Research

Translating an Evidence-Based Algorithm to Decrease Early Post-Operative Urinary Retention After Urogynecologic Surgery

Barbara L. Buchko, Leslie E. Robinson, and Theodore D. Bell

Buchko, B.L., Robinson, L.E., & Bell, T.D. (2013). Translating an evidence-based algorithm to decrease early post-operative urinary retention after urogynecologic surgery. *Urologic Nursing, 33*(1).

The implementation of an evidence-based algorithm along with comprehensive nursing education supports effective clinical decision-making in the prevention of post-operative urinary retention and bladder distention for women who have undergone urogynecologic surgery.

Key Words: **Urinary bladder, urinary retention, postoperative complications, algorithms.**

Urinary retention with bladder distention is a common complication following urogynecologic surgery. Prevention of bladder distention from post-operative urinary retention (POUR) can lead to safer patient care and improved surgical outcomes. Although POUR is recognized as a complication of urogynecologic surgery, published guidelines by professional organizations for the prevention and management of POUR were not found; however, recommendations for the development of clinical practice guidelines have been suggested (Ringdal, Borg, & Hellstrom, 2003; Rizvi, Khan, & Khan, 2005).

The need for standardized management of POUR for women undergoing urogynecologic surgery became apparent at the authors' 572-bed Magnet-designated community teaching hospital following the growth of the gynecologic surgery patient population. Within the first four months of providing post-operative care to this new patient population, a few patients experienced bladder distention, necessitating catheterization with volumes greater than 1,000 ml; one patient required surgical site repair. Nurses questioned variation in physician practice of post-operative bladder management when conflicts arose regarding nurses' recognition and clinical decision-making surrounding bladder distention. In addition, physician orders included the use of bladder ultrasound for bladder assessment. Nurses at the authors' facility had limited experience with the use of the portable bladder ultrasound scanner. These concerns led these nurses and physicians to identify the need for evidence-based standardized management of early POUR to guide timely nurse decision-making at the bedside and ultimately support safe patient outcomes.

Lewthwaite and Girouard (2006) published an algorithm using catheterization to measure post-void residual (PVR) following continence surgery. Use of the algorithm resulted in fewer catheterizations and a shorter length of hospitalization. An algorithm is an effective method to standardize clinical decision-making. The use of algorithms has been identified as an effective method to impart knowledge and guide clinical decision-making (Rathbun & Ruth-Sahd, 2009).

A study to determine health care providers' knowledge about bladder care reported unsatisfac-

Barbara L. Buchko, DNP, RN, *is Director of Evidence-Based Practice and Nursing Research, Department of Nursing, Wellspan Health/York Hospital, York, PA.*

Leslie E. Robinson, MD, *is Associate Residency Program Director, Department of Obstetrics and Gynecology, Wellspan Health, York, PA.*

Theodore D. Bell, MS, *is a Research Program Manager, Emig Research Center, Wellspan Health, York, PA.*

Acknowledgment: *The authors acknowledge the assistance of Deborah Fake, RN, and Faye Hammers, RN, in providing education to nurses. Thank you to Catherine Kelly for her personal assistance and encouragement in manuscript preparation.*

Research Summary

Background

Urinary retention can be a significant post-operative problem for women undergoing urogynecologic surgery. Bladder distention can lead to impaired bladder function, urinary tract infections, and disruption of surgical repair with impaired surgical outcomes.

Purpose

The purpose was to determine whether an evidence-based algorithm to manage post-operative urinary retention in women who have undergone urogynecologic surgery would prevent urinary retention and improve voiding efficiency.

Methods

A pre- and post-intervention comparative design was used to evaluate patient outcomes before and after nurse education and training, and the implementation of an evidence-based algorithm.

Results

There was a statistically significant improvement in voiding efficiency and a reduction in urinary retention with the use of the algorithm.

Conclusions

A nurse-driven, evidence-based algorithm can improve the efficiency of voiding, reduce urinary retention, and decrease the incidence of bladder distention among this population.

Level of Evidence – VI

(Polit & Beck, 2012)

tory levels of understanding. Specifically, nurses had insufficient knowledge about bladder capacity (Williams, Taylor, Bates, Tincello, & Richmond, 2003). Nurses must be well-informed about all aspects of bladder care to provide safe patient care. A post-void residual (PVR) measure is typically used to identify bladder function. Catheterization has been the gold standard for PVR measure; however, more recently, the use of bladder ultrasound has been found to be an effective, less invasive method of measurement. Studies have identified that nurses who receive education and training can safely and effectively use portable bladder ultrasound technology to measure bladder volume (Fedorkow, Dore, & Cotton, 2005; Frederickson et al., 2000; Keita et al., 2005; Lamonerie et al., 2004; Rosseland, Stubhaug, & Breivik, 2002). Use of a standardized evidence-based algorithm and nurse education and training may improve recognition and management of POUR.

Problem Statement

Nurses and physicians identified that management of POUR following urogynecologic surgery was inconsistent. Several patients experienced adverse outcomes, which confirmed the need for a standardized evidence-based protocol. In addition, nurses within the authors' organization had limited experience with the use of the bladder scanner. Physicians and nurses requested the implementation of a) a standard definition of urinary retention, b) a consistent protocol for voiding trials to minimize variation among practitioners, c) enhanced nursing knowledge and skill in use of the portable bladder ultrasound scanner, and d) consistent documentation of voiding trial results. A multidisciplinary team was formed to review the literature and develop an evidence-based algorithm to guide nurse decision-making (Buchko & Robinson, 2012).

Purpose of the Study

A pilot study was designed to determine whether comprehensive nurse education about POUR, use of bladder ultrasound, and implementation of an evidence-based algorithm could prevent POUR with bladder distention in women who have undergone urogynecologic surgery. The goals of standardizing practice were to decrease urinary retention and bladder distention, decrease the frequency of intermittent catheterizations, decrease the duration of continuous catheterization with an indwelling urethral catheter, decrease potential damage to surgical site, and use nursing time efficiently.

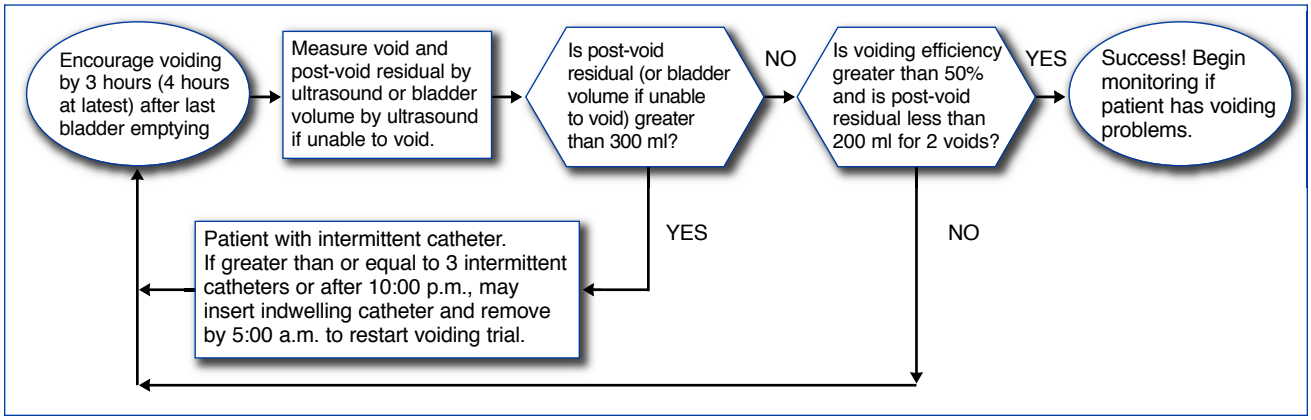
Research Question

Will the implementation of an evidence-based algorithm and comprehensive nurse education reduce the incidence of POUR in women undergoing urogynecologic surgery?

Conceptual Framework

The Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) model and guidelines were used to synthesize recommendations from the evidence (Dearholt & Dang, 2012). The JHNEBP model facilitates bedside nurses' translation of evidence into nursing practice. During the translation phase of the JHNEBP model and guidelines, recommendations from the evidence are implemented as a pilot study. Preliminary outcomes are evaluated and reported to organizational decision-makers for support to disseminate successful interventions internally. Following the steps of the JHNEBP guidelines, a multi-disciplinary team determined it was feasible to implement recommendations from the evidence into practice. Buchko and Robinson (2012) described the development of an evidence-based algorithm to enhance clinical decision-making for prevention and management of POUR for women following urogynecologic surgery.

Figure 1.
Urinary Retention Algorithm



Source: Buchko & Robinson, 2012, p. 264. Used with permission.

Methods

Research Design

A comparative descriptive design was used to evaluate patient outcomes before and after implementation of the algorithm and nurse education.

Sampling Strategy

Data were extracted by retrospective chart review. The criteria for subject enrollment included a) women who had undergone urogynecologic surgery between August 2005 and December 2006, including suburethral sling, Marshall-Marchetti-Krantz or Burch procedure, vaginal hysterectomy, and anterior and posterior colporrhaphy; b) surgery performed by a gynecologist; and c) women cared for on the postpartum-gynecologic unit after transfer from the post-anesthesia-care unit. Women whose surgery was performed by surgeons other than gynecologists and who were cared for on a unit other than the postpartum-gynecologic unit were excluded from the study.

An a priori power analysis was calculated using G*Power 3.1.2 computer software for an independent *t*-test using parameters for a two-tailed test, anticipating a medium effect, with an alpha of 0.05 and power of 0.80. A minimum of 64 trials were needed for each group for an optimal total sample size of 128.

Procedure

The multidisciplinary team designed an evidence-based algorithm to prevent and manage POUR in women following urogynecologic surgery (Buchko & Robinson, 2012). The algorithm defined urinary retention, PVR, voiding efficiency, when and how to assess the patient using bladder ultrasound, when to catheterize (either intermittent or continuous), and success (see Figure 1). The BladderScan BVI 3000 (diagnostic ultrasound), a portable bladder ultrasound, was used by nurses to measure bladder volume.

Training for Nurses

Nurses caring for women following urogynecologic surgery engaged in a one-hour in-service about nurse-driven management of POUR. The educational information included how to use the algorithm as well as physiology of the urinary tract, normal voiding function, post-operative voiding complications, techniques to monitor and diagnose malfunction of voiding process, how to measure for PVR, the concept of voiding efficiency, and use of ultrasound technology for monitoring voiding function. Skilled nurse peers observed clinical nurses' use of the portable bladder ultrasound scanner by return demonstration. Documentation of voiding trials was also emphasized. Physicians were made aware of the algorithm through departmental meetings and letters sent to their offices.

Implementing the Algorithm

To compare utility of the voiding trials algorithm, patients were divided into two groups according to whether they were cared for pre- or post-implementation of the voiding trials algorithm. Data collected included date and time of indwelling urethral catheter insertion (determined by 15 minutes prior to time of incision for initial catheterization); date and time of indwelling urethral catheter removal (determined by documented actual time or time of completion of surgery); date, time, and amount of each measured void; date, time, and amount of bladder ultrasound assessment for bladder volume either if patient unable to void or as PVR; and date, time, and amount of intermittent catheterization when required by algorithm decision points (Buchko et al., 2007). Voiding efficiency was determined by dividing the amount voided by the sum of the amount voided and PVR. This was reported as a percentage. Use of the algorithm was evaluated by reporting a) time to first void, b) measurement of PVR urine, c) urinary retention greater than 300 ml, d) use of intermittent

catheterization, e) measurement of voiding efficiency, and f) urinary retention greater than 500 ml.

General Analytic Strategies

Chi-square test or Fisher's exact test were used to test for significance for categorical variables. The pre- and post-intervention groups were unequal; therefore, the nonparametric alternative to the independent samples *t*-test, the Mann-Whitney *U*, was used to assess the difference between groups for continuous variables. Statistical significance is recognized as $p < 0.05$.

Results

A total of 56 women met inclusion criteria for the study. The average patient age was approximately 58 years. There were 15 women in the pre-implementation group representing 93 voiding trials and 41 women in the post-implementation group representing 219 voiding trials. Six women in the pre-implementation group (40%) and 6 women in the post-implementation group (14.6%; $p < 0.092$) required reinsertion of an indwelling urethral catheter; these reinsertions were considered new voiding trials. Although all patients had urogynecologic surgery, there were differences in the types of surgery between the groups. In the pre-implementation group, more patients had incontinence surgery (80%), whereas 66% of patients in the post-implementation group had incontinence surgery ($p = 0.5$). Pelvic reconstructive surgery was more prevalent in the post-implementation group (61%) compared to the pre-implementation group (27%, $p = 0.034$).

The average time to first void following removal of the indwelling urethral catheter increased with the new protocol; however, the time did not surpass the suggested goal of three to four hours following removal of the indwelling urethral catheter (see Table 1). Frequency of PVR urine measurement increased following implementation of the new protocol ($p = 0.001$) (see Table 2). Bladder ultrasound assessments that measured greater than 300 ml of retained urine without intermittent catheterization decreased following implementation of the algorithm. There were fewer intermittent catheterizations performed post-implementation (13.2%) compared to the pre-implementation group (20.4%). Mann-Whitney *U* test identified that voiding efficiency was less in the pre-implementation group compared to the post-implementation group (median 0.27 vs. 0.58, respectively; $p < 0.001$). There was more bladder distention in the pre-implementation group (10.8%) compared to the post-implementation group (2.7%, $p < 0.05$).

Fewer patients had reinsertion of an indwelling catheter (14.6%) following implementation of the algorithm compared to patients in the pre-implementation group (40%). In addition, there was no statistically significant difference in the length of time of continuous catheterization with an indwelling urethral catheter between the groups (see Table 2). The hospital length of stay increased significantly following implementation of the algorithm.

Table 1.
Descriptive Statistics for Outcomes

Measure	Pre-Intervention ($n = 15$)		Post-Intervention ($n = 41$)		*t*-Test
	M	SD	M	SD	*p*
Time to first void (minutes)	168.53	81.53	225.68	187.79	0.261
Lenth of time for indwelling urethral catheter (hours)	10.90	5.54	12.53	3.89	0.169
Length of stay (days)	0.87	0.52	1.48	0.68	0.003

Table 2.
Clinical Outcome Frequency

Measure	Pre-Implementation $n = 93$ Trials *n* (%)	Post-Implementation $n = 219$ Trials *n* (%)	*p*
PVR measured	47 (50.5)	155 (70.9)	0.001
Intermittent catheterization	19 (20.4)	29 (13.2)	0.107
Urinary retention greater than 300 ml	17 (18.3)	27 (12.3)	0.167
Urinary retention greater than 500 ml	10 (10.8)	6 (2.7)	0.008*

*Fisher's exact test.

Discussion

The goal of standardizing practice to decrease urinary retention and bladder distention was realized in this pilot study. Use of the algorithm was demonstrated by increased frequency of bladder assessment, less use of intermittent catheterization, and significant improvement in the prevention of bladder over distention (bladder volume over 500 ml). Lewthwaite and Girouard (2006) also documented a reduction in catheterization following implementation of a practice guideline for urinary drainage after surgery for urinary stress incontinence. Lewthwaite and Giruouard (2006) did not use bladder ultrasound to determine bladder volume but relied on

voided measurement and patient report of bladder sensation.

Although Fedorkow et al. (2005) found PVR results were not accurate with the bladder ultrasound, clinical experts from the authors' organization believed use of the portable bladder ultrasound would provide sufficient accuracy for early detection of urinary retention to prevent damaging bladder distention. Fedorkow et al. (2005) documented patient reports of higher pain levels with the use of bladder ultrasound compared to catheterization. Anecdotally, nurses from the authors' organization reported that patients requested the use of the bladder ultrasound over catheterization. Measurements for cost and nursing time were not collected; however, with fewer catheterizations, improvement in efficiency of nursing time can be anticipated (Teng, Huang, Kuo, & Bih, 2005) and also decrease cost as suggested by Frederickson et al. (2000).

The length of hospitalization increased in this study, whereas the study by Lewthwaite and Girouard (2006) demonstrated a shortened length of stay. The patient populations in the two groups of this study differed, with the post-implementation group having more complex surgery. The length of hospitalization is often shorter following incontinence surgery than for patients having pelvic reconstructive surgery. An increase in the length of stay in the post-implementation group is likely related to more women having pelvic reconstructive surgery.

Limitations

Although the results of the study demonstrated significant improvement in the prevention of bladder over distention, there were limitations of this study. Because this was a pilot study, there were insufficient numbers to demonstrate statistical significance for every outcome. In addition, a larger comparison group would give more meaning to the results. Ongoing analysis of the algorithm is recommended to determine sustainable change in practice and outcomes.

Only 56% of nurses attended the educational program, which was offered at eight different times during the day and evening shifts over two months. For implementation to be successful, every nurse must understand and use the voiding trial algorithm. Since attendance of the educational program was limited, a computer-based training was designed, and completion became mandatory. This education evaluated nurses' knowledge of POUR through case studies that focused on the use of the algorithm in decision-making. In addition, a standardized physician order set was developed to formalize use of the algorithm for all patients having urogynecologic surgery.

Implications for Practice

Translating evidence-based guidelines for nurses to prevent and manage urinary retention and bladder distention for patients undergoing urogynecologic surgery was challenging. Stakeholder involvement was critical to the development and implementation of the algorithm. Nurse participation in education about the algorithm and clinical knowledge of POUR was fundamental to create a change in nursing practice and patient outcomes. Identifying barriers to implementation and sustainability of an evidence-based practice change should be part of the implementation plan. Sustainability of the practice change is anticipated with completion of mandatory computer-based training and leadership support.

Another barrier was the inconsistent documentation of both PVR and bladder assessment. Nurses reported that results were not recorded because the portable bladder ultrasound was not available when needed. Following identification of the problem, the nurse manager purchased a second bladder scanner.

Based on the JHNEBP model and guidelines, when outcomes of an evidence-based pilot study are favorable, the next step is to implement the recommendations more broadly, if appropriate (Dearholt & Dang, 2012). In the authors' hospital setting, the urogynecologic patient may be cared for on a general surgical unit; therefore, the hospital-wide Nursing Practice Council (shared decision-making structure) was approached to accept the voiding trial algorithm for use throughout the hospital. The request was met with approval and encouragement because the practice recommendation was based in evidence. In addition, because a majority of the findings from the literature were based on the general surgery population, the Nursing Practice Council also requested a change in nursing practice for all post-operative patients to prevent and manage POUR. One focused evidence-based practice project improved outcomes for women undergoing urogynecologic surgery and led to changes in care for all surgical patients within the authors' institution. ◙

References

Buchko, B.L., & Robinson. L.E. (2012). An evidence-based approach to decrease early post-operative urinary retention following urogynecologic surgery. *Urologic Nursing, 32*(5), 260-264, 273.

Buchko, B. L., Robinson, L. E., Douglass, P.H., Lawrence, J.J., Fake, D., Hammers, F., & Madigan, J. (2007). Exemplars: Prevention of post-operative urinary retention after uro-gynecologic surgery. In R.P Newhouse, S.L. Dearholt, S.S. Poe, L.C. Pugh, & K.M. White (Eds.), *Johns Hopkins nursing evidence-based practice model and guidelines* (pp. 182-186). Indianapolis, IN: Sigma Theta Tau International.

Dearholt, S.L., & Dang, D. (Eds.). (2012). *Johns Hopkins nursing evidence-based practice model and guidelines* (2nd ed.). Sigma Theta Tau International.

Fedorkow, D.M., Dore, S., & Cotton, A. (2005). The use of an ultrasound bladder scanning device in women undergoing urogynaecologic surgery. *Journal of Obstetrics and Gynaecology Canada, 27*(10), 945-948.

Frederickson, M., Neitzel, J.J., Miller, E.H., Reuter, S., Graner, T., & Heller, J. (2000). The implementation of bedside bladder ultrasound technology: Effects on patient and cost post-

operative outcomes in tertiary care. *Orthopaedic Nursing, 19*(3), 79-87. doi:10.1097/00006416-200019030-00012

G*Power (Version 3.1.2) [Computer software]. Retrieved from http://www.psycho.uni-duesseldorf.de/abteilungen/aap/gpower3/download-and-register

Keita, H., Diouf, E., Tubach, F., Brouwer, T., Dahmani, S., Mantz, J., & Desmonts, J. (2005). Predictive factors of early postoperative urinary retention in the post-anesthesia care unit. *Anesthesia Analog, 101,* 592-596. doi:10.1213/01.ANE.0000159165.90094.40

Lamonerie, L., Marret, E., Deleeuze, A., Lembert, N., Dupont, M., & Bonnet, F. (2004). Prevalence of postoperative bladder distension and urinary retention detected by ultrasound measurement. *British Journal of Anesthesia, 92*(4), 544-546. doi:10.1093/bja/aeh099

Lewthwaite, B., & Girouard, L. (2006). Urinary drainage following continence surgery: Development of Canadian best practice guidelines. *Urologic Nursing, 26*(1), 33-38.

Polit, D., & Beck, C. (2012). *Nursing research: Generating and assessing evidence for nursing practice* (9th ed.). Philadelphia: Wolters Kluwer/Lippincott, Williams & Wilkins.

Rathbun, M.C., & Ruth-Sahd, L.A. (2009). Algorithmic tools for interpreting vital signs. *Journal of Nursing Education, 48*(7), 395-400.

Ringdal, M., Borg, B., & Hellstrom, A. (2003). A survey on incidence and factors that may influence first postoperative urination. *Urologic Nursing, 23*(5), 341-354.

Rizvi, R.M., Khan, Z.S., & Khan, Z. (2005). Diagnosis and management of postpartum urinary retention. *International Journal of Gynecology and Obstetrics, 91,* 71-72. doi:10.1016/j.ijgo.2005.06.025

Rosseland, L.A., Stubhaug, A., & Breivik, H. (2002). Detecting postoperative urinary retention with an ultrasound scanner. *Acta Anaesthesiologica Scandinavica, 46,* 279-282. doi:10.1034/j.1399-6576.2002.t01-1-460309.x

Teng, C., Huang, Y., Kuo, B., & Bih, L. (2005). Application of portable ultrasound scanners in the measurement of post-void residual urine. *Journal of Nursing Research, 13*(3), 216-223.

Williams, A., Taylor, K., Bates, C., Tincello, D.G., & Richmond, D.H. (2003). Knowledge of female bladder care among medical staff, nurses and midwives: Results of a questionnaire survey. *British Journal of Urology, International*, *91*, 208-210. doi:10.1046/j.1464-410X.2003.03080.x