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Mathematical model explaining iron change in patients with thalassemia

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Dear Editor,

Hemoglobin is an important biochemical pigment seen within erythrocytes. The hemoglobin is the most important content within the red cell. It functions for oxygen carrying, hence, it is very important for human beings. The abnormality of hemoglobin is common in medical practice. The low hemoglobin level from complete blood count is common problem in medicine and it is called anemia. There are many causes of anemia such as iron deficiency disorder and congenital hemoglobin disorders. Thalassemia is a kind of hemoglobin disorder. Thalassemia is due to the inherited abnormality of globin within hemoglobin. The hemoglobin defect resulting in anemia is the feature of thalassemia [1–10]. Thalassemia is an important tropical anemia [1–10]. The patients affected with thalassemia usually have abnormal iron metabolism and the hemochromatosis is very common [1–3]. To manage the thalassemic patient is usually difficult. To maintain the normal hemoglobin level is the aim. However, the easily broken red blood cell is usually the main challenge in clinical management. To support the anemic symptoms of thalassemic patients, transfusion becomes the widely used method. However, the careful consideration is needed before having transfusion therapy used. The transfusion management is usually indicated in cases with severe anemia and this practice can superimpose the severity of hemochromatosis [3]. Here, the author tries to assess the physiological change of iron metabolism in patients with thalassemia by using mathematical model technique. The basic pathophysiological and biological process on hemoglobin, iron, ferritin is used as basic parameters for mathematical model development.

According to the mathematical modeling, there are some differences between cases with and without transfusion (Figures 1 and 2).

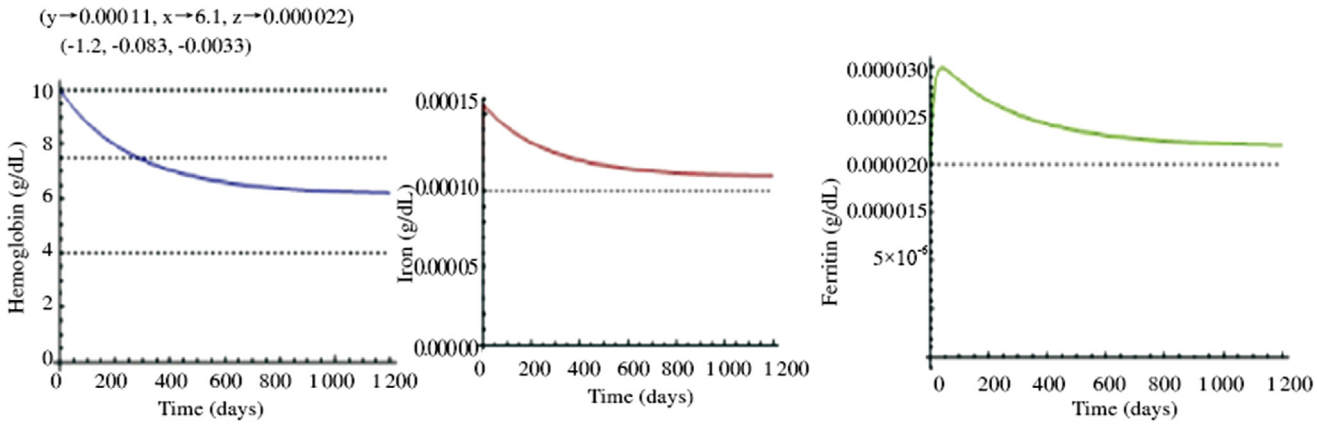

Figure 1. Observational laboratory parameters in thalassemic patients without transfusion.

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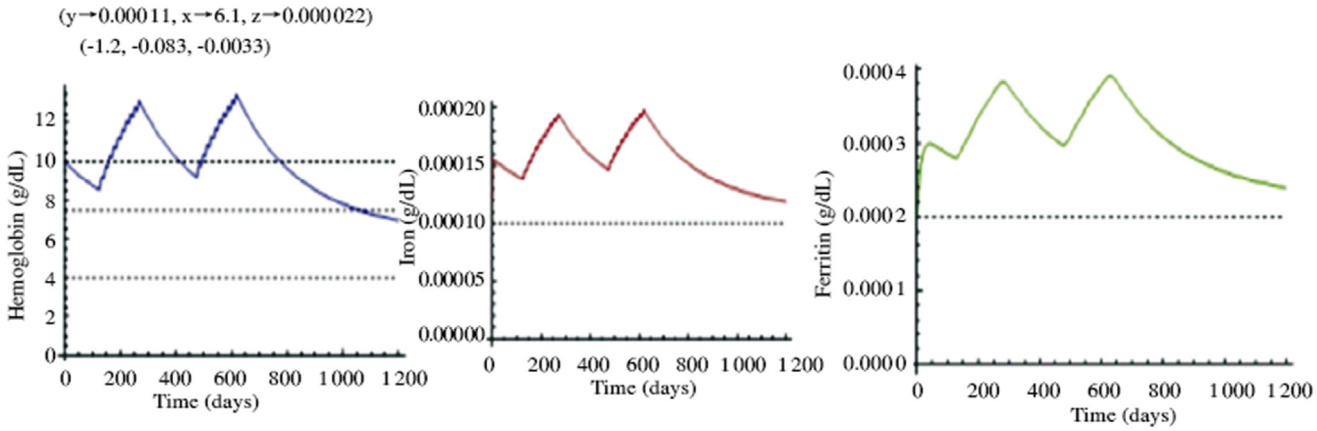

Figure 2. Observational laboratory parameters in thalassemic patients with transfusion.

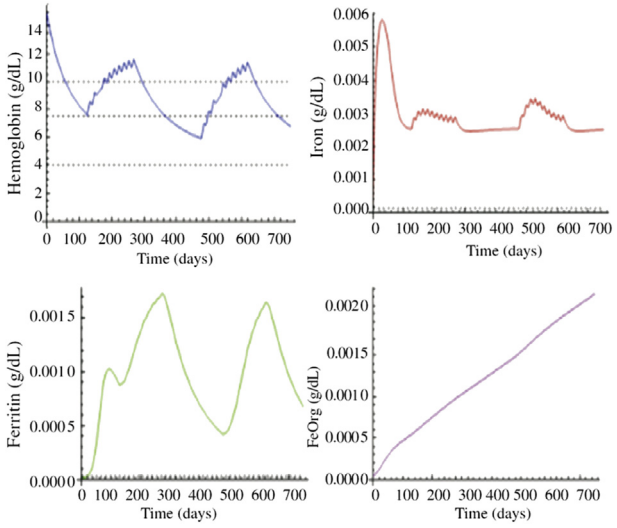

Figure 3. Change of iron in patients with transfusion.
FeOrg: Accumulated iron in organs.

In the cases with transfusion, the change of iron can be seen in Figure 3.

The data from these mathematical models can be useful for further study on transfusion practice for thalassemic patients. Indeed, mathematical model is a useful technique for clarifying the complex pathophysiological process. In the present case, the thalassemia, a complex genetic disease, has been studied. It can be helpful for medical scientists to understand the molecular pathology of disease [11]. There are extremely few reports on this topic. A previously similar report was conducted by Ginzburg and Rivella [12]. In that report, the complex biological process was identified. However, there was still no exact mathematical model study in that report [12].

In conclusion, the authors developed a mathematical model study to help explain the pathophysiological change in thalassemic patients. Effect of standard transfusion therapy is modeled. Also, the *in vivo* iron distribution is also mathematically studied. With this fundamental mathematical model, the effect of transfusion regiment can be further simulated and studied.

Conflict of interest statement

We declare that we have no conflict of interest.

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