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CASE REPORT

Fetal Hypothyroidism

[1]Miguel Ruoti Cosp, [2]Ernesto Gruhn, [3]Monica Ontano, [4]Enrique Calabrese, [5]Lindolfo Mendoza

ABSTRACT

This case report illustrates the prenatal diagnosis of fetal hypothyroidism in a nulliparous 31-year-old woman with a history of four previous cesarean sections. She was presented with chronic renal failure of unknown etiology and had been on dialysis for 3 years along with a subclinical hypothyroidism. At 21.4 weeks of gestation, color Doppler revealed a fetus with symmetrical solid mass in the anterior cervical region with little vascularization compatible with fetal goiter. Aminotic fluid was also increased for gestational age. At 25 weeks of gestation, due to maternal respiratory distress, an amniodrainage was performed. From the same sample, thyroid-stimulating hormone (TSH) was determined yielding 1.3 mIU/mL and 0.1 ng/dL for free T4. At 27 weeks of gestation, membrane rupture occurred. Chorioamniotis was suspected and cesarean section was performed extracting a live 1060 gm female newborn. The newborn was 29 weeks of age by Capurro test and Apgar score was 7/08. On physical examination, a 2 to 3 cm symmetrical tumor was found in cervical region. Admitted to neonatal intensive care unit for mechanical respiratory support, four ampoules of T4 were given, achieving complete regression of thyroid gland size at 15 days of life. At 34 days of age, nosocomial infection, *Klepsiella neumonie,* was confirmed and death occurred at 40 days of life. Isolated fetal hypothyroidism is rare. Ultrasound evaluation allows the identification of compensatory growth of the thyroid, showing a hypoechoic solid image. In extreme cases, it may cause esophageal obstruction and polyhydramnios as well as cervical hyperextension and dystocia during labor.

Keywords: Fetal hypothyroidism, Neonatal evolution, Prenatal diagnosis.

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INTRODUCTION

Fetal thyroid begins its development from day 24 after fertilization as a thickening of the endoderm on the floor of the primitive pharynx. This results in the formation of thyroid diverticulum which gradually elongates to form a vesicular structure.

At the end of the 7th week, the thyroid gland is located near the laryngeal primordium, where it divides into two final lobes with a narrow isthmus communicating. Until the 9th week of pregnancy, thyroid shows the development of a compact proliferating mass of endoderm cells and from the 10th week, the formation of a well-established network of tubules and cords walls from the mesoderm.[1]

At 12th week, the peripheral zone of the cords forms primitive thyroid follicles, initiating secretion of iodinated proteins. This secretion produces spaces that are gradually filling with noniodinated thyroglobulin. Further development of the gland involves the formation of a rich capillary plexus, increased uptake of iodine, and a gradual increase in the secretion of iodinated proteins.[2]

Thyroid hormones are tetraiodothyronine or thyroxine (T_4), which is the mature and most abundant form; triiodothyronine (T_3), which corresponds to less than a 10th of T_4 but is 10–20 times more active; and diiodothyronine (T_2) with a minor effect.

This case report illustrates the prenatal diagnosis of fetal hypothyroidism.

CLINICAL CASE

A nulliparous 31- year-old woman, with the history of four previous cesarean sections was presented with chronic renal failure of unknown etiology. She had been on dialysis for 3 years and had living donor kidney transplantation two and an half years ago. The patient has a chronic allograft nephropathy for one year and a half; and on dialysis between 3 and 4 hours a day to complete a minimum of 20 hours per week. She is a Known hypertensive carrier of severe anemia and subclinical hypothyroidism.

An ultrasound control revealed a fetus with symmetrical solid mass in the anterior cervical region of 20 × 24 mm, with poor vascularization by color Doppler compatible with fetal goiter. In addition amniotic fluid index (AFI) was 24 cm, which was more for the gestational age. She had low placenta and estimated gestation weeks were 21.5 by ultrasound (Figs 1 to 3).

After 15 days, increased cervical solid mass (22 × 33 mm); AFI (35 cm), fetal biometry (23.5 weeks), and low amount of amniotic fluid in the gastric chamber were observed.

At 25 weeks, because of breathlessness, the mother consulted and amniodrainage was performed with a spinal needle no. 18. 2500 cc of amniotic fluid was

[1,5]Professor, [2-4]MD

[1-5]Mother and Child Center, Faculty of Medical Sciences, National University of Asuncion, San Lorenzo, Paraguay

Corresponding Author: Miguel Ruoti Cosp, Professor, Mother and Child Center, Faculty of Medical Sciences, National University of Asuncion, San Lorenzo, Paraguay, e-mail: mruoticosp@gmail.com

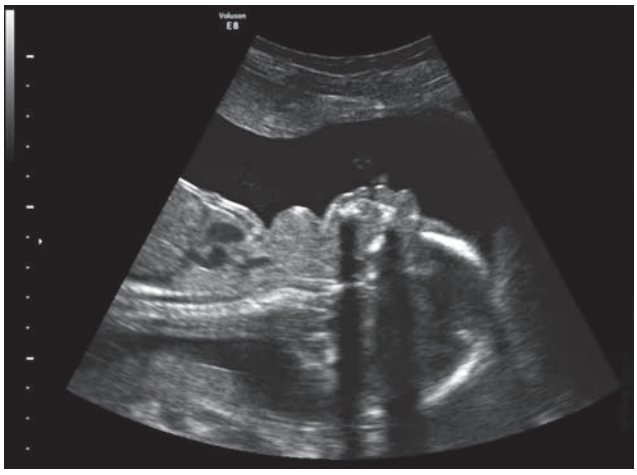

Fig. 1: Echography on fetal profile showing cervical tumor that maintains the cephalic pole in extension

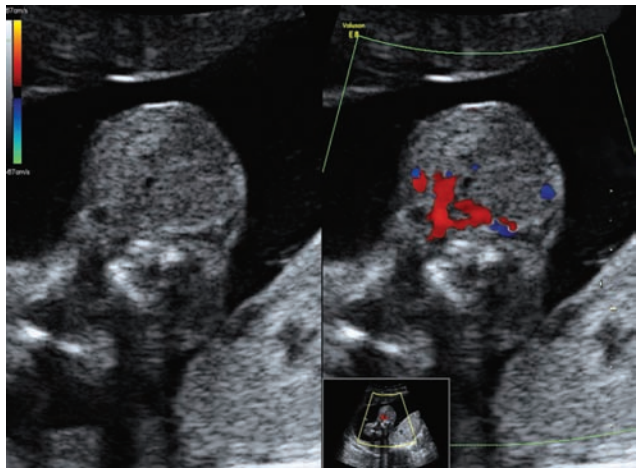

Fig. 2: Color Doppler of the cervical tumor that demonstrates poor vascularization

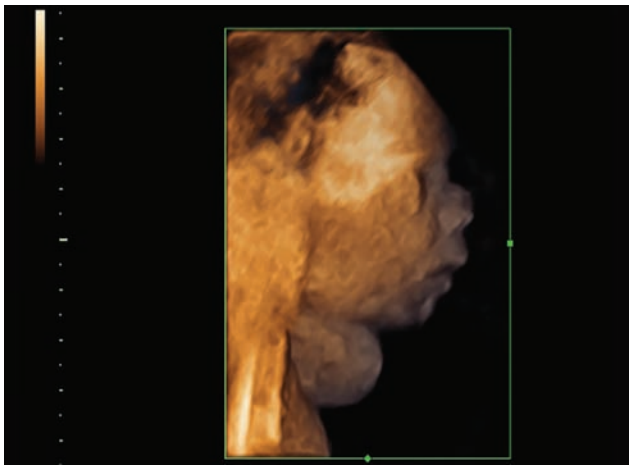

Fig. 3: Three-dimensional ultrasound fetal profile in which the previous cervical tumor is observed

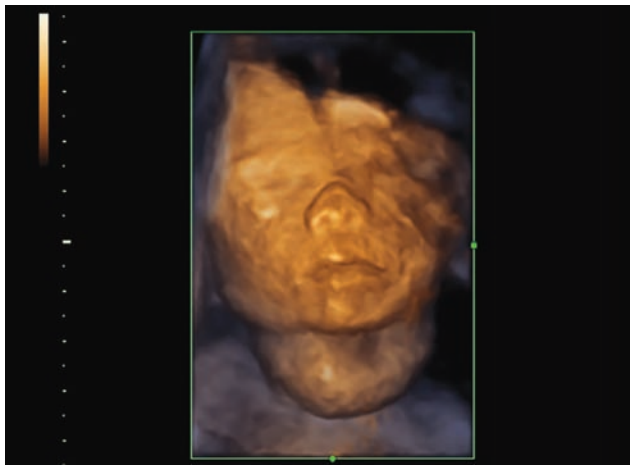

Fig. 4: Three-dimensional sonography of the face and fetal neck

extracted. From the same sample, thyroid-stimulating hormone (TSH) level was determined yielding 1.3 mIU/mL and 0.1 ng/dL for free T_4, which confirmed the diagnosis of fetal hypothyroidism.

At 27 weeks, she was hospitalized due to the loss of clear fluid from the vagina. On the 8th day after admission, chorioamnionitis was suspected with count results of white blood cells of 17600 K/uL, 85% neutrophils, and greater than 48 mg/dL polymerase chain reaction, so it was decided to interrupt the pregnancy.

An arciforme segmental cesarean was performed and a live female newborn was born weighing 1060 gm, 29 weeks per Capurro test and her Apgar score was 7/08, in which we proceeded to the endotracheal intubation prior to cut umbilical cord.

Physical examination finds newborn pink, active, reactive, intubated and a symmetrical tumor of 2 to 3 cm was observed in cervical region (Figs 4 and 5). The infant was admitted to neonatal intensive care unit for mechanical respiratory support.

Fig. 5: Newborn in which the previous cervical tumor is observed

At 34 days of age, nosocomial infection (*Klebsiella pneumonia)*, a chronic lung disease with bullae, secondary apnea, and disorders of the internal environment, was found.

At 40 days of life, the neonatal death occurred.

DISCUSSION

The isolated fetal hypothyroidism is rare, estimated 1/4,000 pregnancies and may occur permanently or temporarily.

Both thyrotropin-releasing hormone (TRH) and fetal TSH are present from 8- to 10-week gestation.

Thyroid-stimulating hormone values increase until the 28th week, preceded by a peak between 16th and 18th week, associated with increased iodine uptake by the fetal thyroid.[1,3]

The elevation of TSH and TRH is related to an increased release of fetal thyroxine (T4F) and the conveyor hormone thyroid hormones [thyroxine-binding globulin (TBG)], which occurs between weeks 20th and 30th of pregnancy. TSH has a transcriptional effect on the gene encoding thyroglobulin and thyroid peroxidase, and stimulates the uptake of iodine and the synthesis and secretion of thyroid hormones.

After 30th week, TBG values are kept constant, while the T4 increases. The TSH decreases by a negative feedback mechanism, which indicates the functionality of the hypothalamic-pituitary-thyroid axis fetal.

The thyroid hormone deficiency during pregnancy may cause altered pathways formation and cell bodies that are mainly observed in pyramidal cells, Purkinje cells, and cortical cells, as well as decreased proliferation and differentiation of glial cells.

Sonographic evaluation of the fetal neck identifies compensatory thyroid growth (goiter), observed as a solid hypoechoic image (as we have observed), and less frequently with cystic components.

In extreme cases, it can cause esophageal obstruction and polyhydramnios with this case or cervical hyperextension and dystocia during labor.[4]

Monograms have been published of the gland size.[5] Some authors relate the volume with the fetal weight between 20th and 30th week, average volume of fetal thyroid[6] was 0.23 ± 0.18 cm^3. The ratio of the volume of fetal thyroid, an estimated fetal weight (0.163 cm^3 ± 0.079 cm^3/kg), was constant throughout her pregnancy.

An abnormal increase in the thyroid gland can also be assessed by means of color Doppler and power Doppler with observing the increase in the number of blood vessels and their ramifications; however, this fact was not assessed as such in this case.

It can get an accurate diagnosis of thyroid status by taking fetal blood sampling through analysis of TSH, T3 or T4 (Table 1) or in amniotic[7] fluid as in our case with TSH values, 0.1 to 0.5 mIU/L, total T4 2.3 to 3.9 mg/dL, free T4 0.4 to 0.7 ng/dL. However, some authors question the accuracy of the results obtained from samples of amniotic fluid.[8]

Table 1: Range of normal values in fetal blood thyroid hormone during pregnancy[1]

		T_4		T_3	
	TSH mUI/L	*Free pmol/L*	*Total nmol/l*	*Free pmol/L*	*Total nmol/L*
20 weeks	1.8 – 7,9	1.7 – 6,8	14 – 68	0.13 – 0,42	0.05 – 0.4
40 weeks	2.4 – 11,9	17 – 29	80 – 194	0.7 – 2,9	0.2 – 3.1

Among the differential diagnoses is cervical teratoma, visualized as a mixed solid cystic mass arising in the thyroid region, is frequently associated with polyhydramnios. Moreover, lymphangioma or hemangioma cervical region tends to be unilateral or asymmetrical, more cystic than solid component, which originates mainly in the lateral area of the fetal neck.

Hypothyroidism is not generally associated with other anomalies and described as a case of Prader-Willi syndrome in a newborn with goiter.[9]

Although usually a self-limiting disorder, associated with a good prognosis, may affect the development including mental.

Treatment is indicated if the diagnosis of fetal hypothyroidism is confirmed. Intrauterine treatment can be performed with intra-amniotic[10] or fetal intramuscular administration of T_4, at a set dose of 10 mg/kg fetal weight once a week. When applied in the amniotic fluid, the fetus swallows 90% of the hormone within 24 hours after administration. With this regime goiter decreases and thyroid hormones return to their normal values.[11,12]

REFERENCES

1. Burrow GN, Fisher DA, Larsen PR. Maternal and fetal thyroid function. N Engl J Med 1994 Oct;331(16):1072-1078.
2. Hernández-Andrade E, Gerulewicz Vannini D. Hipotiroidismo e hipertiroidismo materno y fetal. In: Gratacos E, Gómez R, Nicolaides K, Romero R, Cabero L, editors. Medicina fetal. Madrid: Editorial Médica Panamericana; 2007. p. 586-592.
3. Brown RS. Minireview: developmental regulation of thyrotropin receptor gene expression in the fetal and newborn thyroid. Endocrinology 2004 Sep;145(9):4058-4061.
4. Lazarus JH, Premawardhana LD. Screening for thyroid disease in pregnancy. J Clin Pathol 2005 May;58(5):449-452.
5. Bromley B, Frigoletto FD Jr, Cramer D, Osathanondh R, Benacerraf BR. The fetal thyroid: normal and abnormal sonographic measurements. J Ultrasound Med 1992 Jan;11(1): 25-28.
6. Ho SS, Metreweli C. Normal fetal thyroid volume. Ultrasound Obstet Gynecol 1998 Feb;11(2):118-122.
7. Singh PK, Parvin CA, Gronowski AM. Establishment of reference intervals for markers of fetal thyroid status in amniotic fluid. J Clin Endocrinol Metab 2003 Sep;88(9):4175-4179.

8. Wenstrom KD, Weiner CP, Williamson RA, Grant SS. Prenatal diagnosis of fetal hyperthyroidism using funipuncture. Obstet Gynecol 1990 Sep;76(3 Pt 2):513-517.
9. Insoft RM, Hurvitz J, Estrella E, Krishnamoorthy KS. Prader-Willi syndrome associated with fetal goiter: a case report. Am J Perinatol 1999;16(1):29-31.
10. Corbacioglu Esmer A, Gul A, Dagdeviren H, Turan Bakirci I, Sahin O. Intrauterine diagnosis and treatment of fetal goitrous hypothyroidism. J Obstet Gynaecol Res 2013 Mar;39(3):720-723.
11. Johnson RL, Finberg HJ, Perelman AH, Clewell WH. Fetal goitrous hypothyroidism. A new diagnostic and therapeutic approach. Fetal Ther 1989;4(2-3):141-145.
12. Agrawal P, Ogilvy-Stuart A, Lees C. Intrauterine diagnosis and management of congenital goitrous hypothyroidism. Ultrasound Obstet Gynecol 2002 May;19(5):501-505.