The Impact of Pregnancy Outcomes on Thalassemia Trait in Poor Bangladeshi Mothers

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Abstract

Thalassemia is an inherited blood disorder. The pregnant mothers with thalassemia trait can causes severe to mild complications. The aim of our recent study was to find out the outcome of pregnant mothers with thalassemia trait. This is a prospective case control study in two Hospitals Gonoshasthaya Samaj Vittik Medical College, Savar and Thalassemia Hospital and Institute, Zinzira, Dhaka, Bangladesh. All pregnancies occurred between January 2022 to December 2024 were included. Study group (n =21) are Beta thalassemia trait and normal hemoglobin variants are included in Control group (n = 84). Data was analyzed by Microsoft Excel and Statistical Package for the Social Sciences (SPSS-25).

Beta Thalassemia trait mothers had mean hemoglobin (Hb) 9.2 gm/dl and required Blood transfusion 14% cases. In normal Hb Pattern mothers had mean hemoglobin 11.2gm/dl and Required Blood transfusion 2% cases. Other like Hb E trait and Hb D trait mothers had mean respectively Hb 10.2gm/dl and 10.7gm/dl Hb E trait and Hb D trait mothers required no blood transfusion in their pregnancy. There is a significant relationship between the control group and study group regarding anemia as well as other adverse maternal outcome like gestational hypertension and antepartum hemorrhage. The odds ratio (OR) gestational hypertension is 2.96 and antepartum hemorrhage is 4.15 which reflects study group has more chances of these adverse outcome. The odds ratio (OR) of gestational diabetes postpartum hemorrhage, postpartum depression and cesarean section were more than one (>1), it indicates study group have chance of mentioned adverse outcome. In the study group, the odds ratio (OR) is 0.49 is lower odds for normal vaginal delivery (NVD).

In fetal outcome higher odds are NICU admission, APGAR score <7 at 5 min, also still birth is a risk factor. There are no significant relation with pre term birth, macrosomia and APGAR score<7 at 1 min. The odds ratio (OR) IUGR and fetal weight <2.5kg are lower 0.83 and 0.87 respectively. The present study shows more anemia's in asymptomatic mother who were beta thalassemia carrier. So thalassemia trait mother need special care during and after delivery. To reduce adverse pregnancy outcomes need nutritional supplementation, dietary modification and genetic counseling to the thalassemia trait mothers.

Keywords: Anemia, thalassemia trait, outcome, Pregnancy, Gestation

INTRODUCTION

Anemia during pregnancy is a serious public health issue that millions of women were suffering globally, especially low income country.[1-4] According to WHO 1.6 billion people in the world are suffering in anemia.[2] Anemia reduce oxygen supply in the body at the tissue level.[2] If pregnant mother were severe anemic hemoglobin concentration less than 6 gm/dl which is associated with serious maternal and fetal complications.[1,5] For anemia during pregnancy, maternal most serious complications are increased risk of mortality, most vulnerable to infections, pre-term labor , post-partum hemorrhage and heart disease.[1,5]

During pregnancy fetus grows and metabolic changes, hormonal changes and expand maternal blood volume. Also increase demands of vitamin (folate), nutrients and iron. These are support the fetal growth and development.[6-9] If reduced oxygen carrying capacity of pregnant mother, it can leads to insufficient oxygen to fetus, which can affects fetal growth and development. [10-12] The affected fetus develops intrauterine growth retardation (IUGR), fetal distress, fetal tachycardia, pre term birth and delayed neural development.[1,5,12] In severe cases can lead to fetal heart failure and intrauterine fetal death. [1,5,12] The main causes of anemia during pregnancy are nutritional deficiencies, chronic disease and genetic disorders.[1] The most common causes of microcytic hypochromic anemia are iron deficiency anemia (IDA) and beta thalassemia trait. Most often iron deficiency anemia (IDA) and beta thalassemia occur in same time and produce critical to diagnostic signs.[14]

Thalassemia is a group of inherited blood disorder where reduced synthesis of one or more globin chain. It is a quantitative defect of globin chain. [15-16,18] Thalassemia is transmitted genetically from parents to offspring.[19] In a healthy individual, adult hemoglobin contains two alpha (α) and two beta (β) globin chain, 2 beta globin gene located in chromosome 11 and 2 alpha globin gene located in chromosome 16.[15] Thalassemia results from impaired globin chain due to gene mutation.[15-17] Thalassemia can be divided into alpha thalassemia and beta thalassemia. Both type can be present in the thalassemia trait (minor) or the thalassemia major form.[15] Thalassemia minor is also called beta thalassemia carrier or heterozygous beta thalassemia.[16]

In Asia beta thalassemia is most common genetic disorder.[18] Our neighbor in India more than 35 million people carry beta thalassemia gene. Huge population of the world are carrier of the thalassemia trait.[15] Thalassemia trait presence as a most common causes of anemia in different countries of the world.[17,19] In Bangladesh around 17-22 million people are thalassemia carrier. [20] The National Thalassemia Survey 2024 observed thalassemia minor or carrier prevalence rate was 11.4%.[21] The prevalence of beta Beta thalassemia is higher in Bangladesh and prevalence is 2-3%. [22]

Thalassemia can causes severe to asymptomatic to pregnant mother.[16-17] Thalassemia trait genetically produce minimal health effects, but during pregnancy due to physiological changes increase health risk of mother and fetus.[2] Thalassemia trait is a disease which can most often intermingle with iron deficiency. Various formulas have been developed in clinical practice to differentiate or not miss the diagnosis of thalassemia trait.[23] Due to under diagnosis and under treatment of anemia can produce serious adverse maternal and fetal outcome.[3-4] The aim of our recent study was to find out the outcome of pregnant mothers with Beta thalassemia trait.

MATERIAL AND METHODS

This is a prospective case control study in two Hospitals Gonoshasthaya Samaj Vittik Medical College, Savar and Thalassemia Hospital and Institute, a Project of NGO-IACIB, Zinzira, Dhaka, Bangladesh. All pregnancies occurred between January 2022 to December 2024 were included. Total 454 participating pregnant mothers were routine investigations and hemoglobin electrophoresis were done to detect hemoglobin variants. Then mothers were categorized into two (02) groups study group and Control group. Study group (n =21) are Beta thalassemia trait and among 402 normal hemoglobin variant 84 mothers were included in Control group (n = 84) by simple random sampling.

The inclusion criteria for study group were the following: i) Beta thalassemia trait by hemoglobin electrophoresis, ii) Single pregnancy with regular ANC (antenatal checkup) and delivery in hospital, iii) No other major medical or surgical complications during pregnancy. The inclusion criteria for Control group were the

following: i) Normal hemoglobin variant by hemoglobin electrophoresis, ii) Single pregnancy with regular ANC (antenatal checkup) and delivery in hospital, iii) No other major medical or surgical complications during pregnancy.

All mothers were regularly schedule for ANC (antenatal checkup) at obstetrics department of respective hospital and regular physical examination and routine investigations were done. Special attention to recorded data include anemia, gestational hypertension (HTN), gestational diabetes (GDM), antepartum hemorrhage (APH), post-partum hemorrhage (PPH), postpartum depression (PPD) and mode of delivery (normal vaginal delivery or Cesarean section). The neonatal outcomes were especially were following pre term birth, Macrosomia, IUGR, fetal weight less than 2.5kg, still birth ,APGAR Score at 1 min, APGAR Score at 5 min and NICU admission.

Statistical Analysis

Data was analyzed by Microsoft Excel and Statistical Package for the Social Sciences (SPSS-25). Results were compiled in chart and diagrams and conclusion was drawn.

RESULT

In our study, age ranges of the patients were 18 to 40 years. Mean age was 24.96 years. In our study population 177 (39%) were in age group 18-22 years, 140 (31%) were in age group 23-27 years,114 (22%) were in age group 28-32 years and only 27 (6%) were in age group more than 33 years. In our study majority pregnant women were experience regular menstrual cycle 312(68%) and only 142(32%) were irregular cycle. Pregnant mother who contraceptive used before pregnancy only 179 (47%) and contraceptive not used before pregnancy 205 (53%). Most of the pregnant mother who immunized with Tetanus Toxoid Vaccine (TT Vaccine) was 310 (68%) and near one third of women were unimmunized with Tetanus Toxoid Vaccine. (Table-1)

Table-1: Reproductive and medical characteristics of pregnant women

Variable	Category	Frequency	Parentage
Regularity of menstrual cycle	Regular	312	68%
	Irregular	142	32%
Contraceptive use before pregnancy	Yes	179	47%
	No	205	53%
Tetanus Toxoid Vaccine (TT Vaccine)	Yes	310	68%
	No	144	32%

In our study most of the patients had family history of diabetes mellitus, hypertension, asthma and other disease present in 67(15%) and no family history found 387 (85%). We notated in present diagnosed health problem of pregnant mother like pre diabetes mellitus, hypertension, Poly cystic ovarian disease (PCOD) , asthma and other disease before pregnancy 77(17%) and no previous health problem 337(83%). Among 454 pregnant mothers 73(16%) mothers need infertility treatment before pregnancy. They were need different types of treatment mood. About 57(78%) mothers received with non-pharmacological therapy for lifestyle modification like reducing over weight by exercise and balanced healthy diet, counseling for depression, couple education on sexual intercourse 2-3 times per week, pre-conceptional advice, education regarding fertile period. Non pharmacological therapy such as ovulation inducing Drug (clomifene citrate), hormone (gonadotropins) and metformin used 16(22%). Other mothers only 1(1%) got Assisted reproductive technology (IVF) (Table-2)

In our study population we found normal hemoglobin variants 402 (88%) and abnormal hemoglobin variants 52(12%). The frequency of Beta Thalassemia trait had 21(5%), Hb E trait had 27(6%) and Hb D trait had 4(1%).

Beta Thalassemia trait mothers had mean hemoglobin 9.2gm/dl and required Blood transfusion 14% cases. In normal Hb Pattern mothers had mean hemoglobin 11.2gm/dl and required Blood transfusion 2%. Other like Hb E trait and Hb D trait mother mean respectively Hb 10.2gm/dl and 10.7gm/dl Hb E trait and Hb D trait mothers required no Blood transfusion in their current pregnancy. (Table-3)

Table-2: Mode of infertility Treatment

Variable	Frequency	Percentage
Non pharmacological therapy	57	78%
Pharmacological therapy	16	21%
Assisted reproductive technology(IVF)	1	1%
Total	73	100%

Table- 3: Hemoglobin (Hb) variant and Mean Hb with Required Blood transfusion

Hemoglobin variant	Mean HB	Required Blood transfusion
Beta Thalassemia trait	9.2gm/dl	4.70%
Hb D trait	10.7gm/dl	0%
Hb E trait	10.2gm/dl	0%
Normal HB	11.2gm/dl	2%

In the present study, there were 21 and 84 mother in the study group and control group respectively. There is a significant relationship between the control group and study group regarding anemia as well as other maternal outcome like gestational hypertension and antepartum hemorrhage. The odds ratio (OR) gestational hypertension is 2.96 and antepartum hemorrhage is 4.15 which reflects study group has more chances of these adverse outcome. The odds ratio (OR) of gestational diabetes postpartum hemorrhage, postpartum depression and cesarean section were >1, it means study group have chance of these adverse outcome. The odds ratio (OR) is 0.49 is lower odds which normal vaginal delivery (NVD) is protective factors for study group (Table-4). In fetal outcome higher odds of outcome are NICU admission, APGAR score at 5 min, also still birth is a risk factor. There are no significant relation with pre term birth, macrosomia and APGAR score at 1 min. The odds ratio (OR) IUGR and fetal weight <2.5kg are lower. (Table-5)

Table-4: Maternal outcome of study population

Out come	Study group (n=21)	Control group (n=84)	OR (95% CL interval)	P Value
Anemia	21(100%)	19(22.62%)	144.44	0.0006
Gestational hypertension	5(23%)	8(9.5%)	2.96	0.085
Gestational diabetes	3(14%)	7(8.3%)	1.83	0.41
Antepartum hemorrhage	1(4.8%)	1(1.19%)	4.15	0.32
Postpartum hemorrhage	1(4.8%)	3(3.5%)	1.35	0.78

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Postpartum depression	6(28.5%)	20(23.80%)	1.28	0.65
Normal vaginal delivery	11(52.4%)	58(69.04%)	0.49	0.15
Cesarean section	10(47.6%)	35(41.65%)	1.27	0.62

Table-5: Newborn outcome of study population.

Out come	Study group (n=21)	Control group (n=84)	OR (95% CL interval)	P Value
Pre term birth	1(4.7%)	4(4.76%)	1	1.00
Macrosomia	1(4.7%)	4(4.76%)	1	1.00
IUGR	1(4.7%)	5(5.9%)	0.79	0.83
Fetal weight <2.5kg	2(9.5%)	9(10.71%)	0.87	0.87
Still birth	0	1(1.19%)	1.29	0.87
APGAR Score <7 at 1 min	1(4.7%)	4(4.76%)	1	1.00
APGAR Score <7 at 5 min	1(4.7%)	1(1.19%)	4.1	0,32
NICU admission	2(9.5%)	1(1.19%)	8.7	0.08

DISCUSSION

In our study population we found normal hemoglobin variants 402 (88%) and abnormal hemoglobin variants 52(12%). Among 52 abnormal hemoglobin variants, the frequency of Beta Thalassemia trait 21(5%), Hb E trait 27(6%) and Hb D trait 4(1%). Uddin MM et al. reported prevalence of beta thalassemia minor or trait 21.3%.[24] Beta Thalassemia trait mothers had mean hemoglobin (Hb) concentration 9.2gm/dl and required blood transfusion 14% cases. In normal Hb pattern mothers had mean hemoglobin concentration 11.2gm/dl and their required blood transfusion 2% cases. Other like Hb E trait and Hb D trait mothers had mean Hb 10.2gm/dl and 10.7gm/dl respectively. Hb E trait and Hb D trait mothers had required no blood transfusion in their pregnancy. Similar study Charoenboon C et al. reported hemoglobin concentration slight lower in beta thalassemia trait.[28]

There is a significant relationship between the control group and study group regarding anemia as well as other maternal outcome like gestational hypertension and antepartum hemorrhage. The odds ratio (OR) gestational hypertension is 2.96 and antepartum hemorrhage is 4.15 which reflects study group has more chances of these adverse outcome. The odds ratio (OR) of gestational diabetes postpartum hemorrhage, postpartum depression and cesarean section were >1, it indicates study group have chance of these adverse outcome. The odds ratio (OR) is 0.49 is lower odds which normal vaginal delivery (NVD) is protective factors for study group. In fetal outcome higher odds of outcome are NICU admission, APGAR score at 5 min, also still birth is a risk factor. There are no significant relation with pre term birth, macrosomia and APGAR score at 1 min. The odds ratio (OR) are lower in IUGR and fetal weight <2.5kg.

Camaschella C found pregnant mother with anemia were higher risk of maternal pregnancy outcome gestational hypertensions, Cesarean Section (C- Section), premature rupture of membrane (PROM), Preterm birth and postpartum hemorrhage(PPH).[25] Amooee S et al. found that beta thalassemia minor had higher prevalence of cesarean section and no significant relation with APGAR score, IUGR and GDM.[26] Luewan S et al. found beta

thalassemia were significantly higher risk of Cesarean Section.[27] In this study, there were a significant difference in regarding NICU admission, APGAR Score at 1min and 5 min . But there were no significant difference in regarding pre term birth, macrosomia, IUGR, still birth. Camaschella C found pregnant mother with anemia were higher risk of neonatal outcome neonatal asphyxia and low birth weight (LBW).[25] Amooee S et al. reported that beta thalassemia trait had significantly higher prevalence rate of cesarean delivery and no significant difference regarding APGAR score GDM and preeclampsia. [26] Charoenboon C et al. reported the prevalence of beta thalassemia trait is higher.[28]

Low level of Hb in beta thalassemia trait mothers causes short and long term effect on mother and fetus. As a result serious adverse outcome in pregnancy such as gestational hypertension, abortion, preterm birth and LBW. [29-30] Luewan S et al. reported fetal growth, restriction, pre term birth, low birth weight (LBW) is higher in thalassemia trait mother's fetus.[27] To reduce serious maternal and fetal complications need nutritional supplementation, dietary modification or combination of both.[1]

CONCLUSION

During pregnancy pregnant mother experience various problems and at the same time, the newborn may also. There are more chance of adverse maternal and fetal outcomes in beta thalassemia trait mother than normal hemoglobin variant mothers. Pregnant mother with thalassemia trait associated with anemia, gestational hypertension, gestational diabetes and antepartum hemorrhage, need blood transfusion and fetus may need NICU admission. Early diagnosis and genetic counseling are needed to reduce patient risk of birth thalassemia major baby. The thalassemia trait mother needs to take special care during and after delivery to reduce adverse maternal and fetal outcome.

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Disclosure

The author declares no conflicts of interest. Funding was not obtained for this study.

Author contribution

Dr. Shamima Nasrin Shadia designed the study, collected data, cared for the patients, analyzed the data and wrote the manuscript, Prof. Dr. Sukalyan Kumar Kundu designed the study, analyzed the data and wrote the manuscript, Dr.Sadia Afrin collected data and cared for the patients and Dr.Monira Islam Lima collected data and cared for the patients. Prof. Dr. Moazzem Hossain designed the study and wrote the manuscript.

Declarations

Conflict of interest: The authors were no conflicts of interest in this research work.

Ethics approval: The study received ethical approval from ethics committee of Thalassemia Hospital and Institute.

Consent to participate: The patients and family members were informed about the study including its objectives and procedure. Only patients with written consent were included.

Consent for Publication: Not required

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