e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(8); 125-130

Original Research Article

Study of Thyroid Profile in Pre-Eclampsia, Eclampsia and Normal Pregnancy

Arya Prakash[1], SS Raghuvanshi[2], P Dhurvey[3*], Simmi Dube[4]

[1]MD Medicine, Junior Resident, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[2]DM, Endocrinology, Assistant Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[3]MD Medicine, Professor, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

[4]MD Medicine, Professor and Head, Department of Medicine, Gandhi Medical College, Bhopal, Madhya Pradesh, India

Received: 25-05-2024 / Revised: 23-06-2024 / Accepted: 25-07-2024

Corresponding Author: Dr. P Dhurvey

Conflict of interest: Nil

Abstract:

Background: Preeclampsia is a significant pregnancy complication characterized by hypertension and proteinuria. Thyroid dysfunction has been implicated in its pathophysiology.

Aim and Objective: To investigate the association between thyroid dysfunction and preeclampsia.

Materials and Methods: This observational study included 50 preeclamptic and 50 normotensive pregnant women. Data were collected on antenatal care weeks, blood pressure, pulse rate, random blood sugar levels, urine protein, serum TSH, T3, and T4 levels, kidney function (urea and creatinine), liver function (SGOT, SGPT, and bilirubin), and thyroid status (euthyroid, hypothyroid). Statistical analysis was performed to compare these parameters between the two groups.

Results: There was no significant difference in antenatal care weeks between the case and control groups ($P = 0.580$). Blood pressure measurements showed significantly higher systolic and diastolic pressures in the case group compared to the control group ($P < 0.001$). The pulse rate was found to be similar in both groups ($P = 0.796$). Urine protein levels were significantly higher in the case group ($P < 0.001$), indicating renal involvement. Thyroid hormone analysis revealed higher TSH and T3 levels in the case group, with TSH levels showing a significant difference ($P < 0.001$) and T3 levels also being significantly higher ($P = 0.010$). There was no notable difference in T4 levels between the groups ($P = 0.639$). Kidney and liver function tests showed no significant differences in serum urea, creatinine, SGOT, SGPT, and bilirubin levels between the case and control groups. Thyroid status analysis indicated a higher incidence of hypothyroidism in the case group ($P = 0.001$).

Conclusion: Thyroid dysfunction, particularly elevated TSH and T3 levels, is significantly associated with preeclampsia. Monitoring thyroid function during pregnancy may be crucial for managing preeclampsia and improving pregnancy outcomes. Further research with larger sample sizes and longitudinal designs is necessary to confirm these findings and explore underlying mechanisms.

Keywords: Preeclampsia, Thyroid Dysfunction, Pregnancy, Hypothyroidism, Blood Pressure.

Introduction

Thyroid function plays a crucial role in the physiological adaptations of pregnancy, influencing both maternal and fetal outcomes. [1] During pregnancy, the thyroid gland undergoes significant changes to meet the increased metabolic demands of the mother and the developing fetus. [2] These changes are carefully regulated by the interaction of thyroid hormones, human chorionic gonadotropin (hCG), and estrogen. [1, 3] However, disturbances in thyroid function during pregnancy can lead to a spectrum of complications, including adverse outcomes such as pre-eclampsia and eclampsia. [3]

Pre-eclampsia, a hypertensive disorder characterized by the onset of high blood pressure and proteinuria after 20 weeks of gestation, remains a leading cause of maternal and perinatal morbidity and mortality worldwide. [4] Eclampsia, the more severe progression of pre-eclampsia, is marked by the occurrence of seizures and is associated with even higher risks to both the mother and fetus. [5-6] Despite extensive research, the exact pathophysiology of pre-eclampsia and eclampsia remains incompletely understood, with growing evidence suggesting a possible link between thyroid dysfunction and these hypertensive disorders. [6]

Thyroid hormones, particularly thyroxine (T4) and triiodothyronine (T3), are essential for normal placental function and fetal development. [7,8] Alterations in thyroid hormone levels, such as hypothyroidism or hyperthyroidism, have been associated with various pregnancy complications, including pre-eclampsia. Several studies have reported that thyroid hormone levels, especially the levels of free T4 (fT4), thyroid-stimulating hormone (TSH), and thyroid peroxidase antibodies (TPOAb), may be altered in women with pre-eclampsia compared to those with normotensive pregnancies. [9-11] However, the results are often inconsistent, necessitating further investigation into the relationship between thyroid function and hypertensive disorders in pregnancy.

This study aims to explore and compare the thyroid profile in women with pre-eclampsia, eclampsia, and normal pregnancies. By analyzing the thyroid function in these groups, we seek to better understand the potential role of thyroid dysfunction in the pathogenesis of pre-eclampsia and eclampsia, and its implications for the management and prevention of these conditions. Understanding these relationships could lead to improved clinical outcomes through early detection and targeted interventions.

Materials and Methods

This study was a case-control observational study conducted at the Department of Medicine, Gandhi Medical College, and associated Hamidia Hospital, Bhopal. The study spanned one year, during which data were collected from pregnant women in their third trimester.

The study population consisted of two groups: the case group, comprising pregnant women diagnosed with pre-eclampsia or eclampsia, and the control group, consisting of healthy pregnant women without these conditions. A total of 100 participants were included, with 50 individuals in each group. Inclusion criteria were pregnant women in their third trimester diagnosed with pre-eclampsia or eclampsia, singleton pregnancies, and no prior history of thyroid dysfunction. Exclusion criteria were pregnant women already on thyroid medication, those with renal disease, known hypertension before pregnancy, a known seizure disorder, any chronic systemic illness, or urinary tract infection.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee (IEC) of Gandhi Medical College, Bhopal. Informed consent was obtained from all participants before their inclusion in the study. Participants were assured of the confidentiality of their data and informed of their right to withdraw from the study at any time without any impact on their medical care.

Data Collection

Participants were recruited from the antenatal clinic and obstetrics ward of Hamidia Hospital. After obtaining informed consent, demographic details and medical history were recorded. Blood pressure was measured twice in the right arm in the supine position four hours apart, and urine samples were tested for proteinuria to confirm the diagnosis of pre-eclampsia or eclampsia.

Thyroid Profile Testing

Fasting blood samples were collected from all participants to measure thyroid hormone levels, including Total Triiodothyronine (T3), Total Thyroxine (T4), and Thyroid Stimulating Hormone (TSH). The samples were analyzed using a chemiluminescent assay with standard laboratory techniques.

Methodology

1. **Recruitment and Screening**:
   - Participants were screened for eligibility based on the inclusion and exclusion criteria.
   - Written informed consent was obtained from eligible participants.
2. **Clinical Assessment**:
   - Blood pressure was measured using a standardized sphygmomanometer.
   - Urine samples were tested for proteinuria using dipstick tests (qualitative method).
3. **Laboratory Assessment**:
   - Blood samples were collected and sent to the laboratory for thyroid hormone analysis, liver function test, blood urea and serum creatinine.
4. **Data Management and Analysis**:
   - Data were double-entered into an electronic database to ensure accuracy.
   - Statistical analysis was performed to compare thyroid hormone levels between the two groups.
   - Results were interpreted to determine the association between thyroid profile and pre-eclampsia/eclampsia.

Quality Control

- Regular calibration of equipment was performed to ensure the accuracy of measurements.
- Internal and external quality controls were implemented for laboratory assays.

Statistical Analysis: Data were entered into a master chart in MS Excel and analyzed using EPI Info 7.0 software. Descriptive statistics such as mean and standard deviation were calculated for continu-

ous variables, and proportions were calculated for categorical variables. The Chi-Square test, t-test, and Z-test were used to compare thyroid hormone levels between the case and control groups. A p-value of <0.05 was considered statistically significant.

Results

Demographic and Baseline Characteristics The demographic and baseline characteristics of the participants are summarized in Table 1. There was no significant difference in the mean ANC weeks between the case and control groups.

Table 1: Comparing mean ANC weeks between groups

Group	Mean	Std. Deviation	P-value
Case	30.82	1.424	0.580
Control	30.90	1.344	

Blood Pressure and Pulse Rates:

The comparison of mean systolic blood pressure (SBP), diastolic blood pressure (DBP), and pulse rates between the groups is presented in Table 2. The case group had significantly higher SBP and DBP compared to the control tgroup, with no significant difference in pulse rates.

Table 2: Comparing mean blood pressure and pulse between groups

	SDB			DBP			Pulse rate		
Group	Mean SBP	Std. Deviation	P-value (SBP)	Mean DBP	Std. Deviation	P-value (DBP)	Mean Pulse	Std. Deviation	P-value (Pulse)
Case	150.00	2.893	<0.001	101.00	2.185	<0.001	98.36	11.063	0.796
Control	120.04	11.317		79.36	7.745		94.12	11.237	

Urine Protein Levels: The presence of urine protein was significantly higher in the case group compared to the control group (P < 0.001).

Table 3: Comparing Urine protein between groups

Group	Urine Protein	Frequency	Total
Case	2+	38	50
	3+	12	
	NIL	0	
Control	NIL	50	50

Thyroid Profile: The comparison of thyroid profiles between the groups is shown in Table 4. The case group had significantly higher serum TSH and T T3 levels compared to the control group, with no significant difference in T T4 levels.

Table 4: Comparing thyroid profile between groups

Group	Mean Serum TSH	Std. Deviation	P-value (TSH)	Mean T T3	Std. Deviation	P-value (T T3)	Mean T T4	Std. Deviation	P-value (T T4)
Case	4.0240	3.70515	<0.001	2.0560	1.73491	0.010	11.1518	3.60863	0.639
Control	2.0370	1.24136		1.3578	0.55432		10.5572	3.26049	

Abnormal Thyroid Profile: The prevalence of abnormal thyroid profiles was significantly higher in the case group compared to the control group (P = 0.001).

Table 5: Comparing abnormal thyroid profile between groups

Group	Thyroid Status	Frequency	Total
Case	Euthyroid	38	50
	Hypothyroid	12	
Control	Euthyroid	47	50
	Hypothyroid	3	

Kidney Function Profile: The kidney function profiles are summarized in Table 6. There were no significant differences in serum urea and serum creatinine levels between the groups.

Table 6: Comparing kidney function profile between groups

Group	Mean Serum Urea	Std. Deviation	P-value (Urea)	Mean Serum Creatinine	Std. Deviation	P-value (Creatinine)
Case	30.12	6.527	0.987	1.2480	0.35639	0.105
Control	29.88	6.850		1.1698	0.27144	

Liver Function Test: The liver function tests are detailed in Table 7. There were no significant differences in SGOT, SGPT, and serum bilirubin levels between the case and control groups.

Table 7: Comparing liver function test between groups

Group	Mean SGOT	Std. Deviation	P-value (SGOT)	Mean SGPT	Std. Deviation	P-value (SGPT)	Mean Serum Bilirubin	Std. Deviation	P-value (Bilirubin)
Case	42.1200	4.43382	0.632	44.9200	4.17886	0.088	1.1856	0.38057	0.063
Control	42.4800	3.90311		43.5600	5.51865		2.9430	13.43142	

Thyroid Status and Blood Pressure Abnormality: The relationship between thyroid status and blood pressure abnormality is summarized in Table 8. Blood pressure abnormalities were significantly associated with thyroid status in the groups ($P < 0.001$).

Table 8: Comparing thyroid status with blood pressure abnormality between groups

Thyroid Status	Blood Pressure Abnormality	Case Group	Control Group	P-value
Euthyroid	Eclampsia	6	0	<0.001
	Normal	0	47	
	Pre-eclampsia	32	0	
Hypothyroid	Pre-eclampsia	12	0	<0.001
	Normal	0	3	

Discussion

The average ANC weeks in the case group (30.82 weeks) and the control group (30.90 weeks) are comparable, with no statistically significant difference ($P = 0.580$), allowing for reliable comparison of thyroid profiles and other parameters. Misra et al [12] found elevated serum TSH levels in women with preeclampsia compared to the control group, suggesting thyroid dysfunction as a significant risk factor for preeclampsia. Gui et al [13] also demonstrated that severe and early onset preeclampsia, coupled with thyroid dysfunction, increased the likelihood of preterm birth and low neonatal birth weight. Maduka et al [14] observed lower thyroid hormone levels in preeclamptic women, with the exception of T4, suggesting a possible link between inadequate T4 to T3 conversion and preeclampsia. Bozkurt et al [15] noted decreased levels of fT3 and fT4 in preeclamptic women, while Aryee et al [16] reported subclinical hypothyroidism in pregnant women with preeclampsia and gestational hypertension, emphasizing the need to monitor thyroid hormone levels in managing preeclampsia and its consequences.

The study revealed significantly higher average systolic (SBP: 150.00) and diastolic blood pressure (DBP: 101.00) in the case group compared to the control group (SBP: 120.04, DBP: 79.36), with P values less than 0.001. Pulse rates were similar between the two groups (Case: 98.36, Control: 94.12; $P = 0.796$). This differential in blood pressure patterns between preeclamptic and non-hypertensive pregnant women highlights the importance of blood pressure monitoring. Aryee et al 16 and Bozkurt et al [15] found elevated blood pressure readings in preeclamptic women, while Medjedovic et al [17] emphasized the impact of preeclampsia on thyroid function and recommended regular monitoring of thyroid function and blood pressure.

Su et al [18] study on hypothyroxinemia found no notable variations in blood sugar levels between preeclamptic and non-preeclamptic groups, reinforcing that RBS levels remain stable regardless of preeclampsia. This aligns with Medjedovic et al [17] findings. The current study's finding of higher urine protein levels in the case group ($P < 0.001$) supports Misra et al [12], Maduka et al [14], and Bozkurt et al [15] observations that proteinuria is a key marker of kidney dysfunction in preeclampsia.

Average serum TSH and T T3 levels were significantly higher in the case group (TSH: 4.0240, T T3: 2.0560) compared to the control group (TSH: 2.0370, T T3: 1.3578), with P values less than 0.001 and 0.010, respectively. The lack of disparity in T T4 levels ($P = 0.639$) suggests a strong link between high TSH and T T3 levels and preeclampsia. This aligns with Misra et al [12] and Gui et al [19]findings of increased TSH levels in preeclamptic women, emphasizing the disrupted thyroid hormone metabolism in preeclampsia.

Hypothyroidism was more prevalent in the case group (12 cases) compared to the control group (3 cases), showing a robust correlation between thyroid dysfunction and preeclampsia. Aryee, Misra et al [12], and Gui et al [19] found similar

associations, with higher incidence of thyroid abnormalities in preeclampsia.

Kidney function profiles were comparable between the case and control groups, with no notable disparities in serum urea and creatinine levels. Maduka et al [14] and Bozkurt et al [14] found no significant differences in kidney function indicators between preeclamptic and normotensive groups, suggesting that preeclampsia may not majorly impact kidney function as assessed by these parameters.

Liver function tests, including SGOT, SGPT, and serum bilirubin, showed no notable variations between the case and control groups. This aligns with Maduka et al [14] and Bozkurt et al [15] findings, indicating that while preeclampsia has widespread effects, it does not significantly influence liver function as evaluated by common liver enzymes.

The significant association between thyroid dysfunction and blood pressure problems in preeclampsia highlights the need for regular thyroid function monitoring. This supports findings by Maduka et al [14], Bozkurt et al [15], and Su et al [18], who all emphasized the impact of thyroid function on hypertensive disorders in pregnancy.

Our study's limitations include a small sample size, an observational design that precludes establishing causality, and the lack of accounting for confounding factors and thyroid antibody testing, potentially impacting the findings on thyroid dysfunction and preeclampsia.

Conclusion

Women with preeclampsia exhibited higher serum TSH and T3 levels, elevated systolic and diastolic blood pressure, and increased urine protein, indicating renal involvement. However, liver and renal function tests did not show notable differences, suggesting traditional markers may not fully capture organ involvement in preeclampsia. The findings highlight the prevalence of hypothyroidism in preeclamptic women, stressing the interplay between thyroid health and hypertensive disorders in pregnancy. Comprehensive monitoring is essential for early detection and management, aiming to improve pregnancy outcomes. Future research should explore these relationships further to develop targeted interventions for better maternal and fetal health.

References

1. Moog NK, Entringer S, Heim C, Wadhwa PD, Kathmann N, Buss C. Influence of maternal thyroid hormones during gestation on fetal brain development. Neuroscience. 2017 Feb 7 ;342:68-100. doi: 10.1016/j.neuroscience.2015.09.070.
2. Cignini P, Cafà EV, Giorlandino C, Capriglione S, Spata A, Dugo N. Thyroid physiology and common diseases in pregnancy: review of literature. J Prenat Med. 2012 Oct;6(4):64-71.
3. Saki F, Dabbaghmanesh MH, Ghaemi SZ, Forouhari S, Omrani GR, et al. Thyroid function in pregnancy and its influences on maternal and fetal outcomes. Int J Endocrinol Metab . 2014;12(4). doi: 10.5812/ijem.19378.
4. Dimitriadis E, Rolnik DL, Zhou W, et al. Pre-eclampsia. Nat Rev Dis Primers. 2023;9(8):8. doi: 10.1038/s41572-023-00417-6.
5. Karrar SA, Martingano DJ, Hong PL. Preecla mpsia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK570611/.
6. Phipps EA, Thadhani R, Benzing T, Karumanchi SA. Pre-eclampsia: pathogenesis, novel diagnostics and therapies. Nat Rev Nephrol. 2019 May;15(5):275-289. doi:10.1038/s41581-019-0119-6. Erratum in: Nat Rev Nephrol. 2019 Jun;15(6):386. doi: 10.1038/s41581-019-0156-1.
7. Alemu A, Terefe B, Abebe M, Biadgo B. Thyroid hormone dysfunction during pregnancy: a review. Int J Reprod Biomed. 2016 Nov;14 (11) :677-686.
8. Moog NK, Entringer S, Heim C, Wadhwa PD, Kathmann N, Buss C. Influence of maternal thyroid hormones during gestation on fetal brain development. Neuroscience. 2017 Feb 7; 342:68-100.
9. Leung AM. Thyroid function in pregnancy. J Trace Elem Med Biol. 2012 Jun;26(2-3):137-40. doi: 10.1016/j.jtemb.2012.03.004.
10. Brent GA. The debate over thyroid-function screening in pregnancy. N Engl J Med. 2012;3 66:562–563.
11. De Escobar GM, Obregón MJ, Del Rey FE. Maternal thyroid hormones early in pregnancy and fetal brain development. Best Pract Res Clin Endocrinol Metab. 2004; 18:225–248.
12. Misra M, Singh L, Thakur A, Singh S, Kumar J, Juyal D. Comparative Analysis of Serum Calcium Level and Thyroid Profile in Pregnant Normotensive and Preeclamptic Women: A Case-Control Study. J Clin Diagn Res. 2020 ;14(5).
13. Gui J, Xu W, Zhang J. Association between thyroid dysfunction and perinatal outcomes in women with gestational hypertension: a retrospective study. BMC Pregnancy Childbirth. 2 020;20(1):1–9.
14. Maduka I, Obi N, Egwu M. Evaluation of Thyroid Hormones and Thyroid Antibodies in Nigerian Pregnant Women with Pre-eclampsia. J Med Lab. 2020;30(4):52–61.

15. Bozkurt ME, Yucel O, Saler T. An investigation into thyroid function tests in pregnant women and the relationship between thyroid autoantibodies and preeclampsia. 2020;
16. Aryee NA, Adu-Bonsaffoh K, Arko-Boham B, Quaye O, Asazu H, Tagoe E. Thyroid hormone profile in preeclampsia patients: a case control study. Gynecol Endocrinol. 2023;39(1):21861 36.
17. Medjedovic E, Stanojevic M, Kurjak A, Begic E, Iglica A, Jonuzovic-Prosic S. Association between maternal thyroid function and risk of gestational hypertension and preeclampsia. J Perinat Med. 2022;50(7):904–9.
18. Su X, Liu Y, Li G, Liu X, Huang S, Duan T, et al. Associations of hypothyroxinemia with risk of preeclampsia–eclampsia and gestational hypertension. Front Endocrinol. 2021; 12:777152.
19. Gui J, Xu W, Zhang J. Association between thyroid dysfunction and perinatal outcomes in women with gestational hypertension: a retrospective study. BMC Pregnancy Childbirth. 20 20;20(1):1–9.