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REVIEW

Standardised and structured reporting in fetal magnetic resonance imaging: recommendations from the Fetal Task Force of the European Society of Paediatric Radiology

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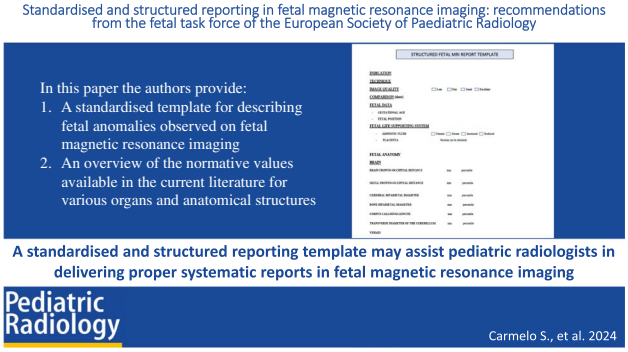
Abstract

Over the last decades, magnetic resonance imaging (MRI) has emerged as a valuable adjunct to prenatal ultrasound for evaluating fetal malformations. Several radiological societies advocate for standardised and structured reporting practices to enhance the uniformity of imaging language. Compared to narrative formats, standardised and structured reports offer enhanced content quality, minimise reader variability, have the potential to save reporting time, and streamline the communication between specialists by employing a shared lexicon. Structured reporting holds promise for mitigating medico-legal liability, while also facilitating rigorous scientific data analyses and the development of standardised databases. While structured reporting templates for fetal MRI are already in use in some centres, specific recommendations and/or guidelines from international societies are scarce in the literature. The purpose of this paper is to propose a standardised and structured reporting template for fetal MRI to assist radiologists, particularly those with less experience, in delivering systematic reports. Additionally, the paper aims to offer an overview of the anatomical structures that necessitate reporting and the prevalent normative values for fetal biometrics found in current literature.

Graphical Abstract



Keywords Biometry · Fetus · Magnetic resonance imaging · Prenatal · Structured report

Introduction

Over the last decades, magnetic resonance imaging (MRI) has undergone significant technical advancements, rendering it a valuable adjunct to prenatal ultrasound (US) for evaluating fetal malformations. MRI furnishes supplementary information critical for guiding prenatal counselling and postnatal management decisions.

As per recommendations from the "Fetal Task Force" of the European Society of Paediatric Radiology (ESPR), various indications exist for conducting fetal MRI, encompassing both central nervous system and body pathologies [1, 2]. Numerous medical (radiological and non-radiological) societies recommend the adoption of standardised and

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structured reporting practices to enhance the consistency and reproducibility of the imaging language [3–14].

While fetal MRI structured report templates are already implemented in some centres, particularly for central nervous system examinations, specific recommendations or guidelines by international societies in the literature are limited [15].

The purpose of this paper is to propose a standardised and structured reporting template in fetal MRI to assist radiologists, particularly those with less experience, in delivering proper systematic reports. In addition to covering general information such as indications, technique, and image quality, we also provide an overview of the anatomical structures that necessitate reporting and the most prevalent fetal biometric data.

Aiming to develop this report template, the authors conducted a survey among the Fetal Task Force members of the ESPR. This questionnaire sought to gather information on the local implementation of structured reporting and the biometric data included in their reports, along with corresponding references from the literature.

Fourteen out of 20 members responded to the questionnaire. The resulting structured report template and the summary of provided fetal biometric data are a concise reflection of the survey's findings and encapsulate the daily reporting practices of these members.

Structured report in fetal magnetic resonance imaging

General information

Indications

A tailored investigation in a proper clinical setting is imperative, and every fetal MRI report should encompass relevant clinical data and family history, especially if related to fetal anomalies. Additionally, informative laboratory test results and, when accessible, genetic data should be included. Conducting a fetal MRI scan following a second-line US scan is mandatory, as it enables a more focused examination and facilitates precise answers to be given to specific questions [1, 2].

The prior ultrasound report should always be available in full text before the MRI examination and the findings prompting a fetal MRI should be summarised in the indications.

This section should also provide information on whether a fetal brain or body MRI (or both) examination is being performed, according to the specific anomalies that have to be clarified. This approach should be discussed with the referring physician and depends on findings including but not limited to the US scan, maternal history and laboratory results.

Technique

Each report should include technical data: field strength, sequences (also if advanced ones—e.g. diffusion tensor imaging, echoplanar- fluid-attenuated inversion recovery—are performed), sedation if used (drug name and dose).

Image Quality

A visual rating system (low-fair-good–excellent), while subjective in nature, should consistently be provided to assess the image quality and reliability of the examination.

Comparison

When a prior MRI examination is accessible, it should be noted in the text, and a comparison should be conducted to inform the reader of any progression, stability, or regression of previously identified anomalies, as well as the emergence of new ones.

Gestational age

The report should consistently include the gestational age because various fetal growth landmarks are gestational age-dependent, and abnormal findings may suggest fetal growth abnormalities.

Additionally, mentioning the fetal position is crucial as it influences the image quality (for instance a breech presentation complicates brain examination due to maternal respiratory movements).

Fetal life supporting system

Amniotic fluid

A subjective evaluation of the volume of amniotic fluid (normal, increased, reduced, absent) should be noted in the MRI report. Polyhydramnios may result in increased fetal motion, whereas oligohydramnios enhances the value of fetal MRI compared to US.

Placenta

The placental position should be mentioned as well as its heterogeneity, which increases with gestational age.

Fetus

Each section of the report concerns a specific anatomical region, and it should include two parts:

- Description of different structures and anomalies in terms of biometry (when feasible) and morphology. Reference data related to biometry are available in the literature [16–32] and summarised in Table 1 according to the related structure. Free tools and software for comparison of images and percentile calculation are also available online [33, 34].
- Interpretation of imaging findings and conclusion.

Below is an outline of the items that should be checked for each anatomical area, as succinctly summarised in the template (Table 2), along with a brief mention of potential pathologies. This list is necessarily not exhaustive and should be tailored to the pathological context.

Fetal brain and skull

Knowledge of the normal development of the brain is crucial for an accurate report, given the dynamic processes of gyration, cortical maturation, and myelination throughout gestation [35].

All brain structures should be described in terms of presence, appearance (e.g. normal, agenesis, hypoplasia, dysplasia, signal intensity) and biometry.

A systematic evaluation of the following structures is mandatory: the pericerebral spaces, the cortical ribbon, the cerebral parenchyma, the subependymal area, the ventricular walls, the ventricles, the midline structures, the posterior fossa, the vascular structures.

Pericerebral space: size (subjective evaluation), appearance (possible identification of arachnoid cyst, haematoma, vascular malformations).

Sulcation anomalies: type (gyration delay, thickened cortex, polymicrogyria, abnormal sulci …), location, extension [36].

Brain parenchyma: appearance and signal intensity (haemorrhage, ischemia, including schizencephaly), volume (subjective evaluation), white matter, mass, basal ganglia.

Subependymal area: appearance (pseudo cysts, haemorrhage, heterotopia).

Lateral ventricles: size, shape regular, irregular (deformation in porencephalic communicating cavity), content (haemorrhage).

Midline structures: anomalies of the corpus callosum in shape and size (partial or complete agenesis, short, thin, thick corpus callosum). *Midline anomalies*: signal intensity (pericallosal lipoma), shape and size of the interhemispheric fissure (incomplete, distorted, displaced, widened) or space-occupying lesion (cyst), septal anomaly, third ventricle (size, shape, position), olfactory bulbs and sulci, optical chiasma, pituitary stalk and gland.

Posterior fossa: amount of pericerebellar fluid (arachnoid cyst, cisterna magna); tentorium (orientation and insertion). Cerebellum: size and appearance of the cerebellar hemispheres (haemorrhage, ischemia, dysplasia, mass), the vermis (orientation, partial or complete agenesis, hypoplasia, ischemia), the fourth ventricle (shape, position and content), and the brainstem (shape, bulge of the pons).

Vascular malformations: type, location.

Table 1 Summary of the main fetal biometric reference data reported in the literature

	References: authors (year)	Resources
Brain	Tilea et al. (2009) [16]	Brain biometry > 26 weeks of gestation
	Harreld et al. (2011) [17]	Corpus callosum biometry
	Conte et al. (2018) [18]	Brain biometry > 20 < 24 weeks of gestation
	Dovjak et al. (2021) [19]	Posterior fossa biometry
Maxillo-facial region	Robinson et al. (2008) [27] Paquette et al. (2009) [20]	Orbit and eye biometry
	Nemec et al. (2015) [23] Kooiman et al. (2018) [26]	Mandibular biometry
Thorax	Rypens et al. (2001) [28] Cannie et al. (2008) [30] Meyers et al. (2018) [25]	Lung volumetry
Abdomen	Hyde et al. (2020) [31]	Meconium/large bowel width
	Witzani et al. (2006) [24] Michielsen et al. (2010) [29]	Kidney volumetry
	Van Vuuren et al. (2012) [32]	Kidney, adrenals, renal pelvis biometry
	Nemec et al. (2011) [21]	Female external genitalia biometry
	Nemec et al. (2012) [22]	Penile biometry

Table 2 Fetal magnetic resonance imaging structured report template

Structured fetal magnetic resonance imaging report template

INDICATION

TECHNIQUE

IMAGE QUALITY ☐ Low ☐ Fair ☐ Good ☐ Excellent

COMPARISON (date)

FETAL DATA

- GESTATIONAL AGE
- FETAL POSITION

FETAL LIFE SUPPORTING SYSTEM

- AMNIOTIC FLUID ☐ Normal ☐ Absent ☐ Increased ☐ Reduced
- PLACENTA Position (to be detailed)

FETAL ANATOMY

BRAIN

BRAIN FRONTO-OCCIPITAL DISTANCE	mm	percentile
SKULL FRONTO-OCCIPITAL DISTANCE	mm	percentile
CEREBRAL BIPARIETAL DIAMETER	mm	percentile
BONE BIPARIETAL DIAMETER	mm	percentile
CORPUS CALLOSUM LENGTH	mm	percentile
TRANSVERSE DIAMETER OF THE CEREBELLUM	mm	percentile

VERMIS

- HEIGHT	mm	percentile
- ANTEROPOSTERIOR DIAMETER	mm	percentile
- AREA	mm^2	percentile

VENTRICLES DIAMETERS (R/L) (if required)	mm	percentile

Table 2 (continued)

TEGMENTO-VERMIAN ANGLE/ PONS AP DIAMETER (if required)	°			
PERICEREBRAL SPACES	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
SUL CATION	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
PARENCHYMA	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
SUBEPENDYMAL AREA	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
LATERAL VENTRICLES	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
MIDLINE STRUCTURES:				
- **CORPUS CALLOSUM**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **CAVUM SEPTUM PELLUCIDUM**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **OLFACTORY BULBS AND SULCI**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **PITUITARY GLAND**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
POSTERIOR FOSSA:				
- **BRAINSTEM**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **VERMIS**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **CEREBELLAR HEMISPHERES**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
- **POSTERIOR FOSSA FLUID**	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
VASCULAR ANOMALIES	☐ Absent	☐ Present (to be detailed)	☐ Cannot be assessed	
SPINE & SPINAL CORD				
SPINAL CORD	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
SPINE	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
MAXILLO-FACIAL REGION				
OROFACIAL CLEFT	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
NOSE	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
ORBITS & EYE-BALLS	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
	In case of hypo/hypertelorism: Ocular diameter (OD) Interocular distances (ID) Binocular distance (BD)			
OPTIC CHIASMA	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
LIPS	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed

Table 2 (continued)

MANDIBLE	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
MAXILLA	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
	In case of micrognathia: Anterior–posterior diameter (APD) Biparietal diameter (BPD) Inferior facial angle (IFA) Jaw index Oropharyngeal space Fronto-occipital diameter (FOD)			
EARS				
EXTERNAL	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
MIDDLE	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
INNER	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
FACIAL MASSES	☐ Absent	☐ Present (to be detailed)	☐ Cannot be assessed	
NECK				
THYROID	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
UPPER AIRWAYS	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
	In case of atresia or congenital high airway obstruction syndrome (CHAOS): Gap length (mm)			
MASSES	☐ Absent	☐ Present (to be detailed)	☐ Cannot be assessed	
THORAX				
THYMUS	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
ESOPHAGUS (on focused investigations)	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
TRACHEA	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed
	In case of atresia or congenital high airway obstruction syndrome (CHAOS): Gap length (mm)			
HEART & GREAT VESSELS	☐ Normal	☐ Abnormal (to be detailed)	☐ Not depicted	☐ Cannot be assessed

Table 2 (continued)

LUNGS	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
	In case of congenital diaphragmatic hernia (CDH) and congenital lung malformations (CLMs): Total fetal lung volume (TFLV) Expected/observed total fetal lung volume ratio (e/o TFLV)
DIAPHRAGM	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
MEDIASTINAL MASSES	☐ Absent ☐ Present (to be detailed) ☐ Cannot be assessed
PLEURAL EFFUSION (Y/N)	
PERICARDIAL EFFUSION (Y/N)	
ABDOMEN	
LIVER	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
GALLBLADDER	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
SPLEEN	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
STOMACH	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
SMALL INTESTINE	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
	Caliber:
COLON	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
	Caliber: Meconium 10 mm below the bladder Y/N
ADRENALS	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
KIDNEYS	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
RENAL PELVIS & URETERS	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
	Antero-posterior diameter (APD) of the renal pelvis (R/L) Ureteral caliber (R/L)
BLADDER	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
PELVIC MASSES	☐ Absent ☐ Present (to be detailed) ☐ Cannot be assessed

Table 2 (continued)

ASCITES (Y/N)	
ABDOMINAL WALL	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
SKELETON	
EXTREMITIES	
- **ARMS**	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
- **LEGS**	☐ Normal ☐ Abnormal (to be detailed) ☐ Not depicted ☐ Cannot be assessed
OTHER BONES NOT PREVIOUSLY SPECIFIED (if abnormal)	(to be detailed)

CONCLUSIONS

Skull: size (macrocrania, microcephaly) and shape (frontal bossing, cloverleaf skull).

Fetal spinal cord and spine

Although US offers higher spatial resolution, MRI may be valuable for analysing the spinal cord, spinal canal and spine.

Special consideration should be given to the morphology of the *spine* (neural tube defects open/closed type, presence or absence of a sac and its content, spinal canal widening, abnormal curvature, vertebral anomalies, partial agenesis, intracanal mass); presence or absence of a subcutaneous mass including its signal intensity and measurements (lipoma, cyst); and anomalies involving the *spinal cord* (level and appearance of the distal end, possible diastematomyelia) [37].

In case of a *presacral mass*: size, signal intensity (solid/cystic/mixed), location, extension (percentage of intra- or extra-pelvic development), involvement of the spinal canal, impact on the abdominal organs (urinary tract) should be described.

Fetal maxillo-facial region

Any changes in skull integrity and shape should be documented, along with any abnormalities affecting the skull base and facial bones.

The size, shape, position, and content of the maxillofacial structures should be meticulously assessed, with particular attention to identifying asymmetric paired organs [38].

The following anomalies may be observed:

Orofacial clefts: appearance of the alveolar ridge and the soft tissues (micrognathia, maxillary hypoplasia/cleft, cleft lip, tongue position) and bony palate (cleft). Normal mandibular biometric volumetric data are provided in the literature as a reference for an objective evaluation [23, 26].

Orbits and eyeballs: presence, number, appearance and size of the eyeballs (anophthalmia, microphthalmia, coloboma, cyclopia, hypo/hypertelorism, dacryocystocele, cephaloceles). The chiasma should also be checked (optic nerve agenesis/hypoplasia).

Nose: appearance and size (arrhinia, choanal permeability, presence of the olfactory bulbs).

External ear: presence and appearance (anotia, microtia, external auditory canal atresia or hypoplasia). *Middle and inner ear*: tympanic cavity, cochlea, and semicircular canals.

In case of *facial masses*: size, location, internal architecture and signal intensity (cystic/solid, haemorrhage, homogeneous/inhomogeneous), extension (e.g. intracranial, cervical or thoracic), relationship with the surrounding structures (e.g. upper airway, brain structures) [38].

Fetal neck

The *thyroid gland* should be thoroughly examined, assessing its presence, signal intensity, size (goitre), and position (ectopia).

Upper airways should be identified as non-dilated fluid-filled structures connecting with the lower airways. In case of an interruption, the location and the length of the gap should be assessed.

In cases of *cervical masses*, it is essential to describe the size, signal intensity (whether cystic/solid, homogeneous/inhomogeneous, and presence of fat/blood/calcification components), and extension (into the mediastinum, face, or tongue). Moreover, the airway patency must be evaluated if an ex utero intrapartum treatment procedure is planned.

Fetal thorax

Normal lungs typically exhibit T2 hyperintensity and T1 hypointensity owing to their fluid content. The diaphragm appears as a thin T2 hypointense structure.

In the event of a *congenital diaphragmatic hernia*, it is crucial to identify herniated structures and to report the volume of herniated liver [25, 28, 30, 39, 40].

As part of prognostic evaluation, it is recommended to calculate the total fetal lung volume and expected/observed total fetal lung volume ratio [25, 28, 30].

The *oesophagus* is rarely visible over its entire length on routine examinations. However, it should be specifically sought on dynamic scans centred on the mediastinum in fetuses suspected of having oesophageal atresia, characterised by a blind-ending cervical pouch [41].

Cardiac situs, axis, and size with cardiothoracic index should always be checked and reported if abnormal. If *congenital heart disease* is suspected, the report should detail the cardiac anatomy [42, 43].

The *thymus* is typically situated in the anterior mediastinum. If necessary, such as in cases of agenesis or hypoplasia, its size can be assessed [44].

In case of a *congenital lung malformation/mass*: location, size, morphology, internal structure (cystic, solid, homogeneous, heterogeneous), possible mass effect on the ipsilateral diaphragm and on the mediastinum, pulmonary lobe(s) involved, arterial supply, and venous drainage (e.g. bronchopulmonary sequestration) should be assessed, providing total fetal lung volume and expected/observed total fetal lung volume ratio.

In case of a *mediastinal mass* (e.g. foregut duplication cysts, lymphatic malformations, teratoma, goitre): size, location, extension (e.g. neck, thoracic wall), morphology, characteristics and/or internal structure (cystic/solid, homogeneous/inhomogeneous, fat/blood/calcification components), presence of an infiltrative pattern (in microcystic lymphatic malformations), compression of surrounding structures (great vessels, trachea, oesophagus, heart, lungs), possible restricted diffusion of solid components on diffusion weighted imaging (DWI), and apparent diffusion coefficient (ADC) maps should be assessed.

Fetal abdomen

Digestive system

The *liver* should be evaluated in terms of size, signal intensity (hypointensity in both T2- and T1-weighted sequences may indicate iron overload), and parenchymal homogeneity (any inhomogeneity may suggest an intraparenchymal mass, which should be described in terms of location, size, morphology, and internal structure) [45]. Normal liver volumetric data are provided in the literature as a reference for an objective evaluation [46].

The fetal *gallbladder* usually appears as a pear-shaped fluid-filled structure with variable signal intensity depending on the gestational age. There are many normal variants regarding its morphology and dimensions [47]. When the gallbladder is absent or if hilar/perihilar cysts are observed, the diagnosis of biliary atresia may be suggested. In such a context, heterotaxia and polysplenia should be searched for [47].

The *stomach* should be seen as a fluid-filled structure in the left hypochondrium; in some settings (congenital diaphragmatic hernia, eventration), its position is important to evaluate [29].

Moreover, MRI facilitates the evaluation of the normal appearance and position of the *intestinal tract*, which should be described based on a combination of T2- and T1-weighted sequences. The meconium should be evaluated in relation to its T1 hyperintense signal and its extension should be assessed (the distal end of the rectum is normally located at least 10 mm below the bladder neck) [48]. The intestinal calibre correlates with the gestational age; the conspicuity of the meconium signal intensity at any part of the bowel increases with time [31]. Reference ranges of bowel width can be found in Hyde et al. [31]. In cases of gastrointestinal obstruction, it is essential to report the location and signal intensity of the contents of dilated loops and the presence of a micro-colon, as this enables assessment of the level of obstruction [49].

Urogenital system

Kidneys: size, location (ectopia), and parenchymal appearance should be evaluated. In the event of a renal mass, it is essential to describe its size, internal structure, and relationship with the renal hilum. DWI with ADC maps can provide

valuable information about the mass, including any signal restriction indicative of malignancy, as well as the presence of residual functional renal parenchyma [24]. Furthermore, the renal cavities should be analysed, and any anomalies should be reported in cases of suspected uro/nephropathies with pelvi-caliceal and ureteral diameters.

Renal parenchymal evaluation can be conducted by assessing a ratio to the liver or renal pelvis' signal intensity for maturation [24]. ADC maps can help in the identification of functional renal parenchyma [24].

The normal *adrenal gland* is typically visible from around 20 weeks gestational age and tends to be relatively large. The report should state the presence as well as the normal size of the adrenal glands [50]. In cases of suprarenal/adrenal masses: size, appearance (cystic, solid, fatty, homogeneous, heterogeneous, haemorrhagic/proteinaceous contents), DWI restriction—indicative of malignancy, may assist in establishing a specific diagnosis (haemorrhage, sequestration, neuroblastoma) [51].

The *bladder*: presence, size, wall (thick, smooth, or irregular), and contents should be assessed.

While *penile abnormalities* are typically better detected with US, MRI reference ranges for the total penile and outer penile length have been published [22].

In case of a *pelvic mass*, it is important to describe its size, location, extent, contents' signal intensity (such as haemorrhagic, pure fluid, or meconial), and its relationships with the surrounding structures (such as spine, digestive tract, bladder), which may help to characterise the malformation (anorectal malformation, urogenital sinus, or cloacal malformation) or tumour.

Abdominal wall defect (gastroschisis, omphalocele): region of involvement, herniated organs, presence or absence of a peritoneal-amniotic membrane, cord insertion and integrity, and bladder location (e.g. exstrophy) should be reported [52].

Fetal skeleton

While indications for imaging the fetal skeleton with MRI are limited and controversial (with US remaining the gold standard technique), evaluation should be considered within the context of conditions such as spina bifida and complex fetal anomalies. MRI can potentially assess deformities and the alignment of joints or bones (e.g. club foot, scoliosis, craniosynostosis, joint dislocation) [53].

The following anomalies may be encountered: limb shortening, absence (location), positional deformities (location, type), skeletal dysplasia, skull (see the "Fetal brain and skull" section), and vertebral anomalies (see the "Fetal spinal cord and spine" section).

Conclusion

The report should end with a concise summary of key findings, including a diagnostic hypothesis and potential syndromes that could guide genetic testing if it has not yet been conducted. Recommendations for follow-up should also be provided, if necessary.

In cases where the examination does not yield conclusive results, this should be clearly stated to facilitate appropriate diagnostic management (e.g. strict imaging follow-up with US and/or repeated MRI, or fetal low-dose CT for skeletal dysplasia) [54].

Discussion

The widespread adoption of structured reporting is essential for delivering the highest quality of service to referring physicians and, ultimately, to patients [9].

Compared to narrative format texts, standardised and structured reports appear to enhance content quality, diminish reader variability, and, through a shared lexicon, facilitate communication among specialists [12, 55, 56]. Each of these elements contributes independently to the more efficient integration of the radiological report into the clinical pathway.

Structured reporting holds the potential to mitigate medico-legal liability and offers advantages for scientific data analysis and the establishment of standardised databases [12, 56].

Structured reports appear to streamline reporting processes and, while challenging to quantify, the enhanced communication facilitated by a well-constructed radiological report can potentially reduce the overall assessment time. This efficiency is attributed to the use of uniform terminology and the inclusion of all necessary information, thereby minimising the need for additional discussions and second readings.

Although some centres share their fetal MRI reporting templates online, these are typically tailored to local experience and practice (https://www.pedrad.org/Specialties/Fetal-Imaging/Fetal-MRI-General-Information#49043614-templates.) . The International Society of Ultrasound in Obstetrics & Gynecology (ISUOG) practice guidelines on fetal MRI provide some general recommendations on what a fetal MRI report should include [15]. However, a comprehensive framework for analysing the fetus using fetal MRI—covering the reporting of both normal and abnormal findings along with organ-specific biometry values—is still absent in the current literature.

More recently, Thater et al. provided a structured report template specifically designed for fetuses with congenital diaphragmatic hernia [57]. However, fetal MRI is now being

applied more broadly to address developmental questions across various organ systems, including facial, thoracic, and gastrointestinal abnormalities, in addition to its established role as a complementary tool for assessing central nervous system abnormalities.

Given the growing significance of fetal MRI and its increasing accessibility [58], our aim is to bridge the current gap by offering a comprehensive framework. This framework is intended to support radiologists who are new to fetal MRI, as well as those with more experience, allowing them to evaluate and refine their current practices. Our proposed template provides a structured approach for the evaluation of all fetal organ systems.

This report template, including the biometric reference data, should be viewed as an initial step. Future validation of this template will be necessary, recognising that the adoption of a new reporting format will require adjustments from both radiologists and referring clinicians.

Conclusion

With this paper, we have provided a standardised template for describing fetal anomalies observed using fetal MRI, along with an overview of the normative values available in the current literature for various organs and anatomical structures. This template may be adjusted according to local procedures and preferences.

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Author contribution C.S. conceived the study. C.S. and M.A. conducted the literature search and analysed the data. C.S. and M.A. drafted the initial manuscript. C.G. and M.C. reviewed the initial manuscript. All authors reviewed and approved the final manuscript.

Data availability Data sharing is not applicable.

Declarations

Conflicts of interest None

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