Section: Obstetrics and Gynaecology

Original Research Article

COMPREHENDING STILLBIRTH IN A TERTIARY CARE CENTRE: CLINICAL PATTERNS AND COMPARATIVE PERSPECTIVES

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ABSTRACT

Background: Stillbirth or death of an otherwise viable fetus in utero is a psychologically traumatic experience for both parents and obstetricians, with profound emotional, social, and economic impact. Despite its magnitude, research and policy attention remain limited. The aim is to analyze stillbirths at a tertiary care centre by assessing incidence, maternal profile, risk factors, and probable causes.

Materials and Methods: A prospective observational study was conducted from July 2023 to December 2024 in a tertiary hospital in western India, including 84 stillbirths and 80 live-birth controls. Maternal history, clinical findings, and outcomes were recorded and analysed using STATA 14.2.

Results: The institutional stillbirth incidence was 4.92%. Major causes included hypertensive disorders (44%), abruptio placentae (36.1%), malpresentation (16.9%), and tight nuchal cord (15.5%). Significant risk factors were low birth weight (83.3%), unbooked status (82%), preterm birth (77.58%), maternal obesity (73.8%), multigravidity (67.9%), and prior adverse obstetric history (29.7%). Placental histology showed fetal vascular malperfusion and uteroplacental insufficiency in 13.1%.

Conclusion: The high prevalence of preterm birth and low birth weight in the stillbirth cohort highlights a common pathway of fetal compromise. While not entirely preventable, the majority of stillbirths can be averted through improved maternal health and high-quality intrapartum care.

Keywords: Stillbirth, placental insufficiency, preterm birth, fetal autopsy, obstructed labour, maternal anaemia

INTRODUCTION

Stillbirth is a devastating pregnancy outcome defined as the birth of a fetus beyond 28 weeks of gestation or weighing more than 1000 g without any signs of life.[1] In developed countries, it is 20 weeks of gestation or a fetus weighing more than 500 g due to the availability of advanced neonatal resuscitation and support systems.[2] An estimated 1.9 million babies were born with no signs of life in 2021 worldwide. The global stillbirth rate was 13.9 per 1000 total births in 2022.[3] Huge inequalities prevail in stillbirth rates across the planet, ranging from 1.6 per 1000 total births to 31.2 per 1000 total births. The risk of a baby being stillborn is 20 times higher in

sub-Saharan Africa and South Asia than in developed European countries.[2] The stillbirth rate in India is 13.9 per 1000 total births.[4] Several causes have been attributed to the origin of stillbirths, which include maternal risk factors and morbidities, genetics, intrapartum events, substance abuse, psychosocial stress, etc. A large number of stillborn babies (25-60 %) are classified under unknown reasons.[5] The English National Health Service reports (50-70%) of stillbirths as unclassified despite the free availability of post-mortem services.[6] Although stillbirths were not initially prioritised in the Millennium Development Goals, the Every Newborn Action Plan (ENAP) in 2014 brought global attention to this long-neglected issue, setting a target for all countries to achieve a stillbirth rate of no more than 12 per 1,000 total births by 2030.[7] Complementing this, the Government of India launched the India Newborn Action Plan (INAP), which aims for a more ambitious single-digit stillbirth rate by 2030.[8] The stillbirth rate has decreased from 21.3 per 1000 total births in 2000 to 13.5 in 2021.[3] However, underreporting of stillbirths is a reality. Misconceptions, social stigma, and non-recognition by health care workers are compounding factors. A high stillbirth rate is a reflection of poor antenatal care. Many stillbirths occur intrapartum, which testifies to inaccessible or poor-quality obstetric services. It is essential to evaluate the cause of stillbirth so that preventive strategies can be implemented and a plausible closure can be offered to grieving parents. The most useful diagnostic test for analysing the cause of stillbirth is a fetal autopsy.[9] or fetal karyotype and placental evaluation.[10,11] In cases where it is not possible, post-mortem MRI can be offered.[12] Many stillbirths across the world can be prevented with improved prenatal care, universal coverage of quality healthcare services, judicious investments, and ambitious government policies.

This study was undertaken to conduct a comprehensive analysis of stillbirths, to understand the possible causative factors contributing to the disease process, and to explore the remedial measures that can be incorporated in our institute.

Objectives:

Primary objectives

- To estimate the incidence of stillbirth in a tertiary care centre.
- To study the clinical profile of patients presenting with stillbirth

Secondary objectives

- To examine the antenatal high-risk factors associated with stillbirth and to elucidate the probable underlying causes.

MATERIALS AND METHODS

Study Design and Setting: A hospital-based prospective comparative observational study was conducted at the Department of Obstetrics and Gynaecology at a tertiary care centre in rural Gujarat, India, over 18 months, from July 2023 to December 2024

Inclusion Criteria

All stillbirth cases with a gestational age greater than 28 weeks and/or a fetal weight exceeding 1000 grams were included, irrespective of singleton or multiple gestation.

Exclusion Criteria

Cases involving a congenitally anomalous fetus, gestational age less than 28 weeks, or fetal weight under 1000 grams were excluded.

A similar number of patients matched for age, parity, and comorbidities were taken as controls. After receiving approval from the Institutional Ethics Committee (IEC/BU/147/Faculty/21/267/2023), eligible participants were enrolled. A complete enumeration sampling technique was employed. Informed consent was obtained from all participants after they were provided with a detailed information sheet in their native language. Data were collected using a pre-formed case record form and entered into an MS Excel sheet. A detailed maternal history was taken, with special attention to demographics, socioeconomic status (using the modified Kuppuswamy classification), booking status, and high-risk factors in present and past pregnancies. Clinical examination and relevant investigations, including complete hemogram, blood sugar profiles, and thyroid function tests, were conducted.

Study Variables: Independent Variables: Demographic profile, socioeconomic status, and risk factors/causes of stillbirth.

Outcome Variables: Gestational age at delivery, mode of delivery, maternal and perinatal mortality and morbidity, birth weight, and condition of the stillborn baby (fresh or macerated). The probable causes of stillbirth were classified using the CODAC (Cause of Death and Associated Conditions) system. In select cases, a pathological fetal autopsy or magnetic resonance imaging (MRI) of the dead fetus was offered.

Statistical Analysis: Data were analysed using STATA software, version 14.2. Descriptive statistics (mean, standard deviation, frequency) were used to summarise the baseline profile. The Independent sample t-test and Chi-square test were used to compare continuous and categorical variables, respectively. A p-value of <0.05 was considered statistically significant.

Functional Definitions: Antepartum stillbirth: Fetal death occurring during pregnancy and before delivery, before the onset of labour. The infant is born without signs of life. Apgar score of 0 at 1 and 5 min determined by physical examination after delivery [with or without electronic monitoring of heart rate, respiratory rate, and pulse oximetry.[13]

Intrapartum stillbirth: Intrapartum stillbirth is defined as fetal death occurring after the onset of labour and before delivery. The infant is born without signs of life. Documentation of a live fetus before or at the onset of labour exists.[14]

Macerated stillbirth: These fetuses mostly died antepartum and can have skin changes consistent with maceration, skin discolouration, darkening, redness, peeling, or oedema.[15]

Fresh stillbirth: Fresh fetus lacks such skin changes and is presumed to have died much more recently [intrapartum].[15]

RESULTS

During the study period, there were 1704 obstetrical deliveries, among which 84 were stillbirths, yielding an institutional stillbirth incidence of 4.92%. [Figure 1]

[Table 1] displays the demographic profile of the cases and controls. The mean maternal age was similar between the stillbirth (cases) group (26.72 ± 3.85 years) and the live birth (controls) group (27.52 ± 4.89 years). There was also no significant difference in the rural/urban distribution between the two groups. However, stillbirth was more common among multigravida women (67.86%) compared to primigravida (32.14%). A striking finding was that 82% of women in the stillbirth group were "unbooked" (had not received adequate antenatal care), compared to 45% in the control group (P<0.001). Furthermore, a majority of stillbirth cases (42.9%) were referred from peripheral government health setups, highlighting the importance of timely and effective referral systems. Three patients delivered twins among the cases.

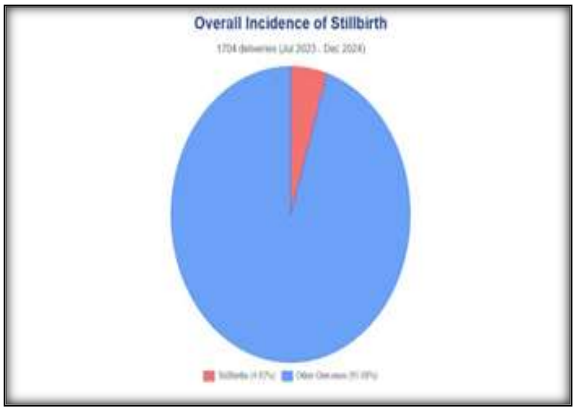

Figure 1: Incidence of Stillbirth at the Institute.

Table 1: Demographic distribution of cases and controls

Characteristics	Case % N (84)		Control % N (80)		Total N (164)	P value
Age (mean) ±SD	**26.7229± 3.85504**		**27.5250± 4.89891**			**0.25**
Gavida						
Primi	27	32.14%	35	43.75%	62	0.1703
Multi	57	67.86%	45	56.25%	102	
Distribution						
Urban	34	40.47%	30	37.50%	64	0.70
Rural	50	59.52%	50	62.50%	100	
Booking status						
Booked	15	17.85%	44	55%	59	0.001
Unbooked	69	82.14 %	36	45%	105	
Referral status						
Private	35	41.66%	12	15%	47	<0.001
Govt	36	42.85%	18	22.50%	54	
Direct from home	13	15.47%	6	7.50%	19	

Statistical test: t-test, chi-square test

[Table 2] elucidates the risk factors significantly associated with stillbirths in our study. Preterm birth emerged as the most prominent contributor, accounting for 77.38% of stillbirths, a finding that was highly statistically significant (P < 0.001). This was followed by maternal overweight, defined as a BMI greater than 23, which was also significantly associated with stillbirths (P = 0.007). Antenatal care utilisation appeared to influence outcomes: while 88.8% of controls had adequate ANC visits, this was lower in cases (75%), suggesting that more frequent ANC may contribute to improved fetal survival.

Notably, multigravidity demonstrated a strong association (p < 0.001), with 67.85% of such cases resulting in stillbirth. Similarly, a prior history of abortion or stillbirth was significantly related to adverse outcomes in the current pregnancy, representing 29.76% of the cases (P = 0.003). Additionally, clotting disorders were identified in 11.9% of affected women and showed a significant correlation with stillbirths (P = 0.002). Fetal growth restriction also approached statistical significance (P<0.001), suggesting a potential link that warrants further investigation.

Conversely, other high-risk maternal conditions—including hypertensive disorders of pregnancy (HDP), moderate to severe anaemia, advanced maternal age (>35 years), maternal infections, premature rupture of membranes (PROM), diabetes, intrahepatic cholestasis of pregnancy, and substance abuse—did not demonstrate a statistically significant direct relationship with stillbirth in our cohort. Nonetheless, these factors may contribute indirectly, particularly through their association with iatrogenic or spontaneous preterm birth, which in turn elevates the risk of stillbirth.

Table 2: Comparison of Risk factors among patients experiencing stillbirth and controls

Risk factors	Cases		Control		Total	P value
	N (84)	%	N (80)	%	N (164)	

Preterm labour	65	77.38%	15	18.75%	80	<0.001
BMI>23	62	73.81	43	53.75%	105	0.007
Multigavida	57	67.85	45	56.25%	102	<0.001
H/O Previous abortion/stillbirth	25	29.76%	9	11.25%	34	0.003
ANC visits 4=/< 4>	21 63	25% 75%	9 71	11.25% 88.8%	30 134	0.038
Clotting disorder	10	11.90%	0	0	10	0.002
Moderate/severe anaemia	7	8.33%	7	8.75%	14	0.92
Age >35yr	3	3.57%	0	0	3	0.09
Infection	3	3.57%	6	7.50%	9	0.32
FGR	45	53.57%	8	10%	10	<0.001
PROM	2	2.38%	0	0	2	0.497
Diabetes	2	2.38%	0	0	2	0.497
Cholestasis	1	1.19%	0	0	1	>0.995
Substance abuse	1	1.19%	0	0	1	>0.995

Statistical test: t-test, chi-square test

[Table 3] delineates the underlying causes of stillbirths, broadly categorised as intrapartum, maternal, fetal, placental, and cord-related factors. The majority of cases (83.1%) had no identifiable intrapartum complication; however, obstructed labour was observed in 2 cases (2.4%), and malpresentation accounted for 16.9% of stillbirths.

With respect to maternal factors, more than half of the women (52%) had no discernible high-risk condition. Among those affected, hypertensive disorders of pregnancy were the predominant contributor, present in 44.6% of cases. Less frequent but notable causes included maternal infections, cholestatic jaundice, and epilepsy, each observed in 1.2% of cases.

Fetal factors were implicated in a smaller proportion of stillbirths. Birth defects accounted for 4.9%, extreme prematurity for 7.3%, and hydrops fetalis for 1.2%. Placental pathology was an important contributor, although in 60.2% of cases, no specific placental cause could be identified. Abruptio placentae was noted in 36.1% of cases, followed by placenta previa (1.2%) and placental insufficiency (2.4%). Histopathological examination of the placenta yielded positive findings in 19 % of the specimens that were sent for evaluation. These included umbilical cord vascular thrombosis [Figure 2], segmental villous necrosis, and intraplacental haemorrhage with thrombosis [Figure 3]. MRI of dead fetuses was inconclusive. Cord complications were less frequent, with the majority (83.1%) showing no abnormality. Nonetheless, a tight nuchal cord was present in 15.7% of cases, and one case (1.2%) was attributed to hypercoiling.

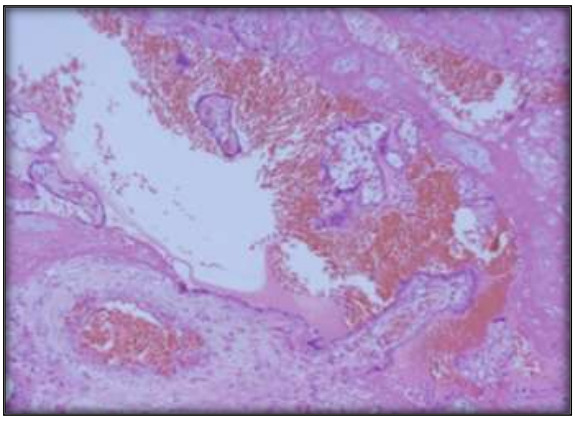

Figure 2: Histopathology report of the umbilical vessel showing vascular thrombosis

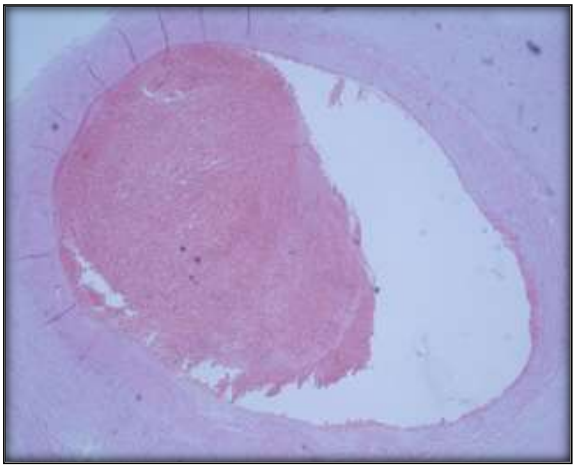

Figure 3: Histopathology report of the placenta showing infarction

Table 3: Etiological factors of stillborn babies

Sr no.	Causes	Cases N (84)	Percentage
1.	Intrapartum		
	Malpresentation	14	16.66%
	Obstructed labour	2	2.38%
2.	Maternal		
	HDP	37	44%
	Infection	3	3.57%
	Diabetes	1	1.19%
	Intrahepatic cholestasis	1	1.19%
	Epilepsy	1	1.19%

3.	Fetal		
	Extreme prematurity	12	14.28%
	Birth defect	4	4.76%
	Hydrops fetalis	1	1.19%
4.	Placental		
	Abruption	30	35.71%
	Insufficiency	2	2.38%
	Placenta previa	1	1.19%
5.	Cord		
	Tight loop	13	15.47%
	Hyper coiling	1	1.19%

Sr No: Serial number
HDP: hypertensive disorders of pregnancy

[Table 4] presents the comparative analysis of fetomaternal outcomes between cases and controls, highlighting several factors strongly associated with stillbirths. The majority of stillbirths were delivered vaginally (53%), though this finding did not reach statistical significance. Preterm delivery, however, showed a striking association: 77.38% of cases were preterm compared to only 18.75% in the control group ($p < 0.001$), underscoring prematurity as a major determinant of stillbirth.

Maternal morbidity was also notable. ICU admission due to medical or surgical complications was significantly higher in cases (41.7%) compared to controls (1.25%), reflecting the severity of maternal compromise associated with stillbirth ($p < 0.001$). Mean hospital stay was correspondingly longer in cases (6 ± 3.82 days) than in controls (4.31 ± 1.14 days). The mean gestational age at delivery was also significantly lower in cases (33.1 ± 3.83 weeks) versus controls (37.5 ± 2.08 weeks; $p < 0.001$).

Labour induction was more commonly associated with stillbirths (72.6% in cases vs. 37.5% in controls). Placental weight was significantly lower among stillbirths (405.5 ± 103.6 g) compared to controls (514.9 ± 81.4 g), reflecting impaired placental function.

Fetal sex distribution also showed significance ($p = 0.05$), with female fetuses comprising 52.9% of cases versus 37.5% of controls. Amniotic fluid characteristics further revealed disparities: clear liquor was more frequent in controls (92.2%) compared to cases (50%), while meconium-stained liquor (21.4% vs. 8.7%) and tobacco juice–colored liquor (28.6% vs. none) were significantly higher among stillbirths. Finally, low birth weight emerged as a key correlate: 83% of stillbirths occurred in low-birth-weight infants, in contrast to 28.8% in controls ($p < 0.001$).

Table 4: Comparison of clinical outcomes between cases and controls

Characteristics	Cases N (84)	%	Control N (80)	%	Total N (164)	P value
Mode of delivery						
Vaginal	45	53%	35	43.75%	80	0.21
LSCS	37	44%	42	52.50%	79	
VBAC	2	2.38%	0	0	2	
Period of gestation						
Term	19	22.61%	78	97.50%		<0.001
Preterm	53	63%	2	2.50%		
Very Preterm	12	14.28%	0	0%		
ICU Admission	35	41.66%	1	1.25%	36	<0.001
Hospital stay (mean)	6±3.821		4.3±1.137			<0.001
Gestational age(mean)	33.1±3.82		37.48±2.07			<0.001
Type of labour						
Induced	61	72.61%	30	37.50%	91	
Spontaneous	23	27.38%	50	62.50%	73	<0.001
Placental weight (mean)	405.48±103.6		514.912±81.4			<0.001
Sex of the foetus						
Female	46	52.87%	30	37.50%	76	0.05
Male	41	47.13%	50	62.50%	91	
Colour of liquor						
Clear	42	50%	73	91.25%	115	
Tobacco juice	24	28.57%	0	0	24	<0.001
Meconium stained	18	21.42%	7	8.75%	25	
Weight of the baby						
Less than 2.5 kg	72	83%	23	28.75%	93	<0.001
More than 2.5 kg	15	17%	57	71.25%	71	
Baby Status						
Fresh	72	83%	0	0	72	
Macerated	15	17%			15	

Statistical test: t-test, chi-square test

LSCS: Lower segment cesarean section
VBAC: Vaginal birth after cesarean section
ICU: Intensive care unit

DISCUSSION

This prospective comparative study revealed a notable institutional stillbirth incidence of 4.92% and delineated a distinct clinical profile of affected pregnancies. The predominant risk factors were largely preventable or amenable to intervention, most notably inadequate antenatal care, hypertensive disorders of pregnancy (HDP), maternal obesity, and prior adverse obstetric outcomes. A striking association emerged between stillbirth and insufficient antenatal care: the majority of women in the stillbirth group were unbooked (82%) and had attended fewer than four antenatal visits. This finding underscores a pressing public health concern. Furthermore, the disproportionately high number of referrals from peripheral centres underscores systemic deficiencies in early risk recognition and timely access to specialised care. Taken together, these results reaffirm the critical importance of early antenatal registration, consistent follow-up, and robust referral pathways as the cornerstone strategies for preventing stillbirths, as also cited in the literature.[16] Puri et al. similarly reported a lower incidence of stillbirth when preconceptional counselling, comprehensive risk assessment, and regular antenatal follow-up were undertaken.[17]

Our findings corroborate the well-established contribution of maternal comorbidities to stillbirth aetiology. Hypertensive disorders of pregnancy (HDP), diabetes, cardiovascular disease, thrombophilias, and anaemia emerged as prominent risk factors. The remarkably high prevalence of preterm birth (77.38%) and low birth weight (83%) among stillbirths highlights the shared final pathway of fetal compromise. Malacova et al. reported that prematurity markedly increased the risk of stillbirth, with a threefold elevation for births before 34 weeks (pooled OR 2.98; 95% CI 2.05–4.34). Moreover, a history of previous stillbirth not only elevated the risk of recurrence but also predisposed to preterm birth (pooled OR 2.82; 95% CI 2.31–3.45) and subsequent small-for-gestational-age (SGA) infants (pooled OR 1.39; 95% CI 1.10–1.76).[18]

Maternal obesity and HDP were strikingly prevalent in our stillbirth cohort, affecting 73.81% and 44% of women, respectively. Obesity has been consistently identified as an independent and dose-dependent risk factor. In a large study spanning 2.8 million births, overweight and obese women had a 1.4–3.2 times higher risk of stillbirth, which escalated sharply with extreme obesity. At 39 weeks, women with a BMI ≥50 had a 5.7-fold higher risk, rising dramatically to 13.6-fold at 41 weeks. Overall, obesity accounted for nearly one-quarter of stillbirths between 37 and 42 weeks of gestation.[19] Similarly, Basta et al. documented a stillbirth rate of 21.9 per 1000 births among women with HDP compared with 8.4 per 1000 in normotensive women, with persistently higher rates across multiple subgroups.[20]

These findings align with extensive evidence implicating maternal comorbidities—particularly HDP and obesity—in the pathogenesis of placental dysfunction and adverse perinatal outcomes, thereby reinforcing the urgent need for early identification, counselling, and tailored management of at-risk women.

In our study, 10 cases (11.9%) of stillbirth were associated with clotting disorders, whereas none were observed in the control group. This aligns with the findings of Monari et al., who demonstrated a higher prevalence of thrombophilic defects, particularly the Factor II mutation, among mothers of stillborn infants.[19] Our cohort provided pathological corroboration of this association, with placental abruption emerging as a predominant cause (36.1%). These results resonate with WHO's 2016 antenatal care recommendations, which emphasise the role of Doppler ultrasound in detecting placental insufficiency, estimated to underlie 5–10% of stillbirths.[21] Similarly, Flenady et al. (2011) reported placental abruption in 10–15% of cases (OR 3.2; 95% CI 2.5–4.1) and fetal vascular malperfusion or infarction in about 13%.[22] The lower mean placental weight in our stillbirth group supports chronic uteroplacental insufficiency as a key mechanism.

Regarding umbilical cord pathology, 83.1% of cases showed no anomalies, indicating a relatively low prevalence of cord-related etiologies. However, 15.5% exhibited tight nuchal cords or true knots (Fig.4), an important contributor to fetal hypoxia and intrapartum asphyxia, while 1.2% demonstrated hypercoiling of the cord (Fig. 5). This condition may compromise fetoplacental blood flow and elevate perinatal risk.

Figure 4: True knot of the Cord

Figure 5: Hypercoiling of the cord

WHO's recommendations on antenatal care (2016) also highlight the utility of Doppler ultrasound for the detection of such cord anomalies, reinforcing the necessity of vigilant intrapartum surveillance through continuous fetal heart rate monitoring and Doppler velocimetry to mitigate cord-related risks and improve perinatal outcomes.[21,22]

Interestingly, our study did not demonstrate a significant association between maternal age and stillbirth, a finding that contrasts with the widely reported bimodal risk observed at the extremes of reproductive age. This discrepancy may reflect the demographic composition of our cohort or limitations in sample size. Similarly, maternal infections were less prevalent among stillbirth cases (3.57%) compared to controls (7.50%), suggesting either a predominant role of non-infectious etiologies or potential underdiagnosis of infectious contributors in this population. Another noteworthy observation was the higher proportion of female fetuses in the stillbirth group, a statistically significant finding that diverges from most large-scale studies, which typically identify male fetuses as being at greater risk—a difference that warrants further exploration.

Parents should be encouraged to consent to a full autopsy, as it often yields crucial diagnostic information. Studies show that an autopsy can change the presumed cause of death in up to 30% of cases, provide new insights in another 25–30%, and influence parental counselling or recurrence risk estimates in 25–50%.[23,24] Miler et al. (2016) further demonstrated that combining placental examination with autopsy altered future medical management in 45% of cases.[25] Even limited protocols, including external examination, imaging, cultures, and selective histopathology or genetic testing, can be valuable. Importantly, autopsy findings enable informed parental counselling on recurrence risks and preventive strategies.[25] Bereavement support is essential, aligning with global consensus recommendations.[26] Women experiencing stillbirth or early miscarriage face heightened risks of depression and post-traumatic stress disorder, warranting sensitive counselling and close follow-up, along with lactation suppression and contraception.

Despite the predominance of placental and maternal factors in our cohort, a striking 60.2% of stillbirths revealed no identifiable placental pathology. This highlights both the inherent diagnostic challenges and the pressing need for more sophisticated investigative modalities to uncover subtle or multifactorial contributors. Collectively, these observations reinforce the complex and heterogeneous nature of stillbirth, where identifiable risk factors coexist with a substantial proportion of unexplained cases, underscoring the importance of continued research into its elusive aetiology.

Limitations: This study was conducted in a single tertiary care institution, which may constrain the external validity and limit the generalizability of the findings to broader populations or diverse healthcare settings. The relatively short duration of the study may not adequately reflect temporal variations or long-term trends in stillbirth patterns. In addition, certain maternal risk factors, such as substance abuse or lifestyle-related variables, were assessed through self-reporting, which is inherently subject to recall bias and underreporting. Future multi-centre studies with longer follow-up and more robust data collection methods are warranted to strengthen the evidence base.

CONCLUSION

The study revealed a substantial institutional burden of stillbirth. The findings illuminate its multifactorial nature, wherein prematurity, maternal comorbidities, inadequate antenatal care, chronic placental insufficiency, abnormal amniotic fluid characteristics, and low birth weight converged as critical determinants. These findings emphasise the urgency of early antenatal registration, optimal management of comorbidities, vigilant fetal surveillance, and robust referral systems to reduce preventable stillbirths.

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