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## Urinary iron excretion test in iron deficiency anemia.

Ikuro Kimura\*

Masatoshi Yamana<sup>†</sup>

Akira NNishishita<sup>‡</sup>

Motoharu Sugiyama\*\*

Akira Miyata<sup>††</sup>

\*Okayama University,

<sup>†</sup>Okayama University,

<sup>‡</sup>Okayama University,

\*\*Okayama University,

<sup>††</sup>Okayama University,

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Ikuro Kimura, Masatoshi Yamana, Akira NNishishita, Motoharu Sugiyama, and Akira Miyata

## Abstract

A urinary iron excretion test was carried out in 22 patients with iron deficiency anemia. The iron excretion index was significantly higher in patients with intractable iron deficiency anemia compared with normal subjects and anemic patients who were responsive to iron therapy. The findings suggest that iron excretion may be a factor that modulates the response of patients to iron therapy.

**KEYWORDS:** iron excretion, iron deficiency anemia, saccharated iron oxide.

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## URINARY IRON EXCRETION TEST IN IRON DEFICIENCY ANEMIA

Ikuro KIMURA, Masatoshi YAMANA, Akira NISHISHITA,  
Motoharu SUGIYAMA and Akira MIYATA

*Department of Internal Medicine, Okayama University Medical School,  
Okayama 700, Japan*

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**Abstract.** A urinary iron excretion test was carried out in 22 patients with iron deficiency anemia. The iron excretion index was significantly higher in patients with intractable iron deficiency anemia compared with normal subjects and anemic patients who were responsive to iron therapy. The findings suggest that iron excretion may be a factor that modulates the response of patients to iron therapy.

**Key words :** iron excretion, iron deficiency anemia, saccharated iron oxide.

Iron deficiency anemia is generally responsive to iron therapy. Occasionally, however, the anemia may not be corrected in the face of what is considered adequate treatment, or it may recur in a short period although the treatment has been completed.

Several years ago we studied the concentration of iron in gastric juice and found it to parallel that of the serum iron level. Furthermore, during the course of recovery from iron deficiency anemia treated with iron, the concentration of iron in gastric juice was found to be elevated. And also when serum iron was elevated after intravenous iron administration, iron excretion into gastric juice occurred. Thus it appeared that iron in gastric juice was in a state of equilibrium with serum iron level (2-6). We also found that some patients with iron deficiency anemia excreted excessive amounts of iron to gastric juice and suggested the presence of a new clinical entity of "iron-losing anemia" for these cases (2, 3, 5). These findings suggested that the excretion of iron may be a variable that should be considered in the evaluation of response to iron therapy. In this paper we describe the results of an iron excretion test in patients with iron deficiency anemia exhibiting a suboptimal response to iron therapy, and discuss a relation between the iron excretion and iron deficiency.

### MATERIALS AND METHODS

Iron excretion tests were carried out in 25 patients with iron deficiency anemia (3 due to blood loss and 22 of unknown cause) and 11 healthy individuals. In

the patients with iron deficiency anemia of unknown cause, 9 had had previous recurrences or were responding poorly to treatment (poor response group) and 13 had had no recurrences and were responding well to treatment (good response group). The iron excretion test was carried out as follows: iron administration was closed for a period of 24 hours before the iron excretion test. The bladder was emptied and the subjects given 300 ml of water to drink were followed by the intravenous administration of iron. No further water was allowed. Urine was collected after 15, 30, 60 and 120 min and serum samples were obtained after 30 and 60 minutes. The iron content of the urine was measured by the method of Losowsky (7), and an iron excretion index was calculated according to the following formula:

Iron excretion index

$$= \frac{\text{urinary iron (from 30 to 60 min) } \mu\text{g}}{\frac{\text{serum iron (30 min*)} + \text{serum iron (60 min*)}}{2} \mu\text{g/dl}}$$

(\* 30 and 60 min after iron injection)

#### RESULTS

There was no significant difference in the serum iron concentration following intravenous iron administration between the good response and the poor response groups of patients with iron deficiency anemia (Figs. 1, 2).

The urinary iron excretion during the first 2 h after intravenous iron administration was slightly higher in the poor response group than in the good response group (Fig. 3). The iron content of urine excreted between 30 and 60 min after iron administration was also higher in the poor response group.

Iron excretion is therefore more clearly expressed by calculating the ratio of urinary iron to serum iron. The poor response group had a mean iron excretion

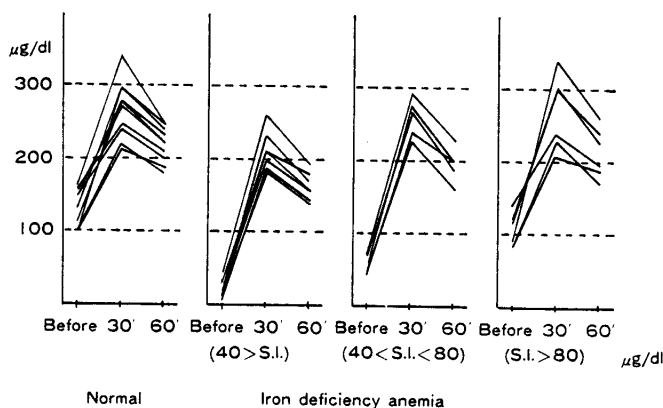


Fig. 1. Changes in serum iron after i. v. injection of 10mg saccharated iron oxide in good response group of iron deficiency anemia.

## Iron Excretion Test in Iron Deficiency

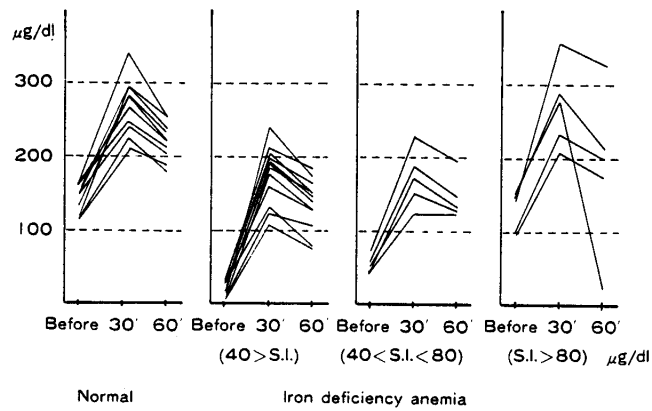


Fig. 2. Changes in serum iron after i. v. injection of 10mg saccharated iron oxide in poor response group of iron deficiency anemia.

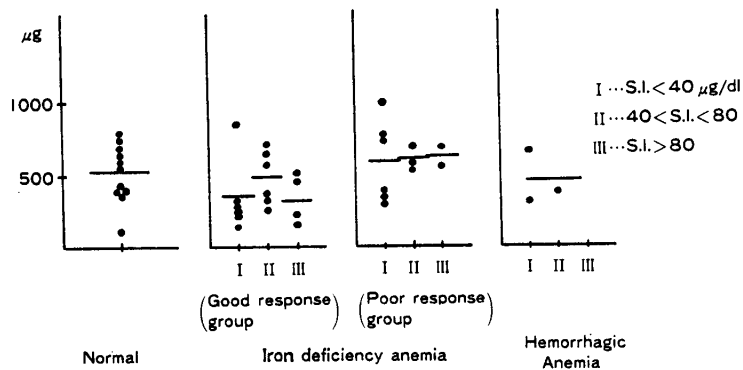


Fig. 3. A total amount of urinary iron excretion at 2 hours after i. v. injection of 10mg saccharated iron oxide.

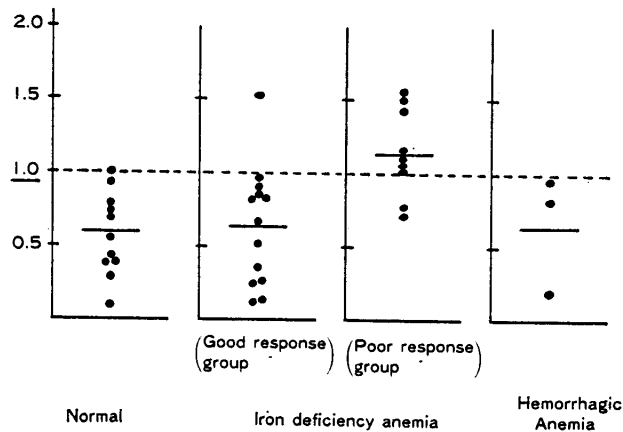


Fig. 4. Iron excretion index.

index of 1.15, which was nearly twice the results of other groups, a significant increase (Fig. 4).

#### DISCUSSION

There are many problems involved in measuring daily urinary iron loss (8): for example, patients must be admitted and watched carefully to ensure accurate collection of urine without iron contamination. Moreover the amount of daily urinary iron content fluctuates even in the same individual. Therefore, an iron excretion test was devised for clinical use to assess iron excretion more accurately over short periods instead of measuring the daily urinary iron loss. An iron excretion index was calculated to estimate the tendency for urinary iron loss in the patient with iron deficiency anemia, whether his serum iron level is low or is normalized after iron treatment.

There are patients with iron deficiency anemia who do not respond well to what is usually adequate iron therapy or who develop anemia repeatedly shortly after the completion of the treatment. It is not clear why this occurs. In this study, such patients with iron deficiency anemia had significant increases in their iron excretion indices. And this result indicates that following intravenous iron administration these patients excrete more iron into the urine than normal controls and patients with iron deficiency anemia who do respond to iron. We have previously shown that iron in gastric juice is generally in a state of equilibrium with serum iron (2-6). However, in some patients with iron deficiency anemia, iron content in gastric juice increased over the normal value after the recovery of the anemia. This result suggested that in these cases increased iron excretion into the gastro-intestinal tract may be the cause of iron deficiency state, termed "iron-losing anemia" (2, 3, 5). It seemed that the equilibrium between serum iron level and gastric juice iron might be broken in these cases. In this study the equilibrium between serum iron level and urinary iron excretion may also vary in the group of patients who demonstrate poor clinical response to iron therapy. At the same serum iron level they seemed to excrete more iron into urine than other groups following intravenous iron administration. The state of this excess iron excretion might be specific for these patients. These patients, therefore, may require a considerably higher dose of iron for the correction of their anemia, or they may require a long term iron treatment. The results presented here may be related to the cause of iron deficiency anemia of unknown origin. And patients who exhibit high iron excretion index may be with "iron-losing anemia".

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