Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379

# Subchorionic Hematoma Size and Adverse Pregnancy Outcomes: A Systematic Review of Evidence from 2022 to 2025

**Zunaira Shakeel**
Student of MS Diagnostic Ultrasound, Department of Radiology and Medical Imaging Technology, Ibadat International University, Islamabad, Pakistan

**Nazish Batool**
Student of MS Diagnostic Ultrasound, Department of Radiology and Medical Imaging Technology, Ibadat International University, Islamabad, Pakistan

**Hilal Ahmad Malik***
Department of Management Sciences, Ibadat International University, Islamabad, Pakistan Email: hilal.ahmed@dms.iiui.edu.pk

**Author Details**

**Keywords:** Subchorionic Hematoma, SCH Size, Adverse Pregnancy Outcomes, Miscarriage, Preterm Birth, Fetal Growth Restriction, Systematic Review

**Received on 01 May 2026**
**Accepted on 22 May 2026**
**Published on 11 Jun 2026**

**Corresponding E-mail & Author*:**

**Hilal Ahmad Malik***
Department of Management Sciences, Ibadat International University, Islamabad, Pakistan Email: hilal.ahmed@dms.iiui.edu.pk

**Abstract**

**Background:** SCH represents one of the most common sonographic discoveries during early gestation, yet the predictive significance of hematoma dimensions in forecasting unfavorable pregnancy outcomes remains inadequately established. This comprehensive review aimed to establish the correlation between SCH dimensions and adverse gestational outcomes, including pregnancy loss, premature delivery, and FGR.

**Methods**: This comprehensive review was conducted following PRISMA 2020 standards. A thorough literature search across PubMed, Scopus, Web of Science, Google scholar, and Cochrane library was performed to identify relevant studies on this subject matter from January 2022 through May 2025. Eligible investigations included original observational research and systematic reviews that documented SCH dimensions and at least one unfavorable pregnancy outcome. Study assessment was performed using the NOS. Due to variations in SCH size definitions and outcome reporting, a descriptive synthesis was performed.

**Results:** 14 articles were incorporated, including over 5,000 natural conception and assisted reproductive technology (ART) pregnant women. There was a consistent dose -response graph between the increasing SCH size and adverse event. FGR was independently related to large SCH with adjusted odds ratios between 5.31 and 10.21 in cohort studies (largest cohort studies). A steady SCH-to-gestational-sac ratio of at least 25% was considered a good cutoff point of quantitative value used in predicting preterm birth. Across various studies, there was high risk of miscarriage especially when SCH was found prior to the 7 week mark of gestation. Importantly, however, the pooled evidence were not able to demonstrate statistically significant association between SCH presence alone and preterm delivery; stratification based on a size was very crucial to the detection of a high-risk case. The results of ART populations were not consistent with some studies eventually proving

that there is a higher risk of miscarriage and others showing no show of significant results.
**Conclusion:** The size of SCH is a better prognostic variable, as opposed to the presence, to adverse pregnancy outcomes. To have meaningful risk stratification, standardized measurement protocols, in particular the gestational-sac-ratio method, should be used in the first-trimester ultrasonographic reporting. Further multicentre research is required that can substantiate these results and come up with evidence-based clinical principles.

## Introduction

One of the most common sonographic abnormalities observed in early pregnancy is Subchorionic hematoma (SCH) and is a collection of blood between the chorionic membrane and uterus wall. It is commonly observed in the case of first-trimester ultrasonography, and its prevalence is reported to be between 1 to 20 percent, based on the population under observation and diagnostic criteria (Elmas et al., 2023; Xu et al., 2023). Having a significant clinical presence despite many cases subsiding psychiatrically, SCH is nonetheless a clinically significant finding as it may be associated with poor pregnancy outcomes.

The clinical impact of SCH has been actively studied, and the increasing argument exists that it could cause complications like miscarriage, preterm delivery, placental abruption, and fetal growth restriction (FGR) (Lou et al., 2024; Yan et al., 2023). Nonetheless, results between research studies are inconsistent especially with regard to the strength and nature of such associations. There are research findings that indicate a definite association between SCH and unfavorable outcomes, and others show minimal or no significant effect, particularly in certain groups such as infertile patients, or patients going through assisted reproductive procedures (Inman et al., 2022; Wang et al., 2024).

New studies have also been interested in the use of SCH features especially size when predicting pregnancy prognosis. Some cohort investigations have proved that large hematomas have a higher likelihood of the development of undesirable outcomes than small (Pan et al., 2023; Liang et al., 2023). An attempt to normalize the definition of what exactly is considered to be large SCH, and to measure the size of hematoma as a relative of gestational sac or placental volume, has also been undertaken, which further notes its prognostic importance (Yoshihara et al., 2024). Furthermore, recent findings show that the size of the SCH can impact results even in assisted reproduction, which highlights its clinical relevance to a larger number of clinical contexts (Wang et al., 2024; Yi et al., 2025).

Although volume of literature has been gradually increasing, the extents to which SCH size is independent predictor of adverse pregnancy outcomes are missing. Heterogeneity in investigations is caused by variations in the study design, population, the ways of measuring size, and outcome.

Considering such inconsistencies and the increasing clinical significance of early risk stratification, it is justified to come up with a synthesis of the existing evidence. This is a systematic review that is focused on assessing the size of subchorionic hematoma in relation to adverse outcomes of pregnancy with the objective being to enhance what it is prognostic and serve as a decision maker in clinical practice.

## Methods

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines to

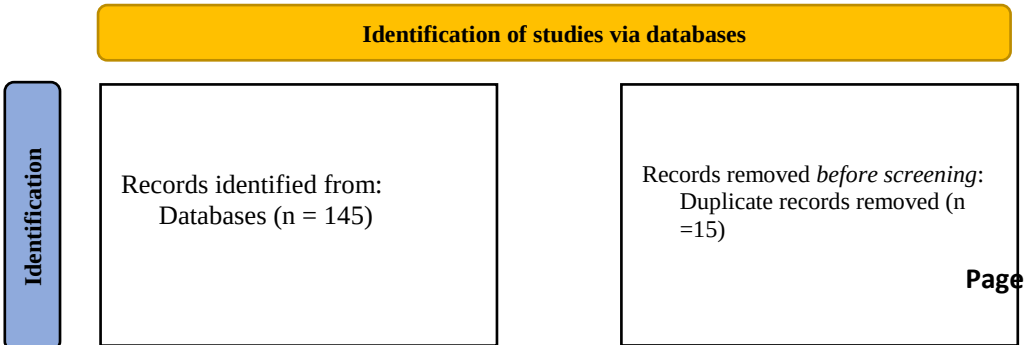
ensure transparent and standardized reporting of evidence synthesis. The review aimed to evaluate the association between subchorionic hematoma (SCH) size and adverse pregnancy outcomes. A comprehensive literature search was performed in PubMed, Scopus, Web of Science, Google Scholar, and the Cochrane Library for studies published between January 2022 and May 2025. The search strategy utilized relevant Medical Subject Headings (MeSH) terms and keywords, including "subchorionic hematoma," "subchorionic hemorrhage," "subchorionic bleed," "SCH size," "hematoma size," "pregnancy outcomes," "miscarriage," "preterm birth," "fetal growth restriction," and "placental abruption," combined using Boolean operators ("AND" and "OR"). In addition, the reference lists of all eligible studies were manually screened to identify further relevant publications.

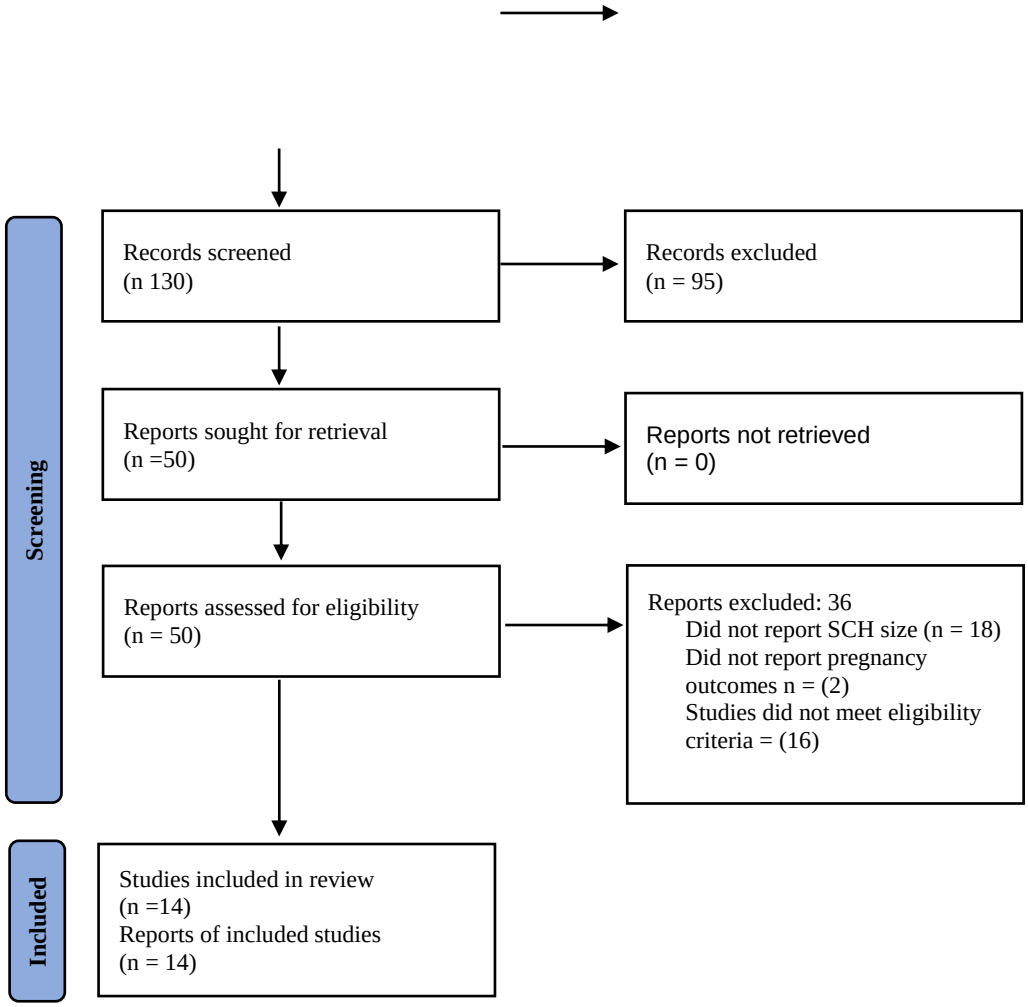
Studies were included if they were observational studies (cohort, case-control, or cross-sectional studies) or systematic reviews involving pregnant women diagnosed with SCH, reported SCH size either quantitatively or categorically, and assessed at least one adverse pregnancy outcome. Studies published from 2022 onward were considered eligible. Relevant studies providing contextual information on SCH-associated risk factors were also retained when deemed important to the review objectives. Case reports, small case series, editorials, narrative reviews, conference abstracts without complete data, animal studies, in vitro studies, and studies published before 2022 were excluded. All identified records were imported into reference management software, and duplicate citations were removed. Two independent reviewers screened titles and abstracts, followed by full-text evaluation of potentially eligible articles. Disagreements regarding study eligibility were resolved through discussion and consensus or by consultation with a third reviewer. Data extraction was performed using a standardized form that captured information on study characteristics, including author, publication year, study design, population characteristics, sample size, gestational age at diagnosis, SCH size definition, and reported pregnancy outcomes. The primary outcome of interest was the association between SCH size and adverse pregnancy outcomes, particularly miscarriage and preterm birth before 37 weeks of gestation. Secondary outcomes included fetal growth restriction, hypertensive disorders of pregnancy, and live birth rates. Methodological quality and risk of bias were assessed independently by two reviewers using the Newcastle–Ottawa Scale (NOS), with disagreements resolved through consensus. Owing to substantial heterogeneity in SCH classification, study design, and outcome reporting across the included studies, a quantitative meta-analysis was not feasible. Therefore, findings were synthesized using a narrative approach.

## Results

### Study Selection

The process of selecting studies is illustrated in the PRISMA flow diagram shown. A total of 145 records were found when searching databases. After removal of those with records that were found to be duplicate and after examination of screening procedures, 14 investigations met the inclusion criteria and were included in the final analysis.






**Study Characteristics**

The included studies were published between 2022 and 2025 and consisted primarily of retrospective and prospective cohort studies. The total sample size across all studies exceeded 5,000 pregnant women. Studies were done in a variety of populations including NAT and assisted reproductive technology (ART) groups.

The majority of studies measured SCH in the first trimester but some measured later in gestation. SCH size was reported either as categorical grading (small, medium, large) or as a quantitative measurement relative to gestational sac size (See Table 1)

**Table 1: Characteristics of Included Studies**

| Author (Year) | Study Design | Population | n | SCH Assessment | Key Findings |
|---|---|---|---|---|---|
| Pan et al. (2023) | Retrospective cohort | Singleton, natural conception | 701 SCH / 640 controls | Volume ($cm^3$); size quartiles | Larger SCH → higher rates of FGR (aOR 10.21), term prelabor rupture of membranes (aOR 1.58), HDP, and gestational thrombocytopenia; longer duration → |

| Author (Year) | Study Design | Population | n | SCH Assessment | Key Findings |
|---|---|---|---|---|---|
| | | | | | FGR (aOR 13.36) |
| Yoshihara et al. (2024) | Retrospective cohort | Singleton pregnancies | 80 SCH / 1,225 controls | Ratio to gestational sac area (Method 1) and circumference (Method 2) | Cutoff: 25% (Method 1) → preterm delivery 24.1% vs. 4.2%; large SCH independently associated with preterm delivery ($p < 0.01$) |
| Liang et al. (2023) | Prospective observational cohort | Singleton pregnancies | 72 SCH / 99 controls | 3-tier grading (small, medium, large) | SCH group: miscarriage 30.6% vs. 2.0%; early preterm birth 8.3% vs. 1.0%; FGR 9.7% vs. 0% (all $p < 0.01$) |
| Wang et al. (2024) | Retrospective cohort | Euploid embryo transfer (PGT-A/SR) | 298 SCH / 1,241 controls | Presence on US 6–8 weeks | Early miscarriage higher (10.1% vs. 5.6%; aOR 1.99); reduced live birth rate; increased HDP |
| Elmas et al. (2023)* | Retrospective observational | Singleton, abortus imminens | 400 SCH / 400 no-SCH | Presence on ultrasound | Abortion 34.2% vs. 24.7% ($p = 0.007$); OR 1.58 for miscarriage; no difference in preterm delivery; no correlation found between hematoma size and pregnancy loss |
| Xu et al. (2023) | Retrospective cohort | Singleton ≤14 weeks | SCH group vs. controls | Presence; autoimmune markers | Reduced protein S, anti-thrombin-III; elevated homocysteine and autoantibodies as risk factors; SCH linked to adverse outcomes |
| Inman et al. (2022) | Retrospective cohort | Infertile patients, all ART cycles | 1,210 pregnancies | Presence on ultrasound | No significant association between SCH and first-trimester miscarriage or |

| Author (Year) | Study Design | Population | n | SCH Assessment | Key Findings |
|---|---|---|---|---|---|
| | | | | | adverse obstetric outcomes in infertile patients |
| Aki et al. (2022) | Retrospective cohort | SCH patients with persistent vaginal bleeding | Not reported separately | Clinical symptom order (bleeding-first vs. other) | Bleeding-first order → prolonged SCH duration → very early preterm delivery; coagulation factor XIII consumed by continuous hemorrhage |
| Huang et al. (2023) | Retrospective analysis | Third-trimester SCH | 1,112 SCH cases | Presence and complications; gestational week | 71.85% had pregnancy complications; premature birth 9.35%; LBW 6.47%; PROM 17.27%; significant relation to GDM in multipara |
| Yan et al. (2023) | Systematic review & meta-analysis | Singleton pregnancies (pooled) | 16 studies (2000–2022) | Presence of SCH | SCH associated with miscarriage (natural: OR 3.07; ART: OR 1.45); NO significant association with preterm delivery (OR 1.11; 95% CI 0.82–1.51) |
| Lou et al. (2024) | Retrospective cohort | Singleton pregnancies | 559 SCH / 585 no-SCH | Presence, size, gestational age at diagnosis | SCH independently associated with miscarriage <20 weeks (aOR 1.94; 95% CI 1.19–3.15); early detection (<7 weeks) riskier (aOR 2.71); large SCH → placental abruption (aOR 5.03) |
| Lou et al. (2025) | Retrospective cohort | Singleton pregnancies (excluded losses <20 wks) | 504 SCH / 551 no-SCH | Presence; SCH size subgroup analysis | SCH independently associated with FGR (4.0% vs. 0.9%, P = 0.001); nomogram |

| Author (Year) | Study Design | Population | n | SCH Assessment | Key Findings |
|---|---|---|---|---|---|
| | | | | | developed; SCH size and location identified as high-risk predictors |
| Yi et al. (2025) | Systematic review | ART populations | 50 studies included | Pathogenesis and risk factors reviewed | ART-specific risk factors for SCH reviewed; endometrial receptivity, ovarian stimulation, and frozen transfer identified as contributors |
| Pakniat et al. (2025) | Case-control study | Singleton first-trimester pregnancies | 251 SCH / 250 controls | Size (≤3 cm vs. >3 cm); first-trimester US | Preterm delivery 15.1% vs. 8.0% (p = 0.02); miscarriage 7.6% vs. 2.8% (p = 0.008); NICU admission 18.3% vs. 10.4% (p = 0.01); no significant difference for IUGR, PROM, preeclampsia, or LBW |

**Note.** Xu et al. (2023) did not report SCH size as a primary variable; however, it was retained in the review as it provides important contextual data on biochemical and autoimmune risk factors associated with SCH and adverse outcomes. Outcome data were interpreted accordingly

**Association Between SCH Size and Adverse Outcomes**

Across the majority of included studies, a consistent dose–response relationship was observed between SCH size and adverse pregnancy outcomes. Pan et al. (2023) found that hematomas in the 50th–75th percentile of size were associated with a 5.3-fold increase in FGR risk (aOR 5.31; 95% CI 1.71–16.56), while hematomas exceeding the 75th percentile (>2.44 $cm^3$) were associated with a 10.2-fold increase in FGR (aOR 10.21; 95% CI 3.64–28.62) and a 6.8-fold increase in placenta adhesion. Yoshihara et al. (2024) established that an SCH-to-gestational-sac ratio exceeding 25% was the optimal cutoff for identifying high-risk pregnancies.

**Miscarriage and Pregnancy Loss**

Several studies consistently demonstrated an increased risk of miscarriage associated with SCH (see Table 2). Lou et al. (2024) found that SCH independently predicted pregnancy loss before 20 weeks (aOR 1.94; 95% CI 1.19–3.15), with the risk amplified when hematomas were detected before 7 weeks of gestation (aOR 2.71;

95% CI 1.45–5.07). Notably, in the Lou et al. (2024) study, hematoma size alone was not significantly associated with miscarriage; however, large SCH significantly increased placental abruption risk (aOR 5.03). The Yan et al. (2023) meta-analysis confirmed miscarriage associations in both natural-conception and ART populations.

**Table 2: SCH and Miscarriage / Early Pregnancy Loss**

| Study | Design | Population | Outcome | Key Finding |
|---|---|---|---|---|
| Elmas et al., 2023 (Thieme) | Retrospective observational | Singleton, abortus imminens | Miscarriage | SCH increases miscarriage risk (34.2% vs. 24.7%; OR 1.58; p = 0.007); size not correlated with pregnancy loss in this study |
| Lou et al., 2024 | Retrospective cohort | Singleton pregnancies | Loss <20 weeks | SCH independently associated with miscarriage (aOR 1.94; 95% CI 1.19–3.15); early detection riskier (aOR 2.71 if before 7 weeks) |
| Pakniat et al., 2025 (HJOG) | Case-control | Singleton first trimester | Miscarriage | Miscarriage 7.6% (SCH) vs. 2.8% (controls); p = 0.008; statistically significant association |
| Liang et al., 2023 | Prospective cohort | Singleton pregnancies | Miscarriage | Miscarriage 30.56% vs. 2.02% in SCH vs. controls (p < 0.0001); higher SCH grade associated with higher loss |
| Yan et al., 2023 (meta-analysis) | Meta-analysis | Pooled singleton pregnancies | Miscarriage | SCH associated with miscarriage: natural pregnancy (OR 3.07; 95% CI 1.98–4.75); ART pregnancy (OR 1.45; 95% CI 1.10–1.90) |

**Preterm Birth**

The evidence on SCH and preterm delivery is more nuanced than earlier literature suggested (see Table 3). The Yan et al. (2023) meta-analysis of 16 studies found no statistically significant pooled association between first-trimester SCH and preterm delivery (OR 1.11; 95% CI 0.82–1.51). However, when stratified by size, Yoshihara et al. (2024) demonstrated that hematomas exceeding the 25% cutoff showed significantly higher preterm delivery rates (24.1% vs. 4.2%, p < 0.01). Aki et al. (2022) identified that the clinical symptom order , specifically bleeding occurring before other symptoms , was a prognostic marker for very early preterm delivery due to prolonged SCH duration and coagulation factor XIII depletion.

**TABLE 3: SCH and Preterm Birth Risk**

| | | | | |
|---|---|---|---|---|
| Yan et al., 2023 | Systematic review & meta-analysis | Pooled singleton pregnancies | Preterm delivery | No significant pooled association (OR 1.11; 95% CI 0.82–1.51); evidence insufficient for definitive conclusion |
| Yoshihara et al., 2024 | Retrospective cohort | Singleton pregnancies | Preterm delivery | Preterm delivery 24.1% (large SCH) vs. 4.2% (non-large SCH) vs. 5.3% (no SCH); $p < 0.01$; size-based cutoff ≥25% of GS area identifies high-risk group |
| Pakniat et al., 2025 (HJOG) | Case-control | General pregnancies | Preterm birth | Preterm delivery 15.1% vs. 8.0%; $p = 0.02$; significant association |
| Aki et al., 2022 | Retrospective cohort | SCH patients with vaginal bleeding | Very early preterm delivery | Bleeding-first clinical pattern → prolonged duration of SCH → very early preterm delivery; continuous hemorrhage linked to coagulation factor XIII depletion |
| Huang et al., 2023 (MDPI) | Retrospective analysis | Third-trimester SCH | Premature birth | Premature birth rate 9.35% across 1,112 SCH cases; LBW 6.47%; PROM 17.27% |

**Fetal Growth Restriction (FGR)**

Recent large-scale studies reported a significant and independent association between SCH and FGR (see Table 4). Lou et al. (2025) found FGR rates of 4.0% in the SCH group versus 0.9% in controls ($p = 0.001$) and developed a nomogram incorporating SCH-related variables to predict FGR risk. Pan et al. (2023) demonstrated that both hematoma size and duration independently predicted FGR after multivariable adjustment.

**TABLE 4: SCH and Fetal Growth Restriction (FGR)**

| Study | Design | Population | Outcome | Key Finding |
|---|---|---|---|---|
| Lou et al., 2025 | Retrospective cohort | Singleton pregnancies (excluded losses <20 wks) | FGR | SCH independently associated with FGR (4.0% vs. 0.9%; P = 0.001); nomogram developed to predict FGR risk |
| Pan et al., 2023 | Retrospective cohort | Singleton, natural conception | FGR | Hematoma size (aOR 1.028 per $cm^3$; $p < 0.001$) and duration (aOR 13.36 at 75th percentile; $p < 0.001$) independently associated with FGR |

| Study | Design | Population | Outcome | Key Finding |
|---|---|---|---|---|
| Liang et al., 2023 | Prospective cohort | Singleton pregnancies | FGR | FGR 9.72% in SCH group vs. 0% in controls (p = 0.0015); PROM 15.28% vs. 4.04% (p = 0.0103) |

**Assisted Reproductive Technology (ART) Populations**

Results of the studies in ART populations were inconsistent (refer to the Table 5). Wang et al (2024) showed that SCH in euploid embryo transfer pregnancies was associated with higher early miscarriage, lower live birth rate and higher rate of hypertensive disorders of pregnancy. Yi et al. (2025) conducted a systematic review of the ART-specific risk factors, including endometrial receptivity, ovarian stimulation technique, and embryo transfer method, that become influential in the context of SCH development. However, a recent study by Inman et al (2022) showed that there was no significant connection between SCH and bad outcomes in infertile patients when it is detected incidentally.

**TABLE 5: SCH in ART Populations**

| Study | Population | Design | Outcome | Key Finding |
|---|---|---|---|---|
| Wang et al., 2024 | Euploid embryo transfer (PGT-A/SR) | Retrospective cohort | Miscarriage, live birth, HDP | Early miscarriage higher (10.1% vs. 5.6%; aOR 1.99; 95% CI 1.25–3.16); reduced live birth rate; increased HDP in SCH group |
| Yi et al., 2025 | ART populations | Systematic review | Risk factors for SCH | Endometrial receptivity defects, ovarian stimulation, and frozen embryo transfer cycles identified as ART-specific risk factors for SCH development |
| Inman et al., 2022 | Infertile patients (all ART cycles) | Retrospective cohort | First-trimester miscarriage | No significant association between incidentally noted SCH and first-trimester miscarriage or adverse obstetric outcomes in infertile population |

**Heterogeneity of Findings**

However, there was some variability among the studies (see Table 6) despite the overall general trend. Variations in the method of measurement of SCH, the definition of outcomes, population characteristics, and the timing of the diagnosis of SCH were an important source of heterogeneity.

**TABLE 6: Sources of Heterogeneity**

| Factor | Studies Affected | Explanation |
|---|---|---|
| SCH measurement method | Pan et al. (2023); Yoshihara et al. (2024); Liang et al. (2023) | Volume in $cm^3$ vs. ratio to gestational sac vs. qualitative grading — prevents direct comparison of effect estimates across studies |

| Factor | Studies Affected | Explanation |
|---|---|---|
| Population differences | Inman et al. (2022); Wang et al. (2024); Yi et al. (2025) | Infertile vs. ART vs. natural-conception populations carry different baseline risks, confounding SCH-specific effects |
| Timing of SCH diagnosis | Aki et al. (2022); Huang et al. (2023) | First-trimester vs. third-trimester hematomas represent clinically distinct entities with different prognostic implications |
| Study design differences | Yan et al. (2023) vs. cohort studies | Meta-analysis pools heterogeneous populations; individual cohorts vary in confounder adjustment, blinding, and follow-up completeness |
| Outcome definitions | All studies | Miscarriage, FGR, and preterm thresholds defined inconsistently (e.g., pregnancy loss <20 vs. <28 weeks; FGR by birth weight vs. estimated fetal weight) |

**Quality Assessment (Newcastle–Ottawa Scale)**

The methodological quality of the included observational studies is summarized in Table 7. The studies generally rated as low to low–moderate NOS (7–9) out of a total of 10. Each systematic review was evaluated and analyzed independently based on the PRISMA guidance for the evaluation of systematic reviews.

**Table 7: Newcastle–Ottawa Scale Quality Assessment**

| Study | Design | Selection (max 4) | Comparability (max 2) | Outcome (max 3) | Total Score (max 9) / Risk of Bias |
|---|---|---|---|---|---|
| Pan et al. (2023) | Retrospective cohort | 4 | 2 | 3 | 9 / Low |
| Yoshihara et al. (2024) | Retrospective cohort | 3 | 2 | 2 | 7 / Low–Moderate |
| Liang et al. (2023) | Prospective cohort | 4 | 2 | 3 | 9 / Low |
| Wang et al. (2024) | Retrospective cohort | 3 | 2 | 2 | 7 / Low–Moderate |
| Elmas et al. 2023 (Thieme) | Retrospective observational | 3 | 1 | 2 | 6 / Moderate |
| Xu et al. (2023) | Retrospective cohort | 3 | 2 | 2 | 7 / Low–Moderate |
| Inman et al. (2022) | Retrospective cohort | 3 | 1 | 2 | 6 / Moderate |
| Aki et al. | Retrospective | 3 | 1 | 2 | 6 / |

| Study | Design | Selection (max 4) | Comparability (max 2) | Outcome (max 3) | Total Score (max 9) / Risk of Bias |
|---|---|---|---|---|---|
| (2022) | cohort | | | | Moderate |
| Huang et al. (2023) | Retrospective analysis | 3 | 1 | 2 | 6 / Moderate |
| Yan et al. (2023) | Systematic review / MA | N/A (AMSTAR) | — | — | Registered; PRISMA-compliant / Low risk |
| Lou et al. (2024) | Retrospective cohort | 4 | 2 | 3 | 9 / Low |
| Lou et al. (2025) | Retrospective cohort | 4 | 2 | 3 | 9 / Low |
| Yi et al. (2025) | Systematic review | N/A | — | — | Literature review; moderate quality |
| Pakniat et al. (2025) HJOG | Case-control | 3 | 2 | 2 | 7 / Low–Moderate |

**Discussion**

This systematic review aimed to summaries data from 14 studies published from 2022-25 with over 5000 pregnant women to assess the relationship between subchorionic hematoma (SCH) volume and poor pregnancy outcomes. All the body of evidence is consistent and shows that more serious complications of pregnancy, such as miscarriage or fetal growth restriction, are positively correlated with enlarged hematoma; in the latter case, a certain size threshold seems to exist beyond which adverse outcomes would be associated with larger hematomas. The data have significant practical implications in the first trimester risk stratification and customization of the antenatal surveillance strategy.

A major and consistent conclusion from all the studies examined was that there was an independent relationship between SCH size to adverse pregnancy outcomes. Pan et al. (2023) and Liang et al. (2023) showed a dose dependent relationship with the greatest hematomas being associated with the greatest risk for FGR, TPROM, and preterm birth. In a subsequent study, Yoshihara et al. (2024) improved this evidence by offering a quantitative benchmark (that is, a ratio of SCH area by CA of > 25%) to help distinguish high-risk cases from low- or normal-risk cases as an objective and repeatable measure. The biological chain of events is ideologically accepted: bigger haematomas are associated with greater disruptions of the trophoblastic, therefore, there is a greater impact on the placental blood suppply and an increased risk of the sequelae to haematoma.

One of the most frequently cited associations of SCH with miscarriage in this review was with miscarriage rates. Lou et al. 2024 showed that SCH was independently associated with a risk of pregnancy loss prior to 20 weeks gestation (aOR: 1.94) and

this risk was greatly increased when SCH occurred by 7 weeks (aOR: 2.71). The miscarriage association has also been confirmed in both natural-conception (OR 3.07) and ART pregnancies in meta-analysis of Yan et al. (2023). The nuanced finding here for Lou et al. (2024) was that in the cohort, the size of the hematoma was not an independent predictor of miscarriage – in fact, a test that was more predictive was the timing in early gestation. This means that rather than size alone, the stage of placental morphogenesis at which SCH occurs could be more relevant clinically to the risk of miscarriage.

Another important finding of this review was that the ORs for SCH and preterm delivery reported in the meta-analysis by Yan et al. (2023) were not statistically significant (OR 1.11; 95% CI 0.82–1.51). This is significant evidence for previous literature, which usually framed this as riskier account, but not this. No clear correlation was found, however, between the size of a SCH when it is considered quantitatively as shown by Yoshihara et al. (2024) that there was a significant increase in the rate of preterm delivery in patients with which SCHs compared to patients without any SCHs (24.1% v 4.2%). Aki et al. 2022 added clinical nuance, based on the fact that timing of the manifestation, namely the first clinical symptom of bleeding, was a strong predictor for longer SCH duration and very early preterm delivery due to coagulation factor XIII depletion. Combined, these results indicate that the factors that drive the risk of prematurity are SCH size, and pattern of clinical presentation, not the mere occurrence of SCH.

One of the most clinically relevant finding of this review is the association between SCH and FGR. In a large singleton pregnancy cohort, Lou et al. (2025) demonstrated the independent predictive association of SCH with FGR (4.0% vs. 0.9%, P = 0.001), and created a predictive nomogram. According to Pan et al., (2023), body surface area (BUA) and duration of hematoma were independently and strongly correlated with FGR; and longer hematomas (>6.86 weeks duration) resulted in a 13.4-fold increase in the odds of FGR. The mechanism is likely to be due to SCH effects on intervillous blood flow which reduce the nutrient and oxygen exchange. These results indicate that those pregnancies associated with large and/or persistent SCH should be monitored for fetal growth specifically rather than in general.

In an earlier study by Wang et al (2024) in euploid embryo transfer pregnancies, SCH was still found to be a risk factor even when aneuploidy was not considered as a confounder (aOR 1.99 for early miscarriage). It is significant that this approach enabled one to subtract the effects of the ART-produced embryos from the effects arising from the developmental history and other events that may affect embryo development in ART patients. In particular, Yi et al. (2025) concluded that endometrial preparation and stimulation protocols were upstream risk factors for the formation of SCHs in ART. In contrast, Inman et al. (2022) reported no significant adverse relationship; this may be due to differences in study power or due to the fact that there were population specific confounders.

There was significant variation between studies, mostly due to differences in definitions of SCH size, in thresholds of outcomes and in characteristics of populations. The single greatest methodology challenge in this field is the absence of a universally accepted measurement protocol as some measurements are absolute, some are in relation to the measurements of the gestational sac and others are qualitative in grading. Furthermore, Elmas et al. (2023) reported in their study that there was no association of pregnancy loss with the size of the hematoma, indicating that size may have different prognostic significance. However, these factors restricted the possibility of carrying out formal quantitative metanalysis for most outcomes.

## Clinical Implications

This review was conducted and has implications for action for antenatal practice. First, SCH size needs to be consistently measured and reported at first-trimester ultrasonography and standardized methods, such as the gestational-sac-ratio method validated by Yoshihara et al. (2024), should be used. Second, counselling should be offered to structured counselling to women with large SCH (SCH ≥25% of gestational sac area) or early onset SCH, with an explanation of the higher possibility of miscarriage, FGR and, potentially, preterm delivery, plus increased monitoring. Third, the clinical symptom pattern (e.g., bleeding-first presentation) should be taken into account along the size of the haematoma in risk stratification. Fourth, the SCH pregnancies in ART should be monitored at the same level as natural-conception pregnancies.

## Limitations of This Review

There are some restrictions to be noted in this review. Firstly, due to their intention, it could be because the time applied to studies was from 2022 onwards but did not capture the appropriate foundational studies from prior to this. Second, there was significant variation in the definition of SCHs, the outcome thresholds of each SCH, and the demographic and population characteristics, so a formal quantitative, systematic meta-analysis was not possible, which necessitated relying on narrative synthesis for findings. Third, most of the studies included were observational in design – two systematic reviews were included, but fully appraising the studies for causal inference was limited because other potential confounders were not always included in the analyses, such as maternal age, thrombophilia, and prior pregnancy history. Fourthly, there is a publication bias, since studies reporting significant associations have a higher chance of being published, which may lead to the bias that reported effect sizes may be higher than the true effect sizes. A minor deviation from the pre-specified inclusion criteria was in 1 of the 5 studies used, which did not report SCH size as a primary study variable (5th study ( Xu et al., 2023 )). Lastly, this review was not prespecifically registered with PROSPERO reducing the ability to protect from outcome reporting bias.

## Future Research Directions

Validation of a universally-accepted, systematic SCH size classification is an important future objective. Long-term, multicentre cohort studies with strict criteria for outcomes and serial measurement of hematoma would really advance the field. More research is needed to determine the effectiveness of additional treatments for women with large SCH, specifically controlled trials of progesterone supplementation.

## Conclusion

In pregnancies where subchorionic hematoma size is greater than predetermined thresholds, this systematic review supports that there is an association with the size of the hematoma with an adverse outcome of the pregnancy, such as miscarriage, fetal growth restriction and preterm delivery. Important: the general results suggest that there is no statistically significant relationship between non-specific presence or absence of SCH and the risk of preterm delivery; however, the size of the haematoma seems to be a better predictor, but results are still not unanimous regarding the best method of measuring and different populations. As mentioned by Yoshihara et al. (2024), the cutoff of SCH-to-gestational-sac ratio ≥25% is considered clinically

applicable for the assessment of the risk for first-trimester screening; however, this needs to be validated in a prospective study. However, in populations undergoing assisted reproductive technology, SCH also predicted higher risk of miscarriage, but the presence of unique confounders across the population analyzed should be explored. Applying these findings to evidence-based, strong clinical guidelines will require standardization of SCH measurement protocols and prospective multicentre studies.

**References**


Aki, M., Katsumata, M., Yamanoi, K., Ueda, A., Nakakita, B., Tani, H., Kawasaki, K., Chigusa, Y., Mogami, H., Mandai, M., & Kondoh, E. (2022). The significance of clinical symptoms of subchorionic hematomas, "bleeding first", to stratify the high-risk subgroup of very early preterm delivery. *Taiwan Journal of Obstetrics and Gynecology*, *61*(2), 243–248. https://doi.org/10.1016/j.tjog.2022.02.011

Elmas, B., Özgü, B. S., Zorlu, U., & Çetinkaya, Ş. (2023). Do first-trimester subchorionic hematomas affect pregnancy outcomes? *Zeitschrift für Geburtshilfe und Neonatologie*, *227*(1), 31–35. https://doi.org/10.1055/a-1929-9500

Huang, H., Han, H., Xie, H., Ying, H., & Bao, Y. (2023). Subchorionic hematoma association with pregnancy complications and outcomes in the third trimester. *Journal of Personalized Medicine*, *13*(3), Article 479. https://doi.org/10.3390/jpm13030479

Inman, E. R., Miranian, D. C., Stevenson, M. J., Kobernik, E. K., Moravek, M. B., & Schon, S. B. (2022). Outcomes of subchorionic hematoma-affected pregnancies in the infertile population. *International Journal of Gynecology and Obstetrics*, *159*(3), 743–750. https://doi.org/10.1002/ijgo.14162

Liang, W., Yan, X., Shi, Y., Chen, B., An, L., Huang, B., & He, F. (2023). Association between graded subchorionic hematoma and adverse pregnancy outcomes in singleton pregnancies: A prospective observational cohort study. *Archives of Gynecology and Obstetrics*, *309*(2), 541–549. https://doi.org/10.1007/s00404-023-06943-8

Lou, Y., Chen, G., Wang, L., Zhao, X., & Ma, J. (2024). Association between first-trimester subchorionic hematoma and pregnancy loss before 20 weeks of gestation in singleton pregnancies. *Scientific Reports*, *14*, Article 30034. https://doi.org/10.1038/s41598-024-81759-3

Lou, Y., Chen, G., Wang, L., Zhao, X., & Ma, J. (2025). A nomogram for predicting the risk of fetal growth restriction in singleton pregnancies with subchorionic hematomas detected in first trimester. *BMC Pregnancy and Childbirth*, *25*, Article 144. https://doi.org/10.1186/s12884-025-07241-8

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Gluud, C., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, Article n71. https://doi.org/10.1136/bmj.n71

Pakniat, H., Hosseini, M. A., Aboutorabi, S. S., Rasti, A., Nabiei, M., & Sadeghi Niaraki, F. (2025). The impact of subchorionic hematoma in the first trimester on maternal and neonatal outcomes in singleton pregnancies. *Hellenic Journal*

*of Obstetrics and Gynecology*, *25*(1), 55–64. https://doi.org/10.33574/hjog.0615

Pan, S., Lan, Y., Zhou, Y., Chen, B., Zhou, F., Dai, D., & Hua, Y. (2023). Associations between the size and duration of asymptomatic subchorionic hematoma and pregnancy outcomes in women with singleton pregnancies. *BMC Pregnancy and Childbirth*, *23*, Article 555. https://doi.org/10.1186/s12884-023-05831-y

Wang, W., Zhao, Q., Liu, Y., Guo, L., Zhou, W., Zhang, Q., Yan, J., & Ni, T. (2024). The impact of first-trimester subchorionic hematomas on pregnancy outcomes after euploid embryo transfer: A retrospective cohort study. *BMC Pregnancy and Childbirth*, *24*, Article 180. https://doi.org/10.1186/s12884-024-06359-5

Xu, T., Lun, W., Wang, P., & He, Y. (2023). Analysis of risk factors and pregnancy outcomes in pregnant women with subchorionic hematoma. *Medicine*, *102*(47), Article e35874. https://doi.org/10.1097/MD.0000000000035874

Yan, X., Xu, H., Li, J., Xu, Z., Niu, Y., & Wang, Y. (2023). Subchorionic hematoma and risk of preterm delivery: A systematic review and meta-analysis. *American Journal of Obstetrics and Gynecology MFM*, *5*(1), Article 100791. https://doi.org/10.1016/j.ajogmf.2022.100791

Yi, X., Zhaxicuo, & Tian, D. (2025). Risk factors of subchorionic hematoma under assisted reproductive technology. *Journal of Obstetrics and Gynaecology Research*, *51*, Article e70142. https://doi.org/10.1111/jog.70142

Yoshihara, T., Okuda, Y., & Yoshino, O. (2024). Quantification of the size of subchorionic hematoma causing pregnancy-related complications: A retrospective cohort study. *Journal of Medical Ultrasonics*, *51*(4), 649–654. https://doi.org/10.1007/s10396-024-01488-y