

## FIVE THINGS TO KNOW ABOUT ...

## Non-obstetric diagnostic imaging in pregnancy

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**A fetal radiation dose of  $\leq$  50 milli-Gray (mGy) is associated with negligible risks**

Data from observational studies of pregnant survivors of nuclear disasters and experimental studies on animals have shown that, in the first two weeks after conception, the main risk is radiation-induced pregnancy termination, which can occur at a radiation dose of 100–200 mGy. From two weeks after conception until term, a minimum fetal radiation dose of 350–500 mGy is required to cause adverse outcomes such as pregnancy loss, fetal malformations, growth restriction and developmental delay.<sup>1</sup> Practice guidelines from the American Congress of Obstetricians and Gynecologists suggest a more conservative threshold of 50 mGy or less during pregnancy to avoid adverse events.<sup>2</sup>

**There is a weak association between antenatal ionizing radiation and childhood cancer**

In case-control studies,<sup>4</sup> in utero exposure to medical diagnostic radiation was associated with a discernable increase in relative risk of childhood leukemia. Given the low baseline rate of childhood cancer, the absolute increased risk from ionizing radiation is small. For example, an antenatal fetal dose of 20 mGy translates to 0.8 additional childhood cancers per 100 babies.<sup>4</sup>

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**No single diagnostic procedure exceeds the threshold of 50 mGy**

Typical fetal radiation doses from common examinations are shown in Appendix 1 (available at [www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.140901/-/DC1](http://www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.140901/-/DC1)).<sup>3</sup> For example, the fetal dose from chest radiographs is less than 0.01 mGy. More than 5000 such radiographs in pregnancy are required to exceed the 50-mGy threshold. By comparison, the fetal dose during a transatlantic flight is 0.01 mGy, and naturally occurring background radiation during pregnancy is 1 mGy.

**Guidelines consider magnetic resonance imaging (MRI) to be safe during the second and third trimesters**

The guideline on MRI imaging from the Society of Obstetricians and Gynaecologists of Canada is based on well-designed cohort studies.<sup>5</sup> Some animal studies have shown teratogenesis with MRI exposure in the first trimester, but no adverse effects in humans have been documented.<sup>5</sup> Given the theoretical concern, MRI in the first trimester should be restricted to situations where other imaging modalities are inconclusive and maternal care depends on further imaging.<sup>5</sup>

**References**

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**Contrast agents are unlikely to cause fetal harm, but they should be used only when benefits of improved diagnostic sensitivity outweigh potential risks**

Iodine-based contrast agents used in computed tomography cross the placenta and may theoretically affect fetal thyroid function. Similarly, gadolinium contrast medium for MRI crosses the placenta and enters the amniotic fluid, which results in prolonged fetal exposure. Animal studies are conflicting. Some have documented adverse effects with high-level exposure. No adverse outcomes have been documented in humans.<sup>6</sup> Although no clinical sequelae from brief exposures to either agent in pregnant women have been reported,<sup>6</sup> these compounds should be used judiciously.

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