

# Purple urine bag syndrome

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## ABSTRACT

Purple urine bag syndrome is a rare disorder where the plastic urinary catheter bag and tubing turn purple. The discolouration is due to the presence of indigo and indirubin pigments which are metabolites of tryptophan. It is associated with urinary tract infection. Bacteria that produce sulphatase and phosphatase are involved in the formation of these pigments. Purple urine bag syndrome is associated with higher morbidity and mortality, compared to urinary tract infection without this phenomenon. We present a case report of this rare phenomenon occurring in a 68-year-old woman.

**Keywords:** chronic urinary catheterisation, indigo pigment, indirubin pigment, purple bag syndrome, urinary tract infection

*Singapore Med J 2009;50(5):e193-e194*

## INTRODUCTION

Purple urine bag syndrome (PUBS) is a rare disorder where the plastic urinary catheter bag and tubing turn purple. PUBS can be distressing for patients, family members and healthcare workers who are unaware of this association. This condition is often associated with urinary tract infection. Discolouration of the urine bag is due to the presence of indigo and indirubin pigments which precipitate and react with the synthetic materials of the catheter and urinary bag. We present a case report of this rare phenomenon.

## CASE REPORT

A 68-year-old obese woman was admitted with fever and pain in the left leg of six days' duration. She was found to have cellulitis over the medial aspect of her left lower leg. Her past medical history included obesity, type 2 diabetes mellitus with peripheral neuropathy, retinopathy, nephrotic range nephropathy, hypertension, dyslipidaemia and carcinoma of the pancreas, which was treated with Whipple's surgery in 1990. The patient also had chronic constipation.

Investigations revealed leucocytosis of  $15.0 \times 10^9$  (normal range [NR] 4.0–11), erythrocyte sedimentation rate of 107 (NR < 15) mm/hr, serum haemoglobin of 8.2 (NR 12–15) g/dL, serum urea of 29.5 (NR 2.9–7.1)



**Fig. 1** Photograph shows purple discolouration of urinary bag and tube with the proximal tubing having predominant bluish discolouration.

mmol/L and serum creatinine of 284 (NR 53–115)  $\mu\text{mol/L}$ . She later developed an abscess over the cellulitis site. Blood culture isolated *Escherichia coli* (*E. coli*). The abscess was initially treated with incision and drainage; however, the wound had to be debrided several times. As a result of her illness, the patient was bedbound. She had to be catheterised to prevent the development of any complications due to chronic urine contamination, as she was at a high risk for pressure sores despite preventative measures. Catheterisation was also used for fluid output monitoring. She was treated initially with intravenous amoxicillin-clavulanic acid 1.2 g thrice daily, which was later changed according to the culture antibiotics sensitivity pattern.

The patient's hospital stay was complicated by acute renal failure which required haemodialysis, bleeding from the wound site which required blood transfusions, and allergic reaction to imipenem. She also had multiple episodes of wound and urinary tract infections. Organisms, including *Pseudomonas aeruginosa*, *E. coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Acinetobacter baumannii*, coagulase-negative *Staphylococcus aureus* and methicillin-resistant *Staphylococcus aureus* (MRSA), were isolated from the wound. However, despite the presence of urine sedimentation and urine analysis showing leucocytosis suggestive of urinary tract infection, no organisms were isolated from the urine, probably as a result of previous antibiotics use. The patient's condition slowly improved. However, on the 76th day of admission, she developed another episode of fever secondary to another urinary tract infection. Three days later, the urine

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bag was noted to have a purple discolouration (Fig. 1). She died on the same day. Blood and urine cultures which were taken on the day of purple discolouration of the urine bag isolated *E. coli*.

## DISCUSSION

PUBS is rare and was first reported in 1978.<sup>(1)</sup> It is a rare manifestation of urinary tract infection. However, a prevalence of as high as 9.8% in institutionalised patients who are on long-term urinary catheter has been reported.<sup>(2)</sup> Interestingly, even a famous historical figure was believed to have been affected by this syndrome, or at least a part of PUBS. In 1812, physicians caring for England's "Mad" King George III noted a bluish tinge to the king's urine, which left a pale-blue ring on the glass near its upper surface. He also had bouts of constipation, a known risk factor for PUBS.<sup>(3)</sup> Bluish discolouration of the urinary catheter has also been described in patients with PUBS, along with purple discolouration of the urinary bag.<sup>(4)</sup>

PUBS has been shown to be associated with the female gender, alkaline urine, constipation, institutionalisation and the use of plastic urinary catheter and bag.<sup>(4,5)</sup> Higher bacterial load in urine, in combination with the above factors, facilitates the development of PUBS. The bacterial species most commonly associated with PUBS are *Providencia* spp., *E. coli*, *Proteus* spp., *Pseudomonas* spp., *Klebsiella pneumoniae*, *Morganella* spp. and *Enterococcus* spp. Less commonly reported associations include *Citrobacter* spp., *Staphylococcus* spp., *Streptococcus* spp. and even MRSA.<sup>(4,7)</sup> Many of these organisms were isolated from our patient, but mainly from the wounds. However, prior to her death, *E. coli* was isolated from both the blood and urine cultures. In addition, our patient had all the risk factors for PUBS – elderly female, constipated and catheterised.

The strong association with constipation and intestinal obstruction has been well described.<sup>(5,6,8)</sup> Chronic constipation alters gut motility and intestinal bacterial flora. Bacterial flora containing tryptophase converts dietary tryptophan to indole, pyruvic acid and ammonia.<sup>(4,8,9)</sup> Indole is absorbed rapidly to the portal circulation and is oxidised to indoxyl in the liver, which is excreted in urine. In an alkaline environment, indoxyl is oxidised to the red pigment indigo. When there is little oxygen, indoxyl gets converted to istatin, which further combines with an indoxyl residue to yield the blue pigment, indirubin.<sup>(7,10)</sup> Sulphatase and phosphatase are the enzymes responsible for these reactions. The urine itself is not discoloured red, blue or purple. Precipitation of the indirubin results in the bluish discolouration, and this has been described.<sup>(6)</sup> Precipitations of both the red and blue pigments and reaction with the synthetic materials of the

catheter and urine bag result in purple discolouration.

It is interesting to note that despite the common occurrence of urinary tract infections in patients with risk factors for PUBS, this interesting syndrome is rarely encountered. There are a few possible reasons. PUBS probably requires the simultaneous presence of various factors: the presence of urinary tract infection caused by sulphatase- and phosphatase-producing bacteria, the presence of high tryptophan in the diet for the formations of the essential pigments, and being catheterised. It has been shown that not all bacteria organisms of the same species produce the phosphatase and sulphatase enzymes required for the formation of the responsible pigments.<sup>(2,4,6,7)</sup> Furthermore, a certain concentration of the pigments may be required for the precipitations to become visible. The presence of alkaline urine, and also the type of materials used to manufacture the urinary catheter and bag may be important factors.<sup>(6)</sup> Interestingly, PUBS in the presence of acidic urine has also been reported.<sup>(11)</sup>

In conclusion, PUBS is a rare manifestation of urinary tract infection. It often occurs in chronically catheterised and constipated women who have significant underlying comorbidities. Although relatively benign and easily treatable, it can be associated with significant morbidity and mortality. The treatment should be aimed at the underlying medical problem rather than purple bag itself. Interestingly, recurrences of purple discolouration of the urine bag, if the urine bag is changed prior to the complete resolution of urinary tract infection, have been reported.

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