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Original Research Article

COMPREHENSIVE ANALYSIS OF THYROID DISORDERS IN PREGNANCY: EXPLORING DISTRIBUTION, CLINICAL FEATURES, INVESTIGATIONS, AND TREATMENT

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Abstract

Background: Thyroid disorders are critical concerns during pregnancy, impacting maternal and fetal well-being. The primary objective of this study is to examine the occurrence of thyroid disorders among pregnant women in India, focusing on their clinical manifestations and treatment approaches. **Materials and Methods:** A cohort of 200 pregnant women was meticulously evaluated. Their thyroid hormone levels were assessed, and clinical symptoms were analyzed. The prevalence of hypothyroidism and hyperthyroidism, along with subclinical and overt forms, was determined. **Result:** Hypothyroidism was detected in 88.50% of cases, with subclinical hypothyroidism being the predominant subtype. Hyperthyroidism was identified in 11.50% of cases, primarily categorized as primary hyperthyroidism. The analysis highlights distinctive symptom profiles in hypothyroidism and hyperthyroidism during pregnancy. Hypothyroidism is marked by prevalent hairfall (67.79%) and irregular menses (15.26%), while hyperthyroidism shows prominent tremors (69.56%) and tachycardia (78.26%). **Conclusion:** This study contributes valuable insights into the prevalence and clinical presentation of thyroid disorders during pregnancy. The findings highlight the importance of timely diagnosis and appropriate management.

INTRODUCTION

Thyroid disease stands as one of the most prevalent and consequential endocrine challenges faced by pregnant women, exerting a profound impact on maternal health and fetal development.[1] Worldwide, thyroid disorders pose a substantial concern during pregnancy. In the specific context of India, around 11% of pregnant individuals are affected by thyroid dysfunction, highlighting the widespread impact of this issue.[2,3] Within this spectrum of disorders, the leading cause arises from inherent irregularities in the thyroid gland. This results in hypothyroidism, a condition marked by insufficient synthesis of essential thyroid hormones.[4] In industrially advanced countries, Hashimoto's thyroiditis emerges as the principal etiological agent underlying thyroid dysregulation.[5] In regions facing socio-economic challenges, the scarcity of iodine becomes a primary factor influencing thyroid disorders. Iodine scarcity hampers the production of essential thyroid hormones, crucial for bodily functions. During pregnancy, the maternal thyroid gland, a highly adaptable organ, undergoes significant changes. It grows by up to 10% to cope with the increased demands of pregnancy, primarily due to elevated estrogen levels. This growth is facilitated by higher levels of thyroid binding globulin, a protein influenced by estrogen. Consequently, the production of thyroid hormones and the body's need for iodine both increase by approximately 50%.

In the context of women with limited thyroid reserves, pregnancy acts as a significant physiological stressor, capable of revealing underlying thyroid abnormalities. The pituitary gland, functioning as the chief regulator of thyroid activity, manages this complex process by releasing thyroid-stimulating hormone (TSH). Within the bloodstream, thyroid hormones, primarily thyroxine (T4), exist in two distinct states: bound and unbound. Carrier proteins trap the bound T4, leading to its sequestration, whereas the unbound form, known as free T4, circulates throughout the body, interacting with various tissues. Clearly, the earliest signs of thyroid irregularities become apparent within the realm of T4 dynamics.[6]

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During pregnancy, the placenta, a crucial player in the intricate process of gestation, produces a hormone called human chorionic gonadotropin (hCG).[7] This hormone, present in significant amounts throughout pregnancy, has a specific affinity for thyroid-stimulating hormone (TSH). Intriguingly, in the early trimester, elevated hCG levels, exceeding 200,000, can significantly boost the production of thyroid hormones (T4 and T3). Paradoxically, this increase in hCG levels inhibits the pituitary gland's secretion of TSH, leading to symptoms resembling hyperthyroidism in some cases.

The thyroid gland plays a vital role in nurturing placental growth and orchestrating the development of the nervous system in fetus. It establishes the foundation for crucial processes like neuronal migration, cell communication, and the formation of myelin sheath. However, when thyroid function falters, it can disrupt these processes, potentially leading to issues such as restricted fetal growth, fetal distress, and hindered brain development. Recognizing the crucial reliance on fetal thyroid hormones, especially in the early trimester, emphasizes the need for timely intervention. Administering thyroxine, a key thyroid hormone, during this critical period can address the challenges posed by thyroid disorders. This intervention has the potential to prevent delays in the baby's neural development.

This research serves as a call for understanding and action, aiming to uncover the complexities of thyroid disorders during pregnancy and explores maternal and fetal thyroid dynamics paving the way for informed and effective management strategies. This study investigates the distribution and clinical features of thyroid disorders during pregnancy, along with exploring treatment approaches for hypothyroidism and hyperthyroidism in expectant mothers. It explores how thyroid problems can disrupt the fragile equilibrium between the mother and fetus, potentially resulting in serious complications such as miscarriage, preterm labor, and placental abruption.

MATERIALS AND METHODS

Study design, duration, site, and participants

This research employs a cohort observational study design to explore thyroid disorders during pregnancy. The study spans a duration of 1 year and is conducted at Dr. D. Y. Patil Medical College, Hospital, and Research Centre situated in Nerul, Navi Mumbai. The study participants encompass pregnant individuals selected from both the In-patient department (IPD) and Out-patient department (OPD), with their participation contingent upon obtaining written consent.

Subject Selection and sample size

The process of subject selection adhered to comprehensive inclusion and exclusion criteria. Inclusion criteria encompassed pregnant women exhibiting abnormal levels of free T3, T4, and TSH, thereby facilitating an exploration of the relationship between thyroid dysfunction and pregnancy. Additionally, pregnant females with established hypothyroidism and hyperthyroidism were included, aiming to elucidate the impact of pre-existing conditions on maternal thyroid health during gestation. The study's robustness was further fortified by a substantial sample size of 200 participants. In contrast, rigorous exclusion criteria were applied to ensure the safety and integrity of the study. Subjects with severe hypoalbuminemia, anemia, renal/hepatic/cardiac failure, sepsis, or cancer were excluded from participation.

Study Procedure

After securing written informed consent, eligible participants were enrolled based on predetermined inclusion criteria. Thyroid hormone levels were monitored during pregnancy. These hormone measurements were correlated with pre- and post-treatment clinical symptoms to illuminate potential associations. Ethical approval was obtained from the Institutional Ethics Committee before study initiation (IEC Ref. No: DYP/IECBH/2021/110). Informed consent documents, available in multiple languages, ensured participant understanding and voluntary participation, upholding ethical standards.

Parameters and Assessments

Thyroid Function Test was performed on fasting blood specimens. Blood samples were collected during fasting to prevent lipemic interference with serum TSH, T3 and T4. The patients were assessed for subclinical hypothyroidism, overt hypothyroidism and hyperthyroidism [Table 1]. Complementing these, thyroid gland ultrasonography unveiled morphological changes. Autoimmune aspects were probed through Anti TPO Antibody and Thyroid Receptor Antibody assessments.

Ludwig's Classification of Hair Fall

The methodology adopted for assessing hair loss patterns was based on Ludwig's classification, a widely recognized system used for categorizing various stages of hair fall. This classification comprises four distinct types, each representing a specific pattern of hair loss. In Type 1, individuals exhibit a presentation of generalized hair thinning, resulting in an overall reduction in hair density. Type 2 involves global diffuse thinning, where hair loss is distributed more uniformly across the scalp. Type 3 is characterized by frontal and temporal hairline recession. The final stage, Type 4, signifies scarring alopecia, with discernible hair thinning and bald patches due to irreversible follicular damage.

RESULTS

The prevalence of hypothyroidism and hyperthyroidism among pregnant individuals was investigated and documented. Of 200 patients, hypothyroidism was observed in 177 individuals, constituting 88.50% of the studied cohort. In contrast,

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hyperthyroidism was noted in 23 patients, representing 11.50% of the total population under investigation. The analysis of thyroid disorders during pregnancy revealed distinct patterns in age, trimester, and types [Table 2]. Among hypothyroidism cases, the 20-25 years age group exhibited a prevalence of 60.46%, aligned with hyperthyroidism cases at 60.87%. The 26-30 years age group showed rates of 33.90% (hypothyroidism) and 34.79% (hyperthyroidism), while those aged 31 and above accounted for 5.64% (hypothyroidism) and 4.35% (hyperthyroidism). Considering trimesters, the 1st trimester had the highest prevalence for both hypothyroidism (50%) and hyperthyroidism (35%), followed by the 2nd trimester with rates of 29% (hypothyroidism) and 22% (hyperthyroidism). In the 3rd trimester, hypothyroidism cases constituted 21%, while hyperthyroidism cases surged to 43%. When categorized by type, subclinical hypothyroidism exhibited the highest prevalence among hypothyroidism cases, at 60%, followed by overt hypothyroidism at 40%. Primary hyperthyroidism accounted for 100% of hyperthyroidism cases.

Significant findings emerged from the analysis of chief complaints and their frequencies among hypothyroidism and hyperthyroidism subjects [Table 3]. In hypothyroidism cases, oedema affected 54.24%, irregular menses 15.26%, and varying hairfall types distributed as follows: Type 1 (67.79%), Type 2 (27.68%), and Type 3 (4.51%). Constipation was present in 69.49%, and weight gain exceeding 12.5 kg was observed in all cases. Among hyperthyroidism cases, 21.73% exhibited exophthalmus, 69.56% experienced tremors, and varying hairfall types were noted: Type 1 (21.74%), Type 2 (21.73%), and Type 3 (56.52%). Tachycardia was prevalent in 78.26%, and 60.86% displayed heat intolerance.

The comparative analysis of thyroid conditions between patients with hypothyroidism and hyperthyroidism unveiled significant insights [Table 4]. Among patients with hypothyroidism, 15.25% were known cases, with 84.75% newly diagnosed. The known cases were distributed across different durations, with 59.26% within 0-1 year, 29.76% within 1-2 years, and 11.12% for 2 years and above. Ultra-sonography findings showed 18.64% with thyroiditis and 81.36% without. Additionally, 39.54% had the presence of Anti TPO Antibody. In contrast, among patients with hyperthyroidism, 8.69% were known cases, and 91.31% were newly diagnosed. The known cases were distributed as 8.69% within 1 year and 91.31% as newly detected hyperthyroidism. Ultra-sonography findings indicated 30.44% with hyper-echoic gland and heterogeneous echotexture, while 69.56% had normal findings. Furthermore, 43.47% presented with Anti TSH Receptor antibody.

Table 1: Thyroid parameter reference ranges during pregnancy

Thyroid Parameter	Normal Range	Subclinical Hypothyroidism	Overt Hypothyroidism	Hyperthyroidism
TSH (µIU/ml)	0.3 - 5.5	> 5.5	> 5.5	< 0.3
T4 (nmol/L)	3.2 - 12.6	3.2 to 12.6	< 3.2	> 12.6
T3 (nmol/L)	0.62 - 1.8	0.62 - 1.8	< 0.62	> 1.8
Free T3 (pmol/L)	2.3 - 4.2	2.3 - 4.2	< 2.3	> 4.2
Free T4 (pmol/L)	0.8 - 1.7	0.8 - 1.7	< 0.8	> 1.7

Table 2: Thyroid disorders in pregnancy: Age, trimester, and type distribution

	Hypothyroidism Patients	Hyperthyroidism Patients	Total Patients
Age Group			
20-25 Years	107 (60.46%)	14 (60.87%)	121 (60.80%)
26-30 Years	60 (33.90%)	8 (34.79%)	68 (34.17%)
31 & above	10 (5.64%)	1 (4.35%)	11 (5.53%)
Total	177 (100%)	23 (100%)	200 (100%)
Trimester			
1st Trimester	88 (50%)	8 (35%)	96 (48.00%)
2nd Trimester	37 (29%)	5 (22%)	42 (21.00%)
3rd Trimester	52 (21%)	10 (43%)	62 (31.00%)
Total	177 (100%)	23 (100%)	200 (100%)
Types			
Euthyroid	0 (0%)	-	0 (0%)
Subclinical Hypothyroid	106 (60%)	-	106 (53.00%)
Overt Hypothyroid	71 (40%)	-	71 (35.50%)
Primary Hyperthyroidism	-	23 (100%)	23 (11.50%)
Total	177 (100%)	23 (100%)	200 (100%)

Table 3: Chief complaints and its frequency observed in subjects with hypothyroidism and hyperthyroidism

Chief Complaints	Hypothyroidism	Chief Complaints	Hyperthyroidism
Oedema		Exophthalmus	
Absent	96 (54.24%)	Absent	18 (78.26%)
Present	81 (45.76%)	Present	5 (21.73%)
Irregular Menses		Tremors	
Absent	150 (84.74%)	Absent	7 (30.43%)

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Present	27 (15.26%)	Present	16 (69.56%)
Hairfall		Hairfall	
Type 1	120 (67.79%)	Type 1	5 (21.74%)
Type 2	49 (27.68%)	Type 2	5 (21.73%)
Type 3	8 (4.51%)	Type 3	13 (56.52%)
Bradycardia		Tachycardia	
Absent	175 (98.87%)	Absent	5 (21.73%)
Present	2 (1.1%)	Present	18 (78.26%)
Dry Skin		Moist Skin	
Absent	12 (6.7%)	Absent	-
Present	165 (93.22%)	Present	23 (100%)
Cold Intolerance		Heat Intolerance	
Absent	-	Absent	9 (39.13%)
Present	177 (100%)	Present	14 (60.86%)
Inappropriate Weight Gain > 12.5 KG	177	-	-
Constipation		-	-
Absent	54 (30.50%)	-	-
Present	123 (69.49%)	-	-

Table 4: Comparative Analysis of Thyroid Conditions in Patients: Hypothyroidism vs. Hyperthyroidism

Category	Patients with Hypothyroidism	Category	Patients with Hyperthyroidism
Duration of Known Case		Duration of Known Case	
Known Case	27 (15.25%)	Known Case	2 (8.69%)
Newly Diagnosed Cases	150 (84.75%)	Newly Diagnosed Cases	21 (91.31%)
Known Case		Known Case	
0-1 year	16 (59.26%)	Hyperthyroidism since 1 Year	2 (8.69%)
1-2 years	8 (29.76%)	Newly detected hyperthyroidism	21 (91.31%)
2 years and above	3 (11.12%)		
Ultra-Sonography Findings		Ultra-Sonography Findings	
Thyroditis present	33 (18.64%)	Hyperechoic gland with heterogenous echotexture	7 (30.44%)
Thyroditis absent	144 (81.36%)	Normal	16 (69.56%)
Anti TPO Antibody		Anti TSH Receptor Antibody	
Present	70 (39.54%)	Present	10 (43.47%)
Absent	107 (60.44%)	Absent	13 (56.53%)

DISCUSSION

A total of 200 pregnant women were enrolled in this study. Those diagnosed with hypothyroidism were initiated on levothyroxine treatment, while patients with hyperthyroid disorders received PTU during the first trimester and Carbimazole during the second and third trimesters. In the first trimester, all pregnant women underwent screening involving TSH, FT3, and FT4 assessments. Notably, the established normal TSH range, as established by a 2005 study conducted by Green WL, lies between 0.5 and 2.5 mIU/ml.[8] Therefore, instances where TSH levels exceeded 2.5 mIU/ml and/or exhibited low T4 or FT4 values during pregnancy prompted the administration of appropriate replacement therapy. This approach was aimed at ensuring optimal thyroid function during pregnancy.

The study's findings provide insights into various aspects of hypothyroidism in pregnant women. Analysis of age distribution revealed that 60.45% were within the 20-25 years group, with 33.89% aged 26-30 years, and 5.64% aged 31 years and above. These observations align with comparable studies conducted across diverse geographical locations. Notably, hypothyroidism exhibited a higher prevalence within the 20-25 years age bracket. For instance, a study by Dhanwal and collegues conducted in Delhi reported an average patient age of 25 years, further substantiating our findings.[9] Trimester distribution showed 50% in the first, 29% in the third, and 21% in the second trimester, aligning with other Indian studies. The highest patient count was observed in the 1st trimester, followed by the 3rd and 2nd trimesters in sequence in the study by Dhanwal et al. Further subclinical hypothyroidism accounted for 60% of cases, while overt hypothyroidism constituted 40%. These findings are consistent with a study, where subclinical hypothyroidism prevalence among pregnant women was 58%, and overt hypothyroidism was observed in 42%,[10] mirroring the patterns identified in our research.

Symptoms like inappropriate weight gain (>12.5%), oedema, irregular menses, hairfall (Ludwig classification), constipation, bradycardia, dry skin, and cold intolerance were assessed. We evaluated symptoms including inappropriate weight gain (>12.5%), edema, irregular menses, hair fall (Ludwig classification), constipation, bradycardia, dry skin, and cold intolerance. A study by Singh and colleague reported similar findings, demonstrating that these symptoms were seen in pregnant patients with hypothyroidism, consistent with the symptoms in non-pregnant individuals with the condition.[11]

In our study, among the participants, 15.25% had a known history of hypothyroidism, while 84.74% were newly diagnosed cases. Previous studies have reported a past history of hypothyroidism in 12% of patients in their study.[10] Notably, 39.54% of

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patients showed the presence of Anti TPO antibodies, a finding in line with other studies that reported approximately 20% prevalence. Poppe and colleagues also indicated a similar prevalence of Anti TPO antibodies (around 20%) in pregnant patients with hypothyroidism.[12]

Hyperthyroidism during pregnancy presents a unique set of challenges due to its potential impact on both the maternal and fetal well-being. In our study, the distribution of hyperthyroidism cases across trimesters revealed that the highest percentage of cases (43%) occurred during the third trimester, followed by 35% in the first trimester and 22% in the second trimester. This pattern aligns with a previous study, which reported a similar prevalence of hyperthyroidism cases being highest in the first trimester.[13]

Primary hyperthyroidism was the predominant type in our study, constituting 100% of cases. This finding was consistent with the previous study, which also reported 100% prevalence of primary hyperthyroidism.[13] Notably, the presence of common signs and symptoms of hyperthyroidism, such as exophthalmos, hair fall, tremors, tachycardia, moist skin, and heat intolerance, was observed among pregnant patients. These clinical indicators were also noted in non-pregnant patients with hyperthyroidism underscoring the consistent symptomatology across pregnancy status.[11]

Analysis of patients' past history revealed that 8.69% had a known history of hyperthyroidism, while 91.30% were newly diagnosed cases. This is in line with the study, where 7% of patients had a known case of hyperthyroidism.[13] Additionally, the duration of known hyperthyroidism cases in our study demonstrated that 8.69% had a history of hyperthyroidism for one year or more, which concurs with the findings reported by previously.[13]

Ultrasound findings exhibited a distinct pattern, with 30.43% of patients showing a hyperechoic thyroid gland with heterogenous echotexture, while 69.56% had a normal thyroid gland. This echoes the observations made by Sandhu and co-workers, who reported a prevalence of 28% for hyperechoic thyroid glands.[11] The assessment of anti-TSH receptor antibodies further contributes to diagnostic and management accuracy for hyperthyroidism. In our study, 43.47% of patients showed the presence of anti-TSH receptor antibodies, which is consistent with pervious findings of approximately 32% prevalence.[11]

Thus, our study contributes to a better understanding of thyroid disorders' prevalence, patterns, and clinical presentations in pregnant women. By shedding light on the significance of timely diagnosis and appropriate management, we emphasize the importance of incorporating thyroid screening into routine antenatal care. This holistic approach can significantly impact maternal and fetal well-being, making strides toward healthier pregnancies and improved maternal outcomes.

Limitations of the study are the single-center approach that may limit the broader applicability of findings. The relatively small sample size could affect statistical robustness. Observational design may introduce confounding variables as well.

CONCLUSION

In this study, we examined the prevalence and characteristics of thyroid disorders in pregnancy, focusing on hypothyroidism and hyperthyroidism. Our findings highlighted a higher prevalence of hypothyroidism among women aged 20-25 years, with subclinical hypothyroidism being the dominant type. Clinical symptoms such as weight gain, edema, irregular menses, hair fall, and more were consistent with prior studies. Hyperthyroidism cases primarily exhibited primary hyperthyroidism, and symptoms like exophthalmos, hair fall, tremors, and tachycardia were shared between pregnant and non-pregnant patients. This research emphasizes the significance of early detection, thorough assessment, and tailored management to ensure optimal maternal and fetal outcomes. The insights gained from this study could serve as a foundation for developing evidence-based guidelines for managing thyroid disorders during pregnancy, thereby enhancing the quality of antenatal care. Further investigations into the long-term effects of thyroid disorders on both mother and child, as well as the effectiveness of specific interventions, are warranted. This research underscores the importance of interdisciplinary collaboration between obstetricians, endocrinologists, and researchers to comprehensively address thyroid disorders in the context of pregnancy.

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