A 78-year-old man presented to our outpatient family medicine clinic with a 3-day history of subjective fever in the absence of additional symptoms. His medical history was significant for prostate and bladder cancers that were managed with radical cystoprostatectomy. He also had oropharyngeal cancer, end-stage renal disease, recurrent urinary tract infections, chronic obstructive pulmonary disease, and hypothyroidism. Additionally, the patient had bilateral percutaneous nephrostomy tubes because of a previous ureteral obstruction.

Upon presentation, the patient was afebrile with a blood pressure of 124/72 mm Hg, a pulse rate of 82 beats/min, and a respiratory rate of 18 breaths/min. Beyond the fever reported by the patient, a review of systems was within normal limits, and he denied recent travel, hospitalization, sick contacts, new medications, or dietary changes.

Results of a physical examination were mostly unremarkable, although it was noted that the patient's left nephrostomy tube and urinary bag appeared to be filled with purple urine (Figure 1). He was aware of this recent change, but he attributed it to the assumption that the ink on the bag was discoloring his urine. A urine specimen was subsequently collected for urine dipstick, which revealed leukocytes and nitrates, indicative of a urinary tract infection. His urine was also found to be alkaline with an elevated pH level of 8.5, suggesting infection with a urea-splitting organism. Results of a urine culture eventually showed mixed growth; while results of study were pending, the patient was started on a 10-day course of ciprofloxacin, 500 mg twice daily. The patient followed up with his nephrologist shortly thereafter, at which time his urinary collection system was replaced to further promote resolution of his condition.

Discussion
First reported in 1978, purple urine bag syndrome (PUBS) is a striking manifestation of urinary tract infections that arise in patients with long-standing urinary catheterization and additional risk factors. Among the most common risk factors are alkaline urine, advanced age, end-stage renal disease, constipation, female gender, and bedridden status. When certain bacteria colonize the urinary collection system in patients with these comorbidities, a purple hue appears in the urinary catheter and bag.

The differential diagnosis for urine discoloration is quite broad, although there are few etiologies of violaceous urine. In 2005, researchers found the prevalence of PUBS among patients with catheters to be roughly 8%. Nevertheless, PUBS remains an unfamiliar entity to many clinicians and can thus be easily misdiagnosed. For this reason, increased awareness of PUBS is crucial not only to reduce morbidity and mortality but also to curtail medical expenditures by avoiding unnecessary investigations and treatments.

PUBS represents an underlying infection in patients who are, by nature of their comorbidities, considered high-risk for poor outcomes. A myriad of risk factors creates a favorable environment for this
condition, several of which were present in our patient. Before delving into our patient’s specific predispositions, a brief discussion regarding the pathophysiology of PUBS is warranted.

Central to the development of PUBS is an aberration in the breakdown of dietary tryptophan, which begins in the intestines where the gut flora metabolize it to indole (Figure 2). Via the portal circulation, indole reaches the liver, where it is conjugated to form indoxyl sulfate for excretion into the urinary tract. In the urine, sulfatase- and phosphatase-producing bacteria convert indoxyl sulfate into indoxyl, which, in the setting of alkaline urine, may be oxidized to indigo (blue pigment) and indirubin (red pigment). When these pigments interact within the urinary drainage system, it culminates in the appearance of a purple urine bag. One prerequisite for the development of PUBS, therefore, is colonization with bacteria capable of producing the sulfatase and phosphatase enzymes. Several organisms have been implicated and include Escherichia coli, Proteus species, Providencia species, Klebsiella pneumoniae, Morganella morganii, Pseudomonas aeruginosa, and Enterococcus species. Interestingly, however, not all strains of the same species can produce these enzymes.

Despite the high frequency of urinary tract infections in patients with catheters, PUBS is an uncommon condition; however, our patient exhibited several of the classic risk factors. The extended presence of his nephrostomy tubes and urinary bag permitted colonization with bacteria capable of producing indoxyl sulfatase and indoxyl phosphatase. In the setting of end-stage renal disease, impaired clearance of indoxyl sulfate provided these organisms with an abundance of substrate used for indoxyl formation. His alkaline urine favored the subsequent conversion of indoxyl to indigo and indirubin, which ultimately reacted within his urine bag to form a purple substance.

Because PUBS arises in patients who are generally in poor health, the morbidity and mortality are higher than with a typical urinary tract infection. Failure to recognize this condition has resulted in Fournier gangrene, urosepsis, and even death in some cases. Unfortunately, there are no formal guidelines for the diagnosis and treatment of PUBS. Given the spectrum of differential diagnoses for discolored urine, it is imperative to obtain a detailed history to identify risk factors while excluding other etiologies such as hematuria, porphyria, medications, or diet. Failure to do so may result in tests and treatments that are costly and ineffective.

Urinalysis is a quick and cost-effective tool that can help detect an underlying urinary tract infection in patients presenting with purple discoloration of their urine bag. Some sources recommend initiation of antibiotics once the diagnosis is made, which may eventually be tailored according to sensitivities determined by urine culture. Fluoroquinolones are a reasonable choice for empiric coverage, as they are effective against most of the pathogens that have been implicated in PUBS. In addition to antibiotics, it is advisable that the patient’s urinary catheter and drainage bag be replaced. If additional risk factors are present and treatable (eg, constipation), addressing these can significantly decrease the risk of recurrence.

**Conclusion**

Although it is infrequently encountered, PUBS should be included in the differential diagnosis for patients with catheters who present with violaceous urine discoloration. Our case illustrates that in some patients, this may be one of only a few clinical signs of underlying infection. Diagnosis and management are relatively straightforward, but some cases warrant the use of antibiotics to avoid potentially devastating sequelae such as Fournier gangrene.

Proper catheter and urinary bag hygiene is also paramount, and replacement is a cornerstone of management. Very few patients develop such complications, and most cases follow a benign clinical course. Heightened awareness of this phenomenon and formal guidelines are needed, as both will improve outcomes and reduce expenditures associated with misguided testing or treatment.

**REFERENCES**

1. Barlow GB, Dickson JAS. Purple urine bags.


