Supplementary Files

Supplementary File 1. Search strategy used in the umbrella review.

1. “morbidly adherent placenta” OR “Placenta previa” OR “Placental previa” OR “Placenta praevia” OR “Placental disorders” OR “placentae previa” OR “low lying placenta”
2. “placenta accreta spectrum” OR “abnormally invasive placenta” OR “placenta accreta” OR “placenta increta” OR “placenta percreta” OR “morbidity adherent placenta” OR “morbidly adherent placenta” OR “invasive placenta” OR “inplatation placenta”
3. “vasa previa” OR “vasa praevia”
4. “Systematic review” OR Meta-analysis OR “Meta analysis” OR synthesis
5. (1 OR 2 OR 3) AND 4

Supplementary File 2. Systematic reviews and meta-analyses that excluded with reasons.

References	Reasons for exclusion
Takemoto Y, 2023[1]	Outcome is not interest.
Matsuzaki S, 2022[2]	Outcome is not interest.
Miller SE, 2023[3]	Outcome is not interest.
Kallianidis AF, 2023[4]	PP, PAS, or VP is not involved.
Siargkas A, 2022[5]	PP, PAS, or VP is not involved.
Siargkas A, 2022[6]	PP, PAS, or VP is not involved.
Rassie K, 2022[7]	PP, PAS, or VP is not involved.
Oltean I, 2022[8]	PP, PAS, or VP is not involved.
Nabhan AE, 2022[9]	Outcome is not interest.
Lin H, 2022[10]	Outcome is not interest.
Hessami K, 2022[11]	Outcome is not interest.
Fernandez-Jimenez N, 2022[12]	Outcome is not interest.
Alam B, 2022[13]	Outcome is not interest.
Spinillo SL, 2022[14]	Outcome is not interest.
Qu H, 2022[15]	Outcome is not interest.
Omar M, 2022[16]	PP, PAS, or VP is not involved.
Mitchell SJ, 2022[17]	Outcome is not interest.
Jenabi E, 2022[18]	It is an umbrella review.
Jenabi E, 2022[19]	It is an umbrella review.
Guzman Lopez JA, 2022[20]	Outcome is not interest.
Cavoretto PI, 2022[21]	Outcome is not interest.
Busnelli A, 2022[22]	It is not the most appropriate studies.
Alzoubi O, 2022[23]	Outcome is not interest.
Alves Junior JM, 2022[24]	Outcome is not interest.
Zhong W, 2021[25]	Outcome is not interest.
Zhang W, 2021[26]	Outcome is not interest.
Wang JQ, 2021[27]	It is not the most appropriate studies.
Vitale SG, 2021[28]	PP, PAS, or VP is not involved.
Tinari S, 2021[29]	Outcome is not interest.
Timor-Tritsch I, 2021[30]	It is not the most appropriate studies.
Soheili M, 2021[31]	PP, PAS, or VP is not involved.
Racher ML, 2022[32]	Outcome is not interest.
Novoa RH, 2021[33]	Outcome is not interest.
Neef V, 2021[34]	Outcome is not interest.
Nankali A, 2021[35]	Outcome is not interest.
Liu C, 2021[36]	Outcome is not interest.
Lim S, 2021[37]	Outcome is not interest.
Liang D, 2021[38]	Outcome is not interest.
Kubler JM, 2021[39]	Outcome is not interest.
Kotlyar AM, 2021[40]	Outcome is not interest.
Jafari M, 2021[41]	Outcome is not interest.

Hu KL, 2021[42]	It is not the most appropriate studies.
Hou W, 2021[43]	Outcome is not interest.
Favilli A, 2021[44]	PP, PAS, or VP is not involved.
Ende HB, 2021[45]	Outcome is not interest.
Dai M, 2021[46]	Outcome is not interest.
Cruz-Lemini M, 2022[47]	Outcome is not interest.
Breintoft K, 2021[48]	It is not the most appropriate studies.
Yang M, 2020[49]	It is not the most appropriate studies.
Turner JM, 2020[50]	Outcome is not interest.
Suarez S, 2020[51]	Outcome is not interest.
Pergialiotis V, 2020[52]	Outcome is not interest.
Pavalagantharajah S, 2020[53]	Outcome is not interest.
Patrick HS, 2020[54]	PP, PAS, or VP is not involved.
Ortiz-Esquinas I, 2020[55]	Outcome is not interest.
Morlando M, 2020[56]	Outcome is not interest.
Khazaei S, 2020[57]	PP, PAS, or VP is not involved.
Huang Y, 2020[58]	Outcome is not interest.
Cutts JC, 2020[59]	PP, PAS, or VP is not involved.
Chaemsaithong P, 2020[60]	PP, PAS, or VP is not involved.
Broere-Brown ZA, 2020[61]	It is not the most appropriate studies.
Khazaei S, 2019[62]	PP, PAS, or VP is not involved.
Jauniaux E, 2019[63]	Outcome is not interest.
Jauniaux E, 2019[64]	Outcome is not interest.
Jansen C, 2019[65]	Outcome is not interest.
Jansen C, 2019[66]	PP, PAS, or VP is not involved.
He Q, 2019[67]	Outcome is not interest.
Ferreira R, 2019[68]	PP, PAS, or VP is not involved.
De Mucio B, 2019[69]	It is not the most appropriate studies.
D'Antonio F, 2019[70]	Outcome is not interest.
Chen L, 2019[71]	Outcome is not interest.
Carroll L, 2019[72]	PP, PAS, or VP is not involved.
Aukes AM, 2019[73]	Outcome is not interest.
Adane AA, 2019[74]	PP, PAS, or VP is not involved.
Workalemahu T, 2018[75]	PP, PAS, or VP is not involved.
Wang W, 2018[76]	It is not the most appropriate studies.
Wan Z, 2018[77]	It is not meta-analysis.
Shahin Y, 2018[78]	Outcome is not interest.
Roberge S, 2018[79]	PP, PAS, or VP is not involved.
Pagani G, 2018[80]	Outcome is not interest.
Ordonez CA, 2018[81]	Outcome is not interest.
Ordonez CA, 2018[82]	Outcome is not interest.
Lalani S, 2018[83]	It is not the most appropriate studies.
Kohn JR, 2018[84]	It is a systematic review without meta-analysis.

Keag OE, 2018[85]	It is not the most appropriate studies.
Glazier JD, 2018[86]	Outcome is not interest.
Glavind MT, 2018[87]	It is a systematic review without meta-analysis.
Gasparri ML, 2018[88]	It is not the most appropriate studies.
Familiari A, 2018[89]	Outcome is not interest.
D'Antonio F, 2018[90]	Outcome is not interest.
Cali G, 2018[91]	It is not the most appropriate studies.
Buca D, 2018[92]	Outcome is not interest.
Zullo F, 2017[93]	It is not the most appropriate studies.
Shobeiri F, 2017[94]	PP, PAS, or VP is not involved.
Jenabi E, 2017[95]	Outcome is not interest.
Jauniaux E, 2017[96]	Outcome is not interest.
Ismail KI, 2017[97]	PP, PAS, or VP is not involved.
Fan D, 2017[98]	Outcome is not interest.
Fan D, 2017[99]	Outcome is not interest.
Fan D, 2017[100]	Outcome is not interest.
van den Akker T, 2016[101]	PP, PAS, or VP is not involved.
Rodger MA, 2016[102]	Outcome is not interest.
Qin JB, 2016[103]	Outcome is not interest.
Qin J, 2016[104]	It is not the most appropriate studies.
Leone Roberti Maggiore U, 2016[105]	Outcome is not interest.
Fan D, 2016[106]	Outcome is not interest.
Di Mascio D, 2016[107]	Outcome is not interest.
Qin J, 2015[108]	It is not the most appropriate studies.
Marchi J, 2015[109]	It is not the most appropriate studies.
Duffy JMN, 2015[110]	PP, PAS, or VP is not involved.
Chibueze EC, 2015[111]	Outcome is not interest.
Tersigni C, 2014[112]	PP, PAS, or VP is not involved.
Klar M, 2014[113]	It is not the most appropriate studies.
Greenwood DC, 2014[114]	It is not the most appropriate studies.
Meng X, 2013[115]	Outcome is not interest.
Maheshwari A, 2013[116]	It is not the most appropriate studies.
Cresswell JA, 2013[117]	Outcome is not interest.
Rao KP, 2012[118]	Outcome is not interest.
Fekete K, 2012[119]	Outcome is not interest.
Abou-Nassar K, 2011[120]	PP, PAS, or VP is not involved.
Rodger MA, 2010[121]	PP, PAS, or VP is not involved.
Zdoukopoulos N, 2008[122]	PP, PAS, or VP is not involved.
Conde-Agudelo A, 2007[123]	It is not the most appropriate studies.
Castles A, 1999[124]	It is not the most appropriate studies.
Hulse GK, 1997[125]	PP, PAS, or VP is not involved.
Ananth CV, 1997[126]	It is not the most appropriate studies.
Ananth CV, 1996[127]	PP, PAS, or VP is not involved.

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Supplementary file 3: AMSTAR-2 Results.

	AMSTAR-2																
Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Quality
Sugai S, 2023	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Busnelli A, 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Li L, 2022	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Iqbal K, 2022	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Jansen C, 2022	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Jenabi E, 2022	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Zhuo L, 2022	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Steane SE, 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Matsuzaki S, 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Karacam Z, 2021	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Matsuzaki S, 2021	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Matsuzaki S, 2021	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Iacovelli A, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Hou YP, 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Tandon P, 2020	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Horton J, 2019	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Jenabi E, 2019	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Balayla J, 2019	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Martinelli KG, 2018	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Sha T, 2018	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Karami M, 2018	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Roque M, 2018	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Shobeiri F, 2017	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low

Karami M, 2017	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Ruiter L, 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Vahanian SA, 2015	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Yin XA, 2015	Y	N	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Critically low
Wang G, 2014	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Huang QT, 2014	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Grady R, 2012	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Gurol-Urganci I, 2011	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Saraswat L, 2010	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Heslehurst N, 2008	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Low
Faiz AS, 2003	Y	N	Y	PY	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Critically low

Q1: Did the research questions and inclusion criteria for the review include the components of PICO?

Q2: Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?

Q3: Did the review authors explain their selection of the study designs for inclusion in the review?

Q4: Did the review authors use a comprehensive literature search strategy?

Q5: Did the review authors perform study selection in duplicate?

Q6: Did the review authors perform data extraction in duplicate?

Q7: Did the review authors provide a list of excluded studies and justify the exclusions?

Q8: Did the review authors describe the included studies in adequate detail?

Q9: Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?

Q10: Did the review authors report on the sources of funding for the studies included in the review?

Q11: If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?

Q12: If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?

Q13: Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?

Q14: Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?

Q15: If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?

Q16: Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?

Supplementary file 4. The detailed information of the factors and outcomes for placental anomalies (PP, PAS, and VP)

Placenta previa factors

AMA (> 45 years)

The authors to identify trends in pregnancy outcomes among pregnant patients older than 45 years. Fourteen included sutudies, involving 101794 placenta previa and 14604565 participants, found pregnant patients aged > 45 years had a significantly higher placenta previa (OR 3.61, 95% 2.70-4.81)[1].

ART (Programmed Frozen ET)

Ten studies were included and found a higher risk of PP in programmed frozen embryo transfer (PC-FET) (OR, 1.27, 95% CI 1.05-1.54, p = 0.01, fixed effects model) (very low quallity)[2]. After adjusted for maternal age, six studies were included and found the absence of an association (OR 1.16, 95% CI, 0.89-1.50, p = 0.27, fixed effects model). Four studies reported OR adjusted for maternal BMI (OR 1.28, 95% CI, 0.90-1.80, p = 0.17, fixed effects model). Two studies reported OR adjusted for the fertilization method (OR 0.84, 95% CI, 0.49-1.43, p = 0.52, fixed effects model). Three studies reported OR adjusted for embryo culture duration (OR 0.93, 95% CI, 0.66-1.31, p = 0.68, fixed effects model). Five studies reported OR adjusted for embryo biopsy (OR 1.58, 95% CI, 1.21-2.07, p = 0.0009, fixed effects model). Four studies reported OR adjusted for the indicationi to IVF/ICS (OR 1.06, 95% CI, 0.78-1.46, p = 0.70, fixed effects model).

IMH

IMH was not association with placenta previa in their meta-analysis[3]. They found the OR was 1.79, however, the 95%CI was 0.64 to 5.01 in their study, which including four studies.

Maternal alcohol

There is no association between prenatal alcohol consumption and placenta previa (aOR, 1.14, 95%CI, 0.84-1.56, p = 0.39) in the meta-analysis which was conducted on the four studies[4]. The true OR for similar future would be expected to lie within the 95% prediction interval, which was calculated to be 0.48-2.68.

Endometriosis

Overall, 19 studies examined the effect of endometriosis on the incidence of placenta previa in the meta-analysis[5]. They found endometriosis was associated with an increased incidence of placenta previa. The OR was 3.65 (95% CI 3.09-4.31) in the unadjusted pooled analysis (n=19) and 3.17 (95% CI 2.58-3.89) in the adjusted pooled analysis (n=12). In the sensitivity analysis in histologically confirmed endometiriosis, they found histologically confirmed endometriosis was correlated with a higher rate of placenta previa in the unadjusted pooled analysis (OR 4.99, 95% CI, 3.30-7.53; n=10) and in the adjusted pooled analysis (OR 4.23, 95% CI, 1.74-10.30; n=4).

Adolescent pregnancy

Seven of the studies reviewed reported results on the placenta previa in their meta-analysis[6]. And, the authors found placenta previa was less common in adolescent pregnancies (OR 0.52, 95% CI 0.31-0.88).

Prior UAE

According to the unadjusted pooled analysis, women who underwent prior UAE had higher rates of placenta previa (OR 5.62, 95% CI 1.48-21.34; n=3) than women who did not undgergo UAE[7]. However, according to the patient background-matched pooled analysis, women who underwent prior UAE did not have higher rates of placenta previa (OR 2.31, 95% CI 0.35-15.22) than women who did

not undergo prior UAE.

Anti-TNF in IBD

In patients with IBD, the authors found compared to patients not anti-TNF naïve during pregnancy, the pooled OR of placenta previa in those exposed to anti-TNF therapy was 1.58 (95% CI 0.30-8.47)[8].

Uterine leiomyoma

There was significant association between the uterine leiomyoma and the risk of placenta previa in studies adjusted (OR 2.21, 95% CI 1.48-2.94) in the meta-analysis[9]. However, this association in crude studies not significant (OR 0.98, 95% CI 0.06-1.90). Also, the results of subgroup analysis showed that uterine leiomyoma 5cm or more increased the risk of placenta previa by 3.53 fold compared with leiomyoma less than 5cm (OR 3.53, 95% CI 1.02-6.05).

ART (endometriosis)

The authors found women with endometriosis who did ART had higher rates of placenta previa (OR 3.31, 95% CI 1.26-8.71) than women with endometriosis who did not ART in their meta-analysis[10].

AMA (> 35 years)

The authors investigated the existence and magnitude of the association between advanced maternal age and occurrence of placenta previa in their meta-analysis[11]. They found an increase in age increased the magnitude of association strength (OR 3.16, 95% 2.79-3.57). In the analysis of subgroups by age group, as age increases, the chance of occurrence of PP also increase, OR = 2.70 (95% CI 2.30-3.10) in studies that used the 35-39 age range; for the >= 40 age range, the chance was 3.80 (95% CI 3.00-4.80).

ART (S) and ART (T)

The authors estimated the associated between placenta previa and ART in singleton and twin pregnancies in their meta-analysis[12]. According to their results, there was a significant association between ART and placenta previa. The overall estimate of OR was 2.67 (95% CI 2.01-3.34) and RR was 3.62 (95% CI 0.21-7.03) based on singleton pregnancies. The overall estimate of OR was 1.50 (95% CI 1.26-1.74) based on twin pregnancies. Based on studies estimating OR in singleton in crude studies, 2.78 (95% CI 1.89-3.67) and in adjusted studies was 2.59 (95% CI 1.70-3.48). Based on studies estimating OR in twins in crude studies, 1.47 (95% CI 1.23-1.71) and in adjusted studies was 2.91 (95% CI 1.08-4.73). There was no significant difference between adjusted and crude studies. However, there was significant difference between the results of high- and low-quality studies in singleton pregnancies.

ART (fresh ET)

There were six matched cohort studies with a high-quality score on the NOS scales in their meta-analysis[13]. They found a lower risk of placenta previa (RR 0.61, 95% CI 0.43-0.88) in pregnancies after frozen embryo transfer than after fresh embryo transfer.

Maternal smoking

Fourteen cohort studies and 7 case-control studies with 9094443 participants were included in their meta-analysis[14]. Based on the random effect model, compared to nonsmoker women, the estimated OR and RR of placenta previa was 1.42 (95% CI 1.30-1.54) and 1.27 (95% CI 1.18-1.35), respectively.

Prior abortion (S) and Prior abortion (I)

The authors found 3 cohort studies and 17 case-control studies with 2134529 participants in their meta-analysis[15]. They reported that there was a significant association between prior spontaneous abortion and the risk of placenta previa (OR 1.77, 95% CI 1.60-1.94) and between prior induced abortion and the risk of placenta previa (OR 1.36, 95% CI 1.02-1.69).

HDP

Seven cohort studies were included in their meta-analysis[16]. When all study results were pooled into the meta-analysis, a significantly inverse correlation between placenta previa and HDP was found (RR 0.55, 95% CI 0.32-0.97). For subgroup analyses, the same results were found in pregnancy-induced hypertension group (RR 0.36, 95% CI 0.23-0.57) but not in other HDPs group (RR 0.94, 95% CI 0.44-2.00). Sensitive analysis showed that all results were not materially altered.

Maternal asthma

The authors investigated if maternal asthma is associated with an increased risk of maternal and placental complications in preganncy in their meta-analysis[17]. Women with asthma had a significantly increased risk of placenta previa compared to women without asthma (RR 1.23, 95% CI 1.07-1.40; n=8). This increased risk remained significant after adjustment for covariates in five studies (OR 1.39, 95% CI 1.17-1.67).

CHB infection

Five studies involving 9088 placenta previa cases were identified in their meta-analysis[18]. No significant association between chronic hepatitis B virus infection and placenta previa was identified (OR 0.98, 95% CI 0.60-1.62).

eSET

Compared with spontaneously conceived singletons, elective single embryo transfer gestations had higher risks of placenta previa (RR 6.02, 95% CI 2.79-13.01; n=1) in their meta-analysis[19].

Prior CS

In the meta-analysis of 37 previously published studies from 21 countries, the authors found the overall pooled random effects odds ratio was 2.20 (95% CI 1.96-2.46)[20]. After adjustment, CS at first birth remained associated with an increased risk of placenta previa (OR 1.60, 95% CI 1.44-1.76). For the six population-based cohort studies, the results was 1.51 (95% CI 1.39-1.65).

Miscarriage (T)

In the meta-analysis, the authors found women with threatened miscarriage were more likely to have placenta previa (OR 1.62, 95% CI 1.19-2.22)[21].

Maternal obesity

In their study, the authors aimed to investigate relationships between obesity and impact on obstetric care[22]. The meta-analysis showed significant slightly reduced odds for placenta previa in obese women (OR 0.83, 95% CI 0.71-0.96).

Maternal cocaine use, male fetus, and preeclampsia

The authors performed a systematic review of the literature to estimate the placenta previa and its risk factors[23]. Three case-control studies demonstrated a higher risk of placenta previa with cocaine use during pregnancy (OR 2.9, 95% CI 1.9-4.3). Male fetuses were associated with higher risk of placenta previa (OR 1.2, 95% CI 1.1-1.3) in seven studies. Preeclampsia showed a protective effect on the risk of placenta previa (OR 0.9; n=3). However, there was no significantly.

Placenta previa outcomes

Blood transfusfusion (CS)

The study conducted to identify risk factors associated with blood transfusion in women undergoing cesarean section. In their meta-analysis, the authors found that placenta previa was found to be significanlty higher (OR 9.54, 95% CI 7.23-12.59; n=17) in the transfused group as compared to the non-transfused group[24].

Preterm delivery

In the meta-analysis, the authors found women with placenta previa were more likely to have a preterm birth before 37 weeks of gestation (risk difference 0.37, 95% CI 0.31-0.42), and before 34, 32, and 28 weeks of gestation ((OR 6.12, 95% CI 4.29-8.72), (OR 8.58, 95% CI 6.35-11.58), and (OR 5.61, 95% CI 4.02-7.83), respectively) than women without placenta previa[25].

IUGR

In the meta-analysis of over 1593226 singleton pregnancies and 10575 confirmed cases of placenta previa in 13 studies, the authors found that pregnancies with placenta previa were associated with a mild increase in the risk of IUGR, with a pooled OR of 1.19 (95% CI 1.10-1.27)[26].

Other outcomes

In the meta-analysis, the authors sought to evaluate the extent of the association between placenta previa and adverse pregnancy outcomes in singleton gestations[27]. In the comparative studies, placenta previa was significantly associated with lower 1- (RR 3.14, 95% CI 1.69-5.85; n=2) and 5-minute (RR 2.73, 95% CI 2.25-3.29; n=3) Apgar scores, NICU admissions (RR 4.09, 95% CI 2.80-5.97; n=5), and neonatal (RR 5.44, 95% CI 3.03-9.78; n=3) and perinatal (RR 3.01, 95% CI 1.41-6.43; n=3) death. However, there ws no significantly between placenta previa and SGA (RR 1.01, 95% CI 0.62-1.65; n=5).

PAS factors

Maternal Smoking

Fourteen studies were included in a meta-analysis[28]. Based on the random effect model, the estimated OR of the risk of PAS associated with smoking was 1.21 (95% CI: 1.02, 1.41). Subgroup analysis was conducted based on study design, and the result showed that the association between smoking and PAS among cohort studies was significant 1.35 (95% CI: 1.15, 1.55), but this association among case-control studies was not significant 0.83 (95% CI: 0.47, 1.19). In addition, there was no significant association between smoking and PAS based on crude/adjust form.

HDP

A meta-analysis was performed to evaluate the potential effects of hypertension in pregnancy on the placenta accreta spectrum[29]. The authors found pregnancy-induced hypertension was significantly related to lower prevalence of placenta accreta spectrum (OR 0.56, 95% CI 0.37-0.84; n=6) with moderate heterogeneity compared to pregnant women with no hypertension. When they looked at the result comparing the prevalence of hypertension in pregnancy in women with placenta accreta compared to no placenta accrete, they found that the placenta accreta spectrum was significantly related to lower prevalence of hypertension in pregnancy (OR 0.65, 95% CI 0.43-0.98) with moderate heterogeneity compared to no placenta accrete.

Prior UAE

Three comparator studies that compared the rate of PAS between women who did and did not undergo prior UAE. The unadjusted pooled analysis demonstrated that women with prior UAE had a higher rate of PAS (OR 28.47, 95% CI 7.61-106.57; n=3) than those who did not undergo prior UAE[7]. In the adjusted pooled analysis (all women had PPH during their previous delivery), prior UAE was still associated with PAS (OR 20.82, 95% CI 3.27-132.41; n=2).

ART

The meta-analysis aimed to explore the relation between ART pregnancy and PAS[30]. The authors found the risk of PAS was significantly higher in women who conceived with ART than in those with spontaneous conception (OR 5.03, 95% CI 3.34-7.56; n=9). In the sensitivity analysis accounting for

the type of embryo transfer, frozen embryo transfer was associated with an increased risk of PAS (OR 4.60, 95% CI 3.42-6.18; n=3) compared to fresh embryo transfer.

Maternal alcohol

The authors only found a single study reported on the prenatal alcohol consumption and PAS in their meta-analysis[4]. And, they indicated that there is no association between prenatal alcohol consumption and PAS (aOR 2.61, 95% CI 0.81-5.44). But, a robust increase in the likelihood of this complication when alcohol was considered as a dichotomous predictor.

ART (frozen-thawed ET)

In the meta-analysis, the authors found that the risk of placenta accreta development increased significantly in the frozen-thawed embryo transfer group compared to the fresh embryo transfer group (aOR 3.51, 95% CI 2.04-6.05; n=2)[31].

Multiple gestations, male fetus, and low SES

The authors described the association between potential influencing factors and PAS in their meta-analysis[32]. A synthesis of the results showed the OR with 95% CI of influencing factors were as follows: multiple gestations 1.90 (1.26-2.88) (n=7), male fetus 0.79 (0.74-0.84) (n=5), and low SES 0.51 (0.37-0.71) (n=3). Sensitivity analysis results suggested that the results of the meta-analysis were robust.

Other factors

In the meta-analysis, the authors explored the strength of association between different maternal and pregnancy characteristics and the occurrence of PAS[33]. They found maternal obesity (OR 1.37, 95% CI 1.04-1.81; n=5), advanced maternal age (OR 3.13, 95% CI 1.40-6.97; n=17), multiparity (OR 2.49, 95% CI 1.71-3.62; n=19), placenta previa (OR 11.00, 95% CI 4.71-25.80; n=24), placenta previa and prior cesarean section (OR 12.00, 95% CI 1.64-88.00; n=12), prior cesarean section (OR 4.66, 95% CI 3.02-7.18; n=33), and prior uterine surgery (OR 4.42, 95% CI 2.96-6.59; n=34) were associated with a higher risk of PAS. However, maternal smoking (OR 1.13, 95% CI 0.88-1.47; n=11), prior elective cesarean section (OR 3.73, 95% CI 0.50-27.71; n=3), prior emergency cesarean section (OR 1.17, 95% CI 0.21-6.65; n=3), prior myomectomy (OR 0.76, 95% CI 0.35-1.66; n=9), prior abortion (OR 1.36, 95% CI 0.84-2.20; n=6), prior curettage (OR 1.87, 95% CI 0.96-3.64; n=16), and short interval between prior cesarean section and subsequent pregnancy (<23 months) (OR 1.81, 95% CI 0.72-4.58; n=2) were not associated with a higher risk of PAS.

Vase previa factors

The authors aimed to review the literature on the risk indicators for vase previa in their study[34]. In the comparative studies, second-trimester placenta previa (OR 18.97, 95% CI 6.13-58.68; n=4), velamentous cord insertion (OR 672.44, 95% CI 112.10-4033.58; n=2), assisted reproductive technologies (OR 18.95, 95% CI 6.61-54.34; n=2), bilobed placenta (OR 71.50, 95% CI 14.64-349.25; n=2), and cord insertion in the lower third of the uterus at first-trimester ultrasound (OR 279.28, 95% CI 1.51-51547.34; n=2) had an increased risk of vase previa. However, there ws no significantly between multiple gestations and vase previa (OR 2.66, 95% CI 0.80-8.79; n=3).

Vase previa outcomes

Only one comparetive study pertaining to vasa previa was identified in the meta-analysis[27]. In the study, vasa previa was significantly associated with preterm delivery (RR 3.36, 95% CI 2.76-4.09), SGA (RR 4.02, 95% CI 2.64-6.12), perinatal death (RR 4.52, 95% CI 2.77-7.39), and 5-min Apgar score <7 (RR 2.18, 95% CI 1.36-3.50).

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