Original Research Article

Classification of maternal mortality by ICD-MM: a retrospective study from a tertiary care hospital of Chhattisgarh

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ABSTRACT

Background: Sustainable development goal 3 (SDG 3) includes an ambitious target of reducing the global maternal mortality rate (MMR) to less than 70 per 100 000 births by 2030. To reach this target, countries need an accurate picture of the levels and causes of maternal deaths. A standardization of the cause of death attribution will improve interpretation of data on maternal mortality, analysis on the causes of maternal death, and allocation of resources and programmes intended to address maternal mortality. International classification of diseases-maternal mortality (ICD-MM) has proven to be easily applicable and helps clarify the cause of maternal death.
Methods: Retrospective study of 142 maternal death cases was done in a tertiary medical centre (medical college) from December 2017 to November 2020 for determining the causes of maternal death and their classification according to ICD-MM.
Results: Direct causes of maternal deaths were observed in 82.39% cases whereas indirect causes were present in remaining 17.61% cases. Hypertensive disorders (35.92%), obstetric haemorrhage (26.06%) and pregnancy related infection (14.79%) constituted the major groups of direct cause of maternal deaths whereas anaemia was the most common indirect cause (7.75%).
Conclusions: Hypertensive disorders (35.92%), obstetric haemorrhage (26.06%) and pregnancy related infection (14.79%) were the major causes of direct obstetric death and anaemia (7.75%) was the most common cause of indirect obstetric death. All of these causes are preventable with targeted interventions. Reducing maternal mortality is one of the key targets within the SDG and ICD-MM is a valuable tool for uniform and standard classification of maternal deaths as well as for developing strategies for reducing maternal death. Training on cause of death certification, maternal death surveillance and response (MDSR) documentation and use of ICD is essential to enable consistent application of ICD coding and improve data collection and analysis.

Keywords: MDSR, ICD-MM, Underlying cause of death, Direct obstetric death, COVID-19

INTRODUCTION

The World Health Organization (WHO) defines maternal death as: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from unintentional or incidental causes.[1] This definition allows identification of a maternal death, based on the cause of the death being recorded as either a direct or indirect maternal cause. The WHO application of international classification of diseases-10 (ICD-10) to deaths during pregnancy, childbirth, and the puerperium: international classification of diseases-maternal mortality (ICD-MM) is intended to facilitate the consistent collection, analysis and interpretation of information on maternal deaths.[2]

Ending preventable maternal mortality (EPMM) is one of the most challenging tasks in most of the country.[3]

Sustainable development goal (SDG) 3 includes an ambitious target of reducing the global maternal mortality rate (MMR) to less than 70 per 100 000 births by 2030 with no country having a maternal mortality greater than 140, a number twice the global average.[1] To reach this target, countries need to identify real clinical causes and health system shortfalls to reduce complications and adverse fatal outcome in pregnancy. A standardization of the cause of death attribution will improve interpretation of data on maternal mortality, analysis on the causes of maternal death, and allocation of resources and programmes intended to address maternal mortality.[2]

Maternal death surveillance and response (MDSR) is a continuous cycle of identification, notification and review of maternal deaths followed by actions to improve quality of care and prevent future deaths.[4] MDSR guidelines recommend that maternal deaths must be classified on the basis of ICD-10.[4] The causes of maternal mortality vary greatly across region and limited studies are available in context of application of ICD-MM in classification of maternal mortality. With this background the following study was undertaken in the department of obstetrics and gynaecology, Chhattisgarh institute of medical sciences with the following objectives: to classify the underlying causes of maternal death according to ICD-MM, and to categorize maternal death into direct or indirect obstetric death.

METHODS

The present study was a retrospective study carried out in the department of obstetrics and gyanecology at Chhattisgarh institute of medical sciences which is a government medical college and second biggest tertiary care centre of Chhattisgarh. It has an annual delivery rate of around 5500 and gets a large number of referrals from primary health centres (PHCs), community health centres (CHCs), as well as district hospitals.

The details of all the maternal deaths from December 2017 to November 2020 were collected from the individual case sheets, facility-based maternal death review form and MDR case summary. The WHO application of ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM was used for classification of causes of maternal mortality. The MDSR form was filled within 24 hours of death and reviewed by the facility maternal death review committee and the Institutional death review committee.

Inclusion criteria

All cases of maternal death fulfilling the WHO definition of maternal death and having complete data on MDSR form were included in the study.

Exclusion criteria

The following cases were excluded from the study: maternal death occurring after 42 days after termination of

pregnancy, maternal death due to accident, homicide or suicide, and maternal death for which data was incomplete or missing.

The definitions of causes of death as per ICD-MM are stated below.

Underlying cause of death

It is defined as the disease or condition that initiated the morbid chain of events leading to death or the circumstances of the accident or violence that produced a fatal injury.

Direct obstetric deaths

Direct obstetric deaths are those resulting from obstetric complications of the pregnancy state (pregnancy, labour and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.

Indirect obstetric deaths

Indirect obstetric deaths are those resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy.

Contributing causes

It may predispose women to death, as either a pre-existing condition or a risk factor.

A total of 142 maternal mortality cases were analyzed in this study for causes of death. Single cause coding was done and underlying cause was determined for each maternal death. Cases were further categorized into direct and indirect obstetric death based on single underlying cause. Contributory causes for each case were also evaluated. All the data was presented as frequencies and percentages.

RESULTS

Classification of causes of death according to WHO ICD-MM is represented in Table 1. Direct causes of maternal deaths were observed in 82.39% cases whereas indirect causes were present in remaining 17.61% cases (Table 2 and Table 3 respectively). Hypertensive disorders (35.92%), obstetric haemorrhage (26.06%) and pregnancy related infection (14.79%) constituted the major groups of direct cause of maternal deaths whereas anaemia was the most common indirect cause (7.75%). Severe preeclampsia (19.01%), puerperal sepsis (14.79%) and postpartum haemorrhage (13.38%) were the significant underlying causes. During the study period, two cases of maternal death with COVID-19 were noted. COVID-19 was attributable to underlying cause in one case due to

development of pneumonia which led to death (Table 3). COVID-19 was assigned as contributory cause in another case because the underlying cause of death was abruptio placenta. Two cases earlier grouped in 'Other obstetric complications' (group 5) were reclassified as aspiration pneumonitis (group 6) (Table 2).

Table 1: Classification of maternal deaths according to WHO ICD-MM (n=142).

Type	Group name (number)	Cases	Percentage (%)
Maternal death: direct	Pregnancy with abortive outcome (1)	4	2.82
Maternal death: direct	Hypertensive disorders in pregnancy, childbirth and puerperium (2)	51	35.92
Maternal death: direct	Obstetric haemorrhage (3)	37	26.06
Maternal death: direct	Pregnancy related infection (4)	21	14.79
Maternal death: direct	Other obstetric complications (5)	2	1.41
Maternal death: direct	Unanticipated complications of management (6)	2	1.41
Maternal death: indirect	Non obstetric complications (7)	25	17.61
	Anaemia	11	7.75
	Cardiac disorders	2	1.41
	Liver disorders	2	1.41
	Respiratory disorders	6	4.23
	Neurological disorders	2	1.41
	Infections/infestations	2	1.41

Table 2: Distribution of underlying causes of direct obstetric death (n=142).

Causes of direct obstetric death	Cases	Percentage (%)
Pregnancy with abortive outcome		
Incomplete abortion	3	2.11
Septic abortion	1	0.70
Hypertensive disorders in pregnancy, childbirth and puerperium		
Severe preeclampsia	27	19.01
Eclampsia	24	16.90
Obstetric haemorrhage		
PPH	19	13.38
Ruptured uterus	10	7.04
Placenta previa	3	2.11
Abruptio placenta	5	3.52
Pregnancy related infection		
Puerperal sepsis	21	14.79
Other obstetric complications		
Amniotic fluid embolism	2	1.41
Unanticipated complications of management		
Aspiration pneumonitis	2	1.41

Table 3: Distribution of underlying causes of indirect obstetric death (n=142).

Causes of indirect obstetric death	Cases	Percentage (%)
Anaemia		
Iron/folic acid deficiency anaemia	9	6.34
Sickle cell anaemia	2	1.41
Cardiac disorders		
Myocardial infarction	1	0.70
RHD	1	0.70
Hepatic disorders		
Hepatitis	2	1.41
Respiratory disorders		
Pneumonia	3	2.11
ARDS	2	1.41
Pulmonary embolism	1	0.70
Neurological disorders		
Meningitis	1	0.70
Stroke	1	0.70
Infections/infestations		
Typhoid	1	0.70
COVID-19	1	0.70

We experienced difficulties while assigning the underlying cause in presence of multiple causes and also for determining the indirect cause of death. Analysis of the case summary and sequence of development of complications facilitated identification of one underlying cause according to the ICD-MM for each case of maternal death.

It was also noted that junior faculty had lack of knowledge for documentation of MDSR form and assigning the cause of death.

DISCUSSION

In the present study, analysis of 142 cases was done from December 2017 to November 2020 for classification of the underlying causes of maternal death according to ICD-MM and categorization of each maternal death into direct or indirect obstetric death.

Direct causes of maternal mortality were present in 82.39% cases whereas indirect causes were responsible for

17.61% cases of maternal mortality. In this study, hypertensive disorders (35.92%) was the major direct cause of maternal death which is similar to the earlier study by Mittal et al (28.02%).[5] In our study, obstetric haemorrhage (26.06%) was the second major cause followed by pregnancy related infection (14.79%). A WHO systemic analysis on global causes of maternal deaths revealed haemorrhage as the major causes of maternal mortality worldwide.[6] Obstetric haemorrhage has also been reported as the leading cause of maternal deaths in India (38%) as well as in the study by Sheth et al (23.80%).[3,4]

Anaemia was the most common indirect cause (7.75%) which is consistent with the preceding studies.[3,5] The triad of hypertension, haemorrhage and sepsis is the leading cause of maternal deaths.[3-6] Severe preeclampsia (19.01%), puerperal sepsis (14.79%) and postpartum haemorrhage (13.38%) were the significant underlying causes in the present study. The distribution of causes and type of maternal death in the present study is consistent with the current literature in global causes of maternal death with 73% of all maternal deaths were due to direct obstetric causes whereas deaths due to indirect causes accounted for 27.5%.[6]

This study highlights importance of maternal death review from unusual causes such as observed during pandemic. During the study period, two cases of maternal death with COVID-19 were noted and the recent WHO guidelines for coding of COVID-19 as a cause of death was used to assign the underlying cause and contributory cause.[7] COVID-19 was attributable to underlying cause in one case due to development of pneumonia leading to maternal death. COVID-19 was assigned as contributory cause in another case because the underlying cause of death was abruptio placenta.

Implications of reclassification of maternal mortality by ICD-MM have been assessed by various studies. A regional study from Sri Lanka reported a 57% increase in the number of maternal deaths due to reclassification of 18 maternal suicides which had previously been classified as coincidental.[8] The impact of reclassifying maternal deaths according to ICD-MM in UK was minimal.[9] Sheth et al reassigned six cases of maternal death to the group 'unanticipated complications of management'.[3] In the present study, only two cases which were earlier grouped in 'other obstetric complications' were reclassified as aspiration pneumonitis and therefore no major influence of reclassification was observed.

In this study, we experienced difficulties while assigning the underlying cause in presence of multiple causes and also for determining the indirect cause of death. The study by Mgawadere et al showed complete agreement for direct maternal deaths whereas weak agreement for other causes and for indirect maternal deaths.[10] In the present study, it was also noted that junior faculty had lack of knowledge for documentation of MDSR form and assigning the cause of death. Our findings are consistent with existing studies which have observed lack of clarity on the concept of underlying cause of death and contributory conditions.[3,10]

Precise clinical knowledge is required for analyzing the course of events around maternal death and assigning a group and underlying cause for each case. There remains apparent confusion between symptoms, signs and diseases, and which conditions should be reported and accordingly tabulated as cause of death.[2] Mgawadere et al have reported poor agreement between cause of death assigned by a facility based maternal review team and an expert panel.[10] They observed that review team considered 36% of maternal deaths to be indirect whereas the expert panel considered only 17.4 % to be indirect maternal deaths.

Reporting errors whether incompleteness or misclassification of causes of maternal death continue to pose a major challenge to data accuracy.[1] An Indian analysis of the data on maternal death reviews submitted by states/union Territories in the health management information system for 2015-2016 shows that more than 60% of the maternal deaths have been classified as others.[4] The inconsistency of reporting, poor quality and coverage of maternal mortality surveillance continues to limit effective implementation of prevention and control strategies of maternal mortality and morbidity.[8]

Consistent use of ICD-MM requires adequate training of health care providers in the attribution and classification of cause of maternal death generally as well as in how to apply the ICD-MM tool.[3,10,11] A pilot study on application of ICD-MM classification system has recommended that a one-page summary of the ICD-10 classification should form part of each country's maternal death audit form so that the maternal death audit committee can refer to it during maternal death review meetings.[11]

Counting maternal deaths is important and more important is identifying actions to improve care, implementing those actions and monitoring the impact on maternal death.[9] Hypertension, haemorrhage, sepsis and anaemia are preventable causes of maternal death. Strategies towards ending preventable maternal mortality has been introduced by WHO which is based on preventive and primary reproductive health care services, comprehensive sexuality education, family planning and contraception as well as adequate care during pregnancy, childbirth and the postpartum period.[12] As direct maternal deaths decrease because of targeted interventions, efforts to reduce maternal mortality have to be focussed on reduction of indirect causes.[6] Addressing the needs of women with pre-existing comorbid disorders such as cardiac disorders, pulmonary disorders and neurological disorders in pregnancy will need additional link between obstetrics and other medical specialities to coordinate specialised care.

Present study is a retrospective hospital-based study with a small sample therefore the results could not be generalized. Despite this limitation, this study is one of the

few studies from India conducted on application of ICD-MM and therefore it provides insight on classification of maternal deaths into direct and indirect obstetric deaths based on underlying causes. This study also highlights importance of maternal death review from unusual causes such as COVID-19.

CONCLUSION

Hypertensive disorders (35.92%), obstetric haemorrhage (26.06%) and pregnancy related infection (14.79%) were the major causes of direct obstetric death and anaemia (7.75%) was the most common cause of indirect obstetric death. All of these causes are preventable with targeted interventions. Reducing maternal mortality is one of the key targets within the SDGs and ICD-MM is a valuable tool for uniform and standard classification of maternal deaths as well as for developing strategies for reducing maternal death. Training on cause of death certification, MDSR documentation and use of ICD is essential to enable consistent application of ICD coding and improve data collection and analysis.

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