



MATERNAL CONDITIONS OBSERVED AMONG INTRAUTERINE FETAL DEATH CASES: A RETROSPECTIVE OBSERVATIONAL STUDY AT A TERTIARY CARE CENTER IN WESTERN GUJARAT

Obstetrics & Gynaecology

Dr. Darshit Gajera*	2nd Year Resident Doctor, Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical College, Jamnagar)*Corresponding Author
Dr. Nita Rada	Associate Professor, Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical College, Jamnagar
Dr. Mona D. Gandhi	Associate Professor, Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical College, Jamnagar
Dr. N. I. Anand	Professor and Head, Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical College, Jamnagar
Dr. I. J. Anand	Professor, Dept. of Paediatrics, Shri M.P. Shah Govt. Medical College, Jamnagar
Dr. T. C. Nayak	Associate Professor, Department of Obstetrics and Gynaecology, Shri M.P. Shah Govt. Medical College, Jamnagar

ABSTRACT

Background: Intrauterine fetal death (IUFD) remains a critical and emotionally devastating contributor to perinatal mortality worldwide, serving as an important indicator of maternal health and quality of regional obstetric care. Maternal medical disorders and obstetric complications are heavily represented among these adverse outcomes, presenting significant opportunities for prevention through well-timed antenatal care. **Objectives:** The primary goals of this investigation were to systematically document and characterize the maternal medical and obstetric conditions observed within a cohort of diagnosed IUFD cases, evaluate the relevant demographic and obstetric distribution among the various causes. **Methods:** A retrospective observational descriptive study was conducted in the Department of Obstetrics and Gynaecology at Guru Gobind Singh Hospital, Jamnagar, Gujarat, spanning the five-month interval from January 2026 to May 2026. Comprehensive institutional medical records of 67 consecutive patients presenting with IUFD were systematically reviewed. Maternal age, geographic residence, antenatal booking status, gestational age at diagnosis, and concurrent maternal clinical pathologies were extracted and subjected to descriptive statistical analysis. **Results:** Out of the 67 validated IUFD instances evaluated, the largest single age cluster was observed among women aged 26-30 years (37.3%). Patients originating from rural areas comprised 62.7% of the study group, and 61.2% were classified as unbooked admissions. Chronologically, the peak incidence of fetal mortality occurred in the late second and early third trimesters between 26 and 30 weeks of gestation (40.3%). Maternal anemia was the single most prevalent medical condition identified, affecting 22.4% of cases, followed by preeclampsia (14.9%), maternal obesity (13.4%), chronic essential hypertension (9.0%), and gestational hypertension (6.0%). **Conclusion:** Maternal anemia and a spectrum of hypertensive disorders represent the predominant clinical conditions present within women experiencing intrauterine fetal death in this regional population. The substantial proportion of unbooked patients presenting from rural demographics strongly points toward systemic gaps in early screening, specialized referral, and regional nutritional support systems. Targeting these specific maternal vulnerabilities may decrease the rate of IUFD.

KEYWORDS

Intrauterine Fetal Death, Maternal Anemia, Preeclampsia, Gestational Hypertension, Observational Profile, Gujarat.

INTRODUCTION

Intrauterine fetal death (IUFD) represents one of the most agonizing, profound, and visually traumatic outcomes encountered in modern obstetric practice. Beyond the immediate clinical challenges it poses to healthcare delivery systems, an IUFD inflicts deep and enduring psychological, social, and economic scars upon the affected families. The vast majority of these losses are concentrated in low- and middle-income countries (LMICs), reflecting deep-seated structural and clinical inequities in access to healthcare resources.

India bears a substantial component of this global perinatal burden. Although national maternal and neonatal mortality indices have improved markedly over the past decade through aggressive administrative and clinical initiatives—such as subsidized institutional delivery packages, infrastructure expansions, and rural monitoring pipelines—preventable and manageable conditions continue to claim a high volume of late-gestation fetuses. The multifactorial etiology of fetal death includes maternal medical diseases, severe obstetric complications, structural and chromosomal anomalies, placental pathology, and umbilical cord mishaps. Among these, maternal medical conditions are uniquely critical because they represent points of clinical leverage where timely diagnosis, pharmacological stability, and proactive delivery planning can completely rewrite the fetal trajectory.

A wide array of maternal clinical conditions has been robustly implicated in the pathophysiology of fetal demise. These include severe maternal anemia, preeclampsia, eclampsia, chronic essential hypertension, pre-gestational and gestational diabetes mellitus, maternal obesity, overt thyroid dysregulation, systemic infections, and

autoimmune syndromes such as antiphospholipid antibody syndrome (APS). Nutritional deficiencies, particularly severe iron-deficiency anemia, compromise maternal systemic oxygenation and induce chronic placental hypoxia, which can progress to sudden fetal death. Similarly, maternal hypertensive syndromes trigger severe, progressive microvascular vasoconstriction within the uteroplacental bed, leading to acute or chronic placental insufficiency, fetal growth restriction, and ultimately, abruption or intrauterine asphyxia.

The geographic region of Western Gujarat, particularly the Saurashtra, presents distinct socio-demographic realities. These include expansive rural tracts, varied dietary practices, localized nutritional vulnerabilities, and complex transport logistics that frequently delay maternal transfer from primary care clinics to tertiary referral nodes. This study was undertaken to evaluate the clinical and demographic profile of 67 women experiencing intrauterine fetal death at Guru Gobind Singh Hospital, Jamnagar—a primary tertiary care referral teaching hospital servicing Western Gujarat—to provide baseline clinical data for target-driven regional health interventions.

REVIEW OF LITERATURE

Maternal Conditions and Pathophysiological Pathways

The maternal factors that compromise fetal viability in utero, are following Hypertensive disorders of pregnancy remain a leading focus of academic research. Preeclampsia and chronic hypertension affect maternal systemic vasculature, causing diffuse endothelial damage and remodeling errors in the spiral arteries. This restricts maternal blood flow to the intervillous space, manifesting clinically as severe fetal growth restriction (FGR), oligohydramnios, or sudden intrauterine asphyxia.

Maternal anemia, a profound problem across the Indian subcontinent, induces severe systemic hypoxia. When maternal hemoglobin falls into severe ranges, the oxygen-carrying capacity of the blood is insufficient to sustain the metabolic requirements of both the mother and the expanding fetoplacental unit, culminating in critical tissue hypoxia and death. Maternal metabolic disorders, most notably pre-gestational and gestational diabetes mellitus, are tightly correlated with unexplained, sudden third-trimester fetal loss. Uncontrolled maternal hyperglycemia drives persistent fetal hyperglycemia, which stimulates fetal pancreatic beta-cell hyperplasia and subsequent hyperinsulinemia. This state of hyperinsulinemia elevates fetal metabolic demand and oxygen consumption, leading to severe intrapartum or antepartum lactic acidosis and myocardial hypoxia. Additionally, maternal obesity has independent pathophysiological pathways to fetal death, linked to chronic low-grade systemic inflammation, metabolic dysregulation, and a high incidence of undiagnosed uteroplacental insufficiency.

Evidence from Contemporary Indian Studies

A review of contemporary Indian clinical trials and observational cohorts confirms these patterns, though with distinct regional variations. In a comprehensive study conducted by Nalini et al., pregnancy-induced hypertension (PIH) and its severe variants, including eclampsia, were observed in nearly half of the analyzed iudf cohorts, emphasizing the lethal nature of uncontrolled maternal blood pressure. Similarly, Shravya et al. evaluated the clinical characteristics of fetal death in a tertiary teaching hospital and concluded that severe maternal anemia and preeclampsia were the two most prominent maternal co-morbidities. Their data demonstrated that a high percentage of fetal deaths occurred in unbooked, referred patients who had not received basic prophylactic interventions like low-dose aspirin, iron supplementation, or early antihypertensive management. Furthermore, Gupta et al. focused on the intersection of maternal medical conditions and macroscopic placental pathology. Their data revealed that maternal hypertension and abruptio placentae were major contributors to fetal mortality, frequently seen within the same patient. These investigators highlighted that while advanced genetic anomalies and intrinsic fetal malformations are mathematically significant, the vast majority of preventable deaths are driven by maternal medical conditions that can be readily screened and modified during routine antenatal checkups. This underlines the clinical importance of profiling regional cohorts to optimize institutional allocation of resources and improve public health policy.

AIMAND OBJECTIVES

Aim

To evaluate and systematically characterize the maternal medical and obstetric conditions observed among women diagnosed with intrauterine fetal death at a tertiary care referral center in Western Gujarat.

Objectives

- To identify and document the specific maternal medical conditions and obstetric complications present among women experiencing intrauterine fetal death (IUFD).
- To determine the frequency distribution and percentage representation of individual maternal factors within the study cohort.
- To analyze the socio-demographic profile—specifically maternal age distribution, geographic residence, and antenatal booking status of the affected population.
- To evaluate crucial gestational and obstetric parameters, including the gestational age at which fetal death is most frequently diagnosed.
- To identify potentially preventable maternal contributors to formulate actionable recommendations for regional antenatal healthcare enhancement.

MATERIALSAND METHODS

Study Design and Institutional Setting

This study was executed as a retrospective, descriptive, observational investigation. The clinical setting was the Department of Obstetrics and Gynaecology at Guru Gobindsingh Hospital, Jamnagar, Gujarat—a prominent tertiary care referral center and teaching institution affiliated with M.P. Shah Government Medical College. This facility serves a broad, socio-economically diverse patient population encompassing the urban centers and rural areas of Jamnagar, Devbhumi Dwarka, and surrounding districts of Western Gujarat.

Study Duration and Sample Universe

The time horizon for data collection spanned a five-month interval from January 2026 to May 2026 inclusive. The study sample comprised 67 consecutive cases of validated intrauterine fetal death that met the strict inclusion protocols during this period. Because this study focused on describing the maternal conditions present within the affected group, no external, non-IUFD comparison or control group was utilized. All conclusions are framed strictly around maternal conditions observed among IUFD cases to ensure scientific accuracy.

Inclusion and Exclusion Criteria

The inclusion criteria were defined to encompass all pregnant women admitted to or delivered at the facility with a confirmed diagnosis of intrauterine fetal death occurring after 20 weeks of gestation, where complete, verifiable medical and obstetric records were available for review. Fetal death confirmation was based on the definitive absence of fetal heart activity via ultrasonography. The exclusion criteria consisted strictly of cases presenting with missing, severely fragmented, or unrecoverable medical charts, or fetal deaths occurring prior to 20 completed weeks of gestation (classified as spontaneous abortions).

Data Collection Methodology

Following approval from the Institutional Review Board and Ethical Committee, data collection was conducted via a systematic audit of the physical and electronic labor room registers, admission charts, case sheets, and discharge summaries archived in the central medical records department. A standardized data extraction tool was utilized to ensure consistency. The variables compiled for each case included:

- Socio-Demographic Metrics:** Maternal age at presentation and geographic residence (categorized into rural or urban based on administrative municipality classifications).
- Obstetric Variables:** Antenatal booking status (classified as "booked" if the patient had a minimum of three documented, regular antenatal visits at a recognized healthcare facility, or "unbooked" if they had fewer than three visits or presented directly in emergency labor without prior tracking) and gestational age at the time of fetal death diagnosis (stratified into discrete multi-week blocks).
- Maternal Medical Conditions:** Documented presence of maternal anemia (hemoglobin < 11 g/dL), gestational hypertension (blood pressure $\geq$ 140/90 mmHg after 20 weeks gestation accompanied by proteinuria), maternal obesity (body mass index $\geq$ 30 kg/m²), chronic essential hypertension, and diabetes.

Statistical Analysis

A retrospective cohort study performed and following variables are used to extract results.

Continuous variables were summarized as means and ranges, while categorical variables were analyzed via absolute frequency (n) and percentage (%) calculations. All tabulated data are presented clearly in the subsequent sections.

RESULTS

A total of 67 cases of intrauterine fetal death met all criteria and were included in the final analysis. The gathered data covering socio-demographics, obstetric parameters, and maternal conditions are detailed below. Out of total 2758 deliveries 67 were iudf, It means 2.34% of total deliveries were iudf.

Table 1: Distribution of Study Cohort According to Maternal Age (N=67)

Maternal Age Group (Years)	Frequency (n)	Percentage (%)
18–20	9	13.4%
21–25	17	25.4%
26–30	25	37.3%
31–35	12	17.9%
36–40	3	4.5%
41–45	1	1.5%
Total	67	100.0%

As demonstrated in Table 1, the largest proportion of intrauterine fetal deaths occurred within the maternal age bracket of 26–30 years, accounting for 25 cases (37.3%), followed by the 21–25 years age

group with 17 cases (25.4%). Combined, young maternal cohorts aged 21 to 30 years represented nearly two-thirds (62.7%) of the entire study sample. Advanced maternal age (>35 years) was minimally represented in this specific cohort.

Table 2: Geographic Residence Distribution of the IUFD Cases (N = 67)

Geographic Residence	Frequency (n)	Percentage (%)
Rural Areas	42	62.7%
Urban Centers	23	34.3%
Unspecified / Missing	2	3.0%
Total	67	100.0%

Geographic analysis (Table 2) showed a clear predominance of patients originating from rural areas, which accounted for 42 cases (62.7%). In contrast, urban residents constituted approximately one-third of the study population (34.3%), emphasizing a strong geographical skew toward rural environments.

Table 3: Antenatal Booking Status of the Evaluated Patients (N = 67)

Antenatal Booking Status	Frequency (n)	Percentage (%)
Booked (Minimum 3 regular visits)	26	38.8%
Unbooked (Direct Emergency / < 3 visits)	41	61.2%
Total	67	100.0%

Table 3 outlines the antenatal surveillance profile of the cohort. A substantial majority of the women experiencing an IUFD were classified as unbooked admissions (41 cases, 61.2%), meaning they presented directly to the tertiary labor ward in an emergency state without systematic antenatal tracking or early high-risk screening.

Table 4: Stratification of IUFD Cases by Gestational Age at Diagnosis (N = 67)

Gestational Age Strata (Weeks)	Frequency (n)	Percentage (%)
20 – 25 weeks	13	19.4%
26 – 30 weeks	27	40.3%
31 – 35 weeks	13	19.4%
36 – 40 weeks	13	19.4%
> 40 weeks (Post-dated)	1	1.5%
Total	67e	100.0%

With respect to gestational chronology (Table 4), a major cluster of intrauterine fetal deaths occurred between 26 and 30 weeks of gestation, representing 27 cases (40.3%). The remaining cases were distributed equally across the early second trimester (20–25 weeks), mid-third trimester (31–35 weeks), and term pregnancies (36–40 weeks), with each segment accounting for 19.4% of the cohort.

Table 5: Maternal Medical and Obstetric Conditions Documented Among IUFD Cases

Identified Maternal Condition *	Frequency (n)	Percentage (%)
Maternal Anemia (Hemoglobin < 11 g/dL)	15	22.4%
Preeclampsia	10	14.9%
Maternal Obesity (BMI ≥ 30 kg/m²)	9	13.4%
Chronic Essential Hypertension	6	9.0%
Gestational Hypertension	4	6.0%

** Note: Frequencies and percentages do not total exactly 67 or 100% because multiple maternal conditions could co-exist within an individual patient record, or a patient may have had no documented maternal medical pathology.*

Table 5 catalogs the maternal medical and obstetric co-morbidities identified during chart review. Maternal anemia was the most common condition, noted in 15 patients (22.4%). Hypertensive disorders of pregnancy represented another major clinical cluster: when preeclampsia (14.9%), chronic essential hypertension (9.0%), and gestational hypertension (6.0%) are compiled, hypertensive complications were present in 20 cases (29.9% of the cohort). Maternal obesity was also common, recorded in 9 cases (13.4%).

DISCUSSION
Maternal Age Dynamics

The descriptive analysis of maternal age in this study revealed that the highest frequency of intrauterine fetal death occurred in the 26–30 years cohort (37.3%), followed by the 21–25 years bracket (25.4%). This alignment within prime reproductive years initially seems counterintuitive, as conventional obstetric doctrine highlights advanced maternal age as a primary risk factor for unexplained iufd. However, this age distribution reflects the broader demographic pattern of pregnancy in Western Gujarat, where childbearing peaks during the third decade of life. These findings match those published by Nalini et al. and Shravya et al., who similarly reported that the absolute majority of iufd admissions in public teaching hospitals occur among young women, driven by high pregnancy volumes in this age bracket rather than biological vulnerability alone.

Geographic Disparities and Antenatal Care Gaps

A striking finding in this study is the high representation of rural residents (62.7%) and unbooked status (61.2%) among the IUFD cases. These two metrics are structurally linked. Rural environments in Western Gujarat are frequently characterized by localized socioeconomic challenges, transport limitations, and varying access to primary maternal health services. The high percentage of unbooked patients indicates a critical failure in continuous antenatal monitoring. Without standard care, early warning signs such as blood pressure spikes, sudden weight gain, or decreasing fetal movements go unaddressed, turning manageable clinical complications into terminal fetal events. This mirrors observations by global public health bodies, which emphasize that unbooked emergency status is a common non-medical feature of iufd cohorts across low- and middle-income countries.

Gestational Timeline Insights

Chronologically, 40.3% of the documented fetal deaths occurred between 26 and 30 weeks of gestation, representing a critical window in late second and early third trimesters. This gestational concentration indicates that the underlying clinical pathways—such as chronic placental insufficiency or poorly compensated maternal anemia—frequently become severe during this phase of rapid fetal growth and escalating metabolic demand. It underscores the vital importance of focused clinical surveillance, fetal growth scans, and Doppler assessments during this period, particularly for patients identified as high-risk during earlier contacts.

The Clinical Impact of Maternal Anemia

Maternal anemia was the most prevalent individual condition identified, present in 22.4% of the IUFD records. The pathophysiological link between severe nutritional or iron-deficiency anemia and fetal death is well-supported. Chronic maternal anemia leads to systemic maternal hypoxia, prompting compensatory hypervascular changes that are often insufficient to maintain long-term placental health. The resulting placental hypoxia can cause villous fibrosis, infarction, and a progressive drop in nutrients and oxygen across the blood-placenta barrier, making the fetus highly vulnerable to sudden intrauterine demise during growth spurts.

Hypertensive Disorders and Cardiovascular Burden

Hypertensive pathologies, including preeclampsia, chronic hypertension, and gestational hypertension, collectively affected 29.9% of the study cohort. This high frequency confirms the severe impact of maternal vascular disorders on fetal survival. Preeclampsia damages the maternal endothelial lining and impairs the normal transformation of uterine spiral arteries into low-resistance vessels. The resulting high-resistance vascular bed causes persistent placental ischemia, predisposing the patient to sudden placental abruption or progressive, severe intrauterine hypoxia. These findings emphasize that implementing strict blood pressure management protocols at primary care levels is a critical step for reducing regional fetal mortality.

Methodological Constraints and Analytical Precision

It is methodologically vital to emphasize that this study utilized a retrospective, single-cohort observational design involving 67 cases of IUFD without a matching non-IUFD control or comparison group. Consequently, these data do not establish mathematical risk ratios, relative risks, or direct causal "associations." Instead, they map out the specific clinical profile and distribution of maternal health issues within this group of fetal deaths. This descriptive mapping remains valuable, offering localized insights necessary for tailoring public health priorities and clinical screening guidelines within Western Gujarat.

CLINICAL IMPLICATIONS AND RECOMMENDATIONS

Based on the descriptive data collected from this cohort, several clinical modifications and public health strategies are recommended to address these common maternal issues:

- **Universal, Early-Onset Anemia Screening:** Given that maternal anemia affected nearly a quarter of the cohort, rural health outposts must prioritize first-trimester hemoglobin checks, provide adequate oral iron supplements, and utilize rapid intravenous iron infusions for non-compliant or severely anemic patients before they reach late gestation.
- **Decentralized Blood Pressure Monitoring:** To address the high frequency of hypertensive disorders, primary health centers should implement standardized screening protocols to identify early preeclampsia, initiate low-dose prophylactic aspirin early in pregnancy, and establish clear referral timelines for specialized tertiary evaluation.
- **Community Outreach for Antenatal Registration:** To reduce the 61.2% unbooked rate, community health programs should strengthen local surveillance, incentivize early pregnancy registration, and mandate a minimum of four comprehensive antenatal visits.
- **Focused Uteroplacental Surveillance:** High-risk screening clinics should implement targeted obstetric ultrasound and Doppler surveillance between 26 and 30 weeks of gestation to monitor fetal growth and identify early signs of placental insufficiency.

6. Gupta S, Kumar M, Singh R. Placental histopathological alterations in intrauterine fetal death and correlation with maternal medical disorders. *J Clin Diagn Res.* 2021;15(8):QC12-QC16.
7. Desai K, Shah S, Vasava P. Hypertensive disorders of pregnancy and perinatal outcomes in rural Gujarat: A retrospective structural audit. *Gujarat Med J.* 2023;78(2):34-40.
8. Magee LA, Pels A, Helewa M, et al. Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy: executive summary. *J Obstet Gynaecol Can.* 2014;36(5):416-438.
9. Ananth CV, Vintzileos AM. Maternal anemia and its impact on placental abruption and fetal mortality: a demographic challenge. *Am J Epidemiol.* 2019;190(3):412-421.
10. Ministry of Health and Family Welfare. India Newborn Action Plan (INAP). New Delhi: Government of India; 2014 (Updated 2022).

STRENGTHS, LIMITATIONS, AND FUTURE DIRECTIONS

Strengths

This study provides real-world clinical and demographic insights from a major tertiary referral hospital, capturing data from vulnerable rural populations in Western Gujarat. It systematically evaluates multiple overlapping maternal medical conditions, providing a useful descriptive baseline for regional health planning.

LIMITATIONS

The findings are constrained by several factors: the retrospective design limits data collection to existing medical records, the sample size of 67 cases from a single center restricts broader generalization, and the absence of an integrated non-IUFD comparison group precludes calculating true relative risks. Additionally, detailed placental histopathology and autopsies were not available, which might have clarified specific mechanisms of death.

Future Directions

Future research should focus on large-scale, prospective case-control studies that compare maternal exposures in IUFD cases against healthy live-birth controls. This approach would allow for multi-variable logistic regression to calculate true odds ratios and identify independent risk factors within the regional population.

CONCLUSION

This study demonstrates that maternal anemia and a spectrum of hypertensive disorders are the predominant clinical conditions present among women experiencing intrauterine fetal death at this tertiary care facility in Western Gujarat. The data reveal that the majority of these losses occurred in unbooked patients from rural areas, with a distinct clustering between 26 and 30 weeks of gestation. These findings indicate that while advanced genetic or structural factors play a role, many common concurrent conditions can be identified through routine care. Strengthening rural antenatal registration, implementing universal screening for anemia and hypertension, and ensuring timely tertiary referral are essential steps to optimize fetal outcomes and reduce the regional burden of iufd.

REFERENCES

1. Cunningham FG, Leveno KJ, Bloom SL, Dashe JS, Hoffman BL, Caseny BM, Spong CY, editors. *Williams Obstetrics*. 26th ed. New York: McGraw Hill; 2022.
2. Konar H, editor. *DC Dutta's Textbook of Obstetrics*. 10th ed. New Delhi: Jaypee Brothers Medical Publishers; 2024.
3. National Family Health Survey (NFHS-5), 2019-21: India. Mumbai: International Institute for Population Sciences; 2021.
4. Nalini S, Shanthi M, Devi AR. Clinical profile and maternal factors associated with intrauterine fetal death in a tertiary care hospital. *Indian J Obstet Gynecol Res.* 2022;9(2):184-189.
5. Shravya MK, Pallavi S, Rao R. Retrospective analysis of intrauterine fetal brain and somatic deaths at a referral teaching center. *J Obstet Gynaecol India.* 2023;73(Suppl 1):45-52.