The Society for Pediatric Radiology
Performance of VCUG Examinations: Safety, Quality of Care, Practice Guidelines
Compare Your Standard of Practice to National Recommendations and Your Peers

September 22, 2008 - This PQI project has been qualified by the American Board of Radiology in meeting the criteria for practice quality improvement (PQI), toward the purpose of fulfilling requirements in the ABR Maintenance of Certification Program.

VCUG MODULE INSTRUCTIONS

1. You will first complete a Baseline Survey based on a review of VCUG examinations which you have performed.
2. For Questions 1-7, review 25 VCUG exams that you have performed and answer the questions for all 25. **Note that the total number of answers must add up to 25.**
3. For question number 8, document your average radiation dose for those 25 exams. To do so add the total dose (either the skin dose (mGys) or dose area product (Gy-cm²) for all 25 exams and then divide the cumulative dose by 25. If you do not record your radiation dose but do record time, indicate the times in the space provided and note to the side that it is time vs. dose. If you do not record your radiation dose, leave this blank.
4. For questions 9-10 answer yes or no based on your standard practice.
5. After you have completed the Baseline Survey print a copy of your initial individual results for your records. This will serve as proof that you completed the survey. It will also allow you to compare your initial results with your follow-up survey.
6. After you complete the Baseline survey, you should review the Discussion Points that will provide a brief evidence based discussion on the questions in the survey.
7. After you finish reviewing the Discussion Points you will be directed to create a Self Improvement Plan. Please print a copy of the Self Improvement Plan for your records.
8. **Note that the SPR will not store any individual information. Therefore the only proof that you completed the module is the copy you keep for your records.**
9. At a future date you will complete a Follow-up Survey involving the same questions listed in the Baseline Survey. You will then compare your performance on the Follow-up with your results on the Baseline Survey and your Self Improvement Plan. You can decide when you complete the Follow-up Survey. When you complete the Follow-up Survey, print a copy for your records.
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BASELINE SURVEY

For Questions 1-7, review 25 VCUG exams that you have performed and answer the questions for all 25. Note that the total number of answers must add up to 25.

1. Was there an appropriate clinical indication?
Yes _________    No _________

2. Did you wash your hands before and after the examinations?
Yes _________    No _________

3. Did you obtain a scout image of the abdomen and pelvis?
Yes _________    No _________

4. Did you use pulsed or continuous fluoroscopy?
Pulsed ____________   Continuous _________

5. What was your primary method of image capture, last image hold or spot radiograph?
Last image hold ____________   Spot radiograph ____________

6. Did you obtain the following views?

   6A. AP Bladder (early filling)
Yes _________    No _________

   6B. Oblique bladder view centered on UVJ (filling complete)
Yes _________    No _________

   6C. Urethra (voiding)
Yes _________    No _________

   6D. AP bilateral renal fossa (post-void)
Yes _________    No _________
6E. AP Bladder (post-void)
Yes _________  No ________

7. Does your report include the grade of vesicoureteral reflux, if present, utilizing the International Reflux System?
Yes _________  No ________

For question number 8, document your average radiation dose for those 25 exams. To do so add the total dose (either the skin dose (mGys) or dose area product (Gy-cm²)) for all 25 exams and then divide the cumulative dose by 25. If you do not record your radiation dose but do record time, indicate the times in the space provided and note to the side that it is time vs. dose. If you do not record your radiation dose, leave this blank.


A. Skin dose (mGys) ______
B. Dose area product (Gy-cm²) ______

For questions 9-10, answer in terms of your standard practice in performing VCUG examinations.

9. Do you offer conscious sedation if requested?
Yes □  No □

10. Is sibling reflux an appropriate indication for a VCUG in pre-school age children?
Yes □  No □

Thank you for taking the initial survey. Please print your responses and retain for your records so that you may compare the results to your Self Improvement Plan and Follow-Up Survey at a later date.
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BASELINE SURVEY DISCUSSION POINTS

1. Was there an appropriate clinical indication?
The clinical indications for performing a VCUG include urinary tract infection, dysuria, hydronephrosis, hematuria, trauma, incontinence, spinal dysraphism, and complex congenital anomalies of the genitourinary tract. The fluoroscopic VCUG may also be used for the follow-up evaluation of vesicoureteral. Digital fluoroscopy units with pulsed fluoroscopy allow for a significant decrease in the radiation dosage of the examination. These issues are addressed further later in the module. An alternative for the follow-up evaluation of children with vesicoureteral reflux is nuclear cystography since it has a lower radiation dose than does the fluoroscopic VCUG.

2. Did you wash your hands before and after the examinations?
Clean hands are the single most important factor in preventing the spread of pathogens and antibiotic resistance in healthcare settings. The Center for Disease Control estimates that each year, nearly 2 million patients in the United States get an infection in hospitals, and about 90,000 of these patients die as a result of their infection. There is substantial evidence that hand hygiene reduces the incidence of infections. Health care workers should wash hands before and after any patient contact. Plain soap is good at reducing bacterial counts. When washing hands with soap and water, wet hands with water, apply soap, and rub hands together for at least 15 seconds, covering all surfaces of the hands and fingers. Rinse hands with water, dry thoroughly with a disposable towel, and use the towel to turn off the faucet. Alternatively, alcohol solution can be used to clean hands as long as there has been no contact with body fluids. In addition, there is evidence that alcohol does not prevent the spread of C. difficile infections. Regardless of the method used for hand cleaning, most centers set a target of 90-95% compliance rates for hand washing.

3. Did you obtain a scout image of the abdomen and pelvis?
A scout radiograph prior to the VCUG can provide important diagnostic information that directs the remaining examination. For example visualization of spine abnormalities leads to heightened suspicion for a neurogenic bladder. Additional abdominal or pelvic abnormalities that may be noted include calcifications, foreign bodies or soft tissue masses. If abdominal and pelvic radiographs have been obtained within the past 6 months then a scout view is probably not necessary.

4. Did you use pulsed or continuous fluoroscopy?
Pulsed fluoroscopy provides substantial reduction in radiation exposure without loss of diagnostic information. It achieves a reduction in exposure by limiting the time during which the patient is exposed to the x-ray beam. Conventional fluoroscopes produce a continuous fluoroscopy beam at 30 image frames per second with an effective exposure duration of 33 msec for each frame. Pulsed fluoroscopy limits the number of exposures to 15.0, 7.5, and 3.75 frames per second. The use of pulsed fluoroscopy allows for a significant
decrease in radiation dosage when compared with pulsed fluoroscopy with maintenance of contrast and spatial resolution. The effective dose can be reduced by 5-10 fold.

5. What was your primary method of image capture, last image hold or spot radiograph? Digital fluoroscopy offers the advantage of image or screen-save so that the last image can be saved without additional radiation to the patient. Limiting the number of spot images and maximizing the number of image-save acquisitions decreases radiation. The use of last image hold allows for a significant decrease in gonadal radiation dosage with maintenance of image quality.

6. Did you obtain the following views?

6A. AP Bladder (early filling)
6B. Oblique bladder view centered on UVJ (filling complete)
6C. Urethra (voiding)
6D. AP bilateral renal fossa (post-void)
6E. AP Bladder (post-void)

The VCUG provides evaluation of the bladder and urethra. It demonstrates anatomic abnormalities including obstruction, and evidence of voiding dysfunction. It also evaluates and characterizes severity of vesicoureteral reflux.

An AP view of the minimally filled bladder is useful to demonstrate a ureterocele or bladder tumor. These lesions may be obscured when more contrast material enters the bladder. Oblique views of the bladder after bladder filling is complete should be obtained centered at the ureterovesical junction. These views are useful in detecting therapeutically significant abnormalities including vesicoureteral reflux and periureteral bladder diverticula. If reflux is observed during late bladder filling, the ipsilateral renal fossa should be imaged in the AP projection prior to voiding.

It is important to obtain a view of the urethra during voiding. The entire urethra should be imaged particularly in boys because disease can occur anywhere from the bladder base to the urethral meatus. Although the catheter may be removed as voiding is initiated, voiding around the catheter is strongly recommended because it allows repeat filling if the examination is technically sub-optimal, and bladder drainage in children who are unable to empty the bladder completely. A urethral catheter does not obscure visualization of urethral pathology. In boys a steep oblique view is optimal because it prevents overlap of urethral segments. The most common urethral abnormality in boys is posterior urethral valves. In girls the urethra is best imaged by AP view. Urethral abnormalities are rare in girls. The most common abnormal condition seen is a “spinning top” urethra which is associated with bladder sphincter dyssynergia.
At the conclusion of voiding, each renal fossa should be imaged to document whether reflux has occurred. Approximately 20% of reflux will be missed if voiding does not occur. Additionally, the presence of congenital lesions such as ureteral duplications should be evaluated. To decrease gonadal radiation in female patients fluoroscopy should be centered on the renal fossa and not include the region of the gonads or the urine-filled bladder.

A post void view of the bladder should be obtained to assess bladder emptying capability. Incomplete bladder emptying may be seen with a neurogenic bladder or with bladder sphincter

7. Does your report include the grade of vesicoureteral reflux, if present, utilizing the International Reflux System?

The VCUG is the only examination that allows precise grading of vesicoureteral reflux. Reflux should be graded according to the International Reflux Study Group grading system. This grading system is based on the height to which contrast material ascends within the ureter and the degree of distension of the pelvicaliceal system (Fig. 1).

The grade is determined by the most severe reflux visualized. The definitions of the International grades of reflux are as follows:

Grade I: Ureter only

Grade II: Ureter, pelvis, and calyces; no dilatation, normal calyceal fornices
Grade III: Mild or moderate dilatation and/or tortuosity of the ureter and mild or moderate dilatation of the renal pelvis. No or slight blunting of the fornices.

Grade IV: Moderate dilatation and/or tortuosity of the ureter and moderate dilatation of the renal pelvis and calyces. Complete obliteration of the sharp angle of the fornices but maintenance of the papillary impressions in the majority of calyces.

Grade V: Gross dilatation and tortuosity of the ureter. Gross dilatation of the renal pelvis and calyces. The papillary impressions are no longer visible in the majority of calyces. Each grade has prognostic significance. The higher the grade the less likely the child is to outgrow the reflux with medical management.

Radiologists have a responsibility to minimize radiation dose to individual patients while maintaining the necessary diagnostic image quality. This is the concept “As Low As Reasonably Achievable (ALARA)”. Those who perform pediatric VCUG examinations should recognize that increased fluoroscopy times increase radiation exposure. Tailoring the fluoroscopic study to obtain the needed diagnostic information, while minimizing radiation dosage particularly to the gonadal region, is therefore essential. The traditional VCUG can expose the child to 100 times the radiation dosage associated with radionuclide scintigraphy. The examination dose should be kept as low as possible and documented in a departmental log or captured in the RIS.

Fluoroscopy units provide operator displays of estimated patient dose. The dose is calculated based on technique, type of filtration and collimated radiation field size. The most common dose measures provided are a) total dose and b) Dose-Area-Product (DAP). The total dose value estimates skin entrance exposure and is expressed in mGy. The DAP is a measure of the skin entrance dose multiplied by the area exposed. The value is expressed in Gy-cm². Although these values are only approximations they provide a useful reference value to compare relative dose on comparable examinations.

9. Do you offer conscious sedation if requested?
The VCUG can be a distressing experience for some children. In a subset of children non-pharmacologic methods to reduce distress may not be enough. Conscious sedation with oral or nasal midazolam has been shown to reduce patient anxiety without affecting voiding dynamics. It can also result in amnesia which may reduce the distress associated with undergoing repeated examinations.

10. Is sibling reflux an appropriate indication for a VCUG in pre-school age children?
Vesicoureteral reflux is the most common heritable disorder of the urinary tract. Reflux is present in approximately one-third of siblings with reflux. Certain factors help stratify the risk of sibling reflux. When stratified by sibling age, 44% of children <2 years have reflux as opposed to 9% of children >6 years. Twins are at particularly increased risk; the risk is greater in monozygotic twins than dizygotic twins. The majority of children with sibling reflux do not have a history of a urinary tract infection. Therefore early screening for reflux in asymptomatic siblings may decrease the incidence of renal damage. This is particularly true in children < 6 years since the rate of reflux is higher and they may not be able to adequately
describe their symptoms. Elective screening can be performed with either a radionuclide cystogram or a voiding cystourethrogram.

References:

SELF IMPROVEMENT PLAN

Identify specific aspects of your current practice performance that fall below group performance & establish performance future targets for yourself.

1. Appropriate Clinical Information
Steps you plan to take to improve the collection of appropriate clinical information.

2. Hand Washing Before and After
Steps you plan to take to improve the incidence of hand washing.

3. Obtain Scout Image
Steps you plan to take to improve the collection of scout images.

4. Use of Pulsed Fluoroscopy
Steps you plan to take to increase the use of pulsed fluoroscopy.
5. Last Image Hold Capture
Steps you plan to take to increase the use of last image holdy.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

6. Obtain all standard views (6A-6E)
Steps you plan to take to improve the collection of all standard views.
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7. Include reflux grade on report
Steps you plan to take to improve the inclusion of reflux grade on reports.
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8. Document fluoroscopy time
Steps you plan to take to increase the documentation of fluoroscopy times.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

9. Do you plan to offer conscious sedation for voiding cystourethrogram?
   Yes ☐   No ☐

10. Do you plan to perform voiding cystourethrograms for sibling reflux?
    Yes ☐   No ☐

Please print a copy of your Self Improvement Plan and retain for your records.