

The High Prevalence of Anemia among Children with Cerebral Palsy at a Vietnam Tertiary Care Hospital

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ABSTRACT

Objective: Cerebral palsy is one of risk factors of malnutrition, especially anemia. In Vietnam, there was lacking of evidence on anemia in this population. Our study aimed to determine the prevalence of anemia among children with CP at a tertiary hospital of Vietnam.

Design: A cross sectional study was conducted from April 2017 to July 2019 in a tertiary hospital in central of Vietnam.

Materials and Methods: We enrolled the patient diagnosed cerebral palsy with aged from 18 years and below. The collected data included clinical characteristics of cerebral palsy as well as assessed anemia status each patient. Diagnosis of anemia based on guideline of World Health Organization 2011.

Results: We included 53 children diagnosed cerebral palsy during study. Male children were major. There were 60 percent of cases suffered the anemia, most of them were in mild level (90.3%). One of five was the iron deficiency anemia. There was a statistically significant difference of underweight and Gross Motor Functional Classification System (GMFCS) level ($p < 0.05$) with proportion of anemia.

Conclusions: The study indicated there was the high prevalence of anemia in children diagnosed cerebral palsy, in which most of them was mild level. Our findings suggest several courses of action for improve nutrition status of this vulnerable population.

KEY WORDS

anemia, cerebral palsy, iron deficiency, disability

INTRODUCTION

Anemia is defined as an abnormal condition of blood in which there is a shortage of red blood cells or the hemoglobin concentration, according to World Health Organization (WHO)¹⁾. Its typical symptoms include fatigue, weakness, dizziness and shortness of breath. This is an emerged global public health problem and causes serious influences particularly to young children and pregnant women. Based on estimation of WHO, the global proportion of anemia in children less than 5 years of age was up to 42 percentage²⁾, especially in Low-middle income countries (LMICs).

In the other hand, the children with cerebral palsy (CP) who have limitation about movement usually accompanied by disorder of sensation, perception, cognition, communication and behavior was commonly a risk factor of poor nutrition or nutritional deficiency including anemia³⁾. Among them, those who is of poor weight^{4,5)}, motor impairments⁶⁾ or having trouble with feeding and swallowing⁷⁻⁹⁾ are at the greatest risk of nutritional problems. Currently, several studies investigated the relationship between anemia and CP. However, it seems that there were few reports of this problem in children with CP in LMICs such as Vietnam. Better understanding of the anemia status in vulnerable population is important to form the proposals aiming to improve situation.

Therefore, our study aimed to determine the prevalence of anemia among children with CP at a tertiary hospital of Vietnam.

METHOD

Design Study

This was a cross sectional study that implemented from April 2017 to July 2019 in Pediatric Center from Hue Central Hospital known as a tertiary hospital in central of Vietnam.

Study Setting and Participants

We included the patient diagnosed cerebral palsy with aged from 18 years and below who admitted at the Pediatric Center, Hue Central Hospital from April 2017 to July 2019.

Data Collection and Clinical Assessment

The data was collected through a standardize questionnaire which

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Table 1: Demographic, clinical characteristics and laboratory findings of children with Cerebral Palsy

Varibales	All patient (n = 53)	Anemia (n = 31)	Non-anemia (n = 22)	p-value
Demographic and clinical characteristics				
Age distribution (years)				
< 2	8 (15.09)	3 (9.7)	5 (22.7)	> 0.05
2 - 5	23 (43.4)	15 (48.4)	8 (36.4)	
> 5	22 (41.51)	13(41.9)	9 (40.9)	
Gender				
Male	29 (54.72)	14 (45.2)	15 (68.2)	> 0.05
Female	24 (45.28)	17 (54.8)	7 (31.8)	
Underweight				
Yes	26 (49.06)	20 (64.5)	6 (27.3)	< 0.05
No	27 (50.94)	11 (35.5)	16 (72.7)	
Clinical classification				
Spastic	33 (62.26)	18 (58.1)	15 (68.2)	> 0.05
Mixed forms	9 (16.98)	5 (16.1)	4 (18.2)	
Others	11 (20.76)	8 (25.8)	3 (13.6)	
GMFCS level				
IV - V	43 (81.13)	29 (93.5)	14 (63.6)	< 0.05
I - III	10 (18.87)	2 (6.5)	8 (36.4)	
Status of anaphylaxis				
Monoplegia	2 (3.77)	1 (3.2)	1 (4.5)	> 0.05
Hemiplegia	6 (11.32)	2 (6.5)	4 (18.2)	
Diplegia	19 (53.85)	12 (38.7)	7 (31.8)	
Quadriplegia	26 (49.06)	16 (51.7)	10 (45.4)	
Laboratory findings of blood				
Hemoglobin (g/dl) *				
Low (< 12 g/dl)	11.2 (10.2 - 12.4)	10.2 (9.8 - 10.7)	12.6 (11.8 - 13.6)	> 0.05
Normal	36 (67.9)	30 (96.8)	6 (27.3)	> 0.05
MCV (fl) *	77.3 (72.6 - 82)	75.3 (69.6 - 81.1)	79 (74 - 82.4)	> 0.05
Decrease (< 80 fl)	34 (64.2)	21 (67.7)	13 (59.1)	
MCH (pg) *	25.8 (24.2 - 27.4)	25.4 (22.8 - 26.1)	27.1 (25.1 - 28.1)	> 0.05
Decrease (< 27 pg)	38 (71.7)	27 (87.1)	11 (50)	
MCHC (g/dL) *	33 (32.1 - 34.1)	32.3 (31.2 - 33.3)	33.8 (32.8 - 34.9)	> 0.05
Decrease (< 30 g/dl)	2 (3.8)	2 (6.5)	0	
RDW (%) *	14.3 (13.3 - 15.8)	14.8 (13.6 - 17.1)	13.8 (13.3 - 14.7)	> 0.05
Increase (> 17%)	8 (15.1)	6 (19.35)	2 (9.1)	
Serum iron (μmol/l)	5.76 (2.9-11.3)	3.7 (2.7 - 7.7)	9.8 (4.5 - 14.0)	> 0.05
Serum ferritin (ng/ml)	60 (16.9-122.2)	47.1 (14.6 - 158.4)	79.3 (47.7 - 118.1)	> 0.05

(*) Median (IQR), others are frequency (percent)

Table 2: Incidence of anemia and iron deficiency

Varibales	All patient	Male	Female	p-value
Incidence of anemia and iron deficiency				
Anemia	31 (58.5)	14 (45.2)	17 (54.8)	> 0.05
Iron deficiency	10 (18.9)	5 (50)	5 (50)	> 0.05
Level of anemia (n = 31)				
Mild	28 (90.3)	13 (46.4)	15 (53.6)	
Moderate	3 (9.7)	1 (33.3)	2 (66.7)	> 0.05
Severe	0 (0)	0	0	
Clinical symptoms of anemia (n = 31)				
Pale or yellowish skin	16 (51.6)	5 (31.2)	11 (68.8)	
Pale Palm	24 (77.4)	10 (41.7)	14 (58.3)	
Pale mucosa of eye	19 (61.3)	7 (36.8)	12 (63.2)	> 0.05
Atrophic glossitis	4 (12.9)	1 (25)	3 (75)	
Nail and toenail	4 (12.9)	1 (25)	3 (75)	
Intellectual disability/ Mental retardation (n = 53)				
Yes	51 (96.2)	27 (52.9)	24 (47.1)	> 0.05
No	2 (3.8)	2 (100)	0	

was developed by senior researchers. Apart from individual information of participants, we gathered clinical characteristics of cerebral palsy as well as assessed anemia status each patient. The clinical characteristics included symptom, paralysis, motor impairment (GMFCS-Gross Motor Functional Classification System) and intellectual disability. Meanwhile, the anemia items contained symptom and degree of anemia, iron deficiency anemia, laboratory findings (MCV, MCH, MCHC, RDW, serum ferritin concentration). Diagnosis of cerebral palsy based on POSTER criteria of Levine 1980⁽⁹⁾ and anemia derived from guideline of WHO 2011⁽¹¹⁾.

Data Management and Analysis

All responses were adapted from written questionnaire to a sheet form of Microsoft Excel 2010 software. Descriptive statistics were used to analyze the baseline characteristics of the study population. The categorical variables were described in frequency and percentage, while continuous variable such as laboratory testing was reported using mean and standard deviation (SD) or median and Interquartile range (IQR). Either Chi-squared test or Fisher's exact test was used for categorical variables, on the other hand, Wilcoxon rank sum test was applied for continuous ones. A significance level of 0.05 was used for all statistical tests. The statistical analysis was carried out applying SPSS 23 (IBM

Table 3: Serum iron and ferritin associated with clinical classification, GMFCS level and status of anaphylaxis

	Clinical classification			p-value	GMFCS level		p-value	Status of anaphylaxis		
	Spastic	Mixed forms	Others		IV - V	I - III		Quadriplegia	Others	p-value
Serum iron	5.0	7.2	2.9	> 0.05	5.0	9.1	> 0.05	5	6.8	> 0.05
($\mu\text{mol/l}$)	(3.1 - 9.5)	(4.2 - 12.6)	(2.2 - 12.1)		(2.7 - 9.3)	(4.6 - 14.0)		(2.4 - 12.4)	(3.2 - 9.4)	
Serum ferritin	69.9	53.2	47.7	> 0.05	60.1	41.2	> 0.05	73.8	56.6	> 0.05
(ng/ml)	(18.1 - 144.5)	(14.2 - 74.7)	(18.3 - 203.7)		(21.3 - 158.4)	(13.6 - 85.8)		(15.0 - 158.4)	(17.6 - 97.1)	

Corporation, Chicago, IL, USA).

RESULT

A total of 53 children diagnosed CP enrolled in this study. The under 5 years of age patients were early diagnosed CP took an account of 58.5 percent. Male children (54.7%) were higher than female (45.3%). There was no significant difference in the prevalence of anemia among different age groups as well as genders. There were approximately 20 percent patients with weight under 2500 gram. Seizure was the key reason that patients admitted hospital with 34 percent, followed by fever (26.4%). In terms of underlying comorbidity, the children suffered epilepsy and underweight was the highest prevalence that took around a half of population.

Table 1 summarizes demographic, clinical characteristics and laboratory findings of children with CP. Twenty anemia cases had a manifestation of poor nutrition. There was a statistically significant difference of underweight ($p < 0.05$) with proportion of the anemia, children with underweight had higher prevalence than non-underweight group. Besides, the results in terms of GMFCS level ($p < 0.05$) were statistic significant, in which IV-V group took 93.5 percent among anemia participants. The predominant clinical classification was spastic ($n = 33$, 62.3%), followed by mixed form ($n = 9$, 17%). Our study indicated that around a half of children with CP was quadriplegia, meanwhile the proportion of paraplegia and hemiplegia was 35.8 and 11.3 percent, respectively. Blood laboratory findings included the median (IQR) of hemoglobin, MCV, MCH, MCHC, RDW, serum iron and serum ferritin by status anemia. From our data, there were decrease of MCV, MCH and MCHC observed in 67.7, 87.1 and 6.5 percent, respectively. Conversely, the proportion of increase RDW was only around 20%. The difference of all tests between anemia and non-anemia was no statistic significant.

Table 2 shows the incidence of the anemia and the iron deficiency in our population. About 60 percent of children with CP suffered anemia, most of them were in mild level according to WHO criteria. The iron deficiency presented nearly one of five among study participants. The female children suffered higher anemia than male although this difference had no statistically significant. The common symptom of anemia from our study was pale palm with 77.4 percent, followed by pale mucosa of eye and pale or yellowish skin with 61.3 and 51.65 percent, respectively. Notably, our study showed up to 96.2 percent children with CP had intellectual disability/ mental retardation problems.

In table 3, the median and IQR (interquartile range) of the serum iron and serum ferritin was presented according by clinical classification, GMFCS level and status of anaphylaxis. Similar with laboratory findings, there was no difference with statistical significance among those variables.

DISCUSSION

The condition of children with CP can remarkably improve if they were diagnosed and received the treatment early. Early detecting of CP is crucial to help patients to develop both mental, intellectual and physical activity. In our study, the prevalence of children with CP was 58.5 percent, in which under 2 ages was 15.1 percent. This result was lower than that reported in the general child population in Vietnam but higher than the study of Rosulescu E at Craiva University¹¹. The rate of gender reported was 1.21 male comparing one female children, this was familiar with Pinto *et al.* from São Paulo, Brazil (1.12: 1)¹².

In present study, the percentage of anemia among participants was approximately 60 (31/53), relative similar to some studies including Ashour M. and Gamal A.^{13,14}, but was higher than study of

Papadopoulos A. in Greece and Ohwada H. in Japan^{15,16}. Among the studies of children with CP, anemia was commonly reported in terms of a quietly high prevalence, however this problem was often ignored by their parents or guardians which was replaced with attention to movement or infectious diseases. Anemia with mild level was predominantly observed in this study, which can lead parent, guardian or health worker to miss this condition. There was one of five patients suffering iron deficiency anemia demonstrated several studies that it can pose to decrease intellectual, movement as well as social interaction¹⁷. The anemia prevalence in our study showed female was higher than male children despite of having no significant difference. Our data was consistent to results of Papadopoulos A *et al.* showing that both anemia and iron deficiency happened more frequently in females, although they were not statistically significant¹⁵.

When we compared anemia incidence with demographic and clinical characteristics of participants, the statistically significant difference only happened with underweight and GMFCS level variables. More details, there was higher prevalence of anemia in children with underweight and IV-V group than non-underweight and I-III. It is difficult for children with CP to normally eat, drink, swallow, chew like others and this can cause condition of malnutrition. The previous studies also showed that children with malnutrition was one of common problem leading anemia. In terms of GMFCS, patients classified IV or V level was limited in their ability to movement and require physical assistance or powered mobility in most settings. Those affected directly the activities of eating, drinking and indirectly status of anemia of children. Our study indicated that there was no association of anemia of children according by clinical classification, GMFCS and anaphylaxis. Diagnose anemia basing on level of serum iron was limited because it reflects numerous factors and vary by age. Besides, serum ferritin was closely depended on infectious or inflammatory conditions. Those explained why we had no relationship of serum iron and ferritin.

In addition, blood laboratory findings also presented having no relation with gender. Based on mean corpuscular volume (MCV) known as the average size of red blood cell, the rate of microcytic anemia, normocytic anemia was 67.7 and 32.3 percent, respectively; no case was macrocytic anemia. Among anemia children, 87.1 was percentage of the decrease of MCH whose etiology common was lacking of iron, thalassemia or infectious diseases. A study of Junca J concluded that decrease of MCV and MCH was significantly associated with iron deficiency ($p < 0.05$)¹⁸. Indicators of increase of RDW and normal of MCHC were 17 and 93.5 percent.

A limitation of this study is that the numbers of patients were relatively small, it was based on hospital population. Therefore, it is not able to show representative general spectrum of anemia in children with CP in Vietnam. The findings should be interpreted with consideration about the scenario from this reported.

CONCLUSION

One of the more significant findings to emerge from this study is that the high prevalence of anemia in children with cerebral palsy, in which mild level was predominant. There were relation among underweight, GMFCS level and anemia. The present study provides additional knowledge to the anemia status of children with CP in Vietnam, and these results suggest several courses of action for improve nutrition status of this vulnerable population in both community and health centers. Further research in this field would be encouraged aiming to determine concisely incidence of anemia in general children with CP in Vietnam.

ETHICAL APPROVAL

All enrolled participants were announced relevant information of study along with written informed consent was obtained from participant's parents or guardians. The study was assessed and accepted by IRB of Hue Central Hospital.

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