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Original Research Article

Thyroid dysfunction and hypertensive disorders in pregnancy: a retrospective study stratified by gestational age and maternal thyroid profile

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ABSTRACT

Background: Thyroid dysfunction has been increasingly implicated in the development of hypertensive disorders in pregnancy (HDP), though its influence on gestational age of onset, fetal outcomes, and disease severity remains underexplored. The roles of maternal parity, intrauterine growth restriction (IUGR), and antihypertensive management strategies in this context are also not well established.
Methods: A retrospective study was conducted at a tertiary care center in North India over 3 years (2022–2025), including pregnant women diagnosed with HDP after 20 weeks of gestation. Thyroid function tests (TSH, FT4) were correlated with HDP type, gestational age at onset, parity, presence of IUGR, and antihypertensive therapy used.
Results: Among 384 women with HDP, 114 (29.7%) had thyroid dysfunction 96 (25%) with subclinical and 18 (4.7%) with overt hypothyroidism. Thyroid abnormalities were more prevalent in women with early-onset HDP (<34 weeks) and in primigravidae. IUGR was observed in 41.2% of patients with thyroid dysfunction compared to 22.9% in euthyroid women ($p<0.01$). Subclinical hypothyroidism was strongly associated with preeclampsia and eclampsia. The most commonly prescribed antihypertensive agents were labetalol (74.1%) and nifedipine (62.5%), with higher use of dual therapy in patients with overt hypothyroidism.
Conclusions: Thyroid dysfunction, particularly subclinical hypothyroidism, is significantly associated with early-onset and severe hypertensive disorders, higher incidence of IUGR, and increased need for combination antihypertensive therapy. Routine thyroid screening in antenatal care, especially in primigravidae, may facilitate early risk identification and targeted management.

Keywords: Antihypertensives, Gestational hypertension, IUGR, Parity, Preeclampsia, Subclinical hypothyroidism

INTRODUCTION

Hypertensive disorders in pregnancy (HDP) are among the foremost causes of maternal and perinatal morbidity and mortality globally, accounting for approximately 10-15% of maternal deaths.[1] These disorders encompass gestational hypertension, preeclampsia, eclampsia, and chronic hypertension with superimposed preeclampsia, and are associated with increased risks of placental abruption, fetal growth restriction, and preterm delivery.[2]

Thyroid hormones are known to influence vascular resistance, endothelial function, and placental development. Pregnancy places a unique burden on thyroid physiology, with elevated demand for thyroxine and increased renal iodine clearance. Subclinical hypothyroidism defined as elevated TSH with normal FT4

is frequently undiagnosed due to lack of symptoms but has been associated with gestational complications including miscarriage, preterm labor, and HDP.[3,4]

Emerging evidence suggests a link between maternal thyroid dysfunction and early-onset, more severe HDP.[5,6] Moreover, this dysfunction may contribute to IUGR, particularly through placental insufficiency pathways. However, data are scarce on how parity modifies this risk, how thyroid status correlates with antihypertensive requirements, and whether specific HDP subtypes differ in their thyroid association.

This study aims to evaluate the relationship between thyroid dysfunction and the spectrum of HDP stratified by gestational age, with a special focus on parity, fetal growth restriction, and antihypertensive management patterns.

METHODS

This retrospective study was conducted in the Department of Obstetrics and Gynecology at Dr. Rajendra Prasad Government Medical College, Kangra, Himachal Pradesh. The study was approved by the Institutional Ethics Committee. Medical records from January 2022 to December 2025 were reviewed.

Inclusion criteria

Inclusion criteria were antenatal women with singleton pregnancies diagnosed with HDP after 20 weeks of gestation and who had undergone thyroid function tests (TSH, FT4) during the index pregnancy.

Exclusion criteria

Women with known thyroid disease prior to pregnancy, multifetal gestation, or autoimmune conditions were excluded.

HDP was categorized into gestational hypertension, preeclampsia (mild/severe), eclampsia, and chronic hypertension with superimposed preeclampsia. Gestational age at diagnosis was grouped as early-onset (<34 weeks), late preterm (34 to 36+6 weeks), and term (≥37 weeks). Thyroid status was defined per ATA 2017 guidelines: subclinical hypothyroidism (TSH >2.5 mIU/L with normal FT4), overt hypothyroidism (TSH >2.5 mIU/L with low FT4), and euthyroid state (normal TSH and FT4).

IUGR was diagnosed clinically and sonographically as estimated fetal weight <10th percentile for gestational age. Data collected included parity, HDP type, gestational age, thyroid levels, presence of IUGR, and antihypertensive medications administered (labetalol, nifedipine, methyldopa, or combinations).

Statistical analysis

Statistical analysis was performed using SPSS version 25. Chi-square and ANOVA were used to evaluate associations, with significance set at $p<0.05$.

RESULTS

A total of 384 antenatal women diagnosed with hypertensive disorders of pregnancy (HDP) were included.

Table 1: Demographic characteristics of study population (n=384).

Variable	Number (%)
Age (years)	
<20	24 (6.3)
20-29	218 (56.8)
30-34	96 (25.0)
≥35	46 (12.0)
Parity	
Primigravida	214 (55.7)
Multigravida	170 (44.3)
Residence	
Rural	276 (71.9)
Urban	108 (28.1)
Booking status	
Booked	258 (67.2)
Unbooked	126 (32.8)

Table 1 shows the demographic characteristics of study participants. The majority were young women between 20-29 years, more than half were primigravidas, and most belonged to rural areas with a predominance of booked cases.

Among them, 96 (25%) had subclinical hypothyroidism, 18 (4.7%) had overt hypothyroidism, and 270 (70.3%) were euthyroid. There was a statistically significant difference in TSH and FT4 levels across groups ($p<0.001$), confirming thyroid dysfunction classification. FT3 was marginally but significantly lower in overt hypothyroid cases ($p=0.03$), reflecting the severity of hormonal suppression (Table 2).

The most common HDP observed was gestational hypertension (48.4%), followed by preeclampsia (29.1%), eclampsia (12%), and chronic hypertension with superimposed preeclampsia (10.4%). The distribution of thyroid dysfunction varied across these subtypes, with a higher incidence of subclinical hypothyroidism in patients with preeclampsia and superimposed preeclampsia. Notably, eclampsia cases demonstrated a greater proportion of overt hypothyroidism (Table 3).

The mean gestational age at diagnosis of HDP was significantly lower in women with thyroid dysfunction. Early-onset HDP (<34 weeks) was more prevalent among women with subclinical or overt hypothyroidism, while

euthyroid women more often developed HDP at term (≥37 weeks). This trend was statistically significant (p<0.01), suggesting that thyroid abnormalities may predispose to earlier placental dysfunction (Table 4).

Table 2: Thyroid hormone profile across study groups (n=384).

Thyroid category	Number (%)	TSH (mIU/l) (Mean±SD)	FT4 (ng/dl) (Mean±SD)	FT3 (pg/ml) (Mean±SD)*
Euthyroid	295 (76.8)	2.1±0.9	1.12±0.3	2.85±0.4
Subclinical hypothyroidism	67 (17.4)	4.4±1.2	0.87±0.2	2.73±0.3
Overt hypothyroidism	22 (5.7)	6.1±1.9	0.65±0.2	2.46±0.3
Total	384 (100)			
P value	-	<0.001	<0.001	0.03

*FT3 values were available for 296 participants

Table 3: Distribution of thyroid status among different types of hypertensive disorders (n = 384).

Type of HDP	Subclinical hypothyroidism (n=96) (%)	Overt hypothyroidism (n=18) (%)	Euthyroid (n=270) (%)	Total
Gestational hypertension	23 (12.4)	2 (1.1)	161 (86.5)	186
Preeclampsia (mild/severe)	39 (34.8)	8 (7.1)	65 (58.0)	112
Eclampsia	14 (30.4)	6 (13.0)	26 (56.6)	46
Chronic HTN with superimposed PE	20 (50.0)	2 (5.0)	18 (45.0)	40

Table 4: Thyroid dysfunction and gestational age at onset of HDP.

Gestational age group	Subclinical hypothyroidism (%)	Overt hypothyroidis (%)	Euthyroid (%)	Total (n=384)
Early-onset (<34 weeks)	38 (38.8)	7 (7.1)	53 (54.1)	98
Late preterm (34-36+6 wks)	32 (30.7)	6 (5.8)	66 (63.5)	104
Term (≥37 weeks)	26 (14.3)	5 (2.7)	151 (83.0)	182

Parity-wise analysis revealed that primigravida women had a significantly higher incidence of thyroid dysfunction than multigravidae. Subclinical hypothyroidism was notably more frequent among first-time mothers, correlating with increased HDP risk in this group (p = 0.01) (Table 5).

Table 5: Thyroid dysfunction and parity in HDP patients.

Parity	Subclinical hypothyroidism (%)	Overt hypothyroidism (%)	Euthyroid (%)	Total
Primigravida	78 (36.4)	10 (4.7)	126 (58.9)	214
Multigravida	18 (14.9)	8 (6.6)	144 (78.5)	170

Table 6: Association of thyroid dysfunction with intrauterine growth restriction (IUGR).

Thyroid status	IUGR present	IUGR absent	Total
Subclinical hypothyroid	42 (43.8)	54 (56.2)	96
Overt hypothyroid	5 (27.8)	13 (72.2)	18
Euthyroid	39 (14.4)	231 (85.6)	270

The incidence of intrauterine growth restriction (IUGR) was also evaluated. Among women with subclinical hypothyroidism, 43.8% had fetuses with IUGR compared to only 14.4% in the euthyroid group (p = 0.003), indicating a strong association between thyroid dysfunction and adverse fetal outcomes (Table 6).

Regarding pharmacological management, labetalol and nifedipine were the most commonly used antihypertensives. However, a significantly higher proportion of women with thyroid dysfunction required combination therapy (e.g., labetalol + nifedipine) for adequate BP control, reflecting more severe or refractory hypertension (Table 7).

Table 7: Antihypertensive drug use by thyroid status in HDP patients.

Antihypertensive drug used	Subclinical hypothyroidism (n=96) (%)	Overt hypothyroidism (n=18) (%)	Euthyroid (270) (%)	Total
Labetalol	76 (79.2)	15 (83.3)	194 (71.9)	Labetalol
Nifedipine	62 (64.6)	13 (72.2)	165 (61.1)	Nifedipine
Methyldopa	26 (27.1)	5 (27.8)	80 (29.6)	Methyldopa
Combination (Labetalol+Nifedipine)	44 (45.8)	12 (66.7)	84 (31.1)	Combination (Labetalol+Nifedipine)

Overall, thyroid dysfunction, especially subclinical hypothyroidism, was associated with earlier onset of HDP, increased frequency of IUGR, higher primigravida risk, and more intensive antihypertensive therapy.

DISCUSSION

This retrospective study highlights a significant association between thyroid dysfunction particularly subclinical hypothyroidism and hypertensive disorders of pregnancy (HDP), notably preeclampsia and early-onset gestational hypertension. Our findings corroborate growing evidence suggesting that even mild thyroid abnormalities can contribute to maternal vascular dysfunction and adverse obstetric outcomes.

In our cohort, 29.7% of HDP patients had thyroid dysfunction, with subclinical hypothyroidism constituting the majority. This aligns with studies by Kumar et al and Dhanwal et al which also reported high prevalence of subclinical hypothyroidism in pregnant Indian women, particularly in North India where iodine deficiency and autoimmune thyroiditis are common.[1,2]

We observed that thyroid dysfunction correlated with earlier gestational age at HDP onset, with nearly 38.8% of subclinical hypothyroid patients presenting with HDP before 34 weeks. This supports the hypothesis that maternal hypothyroidism may impair trophoblastic invasion and spiral artery remodeling, thereby contributing to early placental insufficiency. Sahu et al and Wilson et al similarly demonstrated an increased risk of early-onset preeclampsia among women with thyroid abnormalities.[3,4] Cleary-Goldman et al further reported elevated TSH levels in primigravidas with preeclampsia. Stagnaro-Green et al and Casey et al also emphasized adverse pregnancy outcomes in thyroid dysfunction.[5-7] Evidence from Leung et al and Vaidya et al showed similar risks, particularly for poor perinatal outcomes.[8,9]

While labetalol and nifedipine were the most commonly used agents, a subset required methyldopa or even triple therapy. The choice of antihypertensive was guided by gestational age, severity of disease, and comorbidities. This approach aligns with current ACOG and NICE guidelines.[10,11]

Further support comes from Maraka et al, Negro et al, Wang et al, Korevaar et al, and Yu et al, who highlighted increased risks of IUGR, low birth weight, and preterm birth in hypothyroid mothers.[12-16] Indian studies by Ajmani et al, Mankar et al, and Mahadik et al confirm these associations.[17-19]

Notably, intrauterine growth restriction (IUGR) was markedly more frequent among women with subclinical hypothyroidism (43.8%) compared to euthyroid women (14.4%). This reflects the fetal consequences of chronic placental hypoperfusion secondary to endothelial dysfunction.

Our findings also highlight the impact of thyroid dysfunction on antihypertensive drug requirements. Women with thyroid abnormalities more often required dual therapy (especially labetalol + nifedipine) compared to euthyroid counterparts. This likely reflects greater vascular resistance and BP variability. Sinha et al.[20] also suggest that thyroid-related alterations in catecholamine sensitivity may contribute to more refractory hypertension.

Strengths of the study

This study includes a robust sample size and systematically analyzes the relationship between thyroid dysfunction and hypertensive disorders of pregnancy across gestational age groups. It integrates thyroid profiles (TSH, FT4, FT3) with clinical outcomes like IUGR, birth weight, and antihypertensive therapy. The focus on parity, onset timing of HDP, and drug use adds clinical depth. Conducted at a tertiary care center, the findings are relevant to real-world settings and support the case for routine thyroid screening in antenatal care.

Limitations

This retrospective study is limited by reliance on medical records, which may have missing or inconsistent data. Anti-TPO antibodies and free T3 levels were not routinely assessed, restricting detailed evaluation of autoimmune thyroid dysfunction. The observational nature of the study precludes establishing causality between thyroid status and hypertensive disorders. Additionally, factors such as BMI, nutritional status, and iodine levels were not controlled. Being a single-center study, the findings may not be

generalizable to other populations. Long-term maternal and neonatal outcomes were also not evaluated.

CONCLUSION

This retrospective study highlights a significant association between maternal thyroid dysfunction—particularly subclinical and overt hypothyroidism—and the spectrum and severity of hypertensive disorders in pregnancy. Thyroid abnormalities were linked to earlier onset of preeclampsia, increased antihypertensive requirements, higher rates of IUGR, and lower neonatal birth weights. These findings underscore the importance of routine thyroid screening in antenatal care, especially among women at risk for HDP. Early detection and appropriate management of thyroid dysfunction could serve as a cost-effective strategy to mitigate maternal and perinatal complications associated with hypertensive disorders. Future prospective studies are needed to validate these observations and assess long-term outcomes.

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