



Original Article

Maternal Mortality in an Urban Tertiary Care Hospital
of North India

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Abstract

Objectives: The aims of the study were to help generate information and knowledge regarding the causes and complications leading to maternal deaths (MDs) in an urban tertiary care hospital, to find if any of them are potentially preventable, and to use information thus generated to save lives. **Methods:** The medical records of all MDs occurring over a period of 4 years between January 2003 and December 2006 were reviewed and correlated with maternal age, antenatal registration, mode of delivery, parity, admission death interval, and causes of death. **Results:** The maternal mortality rate (MMR) ranged between 926 and 377/100,000 births in the study period. The causes of deaths were sepsis 23.84%, eclampsia /pregnancy-induced hypertension 17.69%, hemorrhage 13.84%, hepatitis 13.84%, anemia 13.07%, respiratory infections 8.46%, other indirect obstetrical causes 6.15%, and unrelated causes 4.61%. Maximum deaths (71.53%) occurred in women between 21 and 30 years of age while multigravida had MMR of 51.53%. Mortality was highest in postnatal mothers 63.06%. Unbooked cases constituted 92.31% of MDs and included 25% referred cases. **Conclusion:** Overall maternal mortality was 690/100,000. MDs due to direct obstetric causes were 55.38%, indirect obstetric deaths 40%, and unrelated deaths 4.61%. The causes of potentially preventable deaths include deaths due to anemia, sepsis, hemorrhage, DIC, and anesthesia complication, and accounted for 25.38% of all deaths.

Keywords: maternal mortality, direct obstetric death, indirect obstetric death, unrelated deaths.

Introduction

Maternal mortality ratio (MMR) is number of maternal deaths (MDs) per 100,000 live births during a given period. Maternal mortality rate is number of MDs in a given period per 100,000 women of reproductive age during the same period¹. Direct MD is the result of a

complication of the pregnancy, delivery, or their management. Indirect MD is a pregnancy-related death in a patient with pre-existing or newly developed health problem. Other fatalities during but unrelated to pregnancy are nonobstetric/unrelated causes. Late MD is defined as the death of a woman from direct or indirect cause >42 days but <1 year after termination of pregnancy. Fortuitous or incidental causes are deaths from unrelated causes which happen to occur in pregnancy or puerperium (suicide, accident, murder)¹.

Each minute of every day, at least one woman in developing countries dies, as a result of complications arising during pregnancy and childbirth². Global maternal mortality is at 529,000 women per year, of

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which only 1% deaths occur in developed world while 99% occur in developing countries⁴. In developed countries MMR averages at 27/100,000 births. Developing countries have MMR of 480/100,000 while underdeveloped countries have an MMR of 890/100,000 births. Worldwide MMR is 200-600/100,000 births¹.

An estimated 30 million women experience pregnancy every year and 27 million have live births. In India, 125,000 women die per year due to pregnancy-related complications (one death every 5 minutes). National average of MMR is 540/100,000 births (NFHS 98-99), while in rural India the ratio is 619/100,000 births.

Material and Methods

Hindu Rao Hospital is one of the biggest urban general hospitals in North India. It gets referrals from maternity homes, poly-clinics, rural and urban slums, district and primary health centers, other level II hospitals of Delhi administration, MCD, and from neighboring states. The present study was carried out in the Department of Obstetrics and Gynecology of this hospital. The medical records of all MDs occurring in the peripartum period between January 2003 and December 2006 were reviewed irrespective to place of delivery and correlated with various factors like age, parity, hospital antenatal supervision, delivery status, admission death interval, and causes of deaths. All women requiring hospital care were admitted irrespective of the availability of beds, vacancy of ICU bed, or antenatal registration in the hospital. Autopsy could not be conducted on any of the bodies due to lack of consent.

Results and Observations

Between January 2003 and December 2006, there were a total of 18,814 deliveries and 130 MDs. Year-wise distribution of deliveries, MDs, and yearly MMR are shown in Table 1. The mean maternal mortality rate was 690/100,000 births. Unbooked cases were 92.31% (120/130), booked cases (more than three visits) were only 1.54% (2/130), and registered (less than three visits) cases were 6.15% (8/130). Unbooked cases included 24.16% (29/120) referred cases, all of whom had delivered outside [23 vaginal deliveries, 06 lower segment caesarean section (LSCS)], and were subsequently admitted to our hospital. Among institutional deliveries (101/130), 30.69% delivered vaginally, 21.78% had LSCS, and 47.52% died in antenatal period. In our study the postnatal death rate was 63.08% (82/130) and antenatal death rate was 36.92% (48/130). Postnatal MDs (n=82) include 41.54% (n=54) deaths after vaginal delivery and 21.54% (n=28) after LSCS. Antenatal deaths include 7.69% (10/48) early pregnancy deaths (septic abortion, ectopic deaths). Highest mortality of 71.53% was noted in the age group of 21-30 years, while mortality of 16.92 and 11.54% was noted in women aged <20 and >30 years, respectively (Tables 2 and 3). Multigravida women (up to gravida three) had maximum MMR of 51.54% (67/130), while primi and grandmulti-gravida comprised 23.08 and 16.15%, respectively. Parity was not documented in 9.23% (12/130) women. Forty-five percent of women died within 24 hours of admission, direct obstetric deaths occurred in 55.39% (72/130), indirect obstetric deaths in 40% (52/130), and deaths due to unrelated causes in 4.61% (6/130).

Table 1
Year-wise distribution of deliveries and maternal deaths

Year	Deliveries	Maternal Deaths	MMR/100,000 births
2003	4,747	44	926
2004	4,817	33	685
2005	3,928	33	840
2006	5,322	20	377
Total	18,814	130	690

MMR: Maternal mortality ratio

Table 2
Maternal deaths as per age

Years	No. of women <20 years of age	No. of women 21-30 years of age	No. of women >31 years of age	No. of maternal deaths
2003	10	32	2	44
2004	3	26	4	33
2005	3	24	6	33
2006	6	11	3	20
Total	22	93	15	130
	16.92%	71.53%	11.54%	260

Table 3
Delivery method and maternal deaths

Variable	No. of maternal deaths	Percentage (%)
Antenatal (undelivered)	38	(29.23)
Postnatal-vaginal	54	(41.53)
Postnatal-LSCS	28	(21.53)
Early pregnancy death	10	(7.69)
Total deaths	130	

Direct obstetrical deaths include death from sepsis 43.05% (31/72), hemorrhage 22.22% (16/72), eclampsia and pregnancy-induced hypertension (PIH) 31.94% (23/72), and thromboembolism 2.8% (2/72). Year-wise distribution of direct obstetric deaths is illustrated in Table 4. Sepsis cases included postabortion 19.36% (6/31), surgical wound sepsis 29.03% (9/31), puerperal sepsis 29.03% (9/31), and probable septicemia 22.58% (7/31). The latter constituted of cases that were treated as septicemia on clinical grounds though they were culture negative (already on antibiotic). Hemorrhage accounted for 12.31% (16/72) of direct obstetric deaths and included 75% (12/16) of deaths by primary postpartum hemorrhage (PPH) and 25% (4/16) by rupture uterus. Eclampsia and PIH accounted for 17.69% (23/72) of all MDs. Indirect obstetric deaths occurred in 40% (52/130) women, and included deaths due to hepatitis 34.61% (18/52), anemia 32.70% (17/52), respiratory diseases 21.15% (11/52), heart diseases

3.84% (2/52), CNS disease 2.0% (1/52), surgical disease 3.84% (2/52), and enteric fever 2.0% (1/52).

Unrelated causes constituted 4.61% (6/130) of MDs and included anesthesia complication 0.76% (n=1), acute blood reaction 0.76% (n=1), surgical cause (gut perforation) 1.53% (n=2), aspiration syndrome 0.76% (n=1), and COPD cor pulmonale 0.76% (n=1).

Our study when compared with other Indian studies done in the last 15 years on the causes of MDs reveals a varying range of causes (Table 5).

Discussion

MD or maternal mortality is the death of a woman in relation to pregnancy. According to World Health Organization (WHO), "A maternal death is defined as the death of a woman while pregnant or within 42 days of

Table 4
Year-wise distribution of direct obstetric deaths

Year	Sepsis	Hemorrhage	Eclampsia	Embolism	Total
	No. (%)	No. (%)	No. (%)	No. (%)	
2003	9 (20.45)	9 (20.45)	4 (9.09)	1 (2.27)	44
2004	8 (24.24)	5 (15.15)	6 (18.18)	0 (0)	33
2005	7 (21.21)	6 (18.18)	5 (15.15)	1 (3.03)	33
2006	7 (35)	1 (5)	3 (15)	0 (0)	20

Table 5
Comparative analysis

Name MMR (Year)	PIH (%)	Hm. (%)	Sepsis (%)	Anemia (%)	Hepatitis (%)	Early pregnancy deaths (%)	Other indirect causes (%)	Direct obstetric causes (%)	Indirect obstetric causes (%)	Unrelated causes (%)	per 1,000
Sharma S (1994)	17.2	27.5	20.6	10.3	3.4			72.2	27.4	0.4	16.5
Bichli L (1994)	39.6	11.1	29.6		14.8			80.4	17.2	2.4	13.68
Kulkarni S (1996)	24.2	23.7	20.7	17.98	11.98			68.7	30	1.3	17.21
Khosla AH (1999)	35	19.35	32.26	6.45							6.05
Salhan S (2000)	16.3	18.18	14.54	27.27				60	40		3.92
Prasanta R (2005)	50.56	9.72	18.17	4.8	1.84						6.25
Present Study (2003-2006)	18	12	24	13	14	5%	14%	55.38	40	4.61	6.9

termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by pregnancy or its management" (ICD-10).

During the study period of 4 years the MMR ranged between 926/100,000 in 2003 and 377/1,000,000 births in 2006 (Table 1). National average of MMR is

540/100,000 births (NFHS 98-99). Other Indian studies done in the last 15 years have shown wide variations in MMR ranging from 172/100,000 (1996) to 625/100,000 births (2005). Prasanta et al.⁵ have observed the MMR of 625/100000 births. Other studies conducted before 1999 have higher MMR ranging between 130⁷, 160⁹, and 170/100,000 births⁸. Only Salhan et al. (2000)¹⁰ reported

MMR of 392/100,000 births. This variation could be explained due to many variables. This study has high MMR which can be due to the fact that it is one of the tertiary care referral hospital that gets referrals from neighboring states as well.

Our study showed that 71.53% of women die between the ages 21 and 30 years, as highest number of women belong to this age group. Similarly multigravidas constitute 51.53% of MDs. Admission death interval analysis of our study revealed that 45% of women died within 24 hours of admission, possibly due to poor general condition of women on admission, late referrals, and at times due to a long travel time from neighboring states. Twenty-four percent of these women died within 6 hours of admission as they were in moribund or comatose condition. More than half (63.06%) of the MDs occurred in postpartum period and included 41.54% deaths after vaginal delivery and 21.54% after LSCS. Antenatal women constituted 36.92% of all MDs and included 7.69% of early pregnancy deaths also (septic abortion and ectopic deaths). This study highlighted that 92.30% of women were unbooked while only 1.53% were booked cases. Registered cases comprised only 6.15% of all deaths. The analysis revealed that 55.39% of deaths are due to direct obstetrics causes, 40% due to indirect obstetrics causes, 4.61% due to unrelated causes. Other studies have shown variation in direct obstetrics deaths from 60 to 80%. Our figure of 55.39% is closer with Salhan et al (2000)¹⁰ at 60% and Kulkarni et al.⁸ at 68.7%. Percentage variation of indirect obstetrics deaths ranges between 17.2%⁷, and 40%¹⁰ and our study (2006).

Direct obstetric deaths accounted for 55.39% of all deaths in our study and included: sepsis 23.84%, hemorrhage 12.30%, eclampsia and PIH 17.69%, and embolism 1.53%.

Sepsis which is a direct consequence of poor hygiene during delivery accounts for 15% of MDs globally². In comparative analysis it varies between 14.54 and 32.26%. In our study it was 24% which falls between the range but is higher than global figure. Year-wise analysis of our study showed a gradual increase in sepsis deaths from 20.45% in 2003 to 35% in 2006 (Table 4). This increase is probably due to emergence of multidrug resistant strain of bacteria in the urban community, may be due to irrational use of higher generation antibiotics at peripheral level. Another cause is overcrowding in the wards, there is 150-180% bed occupancy rate in

gynecology wards almost throughout the year. Sepsis remains the leading cause of MDs in our study.

Hemorrhage especially during postpartum is sudden, unpredictable, and is more dangerous when woman has preexisting anemia. Globally 25% of all MDs are due to hemorrhage². Other studies show variation between 9.72 and 27.5%. In our study the rate of hemorrhage deaths was 12.31%. Year-wise analysis revealed a significant decrease in deaths due to hemorrhage from 20.45% in 2003 to 5% in 2006. It could be due to liberal use of blood and component transfusions, vigorous fluid replacement, and follow-up with advanced investigative facilities.

Eclampsia and PIH account for 13% of MDs globally². Other studies reveal a large variation in eclampsia deaths between 50.56%⁵ and 16.3%¹⁰. Our study had eclampsia deaths of 18%. Year-wise analysis revealed that percentage deaths in 2003 was 9.09% (presumably underdocumented), while in later years it showed insignificant decline from 18.18% in 2004 to 15% in 2006. Active use of MgSO₄ regimen, better monitoring and investigative facilities, and vigorous management techniques have failed to bring a significant decrease in eclampsia deaths. Thromboembolism deaths during the study period ranged from 3% in 2003-2005 to no deaths in 2004-2006.

Globally indirect obstetrics causes account for 20% of all MDs particularly from anemia, malaria, HIV, CVS disease, etc. Other studies show this range between 17.2%⁷ and 40%¹⁰. In our study it was 40% and included deaths due to hepatitis 13.84%, anemia 13.0%, respiratory diseases 8.46%, heart diseases 1.54%, surgical cause 1.54%, CNS disease 0.77%, and enteric fever 0.77%.

Other studies show anemia deaths range from 4.8 to 27.27%, while in our study it was 13% (Table 5). The percentage of deaths due to anemia is a grossly underestimated figure because pre-existing anemia is a major contributory factor of direct obstetrical deaths due to PPH and sepsis. A significant finding of our study was the high mortality noted in cases of pregnancy complicated by hepatitis (13.84%). It is even marginally higher than anemia deaths (13%). Viral hepatitis is endemic in Delhi. In these cases the cause of death was hepatic failure and encephalopathy and/or coagulation failure. The corresponding rates from other studies are 1.84-14.8%. Unrelated causes constitute 4.61% of all MDs.

Deaths due to anemia and sepsis along with hemorrhage, DIC, anesthesia difficulties/complications, and non-availability of ICU bed are considered potentially preventable causes and accounted for 25.38% (33/130) of all deaths.

Conclusion

The classical triad of causes of maternal mortality in our study remained sepsis, eclampsia, and hemorrhage, in the same order. According to the WHO report (2005) "make every mother and child count" hemorrhage is the leading cause of death. Sepsis and hemorrhage deaths are considered one of the potentially preventable causes of MDs.

The present study highlights the importance of early antenatal registration of all pregnancies and regular follow-up of cases by trained staff. Poor nutritional status, lack of antenatal care, unawareness of warning signs of pregnancy, unsupervised/dai-handled deliveries, social bias toward blood donation, and late referrals are the major contributory factors leading to poor maternal prognosis.

The lessons learnt through review of records of MDs have helped us to identify the high-risk group, solely for the purpose of improving service-delivery system by ascertaining the cause of death, reason(s) for inability to provide appropriate care at appropriate time, and finding the key interventions at service-delivery level to prevent similar deaths. There should be active management of high-risk group by frequent ANC visits, direct consultant supervision, liberal use of CTG, color Doppler study, biochemical markers, fluid and component transfusions, aggressive management of infection, and closer

monitoring of women in labor. Vigorous mass campaign for community-based maternal education program should be the top priority of all maternal and child health programs.

References

1. Maternal death. http://en.wikipedia.org/wiki/maternal_death.
2. Maternal mortality. <http://www.icm.tn.gov.in/intersession/Matnal.htm>.
3. Ronsmans C, Graham WJ. Maternal mortality: who, when, where, and why. *Lancet* 2006; 368 (9542): 1189-200.
4. Matthews Mathai. Reviewing maternal deaths and complications to make pregnancy and childbirth safer. *Regional Health Forum WHO South-East Asia Region* 2005; 9 (1).
5. Pal Amitava, Prasanta R, Samir H, Mondal TK. Review of changing trends in maternal mortality in a rural medical college in West Bengal. *J Obstet Gynecol Ind.* 2005; 55 (6): 521-4.
6. Khosla AH, Dahiya K, Sangwan K. Maternal mortality and 'near miss' in rural north India. *Int J Gynaecol Obstet.* 2000 Feb; 68 (2): 163-4.
7. Bichli L, Razvi NA. Maternal mortality (an analytical study). *J Obstet Gynecol Ind.* 1995; 45: 901-905.
8. Kulkarni S, Athani S, Seetaram S. Maternal mortality of Head Quarter hospital, Bellary. *J Obstet Gynaecol Ind.* 1996; 46 (4): 492-6.
9. Sharma S. A study of maternal mortality in a rural medical college hospital. *J Obstet Gynecol Ind.* 1994; 44: 548-51.
10. Salhan S, Sharma M, Suri J. Maternal mortality in a tertiary hospital. *JOSH* 2000; 7: 78-79.