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Current Diagnostic and Therapeutic Approach in the Management of Thalassemia in Chattogram Region: A Hospital-Based Cross-Sectional Study

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Abstract

Background: Thalassemias are the most common autosomal recessive hemolytic disorder.For survival, most patients require either blood transfusion or bone marrow transplantation and other supportive therapies.It is essential to carry out proper diagnostic and therapeutic approaches and regular follow up.This study aimed to evaluate the current diagnostic protocols and therapeutic approaches used for the management of thalassemia in Chattogram region.

Materials and methods: This cross-sectional study had been conducted with thalassemic patients in three tertiary care hospitals of Chattogram region, three district sadar hospitals and one voluntary thalassemia center of Fatikchari, Chattogram. A pre-structured questionnaire was used to record data,collected from a total of 307 patients (168 male and 139 female) from their pre-recorded hospital data and interviews of the patient and parents.

Results: Among 307 patients 279 patients had adequate informations and 270 patients had documented diagnosis. Findings revealed that HbE β-thalassemia is the dominant type. We couldn't detect any α-thalassemia patients in Chattogram region.

Conclusion: This study on thalassemia has provided valuable insights into the current diagnostic methods, treatment approaches, and associated factors regarding thalassemia .

Key words: Alpha-thalassemia; Autosomal recessive; Beta-thalassemia; Hemoglobinopathy; Hb-electrophoresis.

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Introduction

Hemolytic anemia is a common genetic disease among children. It results mainly from membrane defects, enzyme defects and hemoglobin defects. Hemoglobin defects again may be of two types: Hemoglobinopathies (Qualitative abnormalities) and thalassemia syndrome (Quantitative abnormalities).[1] Worldwide Hemoglobin (Hb) abnormalities are recognized as one of the most prevalent genetic disorders.[2] These disorders are broadly divided into two groups, namely, the structural hemoglobin variants (Abnormal Hb) and the thalassemias.[3,4] Worldwide, thalassemias are the most common autosomal recessive disorder.[5]Generally, thalassemias are categorized into two broad groups: α-thalassemia and β-thalassemia depending on their genetic background and clinical manifestations.[6] Anemia, hemolysis, ineffective erythropoiesis, splenomegaly and bone marrow hyperplasia are the major pathophysiological consequences in thalassemia. Along with cell damage, chronic hypoxia, iron overload and metabolic dysregulation are also present in such patients. Therefore, for survival, most patients require either blood transfusion or bone marrow transplantation.[3,7,8] Bangladesh, has gained a noticeable reduction in infant and under-5 mortality rate by reducing malnutrition and different infectious diseases. We also have gained successes in the different aspects of health services like birth rate control, vaccination, child marriage prevention etc. But, hereditary disorders like thalassemia have received little attention yet in this country. So, it is speculated that very soon

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increasing number of children diagnosed with thalassemia might appear as a huge national burden in health sector of Bangladesh.[9,10] The nationwide prevalence of anemia in children under five years of age (33.1%) and in women (26%) is more than three times higher than that of iron deficiency in children (10.7%) and women (7.1%) suggesting or indicating other determining factors for such unexpected condition. In this situation, the role of Hb disorders along with micronutrients (Such as dietary iron, folate and Zn) deficiency could explain the phenomenon.[11] In controlling the disease, it is necessary to carry out proper diagnostic approaches and therapeutic and supportive management sequentially. At the beginning of the diagnosis of thalassemia, anemic patients are suspected to have the disorder based on family history, phenotype and relevant laboratory screening tests. Though molecular genetic confirmation establishes the diagnosis, at present Hemoglobin electrophoresis, and High-Performance Liquid Chromatography (HPLC) are the methods of choice. These methods provide a reliable means for early and accurate detection or diagnosis of the disease.[12] After diagnostic confirmation, a group of patients receive treatment consisting of blood transfusions at different intervals along with other supportive management lifelong. However, repeated transfusions may cause iron overload in the blood which can lead to problems with the heart, liver, other organs, especially endocrine glands etc. Therefore, iron chelators are often prescribed for the removal of extra iron from the body. In some cases, it might be recommended to consume extra folic acid or other supplements as well.[13] This chronic disease causes a big social and financial burden on patients, families and national health care system.[14] Therefore, it is essential to get extensive knowledge and wide-spread awareness about the existing thalassemia situation.Also, thalassemia prevention programs should be carried out according to the government policy in coordination with the country's local structures, social values, religious laws and cultural traditions and so on.[15] Different studies had been conducted in different areas of our country to determine the prevalence of thalassemia. Butthere is not enough information about the existing diagnostic protocols and therapeutic approaches used in Chattogram region. This cross-sectional study had been carried out to find out and evaluate the current diagnostic procedures andavailable treatment facilities used to manage the thalassemic patients by sharing experiences from the mentioned hospitals.

Materials and methods

This cross-sectional study had been conducted in three tertiary care hospitals of Chattogram region, viz. Chittagong Medical College Hospital, Chattagram Maa Shishu-O- General Hospital, Cox's Bazar Medical College Hospital and three district sadar hospitals, viz. Rangamati Sadar Hospital, Khagrachari Sadar Hospital and Bandarban Sadar Hospital and one voluntary center "Momena-Anowar Mohori Thalassemia center" of Fatikchari, Chattogram from January 2023 to June 2025.

The present collaborative research work had been carried out among the patients admitted for blood transfusion and other supportive treatment. Also, the patients admitted for having early symptoms and signs, who were at risk of having thalassemia and under evaluation were also enrolled based on the clinical expertise of the doctors.

Inclusion criteria of the patients under this study were the diagnosed cases of different types of thalassemia based on Hb electrophoresis test profiles and the clinical expertise of the doctors. Undiagnosed cases or patients under evaluation were excluded.

A pre-structured questionnaire was used to record all the data based on patient interviews, case record forms, prescriptions and laboratory test results. A total of 307 patients' relevant information were collected (168 male and 139 female).

This research work had been carried out in accordance with the Helsinki declaration. In order to conduct this study, written approval was taken from the appropriate authorities of the respective hospitals. Ethical clearance was obtained from the ethical review committee of CVASU.

The collected data were organized and arranged using MS Excel 2010 and further analyzed and represented in tabular form. Statistical Package for Social Science (SPSS Inc. Chicago, IL) version 26 was used for data analysis. Descriptive statistics

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(Frequencies, percentages, minimum, maximum, mean and standard deviation) were performed to analyze the sociodemographic and health profiles of the patients.A p-value of <0.05 was considered statistically significant.

Table I Types of thalassemia among the patients (n=270)

Types of patients	No. of patients	Percentage
Test Given/under evaluation	9	---
Beta Thalassemia Major	70	25.9
Beta Thalassemia Trait	24	8.9
Hb-E Beta Thalassemia	150	55.6
Hb-E Trait	18	6.7
Hb-E Disease	8	3.0

Among 270 patients, most prevailing type was Hb E beta-thalassemia (55.6%), followed by beta-thalassemia major (25.9%) beta-thalassemia trait (8.9%) and Hb E trait (6.7%) respectively.

Table II Age range of the patients according to types of thalassemia (n=267)

Types of patients	No. of patients	Age in years		
		Min-Max	Mean±SD	95% CI
Beta Thalassemia Major	70	.58-47	8.31±7.71	6.47~10.15
Beta Thalassemia Trait	22	1.6-59	26.62±14.55	20.16 ~33.07
Hb-E Beta Thalassemia	149	0.5-58	12.95±10.1	11.28 ~14.62
Hb-E Trait	18	2-39	14.98±12.40	8.81 ~21.15
Hb-E Disease	8	0.5-30	11.49±11.24	2.09~20.90

Table II shows the age range of the thalassemic patients according to thalassemia types. We found minimum age minimum age of the patient was 0.5 years and maximum was 59 years. It may reflect the survivability of the different types.

Table III Signs and Symptoms during diagnosis (n=number of respondents)

Signs and symptoms	No. of patients	Percentage (%)
Palor/anemia (n=240)	137	57.1
Splenomagaly(n=233)	23	9.9
Growth Retardation (n=219)	87	39.7
Irregular Bone Structure (n=146)	14	9.6
Fever (n=237)	148	62.2
Weakness (n=249)	154	61.8
Fatigue (n=212)	94	44.3
Anorexia (n=185)	69	37.3
Breathlessness (n=152)	24	15.8
Dizziness (n=154)	23	14.9
Nausea (n=183)	53	29.0
Convulsion (n=140)	9	6.4

During diagnosis, 57.1% of the attending patients (n=240) had pallor/anemia, 39.7% had growth retardation,9.9% had splenomegaly, 9.6% showed irregular bone structure.Most of the patients complained of the various above symptoms with varying frequency. Most commonly they complained of fever,weakness, fatigue, anorexia and nausea. Some patients also complained of breathlessness, dizziness and convulsion.

Table IV Investigation procedures used for the diagnosis (n= 307)

Investigation procedures	No. of patients	Percentage of lab. reports recorded (%)
Hemoglobin electrophoresis	291	94.8
CBC 262	85.3	
PBF	256	83.3
Serum iron profile	18	5.9

Table IV Shows the common procedures used for the diagnosis of thalassemia. Among 307 patients 291(94.8%) patients had Hb electrophoresis report and 262(85.3%) patients had CBC reports, 256 (83.3%) respondents had PBF reports and 18(5.9%) patients (5.9%) had done serum iron profile. Finally, Hb electrophoresis report had been used for the definitive diagnosis of different types of thalassemia.

Table V Treatment History (n= 307) (n=total number of respondents)

Treatment history	No. of patients (n)	Percentage (%)
Blood transfusion	243	79.2
Iron chelation	96	31.3
Folic acid supplementation	208	67.8
Vitamin D	68	22.1
Iron chelation:		
Deferoxamin	20	6.5
Deferiprone	71	23.1
Deferasirox	5	1.6
Frequency of Blood transfusion	n= 243	Percentage (%)
1 unit/2 weeks	3	1.2
1 unit/3 weeks	23	9.5
1 unit/4 weeks	136	55.9
1 unit/5 weeks	17	6.9
1 unit/6 weeks	31	12.8
1 unit/8 weeks	24	9.9
Irregular	9	3.7

Regarding treatment history 243 patients (79.2%) were getting blood transfusion on different frequency, 96 patients (31.3%) received iron chelation, 208 patients (67.8%) took folic acid

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supplement and 68 patients (22.1%) received vit. D. Out of 243 patients 136 patients (55.9%) were receiving blood transfusion on every 4 weeks, 31 patients (12.8%) on every 6 weeks, 24 patients (9.9%) on every 8 weeks, 23 patients (9.5%) on every 3 weeks, 17 patients (6.9%) on every 5weeks, 3 patients (1.2%) on every 2 weeks. Again 9 patients (15.23%) had irregular transfusion history.

Table VI Complications due to treatment (Hazards during or after transfusion) (n=307)

Complications due to treatment	Frequency (n=307)	Percentage (%)
Fever (During transfusion mainly)	146	47.6
Urticaria	16	5.2
Shock	8	2.6
Hemoglobinuria	2	.6
Transfusion Transmitted Infection	4	1.3
Venous thrombosis	2	0.6

Table VI shows 146 patients (47.6%) got fever, 16 (5.2%) patients suffered from urtcaria, 8 (2.6%) patients had shock, 2 (0.6%) patients had hemoglobinuria, 4 patients (1.3%) gave the history of transfusion transmitted infection and 2 patients (0.6%) gave the history of venous thrombosis.

Discussion

This is a collaborative research work consisting of comprehensive data of 307 patients collected from the above different hospitals. Among the patients 54.7% (168) were male and 45.3% (139) were female. The percentage is slightly higher in the males than the females, which coincides with an earlier study.[16] This study might give an insight into the most common types of thalassemia prevalent in this greater Chattogram region including Chittagong Hill Tracts (CHT). Here we noticed a significant prevalence of HbE β-thalassemia (55.6%) among the patients of this region followed by β-thalassemia major (25.9%) and β-thalassemia trait (8.9%). Studies done in Dhaka, and Dinajpur also found that HbE β-thalassemia are the most common type.[1,17] Regarding age range of the thalassemic patients according to thalassemia types we found minimum age was 0.5 years and maximum was 59 years. It probably reflects the survivability of the different types. Though it mayrequirelarge scale follow up study, specially cohort study as well.

During diagnosis, 57.1% of the attending patients (n=240) had pallor/anemia, 39.7% had growth retardation (n=219), 9.9% had splenomegaly (n=233) 9.6% showed irregular bone structure (n=146). Most of the patients complained of the various above symptoms like fever, weakness, fatigue, breathlessness, anorexia, dizziness, nausea, convulsion etc. with varying frequency.

Among 307 patients 291 patients (94.8%) had Hb electrophoresis report, 262 patients (85.3%) had CBC reports, 256 respondents (83.3%) had PBF reports and 18 patients (5.9%) had done serum iron profile. Finally, Hb electrophoresis report had been used for the definitive diagnosis of different types of thalassemia. Newer advanced laboratory techniques e,g. High performance liquid chromatography (HPLC), Capillary Zone Electrophoresis (CZE) Chorionic Villous Sampling (CVS) amniocentesis, genetic testing etc. should be employed for the diagnostic purpose.Regarding treatment history 243 patients (79.2%) were getting blood transfusion on different frequencies, 96 patients (31.3%) received iron chelation, 208 patients (67.8%) took folic acid supplement and 68 patients (22.1%) got vit. D. During treatment and follow up, 146 patients (47.6%) complained of fever(during or after transfusion mainly), 16(5.2%) patients suffered from urticaria, 8 (2.6%) patients had shock, 2 (0.6%) patients had hemoglobinuria, 4 patients (1.3%) gave the history of transfusion transmitted infection and 2 patients (0.6%) gave the history of venous thrombosis. We observed these complications were mostly during blood transfusionand or afterwords. It is apparent from the study that we require a lot of improvement in the field of diagnosis and management of thalassemia patients nationwide.Safe blood transfusion and management facilities to combat transfusion hazards are urgently required.Iron chelators should be easily available and cheaper.

The findings of the current study provide valuable insights into the current diagnostic and therapeutic approachesin the management of thalassemia in Chattogram region. Another crucial finding is that we found no Alpha-thalassemia patients in Chattogram region. Because the primary cause of thalassemia is the carrier status of both parents with mutated genes.So by promoting public awareness through counselling, thalassemia cases

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can potentially be reduced. Significance of pre-marital counselling and screening is suggested. Furthermore curative treatments like stem cell/bone marrow transplantation, gene therapy and other modern procedures should be introduced as early as possible.

Limitation

The limitation of the study is the relatively small sample size. However, it is essential to note that a single study in a specific region may not be sufficient to draw definitive conclusions.

Conclusion

Conclusion This study might give an insight into the most common types of thalassemia prevalent in this region. Here we noticed a significant prevalence of HbE ß -thalassemia followed by ß-thalassemia major and ß-thalassemia trait. This study has provided valuable insights into the current diagnostic methods, treatment approaches, and associated factors regarding thalassemia. Newer advanced laboratory techniques e,g. High Performance Liquid Chromatography (HPLC) Capillary Zone Electrophoresis (CZE) Chorionic Villous Sampling (CVS) amniocentesis, genetic testing etc. should be employed for the diagnostic purpose. Along with current management approaches, newer drugs, advanced therapeutic techniques like bone marrow or stem cell transplantation, gene therapy should be employed. A lot of improvement in the field of diagnosis and management of thalassemia nationwide is required. Nationwide surveillance, prompt diagnostic and therapeutic facilities should be made available and easily accessible.

Recommendation

The insights gained from this research may serve as a valuable data for future research in the field of thalassemia management. In order to address thalassemia, it is essential to prioritize early screening and pre-marital genetic counseling. Implementing nationwide newborn and prenatal screening programs can identify thalassemia cases in their early stages, allowing for prompt intervention and improved patient outcomes. Public awareness campaigns are essential for thalassemia prevention.

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Contribution of authors

MNUC-Conception, collection of data, interpretation and analysis of data, manuscript writing & final approval.
GD- Design, collection of data, data analysis, critical revision & final approval.
MAF- Collection of data, drafting & final approval.
MSAK- Collection of data, intepretation of data, critical revision & final approval.
MJAM- Collection of data, data analysis, drafting & final approval.
SB-Collection of data, drafting & final approval.
BNA- Collection of data, data analysis, drafting & final approval.
SKMAI -Conception, interpretation and analysis of data, critical revision & final approval.

Disclosure

All the authors declared no conflict of interest.

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