

Congenital Hypothyroidism Following Maternal I-131 Therapy in Unsuspected Pregnancy

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ABSTRACT

The authors report a term infant with congenital hypothyroidism following maternal radioiodine (I-131) treatment for papillary thyroid cancer in unsuspected pregnancy. The woman received 150 millicuries (mCi) of I-131 during the second trimester of pregnancy. Antenatal care was done in the other hospital without the awareness of previous I-131 treatment during pregnancy. The child presented with congenital hypothyroidism and recurring attacks of postprandial bilious vomiting due to midgut malrotation and Ladd bands. This case reminds physicians of the importance of obtaining an accurate menstrual history and providing information on conception in fertile woman before receiving I-131 treatment.

Keywords: Congenital hypothyroidism; radioiodine therapy; thyroid cancer; thyroid scan

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Radioiodine has been widely used in both the diagnosis and therapy of thyroid gland disorders for more than 50 years. More than one million patients with either hyperthyroidism or well differentiated thyroid carcinoma were effectively treated with minimal side effects. Increasing utilization of I-131 may lead to the inherent problems related to the possible harmful effects of radioactivity. Radioiodine treatment is absolutely contraindicated in pregnancy due to the risk of damage to the fetal thyroid gland leading to hypothyroidism or cretinism.^{1,2} An interval of at least four months is advised between maternal I-131 therapy and conception.³

The authors report a case of congenital hypothyroidism whose mother was treated with radioiodine during the second trimester of pregnancy. The present article includes estimated calculation of absorbed dose to the fetus.⁴

CASE REPORT

The male child was born in December 1999 by cesarean section due to cephalopelvic disproportion in a private hospital. The birth weight was 3,300 gm. He had recurring attacks of postprandial bilious vomiting. The plain abdomen 2 days after birth was unremarkable. At the age of 4 days, he had jaundice and subnormal

body temperature. Thyroid function tests at 5 days of age showed very high thyroid stimulating hormone (TSH) of >100 mU/L (normal range = 0.2-4.0 mU/L) and thyroid hormones in the serum were decreased: Thyroxine (T4) 0.79 µg/dl (normal range = 6.5-16.3 µg/dl), free T4 0.19 ng/dl (normal range = 0.9-2.2 ng/dl). The plain abdomen at 9 days after birth demonstrated gastric distention and he was suspected to have gastric outlet obstruction. He was referred to the authors' hospital due to the economic problem of treatment in a private hospital. On admission he was noted to have a large tongue, mild jaundice and hypotonia. Follow-up serum thyroid hormones and TSH showed no significant change. The thyroglobulin level was nearly undetectable of 0.5 ng/ml (normal range = 2.7-21 ng/ml).

The family history revealed that the child's mother was 16 years old. She had thyroid operation for papillary carcinoma in June 1999 and was given 150 mCi of I-131 one month later. She received a suppressive dose of thyroid hormone after radioiodine treatment. Her thyroid function tests were as follows: T4 9.6 µg/dl (N 4.7-13.5 µg/dl) and TSH 0.06 mU/L (N 0.3-4.2 mU/L). One month after I-131 treatment, her pregnancy test was positive.

The estimated fetal absorbed dose was 1.25 Gy and estimated fetal thyroid dose was 3,200 Gy.

Thyroid imaging of the child with Tc-99m pertechnetate was performed and showed no radioactivity in the thyroid region (Fig. 1). Physiologic uptake was noted in the salivary glands. Thyroid ultrasonography

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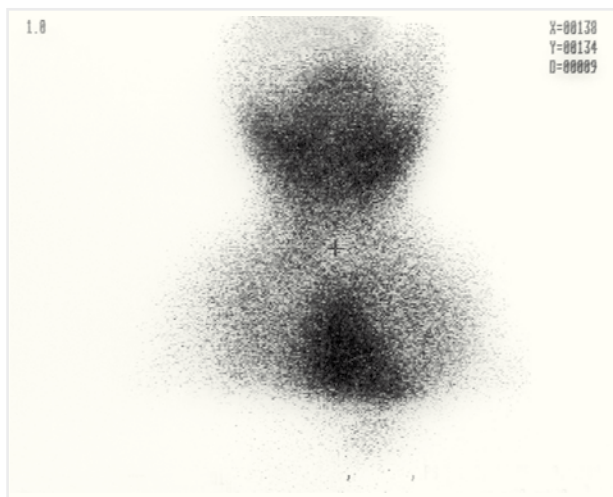


Fig 1. Tc-99m pertechnetate thyroid imaging showed no radioactivity uptake in the thyroid region.

showed ill-defined hypoechogenicity at the thyroid region on both sides suggestive of thyroid gland atrophy (Fig. 2). An upper GI study was undertaken and demonstrated distention of the stomach and the 1st and 2nd part of the duodenum. The position of the duodenojejunal junction was on the right side of the spine. Midgut malrotation was considered.

He was given 10 µg/kg/day of L-thyroxine (Eltroxin®) for hypothyroidism and underwent an abdominal operation for gut obstruction. Midgut malrotation with Ladd bands was demonstrated.

DISCUSSION

After administration of a radiopharmaceutical the distribution of the radionuclide over different source organs will be determined by its biokinetics. It is well documented that I-131 transverse the placental barrier in both animals and humans.⁵ The fetal thyroid is capable of forming a colloid at 10-11 weeks of age and at the same time it is also capable of concentrating iodine and synthesizing thyroid hormones.^{6,7} Then the fetal thyroid gland starts to secrete hormones at about 90 days following conception.^{5,8} Of significant importance is the fact that the fetal thyroid in most experiments has appeared to have a much greater relative

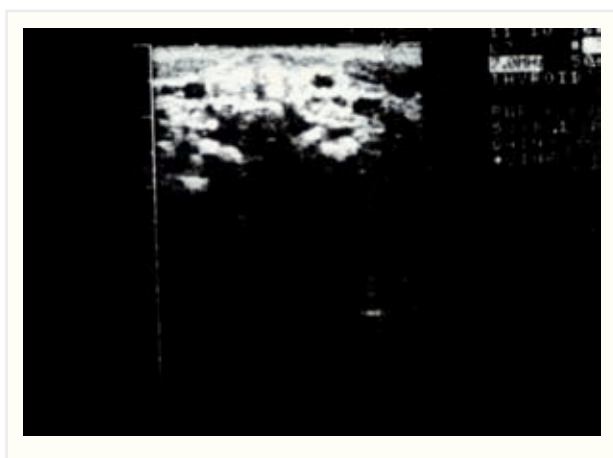


Fig 2. Ultrasonography of the thyroid gland demonstrated ill-defined hypoechogenicity of both lobes of the thyroid gland.

avidity for I-131 than does the maternal thyroid gland.⁵ This means that fetal thyroid gland will be at risk for the deterministic effects from I-131 therapy.

Reports of adverse effects in children following the relatively high dose to the fetal thyroid in mothers unaware of their pregnancy are limited. Stoffer and Hamburger analyzed 182 cases in which I-131 was given for hyperthyroidism in the first trimester of pregnancy. There were no effect in 170 cases and six cases of infantile hypothyroidism and/or mental deficiency. The complications in the other six cases were not greater than those that might be expected in a similar number of random pregnancies.⁹ A thyrotoxic woman treated with 16 mCi of I-131 in her 20th gestational week was reported.¹⁰ A healthy baby was born but at a later stage he appeared to have subnormal mental capacity. In mothers with thyroid cancer who received a very higher dose of I-131 than the afore mentioned cases with hyperthyroidism, all fetuses were proved to be congenital hypothyroidism as reported by Fisher et al.¹¹ The authors' reported case also showed similar result. The calculated fetal thyroid dose of the child indicated that his thyroid was completely ablated. This was proved by the ultrasonography that he had an atrophic thyroid gland that showed no uptake on thyroid scan. The thyroid scintigraphy also helps to exclude the other causes of congenital hypothyroidism in this child such as ectopic thyroid gland and organification defect.

Therapeutic radioiodine exposure in pregnancy may lead to significant fetal radiation risk especially during organogenesis which is in the early fetal period. The rotation and normal fixation of the intestinal tract takes place within the first three months of fetal life. Arrest of rotation constitutes a form of malrotation with its attendant less proper fixation. Malrotation in the authors' reported case was queried whether it related to radiation-induced malformation as it took place within the same period. There has been no published report between the relationship of fetal malrotation and maternal radioiodine treatment for thyroid cancer in unsuspected pregnancy.^{11,12} Gassi et al reported the pregnancy outcomes of 2,009 live births that occurred after radioiodine treatment for thyroid cancer.¹³ There is no evidence that exposure to radioiodine affects the outcomes of subsequent pregnancies and offspring.

Women who have received I-131 during their pregnancies may suffer radiation induced damage to the fetal thyroid glands with resultant hypothyroidism or cretinism. For these reasons, the use of I-131 as a therapeutic agent during pregnancy is completely contraindicated. A pregnancy test is recommended in a woman in fertile age before I-131 treatment regardless of the patient's information about the possibility of pregnancy. The pregnant patient to whom I-131 was administered to should be carefully followed up by both obstetrician and pediatrician in order to detect and treat fetal thyroid dysfunction as early as possible.

CONCLUSION

This case emphasizes that a pregnancy test should always be carried out prior to radioactive iodine treatment in women in fertile age to prevent the potential damage to the fetus.

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