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Case(s)
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Excessive prenatal supplementation of iodine and fetal goiter; report of managment conservatively of fetal goiter: a case report

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Abstract

Objective: Iodine is an essential mineral for the synthesis of thyroid hormones, so its deficiency can lead to serious problems. Therefore, routine iodine supplementation is recommended for pregnant women by World Health Organization .Fetal thyroid disorder is uncommon, and typically arises in the context of a managed maternal thyroid condition. Antithyroid therapy in mothers contributes to 10–15% of cases of congenital hypothyroidism in fetuses. The excessive iodine ingestion above daily intake limits during the pregnancy is a well-known mechanism among the known causes of fetal goiter. The occurrence of fetal goiter in babies of euthyroid mothers is quite rare. Fetal goiter, due to the maternal and fetal complications it causes, affects long-term morbidity and mortality. Among these complications are polyhydramnios, intrauterine growth restriction (IUGR), preterm birth, labor dystocia, hypoxia and brain damage resulting from airway obstruction caused by this mass.

Case(s): At 24 weeks pregnant, a 27-year-old primigravida was referred for a routine second trimester ultrasound evaluation despite not having a relevant family history or any personal thyroid or autoimmune illness. which showed cervical hyperextension and a high vascularized, bilobed, and symmetric mass in the anterior region of the fetal neck measuring 2.6 cm cranio-caudal × 1.5 cm transverse >%95 SD, suggesting fetal goiter. No signs of polyhydramnios, and no other fetal anomalies were found. Overall, these findings stated fetal goiter.

Conclusion: The clinicians and healthcare providers should carefully review the medications and supplements used by patients and ensure they are being used at the correct dosage. Improper use of any medication can lead to teratogenic effects.

Keywords: Hypothyroidism, intrauterine treatment, euthyroid, fetal goiter, iodine supplementation

Introduction

Adequate iodine nutrition is crucial for the synthesis of thyroid hormone. During pregnancy and lactation, there is an increased demand for dietary iodine.[1] During pregnancy, thyroid hormone production increases by 50%, leading to an elevation in daily iodine requirements.[2] This increase can be attributed to several factors: enhanced transportation of iodine across the placenta via active transport, heightened breakdown of thyroxine (T4) into the inactive form reverse triiodothyronine (T3), and a 30-50% increase in the renal excretion of iodide due to higher glomerular filtration rates. This surge typically begins in the latter half of the first trimester and persists throughout pregnancy.

Adequate iodine intake allows the thyroid gland to adjust to the demands of pregnancy.[3]

The World Health Organization (WHO) have issued recommendations for iodine intake tailored to preconception, pregnancy, and postpartum periods. The WHO recommend 150 µg/day iodine intake for adults, which increases to 250 µg/day during pregnancy and lactation.[4,5]

Imbalance in iodine intake, whether excessive or deficient, can adversely affect thyroid function. High-dose iodine exposure triggers a temporary shutdown of thyroid hormone synthesis, termed the acute Wolff-Chaikoff effect.[6] Prolonged exposure to elevated iodine levels downregulates the sodium iodide symporter (NIS), facilitating the resumption of thyroid hormone synthesis,

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known as the escape from the acute Wolff-Chaikoff effect. A breakdown in the acute Wolf-Chaikoff effect may result in hyperthyroidism produced by iodine. This is particularly common in historically iodine-deficient locations, as it is most commonly observed in people with nodular goiter. Individuals with thyroid autoimmunity or pre-existing thyroid conditions may experience iodine-induced hypothyroidism, wherein the acute Wolff-Chaikoff effect occurs but the escape mechanism fails.7,8. The fetus is especially vulnerable to this condition as its ability to fully escape the acute Wolff-Chaikoff effect does not develop until approximately 36 weeks gestation. Consequently, fetal susceptibility to iodine-induced hypothyroidism is heightened.[7-9]

A recent Chinese cohort study showed that urine iodine concentration (UIC) values of 150–249μg/L are related with optimum thyroid function, and that both excessive and insufficient iodine intakes are linked to an elevated risk for hypothyroidism in the first trimester of pregnancy.[10,11]

Fetal goiter is an extremely rare condition occurring in 1 in 40,000 births. While maternal thyroid diseases and iodine deficiency are common known causes, fetal goiter can also be associated with congenital hypothyroidism or hyperthyroidism.[11]

Around the 17th week of pregnancy, the fetal thyroid gland starts to produce hormones after maturing in the 12th week.[12] The most prevalent thyroid condition in newborns, congenital hypothyroidism, has the biggest detrimental effects on intellectual ability.[12]

Thyroid dysgenesis (agenesis, hypoplasia, or ectopy) accounts for the majority of cases of CH (only 15–25% are caused by specific abnormalities in thyroid hormone synthesis/dyshormonogenesis), which is typically inherited autosomally recessively.[13-15]

Fetal goiter is associated with labor dystocia due to the fixed hyperextension of the fetal neck, and airway obstruction at time of birth that may be complicated by neonatal hypoxic ischemic brain injury and death also perinatal complications such as polyhydramnios, preterm delivery, and also long-term morbidity due to neurodevelopmental and growth impairments.[16,17] Thus, prenatal diagnosis of polyhydramnios in these cases, due to poor fetal swallowing, indicates potential airway obstruction and should undergo further diagnostic evaluation in terms of tracheal patency.[18]

However, labor and delivery are typically uneventful in most cases, with neonatal thyroid function normalizing within one month after birth.[17,19]

There is a reduced number of published cases of hypothyroid fetal goiter and there are no standardized guidelines about this topic.[17,20]

Case(s)

At 24 weeks pregnant, a 27-year-old primigravida was referred for a routine second trimester ultrasound evaluation despite not having a relevant family history or any personal thyroid or autoimmune illness. which showed cervical hyperextension and a high vascularized, bilobed, and symmetric mass in the anterior region of the fetal neck measuring 2.6 cm cranio-caudal × 1.5 cm transverse >%95 SD, suggesting fetal goiter (Figures 1 and 2). No signs of polyhydramnios, and no other fetal anomalies were found. Overall, these findings stated fetal goiter.

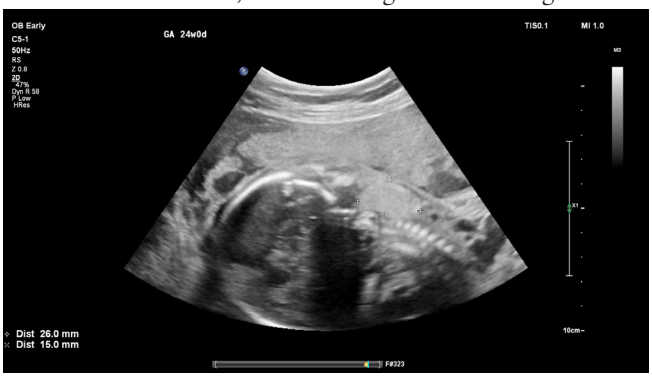


Fig 1. Coronal view of the one lobule of visible thyroid goiter on the anterior face

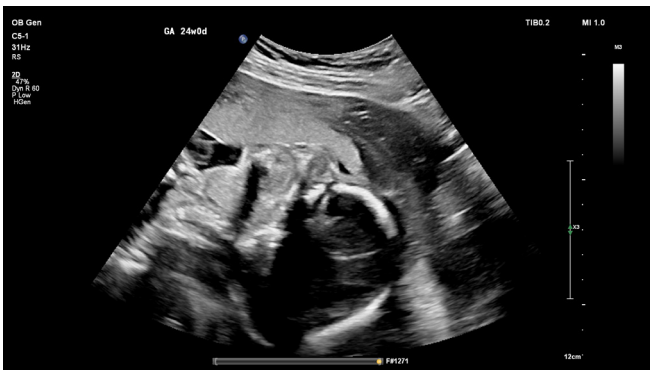


Fig 2. Sagittal view of the 24-week fetus with a visible thyroid goiter on the anterior face and hyperextension neck

The patient seemed to be clinically euthyroid and denied having ever had thyroid problems. Thyroid function tests performed on the mother's serum were also normal (TSH 2.08 mIU/l, free T3 level 2.4 pg/ml, and free T4 level 1.0 pg/ml). Thyroid peroxidase and anti-thyroglobulin antibodies were both within the reference range. No known medication exposures occurred. The only prescription she was known to be taking was a prenatal vitamin.

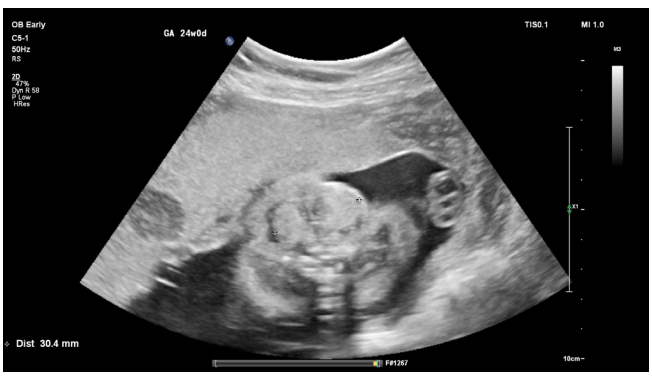
On the 24th week of gestation, the mother's urine iodine content was 972 µg/L /24 h (normal range: 150–249 µg /24 h).

When a detailed anamnesis was taken, it was learned that the patient had misunderstood the recommended dose of medication. It was learned that instead of two drops (250 µg), she used two droppers full of medicine (estimated 5000 µg) starting from the 4th week of pregnancy. Supplements were immediately discontinued and followed up at two week intervals

The patient was informed about the possibility of fetal goiter and hypothyroidism due to excessive iodine intake, along with all associated risks. Amniocentesis and cordocentesis were discussed, and it was explained that fetal TSH measurement would determine the treatment plan as needed, but she did not accept this and intra-amniotic therapy because of the potential risks of the procedures. She declined the invasive procedures and preferred to proceed with expectant management. Subsequent ultrasounds demonstrated resolution of the fetal goiter. During follow -up late onset IUGR was observed.

The patient decided to have her first child delivered by Cesarean. At 37 weeks gestation, she had this procedure, and the result was a 2340 g girl baby with an Apgar score of 8 at 1 minute and 9 at 5 minutes. The thyroid was not palpable at delivery. By the day of birth, postnatal thyroid scans showed a steady state of euthyroidism. The newborn's hearing screen confirmed both sides of the response to be normal. The baby was euthyroid, healthy, and reaching all developmental milestones at eight months of age.

Fig 3. Ultrasound demonstrating two hypoechogenic symetric masses measuring 30 mm transvers lenght



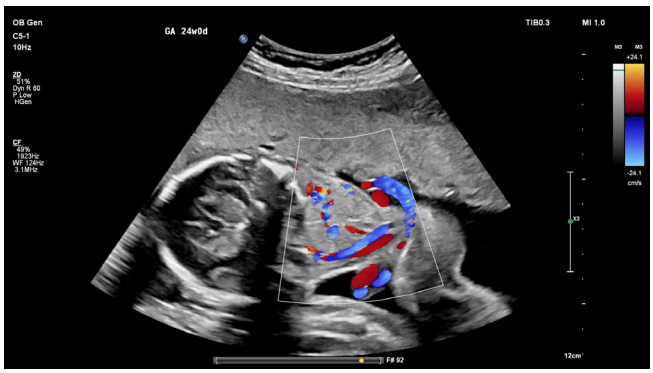


Fig 4. Color Doppler of the fetal goiter, hypervascularization of the fetal thyroid gland

Discussion

Fetal goiters are an unusual finding during pregnancy. When the mother does not have thyroid-stimulating antibodies and all other potential reasons of dyshormonogenesis are ruled out, it is necessary to look into other causes of fetal goiter. This case highlights the significance of looking for iatrogenic explanations for anomalies in fetuses. The natural iodine supplement our patient was taking was equal to 20 times the daily dosage of iodine prescribed during pregnancy. The hypothyroidism and fetal goiter were brought on by the high iodine dosage. Iodine passes through the placenta actively during pregnancy.1 Iodine is concentrated in the thyroid gland and is essential for the synthesis of thyroid hormones. The recommended daily allowance for pregnant women is 250 µg iodine daily.[4]

This case report sheds light on the consequences of maternal excessive iodine intake, which can result in conditions such as fetal goiter, as seen in our case. Additionally, this case presentation demonstrates the immaturity of the Wolff-Chaikoff effect in fetuses, indicating that they have not yet developed the ability to escape from it. The fetus is thought to be particularly susceptible to the suppressive effects of excessive iodine because it cannot avoid the Wolff-Chaikoff effect, a defensive mechanism that stops the creation of excess thyroid hormone in the event that plasma iodine levels abruptly rise.[6-8] Excessive iodine consumption in healthy individuals momentarily and abruptly impairs thyroid hormone secretion and thyroid biosynthesis. Following an extended period of exposure to high levels of iodine, organification and thyroid hormone biosynthesis proceed normally. The developing fetal and neonatal thyroid gland is unable to reduce intracellular iodine transport, in contrast to adults and children. Thus, the fetus continues to be hypothyroid.[7,8] Because fetuses have not yet developed the ability to escape from the Wolff-Chaikoff effect before 36 we-

eks,Formun Üstü excess iodine can result in persistent fetal hypothyroidism.[21,22] This effect resolves when the excessive iodine supplementation is removed.

In another case where fetal goiter developed following excessive iodine intake, it was observed that TSH levels returned to normal 5 weeks after the last iodine intake and 4 weeks after intra-amniotic levothyroxine treatment. To determine whether this condition was temporary or not, another fetal blood sample was taken after four weeks from the last intra-amniotic levothyroxine treatment, and it was shown that thyroid hormone synthesis had resumed.[23]

In our case, due to our patient not permitting cordocentesis, we don't know the levels of thyroid function tests. Delivery occurred 12 weeks after discontinuation of iodine supplementation, and thyroid functions were at normal levels, and fetal goiter was not observed. During pregnancy and childbirth, complications associated with fetal goiter may occur. Tracheal compression can result in postnatal asphyxia, intrathyroidal arteriovenous shunting can lead to high-output cardiac failure in the fetus and subsequent hydrops, and esophageal compression may diminish the fetus's capacity to ingest amniotic fluid, contributing to polyhydramnios, thereby increasing the likelihood of preterm delivery.[20] In addition, neck hyperextension from the goiter could result in malpresentation during delivery and delivery dystocia may occur.[24] In our case, three weeks after discontinuation of iodine, fetal goiter had resolved, and fetal neck hyperextension had improved on examination. Therefore, these complications were not observed in our case.

One of the obstetric complications seen in cases of fetal goiter is intrauterine growth retardation (IUGR). In a retrospective study conducted in 2022, it was noted that 11 of 31 congenital goiter cases where antenatal diagnosis could not be made, IUGR developed.

In our case as well, despite the cessation of iodine and regression of the goiter, IUGR developed. Our patient resembles cases recently described in a case report by Overcash et al. and another case report by Hardley M et al.[23,25] In both cases, the mothers were also exceeding the recommended iodine dosage during pregnancy, leading to fetal goiter. In the case reported by Overcash, the patient did not receive intra-amniotic levothyroxine injections. Subsequently, the infant was diagnosed with bilateral hearing loss, a recognized complication of fetal hypothyroidism.[25] Hearing screening in the other case which one treated with intra-amniotic levothyroxine injections revealed a normal response bilaterally.[23] In our case, intrauterine levothyroxine treatment could not be administered because the patient did not consent to any invasive procedures. Postnatal follow-up examinations revealed normal bilateral hearing tests in both ears.

Additional research is required to ascertain whether intra-amniotic therapy for hypothyroid fetuses substantially reduces the incidence of postnatal sensorineural hearing loss.

Conclusion

In conclusion, our case highlights the importance of timely diagnosis and management of fetal goiter to prevent potential obstetric complications . While antenatal detection and treatment options were limited in our case due to patient preferences, postnatal assessments showed positive outcomes, including the resolution of fetal goiter and normal bilateral hearing tests.

Another point we want to emphasize with this study is that clinicians and healthcare providers should carefully review the medications and supplements used by patients and ensure they are being used at the correct dosage. Improper use of any medication can lead to teratogenic effects.

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