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PRENATAL IMAGING ADVANCES: PHYSIOLOGY AND FUNCTION TO MOTION CORRECTION AND AI: EDITORIAL

Prenatal imaging advances: physiology and function to motion correction and AI—introductory editorial

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Since the earliest articles describing fetal morphology using spin echo MRI sequences in the late 1980's, prenatal imaging has come a long way.[1] Not only is MRI now a well-established adjunct to prenatal ultrasound, the advances in motion correction, artificial intelligence and functional assessment have opened new avenues for research. Increasingly sophisticated pulse sequences and post-processing algorithms now facilitate the potential identification of prenatal imaging biomarkers of disease, and the possibility that prenatal prediction of post-natal outcome could be realised. The role of radiology in the fetal medicine multidisciplinary team is becoming more important for decision making around prenatal counselling, *in utero*[2] and intrapartum[3] management, and post-mortem assessment.[4] This is why *BJR* has published a special feature on this important topic at this point in time.

The first articles in this *BJR* special feature describe the state-of-the-art regarding prenatal assessment of the central nervous and cardiovascular systems, and post-mortem perinatal imaging. Brady et al outline their practical approach to imaging the fetal brain with MRI, focusing on the importance of detailed gestational age-related fetal biometry, and provide troubleshooting suggestions for common interpretation dilemmas.[5] Similarly, van Ameron et al present a review detailing the latest research into fetal cardiovascular blood flow MRI, including developments in data acquisition and post-processing, and their research and clinical applications.[6] Post-mortem perinatal imaging is a developing field affording the option of a minimally invasive autopsy for the investigation of perinatal and pediatric death. Shelmerdine et al review the most recently published research and international guidelines, describing which modalities are best suited to specific indications, and when a full invasive autopsy might be considered should imaging not support the clinical features.[7]

Following this, three articles describing pre-natal MRI biomarker targets with the potential to assess fetal and placental physiology are presented. Currently, the role of fetal MRI in diagnostic troubleshooting is via anatomical clarification. However, research into the use of MRI for physiology and tissue function characterisation is becoming more popular.

Whitby et al present a review summarising current knowledge and potential developments for the use of MRI biomarkers in the prenatal prediction of post-natal outcome in fetuses with lung pathology.[8] Furthermore, Gaunt et al outline current methods and potential biomarkers for assessing fetal physiology *in utero*.[9] The successful growth of the fetus of course depends on the successful growth of the placenta, and there is a growing body of research describing the use of advanced MRI sequences to assess placental physiology. Clark et al present a review highlighting common imaging technologies used in pregnancy and new developments to quantify placental function.[10]

The most onerous limitation in fetal MRI is that of data set corruption from fetal motion. Two articles describe how artificial intelligence and post-processing algorithms might improve scan quality.

Meshaka et al explain how the use of artificial intelligence and more specifically machine learning, could be used for anatomical organ segmentation, improved sequence acquisition and automated biometry assessment, and however improving digital technology could impact future clinical practice.[11] Moreover, Uus et al comprehensively explain how retrospective motion correction methods can be applied to corrupted 2D and 3D data sets, and integrated into clinical practice.[12]

The two final articles in this *BJR* special feature show how cross-sectional imaging can be used as an adjunct to ultrasound for troubleshooting. Bone dysplasias are typically suspected when limb shortening is identified on prenatal ultrasound. Despite the development of non-invasive prenatal genetic testing for the prenatal diagnosis of genetic disease, imaging is essential in demonstrating the disorders manifested phenotype. Nishimura et al review how detailed assessment with ultrasound, MRI and CT can help inform rational prenatal decision-making and counseling.[13] Finally, Goergen et al suggest how MRI can be used in an algorithmic approach to a neuroradiological diagnosis when the cavum septi pellucidi are not visualised on mid trimester ultrasound screening.[14]

At the centre of any maternal and fetal medicine service is a family, under immense stress, contemplating difficult decisions. Should they be realised, the developments outlined in these reviews would provide further invaluable clinical information for prenatal diagnosis and counselling. It has been a pleasure to oversee this special feature, with huge thanks due to the authors, reviewers and editorial staff for their time, efforts and expertise.

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