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The influence of anemia on maternal and neonatal outcomes in adolescent pregnant

Adölesan gebelerde aneminin maternal ve fetal sonuçlar üzerine etkisi

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Abstract

Aim: The aim of this study was to investigate the influence of anemia on maternal and neonatal outcomes in adolescent pregnant.

Methods: The files of 1407 adolescent women who gave birth in our hospital, from January 2010 to June 2015 were retrospectively investigated. Demographic characteristics, hemoglobin concentrations before birth, obstetric and neonatal outcomes were evaluated.

Results: The mean age of the study group was 17.95±1.09 years. Anemia frequency was found as 36%. Anemia was significantly higher with the lack of health insurance. Similarly, anemia in those who had an educational level of elementary school or lower was significantly higher than for high school graduates. Pregnant adolescents who had irregular antepartum care during pregnancy also had a 1.62 times higher anemia risk. A significant correlation was found between anemia and postpartum complications; postpartum transfusion (OR: 9.09) and hemorrhage (OR: 4.76). No statistically significant impact of anemia was found on type of delivery, preterm birth, preeclampsia or gestational diabetes (p>0.05). Neonatal Intensive Care Unit admission was significantly higher for the infants of anemic patients (OR: 2.68). No statistically significant impact of anemia was found on birth weight, gestational age, small for gestational age or Apgar scores of the infants (p>0.05).

Conclusion: Due to its high frequency and adverse maternal and fetal outcomes anemia should be carefully considered during pregnancy in adolescent girls.

Keywords: Adolescent, Pregnancy, Anemia, Outcome, Postpartum

Öz

Amaç: Bu çalışmanın amacı adölesan gebelerde aneminin obstetrik ve neonatal sonuçlar üzerindeki etkisinin incelenmesidir.

Yöntemler: Ocak 2010-Haziran 2015 tarihleri arasında hastanemizde doğum yapan 1407 adölesan gebenin dosyaları retrospektif olarak incelendi. Gebelerin demografik özellikleri, doğum öncesi hemoglobin konsantrasyonları, obstetrik ve neonatal sonuçları değerlendirildi.

Bulgular: Çalışma grubunun yaş ortalaması 17,95±1,09 yıl idi. Anemi sıklığı% 36 olarak saptandı. Sağlık güvencesi olmayan hastalarda anemi sıklığı anlamlı derecede yüksekti. Benzer şekilde, eğitim düzeyi ilkökul ya da daha düşük olanlarda, lise mezunlarına oranla anemi daha sık bulundu. Düzensiz antepartum bakım alan adölesan gebelerde, anemi riski 1,62 kat daha yüksekti. Anemi ve postpartum komplikasyonlar arasında anlamlı bir korelasyon saptandı; postpartum kan transfüzyonu (OR: 9,09) ve kanama (OR: 4,76). Aneminin doğum şekli, preterm doğum, preeklampsi veya gestasyonel diyabet üzerine istatistiksel olarak anlamlı etkisi bulunmadı (p>0.05). Anemik gebe bebeklerinin daha yüksek düzeyde Yenidoğan Yoğun Bakım Ünitesi ihtiyacı olduğu saptandı (OR: 2,68). Aneminin doğum ağırlığı, gestasyonel yaş, gebelik haftasına göre düşük doğum ağırlığı ve Apgar skorları üzerine istatistiksel olarak anlamlı bir etkisi bulunmadı (p>0,05).

Sonuç: Adölesan gebelerdeki yüksek anemi sıklığı ve maternal ve fetal sonuçlar üzerindeki olumsuz etkileri göz önünde bulundurulmalı ve özellikle bu yaş grubu gebelerde anemi göz ardı edilmemelidir.

Anahtar kelimeler: İskemi, Eritropoietin, Endosalpingeal karyorrhesis, Salpenjit, Reperfüzyon

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Introduction

Anemia during pregnancy which is the most common nutritional disorder in pregnancy across the world is defined as a condition where hemoglobin (Hb) level in the blood is less than 11 g/d [1,2]. According to World Health Organization, prevalence of anemia in pregnant women in Turkey is 40% which should be considered as a serious public health problem. Although it is common at all stages of the life cycle, it is most frequently seen in young children and pregnant women [1]. Moreover, teenage mothers are considered as another risky group for anemia because of the increased iron needs and malnutrition as well as early marriage and pregnancy [3]. Adolescents constitute about one fifth of the world population (17.5%) and in the developing countries this group comprises an even higher proportion (23%) of the population [4]. Nearly 16 million adolescent girls between 15-19 ages give birth each year, accounting 11% of all births worldwide including the majority of it in developing countries [3]. In our country, adolescent age group constitutes 17.2% of the population and the proportion of those who gave birth in the 15-19 age group is 16.2% [5]. Pregnancy in very young women is generally considered to be a very high risk event which can cause several medical problems. Anemia, which is also one of these medical problems, is strongly associated with teenage pregnancy [6]. Although adolescent pregnancies have often been reported to be associated with adverse pregnancy outcomes such as preterm birth, low birth weight, small for gestational age infant and higher rates of neonatal and post-neonatal mortality, the impact of anemia on adverse pregnancy outcomes in adolescent pregnant is controversial. Some studies found significant associations whereas others didn't between the low Hb concentration and adverse obstetric and neonatal outcomes [7-12]. Thus the current study aims to investigate the influence of anemia on maternal and neonatal outcomes in Turkish adolescent pregnant.

Materials and methods

This retrospective observational study was done by investigating the files of 1407 adolescent women who gave birth in a major maternity hospital of Ankara-capital of Turkey- in a semi-urban region with partly low or middle socioeconomic level from January 2010 to June 2015. Adolescence was defined as per the WHO definition, 'young individuals between the ages of 10 and 19 years' [13]. All pregnant women aged ≤ 19 who delivered in our hospital during the study period were included in the study. Maternal age was defined as age in completed years at delivery and was calculated from the date of birth recorded from an official document during admission to the hospital. The demographic characteristics, hemoglobin concentrations before birth (in the last trimester or just before birth), obstetric complications, gestational age at birth, birth weights, apgar scores of the infants and neonatal intensive care unit (NICU) admission of the newborns were evaluated. The presence of anemia was defined as a hemoglobin concentration lower than 11.0 g/L according to World Health Organisation's definition [14]. The study group were divided into two groups according to the presence of anemia; anemic group ($Hb < 11$ gr/L; $n=507$) and non-anemic group ($Hb \geq 11$ gr/L; $n=900$) and maternal and

neonatal outcomes of the groups were compared. The study was approved by Ethics Committee.

Maternal and neonatal outcomes

The maternal outcomes were type of delivery (normal vaginal/cesarean), preterm birth (less than 37 completed weeks of gestation), preeclampsia (occurrence of new-onset hypertension- a systolic blood pressure ≥ 140 mm Hg, a diastolic BP ≥ 90 mm Hg or both, at least two occasions 4 hours apart- plus new-onset proteinuria- ≥ 0.3 g/24 h -measured after the 20th week of pregnancy [15]), gestational diabetes (any degree of glucose intolerance with the onset or first recognition during pregnancy), postpartum transfusion and postpartum hemorrhage (a blood loss of 500 ml or more within 24 hours after birth).

Neonatal outcomes were low birth weight (less than 2500 g at birth which was measured within the 24 hours after birth using digital infant scales in our hospital), gestational age at birth (full weeks were calculated to describe the gestational age), small for gestational age infant (weight less than the tenth percentile for gestational age), APGAR score (5 minute < 7) and NICU admission (before discharge from the hospital for any reason).

Statistical Analysis

Statistical analyses were performed using SPSS software (Statistical Package for the Social Sciences, version 20.0; SPSS Inc., Chicago, IL, USA). The suitability of the measurements to normal distribution were determined by "Kolmogorov-Smirnov Test" according to the sample size ($n > 30$). As the data were not appropriate for normal distribution non-parametric tests were used. Mann-Whitney U test was used in the comparison of two independent groups as a non-parametric test. Categorical variables were analysed with "Chi-Square Test" statistics. Logistic regression models were also used to determine the impact of the factors on anemia. Statistical significance was considered at a two-tailed value of $p < 0.05$.

Results

The mean age of the study group was 17.95 ± 1.09 years (range, 14-19 years). 80.6% ($n=1134$) of the patients were educated at elementary school or lower and 19.4% ($n=273$) were high school graduates. Only 10.2% were employed ($n=144$). 85.3% ($n=1205$) had civil marriages and 88.2% ($n=1245$) had health insurance. 65.9% ($n=926$) of the patients had regular antepartum control (≥ 4 times) during their pregnancy. 7% ($n=99$) had antepartum control three times, 5.8% ($n=82$) two times, and 3.6% ($n=50$) one time, whereas 17.7% ($n=249$) had never been followed-up during pregnancy. 0.4% of the patients had multiple pregnancy ($n=5$) and 0.4% had stillbirths ($n=6$).

Anemia frequency was found as 36% ($n=507$). In the anemic group, 58.2% ($n=295$) had mild ($10.0 \leq Hb \leq 10.9$), 40.6% ($n=206$) had moderate ($7.0 \leq Hb \leq 9.9$) and 1.2% ($n=6$) had severe ($Hb < 7.0$) anemia.

The socio-demographic and clinical characteristics of the anemic and non-anemic groups are shown in Table 1. Among all the socio-demographic factors and infant characteristics, educational level, civil marriage, health insurance and regular antepartum control were found to be significantly different between the groups. Other socio-demographic factors were not statistically significant (Table 1). Low educational status and

lack of civil marriage, health insurance and regular antepartum control were found to be higher in the anemic group (p=0.000; p=0.006;p=0.000;p=0.000).

Anemia was significantly higher with the lack of civil marriage (OR:1.52) and with the lack of health insurance (OR:1.87). Similarly, anemia in those who had an educational level of elementary school or lower was significantly higher (OR:3.44) than for high school graduates. Pregnant adolescents who had irregular antepartum control during pregnancy also had a 1.62 times higher anemia risk (95% CI=1.29-2.03) (Table 2).

Table 1: Socio-demographic and clinical characteristics among anemic and non-anemic adolescent pregnant women

| Characteristic | Presence of Anemia | | p value |
|---------------------------------------|--------------------|--------------------|-----------------|
| | Anemic (Hb<11) | Non-Anemic (Hb≥11) | |
| Age (Median) | 18 | 18 | Z=-0.254 |
| [Min-Max] | [14-19] | [14-19] | p=0.799 |
| Gestational Age (Median) | 39 | 39 | Z=-1.058 |
| [Min-Max] | [25-42] | [23-42] | p=0.290 |
| Birth Weight (Median) | 3130 | 3100 | Z=-1.415 |
| [Min-Max] | [840-4390] | [510-4330] | p=0.157 |
| Hemoglobin Levels (Median) | 10.1 | 12.1 | Z=-31.318 |
| [Min-Max] | [6.5-10.9] | [11.0-15.3] | p=0.000 |
| Educational Level | | | |
| Elementary school/lower (%) | 462 (%91.1) | 672 (%74.7) | $\chi^2=56.170$ |
| High School (%) | 45 (%8.9) | 228 (%25.3) | p=0.000 |
| Employment Status | | | |
| Employed (%) | 49 (%9.7) | 95 (%10.6) | $\chi^2=0.280$ |
| Unemployed (%) | 458 (%90.3) | 805 (%89.4) | p=0.597 |
| Civil Marriage | | | |
| Yes (%) | 417 (%82.2) | 788 (%87.6) | $\chi^2=7.429$ |
| No (%) | 90 (%17.8) | 112 (%12.4) | p=0.006 |
| Health Insurance | | | |
| Yes (%) | 427 (%84.2) | 818 (%90.9) | $\chi^2=14.153$ |
| No (%) | 80 (%15.8) | 82 (%9.1) | p=0.000 |
| Regular Antepartum Control (≥4 times) | | | |
| Yes (%) | 298 (%58.8) | 628 (%69.8) | $\chi^2=17.443$ |
| No (%) | 209 (%41.2) | 272 (%30.2) | p=0.000 |
| Iron Supplementation During Pregnancy | | | |
| Yes (%) | 230 (%45.4) | 442 (%49.1) | $\chi^2=1.824$ |
| No (%) | 277 (%54.6) | 458 (%50.9) | p=0.177 |
| Fertility Treatment | | | |
| Yes (%) | 15 (%3.0) | 45 (%5.0) | $\chi^2=3.310$ |
| No (%) | 492(%97.0) | 855 (%95.0) | p=0.069 |
| Smoking | | | |
| Yes (%) | 83 (%16.4) | 138 (%15.3) | $\chi^2=0.264$ |
| No (%) | 424 (%83.6) | 762 (%84.7) | p=0.608 |
| Mode of Delivery | | | |
| Vaginal (%) | 316 (%62.3) | 601 (%66.8) | $\chi^2=2.830$ |
| Cesarean (%) | 191 (%37.7) | 299 (%33.2) | p=0.093 |
| Gender of the Infant | | | |
| Girl (%) | 430 (%47.8) | 257 (%50.7) | $\chi^2=1.101$ |
| Boy (%) | 470 (%52.2) | 250 (%49.3) | p=0.294 |

Table 2: Socio-demographic and clinical variables in association with anemia in adolescent pregnant women

| Variable | OR (95% CI) | p |
|---------------------------------------|------------------|-------|
| Civil Marriage | | |
| Yes | Reference | |
| No | 1.52 (1.12-2.05) | 0.007 |
| Educational Level | | |
| Elementary school or lower | Reference | |
| High School | 0.29 (0.20-0.40) | 0.000 |
| Employment Status | | |
| Employed | Reference | |
| Unemployed | 1.10 (0.77-1.59) | 0.597 |
| Health Insurance | | |
| Yes | Reference | |
| No | 1.87 (1.34-2.60) | 0.000 |
| Regular Antepartum Control | | |
| Yes | Reference | |
| No | 1.62 (1.29-2.03) | 0.000 |
| Iron Supplementation During Pregnancy | | |
| Yes | Reference | |
| No | 1.16 (0.93-1.44) | 0.177 |
| Smoking | | |
| Yes | Reference | |
| No | 0.93 (0.69-1.25) | 0.608 |
| Fertility Treatment | | |
| Yes | Reference | |
| No | 1.73 (0.95-3.13) | 0.072 |

Results of logistic regression analysis are given in Table 3. We found that anemia increased the risk of postpartum transfusion (OR: 9.09) and postpartum hemorrhage (OR: 4.76). No statistically significant impact of anemia was found on type of delivery, preterm birth, preeclampsia or gestational diabetes (p>0.05) (Table 3).

Table 3: Regression Analyses showing the relationship between maternal outcomes and anemia status in adolescent pregnant women

| Maternal Outcome | OR | 95% CI | p |
|------------------------|------|-----------|-------|
| Type of Delivery | | | |
| Anemic | 0.82 | 0.66-1.03 | 0.093 |
| Preterm Birth | | | |
| Anemic | 1.03 | 0.73-1.45 | 0.859 |
| Preeclampsia | | | |
| Anemic | 0.62 | 0.25-1.54 | 0.305 |
| Gestational Diabetes | | | |
| Anemic | 1.12 | 0.90-1.40 | 0.294 |
| Postpartum Transfusion | | | |
| Anemic | 0.11 | 0.06-0.21 | 0.000 |
| Postpartum Hemorrhage | | | |
| Anemic | 0.21 | 0.08-0.60 | 0.003 |

NICU admission was significantly higher for the infants of anemic patients (OR:2.68). No statistically significant impact of anemia was found on birth weight, gestational age, small for gestational age (SGA) or Apgar scores of the infants (p>0.05) (Table 4).

Table 4: Regression Analyses showing the relationship between neonatal outcomes and anemia status in adolescent pregnant women

| Neonatal Outcome | OR | 95% CI | p |
|---------------------------|------|-----------|-------|
| Birth weight <2500 gr | | | |
| Anemic | 1.01 | 0.69-1.49 | 0.938 |
| Gestational Age <37 | | | |
| Anemic | 1.03 | 0.73-1.45 | 0.859 |
| Gestational Age <34 | | | |
| Anemic | 1.04 | 0.53-2.06 | 0.908 |
| Small for gestational age | | | |
| Anemic | 1.08 | 0.70-1.67 | 0.726 |
| APGAR 5.minute <7 | | | |
| Anemic | 1.78 | 0.51-6.18 | 0.362 |
| NICU | | | |
| Anemic | 0.38 | 0.26-0.56 | 0.000 |

Discussion

This study shows the importance of anemia in adolescent pregnant women, especially in terms of maternal outcomes. We found that anemia significantly increases especially the postpartum maternal complications of postpartum transfusion and postpartum hemorrhage. Also, when analyzed in terms of fetal outcomes, we found that NICU admission was significantly higher for the infants of anemic patients.

Anemia is an important public health problem worldwide especially during the pregnancy period. It not only impairs maternal health and well-being, but also causes adverse outcomes for both the mother and the infant. According to WHO, anemia affects half a billion women of reproductive age (15-49 years); 29% of non-pregnant (496 million) and 38% of pregnant women (32.4 million) worldwide [16]. In our study group, the anemia frequency was 36%, which can be classified as a moderate public health problem according to the WHO classification of the public health significance of anemia. The WHO Global Database on anemia gives the anemia prevalence in pregnant women in Turkey as 40.2%, which is defined as a severe public health problem. The lower frequency determined in our study group may be due to the fact that our hospital is located in a developed city of Turkey where there is a relatively better socio-economic level compared to the entire country [14].

Adolescent pregnancy is one of the major health challenges of the 21st century. Not only the adverse health

effects on both the mother and the infant, but also the physical, mental and social difficulties experienced by adolescents makes it a multi-faceted problem worldwide. As most adolescents become pregnant before the completion of their physical, mental and emotional maturation, the social consequences of pregnancy in this age group can be severe, such as school dropout, low education and as a consequence a lack of opportunities for better employment and income [17]. In accordance with this information, most of the adolescents in our study group were found to have low education levels and low employment rates. According to the Turkey Demographic and Health Survey-2013, 18.9% of the adolescent age group [17-21] have a high school education level, which is similar to our results, and 16.9% are employed, which is a little bit higher than our results [5].

We found a significant correlation between low educational status and lack of civil marriage, health insurance and regular antepartum visits and anemia. Many studies in the literature showed significant associations between adolescent pregnancy and low education level, low socioeconomic status, being anemic and having few antenatal visits [18-22]. These results are not surprising since economic challenges due to low educational level and lack of health insurance may cause poor adherence to routine antenatal follow-ups and may prevent having a healthy pregnancy period. Antenatal care is not only essential for the health of the woman and her pregnancy but also presents opportunities to provide information to her about taking iron supplements, good nutrition, balanced diet and preventing anemia. In their study, Ikeanyi and Ibrahim aimed to determine the effect of antenatal care on preventing anemia in pregnancy at term and concluded that anemia was corrected in 69.9% of the women who received antenatal care [23]. It should be kept in mind that antenatal care is the most important way to detect problems in pregnancy so as to prevent unwanted outcomes.

Although no statistically significant impact of anemia was found on type of delivery, preterm birth, preeclampsia and gestational diabetes, a remarkable aspect of our results was the increased risk of the postpartum maternal complications of postpartum transfusion and hemorrhage. The results of the studies in the literature on anemia in terms of maternal complications are controversial. While some studies pointed out that maternal anemia in pregnancy is an important risk factor for preterm birth, preeclampsia, diabetes and increased maternal mortality [7-10], others did not find a correlation [11,12], as the case with our study. At the same time, our findings are consistent with the literature in terms of postpartum maternal results. In her study, Frass determined that postpartum hemorrhage is related to hemoglobin levels at labor and the severity of anemia is an important factor that causes greater blood loss and adverse maternal outcomes [23]. Similarly, in a study done in Scottish population which aimed to estimate the clinical outcomes of antenatal anemia, statistically significant relationship was found between anemia and hemorrhage, transfusion and postpartum infection [24]. Therefore, since adolescent pregnancy itself is a risk factor for life threatening complications such as postpartum hemorrhage [25,26], the negative effects of maternal anemia on the postpartum period, especially in this age group, should never be ignored.

In our study group, no statistically significant impact of anemia was found on birth weight, gestational age, SGA and Apgar scores of the infants. The association between maternal anemia and fetal outcomes remains equivocal with some [7,8,10,27] but no other studies [11,12] documenting an increased risk of low birth weight, SGA and low Apgar scores. Although no correlation between anemia and fetal outcomes were identified in our study, the point to be noted is the significantly increased NICU admission of the infants born from anemic mothers. Similar to our results, Drukker et al. [27] in their study evaluated the effects of anemia on adverse neonatal outcomes and determined higher NICU admission for infants of anemic mothers. They concluded that correction of hemoglobin concentrations even in late pregnancy is very important in preventing these adverse outcomes. Similarly, Raisanen et al. [28] found significant correlation between maternal anemia and increased admission to NICU for their infants and underscore that maternal anaemia is associated with several adverse perinatal outcomes. In addition to these results, most studies in the literature interpreted that teenage pregnant women had a significant number of complications in pregnancy, one of which is a higher percentage of NICU admissions of their infants [29,30]. Therefore, healthcare staff should be particularly careful about emergent complications that may arise in the newborns of adolescent pregnancies complicated by maternal anemia.

The present study has certain limitations. First of all, the retrospective nature of the study is a limitation. Also, since the patients were of similar socio-economic status, it is not possible to generalize the results. In addition, the low number of patients with severe anemia prevented an examination of the relationship between the severity of anemia and maternal-fetal outcomes. Although the effect of maternal anemia on outcomes of pregnancy in the literature is well-studied, despite the growing importance worldwide, adolescent studies of maternal anemia are still not so common. So despite the limitations, our work expands the understanding of the effect of antenatal anemia on both maternal and neonatal outcomes in the adolescent age group. Large, prospective studies with heterogeneous groups are needed to clarify the relationship between maternal anemia and its effect on teenage pregnant women and their infants.

In conclusion, although many health problems are particularly associated with negative outcomes of pregnancy during adolescence, due to its high frequency and adverse maternal and fetal outcomes, anemia should be carefully considered in adolescent girls, especially during the pregnancy period. As it seems hard to prevent adolescent marriages in our culture in the short term, making pregnancy safer for the youngest mothers and their babies must be a priority for our country to meet targets for improving basic health care. For this purpose, health care professionals should focus on education, nutritional support, and regular pre and antepartum control of the adolescent girls and try to create awareness in the community about the complications of both teenage pregnancy and anemia during this period.

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