

Case Report

Case Report: Purple Urine Bag Syndrome with Surprisingly Acidic Urine

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Abstract

Purple Urine Bag Syndrome (PUBS) is a rare clinical phenomenon typically seen in elderly female patients. It occurs in patients who have chronic urethral catheterisation and comorbid conditions such as chronic urinary tract infections, immobility (bedridden or wheelchair-bound), dehydration, constipation, and chronic kidney disease. The pathophysiology of PUBS is thought to develop as a result of the complex metabolic pathway of essential amino acid tryptophan in the gastrointestinal system, forming urine metabolites converted by bacterial enzymes, sulphatase and phosphatase, turning urine bag and tubing purple. PUBS can emerge as asymptomatic bacteriuria or symptomatic urinary tract infection in a patient with an indwelling urinary catheter. This case report uniquely describes an elderly patient who had a prolonged urethral catheter and presented with a purple discolouration of the urine collection bag with acidic urine and a startling *Klebsiella ozaenae* species that has not been reported to cause this phenomenon before. In many literatures, it is noted to be a benign condition; however, it carries a significant morbidity and mortality. Thereupon, it is critical to vigilantly screen chronic catheterised patients and manage them accordingly. Management of PUBS includes: targeted antibiotic therapy, correcting underlying predisposing factors, aseptic changing of urethral catheter, and finally calming patient and caregivers regarding the condition.

Keywords

Purple Urine Bag Syndrome, PUBS, Urinary Tract Infections, *Klebsiella* Spp, Tryptophan Metabolism, Catheter-associated UTI, Elderly Care

1. Introduction

Purple Urine Bag Syndrome (PUBS) is an unusual condition caused by the appearance of purple-coloured urine in patients with indwelling urethral catheters. It often causes distress to patients, their caregivers, and medical staff. Certain bacterial infections in indwelling catheters are linked to this rare phenomenon and are also associated with specific metabolic conditions. Although this condition is benign, it indicates an underlying bacterial infection and makes a clinical

evaluation necessary.

2. Case Presentation

- 1) Patient Profile and history: A 70-year-old male, known to have End Stage Renal Disease (ESRD) secondary to an obstructive uropathy due to a Benign Prostatic Hy-

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perplasia (BPH) with an Estimated Glomerular Filtration Rate (eGFR) of 4 mls/kg/m². The patient had a history of an indwelling urethral catheter for a month and presented to the emergency department with a low-grade fever for 3 days, generalised body malaise and purplish discolouration of the urine bag. Furthermore, he had a history of constipation for the past 2 weeks, no history of abdominal distention, and no history of vomiting. There is no history of any medications or herbal supplement use.

- 2) Examination: The patient was brought in in a wheelchair, a lethargic elderly man, and was afebrile on arrival with purple-coloured discolouration of the urine bag and tubing (Figure 1).
- 3) Vital signs were within normal limits. There were no signs of acute infection, inflammation, or skin abnormalities around the catheter site.



Figure 1. Purple-coloured urine bag and tubing.

Investigations:

1) Urine Analysis:

- a) Macroscopic examination confirmed the purple hue.
- b) The urine dipstick indicated positive findings for pH 6.0, negative nitrates, and positive (3+) leukocyte esterase. The specific gravity was 1.030.
- c) Microscopic examination showed elevated white blood cells 20-25 cells/hpf, red blood cells >100 cells/hpf.

2) Urine Culture:

Klebsiella ozaenae were isolated, the sensitivity pattern of *Klebsiella ozaenae* is depicted in Table 1 below.

Table 1. Antimicrobial sensitivity chart towards *Klebsiella ozaenae*.

Antibiotic	Sensitivity
Ciprofloxacin	R

Antibiotic	Sensitivity
Trimethoprim/Sulphamethoxazol	R
Amikacin	S
Gentamycin	R
Ceftriaxone	R
Ceftriaxone sulbactam	I
Nitrofurantoin	R
Piperacillin /tazobactam	S
Ceftazidime	R
Meropenem	S
Cefepime	R
Amoxylin/clavunic acid	R

3. Blood Tests

- 1) A complete blood count revealed a leukocytosis of 14.4 with a predominance of neutrophils.
- 2) Renal function tests revealed creatinine levels of 222.6 μmol/L and Blood Urea Nitrogen (BUN) levels of 66.64 mmol/L. Electrolytes were within the normal range.
- 3) A blood culture was taken and yielded no bacterial growth after 24 hours.

Management and Outcome

The patient was treated with antibiotics targeting the identified organisms (*K. Ozaenae*), per antibiotic sensitivity results. The catheter was replaced, and strict aseptic techniques were emphasized for ongoing catheter care. The patient developed septic shock and had hyperkalemia while in the ward. The patient passed away 3 days later.

4. Discussion

Purple urine bag syndrome (PUBS) is a rare clinical phenomenon characterised by purple discolouration of the urine bag and tubing system in patients with indwelling per urethra or suprapubic catheters [1]. It is first described in 1978 by Barlow and Dickson [2]. It is thought to be a clinical manifestation of urinary tract infections.

PUBS has been increasingly noted in geriatric, chronic kidney disease, constipation, prolonged urinary catheterisation, increased intake of tryptophan-rich food, use of polyvinyl chloride (PVC) plastic urine bag and tube, high urinary bacterial load, dehydration, female, and alkaline urine [3, 4]. However, it is also reported in a few case reports that in acidic urine, it can also occur, as in our case [5, 6]. The most commonly found bacteria in PUBS are *E. coli*., *Enterococcus spp.*, *Citrobacter spp.*, *Enterobacter spp.*, *Proteus spp.*, *M. morganii*, Methicillin-resistant *Staphylococcus aureus*, and

Klebsiella spp. [3, 4, 7, 8]. It has not been reported that *Klebsiella ozaenae* produces indoxyl sulphate, which is critical in causing PUBS. However, other *Klebsiella* species are known to produce indoxyl sulphate.

The pathogenesis of PUBS begins with the metabolism of the amino acid tryptophan in the intestines by intestinal bacteria into Indole, where it is absorbed into the portal circulation. In the liver, hepatic conjugation transforms Indole into Indoxyl sulfate (Indican). In urine, bacterial enzymes sulphatase and phosphatase, convert Indoxyl sulfate into Indoxyl. Oxidation of Indoxyl occurs in urine to form Indigo (blue) and Indirubin (red). The latter end products react with plastic urine bags and tubes to produce purple discoloration [1, 3, 7].

This case demonstrates various contributing factors to PUBS, chronic kidney disease is associated with decreased clearance of indoxyl sulphate, which causes bacteria to produce more indigo and indirubin [9, 10]. Constipation prolongs

the time for tryptophan deamination, resulting in more indoxyl sulphate formation [10-12]. Alkaline urine perpetuates oxidation, resulting in accelerated purple discoloration; nevertheless, it is not the sole predisposing factor. Consequently, it is possible to occur in acidic urine [12, 13]. PVC urine bag has also been linked to the development of PUBS due to the interaction of the plastic urine catheter bag and pigment produced by bacteria [14-16].

In the vast majority of cases, PUBS is reported as a benign phenomenon; however, it has been associated with increased morbidity and mortality. Overall mortality of 6.8% [4]. This concurs with our case fatality outcome, thereby healthcare workers should be cognisant of the phenomenon, aggressively manage it with appropriate antibiotics, and correct underlying conditions. In addition, applying good genital hygiene and catheter replacement [16, 17].

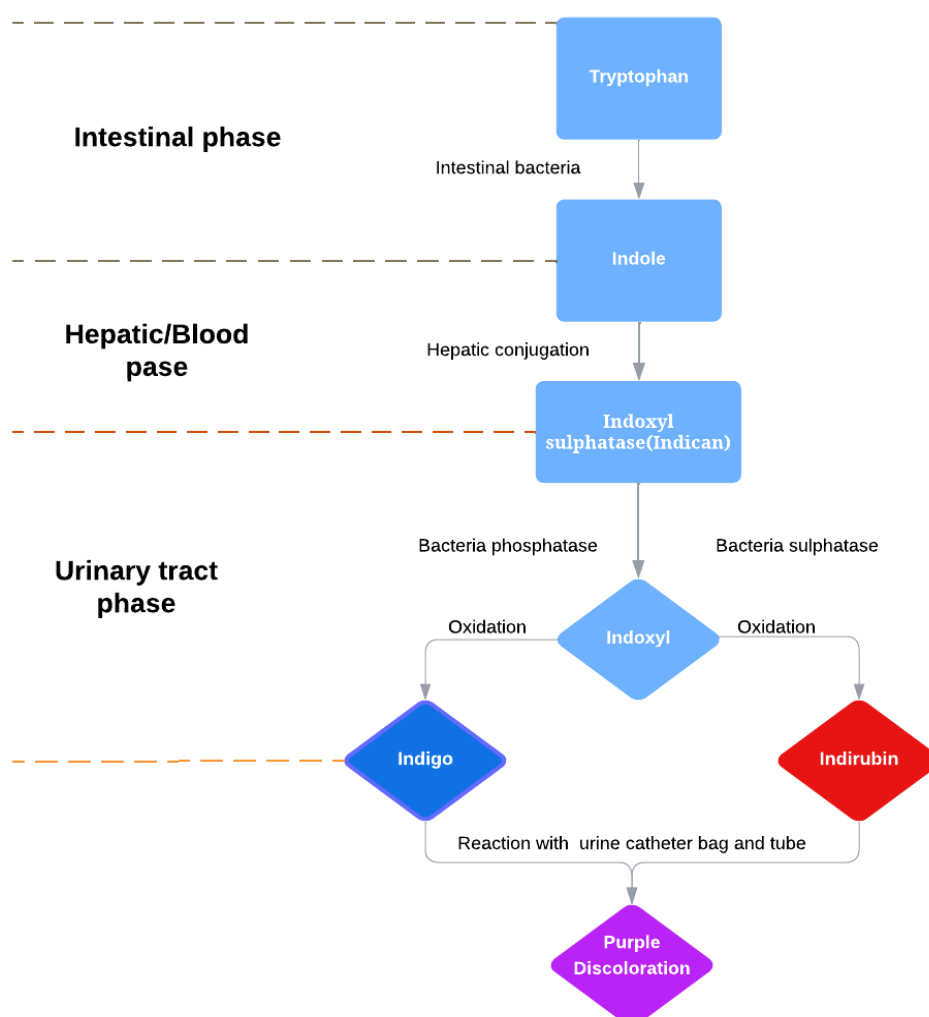


Figure 2. Pathophysiological Tryptophan metabolism pathway in PUBS.

5. Conclusion

This case has highlighted the importance of awareness among healthcare practitioners as it is a rare phenomenon. It has also shown how to manage the case, including calming the patient and caregiver (s). Although uncommon, it has also been brought to attention that even acidic urine can present with PUBS. Treatment includes targeted antibiotic therapy, ameliorating predisposing factors, adhering to urethral or suprapubic catheter hygiene, and raising educational awareness among patient (s) and caregiver (s). It is very important to note that, PUBS can be fatal. Hence, it warrants an early goal directed treatment. Moreover, it is very important to consider prevention of catheter-associated UTI by removing an unnecessary catheter and if, necessary may need to be changed on regular basis.

Abbreviations

PUBS	Purple Urine Bag Syndrome
UTI	Urinary Tract Infection
ESRD	End Stage Renal Disease
BPH	Benign Prostate Hyperplasia
e-GFR	Estimated Glomerular Filtration Rate
R	Resistant
S	Sensitive
I	Intermediate

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Informed Consent

Informed consent was taken and signed from the patient for publication.

Availability of Data and Material

The data are available with corresponding author upon reasonable request will provide.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Author Contributions

Paramjeet Sandhu: Conceptualization, Data curation, Formal Analysis, Project administration, Resources, Validation, Writing - original draft, Writing - review & editing

Shahzmah Suleman: Data curation, Formal Analysis, Validation, Writing - original draft, Writing - review & editing

Hamisi Mkindi: Validation, Writing - original draft, Writing - review & editing

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Conflict of Interest

The authors declare no conflicts of interest.

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