Pharmacological Relief of Acute Urinary Retention in a Remote Environment

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BACKGROUND: In spaceflight, acute urinary retention (AUR) could develop as a sequela of medication use, urinary tract infection, urolithiasis, or intentional urine holding. While AUR is generally treated with bladder decompression, urinary catheterization could be difficult operationally in terms of training and proficiency, supplies, and lack of space or privacy. This report discusses a case in which tamsulosin and lorazepam were used successfully on an offshore ship while awaiting medical evacuation, a situation that could arise in remote locations where aerospace operations are conducted.

- **CASE REPORT:** A 52-yr-old man with hypertension and obstructive sleep apnea but no formal diagnosis of benign prostatic hyperplasia was unable to urinate for over 16 h while on a deep-sea fishing vessel approximately 200 nmi offshore. By phone, the physician providing remote medical direction diagnosed AUR in the setting of possible infection and prescribed acetaminophen, ciprofloxacin, and a trial of tamsulosin as the ship did not have any medical personnel trained to perform urinary catheterization and there were no catheter supplies available. Lorazepam was later added for anxiolysis and potential smooth muscle relaxation. Within 1 h of initial medication administration, the patient successfully voided a large quantity of urine, which tested positive for infection by urine dipstick. The patient was continued on antibiotics and evacuated to a medical facility onshore for further management.
- **DISCUSSION:** Pharmacological treatment could be considered as a temporizing measure where operational constraints limit the ability to perform urinary catheterization to relieve acute urinary retention.
- **KEYWORDS:** tamulosin, benzodiazepine, spaceflight, urinary retention, wilderness medicine.

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cute urinary retention (AUR) is a known medical condition in spaceflight. Possible causes include medications, psychosocial related to intentional delay in voidingdue to schedule and toilet access, and lack of a gravity vector.⁹ In particular, antiemetics routinely used for preventing and treating space and entry motion sickness are known anticholinergics, which predispose otherwise healthy astronauts to urinary retention.

Stepaniak et al.¹³ detailed the clinical course of a Shuttle crewmember with no prior urinary history who developed recurrent AUR on two separate missions both in flight and postflight, requiring multiple urinary catheterizations. On the first flight, only one urinary catheter was available onboard, requiring the crewmember to clean it as well as possible in between intermittent catheterizations or voiding trials during indwelling catheterization. Despite antibiotic prophylaxis with nitrofurantoin and subsequently trimethoprim/ sulfamethoxazole, when the onboard supply of the former medication was depleted, an in-flight urine dipstick was positive for leukocytes and postflight urine culture was positive for trimethoprim/sulfamethoxazole-resistant *E. coli*. On the second flight, the crewmember again needed to self-catheterize on flight days 1 and 2, but was able to void spontaneously until immediately after landing, at which time he developed AUR requiring catheter insertion by a flight surgeon. Urinalysis was positive for infection. The cause of this crewmember's AUR was

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likely multifactorial and his use of both promethazine and scopolamine to treat space motion sickness symptoms was thought to predispose him to AUR.

More recently, a review of in-flight and postflight records from Mercury, Gemini, Apollo, Mir, Shuttle, and International Space Station Expeditions 1–38 found 9 documented cases of AUR and 16 total if symptoms suggestive of urinary retention (bladder fullness/pressure, difficulty initiating/hesitancy) were also included.³ If a crewmember took promethazine, the odds of developing AUR were three times higher. Women were four times more likely than men to develop AUR. Even with antibiotic prophylaxis, the infection rate of urinary catheterization was 42%, and a catheterized crewmember was 2.5 times more likely to have a urinary tract infection (UTI), although the incidence was too low for this to be statistically significant and it was unclear whether the UTI preceded or was caused by AUR.

These cases demonstrate that AUR is a concern for spaceflight and urinary catheterization—the standard of care for treating AUR—is not a benign procedure. Furthermore, urinary catheterization has significant limitations in the operational setting. The ability to perform the procedure requires training and maintenance of proficiency, plus adequate supplies, including disinfection swabs, lubricant, catheters, and collection devices. An environment that allows privacy and the ability for the patient to lie flat is needed, which can be complicated by microgravity or on aircraft ferrying a postflight crewmember. Moreover, the procedure could be time-consuming unless the provider is very experienced, thus negatively impacting tight operational schedules.

Given these challenges, being able to treat AUR pharmacologically would be ideal, not only in spaceflight but also in remote environments that have similar constraints. This report describes a case in which tamsulosin and lorazepam were used successfully to relieve AUR in an offshore fisherman awaiting medical evacuation, a case study that could be applied to aerospace operations.

CASE REPORT

A physician providing remote medical direction to a deep-sea fishing vessel received a phone call about a 52-yr-old man with hypertension and obstructive sleep apnea who had not been able to urinate since the night prior. He was only on ramipril daily and used a continuous positive airway pressure (CPAP) machine at night. He had a 2-yr history of nocturia and decreased urinary stream, but had never consulted for this issue. He had no known drug allergies. He was in his usual state of health at dinnertime the night before the call came in, when he noticed mild dysuria without any urinary frequency, urgency, sense of incomplete bladder emptying, or hematuria. He had no localized redness or itching. There was no history of trauma and he denied any history of new sexual contacts before getting on the boat 10 d prior or since boarding.

The dysuria recurred at 21:30 when he voided before going to sleep and then, at 03:00, he was awoken and kept awake by

the sensation of needing to void. This sensation intensified throughout the morning and he could not urinate despite efforts to relax or drink copious amounts of liquids. He took acetaminophen at 05:00 without relief. He was unable to do his morning shift and finally notified his captain at 13:00, at which time the remote physician was called. At this point it had been 16 h since his last urination.

By phone with the captain as an intermediary, the remote physician obtained more history and ascertained the patient had no fevers or chills, flank pain, back pain, chest pain, cough, myalgias, or shortness of breath. He had not vomited but was beginning to feel nauseated. The captain reported that the patient appeared to be pale, sweaty, and in pain. He was talking quietly and trying not to move. His vital signs were: blood pressure 189/96, pulse 110, RR 22. He was afebrile. Under the physician's direction, the captain palpated the patient's abdomen, which was soft above the umbilicus but noticeably tender below it.

Presuming a diagnosis of acute urinary retention in the setting of possible urinary tract infection or prostatitis, the remote physician requested that the ship be turned back to shore to enable a helicopter or rescue boat to medically evacuate the patient. At the time, the fishing vessel, which had neither the supplies for urinary catheterization nor personnel trained to perform such procedure, was 200 nmi from shore off the coast of Newfoundland and had planned to spend another 7–8 d at sea. The remote physician decided that medical evacuation was necessary, not only to decompress the bladder, but also to diagnose and treat the underlying cause. Given the risk of recurrence, the patient could not remain on the ship and sail even further from shore.

In the meantime, the remote physician reviewed the list of medications available onboard. She prescribed oral acetaminophen 1 g since the patient was in significant discomfort, ciprofloxacin 500 mg for possible infection, and a trial of tamsulosin 0.8 mg. The physician opted for adding in tamsulosin because of the 2-yr history of nocturia and decreased stream strength suggestive of benign prostatic hyperplasia, in addition to the possibility that tamsulosin could help the passage of a stone if that were indeed the cause of the blockage. The latter seemed an unlikely cause of complete obstruction, but the relative risk of tamsulosin administration and possible side effects were far outweighed by the risk of prolonged urinary obstruction.

Approximately 35 min after the first call, the ship's captain called back to report that the medications had not been effective and the patient was beginning to be more anxious. A repeat set of vital signs was taken: blood pressure 180/95, pulse 118, RR 24–26. He remained afebrile with normal oxygen saturation. Medevac had been called and the helicopter would arrive in approximately 2 h.

While it was not surprising that the tamsulosin had not yet taken effect, given the patient's worsening anxiety and with the hopes of achieving some degree of smooth muscle relaxation, the remote physician prescribed lorazepam 1 mg. Morphine sulfate was considered for pain relief and smooth muscle relaxation, but given the patient's large body habitus and history of obstructive sleep apnea, the remote physician felt the risk of apnea outweighed potential benefits. The remote physician also began putting together a step-by-step procedure for talking the captain through a suprapubic aspiration using materials available onboard if this became a necessity.

The captain called and reported that the patient had voided a very large amount of urine 20 min after the lorazepam administration and was feeling significantly better. A urine dipstick showed 3+ leukocyte esterase, positive nitrite, and 2+ blood. Ciprofloxacin was continued as treatment for the presumed UTI. Later the patient was successfully evacuated by helicopter and treated at an onshore medical facility.

DISCUSSION

This case illustrated a typical presentation of acute urinary retention and limitations in resources and trained personnel in a remote environment. Since urinary catheterization was not available, pharmacological treatment was attempted and successfully relieved the patient's AUR. In this case, tamsulosin and lorazepam were used.

Tamsulosin is an adrenergic alpha-1A antagonist that is commonly used to treat benign prostatic hyperplasia, in addition to off-label uses for treating bladder outlet obstruction in males and expulsion of ureteral stones. Mechanistically, it works by relaxing smooth muscle in the prostate, which leads to relaxation of smooth muscle in the bladder neck, with a timeto-peak of 4–5 h when fasting and 6–7 h with food.⁶ Older populations may metabolize tamsulosin at a slower rate. In women, tamsulosin has been shown to cause significant relaxation of the urethra¹² and improve voiding difficulty, especially in those with bladder outlet obstruction.²

Benzodiazepines such as lorazepam are typically used to treat anxiety, seizures, and other central nervous system disorders by binding to gamma-aminobutyric acid (GABA) receptors, with a time to peak of 2 h.4 Since GABA receptors are also found in peripheral tissues, including the urinary bladder,¹⁰ it is plausible that a benzodiazepine could be used to relieve AUR. In fact, gynecological textbooks have historically described the use of benzodiazepines for urinary retention.⁸ However, separate randomized controlled trials showed three different benzodiazepines had no apparent benefit in reducing postoperative urinary retention.^{1,7,8} It is worth pointing out the cause of postoperative urinary retention is multifactorial, with many possible confounders,8 and it is unknown whether the results of those studies could be generalized to AUR outside of the operating room setting. In this case, another potential confounder is the patient being on ramipril for unknown duration; there is some evidence that angiotensin-converting enzyme inhibitors can contribute to UTI and potentially AUR within the first month of initiation.¹¹

Morphine was considered by the remote physician for its smooth muscle relaxation properties, but ruled out due to the possibility of respiratory depression in a higher risk patient. Perhaps just as well: urinary retention is listed as a potential adverse reaction to morphine,⁵ so its use could have worsened the AUR.

In this case, the timing of events suggested that lorazepam was associated with relief of the patient's AUR, perhaps in synergy with tamsulosin, which was starting to take effect. Unfortunately, given the nature of the remote consultation and the authors' inability to follow up with the patient, one cannot know for sure whether the medications were directly responsible. More research could help elucidate the effect of tamsulosin alone versus in combination with another drug.

Still, this case raises the possibility that AUR could be treated pharmacologically in a remote environment where operationally it is challenging to perform urinary catheterization, at least as a temporizing measure while arrangements are made to decompress the bladder in a more optimal setting. It would be worthwhile to include tamsulosin in one's field medical kit, since it has a relatively safe profile and can also be used to treat urolithiasis. Given conflicting information about the benefit of benzodiazepines and morphine, and more importantly due to the challenges of carrying controlled substances in the field and at times across international borders, the flight surgeon should carefully consider whether those medications should be included.

Other "tricks of the trade" that have been used by physicians to help their patients with AUR include playing sounds of running water or placement into a warm bath. The latter, of course, would not be feasible in the field or on orbit, but the same idea could be applied by placing a warm, wet towel on the patient's body to stimulate the urge to urinate.

In summary, this report described a case of acute urinary retention in an offshore fisherman, who successfully voided after a trial of tamsulosin followed by lorazepam while awaiting medical evacuation since urinary catheterization was not possible due to the limitations of the remote environment he was in. For spaceflight, which is known to predispose astronauts to urinary retention due to a number of factors, a trial of tamsulosin can be considered and may obviate the need to perform urinary catheterization in suboptimal settings.

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