

1 Placenta Accreta Spectrum 2021: Roundtable Discussion

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Running Title: Placenta Accreta Spectrum

The placenta accreta spectrum (PAS), the classical terminology for which includes placentas accreta, increta and percreta, is among the most morbid of pregnancy-related conditions. The precise pathophysiologic mechanisms that lead to PAS remain elusively incompletely defined, but the clinical consequences of PAS are clear: placental invasion and the accompanying hypervascularity involving the uterus and placenta place women with this condition at exceptional historical risk for delivery by Caesarean hysterectomy, massive hemorrhage, disseminated intravascular coagulopathy, and, in the most tragic cases, death. Increasingly, for select cases focal myometrial resection with uterine repair^{1, 2} and conservative management strategies³⁻⁵ in which the placenta is left in situ to resorb or be expelled are being used. Some women managed conservatively will still ultimately require delayed hysteroscopy or hysterectomy, and optimal patient selection for these treatment modalities has yet to be defined precisely.^{5, 6}

Interest in optimizing the diagnosis and treatment of PAS is gaining traction, and several groups of multi-disciplinary experts and medical organizations are organizing to understand this condition better.⁶⁻⁹ One of the earliest reports of antenatal detection of the placenta accreta spectrum by imaging was published in 1982 by Tabsh and colleagues, who described a case of placenta increta identified by ultrasound.¹⁰ Ultrasound technology has progressed markedly over the last 4 decades. As controversy remains about optimal imaging and management, we aim to address contemporary questions in the roundtable discussion presented here. The moderators selected the discussants based on their active management of women with PAS and/or their international reputation as experts in PAS based on their involvement in international organizations dedicated to PAS, research, education and publications. Diversity in background,

primary professional focus and opinions were considered when selecting the panel. Questions were developed by the moderators based on questions raised formally or informally at meetings regarding PAS and as part of casual discussion amongst experts outside of formal settings. All discussants answered questions independently, reviewed all preliminary responses, and subsequently were asked for further commentary or rebuttal to the first round of answers. A second round of questions was prompted by the first-round discussion, and the same procedure for collecting responses was used. As these closely pertained to or asked for clarification on the first-round responses, the second-round responses have been incorporated into the first-round discussion that follows for purposes of flow and ease of transition. We hope that you will find the collated discussion here as robust and thought-provoking as we have done.

Questions Posed to the Panel (Figures 1-5)

1. While many referral centers report a diagnostic accuracy with ultrasound of anywhere from 80-95%, three large, population-based studies¹¹⁻¹³ have put the antenatal detection rate at only 50% or less. What is needed to raise this detection rate, since antenatal diagnosis has been shown to improve outcomes?
2. To optimize communication and comparison, attempts are being made to standardize nomenclature and/or protocols in the imaging, reporting, and management of PAS (e.g., FIGO).^{6, 14, 15} Where are we getting traction and where do you foresee obstacles? If appropriate, how do we align nomenclature across disciplines?

3. Should we continue reporting the pre-operative assessment along a classic pathologic staging of PAS (accreta, increta, percreta), or is there any advantage to moving to a surgical correlate (e.g., Low Risk for PAS, Conservative Management Possible, Hysterectomy Anticipated)?
4. How important is it to distinguish focal or occult accreta from extensive PAS, and is there an implication for standardization of terminology and implications for therapy?
5. Is there a need for standardization of short- and/or long-term follow up to conservative treatment?
6. In your experience, what have you found to be the most reliable techniques and findings in facilitating an accurate US diagnosis of PAS?
7. What is the optimal role, if any, for MRI in the pre-operative evaluation for PAS?
8. If there is a role for MRI, what are the implications for standardization in access, utilization, protocol management, and reporting?
9. How important is quality improvement in imaging for PAS? What is the ideal timing and mechanism for providing feedback to team members with results from delivery/surgery/pathology?
10. Is there a role for regionalization of care, as in the concept of Centers of Excellence?

Summary of Responses

1. While many referral centers report a diagnostic accuracy with ultrasound of anywhere from 80-95%, three large, population-based studies¹¹⁻¹³ have put the antenatal detection rate at only 50% or less. What is needed to raise this detection rate, since antenatal diagnosis has been shown to improve outcomes?

Summary

The discussants all agreed that there is a discrepancy in reports of antenatal detection of PAS, which may be, in part, due to the limitations inherent in the retrospective nature of these studies and to which types of centers and patients were included in each study, as noted by Dr. Shrivastava. All agreed that the experience of the sonographer and interpreting physician make a difference. All agreed that screening carefully for a history of prior cesarean delivery and the presence of placenta previa should prompt more detailed interrogation of the placenta and early referral as a second opinion for targeted imaging and, potentially, management and delivery.

Dr. Hobson and Dr. Einerson both stressed the need to raise collective awareness of PAS risk factors, not just among obstetricians, but also patients, family medicine and other physicians, and sonographers.

All discussants indicated the need for specialized training and education to improve diagnostic accuracy, however Prof. Palacios-Jaraquemada countered that while antenatal diagnosis is important, one cannot prevent complications of PAS by accurate diagnostic imaging alone and stressed the importance of clinical

assessment and decision-making at the time of surgery by an experienced surgeon.

Dr. Einerson also offered his hope that, while not currently clinically available, an effective serum biomarker or panel could be potentially game-changing in standardizing detection.

2. To optimize communication and comparison, attempts are being made to standardize nomenclature and/or protocols in the imaging, reporting, and management of PAS (e.g., FIGO).^{6, 14, 15} Where are we getting traction and where do you foresee obstacles? If appropriate, how do we align nomenclature across disciplines?

Summary

All discussants uniformly agreed that standardization of PAS nomenclature would be ideal in having providers and scientists worldwide speak the same language, and that the proposed FIGO guidelines^{14, 15} are a first step in the right direction.

Prof. Collins recommended using the stepwise intra-partum diagnostic criteria as outlined in the guidelines⁶ published by the International Society for Abnormally Invasive Placenta (IS-AIP; *ed. note*: now renamed the International Society for the Placenta Accreta Spectrum,⁸ or IS-PAS, to support nomenclature standardization). This was originally designed to grade clinical severity in a standardized manner for research studies and was the basis upon which the FIGO

classification system was built.¹⁴ This provides robust criteria that can be used to compare outcomes including morbidity, mortality and management success (e.g., type of surgery).

Prof. Collins and Drs. Hobson and Einerson identified that obstacles to adoption include lack of awareness of either the guidelines or the importance of using them. These can be overcome by ensuring journals are made fully aware of both the guidelines and their value, as well as disseminating guidelines to as many professional bodies as possible, such as ACOG, RCOG, ANZCOG, etc. Dr. Hobson also endorsed the importance of international consensus not only among clinicians and medical societies, but also editors and publishers, to ensure uniformity in study design and reporting.

Prof. Palacios-Jaraquemada countered that it will be important to consider that classifications created based on analysis of previously published literature may introduce bias, and that clinical validation in a large sample and agreement by all involved disciplines is required. New nomenclature is not a compulsory commitment; on the contrary, wide agreement has a higher likelihood of being accepted. Prof. Palacios-Jaraquemada and Dr. Shrivastava discussed that broad input and representation from experts who manage PAS across world regions, and who may not be as widely published as those represented by the IS-PAS and FIGO guidelines, ought to be included to help garner acceptance from front-line clinicians and scientists.

Dr. Shrivastava offered that, in addition to utilizing accepted descriptors for purposes of effective and clear communication, there may be a way to promote

standardization of the intraoperative assessment with the use of a consistent image capture digital photographic protocol. Performed in phases during the surgery, purposes could include standardization of documentation and correlation with pre-surgical imaging as a quality improvement measure.

3. Should we continue reporting the pre-operative assessment along a classic pathologic staging of PAS (accreta, increta, percreta), or is there any advantage to moving to a surgical correlate (e.g., Low Risk for PAS, Conservative Management Possible, Hysterectomy Anticipated)?

Summary

A vast majority of the discussants agreed that the use of the classic terminology “accreta, increta, or percreta,” the definitions of which were originally derived from examination of pathology specimens, is insufficient and flawed.

Dr. Einerson, Prof. Palacios-Jaraquemada and Dr. Shrivastava all pointed out that the antenatally suspected degree of invasion does not correlate well with what is identified at the time of delivery or with outcomes. They also noted that while there is the tendency to believe that the variants of PAS exist in distinct categories, in reality, any given specimen may include the full spectrum of disease; all have had cases in which, for example, one portion of the placenta separates, in another there is focal percreta and in still another, extensive accreta.

201 Dr. Shrivastava explained that much of the surgical morbidity derives from the
202 abnormal, engorged hypervascularity surrounding the uterus and placenta, which
203 may not be visible on a pathology specimen once the uterus is removed and
204 desiccated. Dr. Einerson and Dr. Jaraquemada detailed that the current system is
205 highly subjective and susceptible to confirmation bias, by which the surgeon may
206 be more likely to “confirm” what has been reported on imaging, and pathologists
207 may up- or downgrade their diagnosis based on what the surgeon has reported.
208 Additionally, if the surgeon denudes intact serosa during a case, the specimen
209 then has the pathologic appearance of percreta, when a diagnosis of increta might
210 have otherwise been more accurate.

211 All discussants agreed that reporting a descriptive antenatal staging system that is
212 highly predictive of expected surgical difficulty and that might translate into
213 consistent advice on management options is needed. As Prof. Collins noted, “all
214 imaging reports should aim to tell the operating clinician what they are going to
215 find when they open the abdomen”, as these important features will change the
216 surgical approach: How thick is the myometrium in the area of abnormality?
217 Where and to what degree is the vascularity abnormal, including at the
218 cervix/vagina? Does the abnormal focus involve the uterine artery? Is there
219 invasion into the bladder, the broad ligaments or other organs? Prof. Palacios-
220 Jaraquemada also endorsed topographical classification that describes invasion
221 and the relationship with specific arteries or pedicles, to perform better tactical
222 planning, but emphasized that no matter how descriptive the preoperative imaging
223 reports are, ultimately the surgeon must be prepared to find and control

unanticipated complexity, including from extensive adhesions. Dr. Einerson agreed that pelvic adhesive disease is the most undervalued risk factor for surgical difficulty and that it is not currently easily assessed prospectively.

Dr. Hobson countered that there may be room to keep the current nomenclature while using clear descriptions of what is seen on imaging, to allow different centers to manage PAS differently (surgically vs. conservatively), though he emphasized the importance of consistency within any one center. He also recommended that at least one member of each team both review diagnostic imaging and provide surgical management, to ensure complete continuity and provide insights that close the gaps between antenatal diagnosis, surgical findings and outcomes.

4. How important is it to distinguish focal or occult accreta from extensive PAS, and is there an implication for standardization of terminology and implications for therapy?

Summary

All panelists agreed that distinguishing between focal and extensive invasion is worthwhile, with answers ranging simply from “important” to “vitally” or “extremely important.” A recurring theme centered on ensuring appropriate planning, as those cases with extensive involvement require greater intraoperative resources and expertise, while focal accretas may be more amenable to

management with conservative or uterine-sparing techniques such as focal resection and repair.

Prof. Collins highlighted that cases of focal accreta probably make up the majority of the undiagnosed PAS cases reported in the literature. They would be classified as FIGO Grade 1 (abnormally adherent), and are less often the cases with major morbidity.

Drs. Hobson and Shrivastava stressed the importance of distinction considering that PAS represents a wide spectrum of disease and that each case requires individualized management planning. Prof. Palacios-Jaraquemada suggested that when a team standardly approaches each surgery with a wide range of treatment options available, this degree of detail in prospective reporting may not be as important, but that reporting about invasion topography with regard to arterial pedicles is essential with respect to preparation for complications or difficulty.

Dr. Einerson and Prof. Palacios-Jaraquemada commented that cases involving focal accreta are often managed differently than with extensive invasion, and emphasized that it is also not only important to assess how extensive the invasion, but whether there is deep, lower uterine or parametrial invasion, any of which is associated with greater surgical complexity than when the area of invasion occurs higher in the uterus, even if diffuse.

5. Is there a need for standardization of short- and/or long-term follow up to conservative treatment?

267

268 *Summary*

269 There was strong agreement that standardization for conservative management is
270 needed, and that there is a lack of strong evidence to inform management
271 decisions.

272 Dr. Hobson observed that, “each center seems to have a different recipe for
273 conservative management, including antibiotic use, frequency and (timing) of
274 ultrasounds, use of MRI, safe distances to reside from the hospital, advice on
275 future pregnancies, etc.”

276 Dr. Shrivastava and Prof. Palacios-Jaraquemada noted that even within the realm
277 of “conservative management,” one must specify which conservative approach is
278 being taken: 1) leaving the placenta in situ,³ 2) a single-step focal resection of
279 affected myometrium with uterine repair¹ or 3) a Triple-P² or other procedure that
280 includes the use of intravascular balloon occlusion, partial removal of unaffected
281 placenta, and partial myometrial resection and repair. Prof. Palacios-
282 Jaraquemada pointed out that the first description of successful treatment with the
283 placenta left in situ was made in 1933,¹⁶ at a time in which transfusions,
284 antibiotics, ICUs and other resources were not available.

285 It was mentioned that planned delayed hysterectomy is yet another management
286 option employed by some centers¹⁷ and highlighted that without clear guidelines,
287 scientific evaluation of conservative management will be a heterogeneous
288 collection of data points without a relevant basis for meaningful comparison;

289 importantly, an ad hoc approach to conservative management could lead to patient
290 harm without clear guidance and protocols accepted among many institutions.

291 Dr. Einerson emphasized that the frequency of visits is likely less important than
292 the standardization of patient outcomes and evaluation of the patient experience
293 with conservative versus radical surgical management.

294 The need for appropriate patient selection and intrapartum care when considering
295 conservative management was emphasized. Specifically, Prof. Collins reasoned
296 that since antepartum hemorrhage leads to increased intrapartum hemorrhage,
297 women with hemorrhage prior to delivery are not good candidates for
298 conservative management. She argued that conservative management with the
299 placenta left in situ should be done without adjuncts to hasten reabsorption, such
300 as embolization, due to risks for ischemic-reperfusion injury, necrosis and fistula
301 formation, and noted that not only is there no evidence of efficacy for
302 methotrexate, but it has been linked to maternal death in an attempt at
303 conservative management of PAS.³

- 304
- 305 6. In your experience, what have you found to be the most reliable techniques and findings
306 in facilitating an accurate US diagnosis of PAS?

307

308 *Summary*

309 This question generated perhaps the most diverse, though complementary, set of
310 answers. Universally, the discussants recommended scanning the patient with a
311 full bladder and using a combination of transabdominal and transvaginal
312 greyscale imaging. Dr. Einerson commented that the use of greyscale
313 transvaginal imaging with a partially filled bladder is perhaps the most reliable
314 and underutilized technique in patients with a low-lying placenta or placenta
315 previa, as it affords high-resolution images in the region of highest interest, where
316 surgical complexity is high.

317 Prof. Palacios-Jaraquemada commented that visualization of multiple, large and
318 irregular lacunae in combination with neovascularization at the vesico-uterine
319 interface has been shown consistently to correlate with PAS. Dr. Einerson
320 countered that in his experience, the presence of previa, myometrial thinning or an
321 imperceptible myometrium, and placental bulging toward the bladder are more
322 reliable individual signs than lacunae.

323 Prof. Collins stressed that PAS cannot be diagnosed if the bladder is empty; it
324 absolutely must be filled.¹⁸ Additionally, she remarked that there is no single
325 reliable sign, but rather all imaging findings must be put together with the
326 patient's history in order to understand what one will encounter at laparotomy.
327 She also remarked that uterine bulge indicates loss of myometrial integrity, and
328 with additional ultrasound markers indicates abnormal invasion. Without other
329 markers, such as lacunae, however, bulge as a solitary sign should be predicted to
330 indicate a uterine "window" or partial dehiscence of the uterine scar, behind
331 which placenta may be pushing, but without true invasion. Future studies are

332 forthcoming to evaluate for differentiation of placental invasion, in which the
333 placenta will not separate, from scar dehiscence, from which the placenta will
334 separate, but which may place women at risk for abruption or uterine rupture.

335 Dr. Hobson added that one should make use of all ultrasound modalities including
336 2D, color and power Doppler. Increasingly, evidence supports first and early
337 second trimester evaluation of the placenta for signs of PAS, which allows more
338 time for management planning and gives patients increased management choices.

339 Dr. Hobson also added that probe mechanics may alter visualization of the area of
340 interest. For example, if the angle of insonation is too narrow or probe pressure
341 too great, attenuation artifacts may mimic myometrial thinning; if the bladder line
342 is perpendicular to the probe, dropout may mimic loss of bladder line integrity.

343 Finally, the retroplacental space should be interrogated with color Doppler to
344 determine whether a hypoechoic zone is truly just a clear space, or dilated vessels.

345 Multiple discussants highlighted the role of referral to a specialist center for
346 imaging, should there be any uncertainty, and that placenta previa, especially in
347 women with a history of Caesarean section, warrants expert imaging.

348
349 7. What is the optimal role, if any, for MRI in the pre-operative evaluation for PAS?

350
351 *Summary*

In contrast to question 6, this question was the most contested, with clear differences of opinion among discussants. Specifically, Dr. Einerson remarked that “no one yet knows the optimal role for MRI,” and that it should be “considered investigational or experimental,” because at referral centers it performs similarly, but not superiorly, to ultrasound and costs significantly more. He notes that expert MRI evaluation of PAS is not universally available, particularly in rural or underserved communities. Additionally, he states that, like US, MRI may be misleading¹⁹, resulting in false positive or false negative results with serious consequences, such as permitting a patient to deliver outside a referral center or mistakenly deciding upon a particular delivery approach.

Prof. Jaraquemada clarified that in his view, MRI is used not for diagnosis but rather to “characterize the topography of invasion,”^{20,21} in order to provide the surgeon a map from which to plan for surgical complexity, technical difficulty and the possibility of complications. He noted that radiomic analysis of placental MRI images^{22,23} showed excellent performance potential for the risk prediction of postpartum hemorrhage. Prof. Collins agreed that MRI can be very useful for assessment of the extent of parametrial invasion.

Dr. Einerson countered that he struggles with the concept that “MRI helps with surgical planning,” as, in his opinion, transvaginal and transabdominal ultrasound answer the following critical pre-operative and surgical questions with equivalent accuracy: Where is the placenta located? Is PAS focal or diffuse? Is one side of the hysterectomy likely to be easier? Is there significant hypervascularity? Does the bladder appear distorted? While he does not use MRI routinely, or at all to

determine the presence of disease, he recognizes that it can be a useful adjunct in select cases.

Dr. Shrivastava acknowledged that recent reports of the sensitivity and specificity of MRI have proven lower than previously published, and thus limited the utility of MRI in all cases; however, he believes that there may still be a role for MRI in the evaluation of PAS, specifically given its ability to show the placental mass in whole and its relationship to the uterus and surrounding viscera.

Dr. Hobson added that, in his experience, MRI in the early 3rd trimester is “especially useful for adding information regarding posterior, broad ligament/sidewall, cervical or upper segment PAS cases – all areas that can be challenging to image with ultrasound.” Dr. Hobson’s center routinely performs MRI for all patients with any suspected PAS as both an assessment tool and a quality improvement measure. It is felt to facilitate active discussion in multidisciplinary surgical planning meetings and is incorporated into ongoing research protocols.

8. If there is a role for MRI, what are the implications for standardization in access, utilization, protocol management, and reporting?

Summary

395 Prof. Collins indicates that there is a tremendous need for standardization of
396 protocols in MRI²⁴ as currently centers have widely variable approaches that
397 make evaluation of the efficacy of MR difficult to compare across institutions.
398 The benefit of standardization was echoed by Dr. Shrivastava as well. Dr.
399 Einerson reiterated that before accepting its routine use outside of research
400 protocols, MRI in the diagnosis of PAS should be standardized, optimized and
401 proven to be beneficial and reproducible.

402 Dr. Palacios-Jaraquemada offered that technical standardization of MRI should be
403 easier than with ultrasound, especially with image acquisition techniques. He
404 noted that basic acquisition is relatively straightforward, including using an ultra-
405 fast technique, imaging with a semi-filled bladder, making scan slices not thinner
406 than 5mm to avoid artifact and false positives, and ensuring image acquisition
407 includes sequences aligned to the uterine axis. He notes that images obtained via
408 MRI allow for complete volume analysis and are easily shared when a second
409 opinion is needed; volume analysis may be analyzed by different specialists
410 independent of the acquisition method.²¹

411 Prof. Collins noted that one benefit of ultrasound is that imaging in referral
412 centers is often performed by a maternal-fetal medicine doctor who has surgical
413 experience and should understand what is needed to plan surgery.

414 Dr. Hobson highlighted that while there is easy access to high-quality MRI for
415 PAS in tertiary centers in his region (Canada), this may not be the case for more
416 regional or rural centers. Standardization of reporting would improve reporting
417 accuracy across centers, and supports the role of telehealth consultations where

expert radiologists could provide timely second opinions to other nationwide reporting centers.

9. How important is quality improvement in imaging for PAS? What is the ideal timing and mechanism for providing feedback to team members with results from delivery/surgery/pathology?

Summary

All discussants highly valued the role of quality improvement. Dr. Hobson summarized: “All centers dedicated to better outcomes for PAS disorders should be participating in ongoing quality improvement activities. These complex and resource-intense patients should have comprehensive multidisciplinary case reviews done pre- and post-operatively as there are many learning opportunities at each stage of their care. These meetings provide an ideal platform for 360-degree feedback of imaging/delivery/surgery/pathology findings and outcomes to all relevant stakeholders.”

Drs. Einerson and Shrivastava endorsed multidisciplinary planning conferences, stating that, “interdisciplinary team-based learning is key,” and that “quality improvement is critical.” Dr. Einerson recognized that quality improvement outside of referral centers may be more difficult. Missed diagnoses should ideally be communicated back to referring centers or colleagues not involved in the delivery, and while this can be difficult, if handled sensitively it is critically

important. He suggests that reporting back to outside centers might be approached through states' departments of health with a legislative mandate for reporting of misdiagnosed PAS cases.

Prof. Collins indicated that it is vital to have a joint understanding among the team members, and recommended the very straightforward approach of inviting those reporting the imaging to the operating theater, and of having those performing the surgery review the scans.

Prof. Palacios-Jaraquemada underscored that while feedback is critical to helping flatten the learning curve for teams^{25,26}, the spirit in which it is offered should be focused on finding common learning points and useful data to improve future case management, rather than on identifying mistakes or assigning blame.

10. Is there a role for regionalization of care, as in the concept of Centers of Excellence or Maternal Levels of Care?

Summary

Dr. Einerson remarked that the ACOG Levels of Maternal Care designation is a good start, but insufficient. Specifically, a level 3 or 4 hospital may have all of the technical services required of a PAS Center of Excellence but may not have the requisite expertise and volume. Conversely, limiting PAS only to centers that do more than 10 to 20 cases may introduce barriers to care for rural, and ultimately

underserve, patients. Dr. Shrivastava highlights that those centers that aim to become Centers of Excellence must have a commitment to research and data sharing regarding outcomes, to improve knowledge about how to best manage these complex patients. Profs. Collins and Palacios-Jaraquemada noted that centers with high volumes of cases are likely the only venues able to provide sufficient experience to train future PAS surgeons adequately.

Unanimously, the discussants answered that the time has come for regionalization and referral to centers with experienced, multidisciplinary teams. The role of general centers would be to screen for risk of PAS, leaving *pro formas* to the centers of expertise, where research and training should be centered. Improved outcomes have been demonstrated at centers that employ this approach, with high case volumes, and within which quality improvement, education of the next generation of providers, and collaborative research are embedded within the institutional culture. The high-risk nature of PAS dictates that outside of true emergencies, there is no room for improvisation or ad-hoc management, especially in centers that may lack vital resources, such as an onsite blood bank, neonatal critical care, adult critical care and clinical nurse specialists, all of whom play a vital role in improving outcomes for women with PAS.

Moderators' Closing Remarks

The moderators have considered that summary recommendations drawn from panel consensus could be considered. These should be viewed as aspirations in promoting safe care for women with PAS. They are to:

1. Encourage coordinated campaigns by international societies to promote increased awareness of risk factors for PAS and advocate for referral of high risk patients to specialist centers.
2. Support research into serum biomarker diagnosis of PAS.
3. Seek widespread support of and publicize standardized nomenclature and diagnostic criteria for acceptance and consistent use by international societies and journals.
4. Encourage standardization of imaging acquisition protocols and reporting of imaging findings, to include: degree and location of abnormal vascularity; degree and location of myometrial thinning; sites of invasion/bulge and their relationship to vessels/vascular pedicles. Emphasize anatomy over the pathologic labels 'accreta/increta/percreta'. Attempt to distinguish focal from extensive PAS.
5. Support standardization of protocols for conservative management of PAS with clear and consistent patient selection criteria.

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572 Figure Legends

573 Fig 1. Prof. Sally Collins serves as the Vice President of the International Society of the Placenta
574 Accreta Spectrum (IS-PAS) and has authored multiple publications including original scientific
575 research and international evidence-based guidelines (IS-PAS, RCOG, FIGO) regarding imaging
576 and management of PAS. <https://www.wrh.ox.ac.uk/team/sally-collins>

577

578 Fig. 2. Dr. Brett Einerson is an Assistant Professor of Maternal-Fetal Medicine at the University
579 of Utah. He is a founding member of the Pan-American Society for the Placenta Accreta
580 Spectrum (PAS²) and has published original research regarding imaging and management of
581 PAS.

582 <https://healthcare.utah.edu/fad/mddetail.php?physicianID=u6001067&name=brett-einerson>

583

584 Fig 3. Sebastian Hobson is an Assistant Professor of Maternal-Fetal Medicine at Mount Sinai
585 Hospital in Toronto, CA, and a key member of the busy PAS Team there. He is the primary
586 author of the most recent Society of Obstetricians and Gynaecologists of Canada Practice
587 Guideline for the Screening, Diagnosis and Management of Placenta Accreta Spectrum
588 Disorders and lectures internationally regarding PAS.

589 <https://www.obgyn.utoronto.ca/faculty/sebastian-hobson>

590

591 Fig 4. Dr. Jose Palacios-Jaraquemada is a Professor of Anatomy and Head of the Department of
592 the School of Medicine and Associate member of the Department of Obstetrics and Gynecology,
593 CEMIC, University Hospital in Buenos Aires, Argentina. He has published multiple original
594 research manuscripts dedicated to sonographic and magnetic resonance imaging of the placenta

and surgical techniques for PAS and lectures world-wide. He specializes in the uterine-sparing resective technique for PAS.

<https://orcid.org/0000-0002-5240-5320>

Fig 5. Dr. Vineet Shrivastava serves as Vice Chair of the Department of Obstetrics & Gynecology at MemorialCare Miller Women's & Children's Hospital Long Beach. He is a key member of the Placenta Accreta Spectrum Team, is a member of the Pan-American Society for the Placenta Accreta Spectrum (PAS2) and has a long-standing interest in antenatal detection of PAS.

AUTHORS PHOTO CAPTIONS:

Dr. Fox is an Associate Professor of Maternal-Fetal Medicine at Baylor College of Medicine in Houston, TX whose primary clinical and research interests include PAS and hemorrhage. She is a member of the International Society for the Placenta Accreta Spectrum and a founding member of the Pan-American Society for the Placenta Accreta Spectrum and has provided lectures and webinars internationally covering various aspects of PAS.

Dr. Christopher Cassady has served as the lead member of the Texas Children's Hospital and Baylor College of Medicine Radiology Department and senior Magnetic Resonance placental imaging expert.