



A Study on Prevalence of Thyroid Disorders in Pregnancy and its Impact on Maternal and Fetal Outcomes in a Tertiary Care Centre in Villupuram

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Abstract

Thyroid disease is one of the most prevalent endocrine abnormalities discovered during pregnancy. It has been linked to poor maternal and fetal outcomes. The most common obstetric consequences related with thyroid abnormalities are abortion, preeclampsia, abruptio placenta, premature labor, and fetal issues such as prematurity, low birth weight, still birth, and perinatal mortality. To identify the prevalence of thyroid disorders in pregnancy and its impact in material and fetal outcomes. Prospective study was conducted for a period of one year from January 2020 to December 2020. A total of 600 participants were enrolled in the study. The mean age of participants in the case and control group were identified as 24.73 ± 3.72 years and 24.06 ± 3.31 years, respectively. TSH was between 4.21 - 10 mIU/ml in the majority of the participants in the case group with 35.14%, followed by 2.5 - 4.20 mIU/ml with 32.43%. Hyperthyroidism and hypothyroidism were identified with 1% and 5.17%, respectively. Preeclampsia, spontaneous miscarriage was the pregnancy outcomes identified in most of the participants in the case group with 13.51% and 8.11%. The study reveals a significant prevalence of thyroid disorders, particularly hypothyroidism, underscoring the importance of including thyroid function testing in regular antenatal clinic screening. Thyroid dysfunction must be diagnosed and treated as soon as possible in order to minimize negative prenatal outcomes.

Keywords: Hypothyroidism, Thyrotrophin, Pregnancy and Iodine deficiency.

Introduction

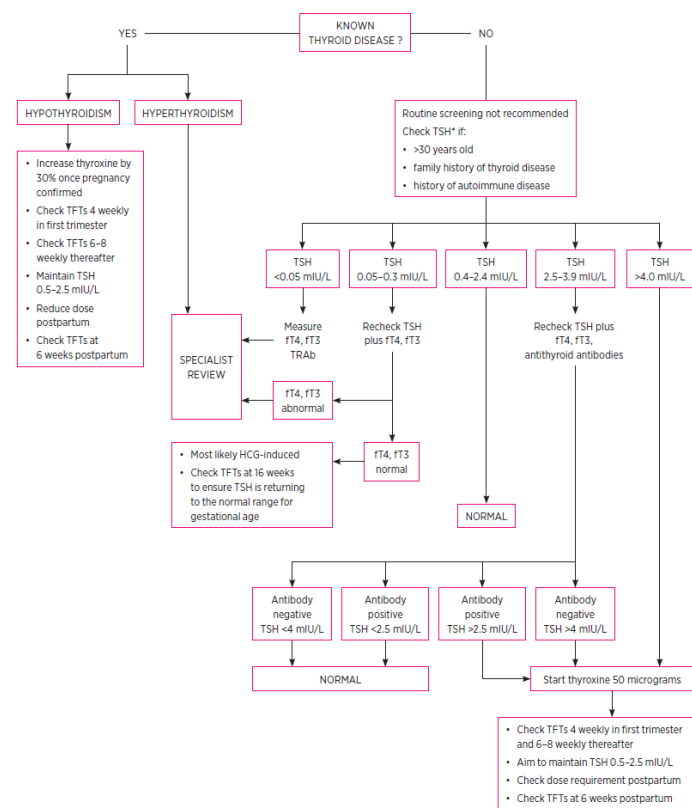
One of the most common endocrine disorders identified in pregnancy is thyroid disorder. It is associated with adverse maternal and fetal outcomes. Abortion, preeclampsia, abruptio placenta, preterm labor, and fetal complications are prematurity, low birth weight; still birth and perinatal death are the common obstetric complications associated with thyroid disorders.^{1,2}

Attention deficit and hyperactivity syndrome are the prenatal and postnatal adverse effects reported in children born to hypothyroid mothers.³ Maternal hypothyroidism during the first trimester can be harmful for fetal brain development and can also lead to mental retardation and cretinism. It includes impairment of mental, physical growth and development.² Western studies showed the prevalence of hypothyroidism in pregnancy as

2.5%, whereas for hyperthyroidism between 0.1 to 0.4%.⁴ Hyperthyroidism seen in 0.2%–0.4% of pregnant women and is commonly related with Grave's disease. The incidence of hypothyroidism in pregnancy is between 0.5%–3.5%.⁵ The prevalence of hypothyroidism was more in Asian countries as compared to western countries. The occurrence of hyperthyroidism is less as compared to hypothyroidism. It is reported in 0.5–2/1000 pregnancies. Sub-clinical hyperthyroidism is identified in 1.7% of pregnancies.⁶ Inappropriate weight gain, cold intolerance, dry skin, delayed relaxation of deep tendon reflexes, constipation, fatigue, and somnolence are the signs and symptoms associated with hypothyroidism during pregnancy.⁷ An increase in thyroglobulin due to increased estrogen and human chorionic gonadotrophin increased renal losses of iodine due to elevation in glomerular filtration rate, modifications in peripheral metabolism of maternal thyroid hormone, and modifications in iodine transfer to the placenta are the various factors that lead to changes in the maternal thyroid function.⁸ During pregnancy, the production of thyroid hormone and iodine requirement is increased by 50%.⁸ Also, the thyroid gland increases in size by 10% in iodine-sufficient countries and to a greater extent in iodine-deficient countries. Pregnancy is considered as a stress test for the thyroid gland and resulting in hypothyroidism in women with limited thyroidal reserve or iodine deficiency.⁹

Maternal thyroid function changes during the period of pregnancy, and inadequate adaptation to these changes lead to thyroid dysfunction. Subclinical thyroid disease is defined by an abnormal TSH in the normal levels of the thyroid hormones. Symptoms with either subclinical hyperthyroidism or subclinical hypothyroidism are identified as mild. Whereas overt thyroid disease is the abnormal levels of both the TSH and thyroid hormones and many more symptoms.¹⁰ Thyroid dysfunction is classified into hyperthyroidism and hypothyroidism.

- Hyperthyroidism is a condition where the thyroid gland is overactive and produces excessive thyroid hormone. It can be managed with antithyroid medications (Methimazole, Propylthiouracil), radioactive iodine, or surgery.
- Subclinical Hyperthyroidism is a mild form of hyperthyroidism and is indicated by decreased level of TSH. Elderly and symptomatic patients are usually treated, while younger and asymptomatic patients can be monitored without treatment.
- Overt Hyperthyroidism is a form of hyperthyroidism that is characterized by a decreased level of TSH and an increased T4 level.
- Hypothyroidism is a condition where the thyroid gland is underactive and does not produce enough thyroid hormone. It can be managed by consuming thyroid hormone pills.
- Subclinical Hypothyroidism is a mild form of hypothyroidism and is indicated by an increased level of TSH.
- Overt Hypothyroidism is a form of hypothyroidism that is characterized by an increased level of TSH and a decreased T4 level. It is treated with thyroid hormone pills. The figure.1 shows the thyroid management in pregnancy.



TFT thyroid function test TSH thyroid stimulating hormone fT4 free thyroxine
 FT3 free triiodothyronine TRAb thyrotropin receptor antibodies HCG human chorionic gonadotrophin
 * TSH concentration varies with gestational age

Figure.1 Thyroid management in Pregnancy

Prevalence of overt thyroid dysfunction is 2–3% in pregnant women, subclinical dysfunction is 10%, while the rate of autoimmunity is 5–10%.^{11,12} Hyperthyroidism occurs in 0.2%–0.4% of pregnant women and is mostly related with Grave’s disease. The incidence of hypothyroidism in pregnancy is between 0.5%–3.5%. The prevalence of thyroid disorders is identified as 11% in India whereas 2.5% in the western countries.^{13–16} The prevalence of hypothyroidism was more in Asian countries as compared to western countries. The occurrence of hyperthyroidism is less as compared to hypothyroidism. It is reported in 0.5–2/1000 pregnancies. Sub-clinical hyperthyroidism is identified in 1.7% of pregnancies.^{6,17} The prevalence of overt hypothyroidism during pregnancy varies between 0.3–0.5% while 2–3% for subclinical hypothyroidism.⁷

Aetiology

Graves’ disease, Transient gestational hyperthyroidism, Toxic multinodular goitre,

Single toxic adenoma, Subacute thyroiditis, Trophoblastic tumor, Iodide induced hyperthyroidism, Struma ovarii, and Thyrotrophin receptor activation are the causes of hyperthyroidism in pregnancy.¹⁸ Iodine deficiency is the leading cause of hypothyroidism worldwide. The most cause of hypothyroidism during pregnancy is autoimmune thyroiditis whereas, radioiodine ablation of the thyroid while treating hyperthyroidism or thyroid cancer and surgery of the thyroid tumors are the other causes. Central hypothyroidism, including lymphocytic hypophysitis or ectopic thyroid and drugs like rifampicin and phenytoin, which accelerate thyroid metabolism, is the rare causes identified for hypothyroidism.¹⁹

Risk factors

Risk factors identified for thyroid dysfunction during the pregnancy.²⁰

- Age >30 years.
- History of thyroid dysfunction or positive thyroid antibodies.
- Type 1 diabetes or other autoimmune disorders.
- Head or neck radiation.
- Use of drugs that affect thyroid function.
- Administration of iodinated contrast materials.
- Goiter or symptoms or signs of thyroid dysfunction.
- Residents in areas of moderate to severe iodine deficiency.
- Multiple prior pregnancies (> 2).
- Previous pregnancy loss, preterm delivery, or infertility.
- Family history of thyroid disease.
- Morbid obesity (BMI > 40 kg/m2)

Pathophysiology

Thyroid physiology is modified during normal pregnancy. These alterations take place throughout the period of pregnancy and help to prepare the maternal thyroid gland to cope with the metabolic demands of pregnancy. The increase in thyroxine-binding globulin is the most identified change. It starts early in the first

trimester, plateaus during mid-gestation, and persists until shortly after delivery. This is due to the stimulation of TBG synthesis by increased maternal estrogen levels and also due to reduced hepatic clearance of TBG.²¹ This TBG concentration can lead to an expansion of the extra-thyroidal pool and results in increased total T3 and T4 levels due to an increase in maternal thyroid hormone synthesis. Maternal thyroid hormone synthesis can also increase due to accelerated renal clearance of iodide resulting from the increased maternal glomerular filtration rate. Increased metabolism of T4 in the 2nd and 3rd trimesters due to an increase in placental type II and type III deiodinases, which convert T4 to T3

and T4 to reverse T3 and T2. Plasma iodide levels decline due to both increased thyroxine metabolism and renal iodide clearance. All these lead to an increase in the size of the thyroid gland in around 15% of pregnant women, which returns to normal during the post-partum period. Serum hCG has an intrinsic thyrotropic activity which increases after fertilization and reaches peaks at 10 to 12 weeks. Hence, in the 1st trimester, free T3 and T4 levels enhance slightly, and TSH levels decline in the 1st trimester with a readjustment in the 2nd and 3rd trimesters, when hCG levels decline. As a consequence, cut-offs to determine hypothyroidism in pregnancy are different in the first trimester and the rest of the pregnancy.¹⁹

Table 1: Changes in thyroid function test in pregnant women with thyroid disease.²²

Maternal condition	TSH	Free thyroxine	Free thyroxine index	Total thyroxine	Triiodothyronine	Resin triiodothyronine uptake
Hyperthyroidism	Decrease	Increase	Increase	Increase	Increase or no change	Increase
Hypothyroidism	Increase	Decrease	Decrease	Decrease	Decrease or no change	Decrease

Table 2: Trimester-specific reference ranges for common thyroid tests.²²

Test	First trimester	Second trimester	Third trimester
Thyroid-stimulating hormone (mIU per L)	0.1 to 2.5	0.2 to 3.0	0.3 to 3.0
Thyroxine-binding globulin (mg per dL)	1.8 to 3.2	2.8 to 4.0	2.6 to 4.2
Thyroxine, free (ng per dL)	0.8 to 1.2	0.6 to 1.0	0.5 to 0.8
Thyroxine, total (mcg per dL)	6.5 to 10.1	7.5 to 10.3	6.3 to 9.7
Triiodothyronine, free (pg per mL)	4.1 to 4.4	4.0 to 4.2	-
Triiodothyronine, total (ng per dL)	97 to 149	117 to 169	123 to 162

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Thyroxine, free (ng per dL)	0.8 to 1.2	0.6 to 1.0	0.5 to 0.8
Thyroxine, total (mcg per dL)	6.5 to 10.1	7.5 to 10.3	6.3 to 9.7
Triiodothyronine, free (pg per mL)	4.1 to 4.4	4.0 to 4.2	-
Triiodothyronine, total (ng per dL)	97 to 149	117 to 169	123 to 162

Management

The treatment of choice for maternal hypothyroidism is the administration of levothyroxine. Pregnant women require larger doses due to the sudden increase in TBG levels. It is caused due to the physiological rise in estrogen, increased placental transport and metabolism of

maternal T4, and also increased distribution volume of thyroid hormones. During pregnancy, the full replacement thyroxine dose is 2–2.4 µg/kg/day. In case of severe hypothyroidism, a thyroxine dose twice the estimated final replacement daily dose can be given for the first few days to rapidly normalize the extrathyroidal

thyroxine pool before returning to the final replacement dose. Women who already on thyroxine prior to pregnancy need to increase their daily dosage by 30-50% above preconception dosage. The thyroxine dose is titrated to reach a serum TSH value less than 2.5 mIU/liter while maintaining free T4 levels in the high normal

range. A follow-up of every 4–6 weeks with free T4 and TSH value till delivery is preferred in order to facilitate periodic adjustment of LT4 supplementation.¹⁹Antithyroid drugs are the preferred management at all stages of pregnancy. Propylthiouracil, Carbimazole, and Propranolol are the drugs used in hyperthyroidism.

Table 3: Drugs used in hyperthyroidism.²³

Drug	MOA	DOSE	Adverse effects
Propylthiouracil	Inhibits thyroxine synthesis; also inhibits peripheral conversion of thyroxine to triiodothyronine	Starting: 300-450 mg/day; maintenance: 50-100 mg/day	Rash, fever, agranulocytosis
Carbimazole	Inhibits thyroxine synthesis	Starting: 15-40 mg/day; maintenance: 5-15 mg/day	As above, plus aplasia cutis and methimazole embryopathy
Propranolol	Reduces adrenergic symptoms	10-40 mg, 3-4 times/day (short term use only)	Bronchospasm, intrauterine growth restriction, neonatal hypoglycemia

Mahadik K et al.²⁵ conducted a prospective observational study on 198 women. The purpose of the study was to determine the maternal and fetal outcomes in pregnant women with deranged thyroid profiles. The study results revealed 11% as the prevalence of thyroid disorder. Among them, subclinical hypothyroidism, overt hypothyroidism, and subclinical hyperthyroidism were identified with 5.6, 3.5, and 1.5%, respectively. Anemia was associated with hypothyroidism in women with subclinical and overt hypothyroidism. LBW, NICU admission, and low APGAR score were identified with 31.6%, 42.1%, and 21.1%, respectively. The risk of anemia, Low Birth weight, NICU admissions, and low APGAR score were higher in women with hypothyroidism as compared to women who are euthyroid. The study concluded that anemia, pre-eclampsia, high caesarean rates, and neonatal morbidities are associated with hypothyroidism.

Nambiar V et al.³² performed a study in 483 pregnant women. The purpose of the study was to identify the prevalence and the effect of thyroid dysfunction on pregnancy. The study results revealed 4.8%, 0.6%, 6.4%, and 12.4% as the prevalence of hypothyroidism, Graves' disease, gestational transient thyrotoxicosis, and thyroid autoimmunity. There was an association identified

between hypothyroidism, TAI, and miscarriage. The study concluded the prevalence and effect of hypothyroidism on pregnancy.

Dülek H. et al.³³ conducted a study in 796 pregnant women. The aim of the study was to identify the prevalence of thyroid dysfunction in pregnant and their association with perinatal outcomes. The study results revealed 13.2% as the prevalence of thyroid dysfunction. Hypothyroidism, subclinical hypothyroidism, and hyperthyroidism were identified with 0.5%, 8.9%, and 2.8%, respectively. There was a correlation identified with TSH and maternal age. The study concluded that subclinical hypothyroidism and hyperthyroidism had no adverse effects on birth weight, cesarean section rates, and Apgar scores.

Ajmani SN et al.³⁴ performed a study in 400 pregnant women. The aim of the study was to determine the prevalence of thyroid dysfunction in normal pregnant women and also to assess the impact of thyroid dysfunction on maternal and fetal outcomes. The study results revealed 12% and 1.25% as the prevalence of hypothyroidism and hyperthyroidism. Preeclampsia and placental abruption are the adverse maternal effects in overt hypothyroidism. Spontaneous abortion, preterm birth, low birth weight, intrauterine growth retardation, and fetal death are adverse fetal

outcomes. Whereas spontaneous abortion, preterm delivery, low birth weight, and intrauterine growth retardation were the adverse fetal outcomes in subclinical hypothyroidism. The study concludes that the presence of thyroid disorders is associated with adverse maternal and fetal outcomes.

Sahu MT et al.³⁵ performed a study in 633 pregnant women. The aim of the study was to identify the prevalence of thyroid dysfunction in pregnancy and its impact on the obstetrical outcome. Subclinical hypothyroidism and overt hypothyroidism were identified in 6.47% and 4.58% of the population. Cesarean section rate for fetal distress was identified high among the subclinical hypothyroid women. Neonatal complications and gestational diabetes were high in the overt hyperthyroidism group. The study concluded the importance of routine antenatal thyroid screening.

Sharmeen M et al.³⁶ conducted a study in 50 pregnant women. The purpose of the study was to identify thyroid dysfunction in pregnancy and its impact on the obstetrical outcome. Overt hypothyroidism was identified higher in the 25 to 44 years age group. Similarly, abortions were more in overt hypothyroidism. In sub-clinical hypothyroidism, 86.2% conceived firstly within 2 years, whereas 66.7% in overt hypothyroidism patients conceived firstly in between 3 to 5 years after marriage. Overt hypothyroids were prone to pregnancy-induced hypertension, intrauterine growth restriction, and gestational diabetes as compared to subclinical cases. Neonatal complications were high in the overt hypothyroidism group. Mean TSH level was more in overt hypothyroidism patients. Caesarean section was performed in the majority of the patients in both groups due to associated medical and obstetrical complications. None of the babies had hypothyroidism. The study concluded that overt hypothyroidism is associated with more maternal complications & adverse parental outcomes than subclinical hypothyroidism.

Dhanwal D et al.³⁷ performed a cross-sectional multicenter study. The purpose of the study was to

identify the prevalence of hypothyroidism in pregnant women. The study results revealed 13.13% was the prevalence of hypothyroidism. Anti-TPO antibodies were identified as positive in 20.74%, while 40% of hypothyroid women were positive for anti-TPO antibodies. The study concluded that sub-clinical hypothyroidism is high among the study population.

Sharma DV et al.¹ conducted a prospective study in 120 patients. The purpose of the study was to identify the prevalence of hypothyroidism in pregnancy and also to determine the fetomaternal outcome with hypothyroidism. The study results revealed 24.29% as the prevalence of hypothyroidism. The rate of still births, hyperbilirubinemia, and admission to neonatal ICU were identified higher in the hypothyroidism group. The study concluded the importance of timely diagnosis and initiation of treatment of hypothyroid disorders.

Pahwa S et al.³⁸ performed a study in 100 pregnant women. The objective of the study was to identify the prevalence of thyroid disorders in pregnant women. The study results revealed that the prevalence of thyroid dysfunction was high in first-trimester pregnant women. Subclinical hypothyroidism, overt hypothyroidism, and subclinical hyperthyroidism were identified with 6%, 2%, and 2%, respectively. The study concluded the importance of routine antenatal thyroid screening.

Mahajan K et al.³⁹ conducted an observational study in 514 women. The purpose of the study was to identify the fetal outcome in pregnancy with thyroid dysfunction. Subclinical hypothyroidism, overt hypothyroidism, and hyperthyroidism were identified with 9.54%, 2.34%, and 0.58%, respectively. Miscarriage, IUD/stillbirth, LBW, and intrauterine growth restriction were the fetal complications identified in hypothyroidism patients. NICU admissions were identified higher in patients with thyroid disorders. The study concluded the association between thyroid disorders and fetal adverse outcomes

Taha, I et al.⁴⁰ conducted a hospital-based prospective study. The aim of the study was to identify the prevalence and complications of overt and subclinical hypothyroidism among pregnant women. Overt hypothyroidism and subclinical hypothyroidism were identified in 9.3% and 14.9% of participants. The rate of caesarean section was high among women with overt hypothyroidism as compared with subclinical hypothyroidism. Intrauterine fetal deaths complicated 3.4% of overt hypothyroid pregnant women, whereas a low apgar score at delivery was identified in 16.1% of neonates of overt hypothyroid mothers and 10.1% of neonates of subclinical hypothyroid mothers. The study concluded the importance of early diagnosis in pregnant women with thyroid disorders.

Mahajan K et al.⁴¹ conducted a study in 514 pregnant women. The purpose of the study was to identify the maternal outcomes associated with thyroid disorders. Deranged thyroid function was identified in 12.45% of the study population. The prevalence of overt hypothyroidism and subclinical hypothyroidism were identified with 2.34% and 9.54% whereas, hyperthyroidism with 0.58%. Anemia and preterm delivery were the common maternal complications identified in women with hypothyroidism. The study concluded the need of routine antenatal screening and proper management for thyroid dysfunction.

Ramachandran R et al.⁴² conducted a prospective observational study in 451 pregnant women. The aim of the study was to identify the prevalence and the impact of thyroid disorders in pregnant women. The study results revealed 22.39% as the prevalence of thyroid dysfunction. The most common thyroid disorder identified was subclinical hypothyroidism with 20.63%. The study concluded the high prevalence of thyroid disorder in pregnancy.

Barse SP. et al.⁴³ performed a prospective study. The purpose of the study was to determine the prevalence of thyroid dysfunction in pregnancy and its effect on the mother and fetus. The study revealed 17.90% as the prevalence of thyroid

dysfunction in pregnancy. Subclinical hypothyroidism, overt hypothyroidism, and hyperthyroidism were identified with 14.6%, 1.9%, and 1.4%, respectively. The study concluded the importance of early diagnosis and prevention of thyroid dysfunction in pregnancy.

Butt F. et al.⁴⁴ conducted a cross-sectional study in 260 pregnant women. The aim of the study was to evaluate the frequency of subclinical thyroid dysfunction among pregnant women. The study results revealed 30.31±3.11 as the mean age of the patients. Mean fT4 level, fT3, and TSH level were identified as 1.84±1.12ng/dl, 2.62±1.14ng/dl, and 4.32±0.91mIU/l, respectively. Thyroid dysfunction was identified in 45.4% of the study population. Subclinical hypothyroidism and hyperthyroidism were identified with 65.2% and 34.7%, respectively. The study concluded the need of control of thyroid disorders during pregnancy.

Saraladevi R et al.⁴⁵ conducted a prospective and comparative clinical study. The aim of the study was to identify the prevalence of thyroid disorder in pregnancy. The study results revealed 11.6% as the prevalence of thyroid disorders. Subclinical hypothyroidism and Overt hypothyroidism were identified with 6.4% and 2.8%, respectively. The rate of miscarriage was identified as high in overt hyperthyroidism. The study concluded the need of universal screening of pregnant women for thyroid disorder.

Singh A et al.⁴⁶ conducted a study in 400 pregnant women. The purpose of the study was to identify the prevalence of thyroid dysfunction and study its implications in pregnancy. The study results revealed the prevalence of hypothyroidism and hyperthyroidism as 7.5% and 0.75%, respectively. Preeclampsia and intrauterine growth restriction were the most common complications identified in pregnant women with hypothyroidism. The incidence of cesarean section was identified as 39.28%. The study concluded the significance of antenatal thyroid screening.

Rajput R et al.⁶ conducted a cross-sectional study in 461 pregnant women. The aim of the study was

to determine the prevalence of thyroid dysfunction in pregnant women during the first trimester. The study results revealed 23.79 ± 3.47 years as the mean maternal age, whereas 8 weeks 5 days as the median gestational age. The median FT3, FT4, and TSH were identified as 3.3 pg/mL, 1.25 ng/dL, and 1.40 mIU/L. The level of anti-TPO was high in 27.8% of the study population. Subclinical hypothyroidism was identified in 21.5% of participants. Whereas overt hypothyroidism and subclinical hyperthyroidisms were identified in 0.4% and 3.3% of participants. The study concluded the prevalence of thyroid dysfunction during pregnancy.

Materials and Methods

Study site: This study was conducted in the Department of Obstetrics and Gynecology at Government Villupuram Medical College and Hospital, Villupuram-605601.

Study population: All the eligible patients undergoing Screening of pregnant women with thyroid disorders during 1st trimester in the Department of Obstetrics and Gynecology at Government Villupuram Medical College and Hospital were considered as the study population.

Study design: The current study was a prospective study

Sample size: Sample size was calculated assuming the major proportion of Hypothyroidism as 5.17% as per the study.⁴⁷ The other parameters considered for sample size calculation were 5% absolute precision and 95% confidence level. The following formula was used for sample size calculation. Based on the previous hospital records, the approximate number of potential Eligible subjects to be attending the study setting during the data collection period were considered as 65. Hence a finite population correction was applied for 65. The following formula was used for sample size as per the study by Daniel WW et al.⁴⁸

$$n' = \frac{NZ^2P(1-P)}{d^2(N-1) + Z^2P(1-P)} \quad (1)$$

Where n = Sample size

N = Population Size = 65

Z = Z statistic for a level of confidence level = 1.960

P = Expected prevalence/proportion of outcome = 0.0517

d = Precision = 0.05

The required sample size as per the above-mentioned calculation was 35. To account for a non-participation rate/ loss to follow up rate of about 5%, another 2, subjects will be added to the sample size. Hence the required sample size would be 37 for cases. For comparison all available controls into the study were 563 and then the total sample size in the study would be 600.

Sampling method: All the eligible subjects were recruited into the study consecutively by convenient sampling till the sample size is reached.

Study duration: The data collection for the study was done between January 2020 to December 2020 for a period of 1 year.

Inclusion Criteria:

- Pregnant women with thyroid disorders in 1st trimester
- Singleton pregnancy
- Primigravida or multigravida

Exclusion criteria:

- Multifetal gestation
- Known chronic disorders like diabetes, hypertension, liver disorders, renal disorders
- Previous bad obstetrics with known thyroid dysfunction.

Ethical Considerations: The study was approved by the institutional human ethics committee. Informed written consent was obtained from all the study participants, and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and the voluntary nature of participation were explained to the participants before obtaining consent. The confidentiality of the study participants was maintained.

Data collection tools: All the relevant parameters were documented in a structured study proforma.

Method of collection of data:

- This is a prospective study involving pregnant women attending AN OPD at Villupuram medical college.

Methodology: 600 pregnant women attending antenatal clinic in the first trimester who fulfilling inclusion criteria were enrolled in the study after institutional ethics approval and consent from study subjects. A detailed history was taken regarding the symptoms of thyroid disorders, menstrual history, obstetric history, past medical history, family history, personal and social history. General examination was done with reference to the general condition of the patient, body temperature: pulse rate, blood pressure, respiratory rate, and the finding were recorded. Systemic examination of the cardiovascular system (CVS), central nervous system (CNS), respiratory system, and thyroid gland was done, and findings were recorded.

Statistical Methods

Thyroid disorders in pregnancy were considered as the primary outcome variable. Impacts of thyroid disorder in maternal and fetal outcome variables were considered as secondary outcome variables. The study group (Cases Vs. Controls) was considered as the primary explanatory variable.

Descriptive analysis was carried out by frequency and proportion for categorical variables. Non-normally distributed quantitative variables were summarized by the median and interquartile range (IQR). Data was also represented using appropriate diagrams like bar diagrams, pie diagrams.

All Quantitative variables were checked for normal distribution within each category of an explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro-Wilk test was also conducted to assess normal distribution. Shapiro Wilk test p-value of >0.05 was considered as a normal distribution.

For normally distributed Quantitative parameters, the mean values were compared between study groups using an independent sample t-test (2 groups). For non-normally-distributed Quantitative parameters, medians and interquartile range (IQR) were compared between study groups using Mann Whitney u test (2 groups).

Categorical outcomes were compared between study groups using the Chi-square test /Fisher's Exact test (If the overall sample size was < 20 or if the expected number in any one of the cells is < 5 , Fisher's exact test was used.)

P-value < 0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.⁴⁹

Result & Discussion

Thyroid disease evaluation during pregnancy is critical for the mother's health during pregnancy, the obstetric outcome, and the child's future development. Maternal hypothyroidism is the most frequent thyroid condition during pregnancy. Fetal loss, placental abruptions, hypertension, preterm delivery, and impaired intellectual function in the offspring are all linked to this condition. There is a scarcity of information about thyroid issues in Indian pregnant women. This study was conducted to identify the prevalence of thyroid disorders in pregnancy and its impact in material and fetal outcomes. A total of 600 subjects were enrolled for the study.

Study Population

In the present study, 6.17% were cases, and 93.83% were controls. Sharin P. Barse et al.⁴³ performed a prospective study on 696 pregnant women in which 17.90% of the women were identified with thyroid disorders and 82.1% without thyroid disorders. In another study by Kalyani Mahajan.et al.,³⁹, in which 12.45% of the study population had thyroid disorders while the remaining 87.55% had normal thyroid function. Sharin P. Barse, et al.⁴³ Kalyani Mahajan.et al.³⁹ Reshmi Ramachandran.et al.⁴² Kalpana Mahadik. et al.²⁵ showed an increased prevalence as compared to the present study.

Table 4 Comparison of study groups between various studies.

Study	Population	Study groups (%)
Present study	600	Cases (6.17%) Control (93.83%)
Reshmi Ramachandran.et al. ⁴²	451	Abnormal thyroid function (22.4%) Normal thyroid function (77.60%)
Kalpna Mahadik. et al. ²⁵	198	Abnormal thyroid function (11%) Normal thyroid function (89%)
Alpana Singh.et al. ⁴⁶	400	Abnormal thyroid function (8.25%) Normal thyroid function (91.75%)

Prevalence of Thyroid Disorders

In the current study, hyperthyroidism and hypothyroidism were identified with 1% and 5.17%, respectively. In Kalyani Mahajan.et al.³⁹ studies the prevalence of hyperthyroidism and hypothyroidism were identified with 0.58% and 11.88%, respectively. In another study by Sharin P. Barse et al.⁴³ 1.4% and 16.5% were identified as

the prevalence of hyperthyroidism and hypothyroidism, respectively. The prevalence of hypothyroidism was more than that of hyperthyroidism in Alpana Singh.et al.⁴⁶ Kalyani Mahajan.et al.³⁹ Kalpna Mahadik, et al.²⁵ Sharin P. Barse, et al.⁴³ studies which resemble to the present study results.

Table.5 Comparison of prevalence of thyroid disorders between various studies.

Study	Population	Thyroid disorders (%)
Present study	600	Hypothyroidism (1%) Hyperthyroidism (5.17%)
Kalpna Mahadik, et al. ²⁵	198	Hypothyroidism (9.1%) Hyperthyroidism (1.5%)
Alpana Singh.et al. ⁴⁶	400	Hypothyroidism (7.5%) Hyperthyroidism (0.75%)

Repeat TSH

Among the case group, the majority of the participants had repeat TSH <3.0 mIU/ml with 51.35% at 16th week followed by 3.0-4.2 mIU/ml with 29.73%. Similarly, at the 20th week, 61.76% had repeat TSH <3.0 mIU/ml, and at 32nd week 97.06% had repeat TSH <3.0 mIU/ml. In Rodrigo Moreno-Reyes, et al.⁵³ studies, TSH in the first trimester was > 2.5 mU/L in 8.3% of the women with thyroid disorder while the TSH in the third trimester was > 3.0 mU/L in 6.1% of the women.

Repeat T4

In the case group, out of 6 participants at 16th week, repeat T4 was increased in 50% of participants. Whereas, out of 5 participants at the 20th week, only 20% had increased T4.

Antibodies

In the present study, 16.67% of the participants showed positive antibodies at the 16th week. Alpana Singh.et al.⁴⁶ performed a prospective study on 400 pregnant women in which antibody were positive in 36.6% of participants with thyroid dysfunction. In Reshmi Ramachandran.et al.⁴² studies 9.90% of the antenatal women had the presence of antibody.

Alpana Singh.et al.⁴⁶ Reshmi Ramachandran.et al.⁴² studies showed an increased rate of antibodies as compared to the present study.

Treatment

Among the case group, 54.05% had adequate treatment, while 45.95% of participants had inadequate treatment.

Mode of Delivery

In the present study, the mode of delivery was LSCS in most of the participants in the case group with 43.24%, followed by normal vaginal delivery with 32.43%. Whereas most of the participants underwent normal vaginal delivery in the control group with 52.58%, followed by LSCS with 32.21%.

Kalyani Mahajan.et al.³⁹ conducted an observational study on 514 women in which the majority of the participants with thyroid disorders underwent cesarean section with 32.08% followed by vaginal delivery with 67.92%. Whereas 74.61% of participants with normal thyroid function had a vaginal delivery with 74.61%, followed by the cesarean section with 25.39%.

Varuni Sharma.et al.¹ performed a prospective study on 120 subjects in which vaginal delivery and cesarean section were observed with 57.89% and 42.11% in participants with thyroid disorder while it was observed as 80.24% and 19.76% in participants without thyroid disorders.

Kalyani Mahajan.et al.³⁹Varuni Sharma.et al.¹ showed similar results with the present study.

Pregnancy Outcomes

In the current study, spontaneous miscarriage, gestational diabetes mellitus, preeclampsia, oligohydramnios, preterm labor, IUGR and low birth weight were identified with 8.11%, 2.7%, 13.51%, 2.7%, 5.41%, 5.41% and 10.81% in cases whereas, it was identified with 5.15%, 4.26%, 2.84%, 4.26%, 6.22%, 5.15% and 5.15% in control group respectively.

Reshmi Ramachandran.et al.⁴² studies conducted a prospective observational study on 451 antenatal women in which miscarriage, GDM, preeclampsia, preterm birth, IUGR, and LBW were identified with 24.75%, 3.96%, 4.95%, 1.98%, 0%, and 1.98% in pregnant women with thyroid disorders while it was identified with 3.42%, 0.29%, 0.86%, 0%, 1.43% and 5.43% in pregnant women without thyroid dysfunction.

In another study by Kalyani Mahajan.et al.³⁹ study miscarriage, low birth weight, IUGR, and no complications were identified with 34.03%, 8.23%, 6.25%, and 54.86% in participants with thyroid disorders while, it was identified with 6.38%, 3.77%, 5.22% and 83.48% in participants with normal thyroid function.

Reshmi Ramachandran.et al.⁴² Kalyani Mahajan.et al.³⁹ Alpana Singh.et al.⁴⁶ showed similar results with the present study in terms of pregnancy outcomes.

Conclusion

To summarize, the current study reveals a significant prevalence of thyroid disorders, particularly hypothyroidism, underscoring the importance of including thyroid function testing in regular antenatal clinic screening. Potential maternal and fetal problems should be made known to women with thyroid disorders. TSH in the blood is a sufficient and cost-effective biochemical diagnostic for thyroid dysfunction screening. Thyroid dysfunction must be diagnosed and treated as soon as possible in order to minimize negative prenatal outcomes.

Limitations

The sample size of the cases is small in the present study. Follow-up of the study population is not performed. Demographic details such as family history not included.

Recommendations

The present study can be conducted in a larger population size. Follow-up and treatment taken can also be included in a future study.

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