option: Continuous antibiotic prophylaxis may be considered for the child over one year of age with a history of urinary tract infections and VUR in the absence of bladder/bowel dysfunction (Table 1).

[Based on review of the data and Panel consensus]

Option: Observational management without continuous antibiotic prophylaxis, with prompt initiation of antibiotic therapy for urinary tract infections, may be considered for the child with VUR in the absence of bladder/bowel dysfunction, recurrent febrile urinary tract infections, or renal cortical abnormalities (Table 1). While this approach is currently under investigation and therefore no firm recommendation can be made, preliminary data suggest that some groups of patients with VUR may do as well with this approach as with continuous antibiotic prophylaxis.

[Based on review of the data and Panel consensus]

Table 1. Treatment of the child with VUR and UTI over one year of age.

	CAP	Observation
No BBD, recurrent febrile UTI, renal cortical abnormalities	option	option
BBD, recurrent febrile UTI, OR renal cortical abnormalities	recommended	not recommended

Option: Surgical intervention for VUR, including both open and endoscopic methods, may be used. Prospective randomized, controlled trials have shown a reduction in the occurrence of febrile urinary tract infections in patients who have undergone open surgical correction of VUR as compared to those receiving continuous antibiotic prophylaxis.

[Based on review of the data and Panel consensus]

Follow-up Management of the Child with VUR

Ongoing monitoring of a child's overall health is necessary. Specific testing related to VUR will depend on the clinical situation and any factors described below that might indicate the potential for ongoing or progressive renal injury. These guidelines apply to all children, irrespective of age.

General follow-up

Recommendation: General evaluation, including monitoring of blood pressure, height, and weight is recommended annually.

[Based on Panel consensus]

Recommendation: Urinalysis for proteinuria and bacteriuria is indicated annually, including a urine culture and sensitivity if the urinalysis is suggestive of infection.

[Based on Panel consensus]

Imaging – cystography and ultrasonography

Recommendation: Ultrasonography is recommended every 12 months to monitor renal growth and any parenchymal scarring. Voiding cystography (radionuclide cystogram or low-dose fluoroscopy, when available) is recommended between 12 and 24 months with longer intervals between follow-up studies in patients in whom evidence supports lower rates of spontaneous resolution (i.e. those with higher grades of VUR [grades III-V], bladder/bowel dysfunction, and older age). If an observational approach is being used, follow-up cystography becomes an option.

[Based on review of the data and Panel consensus]

Option: Follow-up cystography may be done after one year of age in patients with VUR grades I–II; these patients tend to have a high rate of spontaneous resolution and boys have a low risk of recurrent urinary tract infection.

[Based on review of the data and Panel consensus]

Option: A single normal voiding cystogram (i.e. no evidence of VUR) may serve to establish resolution. The clinical significance of grade I VUR, and the need for ongoing evaluation is undefined.

[Based on review of the data and Panel consensus]

Imaging - DMSA

Recommendation: DMSA imaging is recommended when a renal ultrasound is abnormal, when there is a greater concern for scarring (i.e. breakthrough urinary tract infection [BT-UTI; see Glossary for description], grade III-V VUR), or if there is an elevated serum creatinine.

[Based on review of the data and Panel consensus]

Option: DMSA may be considered for follow-up of children with VUR to detect new renal scarring, especially after a febrile urinary tract infection.

[Based on review of the data and Panel consensus]

Surgical treatment of VUR

When intervention with the intention to cure VUR is being considered, open and endoscopic surgical techniques are available with differences in morbidity and success. The resolution rate per 100 children was 98.1 for open surgery (95% CI: 95.1, 99.1) and 83.0 for endoscopic therapy (95% CI: 69.1, 91.4) after a single injection of bulking agent. Data and clinical experience demonstrating the durability of endoscopic therapy for VUR are limited. Post-operative UTIs can occur with either approach and adequate comparative data are lacking. The incidence of post-operative UTI is strongly associated with the incidence of pre-operative UTI, and to the presence of BBD. The number of adverse events following endoscopic or open surgery for VUR was low. The overall postoperative obstruction rate calculated from 28 articles was 0.4 (95% CI: 0.2, 1.2) per 100 children.

Option: Surgical intervention for VUR, including both open and endoscopic methods, may be used. Prospective randomized controlled trials have shown a reduction in the occurrence of febrile urinary tract infections in patients who have undergone open surgical correction of VUR as compared to those receiving continuous antibiotic prophylaxis.

[Based on review of the data and Panel consensus]

Postoperative imaging for patients receiving definitive interventions

There were insufficient data to provide any specific recommendations with regard to the duration of follow-up following definitive interventions. The small but significant risk of post-procedural obstruction was the rationale for the follow-up standard.

Standard: Following open surgical or endoscopic procedures for VUR, a renal ultrasound should be obtained to assess for obstruction.

[Based on review of the data and Panel consensus]

Recommendation: Postoperative voiding cystography following endoscopic injection of bulking agents is recommended.

[Based on review of the data and Panel consensus]

Option: Postoperative cystography may be performed following open ureteral reimplantation.

[Based on review of the data and Panel consensus]

Follow-up Management Following Resolution of VUR

It is recommended that a plan be provided to the family/patient and the primary care physician regarding monitoring for the long-term potential issues related to VUR. This is of particular importance in patients with renal scarring prior to reflux resolution or in whom there is a recurrence of UTI after reflux resolution. While there are no data with which to assess a specific follow-up program, the Panel's recommendations reflect the recognition that the long-term health impact of VUR and renal injury may be distant in time, difficult to accurately predict and subtle in clinical presentation. It is recognized that the incidence of serious health effects may be low, but increase with the length of follow-up. The presence of known renal injury is associated with higher risk of later effects. The recommendation for follow-up with somatic measures and blood pressure reflect routine recommended follow-up by the American Academy of Pediatrics.

Option: Following the resolution of VUR, either spontaneously or by surgical intervention and if both kidneys are normal by ultrasound or DMSA scanning, general evaluation, including monitoring of blood pressure, height, and weight, and urinalysis for protein and urinary tract infection, annually through adolescence is an option.

[Based on Panel consensus]

Recommendation: Following the resolution of VUR, either spontaneously or by surgical intervention, general evaluation, including monitoring of blood pressure, height, and weight, and urinalysis for protein and urinary tract infection, is recommended annually through adolescence if either kidney is abnormal by ultrasound or DMSA scanning.

[Based on Panel consensus]

Recommendation: With the occurrence of a febrile urinary tract infection following resolution or surgical treatment of VUR, evaluation for bladder/bowel dysfunction or recurrent VUR is recommended.

[Based on Panel consensus]

Recommendation: It is recommended that the long-term concerns of hypertension (particularly during pregnancy), renal functional loss, recurrent urinary tract infection, and familial VUR in the child's siblings and offspring be discussed with the family and communicated to the child at an appropriate age.

[Based on Panel consensus]

Screening for VUR in Siblings and Neonates with Prenatal Hydronephrosis

The prevalence of VUR is approximately 27% in siblings of children with VUR (see Chapter 5, table 1). The screening methods to detect VUR include voiding cystourethrogram (VCUG) or radionuclide cystography. Some practitioners use renal ultrasonography to screen for renal abnormalities as a selection criterion for voiding cystography. The goal of screening for VUR in siblings or neonates with prenatally detected hydronephrosis is to identify clinically unapparent VUR in order to initiate preventative therapy, usually CAP. However, the value of CAP in preventing febrile UTI and renal damage in VUR is unproven. Therefore, recommendations for screening are limited by the uncertainty of any potential benefit gained by identifying VUR. Identification of VUR may be of some benefit by increasing the awareness of parents and health providers to the potentially increased risk of pyelonephritis and renal scarring.

Sibling screening

Recommendation: In siblings of children with VUR, a voiding cystourethrogram or radionuclide cystogram is recommended if there is evidence of renal cortical abnormalities or renal size asymmetry on ultrasound or if there is a history of urinary tract infection in the sibling who has not been tested.

[Based on Panel consensus]

Option: Given that the value of identifying and treating VUR is unproven, an observational approach without screening for VUR may be taken for siblings of children with VUR, with prompt treatment of any acute urinary tract infection and subsequent evaluation for VUR.

[Based on Panel consensus]

Option: Sibling screening of older children who are toilet trained may be offered, although the value of identification of VUR is undefined.

[Based on Panel consensus]

Option: Ultrasound screening of the kidneys in the sibling of a child with VUR may be performed to identify significant renal scarring and to focus attention on the presence and potential further risk of VUR.

[Based on Panel consensus]

Option: Screening offspring of patients with VUR can be considered as similar to screening of siblings.

[Based on Panel consensus]

Screening in the neonate with a history of prenatal hydronephrosis

The presence of VUR in neonates with a history of prenatal hydronephrosis can be confirmed by performing a VCUG or radionuclide cystography. Based on the outcomes analysis (see Chapter 5), the incidence of VUR in neonates with prenatal hydronephrosis is approximately 16%. Females with a prenatal diagnosis of PNH had a significantly higher ($p = 0.022$), incidence of VUR compared to male infants. The distribution of VUR grade in neonates was similar to that of children who presented later in life; VUR grade was found to be grade III or greater in two thirds of patients, with renal abnormalities occurring in nearly 50% of those with grades IV-V. These considerations suggest that those with prenatal hydronephrosis are a group at increased risk for VUR and subsequent sequelae. The recommendation for VCUG in children with the Society for Fetal Urology (SFU) grade 3 and 4 hydronephrosis is based on the potential for bladder outlet obstruction being present as well as the risk of VUR.

Recommendation: Voiding cystourethrogram is recommended for children with high-grade ((Society of Fetal Urology grade 3 and 4) hydronephrosis, hydroureter or an abnormal bladder on ultrasound (late-term prenatal or postnatal), or who develop a urinary tract infection on observation.

[Based on review of the data and Panel consensus]

Option: An observational approach without screening for VUR, with prompt treatment of any urinary tract infection, may be taken for children with prenatally detected hydronephrosis ((Society of Fetal Urology grade 1 or 2), given the unproven value of identifying and treating VUR. It is also considered an option to perform a voiding cystourethrogram **in these patients to screen for VUR.**

[Based on Panel consensus]

Interventions for the Child with Breakthrough UTI (BT-UTI)

When a febrile breakthrough UTI (BT-UTI) occurs in a child with VUR receiving CAP, consideration of alternative interventions is recommended. The occurrence of a febrile BT-UTI indicates a failure of therapy and raises the concern for renal injury. The clinical manifestations of BT-UTI may not be classic, particularly in the younger child in whom systemic symptoms may predominate. The specific alternative therapy should be determined based upon the individual risks to the patient, which include clinical factors such as reflux grade, degree of scarring and BBD. Therapy with curative intent, including open surgery, offers protection against febrile UTI, but is obviously associated with morbidity; less morbid approaches, such as endoscopic injection therapy, may have lesser success in VUR resolution. In the absence of new renal cortical abnormalities, a change in the antibiotic used for prophylaxis may be effective. In any event, the occurrence of BT-UTI should signal the need for a re-evaluation of the efficacy of the ongoing treatment plan for the child.

Recommendation: If symptomatic breakthrough urinary tract infection occurs (manifest by fever, dysuria, frequency, failure to thrive, or poor feeding), a change in therapy is recommended. If symptomatic breakthrough urinary tract infection occurs, the clinical scenario will guide the choice of treatment

alternatives; this includes VUR grade, degree of renal scarring, if any, and evidence of abnormal voiding patterns (bladder/bowel dysfunction) that might contribute to urinary tract infection, as well as parental preferences.

[Based on Panel consensus]

Recommendation: It is recommended that patients receiving continuous antibiotic prophylaxis with a febrile breakthrough urinary tract infection be considered for open surgical ureteral reimplantation or endoscopic injection of bulking agents for intervention with curative intent.

[Based on Panel consensus]

Option: In patients receiving continuous antibiotic prophylaxis with a single febrile breakthrough urinary tract infection and no evidence of pre-existing or new renal cortical abnormalities, changing to an alternative antibiotic agent is an option prior to intervention with curative intent.

[Based on Panel consensus]

Recommendation: In patients not receiving continuous antibiotic prophylaxis who develop a febrile urinary tract infection, initiation of continuous antibiotic prophylaxis is recommended.

[Based on Panel consensus]

Option: In patients not receiving continuous antibiotic prophylaxis who develop a non-febrile urinary tract infection, initiation of continuous antibiotic prophylaxis is an option in recognition of the fact that not all cases of pyelonephritis are associated with fever.

[Based on Panel consensus]

Summary and Conclusions

This Guideline does not offer a simple formula for the care of children with VUR since the data were not sufficient to permit development of strict "standards of care" in many instances. However, certain findings from this meta-analysis can be used to guide the management of VUR. In particular, it was determined that VUR significantly increases the risk of developing renal scarring in the setting of acute pyelonephritis, with an odds ratio of 2.8 per patient and 3.7 per renal unit. Also, while resolution of VUR will reduce the incidence of febrile UTI, the overall incidence of UTI may remain unchanged.

Recent studies have demonstrated that CAP has not been proven to reduce the incidence of febrile UTI in children with VUR.[2-5] These results have challenged the core of current expectant therapy of VUR, yet the general applicability of these new findings remains uncertain. Very careful review of the strengths and limitations of these studies must be considered before broadly accepting this approach. However, these data do suggest that an observational approach to VUR with antibiotic therapy initiated on diagnosis of an acute UTI may be an option in selected children.

The following provides a summary of the findings of the meta-analysis and relevant guideline statements. See Clinical Chapters 1–5 for the supporting data and a more complete discussion of each of these topics.

Management of VUR in the child over one year of age with no BBD

On detection of VUR in the child over one year of age, it is recommended that the child be evaluated for evidence of renal disease and for symptoms suggestive of BBD. Children with higher grades of VUR (i.e. grades III to V) are at greater risk of having renal cortical abnormalities. DMSA scanning can be useful in identifying those with preexisting abnormalities. If CAP is used, reassessment of VUR by cystogram between 12 and 24 months after the prior cystogram is recommended to determine when therapy can be stopped. This analysis, as well as the 1997 Guideline[1], found that resolution rates are prolonged with higher grades of VUR. It is recommended, but not mandated, that BT-UTI prompt consideration of a change in approach, which might include varying the antibiotic used for CAP. Therapy with the intention to cure, including open or endoscopic surgery, is recommended for recurrent infections, new renal abnormalities determined by DMSA scanning, and parental preference.

Endoscopic injection therapy for VUR is an option in the treatment of VUR. Success rates for open surgery are 98%, with few complications, compared to rates of 83% for endoscopic surgery; however, the higher success rates for open surgery are offset by the greater expense and the need for in-patient hospitalization.

Postoperative UTIs can occur with either treatment, but are more likely to occur in patients with a prior history of frequent UTIs. Following surgery, an ultrasound to confirm absence of obstruction is a standard of care. While an infrequent occurrence, urinary obstruction may be "clinically silent" and have severe consequences that could be readily corrected. Cystography is a recommendation after endoscopic surgery and an option after open surgery. Following reflux resolution (surgically or spontaneously) it is recommended that a planned follow-up, including assessment for infection, renal abnormalities, and overall health, be continued through adolescence.

Management of the infant under one year of age with VUR

Infants under one year of age may not show clinical evidence of pyelonephritis as clearly as older children and they may have a greater risk of infection-related morbidity. It is therefore recommended that CAP be used in these children until more definitive studies suggest otherwise. Reflux resolution occurs in about 50% of these children within 24 months.

Management of the child with VUR and BBD

Evidence supports the importance of BBD in the natural history and clinical outcomes of VUR; the presence of BBD has been shown to reduce the rates of reflux resolution and increase the incidence of UTI in patients managed with CAP, to reduce the cure rate of endoscopic therapy, and to increase the incidence of UTI after definitive reflux cure. It is therefore recommended that all children be evaluated for possible BBD based on clinical history. Although treatment regimens vary and there are no data supporting one approach over another, the Panel recommends treatment of BBD in the child with VUR as an integral part of reflux management.

Screening the siblings and offspring of patients with VUR

The incidence of reflux in siblings of children with VUR is 27% and the incidence decreases with the age of the sibling. The incidence of renal cortical abnormalities depends on whether the sibling has a history of UTI. The incidence of reflux in the offspring of a patient with VUR is 35.7% (see Chapter 4). It is considered an option and not a recommendation to screen for VUR in siblings and offspring due to the fact that the health benefit of identifying VUR in these patients has not been proven. It is recommended that this information be shared with the family in order to permit an informed decision with the recognition that identifying and managing the VUR may or may not be a benefit to that child.

Screening infants with a history of prenatally detected hydronephrosis for VUR

Infants with prenatally detected hydronephrosis have an incidence of VUR of 16.2% that is not predicted by the grade of hydronephrosis (see Chapter 5, figure 1); therefore, hydronephrosis grade cannot be used to select infants at risk for VUR. This analysis found no significant difference in incidence between sexes. The incidence of renal cortical abnormalities is much greater for children with grades III-V VUR. Again, there has been no demonstration of any health benefit of screening for and identifying VUR in these infants. It is therefore a recommendation that families be informed of the potential risk and permitted to participate in the decision-making.

Conclusions

It is becoming increasingly evident that identification of a child's individual risk factors should be taken into consideration when managing VUR. In recognizing that BBD is a major factor in UTI occurrence, reflux persistence and surgical outcomes, clinical management of BBD is a priority. Similarly, we can be more comfortable with a less intensive intervention in the child with a low risk of renal injury, i.e., those with no prior infections, healthy kidneys, normal voiding and a low-grade of VUR. This does not imply that observation is better, although it is a more appropriate option than previously considered. The clinician who is looking for a "recipe" to manage all children with VUR will be disappointed in this Guideline, but such a "cookbook" approach is what has produced much of the current confusion in the management of VUR. The evolution of VUR management will be guided by better selection of patients for different levels of therapy, a better understanding of the interaction of contributing factors such as BBD and the renal response to infection in VUR management, as well as incorporating family choices in care when medical options are not clearly different. Research efforts need to be intensified to develop a scientific basis for the selection of therapies; in addition, improvements in the VUR literature are needed to permit ongoing review and assessment of our progress.

References

1. Elder, J. S., Peters, C. A., Arant, B. S., Jr. et al.: Pediatric Vesicoureteral Reflux Guidelines Panel summary report on the management of primary vesicoureteral reflux in children. J Urol 1997; **157:** 1846.

2. Garin, E. H., Olavarria, F., Garcia Nieto, V. et al.: Clinical significance of primary vesicoureteral reflux and urinary antibiotic prophylaxis after acute pyelonephritis: a multicenter, randomized, controlled study. Pediatrics 2006; **117:** 626.

3. Montini, G., Rigon, L., Zucchetta, P. et al.: Prophylaxis After First Febrile Urinary Tract Infection in Children? A Multicenter, Randomized, Controlled, Noninferiority Trial. Pediatrics 2008; **122:** 1064.

4. Pennesi, M., Travan, L., Peratoner, L. et al.: Is antibiotic prophylaxis in children with vesicoureteral reflux effective in preventing pyelonephritis and renal scars? A randomized, controlled trial. Pediatrics 2008; **121:** e1489.

5. Roussey-Kesler, G., Gadjos, V., Idres, N. et al.: Antibiotic prophylaxis for the prevention of recurrent urinary tract infection in children with low grade vesicoureteral reflux: results from a prospective randomized study. J Urol 2008; **179:** 674.