

Geographic variation in management of patients with placenta accreta spectrum: An international survey of experts (GPASS)

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Abstract

Objective

To describe global geographic variations in the diagnosis and management of placenta accreta spectrum (PAS).

Methods

An international cross-sectional study was conducted among PAS experts practicing at medical institutions in member states of the United Nations. Survey questions focused on diagnostic evaluation and management strategies for PAS.

Results

A total of 134 centers participated. Participating centers represented each of the United Nations' designated regions. Of those, 118 (88%) reported practicing in a medium-volume or high-volume center. First-trimester PAS screen was reported in 35 (26.1%) centers. Respondents consistently implement guideline-supported care practices, including utilization of ultrasound as the primary diagnostic modality (134, 100%) and implementation of multidisciplinary care teams (115, 85.8%). Less than 10% of respondents reported routinely managing PAS without hysterectomy; these centers were predominantly located in Europe and Africa. Antepartum management and availability of mental health support for PAS patients varied widely.

Conclusion

Worldwide, there is a strong adherence to PAS care guidelines; however, regional variations do exist. Comparing variations in care to outcomes will provide insight into the clinically significant practice variability.

Synopsis

This international study sought to determine the geographic variations in diagnosis and management of placenta accreta spectrum worldwide.

KEYWORDS: cesarean hysterectomy, geographic variation in care, placenta accreta spectrum, prenatal diagnosis

1 INTRODUCTION

The increasing rate of cesarean deliveries worldwide has resulted in a marked rise in the incidence of placenta accreta spectrum (PAS) and accompanying maternal morbidity.¹ Among patients with prior cesarean deliveries, the USA has seen a 30% increase in the incidence of PAS from 2001 to 2011.² In Latin America and the Caribbean, following a

nearly 10-fold increase in the cesarean delivery rate over the past two decades, experts predict a significant rise in the rate PAS.^{1,3}

The risks of PAS are well documented; including, maternal hemorrhage, maternal transfusion, cesarean hysterectomy and need for critical care services.⁴⁻⁶ Antenatal diagnosis of PAS is key; allowing for appropriate mobilization of resources and optimizing maternal outcomes.^{5,7} Multidisciplinary PAS care has gained much recognition in recent years and is considered the standard in PAS management in many regions of the world.^{5,8-10}

Due to constraints in healthcare access and regional care differences, wide variations in PAS care worldwide are likely. The healthcare systems of resource-dense nations may operate under different guidelines and expectations than those of resource-deficient areas. Even between economically equivalent nations, there are fundamentally divergent approaches to PAS care.¹¹ Given the paucity of data on global PAS care, we conducted the Global Placenta Accreta Spectrum Survey (GPASS) study. Our primary objective was to describe the geographic variations in PAS care worldwide, with a particular focus on diagnosis and management.

2 MATERIALS AND METHODS

The study was conducted during the first 6 weeks of 2021. An online survey invitation was sent to 250 PAS experts from centers located in North America, Latin America, South America, Europe, Asia, Africa, and Oceania. PAS centers were defined as meeting either of the following criteria: (1) the institution self-identified as a center of excellence in the care of PAS and/or has a designated team for PAS care or (2) the institution receives a significant number of regional referrals for PAS. They were identified using the following methods: (1) Google[®] search pairing the names of countries represented in the United Nations with the following terms; “placenta accreta spectrum,” “increta,” “percreta,” “accreta center,” “placental disorders,” “abnormally invasive placenta,” “morbidly adherent placenta,” and “cesarean hysterectomy”; (2) PubMed.gov search for centers that had published a PAS-related manuscript over the past 10 years; and (3) the author list provided lists of additional centers based on local/regional databases and regional knowledge, and also confirmed previously identified centers.¹² Countries were grouped by both geographic and ethno-cultural considerations as defined by the United Nations geoscheme.¹³

A survey tool was developed to assess PAS practice patterns worldwide. The survey questions were assessed for geographic application and reviewed for face validity by regional experts. The survey was distributed using the electronic data capture software REDCap and consisted of a maximum of 66 questions, based on branching logic from the previously reported questions^{14,15} (Appendix S1). Diagnostic questions focused on the use of ultrasound imaging and magnetic resonance imaging. Management questions involved use of multidisciplinary care teams, antepartum management, surgical treatment strategies, and postpartum care.

All participants were approached via email and provided with a personalized link to the survey. Email reminders were sent weekly for a period of 6 weeks. Additional outreach occurred by regional experts to maximize participation. Completion of the survey was interpreted as consent to participate in the study. Contacts who did not complete the survey by the end of the study period were deemed non-responses.

Data are presented as number (percentage) and stratified by geographic region. The study was determined to not meet the criteria of human subject research by the institutional review board at Beth Israel Deaconess Medical Center, Boston, MA, USA.

3 RESULTS

3.1 Participants and centers

The survey was distributed to 250 identified PAS centers, with a 54.4% (136) response rate. Of the 136 participants who responded, 62 were from Latin & South America (45.6%), 24 from Europe (17.6%), 21 from the USA & Canada (15.4%), 15 from Southern, Eastern & Southeastern Asia (11.0%), six from Africa (4.4%), four from Oceania (3.0%), and four from Western & Central Asia (3.0%) (Appendix S2). Two of the centers (both from Latin & South America) were excluded from the analysis because they reported not routinely caring for PAS at their institution, resulting in a total of 134 participants (53.6%) (Figure 1). Figure 1 also reports response rates stratified by region. Two-thirds of centers (89, 66.4%) reported between 5 and 30 cases annually, whereas 17 (12.7%) reported caring for over 50 cases per year (Figure 2).

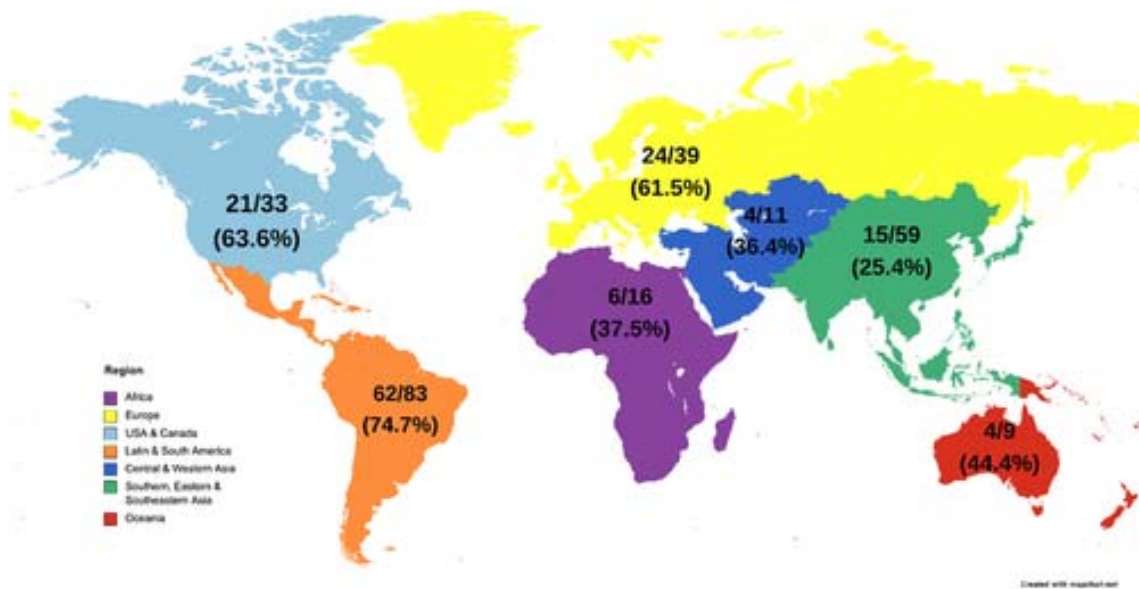


FIGURE 1. Survey response rate by region. Data are displayed as completed surveys / surveys sent (% completed)

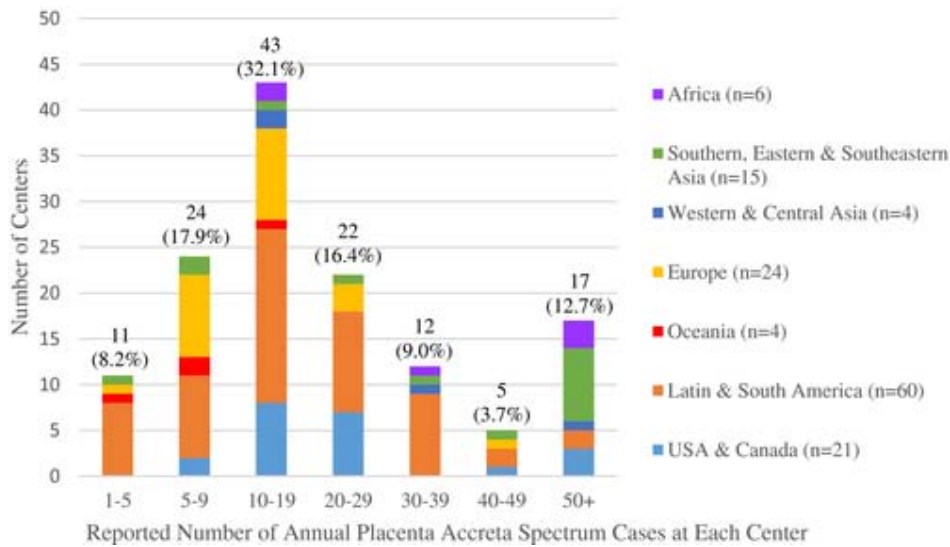


FIGURE 2. Reported number of annual placenta accreta spectrum cases at each center

3.2 Prenatal diagnosis of PAS

All participating centers reported the use of ultrasound for the diagnosis of PAS. Ultrasound was the sole imaging modality used in 83 (61.9%) of centers; the remainder used both ultrasound and magnetic resonance imaging. Six (4.5%) centers reported using serum markers for PAS; specifically α -fetoprotein, pregnancy-associated plasma protein A, and human chorionic gonadotropin, as an adjunct to imaging to further assist with diagnosis. Screening for PAS in the first trimester was reported by 35 (26.1%) of respondents, these centers were predominantly concentrated in the USA & Canada, Europe, and Oceania. The majority of centers (78, 58.2%) reported routinely screening for PAS in the second trimester in at-risk patients.

In cases with prenatal suspicion, multidisciplinary care teams were used by 115 (85.8%) of centers. Across all regions, the most common specialties involved in every case included maternal-fetal medicine (109, 94.8%), prenatal imaging/radiology (91, 79.1%), obstetrical anesthesiology (82, 71.3%), and transfusion medicine (77, 67.0%). On a case-by-case basis, roughly half included urology (65, 56.5%) and critical care medicine (53, 46.1%). General surgery was routinely part of the care team in Latin & South America (22, 46.8%) and Africa (2, 40%). The variability of disciplines routinely used for the management of PAS are presented in Table 1.

TABLE 1. Multidisciplinary care team composition^a

	USA & Canada (n = 21)	Latin & South America (n = 60)	Oceania (n = 4)	Europe (n = 24)	Western & Central Asia (n = 4)	Southern, Eastern & Southeastern Asia (n = 15)	Africa (n = 6)
Multidisciplinary PAS care team utilized	21 (100.0)	47 (78.3)	3 (75.0)	21 (87.5)	4 (100.0)	14 (93.3)	5 (83.3)
Specialties used each case							
Prenatal Imaging/radiology	20 (95.2)	36 (76.6)	3 (100.00)	17 (81.0)	4 (100.0)	9 (64.3)	2 (40.0)
Maternal-fetal medicine	21 (100.0)	44 (93.6)	2 (66.7)	21 (100.0)	4 (100.0)	13 (92.9)	4 (80.0)
Obstetrics	3 (14.3)	33 (70.2)	3 (100.0)	14 (66.7)	1 (25.0)	9 (64.3)	3 (60.0)
Obstetrical anesthesiology	21 (100.0)	26 (55.3)	3 (100.0)	19 (90.5)	2 (50.0)	9 (64.3)	2 (40.0)
Anesthesiology	3 (14.3)	25 (53.2)	1 (33.3)	3 (14.3)	2 (50.0)	11 (78.6)	3 (60.0)
Gynecology/oncology	11 (52.4)	12 (25.5)	0 (0.0)	12 (57.1)	2 (50.0)	5 (35.7)	1 (20.0)
General surgery	0 (0.0)	22 (46.8)	0 (0.0)	0 (0.0)	0 (0.0)	1 (7.1)	2 (40.0)
Interventional radiology	6 (28.6)	11 (23.4)	1 (33.3)	12 (57.1)	1 (25.0)	5 (35.7)	1 (20.0)
Urology	3 (14.3)	34 (72.3)	1 (33.3)	6 (28.6)	3 (75.0)	8 (57.1)	3 (60.0)
Vascular surgery/trauma surgery	1 (4.8)	10 (21.3)	0 (0.0)	4 (19.0)	1 (25.0)	4 (28.6)	1 (20.0)
Critical care medicine	4 (19.0)	37 (78.7)	1 (33.3)	5 (23.8)	2 (50.0)	6 (42.9)	3 (60.0)
Transfusion medicine	15 (71.4)	32 (68.1)	2 (66.7)	13 (61.9)	3 (75.0)	11 (78.6)	1 (20.0)
Mental health/social work	11 (52.4)	13 (27.7)	1 (33.3)	10 (47.6)	3 (75.0)	1 (7.1)	0 (0.0)
Other	2 (9.5)	2 (4.3)	0 (0.0)	2 (9.5)	0 (0.0)	1 (7.1)	0 (0.0)
Specialties used case-by-case							
Prenatal imaging/radiology	0 (0.0)	18 (38.3)	1 (33.3)	5 (23.8)	2 (50.0)	6 (42.9)	3 (60.0)
Maternal-fetal medicine	0 (0.0)	22 (46.8)	2 (66.7)	2 (9.5)	2 (50.0)	9 (64.3)	3 (60.0)
Obstetrics	2 (9.5)	18 (38.3)	1 (33.3)	2 (9.5)	0 (0.0)	6 (42.9)	3 (60.0)
Obstetrical anesthesiology	0 (0.0)	13 (27.7)	1 (33.3)	2 (9.5)	1 (25.0)	6 (42.9)	2 (40.0)
Anesthesia	2 (9.5)	14 (29.8)	0 (0.0)	1 (4.8)	1 (25.0)	8 (57.1)	1 (20.0)
Gynecology/oncology	8 (38.1)	13 (27.7)	3 (100.0)	4 (19.0)	2 (50.0)	7 (50.0)	2 (40.0)

	USA & Canada (n = 21)	Latin & South America (n = 60)	Oceania (n = 4)	Europe (n = 24)	Western & Central Asia (n = 4)	Southern, Eastern & Southeastern Asia (n = 15)	Africa (n = 6)
General surgery	6 (28.6)	15 (31.9)	2 (66.7)	3 (14.3)	1 (25.0)	5 (35.7)	1 (20.0)
Interventional radiology	13 (61.9)	12 (25.5)	1 (33.3)	5 (23.8)	3 (75.0)	9 (64.3)	3 (60.0)
Urology	15 (71.4)	19 (40.0)	1 (33.3)	13 (61.9)	2 (50.0)	11 (78.6)	4 (80.0)
Vascular surgery/trauma surgery	10 (47.6)	12 (25.5)	2 (66.7)	7 (33.3)	3 (75.0)	8 (57.1)	2 (40.0)
Critical care medicine	12 (57.1)	20 (42.6)	1 (33.3)	5 (23.8)	2 (50.0)	9 (64.3)	4 (80.0)
Transfusion medicine	2 (9.5)	17 (36.2)	0 (0.0)	5 (23.8)	1 (25.0)	9 (64.3)	3 (60.0)
Mental health/social work	6 (28.6)	13 (27.7)	1 (33.3)	2 (9.5)	1 (25.0)	1 (7.1)	0 (0.0)
Other	0 (0.0)	2 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (7.1)	0 (0.0)

Abbreviation: PAS, placenta accreta spectrum.

^a Data presented as number (percentage). Participants could choose more than one option so responses do not sum to 100%.

3.3 Antepartum management

Respondents regularly recommended pelvic rest (refraining from placing anything in the vagina) for those with PAS with previa (105, 78.4%); but less frequently in patients without previa (39, 29.1%). On the matter of antenatal hospitalization of women with PAS and previa, respondents were split; 69 (51.5%) recommended routine hospitalization but 61 (45.5%) did not. For PAS patients without previa, 83 (61.9%) of the centers did not recommend an inpatient stay before delivery. A majority (129, 96.3%) of centers attempted to optimize blood counts before delivery. Both oral and intravenous iron supplementation were routinely used—103 (79.8%) and 84 (65.1%), respectively. About half of centers reported using antenatal blood transfusion (67, 51.9%), whereas 12 (9.3%) reported using erythropoietin.

A quarter of the respondents reported routinely using a fetal lung maturity test as a guide to delivery timing. This practice was reported by 27 (45.0%) of Latin & South American centers. If a delivery was scheduled before 34 weeks of pregnancy, centers almost unanimously (133, 99.3%) recommended antenatal corticosteroids for fetal lung maturity; this practice was commonly (86, 64.2%) reported in planned deliveries between 34 and 37 weeks of pregnancy.

3.4 Delivery and surgical management

On most metrics, a majority of centers followed similar protocols when it came to routine surgical management of PAS (Table 2). During a cesarean delivery with suspected PAS, respondents reported that a vertical midline skin incision was routinely performed. A fundal uterine incision was the predominant hysterotomy used in the setting of previa (56, 41.8%), whereas in the absence of previa, a low-transverse uterine incision was the most common approach (40, 29.9%). Regardless of whether previa was present, over 75% of centers did not attempt to remove the placenta if PAS was confirmed intraoperatively (115, 85.8% with previa and 105, 78.4% without previa). A slim majority (78, 58.2% with previa and 77, 57.5% without previa) of centers reported intraoperative FIGO grading.

In the presence of previa, 98 (73.1%) reported proceeding with planned hysterectomy at time of delivery, whereas 8 (6.0%) reported expectant management (leaving the placenta in utero), 13 (9.7%) reported en-bloc resection (surgical resection of placenta with primary repair of defect), and 1 (0.7%) reported delayed hysterectomy. There was little geographic variability among these responses, but expectant management was more generally practiced in Europe and Africa. In the absence of previa, hysterectomy remained the predominant management technique (84, 62.7%), followed by en-bloc resection (19, 14.2%). Vascular occlusive devices were not commonly used in the absence of previa. (Appendix S3).

In the event of PAS being discovered after a vaginal delivery, 51 (38.1%) respondents indicated that they recommend expectant management if the patient requested uterine preservation. Other responses included treatment with methotrexate (15, 11.2%) or immediate hysterotomy with resection (12, 9.0%). If uterine preservation was not requested, centers proceeded with immediate hysterectomy (65, 48.5%) or expectant management (22, 16.4%).

Cesarean delivery was commonly recommended for PAS patients (112, 83.6%) in the absence of a placenta previa. Delivery was predominantly performed under regional

TABLE 2. Routine surgical management of PAS with previa^a

	USA & Canada (n = 21)	Latin & South America (n = 60)	Oceania (n = 4)	Europe (n = 24)	Western & Central Asia (n = 4)	Southern, Eastern & Southeastern Asia (n = 15)	Africa (n = 6)
If PAS is confirmed intraoperatively, is there routinely an attempt to remove the placenta?							
Yes	0 (0.0)	6 (10.0)	0 (0.0)	1 (4.2)	0 (0.0)	6 (40.0)	3 (50.0)
If PAS is confirmed intraoperatively, is FIGO grading performed?							
Yes	6 (28.6)	38 (63.3)	1 (25.0)	14 (58.3)	3 (75.0)	12 (80.0)	4 (66.7)
Are preoperative vascular occlusion devices used?							
Yes	3 (14.3)	5 (8.3)	0 (0.0)	4 (16.7)	0 (0.0)	3 (20.0)	0 (0.0)
No	17 (81.0)	50 (83.3)	4 (100.0)	17 (70.8)	4 (100.0)	10 (66.7)	6 (100.0)
Are intraoperative vascular occlusion devices used?							
Yes	3 (14.3)	6 (10.0)	0 (0.0)	3 (12.5)	0 (0.0)	2 (13.3)	1 (16.7)
No	17 (81.0)	51 (85.0)	4 (100.0)	20 (83.3)	4 (100.0)	8 (53.3)	5 (83.3)
Are preoperative ureteral stents/catheters used?							
Yes	10 (47.6)	23 (38.3)	2 (50.0)	3 (12.5)	3 (75.0)	1 (6.7)	0 (0.0)
No	10 (47.6)	34 (56.7)	2 (50.0)	20 (83.3)	1 (25.0)	12 (80.0)	6 (100.0)
Surgical skin incision							
Vertical midline	18 (85.7)	41 (68.3)	1 (25.0)	13 (54.2)	3 (75.0)	11 (73.3)	3 (50.0)
Pfannenstiel	2 (9.5)	10 (16.7)	1 (25.0)	9 (29.2)	1 (25.0)	3 (20.0)	3 (50.0)
Maylard	0 (0.0)	3 (5.0)	1 (25.0)	1 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)
Cherney	0 (0.0)	2 (3.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Other	0 (0.0)	4 (6.7)	1 (25.0)	3 (12.5)	0 (0.0)	1 (6.7)	0 (0.0)
Missing	1 (4.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Uterine incision							
Low transverse	0 (0.0)	2 (5.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (13.3)	1 (16.7)
High transverse	2 (9.5)	9 (15.0)	0 (0.0)	6 (25.0)	0 (0.0)	8 (53.3)	3 (50.0)

	USA & Canada (n = 21)	Latin & South America (n = 60)	Oceania (n = 4)	Europe (n = 24)	Western & Central Asia (n = 4)	Southern, Eastern & Southeastern Asia (n = 15)	Africa (n = 6)
Classical	7 (33.3)	8 (13.3)	3 (75.0)	3 (12.5)	3 (75.0)	1 (6.7)	1 (16.7)
Fundal	10 (47.6)	32 (53.3)	0 (0.0)	10 (41.7)	0 (0.0)	3 (20.0)	1 (16.7)
Other	2 (9.5)	8 (13.3)	1 (25.0)	5 (20.8)	1 (25.0)	1 (6.7)	0 (0.0)
Missing	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Abbreviations: FIGO, the International Federation of Gynecology & Obstetrics; PAS, placenta accreta spectrum.

^a Data are presented as number (percentage).

anesthesia with conversion to general anesthesia if clinically indicated. In the event that PAS was undiagnosed before delivery, respondents were split on how best to proceed; 60 (44.8%) centers opted for immediate management by the surgical team present, whereas 58 (43.3%) reported an intraoperative consultation by a PAS specialist; 8 (6.0%) of respondents would request consultation from a provider outside the designated PAS care team.

3.5 Postpartum

Recovery and postpartum practices varied. Patients who underwent a hysterectomy most often recovered in the intensive care unit (56, 41.8%). This practice was most common in Latin & South America (34, 56.7%), Oceania (3, 75.0%), and Southern, Eastern & Southeastern Asia (7, 46.7%). Centers in the USA & Canada regularly had patients recover on the labor and delivery unit (10, 47.6%). The majority of centers (86, 64.2%) reported that patients remain admitted for 4–5 days after a PAS delivery. The majority of respondents offered postpartum mental health support to patients with PAS (77, 57.5%). This practice was prevalent in the USA & Canada, Latin & South America, Oceania, and Europe, but rare elsewhere.

4 DISCUSSION

The central aim of the present study was to report the geographic variation in obstetrical diagnosis and management of PAS worldwide. The results illustrate a diverse approach among PAS care professionals practicing in every corner of the globe. Guidelines themselves vary across region, contributing to care variations.¹⁶ Reassuringly, the results highlight strong and consistent adherence to many evidence-based guidelines and recommendations, despite differences in resources and guidance geographically.^{5, 9, 10, 17, 18} One specific example of this is the unanimous use of ultrasound as the primary imaging modality among respondents, as it is the recommended diagnostic tool for PAS in every PAS guideline available.^{10, 17, 19}

Since its introduction in 1996, multidisciplinary care has become the mainstay in PAS care with improved maternal outcomes.^{8, 20, 21} Our study found 85.8% of surveyed centers employ multidisciplinary care teams. This practice has been adopted by all respondents in the USA & Canada as well those in Western & Central Asia. For reasons likely related to resource/personnel availability or lack of prenatal diagnosis, rather than aversion to a multidisciplinary care model, the use of multidisciplinary care teams in other surveyed regions was not universally reported.

Respondents were divided on antenatal hospitalization for patients with PAS and placenta previa. A 2019 report by International Society for Placenta Accreta Spectrum (IS-PAS) states that there is no conclusive evidence supporting the practice of routine inpatient management of patients with PAS who are asymptomatic. Expectant outpatient management is safe and acceptable as long as the patient is counseled and resources are in place for emergent hospitalization if needed.⁹ We suspect the availability of resources is what predominantly drives the regional variations reported in this practice; however, other factors that include, but are not limited to, other co-morbidities, history of preterm birth, family constraints, and physical distance between the place of residence and hospital, likely play a role in the practice.

Most centers use regional anesthesia at delivery with conversion to general anesthesia if clinically appropriate. This practice is consistent with a 2019 Society of Obstetricians and

Gynaecologists of Canada guideline.¹⁰ The practice of employing vascular occlusion devices and/or ureteric stents in cases of PAS remains variable.^{9, 22, 23} The use of prophylactic vascular occlusion balloons to prevent postpartum hemorrhage at delivery has not been shown to consistently decrease blood loss, and may exacerbate the bleeding they are trying to avoid.⁹ Given the inconsistencies in the data, the routine use of prophylactic ureteric stents is not recommended and should be reviewed on a case-by-case basis.^{5, 9, 22}

The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine suggest that the optimal skin incision should be determined on a case-by-case basis.⁵ The IS-PAS has determined that vertical midline skin incisions are generally recommended, although they acknowledge no discernible benefit to using a particular method of skin incision in patients with suspected PAS.⁹ Although there is no preferred uterine incision, guidelines overwhelmingly recommend avoiding the placenta at time of hysterotomy.^{5, 9} The majority of respondents reported following this approach.

PAS often results in preterm birth, most often driven by antepartum hemorrhage or as a planned late term delivery.²⁴ As such, respondents across all regions follow guidelines to administer corticosteroids if delivery is scheduled before 34 weeks of pregnancy. Two-thirds of centers extend this recommendation to patients delivering between 34 and 37 weeks of pregnancy.^{5, 9, 10, 25} A small proportion of centers reported corticosteroid administration beyond 37 weeks of pregnancy.

Among the most debated management strategies is the decision to proceed with hysterectomy versus uterine-sparing techniques. The Society for Maternal-Fetal Medicine and American College of Obstetricians and Gynecologists state that hysterectomy is the recommended treatment in the absence of extenuating circumstances, leaving expectant management for carefully selected cases.⁵ However, the IS-PAS support alternative management techniques including expectant management, en-bloc resection, or immediate hysterectomy.⁹ All three groups recommend against the use of methotrexate, a practice seldomly reported in the present study.^{5, 9}

The present study has many strengths. First, we conducted a robust search for PAS centers worldwide and cross-referenced those centers with international experts, ensuring that we identified as many PAS centers as possible. Second, given the geographic diversity of our expert author panel we ensured that questions would be appropriately interpreted irrespective of geographic location. Third, we had a nearly 55% response rate, ensuring adequate input from geographically diverse centers. However, the present study does have its limitations. Despite our best efforts, it is likely that not all centers were captured by our methodology, most notably, it is quite possible a center was not identified if it did not have an online footprint. We attempted to remedy this by having input from our panel of experts; however, this too has inherent limitations. In addition, centers in Africa, Oceania, and Asia were disproportionately underrepresented relative to population, which may affect the generalizability of practice patterns in these regions. Yet, despite this, we did receive responses from all regions and believe the present study to be the first to present such a breadth of PAS practice patterns. A 2017 survey also assessing PAS practice patterns drew heavily from experts practicing in Europe and Asia; only 15% of 36 respondents practiced elsewhere.¹¹ In addition, our survey asked questions about general practice patterns; as such, we were unable to report on the specific details of PAS cases, including; patient characteristics, adherence to guidelines, or outcomes. Lastly, inherent to survey studies,

despite defining PAS in the survey, respondents interpreted each question as it applied to their center, affecting the generalizability of the results.

To conclude, we present the geographic variations in PAS care worldwide. There is an overwhelming consistency of strong adherence to many existing PAS care guidelines, with some local practices demonstrating clear deviations. The variability of PAS care across geographic regions is indicative of the need for further research into diagnostic and management strategies to better solidify care norms and establish robust evidence-based guidelines.

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CONFLICTS OF INTEREST

AMM and SAS receive salary and research support from the Charles Koch Foundation. All other authors have no conflicts of interest to declare.

AUTHOR CONTRIBUTIONS

The study was designed by ADB, JMH, AMM, PEH, AMA, AJNC, AB, BL, CD, JPJ, LS, PSP, RAA, SH, SW, AAS, and SAS; it was planned by ADB, JMH, AMM, AAS, and SAS and conducted by ADB, JMH, AMM, and SAS. Data were analyzed by ADB, JMH, AMM, and SAS. All authors contributed to writing the manuscript.

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