Greenish discoloration of plasma: Is it really a matter of concern?

Anila Mani, A. P. Poornima, Debasish Gupta

Introduction

Blood plasma is the yellow liquid component of blood, in which the blood cells in whole blood are normally suspended. The color of the plasma varies considerably from one sample to another from barely yellow to dark yellow and sometimes with a brown, orange or green tinge [Figure 1a] also. In addition to the varying shades of yellow color [Figure 1b], some plasma samples are clear and some are milky or turbid. Occasionally, plasma from hemolyzed samples appears reddish. The visual inspection of the plasma product is crucial to decide whether the unit has to be issued for transfusion or not.

Observation

We recently came across a donor plasma unit with greenish discoloration [Figure 1a]. The donor was a 29-year-old young, healthy female, regular, nonremunerated, voluntary blood donor who fulfilled all the criteria for blood donation. At our blood centre, the visual inspection of components is a usual protocol. During the process of component separation, unusual green color in the plasma bag was noted [Figure 1a]. We recalled back the donor and a detailed medical history and drug history was elicited from her. The donor revealed that she was on infertility treatment for the last 2 months before donation. It was confirmed that she was on ethinyl estradiol as a part of her treatment. There was no other significant medical or drug history.

Pathophysiology of the Event

Already, there is literature evidence for the greenish discoloration of the plasma as a result of pregnancy, intake of birth-control pills containing estrogen, rheumatoid arthritis, and drugs such as sulfonamides or due to sepsis with Gram-negative cryophilic bacteria such as *Pseudomonas*.

The plasma unit was subjected to investigations such as blood culture, copper and ceruloplasmin assay, and bilirubin (total, direct, and indirect). Copper (220 µg/dl) and ceruloplasmin (70 mg/dl) levels were found to be elevated. Blood culture was found to be negative with normal levels of total, direct, and indirect bilirubin.

Discussion

Ceruloplasmin is a plasma glycoprotein (α2-globulin), which acts as a copper carrier and as an acute-phase reactant.

Tovey and Lathe reported green plasma in young women on contraceptive pills and confirmed elevated ceruloplasmin levels in the green plasma units by immunodiffusion and oxidase method in their study.[1] The green discoloration of plasma frequently results in the plasma units being discarded or removed from the donor pool from therapeutic use, purely based on its appearance. Clinicians also refuse to transfuse such a discolored plasma product because of the suspicion of *Pseudomonas* contamination.

Wolf et al. reported that elevated ceruloplasmin levels are found after estrogen
administration in female donors, who were taking oral contraceptives and rheumatoid arthritis. The rise in ceruloplasmin in women on oral contraceptives is probably due to the estrogen components, ethinyl estradiol or mestranol. Both of these produce a similar effect.

Serum ceruloplasmin was significantly elevated in patients with rheumatoid arthritis and ankylosing spondylitis. Patients with psoriasis and roentgenologically confirmed arthritis had a significantly elevated mean serum ceruloplasmin concentration. Patients with sarcoidosis showed a tendency towards high ceruloplasmin values if the joints were affected. The use of medications including sulfonamides can lead to greenish discoloration of plasma due to sulfhemoglobin production.

Cotton et al. evaluated the hemostatic potential and capacity of green plasma compared to standard color plasma. This study revealed that plasma from female donors having a green color had a more hypercoagulable thromboelastogram profile for all values (r-value, k-time, angle, and mA) when compared to standard plasma. Differences were also observed with coagulation factor level comparison, with green plasma having higher levels than standard (Factor II, Factor VII, Factor IX, and Factor XI). Using automated thrombogram, green plasma had higher lag time and increased endogenous thrombin potential.

Even if there is no harm in transfusing green-colored plasma unit, according to blood bank policy, we are not issuing any discolored plasma product for transfusion and fractionation.

**Conclusion**

In view of all the supportive evidence which shows the actual reason for the plasma discoloration, it is evident that the green-colored plasma can be safely transfused and can be subjected to plasma fractionation. We recommend that there should be national guidelines regarding the use of discolored plasma products, so that transfusion practices can be made uniform. Thereby, we can avoid unnecessary discard of blood products.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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