Original Article

Prevalence of Gestational Auto-immune Thyroid Dysfunction and its Association with Anaemia in a Rural District of West Bengal

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Abstract

Background: Maternal thyroid dysfunction is associated with risk of obstetric complications and also heralding the risk of abnormal fetal neuro-development. The prevalence and type of thyroid dysfunction in pregnancy varies widely according to ethnicity, demographic and geographical location. Thyroid dysfunction in pregnancy may be associated with autoimmune component too. Anaemia in pregnancy may aggravate with thyroid dysfunction in comparison to euthyroid pregnant subjects. Some epidemiological studies suggested that Iron deficiency anemia may be related to autoimmune thyroid dysfunction in pregnancy. This study aimed to estimate the prevalence of thyroid dysfunction in different trimesters of pregnancy, the association with anemia in pregnancy and whether autoimmunity plays a role in development of thyroid disorder.

Methodology: A cross-sectional study was conducted over a period of 1 year in the department of Biochemistry of Bankura Sammilani Medical College. Antenatal mothers attending the antenatal OPD in different trimester were selected depending on predefined inclusion and exclusion criteria. Blood samples were collected for estimation of serum TSH, Free T4, haemoglobin, haematocrit, RBC indices. Serum anti-TPO antibody was estimated only in patients with altered thyroid hormone concentration. Results of the study was compiled, tabulated and analysed using SPSS version 21.

Results: 326 pregnant mothers were included as study participants among which 164 were in first trimester and 162 were in second trimester. The prevalence of hypothyroidism among pregnant women was found to be 46.3 % whereas only 1.8% were hyperthyroid.93.3% of the hypothyroid pregnant women had sub-clinical hypothyroidism and the remaining had overt hypothyroidism. 8 subjects out of the total 157 patients with deranged thyroid function were found to be anti-TPO positive. The prevalence of iron deficiency anaemia among hypothyroid mothers were 36.4% in comparison to 33.1 % in non-hypothyroid mothers.

Conclusion: Screening of thyroid function status in various stages of gestation is essential because of the high prevalence of hypothyroidism among pregnant women. Estimation of serum anti TPO antibody should be done

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in all thyroid dysfunctions. Thyroid disorders in pregnancy may be associated with increased severity of iron deficiency anaemia.

Key words: Thyroid disorders, anti TPO antibody, Iron deficiency anaemia, Gestation

Introduction

Thyroid dysfunction, one of the most common variant of gestational endocrine disorder results from inappropriate adaptation of thyroid hormone to physiological changes of pregnancy. These variations in results from an interplay of factors like raised thyroglobulin concentration due to physiological hyper-estrogenemia and increased iodine loss due to increment in glomerular filtration rate, alteration of metabolism of maternal thyroid hormones and changes in placental iodine transport. Gestational thyroid hormone synthesis and iodine requirement increases 50% above the baseline non-pregnant level.(1)

Thyroid disorders during first trimester have been associated with adverse obstetric and fetal outcome. The maternal complications are miscarraiges, pregnancy induced hypertension, placental abruption, preterm labour. Thyroid dysfunction may also result in fetal complications like prematurity, intrauterine growth restriction, fetal demise and perinatal mortality. Children born to untreated mothers have profound effect on cognitive and neurological development.

Prevalence of thyroid disorders during pregnancy has a wide geographic, ethnic and environmental variation. Western literature shows a prevalence of hypothyroidism in pregnancy of 2.5% and hyperthyroidism in pregnancy has prevalence of 0.1 to 0.4%. The prevalence of thyroid dysfuncion in Indian pregnant women was found to be 4.8% to 11% according to other studies (2,3). Thyroid hormones increases the synthesis of erythropoietin and thereby stimulates erythropoiesis in the bone-marrow(4). Autoimmune thyroid dysfunctions is a leading pathology of thyroid dysfunction in pregnancy. Autoimmune thyroid disease (AITD) may also cause anaemia due to pernicious anaemia, autoimmune haemolytic syndrome or rheumatic disorders. Deranged iron metabolism, and oxidative stress may causes anaemia in thyrotoxicosis.(5) Moreover, iron-deficient states itself reduces thyroid hormone production as iron is crucial for the catalytic property of thyroid peroxidase. (6). So, presence of thyroid dysfunction may aggravate the chances of anaemia in pregnancy, an iron-starved metabolic phase and a vicious cycle may initiate. In this instance the study is designed to estimate prevalence of thyroid disorders among pregnant women of different trimesters in the Bankura district of West Bengal and to find out the association of anaemia with thyroid dysfunction in pregnancy .

Materials and Method

This cross-sectional observational study was conducted in the Department of Biochemistry of Bankura Sammilani Medical College and Hospital after getting institutional ethical clearance (Vide memo no:BSMC/IEC/2488 dated 26/07/2022). The report of this study is prepared using The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (7). The study participants were apparently healthy pregnant women with uncomplicated singleton pregnancy irrespective of parity attending antenatal OPD. Pregnant Women with multiple pregnancies, previous history of thyroid disorder, hypertension, gestational diabetes, urinary tract infection, renal disease, cardiac, pulmonary disorders, autoimmune disease, repeated miscarriage or any history of obstetric or medical complications and having antithyroid medications were excluded from the study. Considering the prevalence of thyroid disorder in pregnancy 11% and 10% dropout rate respectively, the calculated sample size for each trimester was 165 pregnant patient in each trimester (8). The pregnant women who fulfilled the predefined inclusion and exclusion criteria and voluntarily agreed to participate in the study were included as study subjects after receiving duly written consent. Venous blood was collected using standard aseptic guideline in appropriate vials. Serum TSH, free T4 was estimated by CLIA (Chemiluminiscence immunoassay technique) using Centaur CP analyser. Serum anti-TPO (Thyroid peroxidase) antibodies was estimated using ELISA (Enzyme Linked Immunosorbent assay). The trimester specific reference interval of thyroid hormones

as per European thyroid association was used as Cut-off. (9) Anti-TPO was estimated in Patients with altered thyroid hormones. The anti-TPO antibody titre>40IU/ml will be taken as positive for thyroid autoimmunity (10) Hematological parameters like Red blood cell (RBC) count, , hematocrit (HCT), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular concentration (MCHC) were estimated from EDTA blood using 5 part cell counter of Sysmex.

Statistical Analysis: Data has been collected, compiled and tabulated in Microsoft excel. Data analysis was done using proper descriptive and inferential statistics by SPSS version 21. Prevalence of thyroid dysfunction in different trimesters has been calculated. Association of thyroid dysfunction with anti-TPO positivity and Hematological parameters has been done and considered statistically significant if $P<0.05$.

Results

In this study, about 326 pregnant mothers were included as study participants according to predefined inclusion and exclusion criteria. Among the 326 pregnant mothers, 164 were in first trimester and 162 were in second trimester. The Cut-off for the hypothyroidism was used as TSH concentration > 2.50 µIU/ml and > 3.00 µIU/ml in second trimester was used as per The European Thyroid Association 2014 guidelines. With this criteria, there were 84 and 67 hypothyroid cases among the enrolled 164 and 162 pregnant mothers of first and second trimester respected. However, the number of hyperthyroid cases were very low in this study, like 4 and 2 cases in first and second trimester respectively as evident from Table 1. The hypothyroid cases were categorised as Overt hypothyroidism (TSH>10 µIU/ml) and Sub-Clinical Hypothyroidism respectively as shown in Table 2. The total prevalence of overt hypothyroidism is almost 3%. The haematological parameters of the study population according to trimester has been illustrated in Table-3. The anti-TPO antibody screening was done for all the pregnant mothers having thyroid dysfunction and it was found that 8 subjects out of the total 157 patients with deranged thyroid function were anti-TPO positive. This is shown in Figure-1. A Chi-Square test was done to estimate whether there was a significant difference among the IDA prevalence among the pregnant mothers. The cut-off for Hemoglobin was taken as 11 g/dl and 10.5 g/dl. [11] There was no statistically significant difference in the propensity to IDA among the hypothyroid mothers (as shown in Table-4). But, the prevalence of IDA among hypothyroid mothers were 36.4% in Comparison to 33.1 % in non-hypothyroid mothers.

Table 1: Table showing trimester Specific distribution of cases in Pregnant Mothers. (Figure in parenthesis indicate Percentage).

Sl.no	Trimester	No. of Pregnant mothers	Hypothyroidism	Hyperthyroidism
1.	1st Trimester	164	84 (51.2%)	4 (2.4%)
2.	2nd Trimester	162	67 (41.3%)	2 (1.2%)
3.	Total	326	151 (46.3%)	6 (1.8%)

Table 2: Table showing distribution of Hypothyroidism as overt and Sub-clinical hypothyroidism.

Sl.no	Trimester	Overt Hypothyroidism Cases	Sub-Clinical Hypothyroidism Case
1.	1st Trimester (n=84)	5	79
2.	2nd Trimester (n=67)	5	62
3.	Total (n=151)	10	141

Table 3: Table showing distribution of Hematological parameters as Mean± SD.

Sl	Trimester	Hemoglobin (g/dl)	RBC (cell/cmm)	PCV/HCT (%)	MCV (fl)	MCH (pg)	MCHC (g/dl)
1.	1st Trimester (n=164)	11.4±1.22	4.19±0.5	35.78±3.33	85.3±6.9	27.5±2.7	32.1±1.2
2.	2nd Trimester (n=162)	11.16±1.1	4.11±0.43	35.2±3.18	86.4±7.5	27.2±2.77	31.3±1.0

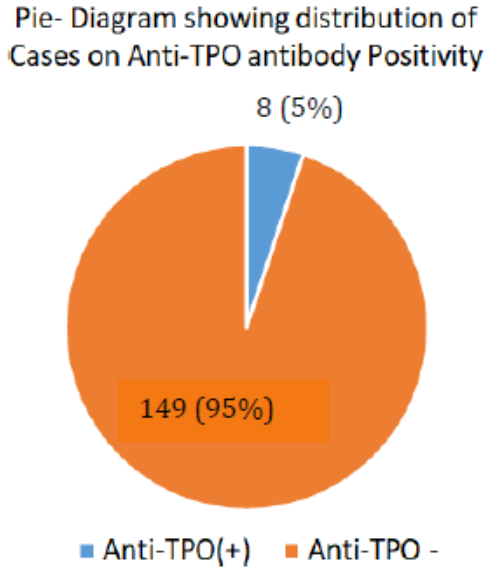

Figure-1: Showing Distribution of Thyroid Dysfunction cases (n=157) on the basis of Anti-TPO positivity

Table: 4 Table Showing distribution of IDA cases among the pregnant mothers with or without hypothyroidism

Sl.no	Thyroid Status	Developed IDA	Did not Develop IDA	P-value
1.	Hypothyroid	55	96	P=0.53#
2.	Non-Hypothyroid	58	117	

[p>0.05 is statistically insignificant]

Discussion

The prevalence of hypothyroidism among pregnant women in the present study was 46.3 % whereas only 1.8% were hyperthyroid. As compared to a cross-sectional multicenter study in India done by Dhanwal et al (12), the results of our study showed a higher prevalence of hypothyroidism among pregnant women. Various prevalence were found in studies done in various parts of India indicating inter-assay, dietary and geographical differences.(13,14)

Further when we categorised the hypothyroid cases, about 93.3% of the hypothyroid pregnant women had sub-clinical hypothyroidism and the remaining had overt hypothyroidism. Both overt and subclinical hypothyroidism have unfavourable outcomes in pregnancy and development of foetus. (15) While guidelines of diagnosis and treatment of overt hypothyroidism is well established, the diagnosis and treatment for subclinical hypothyroidism remains controversial as TSH and fT4 level estimations exhibit inter-assay differences and can be influenced by ethnicity, maternal age, weight and smoking habits. (16)

The anti-TPO antibody screening was done for all the pregnant mothers having thyroid dysfunction and it was found that 8 subjects out of the total 157 patients with deranged thyroid function were anti-TPO positive. Many studies have been done to reveal relation of thyroid autoimmunity with dietary iodine uptake.(17) It has been postulated that more

than adequate iodine uptake may lead to higher prevalence of thyroid autoimmunity(18)

In our study, prevalence of IDA among hypothyroid mothers were 36.4% in comparison to 33.1 % in non-hypothyroid mothers. Apart from nutritional deficiencies, normocytic anaemia may develop in hypothyroid states due to lack of erythropoiesis. Normochromic anaemia has been found to be the most common anaemia in hypothyroidism.(19) Anemia in hypothyroidism can be normochromic normocytic, hypochromic microcytic, and macrocytic.(14)

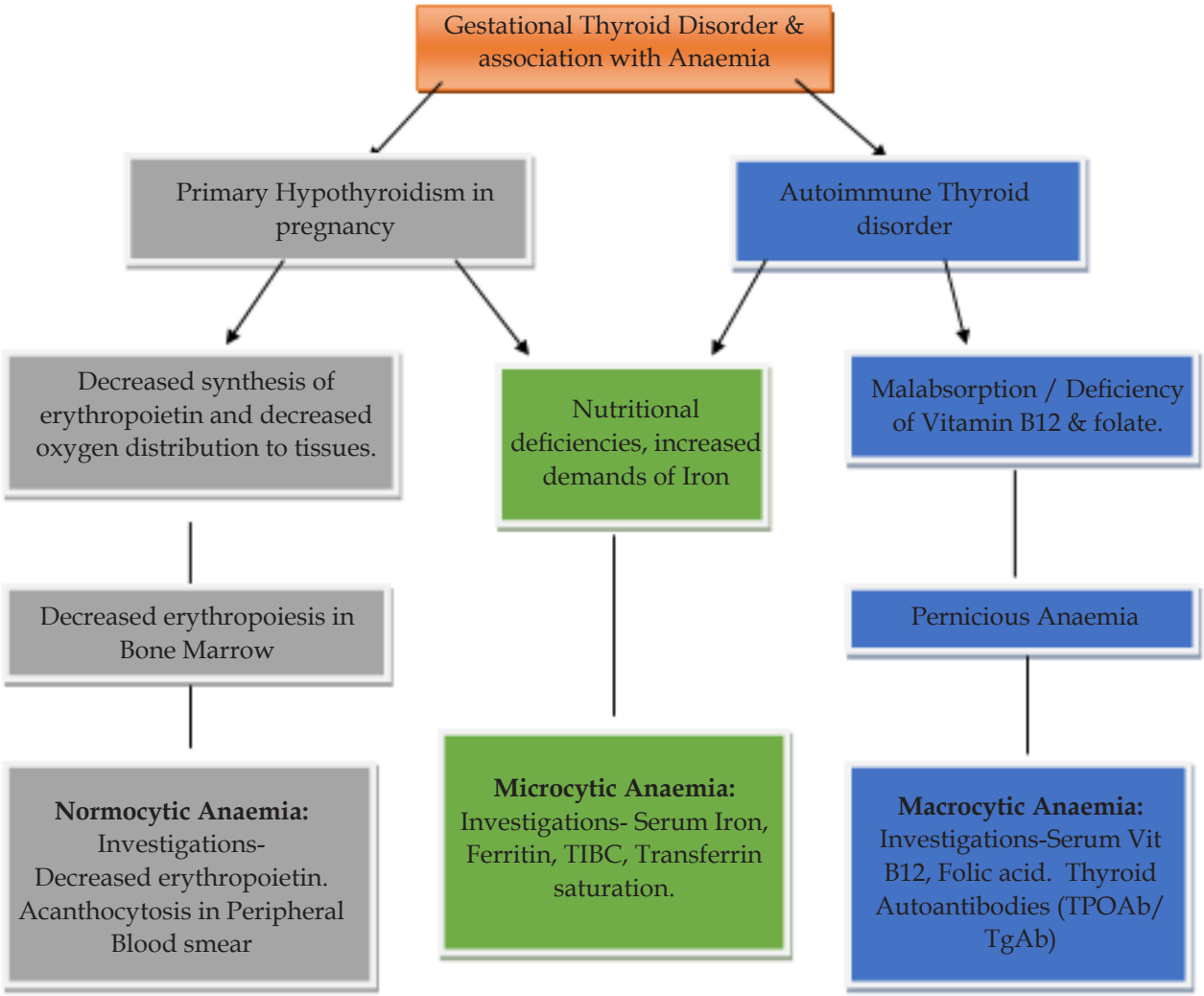

Figure 2: Shows the pathophysiology and different anaemia associated with gestational thyroid disorders.

A study done by Singh et al, concluded that the prevalence of anemia in hypothyroid pregnant patients was 69.95%, highlighting need for appropriate strategies to prevent and treat anaemia. In their study, dimorphic anaemia was most common among hypothyroid pregnant women.(20) Autoimmune thyroid disorders during pregnancy have been associated with various maternal as well as fetal complications.(21) In a meta-analysis done in 2020, indicated that TPOAb-positive pregnant women have increased risk of anemia.(22) Association have been found between autoimmune thyroid disorders and pernicious anaemia.(4) Pregnancy is a physiological state with increased metabolic demands. Most of Indian women already carry the burden of nutritional deficiencies most importantly Iron deficiency. The demand of iron, folic acid, vitamin B12, iodine further increases during pregnancy. Thyroid dysfunction being the most common gestational endocrinal disorder may

affect the severity of anaemia. Autoimmune thyroid dysfunctions is an important pathology of thyroid dysfunction in pregnancy

Conclusion

In present study, the high prevalence of hypothyroidism among pregnant women highlights the importance of screening thyroid disorders in gestation in various stages. Screening of thyroid auto-antibodies should be done in all thyroid dysfunctions. Since thyroid disorders can increase the severity of anaemia in pregnancy, early detection and correction of anaemia should be done. Guidelines to treat anaemia in both hypothyroid and euthyroid states should be followed.

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References

1. Van Raaij JM, Vermaat-Miedema SH, Schonk CM, Peek ME, Hautvast JG. Energy requirements of pregnancy in The Netherlands. Lancet. 1987; 2: 953-5.
2. Nambiar V, Jagtap VS, Sarathi V, Lila AR, Kamalanathan S, Bandgar TR, et al. Prevalence and impact of thyroid disorders on maternal outcome in Asian Indian pregnant women. J Thyroid Res. 2011; 2011: 4290-7.
3. Sahu MT, Das V, Mittal S, Agarwal A, Sahu M. Overt and subclinical thyroid dysfunction among Indian pregnant women and its effect on maternal and fetal outcome. Arch Gynecol Obstet. 2010; 281: 215-20
4. Szczepanek-Parulska E, Hernik A, Ruchała M. Anaemia in thyroid diseases. Pol Arch Intern Med. 2017 May 31;127(5):352-360. doi: 10.20452/pamw.3985. Epub 2017 Mar 28. PMID: 28400547.
5. Gianoukakis AG, Leigh MJ, Richards P, et al. Characterization of theanaemia associated with Graves' disease. ClinEndocrinol (Oxf). 2009; 70:781-787.
6. Khatiwada S, Gelal B, Baral N, Lamsal M. Association between ironstatus and thyroid function in Nepalese children. Thyroid Res. 2016; 9: 2.
7. Cuschieri S. The STROBE guidelines. Saudi J Anaesth. 2019 Apr;13(Suppl 1):S31-S34. doi: 10.4103/sja.SJA_543_18. PMID: 30930717; PMCID: PMC6398292.
8. TriptiSaxena, Pawan Kumar kare, Haresingh Makwane, ChiragGarg et al. Thyroid Dysfunction among Pregnant Women during Different Trimesters of Pregnancy: A Tertiary Care HospitalBased Observational Study. National Journal of Laboratory Medicine. 2020 Jul, Vol-9(3): BO01-BO05
9. Lazarus J, Brown RS, Daumerie C, et al. 2014 European thyroid association guidelines for the management of subclinical hypothyroidism in pregnancy and in children. EurThyroid J 2014;3(2):76–94
10. Stagnaro-Green A, Abalovich M, Alexander E, Azizi F, Mestman J, Negro R, et al. Guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and postpartum. Thyroid. 2011; 21(10): 1081-125.
11. American College of Obstetricians and Gynecologists. ACOG practice bulletin no.95: anemia in pregnancy. Obstet Gynecol. 2008;112(1):201–207.
12. Dhanwal D, Bajaj S, Rajput R, Subramaniam KAV, Chowdhury S, Bhandari R, et al. Prevalence of hypothyroidism in pregnancy: An epidemiological study from 11 cities in 9 states of India. Indian Journal of Endocrinology and Metabolism. 2016;20(3):387.
13. Nidhi J, Melse-Boonstra A, Thomas T, Basavaraj C, Sharma SK, Srinivasan K, et al. High prevalence of maternal hypothyroidism despite adequate iodine status in Indian pregnant women in the first trimester. Thyroid. 2014;24(9):1419-29.
14. Agrawal U, Shrivastava P, Shrivastava S. Hypothyroidism and anaemia in pregnancy. Int J Adv Med. 2016;3(4):851-54.

15. De Groot L, Abalovich M, Alexander EK, et al. Management of thyroid dysfunction during pregnancy and postpartum: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2012;97(8):2543-2565
16. Gietka-Czemel M, Glinicki P. Subclinical hypothyroidism in pregnancy: controversies on diagnosis and treatment. Pol Arch Intern Med. 2021;131:266-275.
17. Papanastasiou L, Vatalas IA, Koutras DA, et al. Thyroid autoimmunity in the current iodine environment. Thyroid 2007;17:729-39
18. Shi X, Han C, Li C, et al. Optimal and safe upper limits of iodine intake for early pregnancy in iodine-sufficient regions: a cross-sectional study of 7190 pregnant women in China. J Clin Endocrinol Metab 2015;100:1630-8
19. Khadija M'RB, Aubert CE, Coslovsky M, Collet TH, Baumgartner C, den Elzen WPJ, et al. Thyroid dysfunction and anaemia in a large population-based study. Clin Endocrinol (Oxf). 2016;84(4):627-31.
20. Singh N, Mani P, Yadav L,Naresh N. Study of anemia in hypothyroid pregnant patients. Int J Reprod Contracept Obstet Gynecol2020;9:1686-90.
21. De Leo S, Pearce EN. Autoimmune thyroid disease during pregnancy. Lancet Diabetes Endocrinol. 2018 Jul;6(7):575-586.
22. Yang Y, Hou Y, Wang H, Gao X, Wang X, Li J, Teng W, Shan Z. Maternal Thyroid Dysfunction and Gestational Anemia Risk: Meta-Analysis and New Data. Front Endocrinol (Lausanne). 2020 Apr 15;11:201.