

Clinical evaluation of pallor in pediatric patients and its correlation with hemoglobin concentration

Manoj Kumar Singh^{1*}, Kaushalendra Kumar Singh², Anuradha Singh³

¹Associate Professor, Department of paediatrics, Patna medical college and hospital, Patna, Bihar, India

²Assistant Professor, Department of paediatrics, Patna medical college and hospital, Patna, Bihar, India

³Assistant Professor, Department of paediatrics, Patna medical college and hospital, Patna, Bihar, India

Received: 18-08-2021 / Revised: 30-10-2021 / Accepted: 02-12-2021

Abstract

Background: Anemia is common disorder. In resource poor settings, most health providers rely on physical signs to diagnose anemia. The diagnosis and management of anemia mostly depends on clinical assessment of anemia by increased paleness of body. Pallor is explained as increased paleness of the skin and mucous membranes. **Aims:** To study sensitivity, specificity and predictive value of pallor at nail bed, palm, tongue and palpebral conjunctiva in diagnosing anemia and correlate pallor with hemoglobin. **Materials and Method:** we had included 300 children aged between 6 months to 5 years out of which 150 having pallor (Cases) and 150 no pallor (Controls) in this study. Four sites palpebral conjunctiva, tongue, nailbed and palms were examined for pallor. Hemoglobin estimation were done by Drabkin's method in all children. Anemia was defined according to WHO criteria (Hb < 11g/dl). Data was analyzed statistically. **Results:** Among 150 children with pallor, tongue pallor was identified in maximum (76%), palmar pallor in minimum (60%). Mean hemoglobin in pallor group ranged from 8.64 to 9.31g/dl and 10.91 to 11.24 g/dl in no pallor group. Hemoglobin was lowest with tongue pallor (8.62g/dl). Children with pallor group, 108(72%) had anemia and no pallor group 117(78%) had no anemia. Maximum sensitivity and specificity were for tongue pallor (58.8%) and palmar pallor (91.8%) respectively and maximum predictive value was for palmar pallor (88.74%). **Conclusion:** Clinical pallor was very useful in detecting anemia, also it had more specific than sensitive value. Best predictor site for detecting pallor in diagnosing anemia was palm.

Keywords: Anemia, Children, Hemoglobin, Pallor

This is an Open Access article that uses a fund-ing model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Anemia refers to low levels of healthy red blood cells or hemoglobin and due to this oxygen-carrying capacity is not sufficient to meet the body's physiologic needs. Every person's physiological demand change with individual age, sex, area of living and altitude level.[1] National Family Health Survey (NFHS IV) data showed that almost 6 out of 10 children in age group 6 months to 5 years age group are anemic in India.[2] There is higher prevalence of anemia in children younger than 2 years age group as compared to older children. Iron deficiency is one of the most common causes of it. This is due to early cessation of breastfeeding and poor complementary feed with low iron content. This risk is further aggravated by infection and parasitic disease due to bare foot walking[3-5].

In remote area where laboratory facilities are not available for detecting anemia, diagnosis of anemia mainly depends on detection of clinical pallor. Pallor is increased paleness of the skin and mucous membranes mainly due to decreased level of hemoglobin in blood. Pallor is seen in places where blood vessels are nearby to the surface such as palms, nail beds and mucous membranes like palpebral conjunctiva and tongue.[7] The Integrated Management of Childhood Illness (IMCI) recommends the use of clinical sign pallor for diagnosing anemia in children. This study was carried out to study

sensitivity, specificity and predictive value of pallor at above sites in diagnosing anemia and to correlate pallor with hemoglobin in children aged 6 months to 5 years.

Materials and Method

This prospective study was conducted at Department of Pediatrics, Patna Medical College and Hospital Patna, Bihar, India between January 2020 to April 2021. The study was approved by institutional research and ethical research committee. Informed consent was taken from all the participants after explaining the study protocol.

In this Case Control study three hundred children out of which 150 cases and 150 controls aged between 6 months to 5 years, were included in this study. Children having shock, edema, icterus and those who were not willing to participate were excluded from this study. Detailed history and examination were done. History was taken from the parents/guardians especially mother regarding the symptoms of anemia for which the child was admitted. Pallor was assessed at four sites mainly conjunctiva, tongue, nail bed and palm. All children were examined for pallor in day light. The detailed clinical examination including general and systemic examination was done. Palpebral conjunctiva was examined by evertting the lower palpebral conjunctiva and pale conjunctiva were those with very or no evidence of red colour on the anterior rim, which matched the fleshy colour of the posterior aspect of palpebral conjunctiva. Tongue for pallor was examined on the dorsal surface. Nail beds without pressing was looked for nail bed pallor. Palmar surface and creases were compared with examiner's palm to detect pallor on palms. 150 children with pallor at any of these four sites were selected as cases (Pallor group) and 150 children without pallor at all these four sites were selected as controls (No pallor group). After physical examination for pallor, blood samples for hemoglobin estimation

*Correspondence

Dr Manoj Kumar Singh

Associate Professor, Department of paediatrics, Patna medical college and hospital, Patna, Bihar, India

E-mail: drmksped@yahoo.com

were taken within 3 hours. Hemoglobin estimation was done by Drabkin's method. Anemia was defined according to World Health Organization (WHO) criteria (Hb <11g/dl in 6months- 5years).The data was analysed statistically using Chi-square test where $p < 0.05$ was significant. Sensitivity, specificity and predictive values were calculated for each pallor site. Hemoglobin values were estimated by

mean and standard deviation. ANOVA was applied to test the significance.

Results

Three hundred children were included in this study, out of which 150 with pallor were assigned as Pallor group and 150 without pallor as No pallor group. Their age and gender distribution were shown in [Table 1]. Both groups were comparable statistically.

Table 1: Gender distribution in Pallor and No pallor group (p value < 0.001)

Sex	Pallor (n=150)	No Pallor (n=150)
Males	87(58%)	84(56%)
Females	63 (42%)	66(44%)

Among 150 children with pallor group, tongue pallor was identified in maximum cases (76%) and palmar pallor in minimum cases (60%) [table 2].

Table 2: Pallor at various sites in Pallor group.

Pallor Sites	Number (n-150)	Percentage (%)
Conjunctiva	105	70
Tongue	114	76
Nail bed	102	68
Palm	90	60

Mean Hemoglobin was found to be the lowest for patients with tongue pallor. (p value.001). Mean hemoglobin in pallor group at

four sites ranged from 8.64 to 9.31g/dl and 10.91to 11.24g/dl in no pallor group [Table 3]

Table 3: Mean hemoglobin in Pallor and No pallor groups

Pallor		Mean Haemoglobin (g/dl)	SD
Pallor	Present	9.31	2.06
	Absent	11.24	1.33
Conjunctiva Pallor	Present	8.64	2.04
	Absent	11.18	1.50
Tongue Pallor	Present	8.62	2.06
	Absent	10.91	1.68
Nail bed Pallor	Present	8.74	2.04
	Absent	11.02	1.69
Palm Pallor	Present	9.07	2.11
	Absent	11.04	1.56

Out of 150 children with pallor group 108(72%) had anemia and 150 children with no pallor group, 117(78%) had no anemia. Correlation of pallor in conjunctiva tongue, nail bed and palm with anemia was statistically significant (p value <0.001).

Maximum sensitivity was for tongue pallor (58.8%) followed by conjunctival (58.4%) and maximum specificity was for pallor in palm (91.8%) and maximum predictive value was for palmar pallor (88.74%). Minimum sensitivity was for palmar pallor (50.10%) and minimum specificity was for pallor in conjunctiva (85.82). [Table 4]

Table 4: Sensitivity, specificity and predictive values for each Pallor site

Pallor site	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Conjunctiva	58.40%	85.82 %	85.90 %	60.90 %
Tongue	58.80 %	86.42%	83.60 %	62.70 %
Nail Bed	55.90 %	88.86%	87.86 %	62.40%
Palm	50.10 %	91.80%	88.74 %	58.60 %

Discussion

Anemia, mostly iron deficiency anemia is common in this age group because of increased demand and reduced intake. In Integrated Management of Childhood Illness (IMCI) it is mentioned that if there is presence of pallor at any site it can be used to diagnose anemia, specially in areas where there is high prevalence of anemia. This study was conducted to assess the usefulness of pallor in children aged 6 months to 5 years, in diagnosing anemia. This would be great help for Pediatricians and Medical Professionals who were working at remote areas where no laboratory facilities were available. In this study we found that anemia was more common in < 2 years age group. 61% children with pallor and 70% of children with anemia were <2yrs age. This may be due to reduced intake of iron in diet following start of complementary feed. This can be overcome by

introducing foods that are rich in iron and other nutrients, like vitamin B12 and folic acid after starting of complementary food.

In this study, maximum sensitivity for detection of anemia was pallor in tongue Just followed by conjunctival pallor this was in conclusive with Kalantri et al and Santa G et al[11,9]. Maximum specificity for detection of anemia was of palmar pallor. This was in conclusive with Chandrasekaran C et al and Regina D et al.All the four sites of pallor that is palpebral conjunctiva, tongue, nail bed and palm had statistical correlation with anemia but the best predictor site was palmar pallor. The best predictor was palmar pallor in study done by Chandrasekaran C et al, Santa G et al and Regina D et al[7-10]. In a study done by Kalantri et al pallor under dorsum of tongue was best predictor. According to study done by Kalter HD et al the best predictor pallor site was conjunctiva[11,12]. According to Chalco JP et al pallor in palm and nail bed are the most common site to predict

pallor [13]. Over all pallor was found to be more specific rather than sensitive. In our study specificity was between 85.82%-91.8% and sensitivity was between 50.10-58.8%. Due to conjunctival congestion associated with febrile illnesses there are chances of missing conjunctival pallor and this may also be due to congestion associated with crying during clinical examination which probably could be attributed to low positive predictive value. Pigmentation largely affects sensitivity of pallor sites especially palmar pallor. In this study palmar creases was compared with examiner palm to look for pallor. Because of racially homogenous sample, that variation was not studied by us. Also there is variation in looking for palmar pallor.

Conclusion

Clinical Pallor was very useful in detecting anemia and also it had more specific value than sensitive value. Clinical pallor of palm was more accurate than pallor at other sites in the diagnosis of anemia in children. So, best predictor site for pallor in diagnosing anemia was palm. Early detection clinically and evaluating by hemoglobin concentration is helpful in improving child health as a whole.

References

1. WHO. Hemoglobin concentrations for the diagnosis of anemia and assessment of severity. Vitamin and Nutrition Information System. Geneva. World Health Organization 201. Available at <http://www.who.int/vmnis/indicators/haemoglobin.pdf>
2. National family health survey FOUR-2015-2016, table 10.12-page no.320, rchiips.org/NFHS-4Reports/India.pdf
3. Oliveira MA, et al. Socioeconomic and dietary risk factors for anemia in children aged 6 to 59 months. *J. Pediatr (Rio J)*. 2007; 83:39-46.
4. Castro TG, Silva-Nunes M, Conde WL, Muniz PT, Cardoso MA. Anemia and iron deficiency among school children in the Western Brazilian Amazon: prevalence and associated factors. *Cad Saude Publica*. 2011; 27:131-42.b
5. Gondim SS, Diniz A da S, Souto RA, Bezerra RG, Albuquerque EC, Paiva Ade A. Magnitude, time trends and factors associate with anemia in children in the state of Paraiba. Brazil. *Rev Saude Publica*. 2012; 46:649-56.
6. Da Silva RM, Machado CA. Clinical evaluation of the paleness: agreement between observers and comparison with haemoglobin levels. *Rev Bras Hematol Hemoter*. 2010; 32(6):444-8.
7. Integrated management of childhood illness (IMCI): Conclusion WHO division of child health and development. Bull World Health Organization. 1997; 75(suppl):119-28 <https://www.ncbi.nlm.nih.gov/>
8. Chandrasekran C. Accuracy of Clinical Pallor in the Diagnosis of Moderate and severe anemia in children 6 month to 5 years: *International Journal of Contemporary Medical Research*. 2016; 3(7):2028-30
9. Santa G. Usefulness of examination of palmar creases for assessing severity of anemia in Indian perspective: A study from a tertiary care center. *Int J Med Public Health*. 2015; 5:169-72.
10. Regina D, Sudharshan RC, Rao R. Correlation of pallor with hemoglobin levels and clinical profile of anemia in primary and middle school children of rural Telangana. *Int j Contemp Pediatr*. 2016; 3:872-77
11. Kalantri A, Karambelkar M, Joshi R, Kalantri S, Jajoo U. Accuracy and reliability of pallor for detecting anaemia: a hospital-based diagnostic accuracy study. *PLoS One*. 2010; 5(1):e 8545. doi :10.1371/journal.pone.0008545.
12. Kalter HD, Burnham G, Kolstad PR, Hossain M, Sehillinger JA, Khan NZ et al. Evaluation of clinical signs to diagnose anemia in Uganda and Bangladesh, in areas with and without malaria. *Bull World Health Organ*. 1997; 75Suppl 1:103-11.
13. Chalco JP, Huicho L, Alamo C, Carreazo NY, Dada CA. Accuracy of clinical pallor in the diagnosis of anaemia in children: a meta-analysis. *BMC Pediatr*. 2005; 8(5):46.
14. Mogensen CB, Sorensen JE, Bjorkman A. Pallor as a sign of anaemia in small Tanzanian children at different health care levels. *Acta Trop*. 2006; 99:113-118.

Conflict of Interest: Nil

Source of support: Nil