Category: Clinical Guidance Statement

Placenta Accreta Spectrum (PAS) (C-Obs 20)

This statement has been developed by the Placenta Accreta Spectrum (PAS) (C-Obs 20) Statement Development Panel and approved by the Women's Health Committee and associated working groups, RANZCOG Council and Board.

A list of the Women's Health Committee membership can be found in Appendix A: Women's Health Committee Membership. A list of the Statement Development Panel Membership can be found in

Appendix B: Statement Development Panel Membership.

Conflict of Interest disclosures have been received from all members of this committee (Appendix C: Overview of the development and review process for this statement).

Disclaimer: This information is intended to provide general advice to practitioners. This information should not be relied on as a substitute for proper assessment with respect to the particular circumstances of each case and the needs of any patient. This document reflects emerging clinical and scientific advances as of the date issued and is subject to change. The document has been prepared having regard to general circumstances (Appendix D: Full Disclaimer).

Purpose:	To provide a clinical care, evidence-based statement to guide registered health professionals in Australia and Aotearoa New Zealand in the diagnosis and management (antenatal-postnatal) of pregnant women with suspected PAS to reduce maternal and fetal mortality and morbidity.
Target audience:	This statement was developed primarily for use by registered health professionals who provide maternity care to women[1] who may be diagnosed with placenta accreta spectrum.
Background:	This statement was first developed by the RANZCOG Women's Health Committee in November 2003. The statement was most recently updated by the Placenta Accreta Spectrum (PAS) (C-Obs 20) Statement Development Panel, a working group of the Women's Health Committee in March 2023.
Funding:	The development and review of this statement was funded by RANZCOG.

[1] *RANZCOG currently uses the term 'woman' in its documents to include all individuals needing obstetric and gynaecological healthcare, regardless of their gender identity. The College is firmly committed to inclusion of all individuals needing O&G care, as well as all its members providing care, regardless of their gender identity.*

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1. Plain language summary

Placenta accreta spectrum (PAS) is a serious but rare pathology in pregnancy. It occurs when the placenta infiltrates deeply into the muscle layer of the uterus (womb). There are three categories: placenta accreta (PA) is the most common and is when the placenta invades only to the surface of the muscle layer of the uterus. In some cases, the placenta may invade into (placenta increta) or beyond the muscle layer onto the surface of the uterus and/or into surrounding organs (placenta percreta). As a result, there may be difficulties after the baby is born with birth of the placenta, as the placenta may be firmly stuck and not be able to be delivered. This in turn this means the uterus cannot contract and then serious blood loss may occur, and hysterectomy may be required. This statement provides guidance for registered health professionals when dealing with this rare but very important complication of pregnancy.

2. Purpose and scope

The purpose of this statement is to provide an evidence-based statement to guide registered health professionals in Australia and Aotearoa New Zealand in the diagnosis and management (antenatal-postnatal) of pregnant women with suspected PAS to reduce maternal and fetal mortality and morbidity.

Out of scope: Placenta previa, or low-lying placenta; prevention of PAS, including information pertaining to intraoperative surgical techniques for caesarean section; and debriefing and professional practice policies following adverse maternal, perinatal outcomes[ii].

3. Terminology

- Placenta accreta: densely adherent placenta due to abnormally deep invasion of the placenta onto the uterine muscle (possibility placenta will separate at birth).[2]
- Placenta increta: adherent placenta embedded into the uterine muscle wall (placenta unlikely to separate at birth).[2]
- Placenta percreta: adherent placenta growing through the uterus and with possible involvement of other organs (placenta unlikely to separate at birth).[2]

[ii] The Australian Commission for Safety and Quality in Health Care Incident Management Guide provides further detail on management of the aftermath following a clinical incident or adverse event. See- https://www.safetyandquality.gov.au/sites/default/files/2021-12/incident_management_guide_november_2021.docx

4. Executive summary

The Clinical Guidance Statement covers the diagnosis and management of women who are pregnant and have clinical findings where PAS is likely or suspected. The statement also provides evidence-based recommendations on treatment and care, surgical management, and radiological interventions.

List of recommendations

Presented in the order of a clinical care pathway.

Diagnosis

Good Practice Point 1

Ultrasound should be the first line imaging modality for diagnosis of PAS and has comparable diagnostic accuracy, wide availability and relative affordability compared to MRI.

All women with suspected PAS should have the diagnosis confirmed by a specialist with skills in the diagnosis of PAS. Standardised definitions should be used in reporting and consideration given to using a template.

MRI should not be the preferred initial imaging modality for suspected PAS.

MRI may be a useful adjunct when ultrasound diagnosis is uncertain or for other reasons as determined by clinical judgement. MRI may be useful with posterior placentation which may be difficult to evaluate on ultrasound.

Treatment and care

Recommendation 1 **Evidence-based recommendation**

Conditional: All women with a probable or confirmed PAS diagnosis (based on the ultrasound) should have a review and management plan, including recommended place of birth, by a multidisciplinary team (MDT). The MDT should have expertise in diagnosis and management, including complex pelvic surgery.

GRADE of evidence- Very low

Good Practice Point 2

GPP: *MDT members should include:*

- Consultant obstetrician planning and directly supervising birth.
- Consultant anaesthetist planning and directly supervising anaesthesia at birth.
- Specialists with skills in the diagnosis of PAS.
- Specialists with skills in complex surgery such as, but not limited to gynae-oncologists, urologists, urogynaecologists, colorectal surgeons, vascular surgeons, interventional radiologists.

Components of the protocol should include:

- On site transfusion service/critical bleeding protocol available, including haematological expertise available.
- Discussion and consent, including possible interventions (such as hysterectomy, leaving the placenta in situ, cell salvage and interventional radiology).
- Local availability of adult and neonatal intensive care (or special care 32+ weeks nursery).
- Provision of patient information for women and their families, and to support clinicians to appropriately inform and counsel women.

Good Practice Point 3
GPP: Timing of referral for consideration by the MDT should occur shortly after first diagnosis or where there is a high degree of suspicion of PAS on the basis of the ultrasound.

Good Practice Point 4
GPP: Timing of birth for women with suspected or confirmed PAS should be based on clinical grounds and the need to optimise fetal maturity.

Surgical interventions

Recommendation 2	Evidence-based recommendation
Conditional: Uterus conserving procedures (e.g., placenta left in situ or partial myometrial resection) may be considered as an alternative to planned caesarean hysterectomy for appropriately counselled women who are willing to follow advice regarding the need for close surveillance. Services caring for women having uterus conserving procedures must have the capacity to manage potential complications including the need for emergency hysterectomy and emergency massive transfusion. GRADE of evidence- Very low	

Good Practice Point 5
GPP: There is insufficient evidence on which to make an evidence-based recommendation as to the use of uterine tamponade techniques. It is recommended that where placental separation has occurred spontaneously, Bakri balloons or B-Lynch sutures may be appropriate as surgical adjuncts to achieve haemostasis, however, manual removal of the placenta in women with PAS is associated with severe haemorrhage and should not be employed solely to allow for the use of uterine tamponade techniques.

Radiological interventions

Recommendation 3	Evidence-based recommendation
Conditional: The routine use of interventional radiology techniques (embolisation or placement of arterial segment balloon designed to arrest arterial blood flow to the uterus) is not recommended for women with PAS at the time of birth. GRADE of evidence- Very low	

5. Introduction

Rationale

Placenta accreta spectrum (PAS) is a rare pathology in pregnancy and characterized by abnormally invasive placentation. There are three categories: placenta accreta (PA) is the most common category and the placental villi penetrate only to the surface of the myometrium; placenta increta (PI) is where the

placental villi invade the myometrium; and placenta percreta (PP) is where the villi invade beyond the myometrium to the uterine serosa and in some cases involve adjacent organs such as the bladder.[3]

Morbid adherence of the placenta to the uterine wall is a potentially life-threatening obstetric complication that frequently requires interventions such as caesarean hysterectomy and high-volume blood transfusion.

Four independent risk factors for placenta accreta have been reported for Australia and Aotearoa New Zealand women. They are previous caesarean section, placenta praevia diagnosed prior to birth, older maternal age, and multiparity.[4, 5]

Background epidemiology

There is evidence to suggest the rates of PAS are increasing globally.[6] A national study from Australia and Aotearoa New Zealand reported the incidence of placenta accreta as approximately 44.2 per 100,000 women (1 in 2000 births) giving birth, with the rate higher in New Zealand hospitals (60.2 per 100,000 women) than Australian (38.8 per 100,000 women).[4] Differences in population demographics and methods of defining and diagnosing placenta accreta may explain the variety in reported data. As previously noted, prior caesarean section has been associated with an increased risk of PAS.[5] It is well reported the rate of caesarean section has increased in recent years and studies have shown the PAS risk increases after each subsequent caesarean birth.[5, 7]

6. Methods

7. In 2022, RANZCOG established a Statement Development Panel (SDP) to update an existing statement on Placenta Accreta. In alignment with current clinical practice and research, the SDP determined the statement title should be renamed to Placenta Accreta Spectrum (PAS). This term is inclusive of all invasive forms of placental adherence- placenta accreta, placenta increta and placenta percreta.

The statement was developed according to approved RANZCOG processes, available in the Manual for Developing and Updating Clinical Guidance Statements. Following these processes, the Research and Policy Team identified local and international guidelines published within the past five years. These included:

- The Royal College of Obstetricians and Gynaecologists (RCOG) Green Top Guideline No. 27a 2018.[1]
- American College of Obstetricians and Gynaecologists (ACOG) Obstetric Care Consensus No. 7 2018.[8]
- FIGO Consensus guidelines on placenta accreta spectrum disorders 2018.[2]
- Society of Obstetricians and Gynaecologists of Canada (SOGC) No. 383 – Screening, diagnosis, and management of placenta accreta spectrum disorders.[9]
- Government of Western Australia North Metropolitan Health Service: Clinical practice guideline: Placenta Accreta Spectrum (2018).[10]
- SA Health Safety and Quality Strategic Governance Committee: Morbidly adherent placenta management (2018).[11]

An additional search for literature published after development of the above guidelines was conducted. A search was applied to MEDLINE and CENTRAL for systematic reviews and primary studies, including randomised control trials (RCT) and case series. Systematic reviews included in the evidence summaries were assessed for quality using the AMSTAR 2 critical appraisal tool.[12]

Assessment of the rigour, certainty and quality of the evidence was performed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach.

Phrasing for recommendations differs according to the strength of evidence- further explanation of recommendation types and classifications can be found in the Manual for Developing and Updating Clinical Guidance Statements for RANZCOG.

Search strategy

- "placenta accreta", "placenta increta", "placenta percreta", "abnormal placentation" and "PAS"
- 2018- February 2023
- Limited to humans
- Published in English language only.

Furthermore, the following additional terms were applied to the literature search for:

- **Clinical Question 1**: 'magnetic resonance imaging' [Mesh] and/or MRI
- **Clinical Question 2**: "protocol" OR "MDT" OR "multidisciplinary team"
- **Clinical Questions 3 and 4**: "treatment" OR "surgery" OR "hysterectomy" OR "conservative management" OR "uterus preserving"
- **Clinical Question 4**: "uterine balloon tamponade" OR ["bakri" OR "balloon occlusion"] AND [uterus OR uterine OR "intrauterine"] OR "B Lynch suture" OR "compression suture" OR "uterine suture"
- **Clinical Question 5**: "balloon occlusion" OR "balloon" OR "catheter" OR "occlusion" OR "7mbolization" OR "embolization"

8. Clinical Questions and Recommendations

Detailed Evidence to Decision summaries for each clinical question, including the study results, absolute effect estimates, grading and certainity of the evidence for the reported outcomes, can be found in Appendix E- Evidence profiles.

Clinical Question 1- Diagnosis

What are the indications for an MRI in a woman with suspected PAS?

P[iii]**-** Pregnant women with suspected PAS, following ultrasound or on clinical grounds

I- Indications for an MRI

C- No MRI

O- Hysterectomy/loss of uterus, maternal and perinatal mortality and morbidity; blood loss

Summary of evidence

Evidence of the diagnostic accuracy of ultrasound is provided to establish the relative value of ultrasound in diagnosis of PAS, as a base for discussing indications for MRI.

D'Antonio et al (2013) conducted as review of 23 studies (n = 3707) of ultrasound diagnostic accuracy, including specific ultrasound features indicative of PAS.[13] Many features of PAS on ultrasound are not highly sensitive but have high specificity: placental lacunae sensitivity 77% (71%-83%), specificity 95% (94%-96%); loss of retroplacental clear space sensitivity 66% (58%-74%), specificity 96% (95%-97%); bladder border abnormalities sensitivity 50% (41%-58%), specificity 100% (99%-100%); colour doppler abnormalities sensitivity 91% (85%-95%), specificity 88% (85%-90%).

[iii] Please note, PICO is a framework for developing a focused clinical question. The letters stand for **P**opulation, **I**ntervention, **C**omparator, **O**utcome. See RANZCOG Manual on Developing and Updating Clinical Guidance Statements – pp. 10 for further detail.

No direct evidence of indications for MRI were identified.

Indirect evidence including MRI diagnostic accuracy and the correlation of MRI findings with clinical outcomes has been provided to inform this recommendation. No RCT evidence of diagnostic accuracy for ultrasound or MRI was identified.

The most recent high quality systematic review and meta-analysis of observational studies of MRI and ultrasound diagnostic accuracy (De Oliveira Carniella et al 2022) finds that the sensitivity and sensitivity of MRI are high (83.8% (95% CI, 0.79–0.88) and 83.1% (95% CI, 0.77–0.88) respectively.[14] The results of this meta-analysis have found that there are no significant differences in the diagnostic value of ultrasound imaging and MRI in detecting PAS.

Familiari et al (2018) conducted a systematic review including 20 studies (1080 pregnancies) with suspected PAS.[15] This review reports high sensitivity and specificity of MRI in determining the depth of invasion of placentation when correlated to histological diagnosis.

The third review (D'Antonio et al 2014) included 18 studies (1010 pregnancies).[16] This study reports similar sensitivity and specificity values for diagnosis of PAS to De Oliveira Carniella et al (2022). This provides sensitivity and specificity values for features on MRI that may aid in surgical planning such as depth of invasion and location of spread to adjacent structures (topography). Of note, MRI had a high predictive accuracy in assessing topography of placental invasion.

The correlation of MRI findings with maternal and perinatal clinical outcomes was reported by Bourgioti et al (2018).[17] 100 women with suspected PAS on ultrasound underwent MRI. 15 MRI features considered indicative of PAS were recorded by three radiologists and were tested for any association with adverse peripartum maternal and neonatal events. Presence of six or more of the MRI features was associated with increased risk of severe bleeding, hysterectomy, and bladder repair. Presence of three or more signs was associated with a complicated birth. MRI signs were not found to be associated with adverse perinatal outcomes.

Good Practice Point 1

GPP: Ultrasound should be the first line imaging modality for diagnosis of PAS and has comparable diagnostic accuracy, wide availability and relative affordability compared to MRI.

All women with suspected PAS should have the diagnosis confirmed by a specialist with skills in the diagnosis of PAS. Standardised definitions should be used in reporting and consideration given to using a template.

MRI should not be the preferred initial imaging modality for suspected PAS.

MRI may be a useful adjunct when ultrasound diagnosis is uncertain or for other reasons as determined by clinical judgement. MRI may be useful with posterior placentation which may be difficult to evaluate on ultrasound.

Clinical Question 2- Treatment and care

What are the important features of a treatment protocol for PAS?

P- Pregnant women with suspected or confirmed PAS
I- Planning for delivery, including PA protocol (i.e., optimise HB, appropriate setting including surgical team (urologists, interventional radiology etc), MTP/MBT protocol in place, patient consented for hysterectomy and transfusion if required)

C- Lack of protocol present
O- Hysterectomy/loss of uterus; maternal and perinatal morbidity and mortality; blood loss

Summary of evidence

Indirect evidence was identified regarding the outcomes for women with PAS managed under Multidisciplinary Teams (MDT) compared to standard care. Within this evidence summary only studies which included protocol driven care were included.

Bartels et al (2018) conducted a systematic review of MDT management of PAS.[18] Studies of patients undergoing caesarean birth for histopathologically confirmed morbidly adherent placenta within tertiary centres with multidisciplinary input, or where multidisciplinary care protocols were in place, as compared with standard patient care, were included. Six retrospective observational studies, including 461 patients, were included in the review. A number of components were common to MDT protocols such as involvement of maternal fetal medicine, gynaecological oncology, anaesthesiology, and urology specialists, use of interventional radiology procedures, placental ultrasound mapping, midline abdominal incision, and regional anaesthesia converted to general as required.

An additional retrospective cohort study (Shamshirsaz et al 2017) published following the Bartels et al systematic review was identified.[19] This study includes 118 singleton pregnancies with histology confirmed PAS which were divided into two groups based on when they delivered, to compare outcomes as surgeons gained more experience in multidisciplinary and protocol driven management. This team managed an average of between two and three cases per month over the study period. Blood loss and transfusion requirements were reduced with the introduction of an MDT management protocol for PAS.

Recommendation 1	Evidence-based recommendation

Conditional: All women with a probable or confirmed PAS diagnosis (based on the ultrasound) should have a review and management plan, including recommended place of birth, by a multidisciplinary team (MDT). The MDT should have expertise in diagnosis and management, including complex pelvic surgery.
GRADE of evidence- Very low

Good Practice Point 2

GPP: *MDT members should include:*

- Consultant obstetrician planning and directly supervising birth.
- Consultant anaesthetist planning and directly supervising anaesthesia at birth.
- Specialists with skills in the diagnosis of PAS.
- Specialists with skills in complex surgery such as, but not limited to gynae-oncologists, urologists, urogynaecologists, colorectal surgeons, vascular surgeons, interventional radiologists.

Components of the protocol should include:

- On site transfusion service/critical bleeding protocol available, including haematological expertise available.
- Discussion and consent, including possible interventions (such as hysterectomy, leaving the placenta in situ, cell salvage and interventional radiology).
- Local availability of adult and neonatal intensive care (or special care 32+ weeks nursery).
- Provision of patient information for women and their families, and to support clinicians to appropriately inform and counsel women.

Good Practice Point 3

GPP: Timing of referral for consideration by the MDT should occur shortly after first diagnosis or where there is a high degree of suspicion of PAS on the basis of the ultrasound.

Good Practice Point 4

GPP: Timing of birth for women with suspected or confirmed PAS should be based on clinical grounds and the need to optimise fetal maturity.

Clinical Question 3- Surgical planning

For women with suspected PAS, does conservation of the uterus or removal of the uterus result in improved health outcomes for mother and baby?

P- Pregnant women with suspected or confirmed PAS
I- Planned delivery of the baby with conservation of the uterus (including leaving the placenta in situ, partial myometrial resection, or placental removal (extirpative approach))
C- Delivery of the baby through an incision away from the placenta, followed by a hysterectomy if the placenta does not spontaneously separate (i.e., planned primary hysterectomy)
O- Hysterectomy/loss of uterus; maternal and perinatal morbidity and mortality; blood loss; future fertility potential

Summary of evidence

There are no RCTs comparing different surgical approaches for suspected PAS. Two comparative studies are presented below.

The largest and most recent comparative observational study was conducted by the PACCRETA Study group (Senthiles et al 2022).[20] This prospective multicentre cohort study of 148 women with PAS (clinically or histologically diagnosed) consented to take part in the study (source population of 520,114 delivered at 176 hospitals). Of the 148 women, 86 had conservative management (leaving all or part of the placenta in situ) and 62 women had planned caesarean hysterectomy. All women were followed up to six months post-birth. Women receiving conservative management were younger, had lower parity, and they were more likely to have arterial embolization compared to women having caesarean hysterectomy (24.4% vs 3%). Conservative management was found to have lower associated risk of needing transfusion > four units of red blood cells (RBCs), hysterectomy, blood loss exceeding 3000mL, adjacent organ injury (12.9% vs 4.7%, aOR 0.29 (95% CI 0.11 - 0.79) p-value 0.02) and non-PPH related severe maternal morbidity (5.8% vs 16%, aOR 0.41 (95% CI 0.19 - 0.86), p-value 0.02) than planned primary caesarean hysterectomy. No maternal deaths occurred in the study period. Perinatal outcomes were not reported. Women with conservative management had a higher associated risk of endometritis, readmission within six months, and an increased chance of hysterectomy (22%) within six months.

Schwikert et al (2021) study (IS-PAS) of women with PAS included 338 women from 14 European countries and the USA between 2008-2019.[21] This study reported on the blood loss of different surgical techniques compared to planned caesarean hysterectomy in women with PAS. Unplanned hysterectomy was associated with increased risk of blood loss >3500mL compared to planned hysterectomy. Little to no difference was found in blood loss between partial myometrial resection and planned hysterectomy. Whilst blood loss >3500mL was less common in women who had successful conservative management (placenta left in situ), in women who required delayed hysterectomy risk of blood loss >3500mL was more likely than planned hysterectomy. Manual removal of placenta was associated with a reduction in blood loss and massive blood

loss (>3500mL), however manual removal of placenta was attempted significantly less frequently in this group and only performed in lower PAS grades of invasion.

Recommendation 2	Evidence-based recommendation
Conditional: Uterus conserving procedures (e.g., placenta left in situ or partial myometrial resection) may be considered as an alternative to planned caesarean hysterectomy for appropriately counselled women who are willing to follow advice regarding the need for close surveillance. Services caring for women having uterus conserving procedures must have the capacity to manage potential complications including the need for emergency hysterectomy and emergency massive transfusion. GRADE of evidence- Very low	

Clinical Question 4: Intraoperative techniques to reduce blood loss

Do the use of uterine tamponade measures (e.g. balloon, B-Lynch suture) improve outcomes for women with PAS?

P- Pregnant women with diagnosed PAS
I- Balloon (Bakri or other)
C- No balloon
O- Hysterectomy/loss of uterus; maternal and perinatal morbidity and mortality; blood loss; future fertility potential

Summary of evidence

No direct evidence comparing uterine tamponade to no uterine tamponade could be identified for this clinical question. Indirect evidence of the comparison of uterine tamponade techniques to caesarean hysterectomy or other haemostatic techniques is summarised below:

Pala et al (2018) conducted a retrospective cohort study including 36 patients with PAS who were treated either with Bakri balloon tamponade or caesarean hysterectomy.[22] This is not the comparison group included in the PICO for this clinical question but provides indirect evidence from which to inform this recommendation. The Bakri balloon was only used for women where placental adherence was less than 50% of the axial segment of the uterus resulting in a lower severity of PAS in the Bakri group compared to the caesarean hysterectomy group. For women in the Bakri group an extirpative approach (forced placental removal) was used, a practice which is no longer recommended in the management of PAS by international review bodies due to an increased risk of severe haemorrhage. Bakri balloon tamponade was considered to be ineffective when bleeding of >100mL was observed from the drainage catheter over a 10-minute period, at which stage a caesarean hysterectomy was performed. Caesarean hysterectomy was required in three of the 19 women treated with Bakri balloon (16%). A lower estimated blood loss was reported in the Bakri balloon group compared to the caesarean hysterectomy group (1794mL vs 2694mL; p-value 0.002), as well as a reduced need for RBC transfusion (2.73 units vs 5.70 units; p-value 0.001), and a shorter operating time (64.47 minutes vs 140.58 minutes; p-value 0.001).

Wolf et al 2020 conducted a retrospective cohort study including 148 patients with PAS (based on ultrasound findings) who had a caesarean section at 35-38 weeks and were treated with either a B-Lynch suture (group A) or internal iliac balloon occlusion (group B).[23] These techniques could only be applied for women where manual separation of the placenta occurred at the time of caesarean section (an extirpative approach, which is no longer recommended due to risk of severe haemorrhage). For those that did not have manual separation of the placenta a caesarean hysterectomy was performed. The degree of PAS was more severe in group A (43.4% percreta vs 16.9% percreta; p-value 0.003). Women in group A experienced a higher rate of caesarean

hysterectomy (36.1%) compared to group B (29.2%) (p-value <0.001), but little to no difference in estimated blood loss (886mL vs 1190mL; p-value 0.347) or operative time (61 mins vs 59 mins; p-value 0.706). A higher number of packed RBCs were transfused intraoperatively in the B-Lynch suture group compared to the arterial balloon group (4 vs 2 units; p-value 0.006) and in the postoperative period (2 vs 0; p-value 0.04).

Good Practice Point 5

GPP: There is insufficient evidence on which to make an evidence-based recommendation as to the use of uterine tamponade techniques.

It is recommended that where placental separation has occurred spontaneously, Bakri balloons or B-Lynch sutures may be appropriate as surgical adjuncts to achieve haemostasis, however, manual removal of the placenta in women with PAS is associated with severe haemorrhage and should not be employed solely to allow for the use of uterine tamponade techniques.

Clinical Question 5: Role of interventional radiology techniques

For women with PAS, does embolisation and the use of intraarterial balloons improve maternal outcomes, such as hysterectomy rate, blood loss and future fertility potential?

P- Pregnant women with PAS
I- Embolisation and intra-arterial balloons
C- No embolisation
O- Hysterectomy/loss of uterus; maternal and perinatal morbidity and mortality; blood loss; future fertility potential

Summary of evidence

A systematic review of endovascular interventional modalities (including balloon occlusion of the abdominal aorta, internal iliac arteries, uterine artery or common iliac arteries, or uterine artery embolisation) was conducted by Shahin et al (2018) including 69 studies (1,811 patients), including one RCT by Salim et al (2015).[24, 25] The search strategy for this systematic review included deliveries complicated by placental implantation abnormalities including PAS and placenta previa. Grade (AMSTAR 2) was moderate.

The RCT by Salim et al 2015 was conducted in Israel of 27 women with suspected PAS based on USS characteristics.[25] Participants were randomised to balloon occlusion of the anterior division of the internal iliac artery prior to caesarean compared to no balloon. Little to no difference was found in number of packed RBC units transfused, need for any blood product transfusion, blood loss >2500mL, need for caesarean hysterectomy, or operating time. All outcomes had very wide confidence intervals, indicating high uncertainty as to the effect of the intervention. Little to no difference in Apgar score <7 at 5 mins. No instances of neonatal death in either group. One case of relaparotomy in the control group and two cases of readmission in the intervention group only precluding a RR estimation for either of these outcomes.

When the Salim RCT was combined with non-randomised studies in Shahin et al (2018) systematic review, endovascular interventions were found to be associated with reduced blood loss (MD - 893.24mL, 95% CI -1,389mL to -397mL, p-value <0.001, 14 studies) and a lower number of RBC units transfused (MD -1.54 units, 95% CI -2.27 to -0.81, p-value <0.001, 11 studies) when compared to no endovascular interventions. Little to no difference was found in unplanned caesarean hysterectomy rates between patients who underwent endovascular interventions and those who did not (OR 0.63, 95% CI 0.25 - 1.57, p-value 0.320, 8 studies). Little to no difference was found in length of hospital stay between the two groups (MD -0.55 days, 95% CI -2.15 to 1.06 days, p-value 0.500, 10 studies).

Considering the subgroup of studies comparing internal iliac artery balloon occlusion to no balloon occlusion, internal iliac artery balloon occlusion was found to be associated with reduced blood loss (MD - 232.11mL, 95% CI -392mL to -72.2mL, p-value 0.004, 7 studies) although the clinical significance of this degree of blood loss reduction is uncertain. A lower number of RBC units transfused was found for women in the internal iliac artery balloon occlusion group (MD -1.45 units, 95% CI -2.40 to -0.49, p-value 0.003, six studies) compared to no balloon occlusion.

Chen et al (2019) conducted a systematic review of abdominal aortic balloon occlusion including 11 studies (731 patients), including only non-randomised studies.[26] Similar to the Shahim et al review, the search strategy for this systematic review included deliveries complicated by placental implantation abnormalities including PAS and placenta previa. Abdominal aortic balloon occlusion was found to be associated with reduced blood loss (MD -1,480mL, 95% CI -1,860mL to -1154mL, p-value <0.001, seven studies) and a lower volume of RBCs transfused (MD -1,125mL, 95% CI -1,264 to -987, p-value <0.001, six studies) when compared to no balloon occlusion. Abdominal aortic balloon occlusion was found to be associated with reduced hysterectomy rate (OR 0.30, 95% CI 0.19 - 0.48, p-value <0.001, 11 studies) and a shorter operative time (MD -29.23 minutes, 95% CI -46.04 to -12.42 mins, p-value <0.001, 7 studies) when compared to no balloon occlusion. Four studies reported little to no difference in Apgar scores between neonates born to women receiving abdominal aortic balloon occlusion and no balloon occlusion. Women in the abdominal aortic balloon occlusion studies experienced a balloon related morbidity rate of 1.7%, including instances of haematoma at the puncture site, and venous thrombus.

Chen et al (2020) conducted an RCT in China of 100 women with placenta previa and suspected PAS (based on USS characteristics), published since both of the above reviews.[27] Participants were randomised to balloon occlusion of the anterior division of the internal iliac artery prior to caesarean section compared to no balloon. Little to no difference was found in number of packed RBC units transfused, blood loss >2500mL, need for caesarean hysterectomy, or operating time. All outcomes had very wide confidence intervals, indicating high uncertainty as to the effect of the intervention. No cases of relaparotomy or readmission were reported precluding a RR estimation for either of these outcomes.

Recommendation 3	Evidence-based recommendation
Conditional: The routine use of interventional radiology techniques (embolisation or placement of arterial segment balloon designed to arrest arterial blood flow to the uterus) is not recommended for women with PAS at the time of birth. GRADE of evidence- Very low	

9. Legal and ethical implications

The recommendations and Good Practice Points are broadly applicable to all women, however for Aboriginal and/or Torres Strait Islander women, and Māori women (*whānau*), there may be further specific cultural needs and requests clinicians could consider following a suspected or confirmed diagnosis of PAS, if asked to do so.

10. Recommendations for future research

This Clinical Guidance Statement identified a gap in available, current, and accessible research on the following topics:

- Clinical utility of a reporting template for the PAS diagnosis
- RCT evidence in the management of PAS
- Optimal surgical management of PAS
- Optimal gestation for planned birth/timing of birth

- Identification of PAS associated with posterior placenta presentation.
- Scar ectopic pregnancies and PAS
- Use of alternative surgical techniques, including local and systemic clot activators
- Assessment of mode of birth based on ultrasound findings- cost effectiveness for PAS
- Prevention of PAS

Qualitative

- Best ways to support women and families with a diagnosis of PAS
- Psychological support for women after hysterectomy related to PAS

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12. Links to relevant RANZCOG College Statements

- Evidence-based Medicine, Obstetrics and Gynaecology (C-Gen 15)
- Birth after previous caesarean section (C-Obs 38)
- Caesarean Birth at Maternal Request (CBMR) (C-Obs 39) (previously Caesarean Delivery at Maternal Request)- Under Review

13. Links to relevant Consumer resources

- Fact Sheet: Placenta Accreta, Women's & Newborn Health- Westmead Hospital, NSW Health (May 2019).
- When things don't go to plan and Recovering from a traumatic birth, Centre for Perinatal Excellence (COPE)- online.
- Through the Unexpected- for parents navigating prenatal diagnosis, such as PAS- online.

14. Links to relevant ATMs and learning modules

No learning modules were identified as relevant to PAS.

Other external learning modules:

- Core obstetric ultrasound- Zedu Learning HQ (RANZCOG CPD Approved Activity)- https://ranzcog.edu.au/event/core-obstetric-ultrasound-2-days-zedu-ultrasound/2023-03-09/

Appendices

Appendix A: Women's Health Committee Membership

Name	Position on Committee
Dr Scott White	Chair and Councillor
Dr Gillian Gibson	Deputy Chair, Gynaecology
Dr Anna Clare	Deputy Chair, Obstetrics
Associate Professor Amanda Henry	Member and Councillor
Dr Samantha Scherman	Member and Councillor
Dr Marilla Druitt	Member and Councillor
Dr Frank O'Keeffe	Member and Councillor
Dr Kasia Siwicki	Member and Councillor
Dr Jessica Caudwell-Hall	Member and Councillor
Dr Sue Belgrave	Member and Councillor
Dr Marilyn Clarke	Aboriginal and Torres Strait Islander Representative
Professor Kirsten Black	SRHSIG Chair
Dr Nisha Khot	Member and SIMG Representative
Dr Judith Gardiner	Diplomate Representative
Dr Angela Brown	Midwifery Representative, Australia
Ms Adrienne Priday	Midwifery Representative, Aotearoa New Zealand
Ms Leigh Toomey	Community Representative
Dr Rania Abdou	Trainee Representative
Dr Philip Suisted	Māori Representative
Prof Caroline De Costa	Co-opted member (ANZJOG member)
Dr Steve Resnick	Co-opted member

Appendix B: Statement Development Panel Membership

Name	Position on Committee
Dr Scott Petersen	Chair (CMFM)
A/Prof Amanda Henry	Member
Dr Steven Grant	Member (NZ)
Dr Sikhar Sircar	Member (NZ)
Dr Karen Mizia	Member (COGU)
Dr Frank Clark	Member
Dr Amy Hercus	Member

Dr Laura Slade	Member
Dr Naven Chetty	Member (CGO)
Dr Sue Belgrave	Member (NZ)
Research & Policy Team	**Position**
Professor Cindy Farquhar	Dean of Research & Policy
Ms Jinty Wilson	Head of Research & Policy
Ms Katie Coulthard	Senior Coordinator, Research & Policy
Research preparation	**Position**
Professor Cindy Farquhar	Dean of Research & Policy
Dr Karyn Anderson	Researcher, University of Auckland

Appendix C: Overview of the development and review process for this statement

i. Declaration of interest process and management

Declaring interests is essential in order to prevent any potential conflict between the private interests of members, and their duties as part of RANZCOG Women's Health Committee or working groups.

A declaration of interest form specific to guidelines and statements (approved by the RANZCOG Board in September 2012). All members of the Statement Development Panels, Statement and Guideline Advisory Group (SaGG) and Women's Health Committee were required to declare their relevant interests in writing on this form prior to participating in the review of this statement.

Members were required to update their information as soon as they become aware of any changes to their interests and there was also a standing agenda item at each meeting where declarations of interest were called for and recorded as part of the meeting minutes.

There were no significant real or perceived conflicts of interest that required management during the process of updating this statement.

ii. Steps in developing and updating this statement

This statement was developed in July 2022- March 2023 by the Placenta Accreta Spectrum (PAS) (C-Obs 20) Statement Development Panel, a working group established by the Women's Health Committee. It was most recently reviewed by the Women's Health Committee in March 2023. The Women's Health Committee carried out the following steps in reviewing this statement:

- Declarations of interest were sought from all members prior to reviewing this statement.
- Structured clinical questions were developed and agreed upon.
- An updated literature search to answer the clinical questions was undertaken.
- At the March 2023 meeting of the Women's Health Committee, the existing consensus-based recommendations were reviewed and updated (where appropriate) based on the available body of evidence and clinical expertise, as set out in the Methodology section below.

RANZCOG statements are developed according to the standards of the Australian National Health and Medical Research Council (NHMRC), which includes the use of GRADE methodology. The Evidence to Decision framework embedded within the MAGIC (Making GRADE the Irresistible Choice) digital platform (https://magicevidence.org) is used to publish the updated statement recommendations. The recommendations published by RANZCOG are approved by the RANZCOG Women's Health Committee, Council and Board respectively. The processes used to develop RANZCOG clinical guidance statements are described in detail at: https://ranzcog.edu.au/wp-content/uploads/2022/08/Manual-for-developing-and-updating-clinical-guidance-statements.pdf

iii. Developing recommendations using GRADE methodology

The relevant GRADE assessments for each recommendation are presented within the online platform used to structure the clinical guidance statement (MAGICapp; https://magicevidence.org/magicapp/).

Appendix D: Full Disclaimer

Purpose

This Statement has been developed to provide general advice to practitioners about placenta accreta spectrum and should not be relied on as a substitute for proper assessment with respect to the particular circumstances of each case and the needs of any person. It is the responsibility of each practitioner to have regard to the particular circumstances of each case. Clinical management should be responsive to the needs of the individual person and the particular circumstances of each case.

Quality of information

The information available in this statement is intended as a guide and provided for information purposes only. The information is based on the Australian/New Zealand context using the best available evidence and information at the time of preparation. While the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) has endeavoured to ensure that information is accurate and current at the time of preparation, it takes no responsibility for matters arising from changed circumstances or information or material that may have become subsequently available. The use of this information is entirely at your own risk and responsibility.

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Exclusion of warranties

To the maximum extent permitted by law, RANZCOG makes no representation, endorsement or warranty of any kind, expressed or implied in relation to the materials within or referred to throughout this statement being in any way inaccurate, out of context, incomplete or unavailable for all expenses, losses, damages and costs incurred.
These terms and conditions will be constructed according to and are governed by the laws of Victoria, Australia.

Appendix E- Evidence profiles

Clinical Question 1- Diagnosis

What are the indications for an MRI in a woman with suspected PAS?

Population: Pregnant women with suspected PAS, following ultrasound or on clinical grounds
Intervention: Indications for an MRI
Comparator: No MRI

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates**		**Certainty of the Evidence** (Quality of evidence)	**Plain language summary**
		No MRI	Indications for an MRI		
MRI - Diagnosis of invasive placentation - De Oliveira Carniello et al (2022)	Based on data from 1301 participants in 17 studies[1]	Sensitivity of MRI in detecting the presence of invasive placentation 83.8% (78.6%–87.9%); specificity 83.1% (77.0%–87.8%). Sensitivity of 83.3% (95% CI, 77.6%–87.8%) and specificity of 83.4% (95% CI, 74.6%–89.7%) for ultrasound.		**Very low** Due to serious risk of bias[2]	
MRI - Depth of placental invasion - Familiari et al (2018)	Based on data from 282 participants in 9 studies[3]	Sensitivity of MRI in determining the depth of placental invasion: accreta 94.4% (15.8%–99.9%), increta 100% (75.3%–100%), percreta 86.5% (74.2%–94.4%); specificity: accreta 98.8% (70.7%–100%), increta 97.3% (93.3%–99.3%), percreta 96.8% (93.5%–98.7%)		**Very low** Due to serious risk of bias[4]	
MRI - Topography of placental invasion - D'Antonio (2014)	Based on data from 428 participants in 2 studies[5]	Sensitivity of MRI in determining the topography of placental invasion 99.6% (98.4%–100%); specificity 95.0% (83.1%–99.4%)		**Very low** Due to serious risk of bias[6]	
MRI in diagnosis of PAS - case series of maternal clinical outcomes - Bourgioti et al (2018)	Based on data from 100 participants in 1 studies[7]	All women underwent antenatal MRI for suspected PAS. 72 of 100 patients had evidence of PAS disorder intraoperatively. Sensitivity, and specificity were 95.8%, and 78.6%. Presence of ≥6 MRI signs (of a total of 15 possible signs) was associated with predicting the odds of massive bleeding (OR: 90.93, 95% CI: 11.3–729.23), hysterectomy (OR: 72.5, 95% CI: 17.9–293.7), and extensive bladder repair (OR: 58.74, 95% CI: 7.35–469.32). Presence of ≥3 MRI signs was associated with predicting the odds of a complicated delivery (OR: 19.08, 95% CI 6.05–60.13).		**Very low** Due to serious risk of bias[8]	
MRI in diagnosis of PAS - case series of perinatal clinical outcomes - Bourgioti et al (2018)	Based on data from 100 participants in 1 studies[9]	All women underwent antenatal MRI for suspected PAS. The MRI score was not significant for predicting adverse neonatal events including preterm delivery (P = 0.558), low birthweight (P = 0.097), and 5-minute Apgar score (P = 0.078).		**Very low** Due to serious risk of bias[10]	

1. Systematic review Supporting references [39]. [44].
2. **Risk of Bias: serious.** Patient selection was convenience sample ;
3. Systematic review Supporting references [38].
4. **Risk of Bias: serious.** High risk of selection bias ;
5. Systematic review Supporting references [40].
6. **Risk of Bias: serious.** High risk of selection bias ;
7. Primary study Supporting references [37].
8. **Risk of Bias: serious.** High risk of selection bias ;
9. Systematic review Supporting references [45]. [37]. [46].
10. **Risk of Bias: serious.** High risk of selection bias ;

Evidence to Decision

Benefits and harms

Research evidence

Evidence from the following recently published guidelines have been used to inform this recommendation:

- The Royal College of Obstetricians and Gynaecologists (RCOG) Green Top Guideline No. 27a 2018
- American College of Obstetricians and Gynaecologists (ACOG) Obstetric care consensus 2018
- FIGO Consensus guidelines on placenta accreta spectrum disorders 2018
- Society of Obstetricians and Gynaecologists of Canada (SOGC) No. 383 - Screening, diagnosis, and management of placenta accreta spectrum disorders
- Government of Western Australia North Metropolitan Health Service: Clinical practice guideline: Placenta Accreta Spectrum (2018)
- SA Health Safety and Quality Strategic Governance Committee: Morbidly adherent placenta management (2018)

Additional primary literature searches were undertaken in MEDLINE and CENTRAL to identify literature published following the development of the above guidelines. 121 articles were screened with three included in this evidence summary.

Additional considerations

In assessing this diagnostic accuracy data, the ACOG guidelines group note: “These data should be interpreted with caution because studies of MRI are even more prone to selection bias than those of ultrasonography because generally only patients with an indeterminate ultrasound examination or at very high risk of placenta accreta spectrum undergo MRI.”

The focus and experience of the supervising/reporting radiologist remains an important and less well-studied factor in the diagnostic accuracy of MRI, since access to expert radiologists with a special interest in pregnancy is highly variable between centres.

A cohort study conducted by Millisher et al (2017) of 20 women with suspected PAS, who underwent MRI examinations without and with gadolinium, found an association between gadolinium use and improvement in MRI-based diagnostic accuracy for the diagnosis of PAS. This finding remained irrespective of radiologist's experience.

Domain	Summary of judgement	Comment
Certainty of evidence	Very low	The evidence identified for this PICO are observational data only. These studies are prone to selection bias because generally only patients with an indeterminate ultrasound examination or at very high risk of placenta accreta spectrum undergo MRI. Prevalence of PAS within study samples was reported to be as high as 75% indicating a highly selected population. Included systematic reviews are of high quality on the AMSTAR checklist.

Domain	Summary of judgement	Comment
Values and preferences	Substantial variability is expected or uncertain	Women are likely to value the greatest diagnostic clarity of PAS in pregnancy and operative planning. Whilst MRI appears to be safe in pregnancy, the safety of gadolinium contrast, helpful in improving the diagnostic accuracy of MRI for PAS, has yet to be established.
Additional considerations		
Ray et al (2016) conducted a cohort study of 1,424,105 deliveries in Canada. Comparing first-trimester MRI (n=1,737) to no MRI (n=1,418,451), there were 19 stillbirths or deaths vs 9,844 in the unexposed cohort (adjusted relative risk [RR], 1.68; 95% CI, 0.97 to 2.90) for an adjusted risk difference of 4.7 per 1000 person-years (95% CI, −1.6 to 11.0). T Comparing gadolinium MRI (n=397) with no MRI (n=1,418,451), the broad outcome of any rheumatological, inflammatory, or infiltrative skin condition occurred in 123 vs 384,180 births (adjusted HR, 1.36; 95% CI, 1.09 to 1.69) for an adjusted risk difference of 45.3 per 1000 person-years (95% CI, 11.3 to 86.8). Stillbirths and neonatal deaths occurred among 7 MRI-exposed vs 9,844 unexposed pregnancies (adjusted RR, 3.70; 95% CI, 1.55 to 8.85) for an adjusted risk difference of 47.5 per 1000 pregnancies (95% CI, 9.7 to 138.2).		

Domain	Summary of judgement	Comment
Resources	Important issues, or potential issues not investigated	Economic evaluation is beyond the scope of this review. However, Magnetic resonance imaging is more expensive than ultrasonography. Undiagnosed PAS may have high operative cost.
Additional considerations		
The addition of MRI to ultrasound imaging rarely changed surgical management in patients suspected to have placenta accreta with caesarean hysterectomies still being performed in patients in whom MRI downgraded the diagnosis. [Shetty 2015]		

Domain	Summary of judgement	Comment
Equity	Intervention likely increases inequity	MRI is less widely available than ultrasonography and its routine use in the diagnosis of suspected PAS may reduce equity for rural and remote women who may be required to travel to another centre to access this service.

Domain	Summary of judgement	Comment
Acceptability	No important issues with the recommended alternative	Clinicians value the highest diagnostic accuracy for suspected PAS in order to develop an appropriate management plan. A 2017/2018 international survey of clinicians indicated that 61% use both ultrasound and MRI imaging for cases of suspected PAS (Cal et al 2018).

Domain	Summary of judgement	Comment
Feasibility	Don't know	The experience of the supervising/reporting radiologist remains an important factor in the diagnostic accuracy of MRI. Ghezzi et al (2022) conducted a comparison of the diagnosis of PAS from MRI findings between radiologists with different levels of experience. There was a strong association between definitive PAS diagnoses and the highest experience level.

		The expertise required to interpret these MRI studies in the context of suspected PAS may be limited in Australia and New Zealand. However, no workforce experience data was identified to inform this. Similarly, accurate ultrasound diagnosis is dependent on skilled sonographers.

Clinical Question 2- Treatment and care

What are the important features of a treatment protocol for PAS?

PICO (4.2.1)
Population: Pregnant women with suspected or confirmed PAS
Intervention: Planning for delivery, including PA protocol (i.e. optomise Hb, appropriate setting including surgical team (urologists, interventional radiology etc), MTP/MBT protocol in place, patient consented for hysterectomy and transfusion is required)
Comparator: No protocol present

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** No protocol present	Protocol present	**Certainty of the Evidence** (Quality of evidence)	**Plain language summary**
Maternal morbidity - MDT protocol driven management vs standard care - patients with PAS having CS/hysterectomy - Bartels et al 2018	Odds ratio: 0.4 (CI 95% 0.25 - 0.65) Based on data from 364 participants in 5 studies[1]	**395** per 1000	**207** per 1000 Difference: **188 fewer per 1000** (CI 95% 255 fewer - 97 fewer)	**Very low** Due to serious risk of bias[2]	We are uncertain whether a multidisciplinary protocol improves or worsen maternal morbidity compared to standard care for patients with PAS having cs/hysterectomy
Transfusion of 4 or more units RBCs - MDT protocol driven management vs standard care - patients with PAS having CS/hysterectomy (Shamshirsaz et al 2017)	(CI 95% -) Based on data from 118 participants in 1 studies[3]	**448** per 1000	**254** per 1000 Difference: **194 fewer per 1000**	**Very low** Due to serious risk of bias, Due to serious indirectness[4]	We are uncertain whether a multidisciplinary treatment protocol improves or worsen the likelihood of transfusion of 4 or more units RBCs compared to standard care for patients with PAS having cs/hysterectomy.
Estimated blood loss - MDT protocol driven management vs standard care - patients with PAS having CS/hysterectomy - Bartels et al 2018	Measured by: Litres Scale: - Lower better Based on data from 461 participants in 6 studies[5]	L	L Difference: **MD 1.12 lower** (CI 95% 1.88 lower - 0.36 lower)	**Very low** Due to serious inconsistency, Due to serious risk of bias[6]	We are uncertain whether a multidisciplinary protocol increases or decreases estimated blood loss compared to standard care for patients with PAS having cs/hysterectomy.
Number of units of red blood cells transfused - MDT protocol driven management vs standard care - patients with PAS having CS/hysterectomy - Bartels et al 2018	Measured by: units Scale: - Lower better Based on data from 461 participants in 6 studies[7]		Difference: **MD 2.65 lower** (CI 95% 4.10 lower - 1.19 lower)	**Very low** Due to serious risk of bias[8]	We are uncertain whether a multidisciplinary protocol increases or decreases number of units of red blood cells transfused compared to standard care for patients with PAS having cs/hysterectomy.
Length of stay - MDT protocol driven management vs standard care - patients with PAS	Measured by: Days Scale: - Lower better Based on data from 461 participants in 6 studies[9]	days	days Difference: **MD 2.61 lower** (CI 95% 5.35 lower - 0.12 higher)	**Very low** Due to serious risk of bias, Due to serious inconsistency[10]	We are uncertain whether a multidisciplinary protocol increases or decreases length of stay compared to standard care for

Benefits and harms	Substantial net benefits of the recommended alternative

Summary

Indirect evidence was identified regarding the outcomes for women with PAS managed under MDTs compared to standard care. Within this evidence summary only studies which included protocol driven care were included.

Bartels et al (2018) conducted a systematic review of multidisciplinary team management of PAS. Studies of patients undergoing caesarean birth for histopathologically confirmed morbidly adherent placenta within tertiary centres with multidisciplinary input, or where multidisciplinary care protocols were in place, as compared with standard patient care were included. Six retrospective observational studies, including 461 patients, were included in the review. A number of components were common to multidisciplinary team protocols such as involvement of maternal–fetal medicine, gynaecologic oncology, anaesthesiology, and urology specialists, use of interventional radiology procedures, placental ultrasound mapping, midline incision, and regional anaesthesia converted to general as required.

An additional retrospective cohort study (Shamshirsaz et al 2017) published following the Bartels et al systematic review was identified. This study includes 118 singleton pregnancies with histology confirmed PAS which were divided into two groups based on when they delivered, to compare outcomes as surgeons gained more experience in multidisciplinary and protocol driven management. This team managed an averaged of 2-3 cases per month over the study time period. Blood loss and transfusion requirements were reduced with the introduction of a multidisciplinary team management protocol for PAS.

Additional considerations

Silver et al (2015) offer indications for referral to a Centre of Excellence in the management of PAS.

A 2015 single centre retrospective cohort study (Brennan et al) of the effectiveness of a standardised operative approach in 98 cases of histologically confirmed placenta accreta supports the early presence of a gynaecological surgeon and oncologist at birth and demonstrates that a ‘call if needed’ approach is not acceptable for these complex cases.

Following the last RCOG PAS guideline development the National Patient Safety Agency in collaboration with the RCOG and the Royal College of Midwives set up an expert working group to develop a care bundle for placenta accreta.

Domain	Summary of judgement	Comment
Certainty of evidence	Very low	All observational evidence. Downgraded for indirectness.
Values and preferences	Substantial variability is expected or uncertain.	Patients are likely to value the highest standard of care. It is a common tradition for Māori women (whānau Māori) and in many First Nations cultures in Australia to keep the placenta (whenua) to bury in a place of significance. A qualitative study reporting the experiences of families. As PAS may require surgical removal of the placenta and/or further histopathology for confirmation of diagnosis and classification, clinicians may need to consider the cultural needs of Māori women and Aboriginal and/or Torres Strait Islander women when PAS is suspected/first diagnosed, including discussion of options for return of the placenta.

Domain	Summary of judgement	Comment
Resources	Important issues, or potential issues not investigated	A single study (Prada et al 2022) was identified during literature searches which compared resources used before and after an MDT protocol was introduced for management of PAS. The mean reduction in resource use after the program was 16.5% per patient. A full economic evaluation was outside of the scope of this recommendation.
Additional considerations		
MDT involves 4-6 medical staff which would involve significant cost.		

Domain	Summary of judgement	Comment
Equity	Intervention likely increases inequity	Only large hospitals are likely to be able to be able to establish an MDT. This would likely require patients to travel to larger hospitals for protocol driven care.
Additional considerations		
Mowat et al (2016) conducted a systematic review of complication rates after gynaecological surgery for surgeons with low-volume vs high-volume caseloads. They found that gynaecologists performing procedures approximately once a month or less were found to have higher rates of		

adverse outcomes in gynaecology, gynaecological oncology, and urogynecology. However, this study did not specifically include caesarean hysterectomy for PAS.
In a small 10-year retrospective cohort study of women requiring hysterectomy during childbirth (n = 18) in Launceston, Tasmania (regional centre) (Lim, Pavlov and Dennis 2014), four cases of PAS were identified antenatally and plans for transfer to a tertiary-level hospital were made. The study reported these women experienced more complications and transfusions (all presented in Launceston with antepartum haemorrhage/pre-term labour). The findings suggested Australian women with PAS birthing in rural and regional areas may be at increased risk. Early antenatal relocation and/or aeromedical retrieval may be an important consideration when planning for care of women located in regional/rural areas in Australia.

Domain	Summary of judgement	Comment
Acceptability	Important issues, or potential issues not investigated	Uncertain of acceptability of protocols that suggest MDT or centralised management of PAS at centres of expertise. A 2019 anonymous survey of UK obstetric units found that 70% manage cases of suspected PAS in house, despite ⅓ of these units manage only one case per year on average. (Sargent et al 2019).
Feasibility	Important issues, or potential issues not investigated	Development of treatment protocols likely to be feasible. Feasibility of establishing MDT care in small centres may be problematic.

Clinical Question 3- Surgical planning

For women with suspected PAS, does conservation of the uterus or removal of the uterus result in improved health outcomes for mother and baby?

Population: Pregnant women with suspected or confirmed PAS
Intervention: Planned delivery of the baby and placenta with conservation of the uterus
Comparator: Delivery of the baby through an incision away from the placenta, followed by a hysterectomy if the placenta does not spontaneously separate

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** Caesarean hysterectomy	Conservative management	**Certainty of the Evidence** (Quality of evidence)	**Plain language summary**
Total estimated blood loss >3000mL up to 6 months after delivery - leaving placenta in situ vs primary caesarean hysterectomy - PACCRETA cohort (Sentilhes et al 2022)	Relative risk: 0.27 (CI 95% 0.15 - 0.47) Based on data from 148 participants in 1 studies	**458** per 1000	**107** per 1000 Difference: **351 fewer per 1000** (CI 95% 389 fewer - 243 fewer)	**Very low** Due to serious risk of bias, Due to serious imprecision[1]	We are uncertain whether conservative management increases or decreases total estimated blood loss >3000ml up to 6 months after delivery compared to planned caesarean hysterectomy.
Transfusion of >4 units of RBCs up to 6 months after delivery - leaving placenta in situ vs primary caesarean hysterectomy - PACCRETA cohort (Sentilhes et al 2022)	Relative risk: 0.29 (CI 95% 0.19 - 0.45) Based on data from 148 participants in 1 studies	**590** per 1000	**163** per 1000 Difference: **427 fewer per 1000** (CI 95% 478 fewer - 324 fewer)	**Very low** Due to serious risk of bias, Due to serious imprecision[2]	We are uncertain whether conservative management improves or worsen transfusion of >4 units of RBCs up to 6 months after delivery compared to planned caesarean hysterectomy.
Hysterectomy up to 6 months after delivery - leaving placenta in situ vs primary caesarean hysterectomy - PACCRETA cohort (Sentilhes et al 2022)	(CI 95% -) Based on data from 148 participants in 1 studies	**1000** per 1000	**221** per 1000 Difference: **779 fewer per 1000**	**Very low** Due to serious risk of bias, Due to serious imprecision[3]	We are uncertain whether conservative management increases or decreases hysterectomy up to 6 months after delivery compared to planned caesarean hysterectomy.
Adjacent organ injury - leaving placenta in situ vs primary caesarean hysterectomy - PACCRETA cohort (Sentilhes et al 2022)	Relative risk: 0.29 (CI 95% 0.11 - 0.79) Based on data from 148 participants in 1 studies	**129** per 1000	**47** per 1000 Difference: **82 fewer per 1000** (CI 95% 115 fewer - 27 fewer)	**Very low** Due to serious risk of bias, Due to serious imprecision[4]	We are uncertain whether conservative management increases or decreases adjacent organ injury compared to planned caesarean hysterectomy.
Non-PPH related severe maternal morbidity - leaving placenta in situ vs primary caesarean hysterectomy - PACCRETA	Relative risk: 0.41 (CI 95% 0.19 - 0.86) Based on data from 148 participants in 1 studies	**161** per 1000	**58** per 1000 Difference: **103 fewer per 1000** (CI 95% 130 fewer - 23 fewer)	**Very low** Due to serious risk of bias, Due to serious imprecision[5]	We are uncertain whether conservative management increases or decreases non-PPH related severe maternal morbidity compared to planned caesarean hysterectomy.

Evidence to Decision

Benefits and harms	Small net benefit, or little difference between alternatives

Moderate benefits for planned birth of the baby and placenta with conservation of the uterus

Moderate harms for planned birth of the baby and placenta with conservation of the uterus.

Summary

There are no RCTs comparing different surgical approaches for suspected placenta accreta spectrum.

Two comparative studies are presented below. Multiple case series evidence for different techniques is presented in an appended table.

The largest and most recent comparative observational study was conducted by the PACCRETA Study group (Senthiles et al 2022). This multicentre cohort study conducted in France drew from a source population of 520,114 delivered at 176 hospitals. 148 women with PAS (clinically or histologically diagnosed) consented to take part in the study, with 86 having conservative management (leaving all or part of the placenta in situ) and 62 women having planned caesarean hysterectomy. All women were followed up to 6 months post-birth. Women receiving conservative management were younger and had lower parity. Women with conservative management were more likely to have arterial embolization compared to women having caesarean hysterectomy (24.4% vs 3%). Conservative management was found to have lower associated risk of needing transfusion >4 units RBCs, hysterectomy, blood loss exceeding 3000mL, adjacent organ injury and non-PPH related severe maternal morbidity. No maternal deaths occurred in the study time frame. No perinatal outcomes were reported. Women with conservative management had a higher associated risk of endometritis and readmission within 6 months.

Schwikert et al (2021) study (IS-PAS) of women with PAS included 338 women from 14 European countries and the USA between 2008-2019. This study reported on the blood loss of different surgical techniques compared to planned caesarean hysterectomy in women with PAS. Unplanned hysterectomy was associated with increased risk of blood loss >3500mL compared to planned hysterectomy. Little to no difference was found in blood loss between partial myometrial resection and planned hysterectomy. Whilst blood loss >3500mL was less common in women who had successful conservative management (placenta left in situ), in women who required delayed hysterectomy risk of blood loss >3500mL was more likely than planned hysterectomy. Manual removal of placenta was associated with lower odds of blood loss >3500mL however, manual removal of placenta was attempted significantly less frequently in this group and only performed in lower PAS grades of invasion.

Additional considerations

The use of methotrexate is not recommended by any current published guidelines. Methotrexate has a very limited effect as the placenta during late pregnancy has only a few rapidly dividing cells, and methotrexate can cause considerable side effects, including bone marrow suppression, which may increase the risks of sepsis. In the Senthilles et al 2010 case series of expectant management of placenta accreta spectrum, there was one maternal death, which was attributed to severe methotrexate toxicity and subsequent septic shock.

Domain	Summary of judgement	Comment
Certainty of evidence	Very low	Large volume of case series evidence of very low quality and prone to publication bias. Thus, the data may be misleading, giving the impression uterus-preserving treatment modalities a higher than true success rate. Of the two cohort studies highlighted in the evidence table both were graded as very low quality based on uncertainty in how/when the treatment group was decided, however, one was able to be ungraded due to evidence of a dose response relationship in blood loss by PAS grade.
Values and preferences	Substantial variability is expected or uncertain	Although conservative management conserves fertility only 28% of women had a subsequent pregnancy in a large French registry study (Senthiles 2010). Of those with preserved fertility 68% of patients stated that they did not want a further pregnancy with more than a third stating this was due to their doctor's advice about risks of recurrence of PAS.
Resources	Important issues, or potential issues not investigated.	A full economic evaluation is outside of the scope of this recommendation.
Equity	Important issues, or potential issues not investigated. Probably reduced equity.	Conservative management can be associated with long follow-up periods with an ongoing risk of secondary PPH and infection. Health equity for rural and remote women is likely to be reduced as these women would either not qualify for conservative management or be required to spend long periods away from home.
Acceptability	Don’t know	

		An international survey of Obstetricians (Cal et al 2018) found that 60% of respondents favoured caesarean hysterectomy in management of PAS. 28% would perform a partial myometrial resection if possible and 25% would attempt a primary placental removal and compression sutures. Around 50% use arterial embolisation or intra-arterial balloons perioperatively.
Feasibility	No important issues with the recommended alternative	Improved outcomes with uterus-preserving techniques are more likely to occur when these techniques are attempted by surgeons working in teams with appropriate expertise to manage such cases.

Clinical Question 4: Intraoperative techniques to reduce blood loss

Do the use of uterine tamponade measures (e.g. balloon, B-Lynch suture) improve outcomes for women with PAS?

Evidence to Decision

Benefits and harms

Research evidence

Primary evidence search conducted to identify evidence for this clinical question on 7th February 2023.

Search terms Balloon occlusion: PAS OR “placenta accreta” OR “placenta increta” OR “placenta percreta” OR “abnormal placentation” AND “uterine balloon tamponade” OR [“bakri” OR “balloon occlusion”] AND [uterus OR uterine OR “intrauterine”]

Search terms compression suture: PAS OR “placenta accreta” OR “placenta increta” OR “placenta percreta” OR “abnormal placentation” AND “B Lynch suture" OR “compression suture” OR “uterine suture”

Combined results of both searches = 122

24 articles were retrieved for full text review.

No studies provided a direct comparison of tamponade techniques compared to no tamponade techniques, therefore, indirect evidence comparing tamponade techniques to other haemostatic or surgical techniques was included. A hierarchical approach to evidence was applied - where systematic reviews were identified these were used (0 studies identified), followed by RCTs (1 identified (Dai et al 2020) but unable to obtain full text in English), followed by case-control and

cohort studies (2 identified Wolf 2020; and Pala 2018). As observational studies were identified case study evidence is not presented in the evidence summary.

Summary

No direct evidence comparing uterine tamponade to no uterine tamponade could be identified for this clinical question. Indirect evidence of the comparison of uterine tamponade techniques to caesarean hysterectomy or other haemostatic techniques is summarized below.

Pala et al 2018 conducted a retrospective cohort study including 36 patients with PAS who were treated either with Bakri balloon tamponade or caesarean hysterectomy. This is not the comparison group included in the PICO for this clinical question but provides indirect evidence from which to inform this recommendation. The Bakri balloon was only used for women where placental adherence was less than 50% of the axial segment of the uterus resulting in a lower severity of PAS in the Bakri group compared to the caesarean hysterectomy group. For women in the Bakri group an extirpative approach (forced placental removal) was used, a practice which is no longer recommended in the management of PAS by international review bodies due to an increased risk of severe haemorrhage. Bakri balloon tamponade was considered to be failed when more than bleeding of >100mL was observed from the drainage catheter over a 10-minute period, at which stage a caesarean hysterectomy was performed. Caesarean hysterectomy was required in 3 of the 19 women treated with Bakri balloon (16%). A lower estimated blood loss was reported in the Bakri balloon group compared to the caesarean hysterectomy group (1794mL vs 2694mL; p-value 0.002), as well as a reduced need for RBC transfusion (2.73 units vs 5.70 units; p-value 0.001), and a shorter operating time (64.47 minutes vs 140.58 minutes; p-value 0.001).

Wolf et al 2020 conducted a retrospective cohort study including 148 patients with PAS (based on ultrasound findings) who had a caesarean section at 35-38 weeks and were treated with either a B-Lynch suture (group A) or internal iliac balloon occlusion (group B). These techniques could only be applied for women where manual separation of the placenta occurred at the time of caesarean section (an extirpative approach which is no longer recommended due to risk of severe haemorrhage). For those that did not have manual separation of the placenta, a caesarean hysterectomy was performed. The degree of PAS was more severe in group A (43.4% percreta vs 16.9% percreta; p-value 0.003). Women in group A experienced a higher rate of caesarean hysterectomy (36.1%) compared to group B (29.2%) (p-value <0.001), but little to no difference in estimated blood loss (886mL vs 1190mL; p-value 0.347) or operative time (61mins vs 59 mins; p-value 0.706). A higher number of packed RBCs were transfused intraoperatively in the B-Lynch suture group compared to the arterial balloon group (4 vs 2 units; p-value 0.006) and in the postoperative period (2 vs 0; p-value 0.043).

Domain	Summary of judgement	Comment
Certainty of evidence	Very low	No formal GRADE was undertaken as identified observational studies only provide indirect evidence for this recommendation.

Domain	Summary of judgement	Comment
Values and preferences	Not set	From paper by Einerson et al 2021: patients had fear, lack of autonomy and medical helplessness related to medical decision making. Mourned loss of future fertility and dissatisfied with the lack of options for treatment for this serious pregnancy complication. No patient satisfaction outcomes were reported in either identified study, but we note the results of the PAS qualitative study above, the heavy burden of treatment of this condition.
Additional considerations		
Qualitative data (Bartels et al 2022- BMC Pregnancy and Childbirth) found women with PAS in Ireland felt paucity of evidence-based, high-quality resources available to inform about treatment options. Management of expectations particularly around experience in theatre and plans if care needs escalation/changes due to clinical condition were also listed as important needs women wanted clinicians to consider.		

Domain	Summary of judgement	Comment
Resources	Don't know	It is acknowledged that indirect evidence alone cannot adequately inform this domain. however, if uterine tamponade techniques resulted in shorter operating times compared to caesarean hysterectomy substantial cost savings may be achieved. Some of this cost savings may be tempered by the cost of surgical equipment (such as Bakri balloon) used to achieve uterine tamponade.
Equity	Probably no impact	Uterine tamponade techniques are commonly used in the management of post-partum haemorrhage and as such are widely used in most hospitals in New Zealand and Australia.
Acceptability	Probably acceptable	A 2018 international survey of obstetricians (Cal et al 2018) found that a primary attempt at placental removal and application of compression sutures was attempted by a quarter of respondents.
Feasibility	Probably feasible	Uterine tamponade techniques are commonly used in the management of post-partum haemorrhage and as such are widely used in most hospitals in New Zealand and Australia.

Clinical Question 5: Role of interventional radiology techniques

For women with PAS, does embolisation and the use of intraarterial balloons improve maternal outcomes, such as hysterectomy rate, blood loss and future fertility potential?

Population: Pregnant women with diagnosed PAS
Intervention: Interventional radiology techniques (embolisation or intra-arterial baloons)
Comparator: No interventional radiology techniques

Outcome Timeframe	**Study results and measurements**	**Absolute effect estimates** No interventional radiology techniques	**Absolute effect estimates** Interventional radiology techniques	**Certainty of the Evidence** (Quality of evidence)	**Plain language summary**
Anterior internal illiac artery balloon vs no balloon - Any transfussion - SALIM 2015 [RCT]	Relative risk: 0.96 (CI 95% 0.33 - 2.75) Based on data from 27 participants in 1 studies[1]	**857** per 1000	**846** per 1000 Difference: **11 fewer per 1000** (CI 95% 574 fewer - 1500 more)	**Low** Due to serious risk of bias, Due to serious imprecision[2]	Anterior internal iliac artery balloon occlusion may have little or no difference on the need for any blood product transfusion
Anterior internal illiac artery balloon vs no balloon - Caesarean hysterectomy - SALIM 2015 [RCT]	Relative risk: 0.92 (CI 95% 0.42 - 2.03) Based on data from 27 participants in 1 studies	**500** per 1000	**460** per 1000 Difference: **40 fewer per 1000** (CI 95% 290 fewer - 515 more)	**Low** Due to serious risk of bias, Due to serious imprecision[3]	Anterior internal iliac artery balloon occlusion may have little or no difference on the need for caesarean hysterectomy
Anterior internal iliac artery balloon vs no balloon - blood loss >2500mL - SALIM 2015 [RCT]	Relative risk: 0.81 (CI 95% 0.37 - 1.76) Based on data from 27 participants in 1 studies	**643** per 1000	**539** per 1000 Difference: **104 fewer per 1000** (CI 95% 405 fewer - 489 more)	**Low** Due to serious risk of bias, Due to serious imprecision[4]	Anterior internal iliac artery balloon occlusion may have little or no difference in blood loss >2500mL
Anterior internal iliac artery balloon vs no balloon - APGAR score <7 at 5 minutes - SALIM 2015 [RCT]	Relative risk: 1.04 (CI 95% 0.36 - 3.0) Based on data from 27 participants in 1 studies	**143** per 1000	**154** per 1000 Difference: **11 more per 1000** (CI 95% 92 fewer - 286 more)	**Low** Due to serious risk of bias, Due to serious imprecision[5]	Anterior internal iliac artery balloon occlusion may have little or no difference on Apgar score <7 at 5 minutes for neonate
Anterior internal iliac artery balloon vs no balloon in placenta praevia with accreta - Blood loss >2500mL - CHEN 2020 [RCT]	Relative risk: 1.42 (CI 95% 0.62 - 3.22) Based on data from 100 participants in 1 studies[6]	**320** per 1000	**400** per 1000 Difference: **80 more per 1000** (CI 95% 122 fewer - 710 more)	**Low** Due to serious risk of bias, Due to serious imprecision[7]	We are uncertain whether anterior internal iliac artery balloon occlusion increases or decreases blood loss >2500mL
Anterior internal iliac artery balloon vs no balloon in placenta praevia with accreta - Caesarean hysterectomy -	Relative risk: 1.67 (CI 95% 0.74 - 3.77) Based on data from 100 participants in 1 studies	**320** per 1000	**440** per 1000 Difference: **120 more per 1000** (CI 95% 83 fewer - 886 more)	**Low** Due to serious risk of bias, Due to serious imprecision[8]	We are uncertain whether anterior internal iliac artery balloon occlusion increases or decreases the rate of caesarean hysterectomy

Benefits and harms

A systematic review of endovascular interventional modalities (including balloon occlusion of the abdominal aorta, internal iliac arteries, uterine artery or common iliac arteries, or uterine artery embolisation) was conducted by Shahin et al (2018) including 69 studies (1,811 patients), including one RCT by Salim et al (2015). The search strategy for this systematic review included deliveries complicated by placental implantation abnormalities including PAS and placenta previa.

- The RCT by Salim et al 2015 was conducted in Israel of 27 women with suspected PAS based on USS characteristics. Participants were randomised to balloon occlusion of the anterior division of the internal iliac artery prior to caesarean compared to no balloon. Little to no difference was found in number of packed RBC units transfused, need for any blood product transfusion, blood loss >2500mL, need for caesarean hysterectomy, or operating time. All outcomes had very wide confidence intervals, indicating high uncertainty as to the effect of the intervention. Little to no difference in Apgar score <7 at 5 mins. No instances of neonatal death in either group. One case of relaparotomy in the control group and two cases of readmission in the intervention group only precluding a RR estimation for either of these outcomes.
- When the Salim RCT was combined with non-randomised studies in Shahin et al (2018) systematic review, endovascular interventions were found to be associated with reduced blood loss (MD - 893.24mL, 95% CI -1,389mL to -397mL, p-value <0.001, 14 studies) and a lower number of RBC units transfused (MD -1.54 units, 95% CI -2.27 to -0.81, p-value <0.001, 11 studies) when compared to no endovascular interventions. Little to no difference was found in unplanned caesarean hysterectomy rates between patients who underwent endovascular interventions and those who did not (OR 0.63, 95% CI 0.25 - 1.57, p-value 0.320, 8 studies). Little to no difference was found in length of hospital stay between the two groups (MD -0.55 days, 95% CI -2.15 to 1.06 days, p-value 0.500, 10 studies).
- Considering the subgroup of studies comparing internal iliac artery balloon occlusion to no balloon occlusion, internal iliac artery balloon occlusion was found to be associated with reduced blood loss (MD - 232.11mL, 95% CI -392mL to -72.2mL, p-value 0.004, 7 studies) although the clinical significance of this degree of blood loss reduction is uncertain. A lower number of RBC units transfused was found for women in the internal iliac artery balloon occlusion group (MD -1.45 units, 95% CI -2.40 to -0.49, p-value 0.003, 6 studies) compared to no balloon occlusion.

Chen et al (2019) conducted a systematic review of abdominal aortic balloon occlusion including 11 studies (731 patients), including only non-randomised studies. Similar to the Shahim et al review, the search strategy for this systematic review included deliveries complicated by placental implantation abnormalities including PAS and placenta previa. Abdominal aortic balloon occlusion was found to be associated with reduced blood loss (MD -1,480mL, 95% CI -1,860mL to -1154mL, p-value <0.001, seven studies) and a lower volume of RBCs transfused (MD -1,125mL, 95% CI -1,264 to -987, p-value <0.001, six studies) when compared to no balloon occlusion. Abdominal aortic balloon occlusion was found to be associated with reduced hysterectomy rate (OR 0.30, 95% CI 0.19 - 0.48, p-value <0.001, 11 studies) and a shorter operative time (MD -29.23 minutes, 95% CI -46.04 to -12.42 mins, p-value <0.001, 7 studies) when compared to no balloon occlusion. Four

studies reported little to no difference in Apgar scores between neonates born to women receiving abdominal aortic balloon occlusion and no balloon occlusion. Women in the abdominal aortic balloon occlusion studies experienced a balloon related morbidity rate of 1.7%, including instances of haematoma at the puncture site, and venous thrombus.

Chen et al (2020) conducted an RCT in China of 100 women with placenta previa and suspected PAS (based on USS characteristics) published since both of the above reviews. Participants were randomised to balloon occlusion of the anterior division of the internal iliac artery prior to caesarean compared to no balloon. Little to no difference was found in number of packed RBC units transfused, blood loss >2500mL, need for caesarean hysterectomy, or operating time. All outcomes had very wide confidence intervals, indicating high uncertainty as to the effect of the intervention. No cases of relaparotomy or readmission were reported precluding a RR estimation for either of these outcomes.

Domain	Summary of judgement	Comment
Certainty of evidence	Very low	Due to a paucity of RCT evidence systematic reviews included non-randomised studies and case series. Systematic reviews by Chen 2019 and Shahim 2018 were appraised as moderate quality using the AMSTAR tool. Included studies in these reviews were further downgraded due to indirectness as they included placenta previa as well as placenta accreta spectrum. Although these conditions are often associated with each other, placenta previa was not the population of interest for this PICO.
Values and preferences	Not set	Similar to results from Clinical Question 5.
Resources	Moderate cost	Chen et al 2020 conducted an RCT comparing internal iliac artery balloon occlusion with no balloon occlusion at the time of caesarean hysterectomy. The analysis of this RCT included hospital costs. Although it is acknowledged that the actual costs of hospital care will vary by location, arterial balloon occlusion was found to be significantly more costly (hospital costs were $7,456 in the balloon group and $4,803 in the no balloon group, p-value <0.01).

Equity	Probably reduced equity	Interventional radiology interventions require fluoroscopy facilities and experienced clinicians, and therefore, are more likely to be available in larger hospitals require patients to travel to access these services. This is likely to reduce equity for those located in rural or remote areas or for whom being away from friends and family presents particular challenges.
Acceptability	Probably acceptable	Interventional radiology interventions are likely to be acceptable to clinicians. A 2018 international survey of obstetricians (Cal et al 2018) asking about clinician's management of PAS indicated that approximately half of clinicians currently use intra-arterial balloons or arterial embolisation. Both balloon catheters and arterial embolisation (performed prophylactically) are inserted using fluroscopic guidance, exposing the fetus to radiation. Radiation dose can be reduced with the use of treatment protocols and experienced interventional radiologists in high-volume centres. Although the risk of fetal radiation exposure may concern women/families, under the treatment of experienced interventional radiologists the amount of radiation exposure for these procedures is associated with a 0.05% lower probability of birth without malformation compared to children born following no radiation exposure.
Feasibility	Varies	In order to safely manage women who have had arterial occlusion techniques recovery wad staff should be familiar with management of arterial sheaths and adequately trained in recognition of ischaemic complications. Transporting patients between units may be a challenge in some units.

Appendix F- Pro forma for ultrasound reporting in suspected abnormally invasive placenta (AIP)

This template is adapted from the following publication: Alfirevic Z, Tang AW, Collins SL, Robson SC, Palacios-Jaraquemada J; Ad-hoc International AIP Expert Group. Pro forma for ultrasound reporting in suspected abnormally invasive placenta (AIP): an international consensus. Ultrasound Obstet Gynecol. 2016 Mar;47(3):276-8. doi: 10.1002/uog.15810. PMID: 26564315.

SUSPECTED ABNORMALLY INVASIVE PLACENTA (AIP)

Ultrasound report

Demographics and Risk Factors

Date: _ _/_ _/_ _ _ _ Gestational age: _ _ weeks _ days

Parity ☐ Mode of conception: Spontaneous ☐ IVF ☐

Number of previous CS ☐ Number of classical CS ☐

Number of previous surgical evacuations (including TOP) ☐

Was Cesarean scar pregnancy suspected/diagnosed in first trimester?	Yes ☐	No ☐	Not known ☐
Previous uterine surgery (e.g. myomectomy, endometrial ablation)	Yes ☐	No ☐	Not known ☐
History of AIP	Yes ☐	No ☐	Not known ☐
Placenta previa on ultrasound	Yes ☐	No ☐	Not known ☐
If yes: Anterior placenta previa	< 2 cm from internal os ☐		Covering internal os ☐
Posterior placenta previa	< 2 cm from internal os ☐		Covering internal os ☐

Ultrasound Signs

Cervical length (without funnel or placental tissue)			**mm**
Grayscale ultrasound parameters and definition	**Yes**	**No**	**Unsure**
Loss of 'clear zone' *- Loss, or irregularity, of hypoechoic plane in myometrium underneath placental bed ('clear zone')*			
Myometrial thinning *- Thinning of myometrium overlying placenta to <1mm or undetectable*			
Abnormal placental lacunae *- Presence of numerous lacunae including some that are large and irregular, often containing turbulent flow visible on grayscale imaging*			
Bladder wall interruption *- Loss or interruption of bright bladder wall (hyperechoic band or 'line' between uterine serosa and bladder lumen)*			
Placental bulge *- Deviation of uterine serosa away from expected plane, caused by abnormal bulge of placental tissue into neighboring organ, typically bladder; uterine serosa appears intact but outline shape is distorted*			
Focal exophytic mass *- Placental tissue seen breaking through uterine serosa and extending beyond it; most often seen inside filled urinary bladder*			
Color Doppler ultrasound parameters and definition	**Yes**	**No**	**Unsure**
Uterovesical hypervascularity *- Striking amount of color Doppler signal seen between myometrium and posterior wall of bladder; this sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact)*			
Subplacental hypervascularity *- Striking amount of color Doppler signal seen in placental bed; this sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact)*			
Bridging vessels *- Vessels appearing to extend from placenta, across myometrium and beyond serosa into bladder or other organs; often running perpendicular to myometrium*			
Placental lacunae feeder vessels *- Vessels with high-velocity blood flow leading from myometrium into placental lacunae, causing turbulence upon entry*			
Parametrial involvement	**Yes**	**No**	**Unsure**
- Suspicion of invasion into parametrium			

Clinical Significance of Ultrasound Findings

Probability of clinically significant AIP: High ☐ Intermediate ☐ Low ☐

Extent of AIP: Focal ☐ Diffuse ☐

Version	Date of Version	Pages revised / Brief Explanation of Revision
v1.0	March / 2023	Statement Development Panel / RANZCOG Women's Health Committee
V2.0	April / 2023	Amendments from WHC first review for targeted consultation
V3.0	July / 2023	Amendments from WHC final review for Council review

Policy Version:	Version 1.0
Policy Owner:	Women's Health Committee
Policy Approved by:	RANZCOG Council/Board
Review of Policy:	March /2028