International Journal of Advanced Research in Medicine

E-ISSN: 2706-9575
P-ISSN: 2706-9567
Impact Factor (RJIF): 6.75
IJARM 2025; 7(3): 125-130
www.medicinepaper.net
Received: 15-06-2025
Accepted: 17-07-2025

Syed Mehfooz Ul Haq Bukhari,
M.Sc. Medical Imaging Technology 2 Year, Department of Paramedical Sciences, Jamia Hamdard, India

Farooq Wali Bakshi
Technology 2 Year, Department of Paramedical Sciences, Jamia Hamdard, India

Bazif Ahmad Parray
Technology 2 Year, Department of Paramedical Sciences, Jamia Hamdard, India

Ubaid Yaseen
Technology 2 Year, Department of Paramedical Sciences, Jamia Hamdard, India

Mohd Abdullah Siddiqui
Clinical Instructor, Department of Paramedical Sciences, Jamia Hamdard, New Delhi, India

Corresponding Author:
Mohd Abdullah Siddiqui
Clinical Instructor, Department of Paramedical Sciences, Jamia Hamdard, New Delhi, India

Evaluation of the safety and clinical utility of fetal and maternal MRI during pregnancy: A retrospective study

Syed Mehfooz Ul Haq Bukhari, Farooq Wali Bakshi, Bazif Ahmad Parray, Ubaid Yaseen and Mohd Abdullah Siddiqui

DOI: https://www.doi.org/10.22271/27069567.2025.v7.i3b.662

Abstract
Background: Magnetic Resonance Imaging (MRI) is an advanced diagnostic tool increasingly used during pregnancy, especially in cases where ultrasonography (USG) is inconclusive or when maternal complications demand detailed imaging. However, concerns persist regarding the safety of MRI on the developing fetus, particularly during the first trimester.
Methods: A retrospective review was conducted on 25 pregnant women who underwent non-contrast MRI scans during various stages of pregnancy. Data were categorized by trimester, clinical indication, and maternal and fetal outcomes.
Results: MRI was most frequently performed in the second trimester (56%), followed by the third (32%) and first trimester (12%). Fetal indications accounted for 44% of cases, obstetric maternal indications 32%, and non-obstetric maternal indications 24%. Among the three first-trimester cases, two were accidental exposures before pregnancy was detected. Out of 25 pregnancies, 24 resulted in live births, and only one neonatal death was reported due to unrelated maternal complications. No MRI-related adverse effects were observed in fetal development, birth weight, or maternal health.
Discussion: The study findings align with existing literature confirming that non-contrast MRI during pregnancy is safe and does not negatively impact fetal or maternal health. MRI was also found to be highly useful in diagnosing conditions that USG could not conclusively detect, helping guide clinical decisions effectively.
Conclusion: Non-contrast MRI is a safe and clinically beneficial imaging modality during pregnancy when performed for valid indications. It poses minimal risk to the fetus or mother and offers significant diagnostic value, especially in the second and third trimesters.

Keywords: Fetal MRI, maternal MRI, pregnancy, MRI safety, prenatal imaging, neonatal outcomes, non-contrast MRI

Introduction

Magnetic Resonance Imaging (MRI) has emerged as a powerful, non-invasive diagnostic tool in modern medicine due to its superior soft-tissue contrast resolution and lack of ionizing radiation. In recent years, its application during pregnancy has increased, particularly in cases where ultrasonography (USG) is inconclusive or where more detailed anatomical information is required to support clinical decision-making [1,2].

Despite the diagnostic advantages of MRI, there have been ongoing concerns about its safety during pregnancy. These concerns are especially prominent during the first trimester due to the theoretical risk of teratogenic effects during organogenesis, even in the absence of ionizing radiation [3]. Although no definitive harmful effects have been consistently documented, clinicians often exercise caution, and guidelines recommend avoiding MRI during the first trimester unless absolutely necessary [4].

MRI is generally considered safe after the first trimester, particularly when gadolinium-based contrast agents are not used. Gadolinium crosses the placenta and has been shown to accumulate in fetal tissues; therefore, its use is contraindicated unless the diagnostic benefit significantly outweighs the potential risk [5]. Non-contrast MRI, on the other hand, is widely accepted as safe for both maternal and fetal health when clinically indicated [6].

The role of MRI in prenatal diagnosis includes the evaluation of central nervous system abnormalities, suspected chromosomal syndromes, placental abnormalities, maternal pelvic

pathology, and acute abdominal conditions such as appendicitis [7]. It can provide critical information that impacts the management of pregnancy and postnatal care.
This study aims to retrospectively evaluate the safety and clinical utility of non-contrast MRI scans performed during pregnancy, examine their indications across trimesters, and assess both fetal and maternal outcomes.

Methodology
This study was designed as a retrospective observational analysis to evaluate the safety and clinical utility of non-contrast Magnetic Resonance Imaging (MRI) during pregnancy. The study was conducted at a tertiary care teaching hospital equipped with modern radiology and obstetric facilities. Data were collected from hospital records, focusing on pregnant patients who underwent MRI scans during different stages of gestation.
A total of 25 pregnant women who underwent non-contrast MRI across all three trimesters were included in the study. The inclusion criteria comprised pregnant women of any age and gestational period who had undergone MRI without the use of gadolinium contrast agents. Only cases with complete medical records, including MRI indication, radiological findings, and documented pregnancy outcomes, were considered. Patients were excluded if they had incomplete records, had undergone contrast-enhanced MRI, or if the pregnancy outcome could not be traced—particularly in the case of multifetal pregnancies with untraceable outcomes.
Data were collected from a combination of radiology department logs, MRI scan reports, antenatal follow-up records, and delivery notes maintained in the obstetrics and gynecology departments. Variables included maternal age, trimester and gestational week at the time of MRI, clinical indication for MRI (categorized as maternal obstetric, maternal non-obstetric, or fetal), whether the MRI was performed intentionally or accidentally (e.g., before pregnancy was detected), and the final pregnancy outcomes, including neonatal status and maternal well-being.
Since the study involved retrospective analysis of anonymized hospital data with no direct patient interaction, informed consent was not required. However, all ethical standards were adhered to, and patient confidentiality was strictly maintained. The study followed institutional research protocols for the use of patient data.
Data analysis was carried out using Microsoft Excel 2016. Descriptive statistics such as frequencies and percentages were calculated to summarize the variables. Results were presented in tabular form and with the help of graphs to illustrate patterns of MRI distribution by trimester, clinical indication, and outcome classification. No inferential statistical testing was performed due to the observational nature of the study and the limited sample size.
This methodology ensured a structured, ethical, and statistically sound approach to assess both the diagnostic role and safety profile of MRI during pregnancy, providing insight into its clinical applications in real-world obstetric imaging.

Data Analysis and Results
This chapter presents the findings from the retrospective analysis of 25 pregnant women who underwent non-contrast Magnetic Resonance Imaging (MRI) during different trimesters of pregnancy. Data were evaluated to determine the safety of MRI exposure during gestation, the clinical utility of MRI for both maternal and fetal indications, and any outcomes associated with its use.

4.1 Distribution of Cases According to Trimester
Among the 25 pregnant patients included in the study, 3 patients (12%) underwent MRI during the first trimester, 14 patients (56%) during the second trimester, and 8 patients (32%) during the third trimester.

Table 1: Distribution of MRI Cases by Trimester

Trimester	No. of Cases	% Age of Cases
First Trimester	3	12%
Second Trimester	14	56%
Third Trimester	8	32%

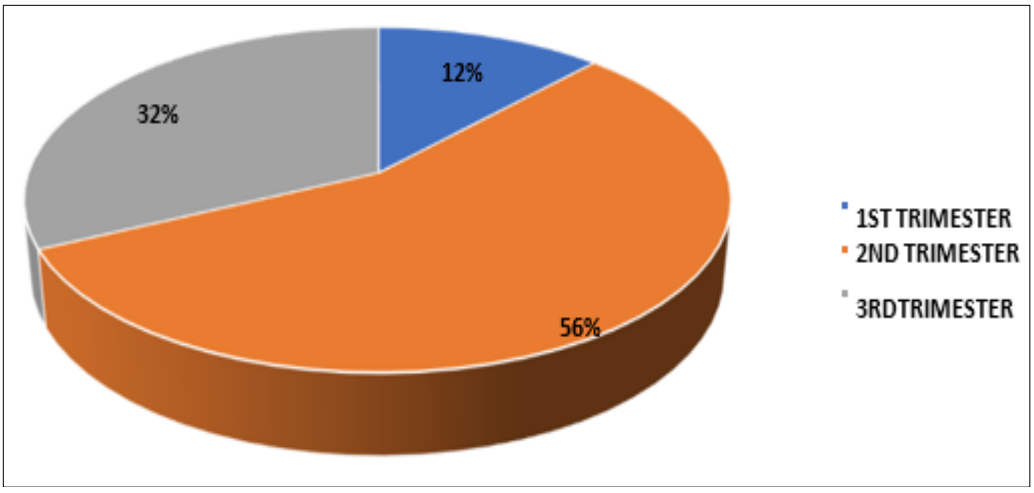

Fig 1: Distribution of MRI Scans According to Trimester of Pregnancy

According to the above table among the 25 patients, 3 patients underwent an MRI examination in the 1st trimester of their pregnancy; 14 patients underwent an MRI examination in their 2nd trimester of pregnancy; and 8 patients underwent an MRI examination in their 3rd trimester of pregnancy. Most patients underwent an MRI scan in their 2nd and 3rd trimester of pregnancy because of the suspected US findings presented in level -I and level -II US scan.

4.2 Indications for MRI: Cases were categorized based on the primary indication for MRI. Out of 25 patients:

- 11 (44%) underwent MRI for fetal indications (e.g., chromosomal abnormalities, Down syndrome, IUGR).
- 8 (32%) for maternal obstetric indications (e.g., vaginal bleeding, bad obstetric history).
- 6 (24%) for maternal non-obstetric causes (e.g., acute appendicitis, stroke).

Table 2: Distribution of Cases by MRI Indication

Indication	No. of Cases	%Age of Cases
Maternal (obstetric)	8	32
Maternal (non-obstetric)	6	24
Foetal	11	44

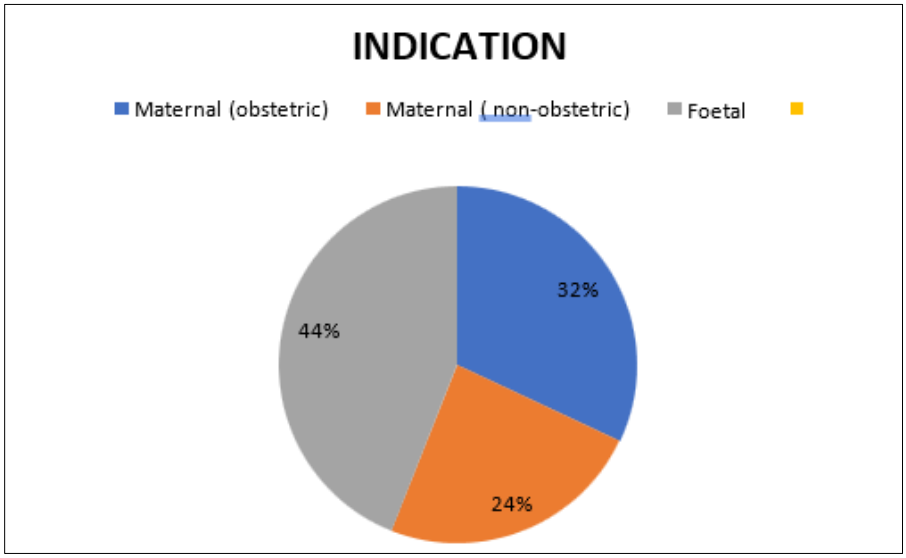

Fig 2: Indications for MRI During Pregnancy

According to the above table, it is shown that among the 25 pregnant patients 8 patients underwent an MRI scan due to obstetric indications; 6 patients underwent an MRI scan due to non-obstetric indications and 11 patients underwent an MRI scan due to foetal pathologies.

4.3 Accidental vs Non-Accidental MRI Exposure
Among the 3 patients who underwent MRI in the first trimester, 2 (66.7%) were scanned accidentally, i.e., before pregnancy had been diagnosed.

Table 3: Accidental vs Non-Accidental MRI Exposure in First Trimester

Accidental	Non-Accidental
2	1

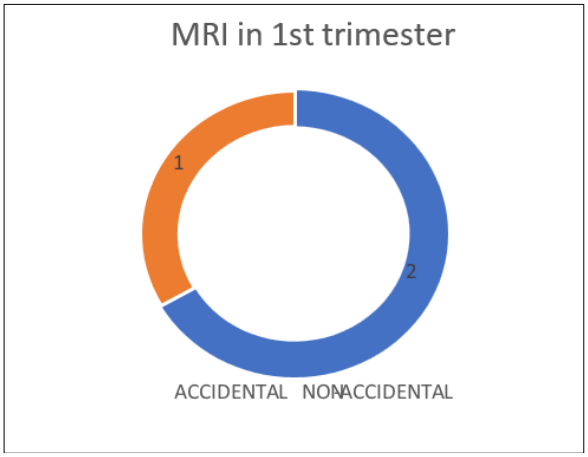

Fig 3: Proportion of Accidental vs. Non-Accidental MRI Scans in First Trimester

It has been noted that the majority of pregnant women who have an MRI during the first trimester of their pregnancy do so accidently, that is, before the pregnancy has been detected. Of the 3 cases (included in this research) in which MRI was performed in the first trimester, 2 scans were performed accidently, that is, without being aware of pregnancy.

4.4 Classification Based on Specific MRI Indications

Each MRI indication was classified and counted based on the presenting clinical concern.

Classification of Data on The Basis of Indication of MRI

Table 4: Classification Based on Indication

Indications	No. Of cases
Vaginal bleeding	4
Acute appendicitis	3
Bad obstetric history	2
Familial genetic disorder	1
Confirmation of US abnormality	3
Suspected chromosomal abnormality	3
+ve KB test	1
Suspected down's syndrome	2
Suspected IUGR	1
Stroke	1
Foetal tachycardia	1
Trauma	2
High risk pregnancy	1
Oligohydramnios	1

From the table, it can be concluded that among the 25 patients that underwent an MRI scan,4 patients suffered from vaginal bleeding; 3 patients suffered from acute appendicitis; 2 patients had a bad obstetric history; 2 patients undergo MRI scan to confirm US findings; 3 fetuses had suspected chromosomal abnormalities; 2 fetuses had suspected Down 'syndrome;and other indications were found in one one patient. The most common individual MRI indications were vaginal bleeding, acute appendicitis, and suspected chromosomal abnormalities.

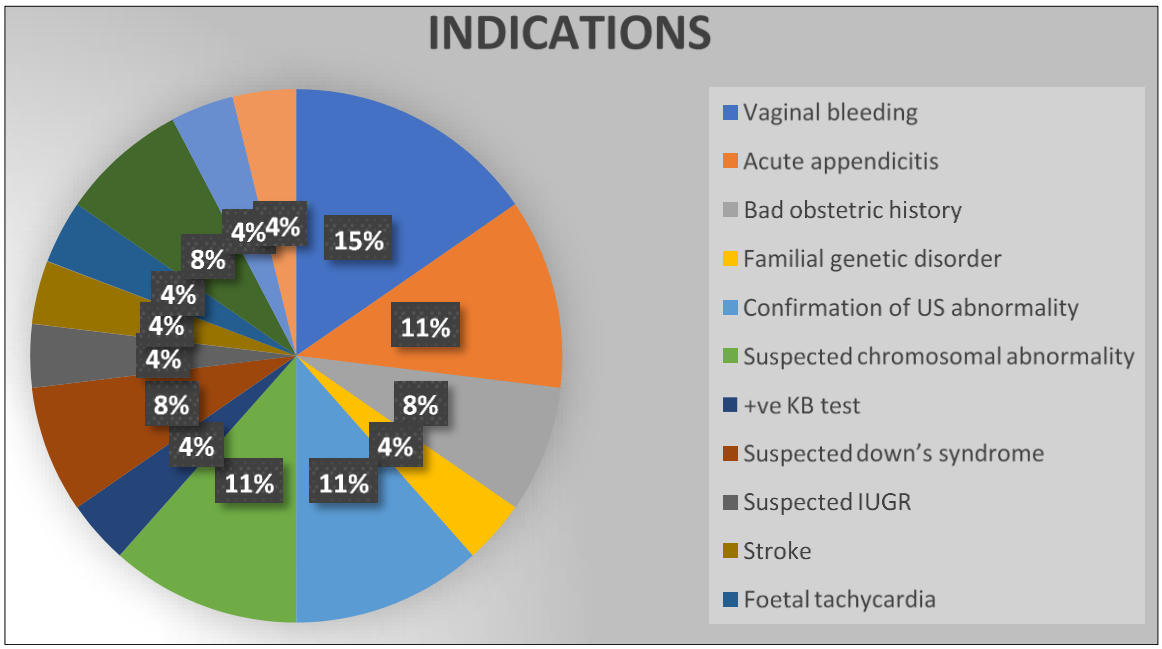

Fig 4: Distribution of Specific Clinical Indications for MRI in Pregnancy

4.5 Pregnancy and Neonatal Outcomes

Out of the 25 pregnancies included in this study, 24 (96%) resulted in live births, while one case (4%) resulted in neonatal mortality. This isolated death was attributed to pre-existing severe maternal complications and not linked to MRI exposure. Among the live births, one neonate experienced transient low oxygen saturation, which was successfully corrected within four hours using an oxygen concentrator. Another neonate, diagnosed antenatally with fetal tachycardia through MRI, was immediately referred to a pediatric cardiac care center following delivery and made a full recovery within 36 hours. All other neonates were born healthy, with no observed birth-related complications. Furthermore, no adverse effects were noted on fetal birth weight, skin condition, or overall appearance. Similarly, no maternal complications or health issues were identified as being associated with the MRI scans. These findings suggest that non-contrast MRI did not negatively affect the course of pregnancy or neonatal health outcomes in any case.

4.6 Summary of Findings: MRI was most commonly performed during the second trimester, accounting for 56% of the total cases, followed by the third trimester (32%) and the first trimester (12%). Among the indications for MRI, fetal-related concerns were the most frequent, making up 44% of all cases. These included suspected chromosomal anomalies, fetal growth restrictions, and congenital abnormalities. Maternal indications, both obstetric and non-obstetric, together constituted the remaining 56%. Notably, accidental MRI exposure in early pregnancy was rare but did occur in two out of the three first-trimester cases, where the scans were performed before pregnancy had been confirmed. Despite these early exposures, pregnancy outcomes were overwhelmingly positive. No complications related to MRI exposure were observed in either the mothers or the fetuses. In fact, MRI proved to be a valuable diagnostic tool, especially in cases where ultrasonography was inconclusive. It played a crucial role in identifying maternal and fetal pathologies, thereby supporting clinical decision-making during pregnancy.

Discussion: This study was conducted to evaluate the safety and clinical relevance of non-contrast Magnetic Resonance Imaging (MRI) during pregnancy. Through the retrospective review of 25 cases, it was found that MRI was not associated with any adverse maternal or fetal outcomes and was particularly useful in confirming or clarifying findings from ultrasound, especially in the second and third trimesters.

The highest number of MRI scans were performed during the second trimester (56%), which aligns with standard clinical practice where MRI is often preferred after the first trimester due to theoretical concerns about early fetal organogenesis [8]. The third trimester accounted for 32% of cases, while only 12% of cases were in the first trimester, among which two were performed unintentionally. Despite concerns about first-trimester exposure, existing literature supports the safety of MRI when performed without gadolinium contrast [9, 10].

A majority of MRI indications were fetal-related (44%), followed by maternal obstetric (32%) and non-obstetric (24%) causes. These results align with similar findings in previous studies that showed MRI is frequently used to evaluate fetal brain anomalies, growth restriction, and suspected syndromes when ultrasonography is inconclusive [11, 12]. In maternal cases, MRI provided clarity in acute conditions like appendicitis, stroke, or trauma where CT would pose radiation risks.

Importantly, 24 out of 25 pregnancies resulted in live births, and the one neonatal death was not related to MRI exposure but to pre-existing maternal complications. Minor complications such as transient hypoxia or neonatal tachycardia resolved quickly and were unrelated to the imaging procedure. This supports evidence that non-contrast MRI during pregnancy does not result in teratogenic effects, developmental delay, or adverse perinatal outcomes [13, 14].

Furthermore, this study emphasizes MRI's role as an adjunct to ultrasound, especially in complex fetal evaluations, chromosomal anomalies, or cases where ultrasound is limited by maternal obesity, oligohydramnios, or fetal positioning [15]. MRI provides superior soft tissue contrast and multiplanar imaging capabilities, making it particularly valuable in high-risk pregnancies.

While the findings reinforce MRI's clinical utility and safety, this study was limited by a small sample size and lack of long-term neonatal follow-up. Also, being a single-center retrospective study, the generalizability of results may be limited. Future research involving prospective multicenter cohorts with longer postnatal follow-up would better establish safety in varied clinical scenarios.

Limitations

This study, while offering important insights into the safety and diagnostic value of non-contrast MRI during pregnancy, is subject to several limitations. Firstly, the small sample size of only 25 patients limits the statistical power and generalizability of the findings to broader populations. Additionally, the study's retrospective design, conducted at a single institution, may introduce selection bias and limit the applicability of the results to different clinical settings or populations. Another limitation is the absence of a control group of pregnant patients who did not undergo MRI, which restricts the ability to compare outcomes and directly attribute findings to MRI exposure. Furthermore, the study assessed only short-term neonatal and maternal outcomes; long-term developmental follow-up of the infants was not available, which would have provided more comprehensive safety data. The categorization of MRI indications—such as distinguishing between obstetric and non-obstetric causes—was based on clinical records and could be influenced by subjectivity in documentation. Lastly, the study focused exclusively on non-contrast MRI scans, and therefore, its conclusions cannot be extended to contrast-enhanced MRI procedures, which may carry different levels of risk during pregnancy.

Conclusion

This retrospective study evaluated the safety and clinical utility of non-contrast Magnetic Resonance Imaging (MRI) during pregnancy in 25 patients who underwent imaging across various trimesters. The findings support the growing body of evidence that MRI, when performed without gadolinium contrast, is a safe diagnostic modality during pregnancy, especially in the second and third trimesters. Importantly, no maternal complications or MRI-related adverse fetal effects were observed. Among the 25 cases, 24 resulted in live births, and the single neonatal death was attributable to severe maternal complications unrelated to MRI. Minor neonatal issues observed were self-limiting and did not appear to be associated with imaging exposure.

MRI played a critical role in confirming or clarifying ultrasound findings, especially in cases where ultrasonography was inconclusive or limited by maternal or fetal factors. It was particularly valuable in assessing fetal anomalies, maternal pathologies such as appendicitis or stroke, and high-risk pregnancies. These results emphasize the usefulness of MRI as a non-invasive, radiation-free tool in obstetric imaging.

While the study's limitations, such as small sample size and short-term outcome focus, are acknowledged, the results add to the clinical confidence in using MRI during pregnancy when medically indicated. Further large-scale, prospective studies with long-term follow-up are recommended to confirm these findings and guide standardized protocols for prenatal MRI use.

References

1. Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document on MR safe practices: 2013. J Magn Reson Imaging. 2013;37(3):501-530.
2. Levine D. MRI evaluation of the fetal central nervous system. Am J Roentgenol. 2001;177(5):1135-1145.
3. Ray JG, Vermeulen MJ, Bharatha A, et al. Association between MRI exposure during pregnancy and fetal and childhood outcomes. JAMA. 2016;316(9):952-961.
4. American College of Radiology (ACR). ACR-SPR practice parameter for imaging pregnant or potentially pregnant adolescents and women with ionizing radiation. 2018. [page range not provided]
5. Webb JA, Thomsen HS, Morcos SK. The use of iodinated and gadolinium contrast media during pregnancy and lactation. Eur Radiol. 2005;15(6):1234-1240.
6. ACOG Committee Opinion No. 723: Guidelines for diagnostic imaging during pregnancy and lactation. Obstet Gynecol. 2017;130(4): e210-e216.
7. Saleem SN. Fetal MRI: an approach to practice: a review. J Adv Res. 2014;5(5):507-523.
8. American College of Radiology. ACR Manual on MR Safety. ACR; 2020. [page range not provided]
9. Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document on MR safe practices: 2013. J Magn Reson Imaging. 2013;37(3):501-530. (Duplicate of #1.)
10. Ray JG, Vermeulen MJ, Bharatha A, Montanera WJ, Park A L. Association Between MRI Exposure During Pregnancy and Fetal and Childhood Outcomes. JAMA. 2016;316(9):952-961. (Essentially duplicate of #3, though here expanded authors.)
11. Levine D. Fetal MRI. Radiology. 2013;266(3):600-619.
12. Saleem SN. Fetal MRI: An approach to practice. J Clin Imaging Sci. 2014; 4:65. (If this is an article numbered “65,” it may be the article ID rather than page number; Vancouver style uses page ranges—so “4:65” may stand.)
13. Patenaude Y, Pugash D, Lim K, Morin L, et al. The Use of Magnetic Resonance Imaging in the Obstetric Patient. J Obstet Gynaecol Can. 2014;36(4):349-363.
14. Reddy UM, Filly RA, Copel JA. Prenatal Imaging: Ultrasonography and Magnetic Resonance Imaging. Obstet Gynecol. 2008;112(1):145-157.
15. Glenn OA. MR imaging of the fetal brain. Pediatr Radiol. 2010;40(1):68-81