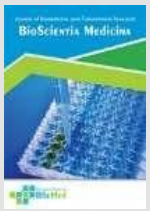
eISSN (Online): 2598-0580



Bioscientia Medicina: Journal of Biomedicine & Translational Research

Journal Homepage: www.bioscmed.com

Relationship between Febrile Seizures and the Incidence of Microcytic Hypochromic Anemia in Children at Sanjiwani General Hospital, Gianyar, Indonesia

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ARTICLE INFO

Keywords:
Febrile seizures
Child
Microcytic hypochromic anemia
Iron depletion

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/bsm.v6i18.736

A B S T R A C T

Background: Febrile seizures are the most common seizures in children. As many as 2% to 5% of children aged less than 5 years have had seizures accompanied by fever, and most occurrences are at the age of 17-23 months. Microcytic hypochromic anemia causes hypoxic conditions and neuronal instability due to iron depletion. This study aimed to explore the relationship between febrile seizures and the incidence of microcytic hypochromic anemia in children at Sanjiwani General Hospital, Gianyar, Indonesia. **Methods:** This study was an analytic observational study with a cross-sectional approach. A total of 59 subjects participated in this study. Data analysis was carried out with the help of SPSS software in univariate and bivariate to determine the relationship between febrile seizures and microcytic hypochromic anemia. **Results:** There is a relationship between the incidence of febrile seizures and the incidence of microcytic hypochromic anemia, with $p<0.05$. This study also showed that the risk of febrile seizures increased 1.7 times higher in individuals with microcytic hypochromic anemia. **Conclusion:** There is a relationship between the incidence of febrile seizures and the incidence of microcytic hypochromic anemia in pediatric patients at Sanjiwani General Hospital, Gianyar, Indonesia.

1. Introduction

Fever in children is a common problem for parents and one of the most common complaints at emergency department visits. Fever is one of the most common reasons for medical consultation in children, accounting for 15-25% of consultations in primary care and emergency departments. Fever is generally not dangerous, but a high fever can cause serious problems in children. The problem that often occurs when the body temperature rises above 38°C is febrile seizures. Febrile seizures are the most common seizures in children. As many as 2% to 5% of children aged less than 5 years have had seizures accompanied by fever, and most occurrences are at the age of 17-23 months. In general, febrile seizures have a good prognosis, but about 30 to 35% of children with first febrile seizures will experience recurrent febrile seizures. Even though it has a good prognosis, febrile seizures are still a frightening thing for parents.[1-5]

Changes in body temperature affect the threshold value of seizures and neural excitability. An increase in body temperature affects ion channels and cellular metabolism, and the production of adenosine triphosphate (ATP). For every increase in body temperature, 1°C will increase basal metabolism by 10-15% and 20% oxygen demand. As a result of these conditions, the oxidation reaction takes place more quickly so that oxygen is used up more quickly. Lack

of oxygen in the tissues can cause hypoxic conditions. Microcytic hypochromic anemia is indicated by low hemoglobin levels causing reduced oxygen-binding ability of red blood cells. Oxygen is needed in the process of active transport of Na-K ions, which are useful for stabilizing nerve cell membranes. Disturbed stability of the nerve cell membrane can result in increased intracellular Na ion concentration resulting in depolarization. Seizures occur when there is excessive depolarization of the neurons in the central nervous system and when this condition is at a steady level and is subjected to strong stimulation, such as high fever (>38^{0}C) and anemic conditions.[6-10] This study aimed to explore the relationship between febrile seizures and the incidence of microcytic hypochromic anemia in children at Sanjiwani General Hospital, Gianyar, Indonesia.

2. Methods

This study was an analytic observational study with a cross-sectional approach and used primary data in the form of pediatric patients who are treated at Sanjiwani General Hospital, Gianyar, Indonesia. A total of 59 research subjects participated in this study. The research subjects met the inclusion criteria in the form of pediatric patients aged 6 months - 5 years who were treated at Sanjiwani General Hospital, Gianyar, Indonesia, and had obtained permission from their parents or guardians to participate in this study. This study was approved by the medical and health research ethics committee of the Faculty of Medicine, Universitas Udayana, Denpasar, Indonesia.

Febrile seizures are seizures that occur in children aged 6 months to 5 years who experience an increase in body temperature (temperature above 38°C/ 100.4°F, with temperature measurement using a thermometer) that is not caused by an intracranial process (head trauma and epilepsy). Microcytic hypochromic anemia is a morphology of anemia most often caused by iron deficiency. Iron deficiency anemia arises due to a reduced supply of iron for erythropoiesis due to depleted iron stores which ultimately result in reduced hemoglobin formation. Anemia is indicated by parameters such as Hb <11g/dl, MCH <27 pg, and MCV <70 fl. Data analysis was carried out with the help of SPSS software version 25. Data analysis was carried out using univariate and bivariate. Univariate analysis was performed to present the distribution of data frequencies for each test variable. Meanwhile, a bivariate test was conducted to determine the relationship between febrile seizures and the incidence of microcytic hypochromic anemia, with a p-value <0.05.

3. Results

Table 1 shows the baseline characteristics of the research subjects. The research subjects showed that the male gender was almost the same as the female gender. The research subjects had an average age of 24 months. The mean of the hematological examination of the study subjects was still within the normal range.

Table 1. Baseline characteristics.

Variable	Total (N=59)
Demographic	
Gender, n (%)	
Male	30 (50,8)
Female	29 (49,2)
Age (months), median (min-max)	24 (7-60)
Hematology examination	
Hb levels (mg/dL), median (min-max)	10,4 (8,3-15,6)
MCH (pg), median (min-max)	23,9 (15,7-34)
MCV (fl), median (min-max)	71,9 (50,1-96,2)

Table 2 shows the relationship between febrile seizures and microcytic hypochromic anemia. The results of this study indicated that there was a relationship between the incidence of febrile seizures and the incidence of microcytic hypochromic anemia, with p<0.05. This study also showed that the risk of febrile seizures increased 1.7 times higher in individuals with microcytic hypochromic anemia.

Table 2. Relationship between febrile seizures and microcytic hypochromic anemia.

Variable	Febrile seizures, n (%)		p-value	PR	CI
	Yes	No			
Anemia status					
Anemia	13 (81,3)	3 (18,8)	0,038*	1,664	1,131-2,447
Not Anemia	21 (48,8)	22 (51,2)			

*Fisher Exact test, significant p<0.05.

4. Discussion

Corticotropin-releasing hormone (CRH) is an excitatory neuropeptide, potentially as a proconvulsant. The state of the immature brain, with high CRH levels in the hippocampus, has the potential to cause seizures when triggered by fever. The mechanism of homeostasis in the immature brain is still weak. It will change in line with brain development and increasing age because in the immature brain state, neurla Na^{+}, K^{+}, and Ca^{++} are not perfect, resulting in impaired post-depolarization repolarization and increased neuron excitability. From the age of 4 months, neonatal iron stores have begun to decrease by half so that exogenous iron is needed to maintain hemoglobin concentration.[11-15]

The age of 4-12 months is a phase of rapid growth, so it requires quite a lot of iron. Iron deficiency in toddlers occurs due to: inadequate supply of iron (decreased intake of iron and/or low availability of iron in food, increased demand for iron due to growth and development and increased loss of iron (due to diarrhea, gastrointestinal bleeding) and parasitic infections. Other studies also state that children with febrile seizures are almost twice as likely to have iron deficiency anemia compared to febrile children without seizures. Iron anemia can be considered as a modifiable risk factor that predisposes to febrile seizures in children between the ages of 6 months and 5 years.[16-20]

5. Conclusion

There is a relationship between the incidence of febrile seizures and the incidence of microcytic hypochromic anemia in pediatric patients at Sanjiwani General Hospital, Gianyar, Indonesia.

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