

Prevalence of microcytosis in neonates: a cross-sectional study in Tehran

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Abstract

Background: Identification of α thalassemia (α thal) a common cause of microcytosis during neonatal periods is an important step prevent unnecessary interventions. Thus, low the mean corpuscular volume (MCV) and the mean corpuscular hemoglobin (MCH) may consider as α -thalassemia key detection points. The present study aimed to determine the prevalence of microcytosis among neonates who born in Tehran, Iran.

Methods: Cord blood samples were collected from 1001 newborns after birth in labor room and their red blood cell parameters were investigated.

Results: MCV was 114.2 fL (95% CI: 113.5-114.9) and twenty three neonates (2.3%) had MCV less than 94 fL that classified as microcytosis and 4 (0.40%) had both low MCH and MCV.

Conclusion: Low MCV especially in normal Hb newborns may hints for α thal detection.

Keywords: Thalassemia, mean corpuscular hemoglobin, microcytosis, Hb Barts.

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Introduction

Alpha-thalassemia (α thal) is one of the most common hemoglobin genetic abnormalities that caused by reduced or absent production of the alpha globin chains (1). Clinical manifestation of α thal varies from mild microcytic to life-threatening anemia (2), thus thalassemia can lead to microcytosis (3). The α thal is prevalent in Southeast Asian, Mediterranean, and Middle Eastern populations (1), where malaria has been epidemic. Southeast Asia is one of the regions with the highest frequency of the α -thalassemia genes. For example one of the highest incidences of α -thalassemia in the world (5-10%) has found in the northern Thailand (4). In Iran the prevalence of thalassemia is vary from 2.5% to 15 % (5). Surprisingly, Rahim has reported the over-

all frequencies of α -thalassemia in the southwest region of Iran, as 57% among microcytic and hypochromic anemia patients (6).

There is no simple biochemical test. For α -thalassemia detection, Hb electrophoresis is an expensive test for routine surveillance of neonates, even in high risk regions for the α -thalassemia gene but there are some cheaper tests for its prediction. Mean corpuscular volume (MCV) below 90 femtoliters (fL) and mean corpuscular hemoglobin (MCH) below 30 picograms (pg) were found to be very high predictive parameters for α -thalassemia detection (7). Hence, low MCV and MCH in high risk regions of countries can point to the presence of this condition and considered also as key points for its detection. Although Iron deficiency

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may also lowers the cause low MCV and MCH values (6).

During in the neonatal period, although microcytosis can occur because of the iron deficiency caused by fetomaternal hemorrhage, but it is extremely uncommon (2). Nonetheless it can be presumed that almost all microcytosis cases in this period are associated with thalassemia. Since β -thalassemia does not present in neonatal period, almost all are due to other type, α thal (2). On the other hand, identification of α thal in neonatal periods is very important to prevent unnecessary interventions (such as Iron therapy) in patients with microcytic anemia (8). For instance, newborn carriers with α thal usually have a slight to moderate (1–5%) increase in Hb Bart (γ_4) when measured by hemoglobin electrophoresis or HPLC. Since the Hb Barts tends to disappear a few weeks after birth, the diagnosis of α thal is not possible for most laboratories, after the neonatal period, and these patients are labeled wrongly as iron deficient anemia, etc. Although there are several studies in this field, but β -thal is more studied than α thal in Iran because of its clinical importance and there are not enough data on the frequency of α thal in different places of Iran. Since Iranian population is a mixture of different ethnic groups, it is crucial to figure out the frequency and distribution of α -thalassemia in various regions of the country. These findings can contribute to a wider understanding of this disorder.

The present study aimed to determine the prevalence of microcytosis in newborns who born in Akbarabadi hospital in Tehran, Iran.

Methods

This was a cross sectional study on 1001

Iranian newborns who born in Akbarabadi hospital, Tehran, Iran. This study was done from March 2010 to March 2011 and approved by the ethical committee of the Tehran University of Medical Sciences and written informed consent was obtained from the parents of eligible infants.

Exclusion criteria were as follow: gestational age less than 37, neonatal hemoglobin lower than 14, severely malnourished mothers (with body mass index lower than 18 kg/m²), and mothers with any chronic medical disease such as diabetes mellitus.

For determining the overall prevalence of neonatal microcytosis, cord blood samples were collected in labor room after birth. All cases were term newborns with normal hemoglobin. Routine red blood cell parameters were investigated by automated cell counters (Sysmex K800, and Sysmex KX-21). Neonatal microcytosis was defined as MCV below 94 femtoliters (fL) and MCH below 29.5 picograms (pg) at birth towards the presence of α thal (9,10).

All statistical analysis was performed using SPSS-17 software, and the value of $p < 0.05$ considered as significant level.

Results

In this study 1001 newborns were evaluated. Most of these neonates were male (51.4%) and the rest (48.6%) female. The SD for weight and gestational age of newborns were 2.844 (0.253) and 38.485 (1.869) respectively. The Mean RBC parameters are shown in Table 1.

The MCV of neonates were 114.2 fl (95% CI: 113.5-114.9) in which twenty three (2.3%) had MCV less than 94 fl that identified as microcytosis and 4 (0.4%) had low MCH and MCV.

The frequency of newborns with normal and abnormal MCV and MCH is presented

Table 1. Red blood cells parameters in study neonates

Parameter	Mean (95% Confidence Interval)	SD
mean corpuscular volume (fL)	114.2 (113.5 - 114.9)	10.309
Mean corpuscular hemoglobin (pg)	36 (35.8 - 36.2)	2.312
Hemoglobin (g/dL)	15.8 (15.7 - 15.9)	2.216
Hematocrite (%)	48.3 (47.5 - 49.2)	6.110

Table 2. Anemia and mean corpuscular hemoglobin states

Parameters	Yes n (%)	No n (%)
MCV<94	23(2.3)	978 (97.7%)
MCH < 29.5 and MCV<94	4(0.40)	997(99.6)

in Table 2. In neonates with microcytosis, low MCH was observed in 17.4% of them.

Discussion

Although anemia is absent or unremarkable in α thal trait, it is important to diagnose the disorder to understand the cause of microcytosis and to avoid repeated expensive analysis and/or prolonged iron therapy. For these reasons, several countries have initiated universal prenatal screening programs to address α thal.

In our study, 2.3% of our newborns had microcytosis (MCV< 94 fL) and only 0.4% showed both low MCV and MCH (MCH< 29.5). We did not perform any Hb electrophoresis for these cases But it seems that MCV<93.6 can predict α thal with 90.9% sensitivity and 82.2% specificity (11). Schmaier et al. in their study showed that 9 (4.5%) of 200 infants had MCV \leq 94 and of these, 6 (67%) had Hb Barts. Moreover all infants with Hb Barts had abnormal range index. They concluded that MCV and MCH screening of newborn can be an easy way for the alpha thalassemia detection. Neonatal MCV \leq 94 and MCH \leq 29.5 should be followed by Hb electrophoresis (9). Shahriari et al also found that frequency of MCV< 100 fL among Shirazian newborns was 32.15% in which 2.35% with MCV< 100 fL showed Hb Barts using Hb electrophoresis. All of these 2.35%, had MCV lower than 93.6 fL and MCH lower than 28.75. Therefore these researchers recommended routine Hb electrophoresis for all newborns with MCV<94 and MCH<29. This will prevent of expensive tests in adulthood especially in premarital screening tests (12). Hadavi et al have reported – α 4.2 deletion in Iranian subjects, with a prevalence of 3.5% (13). The frequency of α thal was 3.6% among Turkish newborns in a study that employed globin gene map-

ping analysis of DNA (14). Additionally, α thal trait was observed in 0.63% of participants in a study conducted in the Antalya region of Turkey (15). Despite these results, a neonatal screening survey of α thal among the United Arab Emirates (UAE) nationals demonstrated that 49% of the studied cases had α -globin gene defect (16). The differences between result of our study and these studies may caused by variation in cut off point for MCV and different sample size and study location. Furthermore we did not study anemic newborns and Hb> 14 was one of the main inclusion criteria.

Conclusion

Although in our study, the prevalence of microcytosis was lower than other studies, but it is considerable since 2.3% prevalence of microcytosis was among newborns with normal hemoglobin. It may strongly suggest that α thalassemia within these newborns. We did not evaluate cases with Hb electrophoresis because of our limitations, therefore further studies to investigate of α thalassemia by Hb electrophoresis among newborns with normal hemoglobin and low MCV is strongly suggested.

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Conflict of interest

All authors have no conflict of interest (none declare).

References

1. Sengchanh S, Sanguansermisri T, Horst D, Horst J, Flatz G. High frequency of alpha thalassemia in the So ethnic group of South Laos. *Acta Haematol* 2005; 114:164-6.
2. Rund D, Rachmilewitz E. β -Thalassemia. *N*

Engl J Med 2005;353:1135-46.

3. Lafferty JD, Barth DS, Sheridan BL, McFarlane AG, Halchuk LM, Crowther MA. Prevalence of thalassemia in patients with microcytosis referred for hemoglobinopathy investigation in ontario. a prospective cohort study. *Am J Clin Pathol* 2007;127:192-6.

4. Lemmens-Zygulska M, Eigel A, Helbig B, et al. Prevalence of alpha-thalassemias in northern Thailand. *Hum Genet Sep* 1996; 98(3):345-7.

5. Rafiei Tabatabaei S, Ashtiani R, Tavakkolifard A, Hadipour Jahromy M, Shiva F, Ghazi-Saiedi M, Khaki M, Rafiee M, Fayyaz M, Rahbar M. The prevalence of minor thalassemia among siblings of major thalassemia patients: A study from Iran. *Annals of Biological Research* 2012; 3 (12):5429-33.

6. Rahim F. Microcytic hypochromic anemia patients with thalassemia: genotyping approach. *Indian J Med Sci Mar* 2009;63(3):101-8.

7. Al-Hilali AM, Al-Jallaf AM, Chunkasseril S. Confirmation of the validity of using birth MCV for the diagnosis of alpha thalassemia trait. *Hematology Reviews* 2009; 1(e20):103-5.

8. Waye JS, Chui DHK. The alpha-globin gene cluster: genetics and disorders. *Clin Invest Med* 2001; 24:103-9.

9. Schmaier A.H, Maurer H.M, Johnston C.L, Scott R.B. Alpha thalassemia screening in neonates

by mean corpuscular volume and mean corpuscular hemoglobin determination. *Journal of Pediatrics* 1973; 83(5):794-7.

10. Weatherall DJ, Clegg JB. The thalassemia syndrome. 4th ed. USA: Blackwell Science; 200:56-59.

11. Al Mansouri AM. Investigation of microcytosis in umbilical cord blood of neonates in Shiraz [dissertation]. Shiraz University of Medical Sciences: 2002.

12. Shahriari M, Pishva N, Karimi M. Prevalence of alphathalassemia in infants in South of Iran. Fifth International Symposium of Hematology and Oncology Shiraz, Iran, 2005.

13. Hadavi V, Taromchi AH, Malekpour M. Elucidating the spectrum of a-thalassemia mutations in Iran. *Haematologica* 2007; 92:992-3.

14. Fei YJ, Kutlar F, Harris HF. A search for anomalies in the zeta, alpha, beta, and gamma globin gene arrangements in normal black, Italian, Turkish, and Spanish newborns. *Hemoglobin* 1989; 13:45-65.

15. Canatan D, Oğuz N, Güvendik İ. The Incidence of Alpha- Thalassemia in Antalya-Turkey. *Turk J Haematol* 2002; 19:433-4.

16. El-Kalla S, Baysal E. Alpha-thalassemia in the United Arab Emirates. *Acta Haematol* 1998; 100:49-53.