

# Management of Cases of Intrauterine Fetal Demise: A Retrospective Analysis

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**Cite as:** Ismayilov T, Uzunay N, Yavaş Yücel Z. Management of Cases of Intrauterine Fetal Demise: A Retrospective Analysis. J Cukurova Anesth Surg. 2026;9(3):695-705. doi: 10.36516/jocass.1903519

**Received:** 05.03.2026, **Accepted:** 15.09.2026, **Published:** 30.09.2026, CC-BY-NC-4.0

## Abstract

**Background:** To evaluate the management process and short-term maternal outcomes of women managed for intrauterine fetal demise (IUFD) and to compare maternal outcomes according to the mode of delivery. **Materials and Methods:** This single-center, retrospective, observational study included 115 women at  $\geq 20$  weeks of gestation with absent fetal cardiac activity on ultrasonography whose management was completed at the same institution. Demographic and obstetric characteristics, delivery-related variables, and maternal morbidity outcomes were evaluated. Multivariable logistic regression analyses were performed to identify factors associated with cesarean delivery and severe maternal morbidity. **Results:** The mean maternal age was  $31.0 \pm 6.9$  years, and the median gestational age was 32.5 (27.1–35.5) weeks. Labor induction was performed in 55.7% of cases, most commonly with misoprostol (37.4%). Vaginal delivery occurred in 74.8% of women. The median admission-to-delivery interval was 4.5 (1.4–15.3) hours. Placental pathological examination was performed in 67.0% of cases, with abnormal findings identified in 94.8%. Postpartum curettage was required in 37.4% of cases, blood transfusion in 18.3%, ICU admission in 8.7%, and severe maternal morbidity occurred in 20.0%. Compared with vaginal delivery, cesarean delivery was associated with greater hemoglobin decline, higher transfusion requirement, and more frequent ICU admission. Increasing gestational age was associated with cesarean delivery (aOR 1.15;  $p=0.015$ ), whereas cesarean delivery was independently associated with severe maternal morbidity (aOR 5.14; 95% CI 1.84–14.38;  $p=0.002$ ). **Conclusion:** Most women with IUFD can be managed successfully with vaginal delivery. Cesarean delivery, when required, is associated with increased maternal morbidity. Clinical decision-making in IUFD should prioritize maternal safety and support the use of standardized management strategies.

**Keywords:** intrauterine fetal demise; maternal morbidity; stillbirth; placental pathology; cesarean delivery; labor induction

## 1. Introduction

Intrauterine fetal demise (IUFD) is characterized by the birth of a fetus without signs of life after 20 weeks of gestation and constitutes a major component of perinatal mortality<sup>1</sup>. The World Health Organization (WHO) generally defines the stillbirth rate as the number of babies born without signs of life at  $\geq 28$  weeks of gestation per 1,000 total births and reports it as a monitoring indicator<sup>2</sup>. Globally, the burden of third-trimester stillbirth remains in the millions, the pace of decline

is slower than that observed for maternal and under-five mortality, and accelerated prevention strategies are required to meet the 2030 targets<sup>3,4</sup>. Conversely, some clinical and national classifications use a threshold of  $\geq 20$  weeks of gestation for fetal death, which further highlights the need for standardization in clinical management, registration systems, and comparability across settings<sup>5</sup>.

The etiology of IUFD is highly heterogeneous, and maternal conditions, placental pathology, fetal/genetic factors, and obstetric complications may coexist and interact. Therefore, management following the diagnosis of IUFD should extend beyond delivery and include a comprehensive evaluation aimed at elucidating the underlying cause and estimating the risk of recurrence in subsequent pregnancies. The ACOG/SMFM consensus emphasizes that macroscopic and microscopic examination of the placenta, umbilical cord, and membranes—along with fetal autopsy and genetic evaluation in appropriate cases—are core components of the assessment. The timing and mode of delivery are determined by balancing benefits and risks in light of gestational age, obstetric history (particularly prior uterine surgery), and maternal preference<sup>6</sup>. Similarly, the RCOG guideline delineates evidence-based options for intrapartum care in late pregnancy losses, induction strategies, and approaches centered on maternal safety<sup>7</sup>.

In daily practice, management pathways for women presenting with IUFD may vary across centers with respect to referral patterns, induction methods, distribution of delivery modes, the rate and yield of placental pathology examination, and the components of short-term maternal morbidity. Global reports indicate that a substantial proportion of stillbirths is associated with preventable factors and underscore the importance of health system-level quality improvement approaches, such as timely diagnosis, appropriate referral, standardized intrapartum care, and structured evaluation packages<sup>8</sup>. In this context, a detailed institution-based characterization of management pathways and maternal outcomes among women presenting with IUFD may strengthen clinical decision-making and contribute to the standardization of care.

Accordingly, the aim of this study was to retrospectively evaluate the management processes and maternal outcomes of women diagnosed with IUFD, to examine clinical and laboratory differences according to the mode of delivery, and to identify potential factors associated with severe maternal morbidity.

## 2. Materials and Methods

### 2.1. Study Design and Setting

This was a single-center, retrospective, observational study evaluating the clinical management and maternal outcomes of women diagnosed with IUFD. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

The study was conducted at the Department of Obstetrics and Gynecology, University of Health Sciences İstanbul Training and Research Hospital. Cases diagnosed with IUFD between January 1, 2021, and December 31, 2024, were retrospectively identified using the hospital's electronic medical record system and archived patient files. Women whose management was completed at the same institution during this period were included in the analysis.

### 2.2. Study Population

Pregnant women at  $\geq 20$  weeks of gestation with IUFD confirmed by the absence of fetal cardiac activity on ultrasonography, whose delivery and clinical management were performed at our institution, were eligible for inclusion. Pregnancy losses  $< 20$  weeks, iatrogenic terminations, and records with critical missing data that precluded evaluation of key outcomes were excluded.

A total of 115 cases meeting these criteria were included in the final analysis.

### 2.3. Data Collection and Study Variables

All data were extracted from electronic medical records and chart notes using a standardized data collection form.

Demographic and obstetric variables included maternal age, nationality, gravida, parity, abortion history, prior mode of delivery, history of pregnancy loss beyond 20 weeks of gestation, gestational age at presentation, antenatal follow-up status, and the number of routine outpatient visits.

Presentation characteristics included presenting complaints and accompanying ultrasonographic findings, such as oligohydramnios/anhydramnios and suspected placental abruption.

Management-related variables included the use and method of labor induction (misoprostol, dinoprostone, oxytocin, or combined regimens), mode of delivery, time from admission to delivery, length of hospital stay, and the need for postpartum curettage.

Fetal variables included fetal sex and birth weight.

For placental pathology evaluation, both the submission status and reported pathological findings were recorded. Fetal autopsy and genetic investigations were not routinely performed at our institution and were dependent on parental consent. In clinical practice, many families preferred immediate burial without further postmortem evaluation, resulting in limited availability of fetal autopsy and genetic testing data. Therefore, these variables were not included in the analysis.

Laboratory assessments included hemoglobin, hematocrit, platelet count, international normalized ratio (INR), and fibrinogen levels measured at admission and at the sixth postpartum hour. Absolute changes between these measurements were calculated.

#### 2.4. Outcomes

The primary outcome of the study was severe maternal morbidity.

Secondary outcomes included mode of delivery, postpartum curettage, blood transfusion requirement, intensive care unit (ICU) admission, length of hospital stay, laboratory changes, and placental pathology findings.

Maternal outcomes were evaluated based on documented postpartum morbidities, including disseminated intravascular coagulation (DIC), HELLP syndrome, and renal dysfunction, as well as the need for additional interventions for postpartum hemorrhage, blood transfusion, and ICU admission.

For the purposes of this study, severe maternal morbidity was defined as the presence of at least one of the following: ICU admission, DIC, blood transfusion requirement, or surgical intervention for postpartum hemorrhage (e.g., B-Lynch suture, arterial ligation, or hysterectomy).

#### 2.5. Ethical Approval

Ethical approval was obtained from the Clinical Research Ethics Committee of University of Health Sciences İstanbul Training and Research Hospital (Approval No: 36; 2011-KAEK-50; Date: 21.02.2025).

All data were anonymized prior to analysis, and the study was conducted in accordance with the principles of the Declaration of Helsinki.

#### 2.6. Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY, USA).

The distribution of continuous variables was assessed using histograms and the Shapiro–Wilk test. Normally distributed variables are presented as mean  $\pm$  standard deviation (SD), whereas non-normally distributed variables are presented as median (interquartile range [IQR]). Categorical variables are presented as n (%).

Comparisons between groups according to mode of delivery were performed using Student's t-test for normally distributed variables and the Mann–Whitney U test for non-normally distributed variables. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

Multivariable logistic regression analyses were performed to identify factors associated with cesarean delivery and severe maternal morbidity. Clinically relevant variables were entered into the regression models. Results are presented as adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

A two-sided p-value <0.05 was considered statistically significant. P-values <0.001 are reported as p<0.001.

Owing to the retrospective study design, some variables contained missing data; therefore, analyses were performed using available-case data, and no imputation procedures were applied.

### 3. Results

A total of 115 women diagnosed with IUFD were included in the study. The mean maternal age was  $31.0 \pm 6.9$  years. The median gestational age at presentation was 32.5 (27.1–35.5) weeks; 28.7% of cases occurred before 28 weeks of gestation, whereas 19.1% occurred at  $\geq 37$  weeks. Overall, 59.1% of women were Turkish citizens. The nulliparity rate was 26.1%. At least one maternal comorbidity was identified in 47.8% of cases, with hypertensive disorders representing the most common comorbidity (29.6%). A history of at least one previous cesarean delivery was present in 28.7% of women, and 12.2% had experienced a prior pregnancy loss beyond 20 weeks of gestation. The median birth weight was 1,580 (882–2,335) g, and 56.5% of fetuses were female (Table 1).

**Table 1. Demographic and obstetric characteristics**

| Variable                                                   | Value             |
|------------------------------------------------------------|-------------------|
| Age, years                                                 | $31.0 \pm 6.9$    |
| Gestational age, weeks                                     | 32.5 (27.1–35.5)  |
| <28 weeks                                                  | 33 (28.7%)        |
| 28–31+6 weeks                                              | 20 (17.4%)        |
| 32–36+6 weeks                                              | 40 (34.8%)        |
| $\geq 37$ weeks                                            | 22 (19.1%)        |
| Gravida                                                    | 3 (2–4)           |
| Parity                                                     | 2 (0–3)           |
| Nulliparous                                                | 30 (26.1%)        |
| Number of abortions                                        | 0 (0–1)           |
| History of $\geq 1$ prior cesarean delivery                | 33 (28.7%)        |
| History of pregnancy loss beyond 20 weeks of gestation     | 14 (12.2%)        |
| Turkish citizenship                                        | 68 (59.1%)        |
| Received antenatal care at our institution                 | 39 (33.9%)        |
| Number of antenatal outpatient visits                      | 0 (0–3)           |
| Maternal comorbidity ( $\geq 1$ )                          | 55 (47.8%)        |
| Chronic hypertension/gestational hypertension              | 34 (29.6%)        |
| Diabetes (pregestational/GDM)                              | 9 (7.8%)          |
| Thyroid disease                                            | 11 (9.6%)         |
| Asthma                                                     | 2 (1.7%)          |
| Other (anemia/cholestasis/HIV/toxoplasmosis/substance use) | 5 (4.3%)          |
| Fetal sex (female)                                         | 65 (56.5%)        |
| Birth weight, g                                            | 1,580 (882–2,335) |

Values are presented as mean  $\pm$  standard deviation, median (IQR), or n (%), as appropriate. Due to missing data, total N may differ across variables. GDM, gestational diabetes mellitus; HT, hypertension; IQR, interquartile range.

The most common presenting complaints were absent fetal cardiac activity detected during evaluation (31.3%) and decreased fetal movements (22.6%). On ultrasonography, no additional significant finding was identified in 79.1% of cases. The most common accompanying findings were oligohydramnios/anhydramnios (8.7%) and suspected placental abruption (6.1%) (Table 2).

Labor induction was performed in 64 women (55.7%), most commonly using misoprostol (37.4%). Delivery occurred vaginally in 86 cases (74.8%) and by cesarean delivery in 29 cases (25.2%). The median interval from hospital admission to delivery was 4.5 (1.4–15.3) hours, whereas the median length of hospital stay was 2.0 (2.0–3.5) days (Table 2).

Placental pathological examination was performed in 77 cases (67.0%). Among the examined placentas, 73 demonstrated abnormal findings. The most common pathological abnormalities were

hemorrhage (72.6%), infarction (54.8%), calcification or microcalcification (45.2%), and villous congestion (41.1%). Less frequent findings included chorioamnionitis/funisitis (13.7%), villous ischemia (9.6%), villitis/intervillositis (8.2%), and single umbilical artery (6.8%). Inflammatory placental lesions, including chorioamnionitis, funisitis, villitis, and intervillositis, were identified in 47.1% of abnormal specimens. Findings suggestive of placental malperfusion, including villous ischemia, increased syncytial knot formation, and extensive perivillous fibrin deposition, were present in 24.3% of abnormal reports.

**Table 2. Presentation characteristics, management, and hospitalization data (n=115)**

| Variable                                            | Value          |
|-----------------------------------------------------|----------------|
| <b>Presenting complaint</b>                         |                |
| Previously diagnosed fetal demise                   | 36 (31.3%)     |
| Decreased fetal movements                           | 26 (22.6%)     |
| Abdominal pain                                      | 15 (13.0%)     |
| Rupture of membranes/fluid leakage                  | 12 (10.4%)     |
| Routine follow-up visit                             | 11 (9.6%)      |
| Vaginal bleeding                                    | 10 (8.7%)      |
| Elevated blood pressure                             | 2 (1.7%)       |
| Other                                               | 2 (1.7%)       |
| In labor                                            | 1 (0.9%)       |
| <b>Notable ultrasonographic finding</b>             |                |
| No additional notable finding                       | 91 (79.1%)     |
| Oligohydramnios/anhydramnios                        | 10 (8.7%)      |
| Suspected placental abruption                       | 7 (6.1%)       |
| Short cervix/funneling                              | 2 (1.7%)       |
| Macerated fetus                                     | 2 (1.7%)       |
| Fetal bradycardia                                   | 1 (0.9%)       |
| Fetal ascites                                       | 1 (0.9%)       |
| Fetal hydrops                                       | 1 (0.9%)       |
| <b>Labor induction</b>                              |                |
| No induction                                        | 51 (44.3%)     |
| Misoprostol                                         | 43 (37.4%)     |
| Oxytocin                                            | 14 (12.2%)     |
| Misoprostol + oxytocin                              | 6 (5.2%)       |
| Dinoprostone (Propress)                             | 1 (0.9%)       |
| <b>Mode of delivery</b>                             |                |
| Vaginal delivery                                    | 86 (74.8%)     |
| Cesarean delivery                                   | 29 (25.2%)     |
| Time from admission to delivery, hours              | 4.5 (1.4–15.3) |
| Length of hospital stay, days                       | 2.0 (2.0–3.5)  |
| Placenta submitted for pathological examination     | 77 (67.0%)     |
| Normal report                                       | 4 (5.2%)       |
| Abnormal pathological finding                       | 73 (94.8%)     |
| <b>Most common placental pathological findings†</b> |                |
| Hemorrhage                                          | 53 (72.6%)     |
| Infarction                                          | 40 (54.8%)     |
| Calcification/microcalcification                    | 33 (45.2%)     |
| Villous congestion                                  | 30 (41.1%)     |
| Chorioamnionitis/funisitis                          | 10 (13.7%)     |

Values are presented as n (%) or median (IQR), as appropriate. Percentages for normal and abnormal pathological findings were calculated among cases that underwent placental pathological examination. † Percentages for specific placental pathological abnormalities were calculated among cases with abnormal placental pathology reports. IQR, interquartile range; IUFD, intrauterine fetal demise.

At admission, the mean hemoglobin level was  $11.4 \pm 1.9$  g/dL, decreasing to  $10.5 \pm 1.6$  g/dL at the sixth postpartum hour. The median hemoglobin decline was 0.8 (0.3–1.5) g/dL. Liver function

tests were within normal limits in 92.2% of women, whereas 7.8% demonstrated varying degrees of transaminase elevation (Table 3).

Postpartum curettage was performed in 43 women (37.4%). Blood transfusion was required in 21 cases (18.3%), and additional interventions for postpartum hemorrhage were required in 15 cases (13.0%). Most hemorrhage cases were managed medically, whereas a limited number required mechanical or surgical interventions, including Bakri balloon placement, B-Lynch sutures, and arterial ligation. Intensive care unit admission occurred in 10 women (8.7%). Overall, documented maternal morbidity was observed in 30 cases (26.1%), most commonly hypertensive disorders (19.1%), uterine atony (9.6%), and DIC (6.1%). Severe maternal morbidity occurred in 23 women (20.0%) (Table 3).

**Table 3. Laboratory parameters and maternal outcomes**

| Variable                                                    | Value         |
|-------------------------------------------------------------|---------------|
| <b>Laboratory parameters at admission</b>                   |               |
| Hemoglobin, g/dL                                            | 11.4 ± 1.9    |
| Hematocrit, %                                               | 34.5 ± 4.9    |
| Platelet count, ×10 <sup>3</sup> /μL                        | 253 ± 94      |
| INR                                                         | 1.01 ± 0.24   |
| Fibrinogen, mg/dL                                           | 419 ± 130     |
| <b>Laboratory parameters at postpartum 6 hours</b>          |               |
| Hemoglobin, g/dL                                            | 10.5 ± 1.6    |
| Hematocrit, %                                               | 31.8 ± 4.6    |
| Platelet count, ×10 <sup>3</sup> /μL                        | 224 ± 90      |
| <b>Change from admission to postpartum 6 hours</b>          |               |
| Hemoglobin decline, g/dL                                    | 0.8 (0.3–1.5) |
| Hematocrit decline, %                                       | 2.7 (1.1–4.6) |
| Platelet count change, ×10 <sup>3</sup> /μL                 | 25 (6–46)     |
| <b>Liver function test status</b>                           |               |
| Normal                                                      | 106 (92.2%)   |
| Mild elevation                                              | 6 (5.2%)      |
| ≥2–3× elevation                                             | 3 (2.6%)      |
| <b>Postpartum interventions and outcomes</b>                |               |
| Postpartum curettage                                        | 43 (37.4%)    |
| Blood transfusion requirement                               | 21 (18.3%)    |
| Additional intervention for postpartum hemorrhage           | 15 (13.0%)    |
| ICU admission                                               | 10 (8.7%)     |
| Documented postpartum morbidity                             | 30 (26.1%)    |
| Hypertensive disorders (preeclampsia/HELLP syndrome/others) | 22 (19.1%)    |
| Uterine atony                                               | 11 (9.6%)     |
| DIC                                                         | 7 (6.1%)      |
| Renal dysfunction (oliguria/anuria)                         | 1 (0.9%)      |
| Severe maternal morbidity*                                  | 23 (20.0%)    |

\*Severe maternal morbidity was defined as ICU admission and/or DIC and/or blood transfusion requirement and/or surgical intervention for postpartum hemorrhage. DIC, disseminated intravascular coagulation; HELLP, hemolysis, elevated liver enzymes, and low platelet count; ICU, intensive care unit; INR, international normalized ratio; PPH, postpartum hemorrhage.

When outcomes were compared according to mode of delivery, women undergoing cesarean delivery had significantly higher gestational age and birth weight than those delivering vaginally ( $p=0.045$  and  $p=0.036$ , respectively). Although the admission-to-delivery interval was shorter in the cesarean group, the duration of hospitalization was significantly longer ( $p=0.036$  and  $p<0.001$ , respectively). Hemoglobin decline was greater following cesarean delivery ( $p<0.001$ ). Blood transfusion requirement, intensive care unit admission, documented maternal morbidity, and severe

maternal morbidity were all significantly more common among women delivered by cesarean delivery (Table 4).

**Table 4. Comparison according to mode of delivery**

| Variable                               | Vaginal delivery (n=86) | Cesarean delivery (n=29) | p      |
|----------------------------------------|-------------------------|--------------------------|--------|
| Gestational age, weeks                 | 31.8 (26.4–35.5)        | 34.0 (30.0–35.4)         | 0.045  |
| Birth weight, g                        | 1,482 (760–2,165)       | 1,920 (1,365–2,585)      | 0.036  |
| Time from admission to delivery, hours | 6.1 (1.7–15.6)          | 2.8 (1.1–4.4)            | 0.036  |
| Length of hospital stay, days          | 2.0 (2.0–3.0)           | 4.0 (2.0–6.0)            | <0.001 |
| Hemoglobin decline, g/dL               | 0.8 (0.1–1.2)           | 1.4 (0.8–2.4)            | <0.001 |
| History of ≥1 prior cesarean delivery  | 14 (16.3%)              | 19 (65.5%)               | <0.001 |
| Labor induction performed              | 60 (69.8%)              | 4 (13.8%)                | <0.001 |
| Postpartum curettage                   | 42 (48.8%)              | 1 (3.4%)                 | <0.001 |
| Blood transfusion requirement          | 10 (11.6%)              | 11 (37.9%)               | 0.004  |
| ICU admission                          | 1 (1.2%)                | 9 (31.0%)                | <0.001 |
| Documented postpartum morbidity        | 12 (14.0%)              | 18 (62.1%)               | <0.001 |
| Severe maternal morbidity*             | 10 (11.6%)              | 13 (44.8%)               | <0.001 |

Values are presented as median (IQR) or n (%), as appropriate. Continuous variables were compared using the Mann–Whitney U test. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate. \*Severe maternal morbidity was defined as ICU admission and/or DIC and/or blood transfusion requirement and/or surgical intervention for postpartum hemorrhage. ICU, intensive care unit; IQR, interquartile range.

In multivariable logistic regression analysis evaluating factors associated with cesarean delivery, a history of at least one prior cesarean delivery was strongly associated with cesarean delivery (aOR 14.77, 95% CI 4.91–44.43;  $p < 0.001$ ). Increasing gestational age was also independently associated with higher odds of cesarean delivery (aOR 1.15, 95% CI 1.03–1.28;  $p = 0.015$ ). Suspected placental abruption demonstrated borderline statistical significance (aOR 5.34, 95% CI 0.93–30.79;  $p = 0.061$ ) (Table 5).

**Table 5. Factors associated with cesarean delivery: multivariable logistic regression analysis**

| Variable                              | aOR   | 95% CI     | p      |
|---------------------------------------|-------|------------|--------|
| History of ≥1 prior cesarean delivery | 14.77 | 4.91–44.43 | <0.001 |
| Gestational age (per 1-week increase) | 1.15  | 1.03–1.28  | 0.015  |
| Suspected placental abruption         | 5.34  | 0.93–30.79 | 0.061  |

aOR, adjusted odds ratio; CI, confidence interval.

In the multivariable logistic regression model evaluating severe maternal morbidity, cesarean delivery remained independently associated with severe maternal morbidity (aOR 5.14, 95% CI 1.84–14.38;  $p = 0.002$ ), whereas no significant associations were observed for the other variables included in the model (Table 6).

**Table 6. Factors associated with severe maternal morbidity: multivariable logistic regression analysis**

| Variable                              | aOR  | 95% CI     | p     |
|---------------------------------------|------|------------|-------|
| Cesarean delivery                     | 5.14 | 1.84–14.38 | 0.002 |
| Gestational age (per 1-week increase) | 1.09 | 0.98–1.21  | 0.125 |
| Maternal comorbidity (≥1)             | 1.31 | 0.47–3.69  | 0.603 |

Severe maternal morbidity was defined as ICU admission and/or DIC and/or blood transfusion requirement and/or surgical intervention for postpartum hemorrhage. aOR, adjusted odds ratio; CI, confidence interval; DIC, disseminated intravascular coagulation; ICU, intensive care unit.

## 4. Discussion

In this retrospective study, we evaluated the management processes and in-hospital maternal outcomes of 115 women diagnosed with IUFD. Our findings highlight three key observations. First, most women were managed with vaginal delivery (74.8%), whereas the cesarean delivery rate was 25.2%. Second, labor induction was performed in more than half of the cases (55.7%), with misoprostol being the most commonly used agent. Third, postpartum curettage, blood transfusion requirement, and ICU admission represented the most prominent maternal morbidity outcomes. Importantly, women who underwent cesarean delivery experienced significantly greater hemoglobin decline, higher transfusion rates, and more frequent ICU admission. Overall, these findings are consistent with contemporary guidelines emphasizing that, in the absence of fetal benefit, management decisions in IUFD should primarily be guided by maternal safety<sup>6,7</sup>.

With respect to the route of delivery, the cesarean delivery rate observed in our cohort (25.2%) falls within the wide range reported in the literature. While some studies have reported very low cesarean delivery rates in IUFD (approximately 2–3%)<sup>9</sup>, others have documented substantially higher rates, largely driven by previous cesarean delivery and failed induction attempts<sup>10</sup>. Gold et al. reported a repeat cesarean delivery rate of approximately 19% among 116 IUFD cases and emphasized the important role of obstetric history, particularly prior cesarean delivery, in determining the mode of delivery<sup>11</sup>. Similarly, Ramirez et al. demonstrated that a trial of labor is frequently preferred among women with antepartum fetal death and a history of previous cesarean delivery, with high success rates in appropriately selected patients<sup>12</sup>. In this context, the strong association between cesarean delivery and previous cesarean delivery observed in our cohort suggests that delivery route decisions were largely driven by obstetric history and maternal indications.

The impact of cesarean delivery on maternal outcomes is particularly relevant in IUFD because the absence of fetal benefit warrants a more restrictive approach to cesarean indications<sup>6,13</sup>. In their review, Ramseyer et al. reported that cesarean delivery may increase maternal morbidity and may also confer long-term risks in subsequent pregnancies through adhesions, abnormal placentation, and hemorrhage<sup>13</sup>. Consistent with these observations, the greater hemoglobin decline and significantly higher rates of blood transfusion and ICU admission observed in the cesarean delivery group support the association between cesarean delivery and increased maternal morbidity in women with IUFD<sup>13</sup>. Nevertheless, cesarean delivery is frequently performed because of maternal indications such as suspected placental abruption, hypertensive emergencies, severe hemorrhage, or a history of uterine surgery. Previous studies evaluating IUFD complicated by placental abruption have similarly highlighted the importance of individualized, risk-based management strategies in determining maternal outcomes<sup>14</sup>.

Regarding induction strategies, the use of labor induction in more than half of the cases and the frequent use of misoprostol are consistent with current guidelines and previous studies. Both the ACOG/SMFM consensus and the RCOG guideline recommend that the timing and method of delivery should be individualized according to gestational age, previous uterine surgery, and maternal preference<sup>6,7</sup>. Misoprostol has been shown to be an effective and generally safe induction agent in IUFD, with high success rates and induction-to-delivery intervals typically completed within 24 hours<sup>15</sup>. More recent studies comparing misoprostol and dinoprostone have similarly demonstrated favorable effectiveness and safety profiles while emphasizing the need for individualized treatment selection according to cervical status and maternal risk factors<sup>16</sup>. The relatively short admission-to-delivery interval observed in our cohort, compared with induction-to-delivery intervals reported elsewhere, may reflect differences in outcome definitions, the inclusion of women presenting in active labor, and the presence of cesarean deliveries performed shortly after admission<sup>15–17</sup>.

The postpartum curettage rate observed in our cohort (37.4%) represents an important finding. This may be related to the gestational age distribution, induction protocols, and local approaches to the management of retained placenta. Previous studies have reported a wide range of retained placenta and operative placental removal rates following labor induction with misoprostol. Green et

al. noted that intervention rates may range from less than 20% to more than 50% and suggested that more aggressive management approaches may increase operative procedure rates<sup>18</sup>. Furthermore, a population-based study demonstrated that IUFD is independently associated with an increased risk of retained placenta (aOR approximately 1.71)<sup>19</sup>. Therefore, the elevated postpartum curettage rate observed in our study may reflect both the increased baseline risk associated with IUFD and a lower threshold for intervention because of concerns regarding hemorrhage, infection, or prolonged hospitalization. Clinically, these findings support the importance of standardized management of the third stage of labor, including appropriate observation periods and structured intervention algorithms based on maternal risk factors<sup>18,19</sup>.

Maternal morbidity outcomes—particularly blood transfusion, ICU admission, and DIC—underscore that the management of IUFD extends beyond delivery and requires close maternal monitoring, including careful hemostatic surveillance. Şimşek et al. reported that severe complications, including transfusion, ICU admission, reoperation, and hysterectomy, may occur at clinically meaningful rates and emphasized the importance of managing IUFD in adequately equipped centers<sup>20</sup>. In our cohort, severe maternal morbidity occurred in 20.0% of cases and was substantially more common among women who underwent cesarean delivery. This finding may reflect both the selection of higher-risk patients for cesarean delivery and the potential contribution of cesarean delivery itself to increased hemorrhagic morbidity and critical care requirements<sup>13,20</sup>. Previous studies have reported that a proportion of women with IUFD may meet criteria for probable DIC at presentation, whereas a smaller proportion subsequently develop clinically confirmed DIC<sup>21</sup>. The DIC rate of 6.1% observed in our study may be related to differences in case mix, including suspected placental abruption, hypertensive disorders, the degree of fetal maceration, and referral patterns. Furthermore, studies evaluating hemorrhagic morbidity after vaginal delivery have demonstrated that IUFD itself may be associated with a substantial maternal burden through bleeding-related complications<sup>22</sup>. Current guidelines emphasize early recognition of coagulopathy, serial laboratory monitoring, and timely replacement of blood products in women with IUFD complicated by DIC. Management should be individualized according to the severity of coagulation abnormalities, ongoing bleeding, and overall maternal condition. These recommendations further support the importance of managing high-risk IUFD cases in adequately equipped centers with multidisciplinary support.

Our placental pathology findings are consistent with previous evidence indicating that placental examination provides the highest diagnostic yield in stillbirth evaluation. Using data from the Stillbirth Collaborative Research Network, Page et al. reported that placental pathology represented the most useful component of the diagnostic evaluation, followed by fetal autopsy and genetic testing<sup>23</sup>. Marsden et al. similarly emphasized the substantial clinical value of placental pathology and suggested that its contribution may increase with advancing gestational age<sup>24</sup>. The frequent identification of hemorrhage, infarction, calcification, villous congestion, and inflammatory lesions in our cohort is consistent with the established role of placental vascular and inflammatory pathology in the pathogenesis of IUFD<sup>25</sup>. These findings support previous evidence linking uteroplacental malperfusion, placental ischemia, and intrauterine inflammation with adverse fetal outcomes. Accordingly, increasing the utilization of placental pathology examination and applying standardized classification systems may improve etiological attribution and enhance counseling regarding future pregnancies<sup>6,12,23</sup>.

The strengths of this study include the simultaneous evaluation of real-world management pathways, including induction strategies, delivery mode, and admission-to-delivery intervals, together with short-term maternal outcomes. However, several limitations should be acknowledged. First, the retrospective single-center design limits causal inference and may be subject to incomplete documentation. Second, etiologic classification systems such as ReCoDe and ICD-PM, as well as rates of fetal autopsy and genetic evaluation, could not be comprehensively assessed. Third, the relatively limited sample size and the lack of long-term maternal follow-up may restrict the generalizability of our findings. Finally, admission-to-delivery intervals are not directly comparable across studies because of differences in outcome definitions and reporting methods.

## 5. Conclusion

Vaginal delivery appears feasible for most women diagnosed with IUFD. Cesarean delivery should be reserved for selected cases with clear maternal indications. The increased hemorrhagic burden, greater transfusion requirement, and higher rate of ICU admission associated with cesarean delivery should be carefully considered during clinical decision-making. Standardized management pathways focused on maternal safety may help optimize outcomes in women with IUFD.

**Author Contributions:** Conceptualization: TI. Methodology: TI, NU, ZYY. Data Curation: NU, ZYY. Formal Analysis: TI. Investigation: TI, NU, ZYY. Supervision: TI. Writing – Original Draft Preparation: TI. Writing – Review and Editing: TI, NU, ZYY. All authors have read and approved the final manuscript.

**Funding:** This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**Institutional Review Board Statement:** Ethical approval was obtained from the Clinical Research Ethics Committee of University of Health Sciences İstanbul Training and Research Hospital (Approval No: 36; 2011-KAEK-50; February 21, 2025).

**Informed Consent Statement:** The requirement for informed consent was waived by the Ethics Committee due to the retrospective nature of the study.

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Data Availability Statement:** The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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