

## Case Report

Open Access, Volume 2

# Purple urine bag syndrome: When the urine turns purple – An under diagnosed spot diagnosis

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Received: Apr 21, 2021

Accepted: May 25, 2021

Published: May 28, 2021

Archived: www.jcimcr.org

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## Abstract

The Purple Urine Bag Syndrome (PUBS) is a rare condition in which the urine turns purple. It may occur in Urinary Tract Infections (UTIs) when bacteria metabolize dietary tryptophan to indole resulting in indigo (blue) and indirubin (red). This condition is mostly seen in elderly female patients with permanent urinary bladder catheterization. Patients, relatives and health professionals may be concerned about this discolouration, which is usually harmless. Medical management of PUBS involves frequent urinary bag change, antibiotic therapy and most importantly reassurance.

We report an 89-years-old long-term catheterized female nursing home resident who was admitted to the emergency room because of a Community Acquired Pneumonia (CAP). After a few days of inpatient treatment her urine bag turned purple. Antibiotic therapy continued and the indwelling urinary catheter was changed resulting in clear urine.

**Keywords:** Purple urine bag syndrome (PUBS); purple discolouration; urinary tract infection (UTI); long-term catheterization.

## Introduction

Observation of urine is important in the daily medical life as changes in colour and consistency may indicate a systemic disease or a medical condition. Purple Urine Bag Syndrome (PUBS) is a spot diagnosis.

Regarding the underlying pathophysiology an alternated metabolism of tryptophan results in purple urine colour. Tryptophan, a dietary amino acid, is metabolized in the gastrointestinal tract into indole. Indole is then transported to the liver where it is sulfonated to indoxyl sulphate (Indican) which is excreted into urine. In the presence of sulfatases and phosphatases, indoxyl sulphate is oxidised to indirubin and indigo. The mixture of these red (Indirubin) and blue (Indigo) pigments turns the urine purple [1,2].

The known risk factors include female gender, elderly patients, long-term catheterization, hospitalization, constipation, Urinary Tract Infections (UTIs), dehydration and alkaline urine. It is assumed that constipation leads to urinary retention which in turn leads to an increased exposure of bacteria [1,3,4]. Whereas alkalised urine catalyses the oxidation of indoxyl sulphate to indirubin and indigo [5].

In contrast to ordinary UTIs, PUBS is generally associated with an asymptomatic course of infection but characterized by a high level of bacterial load in the urine sample [6,7]. Especially some bacteria produce sulfatases and phosphatases, which are responsible for metabolizing tryptophan resulting in the purple discolouration. The spectrum of bacteria generally includes

**Citation:** Kodde C, Othmer T, Krieger D, Polsfuss S, Bauer T. Purple urine bag syndrome: When the urine turns purple – An under diagnosed spot diagnosis. *J Clin Images Med Case Rep.* 2021; 2(3): 1170.

Gram Negative Enterobacteria (GNEB) such as *Escherichia coli*, *Proteus mirabilis*, *Providencia stuartii*, *Providencia rettgeri*, *Morganella morganii*, but also *Klebsiella pneumoniae*, *Enterococcus* species and *Pseudomonas aeruginosa* [1,3].

Even though PUBS is seen as a harmless condition, it can lead to a more severe infection in e.g. immunocompromised patients [8]. The purple hue may cause distress to patients, caregivers and healthcare professionals. It is therefore important to inform about the benignancy and possible underlying conditions and to abstain from prescription of antibiotics on a regular basis.

### Case presentation

An 89-year-old female patient was admitted to the hospital in March 2019 due to a community acquired pneumonia and cardiac decompensation. The patient was brought by the ambulance to the emergency room from a nursing home. The main symptoms were dyspnoea, high fever (39°C) and deterioration of general condition. The patient has been living in a nursing home for several months due to a cerebrovascular accident with arm palsy and dysphagia. Her medical history includes diabetes mellitus type II, obesity and paroxysmal atrial fibrillation. On admission, the bedridden patient showed no signs of a urinary tract infection besides elevated inflammatory markers. The patient was on long-term catheterization and the last change was 17 days prior to admission. The urine catheter bag was made of polyvinyl chloride (CYSTOBAG® Uromed, TK 2000, Oststeinbek, Germany).

The thoracic X-ray showed a pulmonary infiltrate in the left and right lower lobe, consistent with the diagnosis of Community Acquired Pneumonia (CAP). The laboratory findings revealed elevated C- Reactive Protein (CRP) and leucocytosis but a normal creatinine level. Before the initiation of antibiotic therapy with Piperacillin/Tazobactam to treat the CAP, a urinalysis was performed. Urinary pH was 9.0 and it was positive for nitrite. Furthermore, erythrocytes, leucocytes and proteins were detected. A few days later urine culture revealed growth of *Enterococcus faecalis* ( $10^5$ /ml) and *Proteus mirabilis* ( $10^5$ /ml).

The patient had constipation for two days before the purple hue appeared and laxatives were given resulting in a regular defecation. Four days after admission the urine suddenly turned purple (Figure 1). By that time, the patient did not show any signs of UTI and the inflammatory markers were declining. Consequently, the catheter was changed. The purple discoloration disappeared over the next few days. The urine was cultured repeatedly but without detection of any bacterial growth. After changing the catheter, the purple urine did not recur. The patient was discharged after 8 days of hospitalization.



**Figure 1:** Purple colour of urine, urine bag and tubing.

### Discussion

PUBS is a rare condition and only a few case reports have been published so far. It is evident that mostly elderly females living in a nursing home who have a permanent urine catheter have been diagnosed with PUBS [3,9]. In general, these patients are at a higher risk of developing a bacterial UTI. Some of the uropathogenic bacteria are responsible for producing indoxyl phosphatase and sulfatase which are supposed to play a key role in the mechanism of turning urine purple. Another risk factor, which increases the risk of PUBS is an alkaline urine. An alkaline environment catalyses the breakdown of indoxyl sulphate into indigo and indirubin. Although alkaline urine is not mandatory for PUBS, studies have shown that 91.3% of PUBS cases happen in an alkaline setting and rarely in an acidic urine [1,3,10].

Another key role plays the intestine where tryptophan is converted to indole. Constipation precipitates PUBS: It alters the gut motility resulting in a bacterial overgrowth and prolonged time to metabolize tryptophan. To treat constipation, laxatives are often prescribed. Laxatives itself may also promote PUBS by leading to inflammatory colorectal mucosa damages and overgrowth of bacteria which produce indigo [3,6,11]. Especially those patients who are in palliative care on a great exposure because the prescription of opioids is common and constipation occurs as a side effect.

Additionally, elderly patients in general are prone to be immobilised due to comorbidities, which requires long-term catheterization increasing the risk of a urinary bacterial infection and thus PUBS. In persistent PUBS it is also important to consider the material of the urine bag. Most of the catheter systems consists of a silicone tube and a urine bag containing Polyvinyl Chloride (PVC). This sort of plastic facilitates the staining by the pigments indirubin and indigo. A change in the material may stop PUBS from recurring.

In our case the patient presents the most known risk factors. Upon admission the elderly female patient showed an alkaline urine (pH 9) and a urine culture positive with significant bacterial count for *Proteus mirabilis* and *Enterococcus faecalis*. Due to a stroke the patient was bedridden, living in a nursing home and was on indwelling urinary catheter. Initially, the patient showed a regular defecation but was then constipated for two days. Laxatives (Lactulose) were already given in the nursing home on a

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regular basis [1,3].

It is noteworthy that PUBS is rarely reported, probably because it is underdiagnosed. On one hand it can be misdiagnosed for haematuria by medical professionals on the other hand the interaction and accumulation of different risk factors is required to develop PUBS.

### Conclusion

PUBS is a rare, mostly benign condition, but it is associated with UTIs and other comorbidities. It occurs mainly in female, elderly, bedridden patients with an indwelling urinary catheter. A group of patients who are predisposed for a higher mortality. In an elderly population, it is important for health professionals to be aware of this syndrome, especially because it is a spot diagnosis. Unnecessary use of antibiotics should be prevented by understanding the pathophysiology, which leads to purple urine.

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