Recurrent purple urine bag syndrome presenting with full spectrum of disease severity: case report and review of literature

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Abstract Purple urine bag syndrome (PUBS) is a unique phenomenon characterized by purple discoloration of the urinary catheter bag and tubing following urinary catheterization lasting for hours to days. The purple discoloration is a mixture of indirubin dissolved in plastic with indigo on its surface. PUBS is most commonly associated with urinary tract infection (UTI) caused by bacteria with indoxyl phosphatase/sulfatase activity. It occurs predominantly in chronically catheterized, constipated elderly female patients. It usually appears to be asymptomatic and harmless, but rarely it can present as a severe illness. We report on a 29-year-old female with urinary ileal diversion presenting with multiple episodes of PUBS each with an asymptomatic state of varying severity, symptomatic UTI and severe sepsis requiring intensive care. To our knowledge, this is the first report where a single young patient had recurrent PUBS which presented with a full spectrum of disease severity at different occasions.

Keywords Purple urine · Urinary tract infection · Indirubin · PUBS · Ileal conduit

Introduction

Purple urine bag syndrome (PUBS) was first reported in 1978 [1]. PUBS refers to purple discoloration of the urinary drainage bag following urinary catheterization. The purple

discoloration is a mixture of indirubin dissolved in plastic with indigo on its surface. Indirubin and indigo are metabolites of tryptophan, red and blue in color, respectively. Thus, PUBS can present as reddish, bluish or a combined purplish discoloration of the urinary catheter bag [2]. Food containing tryptophan is metabolized by intestinal bacteria to indole, which is converted to indoxyl sulphate in the liver and excreted into urine in high concentrations. Bacteria in the urinary tract or catheter bag with indoxyl phosphatase/sulfatase activity will metabolize indoxyl sulphate into indigo or indirubin (Fig. 1), which subsequently reacts with the catheter bag. PUBS is most commonly associated with the following risk factors: urinary tract infections, elderly female patients, dementia, constipation, alkaline urine, high urinary bacterial counts, and chronic kidney disease [3–6]. Most reported cases of PUBS are benign in nature, harmless, and do not require intensive treatment [7]. A few cases report alarming features of PUBS requiring aggressive treatment [8, 9]. We present a case of a 29-year-old female with urinary ileal diversion who presented with multiple episodes of PUBS with a full spectrum of disease severity. To our knowledge, this is the first case of PUBS occurring in the same patient with both benign and severe features of PUBS, and a treatment regimen varying from no treatment to intensive care unit (ICU) admission, respectively.

Case report

Episode 1

A 27-year-old Caucasian female had a significant history of recurrent urinary tract infections, chronic constipation, cerebral palsy, and neurogenic bladder. She initially

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Fig. 1 Pathogenesis of purple urine bag syndrome: the food containing tryptophan being metabolized by intestinal bacteria to indole, which is converted to indoxyl sulphate in the liver and excreted into urine in high concentration. The bacteria in the urinary tract with indoxyl phosphatase/sulfatase activity will metabolize indoxyl sulphate into indigo or indirubin

managed her neurogenic bladder with a suprapubic catheter, but later was switched to ileal conduit diversion due to severe pain at the stomal site, recurrent UTI, and lack of proper nursing care for intermittent catheterization. During the urinary diversion procedure, she underwent cystectomy to prevent future complications. Interestingly, she did not have history of urolithiasis. She presented with a 3-day history of fatigue and fever, and reported that 5 weeks prior to her presentation her urinary bag displayed purple discoloration. Her urinary bag was changed every 2–3 days. The patient has a history of chronic urinary colonization with *E. coli*. Cultures taken 3 and 4 months prior showed *E. coli* greater than 100,000 with resistance to ampicillin, ciprofloxacin, gentamicin and piperacillin. She had not been on any antibiotics prior to this admission.

On presentation, her systolic blood pressure was in the 70s, with a heart rate in the 140–150s, and respiratory rate of 21 per minute. She was febrile (38.4 °C). She was lethargic but cooperative and conversant. She had slight tenderness to palpation in the right upper quadrant. Her ileal conduit was located in her right lower abdomen with pink-appearing stoma. The urine bag was purple with yellow urine (Fig. 2). She had contractures of the lower extremities and restricted range of motion in her upper extremities secondary to cerebral palsy. The rest of her

Fig. 2 Dark purple discoloration of urinary bag (adapted from Bhattarai et al. [9] with permission)

physical examination was unremarkable. Labs revealed a white blood cell count of 34,000/mL (normal 4500–10,800/mL), lactic acid 6 mmol/L (0.5–2.2 mmol/L), ESR 50 mm/h (0–20 mm/h), and CRP 21.4 mg/dL (<1.0 mg/dL). Urinalysis showed urine pH 8.5, large leukocyte esterase, white blood cell count of 110, positive bacteria and triple phosphate crystals. The patient was initially started on piperacillin–tazobactam in the emergency department. She required transfer to the ICU due to persistent hypotension, and antibiotics were empirically started with meropenem and daptomycin. The urine cultures grew vancomycin-resistant *Enterococcus* with greater than 100,000 colonies, *Proteus mirabilis* with greater than 80,000 colonies, and *E. coli* with greater than 100,000 colonies. Antibiotic susceptibility returned which showed all three organisms were susceptible to meropenem and levofloxacin. The patient was on meropenem for 5 days and her symptoms improved significantly. She was discharged on levofloxacin for 14 more days. Urinary bag discoloration had resolved by the time of discharge.

Episode 2

Four months later, the patient presented to her urologist complaining of stomal tenderness, lower abdominal pain and recurrent purple discoloration of her urinary tubing and bag. She denied fever, chills, nausea, vomiting or other urinary symptoms. On examination her pulse was 110 per minute, blood pressure 120/74 mmHg and respiration rate was 18 per minute. Her abdomen was benign and her stoma was viable and pink. The only significant finding on examination was a purple urinary bag with significant debris and mucus. Urinalysis showed yellow urine with pH 8.5, nitrite positive, moderate bacteria and triple phosphate crystals. Urine culture grew greater than 100,000 colonies of *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Enterococcus*

(not VRE), and *Alcaligenes species*. Culture susceptibilities showed these bacteria were susceptible to ciprofloxacin. Thus, the patient was treated with ciprofloxacin for 2 weeks. Her PUBS resolved after treatment.

Episode 3

After 2 years without PUBS, but with a total of six episodes of urinary tract infections involving organisms such as *E. coli*, *Proteus species*, *Enterococcus* (not VRE) species, she presented again to her primary care physician's office with a complaint of a purple urine bag for 2 weeks. The patient denied fever, chills, suprapubic or abdominal pain, or any other complaints. On examination, her pulse was 90 per minute, blood pressure was 143/86 mmHg, respirations were 16 per minute, and she was afebrile. The remainder of the physical examination was unremarkable except for a purple urinary bag. Urinalysis showed cloudy yellow urine with pH 8.0, nitrite positive, occasional bacteria, and triple phosphate crystals. Urine culture showed greater than 100,000 colonies of *E. coli*. Since the patient had an asymptomatic UTI, no antibiotic was given. The patient's PUBS resolved after 3 weeks without any treatment.

Discussion

Purple urine bag syndrome is a rare phenomenon in an acute care medical center. The exact prevalence of PUBS is unknown. Shiao et al. [5] reported the prevalence of PUBS in four institutions ranged from 0 to 40 %. Other reports also showed a wide range of prevalence including 9.8 % (7 of 71) in Dealler et al. [2], 8.3 % (13 of 157) in Su et al. [6] and 42.1 % (8 of 19) in Lin et al. [12]. Most of these studied populations were in long-term care facilities. This may reflect diversity in the local bacterial epidemiology, in patient population, or in the facility environment.

PUBS is commonly associated with urinary tract infections, elderly female patients, dementia, constipation, alkaline urine, high urinary bacterial counts, and chronic kidney disease [3–6]. PUBS predominately occurs in females, likely because the female urethra is more prone to bacterial infection due to its short length and proximity to the anus [5]. Constipation increases the risk of PUBS due to decreased intestinal motility resulting in bacterial overgrowth of the intestine. This bacterial overgrowth increases the metabolism of tryptophan to indole, resulting in a high level of indigo and indirubin in the urine [10]. Also, Mantanie et al. [4] reported the urine bacterial counts in PUBS were significantly higher as compared to patients without PUBS, which indicates a higher bacterial load may be necessary for development of PUBS. The likelihood of PUBS occurring is low, but the probability of PUBS is

much higher with the right elements: multiple risk factors, UTI with high bacteria load, bacteria which possess the right enzymes, and chronic catheterization. Our patient had multiple risk factors including female gender, chronic constipation, wheel-chair bound, permanently catheterized (ileal conduit) and recurrent UTI with alkaline urine. Our patient is unique as she is young; probably this is the first case of PUBS reported in a young female.

Most PUBS cases occur in alkaline urine, pH > 7; however, PUBS in acidic pH has been reported [4, 11]. The common bacterial strains associated with PUBS include: *E. coli*, *Proteus species*, *Pseudomonas species*, *Enterococcus species*, *Citrobacter species*, *Klebsiella species*, *Morganella* and *Providencia species* [2, 6]. Our patient's urine culture and urinalysis were consistent with previous reports.

Furthermore, most reported PUBS cases are harmless and asymptomatic [6, 10, 12, 13]. A few reports associate PUBS with more severe complications that require intensive treatment [8, 9, 14], such as in our patient. The morbidity and mortality significance of PUBS remain unclear. Also, available evidence is insufficient to establish guidelines for treatment [7]. Some authors suggest that improving the care of urinary catheters, as well as urological sanitation and controlling constipation are essential for the prevention of PUBS [10, 12]. In addition, guidelines from the Infectious Diseases Society of America state that screening for asymptomatic bacteriuria in elderly people or patients with chronic catheters is not recommended [15]. PUBS is categorized as an asymptomatic bacteriuria because purple discoloration itself is not a symptom of UTI [10]. Thus, a few authors have recommended not performing routine urine cultures in patients with a permanent catheter, including asymptomatic PUBS [10, 16, 17]. However, we strongly recommend that any PUBS should be managed on a case-by-case basis. Our patient's first episode of PUBS progressed to severe sepsis that required aggressive treatment, including ICU admission and intravenous antibiotics. Therefore, early recognition of PUBS as a source of infection is essential for prompt treatment. Our patient's second episode of PUBS presented as symptomatic UTI only requiring 2 weeks of oral antibiotics. Her third episode of PUBS presented as an asymptomatic UTI which resolved in 3 weeks without any treatment.

Compliance with ethical standards

Conflict of interest The authors have declared that no conflict of interest exists.

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