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Original Research Article

Subchorionic Hematoma Volume in the First Trimester and Risk of Spontaneouse Abortion

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Abstract: ***Background*:** Subchorionic hemorrhage (SCH), also referred to as subchorionic hematoma, is the most common sonographic abnormality associated with first-trimester vaginal bleeding. It occurs between 6 and 13 weeks of gestation and is reported in approximately 11% of pregnancies. SCH is characterized by bleeding between the chorionic membrane and the uterine wall. ***Aim*:** This study aimed to evaluate the association between the volume of first-trimester subchorionic hematoma and the risk of spontaneous miscarriage. ***Methods*:** A cross-sectional study was conducted involving 53 pregnant women in their first trimester, aged 18–35 years, who attended the obstetric clinic at Al-Diwaniyah Maternity and Children Teaching Hospital between May and November 2022. Women with a viable intrauterine pregnancy, gestational age between 6 and 13 weeks, and an ultrasound-confirmed diagnosis of subchorionic hematoma were included in the study. Fetal viability was assessed by ultrasonography. Hematomas were categorized according to their volume. Data were collected and analyzed using Statistical Package for the Social Sciences (SPSS) version 23. ***Results*:** The mean age of the participants was 28.3 ± 6.4 years (range: 18–35 years). Participants were stratified into three age groups. The mean hematoma volumes were 9.4 ± 2.5 cm^3 for small hematomas, 16.3 ± 1.2 cm^3 for medium hematomas, 22.7 ± 3.4 cm^3 for large hematomas, and 37.2 ± 9.4 cm^3 for very large hematomas. Women who experienced spontaneous abortion had significantly larger hematoma volumes compared with those who maintained their pregnancies ($p < 0.05$). The mean gestational age was 8.9 ± 1.3 weeks among women with small hematomas and 10.2 ± 1.9 weeks among those with very large hematomas. ***Conclusion*:** An Increased Volume of Subchorionic Hematoma during the First Trimester is Significantly Associated with a Higher Risk of Spontaneous Abortion.

Keywords: Subchorionic hemorrhage, Subchorionic hematoma, First-trimester bleeding, Spontaneous miscarriage, Spontaneous abortion, Ultrasonography.

INTRODUCTION

Pregnancy is conventionally divided into three trimesters: the first trimester (0–13 weeks), second trimester (14–26 weeks), and third trimester (27–40 weeks). Each trimester is characterized by distinct maternal physiological adaptations and fetal developmental milestones [1]. During the first trimester, organogenesis occurs, and pregnant women commonly experience symptoms such as nausea, fatigue, breast tenderness, and increased urinary frequency [2]. The second trimester is often associated with a reduction in early pregnancy symptoms and is considered a period of relative maternal well-being. Fetal movements, known as quickening, are typically perceived between 16 and 20 weeks of gestation. Fetal sex may be identified by ultrasonography as early as 14 weeks, while detailed anatomical assessment is commonly performed between 18 and 20 weeks of gestation [4]. During the third trimester, rapid fetal growth and maturation occur, while maternal symptoms may include dyspnea, hemorrhoids, urinary incontinence, varicose veins, and sleep disturbances due to progressive uterine enlargement [5]. At this stage, fetal organs become fully functional, and the fetus usually assumes a cephalic presentation in preparation for delivery [2].

Following fertilization, the zygote undergoes a series of mitotic divisions to form a morula and subsequently a blastocyst. Approximately six days after fertilization, the blastocyst implants into the uterine endometrium [2]. The inner cell mass develops into the embryoblast, whereas the outer cell mass differentiates into the trophoblast. The trophoblast subsequently gives rise to the cytotrophoblast and syncytiotrophoblast, which are essential for implantation and placental development [2]. Chorionic villi emerge as projections from the cytotrophoblast and continue to proliferate and branch extensively, forming the chorion frondosum, which contributes to the fetal component of the placenta [3].

As placental maturation progresses, the chorionic villi become increasingly vascularized and specialized for maternal–fetal exchange. Terminal villi develop thin syncytiovascular membranes that facilitate efficient transfer of oxygen, nutrients, and metabolic waste products between the maternal and fetal circulations [3]. Stem villi provide structural support and contain larger fetal blood vessels, whereas terminal villi serve as the primary sites of exchange. The chorion frondosum ultimately forms the bulk of the placental disc, while the chorion laeve regresses during placental development [2, 3].

Miscarriage is one of the most common complications of pregnancy, with an estimated prevalence of approximately 20% [6]. It is defined as the spontaneous loss of a pregnancy before 20 weeks of gestation. Clinically, miscarriage may be classified as threatened, inevitable, incomplete, complete, missed, recurrent, biochemical, or septic miscarriage [6, 7]. Threatened miscarriage is characterized by vaginal bleeding in the presence of a viable intrauterine pregnancy, whereas incomplete miscarriage involves partial expulsion of the products of conception. Complete miscarriage refers to complete expulsion of all pregnancy tissues, while septic miscarriage is associated with uterine infection. Recurrent miscarriage is generally defined as three consecutive pregnancy losses before 20 weeks of gestation [6].

The etiology of miscarriage is multifactorial and includes chromosomal abnormalities, Mendelian genetic disorders, endocrine dysfunction, immunological abnormalities, uterine anomalies, infectious diseases, and environmental factors [6-9]. However, in a substantial proportion of cases, the underlying cause remains unknown [6-9].

First-trimester vaginal bleeding is a common obstetric complication, affecting approximately 16–25% of pregnancies [8]. Among the various causes, subchorionic hemorrhage (SCH), also known as subchorionic hematoma, is the most frequently identified sonographic abnormality and accounts for approximately 11% of pregnancies [8]. SCH is characterized by bleeding between the chorionic membrane and the uterine wall, usually resulting from partial separation of the chorion from the endometrium [1].

Subchorionic hematoma is a common ultrasonographic finding among women presenting with vaginal bleeding during early pregnancy. Although many patients experience light vaginal bleeding, some remain asymptomatic and are diagnosed incidentally during routine ultrasonographic examination [10]. The exact pathogenesis of SCH remains unclear; however, uterine malformations, recurrent pregnancy loss, and pelvic infections have been proposed as potential predisposing factors [1]. Since its first description in 1981, the clinical significance of SCH has remained controversial. Several studies have reported associations between SCH and adverse pregnancy outcomes, including hypertensive disorders of pregnancy, placental abruption, preterm delivery, and pregnancy loss [11].

Clinical presentation varies from asymptomatic cases to vaginal bleeding accompanied by abdominal pain, uterine cramping, or contractions. Comprehensive obstetric and gynecological history taking is essential, including documentation of previous pregnancies, sexually transmitted infections, pelvic inflammatory disease, and risk factors for ectopic pregnancy [12, 13]. Physical examination should include abdominal and pelvic assessment. In women presenting with vaginal bleeding, a speculum examination is recommended to assess cervical status and identify any retained products of conception, which should be submitted for histopathological evaluation when present [14].

Ultrasonography is the imaging modality of choice for evaluating first-trimester bleeding and can identify intrauterine hemorrhage in approximately 22% of affected women [15]. Sonographically, SCH appears as a crescent-shaped hypoechoic or anechoic collection adjacent to the gestational sac or placenta. Diagnosis may be challenging because hematomas can mimic amniotic fluid, placental tissue, or myometrium depending on their echogenic characteristics [1]. In pregnancies between 10 and 12 weeks of gestation, fetal cardiac activity should be confirmed, with a normal fetal heart rate ranging from 110 to 160 beats per minute [14].

Pregnant women presenting with vaginal bleeding or abdominal pain should undergo prompt assessment, including pregnancy testing, serum β-human chorionic gonadotropin measurement, and ultrasonography to exclude potentially life-threatening conditions such as ectopic pregnancy [14]. Additional laboratory investigations, including complete blood count, coagulation profile, and blood typing, may be necessary in cases of severe bleeding or hemodynamic instability [8].

Management of SCH depends on gestational age, hematoma size, symptom severity, and maternal clinical status [12]. Rh-negative women with vaginal bleeding should receive anti-D immunoglobulin when indicated to prevent Rh alloimmunization in future pregnancies [13]. Treatment strategies should be individualized according to clinical presentation and hematoma characteristics.

Several studies have investigated the prognostic significance of SCH. Evidence suggests that pregnancy outcome is influenced by hematoma size, maternal age, and gestational age at diagnosis [8]. Hematomas occupying 25% or more of the gestational sac volume have been associated with a significantly increased risk of pregnancy loss. Furthermore, retroplacental hematomas appear to confer a poorer prognosis than marginal hematomas [12]. Earlier detection of SCH during pregnancy has also been associated with higher rates of subsequent pregnancy failure [15].

Women with SCH have an increased risk of spontaneous miscarriage, placental abruption, preterm labor, premature rupture of membranes, and both early and late pregnancy loss [12]. Some studies have additionally identified SCH as a risk factor for pregnancy-induced hypertension during the third trimester [14]. However, evidence regarding its impact on overall pregnancy outcome remains inconsistent, and the relationship between hematoma volume and miscarriage risk continues to be debated.

Therefore, the present study aimed to evaluate the association between first-trimester subchorionic hematoma volume and the risk of miscarriage among pregnant women.

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was conducted at the Obstetrics Clinic of Al-Diwaniyah Maternity and Children Teaching Hospital, Al-Diwaniyah, Iraq, between May 2022 and November 2022. The study enrolled pregnant women aged 18–35 years who presented during the first trimester of pregnancy and were diagnosed with subchorionic hematoma (SCH).

Eligible participants had a viable singleton intrauterine pregnancy with a gestational age ranging from 6 to 13 weeks. Fetal viability was confirmed by ultrasonographic examination. The volume of the subchorionic hematoma was measured and recorded for all enrolled patients.

Inclusion Criteria

The study included pregnant women who met the following criteria:

- Age between 18 and 35 years.
- Viable singleton intrauterine pregnancy.
- Gestational age between 6 and 13 weeks.
- Ultrasonographic diagnosis of subchorionic hematoma.

Exclusion Criteria

Patients were excluded if they met any of the following criteria:

1. Multiple gestation.
2. Presence of uterine pathology, including uterine fibroids or endometrial polyps.
3. Gross fetal congenital anomalies.
4. Systemic disorders such as hepatic disease, renal disease, coagulopathies, or autoimmune disorders.
5. Refusal to participate or inability to comply with the study protocol.

Data Collection

All participants underwent detailed history taking and comprehensive clinical examination using a structured questionnaire. Data collected included demographic characteristics, presenting complaints, history of the current illness, past medical and surgical history, obstetric history, laboratory findings, and ultrasonographic findings.

Gestational age was determined based on the date of the last menstrual period and confirmed by ultrasonographic assessment before study enrollment.

Participants were categorized into four groups according to the size of the subchorionic hematoma relative to the gestational sac:

- **Small hematoma:** <20% of the gestational sac size.
- **Medium hematoma:** 20–50% of the gestational sac size.
- **Large hematoma:** 50–66% of the gestational sac size.
- **Very large hematoma:** >66% of the gestational sac size.

This classification was used to evaluate the association between hematoma volume and the risk of spontaneous miscarriage.

Participants were subsequently classified into two outcome groups:

1. Women who experienced spontaneous abortion.
2. Women whose pregnancies continued beyond the first half of gestation.

Ultrasonographic Assessment

All ultrasonographic examinations were performed by the same investigator using real-time ultrasound equipment equipped with 3.5-MHz and 5-MHz transducers. Scanning was conducted in longitudinal, transverse, and oblique planes to ensure accurate assessment of the hematoma dimensions.

Subchorionic hematoma was defined as a hypoechoic or anechoic crescent-shaped collection located between the chorionic membrane and the myometrium. Hematoma volume was calculated using the following formula:

Hematoma volume (cm^3) = Transverse diameter × Anteroposterior diameter × Longitudinal diameter × 0.52

Where 0.52 represents a correction factor accounting for the ellipsoid shape of the hematoma.

Patients with viable embryos or fetuses and documented SCH were followed by serial ultrasonographic examinations at intervals of 7–10 days. Follow-up continued until one of the following outcomes occurred:

- Resolution of the hematoma.
- Spontaneous pregnancy loss.
- Pregnancy progression beyond 24 weeks of gestation.

All participants received progesterone therapy in the form of oral tablets and vaginal suppositories and were advised to limit physical activity and maintain adequate rest throughout the follow-up period.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment, and all procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

Statistical Analysis

Data were entered into a computerized database and analyzed using the Statistical Package for the Social Sciences (SPSS) software, version 23 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were presented as frequencies and percentages. Statistical significance was determined using appropriate statistical tests, and a p-value <0.05 was considered statistically significant.

RESULTS

Total of sample was 53 patients with mean age of patients was 28.3±6.4. The sample was divided to three categories according to age of women, twenty six point five percent of sample were age between 18-25 years, 58.5% in age group from 26-30 years and 15% the age range from 31-35 years. According to residency 73.5% of patient live in urban areas and 26.5% come from rural regions.

Seventeen percent of patients were primigravida and 83% were multiparous. The mean gestational age of patients was 9.8±2.4 and BMI was 29.1±3.6, as shown in table one.

Table 1: Patients characters included in present study

Variables		Number	Percent
Age	18-25 year	14	26.5%
	26-30 year	31	58.5%
	31-35 year	8	15%
Residency	Urban	39	73.5%
	Rural	14	26.5%
Gravidity	Primigravida	9	17%
	Multiparous	44	83%
Gestational age		9.8±2.4	
BMI		29.1±3.6	

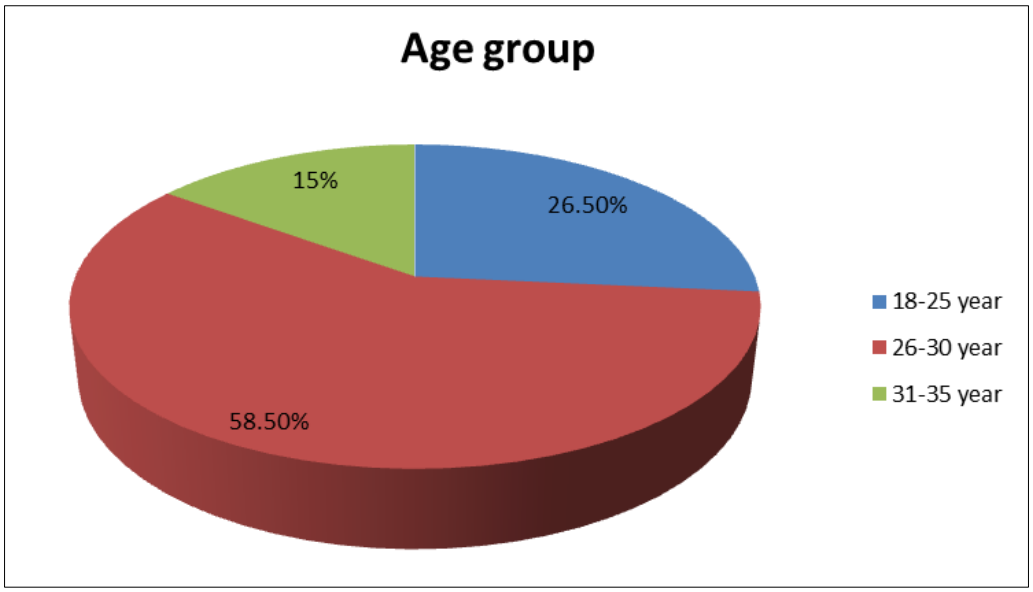

Figure 1: Age distribution of subjects in present study.

The incidence of abortion was seen in 71.6% of patients with subchorionic hematoma and 28.4% continue pregnancy without abortion. As shown in table 2.

Table 2: The incidence of abortion in the present study

Variables		Subchorionic hematoma	
		Number	Percent
Abortion	yes	38	71.6%
	No	15	28.4%
	Total	53	

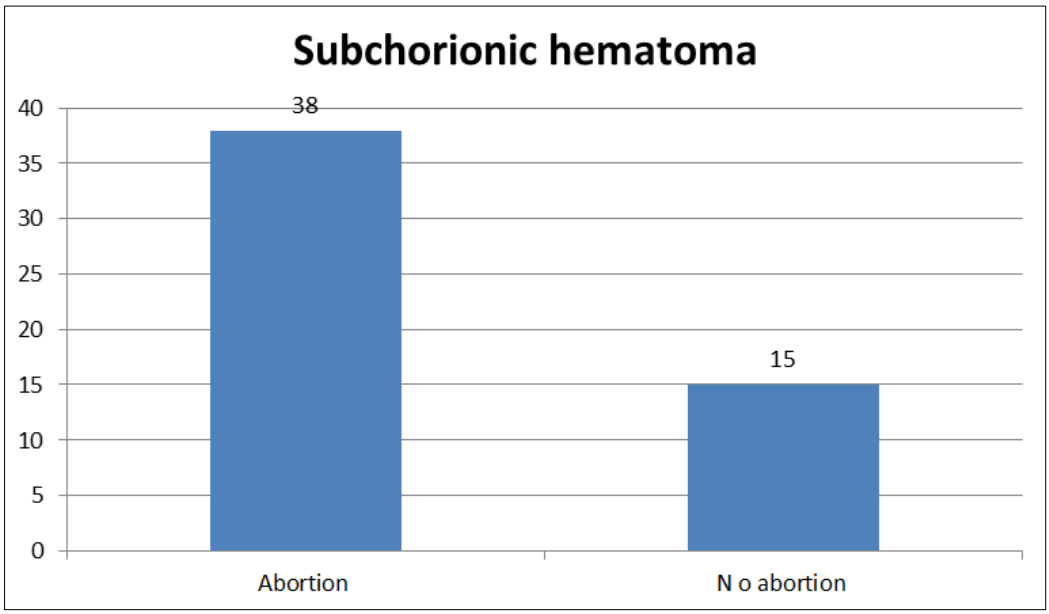

Figure 2: subchorionic hematoma outcome in this study

In table 3 show relation of incidence of abortion according to patients variables, there were no statistical significant association between age and occurrence of abortion. Abortion happened in 76.9% of urban living whereas 57.1% of rural residency had abortion in our sample. More over multiparous show higher percentage of abortion 75% in compare to 55.5% of primigravida women which are presented with abortion. Gestational age are not significant difference between women end by abortion and that had no abortion.

Table 3: The relation between demographical data and abortion in this study

		Abortion			
		Yes	No	Total	p-value
Age	18-25	8	6	14	0.06
	26-30	26	5	31	
	31-35	4	4	8	
Residency	Urban	30(76.9%)	9(23.1%)	39	0.2
	Rural	8(57.1%)	6(42.9%)	14	
Gravidity	Primigravida	5(55.5%)	4(44.5%)	9	0.4
	Multiparous	33(75%)	11(25%)	44	
Gestational age		9.9±2.1	9.6±3.1	9.8±2.4	0.3

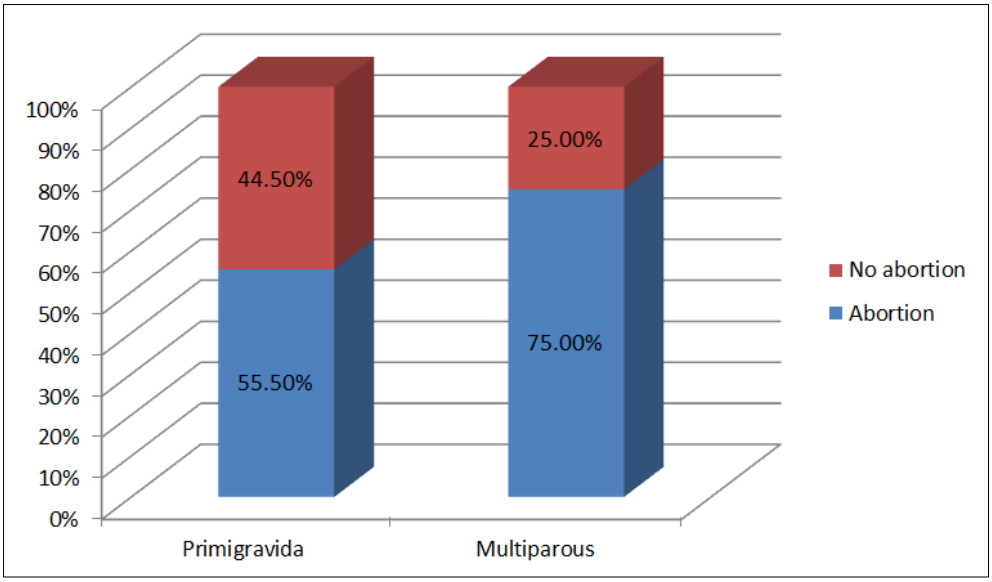

Figure 3: The outcome of pregnancy in according to parity in this study

There were four categories of hematoma size, small volume 9.4±2.5 cm^3, medium 16.3±1.2 cm^3, large 22.7±3.4 cm^3 and very large 37.2±9.4 cm^3 The size of hematoma increase with advance in gestational age, the patients with small size hematoma had mean of gestational age about 8.9±1.3 week whereas patients in class of very large hematoma 10.2±1.9 week. These results demonstrate in table 4. Patients with abortion appear larger size of hematoma than women with no abortion. These difference was significant and reveal in table 5.

Table 4: The categories of hematoma in this study

	Small	Medium	Large	Very large
Volume of the hematoma, cm^3	9.4±2.5	16.3±1.2	22.7±3.4	37.2±9.4
Gestational age	8.9±1.3	9.2±2	9.1±2.3	10.2±1.9

Table 5: The size of hematoma in relation to abortion in this study

Variables		Size of Subchorionic Hematoma
Abortion	yes (38)	31.4± 15.1 cm^3
	No (15)	16.2 ± 7.3 cm^3
	p-value	0.01

DISCUSSION

Subchorionic hematoma (SCH) may adversely affect pregnancy through several mechanisms. Theoretically, a large hematoma may compromise pregnancy viability through its direct mechanical effect and pressure on the gestational sac. Furthermore, pregnancy outcome may depend on the hematoma's location, its proximity to the placenta, and its overall volume [16]. First-trimester bleeding, with or without hematoma formation, may trigger a chronic inflammatory response within the decidua, resulting in persistent myometrial activity and subsequent pregnancy loss [17]. It has been reported that approximately two-thirds of miscarriages are associated with abnormalities in placentation, characterized by thinning and fragmentation of the trophoblastic layers, reduced cytotrophoblastic invasion of the spiral arteries, and subsequent weakening and rupture of placental structures [3].

In the present study, the mean maternal age was 28.3 ± 6.4 years, while the mean gestational age at diagnosis was 9.8 ± 2.4 weeks. Primigravidae represented 17% of the study population, whereas 83% were multiparous. These findings are comparable to those reported by Şükür *et al*., [1]. Similarly, Isabel *et al*., reported a mean maternal age of 28.7 ± 8.2 years and a mean gestational age of 9.2 ± 2.0 weeks at the time of ultrasound evaluation (18). In contrast, Naert *et al*., reported a higher maternal age of 32.7 years and a mean gestational age of 8.5 weeks [14]. Moreover, the proportion of primigravid women in our study was lower than that reported by Al-Memar *et al*., [19].

The incidence of spontaneous abortion among women with SCH in the current study was 71.6%, whereas 28.4% of pregnancies continued beyond the first half of gestation. Women who experienced miscarriage had a slightly higher mean maternal age (28.8 ± 6.4 years vs. 27.8 ± 8.3 years) and gestational age at diagnosis (9.9 ± 2.1 weeks vs. 9.6 ± 2.4 weeks) compared with those whose pregnancies continued. However, these differences were not statistically significant. These findings are consistent with those reported by Isabel *et al*., (18). Conversely, a prospective study conducted by Dongol *et al*., reported a miscarriage rate of only 27%, which is considerably lower than that observed in the present study [20]. Similarly, Naert *et al*., found no significant association between gestational age at diagnosis and miscarriage risk [14].

In our cohort, women with small hematomas had a mean gestational age of 8.9 ± 1.3 weeks, whereas those with very large hematomas had a mean gestational age of 10.2 ± 1.9 weeks. Furthermore, women who experienced miscarriage had significantly larger hematoma volumes than those with ongoing pregnancies. These findings are in agreement with the results reported by Isabel *et al*., [18]. Likewise, Ball *et al*., in a retrospective case-control study involving 238 women with ultrasonographically diagnosed SCH, demonstrated a significant association between SCH and both miscarriage and preterm delivery. They further reported that the risk of pregnancy loss increased proportionally with hematoma size [21].

Similarly, Nagy *et al.,* compared 187 patients with SCH to 6,488 controls and found significantly increased rates of miscarriage, intrauterine growth restriction (IUGR), and preterm delivery among women with SCH. However, they did not identify a significant association between hematoma size or location and pregnancy outcome [22]. Norman *et al*., also reported that women with SCH were at increased risk of preterm birth [23]. Furthermore, a meta-analysis conducted by Tuuli *et al*., including 1,735 women from seven studies, demonstrated that SCH significantly increased the risks of early and late pregnancy loss as well as preterm premature rupture of membranes (PPROM) [8].

Uluğ *et al*., reported that first-trimester bleeding was associated with an increased risk of preterm delivery and low birth weight. However, they found no significant relationship between pregnancy prognosis and either the presence or size of SCH [24]. Likewise, Özkaya *et al*., evaluated 43 patients with SCH and found that SCH increased the risks of miscarriage and IUGR but was not significantly associated with preterm delivery [25].

The findings of Al-Memar *et al*., demonstrated an overall increased risk of preterm birth among pregnancies complicated by first-trimester SCH, which is consistent with previous studies [19-22]. In addition, a systematic review by Xiang *et al*., identified retroplacental location and persistence of SCH as strong predictors of adverse pregnancy outcomes [4].

Conversely, Johns *et al*., reported that although first-trimester vaginal bleeding was associated with adverse pregnancy outcomes, the presence of SCH itself did not significantly influence prognosis [26]. Similarly, the meta-analysis by Qin *et al.,* demonstrated that first-trimester SCH significantly increased the risk of spontaneous abortion, preterm birth, placental abruption, and fetal growth restriction compared with uncomplicated pregnancies [27].

Tuuli *et al*., further concluded that intrauterine hematoma (IUH) increases the risks of spontaneous abortion, stillbirth, preterm delivery, and PPROM [8]. Xiang *et al*., reported that retroplacental, posterior, fundal, and persistent hematomas were associated with adverse pregnancy outcomes [4]. However, their analysis included women diagnosed during both the first and second trimesters. The literature remains inconsistent regarding the relationship between SCH and miscarriage, with some studies reporting no increased risk [1], while others demonstrate a significant association [28]. Previous investigations have also suggested that SCH diagnosed before 7–8 weeks of gestation is associated with a higher risk of pregnancy loss [12]. In contrast, Al-Memar *et al*., found no increased risk of miscarriage after adjustment for vaginal bleeding, pelvic pain, and gestational age at diagnosis [19].

Qin *et al.,* suggested that small hematomas may have minimal clinical consequences, whereas larger hematomas are associated with significant pregnancy complications [27]. Similarly, Hashem *et al*., demonstrated that spontaneous abortion occurred more frequently among women with large hematomas than those with small hematomas, findings that were also supported by Özkaya *et al*., [25-29]. Nevertheless, differences in SCH classification systems among studies limit direct comparisons and hinder definitive conclusions regarding the impact of hematoma size on pregnancy outcomes.

The exact mechanisms underlying the association between SCH and adverse pregnancy outcomes remain uncertain. One proposed explanation is premature perfusion of the intervillous space before placental adaptation to oxidative stress, resulting in placental dysfunction [1]. Another possible mechanism involves the underlying causes of SCH and its secondary mechanical effects. Shallow trophoblastic invasion and impaired angiogenesis may result in fragile blood vessels that predispose women to both SCH formation and adverse pregnancy outcomes [8]. Moreover, the presence of a hematoma, particularly in a retroplacental location, may create an area of placental weakness, increasing the likelihood of placental separation and subsequent placental abruption [8]. The findings of the current study support the hypothesis that SCH exerts a mechanical effect on pregnancy maintenance. Detachment of the gestational sac from the endometrium and the presence of a large hematoma may contribute to pregnancy loss. However, if the gestational sac remains viable and successfully reattaches to the endometrial lining, pregnancy may continue without further adverse consequences [1].

Several mechanisms have also been proposed to explain the association between SCH and preterm birth. One hypothesis suggests that SCH interferes with normal placental implantation and development [30]. Stabile *et al*., in a retrospective cohort study evaluating SCH, cervical length, and preterm birth, demonstrated a significant association between SCH and preterm delivery even after adjustment for cervical length, vaginal bleeding, and progesterone use [30]. These findings suggest that mechanisms other than cervical shortening may contribute to preterm birth in women with SCH. One such proposed mechanism is subclinical intrauterine infection [19].

CONCLUSION

This study concluded that there is a relation between the volume of the subchorionic hematoma in the first trimester and increased risk of spontaneous abortion.

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