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The Use of Magnetic Resonance Imaging in the Obstetric Patient

This clinical practice guideline has been prepared by the Diagnostic Imaging Committee, reviewed by the Family Physician Advisory Committee, and approved by the Executive and Council of the Society of Obstetricians and Gynaecologists of Canada.

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Abstract

Objective: To review the biological effects and safety of magnetic resonance imaging (MRI) in the obstetric patient and to review procedural issues, indications, and contraindications for obstetrical MRI.

Outcomes: This guideline is intended to reassure patients and clinicians of the safety of MRI in pregnancy and to provide a framework for its use.

Evidence: Published literature was retrieved through searches of PubMed or Medline in 2013 using controlled vocabulary and key words (e.g., MRI, safety, pregnancy). Results were restricted to systematic reviews, randomized control trials/controlled clinical trials, and observational studies published in English and in French. There were no date restrictions. Searches were updated on a regular basis and incorporated in the guideline to July 2013. Grey (unpublished) literature was identified through searching the websites of health technology assessment and health technology-related agencies, clinical practice guideline collections, clinical trial registries, and national and international medical specialty societies.

Values: The quality of evidence in this document was rated using the criteria described in the Report of the Canadian Task Force on Preventive Health Care (Table).

Benefits, harms, and costs: This article is intended to reassure obstetric care providers that if used in an appropriate manner without the use of contrast agents, MRI in the obstetrical patient is safe for mother and fetus in the second and third trimesters. Because obstetrical MRI is expensive and has limited availability in Canada, this clinical guideline is intended to encourage the judicious use of this resource.

Summary Statements

1. Fetal magnetic resonance imaging is safe at 3.0 tesla or less during the second and third trimesters. (II-2)
2. It is safe to continue breastfeeding after receiving a gadolinium contrast agent. (III)

Recommendations

1. Use of magnetic resonance imaging during the first trimester of pregnancy should be restricted to maternal indications for which the information is considered clinically imperative. Inadvertent exposure to magnetic resonance imaging during the first trimester has not been associated with any long-term sequelae and should not raise clinical concern. (III-C)
2. Gadolinium contrast may be used in pregnant women when the benefits outweigh the potential risks. (III-C)

Keywords: MRI, safety, prenatal diagnosis, indication

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Key to evidence statements and grading of recommendations, using the ranking of the Canadian Task Force on Preventive Health Care

Quality of evidence assessment*	Classification of recommendations†
I: Evidence obtained from at least one properly randomized controlled trial	A. There is good evidence to recommend the clinical preventive action
II-1: Evidence from well-designed controlled trials without randomization	B. There is fair evidence to recommend the clinical preventive action
II-2: Evidence from well-designed cohort (prospective or retrospective) or case–control studies, preferably from more than one centre or research group	C. The existing evidence is conflicting and does not allow to make a recommendation for or against use of the clinical preventive action; however, other factors may influence decision-making
II-3: Evidence obtained from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of treatment with penicillin in the 1940s) could also be included in this category	D. There is fair evidence to recommend against the clinical preventive action
	E. There is good evidence to recommend against the clinical preventive action
III: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees	L. There is insufficient evidence (in quantity or quality) to make a recommendation; however, other factors may influence decision-making

*The quality of evidence reported in these guidelines has been adapted from The Evaluation of Evidence criteria described in the Canadian Task Force on Preventive Health Care.[38]

†Recommendations included in these guidelines have been adapted from the Classification of Recommendations criteria described in the Canadian Task Force on Preventive Health Care.[38]

INTRODUCTION

Ultrasound is currently the standard approach for the initial evaluation of fetal anatomy. It is an imaging modality that is widely available, is cost-effective, and allows real-time examination of the fetus.[1] US has the advantage of providing better spatial resolution than many other imaging techniques including MRI. However, for a variety of reasons, US may not allow adequate assessment of a complex case or provide critical information for antenatal clinical management. MRI can provide additional information resulting in better counselling, management, and perinatal outcomes.[2] This guideline has been developed to discuss safety, pre-procedure counselling, procedural considerations, and indications in the use of obstetrical MRI.

SAFETY OF MRI IN THE OBSTETRICAL PATIENT

Maternal Risks

Maternal risks associated with the use of MRI are the same as for non-pregnant patients.[3,4] One safety consideration for the obstetrical patient is prolonged supine positioning. A gravid uterus of significant size can lead to hypotension due to compression of the inferior vena cava. This can be avoided by placing the patient in a lateral oblique or lateral decubitus position.

Fetal/Neonatal Risks

Theoretical fetal concerns include teratogenic and biological effects. It is known that MRI may cause effects at the cellular level from the induction of local electric fields, currents from static and time-varying magnetic fields, and tissue and cellular heating from RF fields. Most of the biological effects associated with exposure to RF fields are related to thermogenesis. The term "specific absorption rate" refers to the dosimetric absorption of RF power. During an MRI procedure, the SAR is influenced by many complex factors and variables including the strength of the static magnetic field, the type of RF pulse used, the repetition time, the type of transmitting RF coil used and volume of tissue contained within, and the anatomical region exposed, among other factors.[5]

Other physiological, physical, and environmental factors include exposure length, the rate of energy deposition, physiological thermoregulatory response, concomitant illness, and local environmental conditions.[5] Limits are determined for SAR for each pulse sequence to ensure that the increase in body temperature is less than 0.5°C. Maternal and fetal temperatures remain within the specified limits even when sequences with higher SAR values are used, including when SAR increases significantly when using higher magnetic fields.

ABBREVIATIONS

MRI	magnetic resonance imaging
RF	radiofrequency
SAR	specific absorption rate
US	ultrasound