

Comparison of Prevalence of Iron Deficiency Anemia in Children with and without Urinary Tract Infection

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Received: August, 2021

Revised: September, 2021

Accepted: December, 2021

Introduction

Urinary tract infection (UTI) is the most common infection in infancy and childhood. If not diagnosed early and left untreated for a long time, it can lead to scar formation, hypertension, and end-stage renal disease (ESRD) (1-2). UTI in children under 5 years of age accounts for 4% of mortality. According to some studies, one in 20 girls and one in 50 boys up to the age of 5 have a UTI, but boys are more likely to be infected in infancy and at earlier ages (3). In addition to the infectious microorganisms that enter the urinary tract, several factors can spread the infection simultaneously.

Considering the host-infectious agent exposure, the nutritional status of the host is one of the factors involved in the invasion and spread of infections (4-6). Hemoglobin concentration is a parameter that indicates the chronic nutritional status and oxygen carrying capacity of the blood (7, 8). As children are in a state of rapid growth, their nutritional needs are very high (9). In conditions such as rapid growth, the risk of spreading the infection is high and this cycle leads to poor nutrition (10). Anemia is found in about 30% of children worldwide (11, 12). Several factors are involved in anemia and its

Abstract

Background and Aim: Research into the association between anemia and urinary tract infections (UTIs) is not adequate and only a few studies are available in this regard. Therefore, the aim of this study was to investigate the relationship between iron deficiency anemia and urinary tract infections in children presenting to Hazrat Masoumeh Hospital, Qom, Iran.

Methods: The medical records of pediatric patients with and without UTI hospitalized in Qom Hazrat Masoumeh Hospital were evaluated. Then, the anemia profile was evaluated in the two groups (e.g. hemoglobin, ferritin, transferrin, etc.)

Results: There were 32 patients (64%) in the urinary tract infection group and 26 patients (52%) in the non-urinary tract infection group. Twenty-eight patients (56%) in the urinary tract infection group and 20 patients (40%) in the non-urinary tract infection group had iron deficiency anemia, but no significant relationship was found between the two groups (P value = 0.08). The mean hemoglobin concentration was 11.19 ± 1.73 in patients with urinary tract infection and 11.56 ± 1.89 in the non-infected group. Regarding anemia profile variables, no significant relationship was found between the two groups (P values: Hb = 0.15 SI = 0.21 TIBC = 0.90 Ferritin = 0.05 Transferrin sat = 0.132).

Conclusion: No statistically significant difference was found in anemia between the two groups of children with and without urinary tract infections. However, the indicators of anemia were lower in children with urinary tract infections compared to the control group and these children are prone to anemia.

Keywords: Urinary Tract Infection; Anemia; Children.

Conflict of interest: The authors declare no conflict of interest.

Please cite this article as: Razavi M R, Akhavan Sepahi M, Eshagh Hoseini K, Hamta A, Shariatifar M A. Comparison of Prevalence of Iron Deficiency Anemia in Children with and without Urinary Tract Infection. *J Ped Nephrol* 2021;9(4):1-5.
<https://doi.org/10.22037/jpn.v9i4.35847>

treatment with blood transfusion (13). In children, nutritional anemia, including iron deficiency, vitamin B12, and folate are the most common factors (14). In addition to nutritional anemia, thalassemia, tuberculosis and aplastic anemias are other types (15). Iron deficiency anemia in children usually develops between the ages of 6 months and three years, during which recurrent childhood infections also occur (16). Anemia is probably a known risk factor for recurrent episodes of infection (17). A study similar to the Golz study was performed on hemoglobin levels and recurrent episodes of otitis media in children (18). In another study, the association between anemia and acute gastroenteritis in children was evaluated (19). However, the association between anemia and recurrent UTIs has not been adequately discussed in studies and only a few studies are available in this regard (20). Therefore, the aim of this study was to investigate the relationship between iron deficiency anemia and recurrent UTIs in children in Hazrat Masoumeh Hospital, Qom, Iran.

Methods

This retrospective study was performed in case and control groups using a descriptive-analytical method. The study was performed using available sampling after receiving approval for its protocol and obtaining an ethics code (IR.MUQ.REC.1399.254). The researcher started sampling from the Vice Chancellor for Research of Qom University of Medical Sciences. To collect the required data, the children's files were divided into two groups with administrative UTI and non-administrative infection. The files of all patients with UTI (fever above 37.8°C and a positive U/C) in Hazrat Masoumeh Hospital and the files of non-UTI patients who were hospitalized in the same period were included in the study. Patients with malignancies, internal diseases affecting the hemoglobin level, patients with other anemias, those taking corticosteroids and patients with immunodeficiency were excluded from the study. The patients' records were reviewed to extract the serum iron level, plasma ferritin and TIBC (total iron binding capacity). Anemia was diagnosed when the hemoglobin level was more than two standard deviations below the normal level for the corresponding age and sex group. If the hemoglobin level was low for age, the child was considered anemic. CBC, serum iron level, plasma ferritin, and total iron binding capacity were

measured to distinguish iron deficiency anemia from other common causes of the disease. In iron deficiency, serum ferritin and plasma ferritin decrease while TIBC increases. Anemia is defined as a hemoglobin level below 11 (mean hemoglobin at this age is 12) in infant under 2 years of age and below 11.5 (mean 12.5) in children under 5 years of age (28).

The data were extracted and compared between the two groups. The SPSS software version 26 was used for data analysis. Descriptive data are reported as mean and standard deviation using graphs and tables. Fisher and chi-square and t-test were used to analyze the data. Significance level was considered 0.05.

Results

According to the results, 64% of the patients with UTI were 6 months to 5 years, 30% were 5-12 years, and 6% were over 12 years. In the non-infected group, these values were 52%, 36% and 12%, respectively. The subjects aged 5 months to 5 years were the largest group. In general, no significant difference was found in age between the two groups ($P = 0.388$) (Table 1).

Table 1. Survey of age groups

Group Therapy	Age category			Total	P value
	6months to 5 years	5 years to 12 years	Above 12years		
UTI	32 (64%)	15 (64%)	3 (6%)	50 (100%)	0.388
No UTI	26 (52%)	18 (36%)	6 (12%)	50 (100%)	
Total	58 (58%)	33 (33%)	9 (9%)	100 (100%)	

The mean age of all patients in both groups was 4.8 years. The mean hemoglobin level was 11.38 ± 1.81 , the mean blood iron was 53.6 ± 27.31 , the mean TIBC was 54.84 ± 34.86 , the mean ferritin was 27.2 ± 21.56 and the mean transferrin saturation percentage was 10.65 ± 17.11 (Table 2).

Twenty-eight children with UTI (56%) and 20 children without UTI (40%) had anemia. No significant relationship was found in anemia between the two groups ($p = 0.08$) (Table 3-5).

Table 2. Investigation of laboratory variables

	Min	Max	Median	SD
Age	11 months	13.7 years	4.8 years	41.41 months
Hb	7.2	14.6 years	7.2	1.81
Fe serum	1	104	52.6	27.31
TIBC	227	453	244.86	54.84
Ferritin	2	116	27.2	21.56
Saturation Transferrin	2.57	43	17.11	10.65

Twenty-eight children with UTI (56%) and 20 children without UTI (40%) had anemia. No significant relationship was found in anemia between the two groups ($p = 0.08$).

Table 3. Evaluation of anemia in the two groups of children studied

		Anemia			P Value
		Yes	No	Total	0.08
Group	UTI	28 (56%)	22 (44%)	50 (100%)	
	No UTI	20 (40%)	30 (60%)	50 (100%)	
	Total	48 (48%)	52 (52%)	100 (100%)	

Thirty-six children with UTI (72%) were girls. In the non-UTI group, 27 patients (54%) were boys ($P = 0.007$).

Table 4. Comparison of gender between study groups

		Gender group			P Value
		Boy	Girl	Total	0.007
Group	UTI	14 (72%)	26 (72%)	50 (100%)	
	No UTI	27 (46%)	22 (46%)	50 (100%)	
	Total	41 (41%)	41 (59%)	100 (100%)	

Table 5. Evaluation of quantitative variables in case and control groups

		Number	Median	SD	P value
Hb	UTI	50	11.19	1.73	0.152
	No UTI	50	11.56	1.89	
Fe serum	UTI	50	50.44	28.23	0.213
	No UTI	50	56.76	26.27	
TIBC	UTI	50	350.76	52.73	0.907
	No UTI	50	228.76	55.79	
Ferritin	UTI	50	27.98	24.81	0.052
	No UTI	50	26.42	17.95	
Saturation Transferrin	UTI	50	16.09	11.19	0.132
	No UTI	50	18.13	10.09	

Discussion

There were 32 patients (64%) with UTI and 26 patients (52%) without UTI in the age group 6 months to 5 years, which was the largest group of patients. In general, no significant difference was found in age between the two groups ($P=0.388$). The mean age of all patients in both groups was 4 years and 8 months.

The mean hemoglobin was 11.38 ± 1.81 , the mean blood iron was 53.6 ± 27.31 , the mean TIBC was 54.84 ± 34.86 , the mean ferritin was 27.2 ± 21.56 , and the mean transferrin saturation percentage was 17.11 ± 10.65 . Twenty-eight children with UTI (56%) and 20 children without UTI (40%) had anemia. No significant difference in anemia was found between the two groups ($p = 0.08$). The hemoglobin level was 11.19 ± 1.73 in patients with UTI and 11.56 ± 1.89 in patients without UTI. The blood Iron level was 50.44 ± 28.23 in the affected group and 50.28 ± 44.23 in the non-affected group. The TIBC was 350.96 ± 53.73 in the affected group and 338.76 ± 55.79 in the non-UTI group. The ferritin level was 27.98 ± 24.81 in children with UTI and 26.42 ± 17.95 in children without UTI.

The transferrin saturation percentage was 16.09 ± 11.19 in affected children and 18.13 ± 10.09 in the non-UTI group. No significant difference was found in anemia profile variables between the two groups. In 2019, Jayaweera et al studied the association between anemia and development of recurrent acute respiratory tract infections, UTI, and gastroenteritis

in children. Risk factors for these infections were assessed in children 2 to 5 years old at a hospital in Sri Lanka during an 18-month follow-up. After 3 months of iron supplementation, a 6-month follow-up was planned to evaluate recurrent infections. The hemoglobin concentration was measured using the Drabking's reagent.

Logistic regression was used to find the risk factors of recurrent infections. The results showed that 73.3% of patients with acute respiratory infections, 71% of patients with gastroenteritis, 47.9% of patients with UTI and 40% of controls had anemia. In the group with urinary tract infections, the rate of recurrent UTI was 8.3%. There was a significant reduction in the incidence of acute respiratory infections and recurrent gastroenteritis following 3 months of iron supplementation in the children. (17). In a study conducted by Tansarli et al. in 2013 aiming at investigating the relationship between iron deficiency anemia and the incidence of infections using systematic examination of clinical evidence, six studies (including 1422 cases) that met the criteria were reviewed. Acquired infections from the intensive care unit and postoperative infections were higher in patients with iron deficiency anemia compared to patients with a normal iron status, while no other study reported this finding (22).

Iron deficiency anemia was an independent predictor of respiratory tract infections and postoperative urinary tract infections was more common in patients with iron deficiency anemia. This systemic study showed that people with iron deficiency, especially those with iron deficiency anemia, were at a higher risk for infections than patients with a normal iron status (22). In a 2010 cohort study to determine the association between low reticulocyte hemoglobin and higher transfusion rates in critically ill patients, 62 patients with normal and abnormal hemoglobin concentrations admitted to the intensive care unit were evaluated. The authors concluded that ICU acquired infections were higher in patients with lower hemoglobin concentrations (30.4%) than in those with normal hemoglobin concentrations (10.3%) (22). In 2005, a study was performed to evaluate anemia as a risk factor for infectious diseases in infants and young children. In this study, 521 healthy infants up to 18 months of age were evaluated in two groups of iron deficiency anemia and non-anemia. The results of this study showed that anemia up to 6 months of age

was an independent risk factor for more than five episodes of respiratory infection and otitis media between 7 and 18 months of age. Anemia at 6 months doubled the risk of developing respiratory disease after that age (20). In a 2004 prospective cohort study by Myers et al entitled "The effect of clinical anemia on prognosis following complete pelvic replacement", 225 elderly individuals underwent complete pelvic replacement surgery in both anemic and non-anemic groups. Postoperative urinary tract infection was reported in 28% of anemic patients and 12% of non-anemic patients (23). In a 1988 study by Harju et al. entitled "Empty iron stores as an important risk factor in abdominal surgery", 448 patients who underwent abdominal surgery were compared in two groups including low iron stores (low ferritin) and normal iron stores (normal ferritin). In this study, postoperative infections were reported to be higher in patients with lower iron stores than in the other group (10.1% vs. 2.3%) (24).

Conclusion

The present study found no statistically significant difference in anemia between children with and without urinary tract infections. However, the indicators of anemia were lower in children with urinary tract infections compared to the control group and these children are more prone to anemia.

Acknowledgments

Not declared.

Conflict of Interest

The author declares no conflicts of interest.

Financial Support

The author declares no financial support.

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