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RESEARCH ARTICLE

MATERNAL MORTALITY AT A TERTIARY CARE CENTER-AN AUTOPSY STUDY

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ABSTRACT

Background: Maternal mortality is a global health problem. WHO claims some progress towards reduction in maternal mortality especially in the past decade. The key requirement in further reduction is to understand the causes of deaths and formulate effective policy and health program strategies.

Aims: Evaluation of causes of maternal deaths based on autopsy findings as per categorization of WHO application of ICD 10 MM.

Materials and Methods: The present study comprised of 155 cases of maternal deaths .The complete autopsy was done by a team of pathologist and forensic experts. Detailed external, in situ and gross examination of organs was done. Representative bits from all organs were taken and processed as per the standard protocol. Slides were examined jointly by two pathologist and final opinion was formulated to know the cause of death. All deaths were categorized as per WHO application of ICD 10 MM.

Results: Direct causes of maternal deaths outnumbered indirect causes. Amongst direct causes obstetric haemorrhage 29.68% was the leading contributor followed by PIH (21.29%). Amongst indirect causes of maternal deaths a wide range of causes were found involving different systems. . Contributory causes were found in (86)56.13 % of cases.

Conclusion: Majority of maternal deaths were due to direct causes (62.58%). Potentially preventable causes were haemorrhage and sepsis. Present study encourages categorization of maternal deaths as per WHO application of ICD10MM coding system as it gives leading and contributory causes of maternal deaths and helps us in formulating a meaningful clinical groups and makes us understand the areas of weakness to formulate effective health care strategies.

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INTRODUCTION

In India for every 10 minutes woman dies due to complication of pregnancy or child birth. Maternal mortality is unacceptably high. Maternal mortality index reflects the quality of maternal care services. Some progress towards reduction in maternal mortality has been reported in last few decades. Further reduction needs extensive efforts by health care policy makers to adapt the effective strategies for safe motherhood. The fundamental requirement for further reduction in maternal death is to understand the etiology and causes of maternal deaths. WHO defines maternal mortality as the death of a women whilst pregnant or within 42 days of delivery or termination of pregnancy from any cause related to or aggravated by pregnancy or its management but excluding deaths from incidental or accidental causes.

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ICD 10(MM) classifies maternal deaths into two broad groups (Shrotri, 1994)

- Direct obstetric deaths resulting from obstetric complications of pregnancy state. (pregnancy, labor, and the puerperium) from interventions, ommissions, incorrect treatment or from a chain of events resulting from any of the above.
- Indirect obstetric deaths 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.

Late maternal death is the death from direct or indirect causes more than 42 days but less than a year after termination of pregnancy (Shrotri, 1994). According to WHO application of ICD 10 (MM) to maternal deaths, direct causes include abortion, hypertensive disorders, obstetric haemorrhage,

pregnancy related infections, other obstetric complication, unanticipated complications (Shrotri, 1994). Amongst indirect causes include non obstetric complications.

analysis. All cases were categorised into direct and indirect maternal deaths as per WHO application to ICD10 (MM) and further analysis was done. Maternal mortality ratio of tertiary care centre was compared with other studies.

Table 1. Groups of underlying causes of death during pregnancy, childbirth and the puerperium (Shrotri, 1994)

Type	Group name/number	Examples of potential causes of death
Maternal death: direct	1. Pregnancies with abortive outcome	Abortion, miscarriage, ectopic pregnancy and other conditions leading to maternal death and a pregnancy with abortive outcome
Maternal death: direct	2. Hypertensive disorders in pregnancy, childbirth, and the puerperium	Oedema, proteinuria and hypertensive disorders in pregnancy, childbirth and the puerperium
Maternal death: direct	3. Obstetric haemorrhage	Obstetric diseases or conditions directly associated with haemorrhage
Maternal death: direct	4. Pregnancy-related infection	Pregnancy-related, infection-based diseases or conditions
Maternal death: direct	5. Other obstetric complications	All other direct obstetric conditions not included in groups to 1–4
Maternal death: direct	6. Unanticipated complications of management	Severe adverse effects and other unanticipated complications of medical and surgical care during pregnancy, childbirth or the puerperium
Maternal death: Indirect	7. Non-obstetric complications	Non-obstetric conditions • Cardiac disease (including pre-existing hypertension) • Endocrine conditions • Gastrointestinal tract conditions • Central nervous system conditions • Respiratory conditions • Genitourinary conditions • Autoimmune disorders • Skeletal diseases • Psychiatric disorders • Neoplasms • Infections that are not a direct result of pregnancy
Maternal death: Unspecified	8.Unknown/undetermined	Maternal death during pregnancy, childbirth and the puerperium where the underlying cause is unknown or was not determined
Death during pregnancy, childbirth and the puerperium	9. Coincidental causes	Death during pregnancy, childbirth and the puerperium due to external causes

Present retroprospective study was undertaken to ascertain the various causes of maternal deaths based on autopsy findings and to categarise them according to WHO application of ICD10(MM) code. This study also intends to determine the maternal mortality ratio(MMR) of tertiary care centre. Present study emphasizes on categorization of maternal deaths as WHO application of ICD 10(MM) as it provides clinically meaningful groups of maternal death. It also provides uniformity in collecting and classifying the data from various sources and thus improves quality of data which gives ease for comparison. This will be an useful framework for statistical researches, analysts, health care providers to develop effective programs and strategies to reduce maternal deaths.

MATERIAL AND METHODS

The present study is retroprospective autopsy study comprising of 155 cases of maternal deaths during a period from January 2013 to June 2016 over a span of 3.5 years. Study was conducted after the approval of institutional ethics committee. All the maternal autopsies during the study period were done by a committee comprising of forensic experts, pathologist and a medical officer. Autopsy protocol was similar to other pathological autopsies. Special emphasis was given to examination of pelvic organs, search for embolism, HELLP syndrome, acute fatty liver of pregnancy. Culture studies of body fluids were done as per the need of case. Detailed gross examination of all organs was done. Organs were dissected as per standard protocol. Representative bits from pathological area of all organs were submitted for histopathological examination. Sections were processed for paraffin embedding and H and E staining. Special stains were employed wherever necessary. Thorough microscopic examination in the light of clinical findings was performed to form the final opinion. Epidemiological data was retrieved from hospital record for

RESULTS

Total 155 consecutive autopsies of maternal deaths during study period were analyzed for epidemiological factors. Analysis of final autopsy diagnosis and it's categorization as per WHO application of ICD 10(MM) was also analyzed.

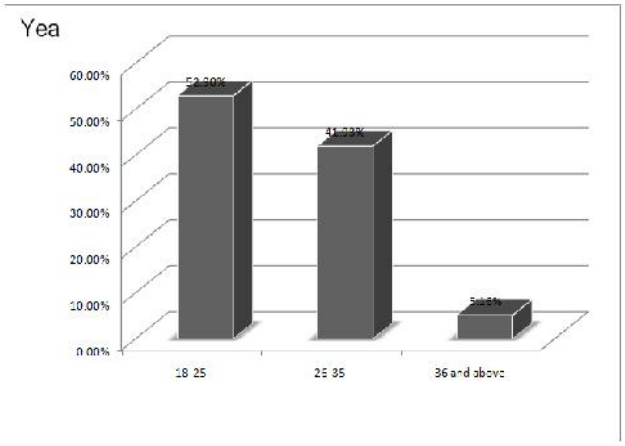


Fig. 1. Age wise distribution of cases (n = 155)

Table 2. Epidemiological factors in maternal death (n = 155)

		Number of cases	Percentage (%)
Weeks of gestation (n= 155)	< 28 wks	9	5.81
	28-36 wks	144	92.90
	> 36 wks	2	1.29
	Total	155	100
Parity (n= 155)	Primi	92	59.35
	Multi	63	40.65
	Total	155	100
Area	Rural	90	58.06
	Urban	65	41.94
	Total	155	100

Maximum deaths occurred in the age group of 18-25years accounting for 52.9% of cases followed by 41.93% cases in the age range of 26-35 years.

- Maternal deaths between 28-36 wks of gestation were found in 92.9% cases. Maximum deaths occurred in primipara (59.35)
- Majority of cases were belonging to rural area (58.06%) as against (41.94%) cases from urban area.

Causes of Maternal Death

Contributory causes were found in (86)56.13 % of cases.

Amongst central nervous system involvement contributory causes were found in 8(9.20%) women where 6 had meningitis and two women suffered from meningoencephalitis. About 17 (19.54%) mothers had hepatobilliary lesion. Out of 17 mothers 12(13.79%) developed submassive hepatic necrosis during the periparturation period where as 5(5.75%) women had hepatitis. These causes contributed or certainly increased the risk of maternal outcome.

Table 3. Causes of Maternal Deaths according to WHO application of ICD10 (MM)

	(n = 155)	Number of cases	Percentage (%)
Direct causes	Abortion	3	1.94
	Pregnancy induced hypertension	33	21.29
	Obstetric haemorrhage	46	29.68
	Pregnancy infections (sepsis)	12	7.74
	Other obstetric complications(Ruptured Uterus)	4	2.58
	unanticipated complications		
Total			63.23
Indirect Causes	Non obstetric complications	57	36.77
Total			36.77

Table 4. Contributory Causes of Maternal Deaths

Contributory Causes		Number of Cases	Percentage (%)
Cardiac disease		0	0
Central nervous system condition	Meningitis	6	6.9
	Meningoencephalitis	2	2.3
Gastrointestinal tract and hepatobilliary conditions	Submassive hepatic necrosis	12	13.79
	Hepatic necrosis	5	5.75
Respiratory condition	Pneumonia	56	64.37
	ARDS	13	14.94
Genitourinary conditions	ATN	44	50.57
	CPN	9	10.35
	APN	3	3.45
Others		-	-

The table depicts the causes of maternal deaths as direct and indirect as per WHO classification of ICD 10(MM). Direct causes of maternal deaths outnumbered indirect causes comprising of 63.23% as against 36.77% from indirect category. Amongst direct causes obstetric haemorrhage 29.68% was the leading contributor followed by PIH (21.29%). Pregnancy related infections (Peuperial sepsis), other obstetric complications (Ruptured uterus), abortion were seen in a minority of a cases comprising of 7.74%, 2.58% and 1.94% respectively. Amongst indirect maternal deaths a wide range of causes were found involving different systems. Pneumonia and acute tubular necrosis were the dominant contributors. Pneumonia was the king of the death 30 (52.63%) of cases followed by acute tubular necrosis of kidney in 23(40.37%) women. In most of the cases lobar pneumonia was the leading subtype. Meningitis was found in 3 (5.25%) of cases. None of the cases had unanticipated complications, undetermined child birth and coincidental causes. Contributory causes includes the conditions that may exist prior to development of the underlying cause of death or develop during the chain of events leading to death and which by its nature, contributed to the death.

- There was a wide range of causes involving many systems. Many mothers had more than one or two contributory causes involving many systems.

In the present study 69 (79.31%) women had respiratory lesion as contributory causes. Pneumonia was the leading cause seen in 56 (64.37%) maternal deaths. In most of the cases it was developed as a chain of events. ARDS was observed in 13 (14.94%) of mothers. The cause of ARDS could not be ascertained. Renal lesions were found in 56 (64.37%) of cases. Lesions observed as contributing factors were ATN in 44 (50.51%) cases, Chronic pyelonephritis in 9 (10.35%).
and acute pyelonephritis in 3 (3.45%) of mothers.

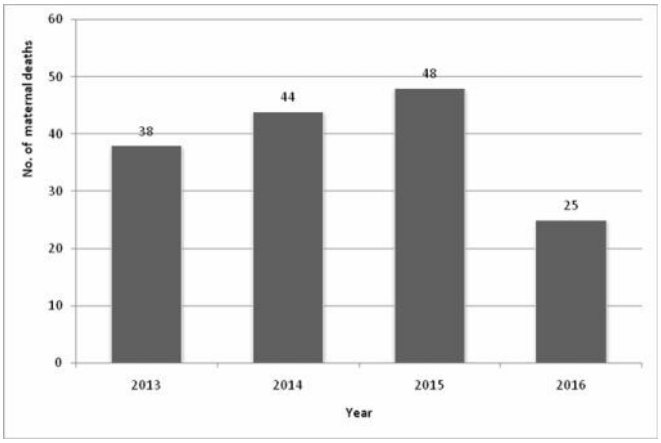


Fig. 2. Maternal Deaths in Tertiary Care Center

Maximum number of maternal deaths occurred in the year 2015.

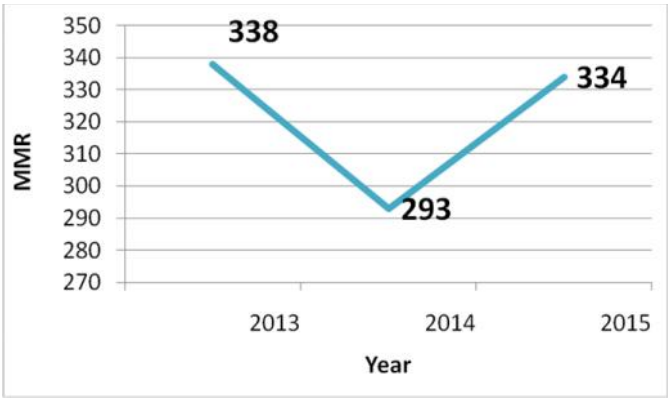


Fig. 3. Maternal Mortality Rate of Tertiary Care Center

- In the present study MMR was hovering around 340. However there was a slight decline in2014 accounting for 293 per 1,00,000 live birth.

Present In study direct causes were more than indirect deaths similar observation were made by Halim A et al, Kavatkar et al.

DISCUSSION

WHO application of ICD 10(MM) coding system was formulated by WHO working committee comprised of more than 40 members from various international agencies who formulated the draft and final version of document came into existence. Maternal health is a measure of quality of health care of the country. Reduction in maternal mortality needs to understand the underlying causes of death. Contributory causes may not lead to death but increases the risk for mortality. Majority of countries has ICD coding system for diseases and health related problems. Applying ICD coding for maternal death will enhance consistent reporting for clinical condition. It will provide uniformity in diagnosing and categorizing the cause of death and will help in formulating the preventive strategies.

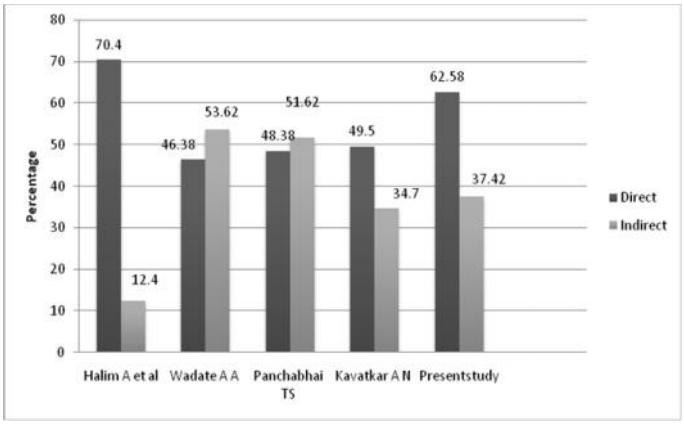


Fig. 4. Comparison of Causes of Maternal Deaths

Present In study direct causes were more than indirect deaths similar observation were made by Halim A et al, Kavatkar et al.

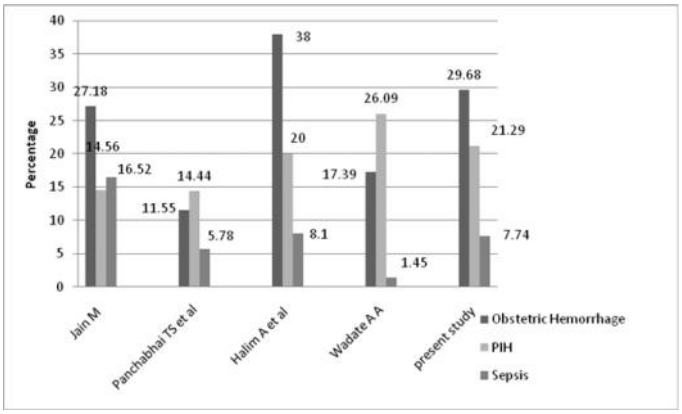


Fig. 5. Comparison of Direct causes of Maternal Deaths

In Present study amongst direct causes Obstetric Hemorrhage was the leading cause followed by PIH and sepsis. Other studies also observed the similar findings. Hence more attention needs to be focused to combat these potentially controllable causes. In review article of the maternal autopsy by D. Rushton quoted that maternal death due to direct obstetric causes continues to decline. T.S. Panchabhai in his study found direct maternal death in 58.62% of women. Wadate et al found 46.38% of women died due to direct obstetric causes. In the present study direct maternal deaths outnumbered the indirect maternal deaths which are in agreement with other studies but present study found little higher % of direct maternal death. This could be attributed to additional medical disorders complicating the pregnancy which contributed to increased risk for mortality. Other workers did not adopt the WHO application of ICD10MM.

Table 5. Comparison of epidemiological factors

		M. Jain 2003	Panchabhai TS et al 2009	Wadate AA 2015	Present study 2016
Age	18-25yrs	42.02%	56.68%	50.72%	52.9%
Gravida	Primi	27.46%	37.54%	-	44.52%
	Multi	72.54%	62.45%	-	55.48%
Area	Rural	61.6%	-	52.17%	58.06%
	Urban	38.92%	-	47.83%	41.93%

- In the present study maximum deaths occurred in age group of 18-25 which were in accordance with other study. Maximum deaths occured in multi gravida and in mothers residing in a rural area which are comparable with other study.

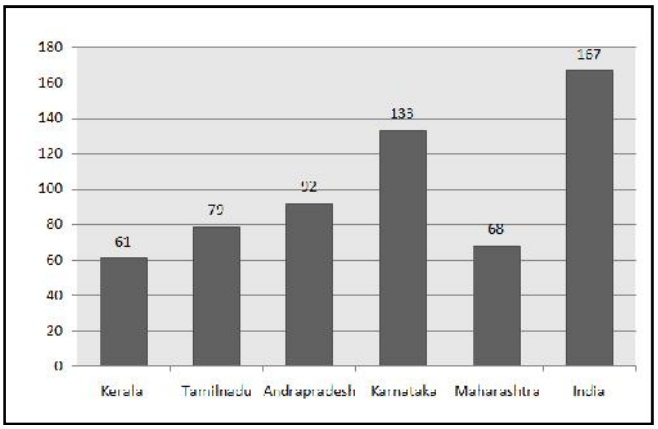
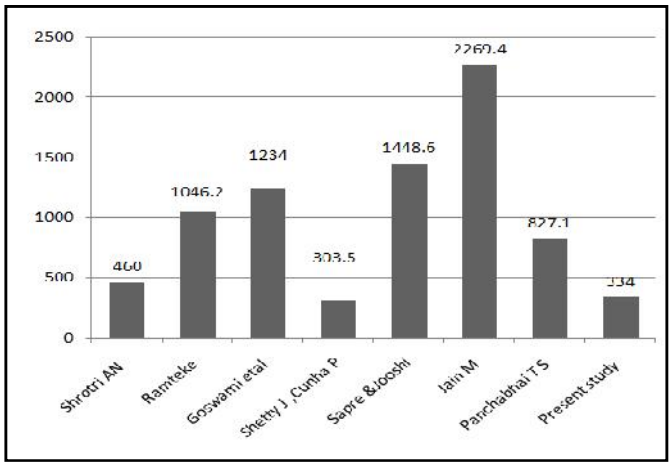


Fig 6. Comparison of Maternal Mortality Rate

This chart depicts MMR of different states of last 3 year plan. Fortunately Maharashtra shows a declining trend.



- Above chart depicts comparison of MMR in various institute which ranges from 300 – 2300. Present study shows declining trend of 334 as compared to other institute.

Conclusion

For accurate diagnosis in maternal deaths autopsy and histopathological examination is essential. Its categorization as per WHO application of ICD10MM coding system is important as it gives leading and contributory causes of maternal deaths and helps us in formulating a meaningful clinical groups. It also makes us understand the areas of weakness. Present study encourages categorization of causes of maternal deaths as per WHO application of ICD10MM coding system as it provides uniformity and consistency in reporting. The present study provides an input and useful framework for statistical officers, researchers and health care providers to elucidates area of weakness and help in formulating effective health strategies and policy to reduce maternal deaths and maternal mortality rate in the tertiary care center.

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The WHO application of ICD -10 to deaths during pregnancy, child birth and puerperium: ICD-MM

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