Subject Review

Management of Urinary Retention: Rapid Versus Gradual Decompression and Risk of Complications

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The literature was reviewed to quantify the risk of complications related to the relief of obstruction in urinary retention. We also sought to determine whether the risk of complications is higher with rapid or gradual decompression (or “clamping”) of the obstructed urinary bladder. The medical literature was identified by a search of the MEDLINE database and a manual review of the bibliographies of the identified articles. Studies show that, after quick, complete relief of obstruction, hematuria occurs in 2 to 16% of patients; however, clinically significant hematuria is rare. After relief of obstruction, blood pressure often decreases, but it usually normalizes and does not progress to clinically significant hypotension. Postobstructive diuresis occurs after relief of obstruction in 0.5 to 52% of patients; however, it is easily managed and rarely of clinical significance. We were unable to identify any randomized controlled studies that directly compared quick, complete emptying with gradual emptying of the obstructed bladder. Moreover, we identified no studies supporting the practice of gradual emptying of the obstructed bladder. The available published studies support quick, complete emptying for relief of the obstructed urinary bladder. We conclude that hematuria, hypotension, and postobstructive diuresis may occur after decompression of the obstructed urinary bladder, but these complications are rarely clinically significant. Quick, complete emptying of the obstructed bladder is safe, simple, and effective and is recommended as the optimal method for decompressing the obstructed urinary bladder. Prudent, supportive care is needed for all patients, with special attention to elderly patients and those with hypovolemia.


HPCR = high-pressure chronic retention; LPCR = low-pressure chronic retention

Urinary retention occurs commonly in men and women in both the ambulatory and the hospital settings; however, it is more frequent postoperatively and in men and elderly persons. The initial management of urinary retention includes drainage of urine from the distended bladder by catheter. Hematuria, hypotension, and postobstructive diuresis have occurred after bladder drainage by catheter, and the risk of these complications has been thought to be increased when the bladder is rapidly decompressed. As a result, the medical literature has recommended, and continues to recommend, gradual emptying as the method of choice in a patient with urinary retention. Nevertheless, some investigators continue to question the validity of this recommendation. Practicing clinicians seek answers to the following questions: What are the possible complications of urinary retention, how frequently do they occur, how should they be managed, and can decreasing the rate of urine release, by “clamping” a bladder catheter, prevent these complications?

We searched the medical literature from January 1966 through December 1996 available through MEDLINE to address these issues. Multiple search strategies were used to identify all possible relevant articles. Examples of the subject headings and text words used include the following: urinary retention, urinary obstruction, continuous drainage, quick emptying, gradual release, fractionated drainage, clamping, hypotension, hematuria, and diuresis. All identified articles were reviewed to address the current controversies regarding the management of urinary retention and the associated complications. All relevant articles cited in the bibliographies of the retrieved articles were also reviewed. The information was synthesized and is presented herein in a discussion of the classification of urinary retention, complications of urinary retention (hematuria, hypovolemia, etc.).
tension, and postobstructive diuresis), and optimal rate of decompression.

CLASSIFICATION
Acute urinary retention has been defined as that associated with suprapubic pain, whereas chronic urinary retention is painless. In general, chronic urinary retention represents prolonged retention; however, the presence of pain is the criterion used to distinguish acute from chronic urinary retention. Chronic urinary retention has been further classified into two types, high-pressure chronic retention (HPCR) and low-pressure chronic retention (LPCR), based on the intrinsic detrusor pressure during the filling phase of micturition—high in HPCR and normal in LPCR. Incomplete voiding occurs with chronic urinary retention. As more urine fills the bladder, the pressure within the bladder remains within normal limits in LPCR. With HPCR, the bladder contains residual urine at higher than normal pressures, and as more urine fills the bladder, these pressures continue to increase. The presence of increased pressure is of critical importance because continuously increased bladder pressures in HPCR can lead to upper urinary tract damage.

The manifestations of HPCR are unique: late-onset enuresis; a tense, palpable bladder; hypertension; and progressive renal impairment caused by the chronically increased urinary tract pressures. Hypertension occurs in up to two-thirds of cases. Anatomically, HPCR is associated with bilateral hydronephrosis and bilateral hydroureters. The diagnosis of HPCR can be elusive because the initial manifestations may be hypertension, edema of the lower extremities, or renal failure. In the series described by Jones and associates, painless bladder distention and hydronephrosis were unsuspected in 24% of the 21 patients with HPCR. Therefore, HPCR should be considered in the assessment of an elderly patient with unexplained hypertension, edema of the lower extremities, or renal failure. After treatment, the long-term outlook for patients with HPCR is good.

LPCR represents retention at normal bladder pressures, before and after filling. Most patients with LPCR have outlet obstruction due to benign prostatic hypertrophy. They are able to produce high detrusor pressures for voiding and have the classic initial symptoms of hesitancy, decreased force of stream, and increased frequency. If symptoms are moderate to severe, obstruction can be relieved surgically or through pharmacologic methods; however, because bladder pressures are normal, urgent surgical intervention is unnecessary. The major complications of LPCR are acute urinary retention and infection. A separate, small subgroup of patients with LPCR can produce only low detrusor pressures. These patients have pronounced hesitancy and commonly use the Valsalva maneuver to maintain voiding. Unfortunately, surgical intervention is usually of little benefit in this subgroup of patients.

COMPLICATIONS
Hematuria.—Hematuria as a complication of the release of urinary tract obstruction has been a concern for many years. Quick, complete emptying of the bladder has been thought to be a predisposing factor for hematuria. In studies of quick, complete emptying, hematuria occurred in 2 to 16% of patients (Table 1). None of these studies, however, reported any episodes of severe hematuria, defined as hematuria significant enough to necessitate further invasive therapy (such as catheter irrigation or transfusions) or to cause death. In addition, none of the studies found an association between the initial bladder volume and the risk of hematuria.

Hypotension.—Hypotension and circulatory collapse after emptying of the obstructed bladder have been reported. The systemic blood pressure is increased by the urinary vesicovascular reflex in response to acute urinary distention and pain. Taylor, in studies of bladder emptying in animals and humans, showed that a sudden reduction in bladder wall tension reflexly produced vasodilatation with a concomitant decrease in blood pressure. Taylor concluded that a reduction in blood pressure occurs with no serious clinical consequences when a patient has healthy cardiovascular and nervous systems; however, a patient without the ability to compensate appropriately because of advanced age or hypovolemia may be at risk for prolonged hypotension after quick decompression of the bladder. Published studies that have commented or presented data on the occurrence of hypotension in association with quick, complete emptying of the bladder are summarized in Table 2. For our purposes, significant hypotension was defined as hypotension that was directly related to bladder decompression and that necessitated fluid resuscitation. These studies demonstrate a decrease in systemic blood pressure with quick, complete emptying; however, the actual change in blood pressure results in normalization of blood pressure without cardiovascular collapse.

Postobstructive Diuresis.—In 1951, Wilson and colleagues first presented clinical evidence that renal impairment due to acute or chronic obstruction of the lower urinary tract can occasionally lead to such a copious loss of salt and water that life is endangered. More recent studies demonstrated that most cases of obstruction result in an increase in salt and water excretion, which is usually beneficial to the patient, by reversing a fluid overload state. Postobstructive diuresis has been arbitrarily defined as persistent urinary outputs that range from 125 to 200 mL/h. The true proportion of patients who experience postobstructive
Table 1.—Studies of Hematuria After Quick, Complete Emptying of Bladder*

<table>
<thead>
<tr>
<th>Reference†</th>
<th>Design Type</th>
<th>Episodes (no.)</th>
<th>Age (yr)</th>
<th>Hematuria</th>
<th>Severe hematuria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glahn &amp; Plucnar,’ 1984</td>
<td>Consecutive AUR</td>
<td>300</td>
<td>6-91</td>
<td>62</td>
<td>16</td>
</tr>
<tr>
<td>Christensen et al,’ 1987</td>
<td>Consecutive AUR</td>
<td>10</td>
<td>66-81</td>
<td>74.5</td>
<td>10</td>
</tr>
<tr>
<td>Paquin et al,’ 1981</td>
<td>Consecutive AUR</td>
<td>50</td>
<td>31-90</td>
<td>NR</td>
<td>12</td>
</tr>
<tr>
<td>Brecher &amp; Chwalla,’ 1931</td>
<td>Retrospective AUR</td>
<td>300</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Seifert,’ 1940</td>
<td>Retrospective AUR</td>
<td>126</td>
<td>NR</td>
<td>NR</td>
<td>2</td>
</tr>
</tbody>
</table>

* AUR = acute urinary retention; CI = confidence interval; NR = not reported.
† Glahn and Plucnar excluded known vesical tumors, prostate cancer, postoperative urologic procedures, and difficult catheterization; no exclusion criteria were described in the other studies. The study by Christensen and associates consisted of seven episodes of continuous and three of fractionated decompression.

diuresis is unclear; however, the range is 0.5 to 52%, depending on how postobstructive diuresis is defined. Proposed mechanisms for this type of diuresis include osmotic diuresis due to urea, involvement of natriuretic and diuretic factors, disordered function of proximal or distal nephrons, altered tubular permeability, and disturbances in sodium-regulating hormones. The actual cause is most likely a combination of these mechanisms.

The clinical presentation does not predict which patients will have postobstructive diuresis. Significant diuresis has not been shown to correlate with the initial creatinine value or a subsequent decrease in the creatinine value. No correlation has been found between the severity or duration of postobstructive diuresis and the plasma urea value before decompression, electrolyte values, creatinine clearance, bladder pressure, or blood pressure. Vaughan and Gillenwater studied 22 patients (age range, 34 to 85 years) who had postobstructive diuresis and found that patients with the greatest risk of significant postobstructive diuresis had fluid overload, severe renal impairment, or central nervous system manifestations. They also cautioned that excessive fluid replacement may prolong the diuresis by propagating it; they suggested replacement of two-thirds of the fluid output.

Table 2.—Studies of Blood Pressure Response With Relief of Urinary Retention*

<table>
<thead>
<tr>
<th>Reference†</th>
<th>Design Type</th>
<th>Episodes (N = 451)</th>
<th>Age (yr)</th>
<th>Comments‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glahn &amp; Plucnar,’ 1984</td>
<td>Consecutive AUR</td>
<td>300</td>
<td>6-91</td>
<td>“No cases of cardiovascular complications”</td>
</tr>
<tr>
<td>Christensen et al,’ 1987</td>
<td>Consecutive AUR</td>
<td>10</td>
<td>66-81</td>
<td>Significant median BP decrease, “none clinically important”</td>
</tr>
<tr>
<td>George et al,’ 1983</td>
<td>Consecutive HPCR</td>
<td>14</td>
<td>25-81</td>
<td>BP normalized after emptying</td>
</tr>
<tr>
<td>Ghose &amp; Birks,’ 1985</td>
<td>Cases HPCR</td>
<td>2</td>
<td>51-63</td>
<td>BP normalized after emptying</td>
</tr>
<tr>
<td>Jones et al,’ 1987</td>
<td>Consecutive HPCR</td>
<td>11</td>
<td>34-87</td>
<td>BP normalized after emptying</td>
</tr>
<tr>
<td>O’Connor,’ 1920</td>
<td>NR</td>
<td>56</td>
<td>46-86</td>
<td>Mean decrease (mm Hg) in SBP = 40, DBP = 14; greatest decrease in SBP = 85, DBP = 45 (all but two in normal range after drainage)</td>
</tr>
<tr>
<td>Taylor,’ 1965</td>
<td>NR</td>
<td>AUR</td>
<td>18</td>
<td>No significant complications</td>
</tr>
<tr>
<td>Lapides &amp; Lovegrove,’ 1965</td>
<td>NR</td>
<td>AUR</td>
<td>40</td>
<td>Experimentally distended bladders, then released</td>
</tr>
</tbody>
</table>

* AUR = acute urinary retention; BP = blood pressure; DBP = diastolic blood pressure; HPCR = high-pressure chronic retention; NR = not reported; SBP = systolic blood pressure.
† Glahn and Plucnar excluded known vesical tumors, prostate cancer, postoperative urologic procedures, and difficult catheterization; no exclusion criteria were described in the other studies. The study by Christensen and associates consisted of seven episodes of continuous and three of fractionated decompression.
‡ No studies documented significant hypotension.
lower risk of associated complications, specifically hematuria and hypotension. Various mechanisms have been suggested to explain the onset of hematuria after quick, complete emptying of the bladder, all based on sudden decompression causing injury to the urinary tract and resulting in hemorrhage. This theory, however, ignores the possibility of other etiologic factors contributing to the occurrence of hematuria, such as infection and iatrogenic trauma. Alternatively, animal studies suggest that hematuria develops as a result of bladder wall damage that occurs before catheterization. Therefore, the rate of release is unrelated to the onset of hematuria. In addition, some investigators believe that gradual decompression blunts the vesicovascular reflex and avoids subsequent hypotension. Several methods have been suggested to accomplish gradual emptying of the bladder, including elevation of the tubing and collecting device, narrowing of the outlet diameter, and stepwise emptying of the bladder in small (200 to 300 mL) fractions. These labor-intensive, time-consuming techniques are of unproven efficacy. No controlled studies have shown a decrease in intravesical pressure as a function of released volume. These investigations have shown a decrease in intravesical pressure of approximately 50% with removal of the first 100 mL of urine. After this initial substantial decrease in pressure, the intravesical pressure declines only slightly. Christensen and associates compared quick, complete emptying with release of 100-mL fractions in patients with acute urinary tract obstruction. No significant complications were reported with either method. Results of fractionated release were similar to those of quick release—an initial, sudden decrease in intravesical pressure followed by minimal further reduction in pressures (Fig. 1). Therefore, to effect gradual reductions in intravesical pressures, less than 50 mL of urine should be released from the bladder. A nursing survey showed that 57% of nurses prac-

Fig. 1. Pressure-volume curve comparing intravesical pressures with continuous decompression (N = 7) and fractionated decompression (N = 3) of bladder. (Modified from Christensen and associates. By permission.)
tice gradual emptying; however, all release more than 750 mL initially before clamping the catheter. When performed in this manner, gradual emptying does not differ from quick, complete emptying.

**DISCUSSION**

All available studies between 1920 and 1997 of the complications of relief of urinary retention are summarized in Tables 1 and 2. The available data analyzing relief of urinary retention are limited. A little more than 300 cases were studied within the past 20 years and none within the past 10 years. Most reported cases are of acute urinary retention relieved by quick, complete emptying, with only three of gradual decompression. The largest, most recent study by Glahn and Plucnar (1984) reviewed 300 episodes of acute urinary retention treated with quick, complete emptying. Consecutive hospital admissions, emergency department admissions, and inpatient episodes were analyzed. This treatment trial was limited, however, because it was not randomized or controlled. Of the 300 episodes that were observed, no significant complication was noted. No clinically significant complications were reported in any of the studies summarized in Tables 1 and 2.

No randomized controlled trials have compared the outcomes of quick, complete emptying with those of gradual emptying of the obstructed urinary bladder. Such a study would be technically difficult to perform because of the need for repeated release of small fractions of urine (less than 50 mL, based on the results of the studies described) to effect gradual reduction of intrabladder pressures in the group undergoing gradual emptying. In addition, significant hematuria and hypotension seem to be such infrequent complications that the study would need a large sample size to demonstrate statistically significant risk differences.

Over time, populations and catheterization techniques have changed. As the general population ages, comorbid conditions become more prevalent, and patients are likely to have an increased risk of complications. Nonetheless, no published reports have noted increased complications due to bladder drainage.

In LPCR, bladder pressures are normal at all times; therefore, complete emptying of the bladder is appropriate. In HPCR, bladder pressure is increased, but the same rationale for quick emptying in acute urinary retention applies. The available literature supports the practice of quick, complete emptying of the obstructed urinary bladder. The literature lacks any evidence to support the practice of gradual emptying of the urinary bladder. Studies of bladder physiology suggest that gradual reduction of intrabladder pressures is difficult, if not clinically impossible, to accomplish. Additionally, as currently practiced, gradual emptying of the urinary bladder (or clamping) actually reduces intrablaradder pressures rapidly. Of the cases reported in the literature, none were found in which death could be directly attributed to complications of quick, complete emptying of the bladder.

**CONCLUSION**

On the basis of our review of the literature on management of urinary retention, we recommend quick, complete emptying of the obstructed urinary bladder in all instances. This method is easily performed and has not been shown in clinical trials to be associated with any increased risk of complications. No evidence supports the current practice of gradual emptying of the urinary bladder—specifically, clamping of the urinary catheter after release of 750 mL of urine. Hematuria and decreases in blood pressure occur with decompression of the bladder; however, these seem to be of little clinical consequence. Postobstructive diuresis occurs, perhaps frequently, but it is usually of benefit to the patient who generally is in a fluid-overload state. Management consists of judicious replacement of urinary output, with care not to perpetuate the diuresis with excessive fluid replacement. Prudent, supportive care for all patients is important; elderly patients and those with hypovolemia need special care.

**ACKNOWLEDGMENT**

We thank Dietlinde Wahner-Roedler, M.D., and Jon M. Bylander, M.D., for translation of articles.

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