Imaging acute abdominal and pelvic presentations in pregnancy

Consensus guidelines from British Society of Urogenital Radiology, the British Society of Gastrointestinal Radiology and the Royal College of Radiologists

Introduction

Acute abdominal and pelvic symptoms are common during pregnancy. Most are physiological or self-limiting in nature - such as uterine contractions, round ligament pain, compression from the gravid uterus, or hormonal effects on the gastrointestinal tract. However, identifying acute abdominal and pelvic presentations in pregnancy (AAPP) that may require medical or surgical intervention presents significant diagnostic challenges. Clinical and radiological evaluation can be complicated by pregnancy-related physiological changes, displacement of abdominal and pelvic organs by the gravid uterus, and altered blood parameters like white cell count 1, 2.

Timely and accurate diagnosis of more serious conditions is essential to safeguard the health of both the pregnant patient and the foetus. While imaging is central to evaluating many of these conditions, it also carries potential risks. Concerns about radiation exposure-shared by both patients and clinicians-can complicate decision-making. However, in many acute scenarios, the actual risks associated with imaging are lower than often perceived and are outweighed by the benefits of timely diagnosis and intervention. Surgical intervention is required in approximately 0.5%-2% of these cases 3, and imaging plays a critical role in identifying those that need intervention, offering a safer and less invasive alternative to diagnostic options such as laparoscopy.

Within the current NHS setting, access to imaging is not always consistent, and the level of interpretative expertise - particularly outside of normal working hours-can vary. A national survey conducted by BSUR and BSGAR (in press), highlighted variation in practice, knowledge and confidence among UK radiologists when managing these complex cases.

To address these issues, BSUR, BSGAR, and RCR have collaborated to produce practical, evidence-based guidelines for use in radiology departments nationwide. Developed by a panel of NHS radiologists, these guidelines aim to provide a clear, standardised approach to support radiologists and clinical teams across the UK in imaging AAPP effectively.

Authors

In 2023 the British Society of Urogenital Radiology (BSUR), the British Society of Gastrointestinal Radiology (BSGAR) and the Royal College of Radiologists (RCR) committed to developing these consensus guidelines. BSUR and BSGAR members were invited by email to participate, and appointed to ensure broad geographical representation across the UK with input from both teaching and non-teaching hospital settings. The panel comprised 18 radiologists: 2 chairs (appointed by BSUR and BSGAR), 1 research fellow, and 14 panel members -Table 1.

Further acknowledgements can be found at the end of the document.

Table 1. Guidelines panel members

Panel Chairs	**Place of work**	**Hospital**	**Affiliation**
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Rebecca Wiles	Liverpool, England	Teaching	BSGAR/BSUR
Research fellow	**Place of work**	**Hospital**	**Affiliation**
Rachel Gravell	Leeds, England	Teaching	BSGAR
Panel Member	**Place of Work**	**Hospital**	**Affiliation**
Ian Zealley	Edinburgh, Scotland	Teaching/DGH	BSUR/BSGAR
James Stephenson	London, England	Teaching	BSGAR
Vikas Shah	Leicester, England	Teaching	BSGAR
Katherine Moore	Wales	Teaching/DGH	BSGAR
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Methodology

The guidelines development process followed the principles outlined in the European Society of Gastrointestinal Radiology (ESGAR) Guidelines for the Development of Consensus Guidelines 4, using a modified Delphi methodology 5, and was broadly informed by the AGREE II instrument 6,7.

Following selection of the panel and chairs, the scope and aims of the guidelines were defined at a face-to-face meeting. The chairs then developed an initial detailed questionnaire covering all proposed items for inclusion in the consensus statement. This draft was circulated to the panel for feedback and subsequently refined based on their responses.

A comprehensive literature search was conducted to identify relevant studies, with the search strategy outlined in Appendix 1. Abstracts were screened, and a curated list of studies was shared with the group. The literature review focused on imaging safety in suspected AAPP during pregnancy and on strategies for achieving accurate, timely diagnosis within current NHS resources.

Approved questionnaires were converted into individual consensus statements and distributed to the panel along with the supporting literature. Panel members rated their agreement using a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Statements that achieved ≥80% agreement (ratings of 4 or 5) were accepted, with corresponding levels of evidence cited. For statements that did not reach consensus, revisions and discussions were undertaken, leading to further rounds of voting. In total, three Delphi rounds were required.

A manuscript was then prepared by the coordinating chairs and circulated to the group, including patient information leaflets, consent forms and scan protocols (see appendices 1-4). The final version was reviewed and approved by the Royal College of Radiologists Professional Practice Board and underwent public consultation.

Guidelines and Recommendations

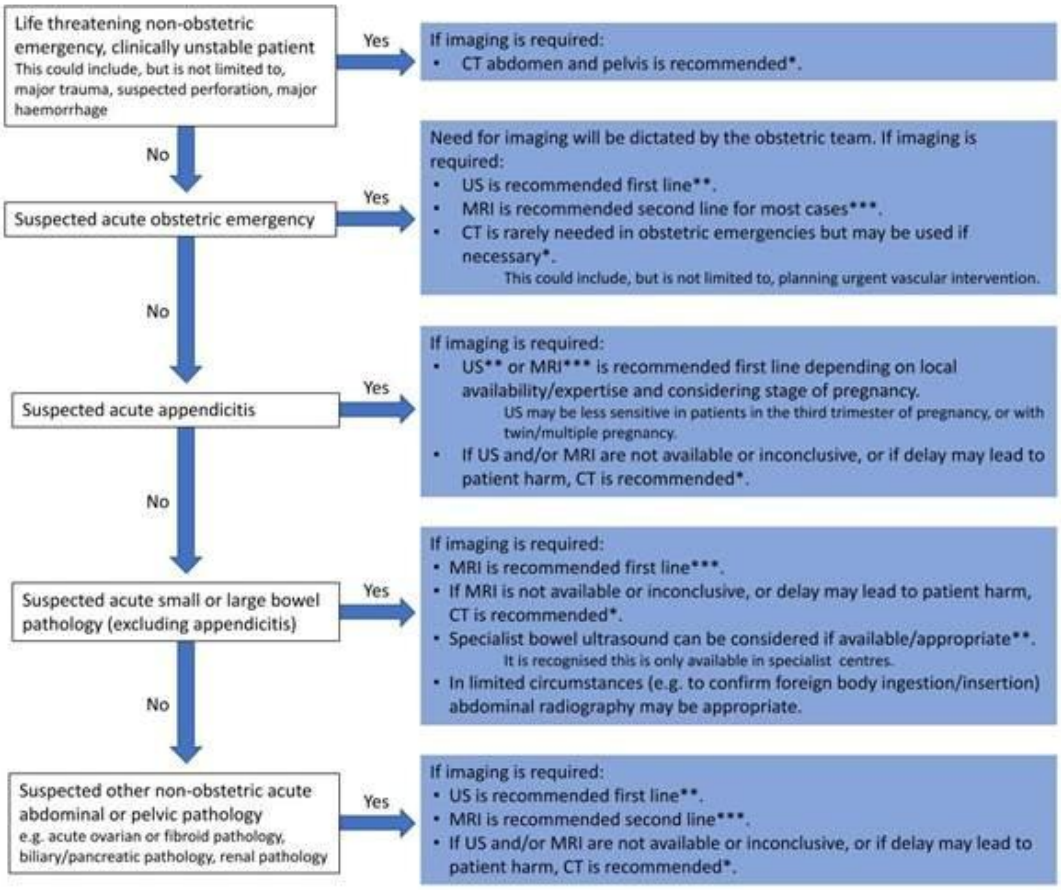
A summary of the recommendations is described in the algorithm (Fig 1). Each point in the algorithm is discussed separately below. Grades of evidence as per the Oxford Centre for Evidence Based Medicine (OCEMB) 8,9 agreement level of the group (in %) and strength of recommendation are included in brackets after each statement.

The guidelines are divided into three sections:

1. Governing concepts
2. Imaging use in specific clinical scenarios

3. How to deliver a service

Fig 1. Summary of recommendations



Guidance notes

Availability of imaging depends on radiographer and/or radiologist availability and expertise.

***CT**

- A designated member of the clinical team should discuss the risks and benefits of the imaging investigation with the patient. If the patient is too unwell to have the discussion, this can take place with their advocate if available.
- The use of a patient information leaflet is recommended.
- Specific documented consent is recommended.
- The protocol should be tailored to pregnancy and to the clinical question.
    - Intravenous (IV) contrast can be administered as it would be for the same clinical indication in a patient who is not pregnant. If IV contrast is required, the nominated member of the team should advise the patient that there is a theoretical risk of hypothyroidism and a heel prick test is advised at birth. This is already recommended for all babies as part of routine neonatal screening in the UK.
- Abdominal shielding should be avoided.

****Ultrasound**

- The patient should be advised that ultrasound causes no known risk to the unborn baby.
- Specific documented consent (beyond that obtained for non-pregnant patients) is not required.
- The use of a patient information leaflet is not required.

*****MRI**

- The patient should be advised that MRI causes no known risk to the unborn baby.
- Specific documented consent (beyond that obtained for non-pregnant patients) is not required.
- The use of a patient information leaflet is recommended.
- Due to theoretical risks, MRI should be avoided in the first trimester if possible. However, in AAPPP cases, this is often impractical, and MRI remains preferable to CT.
- The protocol may be tailored to the clinical question (see suggested protocol in accompanying materials).
    - It is recommended that a radiologist supervise the MRI scan, either remotely or on-site, to tailor the study if possible, provided it does not cause delay that may lead to patient harm.
    - Gadolinium-based IV contrast and antispasmodic agents should be avoided.

1. Governing concepts

Decision making and clinical involvement

Imaging in pregnancy involves balancing maternal and foetal considerations, recognising that maternal health is essential to foetal wellbeing. Decisions should be based on clinical urgency, the potential risks of imaging, and the diagnostic value of available modalities. In the current NHS setting, these decisions are also shaped by rising demand, limited resources, and the need for multidisciplinary input. The following principles form the basis for safe, effective, and patient-focused imaging in pregnancy.

i) Imaging should be available for the evaluation of pregnant patients presenting with AAPP. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

ii) Non-ionising imaging modalities (e.g. ultrasound, MRI) should be prioritised over ionising radiation modalities (e.g. CT, X-ray) in pregnant patients at all stages of pregnancy if appropriate to the clinical scenario. (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

iii) For all imaging modalities, the "as low as reasonably achievable" (ALARA) principle should be adhered to. This should not be at the expense of obtaining adequate diagnostic information. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

iv) The decision to use imaging should involve a risk-benefit analysis, considering the stage of pregnancy and clinical scenario. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

v) "Availability/appropriateness" of imaging includes not just access to equipment but also an appropriately experienced person* to interpret and report within a suitable time frame. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

****Depending on the imaging modality, this may include, but is not limited to, a radiologist, sonographer or obstetrician.***

vi) A multidisciplinary approach involving obstetricians, radiologists and surgeons/physicians is recommended in imaging AAPP. The seniority of team members will depend on the clinical scenario, but will usually involve consultant to consultant referral, especially if involving ionising radiation. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

Imaging plays a crucial role in assessing most patients with acute abdominal and pelvic presentations. This remains true in pregnancy, but there is the added consideration of how different imaging modalities may affect the foetus 2, 10–14.

The foetus is particularly sensitive to ionising radiation, especially during early gestation. While the radiation doses used in a one-off diagnostic imaging study are below the thresholds associated with deterministic effects such as miscarriage, growth restriction, or congenital anomalies there remains a theoretical, dose-dependent stochastic risk of childhood cancer 15,16. The exact risk for each individual varies with multiple factors and as such can only be estimated. According to the International Commission on Radiological

Protection (ICRP), in utero exposure to 10 mGy is associated with a risk of death from childhood cancer of approximately 1 in 1,700 exposed individuals 17.

Given this small but uncertain risk, non-ionising imaging modalities (ultrasound and MRI) are preferred over ionising techniques (primarily CT and plain radiography) 18, 19–21. Nonetheless, ionising studies may be justified when the diagnostic benefit outweighs the potential foetal risk. The As Low As Reasonably Achievable (ALARA) principle should always be observed, and current IR(ME)R regulations (at the time of writing, latest amendment in 2024) must also be followed 22-24.

As with all imaging decisions, imaging in pregnancy should only be undertaken if it is likely to change management, considering fetal-maternal safety, the suspected diagnosis, the diagnostic value of available modalities, alternative options (including proceeding straight to surgery or avoiding imaging altogether), and the patient's informed wishes. In pregnancy, these considerations are even more critical, and senior clinical and radiological input is strongly recommended 25,26.

Concerning MRI, where scanners with field strengths of 1.5 Tesla (1.5T) and 3 Tesla (3T) or higher are available, there is no evidence that higher field strength is harmful to the pregnant person or foetus 27. However, the use of 1.5T should be preferred in keeping with ALARA principles. When clinically indicated and available, MRI at 3T remains preferable to imaging techniques that involve ionising radiation.

A 2025 BSUR-BSGAR survey (in press) demonstrated significant variation in imaging practice across UK centres. In particular, the availability of different imaging modalities and the expertise required to interpret studies varied both geographically and according to the time of day or week. The panel therefore emphasises the critical importance of "availability" when planning imaging for AAPP. Availability should be understood to encompass not only physical access to imaging equipment but also access to appropriately trained personnel. This includes qualified operators-typically radiographers for CT or MRI, or sonographers or radiologists for ultrasound-as well as a suitably experienced person to interpret the results and produce an accurate report (usually radiologists for CT or MRI, and radiologists or sonographers for ultrasound). Ensuring both technical and interpretive expertise is essential to ensure timely and accurate imaging for this group of patients.

Assessment of the foetus

vii) If the radiologist reporting the study does not have expertise in obstetric/placental imaging (and the foetus/placenta is imaged), a comment* can be made in the report that the study is to assess for non-obstetric pathology, and the foetus and placenta have not been assessed. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

For example "The study is conducted to assess non-obstetric pathology. The foetus and placenta have not been evaluated as part of this examination."

viii) Where specific clinical concern for the foetus or placenta cannot be resolved with the imaging technique performed, or when radiologist expertise is not available for interpretation, then the obstetric team should be notified, and further imaging may be

performed at their discretion. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

The BSUR-BSGAR survey on current clinical practice found considerable variation in how the foetus and placenta were addressed in scans performed for AAPP, reflecting the limited familiarity most radiologists have with foetal imaging 28. In the survey, 42% of radiologists stated in their report that the foetus or placenta was not assessed, while 12% made no comment.

The panel recommends that when a pregnant patient requires imaging, the reporting radiologist or sonographer should not be constrained by lack of expertise in foetal or placental assessment 10,29. In urgent scenarios, maternal wellbeing is the primary consideration, and the reporter should provide a report addressing the clinical question relating to maternal health or survival. Findings related to other structures, including the foetus or placenta, may be evaluated separately outside the acute setting if relevant. Where additional foetal assessment is required, this would usually be performed with ultrasound, or in selected cases, by referral for specialist centre foetal MRI 13 -though the latter is rarely indicated in the acute setting.

2. Imaging use in specific clinical scenarios

Life threatening emergency, clinically unstable patient

i) In suspected acute life-threatening non-obstetric pathology requiring imaging*, choice of imaging is determined by availability and clinical urgency. The welfare of the pregnant patient should be the primary consideration, and CT is typically the most appropriate imaging modality in these circumstances. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

****This could include, but is not limited to, major trauma, suspected gastrointestinal tract perforation, major haemorrhage.***

Trauma is the leading non-obstetric cause of death in pregnant women 30. When imaging is required for suspected acute, life-threatening emergencies—including major trauma—the panel recommends CT as the primary imaging method, since the risk to the pregnant patient from missed serious pathology likely far exceeds the potential radiation risk to the foetus 31,32, 68. This approach aligns with guidelines from both the European Trauma Course 30 and Advanced Trauma Life Support 33.

Suspected acute obstetric emergency

i) Need for imaging will be dictated by the obstetric team. (Agreement: 86%, Evidence grade: D, Strength of recommendation: strong).

ii) When imaging is required, US is recommended as the first line investigation. (Agreement: 93%, Evidence grade: B, Strength of recommendation: strong).

iii) In limited scenarios MRI should be considered as a second line investigation. (Agreement: 93%, Evidence grade: B, Strength of recommendation: strong).

iv) CT is rarely needed in obstetric emergencies but may be used if necessary*. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

****This could include, but is not limited to, planning urgent vascular intervention.***

Some causes of AAPP are directly related to the gravid uterus. These include ectopic pregnancy, placental abruption, and uterine rupture. Such conditions are typically suspected and managed by the obstetric team, with USS being the recommended first-line imaging modality 34. If USS does not provide sufficient information, MRI is recommended as the next step 35. CT is rarely required, but in emergency situations-such as suspected acute bleeding-it may be preferable to proceeding directly to emergency surgery 36, 37. As these situations are expected to be rare, the panel recommends discussion between the most senior members of the team, as outlined in Section 1.

Suspected Acute Appendicitis

i) If imaging is required, US or MRI is recommended as the first line investigation if available/appropriate. Choice of imaging may depend on the stage of pregnancy*. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

****US may be less sensitive in patients in the third trimester of pregnancy, or with twin/multiple pregnancy.***

ii) If US or MRI is not available or inconclusive, or delay may lead to patient harm, CT may be considered if appropriate to the clinical scenario. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

In pregnancy, the appendix is often displaced or compressed by the gravid uterus, making it harder to visualise on ultrasound. This reduces ultrasound sensitivity for appendicitis, especially as views of deep structures are limited. Reported accuracy varies widely due to operator dependence and gestational age. Two recent meta-analyses report sensitivities of 56% and 77.6%, and specificities of 88% and 75.3% 38,39. Sensitivity also declines with advancing pregnancy-from 69% in the first trimester to 51% in the third 38.

MRI offers higher accuracy, with reported sensitivity and specificity of 92% and 98% 40, though its use is limited by availability, timing, and reporting expertise.

While CT data in pregnant patients is limited, studies in non-pregnant populations show high accuracy-97% sensitivity and 96% specificity 41. In the recent BSUR/BSGAR survey, UK radiologists reported slightly better access to ultrasound than MRI for AAPP, but both were significantly less available than CT, which was always widely accessible.

The panel recommends using ultrasound or MRI based on local access and expertise. MRI may be preferred later in pregnancy if available. However, given CT's superior availability and excellent diagnostic performance, its use is occasionally justified when it is the best available option.

Suspected acute small or large bowel pathology (excluding appendicitis).

i) If imaging is required, MRI is recommended as the first line investigation if available/appropriate. (Agreement: 86%, Evidence grade: C, Strength of recommendation: strong).

ii) If MRI is not available or inconclusive, or delay may lead to patient harm, CT may be considered if appropriate to the clinical scenario. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

iii) Specialist bowel ultrasound* can be considered if available/appropriate. (Agreement: 93%, Evidence grade: C, Strength of recommendation: strong).

****It is recognised this may only be available in specialist centres with local expertise.***

iv) In limited circumstances (e.g. to confirm foreign body ingestion/insertion) abdominal radiography may be appropriate as a first line investigation. (Agreement: 86%, Evidence grade: D, Strength of recommendation: strong).

In non-pregnant patients, suspected acute bowel pathology is usually investigated with ionising radiation, most commonly abdominal radiography or CT. Although MRI is not routinely used for this indication, many centres have experience with MRI enterography 42. Where available and supported by appropriate reporting expertise, MRI is recommended as first-line to avoid ionising radiation. If MRI is unavailable or local expertise is limited, CT should be performed when imaging is required.

The panel does not recommend routine use of abdominal radiographs, as they expose the patient to ionising radiation but are unlikely to provide sufficient diagnostic information to guide management 43. Exceptions include limited scenarios such as confirming or excluding a radiopaque foreign body that may cause harm 44.

Bowel ultrasound has variable availability across the UK. In centres with expertise, it has demonstrated high sensitivity (92%) for detecting small bowel Crohn's disease 42. For selected indications such as suspected inflammatory bowel disease, ultrasound may be a suitable alternative in such centres.

Suspected other non-obstetric acute abdominal or pelvic pathology e.g. acute ovarian or fibroid pathology, biliary/pancreatic pathology, renal pathology

i) Ultrasound is recommended as the first line investigation if available/appropriate. (Agreement: 93%, Evidence grade: D, Strength of recommendation: strong).

ii) If ultrasound is not available/appropriate or results are inconclusive, MRI is recommended if available/appropriate. (Agreement: 100%, Evidence grade: C, Strength of recommendation: strong).

iii) If MRI is not available or inconclusive, or delay may lead to patient harm, CT may be considered if appropriate to the clinical scenario. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

Outside of the specific scenarios described above, USS is generally recommended first line in AAPP if available and appropriate, with MRI or CT second line depending on availability 11, 45.

3. How to deliver a service

Ultrasound

i) The patient should be advised that ultrasound causes no known risk to the foetus. (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

ii) Specific documented consent (beyond that obtained for non-pregnant patients) is not required. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

iii) The use of a patient information leaflet is not required. (Agreement: 93%, Evidence grade: D, Strength of recommendation: strong).

Diagnostic ultrasound is considered safe in pregnancy, with no evidence of adverse maternal, foetal, perinatal, or childhood outcomes 2,10,12,46. Theoretical risks from tissue heating and mechanical effects have not been demonstrated in human studies. Potential temperature elevation is minimal with B-mode imaging but higher with colour and spectral Doppler; therefore, the thermal index and mechanical index should be kept as low as reasonably achievable, with obstetric presets ensuring parameters remain within safe limits 46. As most patients are already familiar with the safety of ultrasound in pregnancy, an extended discussion of these technical considerations is not necessary. The panel does not recommend a separate consent process or patient information leaflet solely due to pregnancy 2,18.

MRI

i) The patient should be advised that MRI causes no known risk to the foetus. (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

ii) Specific documented consent (beyond that obtained for non-pregnant patients) is not required. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

iii) The use of a patient information leaflet is recommended*. (Agreement: 71%, Evidence grade: B, Strength of recommendation: weak).

An example of which is given in Appendix 2

iv) Due to theoretical risks, MRI should be avoided in the first trimester if possible. However, in AAPP cases, this is often impractical, and MRI remains preferable to CT. (Agreement: 86%, Evidence grade: C, Strength of recommendation: strong).

v) Radiology departments should have an MRI protocol* for investigating AAPP. The protocol may be tailored to the clinical question. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

**An example of which is given in Appendix 5*

vi) It is recommended that, if possible, a radiologist supervise the MRI scan (either remotely or on-site) to tailor the study , provided it does not cause delay that may lead to patient harm. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

MRI does not use ionising radiation and is considered safe in pregnancy, as there is no conclusive evidence of foetal harm 2,11,18. Although theoretical risks such as foetal hyperthermia and inner ear damage have been proposed 27, these are mitigated by modern scanner techniques, including reduced specific absorption rate (SAR) and optimised scan duration 2,10,27. As organogenesis occurs in the first trimester, some guidelines suggest MRI should be deferred until after this period where possible 27. However, the panel recommends that this is not usually practical in the acute setting and MRI can still be used safely in the first trimester for AAPP when clinically indicated 19,47–49.

Patients should be informed that MRI is not known to cause harm in pregnancy and is safer than imaging that uses ionising radiation. Specific documented consent for MRI in pregnancy is not required, in line with standard NHS practice for clinically indicated imaging performed within accepted safety parameters. However, the panel recommends that clinical teams consider providing a patient information leaflet (PIL) to support communication and alleviate concerns 50. This is not a 'strong' recommendation, as many panel members felt it was unnecessary and could inadvertently cause anxiety in patients who are already being reassured that MRI is safe during pregnancy. An example PIL can be found in Appendix 2.

Responders to the BSUR/BSGAR survey reported that Out-of-hours MRI may be handled by registrars or teleradiology providers (see *Section 3. Service provision/training)* who may be unfamiliar with local protocols. To reduce delays and ensure consistent practice, the panel recommends that all departments implement a default protocol for MRI in suspected AAPP. A suggested protocol is provided (see Appendix 5), designed to be concise and adaptable. The panel recommends structuring sequences so that the examination can be terminated early if the clinical question is answered-for example, identification of an inflamed appendix on initial sequences-if a supervising radiologist is available, this is in line with ALARA principles 11,51. While the panel recognises that (direct or remote) supervision may not be practical in all NHS settings, particularly out of hours, this is presented as an aspirational standard to reduce scan time and to ensure sufficient diagnostic information is obtained.

vii) Intravenous gadolinium-based contrast should be avoided. (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

viii) Anti-spasmodic agents (e.g. Buscopan) should be avoided. (Agreement: 86%, Evidence grade: D, Strength of recommendation: strong).

The administration of intravenous gadolinium during pregnancy has been associated with a small increase in the risk of rheumatological, inflammatory, or dermatological conditions, as well as stillbirth and neonatal death 2,11,52. Therefore, the panel recommends against the use of IV gadolinium unless absolutely necessary - something rarely, if ever, required in the investigation of AAPP.

The panel does not recommend the use of Buscopan (hyoscine butylbromide) during MRI in pregnancy 2,53. Although widely used in general MRI protocols, its safety in pregnancy is not well established. The Summary of Product Characteristics notes that reproductive safety data from animal studies are inadequate, and its use in pregnancy is therefore not advised as a precautionary measure 54. Additionally, the panel notes that later in pregnancy, Buscopan may not provide as much benefit due to reduced bowel motility and limited displacement of bowel loops by the gravid uterus 1.

CT

i) A designated member of the clinical team should discuss the risks and benefits of the imaging investigation with the patient and/or their advocate (if present and the patient is too unwell to have the discussion). This is not typically expected to be the radiologist. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

ii) The designated member of the clinical team should obtain consent (if possible) and document it in the patient record. If the patient is unable to consent (for example because they are too unwell), the team can determine that the scan is in the patient's best interests, and it should proceed without delay. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

****An example consent form is given in Appendix 4***

iii) The use of a patient information leaflet is advised*. (Agreement: 93%, Evidence grade: C, Strength of recommendation: strong).

****An example of which is given in Appendix 3***

iv) Radiology departments should have a CT protocol* for investigating AAPP. The protocol may be tailored to the clinical question. (Agreement: 93%, Evidence grade: C, Strength of recommendation: strong).

****Further information on the practice of CT in pregnancy is provided in Appendix 6***

v) IV contrast can be administered as it would be for the same clinical indication in a patient who is not pregnant. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

vi) If IV contrast is required, the nominated member of the team should advise the patient that there is a theoretical risk of hypothyroidism and a heel prick test is advised at birth (and that this is performed as part of routine neonatal screening in the UK). (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

When CT is required, and the pregnant patient can consent, appropriate informed consent can be obtained, with time taken to discuss the issues of radiation exposure.

Because of the theoretical risk to the foetus the panel recommends that the clinical team discuss with the patient (or their advocate) 14,18,55,56. Documented consent is recommended, as is the use of a patient information leaflet, examples of which can be found in appendices 3 and 4.

Ultra-low dose protocols are generally avoided in pregnant patients as they can be non-diagnostic, potentially leading to both a delay in diagnosis and further radiation exposure from additional imaging 57,58. Single-phase contrast-enhanced CT should be used where possible to minimise foetal radiation exposure. Exceptions to this include suspected urinary tract injury and suspected active bleeding 15. Dose reduction techniques including organ dose modulation, reducing tube current/voltage and iterative reconstruction should be considered 69. Specific guidance on CT optimisation techniques can be found in appendix 6.

CT uses iodinated contrast. The thyroid gland of the developing foetus is sensitive to iodine loads. Despite this, there is no evidence that the administration of CT contrast during pregnancy causes thyroid dysfunction in the neonate 70 and contrast agents are considered safe for use in pregnancy when clinically indicated 71. Enteric contrast can also be used safely in pregnancy 59. As part of standard neonatal care, thyroid function is routinely assessed within the first week of life, ensuring that any abnormality, whether or not related to iodine exposure, is detected and appropriately managed 10, 11, 60, 61, 62.

vii) Abdominal shielding should be avoided. (Agreement: 93%, Evidence grade: B, Strength of recommendation: strong).

Historically, abdominal lead shielding was sometimes used in imaging studies involving ionising radiation when the foetus was not directly within the primary beam. However, as the predominant source of foetal radiation dose in such procedures is internal scatter rather than direct exposure, the use of abdominal shielding is unlikely to provide meaningful dose reduction. Furthermore, inadvertent placement of shielding within the imaging field may trigger automatic exposure control mechanisms, potentially resulting in increased radiation dose. Current guidelines from the American College of Radiology/Society of Paediatric Radiology, American Association of Physicists in Medicine, European Society of Radiology/Society of Radiographers and British consensus guidelines advise against the routine use of lead shielding 13, 63-65.

Plain radiography

i) Abdominal radiograph is rarely indicated and should only be considered in specific clinical scenarios. (Agreement: 100%, Evidence grade: A, Strength of recommendation: strong).

ii) Abdominal shielding should be avoided. (Agreement: 100%, Evidence grade: B, Strength of recommendation: strong).

See “Suspected acute small or large bowel pathology (excluding appendicitis) *iv*” and “CT - *vii”.* Abdominal radiographs are considered under specific circumstances, but generally avoided, 66, 67. Abdominal shielding should be avoided as above 65.

Service provision/training:

i) Radiology services should develop MRI imaging for assessment of AAPP. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

ii) Radiology training should include imaging pathways to assess AAPP and interpretation of MRI. (Agreement: 100%, Evidence grade: D, Strength of recommendation: strong).

In the BSUR/BSGAR AAPP UK survey, respondents reported variation in who interprets MRI for AAPP, with the most common responses being: “any available consultant radiologist” (23%), “provisionally reporting radiology registrar” (11%), “gastrointestinal radiologist” (19%), “genitourinary radiologist” (15%), and “outsourcing company” (7%). This indicates that interpreting MRI in AAPP requires input from radiologists across a range of subspecialties. Although MRI use for AAPP is currently limited, it is expected to become more common as access improves. The panel therefore advises radiology departments and training programmes to plan proactively. This may have implications for trainee education and could be integrated into existing abdominal radiology rotations.

Discussion

These guidelines aim to address a longstanding gap in UK practice by providing nationally agreed recommendations for imaging acute abdominal and pelvic presentations in pregnancy. Previously, practice varied widely, often relying on local custom or extrapolation from non-pregnant populations, leading to diagnostic delays and inconsistent care. By combining available evidence with expert consensus, this document aims to offer a pragmatic framework aligned with contemporary NHS practice.

A key principle underpinning the consensus is that maternal health takes precedence, as it is integral to foetal wellbeing. The guidance prioritises non-ionising imaging, while recognising that CT and other ionising studies may be necessary in acute settings where delay would compromise outcomes. In such cases, radiation risks should be clearly communicated without unduly delaying urgent imaging.

The guideline acknowledges variability in service provision, particularly out of hours, and highlights the need for practical solutions such as standardised MRI protocols and accessible patient information. Recommendations regarding radiologist supervision are aspirational, reflecting current NHS constraints while emphasising the value of senior clinical input. The distinction between maternal and foetal imaging is also clarified, supporting confident imaging for maternal pathology with appropriate referral when foetal assessment is required.

This represents the first UK consensus jointly developed by RCR, BSUR and BSGAR in this area, aiming to standardise practice and support clinicians managing complex scenarios, while recognising the ongoing need for service development and training.

Conclusion

Imaging plays a central role in the diagnosis of acute abdominal and pelvic pathology in pregnancy, yet variation in practice and safety concerns continue to challenge clinicians. These guidelines provide an evidence-based framework to support safe, timely, and consistent imaging across the NHS, emphasising maternal health, preferential use of non-ionising modalities and judicious use of CT when indicated. Standardised protocols,

multidisciplinary working and appropriate senior input are key to improving diagnostic accuracy and outcomes.

The panel intends for these guidelines to empower radiologists and clinical teams to approach imaging of pregnant patients with acute abdominal and pelvic presentations with confidence rather than apprehension.

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Georgina Blenkinsopp, Krista Gelder, Leonardos Papadopollous, Sophie Freeman, Dileep Wijeratine, the RCR i-Rfer team, the RCR professional practice board

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Appendix 1

Literature Search

A systematic literature review was performed in PubMed and Ovid (including OvidMedline + EMBASE classic) and Cochrane searching title and abstract using the search terms: pregnan* OR obstetric AND abdom* AND “Computed tomography” OR CT OR MRI OR “magnetic resonance imaging” OR “ultrasound” OR “plain film” OR radiograph* OR x-ray OR contrast OR imaging.

Search terms were formed following an initial review of the literature. Included were manuscripts published in English from 2000 until the date of the literature search, limited to human studies with abstract available. Filters were applied to search the following publications: Abstract, Books and Documents, Classical Article, Clinical Study, Clinical Trial, Comparative Study, Controlled Clinical Trial, Evaluation Study, Government Publication, Guideline, Legislation, Meta-Analysis, Multicenter Study, Observational Study, Practice Guideline, Randomized Controlled Trial, Review, Systematic Review

The literature search was performed on the 3rd of February 2025 and updated on the 20th of March 2025. The titles of the manuscripts identified by the literature search were reviewed for relevance by RG, and those which appeared suitable were reviewed in further detail. The included manuscripts were then disseminated to the group to aid the formulation of the guidelines.

Appendix 2

INFORMATION FOR PREGNANT PATIENTS UNDERGOING AN MRI SCAN

What is an MRI scan?

MRI stands for **Magnetic Resonance Imaging**. It is a safe, non-invasive scan that uses strong magnetic fields and radio waves to produce detailed images of the inside of your body. MRI does not use any X-ray radiation, unlike X-rays or CT scans.

Why might I need an MRI scan during pregnancy?

If you become unwell during pregnancy, your medical team may need detailed images to help understand what is happening and how best to treat you. MRI can provide important information that other scans, like ultrasound, may not be able to show clearly.

Is an MRI scan safe for pregnant people?

Yes, MRI is safe during pregnancy. Before the scan, radiographers will ask you some routine questions and perform standard safety checks—like checking for metal implants—to make sure the MRI is safe for you. These checks are the same for all patients and are not specific to pregnancy.

Is an MRI scan safe for the unborn baby?

Yes, MRI is safe during pregnancy. There is no evidence it harms you or your unborn baby, and it's not linked to birth defects, growth issues, or hearing problems. While there are some theoretical risks, your medical and radiology team will only recommend an MRI if it's necessary for your care. If possible, they may wait until after the first trimester but won't delay it if waiting could risk your health.

The theoretical risks are explained below.

- **Magnetic field** -the MRI scanner uses a very powerful magnetic field. There is no evidence to suggest that this poses any risk to the unborn baby.
- **Heating** -the scanner can have a heating effect, and it uses height and weight calculations to keep this heating to a minimum. As a safety precaution, radiographers closely monitor the heating effect of the scan, known as the Specific Absorption Rate (SAR), to ensure it remains within safe limits throughout the procedure.

- **Noise** -During the scan, you will hear loud knocking or tapping sounds. These sounds come from electrical currents switching on and off to help produce the images, it is completely normal. You will be protected from this noise by the use of ear defenders. There is no evidence to suggest there is any risk to the unborn baby from this noise during pregnancy.

What to Expect During the Scan

Once all the safety checks have been completed, you will be asked to change into a hospital gown and store your belongings securely in a locker during the scan.

You will lie on a padded table that gently moves into the MRI scanner. The scan usually takes between 20 and 45 minutes, depending on the area being examined. It is important to stay as still as possible throughout to ensure clear images.

The scanner makes loud tapping or knocking sounds, but you will be given earplugs or headphones to reduce the noise (you can also listen to music if you wish). You can speak to the radiographers at any time through an intercom, and they will monitor you throughout.

If lying flat is uncomfortable, you can lie on your side with plenty of cushions for support. Please let us know your preference -we want to make you as comfortable as possible.

If you feel anxious or claustrophobic, tell the radiographers before or during the scan. They will talk you through options to help you feel more at ease. Your comfort and safety are the priority.

Who can I talk to if I have questions or concerns?

If you have questions or concerns about your MRI, please speak to any member of the team caring for you, or the radiology team. They are here to support you in making informed decisions about your care.

Appendix 3

INFORMATION FOR PREGNANT PATIENTS UNDERGOING A CT SCAN

What is a CT scan?

A CT (computed tomography) scan is a type of scan that uses X-ray radiation to take detailed images of the inside of your body. It can help your medical team quickly make a diagnosis and plan the best treatment.

Why might I need a CT scan during pregnancy?

If you become unwell during pregnancy, your medical team may need detailed images to help understand what is happening and how best to treat you. CT scans are only used during pregnancy when they are the safest and most effective way to get the information needed.

Whenever possible, other types of scans that do **not** use X-ray radiation -such as ultrasound or MRI -will be considered first. However, if a CT scan is the best or only option, your medical team will explain the reasons for this and discuss the potential risks and benefits with you before going ahead.

Is a CT scan safe for pregnant people?

The CT scan generally carries very low risks. The main concern is exposure to a small amount of X-ray radiation, which is usually not harmful when only one scan is done. During pregnancy, the breast tissue is more sensitive to X-ray radiation, which could very slightly increase the risk of breast cancer. We don't know the exact size of this risk, but it is thought to be very small and is usually considered to be outweighed by the benefits of the scan.

Is a CT scan safe for the unborn baby?

There are some risks related to X-ray radiation exposure, but these have been carefully weighed against the benefits before recommending the scan.

X-ray Radiation exposure

During a CT scan, your unborn baby will be exposed to a **very small amount of X-ray radiation**. This amount is **too low to cause miscarriage, birth defects, or problems with your baby's growth or development**.

The main possible risk is a **very small increase** in the chance of your child developing cancer later in life. However, this risk is still **very low**, and every effort is made to keep your unborn baby's exposure to X-ray radiation as low as possible.

X-ray Radiation is measured in units called **milligray (mGy)**. According to UK National guidelines (1), each **1 mGy of X-ray radiation**, may increase the risk of childhood cancer by approximately **1 in 10,000** (or 0.01%). To put this into perspective, about 1 in 500 children (0.2%) develop childhood cancer naturally, without any exposure to medical scans that involve X-ray radiation. This natural chance is known as the background risk.

How much X-ray radiation is involved in different CT scans?

The amount of X-ray radiation your unborn baby is exposed to depends on the type of scan and stage of pregnancy. The estimated additional risk of childhood cancer also varies, but it remains very low, even for larger scans:

Type of CT Scan	Foetal Dose (mGy)	Estimated Additional Risk of Cancer	Background Risk	Total Estimated Risk (Scan + Background)
CT abdomen (not including pelvis)	1.0 -10.0	1 in 10,000 to 1 in 1,000	1 in 500	1 in 500 to 1 in 455
CT abdomen and pelvis	10.0 -25.0	1 in 1,000 to 1 in 400	1 in 500	1 in 500 to 1 in 285
CT whole body (trauma scan)	~25 mGy (approx.)	1 in 400	1 in 500	~1 in 220

Notes:

- **Foetal dose** is the estimated amount of X-ray radiation the unborn baby is exposed to during the scan.
- **Background risk** is the chance of childhood cancer in all children, regardless of X-ray radiation exposure (about 1 in 500 or 0.2%).
- **Total estimated risk** combines the natural background risk with the small added risk from the CT scan.
- These figures are estimates based on current UK guidelines (1,2) and may vary slightly depending on the exact scan technique and equipment used.

Are there any alternative scans I could have?

Yes. Some scans, like **ultrasound (US)** or **Magnetic Resonance Imaging (MRI)**, do **not** use X-ray radiation. However, they are not always suitable for diagnosing certain conditions. Your medical team will always consider these alternatives first and will only recommend a CT scan if it is the best option for you and your unborn baby.

Can a shield be used to protect my unborn baby from radiation?

In the past, lead aprons or shields were sometimes used to protect the unborn baby during scans. However, current **UK and international guidance does not recommend routine shielding (3,5)** during CT scans in pregnancy.

Modern scanners are designed to limit radiation very precisely. Using a shield can sometimes interfere with the scan or even increase the overall radiation dose (5).

What about the contrast dye sometimes used in CT scans?

Some CT scans use an injection of dye into a vein (called **contrast**) to make the images clearer. There is **no actual evidence** that this dye harms your unborn baby.

However, due to a theoretical risk of causing hypothyroidism, as a precaution, your baby's **thyroid function** (a gland in the neck that controls growth and development) should be checked in the first week after birth. This is just to make sure everything is normal. This is already offered as part of routine neonatal screening in the UK and so will not involve an extra test for your baby. If there is a problem -which is very rare -it can be treated easily and early.

What to Expect During Your CT Scan

Once the safety checks have been completed, you may be asked to change into a hospital gown and store your belongings securely in a locker during the scan.

You will lie on a padded table that gently moves into the CT scanner, a large, round, donut-shaped machine.

The scan usually takes a few minutes, depending on the area being checked.

It's important to stay as still as possible to ensure clear images,

The machine will make some buzzing or whirring noises while it works.

Sometimes, you may be asked to hold your breath for a few seconds.

If lying flat is uncomfortable, you can lie on your side with plenty of cushions for support. Please let us know your preference -we want to make you as comfortable as possible.

You might have a small injection of dye into your vein. Your medical team will tell you if this is needed.

You can talk to the medical team through a microphone if you feel uncomfortable or have any questions during the scan.

The medical team will watch over you the whole time to keep you safe and comfortable.

Who can I talk to if I have questions or concerns?

If you have questions or concerns about your CT scan, please speak to any member of the team caring for you, or the **radiology team**. They are here to support you in making informed decisions about your care.

Appendix 4

Patient Consent Form for CT Imaging in Pregnancy

Patient Information:

Name: _____
Date of Birth: _____
Hospital number : _____NHS number :
_____

Statement of Health Professional

To be completed by a health professional with appropriate knowledge of the proposed procedure

I have explained the procedure to the patient. I have explained:

The intended benefits:

- The CT scan aims to provide valuable diagnostic information that could be crucial for managing your health during pregnancy.

The significant, unavoidable or frequently occurring risks:

This investigation may slightly increase the chances of your unborn baby developing cancer later in their life. However, the actual risk is almost the same as that of unborn babies who have not had a CT scan. The scan will not add to risks of miscarriage or problems with your unborn baby's growth or development.

During pregnancy, your breast tissue is more sensitive to X-ray radiation, which could very slightly increase the risk of breast cancer if the CT scan involves imaging the chest area. We don't know the exact size of this risk (it is a *theoretical* risk), but it is thought to be very small.

- Some CT scans use an injection of contrast dye into your vein to make the images clearer. There is no actual evidence that this dye harms your unborn baby. However, due to a *theoretical* risk of causing hypothyroidism, as a precaution, your baby's thyroid function should be checked in the first week after birth. This is already offered as part of routine neonatal screening in the UK and so will not involve an extra test for your baby. If there is a problem -which is very rare - it can be treated easily and early.

I have discussed what the procedure is likely to involve, the benefits and risks of any available alternative treatments (including no treatment) and any concerns of this patient.

The following patient information leaflet has been provided.....

Signed.....

Name (PRINT).....

Job Title..... Date.....

Statement of interpreter (where appropriate)

I have interpreted the information above to the patient to the best of my ability and in a way in which I believe they can understand.
Signed.....

Name (PRINT).....

Job Title..... Date.....

Statement of patient

Please read this form carefully. If your investigation has been planned, you should already have your own copy describing the benefits and risks. If not, you will be offered a copy now. If you have any further questions, please ask -we are here to help. You have the right to change your mind at any time, including after you have signed this form.

I acknowledge that I have been informed of the potential risks and benefits of undergoing a CT scan during pregnancy. I understand that while the healthcare provider will make every effort to minimise X-ray radiation exposure, there may still be associated risks.

I have had the opportunity to ask questions about the procedure, its risks, and alternatives, and all my questions have been answered to my satisfaction. I understand that I can withdraw my consent at any time without affecting the quality of care I receive.

I agree to the procedure as described on this form.
Signed.....

Name (PRINT).....

Date.....

Statement of patient's witness or representative

A witness should sign below if the patient is unable to sign but has indicated their consent. Alternatively, for patients who lack capacity, the next of kin or legally authorised representative should sign below, in accordance with local policy.

Signed.....

Name (PRINT).....

Relationship to patient.....Date.....

Appendix 5

Suggested MRI protocol for Investigating AAPP

General protocol

This is a comprehensive MRI protocol designed to investigate most causes of AAPP

Sequence	**Plane**	**Area covered**
T2 Single-Shot Fast Spin Echo is suggested*	axial/coronal/sagittal	abdo/pelvis
T2 Single-Shot Fast Spin Echo is suggested*	sagittal	pelvis (to cover whole uterus, cervix and vagina if possible)
T2 with fat suppression Single-shot Fast Spine Echo is suggested*	axial	abdo/pelvis
Balanced Steady-State Free Precession (bSSFP)*	axial/coronal	abdo/pelvis
T1 & T1 with fat suppression or T1 DIXON In phase and water only reconstructions	axial	abdo/pelvis
DWI + ADC map Two B values -0 or 50 and 800 or 1000	axial or coronal	abdo/pelvis

*Vendor Specific Sequence Names

Sequences Generic name	Siemens	GE	Philips	Canon/Toshiba	Hitachi
SSFSE	HASTE	SSFSE	SSh-TSE	SSFSE/FASE	SS-FSE
bSSFP	TRUFI/TrueFISP	FIESTA,COSMIC	Balanced FFE	True SSFP	BASG or SARGE

Supervision and Sequence Selection

It is recommended that the MRI scan be supervised by a radiologist. With radiologist oversight, the study may be terminated early if the relevant pathology is identified and/or the clinical question has been satisfactorily answered.

When appropriate, consider beginning with the sequences most likely to reveal the suspected pathology. For example:

- Gynaecological pathology may be best demonstrated on sagittal and axial T2-weighted sequences.
- Bowel pathology may be best demonstrated using coronal T2 and axial T2 with fat suppression sequences.

Additional Sequences (as indicated)

Depending on clinical suspicion, the following additional sequences may be helpful:

- Suspected urinary tract pathology: Add MR urography.
- Suspected biliary or liver pathology: Add MRCP.

Appendix 6

CT - Practical Considerations in AAPP

General Principles

No single CT protocol is recommended because of variations in scanners and patient factors. The principles outlined above-considering alternative imaging, ensuring patient counselling and consent, appropriate use of contrast, and avoiding shielding-should be followed. While input from medical physics is valuable when available, it should not delay urgent imaging.

Scanner Familiarity

- Use the newest scanner with the lowest Local Diagnostic Reference Levels (LDRLs).
- Understand your Automatic Exposure Control (AEC) system; adjust as appropriate.
- Position the patient at the isocentre for optimal AEC performance.

Protocol Optimisation

- Enable organ dose modulation.
- Reduce tube current/voltage if appropriate.
- Use iterative reconstruction (IR) to reduce dose or improve image quality.
- Avoid multiphase or repeat scans; trauma protocols can achieve arterial and venous imaging in a single acquisition.
- Refer to your local image optimisation team and medical physics department.