



# CONGENITAL GOITER EVALUATION AND AIRWAY PERMEABILITY BY FETAL MAGNETIC RESONANCE IMAGING\*



## Key words (MeSH)

Goiter  
Magnetic resonance  
imaging  
Infant newborn  
Ultrasonography

## Palabras clave (DeCS)

Bocio  
Imagen por resonancia  
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Valoración del bocio congénito y permeabilidad de la vía aérea mediante resonancia magnética fetal

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## Summary

Congenital goiter is an uncommon condition caused by altered fetal thyroid function of endogenous or exogenous cause (maternal thyroid dysfunction, iodine deficiency in the diet or secondary to taking medication). The impact on the mature development of the fetus, as well as the compression of adjacent structures due to increased size, which may be a risk factor for airway obstruction and hypoxic-ischemic lesions, make the diagnosis and treatment of this pathology of vital importance. It is usually diagnosed by ultrasound in the second or third trimester of pregnancy, but magnetic resonance imaging (MRI) has become a complementary and important diagnostic technique in the event of an intrapartum treatment procedure.

## Resumen

El bocio congénito es una patología infrecuente, que se genera por alteración de la función tiroidea fetal de causa endógena o exógena: disfunción tiroidea materna, déficit de aporte de yodo en la dieta o secundario a la toma de medicación. La repercusión en la maduración del feto, la compresión de estructuras adyacentes debido al aumento de tamaño, lo cual puede ser un factor de riesgo de obstrucción de la vía aérea y de lesiones hipóxico-isquémicas, hacen que el diagnóstico y tratamiento de esta patología sea de vital importancia. Habitualmente, se diagnostica por ecografía en el segundo o tercer trimestre de embarazo, pero la resonancia magnética (RM) se ha convertido en una técnica diagnóstica complementaria e importante ante un eventual tratamiento intraparto.

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## Introduction

Congenital goiter is a rare entity, present in 1/4000 of live newborns (1) and in 8% of fetuses of hyperthyroid mothers with antithyroid therapy.

Fetal hyperthyroidism is associated with maternal thyroid-stimulating antibodies passing through the placenta, and fetal hypothyroidism, maternal antithyroid medication, congenital errors of iodine metabolism, maternal lithium therapy and endemic iodine deficit. Another cause of fetal hypothyroidism is Prended syndrome (goiter-associated sensorineural deafness, autosomal recessive).

The purpose of this work is to recognize the role of magnetic resonance imaging (MRI) in the diagnosis of this pathology and the assessment of airway permeability in enhanced sequences in T2 or balanced sequences.

## Case report

35-year-old female, 34 weeks gestation and personal history of hyperthyroidism secondary to a toxic adenoma in the first pregnancy treated with antithyroid drugs. Left hemithyroidectomy was performed with negative autoimmunity. In the second pregnancy she presented again thyroid hyperfunction and started antithyroid treatment.

In the ultrasound of the third trimester a mass of high echogenicity was visualized in the anterior region of the neck, of 8 cm of maximum diameter, with apparent permeability of the airway (figure 1).

Given the large size of the cervical mass and the possibility of compression of the airway, fetal MRI was performed to characterize the mass and assess the permeability of the airway in view of the possible need for extra-uterine intrapartum treatment (EXIT) (2).

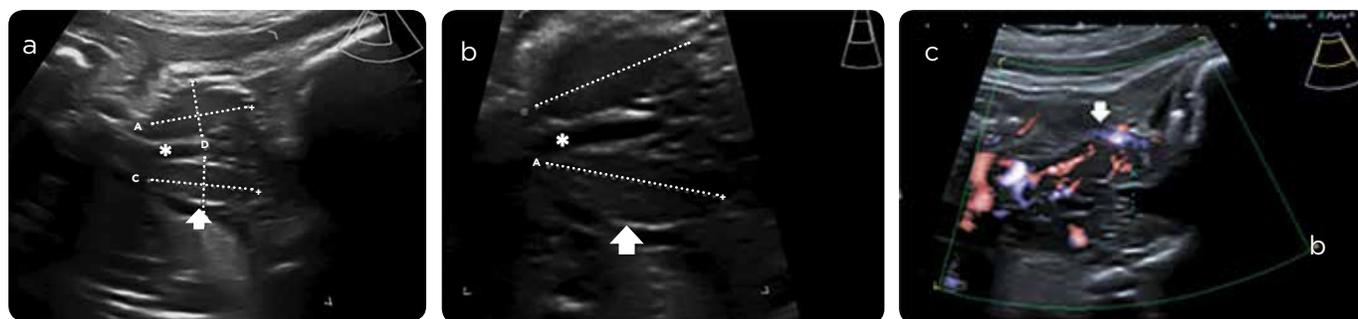


Figure 1. Congenital goiter. Third trimester ultrasound. a and b) Coronal. c) Sagittal with increased Doppler registration. Goiter (white arrow) generating a decrease in the size of the airway (asterisk).

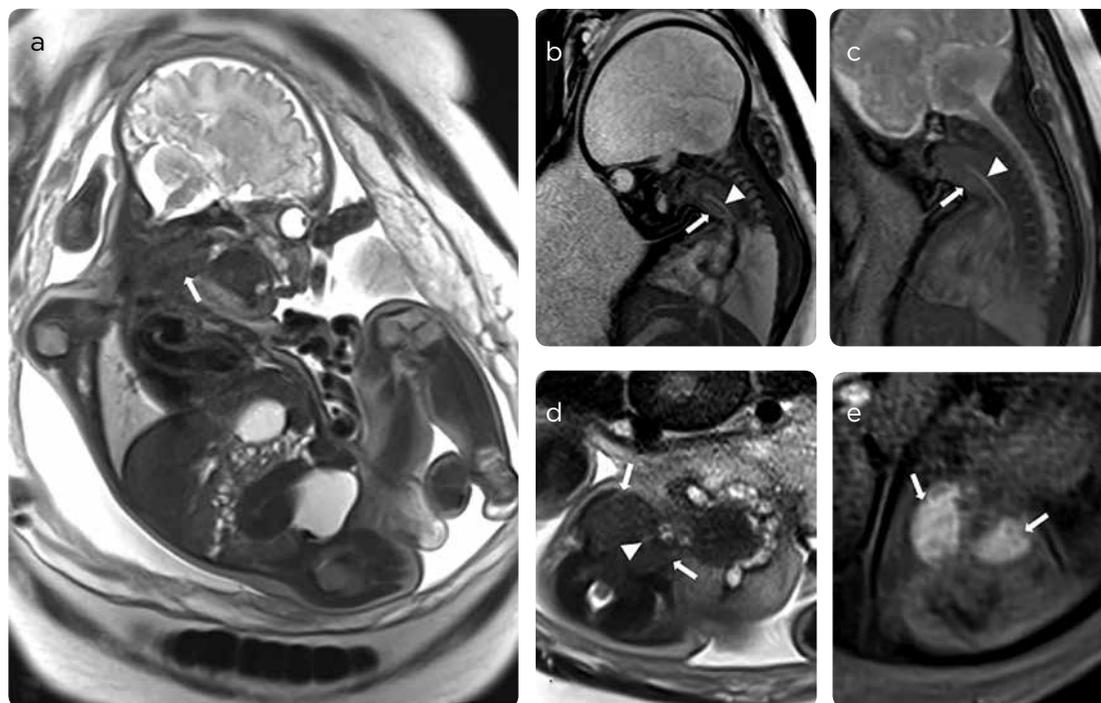


Figure 2. Congenital goiter. MR. a) Sagittal FIESTA. b and c) Sagittal T2 HASTE. d) Axial with T2 HASTE information. e) Axial with T1 information: low signal anterior cervical mass in sequences with T2 information and high signal in sequence with T1 information (white arrow). Permeable airway, high signal in sequence with T2 information (arrowhead) although discreetly stenosed.

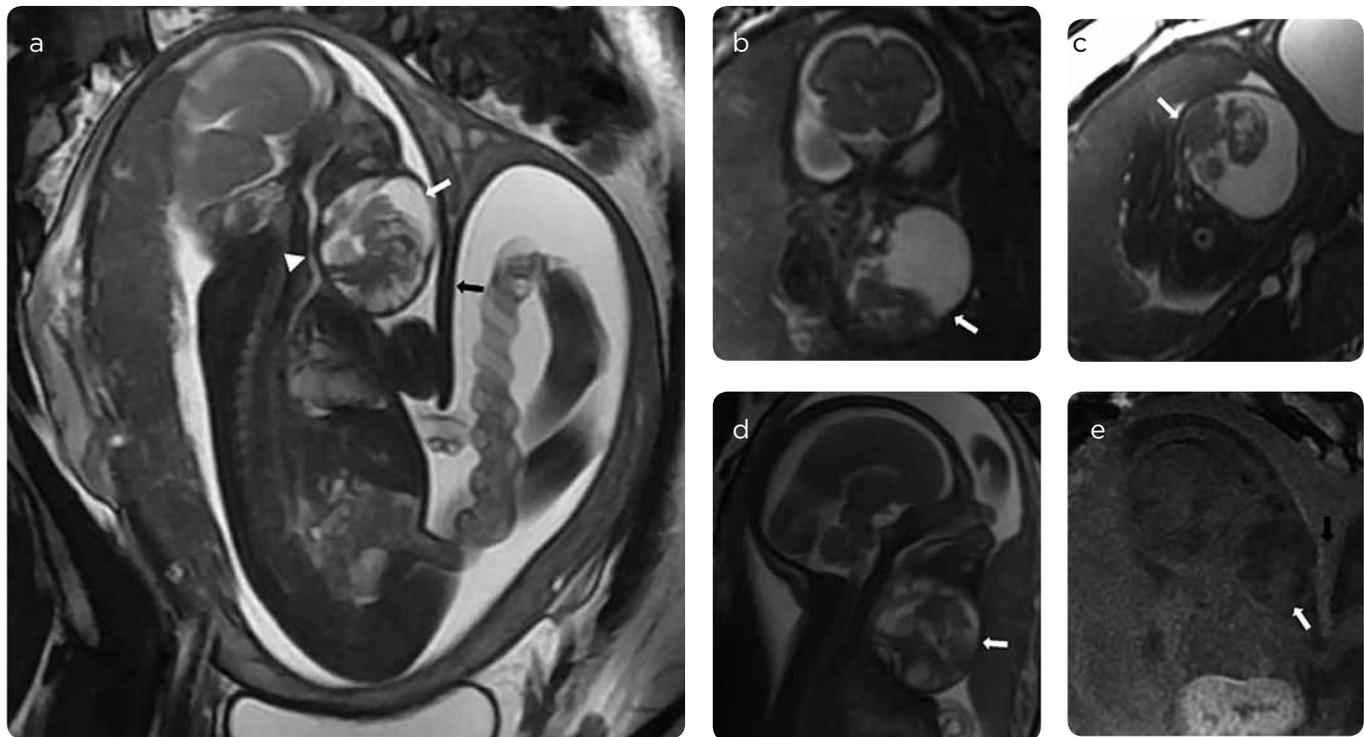


Figure 3. Cervical teratoma. MR. a) Sagittal FIESTA. b) Coronal FIESTA. c) Axial FIESTA. d) Sagittal FIESTA. e) Sagittal 3D LAVA. Large cervical mass with solid component (medium signal strength in sequences with information T1 and FIESTA) and cystic component (low signal in sequence with information T1 and high signal in sequence FIESTA) is observed. The mass originates in the anterior cervical region (white arrow) and extends to the left laterocervical region, submandibular, left parapharyngeal and carotid space. Cranially it affects the floor of the left mouth reaching the midline and extends to the oropharynx, displacing the oropharynx and hypopharynx in the right posterolateral direction. Displacement of the laryngeal light and the trachea in the right posterolateral direction is observed, although the light remains permeable (white arrowhead). Partial septate uterus type VB (black arrow). Gestational age: 27.5 weeks.

## Discussion

This case is unique because there are few publications of congenital goiter studied by fetal MRI in which airway compromise is evaluated.

The most frequent cervical masses in the fetus are teratomas and goiter in the anterior cervical region, and cystic hygromas in the posterolateral region (3,4), although bronchial cysts are also frequent.

MRI makes it possible to identify and differentiate cervical masses thanks to their spatial resolution, great tissue differentiation and multiplanar character.

When congenital goiter is diagnosed in the second trimester, levels of TSH in amniotic fluid are useful for the study of fetal thyroid metabolism. However, diagnosis is made by measuring fetal TSH, free T3 and free T4 in fetal blood, by cordocentesis. The thyroid function of fetuses with mothers with Graves' disease is altered in 2-12% of cases (5).

Congenital goiter appears as a high signal solid mass in T1-powered sequences and medium signal in T2-powered sequences (6) or high signal compared to muscle (7) (figure 2).

As it contains amniotic fluid, the airway will show high signal in sequences with T2 information and balanced sequences.

In large goiters there is a decrease in tracheal light and they can produce tracheal stenosis. MRI can identify airway involvement and quantify the degree of stenosis. The anterior contour of the neck becomes convex and a posterior displacement of the esophagus and the vascular structures of the neck are observed. In cases of bulky goiters,

the cervical spine may be hyperextended, causing dystocia of labour and making caesarean section necessary (8).

In the immediate postpartum period, the newborn may have difficulty breathing due to compression over the trachea or tracheomalacia.

Associated radiological findings may include polyhydramnios (due to swallowing difficulties), hidrops fetalys (secondary to vascular short circuits in the thyroid), delayed or accelerated intrauterine growth (in the case of fetal hyperthyroidism), delayed bone maturation in hypothyroidism or accelerated in hyperthyroidism (8).

The main differential diagnosis is cervical teratoma. Teratomas are the most frequent congenital tumours (5). Ninety percent of them contain the 3 germ lines: endoderm, mesoderm and ectoderm and represent 25-35% of all fetal tumors (9). They occur in 1/20,000-1/40,000 of newborns and 2-9% of them are located in the head and neck, and the sacrococcygeal region is the most frequent location (5, 9). They are visualized as a solid or cystic mass (8) with low signal in sequences with T1 information and high signal in sequences with T2 information (figure 3). Areas with high signal fat content can be observed in sequences with T1 information that they suppress with fat suppression techniques, unlike goiter that does not suppress their signal. Teratomas may show calcifications in up to 50% of cases (2, 8) and sources of haemorrhage (8). The main postnatal complication is airway compromise. Prenatal diagnosis is crucial and fetal MRI is of great help in differential diagnosis with goiter and in assessing airway

compression, in which case extrauterine intrapartum treatment (EXIT) is indicated (10).

In conclusion, MRI is a useful imaging technique for the diagnosis and characterization of congenital goiter, which can assess the compression of the trachea and quantify the degree of stenosis. It also allows differential diagnosis with other cervical masses in the fetus, such as teratomas.

## References

1. Göktolga U, Karasahin KE, Gezginç K, et al. Intrauterine fetal goiter: diagnosis and management. *Taiwan J Obstet Gynecol.* 2008;47(1):87-90.
2. Dighe MK, Peterson SE, Dubinsky TJ, et al. EXIT procedure: technique and indications with prenatal imaging parameters for assessment of airway patency. *Radiographics.* 2011;31(2):511-26.
3. Saleem SN. Fetal MRI: An approach to practice: A review. *J Adv Res.* 2014;5(5):507-23
4. Benacerraf B, Nyberg D. The face and neck. In: Nyberg D, McGahan J, Pretorius D, Pilu G, editors. *Diagnostic imaging of fetal anomalies.* Philadelphia: Lippincott Williams & Wilkins; 2003.
5. Zugazaga Cortázar A, Martín Martínez C. Utilidad de la resonancia magnética en el estudio prenatal de las malformaciones de la cara y el cuello. *Radiología.* 2012;54(5):387-400.
6. Karabulut N, Martín DR, Yang M, et al. MR imaging findings in fetal goiter caused by maternal graves disease. *J Comput Assist Tomogr.* 2002;26(4):538-40.
7. Kondoh M, Miyazaki O, Imanishi Y, et al. Neonatal goiter with congenital thyroid dysfunction in two infants diagnosed by MRI. *Pediatr Radiol.* 2004;34(7):570-3.
8. Baert AL, Reiser MF, Hricak H, Knauth M. *Fetal MRI.* Medical radiology. Springer; 2011.
9. Orrego J, Jaramillo ML, Ballesteros A, et al. Teratoma cervical congénito: reporte de casos. *Rev CES Med* 2009;23(1):77-83.
10. Aguado del Hoyo A, Ruiz Martín Y, Lancharro Zapata A, et al. Valoración radiológica de los tumores congénitos. *Radiología* 2015;57(5):391-401.

**Conflict of interest:** none.

## Ethical Responsibilities

Protection of people and animals. The authors state that no human or animal experiments have been carried out for this research.

Data confidentiality. The authors state that they have followed the protocols of their workplace on the publication of patient data.

Right to privacy and informed consent. The authors state that no patient data appear in this article.

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