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THE ACCURACY OF A CATHETERIZED RESIDUAL URINE

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ABSTRACT

Residual urine is important in the evaluation of the urological patient. The gold standard to obtain this information is a catheterized specimen. We examined the accuracy of a catheterized value to ascertain whether the bladder was emptied completely. After the bladder was catheterized 10 ml. radiocontrast material were instilled into the bladder to allow radiographic documentation of complete evacuation. We found that 26 per cent of 515 patients evaluated had residual urine after routine attempts were made to evacuate the bladder fully. We conclude that a single residual urine estimate may be inaccurate and one should not always base therapeutic decisions upon any single such measurement. (*J. Urol.*, 141: 15-16, 1989)

A catheterized residual urine sample is accepted as reliable, useful data in the assessment of many urological problems. This parameter frequently is followed in patients with neuro-pathic bladder dysfunction, urinary incontinence, urinary tract infections, obstructive uropathic conditions, upper tract dilatation and vesicoureteral reflux. It indeed is the standard against which other modalities are compared, such as the phenolsulfonphthalein excretion test,¹⁻⁴ post-void intravenous radiographs,⁵ percussion, palpation, ultrasonography⁶⁻¹⁰ and radioisotope studies.

Recently, government agencies have shown an interest in the quantitative values of post-void residual as one of many variables used to assess patient selection and potential reimbursement in prostatism and other common problems. Because of these considerations we evaluated the accuracy of urethral catheterization in the assessment of bladder residual urine.

MATERIALS AND METHODS

We studied 515 consecutive patients who had been referred for urodynamic evaluation due to voiding dysfunction. The population included 222 male and 293 female patients between 2 months and 88 years old. There were 50 children less than 15 years old. Of the patients 51 had chronic catheter drainage (either suprapubic or urethral). All patients were without demonstrable vesicoureteral reflux or bladder diverticula.

Full-time urological nurse specialists catheterized the patients with a lubricated 12F Nelaton catheter for residual urine in a routine sterile fashion immediately before urodynamic assessments were made. The values obtained were recorded as the initial residual estimate. Without moving the patient 10 ml. iodinated radiocontrast material were instilled through the same catheter. Bladder volumes then were assessed and the bladder was evacuated under fluoroscopic imaging within 5 minutes. A potential second corrected bladder residual, with the 10 ml. radiocontrast material subtracted and added to the initial residual estimate, gave the true residual volume. If no additional residual was found under fluoroscopic imaging then the initial estimate would equal the true volume. A correct residual volume was recorded. However, we were equally interested in patients with an inaccurate initial assessment of residual urine, those in whom the initial estimate did not equal the true volume. Apart from the patients with chronic indwelling catheters, urine volumes were not true residuals, since all patients did not void just before catheterization. Those with indwelling catheters were assessed in a similar fashion after

removal of the chronic catheter and placement of a 12F catheter as in the others evaluated.

To evaluate the results the patient population was divided into 2 sequential groups. Group 1 included 264 patients evaluated with routine techniques before the nursing staff was aware of potential inaccuracies of the initial catheterized residual urines. Group 2 included 251 patients who were evaluated after the nursing staff was fully informed of the potential inaccuracies of the initial catheterized residual urines, and was advised to use all maneuvers and tricks to evacuate the bladder with these initial catheterizations, including suprapubic pressure, advancing the catheter back and forth, syringe suction and twisting the catheter. In both groups the 12F catheter was placed in an identical fashion with no change in type or amount of lubricant. The patients in groups 1 and 2 then were compared. Patients in both groups were categorized as male and female, less than 15 years old and with chronic indwelling catheters.

RESULTS

Of the 116 male patients evaluated in group 1, 35 (30 per cent) had inaccurate initial assessments of residual urine confirmed by fluoroscopic evaluations. The initial estimate ranged from 0 to 600 ml., with a mean of 133 ml. In contrast, the total residual urine volume ranged from 15 to 800 ml., with a mean of 199 ml. The mean difference between the initial catheterized assessments and the fluoroscopically confirmed true total residual volume was 76 ml. (standard deviation 76 ml.). In group 2, 15 of 106 male patients (14 per cent) had incorrect initial assessments of residual urine. The initial assessment ranged from 0 to 600 ml., with a mean of 97 ml. Mean total residual urine was 182 ml. The mean difference between the true volume and the initial assessment was 85 ml. (standard deviation 60 ml.). Of the total male patients evaluated 50 had inaccurate initial assessments. However, 172 patients had correct assessments of residual urine (initial evaluation equals true volume).

Incorrect initial evaluations of residual urine were noted in 40 of 148 female patients (27 per cent) in group 1 and 42 of 145 (29 per cent) in group 2. The initial estimates ranged from 5 to 250 ml. (mean 79 ml.) and 5 to 400 ml. (mean 75. ml.), respectively. Total residual urine ranged from 25 to 300 ml. (mean 130 ml.) and 40 to 460 ml. (mean 126 ml.), respectively. The mean difference between the initial estimate and true volume was 52 ml. (standard deviation 36 ml.) in group 1 and 51 ml. (standard deviation 31 ml.) in group 2.

We evaluated 27 children (18 girls and 9 boys) less than 15 years old in group 1 and 33 (21 girls and 12 boys) in group 2. Inaccurate initial estimates were recorded in 3 boys and 3 girls in group 1, and 3 girls and 1 boy in group 2. The mean initial

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estimates of residual urine were 51 ml. (range 0 to 13 ml.) and 72 ml. (range 7 to 120 ml.), respectively. The true residual volume ranged from 15 to 180 ml. (mean 90 ml.) and 42 to 230 ml. (mean 125 ml.), respectively. The mean difference between the true volume and the initial estimate was 39 ml. (standard deviation 33 ml.) in group 1 and 54 ml. (standard deviation 51 ml.) in group 2.

Chronic indwelling catheters were present in 31 patients in group 1 and 20 in group 2. Inaccurate initial values were recorded in 6 of 27 male and 1 of 4 female patients in group 1, and 2 of 9 female and 1 of 11 male patients in group 2. The initial estimates ranged from 0 to 95 ml. (mean 16 ml.) and 0 to 45 ml. (mean 25 ml.), respectively. Total true volume ranged from 20 to 195 ml. (mean 86 ml.) and 20 to 115 ml. (mean 65 ml.), respectively. The mean difference between the total true volume and the initial estimate was 70 ml. (standard deviation 44 ml.) in group 1 and 40 ml. (standard deviation 38 ml.) in group 2.

With each group of patients (men, women, children and those with chronic indwelling catheters) those with large bladder volumes (more than 150 ml.) comprised most of the patients with large discrepancies between initial catheterized estimates and fluoroscopically confirmed volumes.

DISCUSSION

Quantification of normal bladder residuals has been attempted in the past because bladder residual urine is considered an integral part of the assessment and followup of numerous urological problems.¹¹⁻¹³ It has been believed that catheterization values are accurate and that they constitute a standard upon which procedures that are supposedly less invasive have been compared. Among our study population of 515 patients referred for urodynamic evaluation experienced urological nurse specialists were unsuccessful in completely evacuating bladders in 26 per cent of the patients. Why is this so? During fluoroscopic imaging it was noted that some catheters were actually tenting up the dome of the bladder and could represent a potential source of incomplete urine evacuation. Variable amounts of lubricant and other debris also may have been responsible for ineffective bladder emptying with catheterization. To help facilitate adequate drainage and assessment of residual urine, a larger caliber catheter may be helpful to eliminate the possibility of obstructing debris and/or lubricant, and decrease the likelihood of a kinked catheter within the bladder. Those with large bladder volumes had the largest discrepancies, which may be due to a collapsing bladder folding the catheter with resultant obstruction.

In addition, use of catheter manipulation, including suprapubic pressure, advancing the catheter back and forth, syringe suction and catheter twisting, improved evacuation from 27 per cent in group 1 without to 21 per cent in group 2 with such manipulations. It should be noted that none of our patients had bladder diverticula or vesicoureteral reflux that could further complicate the effective evacuation of the bladder.

Our results show that use of catheter drainage as the ultimate standard to assess bladder residual urine presents a potential for inaccuracy. To rely on any single value of a catheterized residual urine for assessment, management or patient selection may present problems if such decisions are based on inconsistent and unreliable results. During formulation of clinical judgments a series of estimates should be used to minimize the risk of basing a therapeutic decision on data that may be inaccurate.

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