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Sympathetic Skin Response in Children with Iron Deficiency Anemia

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ABSTRACT BACKGROUND: Iron deficiency anemia (IDA) is particularly high in children in developing countries .Sympathetic skin response (SSR) is a polysynaptic reflex, and its final efferent pathway involves pre- and post-ganglionic sympathetic sudomotor fibers that ultimately activate the sweat glands through sympathetic outflow . The aim of this study was to investigate whether IDA is involved in SSR.

METHODS: 24 patients (17 girls, 7 boys) with IDA and 20 healthy children (11 girls, 9 boys) were enrolled in the study.

RESULTS: Significant differences were observed between the palmar SSR results (latency, ms) of the patient and the control groups (1.09±0.24, 0.92±0.30, p= 0.048). There was no correlation between ferritin levels and SSR results of the patient group (p=0.65).

CONCLUSIONS: The evidence from this preliminary study suggests that efferent C fibers of the sympathetic nervous system may not intact in IDA. The sudomotor autonomic function test may be useful to detect autonomic involvement earlier.

Keywords: *Iron deficiency anemia, sympathetic skin response, children*

INTRODUCTION

Iron deficiency anemia (IDA) is particularly high in children in developing countries [1].Iron plays an important role in various neurometabolic processes, which can be altered by iron deficiency. Hypoxia may lead to neuronal dysfunctions in IDA[2, 3, 4, 5, 6, 7, 8, 9]. Sympathetic skin response (SSR) is a polysynaptic reflex, and its final efferent pathway involves pre- and post-ganglionic sympathetic sudomotor fibers that ultimately activate the sweat glands through sympathetic outflow [10].SSR is coordinated in the posterior hypothalamus or upper brainstem reticular formation [11]. The aim of this study was to investigate whether sympathetic skin responses are affected by the presence of iron deficiency anemia.

Materials and methods

This study was performed prospective at Harran University Hospital it was approved by the local ethics committee. There was informed consent obtained from the parents of all study participants.24 children (17 girls, 7 boys, mean age :13.7±1.79) with IDA and 20 healthy children(11 girls, 9 boys,mean age 12.4±1.93) were enrolled in the study. Patients with IDA with a hemoglobin value of less than 5 gr/dl were excluded from this study. All children were thoroughly examined clinically to rule out other causes of neuropathy. Electrophysiological testing was carried out according to the Technical Standards of the International Federation of Clinical Neurophysiology[12]. Childrens were investigated in a dark and silent room in a supine position with their eyes closed. Body,and skin temperature was controlled, temperature were same. EMG was performed using a filter setting of 0.1–32 Hz, a sensitivity setting of 1 mV div^{-1}, and a sweep rate of 5 s. The SSR was recorded with surface electrodes (palmar) on the skin (Electromyography machine Dantec, Keypoint, Denmark).The study data were analyzed using SPSS (Statistical Package for Social Sciences) for Windows version 11.5. Differences between groups were evaluated with the Mann-Whitney U-test. A value of $p < 0.05$ was accepted as statistically significant. Relations between variables were studied by the Pearson correlation test.

Results

All physical examination results of the children involved in this study were normal. The children did not report any symptoms of autonomic dysfunction. Significant differences were observed between the palmar SSR results (latency, ms) of the the children with IDA and the control groups (1.09±0.24, 0.92±0.30, p= 0.048). There was no correlation between ferritin levels and SSR results of the the children with IDA group (p=0.65).

Discussion

The palmar SSR results of the the children with IDA were different from those of the control group. There was no correlation between ferritin levels and SSR results of the children with IDA. Iron plays an important role in various metabolic and enzymatic processes. Iron deficiency may have an effect on neurological and intellectual functions. Many of the iron containing enzymes of the central and peripheral nervous systems could be affected adversely by IDA [7,14]. SSR is coordinated in the posterior hypothalamus or upper brainstem reticular formation [11]. SSR is an indicator of sudomotor function mediated by amyelinic efferent Cfibers of the sympathetic nervous system [13].

IDA alters the behavior of infants in the cognitive, motor, and socio emotional domains and interferes with optimal development. Iron plays key roles in the normal progression of several neurofunctional systems. The mechanisms by which chronic iron deficiency in infancy could contribute to adverse adult outcomes are undoubtedly complex.

From animal models, it is clear that early-life iron deficiency adversely impacts the developing brain. IDA is associated with altered short and long-term neurofunctional development, including impaired myelination and dendritogenesis; altered neurotransmitter functioning; changes in neurometabolism in the hippocampus, striatum, and cortex; and altered gene and protein profiles [15, 16, 17, 18].

In our study, there was no correlation between ferritin levels and SSR results of the children with IDA. Interestingly, we identified prolonged latency of SSR in the extremities.SSR is a polysynaptic reflex. The data may suggest that there are affected areas in the amyelinic efferent C-fibers or other parts of the reflex arc, but it is not clear. Because of the SSR is coordinated in the posterior hypothalamus or upper brainstem reticular formation. To our knowledge, there is no previous description of whether there is a correlation between ferritin levels and SSR latency in children and of differences between SSR of the children with IDA and a healthy group. This study is preliminary, and SSR in IDA should be studied in larger randomized groups. The evidence from this preliminary study suggests that efferent C fibers of the sympathetic nervous system may not intact in IDA. The sudomotor autonomic function test may be useful to detect autonomic involvement earlier.

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