Investigation of platelet aggregation by impedance and optic methods in children with iron deficiency anaemia

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Abstract—Although it is known that platelet count is altered in iron deficiency anaemia (IDA), the qualitative extent of this interference is not well documented. In the present study we investigated platelet aggregation (PA) by impedance and optic methods in IDA. Forty-seven patients (plasma group: 16 boys, 9 girls and whole blood group: 11 boys, 11 girls) with IDA and thirty-one healthy children (plasma group: 6 boys, 10 girls and whole blood group: 6 boys, 9 girls) were enrolled into the study. Template bleeding times were measured by the Ivy method in all children. In the control group whole blood count, serum iron levels, bleeding time and PA were determined. After basal PA was determined in the patients and controls, ferrous sulphate was orally administered to the patients at a dose of 6 mg/kg/24 h for three months. Then, PA tests were performed again in the IDA (test group) patients.

Ristocetin-induced PA was suppressed in both plasma and whole blood groups. Inhibition by both collagen \( p < 0.05 \) and ristocetin \( p < 0.001 \)-induced PA was determined by the optic method. Similarly in PA measured by the impedance method a suppression to adenosine diphosphate \( p < 0.001 \) and to ristocetin \( p < 0.01 \) was found. However, no significant alteration was observed in the bleeding time. All defective responses were reversed by the iron supplementation therapy. In addition, a significant correlation was found between some parameters of PA and several haematological values. In conclusion, although defective PA responses cannot be clinically demonstrated in patients with IDA, this suppression of PA may be detected by laboratory examination. Therefore, it is advised that care should be taken when using anti-aggregant agents in IDA.

Key words: Platelet aggregation; iron deficiency anaemia; children.

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INTRODUCTION

Iron deficiency is the most commonly encountered type of nutritional deficiency in both developed and developing countries [1]. Iron is known to play an important role in various metabolic and enzymatic processes and is an essential element for the platelets too [2]. Iron exerts an effect on the phosphorylation of p 47 protein (pleckstrin) (a substrate of protein kinase C in the platelet) [3]. It has recently been reported that some iron deficiency-related findings may actually result from enzymatic dysfunctions in which iron plays important roles [4]. The platelets contain iron binding enzymatic systems, therefore it is not inconceivable that in case of iron deficiency anaemia (IDA) platelets would also be affected.

Iron inhibits over-production of platelets and thus affects thrombopoiesis. Changes in platelet counts in IDA cases have been reported [5, 6]. However, the effects of IDA on platelet functions have been poorly understood [7, 8]. Malhotra et al. [8] have detected hypoactive PA in IDA and have shown that this recovered following iron supplementation therapy. However, the authors did not say whether bleeding time was affected by the PA. It is known that defective PA prolongs bleeding time. We have also investigated bleeding time and its correlation with possible PA defects.

Although PA tests are carried out routinely using platelet rich plasma (PRP; optic method), the application of the impedance method from whole blood samples has also been recommended. Both techniques appear to have advantages and disadvantages compared to each other [9, 10]. It has been suggested that PA studies by the impedance method provide an environment very similar to in vivo conditions [11–13]. However, the pathological factors (such as hyperlipidaemia, hyperbilirubinaemia), which may affect PA, are eliminated in PRP [10, 14, 15]. We have therefore investigated PA in IDA by using two different methods, that is, the optic and impedance techniques, with the objective of determining any possible defects of PA in IDA.

PATIENTS AND METHODS

The permission of the parents of the patients and the agreement of the ethics committee were obtained before commencing the present study. Control and patient (test) subjects were divided as plasma (optic method) and whole blood (impedance method) according to the environment in which the platelets were studied. Forty-seven patients (plasma group: 16 boys, 9 girls; mean age 20.6 ± 4.7 months, range: 3–120, and whole blood group: 11 boys, 11 girls; mean age: 24.3 ± 5.2 months, range: 3–96) with IDA and 31 healthy children (plasma group: 6 boys, 10 girls; mean age 17.9 ± 3.4 months, range: 1–36, and whole blood group: 6 boys, 9 girls; mean age: 16.7 ± 3.4 months, range: 2–44) were enrolled into the study. IDA findings were confirmed in all test group subjects studied. Patients with an Hb value of less than 5 g/dl were not included in the study owing to a possible deficiency in other nutritional conditions [2]. None of the children (both the patients and healthy