

NBT Test in Children with Iron Deficiency Anemia

(NBT Test in Iron Deficiency)*

Seyhan Özgüner, M.D.** / Çiğdem Altay, M.D.*** /
Sevgi Yetgin, M.D.***

Reduced bactericidal capacity of polymorphonuclears in iron deficiency anemia cases has been reported by Arbeter et al¹ and Chandra.² Decreased synthesis of the heme containing enzymes myeloperoxidase as a result of iron deficiency, has been suggested as an explanation for this defect. However, according to Arbeter et al, myeloperoxidase was not found to be decreased in all patients. For this reason, the exact mechanism for this defect needs to be elucidated. With this purpose in mind we assayed the NBT dye reduction test in patients with iron deficiency anemia.

Material and Methods

The study group consisted of a total of 55 patients classified into the following two groups:

Group A - 46 patients with iron deficiency anemia, and

Group B - 9 patients with iron deficiency anemia plus bacterial infection. The control group included 19 healthy children.

The diagnosis of iron deficiency anemia was established on the basis of a hemoglobin level less than 10 g/dl, microcytosis and hypochromia of peripheral red blood cells, serum iron < 50 µg/100 ml, and saturation of transferrin < 15 %. The capacity of granulocytes to reduce NBT was estimated quantitatively by the method of Baehner and Nathan.³ Hematological data were obtained by routine procedures.

* From Hacettepe University, School of Medicine, Department of Pediatrics and the Children's Medical Center.

** Instructor in Pediatrics.

*** Associate Professor of Pediatrics.

Results

In the iron deficient groups, A and B, the mean hemoglobin level was 7.3 ± 0.19 g per 100 ml with the hematocrit level being 23.8 ± 0.8 %. In the control group the mean level of hemoglobin was 12.7 ± 0.3 g /100 ml, while the mean hematocrit was 37 ± 0.9 %. In the iron deficient group, the mean level of serum iron was 27.3 ± 1.4 μ g /100 ml with the mean level of total iron binding capacity being 452 ± 12 μ g per 100 ml. In the control group the mean level of serum iron was 90.0 ± 2.3 μ g /100 ml and the mean level of serum total binding capacity was 301 ± 9.2 μ g /100 ml.

For the iron deficient group and the control group, optical densities (OD) during the resting state were 0.147 ± 0.016 and 0.124 ± 0.009 , respectively. The difference between these values was insignificant ($P > 0.05$). After phagocytosis the optical densities in group A and control groups were 0.248 and 0.226, respectively ($P > 0.05$).

In patients with iron deficiency anemia plus infection, optical density for the resting state was 0.170 ± 0.02 ($P < 0.05$), while the ΔOD was not significantly different from that of the control group. See Table I.

TABLE I
RESULTS OF THE NBT DYE REDUCTION TEST

Group	No. of Cases	Mean Value of Optical Density		
		Unstimulated	Stimulated	ΔOD
A	46	0.147 ± 0.016 $P > 0.05$	0.248 ± 0.021	0.101 ± 0.007 $P > 0.05$
B	9	0.170 ± 0.02 $P < 0.05$	0.288 ± 0.03	0.117 ± 0.01 $P > 0.05$
Control	19	0.124 ± 0.009	0.226 ± 0.001	0.102 ± 0.009

Discussion

Although severe infections were not usually observed in patients with iron deficiency anemia, frequent upper respiratory infections and mucocutaneous candida infections have been reported by Lahey⁴, Andelman et al⁵ and Higgs et al.⁶ Failure of the granulocytes killing capacity in these subjects has been shown by Arbeter et al¹ and Chandra.²

In the study reported by Chandra², NBT dye reduction test was also found to be defective in these patients; however, our observations did not reveal such a defect. In addition to this finding, in patients with iron deficiency plus bacterial infection, optical density for the resting state was found to be statistically higher than that of the controls. This indicates that in iron deficiency state, granulocytes do not behave differently from normal ones regarding NBT dye response in the presence of an infection. Our findings suggest that myeloperoxidase or some other enzymes, which may be responsible for bacterial killing and do not cause abnormal NBT dye tests in their deficient state, should be investigated.

Summary

The capacity of granulocytes to reduce NBT dye during phagocytosis was studied in 45 children with iron deficiency anemia and in 19 healthy children. No difference was found in dye reduction between the control and study groups.

REFERENCES

1. Arbetz, A., Echeverri, L., Franco, D., Munson, D., Velez, H., and Vitale, J. J.: Nutrition and Infection. Federation Proceedings 30: 4, 1971.
2. Chandra, R. K.: Reduced Bactericidal Capacity of Polymorphs in Iron Deficiency. Archives of Disease in Childhood, 48: 11, 1973.
3. Baehner, R. L., Nathan, D. G.: Quantitative Nitroblue Tetrazolium Test in Chronic Granulomatous Disease. New England Journal of Medicine, 278: 18, 1968.
4. Lahey, M. E.: Iron Deficiency Anemia. Pediatric Clinics of North America 4: 2, 1957.
5. Andelman, M. E. and Sered, B. R.: Utilization of Dietary Iron by Term Infants. American Journal of Diseases of Children, 11: 1, 1966.
6. Higgs, J. M., and Wells, R. S.: Chronic Mucocutaneous Candidiasis: Associated Abnormalities of Iron Metabolism. British Journal of Dermatology Supplement, 8: 86, 1972.