

Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY ON STILLBIRTH CLASSIFICATION USING THE RECODE SYSTEM IN A TERTIARY CARE HOSPITAL, BALLARI

Soujanya Hyati¹, Alfia², Vedhika Natarajan³.

¹⁻³Senior Resident, Department of Obstetrics and Gynecology, KMCRI, Hubballi, Karnataka, India.

²Assistant Professor, Department of Obstetrics and Gynecology, KMCRI, Hubballi, Karnataka, India.

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Corresponding Author:

Dr. Soujanya Hyati,
Senior Resident, Department of
Obstetrics and Gynecology, KMCRI,
Hubballi, Karnataka, India.
Email: soujanyaHyati172@gmail.com

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ABSTRACT

Background: Stillbirth remains a major global public health problem, particularly in low- and middle-income countries. Accurate classification of stillbirths is essential for identifying the underlying causes and associated risk factors. The Relevant Condition at Death (ReCoDe) classification system is a standardized method used to classify stillbirths. The present study was conducted to determine the proportion of stillbirths and associated risk factors using the ReCoDe classification system in a tertiary care hospital in Ballari.

Materials and Methods: A prospective observational study was conducted in the Department of Obstetrics and Gynecology at a tertiary care hospital in Ballari. Pregnant mothers with intrauterine fetal death at 28 weeks or more gestational age and birth weight of 1000 grams or more were included. Data were collected using a predesigned proforma and stillbirths were classified using the ReCoDe classification system. Data were analyzed using SPSS version 23 and expressed as frequencies and percentages.

Results: A total of 209 stillbirths were included in the study. Majority of the mothers (54.5%) belonged to the age group of 24–29 years and 42.6% were primigravida. Most of the deliveries (74.6%) were vaginal deliveries. Macerated stillbirths accounted for 86.1% of cases. According to the ReCoDe classification, fetal growth restriction (17.2%), abruptio placentae (12.4%), oligohydramnios (7.2%), and hypertensive disorders of pregnancy (66%) were the major associated conditions. Intrapartum asphyxia accounted for 13.4% of stillbirths, while 19.1% of cases remained unclassified.

Conclusion: The ReCoDe classification system was effective in identifying the relevant conditions associated with stillbirths. Hypertensive disorders of pregnancy, fetal growth restriction, and placental abnormalities were the major contributors to stillbirths. Early identification of high-risk pregnancies, regular antenatal care, and timely obstetric intervention may help reduce stillbirths and improve perinatal outcomes.

Keywords: Stillbirth, ReCoDe classification, fetal growth restriction, hypertensive disorders, intrauterine fetal death, placental abnormalities.

INTRODUCTION

Stillbirth remains a major global public health burden, with an estimated 2.6 million stillbirths occurring each year worldwide, the majority in low- and middle-income countries.^[1,2] It can be defined as a baby born with no signs of life at or after 28 weeks gestation is a devastating outcome for families and society.^[1] Despite the substantial burden of stillbirths, they have been largely overlooked in

global health agendas and progress in reducing stillbirth rates has been slow.^[3]

Accurate classification of stillbirths is essential for understanding the causes and risk factors associated with these deaths and for developing targeted interventions to prevent them.^[4] However, the classification of stillbirths continues to pose significant challenges owing to their multifactorial etiology and the lack of a universally accepted system, as currently available classification methods

are often limited by subjective interpretation, poor reproducibility, and incomplete capture of clinically relevant information.^[5,6] To address these limitations, The Relevant Condition at Death (ReCoDe) classification system was developed as a standardized tool for classifying stillbirths based on the most relevant condition at the time of death.^[7] ReCoDe aims to provide a more objective and comprehensive approach to stillbirth classification by considering all available information, including clinical, pathological, and laboratory findings.^[8] Several studies have applied the ReCoDe classification system to stillbirth cases and have demonstrated its utility in identifying the leading causes of stillbirths in different settings. For example, a study conducted in the United Kingdom found that the most common conditions associated with stillbirths were fetal growth restriction, placental insufficiency, and congenital anomalies.^[9] Another study in South Africa reported that intrapartum asphyxia, hypertensive disorders, and infections were the major contributors to stillbirths.^[10] However, the application of ReCoDe in prospective studies is still limited and more research is needed to evaluate its performance and potential impact on stillbirth prevention strategies. Thus, this prospective observational study aims to determine the proportion of stillbirths and associated risk factors using the ReCoDe classification system in a tertiary care hospital in Ballari.

MATERIALS AND METHODS

Study Design and setting: A prospective observational study was conducted in the Department of Obstetrics and Gynecology (OBG) at tertiary care hospital, Ballari, Karnataka, India. The hospital provides both outpatient and inpatient services and includes various departments such as General Medicine, General Surgery, Pediatrics, Obstetrics and Gynecology, Orthopedics, Ophthalmology, ENT, Dermatology, Psychiatry, Radiology, Anesthesiology, and Emergency Medicine. The Department of Obstetrics and Gynecology provides comprehensive maternal and child healthcare services including antenatal care, intrapartum care, postnatal care, emergency obstetric services, and neonatal care.

Study Population: Pregnant mothers admitted to the Department of OBG with intrauterine fetal death at 28 weeks or more gestational period and having birth weight 1000 grams or more and Foetuses that died in utero during labour at or above 28 weeks of gestation were included in the study.

Sample Size and Data Collection: The sample size was determined based on the number of women who met the inclusion criteria during the study period. The study was conducted over a period of one year, from January 2025 to December 2025, including all stillbirths that occurred during this period. Upon admission, a detailed history, demographic details,

and obstetric history were documented for each participant. The labour management details were recorded after the birth of the stillborn baby. The stillborn was examined externally to look for evidence of maceration and fresh stillbirth. The gender of the baby, birth weight, and gestational age were recorded in a standard format and the following investigations were performed: Routine investigations such as screening tests, Chest X-ray, Complete blood count, Blood grouping, Coagulation profile, Histopathological examination of placenta and its membranes, including the umbilical cord, Ultrasonography (USG), Arterial blood gas (ABG) analysis of the stillborn baby. The probable cause of death was assigned based on the clinical findings, investigation results, and the ReCoDe classification system. If needed, the baby and the placenta were sent for autopsy to further ascertain the cause of death.

Data Analysis: The collected data were entered into a Microsoft Excel spreadsheet and analyzed SPSS version 23, a statistical software [SPSS Inc. a software house headquartered in Chicago], was employed for analysis, with findings presented in tabular and graphical formats. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to summarize the demographic and clinical characteristics of the study population. The distribution of stillbirths according to the ReCoDe classification system was presented as frequencies and percentages.

Ethical Considerations: Ethics approval is taken from the institutional ethical committee. All the participants were provided the informed consent in writing and explained to them in their local language with the explicit assurance that the data provided by them would remain confidential and would not be affected by study participation or protocols.

RESULTS

In [Table 1], the socio-demographic characteristics of the pregnant mothers reveal that the majority, around 55%, belonged to the age group of 24–29 years, followed by 23% in the age group of 18–23 years. Most of the mothers, around 63%, were from rural areas, while 37% belonged to urban areas. Regarding educational status, around 65% of the mothers were literate, whereas 35% were illiterate.

[Table 2] shows the distribution of pregnant mothers according to pregnancy and delivery related characteristics. Regarding gestational age, the majority, around 36%, had gestational age between 34–36 weeks, followed by 30% with gestational age more than 37 weeks. In terms of gravida status, around 43% were primigravida, followed by 31% who were gravida 2. Majority of the deliveries, around 75%, were normal vaginal deliveries, followed by 17% delivered through LSCS. Previous history of stillbirth was absent in around 97% of the mothers, while only 3% had a previous stillbirth. With respect to birth weight, majority of the babies,

around 34%, had birth weight between 2001–2500 grams, followed by 32% between 1501–2000 grams. Male babies accounted for around 61% of the stillbirths, while female babies constituted around 39%.

[Table 3] shows the distribution of pregnant mothers according to the ReCoDe subgroups. Under Group A (Fetus), foetal growth restriction was the most common fetal cause contributing to around 17% of the cases, while lethal congenital anomaly accounted for 1% and nonimmune hydrops for 0.5% of the cases. In Group B (Umbilical cord), cord prolapse accounted for around 5% and constricting loop or knot for around 1% of the cases. Among placental causes in Group C, abruptio placenta was the most common cause contributing to around 12%, followed by placenta previa accounting for around 4% of the cases. Under Group D (Amniotic fluid), oligohydramnios accounted for around 7% of the cases, while polyhydramnios contributed to around 2%. Uterine causes under Group E were minimal, with rupture and uterine anomalies contributing to

0.5% each. In Group F (Mother), hypertensive disorders of pregnancy were the most common maternal condition contributing to around 66% of the cases, followed by thyroid disorders accounting for around 9% and diabetes mellitus contributing to around 2%. In Group G (Intrapartum), asphyxia accounted for around 13% of the cases, while no cases of birth trauma were reported. Under Group I (Unclassified), around 19% of the stillbirths had no relevant condition identified.

[Figure 1] shows the distribution of pregnant mothers according to the type of birth. Majority of the stillbirths, around 86%, were macerated stillbirths, while fresh stillbirths accounted for around 14% of the cases. [Figure 2] shows the distribution of pregnant mothers according to the ReCoDe groups. The highest proportion of stillbirths belonged to Group I (Unclassified) accounting for around 19%, followed closely by Group A (Fetus) accounting for around 19% and Group C (Placenta) contributing to around 17% of the cases.

Table 1: Distribution of Pregnant mothers according to the sociodemographic variables. (n=209)

Sl no	Variables	Categories	Frequency (percentage) n (%)
1	Age (in years)	18-23 24-29 30-35 36-41	48 (23) 114 (54.5) 41 (19.6) 6 (2.9)
2	Place of residence	Rural Urban	132 (63.2) 77 (36.8)
3	Educational status	Illiterate Literate	73 (34.9) 136 (65.1)

Table 2: Distribution of Pregnant mothers according to the Pregnancy and Delivery Related Characteristics. (n=209)

Sl no	Variables	Categories	Frequency (percentage) n (%)
1	Gestational age in weeks	28- 30 31- 33 34- 36 >37	31 (14.8) 40 (19.1) 75 (35.9) 63 (30.1)
2	Gravida status	1 2 3 ≥4	89 (42.6) 65 (31.1) 31 (14.8) 24 (11.5)
3	Mode of delivery	LSCS NVD Assisted breech	35 (16.7) 156 (74.6) 18 (8.6)
4	Previous stillbirth	Yes No	7 (3.3) 202 (96.7)
5	Birth weight (in grams)	1001- 1500 1501- 2000 2001- 2500 2501- 3000 >3001	40 (19.1) 67 (32.1) 70 (33.5) 22 (10.5) 10 (4.8)
6	Gender of the baby	Male Female	127 (60.8) 82 (39.2)

Table 3: Distribution of Pregnant mothers according to the ReCoDe sub groups. (n=209)

Sl no	Variables	Categories	Frequency (percentage) n (%)
1	Group A (FETUS)	Lethal congenital anomaly Infection Nonimmune hydrops Isoimmunisation Fetomaternal haemorrhage Twin-twin transfusion Foetal growth restriction	2 (1) 0 (0) 1 (0.5) 0 (0) 0 (0) 0 (0) 36 (17.2)
2	Group B (UMBILICAL CORD)	Cord prolapse Constricting loop or knot Velamentous insertion of cord	11 (5.3) 3 (1.4) 0 (0)

		Others	0 (0)
3	Group C (PLACENTA)	Abruptio placenta Placenta Previa Vasa previa Placental insufficiency Others	26 (12.4) 9 (4.3) 0 (0) 0 (0) 0 (0)
4	Group D (AMNIOTICFLUID)	Chorioamnionitis Oligohydramnios Polyhydramnios Others	1 (0.5) 15 (7.2) 4 (1.9) 0 (0)
5	Group E (UTERUS)	Rupture Uterine anomalies Others	1 (0.5) 1 (0.5) 0 (0)
6	Group F (MOTHER)	DM Thyroid Essential HTN Hypertensive disorders of pregnancy Lupus or antiphospholipid syndrome Cholelithiasis Drug misuse Others	5 (2.4) 18 (8.6) 0 (0) 138 (66) 0 (0) 0 (0) 0 (0) 0 (0)
7	Group G (INTRAPARTUM)	Asphyxia Birth trauma	28 (13.4) 0 (0)
8	Group H (TRAUMA)	External factors Iatrogenic factors	0 (0) 0 (0)
9	Group I (UNCLASSIFIED)	No relevant condition identified No information available	40 (19.1) 0 (0)

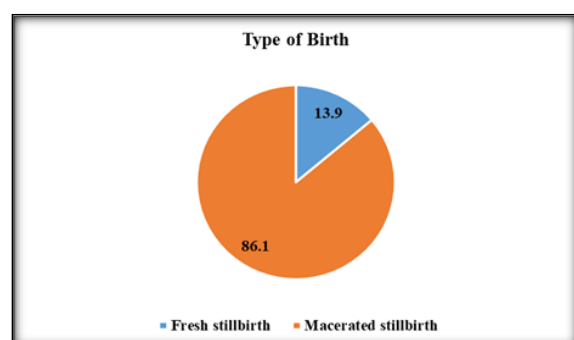


Figure 1: Distribution of Pregnant mothers according to the type of Birth.

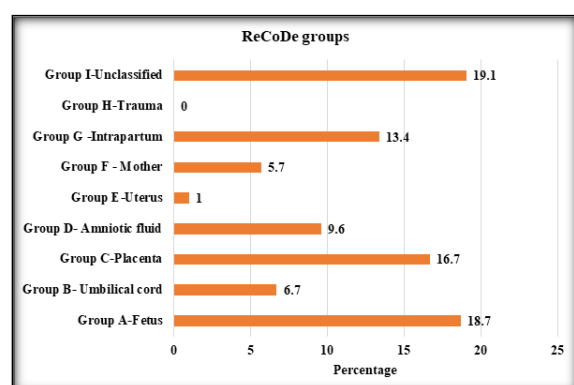


Figure 2: Distribution of Pregnant mothers according to the ReCoDe groups. (n=209)

Supplementary files

Tool: The ReCoDe classification system is based on a hierarchical approach with the primary cause of death being assigned to one of nine main categories: fetal, umbilical, placental, amniotic fluid, uterine, mother, intrapartum, trauma, and unclassified. Each main category is further divided into subcategories, providing a more detailed description of the relevant condition. The ReCoDe system also allows for the

assignment of associated conditions that may have contributed to the death but were not the primary cause.

The application of the ReCoDe classification system in prospective studies has the potential to provide a more accurate and comprehensive assessment of the causes and risk factors associated with stillbirths. By collecting data on a wide range of clinical, pathological, and laboratory findings, prospective studies can help identify the most relevant conditions at the time of death and shed light on the complex interplay of factors that contribute to stillbirths. Furthermore, prospective studies using the ReCoDe classification system can help evaluate the performance of the system in different settings and populations. By comparing the findings of different studies, researchers can assess the reproducibility and validity of the ReCoDe system and identify areas for improvement or adaptation. The findings of prospective studies using the ReCoDe classification system can have important implications for clinical practice and public health policies. By identifying the leading causes and risk factors associated with stillbirths, healthcare providers can develop targeted interventions to prevent these deaths, such as improving antenatal care, managing maternal conditions, and optimizing intrapartum care.

Public health policies can also be informed by the findings of these studies, leading to the development of evidence-based guidelines and recommendations for stillbirth prevention. The application of the ReCoDe classification system in prospective observational studies has the potential to provide valuable insights into the epidemiology of stillbirths and inform the development of targeted interventions to reduce their occurrence.

By using a standardized and comprehensive approach to stillbirth classification, these studies can contribute to the growing body of evidence on stillbirth

prevention and ultimately help reduce the global burden of this devastating outcome.

Group A: Fetus	Group E: Uterus
1.1 Lethal congenital anomaly	5.1 Rupture
1.2 Infection	5.2 Uterine anomalies
1.3 Non-immune hydrops	5.3 Other
1.4 Isoimmunisation	Group F: Mother
1.5 Fetomaternal haemorrhage	6.1 Diabetes
1.6 Twin-twin transfusion	6.2 Thyroid diseases
1.7 Fetal growth restriction	6.3 Essential hypertension
Group B: Umbilical cord	6.4 Hypertensive diseases in pregnancy
2.1 Prolapse	6.5 Lupus or antiphospholipid syndrome
2.2 Constricting loop or knot	6.6 Cholestasis
2.3 Velamentous insertion	6.7 Drug misuse
2.4 Other	6.8 Other
Group C: Placenta	Group G: Intrapartum
3.1 Abruptio	7.1 Asphyxia
3.2 Praevia	7.2 Birth trauma
3.3 Vasa praevia	Group H: Trauma
3.4 Other placental insufficiencies	8.1 External
3.5 Other	8.2 Iatrogenic
Group D: Amniotic fluid	Group I: Unexplained
4.1 Chorioamnionitis	
4.2 Oligohydramnios	
4.3 Polyhydramnios	
4.4 Other	

ReCoDe classification System.

DISCUSSION

In the present study, a total of 209 pregnant mothers with intrauterine fetal death at 28 weeks or more gestational age and birth weight of 1000 grams or more were included. Majority of the women, around 54.5%, belonged to the age group of 24–29 years, followed by 23% in the age group of 18–23 years. Similar findings were reported by Gupta A et al., where 54.7% of women belonged to the 24–29 years age group and 63.4% were from rural areas.^[3] Changede P et al. also reported similar observations in their study conducted in Mumbai.^[4]

Distribution according to gestational age revealed that 35.9% of the mothers had gestational age between 34–36 weeks, followed by 30.1% with gestational age above 37 weeks. Gupta A et al. reported similar findings, where 36.24% of stillbirths occurred between 33–36+6 weeks and 30.66% occurred after 37 weeks, which is comparable with the present study findings.^[3]

In the present study, about 42.6% were primigravida, followed by 31.1% gravida 2 mothers. Similar findings were observed in the study by Gupta A et al., where 31.01% were primigravida.^[3]

Only 3.3% of women in the present study had a previous history of stillbirth. Gupta A et al. reported similar findings, with 2.44% having previous stillbirth history.^[3] Regarding mode of delivery, majority of the mothers (74.6%) underwent normal vaginal delivery, while 16.7% underwent LSCS. These findings were comparable with those reported by Gupta A et al., where most stillbirths were delivered vaginally.^[3] Coming to birth weight, majority of the babies (33.5%) weighed between 2001–2500 grams, followed by 32.1% weighing between 1501–2000 grams. Similar findings were observed by Gupta A et al.^[3]

In the present study, male babies accounted for 60.8% of the stillbirths, while female babies constituted 39.2%. Gupta A et al. also reported male predominance among stillbirths. Smith GC et al. demonstrated that male fetuses have a comparatively higher risk of stillbirth than female fetuses.^[6] Distribution according to type of birth showed that 86.1% were macerated stillbirths and 13.9% were fresh stillbirths. Similar findings were reported by Gupta A et al., where 87.1% were macerated stillbirths. Newtonraj A et al. also observed higher proportions of macerated stillbirths.^[5]

According to ReCoDe Group A (Fetus), foetal growth restriction was the most common fetal condition contributing to 17.2% of the cases, while lethal congenital anomaly accounted for 1% of the cases. Under ReCoDe Group B (Umbilical cord), cord prolapse accounted for 5.3% and constricting loop or knot for 1.4% of the cases. Gupta A et al. also reported similar findings.^[3] Among placental causes in Group C, abruptio placenta was the most common condition contributing to 12.4% of stillbirths, followed by placenta previa accounting for 4.3%. Gupta A et al. reported comparable findings.^[3] Placental abnormalities are important causes of stillbirth as they impair fetoplacental circulation and fetal oxygenation. Ananth CV et al. also demonstrated a strong association between abruptio placentae and adverse perinatal outcomes.^[8] In Group D (Amniotic fluid), oligohydramnios contributed to 7.2% of the cases, while polyhydramnios contributed to 1.9%. Under Group E (Uterus), uterine rupture and uterine anomalies accounted for 0.5% each. These findings were consistent with the study conducted by Gupta A et al.^[3] In Group F (Mother), hypertensive disorders of pregnancy were the most common maternal condition contributing to 66% of the cases, followed by thyroid disorders (8.6%) and diabetes mellitus (2.4%). Similar findings were reported by Gupta A et al. and Changede P et al., where hypertensive disorders were identified as major contributors to stillbirth.^[3,4] A study by Ajini KK et al. revealed that the commonest causes were hypertensive disorders (27.68%), congenital anomalies (15.81%) and diabetes (14.68%).^[9] A study by Shah J et al. revealed that the most common cause of stillbirth was maternal causes accounting for 43.6% of all stillbirths followed by placental causes and amniotic fluid causes (17%).^[10] Tomashek et al. from the United States of America reported that a diagnosis of moderate anemia made before 28 weeks of gestation increases the hazard of stillbirth in non-black mothers by 4.4 times.^[11]

In the present study, Group G (Intrapartum) showed that asphyxia contributed to 13.4% of stillbirths. No cases were identified under Group H (Trauma) in the present study, which was comparable with the findings reported by Gupta A et al.^[3] Under Group I (Unclassified), no relevant condition was identified in 19.1% of the stillbirths. Similar findings were observed by Gupta A et al., where 18.12% of cases remained unclassified.^[3]

CONCLUSION

The ReCoDe classification system was effective in identifying the relevant conditions associated with stillbirths. Hypertensive disorders of pregnancy, fetal growth restriction, and placental abnormalities were the major contributors to stillbirths. Early identification of high-risk pregnancies, regular antenatal care, and timely obstetric intervention may help reduce stillbirths and improve perinatal outcomes.

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