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ASSESSMENT OF CLINICAL INDICATORS FOR ANAEMIA IN THE ALGORITHM FOR INTEGRATED MANAGEMENT OF CHILDHOOD ILLNESS (IMCI), WAD MEDANI PAEDIATRICS HOSPITAL, SUDAN 2001-2002

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Abstract:
The object of this study was to assess IMCI clinical indicators used for the assessment and classification of anaemia in underfines. A total of 500 children (aged 2-59 month)were selected by systematic random method from sick children attending to the outpatient department of the paediatrics hospital in Wad Medani, Sudan. The study doctors obtained a standardized history and carried out IMCI standard case management. Heamoglobin concentration and blood smear for malaria parasites were then performed for every enrolled child. Using the WHO Hb levels to diagnose anaemia, the sensitivity and specificity of IMCI guidelines to classify anaemia were examined. The sensitivity and specificity of " no palmar pallor" as a predictor of no anaemia were 60% and 50% respectively; and of "some pallor" as predictor of mild-moderate anaemia were 44%, 60%; whereas "severe pallor" showed a sensitivity of 52% and a very high specificity for 90% on detecting children with severe anaemia. Palmar pallor was not significantly associated with the presence of malaria as detected by a positive blood film for plasmodium falciparum. The study thus provides technical validation of IMCI algorithm for the assessment of anaemia. However, it did not provide proof of a significant association between palmar pallor and malaria, in the presence of fever.

Introduction & Rationale:
Infant and young child mortality remains unacceptably high (12 million /year) in developing countries. Seven in every ten of these deaths are due to: diarrahoea, pneumonia, malaria, measles and malnutrition, and often a combination of these conditions [(1).] So, a challenge facing policy makers and international organizations

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in developing countries is reduction of underfives mortality and morbidity. The integrated management of childhood illness (IMCI) is an important approach to achieve such aim. Under IMCI, simple and tested guidelines were developed to help health workers at first level facilities assess sick children, classify their illness and provide appropriate management including counseling of mothers and decision on referral and follow up care. The guidelines were designed to satisfy the needs and suit conditions of the majority of developing countries as they rely on the detection of cases based on simple symptoms and clinical signs which health workers of diverse backgrounds can be trained to recognize accurately [(2).] However, countries were encouraged to adapt the generic guidelines according to their local situations.

Based on IMCI algorithm, pallor of the palms of each sick child is assessed and graded as "no pallor", some pallor" or " severe pallor". Children with some or severe palmar pallor will be classified as "anaemia" and "severe anaemia" respectively. Those classified as anaemia will receive iron therapy, while others with severe anaemia must be referred urgently to hospital. According to Sudan adaptation, any child who is classified as anaemia (whether some or severe) should receive antmalarial treatment on the assumption that malaria is the main cause of anaemia among children in malaria-high risk ares .

The objectives of this study are: to assess palmar pallor as a predictor of anaemia and to assess the need to give antmalarial treatment to every sick child with palmar pallor.

Patients and Methods:

This was a period prevalence study of children aged 2 months up to five years. The study was conducted in Wad Medani, Pediatrics Teaching Hospital, a 120 bed hospital in Wad Medani, the capital of Gezira state in Central Sudan.

A random sample of sick children who reported to the hospital outpatient department during the period:1st of December 2001 up to the end of May 2002 were enrolled in the study. Systematic random sampling method was used including into the study an average of 4-6 children per day (from Saturday to Thursday every week). This was meant to extend the study as long as six months, so as to reduce seasonal variation in malaria transmission which has two peaks: February – March and August- September [(3)].

Four IMCI- trained doctors participated in the study. During their basic training in IMCI their performance of clinical skills was excellent and two of them were selected as IMCI facilitators. Before the study began a senior paediatrician (who

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is as well a senior IMCI clinical instructor) conducted on-site refreshing training

of the four doctors. The main focus of the pre-study training was on the detection of the different grades of palmer pallor. At the end of the training each doctor was allowed to assess independently 30 children from the inpatient ward and record their results . the 30 children were selected by the training pediatrician on the bases of their degree of palmer pallor:10 had severe pallor, 10 some pallor and 10 had no palmer pallor.The rate of correct assessment was very high for "no pallor" and "severe pallor": 97.0% and 90.0% respectively, while "some pallor" was correctly assessed.

Consent for enrollment in the study was obtained from each sick child's caretaker.

For each enrolled child:

- An enrollment structured interview was conducted with the caretakers by the study doctors. Questions included inquiries about the child's sex, age , presenting symptoms, history of receiving antmalarial treatment within two weeks prior to the study.
- A standard IMCI case management was conducted by one of the study doctors. This included the assessment for anaemia by determining the presence/absence and degree of palmer pallor.
- Haemoglobin concentration was measured and a blood smear was examined for malaria parasites.

The study doctors did not have access to the results of laboratory investigations which were done after the enrollment interview and clinical assessment were completed and recorded.

Children with severe classifications (other than severe anaemia) who were in need for urgent treatment and others who received anti malarial treatment within two weeks before enrollment were excluded from the study.

Lab. Investigations:

- Examination of blood smears was conducted in a reference laboratory of the Blue Nile training and research institute – a WHO collaborative institute in Gezira University by an experienced technician (with an MSc in malariology).Thick blood smears were stained with 3% Giemsa stain for 30 minutes.
- Haemoglobin was measured from venous blood obtained by a venepuncture collected in EDTA by a standard calorimetric methods. Haemogloben measurement was done by an experienced haematology technician in Gezira University reference lab.

Definitions:

Children with a haemoglobin level < 5.0 g/dl were classified as "severe anaemia". Those with a level of 5.0 - < 11.0 g/dl as " mild-moderate anaemia" whereas children with a haemoglobin of 11.0 g/dl or more were considered as being " not anaemic".

Analysis:

Categorical variables were analyzed using frequency distributions. Differences between groups were assessed by x^2 test. Two-by-two tables for the calculation of sensitivity and specificity were constructed as follows: for Hb level < 5.0 g/dL, children categorized with "severe pallor" were compared to the combination of children with " some pallor" and " no pallor" . For Hb 5.0 ,<11.0 g/dL, the "severe pallor" and " no pallor" group were combined and compared to those with " some pallor" ; and for Hb >= 11.0 g/dL children with "no pallor" were compared to the combination of those with " some pallor " and " severe pallor".

Results:

During the study period, a total of 500 children were assessed. 280 (56.0%) were girls and 220(44.0%) were boys. The median age of the study group was 17.5 months (range 2-59 months). 314 (62.8%) of children were from tribes that have an African origin mainly in Western and Southern Sudan (Nuba, Shuluk , Fallata, Hawsa, Daju) while the rest of children (186,37.2%) belonged to Arabic tribes in Northern Sudan (Ababda, Gaaleen, Rubatab and Shygia). The complaints most commonly encountered among the sick children were: fever (84.4%), cough (59.5%), diarrhea (12%)and ear problem(9.8%).

The prevelance and distribution of the different IMCI grades of palmar pallor were shown in table (1).

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According to IMCI algorithm, more than 50% of the children were classified as anaemia(some or severe).

Table (1): the prevalence and Distribution of palmar pallor among the study Population

IMCI indicators for anaemia	No. (%) of sick children
No palmar pallor	232 (46.4%)
Some palmar pallor	209 (41.8%)
Severe palmar pallor	59 (11.8%)
Total	500 (100%)

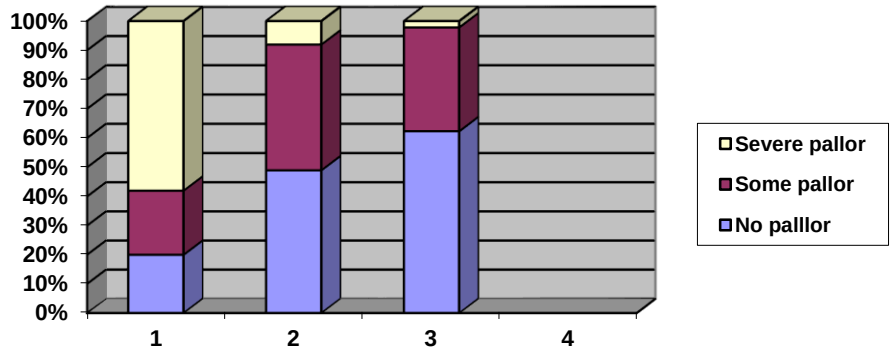
Haemoglobin concentrations of the study group had a mean level of 9.1 g/dL and a range of 2.0-14.8 g/dL. WHO definition and classification of anaemia was applied to diagnose and classify anaemia in the sick children:severe anaemia (Hb <5.0 g/dL), mild-moderate anaemia (Hb=5.0 - <11.0 g/dL) and no anaemia (Hb>==11.0 g/dl). According to this classification 5% of the children in the study population were severly anaemic and 76% had mild-moderate anaemia (table 2).

Table(2): The prevalence and Distribution of Anaemia (by Hb g/dL) among the study population

Reference Diagnosis	**Hb (g/dL)**	**No. (%) of children**
Severe anaemia	<5.0	25 (5%)
Mild-moderate anaemia	5-<11	378 (76%)
No anaemia	>=11	97(11%)
Total		500(100%)

Within each of the previously mentioned groups of children (in table 2), the percentages of different degrees of palmar pallor are presented in fig.(1).

Fig (1) : The percentage of different degrees of palmar pallor within different categories of children according to their haemogloben concentration.



At 95% level of confidence there was a strongly demonstrated association between Hb level and IMCI clinical assessment of palmar pallor.

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Comparison made between the numbers of children with different classifications of anaemia according to IMCI algorithm and their corresponding reference diagnoses of anaemia (by Hb concentration) are shown in table (3). palmar pallor had a sensitivity of 60%, 44% and 52% when used as an indicator for "no anaemia" , "mild-moderate anaemia" and "severe anaemia" respectively. It showed a specificity of 50% , 66% and 90% for the same order of the reference diagnoses of anaemia.

Table (3): the prevalence , Distribution , sensitivity of IMCI classifications of anaemia compared with reference diagnoses of anaemia.

IMCI classification		**Reference diagnoses of anaemia**				
	No. of children	No anaemia Hb>=11g/dL	Mild-moderate anaemia Hb=5-<11g/dL	Severe anaemia Hb<5 g/dL	sensitivity	specificity
No pallor	232	59	167	6	60%	50%
Some pallor	209	35	168	6	44%	66%
Severe pallor	59	3	43	13	52%	90%

According to IMCI algorithm, Sudan adaptation, all anaemic children in the study (whether having some or severe pallor), should receive antimalarial treatment on the assumption that malaria is the most probable cause of their anaemia. Results of their blood films examind for malaria were shown on table (4). Based on chi square (x^2), these results demonstrated no association between the diagnosis of malaria (by blood film examination) and IMCI clinical assessment of anaemia (by palmar pallor). Even after combining palmar pallor with fever (table 4), still pallor as a clinical indicator was independent of the result of blood films examined for malaria.

Table (4): The prevalence and Distribution of malaria (diagnosed by BF) in children according to their IMCI classifications of anaemia

Result of BF	IMCI classifications of anaemia			
	No anaemia	anaemia	Severe anaemia	Total
Positive	143	123(109 ,14)	37 (31.6)	303
Negative	89	86(76 , 10)	22(20 ,2)	197
Total	232	209	59	500

Discussion:

IMCI algorithm directly addressed the majority of problems by which enrolled children had presented for medical care. More than half the children (52.6%) were identified by IMCI approach as "some" or "severe palmar pallor" and thus been classified as anaemia or severe anaemia respectively. The prevalence of anaemia in this study was even higher (82%) when applying the WHO criteria for diagnosing anaemia (Hb < 119/dL) . WHO has estimated that 43% of the world's children under five years of age are anaemic

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(defined as a hemoglobin concentration <11g/dl [4] . Our results are comparable to results of studies conducted in both Uganda and Bangladesh , where 57% and 81% of underfives were anaemic respectively (on the basis of haematocrit or haemoglobin levels)[5]. Also, 61% of children (<5) assessed in a study in Western Kenya turned out to be anaemic (Hb <11 g/dL) [6]. All results demonstrated the burden of illness form anaemia which is affecting the health status of young African and Asian countries. They also confirmed the importance of identifying and appropriately managing anaemia in sick children.

IMCI algorithm deals with two different populations of anaemic children: those with moderate anaemia requiring iron supplementation and those with severe anaemia whose survival can be improved by admission to hospital and blood transfusion. Five percent of the study population had severe anaemia (WHO criteria). That is a considerably high result when compared with results of similar facility based studies in Uganda and Bangladesh (2% each) [5].

In Uganda and Bangladesh severe palmar pallor and conjunctival pallor, individually and together, had a sensitivity of 10-50% and a specificity of 99% for severe anaemia [5]. An other study in Malawi has shown that primary health care workers can reliably use palmar pallor to detect 66% of children with moderate anaemia (Hb: 5.8 g/dL) and 93% of those with severe anaemia(Hb < 5 g/dL) [4]. In our study, severe palmar pallor as a predictor of severe anaemia, showed a sensitivity of 52% and a specificity of 90%. This reasonably high specificity is expected to limit the number of unnecessary referrals

A study in a Kenyan district hospital showed that severe palmar pallor had a sensitivity of 84% and a specificity of 92% in predicting severe anaemia[7], whereas in western Kenya, severe palmar pallor had a sensitivity of 60%[6].

Investigation in the Gambia reveled that definite pallor of the palms and definite pallor of the conjuctiva in combination had the best sensitivity and specificity for cut-off points of packed cell volume (between 14% and 16% , and that at all cut-off points, the sensitivity for definite pallor of the conjuctiva alone was always slightly higher than for definite pallor of conjuntiva and palms, but the specificity was slightly lower [8].

Both results are comparable to results of this study and previously quoted studies. The moderate sensitivity (42%) of some palmar pallor as a predictor of mild-moderate anaemia indicates that many children would not receive treatment for anaemia even though their haemoglobin level was < 11.0 g/dL.

In Bangladesh, palmar pallor was also not effective for detecting mild-moderate anaemia. When combined with conjuctival pallor, both signs detected 71-87% of cases of moderate anaemia and half the cases of mild anaemia [5].

The depressed sensitivity of some pallor as predictor of mild-moderate anaemia in our study might be explained by a difficulty in assessing for this degree of palmar pallor which the study doctors had encountered with a number of the enrolled dark-skinned children who constituted about 60%of the study population. However this issue needs further study and evaluation of the percentage of those children together with analysis of inter observer variation among the study doctors.

In Western Kenya, haemoglobin levels were found to be significant associated with the likelihood of being parasitaemic, and a sexual parasites of P. falciparum were demonstrated by blood smear among 93% of severely anaemic children, in 5% of children with moderate anaemia (Hb 5.0 – 7.0 g/dL) and in 61% of children with mild anaemia (Hb 8.0 – 10.9 g/dL) [6]. In our study palmar pallor alone, or combined with fever did not have a significant predictive value for malaria. The high prevalence of anaemia (81%) does not need to be due to malaria only. Other problems need to be looked for such as parasitic infestations and nutritional deficiencies. Sickle cell disease which is a common cause of anaemia in Sudan still need be considered, specially that it is prevalent in Negroid tribes who constituted 60% of our study population.

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