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Accuracy of Residual Urine Measurement in Post-operative Gynecological Patients by Normal Saline Instillation versus Re-catheterization

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Abstract : **A total of 90 post-operative gynecological patients who needed residual urine measurement were studied in the Department of Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, Mahidol University, between June 1, 1999 and April 30, 2000. Residual urine of each patient was measured by normal saline instillation technique, followed by re-catheterization which was considered as the gold standard. The accuracy and agreement of the results of residual urine measurement by the two techniques were calculated. In comparison with re-catheterization, the accuracy of the normal saline instillation technique was 83.3%, with 66.7% sensitivity, 96.1% specificity, 92.8% positive predictive value, 79% negative predictive value, 3.9% false positive rate, and 33.3% false negative rate. The Kappa coefficient was 0.65 ($P < 0.001$). No complications from either technique were found. Residual urine measurement in post-operative gynecological patients by normal saline instillation yielded fair to good agreement with re-catheterization. Due to a high percentage of false negative rate, this new method may not be suitable for current clinical practice. Improvement of the technique and further studies are needed.**

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เรื่องย่อ : **ความถูกต้องแม่นยำของการวัดปริมาณปัสสาวะที่เหลือค้างหลังการถ่ายปัสสาวะในผู้ป่วยที่ได้รับการผ่าตัดทางนรีเวช เปรียบเทียบวิธีใส่น้ำเกลือกับวิธีสวนวัดจริง**

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**ภาควิชาสูติศาสตร์-นรีเวชวิทยา, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพมหานคร 10700.*

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ทำการศึกษาผู้ป่วยหลังผ่าตัดทางนรีเวชจำนวน 90 ราย ที่หลังผ่าตัดต้องได้รับการวัดปริมาณปัสสาวะที่เหลือค้างหลังถอดสายสวนปัสสาวะที่ภาควิชาสูติศาสตร์-นรีเวชวิทยา คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล ระหว่างวันที่ 1 มิถุนายน 2542 – 30 เมษายน 2543 โดยวัดปริมาณปัสสาวะที่เหลือค้างด้วยวิธีใส่น้ำเกลือ จากนั้นวัดด้วยวิธีสวนวัดจริงในผู้ป่วยคนเดียวกัน โดยถือว่าวิธีสวนวัดจริงเป็นวิธีมาตรฐาน (gold standard) คำนวณค่าความถูกต้องแม่นยำ และค่าความสอดคล้องของการวัดปริมาณปัสสาวะที่เหลือค้างของทั้งสองวิธี ผลการวัดปริมาณปัสสาวะที่เหลือค้างด้วยวิธีใส่น้ำเกลือเมื่อเทียบกับวิธีสวนวัดจริง พบว่ามีค่าความถูกต้อง ร้อยละ 83.3 ความไว ร้อยละ 66.7 ความจำเพาะ ร้อยละ 96.1 ค่าทำนายผลบวก ร้อยละ 92.8 ค่าทำนายผลลบ ร้อยละ 79 ผลบวกลวง ร้อยละ 3.9 ผลลบลวง ร้อยละ 33.3 ค่าความสอดคล้องระหว่างสองวิธีเมื่อนำมาวิเคราะห์โดยวิธีแคปป้าเท่ากับ 0.65 ($P<0.001$) ไม่พบภาวะแทรกซ้อนจากการวัดทั้งสองวิธี การวัดปริมาณปัสสาวะที่เหลือค้างหลังการถ่ายปัสสาวะในผู้ป่วยหลังผ่าตัดทางนรีเวชด้วยวิธีใส่น้ำเกลือเมื่อเทียบกับวิธีสวนวัดจริง มีความถูกต้องแม่นยำดีพอสมควร แต่เนื่องจากมีผลลบลวงที่ค่อนข้างสูง วิธีใหม่นี้จึงยังไม่เหมาะสมที่จะนำมาใช้แทนวิธีสวนวัดจริงในทางปฏิบัติ ควรมีการปรับปรุงวิธีการวัดเพื่อให้ได้ผลที่มีความถูกต้องแม่นยำมากยิ่งขึ้น และมีการศึกษาเพิ่มเติมต่อไป

INTRODUCTION

Disorders of micturition have become important urological complications of some gynecological procedures such as radical hysterectomy, vaginal hysterectomy, and/or anterior colporrhaphy with posterior colpoperineorrhaphy (A-P repair). The pathophysiological mechanisms responsible for changes in lower urinary tract function after radical hysterectomy are due to changes in the musculo-elastic properties of the bladder wall and damage to the neural innervation[1-5], and those of vaginal hysterectomy and/or A-P repair are due to reflex urethral spasm and local post-surgical edema.[6-8] Insertion of an indwelling transurethral catheter for a period of time is essential for these patients after the above procedures. At the time that the transurethral catheter is removed, a residual urine measurement is required to assess the adequacy of bladder emptying. A residual urine of more than 100 ml is considered abnormal and leads to re-catheterization with an indwelling catheter for 3-5 consecutive days.[1]

It has been believed that catheterization values are accurate[9] and they constitute the standard with which procedures that are supposedly less invasive have been compared.[10-17] However, catheterization may be uncomfortable for the patient and cause urinary tract infection or urethral trauma.[18]

To avoid the disadvantages of re-catheterization, normal saline bladder instillation has been used in some institutions to assess the residual urine which is the discrepancy between the instillation and voiding volume. However, no study has been carried out to compare the accuracy of this technique with that of re-catheterization. The purpose of this study was to evaluate the accuracy of residual urine measurement by normal saline instillation and re-catheterization in post-operative gynecological patients, who needed residual urine measurement.

MATERIALS AND METHODS

From June 1, 1999-April 30, 2000; 90 consecutive post-operative gynecological patients, who needed residual urine measurement after the removal of transurethral catheter, were evaluated. Patients with a history of recurrent urinary tract infection or concomittent urinary tract injury during the gynecological procedures were excluded. On the day of transurethral catheter removal, 200 ml of normal saline solution or less, if the patient had a strong desire to void, was instilled into the bladder through the indwelling transurethral catheter. The volume was recorded and then the catheter was removed. The patient was asked to void immediately and the voiding volume was measured and recorded. The residual urine was the discrepancy between the instillation and voiding volume. Residual urine measurement was then performed in the same patient by the re-catheterization technique. After 2 spontaneous emptyings, the patient was immediately catheterized with a lubricated 12F Nelaton catheter for residual urine measurement in a routine sterile fashion. An indwelling transurethral catheter was reinserted if the residual urine determined by re-catheterization was more than 100 ml or the patient could not void within 6 hours after the removal of the catheter. Residual urine measurement by re-catheterization was used as the "Gold Standard". A residual urine volume of $\leq$ 100 ml would be defined as "Negative", while that of > 100 ml was classified as "Positive".

The residual urine measurement by the normal saline instillation technique was related to that of re-catheterization by contingency table methods and evaluated for significance by Chi-square analysis. The agreement of the results was calculated using the Kappa coefficient. A p value < 0.05 was considered significant.

RESULTS

The patients' ages ranged from 29-80 years with a mean age of 54.4 ± 13.7 years. Almost all the patients (98.9%) were multiparous and nearly 60 percent were in the postmenopausal period. Since the most common diagnosis of these patients was uterine prolapse, vaginal hysterectomy with A-P repair was the most common gynecological procedure performed, followed by radical hysterectomy for stage I cervical cancer. The duration of indwelling transurethral catheter was 3-7 days in most of the patients (82.2%) (Table 1).

Comparison of residual urine measurement by normal saline instillation and re-catheterization is shown in Table 2. The sensitivity and specificity were 66.7% (95%CI = 49.7-80.4) and 96.1% (95%CI = 85.4-99.3), respectively. The positive predictive value of the procedure was 92.8% (95%CI = 75.0-98.8) and the negative predictive value of the procedure was 79% (95%CI = 66.5-87.9) with a false positive and negative rate of 3.9% and 33.3 %, respectively. There was significant agreement in the results of residual urine measurement by the two techniques (Kappa coefficient = 0.65, $P < 0.001$).

DISCUSSION

Some gynecological procedures, such as radical hysterectomy, vaginal hysterectomy and/or A-P repair have documented adverse effect on the function of lower urinary tract.[1-8] Measurement of post-micturition bladder volume or residual urine is important in the assessment of voiding disorders. A catheterized residual urine sample is accepted as reliable and useful in the assessment of many urological problems[9]. It is, indeed, the standard against which other modalities are compared, such as the phenolsulfonephthalein excretion test[10], post-voiding intravenous radiographs[11], percussion, palpation and ultrasonography.[12-17] Although catheterization is the

Table 1. Patient characteristics.

	Number	Percent
Parity		
0	1	1.1
1	33	36.7
≥ 2	56	62.2
Status		
Premenopause	38	42.2
Postmenopause	52	57.8
Diagnosis		
Stage I cervical cancer	30	33.3
Uterine prolapse	41	45.6
Cysto-rectocele	18	20.0
Vagino-cutaneous fistula	1	1.1
Gynecologic procedure		
Radical hysterectomy	30	33.3
Vaginal hysterectomy with A-P repair	38	42.3
A-P repair	20	22.2
Vaginal hysterectomy	1	1.1
Fistulectomy	1	1.1
Duration of indwelling transurethral catheter		
3-7 days	74	82.2
8-10 days	16	17.8

Table 2. Contingency table arranged to show the prediction potential of residual urine measurement by the normal saline instillation technique.

	Re-catheterization		Total
	> 100 ml (Positive)	≤ 100 ml (Negative)	
> 100 ml (Positive)	26	2	28
≤ 100 ml (Negative)	13	49	62
Total	39	51	90

*Sensitivity 66.7% (26/39), specificity 96.1% (49/51), positive predictive value 92.8% (26/28), negative predictive value 79% (49/62).

most accurate method of assessing residual urine volumes, it may be uncomfortable for the patient and cause urinary tract infection or urethral trauma.[18] Ultrasonography now provides a possible alternative method for estimating bladder volume non-invasively but a review of the published results of this technique presents a confusing picture, particularly with low residuals.[12-17]

Normal saline bladder instillation before the removal of transurethral catheter is simple and has been used in some institutes to assess the residual urine. However, it is not a physiological state since the bladder is filled with a large amount of fluid (200 ml of normal saline solution) within a short period of time. The ability to confirm this measurement in patients avoids the discomfort and the risks of urethral trauma and urinary tract infection from re-catheterization. In our study, although normal saline instillation yielded fair to good accuracy and agreement with re-catheterization, it may not be suitable for clinical practice due to its low sensitivity and high false negative rate. The rapid distension of the bladder wall by the instillation technique may contribute to the inadequacy of bladder emptying in this study. If one believes the result of normal saline instillation, the patient may have the transurethral catheter removed before the bladder has really returned to proper function, which leads to urinary retention and subsequent urinary tract infection.

CONCLUSION

Normal saline bladder instillation should not be used instead of re-catheterization for the measurement of residual urine, due to its low sensitivity and high false negative rate.

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