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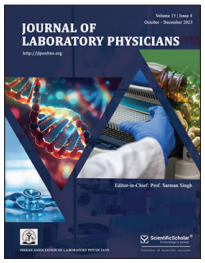
Journal of Laboratory Physicians

Article in Press



Case Series

Urinary tract infections and purple urine bag syndrome- A neglected entity

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Received: 28 June 2024
Accepted: 23 October 2024
EPub Ahead of Print: 30 November 2024
Published:

DOI
10.25259/JLP_128_2024

Quick Response Code:

ABSTRACT

Purple Urine Bag Syndrome (PUBS) is a rare condition characterized by the discoloration of urine bags in patients with prolonged catheterization. Objectives of the study is to report a case series of PUBS and highlight its association with underlying urinary tract infections (UTIs). This is a prospective observational case series included 15 adult patients with PUBS and prolonged catheterization between June 2023 and March 2024. Results of Our case series included 10 male and 5 female patients, with a mean age of 72 years. The majority had comorbidities like chronic kidney disease (53.3%), type 2 diabetes mellitus (46.7%), and hypertension (40%). All patients had undergone prolonged catheterization, with a mean duration of 6 weeks. Urine culture showed growth of Klebsiella, E. coli, and Pseudomonas aeruginosa. In conclusion PUBS is a rare but significant condition that requires prompt attention to prevent complications. Healthcare professionals should be aware of this entity and take necessary measures to prevent and manage UTIs in patients with prolonged catheterization.

Keywords: Purple urine bag syndrome, Urinary tract infections, Prolonged catheterization, Healthcare-associated infections

INTRODUCTION

Purple urine bag syndrome (PUBS) is a very rare entity presenting as a purple discoloration of urine. It occurs due to urinary tract infection by bacteria that metabolize tryptophan into indigo, and indirubin pigments precipitate inside the urine bag system, giving it a purple hue, and is mostly seen in patients who are bedridden and catheterized for a long time.[1] Patients with purple urine usually do not complain of any symptoms. The purple discoloration of the urine bag is often the only finding frequently noted by caregivers. Despite being a benign condition, PUBS is alarming as it is often associated with urinary tract infections (UTIs) and their complications. There are various factors that increase the risk including poverty, using a polyvinyl catheter, and having an underlying health condition.[2,3] It was first described in 1978 by Barlow and Dickson, and since then, it has been observed repeatedly in bedridden elderly patients.[3,4] There are very few studies on PUBS done in india.The studies done by Ahmed et al and Ansari et al include only one case.There is another larger indian study done by Kumar et al include 46 cases.[5-7] PUBS can help in early identification of patients with UTI and prevent further complications. The aim of our case series was to record the prevalence of predisposing factors in our institute. Therefore, we can draw safe conclusions about its recognition and propose a method for its effective prevention and management. In this study, we have summarized a case series of 15 cases with PUBS.

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CASE SERIES

This prospective observational case series was conducted between June 2023 and March 2024. The study was initiated after identifying an index case of PUBS in June 2023, which prompted us to identify additional cases. The index case was a 65-year-old female with type 2 diabetes mellitus, chronic kidney disease, and chronic constipation who developed PUBS after 6 months of catheterization. Following this, we prospectively screened patients with prolonged catheterization and identified 14 additional cases of PUBS and associated UTIs between July 2023 and March 2024. Patient demographics, comorbidities, catheterization duration, and urine culture results were recorded for all 15 cases. The study population consisted of adult patients with PUBS and prolonged catheterization, with a mean age of 72 years. To ensure completeness, we also reviewed catheterization logs and microbiology reports to confirm the diagnosis of PUBS and associated UTIs. All 15 patients were followed up for a median duration of 3 months after PUB's diagnosis, during which regular urine culture and sensitivity testing were performed, and antibiotic therapy was adjusted as needed. Catheter changes and maintenance were also monitored. The outcome measures assessed in this study were the resolution of PUBS, defined as the disappearance of purple discoloration from the urine bag, and the recurrence of UTIs, defined as the presence of symptoms or a positive urine culture after resolution of PUBS, indicating a new or persistent infection. This prospective observational design allowed us to monitor the development of PUBS in patients with prolonged catheterization and identify potential risk factors.

RESULTS

Our study consisted of 10 males and 5 females, with a mean age of 72 years (range: 60–90 years). The majority had comorbidities, including chronic kidney disease (53.3%), type 2 diabetes mellitus (46.7%), hypertension (40%), chronic constipation (26.7%), cerebrovascular accident (26.7%), coronary artery disease (20%), chronic liver disease (13.3%), and rheumatoid arthritis (6.7%) [Table 1]. The common symptoms included are recurrent UTIs (93.3%), purple-colored urine (100%), and prolonged catheterization (100%). All patients had undergone prolonged catheterization, with a mean duration of 6 weeks (range: 3–8 months). Urine culture showed growth of *Klebsiella* (40%), *Escherichia coli* (33.3%), and *Pseudomonas aeruginosa* (20%), with polymicrobial growth in one patient (6.7%). The cases presented with varied clinical profiles [Table 2]. The cases included a 65-year-old female with type 2 diabetes mellitus, chronic kidney disease, and chronic constipation who developed PUBS after 6 months of illness. An 80-year-old male with chronic kidney disease stage 4 and hypertension developed PUBS after 8 months of catheterization. Other cases included a 70-year-old female with diabetes mellitus, coronary artery disease, and chronic kidney disease stage 3; a 76-year-old male with type 2 diabetes mellitus, diabetic nephropathy, and constipation; and a 75-year-old male with diabetes mellitus, coronary artery disease, UTI, and stricture urethra. A 70-year-old male patient had type 2 diabetes mellitus, diabetic retinopathy, chronic kidney disease stage 2, coronary artery disease with left ventricular systolic dysfunction with ejection fraction - 42%, and left hemiparesis developed PUBs after 5 months of catheterization. Another case of a 72-year-old female patient diagnosed to be having paraparesis (a case of transverse myelitis) and on urine catheter for 4 weeks and developed PUBS. She also had a history of chronic constipation additional cases involved patients with chronic liver disease, encephalopathy, intestinal perforation, sepsis, stroke, paraparesis, rheumatoid arthritis, and hypertension. Specifically, 9 patients had recurrent UTIs, and 6 had a history of hospitalization due to UTIs. The patients developed PUBS after prolonged catheterization, ranging from 25 days to 8 months (median duration: 3 months). In addition, we have also included a Review of Comparative Analysis of PUBS Cases in India [Table 3].

Table 1: Demographic and clinical profile of patients.

Characteristics	Number of patients (%)
Male: Female	10:5
Age	72±8 years
Comorbidities	
Chronic kidney disease	8 (53.3)
Type 2 diabetes mellitus	7 (46.7)
Hypertension	6 (40)
Chronic constipation	4 (26.7)
Cerebrovascular accident	4 (26.7)
Coronary artery disease	3 (20)
Chronic liver disease	3 (20)
Rheumatoid arthritis	
Stricture urethera	

Management and outcome

All patients underwent prompt catheter changes and received optimal catheter care to manage PUBS. Antibiotic treatment was tailored to each patient's specific urine culture results, ensuring targeted therapy against the identified pathogens. Fortunately, no significant complications were reported in any of the 15 patients, highlighting the effectiveness of prompt intervention and appropriate management in preventing further adverse outcomes.

DISCUSSION

PUBS was first reported in 1978, and since then, it has been recognized as a rare and seemingly benign

Table 2: Differential manifestations of PUBS.

Patient	Age/Sex	Comorbidities	Catheterization duration	Urine culture
1	65/F	DM, CKD, Constipation	6 months	No growth
2	80/M	CKD stage 4, Hypertension	8 months	*Klebsiella*
3	70/F	DM, Coronary artery disease CKD stage 3	4 weeks	*E. coli*
4	76/M	DM, Diabetic Nephropathy, Constipation	3 months	No growth
5	75/M	DM, Coronary artery disease UTI, Stricture urethra	25 days	No growth
6	62/M	Chronic liver disease, Encephalopathy, Hypertension	1 month	No growth
7	70/M	DM, Diabetic retinopathy, CKD stage 2, Coronary artery disease	5 months	Polymicrobial
8	64/M	COAD, Hypertension, respiratory failure	20 days	No growth
9	72/F	Paraparesis, Chronic constipation	4 weeks	*Klebsiella*
10	83/M	CKD stage 2, Hypertension, Intracerebral hemorrhage	8 weeks	No growth
11	68/F	Intestinal perforation, Sepsis, Multiorgan failure	5 months	No growth
12	85/M	Hypertension, Stroke, CKD stage 3	5 months	No growth
13	66/M	DM, Diabetic nephropathy/CKD	6 months	No growth
14	70/M	DM, Encephalopathy (Hypoglycemic)	6 weeks	Polymicrobial (*E. coli*, *Klebsiella*)
15	73/F	Rheumatoid arthritis, Hypertension, CKD stage 2	8 weeks	*E. coli*

DM: Diabetes mellitus, CKD: Chronic kidney disease, UTI: Urinary tract infections, COAD: Chronic obstructive airway disease, PUBS: Purple urine bag syndrome, *E. coli*: *Escherichia coli*

Table 3: PUBS cases in India: Demographics, management, and outcomes.

Study/Year	Number of cases	Age/Sex	Comorbidities	Catheterization Duration	Urine Culture	Outcome measure/ Management
Ahmad *et al*. (2020)[5]	1	73 years, F	HTN, Stroke	6 months	Providencia rettger	Resolution of PUBS/ Antibiotics, Catheter change
Kumar *et al*. (2021)[6]	46	34–87 years, M/F	Bedridden, chronic constipation, CVA, Dementia	7 days–130 days	*E. coli*, *Klebsiella*, Pseudomonas	Resolution of PUBS/ Antibiotics, Catheter change
Ansari *et al*. (2022)[7]	1	72 years/M	DM/HTN/CVA/CKD	3 weeks	*E. coli*/Enterococcus	Resolution of PUBS/ Antibiotics, Removal of catheter
Present Study (2023–2024)	15	62–85, M/F	DM, CKD, HTN	1–8 months	*E. coli*, *Klebsiella*, Polymicrobial	Resolution of PUBS, No recurrence/Antibiotics, Catheter change, Regular follow-up

PUBS: Purple urine bag syndrome, HTN: Hypertension, DM: Diabetes mellitus, CKD: Chronic kidney disease, CVA: Cerebrovascular accident, *E. coli*: *Escherichia coli*, M: Male, F: Female

condition.[8] Despite its rarity, studies suggest that PUBS may affect a significant proportion of long-term catheterized patients, with prevalence rates ranging from 8% to 16%.[1] This phenomenon highlights the importance of vigilance and prompt management of UTIs in vulnerable patient populations. The pathogenesis of PUBS is thought to involve the bacterial decomposition of tryptophan in the gut lumen, leading to the production of indoxyl sulfate, which subsequently oxidizes to indigo upon exposure to air.[9-11] Tryptophan, an essential amino acid obtained from dietary sources such as oats, bananas, milk, cheese, bread, chicken, and peanuts,[12] plays a pivotal role in this process. PUBS is often described in patients with specific clinical profiles, including those with alkaline urine, prolonged bed rest, and chronic kidney disease. Catheterization is a major contributor to the risk of developing PUBS, while acidic urine has been linked to increased danger.[13] The syndrome has also been associated with various bacterial species, including *Klebsiella pneumoniae*, *Proteus mirabilis*, *E. coli*, *Morganella morganii*, and *P. aeruginosa*.[14-16] Interestingly, data from past literature suggest that PUBS can be precipitated by other intestinal conditions, such as intestinal obstruction.[17-20] This finding underscores the complex interplay between UTIs, catheterization, and systemic health. In the current healthcare landscape, treating catheter-associated urinary tract infections as minor issues is no longer sufficient.[21] The emergence of antimicrobial resistance and the increasing

Figure 1: A 70-year-old male patient had type 2 diabetes mellitus, diabetic retinopathy, stroke, left hemiparesis bedridden with urinary catheter *in situ* and developed purple urine bag syndrome.

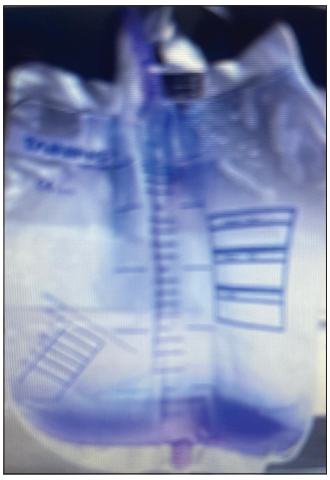

Figure 2: A 72-year-old female patient having Paraparesis and on urine catheter for 4 weeks. She also had a history of chronic constipation and developed purple-colored urine.

prevalence of chronic conditions underscore the need for enhanced vigilance and proactive management of UTIs. To mitigate the risk of PUBS and related complications, healthcare providers should prioritize the Minimizing catheterization time, Regular catheter changes and Enhanced catheter care, Prompt diagnosis and treatment of UTIs. Particularly for elderly patients, these measures can significantly reduce the risk of PUBS and improve overall health outcomes.[21] By adopting a proactive approach to urinary tract infection management, healthcare providers can optimize patient care and reduce the burden of PUBS and related complications.

CONCLUSIONS

PUBS is a rare and benign condition that serves as a visual indicator of underlying bacteriuria and urinary tract infection. Although PUBS is often asymptomatic and harmless in itself, it should not be dismissed as a trivial matter. Rather, it warrants attention and prompt management to prevent potential complications and exacerbation of underlying health issues. As a manifestation of an ongoing urinary tract infection, PUBS can pose a significant health risk if left untreated, particularly in patients with pre-existing chronic conditions. Therefore, healthcare providers should remain vigilant and take appropriate measures to address the underlying infection and prevent further complications.

Acknowledgment

The authors acknowledge the support of the hospital staff and patients who participated in this study.

Author contribution

Jyoti: Data Curation, Investigation, Writing - Review & Editing
Vikas: Conceptualization, Methodology,
Veenu: Supervision, Validation

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript, and no images were manipulated using AI.

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How to cite this article: Jindal J, Garg V, Gupta V. Urinary tract infections and purple urine bag syndrome- A neglected entity. J Lab Physicians. doi: 10.25259/JLP_128_2024