

International Journal of Gynaecology Research



ISSN Print: 2664-892X
ISSN Online: 2664-8938
IJGR 2024; 6(1): 17-20
www.gynecologyjournal.net
Received: 03-01-2024
Accepted: 08-02-2024

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First trimester screening for thyroid disorders in pregnancy

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DOI: <https://doi.org/10.33545/2664892X.2024.v6.i1a.19>

Abstract

Thyroid disorders are common during pregnancy and can have significant implications for both maternal and fetal health. Early detection and management are crucial to prevent adverse outcomes. This review explores the importance of screening for thyroid disorders in the first trimester, the current guidelines and practices, and the potential impact on pregnancy outcomes.

Keywords: Thyroid disorders, pregnancy, fetal health

Introduction

Thyroid disorders are among the most common endocrine issues encountered during pregnancy, significantly affecting maternal and fetal health. The thyroid gland, which regulates metabolism through the production of thyroid hormones, undergoes substantial physiological changes during pregnancy to meet the increased metabolic demands. These hormones, including thyroxine (T₄) and triiodothyronine (T₃), are crucial for normal fetal development, especially during the first trimester when the fetus is entirely dependent on maternal thyroid hormones. Thyroid dysfunctions, such as hypothyroidism (low thyroid hormone levels) and hyperthyroidism (high thyroid hormone levels), can lead to serious complications if not identified and managed promptly. Hypothyroidism is associated with increased risks of miscarriage, preterm birth, gestational hypertension, preeclampsia, and placental abruption. It can also lead to impaired neurodevelopment in the fetus, resulting in cognitive impairments and developmental delays. On the other hand, hyperthyroidism can cause severe pregnancy complications like preeclampsia, preterm labor, and fetal growth restriction. Given these potential risks, early screening for thyroid disorders is crucial. Early detection allows for timely intervention, which can mitigate adverse outcomes and promote healthier pregnancies. Various medical organizations have developed guidelines for screening, with most recommending targeted screening for high-risk groups. High-risk factors include a personal or family history of thyroid disease, symptoms of thyroid dysfunction, autoimmune disorders, and previous pregnancy complications. Screening typically involves measuring serum thyroid-stimulating hormone (TSH) levels, the primary test for assessing thyroid function. If TSH levels are abnormal, further testing of free thyroxine (free T₄) and thyroid peroxidase antibodies (TPOAb) is conducted to confirm the diagnosis and identify the underlying cause. Trimester-specific reference ranges for TSH are often used to account for the physiological changes in thyroid function during pregnancy. Early screening and appropriate management of thyroid disorders can lead to better pregnancy outcomes by reducing the risks of miscarriage, preterm birth, and other complications. It also ensures adequate thyroid hormone levels for the developing fetus, promoting normal neurodevelopment and reducing the likelihood of long-term developmental issues.

Main Objective

The main objective of early screening for thyroid disorders during pregnancy is to detect and manage thyroid dysfunctions early, ensuring better health outcomes for both mother and baby.

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Physiological Changes in Thyroid Function during Pregnancy

Pregnancy induces several physiological changes that affect thyroid function. These changes are essential to meet the increased metabolic demands of both the mother and the developing fetus. One of the primary changes is an increase in thyroid hormone production. This is driven by the elevated levels of human chorionic gonadotropin (hCG), which shares a similar structure to thyroid-stimulating hormone (TSH) and can weakly stimulate the thyroid gland. As a result, serum free thyroxine (free T₄) and triiodothyronine (T₃) levels rise, particularly in the first trimester.

Another significant change is the increased demand for iodine, which is necessary for thyroid hormone synthesis. Pregnancy enhances renal clearance of iodine, leading to a higher requirement for dietary iodine. The increased production of thyroid-binding globulin (TBG), stimulated by elevated estrogen levels, also affects thyroid function. Higher TBG levels result in more thyroid hormones being bound and less available in the free form, necessitating greater thyroid hormone production to maintain adequate free hormone levels.

Furthermore, pregnancy induces a shift in the immune system, which can influence autoimmune thyroid disease. Some women may experience a reduction in thyroid autoantibodies during pregnancy, potentially leading to changes in thyroid function. These physiological changes underscore the importance of closely monitoring thyroid function during pregnancy to ensure both maternal and fetal well-being.

Importance of Early Screening

Early screening for thyroid disorders during pregnancy is crucial for several reasons, significantly impacting both maternal and fetal health. Thyroid dysfunction, including hypothyroidism and hyperthyroidism, can lead to severe complications if left undiagnosed and untreated. Identifying these disorders early, particularly in the first trimester, allows for timely intervention and management, preventing a cascade of adverse outcomes.

One of the primary benefits of early screening is the safeguarding of maternal health. Pregnancy induces physiological changes that can unmask or exacerbate thyroid disorders. Hypothyroidism can lead to fatigue, weight gain, and depression, and, in severe cases, it can cause gestational hypertension, preeclampsia, anemia, and placental abruption. Hyperthyroidism, on the other hand, increases the risk of hyperemesis gravidarum (severe morning sickness), preterm labor, and heart failure. Early detection and treatment of these conditions can mitigate these risks, ensuring a healthier pregnancy for the mother.

For the fetus, maternal thyroid hormones are vital, especially during the first trimester when the fetal thyroid gland is not yet functional. Thyroid hormones are crucial for brain development, and untreated maternal hypothyroidism can lead to intellectual disabilities and developmental delays in the child. Conversely, uncontrolled hyperthyroidism can cause fetal growth restriction, preterm birth, and even fetal loss. Early screening ensures that any thyroid dysfunction is promptly managed, providing the fetus with the necessary thyroid hormones for normal growth and development.

Early screening also positively impacts overall pregnancy

outcomes. For instance, treating hypothyroidism can reduce the risk of miscarriages, preterm births, and low birth weight. Effective management of hyperthyroidism can prevent complications like preeclampsia and placental abruption. Early identification and treatment of thyroid disorders lead to better pregnancy outcomes, reducing the incidence of these complications and promoting the well-being of both mother and baby.

Neonatal health is another critical area influenced by early screening. Infants born to mothers with untreated thyroid disorders are at higher risk for complications such as low birth weight, prematurity, and respiratory distress. Early screening and treatment reduce these risks, improving neonatal health outcomes and ensuring a healthier start for the newborn.

Furthermore, maternal thyroid hormones play a crucial role in early fetal brain development. Adequate levels of these hormones are necessary for the proper formation and maturation of the central nervous system. Children born to mothers with untreated hypothyroidism are at risk for lower IQ and developmental delays. Early screening allows for prompt treatment, ensuring normal cognitive development and reducing the risk of long-term developmental issues in the child.

Identifying high-risk groups through early screening is also essential. Women with a history of thyroid disease, autoimmune disorders, or previous pregnancy complications are at higher risk for thyroid dysfunction during pregnancy. Early screening helps identify these women, allowing for closer monitoring and timely interventions if thyroid dysfunction develops. This proactive approach ensures that potential issues are managed before they lead to severe complications.

Cost-effectiveness is another important consideration. While there is debate about the cost-effectiveness of universal versus targeted screening, early detection and treatment of thyroid disorders can potentially reduce healthcare costs associated with managing pregnancy complications and long-term developmental issues in children. Treating thyroid disorders early can prevent expensive interventions and hospitalizations related to pregnancy complications, preterm births, and neonatal intensive care. The potential to prevent these costly outcomes may justify the expense of early screening.

In summary, early screening for thyroid disorders during pregnancy is vital for ensuring optimal maternal and fetal health. The benefits of early detection and treatment are well-documented, including reduced risks of pregnancy complications, improved fetal development, better neonatal health, and positive long-term outcomes for the child. Implementing effective screening protocols and adhering to clinical guidelines can significantly enhance pregnancy outcomes and promote the well-being of both mother and child.

Current Screening Guidelines

The current screening guidelines for thyroid disorders during pregnancy vary among different medical organizations and countries. These guidelines aim to ensure early detection and management of thyroid dysfunction to prevent adverse outcomes for both the mother and the fetus. Here is a detailed overview of the guidelines from key organizations:

American Thyroid Association (ATA)**2017 Guidelines for the Diagnosis and Management of Thyroid Disease during Pregnancy and the Postpartum**

Targeted Screening: The ATA recommends targeted screening rather than universal screening. Screening should be focused on high-risk women, including those with:

A history of thyroid dysfunction or thyroid surgery, A family history of thyroid disease, Symptoms of thyroid dysfunction, Type 1 diabetes or other autoimmune disorders, Previous head or neck radiation, Previous miscarriage or preterm delivery, Infertility or undergoing assisted reproductive technologies.

The primary screening test (TSH Testing) is the measurement of serum thyroid-stimulating hormone (TSH) levels. If TSH levels are abnormal, further testing of free thyroxine (free T₄) and thyroid peroxidase antibodies (TPOAb) may be conducted to confirm the diagnosis and determine the cause. The ATA recommends trimester-specific reference ranges for TSH levels, acknowledging that normal TSH levels vary throughout pregnancy. If trimester-specific ranges are not available, a TSH upper reference limit of 4.0 mIU/L can be used during pregnancy.

Endocrine Society**2012 Clinical Practice Guideline for the Management of Thyroid Dysfunction during Pregnancy and Postpartum**

Targeted Screening: Similar to the ATA, the Endocrine Society advocates for targeted screening of high-risk groups. Women who should be screened include those with:

A history of thyroid disease, Clinical symptoms of thyroid dysfunction, A family history of thyroid disease, Type 1 diabetes or other autoimmune disorders, Previous miscarriage, preterm delivery, or infertility. The Endocrine Society recommends measuring TSH levels as the initial screening test. If TSH levels are elevated, free T₄ should be measured to confirm hypothyroidism. In cases of low TSH, free T₄ and total triiodothyronine (T₃) should be assessed to diagnose hyperthyroidism. Testing for TPOAb is recommended for women with elevated TSH levels, as the presence of antibodies indicates autoimmune thyroid disease.

American College of Obstetricians and Gynecologists (ACOG)**2015 Committee Opinion on Thyroid Disease in Pregnancy**

Selective Screening: ACOG does not recommend universal screening for thyroid disorders in pregnant women. Instead, they support selective screening based on clinical risk factors. Women who should be screened include those with:

A history of thyroid disease or symptoms of thyroid dysfunction, Type 1 diabetes or other autoimmune disorders, A history of infertility or previous pregnancy loss. ACOG emphasizes the importance of clinical judgment in deciding whom to screen, taking into account individual patient history and risk factors. TSH is the primary screening test, with additional testing of free T₄ and TPOAb as needed based on TSH results and clinical indications.

National Institute for Health and Care Excellence (NICE) - UK**2014 Clinical Guidelines on Thyroid Disease in Pregnancy**

Targeted Screening: NICE guidelines recommend targeted screening for thyroid dysfunction in pregnant women who

have: A history of thyroid disease, Clinical symptoms suggestive of thyroid dysfunction, other autoimmune diseases, such as type 1 diabetes.

Measurement of TSH levels is the first step in screening, followed by free T₄ testing if TSH levels are abnormal. The presence of thyroid autoantibodies may also be assessed in certain cases.

International Federation of Gynecology and Obstetrics (FIGO)**2015 FIGO Guidelines on Thyroid Disorders in Pregnancy**

Targeted Screening: FIGO advocates for targeted screening, focusing on high-risk groups similar to those identified by other organizations. TSH testing is recommended as the initial screening test, with free T₄ and TPOAb testing as follow-up for abnormal TSH levels.

Impact on Pregnancy Outcomes

Early screening for thyroid disorders during pregnancy significantly impacts pregnancy outcomes by preventing a host of complications that could otherwise jeopardize both maternal and fetal health. Thyroid dysfunctions such as hypothyroidism and hyperthyroidism, if left untreated, can lead to serious issues, including miscarriage, preterm birth, fetal growth restriction, and long-term developmental problems in children. A detailed analysis of these impacts underscores the necessity of early screening and intervention. Thyroid hormones are integral to the development and metabolism of the fetus, particularly during the first trimester when the fetal thyroid gland is not yet functional. The fetus relies entirely on maternal thyroid hormones for growth and neurodevelopment. Hypothyroidism, characterized by low levels of thyroid hormones, can lead to insufficient hormone supply to the fetus, resulting in miscarriages and preterm births. Studies have shown that pregnant women with untreated hypothyroidism have a significantly higher risk of pregnancy loss, especially in the early stages. By screening and treating hypothyroidism early, this risk can be considerably reduced, leading to better pregnancy retention rates. Hyperthyroidism, marked by excessive thyroid hormone production, poses its own set of risks, including preterm labor and fetal growth restriction. These conditions arise due to the hypermetabolic state induced by high thyroid hormone levels, which can cause complications such as gestational hypertension and preeclampsia. Preeclampsia, a severe hypertensive disorder, can lead to premature birth and low birth weight, adversely affecting neonatal health. Early screening allows for the timely administration of antithyroid medications, which can control hyperthyroid symptoms and reduce the likelihood of these complications. The neurodevelopmental impact on the fetus is one of the most critical considerations. Thyroid hormones play a crucial role in the development of the fetal brain and nervous system. Inadequate maternal thyroid hormone levels due to untreated hypothyroidism can lead to cognitive impairments and developmental delays in children. Research has indicated that children born to mothers with untreated thyroid dysfunction exhibit lower IQ levels and poorer performance on developmental assessments. Conversely, early identification and treatment of maternal thyroid disorders ensure that the fetus receives adequate hormone levels, supporting normal brain development and

reducing the risk of neurodevelopmental disorders. Neonatal health is also directly influenced by maternal thyroid status. Infants born to mothers with untreated thyroid disorders are at increased risk for complications such as respiratory distress, jaundice, and feeding difficulties. These conditions often necessitate admission to neonatal intensive care units (NICUs), leading to longer hospital stays and increased healthcare costs. Early screening and management of maternal thyroid dysfunction can mitigate these risks, resulting in healthier neonates with fewer complications and shorter hospital stays. Furthermore, thyroid disorders can influence delivery outcomes. Unmanaged hypothyroidism or hyperthyroidism is associated with higher rates of cesarean deliveries due to complications like fetal distress and labor abnormalities. Cesarean sections, while sometimes necessary, carry higher risks of infection, longer recovery times, and increased morbidity for the mother. By ensuring proper thyroid function through early screening and treatment, the likelihood of a normal vaginal delivery is increased, which is generally associated with better maternal and neonatal outcomes. The long-term health of the child is another crucial aspect. Children exposed to untreated maternal thyroid dysfunction in utero are at higher risk for long-term health issues, including developmental delays and learning disabilities. Early screening enables healthcare providers to address thyroid dysfunction promptly, promoting better long-term health and developmental outcomes for the child. In conclusion, early screening for thyroid disorders during pregnancy is essential for optimizing pregnancy outcomes. It prevents a range of complications that can significantly affect both the mother and the fetus. By identifying and treating thyroid dysfunction early, healthcare providers can ensure better maternal health, improved fetal development, healthier neonatal outcomes, and positive long-term developmental prospects for the child. Implementing effective screening protocols and adhering to clinical guidelines are crucial steps toward achieving these outcomes, highlighting the indispensable role of early thyroid screening in prenatal care.

Conclusion

Early screening for thyroid disorders during pregnancy is essential for ensuring optimal outcomes for both mother and fetus. By identifying and managing conditions such as hypothyroidism and hyperthyroidism early in pregnancy, healthcare providers can prevent a range of serious complications, including miscarriage, preterm birth, fetal growth restriction, and long-term developmental issues in children. Thyroid hormones play a critical role in fetal development, particularly in the brain and nervous system, making early detection and treatment vital for preventing cognitive impairments and developmental delays. Additionally, maternal health benefits from early screening through reduced risks of gestational hypertension, preeclampsia, and other pregnancy-related complications. Neonatal health also improves, with fewer instances of respiratory distress, jaundice, and feeding difficulties, leading to shorter hospital stays and lower healthcare costs. Early screening promotes better delivery outcomes by reducing the likelihood of cesarean sections and associated complications. Overall, implementing effective screening protocols and adhering to clinical guidelines is crucial for achieving healthy pregnancies and promoting long-term

health and development in children, underscoring the indispensable role of early thyroid screening in prenatal care.

Conflict of Interest: Not available

Financial Support: Not available

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How to Cite This Article

Gregori S, Garnotel GL. First trimester screening for thyroid disorders in pregnancy. *International Journal of Gynaecology Research*. 2024;6(1):17-20.

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