

Original Research Article

Efficacy of site of pallor to detect anemia and its correlation with etiology in under five children

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ABSTRACT

Background: The diagnosis and management of anemia largely depends on clinical assessment for pallor. Objective was to evaluate the usefulness of clinical pallor to detect anemia, to correlate pallor with grades and etiology of anemia.

Methods: This case control study included 300 children in the age group of 6 months to 5 years. Pallor was assessed in four sites conjunctiva, tongue, nailbed and palm. Children with pallor at any one site were taken as study group (n=150) and without pallor at all 4 sites as controls (n=150). Hemoglobin estimation and other relevant investigations were done. Anemia was diagnosed according to WHO criterion (Hb<11 g/dl in 6 months-5 years) and graded as mild, moderate and severe.

Results: Both groups were comparable in characteristics of age and gender (p value>0.05). In pallor group, 119 had anemia, whereas non pallor control group had 45 anemics. Sensitivity and specificity of pallor for anemia detection were 72.6% and 77.2% respectively. Maximum sensitivity, specificity and predictive values were found for palmar pallor. Tongue turned out to be least sensitive for identifying pallor. All the four sites were found to have statistically significant correlation in identifying mild, moderate and severe grades of anemia. Among causes of anemia; iron deficiency anemia was the etiology in 81.1% of cases. Pallor at each site showed no statistically significant correlation with etiology.

Conclusions: Pallor is useful in detecting anemia. Multiple site examination is suggested as it increases the sensitivity. No positive correlation observed between pallor and its etiology.

Keywords: Anemia, Etiology, Grades, Pallor, Under five children

INTRODUCTION

Anemia is the most common haematological disease of infancy and childhood. It is a nutritional problem of global importance. It is defined as reduction in haemoglobin concentration or RBC volume below range of values.¹ In children, it is usually caused by decreased RBC production or increased RBC turnover and is associated with impaired physical growth and mental

development. Despite increased understanding of methods of detection and prevention the prevalence is very high. The incidence is more in developing countries.

The health risks of severe anemia are profound. Anemia has been a big problem in India and the National family health survey (NFHS IV) data showed around 58% prevalence of anemia in children less than 5 years of age.²

The diagnosis and management of anemia largely depends on clinical assessment for pallor. Assessment of pallor for anemia is an important part of general physical examination of every patient. Sites used are conjunctiva, tongue, face, lip, nailbed, and palm. Usefulness of pallor in severe anemia is well established but not in mild anemia. The integrated management of childhood illness (IMCI) strategy developed by the World health organization recommends the use of palmar pallor as the initial screening tool.³ Even while describing pallor, vague terms like mild, probable etc. are used. There are hardly any studies assessing the accuracy of pallor for detection of anemia in Indian pediatric population. This study was undertaken with the objectives of evaluating the usefulness of pallor in four anatomical sites to detect anemia, to correlate pallor with grades of anemia and with the etiology of anemia.

METHODS

This case control study was done in Father Muller Medical college, Mangalore from October 2012-March 2014. Purposive sampling technique was used. Parental consent was obtained from all the study participants. 300 children in the age group of 6 months to 5 years were included in the study. Children were excluded if they did not meet age criteria, those with shock and if they were already diagnosed with anemia. Detailed history and examination were done. History was collected from the mothers as well as child.

Pallor was assessed in four sites namely conjunctiva, tongue, nail bed and palm under day light. Conjunctiva was examined by everting the lower palpebral conjunctiva. Pale conjunctiva is those with very less or no evidence of red color on the anterior rim, which matched the fleshy color of the posterior aspect of palpebral conjunctiva. Tongue was examined on the dorsal surface. Nailbeds without pressing was looked for nailbed pallor. Palmar surface and creases were compared with

examiner's palm to detect pallor. Children with pallor at any one site were taken as study group (n=150) and without pallor at all four sites as controls (n=150).

After history and physical examination, blood sample was taken for haemoglobin estimation and other relevant investigations. All samples were collected within 3 hours of physical examination. Anemia was diagnosed according to WHO criterion (Hb<11 g/dl in 6 months- 5 years).⁴ Anemia was divided into mild (Hb: 10-10.99 g/dl), moderate (Hb: 7-9.99 g/dl) and severe (Hb: <7g/dl). Anemic patients were further investigated to find out the etiology. Study was approved by Institutional Ethics Committee. Data were expressed as frequency and percentages. Chi square test was used to calculate association between variables, and sensitivity and specificity. P value<0.05 was considered significant. Statistical analysis was performed using SPSS v21.

RESULTS

Three hundred patients were included in the study of which 150 were assigned as cases (pallor-study group) and 150 as controls (no pallor group). Both the groups were matched in terms of age and gender. There were 91 male and 59 females in pallor group whereas 83 and 67 in nonpallor group. Age distribution as <1 year, 1-3 years and 3-5 years in 32%, 30% and 38% respectively in pallor group. In control group these were 26.7%, 42.7% and 30.7%.

Out of 150 patients with pallor, 119 had anemia, whereas non-pallor control group had only 45 anemics. Sensitivity and specificity of pallor for anemia detection were 72.6% and 77.2% respectively. Positive predictive value and negative predictive values stand at 79.33% and 70.00% respectively. The mean hemoglobin in pallor group was 9.34±2.2 g/dl and in non-pallor group it was 11.43±1.04 g/dl.

Table 1: Relation of anemia with pallor at all sites.

	No anemia N (%)	Mild anemia N (%)	Moderate anemia N (%)	Severe anemia N (%)	P value
Conjunctiva (n=104)	15 (14.4)	17 (16.3)	53 (51)	19 (18.3)	<0.001
Tongue (n=86)	10 (11.6)	16 (18.6)	43 (50)	17 (19.8)	<0.001
Nail bed (n=108)	14 (13)	28 (25.9)	48 (44.4)	18 (16.7)	<0.001
Palm (n=120)	11 (9.2)	34 (28.3)	57 (47.5)	18 (15)	<0.001

Identification of pallor in various sites

In the study group (with pallor), pallor was identified in 104 (69.4%) in conjunctiva, 86 (57.30%) in tongue, 108 (72%) in nailbed and 120 (80%) in palm. Sixty-one cases had pallor in all 4 sites. The sensitivity, specificity and predictive values of each site are given in Figure 1. Maximum sensitivity, specificity and predictive values

were found for palmar pallor. Tongue turned out to be least sensitive for identifying pallor.

Pallor was correlated with grades of anemia in all four sites (Table 1). All the four sites were found to have statistically significant correlation with anemia (p value<0.001). Sensitivity of pallor in all the four sites was found to have positive correlation with severity of

anemia. To detect severe anemia sensitivity of conjunctival pallor was 100% (Table 2).

Etiology of anemia and relation with pallor

Iron deficiency anemia was the etiology in 81.1% of cases. Hemolytic anemia and leukemia in 1.8% each, chronic diseases and malaria in 3%, others were the causes in 9.1%. Other causes included megaloblastic anemia, hypothyroidism, autoimmune hepatitis, CMV infection and acute bleeding. Pallor at each site was tried to correlate with etiology (Table 3). However, no statistically significant correlation was found.

Table 2: Sensitivity of each site in detecting grades of anemia.

Sites	Anemia		
	Mild (%)	Moderate (%)	Severe (%)
Conjunctiva	22.1	78.0	100.0
Tongue	20.8	63.2	89.5
Nailbed	36.4	70.6	94.7
Palm	44.2	83.8	94.7

Table 3: Association of site of pallor with etiology.

Sites	Iron def	Hemolytic anemia	Chronic diseases	Leukemia	Malaria	Others	P value
Conjunctiva (n=89)	69	3	3	3	2	9	0.246
Tongue (n=76)	58	3	2	3	1	9	0.11
Nailbed (n=94)	71	3	4	3	2	11	0.144
Palm (n=109)	85	3	4	3	3	11	0.414

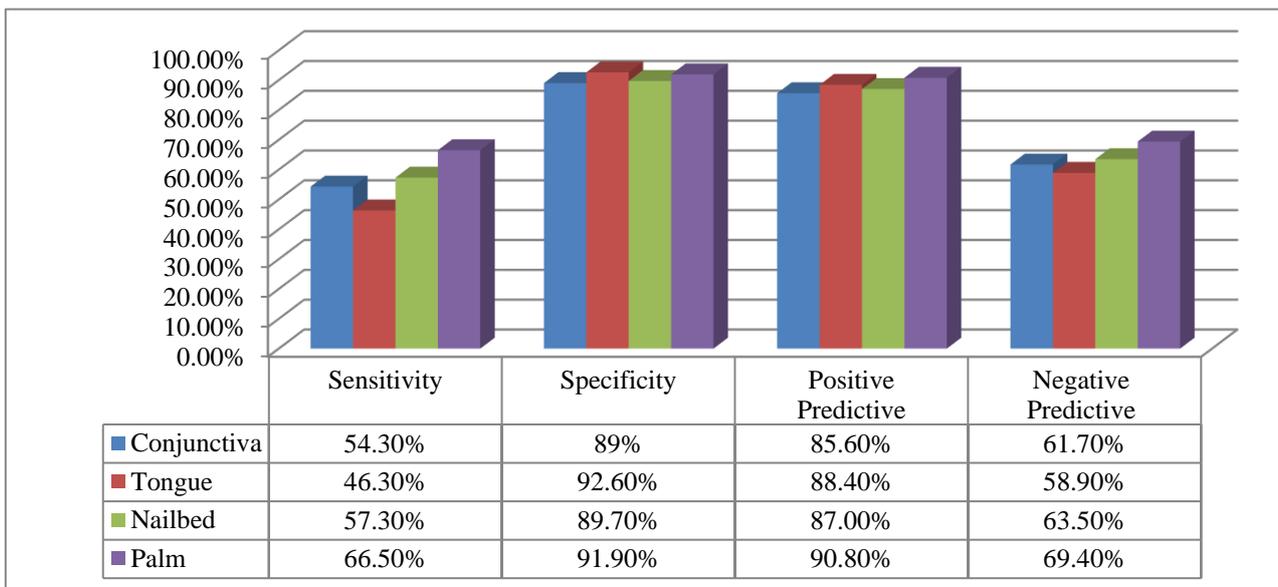


Figure 1: Usefulness of each site to detect anemia.

DISCUSSION

Anemia is common in this age group especially iron deficiency because of increased demands of iron and reduced oral intake. Bad feeding habits, especially during the weaning period, results in replacement of breast milk by foods that are poor in iron and other nutrients, including vitamin B12 and folic acid which exacerbate the problem.⁵ In 2012 a study on anemia was conducted in rural Maharashtra by Kumar et al and observed that maximum anemia cases were in age group 1-5 years.⁶ According to NFHS-III survey, almost 7 in 10 children aged 6-59 months are anemic, including 40 percent who are moderately anemic and 3 percent who are severely

anemic.⁷ The NFHS-IV survey showed some improvement with 58% anemics compared to earlier 70%.^{2,8} In our study among 300 children, 65.7% were less than 3 years. No statistically significant correlation was found with age and pallor although increased pallor occurrence was observed in <3years. Pallor and anemia were found to be more in males. Difference may be because of different growth patterns resulting in increased demand. Many studies found no association between anemia and gender whereas other authors reported that anemia is more common in boys.^{5,9-11} A study in rural Maharashtra found that anemia prevalence was more in males.⁶

Out of 150 children with pallor, 119 had anemia. Like most of the studies pallor was strongly associated with anemia.^{6,12} Sensitivity of pallor for anemia is found to be 72.6% and specificity 77.2%. Pallor was found to be more specific than sensitive. Most of the studies indicate that pallor at each site is associated with significantly lower hemoglobin concentration. The relative performance of different anatomical studies was not consistent among studies, sensitivity varied from 81% to 29% in different population. Among 150 children with pallor, palmar pallor was identified in maximum cases (80%), tongue pallor in minimum cases (57.3%). All four sites had statistical correlation with anemia.

Palmar pallor was found to be the most sensitive and specific site for pallor followed by nailbed. Sensitivity was the least for tongue pallor and specificity was the least for conjunctiva and nailbed. Over all pallor was found to be more specific test rather than sensitive. Specificity ranged from 89-92%, sensitivity 45-60%. Out of 164 anemic patients 45 (27.4%) were not clinically detected. As pallor is considered as a screening test where sensitivity should be good, multiple site examination is advisable. Because overall sensitivity of pallor for anemia is much more (72%) compared to each site (45-66%).

A meta-analysis of 11 studies was done by Chalco et al concluded that none of the clinical signs were highly accurate for the diagnosis of anemia, but pallor was found to be more specific than sensitive.¹³ Pooled estimates of sensitivity ranged from 29.2 to 80.9% and estimates of pooled specificity varied from 67.7 to 90.8%. They concluded that that pallor correlates well with the Hb estimation as only 7.5% of the anemic children were not detected clinically. One study reported sensitivity, specificity, and positive predictive value (PPV) of palmar pallor as an indicator for anemia at 50%, 93%, and 92%, respectively which is close to the values observed in present study.¹⁴

Conjunctival pallor was missed in many patients because of the congestion associated with febrile illness. Also because of the congestion associated with crying while palpating. Tongue also will be congested in many infections, which probably can be attributed to low positive predictive value. Pigmentation largely affects sensitivity of pallor sites especially palmar pallor. Because of racially homogenous sample, that variation was not studied by us. There is variation in looking for palmar pallor. It is recommended to look at palmar creases for pallor. In this study palmar surface and creases was compared with examiner's palm to look for pallor. In one Bangladesh study, the site of the palmar pallor was assessed over the thenar eminence without extending the fingers and found that palmar pallor did not work as well as conjunctival pallor for the detection for severe or some anemia.¹⁵ In clinical approach many times pallor is graded as two or three. Such grading of pallor into 2 or 3 was done in some studies.^{12,15,16}

Pallor at each site was correlated with various etiologies like iron deficiency, malaria, leukemia, thalassemia. However, no significant correlation was found with any etiology. Few studies have found correlation with malaria and thalassemia. Study by Kalter and associates reported that anemia was more easily diagnosed in children with malaria.¹⁵ Yalcin and colleagues reported that pallor of the conjunctiva is the most accurate in the cases of beta thalassemia with good sensitivity and specificity regardless of age and gender.³ Another study concluded that palmar pallor is easy to recognize and might be helpful for health workers as an indicator not only for anemia but also for malarial parasitaemia whereas this clinical sign cannot replace thorough laboratory diagnostics.¹⁷ A study was done in Kenya to correlate palmar pallor with parasitic infestations and to establish palmar pallor as an indicator of anthelmintic treatment. They concluded that palmar pallor is associated with anemia but not with intestinal helminth infection.¹⁴

Limitations

The sample population consisted of hospitalized patients. Whether it has any influence because of high prevalence of anemia in hospitalized patients is not known. Another limitation is subjective variation of clinical pallor, which is common is not included here.

CONCLUSION

Pallor was found to be very useful in detecting anemia especially in moderate and severe cases. The best predictor of anemia in this study was palmar pallor. Multiple site examination is suggested as it increases the sensitivity. However, pallor was found to have no correlation with etiology of anemia.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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