Purple Urine Bag Syndrome in an Elderly Nursing Home Resident

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Purple urine bag syndrome (PUBS) is a rare condition found in patients with chronic urinary catheterization and is characterized by purple-colored urine, bags, or tubing.[1] Patients with PUBS are typically women who have a urinary tract infection (UTI), alkaline urine, and constipation.[2] This article presents the case of an elderly woman with PUBS and reviews the diagnosis and management of this syndrome.

CASE PRESENTATION

Initial Presentation and History

A chronically bedridden 88-year-old woman with a history of neurosyphilis, dementia, gastrointestinal bleeding, hypertension, and coronary artery disease was transferred from a nursing home to the emergency department due to a purplish tinge of the urine in her Foley catheter bag. The patient also had a gastric tube in place as she was unable to feed herself. The patient's debilitated state had required the long-term use of a urinary catheter, and she had a history of repeated UTIs with *Escherichia coli* over the past 2 years.

Physical Examination and Laboratory Evaluation

On physical examination, the patient was afebrile, and her vital signs were within normal limits. Abdominal examination was unremarkable, and the gastric feeding tube site was clean. She had multiple, deep decubitus ulcers on her right foot. The Foley catheter collecting bag, tubing, and urine had a purplish discoloration (**Figure**). Urinalysis revealed a pH level exceeding 9 (normal, 5.0–8.0), 21 to 30 white blood cells per high-power field (hpf; normal, 0–2 hpf), 6 to 10 red blood cells per hpf (normal, 0–2 hpf), protein of 100 mg/dL, no nitrites, and a large amount of leukocyte esterase. Complete blood count, electrolytes, and basic metabolic profile were within normal limits. The patient was initially admitted with a working diagnosis of UTI and hemorrhagic cystitis.

Hospital Course and Treatment

Specimens for blood cultures and urine cultures were drawn. The patient was empirically started on gentamicin (80 mg intravenously every 8 hr) because she was allergic to penicillin and sulfacetamide drugs. The Foley catheter was changed on hospital day 2, and the purple-colored urine became clear on hospital day 3. Cystoscopy did not reveal any abnormal findings. Biochemical tests or spectroscopic analysis of the urine was not performed for this patient. On hospital day 4, urine cultures grew *Providencia stuartii* in excess of 100,000 colonies, which was sensitive to cefoxitin and cefotaxime. The patient was subsequently diagnosed with PUBS, and her antibiotic regimen was changed to cefotaxime (1 g intravenously every 12 hr). The patient was discharged to the nursing home on hospital day 10 with the urinary catheter left in place. It is not known whether there were any changes in the care of the urinary catheter in this patient, but she did not present with any further episodes of PUBS.

PURPLE URINE BAG SYNDROME

PUBS is a rare phenomenon wherein the urine catheter collecting bag and the tubing as well as the urine of a patient is noted to turn purple hours to days after urinary catheterization.[3] It was first reported in 1978 by Barlow and Dickson[4] and was seen in patients with urinary diversions. PUBS is found predominantly in bedridden, elderly women who require long-term urinary bladder catheterization.[5]

Etiology

Several hypotheses have been proposed regarding the etiology of PUBS, which have inconsistencies among

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Figure. The case patient's Foley catheter collecting bag, tubing, and urine demonstrating a purplish discoloration.

them. According to the most popular theory,[2] the chain reaction responsible for PUBS begins with dietary tryptophan being metabolized by gut bacteria, which produces indole. Indole is then converted into indoxyl sulfate (or indican) in the liver, which is then excreted in the urine. Certain bacterial strains possess an enzyme (a phosphatase with minor sulfatase activity) that acts on the indoxyl sulfate to produce indigo.[1] The purple discoloration of the urine bag occurs as a result of indirubin (which is red) dissolving in the plastic and mixing with the fine blue indigo crystals in the urine.[6]

Barlow and Dickson,[4] however, proposed that indoxyl sulfate is oxidized to indigo only after urinary excretion and exposure to air. Sammons et al[7] theorized that indicanuria in patients leads to a blue color only when the urine is treated with an oxidizing agent such as sodium hypochlorite (bleaching powder). In another observation, purple discoloration of the urine was associated with a highly alkaline urine in contact with the plastic collecting bag, which caused the dye used to eliminate the yellow tint of the bag to discolor the urine.[5] However, PUBS has also been observed in patients with acidic urine.[8] A study using mass spectroscopy suggested that the molecular structure of the causative pigment is a steroidal or bile acid conjugate, not indigo.[8]

Clinical Features and Course

Published case reports reveal that patients with PUBS have similar features. PUBS is most frequently observed in chronically catheterized and constipated women who have alkaline urine and UTIs.[9] Most patients were bedridden, and many had cognitive impairment.[10] The **Table**[2,3,5,6,9,11–13] compares the case patient with other selected patients described in recently published English-language case reports. Most patients had a benign course, with the purple discoloration resolving after antibiotic therapy and replacement of the urinary catheter. One patient developed sepsis from pneumonia and UTI but improved after a course of antibiotics.[5] Two patients died of causes unrelated to PUBS (carcinomatosis[12] and sepsis not related to UTI[13]).

A case-control study by Mantani et al[8] revealed that the incidence of PUBS is higher in long-term care settings where patients receive limited antibiotic treatment for UTIs. In addition, most samples taken from patients in the PUBS group had significantly higher bacterial counts (by 1–2 logs) than samples from the control group.[8] Several bacterial species are associated with PUBS. The most commonly involved pathogen is *P. stuartii,* but other species (eg, *Klebsiella pneumoniae, E. coli, P. rettgeri, Proteus mirabilis, Pseudomonas aeruginosa, Enterobacter agglomerans,* methicillin-resistant *Staphylococcus aureus, Citrobacter* spp., group B streptococci, and *Morganella morganii)* are associated as well.[1,3–5,6,8–12,14]

Diagnosis

The diagnosis of PUBS is not well defined. PUBS is associated with purple urine, bagging, and tubing and UTI. However, a method for confirming the diagnosis of PUBS has not been described. Barlow and Dickson[4] performed spectroscopic analysis of affected patients' urine, which demonstrated that the pigment responsible for the urine discoloration was indigo. Dealler et al[1] reported that patients with PUBS have a higher concentration of indoxyl sulfate than control patients. Among the 41 species of bacteria tested, only 3 were able to produce indigo from indoxyl sulfate: *P. stuartii, K. pneumonia, and E. agglomerans.*[1] Lin et al[13] proposed that it is unnecessary to perform tests other than microbiology and biochemistry. At present, there is no specific recommended approach to diagnosing PUBS other than visual identification of the purple urine, bag, and tubing.

Treatment

PUBS is treated with antibiotics directed at the specific organism that caused the UTI.[6,14] However, some authors argue that it is unnecessary to aggressively treat patients with PUBS and advocate constipation control and urologic sanitation as the fundamentals of treatment for PUBS.[6] Improvement in the care of the urinary catheters prevents both PUBS and catheter–associated UTIs.[9]

Table. Comparison of Patients with Purple Urine Bag Syndrome from Selected Case Reports

Cases	Age (yr)/ Sex	Clinical Presentation	Comorbid Conditions	Urinalysis	Urine Culture	Diagnosis	Treatment	Outcome
Case patient	88/F	Purple urine, afebrile	Neurosyphilis, dementia, hypertension, coronary artery disease	pH: 9 RBC: 6–10 hpf WBC: 21–30 hpf	*Providencia stuartii*	UTI	Gentamicin then cefotaxime; urinary catheter changed	Purple discoloration cleared 3 days after admission
Ribeiro et al[2]	56/F	Purple urine	Amyotrophic lateral sclerosis with associated long-term Foley catheter use	Urine: alkaline	*Morganella morganii, Pseudomonas aeruginosa, Proteus mirabilis*	UTI	NR	The color of the urinary catheter drainage system and bag increased in intensity the longer the system remained unchanged
Roggla et al[3]	91/F	Purple urine	NR	NR	*Escherichia coli, P. mirabilis*	UTI	NR	NR
Vallejo-Manzur et al[5]	72/M	Purple urine, lethargic, afebrile, BP 70/50 mm Hg, distended bladder	Renal failure, stroke, Parkinson's disease	pH: 9 RBC: 20–25 hpf WBC: many	*E. coli*	UTI and pneumonia	Piperacillin-tazobactam of 3 days' duration, levofloxacin of 14 days' duration	Improved and discharged to nursing home after 8 days of hospitalization
Wang et al[6]	61/F	Purple urine, afebrile	Renal failure, neurogenic bladder, constipation, diabetes mellitus	pH: 8 RBC: 2–3 hpf WBC: 8–10 hpf	*E. coli, Enterococcus faecalis, P. vulgaris*	UTI	Cefuroxime; Foley catheter changed	Purple urine cleared
Chiou et al[9]	90/F	Purple urine, afebrile, abdominal tenderness	Multiple spinal fractures	pH: 8 WBC: 5–10 hpf	*P. aeruginosa, Klebsiella pneumonia, M. morganii*	UTI	First-generation cephalosporin and gentamicin	Purple urine disappeared on day 3 of hospitalization (after change of catheter)
al-Jubouri and Vardhan[11]	85/F	Purple urine	NR	pH: 8.5	*Providencia* spp.	UTI	NR	NR
Ihama and Hokama[12]	93/F	Purple urine	Advanced gastric cancer, constipation	pH: 9 RBC: 3–5 hpf	*Providencia, Alcaligenes* spp.	UTI	Catheter replaced	Purple urine resolved after placement of new urinary catheter; patient died 2 mo later from carcinomatosis
Lin et al[13]	79/M	Purple urine	Aspiration pneumonia, acute respiratory failure, sepsis, diarrhea	pH: 8 WBC: many	*Klebsiella*	UTI	IV antibiotics	Died of sepsis (not related to UTI)

BP = blood pressure; F = female; hpf = high-power field; IV = intravenous; M = male; NR = not reported; RBC = red blood cell; UTI = urinary tract infection; WBC = white blood cell.

CONCLUSION

PUBS usually has a favorable prognosis. Because PUBS is a rare condition with an alarming appearance, it may cause anxiety in patients and their families. For this reason, physicians should be able to identify PUBS as well as understand both the prevention and treatment of the syndrome. **HP**

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