Clinical case

Infant’s bilobar thyroid agenesis and mother’s I-131 accidental administration

Agénésie thyroïdienne bilobaire chez le nouveau-né après administration accidentelle d’iode-131 pendant la grossesse

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Abstract

Bilobar thyroid agenesis is one of rare diseases. Genetic and environmental factors may associate with bilobar thyroid agenesis. But the mechanism is still not completely understood. It had been showed that I-131 administration during pregnancy may induce thyroid dysfunction in newborn. Here we reported a case of female hospital staff who received I-131 accidently during (10–12th gestational weeks) and after her pregnancy. The absorbed dose to fetus was higher than 30 mGy. At birth, the infant was found to have no thyroid. It was speculated that the fetal thyroid agenesis may be related with mother’ I-131 administration during pregnancy. In addition, this case report also indicated that the radiation dose should be minimized to any developing embryo.

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Résumé

L’agénésie thyroïdienne bilobaire est une maladie rare associée à des facteurs génétiques et environnementaux. Le mécanisme n’est pas totalement élucidé. Il est démontré que l’administration d’iode-131 chez la femme enceinte peut induire une dysfonction thyroïdienne chez le nouveau-né. Nous présentons le cas d’une soignante ayant reçu accidentellement de l’iode-131 pendant la grossesse (10–12 semaines d’aménorrhée) et après l’accouchement. La dose absorbée était de plus de 30 mGy. À sa naissance, l’enfant n’avait pas de glande thyroïde. L’hypothèse d’une agénésie thyroïdienne fœtale en rapport avec l’administration d’iode-131 pendant la grossesse est discutée. En plus, ce cas montre l’importance d’une réduction de dose de radiation pendant le développement de l’embryon.

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1. Introduction

I-131 has been widely used in nuclear medicine for treatment of Graves’ disease or thyroid cancer. Few reports regarding fetal uptake of radionuclide after radioiodine treatment of pregnant women have been published [1,2]. There still remain many questions about the clinical outcome of the fetus in this accidental clinical situation. In this paper, we present the case of a woman who received I-131 during and after pregnancy and report the fetal outcome.

2. Case presentation and discussion

In May 2007, the dosimeter of a female staff member in the department of nuclear medicine reached 9.4 mSv. A urine sample was collected and the gamma spectrum analysis showed that the isotope was I-131. According to ICRP publications and other references [3,4], we estimated that the total radioactivity of administered I-131 was greater than 10 mCi (9–22 mCi). Further information showed that the woman had an 8-month-old infant who was born at full term, but had no thyroid; both lobes of the thyroid gland were found to be absent (bilocar thyroid agenesis). Thyroid function tests at 4 days of age showed a high level of TSH (80 mU/L) and low levels of free T3 (0.5 μg/dL) and free T4 (0.4 ng/dL). The infant was given thyroxine treatment initiated at the age of 14 days. The
history of the woman’s dosimeter was checked. It had reached 1.92 mSv in February 2006, a level clearly higher than her colleagues (0.18–0.39 mSv). Radiation exposure was suspected. After examining her working conditions, we estimated that she may have received I-131 at that time, although no estimate of the total I-131 radioactivity intake could be established. She was in her 12–14 gestational week in February 2006, corresponding to a fetal age of 10–12 weeks. According to the data collected in May 2007 (9.4 mSv; total radioactivity about 15mCi), we roughly estimated that about 4 mCi I-131 had been administered in February 2006. Considering data in the literature, we estimated that the dose absorbed by the fetal body was 0.2 mGy/MBq [1,5]. Thus, the fetus was exposed to a dose of about 30 mGy. Again considering published data [5,6], the thyroid dose was estimated at 0.65 Gy/MBq, giving a thyroid absorbed dose greater than 90 Gy.

It is known that I-131 can cross the placenta barrier in both animals and humans. It has been suggested that thyroid embryogenesis is completed at 10–12 week gestation after which the gland is capable of concentrating iodine. If the fetus is exposed to I-131 after 11 weeks, the infant may be born athyreotic. In addition, the risk of undesirable effects of the ionizing radiation on the thyroid is greater in children than adults because of high proliferative activity of follicular cells in the glands of children. In our case, the infant may also have received I-131 through breast milk since the administration of I-131 continued after delivery; the woman’s total thyroid absorbed dose was about 360 Gy. Thus, we postulated that the bilobar thyroid agenesis might be associated with the administration of I-131. Berg et al. [1] also reported that a 43-year-old woman treated with 500 MBq (13 mCi) in her 20th gestational week delivered a boy with a total loss of thyroid function. Gamma camera examination using I-131 showed the thyroid was only poorly visible. Other authors have suggested that radioiodine administration at some time later than the 10th week of gestation may result in thyroid ablation or fetal and neonatal hypothyroidism [5]. It has been shown that the thyroid hemiagenesis can be found in normal children, but the real incidence in the general population is unknown.

Bilobar thyroid agenesis has rarely been reported. The cause of agenesis is largely unknown. It is thought to result from descent disturbance, lobulation defect or defects in the interaction between median thyroid anlage and lateral thyroid rest [7]. Some case reports showed that I-131 administered during pregnancy was related with thyroid diseases, such as hypothyroidism and thyroid autoimmunity [1,8]. The cases reported by Berg et al. [1,5] also suggested that I-131 administered during pregnancy may be associated with bilobar thyroid agenesis. The total absorbed doses in the two cases above were 100 mGy and 1.26 Gy, respectively. However, in our case, the dose was below 100 mGy. Studies have demonstrated that the risk of congenital effects have been negligible at doses of 50 mGy or less compared with other risks [9]. The ICRP report and other references also suggested that an absorbed dose less than 100 mGy may not induce abortion, malformation and adverse pregnancy outcomes [10–14]. The dose estimated in this case, however, is very uncertain due to lack of data. We estimated that the actual dose would be higher than 30 mGy. Thus, we supposed that I-131 administered or radiation exposure during the early gestation (12–14 weeks) may be one of the reasons for the observed bilobar thyroid agenesis.

3. Conclusions

Earlier data also suggested that there is a threshold for radiation effects. But data from Chernobyl fallout did demonstrate an increased risk of thyroid cancer [15]. In this case report, we speculate that I-131 administration during pregnancy may be associated with infant thyroid agenesis. However, bilobar thyroid agenesis is an exceptionally rare phenomenon. Further investigations are needed to determine whether the bilobar thyroid agenesis is inevitable or incidental for this case. In addition, this case report would also indicate that the radiation dose delivered to any developing embryo should be minimized.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References

