

Perinatal audit and assessment of causation of stillbirth in a tertiary care referral center: comparing two classification systems (WHO and ReCoDe)

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ABSTRACT

Background: Stillbirth is one of the most common and preventable adverse outcome of a pregnancy. This significantly contributes to the perinatal mortality and is an indicator of quality of antenatal care. Perinatal audit and classification of causation is a crucial step towards prevention of stillbirths. Numerous classification systems have been proposed and are been diversely used. The ideal system to be adapted is an important question that still remains unanswered. **Objectives:** The objective of the present study was to (1) Evaluate the rate, characteristics, risk factors and causes of stillbirth in a referral teaching hospital, (2) To compare maternal causes assigned by the ReCoDe and WHO classification systems for the evaluation of the stillbirths in a hospital setting. **Methods:** This was a retrospective descriptive study, where the details of the stillbirths born from August 2016 to July 2017 born in Maulana Azad Medical College and associated Lok Nayak Hospital were collected in prescribed predesigned format for the classification by the WHO and ReCoDe systems. The stillbirth rate and the characteristics were determined. Comparison of assigned causes, strengths and the limitations of both the classification systems were made. **Results:** Stillbirth rate was 37.78/1000 live births which included 45.99% and 54.01%, fresh and macerated respectively. 54.7% and 45.3% of the stillborn were male and female respectively with a mean gestational age of 34.06 weeks. The proportion of low birth weight, preterm and growth retarded babies were 79.32%, 66.67% and 23.5% respectively. Among the causes poor antenatal attendance, primiparous, prematurity, GDM, PIH, APH, birth asphyxia, poor intrapartum care was predominant. On comparing the WHO with ReCoDe system, the ReCoDe could identify only few maternal causes. Both systems matched the assignment of cause in 56.58% and failed to assign the same cause in 43.42%. The WHO system had an advantage of identifying the delays leading to causation, which can be the first vital step towards prevention of many stillbirths. **Conclusion:** Even though, several classification systems are available for the perinatal audit and assessment of causation of stillbirth, there is a need for a novel classification system that determines both fetal and maternal causes and the assigns due importance to preventable factors and delays.

Keywords: Cervical cancer, liquid based cytology, HPV DNA.

In 2015, as per WHO reports there were 2.6 million stillbirths globally and nearly 7178 deaths a day¹. Majority were in developing countries, with three fourth in South Asia and sub-Saharan Africa. The estimated trend in maternal mortality and under five years mortality rate reduction is faster as compared to stillbirth rate reduction². In India, the rate was 22/1000 pregnancies in 2015³, the highest rates of

stillbirth in the world¹. It accounted for 592,100 stillbirths out of a total 2.6 million of such births³. During 2013-14 the under - 5 child mortality has fallen by a significant by four points but stillbirths still remain a neglected global endemic and majority (97%) are in the low middle income countries^{4, 5}. In various studies low socioeconomic status, lack of antenatal and intrapartum care, prior stillbirth are

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major factors^{6,7}. Early identification of these risk factors and appropriate antenatal care may prevent stillbirths and improve pregnancy outcomes and are used as an important indicator of the quality of care⁸.

Chart 1: Classification system according to relevant condition at death (ReCoDe)

<p>Group A: Fetus</p> <ol style="list-style-type: none"> Lethal congenital anomaly Infection <ol style="list-style-type: none"> Chronic Acute Non-immune hydrops Isoimmunisation Fetomaternal hemorrhage Twin-twin transfusion Fetal growth restriction* <p>Group B: Umbilical cord</p> <ol style="list-style-type: none"> Prolapse Constricting loop or knot† Velamentous insertion Other <p>Group C: Placenta</p> <ol style="list-style-type: none"> Abruptio Praevia Vasa praevia Other “placental insufficiency”‡ Other <p>Group D: Amniotic fluid</p> <ol style="list-style-type: none"> Chorioamnionitis Oligohydramnios† Polyhydramnios† Other <p>Group E: Uterus</p> <ol style="list-style-type: none"> Rupture Uterine anomalies Other 	<p>Group F: Mother</p> <ol style="list-style-type: none"> Diabetes Thyroid diseases Essential hypertension Hypertensive diseases in pregnancy Lupus or antiphospholipid syndrome Cholestasis Drug misuse Other <p>Group G: Intrapartum</p> <ol style="list-style-type: none"> Asphyxia Birth trauma <p>Group H: Trauma</p> <ol style="list-style-type: none"> External Iatrogenic <p>Group I: Unclassified</p> <ol style="list-style-type: none"> No relevant condition identified No information available <p>* < 10th customised weight for gestational age centile. †If severe enough to be considered relevant. ‡Histological diagnosis.</p>
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A suitable classification system is central to any effort to reduce its incidence. There are many systems of classifications available for classifying perinatal deaths. ReCoDe, INCODE and TULIP⁹⁻¹¹, have categories that may require histological evidence to support certain diagnoses. INCODE has subcategories for congenital abnormalities for various body systems – diagnosis of which may require a post mortem. In addition, some systems may require chromosomal assays to enable a final diagnosis to be made^{11, 12}. In two of the systems, a specific, computerized system and program for recording patient information was used in the development of the system and such a system may also be required for the application of the system^{13,14}. The new ICD-PM¹⁵, which is a WHO application of ICD-10 to deaths during the perinatal period, was developed to allow for minimal data requirement and requires fewer clinical details compared with some other recently developed classification systems. However, some systems such as Keeling et al (1989)¹², Langhoff-Roos et al (1996)¹⁶ and Korteweg et al (2006)¹¹ require a lot of detail for their application. Due to the limitations of the ICD system and

lack of an international approach, numerous classification systems have been proposed and are been diversely used. There is no comparison of these systems available. The ideal system to be adapted is an important question that still remains unanswered. In our study we compared ReCoDe and WHO classification systems.

Materials and method

This was a retrospective descriptive study, where the details of the stillbirths born from August 2016 to July 2017 born in Maulana Azad Medical College and associated Lok Nayak Hospital were collected in prescribed predesigned format for the classification by the WHO and ReCoDe systems.

Chart 2: Maternal conditions in ICD-PM and the main maternal conditions (defined by ICD-10) included in each group (WHO classification)

<p>M1: Complications of placenta, cord and membranes</p> <ol style="list-style-type: none"> placenta previa other forms of placental separation and hemorrhage placental dysfunction, infarction, insufficiency fetal-placental transfusion syndromes prolapsed cord / other compression of umbilical cord chorioamnionitis other complications of membranes <p>M2: Maternal complications of pregnancy</p> <ol style="list-style-type: none"> incompetent cervix preterm rupture of membranes oligo / polyhydramnios ectopic pregnancy multiple pregnancy maternal death malpresentation before labour other complications of pregnancy <p>M3: Other complications of labour and delivery</p> <ol style="list-style-type: none"> breech delivery and extraction other malpresentation, malposition, and disproportion during labour and delivery forceps delivery / vacuum extraction caesarean delivery precipitate delivery preterm labour and delivery other complications of labour and delivery 	<p>M4: Maternal medical and surgical conditions</p> <ol style="list-style-type: none"> pre-eclampsia / eclampsia gestational hypertension other hypertensive disorders renal and urinary tract diseases infectious and parasitic disease circulatory and respiratory disease nutritional disorders injury surgical procedure other medical procedures maternal diabetes including gestational diabetes maternal anesthesia and analgesia maternal medication tobacco / alcohol / drugs of addiction nutritional chemical substances environmental chemical substances unspecified maternal condition <p>M5: No maternal condition</p> <ol style="list-style-type: none"> no maternal condition identified (healthy mother)
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The objective of the present study was to (1) Evaluate the rate, characteristics, risk factors and causes of stillbirth in a referral teaching hospital, (2) To compare the ReCoDe⁹ and WHO classification systems (ICD-PM)¹⁵ for the evaluation of the stillbirths in a hospital setting. The stillbirth rate and the characteristics were determined and the comparison of assigned causes, strengths and the limitations of both the

classification systems were compared. The details of ReCoDe and WHO classification systems (ICD-PM) are given in chart 1 and 2. The statistical analysis was done using the software version SPSS 23.0. Data were presented as frequency and percentage.

Results

Table 1: Maternal and fetal characteristics associated with stillbirth

Variables	Number (N)	Percentage (%)
Age (Years)		
<16	1	0.2
16-20	32	8.3
21-25	158	40.8
26-30	129	33.3
31-35	54	13.9
36-40	12	3.3
>40	1	0.2
Parity		
G1	117	30.2
G2	100	25.8
G3	103	26.6
G4	33	8.6
G5	24	6.2
G6	6	1.6
G7	3	0.8
G9	1	0.2
Gestational age (Weeks)		
<28	35	9
28-32	96	24.8
32-37	146	37.7
37-42	110	28.5
Birth weight (Kg)		
>2.5	80	20.67
1.5-2.5	135	34.88
1-1.5	78	20.15
<1	95	24.54
Twin pregnancies	21	5.43
Singleton pregnancies	366	94.57
Previous stillbirths		
1	29	7.5
2	2	0.4
3	2	0.4

Total stillbirths were 387 which was 37.78 /1000 live births which included 178(45.99%) and 209(54.01%), fresh and macerated respectively. 54.7% and 45.3% of the stillborn were male and female respectively with a mean gestational age of 34.06 weeks. The mean maternal age was 26.4 years as seen in table 1. The proportion of low birth weight, preterm and growth retarded babies were 79.32%, 66.67% and 23.5% respectively as described in table 2.

Both ReCoDe and WHO systems matched the assignment of cause in 210(54.3%) cases (table 3) and failed to assign the same cause in 45.7%. In 87(22.5%) cases, the cause remained unexplained according to ReCoDe but amongst those 32(8.3%) are being identified by WHO system and assigned maternal causes (table 4). Both systems failed to identify causes in 55 cases. 145 cases were identified by ReCoDe system, as it assigned fetal causes and intrapartum birth asphyxia. Lethal congenital anomalies were

identified in 28 babies. Eight babies had anencephaly, two had arthrogyroses, two had bilateral renal agenesis, two CDH, one had nonimmune hydrops with cystic hygroma, two had Dandy walker malformation, one with MMC with Dandy Walker malformation, two had holoprocencephaly, Arnold Chiari malformation with hydrocephalus were two, two had MCKD, one with tricuspid atresia, and one had duodenal atresia, one with congenital heart block, one with overriding of aorta.

Table 2: Etiology wise distribution of the stillbirth during the study period (ReCoDe)

Variables	Number (N)	Percentage (%)
Fetus		
Congenital anomaly	28	7.2
Infection	1	0.2
Non-immune hydrops	8	2.1
Isoimmunisation	2	0.4
Feto -maternal hemorrhage	0	0
Twin -twin transfusion	1	0.2
Fetal growth restriction	83	21.4
Umbilical cord		
Prolapsed	8	2.1
Constricting loop & knot	4	1
Velamentous insertion	0	0
Other		
Placenta		
Abruption	44	11.4
Previa	7	1.8
Vasa previa	0	0
Other placental insufficiency	0	0
Other	1	0.2
Amniotic fluid abnormalities		
Chorioamnitis	2	0.4
Polyhydramnios	3	0.8
Oligohydramnios	3	0.8
Uterus		
Rupture	13	3.6
Anomalies	0	0
Other	0	0
Mother		
Diabetes	7	1.8
Thyroid	5	1.4
Essential hypertension	0	0
Hypertensive diseases in pregnancy	47	12.2
Lupus/antiphospholipid syndrome	0	0
Cholestasis	4	1
Drug misuse	0	0
Others	17	4.4
Intrapartum		
Asphyxia	12	3.1
Birth trauma	0	0
Trauma		
External	-	-
Iatrogenic	-	-
Unclassified		
No relevant condition identified	87	22.5
No information available	0	0

Delays were identified by WHO system.138 mothers delayed the decision to seek care, 16 mothers had delayed arrival at a health facility and 70 had delayed the provision of adequate care. 50 mothers had delayed decision in seeking

medical care and also delayed arrival in facility. 113 mothers had no delay.

Table 3: Common causes identified by both the classification systems

Causes	ReCoDe	WHO	Number (N=210)	Percentage (%)
Diabetes	F1	M4(11)	8	2.1
Abruptio	C1	M2(2)	44	11.4
Hypertension	F4	M4(1,2)	49	12.7
Cholestasis	F6	M4(17)	2	0.5
Cord prolapse	B1	M2(5)	8	2.1
Cord knot	B2	M3(7)	3	0.8
Placenta previa	C2	M2(1)	7	1.8
Chorioamnitis	D1	M2(6)	2	0.5
Oligohydramnios	D2	M1(3)	3	0.8
Uterine rupture	E1	M3(7)	13	3.4
Other maternal condition (Acc to ReCoDe)	F8	M4(7),15,6, 5,9	16	4.1
No cause	II	M5	55	14.2

Table 4: No cause in ReCoDe but cause assigned by WHO classification

Causes	WHO group	Number of cases with no cause in ReCoDe (n=32)	Percentage (%)
Circulatory and respiratory disease	M4(6)	4	1
Multiple pregnancy	M1(4)	8	2
Nutritional (anemia)	M4(7)	10	2.6
Maternal medications	M4(13)	2	0.5
Infectious and parasitic disease	M4(5)	3	0.8
Malpresentation	M3(2)	3	0.8
Breech	M3(1)	2	0.5

Discussion

Despite the significant advances, stillbirth continues to be high in the developing countries, contributing to 97% of stillbirths reported worldwide annually. India shares the highest burden of stillbirths (75%) as compared to other South-East Asian countries¹⁷. Fetal deaths remains high though perinatal mortality has reduced over few decades. Hence the present study carried out to study stillbirth epidemiology and etiology. In the present study, we observed 387 stillbirth during August 2016 to July 2017 with average stillbirth rate is 37.78/1000 birth.

This stillbirth rate in our study is lower compared with studies C Okeudo et al¹⁸ in south east Nigeria (180/1000 deliveries), Sujata et al¹⁹ (110.69), Chitrakumari et al²⁰ (64.1) and Bhattacharya S et al²¹ (59.76/100 deliveries) in north Bengal while higher with Shaaban LA et al²² (10.1 per 1000 deliveries), Korde-Nayak VN et al²³ (35.2), and the national average 39/1000 live birth²⁴. Depending on geographic region, socioeconomic condition, hospital settings the stillbirth rates vary widely.

Fetal growth restriction was the most common cause identified followed by hypertensive diseases and abruptio placentae. Nearly 71% of stillbirths were preterm in our

study which corresponds to previous studies^{21, 23}. The highest prevalence of stillbirths were in the age group of 21-25 age group and 8.5 percent of stillbirth were contributed by the age group of 16-20 yr of age, which shows early marriages and teenage pregnancy contributes to the stillbirths. 30.2 percent primigravida had stillbirths which show that primiparity as a risk factor for maternal and perinatal outcome in comparison with multigravida.

Stillbirths are broadly categorized as antepartum/intrapartum. Time of death is important to reduce the incidents of stillbirths by appropriate interventions and is a marker of quality of intrapartum care. Intrapartum deaths constituted 15%. Global modeling estimates that 1/3rd of all stillbirths are intrapartum²⁵. In Prasanna et al study, 27.17% deaths occurred during labor²⁶. The other way of classifying stillbirths is based on the appearance of the fetus. In fresh stillbirths, death occurred less than 12 hours and skin is intact. In macerated stillbirths, where death occurred more than 12 hours before delivery, skin is discolored and peeled off, skull becomes soft and amniotic fluid, umbilical cord is darkly stained²⁷. In our study, 45.99% and 54.01% are fresh and macerated respectively.

When WHO and ReCoDe systems were compared, maternal causes were better assigned by WHO system and fetal causes are better by ReCoDe. According to “Three delay model” (1) delay the decision to seek care; (2) delay arrival at a health facility; and (3) delay the provision of adequate care, delays were also identified in our study²⁸. The WHO system had an advantage of identifying the delays leading to causation, which can be the first vital step towards prevention of many stillbirths. It was found that poverty and low education status of parents were the predominant causes of delays²⁹⁻³¹.

The every newborn action plan has the target of 12 or fewer stillbirths per 1000 births in every country by 2030³². Fetal growth restriction, prematurity and low birth weight due to various medical and obstetrics cause were associated with higher percentage of stillbirth. Maternal under nutrition, anemia, cervicovaginal infection, heavy and strenuous work during pregnancy contributes to the onset of preterm labour and stillbirth of premature and low birth babies²². Efforts must be made to improve the quality of care provided during the antenatal period by awareness sessions by skilled birth attendants in the community, routine antenatal checkups, prenatal screenings, early recognition of danger signs made available at the right time and timely referral of high risk cases to the tertiary care centre is need of hour for reducing still birth rate. High quality Intra partum monitoring care at a

tertiary care centre by providing adequate infrastructure, trained manpower standardized protocols, use of partogram will certainly reduce the substantive number of still.

Conclusion

Developing countries like India have the highest still birth rates and perinatal audit and classification of causation is a crucial step towards prevention of stillbirths. The WHO system had an advantage of identifying the maternal causes of perinatal mortality better and the delays leading to causation, which can be the first vital step towards prevention of many stillbirths.

Conflict of interest: None. **Disclaimer:** Nil.

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