Short Communication

Tackling the Menace of Anemia and Hemoglobinopathies among Young Adults – Conceptualizing University-Level Screening

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Abstract

Background: National family health survey-4 data suggests alarmingly high prevalence of anemia among adult population. Hemoglobinopathies such as thalassemias and structural hemoglobin (Hb) variants are the commonly seen autosomal, recessively inherited, monogenic disorders of Hb production, and pose a significant health burden in India. Premarriage screening for thalassemia would help to prevent such marriage, reduce health and financial burdens. **Objectives:** To assess the burden of anemia and hemoglobinopathies, among newly admitted college students through a University-level screening program. **Methodology:** A cross-sectional study was conducted among college students of the University. The study was part of regular health check-up of all new admissions. Sample frame included all the 4197 students who appeared for health screening and were screened for anemia and hemoglobinopathies. **Results:** Out of 4197 students, 73.2% were male and a total of 19.5%were anemic. Gender-wise prevalence among males and females was 13.6% and 35.7%, respectively. Among anemic, the proportion of mild, moderate, and severe anemia was 69%, 29%, and 2%. Prevalence of typical beta thal minor and sickle cell trait was found to be 2.6% and 1.4%. **Conclusions:** Anemia and hemoglobinopathies are significant public health challenges. University setup offers a unique opportunity for modeling and pilot testing integrated interventions for screening and management.

Keywords: Anaemia, hemoglobinopathies, screening, young adults

Introduction

Malnutrition is one of the greatest public health challenges of recent times in the Indian context and most studies are focused on the pediatric age group. Recent evidence from the national family health survey (NFHS)-4 data suggests alarmingly high prevalence of anemia even among adult population. NFHS 2015–16 (NFHS-4) factsheets for Vadodara, Gujarat, and India reported anemia prevalence (hemoglobin [Hb] <12.0 g/dl) of 48.1%, 51.8%, and 50.9% for urban, nonpregnant women in the age group of 15–49 years. The anemia prevalence was even higher among rural nonpregnant women. Even among men, anemia prevalence (Hb < 13.0 g/dl) was reported to be 18.4% and 25.1% for urban and rural India, respectively.[1]

Iron deficiency is thought to be the most common cause of anemia globally, but other nutritional deficiencies (including folate, Vitamin B12, and Vitamin A), acute and chronic inflammation, parasitic infections, and inherited or acquired disorders that affect Hb synthesis, red blood cell production or red blood cell survival, can all cause anemia.[2]

Hemoglobinopathies such as thalassemia's and structural Hb variants are the commonly seen autosomal, recessively inherited, monogenic disorders of Hb production and pose a significant health burden in India.[2] Genetic mutations may reduce or abolish the synthesis of α or β globin chains in Hb structure and result in α or β thalassemia trait (BTT). When mutations in these genes cause structural changes, the structural Hb variants are produced such as Hb S, Hb D, Hb E.[3,4]

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Untreated thalassemia can result in medical complications which may require frequent blood transfusions and could also result in death at early age. Commonly such children will die early or can survive with frequent blood transfusions and related complications. Premarriage screening for thalassemia would help to prevent such marriage, reduce health and financial burdens on families, societies, and the nation.

Given the burden of anemia and hemoglobinopathies, their mutual interaction and intergenerational consequences, we conceptualized a University-level study to screen newly admitted college students.

Methodology

It was a cross-sectional study conducted among college students of the University, located in a rural village during 2018. The present study was part of regular health check-up of all new admissions of the University. Permission was taken from the institutional human research ethics committee prior to the data collection procedure. Sample frame included all the students appearing for health screening and who willingly gave written consent to take part in the research.

Data collection included students name, institute name, program/course name, Enrolment ID number, and gender, contact details, etc., Approximately. 2 ml of the blood sample was collected in Ethylenediaminetetraacetic acid bulb for HB estimation and thalassemia screening along with necessary laboratory identification data and procedure. Horiba pentra DX nexus instrument was used for Hb estimation and Bio-RAD V-II instrument for Hb Electrophoresis (high-performance liquid chromatography) was used for thalassemia test.

The WHO criteria for the diagnosis of anemia were used for the present study.[5] Blood reports were returned to students after data entry. Students were also informed about their reports by mobile messages. Those who were positive for thalassemia screening were also provided counseling services about the disease and inheritance pattern.

Data were entered and analyzed using Microsoft excel software. Average, standard deviation, range was calculated for Hb values. Further, they were classified in mild, moderate, severe anemia, and normal values. Male-female difference in Hb value was also calculated. Frequency of thalassemia positive and trait was calculated. Hb pattern was also checked among the positives during screening.

Results

Total of 4197 students were screened for anemia and hemoglobinopathies. Out of 4197 students, 73.2% (3072) were male, and a total of 19.5% (820) were anemic. Gender-wise prevalence among males and females was 13.6% (418) and 35.7% (402), respectively. Among anemic, proportion of mild, moderate, and severe anemia was found to be 69% (566), 29% (235), and 2% (19). Figure 1 shows comparative prevalence of mild, moderate, and severe anemia among males and females. There was statistically significant prevalence of anemia among females as compared to males ($P < 0.001$).

Table 1 highlights the prevalence of various hemoglobinopathies. However, no statistically significant difference was found for the prevalence of various hemoglobinopathies among males and females. Prevalence of typical beta thalassemia minor and sickle cell trait (SCT) was found to be higher at 2.6% (108) and 1.4% (59), compared to other hemoglobinopathies. More males (2.7%) showed typical beta thal minor compared to females (2.1%); and on the contrary, more females (1.5%) were found to have SCT compared to males (1.4%).

Table 1 shows anemia status of those who were found positive for any of the hemoglobinopathies. Anemia was co-existent with most of the hemoglobinopathies, except for sickle cell, double heterozygous for sickle cell and Beta thalassemia, Delta beta thalassemia trait, and D-Iran trait. It was worth noticing that about 38% and 65% individual's positive for typical beta thal minor and SCT, were nonanaemic.

Discussion

Our study found anemia prevalence of 13.6% and 35.7% among male and female, with a total prevalence of 19.5%. Moderate and severe anemia accounted for 31% of total anemic cases. Our results are similar to those reported in

Table 1: Prevalence of anaemia with various haemoglobinopathies

Types of haemoglobinopathies	Number of individuals affected (%)	Anaemia (%)
Typical beta thal minor	108 (2.57)	67 (62.03)
Typical beta trait	24 (0.57)	14 (58.33)
Sickle cell trait	59 (1.40)	21 (35.59)
Hb-D Punjab trait	22 (0.52)	2 (9.09)
Hb-E trait	3 (0.07)	3 (100)
Double heterozygous for sickle cell and HPFH	9 (0.21)	4 (44.44)
Others*	5 (0.12)	0 (0)
Total positive	230 (5.48)	111 (48.26)
Total negative	3967	709
Total	4197	820

*Others: Sickle cell, double heterozygous for sickle cell and Beta Thal, Delta beta thal trait and D-IRAN trait. Hb: Hemoglobin

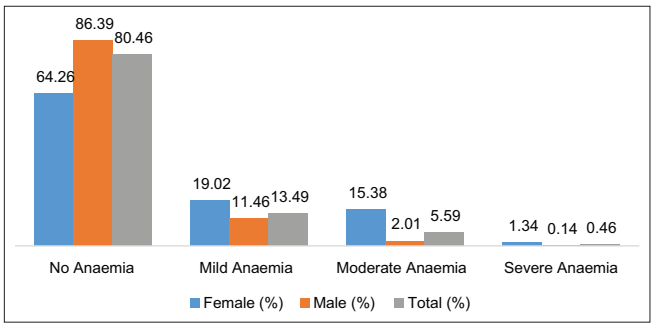

Figure 1: Frequency of anaemia among males and females

other nationally representative surveys.[1] The prevalence of anemia varies greatly according to the host factors such as age, gender, physiologic causes, pathologic causes, nutritional factors, and socioeconomic conditions. The possible risk factors could be stress of the professional course that demands long study hours, changes in the dietary habits, and increased body consciousness or tendency to lose weight, combined with menstrual loses.[6] A Pune-based study has reported that mean intake of nutrients (energy, protein, and iron) were significantly lesser among anemic adolescents. It also noted that mean energy and micronutrient (Vitamin C, folate, and iron) intake was significantly higher among those consuming traditional breakfast compared to those having bakery products in breakfast.[7]

High prevalence of anemia, and its known effects on cognitive abilities and study outcomes, warrants design and pilot testing of context-specific public health interventions. Academic institutions provide multitude of opportunities to learn epidemiology and address anemia and related complications among young adults. Program experiences suggest that timely and effective communication about the consequences of anemia and benefits of the treatment, peer motivators, individual self-compliance cards and class registers, integrated package of evidence-based interventions can ensure one's adherence to the anemia management interventions.[8,9]

With regards to hemoglobinopathies, a study from South Gujarat, involving college students and some school students with a sample size of 32,857, reported 4.4% and 1.3% prevalence of BTT and SCT, respectively. Incidence of mild to moderate anemia was higher in BTT and SCT compared to non-BTT/SCT participants.[10] An estimation study among medical students from Rajkot reported anemia and BTT prevalence of 23% and 3.5%, respectively, which is closer to our estimations.[11] A multi-center study, comprising 56,780 college students and pregnant women, reported overall prevalence of BTT at 2.78% and in the range of 1.48%–3.64% in six different Indian cities. It recommended to establish centers for education, screening, and counseling in medical colleges and other academic institutions, which can facilitate students to understand their thalassemia status, its consequences, and partner selection for marriages.[12]

As government has mandated BTT screening among college students, this shall be rigorously followed up with adequate counseling and general awareness to prevent marriages of thalassemia minors. However, the utility of screening college students for BTT and hemoglobinopathies as part of premarital screening strategy and its implications for avoidance of marriage between thalassemia carriers has not been widely documented.[13,14]

Conclusions

Anemia and hemoglobinopathies are significant public health challenges and their intergenerational consequences demand adequate attention for screening, prevention, and management. Prevalence of anemia among those affected with hemoglobinopathies, recommends the need of intervention in form of genetic counseling, regular follow-up added with appropriate treatment if needed. That will tackle the menace of these conditions well before they get married and thus prevent the intergenerational consequences.

Recommendations

In a University-setting co-located with Medicine, Nursing, Nutrition Sciences, and Public Health disciplines, it allows an immense opportunity to design, pilot test, and compare evidence-based intervention programs for young adults and evaluate their clinical and cost-effectiveness in improving anemia outcomes. Preventive and curative interventions in form of health education, lifestyle modification (diet and physical activity), and appropriate nutrition supplementation with iron folic acid can be helpful to manage anemia among students. In future, we plan robust epidemiological investigation, including study of relevant clinical parameters and biomarkers, to understand potential risk factors for given sex/location/diet-specific sub-groups. It could be extended as a longitudinal study to understand changes in students' Hb level, corresponding risk factors, and its impact on their cognitive abilities and learning outcomes. Such insights will allow to design integrated packages of evidence-based interventions, and their effectiveness could be evaluated through pre-post or randomized control studies.

Limitations

The present study could not explain association between anemia and hemoglobinopathies, which may require larger sample size for a more detailed study.

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Conflicts of interest

There are no conflicts of interest.

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