

## Acidic Urine Precipitating Purple Urine Bag Syndrome-A Puzzling Case Series

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### Abstract

Purple urine bag syndrome or purple bag syndrome is an unusual condition seen mostly in women who have been using a urinary catheter for prolonged periods of time. Commonly accompanied by alkalinised urine. On metabolization of tryptophan to produce indole, there is breakdown of indole into indoxyl sulphate. This is linked to bacterial urinary infections that produce sulphatase and phosphatase. Indoxyl sulphate on excretion is broken down into Indigo (blue) and indirubin (red), and their combination that results in purple, is to blame for the etiology.

An 80 year old male with Parkinsonism, a 77 year old female bedridden due to bilateral fracture neck of femur and an 84 year old male with discolored urine all presented with purple colored urine/urine bag. This case series is about the above 3 patients who presented with acidic urine and their management.

Purple urine bag syndrome or purple bag syndrome is a concerning condition for patients as well as their families however prompt investigations, oral or intravenous antibiotics and a change in catheter will help symptomatically.

**Keywords:** Purple urine;acidic purple urine;tryptophan metabolism.

### Introduction

The first report of Purple urine bag syndrome was in late 1970s [1]. It is an unusual condition characterized by purple discoloration of the urine bag/catheter. In history, it is said when King George III had long standing constipation he had an episode of purple to blue colored urine [8]. Most commonly seen in the female gender and in ill patients with long standing urinary catheters. [2,3]. PUBS is also seen in patients with chronic constipation; in patients having alkaline urine; or those who use plastic urine catheter for long periods of time [2,4,5].

In hospitalised patients who were catheterised for long periods of time, the prevalence of PUBS is reported as 9.8% [2,3,4]. Urinary tract infection is frequently linked to this illness. The formed pigments indigo-the blue pigment; indirubin-the red pigment react with the artificial substances of the urine catheter and the attached urinary bag causing discoloration of the urine bag.

It is important to understand that this binding causes the discoloration and the freshly voided urine by itself is not discolored.

### Case Reports

#### Case 1- [Figure 1]

An 80 year old male came with complaints of ulcer over gluteal region for 5 days and burning micturition for 3 days. He was a known case of Parkinsonism, Type 2 diabetes mellitus. He was bedridden for 3 years due to this debilitating ailment and was chronically catheterised as a result. He had a history of constipation for 3 years. Purple colored urine and urine bag was seen 3 days before they visited the ER for management. Urine routine examination showed a pH of 5.7 with plenty of pus cells. Urine culture showed growth of E. Coli levels were more than 105/mL. Intravenous antimicrobial therapy was given twice every day and intravenous aminoglycoside once daily. The purple discoloration of urine disappeared. Subsequent urinalysis was normal and the patient was discharged in stable condition.



**Figure 1-80 year old male with purple urine**

### **Case 2-[Figure 2]**

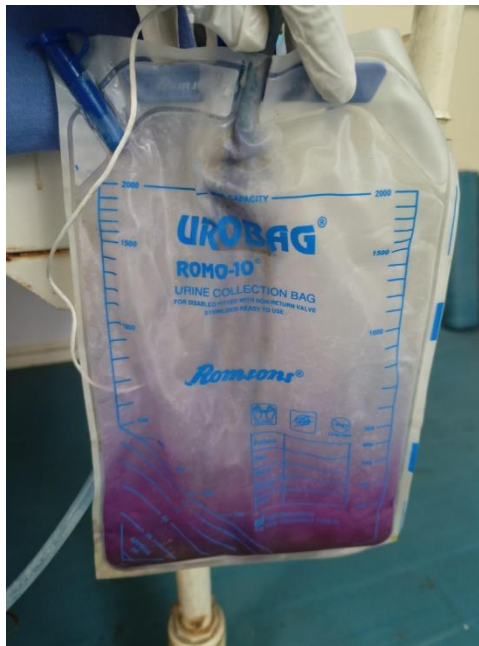
A 77 year old hypertensive female came to General Surgery OPD with complaints of lower abdomen pain and purple colored urine bag[Figure 2].She had a history of fall which resulted in fracture neck of femur on both sides.She was confined to the bed for over 1 year and was catheterised the entire duration.She was a known case of renal calculi and had complaints of repeated frequent urinary tract infections and 2 episodes of hematuria in the past.Urine routine showed an acidic pH of 5.5 with 40-50 pus cells per high power field and 10 to 20 red blood cells per high power field.Urine culture was sent for the patient which showed growth of 'Pseudomonas aeruginosa' organism.She was treated with Intravenous injection Ciprofloxacin for 5 days and discharged home.



**Figure 2-77 year old female with purple bag syndrome**

### Case 3-[Figure 3]

84 year old male presented with purple colored urine for 4 days. He had a chronic history of constipation, poor urine stream and urinary retention the cause of which was diagnosed as benign prostatic hyperplasia. Due to retention of urine, he had been catheterised on and off for 3 years. Urine routine recorded a pH of 5.6 with 10 pus cells per high power field and no RBCs. His urine culture grew *E. Coli*. He was treated by giving oral antibiotics-combination of trimethoprim and sulfamethoxazole for 7 days and by a change of catheter. He was counseled regarding catheter related hygiene and frequent change of urinary catheter as well as urine bag.



**Figure 3-84 year old male with purple bag syndrome**

### Discussion

PUBS was first reported in 1978 by Barlow and Dickson. They reported this unusual phenomenon of purple color in urine bags in inpatient wards in spina bifida children [9,10].

In adults, a wide range of factors may produce urinary discoloration [TABLE 1].

Numerous medications as well as the consumption of intensively colored foods may produce changes in urine color, ranging from red or orange to blue-green [11,12].

Purple colored discoloration of the urine bag is an uncommon complication associated with urinary tract infection. Sometimes, these infections may be concomitant with stone in the kidney and/or the urinary bladder due to the alkalization of urine from urease-catalyzed urea hydrolysis [14]

It is due to abnormal tryptophan metabolism. Dietary sources of Tryptophan are oats, bananas, dried prunes, milk, tuna fish, cheese, bread, chicken, turkey, peanuts, and chocolate [13]

Tryptophan generally exists in the intestines in all patients. It is broken down by the gut bacteria into its components. This metabolization of Tryptophan produces indole which is absorbed into portal circulation. Indole is converted into indoxyl sulphate in the liver. Indoxyl sulphate is also known as Indican. Bacteria produce indoxyl sulphatase, an enzyme which digests indoxyl sulphate into indoxyl. This is then excreted into the urine. In alkaline urine, Indoxyl changes into indigo (blue color) and indirubin (red color) which when combined produce purple color of the urine [3,4]. Many bedridden and chronically ill patients suffer from habitual or chronic constipation. As a result, the transit time for tryptophan in the gut increases drastically. The longer tryptophan stays in the gut, the more its conversion to indole. This is the pathophysiology behind purple urine bag syndrome being common in patients suffering from long standing constipation or catheterised for long periods of time [4,5]

Although generally seen in alkaline urine, it can occur in acidic urine. PUBS occurring in acidic urine have been reported in 2 cases in the past [15]. Several works published in the past show a high relation between conversion of Indican to indoxyl by indoxyl sulphatase and highly alkaline urine. [8,16]

*Klebsiella pneumoniae*, *Escherichia coli* and *Pseudomonas aeruginosa* are the most commonly associated organisms with this condition [5,6]. Phosphatase and sulphatase produced by the bacteria are responsible for the pigments which give rise to the discoloration. In order to see the precipitations, a certain level of the pigments is required. These are not produced by all bacteria in the same species [5,7]. Other important factors include the presence of alkaline urine, type of materials used to manufacture the urinary catheter and bag [5,7]. Although similar, this pathology should not be confused with Drummond syndrome due to abnormal tryptophan metabolism. It is seen in babies and is also called “blue diaper syndrome”. It is a genetic disorder with an autosomal or x-linked recessive pattern of inheritance

**TABLE 1: CAUSES OF DISCOLORATION OF URINE**

	COLOR	CAUSES
	DARK YELLOW	Concentrated specimen
	ORANGE	<b>Foods</b> -Carotene containing foods such as carrots <b>Drugs</b> -Vitamin supplements, Rifampicin, Phenazopyridine
	RED	<b>Foods</b> -Beets, Rhubarb <b>Drugs</b> -Laxatives, Chlorpromazine <b>Conditions</b> -UTI, Nephrolithiasis, Porphyria, Hemoglobinuria
	PINK	<b>Conditions</b> -Uric acid crystals
	GREEN	<b>Foods</b> - Asparagus <b>Drugs</b> - Propofol, Fluorescein <b>Conditions</b> - Urinary tract infection ( <i>Pseudomonas aeruginosa</i> )
	BLUE	<b>Drugs</b> - Amitriptyline, Indomethacin, Methylene blue <b>Conditions</b> -Blue diaper syndrome
	BROWN	<b>Foods</b> -Fava beans <b>Drugs</b> -Antimalarials, antimicrobials, methocarbamol, Nitrofurantoin <b>Conditions</b> -Porphyria, hemolytic anemia
	BLACK	<b>Drugs</b> -Methyldopa <b>Conditions</b> -Malignant melanoma, Alkaptonuria

## Conclusion

PUBS is a puzzling condition for the patients as well as their families. It occurs as a result of the metabolism of tryptophan to produce pigments that turn catheter bags purple in the presence of a urinary tract infection. It occurs in old age, bedridden females with catheters for long periods of time; in patients with alkaline urine, constipation or chronic kidney disease. It can be managed by regular and frequent changing of the urinary bag and urinary catheter and maintaining patient hygiene.

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