ORIGINAL RESEARCH

Clinicohaematological Patterns Of Anemia And Their Correlation With Clinical Conditions In Children Aged 5 To 12 Years In Tertiary Care Centre

**[1]Dr Vikas Gupta,[2]DrRashmi Dwivedi,[1]Dr Gurmilan Gupta,,
[1]Dr Deepika Joshi**

[1]PG student, [2]Professor &Head,Department of Paediatrics, L.N Medical College and Research Centre, Bhopal, Madhya Pradesh, India

Correspondence:
DrVikas Gupta
PG student, Department of Paediatrics, L.N Medical College and Research Centre, Bhopal, Madhya Pradesh, India

Abstract
Introduction:
Anemiaisoneofthemostimportantdisordersofbloodininfancyandearlychildhood. InIndia,thenationalprogramforpreventionandcontrolofanemiafocusesonpregnant women and young children less than 5 years. Therefore, the present study was carried out to assess clinicohematological patterns ofanemia in children aged 5 to12 years and its correlation with clinical conditions in atertiarycareCentre. **Material and Methods:** Thepresentstudy was carriedoutin among 160 IPD patients aged 5 to 12 years old. A thorough clinical examination of every childwas done followed by routine investigations for anemia in the hospitallaboratory. Frequency and percentage were calculated &statistical test (Chi Square and t- test) was applied wherever applicable; P value <0.05wastaken as statisticallysignificant. **Results:** MicrocyticHypochromic ismost common type morphologicalpattern of anemia and most common etiology found to be iron deficiency ornutritionalanemia. out of 113 cases of iron deficiency anemia, 75 weremicrocyticandhypochromic,22werenormocytichypochromic,10werenormocyticnor mochromic, and 6 were dimorphicanemia. 5 of 8 cases of megaloblastic anemia exhibit a macrocytic appearance,whereas three had a dimorphic appearance. 5 of 7 thalassemia patientswere microcytic hypochromic, while the other two were normocytic hypochromic.one case of sickle cell anemia was normocytic hypochromic, while the other threecaseswerenormocyticnormochromic. **Conclusion:** Anemiaiscommonamong5to12yearschildrenandtheygenerallypresentwithgastrointestina lorrespiratorysymptomsandthereisdirectcorrelation between clinical conditions and anemia. This group of children are the most vulnerable to dietary deficiencies, causingfinancial, emotional, and psychological hardship to patients and their families, as wellasdepleting vitalnationalresources. Hence it is recommended that children between 5-12 year attending OPD shouldroutinelyscreenfortheirnutritionalstatus and presenceof anemia
Keywords: Iron deficiency,Nutritionalanemia; Weakness; Fatigue

Introduction

Anemiaisoneofthemostimportantdisordersofbloodininfancyandearlychildhood.[1]Itisahugeglobalhealthissue,particularlyindevelopingnationssuchas India. In underdeveloped countries, up to 51% of children aged 0 to 4 years and46% of children aged 5 to 12 years are anaemic.[1-3] The WHO has estimated that,globally 1.62 billion people are anemic with the highest prevalence of anemia (47.4%)among preschool aged children, of these 293 million children, 89 million live in Indiawhile prevalence of anemia among school children is 25.4%.[4] Prevalence of anemiain 5 to 12 years aged children is 62.5% (among vegetarian) and 51% (among non-vegetarian).[5]

InIndia,thenationalprogramforpreventionandcontrolofanemiafocusesonpregnant women and young children less than 5 years. Very less and limited studiesarethereon5to12yearsagegroupandalsomuchstudyonmorphologicalclassificationofanemia had notbeen donepreviouslyinthis particularagegroup. Therefore, the present study was carried out to assess clinicohematological patterns ofanemia in children aged 5 to12 years and its correlation with clinical conditions in atertiarycareCentre.

Material and Methods

Thepresentcrosssectionalstudy was carriedoutin the departmentofPediatrics, L.N. Medical College & Research Centre and associated J.K Hospital Bhopal duringthe period of December 2019 to December 2021. The study included 160 IPD patients aged 5 to 12 years old who were admitted to the Pediatric ward of J.K hospital inBhopal with anemia, as well as those who arrived with other complaints and werefoundto beanemic incidentally. As per statistician calculationtotalof210patients had to beenrolled in study, but due to covid-19 pandemic 160patients admitted in Pediatricwardand thosesatisfying theinclusion criteriaare enrolled inthestudy. Inclusioncriteria comprises of allpatientsinagegroup5-12 yearsageadmittedinpediatricward and those who are willing to sign informed consent form, whoseconsentgivenbytheirparents andassentfromchildabove10yrsage. ExclusionCriteria consisted of childrenlessthan5yearsandmorethan12years, outpatientswhowerenot admittedinthehospital, childrenonironmedications, thosegivenbloodtransfusioninlast3months and childrenofunwillingparents.AfterobtainingclearancefromtheInstitutionalEthicalCommittee,relevant clinical data wererecordedinastructuredproformaincludingdetailedhistorywasrecordedwithparticular symptoms suggestive of anemia such as weakness and easily fatigability,breathlessness on exertion and pica. A thorough clinical examination of every childwas done followed by routine investigations for anemia in the hospitallaboratoryand under the guidanceof the facultyinchargeof thelaboratory.

Routineinvestigationsconsisted of completehaemogramwhichconsistofestimationofHb%,RBCscounts, packed cell volume (PCV), total leucocytes count (TLC), differentialleucocytescounts(DLC),RBCindices (MCV,MCH,MCHC),redcelldistributionwidth (RDW),plateletcounts; peripheralsmear, reticulocytecount, serumferritin and otheradditionaltestssuchasstoolandurineexaminations,liverandrenalfunctiontests,Mantouxtest, andradiographicinvestigationssuchasXray,ultrasonography,and CTscan wereperformed if needed.

The Venous Blood samples of adequate amount were collected in EDTA vials and thecollectedbloodsamplewasfurtheranalyzedusingMindray5-partsautoanalyser and swelab 3-parts autoanalyserfor estimation of various parameters.includingHB%,RBCcounts,PCV, totalWBCcountsincludingdifferentials leucocytes count, RBC indices including MCV, MCH, MCHC. Redcell distribution width and platelet counts.Hb was estimated by Sahli'smethod

and express in gm%, PCV, MCV, MCH, MCHC & RDW were determined byautomated cell counter and supravital staining technique with methylene bluestainingwasusedforreticulocytecount.GlassslidesarepreparedusingLeishmanstain for peripheral smear and anemiawasclassifiedmorphologicallybasedonperipheralsmear.

After routine complete hemogram and peripheral smear, reticulocyte counts usingsupravital technique with methylene blue stain were done in view of hemolyticanemiaandS.FerritinweredoneusingMinividas(Biomerieux)analyser with SPR strips among the microcytic hypochromic anemia casestodiagnoseirondeficiencyanemia. AnemiawasclassifiedinthisstudyaccordingtoWHOcriteria:[6,7]Hbconcentration of less than 11gm/dl (among children between 6 months to 6 years)and a hemoglobin concentration of less than 12 gm/dl – (among children between6yearsto 12years). Normal values of RBC indices taken as,[8] PCV-35-45%, MCV-77-95fl, MCH-25-33pg,MCHC-31-37gm/dlandRDW 14.5-18.5. Based on the MCV values, anemia was classified as microcytic, normocytic, ormacrocytic based on the size of the RBCs: microcytic when MCV is less than 77 fl,normocytic when MCV is between 77 and 100 FL, and macrocytic when MCV isgreaterthan 100 fl.

The cases with reduced Hb% below cut off value and RDW more than 15% andMentzerindexmorethan13alongwithperipheralsmearshowingmicrocyticHypochromicRBCsandmarkedanisopoikilocytosiswithTeardropcellswasconsideredsuggestiveofIron DeficiencyAnemia,whichfurtherconfirmedbyreduced serum ferritin levels . Reduced Hb% belowcutoffvalue and Mentzerindex less than 13alongwith peripheral smear showingmicrocytic HypochromicRBCs and Target cells and increased level of ferritinwas considered suggestive ofThalassemia.[9,10] were subjected to Hb electrophoresis for confirmation of diagnosis.Whenaperipheralsmearrevealedmacrocyticanemiawithmegaloblasticcharacteristics such as megaloblast, hyper segmented neutrophils, and Howel JellyBodies, as well as an MCV > 100fl, megaloblastic anemia was identified. Anemiaalongwithsicklecellseenonperipheralsmearwithpositivesicklingtestsuggestiveofsicklecellanemia.Anemiawithperipheralsmearshowingbothmicrocytichypochromicand macrocytic cells suggestiveof dimorphicanemia. Peripheral smear with indications of RBC breakdown in the form of schistocytes,crenated RBCs, increased reticulocyte count, and morphological variants such targetcells, which were largely detected in thalassemia, were the diagnostic criteria forhemolyticanemia.

Data was entered in MS excel 2007, analysis was donewith the help of Epi-Info7 software. Frequency and percentage were calculated &statistical test (Chi Square and t-test) was applied wherever applicable; P value <0.05wastaken as statisticallysignificant.

Results

In our study as shown in table 2 Microcytic Hypochromic Anemia (55%) was found to be most prevalentmorphologicalpatternofanemia,followedbyNormocyticHypochromicAnemia(21.25%),NormocyticNormochromicAnemia(13.12%),andDimorphicAnemia(7.5%).TheleastcommonmorphologicalvariantwasMacrocyticAnemia(3.12%).

Inthis study acute gastroenteritisand acute diarrhealdisorders, followedby respiratorytractinfections, werethemostcommon clinicaldiagnoses related withanemia

(table 1).Inthisstudy,irondeficiencyanemia(70.6%)wasthemostcommontypefollowedbyMegaloblasticanemia(5%)andThalassemia (4.4%)&sicklecell anemia (table 3).

Table 1: DISTRIBUTIONOFCASESBASEDONCLINICALDIAGNOSIS

ClinicalDiagnosis	No.	%
AcuteGastroenteritisandAcuteDiarrhealDiseases	65	40.6
Respiratory tractinfections	45	28.1
Tuberculosis	13	8.1
Denguefever	12	7.5
Entericfever	9	5.6
Bronchialasthma	5	3.1
Acuteappendicitis	5	3.1
AcuteGlomerulonephritis	4	2.5
Rickets	2	1.3

Table 2: DISTRIBUTIONOFCASESBASEDONMORPHOLOGICALPATTERN

MorphologicalTypes	Number	Percentage
MicrocyticHypochromic Anemia	88	55
NormocyticHypochromicAnemia	34	21.25
NormocyticNormochromicAnemia	21	13.12
DimorphicAnemia	12	7.5
MacrocyticAnemia	5	3.12
Total	160	100

Table 3: DISTRIBUTIONOFCASESBASEDONETIOLOGY

Etiology	Number	Percentage
Irondeficiencyanemia(IDA)	113	70.6
Megaloblasticanemia	8	5
Thalassemia	7	4.37
Sicklecellanemia	4	2.5
Others. 1Anemiaduetoinfectiousdisease-75% 2.Anemiaduetorenalcause-14.3%3.Anemiaduetoblood loss-10.8%	28	17.5
Total	160	100

Table 4: Correlation between etiological andmorphologicaltype ofanemia

Etiologicaltype	Morphologicaltype					
	Microcytic hypochromic anemia	Normocytich ypochromica nemia	Normocyticn ormochromica nemia	Dimorphic anemia*	Macrocytic anemia	Total
Iron deficienc yanemia	75	22	10	6	0	113
Megaloblasticanemia	0	0	0	3	5	8
Thalassemia	5	2	0	0	0	7
SickleCellAnemia	0	1	0	3	0	4

Others	8	8	12	0	0	28
Total	**88**	**34**	**21**	**12**	**5**	**160**

In this study, it was found that out of 113 cases of Iron Deficiency Anemia, 75 wereMicrocyticandHypochromic,22wereNormocyticHypochromic,10wereNormocyticNormochromic, and 6 were DimorphicAnemia. Five of the eight cases of Megaloblastic Anemia exhibit a Macrocytic appearance,whereas three had a Dimorphic appearance. Five of the seven Thalassemia patientswere Microcytic Hypochromic, while the other two were Normocytic Hypochromic.One case of Sickle Cell Anemia was Normocytic Hypochromic, while the other threecaseswereNormocyticNormochromic (table 4 and graph 1).

Graph 1:Correlation between etiological and morphologicaltypeofanemia
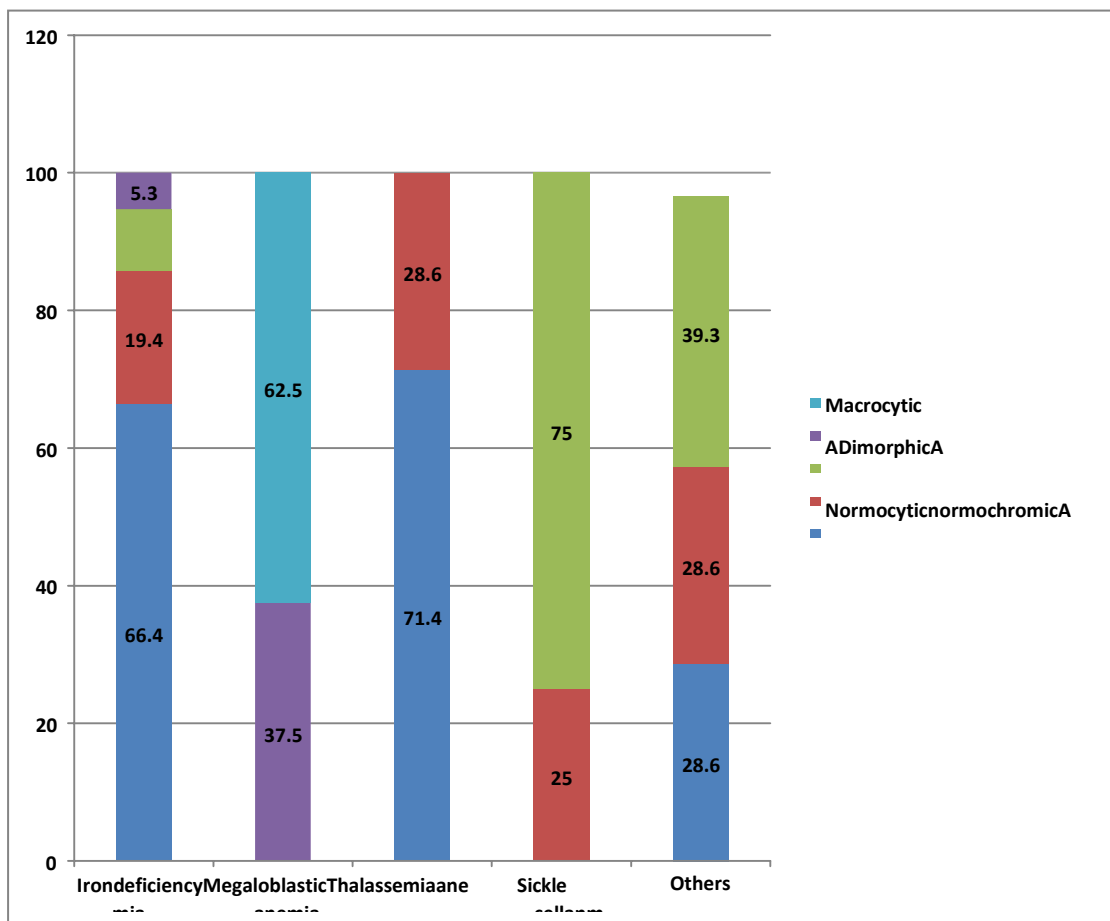
Discussion

Anemiaisaseriousglobalpublichealthproblemthatparticularly   affectsyoungchildren.It

isone of the mostextensive pandemics, affecting mostly developingcountries. About 3.5 billion persons are affected by anemia in developing countries. It is an important cause of morbidity and mortality of young and growing children inrural areas of developing countries.According to CNCC India 2016-18 Overall, 41% of preschoolers aged1–4 years, 24% of school-age children aged 5–9 years and 28% of adolescents aged10–19years had somedegreeofanemia.[11]

Since most of the studies were done on a very wide age groups including 0-14 yearsamongst which most studied group was preschool children (0-5yr)and very fewstudies were conductedandscarcity of dataamongst age group 5-12yrs. As thechildren come for regular follow up in OPD or hospital in view of vaccination andanthropometric assessment so the preschool age group data is easily available. After 5years the children fail to regular follow up and the cases remain undetected unlessbrought to hospital for some other illness and detected incidentally for anemia. Hence,weconductedstudyonparticularagegroupof5-12yearstounderstandtheclinicohaematological pattern and their co-relation with clinical condition admitted inour tertiaryCentre.

Iron deficiency anemia was the most prevalent etiology (70.6 percent), followed byMegaloblastic anemia (5%), Thalassemia trait (4.4 percent), sickle cell anemia (2.5percent), and anemia with other specific etiologies (17.5 percent) in this study. Whilein a study conducted by Miller CJ et al [12] found that anemia withnospecificetiology 36.1%, iron deficiency anemia 9.9%, anemia due to G6PDdeficiency 9.1%,Sicklecelltrait4.6%andβthalassemia8.7%.Ahighprevalenceofαthalassemiawas observed. Srinivas M et al[13] found that pallor wasthe most common symptom followed by splenomegaly and cough. They found that58% of children were anemic due to iron deficiency anemia, 27 % were having sicklecell disorder, 9 % were having Thalassemia, 5 % with megaloblastic anemia and 2%with aplastic anemia. So, in present study out of 316 cases, 173 were males and 143were females. It was found that 58% of children were anemic due to iron deficiencyanemia,27%werehavingsicklecelldisorder,9%werehavingThalassemia,and5 % with megaloblastic anemia and 2% with aplastic anemia. Malepredominance(55%) Most common symptoms pallor followed by Splenomegaly and cough. Mostcommonetiologyis irondeficiencyanemia.

A similar study was conducted bySaba F et al[14]and found that 72.79% were anemic, out of which a majority of childrensufferedfromnon-hemoglobinopathiesandameagresufferedfromhemoglobinopathies.Childrenintheagegroupof6months to 1yearweremostaffectedwithnon-hemoglobinopathies. Moderatedegreeofanemia wasthecommonestgradeofanemia(80%),whilemicrocytichypochromicanemiawascommonestmorphologicaltypeofanemia(48%).

The most prevalent presenting symptoms in this study were gastrointestinal (46.8%),whichincludedvomiting,diarrhea,andabdominaldiscomfort,followedbyrespiratory symptoms and fever (33.7%), and failure to thrive. Skin rashes, urinaryproblems, CNS signs, face puffiness, and ear discharge are all symptoms of jaundice.Pallor found to be most common clinical sign followed by other common signsincluded signs of dehydration associated in diarrhea, hepatosplenomegaly associatedwithjaundice.Fever,shortstature,tachypnoea/tachycardiaandcervicallymphadenopathy, pedal edema, hemiparesis/ hemiplegia, dry skin, muscle

wasting,microcephaly was seen in some cases. The most prevalent diseases related withanemiaweregastrointestinaldiseases(40%)andrespiratorydiseases(33.7%),followed bynutritionaldisorders,CNSdiseases,infectiousdiseases,andrenal diseases.WhileViswanadhamK et al[15]studiedclinicalprofileandfactorassociated with anemia in the school going and observed weakness as most common complaint followed by fatigue, decreased appetite, headache, shortness of breath, sore tongue and coldness in hands and feet. A similar study was conducted by Nilofer FK et al[16]inChennaibyinthepediatricwardr e p o r t e d g astrointestinalsymptomsincludingpainabdomen,vomiting,loosestool as the most common presentations followed by the respiratory symptoms. Thecommonest presenting condition was acute gastroenteritis followed by respiratoryinfections. Microcytic Hypochromic was the most common morphological patternandmost common etiologyfound to beIron deficiency.

The programs related to nutritional rehabilitation also need to be taken up for this agegroup of 5-12year children. And gender bias regarding healthy food and lifestyleshould beaddress bycreatingmore awareness.

Nutritional inadequacy has been linked to delays in psychomotor development as wellas increased morbidity and mortality in children, making it one of the most criticalareas for improvement in primary health care. So, to create mass awareness and tomake their living standards better, some crucial Steps should be taken, so that earlysigns of disease are   not   overlooked   and   children   are   brought   to   the   hospital   early fordetectionofdiseaseandappropriate intervention.

Conclusion

Anemiaiscommonamong5to12yearschildrenandtheygenerallypresentwithgastrointestinal orrespiratorysymptomsandthereisdirectcorrelation between clinical conditions and anemia. This group of children are the most vulnerable to dietary deficiencies, causingfinancial, emotional, and psychological hardship to patients and their families, as wellasdepleting vitalnationalresources.Asa result,screening for thesedisordersisrequired, as is early screening for anemia and related conditions. Dietary deficits affectchildren aged 5 to 12 and is psychological burden forpatients and their families, as well as depleting   critical   national   resources.   As   a result,screeningfortheseillnesses,aswellasearlydetectionofanemiaandrelatedproblems,is essential. Hence it is recommended that children between 5-12 year attending OPD shouldroutinelyscreenfortheirnutritionalstatus and presenceof anemia

References

1. Gupte S, Gupta RK, Gupta R. Iron Deficiency Anemia: A Diagnostic ApproachinChildren. JK Science.2000;2:175-9.
2. Garder B. Anemias of Inadequate Production. In: Kliegman RM, Behrman RE,JensonHB,StantonBF(eds).NelsonTextbookofPediatrics.18thedn.Philadelphia,W .B. Saunders. 2008:2011-4.
3. Gupte S: PediatricHematology . In Gupte S. The Short Textbook of Pediatrics.10thedn. New Delhi. Jaypee. 2004:454-62.
4. WorldwidePrevalenceofAnemia1993– 2005.Geneva,Switzerland:WorldHealthOrganization; 2008.
5. Jhansi Rani P, Elizabeth Bandrapalli. Study of prevalence of anaemia in school children and factors associated with it. International Journal of Contemporary Medical Research 2017;4(9):1902-1905.
6. Demaeyer EM, Dollaman P, Gurney JM, Hallberg L, Sood SK. Preventing

andcontrollingirondeficiencyanaemiathroughprimaryhealthcare.Geneva:WorldHealth Organization; 1989. pp. 26-36.

7. DeMaeyer E, Adiels-Tegman M. The prevalence of anemia in the world. WorldHealthStat 1985;38:302-16.

8. Lewis SM. Reference ranges and normal values. 10th ed. In: Dacie and LewisPractical haematology, Mitchell S Lewis, Barbara J Bain, Imelda Bates, eds.Philadelphia:Churchill Livingstone; 2006. p. 11.

9. Eldibany MM, Totonchi KF, Joseph NJ, Rhone D. Usefulness of certain redbloodcellindicesindiagnosinganddifferentiatingthalassemiatraitfromirondeficiency anemia. Am J ClinPathol. 1999 May;111(5):676-82

10. Mentzer Index for Differential Diagnosis of Iron Deficiency anaemia and BetaThalassemia TraitAuthor:Dr Ajeet GopchadeDOI:https://dx.doi.org/10.18535/jmscr/v4i12.135

11. MinistryofHealthandFamilyWelfare(MoHFW),GovernmentofIndia,UNICEFandPopulationCouncil.2019.ComprehensiveNationalNutritionSurvey(CNNS) NationalReport. New Delhi

12. Miller CJ, Dunn EV, Berg B, Abdouni SF. A hematological survey of preschoolchildren of the United Arab Emirates. Saudi Medical Journal 2003;24(6):609-13.

13. SrinivasM,RamyaC.,ShashidharValugula,SandeepG.,SreenivasKotlaClinicohematological profile and outcome of anemia in children at tertiarycare hospital, Karimnagar, Telangana,India.Int JRes Med Sci. 2015 Dec;3(12):3567-3571.

14. SabaF,PoornimaS,BalajiPA,VarneSR,JayashreeK.Anemiaamonghospitalized children at a multispecialty hospital, bangalore (karnataka), India. JFamily Med Prim Care. 2014 Jan;3(1):48-53. doi: 10.4103/2249-4863.130275.PMID:24791237; PMCID: PMC4005201.

15. Kashi Viswanadham, Anurup Sahu. A study of clinical profile and factor associated with anemia in the school International Medical Journal. September 2017; 4(9): 914-917.

16. Nilofer FK, Lilly RV. Clinicohematological Study of Different Patterns of Anemia in Infancy and Childhood. Journal of Pharmaceutical Research International. 2021;33(20A):44-55.