International Journal of Medical Science and Education
pISSN- 2348 4438 | eISSN-2349-3208
Published by Association for Scientific and Medical Education (ASME)
Int.J.Med.Sci.Educ. July-Sept. 2019; 6(3):113-119
Available Online atwww.ijmse.com
Original Research Article

A SINGLE CENTER OBSERVATIONAL STUDY TO ASSESS THE PREVALENCE OF THYROID DISORDERS DURING PREGNANCY AND THEIR IMPACT ON MATERNAL AND FETAL OUTCOMES

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Received:10/07/2019 ***Revised:20/09/2019*** ***Accepted:25/09/2019***

ABSTRACT

Background: Thyroid disorders can silently affect pregnant women and their babies, causing serious problems, weaving intricate threads that affect both the bearer of life and the life within. The role of thyroid function in pregnancy emerges as a critical axis upon which maternal and fetal well-being status is impacted. **Objective:** To investigate how common thyroid disorders are during pregnancy and how they affect pregnancy outcomes for both mothers and babies. **Methods:** Over the course of one year, we enrolled 400 pregnant women who were between 13 and 26 weeks into their pregnancies. **Results:** The prevalence of thyroid dysfunction was found to be 20%; prevalence of hypothyroidism was 13.25%, with 4.25% having overt hypothyroidism and 9% having subclinical hypothyroidism. Adverse maternal and neonatal outcomes, including spontaneous abortion, preterm birth, low birth weight (LBW), and intrauterine growth retardation (IUGR), were significantly more prevalent in overtly and subclinically hypothyroid women, encompassing adverse fetal outcome such as spontaneous abortion (P = 0.038), preterm delivery, LBW, and IUGR, while adverse maternal outcomes such as preeclampsia and placental abruption. Subclinical hyperthyroid status was also associated with adverse maternal and newborn outcomes. **Conclusions:** Early detection and management of thyroid disorders during pregnancy are crucial to improving pregnancy outcomes. Our findings emphasize the importance of close monitoring and timely intervention in pregnant women with thyroid dysfunction.

Keywords: thyroid disorders, Maternal health, Fetal well-being, Subclinical hypothyroidism,Low birth weight (LBW)

INTRODUCTION

Thyroid disorders can silently affect pregnant women and their babies, causing serious problems, weaving intricate threads that affect both the bearer of life and the life within**.(1)** As science continues its persistent search of understanding the complexities of human physiology, the role of thyroid function in pregnancy emerges as a critical axis upon which maternal and fetal well-being status. Through our observational research, we aim to shed light on how common thyroid disorders are and how they affect pregnancy outcomes for both mothers and babies.

During pregnancy, the thyroid gland plays a complex role similar to that of a conductor directing a symphony. Its hormones, thyroxine (T4) and triiodothyronine (T3), have a significant impact on essential physiological processes like metabolism, growth, and development. However, when thyroid function becomes irregular, it can lead to disorders such as hypothyroidism, hyperthyroidism, or autoimmune thyroiditis, disrupting the balance and harmony required for a healthy pregnancy**.(2)**

The prevalence of thyroid disorders in pregnancy casts a shadow over the global landscape of maternal health, affecting women across diverse geographical and socioeconomic spectra. Epidemiological studies have underscored the substantial burden of thyroid dysfunction, with estimates suggesting a prevalence ranging from 2% to 5% for hypothyroidism and up to 0.5% for hyperthyroidism during gestation**.(3)** Despite its pervasive presence, thyroid disorders often lurk unnoticed, their subtlety concealing their potential to sow seeds of adverse outcomes.

The impacts of unchecked thyroid dysfunction reach far beyond the mother's health, affecting the growing fetus nestled within the protective confines of the womb. Thyroid hormones play a vital role in shaping the neurological development of the fetus, influencing cognitive function and neurological well-being. When maternal thyroid disorders disrupt this delicate process, it sets off a chain reaction of consequences, including cognitive issues, restricted fetal growth, premature birth, and, in severe cases, neonatal death**.(4)**

The connection between a mother's thyroid health and the well-being of her offspring goes beyond simple statistical associations, delving into the core of intergenerational health**.(5)** Research has shed light on the relationship between maternal thyroid problems and an increased likelihood of neurodevelopmental disorders in children, revealing a complex interplay where the effects of maternal physiology ripple through generations**.(6,7)**

As the risks associated with thyroid disorders during pregnancy gain attention, there's a growing discussion about screening pregnant women for thyroid issues. While some studies suggest that screening for hypothyroidism is worth the cost, there's still a need for more evidence on its effectiveness **(8-11).** Therefore, our goal is to investigate how common thyroid problems are during pregnancy and how they affect pregnancy outcomes.

MATERIALS AND METHODS:

Our study was conducted in Department of Obstetrics and Gynecology at American International Institute of Medical Sciences, Udaipur, India. Before commencing our research, we obtained ethical approval from the hospital's committee and ensured that all participants provided informed consent.

Over the course of one year, we enrolled total of 400 pregnant women who were between 13 and 26 weeks into their pregnancies. We specifically selected participants who were in good health, with singleton pregnancies and no other medical conditions. Those with multifetal gestation or known thyroid/metabolic disorders, such as diabetes or hypertension, were excluded from the study.

Each participant underwent a standard series of assessments, including history-taking, clinical examination, and routine antenatal investigations. Additionally, we collected serum samples from each participant to measure various thyroid hormones, including T3, T4, TSH, and anti-TPO antibody levels. These samples were collected alongside other routine investigations to ensure convenience and minimal disruption for the participants.

To interpret the thyroid function test results, we referred to the 2011 Guidelines of the American Thyroid Association for the Diagnosis and Management of Thyroid Disease during pregnancy. These guidelines provided specific reference ranges for TSH levels during each trimester of pregnancy. We also opted for free T4 measurement over direct immunoassay of total T4 due to the potential impact of pregnancy-related alterations in serum proteins.

Our statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS-20). For comparisons between groups, we utilized Fischer's exact test, especially when the number of measures in one group was less than five. Continuous variables were presented as mean±SD and analyzed using unpaired, two-tailed student's t-test. Through these analyses, we sought to uncover any associations between thyroid function and maternal/fetal outcomes.

RESULTS

In our study, we categorized all patients based on their thyroid function. Out of the total 400 patients, 80 (20%) showed abnormalities in their thyroid function, resulting in a prevalence of thyroid dysfunction of 20%. The prevalence of hypothyroidism was found to be 13.25%, with 4.25% having overt hypothyroidism and 9% having subclinical hypothyroidism. Conversely, hyperthyroidism had a prevalence of 6.75%, where 3% had overt hyperthyroidism and 3.75% had subclinical hyperthyroidism.

We conducted Anti-TPO antibody tests in patients with abnormal TSH levels, revealing positive results in 58% of hypothyroid patients. Interestingly, no anti-TPO antibodies were detected in hyperthyroid patients.

Maternal age appeared to be higher in cases of overt hypothyroidism and overt hyperthyroidism. Our study also noted variations in mean BMI across different thyroid conditions. Euthyroid patients had a mean BMI of 22.05, while subclinical hypothyroid patients had a mean BMI of 24.20. Overt hypothyroid patients exhibited the highest mean BMI of 26.50, whereas subclinical hyperthyroid patients had a mean BMI of 20.80, and overt hyperthyroid patients had a mean BMI of 22.20.

The prevalence of anemia is highest among the subclinical hypothyroidism group (19.44%), followed by

the euthyroid group (17.50%). Overt hypothyroidism and subclinical hyperthyroidism groups also exhibit significant rates of anemia (11.76% and 6.67%, respectively), while the overt hyperthyroidism group shows a slightly higher prevalence (16.67%).

Table 1: Obstetrical variables in the antenatal period

Type	Age Mean±SD	BMI Mean ±SD
Euthyroid (N=320)	25.10 ± 4.20	22.05 ± 3.5
Subclinical hypothyroidism (N=36)	27.50 ± 3.90	24.20 ± 2.2
Overt hypothyroidism (N=17)	30.20 ± 5.30*	26.50 ± 1.9*
Subclinical hyperthyroidism (N=15)	28.00 ± 2.60	20.80 ± 0.15
Overt hyperthyroidism (N=12)	31.80 ± 1.40*	22.20 ± 1.8*

***P≤0.05**

Subclinical hypothyroidism demonstrates the highest prevalence of preeclampsia (41.67%), followed by the euthyroid group (11.88%). Overt hypothyroidism groups show a similar incidence rate (11.76%), while no cases were reported in subclinical hyperthyroidism and the overt hyperthyroidism group.

Overt hypothyroidism group exhibits the highest incidence of abruption (11.76%), followed by subclinical hypothyroidism (5.56%). The euthyroid group had lesser incidence (3.13%) and other hyperthyroid disorder groups do not show cases of abruption.

The overt hyperthyroidism group has the highest prevalence of GDM (26.67%), followed by the Overt hypothyroidism group (5.88%). The Subclinical hypothyroidism and euthyroid groups also report cases of GDM, albeit at lower rates.

Subclinical hypothyroidism group has the highest incidence of PPH (13.89%), followed by the Overt hypothyroidism group (5.88%). Euthyroid group also report some cases (1.25%) of PPH, while no cases were reported in the Subclinical hyperthyroidism and overt hyperthyroidism group.

The prevalence of mode of delivery varies among the different thyroid disorder groups. In the Euthyroid group, the majority of deliveries were normal delivery (Vaginal) (92.81%), followed by Cesarean Section (C-section) (5.63%), Vacuum Extraction (0.31%), and Forceps Delivery (0.63%).

For Subclinical Hypothyroidism, the predominant mode of delivery was Normal Delivery (Vaginal) (63.89%)*, followed by Cesarean Section (C-section) (27.78%), and Vacuum Extraction (5.56%). In the Overt Hypothyroidism group, the majority of deliveries occurred through Cesarean Section (C-section) (52.94%)*, followed by Normal Delivery (Vaginal) (47.05%).

For Subclinical Hyperthyroidism, all deliveries were Normal Delivery (Vaginal) (100.00%). In the Overt Hyperthyroidism group, the majority of deliveries were Normal Delivery (Vaginal) (83.33%), followed by Cesarean Section (C-section) (16.67%). The table 3 provides insights into the prevalence of different modes of delivery across various thyroid disorder groups.

Table 2: Maternal complications in different groups

Maternal Complications	Euthyroid N% = 320	Subclinical hypothyroidism N% = 36	Overt hypothyroidism N% = 17	Subclinical hyperthyroidism N% = 15	Overt hyperthyroidism N% = 12
Anemia	56 (17.50)	7 (19.44)	2 (11.76)	1 (6.67)	2 (16.67)
Preeclampsia	38 (11.88)	15 (41.67)*	2 (11.76)	0	0
Abruption	10 (3.13)	2 (5.56)	2 (11.76)*	0	0
GDM	6 (1.88)	2 (5.56)	1 (5.88)	0	4 (26.67)*
PPH	4 (1.25)	5 (13.89)	1 (5.88)	0	0

Table 3. Mode of Delivery in different groups

Mode of Delivery	Euthyroid N% = 320	Subclinical Hypothyroidism N% = 36	Overt Hypothyroidism N% = 17	Subclinical Hyperthyroidism N% = 15	Overt Hyperthyroidism N% = 12
Normal Delivery (Vaginal)	297 (92.81%)	23 (63.89%)*	8 (47.05%)	15 (100.00%)	10 (83.33%)
Cesarean Section (C-section)	18 (5.63%)	10 (27.78%)	9 (52.94%)*	0 (0.00%)	2 (16.67%)
Vacuum Extraction	1 (0.31%)	2 (5.56%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
Forceps Delivery	2 (0.63%)	1 (2.78%)	0 (0.00%)	0 (0.00%)	0 (0.00%)

Table 4. Fetal Outcomes in different groups

Fetal Outcomes	Euthyroid N% = 320	Subclinical hypothyroidism N% = 36	Overt hypothyroidism N% = 17	Subclinical hyperthyroidism N% = 15	Overt hyperthyroidism N% = 12
Preterm birth	18 (5.63)	17 (47.22)*	7 (41.18)*	0	0
IUGR	12 (3.75)	5 (13.89)	5 (29.41)*	0	0
LBW	40 (12.50)	12 (33.33)*	15 (88.23)*	0	0
Abortions	9 (2.81)	2 (5.56)	2 (11.76)*	2 (13.33)	1 (12.50)
Still Births	4 (1.25)	0	1 (5.88)*	0	0

Table.5 Neonatal Outcomes in different groups

Neonatal Outcomes	Euthyroid N% = 320	Subclinical hypothyroidism N% = 36	Overt hypothyroidism N% = 17	Subclinical hyperthyroidism N% = 15	Overt hyperthyroidism N% = 12
Respiratory distress syndrome	16 (5.00%)	6 (16.67%)	3 (17.65%)	0 (0%)	0 (0%)
Sepsis	8 (2.50%)	2 (5.56%)	1 (5.88%)	0 (0%)	0 (0%)
Hypoglycemia	3 (0.94%)	2 (5.56%)	0 (0%)	0 (0%)	0 (0%)
Hypothermias	3 (0.94%)	2 (5.56%)	0 (0%)	0 (0%)	0 (0%)
Intracranial bleed	3 (0.94%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Necrotizing enterocolitis	1 (0.31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Early neonatal death	6 (1.88%)	2 (5.56%)	0 (0%)	0 (0%)	0 (0%)

***P≤0.05**

Table.6 The association between Thyroid Autoimmune Disease (TAI) patients and the corresponding miscarriage rates.

TAI (Thyroid Autoimmune Disease) among hypothyroidism N=53	Miscarriage Rate
Absent=22	1 (9.09%)
Present=31	12 (38.7%)

The rate of cesarean section was notably elevated among patients with overt hypothyroidism (P = 0.0031) compared to the euthyroid controls. However, no substantial rise was observed in the subclinical hypothyroid and hyperthyroid groups. Notably, cesarean sections for fetal distress emerged as the most prevalent indication across all groups.

Adverse fetal outcomes were significantly more prevalent in overt hypothyroidism group compared to euthyroid women, encompassing spontaneous abortion (P = 0.038), preterm birth (P = 0.03), low birth weight (LBW), intrauterine growth retardation (IUGR) (P = 0.01), and fetal death (P = 0.030). Similarly, adverse fetal outcomes in subclinical hypothyroidism included spontaneous abortion, preterm delivery, LBW, and IUGR in comparison to euthyroid women, with preterm birth exhibiting statistical significance (P = 0.01). Subclinical and overt hyperthyroidism groups also had adverse fetal outcomes; however only spontaneous abortion was noted in present study.

DISCUSSION

The study examined the prevalence and impact of thyroid dysfunction on maternal and neonatal outcomes. Thyroid dysfunction was observed in 20% of the study population, with hypothyroidism prevalent in 13.25% and hyperthyroidism in 6.75%. This underscores the importance of thyroid function assessment in prenatal care.

Thyroid disorders represent a prevalent endocrine issue among pregnant women, exerting significant impacts on both maternal and fetal well-being throughout gestation. However, timely identification and management of thyroid dysfunction during pregnancy can substantially improve outcomes.**(12)**

Early detection of thyroid disorders during pregnancy is feasible through routine thyroid function testing during initial prenatal consultations or promptly after pregnancy confirmation.**(13)** The debate over the upper limit of normal thyroid-stimulating hormone (TSH) levels during pregnancy has been ongoing. Recent guidelines set forth by the American Thyroid Association (ATA) and the National Association of Clinical Biochemists (NACB) have narrowed this threshold to 2.5 mIU/L in the first trimester and 3.0 mIU/L in subsequent trimesters. This adjustment is rooted in research demonstrating that the vast majority of rigorously screened euthyroid individuals exhibit TSH levels within the range of 0.4 to 2.5 mIU/L.**(14)**

The revised guidelines consequently expand the diagnostic criteria for hypothyroidism during pregnancy, potentially increasing its prevalence by up to fivefold. Notably, the prevalence of hypothyroidism in pregnancy varies widely across regions, ranging from 2.5% in Western populations to 11% in India.**(15)**

The findings from our study underscore the critical importance of these guidelines in clinical practice. By categorizing patients based on their thyroid function, our study revealed notable associations between thyroid dysfunction and adverse maternal and neonatal outcomes. Specifically, overt hypothyroidism was linked to complications such as preeclampsia and placental abruption, while adverse fetal outcomes, including spontaneous abortion and preterm birth, were more prevalent in hypothyroid cases compared to euthyroid women. These insights highlight the necessity of vigilant thyroid function assessment and management during pregnancy to optimize maternal and neonatal health outcomes.

In our study cohort, we observed a significantly higher miscarriage rate among individuals with Thyroid Autoimmune (TAI) conditions compared to those without (9.09% versus 38.7%), indicating a fourfold increase in miscarriage risk (Table 6). This association aligns with findings from previous research **(16-19),** suggesting that TAI serves as a potential indicator of a broader immune imbalance, potentially leading to fetal rejection **(20).** Moreover, the presence of TAI may signify underlying thyroid hormone insufficiency, attributed to the diminished functional reserve characteristic of chronic thyroiditis **(20)**. Additionally, women with thyroid antibodies tend to conceive later, with an average delay of 3-4 years, rendering them more susceptible to pregnancy loss. Furthermore, within our cohort, the relatively advanced age observed among patients experiencing miscarriage could have further contributed to the heightened risk of pregnancy loss. These insights underscore the multifactorial nature of miscarriage risk in individuals with TAI and highlight the importance of comprehensive management strategies in mitigating adverse pregnancy outcomes.

Hypothyroidism is implicated in the constriction of vascular smooth muscles in both systemic and renal vessels, leading to elevated diastolic pressure, increased

peripheral vascular resistance, and reduced tissue perfusion. This mechanism may underlie the pathophysiology of preeclampsia in individuals with hypothyroidism, as evidenced by previous research **(21-22).** Moreover, thyroid dysfunction has been linked to proteinuria, resulting in excessive excretion of thyroxine and thyroid-binding globulins. In rare cases, severe proteinuria may lead to losses of thyroid-binding globulins and thyroxine that cannot be adequately compensated by the body **(23-25).**

The association between hypothyroidism and low birth weight (LBW) can be attributed to its correlation with preeclampsia. Insufficient fetal thyroxine levels may disrupt the development of the pituitary-thyroid axis in the newborn, affecting fetal pituitary growth hormone secretion, vascular responsiveness and maturation, as well as cardiovascular homeostasis during intrauterine development **(26,27).** These factors contribute to the observed phenomenon of reduced neonatal birth weight in offspring born to mothers with poorly controlled hypothyroidism, either at the initial presentation or during the third trimester. In our study, LBW was observed in 50.9% of women with hypothyroidism, compared to a 20% prevalence reported in another study **(28-29).** These findings emphasize the significance of effective management of hypothyroidism during pregnancy to mitigate adverse fetal outcomes such as LBW.

Limitation of the above study includes a relatively small sample size and a single-center design, limiting the generalization of the findings. Additionally, the retrospective nature of the study may introduce bias due to incomplete medical records or unaccounted confounding variables.

CONCLUSION

Our study highlights the significant impact of thyroid dysfunction on maternal and fetal outcomes during pregnancy. Early detection and management of thyroid disorders are crucial to improving pregnancy outcomes. Our findings emphasize the importance of close monitoring and timely intervention in pregnant women with thyroid dysfunction. Further research is needed to explore the underlying mechanisms and to develop effective strategies for the management of thyroid disorders in pregnancy. These insights can inform clinical practice and contribute to better maternal and fetal health outcomes.

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How to cite this article: Sheth J.M., Bhagat B.H. A single center observational study to assess the prevalence of thyroid disorders during pregnancy and their impact on maternal and fetal outcomes. Int.J.Med.Sci.Educ 2019;6(3): 113-119.