

MATERNAL DEATHS IN PUNJAB: A 3-YEAR AUDIT FROM A TERTIARY LEVEL GOVERNMENT INSTITUTE

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ABSTRACT

Objective: This study aims to recognize the most common causes and delays in maternal death.

Methods: This is an observational study from Government Medical College Amritsar from the period December 2017 to November 2020 which included all cases of maternal death irrespective of gestational age and up to 42 days postpartum.

Results: Maternal mortality ratio in our institute during 3-year study period (2018–2020) was 1081 per 100,000 live births. About 90.9% of the maternal deaths were unregistered emergency cases, 11.7% were brought dead, and 33.8% deaths took place within 24 h of admission. Direct obstetric causes were the most common causes of maternal death (49%), while indirect causes were responsible for 42.8% deaths. Hypertensive disorders and hemorrhage were responsible for almost one third cases and severe anemia was an aggravating factor in 31.5%. Maternal deaths were associated with type 1 delay in 57.6%, type 2 delay in 9% cases, and type 3 delay in 21.2%.

Conclusion: Hypertensive disorders of pregnancy and obstetric hemorrhage continue to be the leading threats to maternal lives. Improvement in public health services and special campaigns focusing on prevention of viral hepatitis and other infectious diseases can be helpful in decreasing maternal death due to indirect causes. Need of the hour is quality intrapartum and emergency obstetric care at first referral units. Indirect causes of maternal death are a significant public health issue which needs to be addressed.

Keywords: Maternal mortality, Three delay model, Maternal mortality ratio.

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INTRODUCTION

The world woke up to the problem of unacceptably high maternal deaths globally, late in the 1980s with the Safe Motherhood Initiative and India has shown sustained commitment over past four decades to the cause of bringing down the national and global maternal mortality ratio (MMR) [1]. We as a country still contribute to 15% of global maternal death burden and the Sample Registration Survey of India 2017–2019 released recently reminded us that we have a long way to go before we accomplish our Sustainable Development Goal of reducing MMR below 70/thousand live births [2]. The MMR estimates for India for 2017–2019 is 103. What is a matter of concern for the stakeholders in Punjab is that the estimated MMR for Punjab is 114 is much higher than the national MMR.

A detailed analysis is the need of the hour to have some actionable evidence to give a boost to our efforts to reduce maternal deaths. This study is an effort to gather such evidence from all cases of maternal deaths reported from Government Medical College, Amritsar from the period December 2017–November 2020.

The aims and objectives of the study were as follows:

1. To find the most common causes of maternal deaths.
2. To find the most common delays leading to maternal deaths.

The three-delay model proposes that maternal death can be associated with three delays: Delay 1 in taking decision to seek care, Delay 2 in reaching the appropriate facility, and Delay 3 in receiving proper care at health-care facility [3].

METHODS

It is an observational study, based on the indoor records of all the cases of maternal deaths reported from Government Medical College Amritsar from the period December 2017 to November 2020.

Inclusion criteria

All the deaths of women who were pregnant or had a termination of pregnancy within 42 days before death, irrespective of the gestational age, who died due to a complication of pregnancy, delivery, or its management. These included the cases that were dead on arrival in the hospital as well.

The indoor files of all the cases of maternal deaths reported from the institute in the study period were studied and data regarding patient profile, record of antenatal care (where available), condition on admission, interventions done, cause of deaths, and delays identified were collected without disclosing the patient identity. The data were analyzed statistically and compared with contemporary studies from other parts of the country. The study was conducted after due approval from the Institutional Ethics Committee.

RESULTS

During the study period of 3 years, there were 222 maternal deaths reported from our institute. Twenty-six (11.7%) of these were dead on arrival while 196 were hospital deaths. With a total 18,131 live births during the study period, our MMR was 1081 per 100,000 live births.

Eighty-nine (40%) of these women had their first pregnancies while 133(60%) were multigravida, of which 9 (4.05%) patients were grand-multiparous. Ten (4.5%) were teenage pregnancies while maternal age was more than 35 in 8 (3.6%). About 92% of maternal deaths were in the age group of 20–35 years.

Condition on admission

Other than 26 (11.7%) patients who were dead on arrival, in more than two-third cases, that is, 149 (67.12%) patients were serious on

admission. Among these serious patients, 29 (13%) patients had severe respiratory distress but were conscious and maintaining circulation, while 47 (21.17%) patients were very critical, gasping, in shock or in cardiac arrest and needed cardiopulmonary resuscitation on admission itself. One-fifth, that is, 47 (21.17%) patients were stable on admission, although with risk factors and complications.

Apart from 26 brought dead, around one-third of deaths, that is, 75 (33.8%) took place within 24 h of admission. Among these also, almost half the deaths, that is, 38 took place within 6 h of admission. There were 86 (38.74%) cases in which admission death interval was more than 72 h.

Only 22 (9.9%) of the maternal deaths were registered during pregnancy at our institute, rest all were emergency admissions. About 47.3% of patients were from our own district while remaining were from surrounding districts. Seven (3.15%) patients were migrant from other states.

Among 22 registered patients who died, only six were on regular follow-up, three of them were diagnosed cases of placenta accreta syndrome, one had restrictive lung disease, one died of community acquired pneumonia, and one died of postpartum atypical eclampsia. Twelve of these registered cases were lost in follow-up and seven of them delivered outside and were brought to our institute with complications. Five of the registered cases had been informed about risk factors and complications, but they were non-compliant.

In total, 55 (24.77%) patients were already delivered at the time of admission and 7 (3.15%) had undergone abortion (five criminal abortion, one spontaneous abortion with coagulopathy, and one ruptured ectopic).

Time of complications and maternal death

Fifty-five (24.77%) patients died while pregnant and 12 (5.4%) were in labor when they expired. Another 9 (4.05%) women died within 42 days of an abortion.

Of the 146 women who died in postpartum period, 134 (92%) were institutional births. Of these 146 patients, 89 (60.96%) were delivered vaginally, 55 (38%) were cesarean deliveries, and two underwent laparotomy for rupture uterus. Out of the vaginal delivery patients, 10 (7%) were home deliveries and two patients delivered in vehicles en route to hospital.

Although most patients died within 48 hours after delivery in 76 (34.23%) followed by antepartum period in 55 (24.78%), the time of onset of complications was mostly third trimester of pregnancy in 142 (64%) followed by the intrapartum period (during labor or during caesarean) in 41 (18.47%).

Perinatal mortality

Amongst the 146 postpartum deaths, there were 61 stillbirths and 14 neonatal deaths amounting to 51.4% perinatal mortality. Not just that, these maternal deaths left another 268 children motherless, 71 of them newborns.

ICU, mechanical ventilation, and interventions

One hundred and fifty-one (77%) patients were shifted to ICU immediately, another 29 were shifted to ICU sometime later during course of management, while there were 16 patients who could not be revived in emergency and could not be shifted to ICU. One hundred and twelve (57%) needed ventilator support on the day of admission itself.

Apart from resuscitation and supportive treatment, major interventions among 196 of admitted cases included multiple blood transfusion in 93 (47.45%) cases, laparotomy in 10 (5.1%), cesarean hysterectomy in 3 (1.53%), and dialysis in 7 (3.6%) cases.

Delays

On trying to identify the delay that eventually led to maternal death, Delay 1 (delay in seeking care) was identified in 128 (57.6%) cases. Most common delay was ignoring the symptoms of complications and danger signs in 109 (49%) cases. In 51 (23%) of them, danger signs were ignored for more than a week. Ten cases had home delivery and five had undergone illegal abortion.

In 31 (14%) cases, there was clear history that no ANC was taken including four cases where pregnancy went unnoticed till the onset of complications.

There were 34 (15.3%) cases of non-compliance where complications were identified, despite that medical advice was not followed. In 11 (4.9%) cases, referral was advised by first referral unit, but time was lost in reporting to tertiary care center.

Four of the maternal deaths were victims of sexual assault, two of them were mentally retarded. All these cases were diagnosed very late, antenatal care was not taken and there was failure to take care of this vulnerable population.

Delay 2 (delay in reaching appropriate facility) included 20 cases (9%) of which two cases who delivered en route to the hospital and 18 (8.1%) cases that travelled to more than one center before reaching the tertiary care facility.

Among the Delay 3 (21.2% cases), there were 12 (5.4%) instances where complications were not timely diagnosed and there was delay in referral. Three eclampsia cases and four PPH cases referred from FRUs were brought dead to the tertiary center. Eleven patients with PPH were referred without stabilization. Seven of the referred patients were referred in advanced labor and reached the hospital in second stage of labor. Also included among Delay 3 were two cases of improper closure of uterine incision in cesarean delivery, one instance each of mismanaged third stage of labor leading to uterine inversion and early discharge of patient after cesarean delivery on 3rd day.

Delayed or missed diagnosis and inappropriate management of anemia and hypertension often reflect a combination of Delay 1 and Delay 3 and were seen in 30% cases.

At our institute, we identified two cases where delay was due to non-availability of blood, another 1 where timely decision of cesarean hysterectomy was not made.

In 48 cases (21.6%), the delay could not be found due to incomplete records or unclear antenatal events.

Cause of death

Direct obstetric causes were the most common causes of maternal death accounting for 109 (49%) of maternal deaths, while indirect causes were responsible for 95 (42.8%) deaths. In 18 cases (8.1%), cause of death could not be ascertained.

Among direct causes, hypertensive disorders were the leading cause of maternal death with 47 (21.2%) cases followed by obstetric hemorrhage that led to 29 (13.06%) maternal deaths. Among indirect causes, respiratory diseases were foremost being responsible for 37 cases (16.7%) which included deaths due to viral and bacterial pneumonia and pulmonary tuberculosis. Second leading indirect cause was liver disease leading to 32 (14.4%) deaths, almost half of which were confirmed to be due to HEV infection.

Amongst infections, HEV that caused 15 deaths (6.75%) was the leading pathogen followed by COVID-19 infection (5%) that led to 11 deaths and was the aggravating factor in another two cases. Influenza virus and tuberculosis were responsible for five deaths each and dengue infection led to three maternal deaths. Malaria was responsible for one maternal death in this 3 years period.

In our study, anemia was the underlying cause of 2.25% deaths and an aggravating factor for one third of deaths (31.5%). Multiple gestation as an aggravating factor was present in 14 cases (6.3%) (Table 1).

DISCUSSION

Maternal mortality ratio in our institute during three year study period (2018–2020) was 1081 per 100,000 live births which was much higher than that reported by other tertiary care teaching institutes in the past one decade (Table 2). It was reported to be 554.69/100,000 live births of live births at GTB Hospital (2005–2014), New Delhi in 10 years audit reported by Singla, 361.71/100,000 live births reported from Safdarjung Hospital, New Delhi (2013–16) by Mittal, 915/100000 live births from KEM Hospital, Mumbai (2010–16) by Aggarwal, and 802 per 1,00,000 live births at Institute of Medical Sciences, Bilaspur, Chhattisgarh (January 2018–July 2020) reported by Jogi and 364 per 1,00,000 live births at Gulbarga institute of Medical Sciences, Kalaburgi, Karnataka (2016–17) as reported by Doddamani [4-8].

Singla reported 10.5% and Aggarwal reported 8.1% of maternal deaths to be in teenagers, while in our study, this figure was only 4.5% similar to 3.6% reported by Jogi and 3.3% by Mittal [3,5-7]. The prevalence of maternal age more than 35 years was 3.6% in our study similar to that reported by Aggarwal (3.5%) [6]. On the other hand, the prevalence of maternal age more than 35 years was 14.3% and 9.3% in studies by Jogi and Doddamani, respectively [7,8].

We found 40% of maternal deaths to be in primigravidas and 60% in multigravidas, while 4% were grand multipara. The proportion of primigravidas to multiparas in maternal death cases varied from 30:70 to 50:50, whereas the incidence of grand multiparity was 12–18% in most of the studies, as shown in Table 1.

This shows that maternal age and order of pregnancy are not major factors contributing to maternal death in more than 90% cases.

About 90.9% of the maternal deaths reported by our institute were unregistered emergency cases, similar to results by Singla (93.9%) and Mittal (88.46%) [4,5].

In our study, at least, 55% had taken some form of ANC, 14% patients had not taken any ANC, while ANC record of 45% cases was not available. Aggarwal and Jogi reported 23.6 % and 20.5% prevalence of cases with no ANC [6,7]. Singla, on the other hand, reported that an alarming 73.6% had not taken any form of ANC [4].

In our study, 11.7% were brought dead and 33.8% deaths took place within 24 h of admission. The total figure of 45.5% is similar to results

reported by Singla, Mittal, and Jogi (47.4%, 45.05%, and 53.6%, respectively) [4,5,7]. On the other hand, Khandale reported only 5.12% deaths within 24 h of admission [9]. Mittal reported 32.96% cases to be critical on admission and another 46.97% were serious while in our study, 24% were critical and 72.5% were serious [5].

Around two-third deaths took place in the postpartum period in our study which is similar to the results by Singla, Aggarwal, and Khandale and reported more than half the deaths to be in postpartum period (53.84%, 60%, and 52.3%, respectively) [4,6,9]. In most cases, time of onset of complications was third trimester of pregnancy (64% cases) followed by that during labor or during cesarean in 18.5%. None of the contemporary studies have deliberated on this aspect.

We found that direct obstetric causes were the most common causes of maternal death (49%), while indirect causes were responsible for 42.8% deaths. Singla, Mittal, and Khandale reported 67.8%, 69.81%, and 61.5% of maternal deaths due to direct obstetric causes [4,5,9]. Aggarwal reported only 40% maternal deaths due to direct causes, while Jogi reported the numbers to be 83% [6,7].

Hypertensive disorders were the most common cause of maternal death being responsible for 21.17% of maternal deaths in our study. Studies from other authors reported hypertensive disorders as the cause in approximately 12 to 37% cases. Nearly half of the deaths (46.8%) in hypertensive cases were due to respiratory distress in our study. Nearly 47.6% of these 47 deaths had severe anemia as an aggravating factor.

Wider variations were seen in obstetric hemorrhage as the cause of maternal deaths which accounted for 13% of maternal deaths in our study. Singla, Mittal, Aggarwal, and Khandale reported this to be 10–19% [4,5,6,9]. Jogi and Doddamani showed it as the cause in 25.9 and 38.4%, respectively [7,8].

Pregnancy-related infections or sepsis were the second leading cause of maternal death reported by Mittal (20.87%) [5], whereas it contributed to 5–15% of maternal deaths in other studies including ours (8.6%) [4-9].

As per the report of RGI in 2001–03, hemorrhage (38%), hypertensive disorders (5%), sepsis (11%), and abortion (8%) were the leading causes of maternal deaths in India [10]. An analysis of data available in MDSR software for 2015–16 showed that obstetric hemorrhage and hypertensive disorders of pregnancy together continue to contribute to more than 30% of the total maternal deaths with thromboembolism (4–5%), sepsis (3–4%), abortion (3–4%), and obstructed labor (around 2%) are other key direct obstetric causes [10].

In our study, hypertensive disorders and hemorrhage were responsible for almost one-third of maternal deaths. Other studies showed that the contribution of these two major factors together was 21–56% of maternal deaths.

Abortion-related complications were responsible for 3.15% of maternal deaths in our study similar to results of other studies [4,5,6]. Most of these were unsafe abortions and one case with ruptured ectopic. A 3–8% of maternal deaths were due to unsafe abortions and 12–18% were in grand multiparous females as per recent studies [4-7]. This highlights the failure of family planning program to influence the masses.

Among indirect causes, anemia was a significant comorbid factor (71.97%) and an indirect cause of maternal mortality in 14–16% cases [4,5,9]. In our study, severe anemia was the underlying cause of only 2.25% deaths but an aggravating factor in 31.5%.

HEV hepatitis as a cause of 7.1% and 8.4% maternal death was reported by Singla and Aggarwal similar to our results (6.7%) [4,6]. This is essentially a public health issue and a lot needs to be done to ensure the availability of clean water and food for all to reduce this burden.

Table 1: Causes of maternal death

Causes	Number
A. Direct causes	109
Hypertensive diseases in pregnancy	47
Obstetric haemorrhage	29
Pregnancy related infections	19
Pregnancy with abortive outcomes	7
Others	7
B. Indirect causes	95
Respiratory diseases (H1N1, COVID-19, TB, bacterial pneumonia etc.)	37
Liver diseases (viral hepatitis)	32
Cardiac diseases	9
Other systemic infections (dengue, typhoid, malaria, ludwig's angina)	6
Hematological diseases	5
Neurological diseases	4
Renal diseases	2
C. Unknown	18
Total	222

TB: Tuberculosis

Table 2: Comparative table of all causes of maternal death

Author, institute, study period	MMR Per 100,000	Maternal age (years) (%)		Maternal parity (%)		Death within 24 h of admission (%)	Cause of death (%)															
		<20	>35	Primigravida	Multigravida		Grandmultipara	Direct	Indirect	Abortion related	Hypertensive disease	Sepsis	Cardiac Anaemia*	TB	Dengue	Malaria	HEV					
Present study, GMC Amritsar 2017-2020	1081	4.5	3.6	40	60	4	45.5	49	42.8	4	8.6	13.1	21.2	13.1	2.25+31.5*2.25	1.35	0.45	6.7				
Singla, GTB Hospital, Delhi, 2005-2014	554.7	10.5	-	32	-	14.2	47.4	67.85	31.84	4.8	14.5	19.1	24.4	19.1	15.3	3	0.7	0.3	7.1			
Aggarwal, KEM Hospital, Mumbai, 2010-2016	915	8.1	3.5	40	60	12	-	40	60	4.4	11.9	11	11.9	11	5.6	6.5	2	11	1.8	3.1	8.4	
Mittal, Safdarjung Hospital, New Delhi, 2013-2016	361.7	3.3	-	30	70	13.7	45	69.81	25.5	2.74	28.0	12.36	28.0	12.36	20.9	3.3	16+72	-	5.5	-	-	-
Doddamani, IMSKalaburgi Karnataka, 2016-2017	364	6.2	9.3	44	56	17.4	-	-	3	-	29.2	38.4	29.2	38.4	12	3	-	-	-	-	-	-
Jogi, IMS, Bilaspur, Chhattisgarh, 2018-2020	802	3.6	14.3	50	50	14.3	53.6	83	17	1.8	36.6	25.9	36.6	25.9	14.3	1.8	7.1+57*	-	-	-	-	-

TB: Tuberculosis, MMR: Maternal mortality ratio, HEV: Hepatitis E virus

Another important preventable indirect cause of maternal death is tuberculosis which accounted for 3% and 2.6%, respectively, maternal deaths as reported by Singla and Khandale similar to our result (2.25%) [4,9]. Aggarwal, however, reported 11% maternal deaths due to tuberculosis [5]. In our study, during the pandemic year 2020, five deaths were reported due to neglected cases of tuberculosis. In previous 2 years, there was no maternal death reported due to tuberculosis. This may be reflecting a resurgence of tuberculosis because most of the health resources were focused on managing the pandemic.

There were five maternal deaths due to influenza in 2 months from January to February 2019 during influenza epidemic and 13 deaths related to COVID-19 pandemic during 5 months period from July to November 2020. This highlights the special need for immunization of reproductive age group women against these infections as a component of national immunization program.

Mittal found type 1 (64.28%) and type 2 (34.06%) delay were the most common delays and type 3 was only 1.64%. He also reported 29.38% cases referred without adequate life support measures [6].

Jogi found that type 1, type 2, and type 3 delays were present in 95.54%, 70.54%, and 47.32% cases, respectively [7]. Khandale reported 85.89% type 1 and relatively low type 2 and type 3 delays (10.25% and 3.84%, respectively) [9].

In our study, there were type 1 delay in 57.6%, type 2 delay in 9% cases, and type 3 delay in 21.2%.

A paper by Institute of Economic Growth in 2015 mentions that in Punjab and Haryana, the pace of reduction in MMR does not augur well with their developmental profile [11]. Sample Registration Survey of India 2017-19 quotes MMR for Punjab (114) to be higher than the national MMR (103) [2].

The high MMR reported in our government teaching institute compared to other such institutes in different parts of country also tells us that we need to look beneath the surface to really find the cause of this unacceptably poor state of maternal health in Punjab compared to other states.

About 31.5% of the maternal deaths in our study had severe anemia as the aggravating factor, 14% never took ANC, 12.2% were undiagnosed hypertensives, and 2.2% had tuberculosis. All these facts reflect poorly on the quality of antenatal care.

The fact that 26 cases were brought dead and another 38 died within 6 h of admission raises question over the basic emergency obstetric services provided at primary and secondary care centers before referral and during transport in these 29% women. Among the brought dead, three were eclampsia cases and four had PPH. Eleven patients with PPH were referred without stabilization. Seven of the referred patients reached the hospital in second stage of labor. All these instances raise question over the referral mechanisms being followed by peripheral centers, private hospitals, and first referral units. This issue must be seriously addressed if we want to decrease the burden of preventable maternal deaths caused due to the hypertensive disorders and hemorrhage.

At tertiary center also, shortage of senior obstetricians, lack of dedicated obstetric care intensivist, lack of facilities such as interventional radiology and absence of critical care obstetrics infrastructure, and hinder with the quality of care needed for the sick patients referred here from all surrounding districts.

CONCLUSION

Hypertensive disorders of pregnancy and obstetric hemorrhage continue to be the leading threats to maternal lives. Delay in seeking

help is a common contributor reflecting the ignorance that needs to be addressed. Quality of ANC needs to be improved to decrease the burden of maternal deaths especially focusing on timely diagnosis and treatment of anemia and hypertensive disorders in pregnancy. Improvement in public health services and special campaigns focusing on prevention of viral hepatitis and other infectious diseases can be helpful in decreasing maternal death due to indirect causes. Emphasis is required on increasing the number of tertiary care centers that should be well supported by infrastructure, consumables, and supplies along with dedicated human resources for critical care in obstetrics. Quality antenatal care for timely diagnosis and management of hypertensive disorders and anemia are the most important interventions for prevention of maternal deaths. Equally significant is the quality intrapartum care and basic emergency obstetric care at first referral units. Indirect causes are also becoming increasingly significant and public health system and general sanitation can address some of the major causes responsible for maternal death.

AUTHOR'S CONTRIBUTION

Study design was prepared by Suparna Grover and Sujata Sharma. Data collection was done by Suparna Grover and Himanshi Sidana, while data analysis and preparation of the manuscript was done by Suparna Grover and Ajay Chhabra.

CONFLICTS OF INTEREST

The authors have no direct or indirect financial interest in the subject matter discussed in the manuscript and have received no funding from any resource.

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