International Journal of Clinical Urology
2024; Vol. 8, No. 1, pp. 4-11
https://doi.org/10.11648/j.ijcu.20240801.12

Methodology Article

Rate of Post Obstructive Diuresis in Rapid Versus Gradual Bladder Decompression in Patients with Chronic Urinary Retention

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Abstract

Background: Post-obstructive diuresis (POD) is a polyuric state in which copious amounts of salt and water are eliminated the relief of a urinary tract obstruction. POD is a clinical diagnosis based on urine output exceeding 200 mL per hour for two or more consecutives hours or 3L in 24 hours after decompressing an obstructed bladder, bilateral ureteric obstruction or ureteric obstruction in a solitary kidney. Methodology: This was a prospective, randomized study in which patients with chronic urinary retention were randomized into two groups: A and B. Group A had rapid urinary decompression with 18Fr urethral catheter attached to a urine bag, while group B had gradual decompression using a urethral catheter attached to an intravenous fluid giving set which was then attached to urine bag. Post obstructive diuresis in each group were assessed at designated times. Data Analysis and Result Presentation: Data was analyzed using the Statistical Package for Social Sciences (IBM) SPSS version 21. Data was summarized by descriptive statistics. The two arms were compared for similarities in demographic variables. Continuous and categorical variables were compared using student t- test and Pearsons‘ Chi – square respectively. Significant p value was 0.05. Result: Sixty patients were recruited into the study and randomized into group A (rapid urinary decompression) and B (gradual urinary decompression) with 30 patients in each group. Thirteen patients (43.33%) had post obstructive diuresis

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Received: 27 January 2024; **Accepted:** 5 February 2024; **Published:** 10 May 2024

in group A compared to 15 patients (50%) in group B. p value of 0.584. Diuresis resolved within 24 hours in 9 patients (30%) in group A and 11 patients (36.7%) in group B. p value of 0.999. The mean reduction in systolic blood pressure was 8.21 ± 2.63mmHg in group A and 7.63 ±2.14mmHg in group B. p value of 0.583. The mean reduction diastolic blood pressure was 3.84 ±1.31mmHg in group A and 3.41 ±1.16mmHg in group B. P value of 0.624. No patient in both groups developed hypotension (BP of <90/60). Conclusion: There was no statistically significant different in post obstructive diuresis. However, over 46.7% of patients had diuresis in both groups without any one developing hypotension. This may be due to routine prophylactic fluid and electrolyte replacement using normal saline.

Keywords

Chronic Urinary Retention (CUR), Bladder Outlet Obstruction (BOO), Benign Prostatic Hyperplasia (BPH), Rapid Bladder Decompression, Gradual Bladder Decompression

1. Introduction

1.1. Background

Urinary retention is the inability to voluntarily empty the urinary bladder of urine. [1]

Retention can be acute, chronic or acute-on-chronic. Acute urinary retention (AUR) is a sudden onset of inability to void associated with suprapubic pain which is relieved by draining of the bladder. [2]

The International Continence Society defines chronic urinary retention (CUR) as painless retention associated with increased volume of residual urine and bladder that remains palpable or percussible after voiding. [3] The American Urological Association (AUA) Quality Improvement and Patient Safety Committee defined CUR as an elevated post-void residual urine volume (PVR) of greater than 300mls that has persisted for at least six months documented on two or more separate occasions in patients who are not in total retention. [4] Urine volume of 500 to 800 mls is typical of acute retention, while >800 mls is common with chronic retention. [2, 4]

Initial management of chronic urinary retention is the drainage of the bladder by urethral catheterization and if this fails then by urinary diversion such as suprapubic cystostomy. [5] The method of relief of CUR has been debated for decades. The two primary methods of emptying the obstructed bladder are rapid and gradual emptying.

Relief of CUR may be associated with diuresis, hypotension and electrolyte derangement. [6]

Post-obstructive diuresis (POD) is a polyuric state in which copious amounts of salt and water are eliminated after the relief of a urinary tract obstruction. The incidence of POD is unclear but estimates suggest 0.5% to 52% of patients will experience it after urinary bladder decompression. [6] POD is a clinical diagnosis based on urine output exceeding 200 mL per hour for two or more consecutives hours or 3L in 24 hours after decompressing after decompressing an obstructed bladder, bilateral ureteric obstruction or unilateral ureteric obstruction in a solitary kidney. [7]

Diuresis may be a normal physiologic response to help eliminate excess volume and solutes accumulated during the prolonged obstruction. In most patients, the diuresis will resolve once the kidneys normalize the volume and solute status and homeostasis is achieved. Some patients will continue to eliminate salt and water even after homeostasis has been reached, this is referred to as pathologic POD. These patients are at risk of severe dehydration, electrolyte imbalances, hypovolemic shock, and even death. [7] Numerous mechanisms have been proposed to describe the pathophysiology of POD, which include a progressive reduction in the medullary concentration gradient secondary to vascular washout, down-regulation of sodium transporters in the thick ascending loop of Henle, reduction in glomerular filtration rate which leads to ischemia and loss of juxtamedullary nephrons and reduced response of the collecting duct to circulating antidiuretic hormone, leading to nephrogenic diabetes insipidus. [7] The likely cause is a combination of all these mechanisms.

There are very few clinical markers that help predict which individuals with physiologic POD we progress to pathologic POD. There is no correlation between initial creatinine values, urea values, electrolyte values, creatinine clearance, or presence of hypertension with the severity of diuresis. [8] Some studies have found that the presences of renal insufficiency, heart failure or evidence of volume overload are risk factors for developing substantial POD. [8]

1.2. Justification for the Study

Chronic urinary retention is a common presentation in surgical practice. Although the incidence is not well documented, anecdotally, 1-2 cases are seen per week. The initial management usually requires urethral catheterization to decompress the bladder.

The anticipatory admission for observation for occurrence of post obstructive diuresis; or their actual occurrence often

increases the length of hospital stay and thus the cost of management. There is no specific protocol/guideline for managing patients with CUR in our setting.

The current practice in our center is such that patients presenting in chronic urinary retention are relieved of such retention and allowed to go home except for those that have suprapubic cystostomy and some who are given anticipatory admission on account of clinical findings that were thought to predispose the patient to post obstructive diuresis, hypotension and electrolyte derangement.

This proposed study will help to determine the safe method of urinary bladder decompression. The results obtained would add to our scientific knowledge, improve our outcomes, contribute to best practice and help in establishing a protocol in the initial management of our patients with CUR which can then contribute to global scientific knowledge and also form a basis for further clinical research.

1.3. Aim and Objectives

1) To determine the rate of development of diuresis following rapid versus gradual bladder decompression in patients with CUR.
2) To determine the rate of development of hypotension following rapid versus gradual bladder decompression in patients with cur.

1.4. Research Question

Is there any significant difference in post obstructive diuresis after the relief of CUR either by gradual or rapid urinary bladder decompression?

1.5. Hypothesis

1.5.1. Null Hypothesis

There is no difference in post obstructive diuresis after gradual versus rapid urinary bladder decompression in patients with chronic urinary retention.

1.5.2. Alternative Hypothesis

There is difference in post obstructive diuresis after gradual versus rapid urinary bladder decompression in patients with chronic urinary retention.

2. Methodology

The study was a prospective, hospital-based, randomized comparative clinical study. Simple randomization was used. Patients were randomized to rapid (Group A) or gradual (group B) decompression by balloting. Each patient picked from an envelope which contains equal numbers of ballot papers labeled A and B and then assigned to the group corresponding with the letter on their ballot paper.

Indwelling size 18Fr urethral catheter was used to decompress the bladder in an aseptic technique after prophylactic antibiotics and lubrication with 10mls of 2% xylocaine gel.

For rapid decompression (Group A), the bladder was drained completely by placing the drainage bag at a level of about 50cm lower than the bladder. The volume was assessed using a calibrated container.

For gradual decompression (Group B), the bladder was drained gradually by using an intravenous (IV) giving set as described by Perry et al. [9] An intravenous infusion giving set was connected between the urethral catheter and the drainage bag. The urine was drained gradually by the roller of the giving set which was used to control the rate of drainage at 100mls/min for every 2 minutes and then stopped for 5 minutes until the bladder was completely drained. [10]

Urine volume after decompression was noted and hourly urine output for the first 24 hours was recorded. Patients were placed on intravenous normal saline 1liter 8hourly, intravenous ciprofloxacin 200mg 12hourly.

Blood pressure was measured before decompression then hourly for twenty-four hours.

2.1. Study Duration

The study was carried out between 2019 and 2021. Entry point was at the time of presentation at emergency/urology clinic before urethral catheterization to 24 hours after catheterization.

2.2. Sample Size Determination

The incidence of post decompressive complications could be up to 52%. [13] In this study, 70% reduction in complication rate from 52% to 15% with gradual bladder decompression will be regarded as being clinically significant. At a power of 80% and a significance level of 5%, sample size will be calculated using the formula for the sample size for comparison of two proportions as follows; [11]

$$n = \frac{2(Z\alpha + Z\beta)^2 P(1-P)}{(P1 - P2)^2}$$

Where n = the sample size required in each group (double this for total sample)

P1 = first proportion – here 0.52

P2 = second proportion – here 0.15

P1 – P2 = size of difference of clinical importance – here 0.37

P = Pooled occurrence = prevalence in case group (P_1) + Prevalence in control group(P_2)/2= (0.52 + 0.15) /2 = 0.335

Z_α= the desired significance level – here 1.96(from Z table at type 1 error of 5%)

Z_β= the desired power – here 0.842(from Z table at 80% power)

Thus,

$$n = \frac{2[1.96 + 0.842]^2 0.335(1 - 0.335)}{0.37^2} = 25.55$$

Giving a 15% attrition rate was considered for patients who voluntarily withdraw or were lost to follow up

Estimated sample size = 25.55 + 3.833= 29.42

A sample size of 60 participants (30 in each group) would be recruited.

3. Data Analysis

Data gathered with the aid of the questionnaire was entered into the Statistical Package for Social Sciences software (SPSS version 21) for analysis. Categorical variables was computed with Chi-square, continuous variables was analyzed with student's t-tests as appropriate. Result of analysis was presented with the aid of bar charts and tables for clarity. p value was considered significant at < 0.05.

4. Results

Comparison of demographic characteristics among the groups.

The mean age of the patients recruited into group A was 68.50 ± 14.77 years while that of group B was 73.33 ± 13.19 years. P value = 0.187.

Comparison of duration of symptoms and initial volume of urine drained among the groups.

Sixty patients were recruited into the study with 30 patients in each group.

The mean duration of symptoms was 3.60 ± 1.69 months for patients in group A and 4.83 ± 4.69 months for patients in group B. P value = 0.181. The mean initial volume of urine drained from patients in group A was 1657.33 ± 612.06mls (range 800 – 3000mls) and 2376.67 ±1445.07mls (range 1000 – 6700mls) for patients in group B. Table 1.

Causes of urinary retention among the groups

58 patients studied had enlarged prostate while 2 patients had neurogenic bladder. Figure 1. Patients's presentation

45 patients presented with acute on chronic retention while 15 patients presented with overflow incontinence.

Comparison of rate of post obstructive diuresis among the groups.

Thirteen patients (43.33%) had post obstructive diuresis in group A. Diuresis resolved within 24 hours in 9 patients (30%) but persistent more than 24 hours in 4 patients (13.3%). In group B, 15 patients (50%) developed post obstructive diuresis which resolved within 24 hours in 11 patients (36.7%) and persisted more than 24 hours in 4 patients (13.3%). P value = 0.584. Table 2. Comparison of hypotension among the groups.

The mean reduction in systolic blood pressure was 8.21 ± 2.63mmHg in group A and 7.63 ± 2.14mmHg in group B. p value of 0.583. The mean reduction in diastolic blood pressure was 3.84 ± 1.31mmHg in group A and 3.41 ± 1.16mmHg in group B. P value of 0.624. No patient in both groups developed hypotension (BP of <90/60). Table 3.

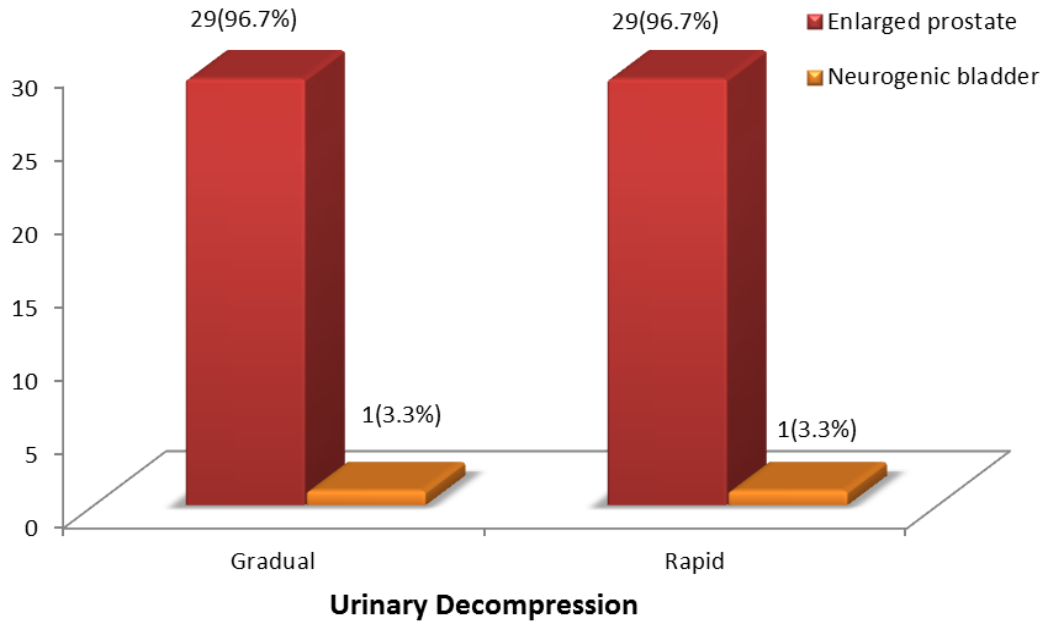

Figure 1. *Causes of urinary retention among the groups.*

Table 1. Comparison of duration of symptoms and initial volume of urine drained among the groups.

Variables	Urinary Decompression		χ^2/t	P
	Rapid (%)	Gradual (%)		
Duration of symptoms (months)			3.267	0.352
< 3	7 (23.3)	5 (16.7)		
3 – 6	17 (56.7)	13 (43.3)		
7 – 12	4 (13.3)	6 (20.0)		
≥ 12	2 (6.7)	6 (20.0)		
Mean ± SD	3.60 ± 1.69	4.83 ± 4.69	1.353	0.181
Volume of urine			8.184	0.085
< 1000	3 (10.0)	0 (0.0)		
1000 – 2000	18 (60.0)	16 (53.3)		
200I – 3000	8 (26.7)	7 (23.3)		
3001 – 4000	1 (3.3)	3 (10.0)		
≥ 4000	0 (0.0)	4 (13.3)		
Mean ± SD	1657.33 ± 612.06	2376.67 ± 1445.07	2.511	0.015

Table 2. Comparison of rate of post obstructive diuresis among the groups.

Post Obstructive Diuresis	Urinary Decompression		χ^2	P
	Rapid n=30 (%)	Gradual n=30 (%)		
Post decompressive diuresis	13 (43.33%)	15 (50%)	0.300	0.584
Resolved within 24 hours	9 (30.0)	11 (36.7)	0.001	0.999
Persisted more than 24 hours	4 (13.3)	4 (13.3)		

Table 3. Comparison of mean post decompressive blood pressure among the groups.

Variables	Urinary Decompression	Rapid (%)	*T*	P
	Rapid (%)			
Mean reduction in systolic BP	8.21 ± 2.63	7.63 ± 2.14	0.850	0.583
Mean reduction in diastolic BP	3.84 ± 1.31	3.41 ± 1.16	0.721	0.624
Post decompressive Hypotention	0 (0.0)	0 (0.0)		

5. Discussion

Chronic urinary retention is a common urological emergency which occurs in 2–7 men per 1,000. [12, 13] The incidence is not well documented in women because symptoms of incomplete emptying and obstructed flow do not reliably predict CUR in them. [14, 15] It is more than ten times commoner in men than in women and the incidence increases with age. Men in their seventy years of age are five times

more at risk than men in their forty years of age. [16] This is similar to our study in which most of the patients are elderly.

The most common cause irrespective of the age is bladder outlet obstruction, [2] the aetiology of which may be enlargement of the prostate gland (benign or malignant), drugs (e.g. anticholinergics, antispasmodics), congenital deformities (e.g. meatal stenosis, posterior urethral valves) or urethral strictures (from trauma or infection). [16, 17]

Our study corroborates this. 96.7% of the patients had enlarged prostate while 3.3% had neurogenic bladder.

Patients with chronic urinary retention may present with complete lack of voiding (acute-on-chronic retention), incomplete bladder emptying, overflow incontinence, urinary tract infection, urinary tract stones, urosepsis or obstructive uropathy. Majority of our patients (75%) had acute on chronic retention while the remaining patients (25%) had overflow incontinence.

The resultant functional and anatomical changes within the urinary tract termed obstructive uropathy ranked 11th among causes of death due to kidney and urologic diseases. It also ranked 9th in terms of cost of all kidney and urological diseases in the USA, as estimated by the National Institute of Health (NIH) and Kidney and Urologic Diseases Advisory Board (KUDAB) study. [18] The incidence and economic implication are not known in our setting; however, it is nonetheless a commonly encountered urological problem. [2]

In this study, initial mean volume of urine drained among patients that had rapid urinary decompression was 1657.33 ± 612.06mls (range of 800 – 3000mls) and 2376.67 ±1445.07mls for patients that had gradual urinary decompression (range 1000 – 6700mls). The difference is likely to be due to lack of clear demarcation between complete emptying of the bladder and onset of post obstructive diuresis in gradual decompression. This is similar to mean urine volume of 2400mls reported by O'Reilly *et al.* [19] and slightly higher than what was reported by other studies. [4, 10] Boettcher *et al.* [10] reported a mean volume of 1089 ± 469mls (range of 200 – 2,800mls) in rapid decompression and 1260.9 ± 671mls (range 300 – 4,100mls) in gradual decompression.

Post obstructive diuresis is a polyuric state with urine output of 200/h for two or more consecutive hours following urinary decompression. The reported incidence of post-obstructive diuresis has a wide variation ranging from as low as 0.5% and to as high as 78%. [13, 19-21]

In this study, total of 28 patients (46.67%) developed POD. Thirteen patients (43.33%) had post obstructive diuresis in group A compared to 15 patients (50%) in group B. p value of 0.584. Diuresis resolved within 24 hours in 9 patients (30%) in group A and 11 patients (36.7%) in group B. p value of 0.999. This correlate with other similar studies. [6, 13, 22-24] There was no statistically significant difference in the rate of diuresis following rapid versus gradual urinary decompression. However, 46.7% of patients in both groups had post obstructive diuresis These patients are at risk of severe dehydration, electrolyte imbalances, hypovolemic shock, and even death. [7]

Excessive fluid loss and sudden reduction in bladder wall tension reflexly producing vasodilatation with a concomitant decrease in blood pressure and excessive fluid loss from POD can result in hypotension. [8] Many studies have reported Hypotension and circulatory collapse complicating drainage of chronic urinary retention. [7, 8, 25]

In this study, the mean reduction in systolic blood pressure was 8.21 ± 2.63mmHg in group A and 7.63 ± 2.14mmHg in group B. p value of 0.583. The mean reduction in diastolic blood pressure was 3.84 ± 1.31mmHg in group A and 3.41 ± 1.16mmHg in group B. P value of 0.624. No patient in both groups developed hypotension or circulatory collapse (BP of <90/60). This may be due to routine admission and maintenance intravenous fluid giving to all patients with CUR.

6 Conclusion

There was no statistically significant different in post obstructive diuresis. Though 46.7% of patient had post obstructive diuresis in both groups without any one developing hypotension. This may be due to routine maintenance fluid and electrolyte replacement using normal saline. We recommend prophylactic maintenance fluid and electrolyte administration using intravenous normal saline for all patients being decompressed of CUR irrespective of method of decompression, this may reduces the risk of hypotension and circulatory collapse.

Abbreviations

AUR: Acute Urinary Retention
CUR: Chronic Urinary Retention
BOO: Bladder Outlet Obstruction
BPH: Benign Prostatic Hyperplasia
SPSS: Statistical Package for Social Sciences
PVR: Post Void Residual
FR: French
ERC: Ethical Review Committee

Ethical Clearance

Ethical clearance was obtained from the Ethical Review Committee (ERC) of the UITH, Ilorin, as part of part-two fellowship dissertation study of National Post Graduate Medical College of Nigeria titled 'Comparison of post decompressive complications in rapid versus gradual bladder decompression in patients with chronic urinary retention' with approval number ERC PAN/2018/11/1845. The intent and importance of the study were explained to all patients and only those that consented to participate in the study were recruited.

Author Contributions

Peter Olalekan Odeyemi: Conceived the study, manuscript writing, literature search, data collection, data analysis.

Najeem Adedamola Idowu: Data collection, literature search.

Is'haq Ishola Aremu: Litrature search, Manuscript writing.

Musa Ayinde: Litrature search, Manuscript writing.

Olusola Oyewole Oladosu: Litrature search, Manuscript writing.

Olaolu Olusegun Olanipekun: Litrature search, Manuscript writing.

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Olalere Ayankemi Adenike: Litrature search, Manuscript writing.

Stephen Ishola Adedokun: Litrature search, Manuscript writing.

Olusola Tunde Ekunnrin: Litrature search, Manuscript writing.

Wakeel Okanlawon Muritala: Litrature search, Manuscript writing.

Olusola Olateju Akanbi: Litrature search, Manuscript writing.

Funding

The study was funded by the researcher. There was no additional cost to the patient/care giver.

Data Availability Statement

Available on request.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Negro C. L. A, Muir G. H; Chronic urinary retention in men: How we define it, and how does it affect treatment outcome. BJU Int. 2012; 110: 1590–1594.

[2] Muhammed A, Abubakar A. Pathophysiology and management of urinary retention in men. Arch Int Surg. 2012; 2(2): 63-69.

[3] Abrams P, Cardozo L, Fall M, Griffiths D, Rosier P, Ulmsten U, et al. The standardization of terminology in lower urinary tract function: report from the standardization sub-committee of the International Continence Society. Urology. 2003; 61(1): 37-49.

[4] Stoffel J. T, Peterson A. C, Sandhu J. S, Suskind A. M, Wei J. T, Lightner D. J. AUA White Paper on Non neurogenic Chronic Urinary Retention: Consensus Definition, Treatment Algorithm, and Outcome End Points. J Urol 2017; 198: 153–160.

[5] Sliwinski A, D'Arcy F. T, Sultana R, Lawrentschuk N. "Acute urinary retention and the difficult catheterization: current emergency management". Eur J Emer Medicine. 2016; 23(2): 80–88.

[6] Nyman M. A, Schwenk N. M, Silverstein M. D. Management of urinary retention: rapid versus gradual decompression and risk of complications. Mayo Clin Proc 1997; 72(10): 951-956.

[7] Pais V. M, Strandhoy J. W, Assimos D. G. Pathophysiology of urinary tract obstruction. Campbell-Walsh Urology. 2007; 2: 1195-1226.

[8] Collin H, Trustin D. Post obstructive diuresis; Pay close attention to urinary retention. Can. Fam. Phy. 2015; 61(2): 137–142.

[9] Perry A, Maharaj D, Ramdass M. J, Naraynsingh V. Slow decompression of the bladder using an intravenous giving set. Int J Clin Pract 2002; 56: 619-621.

[10] Boettcher S, Brandt A. S, Roth S, Mathers M. J, Lazica D. A. Urinary retention: benefit of gradual bladder decompression-myth or truth? A randomized controlled trial. Urol Int. 2013; 91(2): 140-144.

[11] Bartlett, J. E, Kotrlik, J. W, Higgins, C. "Organizational research: Determining appropriate sample size for survey research". J. InformTechn, Learning, and Performance J. 2001; 19 (1): 43–50.

[12] Emberton M, Fitzpatrick J. M. The Reten–World survey of the management of acute urinary retention: preliminary results. BJU Int. 2008; 101(s3): 27-32.

[13] Selius B. A, Subedi R. Urinary retention in adults: diagnosis and initial management. Am Fam Phy. 2008; 77(5): 643–650.

[14] Jeon S, Yoo E. H. Predictive value of obstructive voiding symptoms and objective bladder emptying tests for urinary retention. J Obstet Gyaecol 2012; 32: 770.

[15] Kalejaiye O, Speakman M. J. Management of acute and chronic retention in men. Eur Urol Sup. 2009; 8(6): 523-529.

[16] Kaplan S. A, Wein A. J, Staskin D. R, Roehrborn C. G, Steers W. D. Urinary retention and post-void residual urine in men: separating truth from tradition. J Urol. 2008; 180(1): 47-54.

[17] Kowalik, Urszula; Plante, Mark K. Urinary Retention in Surgical Patients. Surg Clin. N. Am. 2016; 96 (3): 453–467.

[18] Meigs J. B, Barry M. J, Giovannucci E, Rimm E. B, Stampfer M. J, Kawachi I. et al. Incidence rates and risk factors for acute urinary retention: the health professionals follow up study. J Urol. 1999; 162(2): 376-382.

[19] O'Reilly P. H, Brooman P. J, Farah N. B, Mason G. C. High pressure chronic retention. Incidence, aetiology and sinister implications. Br J Urol 1986; 58: 644-646.

[20] Tanagho E. A, Bella A. J, Lue T. F, Tanagho E. A, McAninch J. W. Neuropathic bladder disorders. In: Smith's general urology, San Francisco. Lange Medical Books/McGraw-Hill, 2008: 438-453.

[21] Kim K. M, Kogan B. A, Massad C. A, Huang Y. C. Collagen and elastin in the obstructed fetal bladder. J Urol 1991; 146: 528-531.

[22] Lane I. F. Diagnosis and management of urinary retention. Vet Clin North Am Small Anim Pract 2000; 30: 25-57.

[23] Gould F, Cheng C. Y, Lapides J. Comparison of rapid versus slow decompression of the distended urinary bladder. Invest Urol 1976; 14: 156-158.

[24] Glahn B. E, Plucnar B. J. Quick complete emptying of the bladder in 300 cases of urinary retention. The occurrence of haematuria. Dan Med Bull 1984; 31: 68-70.

[25] Taylor D. E, Viscero-vascular reflexes and the surgical patient. J Royal Coll Surg. 1966; 12(1): 61-67.