

## GREEN SERUM: CAUSES AND CLINICAL OUTCOMES: A CASE REPORT

## Biochemistry

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## ABSTRACT

**AIM:** Analyse the significance of green serum in a clinical laboratory**METHADODOLOGY:** Serum sample of a 20year old male patient presenting to ER with complaints of altered sensorium since last 3 days and a history of fever and yellow discolouration of the eyes since last 5 days was received in the lab for evaluation. As per protocol sample was centrifuged and serum was obtained for evaluation in the Beckman Coulter AU480 autoanalyser. When observed the serum was found to be green in colour**RESULT:** The biochemistry report showed excessively elevated serum bilirubin (34 mg/dl) with predominance of unconjugated bilirubin. SGOT was 248U/L and SGPT levels were found to be normal. Serum K<sup>+</sup> of was 2.0 mmol/dl and elevated TLC were the other significant finding.**CONCLUSION:** Occurrence of green serum is a very rare phenomenon. Even though it is theoretically possible to find green serum in pregnancy or in long standing rheumatoid arthritis but actually it is very hard to find. In our institution several samples obtained both from the obstetrics & gynaecology department and orthopaedic for RA cases were found to be of normal straw colour. In the above mentioned patient in view of all the other causes being ruled out an assumption of partial biliverdin reductase deficiency could be made as it has been found to be associated in the setting of fulminant hepatic failure mainly caused by alcoholism.

## KEYWORDS

fulminant hepatic failure, hepato-renal syndrome, hepatic encephalopathy, conjugated hyperbilirubinemia, unconjugated hyperbilirubinemia.

## CASE HISTORY &amp; INTRODUCTION

A 20 year old male patient presented to our emergency department with altered sensorium since 3 days and with a history of fever and yellow discolouration of eyes since 5 days. A history of repeated episodes of vomiting and reduced appetite since 5 days was also given. Patient was a known alcoholic since last 5 years with his attendants giving history of heavy drinking. Other history was non-significant with no significant family history. Prior to coming to the hospital patient was put on indigenous medications for three days. A provisional diagnosis of acute fulminant hepatitis with hepatic encephalopathy was made and the relevant investigations were sent for further evaluation. The blood investigations showed very high TLC (Total leucocyte count) with severe hypokalaemia (K<sup>+</sup>: 2.0 mmol/dl). LFT was deranged with low albumin (2.0g/dl) and very high SGOT (248 IU/L), SGPT was found to be normal. Total bilirubin was 32.4 mg/dl with predominant unconjugated bilirubin. The patient's condition worsened over the period of 4-5 days with progressing renal failure and subsequent development of hepato-renal syndrome. The most significant finding for the patient was that when his sample was centrifuged for obtaining serum for running of blood investigations it was found to be green in colour. Subsequently the patient passed away in the ICU. The causes of green serum were considered and subsequently tests were conducted to rule them out. Serum copper and total ceruloplasmin levels were estimated which came out to be normal. Also there was no history of any dye ingestion for imaging. Rheumatoid factor was also found to be negative and as mentioned there was no history of any joint complaint.

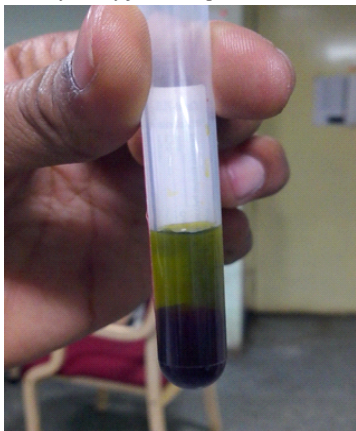


FIGURE PATIENT SERU

## DISCUSSION:

Bilirubin is the breakdown product of haemoglobin. Under physiological conditions in human adults  $1-2 \times 10^8$  erythrocytes are broken down per hour. Thus in a 70kg human being, per day 6g of haemoglobin is turned over<sup>1</sup>. When haemoglobin is broken down the protein globin breaks down into the constituent amino acids which are reused. The iron released enters into the liver and goes into the iron pool. Most of the haemoglobin is broken down in the reticuloendothelial cells of the liver, spleen and bone marrow. The breakdown is initiated by enzyme heme oxygenase which is a substrate inducible enzyme. Heme gets broken down into biliverdin which is a green coloured pigment. In mammals an enzyme biliverdin reductase immediately acts on the biliverdin to produce bilirubin, which then combines with the plasma protein albumin and is carried into the liver. It is estimated that 1g of heme yields 35mg of bilirubin<sup>1</sup>.

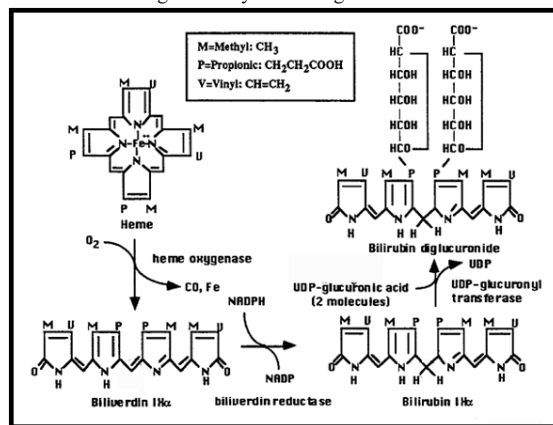


FIGURE HEME BREAKDOWN

Green serum is very rare. The main causes are :

- A: increased copper levels
- B: increased biliverdin levels due to partial biliverdin reductase deficiency
- C: dye ingestion
- D: long standing cases of rheumatoid arthritis
- E: pregnancy and females taking oral contraceptives

## COPPERABNORMALITIES:

In over 1000 blood transfusion bottles checked at the Leeds Blood

Transfusion Laboratory in 1968, about 1% had green plasma, and a link between the green colouration and women taking combined oral contraceptives was noticed (15/19 from a random sample). The green colour was thought to be due to ceruloplasmin, a blue, copper-containing glycoprotein. Elevated levels (35–70 mg/100 mL) were found in these blood samples<sup>2</sup>.

Green plasma has long been known to occur in pregnancy. As oestrogens are sometimes effective in elevating ceruloplasmin in patients with Wilson's disease, increased ceruloplasmin in these pill users was probably due to the oestrogen in the pill".<sup>2</sup>

#### **BILE PIGMENTS:**

Green jaundice has been documented with cases of green serum and green-black urine. A review on green jaundice concluded that "a mixture of biliverdin, mesobiliverdin and related pigments appeared to contribute to the green colour observed." More recently, it has been concluded that this green jaundice may be caused by a genetic defect in the biliverdin reductase-A (BVR-A) gene causing reduced activity of the enzyme that converts biliverdin to bilirubin, in conjunction with decompensated liver cirrhosis.<sup>3</sup>

#### **IMAGING DYES:**

At least one report of green colouration of serum has been reported with a fluorescent dye used to evaluate mesenteric-vessel viability by intraoperative angiography in a patient with colon cancer<sup>7</sup>.

#### **GREEN COLOUR IN RHEUMATOID SERUM:**

It's presence has been noted in the serum of patients with rheumatoid arthritis, but the nature of green colour in patients suffering from rheumatoid arthritis remains unknown. It was noted that green serum was not seen in patients with clinically or radiologically more severe cases, but was found more frequently in those with arthritis of longer duration of more than 10 years. In a study conducted in the Dept. of Medicine, Leeds & Royal Bath Hospital U.K it was found that a definite green colour was present in 12.5 per cent. Of the rheumatoid population, it was more common in women ( 14%) than men(5%). It was difficult to grade the sera between green and yellow with certainty and these were included with the yellow group in the clinical correlations.<sup>9</sup>

#### **CONCLUSION:**

Occurrence of green serum is a very rare phenomenon. Even though it is theoretically possible to find green serum in pregnancy or in long standing rheumatoid arthritis but actually it is very hard to find it. In our institution several samples obtained both from the obstetrics & gynaecology department and orthopaedic dept. for RA cases were found to be of normal straw colour. In the above mentioned patient in view of all the other causes being ruled out an assumption of partial biliverdin reductase deficiency could be made as it has been found to be associated in the setting of fulminant hepatic failure mainly caused by alcoholism.

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