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Case Report

A Peculiar Manifestation of Urinary Tract Infection in a 76-year-old Female

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ABSTRACT

Purple Urine Bag Syndrome (PUBS) is a rare and benign clinical phenomenon associated with urinary tract infections, characterized by the distinctive purple discoloration of a urinary catheter bag. The underlying cause of PUBS is related to bacterial activity involved in the breakdown of tryptophan, mainly in individuals with predisposing factors such as long-term catheterization, constipation, alkaline urine, and being female. We present the case of a 76-year-old female patient with a history of tuberculous spondylitis who developed PUBS during her hospital stay. The patient had been bedridden for three years and had been given a urinary catheter, which was routinely replaced by a non-medical family member and without a proper antiseptic procedure. A urine culture revealed the presence of Proteus mirabilis, and the patient was treated with intravenous antibiotics while also replacing the urinary catheter and bag. After five days of treatment, the urine bag and catheter remained clear, and the patient was discharged. PUBS is a significant indicator of urinary tract infection, necessitating prompt medical intervention to prevent complications. Healthcare professionals should be aware of this syndrome to enable early detection and appropriate management.

Keywords: Urinary tract infection, CAUTI, purple urine bag syndrome, Proteus mirabilis, and tryptophan.

Highlights: Purple urine bag syndrome is a rare clinical sign of urinary tract infection, manifested as purple discoloration of urinary catheter bag. Healthcare professionals should be aware of this syndrome in order to provide early medical intervention and to prevent complications.

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INTRODUCTION

Purple urine bag syndrome (PUBS) is a rare condition that was first reported in 1978.[1] It is a purplish discoloration of the urinary bag, and a rare manifestation of urinary tract infection (UTI).[2,3] It is caused by bacteria involved in the tryptophan metabolism in patients with predisposing factors such as long-term use of a urinary catheter, constipation, and female gender.[4,5] Notably, while the vivid discoloration is benign, it acts as a visual cue for clinicians as the most common clinical presentation.[6]

Although the appearance of PUBS is benign, it can serve as a disconcerting sight for family members and caregivers alike. For medical professionals, the emergence of PUBS indicates an underlying red flag, often pointing toward a UTI that may have arisen due to lapses in the maintenance or hygiene of the urinary catheter. Such overlooked infections could escalate, ushering in considerable morbidity and even life-threatening consequences.[7,8] We present a rare purple urine bag syndrome in a 76-year-old woman with a history of long-term use of a urinary catheter.

CASE REPORT

A 76-year-old Indonesian woman was admitted to the hospital due to nausea and vomiting that had worsened for two hours before admission. She had a history of tuberculous spondylitis two years before admission and was treated with anti-tuberculosis drugs for one year. A spine MRI detected a Th10-Th12 Spondylitis with paravertebral abscess due to suspect Tuberculosis, Spondylarthroses L3-L4, L4-S1 Spondylarthroses, and Herniated Disc L2-L3, L3-L4, L4-L5. She was then immobilized and bedridden for most of her days. Her lower limb muscles are atrophic, and there was no decubitus ulcer. She was fitted with an indwelling urinary catheter from 2019 with a one-month interval of self-changing. The patient also had a history of epilepsy, with her first seizure in 2019, and is currently on maintenance therapy.

The patient also suffered from chronic constipation since she was a teenager, and it became severe since she was bedridden. She denied complaints and manifestations of urinary symptoms.

Figure 1. The Urinary Catheter Bag Showing Purple Staining.

During hospitalization, her vital signs were within normal limits, and her signs of dehydration were improving. She had normal urine output and creatinine with eGFR 88.82 mL/min/1.73 m^2. On the fifth day of admission, her urinary catheter and bag showed purplish discoloration as shown in Figure 1. However, when collected, the urine was yellowish (Figure 2).

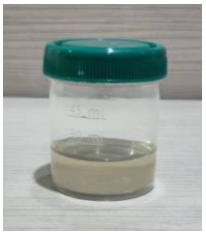

Figure 2. Urine Collected from Urine Bag.

Further history-taking revealed that her urinary catheter was inserted every month by a non-medic without any antiseptic procedure. Her urinalysis revealed a pH of 8.0 (6.5-8.5), leukocyte esterase +3 (negative), positive bacteria (negative), and triple phosphate crystal (negative). A urine culture sample was collected and later revealed $>10^5$ CFU of *Proteus mirabilis,*

which was resistant to nitrofurantoin and trimethoprim/sulfamethoxazole. She has subsequently managed with intravenous ciprofloxacin 400 mg twice daily with a urinary catheter and bag replacement.

After five days of antibiotic therapy, the urine bag and catheter remained clear and normal, with no purple discoloration (Figure 3). Additional urinalysis and urine culture showed no bacteria present. The patient was discharged and scheduled for a follow-up seven days post-discharge.

Figure 3. Normal Urine After Treatment with Antibiotics and Replacement of A Urine Catheter and Urine Bag.

DISCUSSION

Purple urine bag syndrome (PUBS) is a rare presentation of urinary tract infection that involves a series of processes beginning with the intake of tryptophan.[9] Tryptophan metabolite is believed to have a role in purple urine discoloration.[2] The gut bacteria in the digestive system break down tryptophan to produce indole. As indole enters the liver, it is converted into indoxyl sulphate through the portal circulation.[10] Indoxyl sulphate is excreted mostly into the urine. Some bacteria may have an enzyme called indoxyl sulphatase and phosphatase, which converts the indoxyl sulphate into indoxyl.[2,11,12] The indoxyl, in the alkaline urine, will be oxidized into indigo (blue pigment) and indirubin (red pigment), which will mix and react with the urinary catheter bag, producing purple colour.[13] However, PUBS has also been encountered in patients with acidic urine. A high bacterial load is needed to precipitate PUBS. Aside from the sulphatase and phosphatase-producing bacteria, some predisposing factors must be present to develop PUBS.[6,13]

Patients with long-term urinary catheter usage, constipation, dementia, alkaline urine, dehydration, and female gender are at risk of developing PUBS.[4,13,14] A high bacterial load in the urine combined with these factors facilitates the development of PUBS and increases the availability of bacterial sulphatases and phosphatases. A previous study reported PUBS prevalence was 8.3-16.7% in patients using a long-term indwelling catheter. Colonic bacterial overgrowth occurs in chronic constipation, intussusception, and ileal diversion. The overgrowth bacteria increase the determination of tryptophan, and also increases the production of indole. Indoxyl production is increased in catheter-associated urinary tract infections (CAUTI). Some bacteria have been reported in PUBS, including *Proteus species, Escherichia coli, Providencia rettgeri*, *Providencia stuartii, Klebsiella pneumoniae, Enterococcus species, Pseudomonas aeruginosa,* and *Morganella morganii*.[8,15,16] Our patient is a 76-year-old female with a history of immobilization in the past three years and was on chronic urinary catheterization, which was applied by a non-medic staff with no sterile procedure. She often experienced constipation. A purplish hue was observed exclusively in the urinary catheter and bag during the hospital stay. However, the urine itself remained clear when collected. The reason behind this clear urine remains uncertain. However, these observations are consistent with another documented report.[17,18] Her urinalysis showed a pH of 8.0, the presence of +3 leukocyte esterase, triple phosphate crystal, and positive bacteria, which was later revealed as *Proteus mirabilis* from the urine culture. *Proteus mirabilis* is a gram-negative rod-shaped bacterium that frequently causes CAUTI, either as a single

or polymicrobial agent. The bacterium has urease, so it can increase the hydrolysis of urea and later causes the alkalinization of urine. Urinary tract infection which involves *P. mirabilis* may be complicated by the formation of urolithiasis, permanent renal damage, and may further progress into urosepsis.[19]

The most common manifestation present is fever and hypotension. Most live in long-term care units, and the most common comorbidity is diabetes. The pH of the urine ranged between 8.0 and 8.1 across each decade, which is consistent with the documented finding from PUBS research that PUBS occurs more frequently in alkaline than acidic urine.[20,21]

Although PUBS is usually benign and asymptomatic in most cases, the presence of PUBS should alert the clinician of underlying UTI, which should be the center of concern in patient management.[17,22] Patients on prolonged catheterization, multimorbid, and geriatric patients may not have classic signs of UTI.[23] Replacing the urinary catheter and the urinary bag should be done, and the antibiotic for UTI should be administered.[17,24,25] In our case, we administered intravenous ciprofloxacin 400 mg twice daily for empirical antibiotics. The urine culture later revealed that the bacteria were sensitive to the antibiotic. Specific measures like increasing mobility, implementing safe and hygienic methods during catheterization, and treating other risk factors like constipation can decrease the chance of developing PUBS.

STRENGTH AND LIMITATION

In our case study, we rigorously cataloged the patient's medical background and performed in-depth laboratory tests. We attributed UTI as the causative element for PUBS even without pronounced clinical indications. Appropriate treatment of the UTI not only facilitated the rapid mitigation of PUBS but also underscored the efficacy of timely intervention in promptly addressing PUBS manifestations. However, it is essential to note that this report is based on a singular case.

CONCLUSIONS

Purple urine bag syndrome is mostly a benign condition. Families and healthcare professionals who are unaware of this phenomenon, however, could concern with the sudden unexplainable changes in the urine bag color. However, physicians should be aware that this condition indicates underlying recurrent UTIs brought on by improper placement and management of urinary catheters. While being largely harmless and readily cured, it can be linked to significant morbidity and death.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

AUTHOR CONTRIBUTION

Concept - AC, AY, NA, PM; Design - AC, AY, NA, PM; Supervision - AC; Resources - XX; Materials - XX; Data Collection and/or Processing - AC, AY, NA, PM; Analysis and/or Interpretation - AC, AY, NA, PM; Literature Search - AC, AY, NA, PM; Writing Manuscript - AC, AY, NA, PM; Critical Review - AC.

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