


Utility of ICD-PM Classification in Assigning Cause of Death in Stillbirths in a Tertiary Care Hospital in North India

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ABSTRACT

Background and objectives: There are several classification systems in place to assign cause of death in stillbirths, but there is a lack of uniformity in these systems in providing complete information regarding the cause of stillbirths. Our objectives were: (1) To identify the causes of stillbirth by applying ICD-PM classification. (2) To study the risk factors compared to control cases responsible for stillbirth from the available data.

Materials and methods: This was a prospective study conducted in a Tertiary Care Hospital from January 2021 to November 2021 in North India. There were 20,732 total deliveries during this period. A total of 1,495 stillbirths delivered in this period. Women who came with intrauterine fetal demise after 20 weeks of gestation and those who delivered a stillborn baby were included in the study. Women having a live birth served as controls. Antenatal and labor room records, as well as history given by the patient with stillbirths were recorded and critically analyzed. The data were recorded on the stillbirth review form approved by the World Health Organization (WHO) and were analyzed according to the ICD-PM classification.

Results: The most common maternal cause of all stillbirths according to the ICD-PM classification in our study was M4 (33%). The most common fetal cause of antepartum stillbirths was A3 (31.93%). The most common fetal condition responsible for intrapartum stillbirths was I3 (55%).

Keywords: Classification, India, Stillbirths.

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INTRODUCTION

Around 2 million stillbirths occur over the world annually. Out of the total, 98% occur in low and middle-income countries. These countries still have a high stillbirth rate as compared to the developed countries.¹

The Every Newborn Action plan has set a goal of a stillbirth rate of 12 or less per 1,000 births globally by the year 2030.² To reach the goal, there should be an improvement in the quality of antenatal and intrapartum care. There are many stillbirth classifications worldwide including ReCoDe, INCODE, and TULIP,³⁻⁵ which are used in various parts of the world to find the cause of stillbirths. There is a lack of uniformity in the various stillbirth classification systems in providing complete information regarding the cause of deaths in stillbirths based on which an action-oriented approach can be undertaken to improve quality of care as well as reduce the stillbirth rate. World Health Organization (WHO) initiated the application of ICD-PM classification for uniformity over the world.

The WHO came up with the ICD-10 International Classification of Diseases in the year 2016, for use in perinatal mortality. The ICD-PM classification categorizes perinatal mortality, which also includes stillbirth, by the time of death (antepartum, intrapartum, and neonatal deaths).⁶ The ICD-PM is a standardized classification of perinatal mortality which is based on the time of occurrence of mortality (antepartum, intrapartum) into maternal and fetal causes thus enabling comparisons between different settings.⁶

This system is used to assign the fetal cause of death as well as the maternal factors that might be the contributing factors.⁶ The maternal factors play a very important role in stillbirths as well as early neonatal deaths. Through this study, the fetal and maternal causes of stillbirth in our center were identified by using the ICD-PM classification. This will help in the implementation of focused actions to reduce the stillbirth rate and allocation of resources.

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MATERIALS AND METHODS

The study was approved by the Ethics Committee as a part of the Neonatal Perinatal Database Registry (NNPD). This is a prospective analytical study conducted in the Department of Obstetrics and Gynaecology in a tertiary care hospital in Northern India. Women who came with Intra-uterine fetal demise after 20 weeks of gestation and those who delivered a stillborn baby were included in the study from the period of January 2021 to 15th November 2021. Women having a live birth served as controls.

All the details of stillbirths were recorded on the Stillbirth Review Form, approved by WHO. Antenatal, labor room records and history were recorded, critically analyzed, and audited. The following information was collected: Maternal characteristics (age, parity); Antepartum factors (antenatal visits, gestational age at delivery, risk factors, medical conditions); Intrapartum factors (mode of delivery, obstetric factors); and Fetal factors (birth weight, congenital anomalies, fresh or macerated stillbirth). The data was

Table 1: Comparison of mother's age and gestational age, and risk factors between cases and controls

Mother's age (years)	Cases (n = 1,494)	Controls (n = 1,259)	Total	p-value
<=20	104 (6.96%)	120 (9.53%)	224 (8.14%)	
21–30	1,098 (73.49%)	1,047 (83.16%)	2,145 (77.92%)	
31–40	288 (19.28%)	92 (7.31%)	380 (13.80%)	
41–50	4 (0.27%)	0 (0%)	4 (0.15%)	
Gestational age				
<37 weeks	992 (66.4%)	95 (7.55%)	1,087 (39.48%)	<0.0001
≥37 weeks	502 (33.6%)	1,164 (92.4%)	1,666 (60.52%)	
Booked/Unbooked				
Booked cases	1,203 (80.52%)	547 (43.45%)	1,750 (63.57%)	<0.0001
Unbooked cases	291 (19.48%)	712 (56.55%)	1,003 (36.43%)	
Risk factors				
Anemia	136 (9.1%)	591 (46.94%)	727 (26.41%)	<0.0001 [‡]
Urinary tract infection	7 (0.47%)	13 (1.03%)	20 (0.73%)	0.083 [‡]
Chronic hypertension	131 (8.77%)	66 (5.24%)	197 (7.16%)	0.0003 [‡]
Gestational diabetes mellitus	59 (3.95%)	36 (2.86%)	95 (3.45%)	0.119 [‡]
FGR	438 (29.32%)	207 (16.44%)	645 (23.43%)	<0.0001 [‡]
Pre-eclampsia	272 (18.21%)	108 (8.58%)	380 (13.80%)	<0.0001 [‡]

[‡]Chi-square test

extracted and qualitative analysis was done to classify causes of stillbirth as per ICD-PM classification. The live birth occurring immediately after delivery of a stillbirth was taken as a control case. The various characteristics between cases and controls were analyzed. Mean, median, averages, and *p* values were calculated using SPSS software.

Definitions

Stillbirth

Any fetal death occurring prior to the complete expulsion of the fetus >20 weeks, birth weight of 500 gm, and length of >25 cm. This definition was utilized in our study for research purposes as was advocated by WHO.⁷

Definition of components of ICD-PM classification.

Antepartum Death

Antepartum stillbirth was defined as when fetal heart sounds were absent before the onset of labor and were subclassified into five categories as A1, A2, A3, A4, and A5.

Intrapartum Death

Intrapartum stillbirth was defined as when fetal heart sounds became absent after the onset of labor but before birth and were subclassified into six categories as I1, I2, I3, I4, I5, and I6.

Maternal Factors

The associated maternal conditions contributing to the stillbirth were identified and subclassified into five categories as M1, M2, M3, M4, and M5.

Data Analysis

The presentation of the categorical variables was done in the form of numbers and percentages (%). On the other hand, the quantitative data with non-normal distribution as median with 25th and 75th percentiles (interquartile range).

The data entry was done in the Microsoft Excel spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software.

RESULTS

There were a total number of 20,732 deliveries out of which there were a total of 1,494 stillbirths that occurred during the period between January 2021 to November 2021. The total controls were mothers who delivered live babies during this period. The data obtained was analyzed to identify the different characteristics between the mothers with stillbirths and those having live births.

In both the groups, the age range of 21–30 years dominated ($p < 0.0001$), however the percentage of mothers in the age-group of 31–40 was significantly higher in cases as compared to controls as shown in Table 1. About 66.4% of mothers with stillbirths had preterm delivery as compared to only 7.5% of those who had live births. The median gestational age of 35 weeks among cases was significantly lower than the median gestational age of controls 38.4 weeks (Table 1). The proportion of patients with certain risk factors (Table 1)—hypertension, fetal growth restriction, pre-eclampsia was significantly higher in cases as compared to controls: Chronic hypertension—8.77 vs 5.24% (p -value 0.0003), fetal growth restriction—29.32 vs 16.44% (p -value < 0.0001) pre-eclampsia—18.21 vs 8.58% (p -value < 0.0001). However, anemia was significantly lower in cases as compared to controls (9.1 vs 46.94% with p -value < 0.0001) which may be explained by the fact that gestational age at delivery was significantly lower for cases as compared to controls. There was a significantly lower number of unbooked patients in cases as compared to controls (19.48 vs 56.55%). This may be due to a high number of complications in cases which could have led them to get booked at tertiary care centers at early gestation. Distribution of other risk factors was comparable between cases and controls—urinary tract infection (0.47 vs 1.03%, p -value 0.083), undernutrition (0.67 vs 0.40% p -value 0.334), gestational diabetes (3.95 vs 2.86% p -value 0.119). The majority of stillbirths [1,088 (72.82%)] occurred during the antepartum period (Table 1). The most common maternal condition (Table 2) responsible for stillbirths was M4, medical and surgical conditions (33%) followed by M1 (26.2%). No maternal condition was identified in 230. The main fetal causes of antepartum stillbirths (Table 3) were A3, intrauterine hypoxia (45.3%) followed

Table 2: Distribution of main maternal condition of study subjects

<i>Main maternal condition</i>	<i>Frequency</i>	<i>Percentage</i>
<i>M1: Complications of placenta, cord, and membranes</i>		
Fetus and newborn affected by chorioamnionitis/abnormality of membranes, unspecified	13	0.87%
Fetus and newborn affected by other and unspecified morphological and functional abnormalities of placenta	20	1.34%
Fetus and newborn affected by other forms of placental separation and hemorrhage	214	14.32%
Fetus and newborn affected by placenta previa	37	2.48%
Fetus and newborn affected by prolapsed cord/other compression of umbilical cord	62	4.15%
<i>M2: Maternal complications of pregnancy</i>		
Fetus and newborn affected by malpresentation before labor	3	0.20%
Fetus and newborn affected by maternal complication of pregnancy/incompetent cervix	27	1.81%
Fetus and newborn affected by multiple pregnancy	43	2.88%
Fetus and newborn affected by oligohydramnios	96	6.43%
Fetus and newborn affected by polyhydramnios	21	1.41%
Fetus and newborn affected by premature rupture of membranes	54	3.61%
<i>M3: Other complications of labor and delivery</i>		
Fetus and newborn affected by abnormal uterine contractions/other specified complications of labor and delivery	22	1.47%
Fetus and newborn affected by breech delivery and extraction/by other malpresentation, malposition, and disproportion during labor and delivery	16	1.07%
Fetus and newborn affected by cesarean delivery	7	0.47%
Other complications of preterm labor and delivery	5	0.33%
<i>M4: Maternal medical and surgical conditions</i>		
Fetus and newborn affected by unspecified maternal condition	2	0.13%
Maternal hypertensive disorders	252	16.87%
Maternal infectious and parasitic diseases	38	2.54%
Maternal injury	1	0.07%
Maternal nutritional disorders	83	5.56%
Maternal renal and urinary tract diseases	1	0.07%
Other maternal circulatory and respiratory diseases	16	1.07%
Other maternal conditions	96	6.43%
Other maternal medication	11	0.74%
<i>M5: No maternal conditions</i>		
No maternal condition identified (healthy mother)	230	15.39%

Table 3: Distribution of fetal causes in antepartum stillbirths of study subjects

<i>Antepartum death</i>	<i>Frequency</i>	<i>Percentage</i>
Congenital malformations, deformations, and chromosomal abnormalities		
Birth defect	5	0.33%
Congenital malformation/chromosomal abnormalities	37	2.48%
Infection		
Congenital infectious and parasitic disease, unspecified	1	0.07%
Congenital viral disease, unspecified	2	0.13%
Infection specific to the perinatal period, unspecified	5	0.33%
Intra-amniotic infection of fetus, not elsewhere classified	2	0.13%
Other congenital malaria	1	0.07%
Other congenital viral diseases (chickenpox)	1	0.07%
Other specified infections specific to the perinatal period	1	0.07%
Antepartum hypoxia		
Intrauterine hypoxia first noted before onset of labor	30	2.01%
Intrauterine hypoxia, unspecified	477	31.93%
Other specified antepartum disorder		
Congenital anemia from fetal blood loss	2	0.13%
Fetal blood loss from cut end of cord of co-twin	1	0.07%

(Contd...)

Table 3: (Contd...)

<i>Antepartum death</i>	<i>Frequency</i>	<i>Percentage</i>
Hydrops fetalis due to other and unspecified hemolytic disease	6	0.40%
Hydrops fetalis not due to hemolytic disease	3	0.20%
Intracranial (nontraumatic) hemorrhage of fetus and newborn, unspecified	1	0.07%
Other congenital anemias, not elsewhere classified	1	0.07%
Other specified conditions originating in the perinatal period	1	0.07%
Rhesus isoimmunization of fetus and newborn	1	0.07%
Disorders related to fetal growth		
Exceptionally large baby	1	0.07%
Fetal malnutrition without mention of light or small for gestational age	4	0.27%
Light-for-dates	14	0.94%
Other heavy for gestational-age infants	8	0.54%
Slow fetal growth, unspecified	200	13.39%
Small for gestational age	136	9.10%
Antepartum death of unspecified cause		
Birth defect	5	0.33%
Unspecified cause of antepartum death	141	9.44%

Table 4: Distribution of fetal causes in intrapartum stillbirths of study subjects

<i>Intrapartum death</i>	<i>Frequency</i>	<i>Percentage</i>
Congenital malformations, deformations, and chromosomal abnormalities		
Congenital malformation/chromosomal abnormalities	45	3.01%
Birth trauma	0	0.00%
Acute intrapartum event		
Intrauterine hypoxia first noted during labor and delivery	6	0.40%
Intrauterine hypoxia, unspecified	225	15.06%
Infection		
Congenital viral disease, unspecified	1	0.07%
Infection specific to the perinatal period, unspecified	1	0.07%
Intra-amniotic infection of fetus, not elsewhere classified	1	0.07%
Other congenital viral diseases	1	0.07%
Other specified infections specific to the perinatal period	1	0.07%
Other specified intrapartum disorder		
Fetal blood loss from placenta	1	0.07%
Hydrops fetalis due to other and unspecified hemolytic disease	4	0.27%
Rhesus isoimmunization of fetus and newborn	2	0.13%
Disorders related to fetal growth		
Extreme immaturity	2	0.13%
Extremely low birth weight	1	0.07%
Fetal malnutrition without mention of light or small for gestational age	1	0.07%
Light for gestational age	6	0.40%
Other preterm infants	1	0.07%
Post-term infant, not heavy for gestational age	1	0.07%
Slow fetal growth, unspecified	40	2.68%
Small for gestational age	37	2.48%
Intrapartum death of unspecified cause		
Other	3	0.20%

by A5, FGR (33.7%). Birth defect was seen in only 5 out of 1494 patients (0.33%). The main fetal causes of intrapartum stillbirths (Table 4) were I3, intrauterine hypoxia (55.2%) followed by I6, disorders of fetal growth (21.4%).

DISCUSSION

ICD-PM classification was applied to our study group involving 1,494 cases of stillbirth (Table 5).

Table 5: Distribution of maternal and fetal causes in antepartum and intrapartum stillbirths as per ICD-PM classification

Maternal condition	M1	M2	M3	M4	M5	Total
Antepartum stillbirth	231 (21.2%)	176 (16.2%)	88 (8.1%)	392 (36%)	201 (18.5%)	1,088 (72.8%)
A1	1	6	0	12	15	34
A2	3	5	6	10	1	25
A3	148	93	14	222	16	493
A4	3	7	0	28	8	46
A5	59	57	7	146	98	367
A6	4	9	6	18	86	123
Intrapartum stillbirth	161 (39.7%)	68 (16.7%)	47 (11.6%)	101 (24.9%)	29 (7.1%)	406 (27.2%)
I1	2	11	1	8	6	28
I2	0	0	0	0	0	0
I3+	112	32	18	55	7	224
I4	12	6	0	8	0	26
I5	5	6	14	5	4	34
I6	31	14	4	27	11	87
I7	0	0	3	0	4	7
Total	392 (26.2%)	244 (16.3%)	135 (9%)	493 (33%)	230 (15.4%)	1,494

Among 1,088 cases of antepartum stillbirth, the main maternal condition of subjects was M4 (36%) followed by M1 (21.2%) which comprised mainly of placental separation and hemorrhage (14.32%). This result is similar to the one obtained by Dase et al.⁸ who studied the causes of stillbirth by ICD-PM classification in the Nigerian population in the period between 2010 and 2018. They found that the main maternal condition for antepartum stillbirth was M4 in 69.3% of cases. However, Aminu et al.⁹ in their study conducted on Sub-Saharan African women with stillbirths found that the main maternal condition responsible for antepartum stillbirths was M1 in 31.1% cases.

The predominant fetal cause of antepartum stillbirths in our study was A3, intrauterine hypoxia (45.3%) followed by A5, a disorder related to the growth of babies predominately FGR (33.7%). This result is in contrast to that published by Dase et al.⁸ and Aminu et al.⁹ who found fetal growth-related disorder A5 (56.7%) and unspecified cause, A6 (88.9%) in their study.

The main maternal condition in 406 cases of intrapartum stillbirths in our study was M1 (complications of placenta, cord, and membranes) in 39.7% of cases with the main cause being placental separation followed by M4 (medical and surgical disorders) in 24.9%. This result was similar to that obtained by Dase et al.⁸ and Aminu et al.⁹ who also found M1 as the main maternal condition in intrapartum stillbirths in their study in 45.8 and 24%, respectively.

The main fetal condition responsible for 406 cases of intrapartum stillbirth in our study was I3 (acute intrapartum event in 55.2% of cases followed by I6 (disorders of fetal growth) in 21.4%. This was in contrast to Dase et al.⁸ and Aminu et al.⁹ who found I7 (unspecified causes) as the main fetal condition responsible for intrapartum stillbirths in their study in 45.1 and 61.1% cases, respectively.

The purpose behind this classification is that we could identify the main maternal and fetal conditions responsible for stillbirths in our setup. This could be used to formulate policies based on these findings to reduce our still birth rate and improve quality of care to the antenatal women delivering in our hospital.

CONCLUSION

The most common maternal cause of all stillbirths according to ICD-PM classification in our study was M4 (33%). The most common fetal cause of antepartum stillbirths was A3 (45.3%)—intrauterine

hypoxia. The most common fetal condition responsible for intrapartum stillbirths was I3 (55%)—acute intrapartum event.

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