

Purple urine bag syndrome: an educational case of a colorful condition in the chronically catheterized

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Abstract

Purple Urine Bag Syndrome is a rare condition characterized by purple discoloration of the urinary drainage bag. It is typically seen in elderly patients with chronic indwelling urinary catheterization, and is associated with urinary tract infections with high bacterial load, female gender, severe disability, constipation, and alkaline urine. This phenomenon occurs when tryptophan metabolites in the urine are broken down by bacteria containing indoxyl sulphatase and phosphatase enzymes. This results in the production of indigo and indirubin, which combine to give a purple appearance. This article presents a 78-year-old male with chronic urinary retention requiring intermittent Foley catheterization for the last three months, who was brought to the Emergency Department for altered mental status and purple urinary bag discoloration. Urinalysis was suggestive of urinary tract infection, and Vancomycin, Aztreonam, and Levaquin were initiated. After urine culture and antibiotic susceptibility testing, only Levaquin was continued, and subsequently the patient's symptoms resolved. This case serves to educate healthcare professionals in West Virginia about this condition, which we hope will benefit in its diagnosis, management, and targeted prevention, especially in light of an aging population.

Keywords

purple urine bag syndrome, catheter-associated urinary tract infection, tryptophan, geriatrics, nursing home care

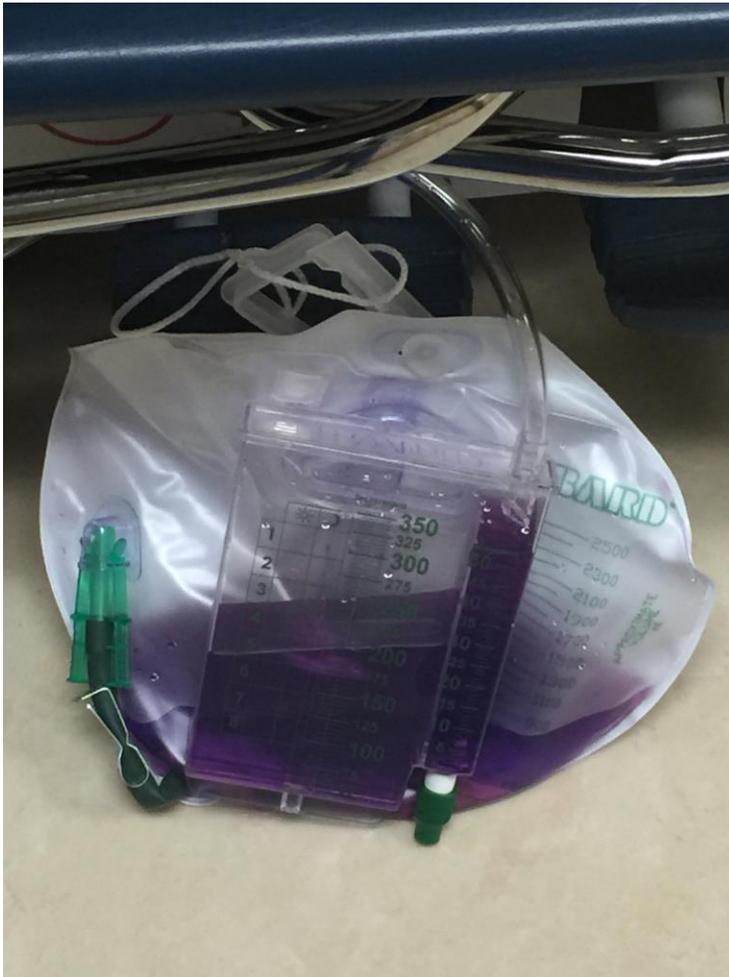
Introduction

Purple Urine Bag Syndrome (PUBS) is a rare condition characterized by purple discoloration of the urinary drainage bag. It is typically seen in elderly patients with chronic indwelling urinary catheterization, and is associated with urinary tract infections (UTI) with high bacterial load, female gender, severe disability, constipation, and alkaline urine. This phenomenon occurs due to tryptophan metabolites in the urine being broken down by bacteria containing indoxyl sulphatase and phosphatase enzymes. This results in the production of indigo, appearing blue, and indirubin, appearing red, which combine to give a purple appearance.¹ This purple color is often alarming and distressing to both the physician and patient, but is generally considered a benign process, simply requiring the appropriate antibiotics to treat the UTI as well as changing of the urinary catheter and drainage bag for treatment.

Case Presentation

A 78-year-old male with past medical history of chronic obstructive pulmonary disease (COPD), benign prostatic hyperplasia (BPH), and recurrent urinary retention secondary to BPH requiring intermittent Foley catheterization for the last three months, was brought to the emergency department (ED) for evaluation of altered mental status and purple urinary bag discoloration (**Figure 1**). The urinary catheter was last changed three weeks prior to this admission in the ED of another local hospital. His caregiver mentioned that he appeared increasingly confused for the last few days. None of his medications were known to cause urine discoloration. On physical examination, the patient was found to be afebrile, tachycardic, and oriented only to person.

Figure 1: Purple discoloration of urinary drainage bag upon patient's presentation



Urinalysis was suggestive of a UTI, with positive leucocyte esterase and nitrites, >100 WBCs/HPF, 21-30 RBCs/HPF, abundant bacteria, and pH of 8.5.

In the ED, Vancomycin, Aztreonam, and Levaquin were started due to the impression of sepsis. The purple urine disappeared after the urinary catheter and drainage bag were changed (**Figure 2**). Thereafter the patient developed a fever, and as a result Aztreonam was changed to Meropenem to cover extended-spectrum beta-lactamase (ESBL)-producing organisms. Vancomycin and Levaquin were continued at that point to cover other possible hospital-acquired pathogens. Subsequently, the urine culture grew *E. coli* and *K. pneumoniae*, both known to have the enzymes that result in PUBS. Antibiotic susceptibility results revealed sensitivity to Levaquin, resulting in discontinuation of Vancomycin and Meropenem. Finally, as the patient's mental status improved and his symptoms resolved, he was discharged home on Levaquin for a total of 10 days.

Figure 2: Resolution of purple urine discoloration after changing urinary catheter and drainage bag and initiating antibiotics



Discussion

PUBS is an uncommon condition in which the urinary drainage bag turns purple in patients with chronic indwelling urinary catheterization. Interestingly, the first historical mention of this condition was in 1812, as it was found in King George III, whereas the first mention in medical literature was in 1978.^{2,3} Among patients with chronic indwelling urinary catheter use, the reported prevalence has varied considerably, from 8.3% to 42.1%.^{4,5}

In addition to urinary catheterization, PUBS is associated with urinary tract infections (UTI) with high bacterial load, female gender, old age, severe disability, constipation, alkaline urine, increased dietary tryptophan content, renal failure, and the use of plastic urinary catheters and drainage bags. The bacteria most commonly associated with this condition include: *Providencia stuartii*, *Providencia rettgeri*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Escherichia coli*, *Morganella morganii*, and *Enterococcus spp.*¹ A seemingly paradoxical aspect of this condition is that although many individual risk factors occur frequently, PUBS itself presents rarely. This is likely due to the fact that numerous risk factors must be present concurrently, and if any key risk factor is not present, an appreciable amount of purple urine discoloration will not be produced.⁶ Additionally, only a portion of each bacterial

species listed above carries indoxyl phosphatase and sulphatase enzymes, as they are not ubiquitously found.⁷

A number of conditions may cause urine discoloration, producing a variety of abnormal colors. For example, red and orange urine may be caused by medications like Rifampin, Warfarin, Isoniazid, and Sulfasalazine, medical conditions producing intravascular hemolysis like hemolytic anemia, thalassemia, and transfusion reactions, other medical conditions like nephrolithiasis and porphyria, and foods like beets and carrots. Brown urine may be caused by medications like Metronidazole and Nitrofurantoin, medical conditions like hemolytic anemia and porphyria, and foods like fava beans and rhubarb.⁸ Due to the complexity of urine discoloration, it is vital for physicians to complete a detailed history and have a differential diagnosis before initiating a work-up.

PUBS is generally considered to be a benign condition, with major sequelae occurring rarely. In fact, the majority of patients are asymptomatic and only require changing of the urinary catheter and drainage bag. On the other hand, some patients may have symptoms of a UTI, and will require more of a diagnostic work-up and management, including routine antibiotics, followed by a urine culture and antibiotic susceptibility testing, leading to an antibiotic regimen tailored to the causative bacteria.¹ This case presentation clearly follows the aforementioned approach to PUBS in a patient with a symptomatic UTI. While major sequelae are very infrequent, there have been reports of the development of Fournier's gangrene, a perineal infection with a high mortality rate, requiring debridement of the necrotic tissue.⁹

In summary, PUBS is an uncommon condition exhibiting purple discoloration of the urinary drainage bag, typically in patients with chronic indwelling urinary catheterization. The presentation and discussion of this condition will be valuable in raising awareness and educating healthcare professionals in the state of West Virginia. A detailed literature review found that there have been no cases of PUBS reported in medical literature at the time of this manuscript's publication. Since the patients at greatest risk for this condition are the elderly, its prevalence will likely continue to increase along with the aging baby boomer population. According to the West Virginia Center on Budget and Policy, nearly one-fourth of the state's population will be over 65 years old by 2035.¹⁰ Thus, it is vital to further educate healthcare professionals about PUBS, especially due to its alarming presentation, which may result in an unnecessary or deleterious work-up and/or treatment. Finally, properly understanding this condition and its pathogenesis allows for more effective preventative measures targeting those at greatest risk, such as changing the urinary catheter more frequently.

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