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Changing trends in perinatal outcomes of placenta accreta spectrum: a comparative analysis of cesarean hysterectomy cases in Southern Iran over a decade

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Abstract

Background Placenta accreta spectrum (PAS) is a severe obstetric condition associated with substantial maternal and neonatal morbidity. This study aimed to evaluate a five-year experience of PAS management in a tertiary referral center and compare outcomes with those from a preceding five-year period.

Method this retrospective cohort study was conducted at hospitals affiliated with Shiraz University of Medical Sciences, a tertiary referral center in southern Iran. Pregnant women diagnosed with PAS between January 2020 and December 2024, compared with a historical cohort from January 2015 to December 2019. Clinical and operative data of PAS cases were reviewed. Maternal morbidity and mortality were defined as primary outcomes, while operative characteristics, intraoperative complications, and neonatal outcomes were secondary outcomes. Statistical analyses were performed using SPSS software, with Mann–Whitney and Chi-square tests applied for inter-period comparisons. Maternal morbidity and mortality, operative blood loss, intraoperative complications, gestational age at diagnosis and delivery, and neonatal outcomes were assessed.

Results Of 325 PAS cases, 300 women underwent hysterectomy and were included in the analysis. The mean gestational age at operation was 31.16 ± 6.16 weeks, and 97% had a prior cesarean section. PAS was diagnosed before 14 weeks in 5%, between 14 and 28 weeks in 41%, and after 28 weeks in 54% of cases. Emergency surgery was required in 18.3%. Mean intraoperative blood loss was 2119.76 ± 1612.93 mL and was significantly higher in placenta percreta ($p < 0.001$). Bladder injury occurred in 23%, and 79% required packed cell transfusion. Neonatal survival was 83.7%, with 74.7% admitted to the NICU. Compared with the earlier cohort, gestational age at diagnosis was significantly earlier, hospital stay was shorter, and fifth-minute Apgar scores were higher (all $p < 0.001$).

Conclusions Enhanced prenatal diagnosis and multidisciplinary management have improved maternal and neonatal outcomes in PAS over recent years.

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cesarean section rate and enhanced diagnostic vigilance, these advances have translated into safer and more controlled management. Continued emphasis on early recognition, referral to experienced centers, and protocol-driven multidisciplinary care remains essential to further improve maternal and neonatal outcomes in PAS.

Abbreviations

CS	Cesarean section
D&C	Dilation and curettage
GA	Gestational Age
ICU	Intensive care unit
NICU	Neonatal intensive care unit
PAS	Placenta accreta spectrum
PRBC	Packed red blood cells
SD	Standard deviation
SUMS	Shiraz University of Medical Sciences

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Authors' contributions

Sh.MA, HB, FSH, HV, NA, AH: concept and design. ZSP, KhB, ZO: Acquisition of data. FA: Pathologic evaluation. AMK: statistical Analysis. All authors contribute in writing and editing the draft. All authors approved the final version.

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Data availability

All data analyzed during this study are included in this published article.

Declarations

Ethical approval and consent to participate

The study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences (Approval code: IR.SUMS.MED.REC.1403.454) and was conducted in accordance with the principles of the Declaration of Helsinki.

Consent for publication

All participants provided consent for anonymous publication of their data.

Competing interests

The authors declare no competing interests.

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References

- Han X, Guo Z, Yang X, Yang H, Ma J. Association of placenta previa with severe maternal morbidity among patients with placenta accreta spectrum disorder. *JAMA Netw open*. 2022;5(8):e2228002–e.

- Piñas Carrillo A, Chandraran E. Placenta accreta spectrum: Risk factors, diagnosis and management with special reference to the Triple P procedure. *Womens Health (Lond)*. 2019;15:1745506519878081.
- Lu T, Li H, Wang L, Li M, Wang Y. Impact of placental location matter in placenta accreta spectrum disorders. *Quant Imaging Med Surg*. 2024;14(12):9086.
- Silver RM, Landon MB, Rouse DJ, Leveno KJ, Spong CY, Thom EA, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. *Obstet Gynecol*. 2006;107(6):1226–32.
- Betran AP, Ye J, Moller A-B, Souza JP, Zhang J. Trends and projections of caesarean section rates: global and regional estimates. *BMJ global health*. 2021;6(6):e005671.
- Maged AM, El-Mazny A, Kamal N, Mahmoud SI, Fouad M, El-Nassery N, et al. Diagnostic accuracy of ultrasound in the diagnosis of Placenta accreta spectrum: systematic review and meta-analysis. *BMC Pregnancy Childbirth*. 2023;23(1):354.
- Cahill A, Beigi R, Heine P. Placenta accreta spectrum. *Obstetric care consensus* 7. American college of obstetricians and gynecologists. *Obstet Gynecol*. 2018;132:e259–75.
- Tikkanen M, Paavonen J, Loukovaara M, Stefanovic V. Antenatal diagnosis of placenta accreta leads to reduced blood loss. *Acta Obstet Gynecol Scand*. 2011;90(10):1140–6.
- Warshak CR, Ramos GA, Eskander R, Benirschke K, Saenz CC, Kelly TF, et al. Effect of predelivery diagnosis in 99 consecutive cases of placenta accreta. *Obstet Gynecol*. 2010;115(1):65–9.
- Eller AG, Bennett MA, Sharshiner M, Masheter C, Soisson AP, Dodson M, et al. Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team compared with standard obstetric care. *Obstet Gynecol*. 2011;117(2 Part 1):331–7.
- Kasraeian M, Hashemi A, Hessami K, Alamdarloo SM, Vahdani R, Vafaei H, et al. A 5-year experience on perinatal outcome of placenta accreta spectrum disorder managed by cesarean hysterectomy in southern Iranian women. *BMC Womens Health*. 2021;21(1):243.
- Tinari S, Buca D, Cali G, Timor-Tritsch I, Palacios-Jaraquemada J, Rizzo G, et al. Risk factors, histopathology and diagnostic accuracy in posterior placenta accreta spectrum disorders: systematic review and meta-analysis. *Ultrasound Obstet Gynecol*. 2021;57(6):903–9.
- Jauniaux E, Collins S, Burton GJ. Placenta accreta spectrum: pathophysiology and evidence-based anatomy for prenatal ultrasound imaging. *Am J Obstet Gynecol*. 2018;218(1):75–87.
- Silver RM, Fox KA, Barton JR, Abuhamad AZ, Simhan H, Huls CK, et al. Center of excellence for placenta accreta. *Am J Obstet Gynecol*. 2015;212(5):561–8.
- Tantibirojn P, Crum C, Parast M. Pathophysiology of placenta creta: the role of decidua and extravillous trophoblast. *Placenta*. 2008;29(7):639–45.
- Lucidi A, Janiaux E, Hussein AM, Nieto-Calvache A, Khalil A, D'Amico A, et al. Emergency delivery in pregnancies at high probability of placenta accreta spectrum on prenatal imaging: a systematic review and meta-analysis. *Am J Obstet Gynecol MFM*. 2024;6(10):101432.
- Al-Khan A, Gupta V, Illsley NP, Mannion C, Koenig C, Bogomol A, et al. Maternal and fetal outcomes in placenta accreta after institution of team-managed care. *Reproductive Sci*. 2014;21(6):761–71.
- Schwicker A, van Beekhuizen HJ, Bertholdt C, Fox KA, Kayem G, Morel O, et al. Association of peripartum management and high maternal blood loss at cesarean delivery for placenta accreta spectrum (PAS): a multinational database study. *Acta Obstet Gynecol Scand*. 2021;100:29–40.
- Mehrabadi A, Hutcheon JA, Liu S, Bartholomew S, Kramer MS, Liston RM, et al. Contribution of placenta accreta to the incidence of postpartum hemorrhage and severe postpartum hemorrhage. *Obstet Gynecol*. 2015;125(4):814–21.
- Lim G, Horowitz JM, Berggruen S, Ernst LM, Linn RL, Hewlett B, et al. Correlation of probability scores of placenta accreta on magnetic resonance imaging with hemorrhagic morbidity. *J Clin Anesth*. 2016;34:261–9.
- Rac MW, Wells CE, Twickler DM, Moschos E, McIntire DD, Dashe JS. Placenta accreta and vaginal bleeding according to gestational age at delivery. *Obstet Gynecol*. 2015;125(4):808–13.
- Sharma A, Bansal N, Singh P, Sarda P, Gupta N, Singh P. Evaluation of clinical profile, risk factors and management challenges in placenta accreta spectrum. *Int J*. 2020;4(6):162–6.
- Koshy RC. Efficacy of tranexamic acid in reducing blood loss, blood and blood products requirements in Caesarian sections for patients with placenta accreta. *Ain-Shams J Anesthesiology*. 2019;11(1).