

Screening of antenatal patients for anaemia and haemoglobinopathies

Abstract

Introduction: Anaemia is an extremely common condition in pregnancy worldwide, conferring a number of health risks to mother and child. Iron deficiency is most widespread micronutritional deficiency in the world and disproportionately affects female because of increased iron requirements during menstruation, pregnancy and lactation. Haemoglobinopathies are a group of inherited disorders because of abnormalities in haemoglobin synthesis or structure. Thalassemia and Sickle cell anaemias are the most prevalent haemoglobinopathies and a national health burden in India so identifying these disorders during antenatal period is necessary to take appropriate measures.

Methods: A prospective study of screening for haemoglobin variants in Antenatal Patients due to low haemoglobin and evaluation of other causes was performed for 1 year with 570 samples. In Low Hb patients' CBC, Reticulocyte staining and sickling test was performed. Haemoglobin analysis was done by HPLC BIO RAD VARIANT II. In Iron Deficiency Anaemia (IDA) Serum ferritin & Serum Iron level were done and in Megaloblastic Anaemia(MA) Vitamin B12 level were done.

Result: Prevalence of anaemia in antenatal patients was 90.25%; in this IDA presented with 84.21%, MA with 4.73% and Dimorphic anaemia 1.27%. Prevalence of haemoglobinopathies in this study was 9.75%; in this Beta Thalassemia Minor present with 5.08%, Sickle Cell Trait 4.03%, Hb D Punjab 0.52% and Hb Q india 0.17%.

Conclusion: Antenatal screening for genetic disorders, such as Beta thalassemia, Sickle Cell Anaemia, aims to reduce the burden of these diseases by offering information to individual with a high likelihood of giving birth to affected babies and giving parents more choices regarding their reproductive decisions. For this, premarital and antenatal screening should be mandatory to prevent the birth of affected offspring.

Keywords: haemoglobinopathies, hplc, sickle cell anaemia, megaloblastic anaemia

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Introduction

Anaemia is one of the most frequent complications related to pregnancy. Normal Physiologic changes in pregnancy affect the hemoglobin(Hb), and there is a relative or absolute reduction in Hb concentration. Iron Deficiency is the most widespread micronutritional deficiency in the world¹ and inversely affects female because of increased requirements during menstruation, pregnancy, and lactation. Iron Deficiency is most common cause of anaemia in pregnancy. Megaloblastic anaemia is one of the acquired nutritional anaemias that may complicate pregnancy. It is most often secondary to folic acid deficiency because folate requirements are increased during gestation.² Haemoglobinopathy is the medical term for a group of inherited blood disorders and disease that primarily affects red blood cells.³ They are single-gene disorders and, in most cases, they are inherited as autosomal co-dominant traits.⁴ Inherited abnormalities of haemoglobin synthesis include a variety of disorders ranging from decreased production of alpha or beta globin chains to structurally abnormal haemoglobin variants. Common haemoglobin disorders in India include alpha and beta thalassemia along with structural variants such as Hb S, Hb E, Hb D Punjab and their compound heterozygous state.⁵ Thalassemia and Sickle Cell Anaemia is most prevalent Haemoglobinopathy in India, which affects the outcome of pregnancy. Thalassemia is mostly present in Sindhi, Bhanushali community and Sickle Cell Anaemia is present in Tribal Area. Proper Screening for anaemia and haemoglobinopathy in antenatal patients prevent complication in pregnancy and improve pregnancy outcome. Husband Screening also necessary for Haemoglobinopathy.

Aims & objective

- The aim of the study is to assess the prevalence of anaemia and other haemoglobinopathies in our antenatal patients.
- Evaluation of other factors related to haemoglobinopathies.
- For this, encourage the antenatal patients to come back for proper screening and follow-up.

Material & methods

This prospective study was done at the blood centre of a tertiary care teaching hospital during the period of Jun 2022 to Jun 2023. Around 700 Samples came for HPLC Annually. After the consent was taken (Figure 1), Two ethylenediaminetetraacetic acid samples were received, and the complete blood count was done by fully automated haematology analyzer (Horiba Penta from HORIBA India Pvt. Ltd. In Bhambholi, Maharashtra, India). Reticulocyte staining was performed using methylene blue dye. The sickling test was done using a solution of 2% sodium metabisulfite to differentiate between Hb S and Hb D. Haemoglobin analysis was done by High-Performance Liquid Chromatography (HPLC) Bio-Rad VARIANT II (Figure 2 & 3).

Results

During the period of 1 year, total 570 antenatal samples received for screening purpose. Out of these, 514 (90.25%) patients presented with Anaemia. Out of these 514 were anaemic patients, 480(84.21%) patients presented with Iron Deficiency Anaemia, 27(4.73%) presented with Megaloblastic Anaemia, 7(1.27%) presented with Dimorphic Anaemia (Figure 4 & 5).



Figure 1 HPLC bio – Rad variant II.

**DEPARTMENT OF IMMUNOHAEMATOLOGY & BLOOD TRANSFUSION
HEMOGLOBINOPATHIES SCREENING CONSENT FORM**

Date: _____

Name: _____ ID No. _____

Age: _____ Sex: M/F OPD/Indoor No.: _____

Ward: _____ Unit: _____

Clinical Diagnosis: _____

Past History: _____

Sibling/Family History: _____

Previous Blood Transfusion History: Y/N. If yes, Last Transfusion Date: _____ Number: _____

Requesting Clinician's Name: _____ Contact No: _____

<p>CBC Findings</p> <ol style="list-style-type: none"> 1. Hb- 2. Hct- 3. TC/DC- 4. MCV - 5. MCH - 6. MCHC- 7. RDW - 8. Plt Count - 9. RBC Count - 10. ESR - 11. Reticulocyte Count - 12. Peripheral Smear Findings - _____ 	<p>Other Investigation</p> <ol style="list-style-type: none"> 1. Assessment of Iron Status: <table border="0" style="margin-left: 20px;"> <tr> <td>S. Iron-</td> <td>Ferritin-</td> <td>TIBC-</td> </tr> </table> 2. S. Bilirubin- 3. Osmotic Fragility Test- 4. Sickling Test- 5. HbS Solubility Test- 6. G6PD Test- 7. Hb Electrophoresis- 8. DAT/IAT- 	S. Iron-	Ferritin-	TIBC-
S. Iron-	Ferritin-	TIBC-		

Signature of Requesting Doctor

Hemoglobinopathies Screening Request Form/Format/Version2.0

Figure 2 HPLC request form.

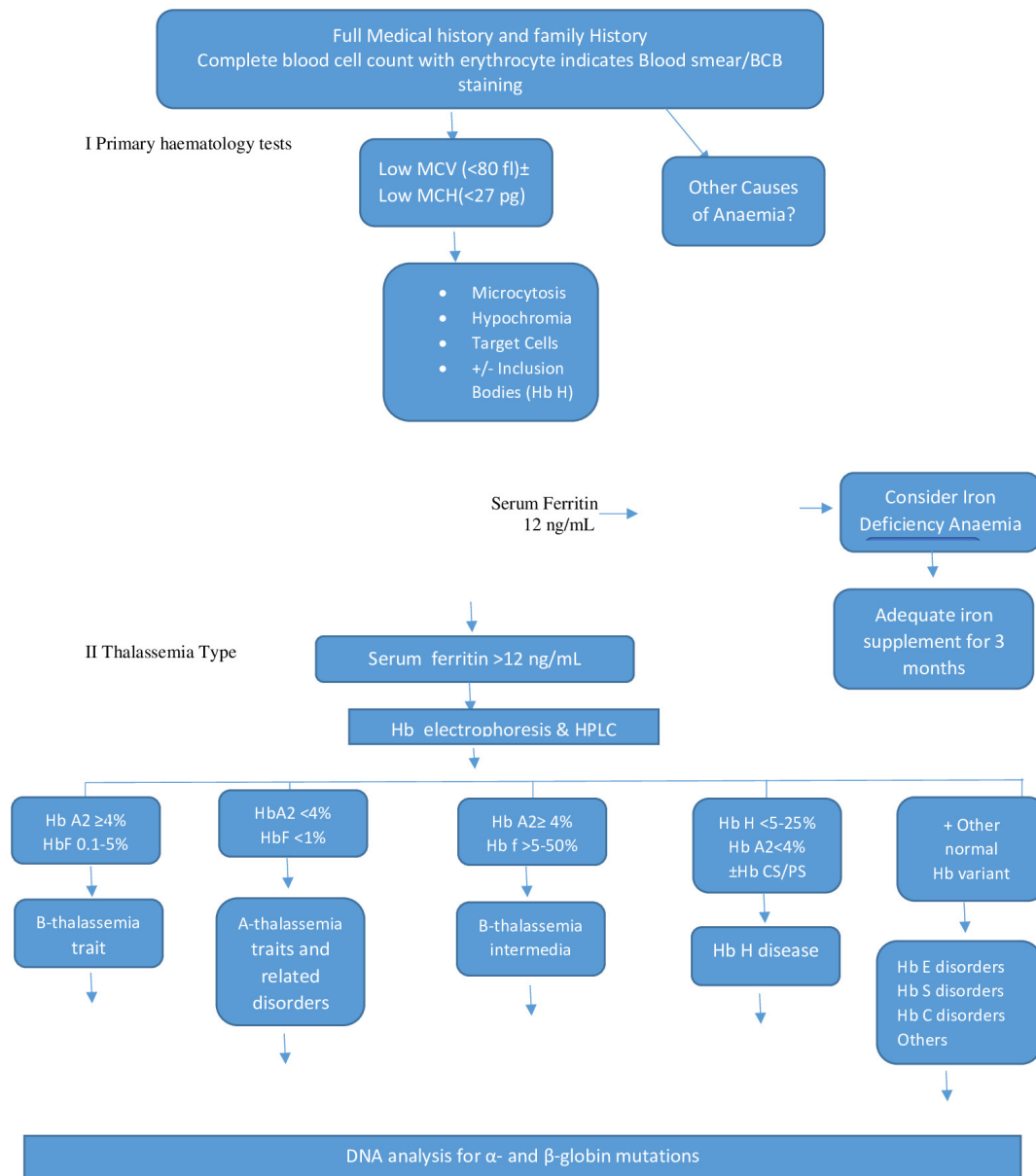


Figure 3 Algorithm for anaemia and haemoglobinopathy.



Figure 4 Anaemia prevalence.

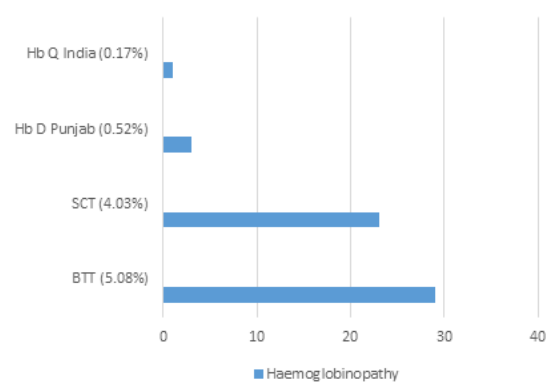


Figure 5 Prevalence of haemoglobinopathy.

Discussion

Anaemia is one of the most common nutritional deficiency disorders affecting the pregnant women in the developing countries. Anaemia during pregnancy is commonly associated with poor pregnancy outcome and result in complications that threaten the life of both mother and fetus. To improve maternal and fetal outcome, it is recommended that the primary health care has to be strengthened, prevention, early diagnosis, and treatment of anaemia in pregnancy. Indian Council of Medical Research (ICMR) survey showed that over 70% of pregnant women in the country were anaemic.⁶ In my study, higher prevalence rate 90.25% present. Anemia prevalence was observed by Viveki et al.,⁷ (82.9%), Totega et al.,⁸ (84.9%), Agarwal et al.,⁹ (84%), which is slightly lower than my study. In study of Gautam et al.,¹⁰ prevalence was 96.5%, which is slightly higher than my study (Table 1).

Haemoglobinopathies are common disorders in our country. These are autosomal recessive inherited disorders. These disorders, which are mainly confined to certain areas, religions, caste and tribes, particularly with consanguineous of marriages, are now widely prevalent all over the world. Among these disorders, Thalassemia and Sickle Cell syndrome are major health problem. The frequency of beta thalassemia trait in india has been reported to vary from 1 to 17% depending on the region studies with average

of 3.3%. Appropriate laboratory tests are required for diagnosis and confirmation of these disorders. HPLC offers the distinct advantage over classic haemoglobin electrophoresis as it can more accurately identify and quantitate abnormal haemoglobin. Out of 570 patients studied, 56 patients (9.75%) displayed various abnormal hemoglobin fraction HPLC runs. In the study done by Kuntal et al.¹¹ Incidence of haemoglobinopathies was found to be 5.8%, and in Urshlla et al.¹² prevalence was 5.1% which is lower than our study. Another study done by Paul Thomas et al.¹³ in which prevalence was 8.67% which is slightly lower than my study (Table 2).

In our study 29 (5.08%) patients present with Beta Thalassemia Trait. In study done by Urshlla et al.,¹² prevalence was 2.9%, which is lower than my study. Another Study done by P Kulkarni et al.,¹⁴ prevalence was 8.5% which is higher than my study (Table 3). In our study, 23 patients (4.03%) were diagnosed as Hb S heterozygous having S-window with abnormal haemoglobin ranging from 30-40%. In study done by Kuntal et al.,¹¹ prevalence was 6.4% which is higher than my study. Another study done by Nwabuko et al.,¹⁵ prevalence was 19.77% which is much higher than my study (Table 4). In my study Hb D Punjab constituted of 3 cases (0.52%) and Hb Q India 1 case (0.17%). In study of Urshlla et al.,¹² prevalence of Hb D Punjab was 0.4% which is lower than my study and prevalence of Hb Q India was also 0.4% which is higher than my study (Table 5).

Table 1 Comparison of prevalence of anaemia in antenatal patients in various studies

	Our study	ICMR	Viveki et al., ⁷	Totega., ⁸	Agarwal et al., ⁹	Gautam et al., ¹⁰
Anaemia prevalence	90.25%	70%	82.90%	84.90%	84%	96.50%

Table 2 Comparison of prevalence of haemoglobinopathies in antenatal patients in various studies

	Our study	Kuntal et al., ¹¹	Urshlla et al., ¹²	Paul Thomas et al., ¹³
Prevalence	9.75%	6%	5.10%	8.67%

Table 3 Comparison of prevalence of beta thalassemia trait in antenatal patients in various studies

	Our study	Urshlla et al., ¹²	P Kulkarni et al., ¹⁴	Paul Thomas et al., ¹³
Prevalence	5.08%	3%	8.50%	8.67%

Table 4 Comparison of prevalence of sickle cell trait in antenatal patients in various studies

	Our study	Kuntal et al., ¹¹	Nwabuko et al., ¹⁵
Prevalence	5.08%	6%	19.77%

Table 5 Comparison of prevalence of Hb D Punjab & Hb Q India in antenatal patients in various studies

	Our study	Urshlla et al., ¹²
Prevalence of Hb D Punjab	0.52%	0%
Prevalence of Hb Q India	0.17%	0.40%

Screening of Anaemia in early pregnancy helpful to improve future outcome. To prevent anaemia, IFA (Iron Folic Acid) tablet given to patients after complete her first trimester. Screening for haemoglobinopathies in antenatal period helps to identify couples at risk who could get their babies' blood checked at birth and opt for prenatal diagnosis in subsequent pregnancies.¹⁶ Ideally, HPLC must be used as a screening tool, followed by molecular studies, like PCR, amplification refractory mutation system and other similar tests to determine specific mutations responsible for the Hb disorder. In cases of hemoglobinopathies, beta thalassemia mutations, when present, significantly modify the phenotype that is why molecular studies have been considered gold standard for the diagnosis of hemoglobinopathies.

Conclusion

Antenatal screening for anaemia and genetic disorders, such as β -thalassemia, Sickle Cell Disease (SCD), aims to reduce the burden of these diseases by offering information to individual with a high likelihood of giving birth to affected babies and giving parents more choice regarding their reproductive decisions, including prenatal genetic diagnosis and termination of pregnancy. In most cases, screening is offered to pregnant women during early gestation, allowing parents to make an informed decision about their reproductive options. However, in countries where medical termination of affected pregnancies is not permitted or acceptable, screening is offered prior to conception, often during the premarital stage at which couples choose their reproductive partners. In some countries or regions with

high prevalence of disease or carrier rates, screening is offered to children of school age, long before individuals reach reproductive capacity, with the aim of allowing 'at risk' individuals to make an informed choice of their future reproductive partners.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/they're and other clinical information to be reported in the journal. The Patient understand that their name and initials will not be published and due to efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

The author declares that there is no conflict of interest.

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References

- Pasricha SR, Drakesmith H, Black J, et al. Control of iron deficiency anaemia in low-and middle-income countries. *Blood*. 2013;121(14):2607–2617.
- Campbell BA. Megaloblastic anaemia in pregnancy. *Clin Obstet Gynecol*. 1995;38(3):455–462.
- Centers for disease control and prevention. "Haemoglobinopathies Research". 2019.
- Weatherall, DJ, Clegg JB. "Inherited haemoglobin disorders: An increasing global health problem". *Bull World Health Organ*. 2001;79(8):704–712.
- Rao S, Kar R, Gupta sk, et al. Spectrum of haemoglobiopathies, diagnosed by cation-exchange HPLC and modulating effects of nutritional deficiency anemias from North India. *Indian J Med Res*. 2010;132(5):513–519.
- Kalaivani K. Prevalence and consequences of anaemia in pregnancy. *Indian J Med Res*. 2009;130(5):627–633.
- Viveki RG, Halappanavar AB, Viveki PR, et al. Prevalence of anaemia and its epidemiological determinants in pregnant women. *Al Ameen J Med Sci*. 2012;5(3):216–223.
- Totega GS. Prevalence of anaemia among pregnant women and adolescent girls in 16 districts of India. *Food Nutr Bull*. 2006;27(4):311–315.
- Agarwal KN, Agarwal DK, Sharma A, et al. Prevalence of anaemia in pregnant & lactating women in India. *Indian J Med Res*. 2006;124(2):173–184.
- Gautam VP, Bansal Y, Taneja DK, et al. Prevalence of anaemia amongst pregnant women and its socio-demographic associates in a rural area of Delhi. *IJCM*. 2002;27(4):157–60.
- Kuntal P, Bhavya S, Mansi B, et al. Prevalence of sickle cell anaemia in pregnancy: a prospective study in tertiary health centre. *International Journal Science and Healthcare Research*. 2017;2(3):59–65.
- Urshlla K, Reeta D, Nithin K, et al. Prevalence of Haemoglobinopathies in Antenatal Screening by HPLC. *International Journal of Research & Review*. 2017;4(5):96–99.
- Paul T, Lola O, Mabel A, et al. Antenatal screening for haemoglobinopathies in primary care: a whole system participatory action research project. *Br J Gen Pract*. 2005;55(515):424–428.
- Kulkarni P, Ramesh NM, Sri NM, et al. The prevalence of beta thalassemia trait among the pregnant women who attended the ANC clinic in a PHC, by using the NESTROF Test in Bangalore, Karnataka. *J Clin Diagn Res*. 2013;7(7):1414–1417.
- Nwabuko OC, Okoh DA, Iyalla C, et al. Prevalence of sickle cell disease among pregnant women in a tertiary health center in south-south Nigeria. Sub-Saharan. *Afr J Med*. 2016;3(3):132–136.
- Ghosh K, Roshan C, Mamta M, et al: Guidelines for screening, diagnosis and management of hemoglobinopathies; *Indian J Hum Genet*. 2014;20(2):101–119.