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Evaluation of Types of Anemia among Malnourished Children Using Blood Film Examination

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ABSTRACT:

Background Malnutrition is one of the most common serious diseases in the world, in which it carry high morbidity and mortality rates. and most of those children commonly exposed to anemic, for many reasons like low iron, folic acid,vit B12 in the food, also impaired absorption due to presence of chronic illnesses or parasitic infestations. Anemia most commonly measured as grams of hemoglobin per liter of blood.

Cutoffs to define anemia are 11 gram per dl for children 6-59 months . **Aim:** To find the types of anemia using blood film examination in malnourished children

Patients and Methods: A case control study was done in Tikrit Teaching Hospital and Aldour city during the period from thirteen of june 2013 to first of October 2013.,The total number of cases was (100) diagnosed as malnutrition ,70 of them was anemic . Another 100 normal weight children of same age was taken as control ,54 of them was anemic. The age of the children included in this study was between (2) months and (5) years. Blood film examination was done to all children included in this study (malnourished and control cases). Also the clinical signs and symptoms of malnutrition was assessed for each child ,which include the mid upper arm circumference, weight per height ,weight per age, height per age and occipito-frontal circumference

Results: The study revealed that there was a significant relation between the age of children and the malnutrition in which most of cases were under six months of age in malnourished cases(48,6%), and there was significant relation between the types of feeding and malnutrition in which most of cases were on mixed feeding in malnourished cases(37,1%) versus (9,3%)in control cases, and there was a significant relation between the(mid upper arm circumference, occipito-frontal circumference) and malnutrition

Conclusion: There was a significant relation between the the level of MCV,MCH and MCHC in malnourished cases in comparison to control cases.

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Introduction

Malnutrition is a medical condition caused by an improper or insufficient diet. However, it is frequently used to mean undernutrition from either inadequate calories or inadequate specific dietary components for whatever reason. [1]

People who are malnourished may:

a-Not consume adequate calories and protein for growth and maintenance, such as undernutrition or protein–energy malnutrition .

b-Have abnormal nutrient loss (due to diarrhea or chronic illness) or increased energy expenditure (secondary malnutrition) [1].

Undernutrition encompasses stunting, wasting, and deficiencies of essential vitamins and minerals (collectively referred to as micronutrients). The term hunger, which describes a feeling of discomfort from not eating, has been used to describe undernutrition, especially in reference to food insecurity.[2]

The term "severe malnutrition" is often used to refer specifically to protein–energy malnutrition. protein–energy malnutrition is often associated with micronutrient deficiency Two forms of PEM are kwashiorkor and marasmus, and they commonly coexist. [3]

Anemia most commonly measured as grams of hemoglobin per liter of blood. Cutoffs to define anemia are 11 gram per dl for children 6-59 months.and hemoglobin level 11.5 for cildrden 5-11 years. And hemoglobin level 12 gram /dl for children 12-14 years. [4]

Aim

This study aims at decreasing the morbidity among malnourished cases by early detection of the types of anemia using simple blood film examination.

Patient and Methods

A case control study done on children with malnutrition attending Tikreet Teaching Hospital ,pediatric department (inpatient and outpatient)during the period from thirteen of june 2013 tofirst of October 2013.

Patient diagnosed as a case of malnutrition according to WHO program of malnutrition which divide the patients with malnutrition into -1 ,

-2,-3,and -4 standard deviation below the mean for age and sex(appendix 1).

During the study only -2 ,-3, and -4 standard deviation patients were included as these patients who only admitted to the pediatric department and to avoid bias by including cases with -1 standard deviation which is only a mild type of malnutrition that anemia and its types may be not evident early .

Each patient with malnutrition were assessed by a prepared questionnaire which include name ,age,sex,residence,type of feeding ,type of diet, and each patient was examined for signs of malnutrition wasting and thinness .Each child was assessed for malnutrition by measurements which include(weight for height, weight for age, height for age, ,mid arm circumference and occipito frontal circumference),and each patient with malnutrition were send for hemoglobin level for presence of anemia, and those patients who were anemic were send for blood film for the type of anemia.

A similar number of children with normal weight were assessed by similar questionnaire as above and send for hemoglobin level and those who were anemic were send for blood film for assessment of type of anemia, these cases considered as control group.

Inclusion Criteria

1-children aged two months to five years.

2-children with weight for height -2,-3 and -4 standard deviation.

3-patients with on no tonic treatment.

Exclusion Criteria

1- Ages less than two months to exclude those premature patients who have under weight and failure to thrive due to prematurity (WHO recommendation).()

2-ages more than five years because these ages are not included in WHO program for malnutrition because after five years the child is no more depend on the family for provision of diet.

Hemoglobin level and blood film

1- Each child send for hemoglobin level and complete blood count and platelet count ,MCV,MCH,and MCHC by taking a peripheral blood after applying tourniquet above the site where the blood will be drawn after

clean and sterilize the injection site with antiseptic and will insert aneedle directly into the vein .

Then after that remove the needle from the syringe ,then put the blood in red tube which contain (EDTA)which is the dipotassium or disodium salt of ethylenediamine tetra acetic acid ,which is strong anticoagulant in proportion 2mg per 1 ml of blood. Then put the blood in hematology analyzer (called APOOT-RUBBY)then the take the reading. The normal ranges for hemoglobin depend on the age and, beginning in adolescence, the gender of the person. The normal ranges are:

hemoglobin level(more than 11) gram per deciliter for children 6-59 months.

and hemoglobin level (more than 11.5)gram per deciliter for children 5-11 years.(42)

This test was done for malnourished children and control cases, and those with anemia were send for blood film.

2- A **blood film** or **peripheral blood smear** is a thin layer of blood smeared on a microscope slide and then stained in such a way to allow the various blood cells to be examined microscopically. Blood films are made by placing a drop of blood on one end of a slide, and using a *spreader slide* to disperse the blood over the slide's length. The aim is to get a region, called a monolayer, where the cells are spaced far enough apart to be counted and differentiated. The monolayer is found in the "feathered edge" created by the spreader slide as it draws the blood forward. The slide is left to air dry, after which the blood is fixed to the slide by immersing it briefly in methanol.. After fixation, the slide is stained to distinguish the cells from each other. Routine analysis of blood in medical laboratories is usually performed on blood films stained with Romanowsky, Wright's, or Giemsa stain.. These stains allow for the detection of white blood cell, red blood cell, and platelet abnormalities. After staining, the monolayer is viewed under a microscope using magnification up to 1000x. Individual cells are examined and their morphology is characterized and recorded by experienced hematologist.(36)

RESULTS

The total number of cases was(100) diagnosed as malnutrition ,70 of them were anemic .

The prevalence of anemia among mal nourished cases was 70 %.

Another 100 normal weight children of same age was taken as control ,54 of them was anemic (the prevalence of anemia was 54%).

Table (1) the classification of malnutrition according to Waterlaw classification .

Which shows that most of the cases were had -2SD (43 cases)and most of them at 2-6 months of age(41,9%) .

	_2SD		**_3SD**		**_4SD**		**Total**	
age	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
2-6 month	18	41.9	13	59.1	3	60	34	48.6
6-12 month	12	27.9	9	40.9	1	20	22	31.4
12-18 month	8	18.6	0	0	1	20	9	12.9
18-24 month	5	11.6	0	0	0	0	5	7.1
total	43	100	22	100	5	100	70	100.0

df=6, p value > 0.05 not significant

Table (2) Hematological findings in malnourished cases in comparison to control.

There was a significant leucocytosis in malnourished cases(28%) , in comparison to control cases (16%)

	Malnutrition			**Control**		
Haematologycal findings	**Normal no.(%)**	**low no.(%)**	**High no.(%)**	**Normal no.(%)**	**low no.(%)**	**High no.(%)**
Hb*	30(30)	70(70)	0(0)	46(46)	54(54)	0(0)
WBC*	67(67)	5(5)	28(28)	71(71)	13(13)	16(16)
Platelates	79(79)	0(0)	21(21)	86(86)	0(0)	14(14)

*significant in comparison to control

Table (3) distribution of cases according to blood film and types of malnutrition comparison to control. Which show about two thirds (65,7%)of malnourished cases were normchromic normocytic .and no cases seen with macrocytic anemia.

Types of bl.film	_2SD		_3SD		_4SD		Total	
	No	%	No	%	No	%	No	%
Normocromic normocytic	27	38.5	16	29.9	3	4.3	46	65.7
hypochromic micricytic	16	22.9	6	8.6	2	2.9	24	34.3
normochromic macrocytic	0	0	0	0	0	0	0	0
P value*	>0.05							

*Not significant

Table (4) distribution of malnourished and controls cases according to blood film,which show normochromic normocytic anemia more than microcytic anemia with high percentage in control cases than in malnourished cases, also in both malnourished and control cases there is no macrocytic anemia seen by blood film.

Types of bl.film	Malnutrition		control	
	No	%	No	%
Normocromic normocytic	46	65.7	40	74.1
hypochromic micricytic	24	34.3	14	25.9
normochromic macrocytic	0	0	0	0
Total	70	100	54	100
P value*	>0.05			

*Not significant

Table (5) the distribution of cases according to MCV, MCH, MCHC in malnourished cases in comparison to control.which show there was a significant relation between the MCV and MCH and MCHC levels in malnourished cases in comparison to control cases .

	Malnutrition			**Control**		
	Normal no.(%)	**low no.(%)**	**High no.(%)**	**Normal no.(%)**	**low no.(%)**	**High no.(%)**
MCV*	81(81)	19 (19)	0(0)	91(91)	9(9)	0(0)
MCH*	73(73)	27(27)	0(0)	87(87)	13(13)	0(0)
MCHC*	73(73)	27(27)	0(0)	87(87)	13(13)	0(0)

*significant in comparison to control

Table (6) Hematological findings among malnourished and control groups.which show 14 of malnourished groups with poikilocytosis in comparison to 4 cases in control groups,also 5 cases of mal nourished groups were abnormal RBC.

H. findings	**Malnutrition**		**control**	
	No	**%**	**No**	**%**
Poikilocytosis	14	20	4	7.4
Target cell	4	5.7	1	1.9
Nucleated RBC	5	7.1	0	0
P value*	>0.05			

*not significant

Table (7) serum Fe among patients hypochromic microcytic anemia according to types of malnutrition. Which show 8 cases only seen with iron deficiency anemia half of them with -3SD.

serum Fe	**_2SD**		**_3SD**		**_4SD**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Normal	0	0	0	0	0	0	0	0
low	2	2.9	4	5.7	2	2.9	8	11.4
high	0	0	0	0	0	0	0	0
total	2	2.9	4	5.7	2	2.9	8	11.4

NOTE;all patients with microcytic anemia were send to serum total iron ,and only 8 of them do the test.

Discussion :

The reason why most of cases were –2SD is that most of cases were under six months of age so the diagnosis of malnutrition done early so that the patient diagnosed in the -2SD before it pass in to -3SD and -4SD,and also because it is little nowadays to see -3SD and -4SD because most of families have good salaries that they can bring milk and diet to their child easily to the level that prevent their child to pass in to -3SD,-4SD,this is goes with a study in Kenya in 2009 which is showed that most of cases were at –2SD which is about 76% of cases and 19% of cases were -3SD and the rest were -4SD.(5)

In general 20% of children <5 years of age in low- and middle-income countries were underweight (weight-for-age <−2 standard deviations [SD]), and 32% were stunted (height-for-age <−2 SD).

Somewhat surprisingly, underweight rates in many South Asian countries (India, Bangladesh, Nepal, Vietnam and Pakistan) were much higher than, and often nearly double, the rates in many sub-Saharan African countries. The combination of the high prevalence rates and the large population sizes in Asia mean that this region carries the highest burden of underweight children. Even though underweight and stunting are more prevalent among the poor, the prevalence rates among the highest income quintiles are also high.(5)

In comparism to control cases ,there was significant relation between the level of Hb ,WBC and platelets and malnutrition, in which leucocytosis as occurring more in malnutrition, as it is usually accompanied by infectious processes or chronic disease.This does not goes with study in Ghana2006 which is said that malnourished child were suffer from leucopenia which may be due to many reasons as Protein malnutrition induces structural alterations in lymphoid organs, especially in thymus-dependant areas . This Protein deficiency leads to lymphopenia, and also Hypoprotenic diets (those with an inadequate composition of aminoacids) have a neutropenic and eosinopenic effect.

This study show also lymphopenia is a result of the reduction in cell proliferation which in turn can be a direct consequence of the lack of protein or elements like iron, zinc and copper or due to hormonal imbalance involving adrenaline, insulin, thyroxin or cortisol.(6)

In fact the haemopoietic tissue, like all tissues that present a high rate of renewal and cellular proliferation, has a high demand for nutrients. The need for protein by the process of haemopoiesis could in itself justify the occurrence of anemia and leucopenia which are frequently encountered in malnourished individuals.(7)

The reason why most of study cases were normochromic normocytic anemia Is that most of our stydy cases were under six months of age (means there were discovered early)so that there is no time for the RBC to be hypo chromic microcytic as it known that early in anemia (mainly iron deficiency anemia)there will be normochromic normocytic anemia and then if not treated it will pass in to hypochromic microcytic anemia .And the reason why there is no case of macrocytic anemia discovered in the study it may be due to that there will be a little attention of physician and the hematologist regarding the occurrence of megaloplastic anemia and may be also due to that most of these cases were younger than six months of age that not give time for RBC to be macrocytic.This is goes with a study in Kenya in 2008 in which most of cases were normochromic normocytic anemia and to alesser extent the microcytic anemia and macrocytic anemia .(8)

Usually the most frequent cause of nutritional anaemia is iron deficiency and less frequently folate and Vitamin B12. Nutritional anaemia is prevalent mostly in developing countries. It affects mostly children under five years and pregnant women. Iron deficiency may be present in under-five year children without anaemia.Iron deficiency can be due to less dietary iron intake or due to excessive loss of iron from body.(9)

The reason why most of cases have normal MCV,MCH,and MCHC is that

as mentioned above most of our cases were normochromic normocytic anemia that leads to normality in MCH, MCV and MCHC level. This goes with a study in China in 2008 which show 65% of anemic cases in malnourished children were normal MCV ,MCH and MCHC levels.(10)

Usually the anemia may be morphologically categorized on the basis of RBC size (mean corpuscular volume(MCV))and microscopic appearance ,they can be classified as microcytic,normocytic,and macrocytic based on whether the MCV is low,normal,or high respectively. Examination of the peripheral blood smear often reveals changes in RBC appearance that will help ti futther narrow the diagnostic categories .(44) Iron deficiency anemia is the most common cause of microcytic anemia, Iron deficiency anemia caused by inadequate dietary iron, and blood loss, another most common alternative causes of microcytic anemia are thalassemia and hemoglobinopathies, including hemoglobin E and C.(9) macrocytic anemia characterized by ineffective erythropoiesis, a kinetic term that describes active erythropoiesis associated with premature cell death and decreased red blood cell (RBC) output from the bone marrow. The RBCs are larger than normal at every developmental stage, and maturational asynchrony between the nucleus and cytoplasm of erythrocytes.(8) .

There is usually an associated thrombocytopenia and leukopenia. The peripheral blood smear is notable for large, often oval, RBCs ,with increased mean corpuscular volume (MCV).Neutrophils are characteristically hypersegmented, with many having more than 5 lobes. Almost all cases of childhood megaloblastic anemia result from folic acid or vitamin B12 deficiency; rarely, they may be caused by inborn errors of metabolism.(10)

Conclusion :

There was a significant relation between the the level of MCV,MCH and MCHC in malnouriehed cases in comparisim to control cases ,in which (19%) of MCV malnourished cases

was low in comparisim to (9%) in control cases,and(27%) of both MCHC and MCH was low in comparisim to(13%) in control cases.

Referances

1-Dale NM, Grais RF, Minetti A, et al: Comparison of the new World Health Organization growth standards and the National Center for Health Statistics growth reference regarding mortality of malnourished children treated in a 2006 nutrition program in Niger, *Arch Pediatr Adoles Med* 163:126–130, 2009.

2-Collins S: Treating severe acute malnutrition seriously, *Arch Dis Child* 92:486–499, 2007.

3- Morris SS, Cogill B, Uauy R, et al: Effective international action against undernutrition: why has it proven so difficult and what can be done to accelerate progress? *Lancet* 371:608–620, 2008.

4-Ahmad S, Ellis J, Nesbitt A, Molyneux E: Pericardial effusions in children with severe protein energy malnutrition resolve with therapeutic feeding: a prospective cohort study, *Arch Dis Child* 93:655-671, 2008.

5-Committee on Nutrition American Academy of Pediatrics: Nutritional needs of the preterm infant. In Kleinman RE, editor: *Pediatric nutrition handbook*, ed 6, Elk Grove Village, IL, American Academy of Pediatrics,pp 403–419. 2009.

6-Ganz T: Molecular pathogenesis of anemia of chronic disease, *Pediatr Blood Cancer* 46:554–557, 2006.

7- Moy RJ: Prevalence, consequences and prevention of childhood nutritional iron deficiency: a child public health perspective, *Clin Lab Haematol* 28:291–298, 2006.

8-Schaefer AI: Molecular basis of the diagnosis and treatment of anemia and essential thrombocythemia. *Blood* 107:4214–4222, 2006.

9-Gahagan S: Failure to thrive: a consequence of undernutrition, *Pediatr Rev* 27:e1–e11, 2006

10- American Academy of Pediatrics: Failure to thrive. In Kleinman RE, editor:*Pediatric nutrition handbook*, ed 6, Elk Grove Village, IL, 2009, American Academy of Pediatrics, pp 601–636.