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Original Research Article

Medico-Legal Audit of Contributory and Potentially Avoidable Factors in Maternal Deaths Brought for Autopsy at a Tertiary Care Centre

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Abstract

Background: Maternal death is an important medico-legal event because it may involve questions related to cause of death, treatment received, referral, delay, preventability and possible negligence. Apart from establishing the final cause of death, medico-legal autopsy, when interpreted along with hospital records and inquest papers, helps in identifying contributory and potentially avoidable factors.

Materials and Methods: This autopsy-based prospective cross-sectional study was conducted at VDGMCH Latur over a period of two years from July 2015 to June 2017. All maternal deaths brought for medico-legal autopsy and fulfilling the inclusion criteria were included. Data were collected from post-mortem reports, police inquest papers, hospital records, death summaries, antenatal records, investigation reports and relevant ancillary reports.

Results: A total of 64 maternal deaths were included. During the same period, there were 17,271 live births, giving an institutional maternal mortality ratio of 370.56 per 100,000 live births. Maternal autopsies constituted 9.54% of total female autopsies and 13.53% of autopsies among females of reproductive age group. Most deaths occurred among women aged 21-25 years (50.00%), rural residents (67.19%), women from socioeconomic class V (56.25%), wage labourers (45.31%) and illiterate women (43.75%). Although 76.56% were antenatally registered, 26.56% had no antenatal visit. Nearly half of the deaths occurred within 24 hours of hospitalization. Most deaths occurred in the postnatal period (71.88%). Direct obstetric causes accounted for 73.43% of deaths, with haemorrhage being the leading cause (28.12%), followed by pre-eclampsia/eclampsia (18.75%) and sepsis (12.50%).

Conclusion: Maternal deaths in the present study were commonly associated with young age, rural residence, lower socioeconomic status, poor education, inadequate antenatal care, early death after hospitalization, postnatal period, anaemia, eclampsia and direct obstetric causes. Many deaths were associated with potentially avoidable factors such as inadequate antenatal risk detection, anaemia, haemorrhage, hypertensive disorders, sepsis, unsafe abortion and delayed definitive care. Medico-legal autopsy, supported by clinical records and inquest papers, is valuable in maternal death review.

Keywords: Maternal death, medico-legal autopsy, contributory factors, avoidable factors, forensic medicine, antenatal care, maternal death review.

Introduction

Maternal death is one of the most serious events in medical practice and has important medical, social and medico-legal implications. Although pregnancy and childbirth are physiological processes, they may be complicated by haemorrhage, hypertensive disorders of pregnancy, sepsis, unsafe abortion, anaemia and other medical disorders. Maternal mortality reflects not only the health status of women, but also the effectiveness of antenatal care, referral services, emergency obstetric care and health-care delivery.

Globally, the maternal mortality ratio declined from 385 per 100,000 live births in 1990 to 216 per 100,000 live births in 2015. However, developing regions continued to contribute nearly 99% of global maternal deaths, and India contributed substantially to this global burden. [1] In the Indian context, haemorrhage, sepsis, hypertensive disorders, unsafe abortion, obstructed labour and

indirect medical causes remain important contributors to maternal deaths. [2]

Maternal death is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental or incidental causes. [3] Maternal deaths are commonly classified into direct and indirect causes. Direct maternal deaths result from obstetric complications of pregnancy, labour or puerperium, or from interventions, omissions or incorrect treatment. Indirect maternal deaths result from pre-existing diseases or diseases that develop during pregnancy and are aggravated by the physiological effects of pregnancy. [3]

From the Forensic Medicine point of view, maternal death has special importance because such deaths may raise questions regarding cause of death, sequence of events, treatment received, referral, delay, avoidability and negligence. The medico-legal study of death forms an important component of forensic thanatology, and determination of cause and mechanism of death requires careful examination of history, records and post-mortem findings. [4]

Maternal death evaluation should not be limited only to assigning the final cause of death. It should also examine the circumstances and contributory factors that led to death. These may include young age, rural residence, low socioeconomic status, illiteracy, anaemia, inadequate antenatal care, delayed care-seeking, delayed referral, inadequate transport, late arrival at tertiary care centre, postpartum complications and lack of timely definitive treatment. Ganatra et al. emphasized that maternal deaths may occur because care is too far, too little and too late. [5] Iyengar et al. also highlighted the role of care-seeking, access to care and delays in pregnancy-related deaths. [6]

Facility-based maternal death review is important for identifying avoidable factors and gaps in the health system. Bangal et al. reported that delay in decision-making, delay in reaching care and delay in receiving care were important background contributors in maternal deaths. [7] Community and health-system factors such as antenatal care, skilled attendance, emergency transport and access to comprehensive obstetric care are important in reducing maternal mortality. [8,9]

Autopsy-based studies are especially useful in Forensic Medicine because they provide objective evidence regarding cause of death and allow correlation with clinical records, treatment history and inquest documents. Panchabhai et al. and Dinyain et al. emphasized the role of autopsy in maternal death evaluation and in identifying true causes of death. [10,11] The present study was undertaken to evaluate the medico-legal profile, contributory factors and potentially avoidable factors in maternal deaths brought for autopsy at a tertiary care centre.

Aim And Objectives

Aim: To evaluate the medico-legal profile, contributory factors and potentially avoidable factors in maternal deaths brought for autopsy at a tertiary care centre.

OBJECTIVES

1. To study the sociodemographic profile of maternal deaths brought for medico-legal autopsy.
2. To assess antenatal care, treatment pathway and hospital stay-related factors among maternal deaths.
3. To study delivery circumstances, pregnancy outcome, parity and period of death in maternal death cases.
4. To identify important contributory factors associated with maternal deaths.
5. To identify potentially avoidable factors based on post-mortem records, hospital records and inquest documents.

Materials and Methods

The present study was an autopsy-based prospective cross-sectional study conducted in the Department of Forensic Medicine and Toxicology at a tertiary care centre.

Study Period: The study was conducted over a period of two years from July 2015 to June 2017.

Study Population: All cases of maternal deaths brought to the mortuary of VDGMCH Latur for medico-legal autopsy during the study period were considered for inclusion.

Inclusion Criteria: All cases of maternal death brought for medico-legal autopsy were included. Maternal death was defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, from any cause related to or aggravated by pregnancy or its management, but not from accidental or incidental causes.

Exclusion Criteria: Deaths due to unnatural causes such as suicide, homicide, accident and burns were excluded. Decomposed bodies and deaths not fulfilling the definition of maternal death

were also excluded.

Data Collection: Data were collected from post-mortem reports, inquest papers, police documents, hospital case papers, death summaries, antenatal records, investigation reports, histopathology reports, chemical analysis reports and microbiology reports wherever available. History was also obtained from relatives and investigating officers.

Study Variables: The variables studied included age, religion, residence, socioeconomic class, occupation, education, family type, antenatal registration, antenatal visits, primary treatment, type of treatment facility, hospital stay, place of delivery, mode of delivery, delivery/intervention conducted by, pregnancy outcome, parity/gravida, pregnancy status at death, past medical history and cause of death.

Contributory and potentially avoidable factors were assessed from documented variables such as lack of antenatal visit, rural residence, lower socioeconomic class, illiteracy, death within 24 hours of hospitalization, anaemia, eclampsia, postnatal period, haemorrhage, sepsis and unsafe abortion. Formal delay classification was not available in every case; therefore, avoidability was interpreted cautiously from documented clinical, autopsy and treatment-related information.

Statistical Analysis

Data were compiled and analysed using Microsoft Excel and SPSS software. Results were expressed as frequencies and percentages.

Results

During the study period, 69 maternal deaths were recorded. Out of these, 64 cases fulfilled the inclusion criteria and were included in the study. Five cases were excluded, including two poisoning cases, two decomposed bodies and one late pregnancy-related death due to post-tubectomy aortic injury. During the same period, there were 17,271 live births, giving an institutional maternal mortality ratio of 370.56 per 100,000 live births.

Maternal autopsies constituted 9.54% of total female autopsies and 13.53% of autopsies among females of reproductive age group. Routine maternal deaths formed the majority, followed by undelivered cases and abortion-related deaths. (Table 1)

The maximum number of maternal deaths occurred in the age group of 21-25 years, followed by 16-20 years and 26-30 years. Most deaths were observed among Hindu women, followed by Buddhist and Muslim women. The majority of cases belonged to rural areas and nuclear families. (Table 2)

Most maternal deaths occurred among women from lower socioeconomic classes, particularly class V and class IV. Occupation-wise, the maximum deaths were seen among wage labourers, followed by farmers and women doing household work. Educationally, illiterate women formed the largest group, followed by women educated up to primary level. (Table 3)

Antenatal registration was present in most cases; however, more than one-fourth of the mothers had not attended any antenatal visit. Among those who had antenatal care, the highest proportion had more than three antenatal visits. Most cases had received primary treatment, and the majority had received specialty care before death. (Table 4)

Regarding hospital stay, the highest proportion of deaths occurred between 6 and 24 hours of hospitalization. Nearly half of the deaths occurred within 24 hours of hospitalization. (Table 5)

Most deliveries occurred at tertiary health centres, while a considerable proportion of women remained undelivered or unintervened. Vaginal delivery was the most common mode of delivery, followed by caesarean section and undelivered status. Most deliveries or interventions were carried out by doctors. Live birth was the most common pregnancy outcome, followed by undelivered/IUD cases. (Table 6)

Primigravida/primipara women contributed the highest proportion of maternal deaths. Most deaths occurred in the postnatal period. Anaemia and eclampsia were the most common associated medical histories among the deceased mothers. (Table 7)

Direct causes accounted for nearly three-fourths of maternal deaths, while indirect causes accounted for the remaining deaths. Haemorrhage was the leading cause of death, followed by pre-eclampsia/eclampsia, sepsis and unsafe abortion. Among indirect causes, anaemia and other medical causes were important contributors. (Table 8)

Important contributory and potentially avoidable factors identified from the available records included rural residence, low socioeconomic status, illiteracy, no antenatal visit, death within 24 hours of hospitalization, postnatal period, anaemia,

eclampsia, haemorrhage, sepsis and unsafe abortion. (Table 9)

Table 1: Burden and type of maternal deaths

Variable	Category	Count	Percentage
Female autopsies	Total female autopsies	671	100.00
	Autopsies of females aged 15-49 years	473	70.46
	Maternal autopsies	64	9.54 among total female autopsies; 13.53 among reproductive-age female autopsies
Type of maternal death	Routine maternal deaths	42	65.62
	Abortion deaths	4	6.25
	Undelivered	18	28.13

Table 2: Age and basic sociodemographic profile of maternal deaths

Variable	Category	Count	Percentage
Age group	16-20 years	14	21.78
	21-25 years	32	50.00
	26-30 years	13	20.31
	31-35 years	2	3.13
	36-40 years	1	1.56
	41-45 years	1	1.56
	>45 years	1	1.56
Religion	Hindu	31	48.43
	Muslim	14	21.88
	Buddhist	18	28.12
	Christian	1	1.57
Residence	Rural	43	67.19
	Urban	21	32.81
Family type	Nuclear	41	64.06
	Joint	23	35.94

Table 3: Socioeconomic, occupational and educational vulnerability profile

Variable	Category	Count	Percentage
Socioeconomic class	Class I	0	0.00
	Class II	1	1.56
	Class III	6	9.38
	Class IV	21	32.81
	Class V	36	56.25
Occupation	Household work	15	23.44
	Farmer	16	25.00
	Wage labourer	29	45.31
	Private company job	3	4.69
	Government job	1	1.56
Education	Illiterate	28	43.75
	Primary	16	25.00
	Secondary	11	17.19
	Higher secondary	5	7.81
	Graduate	3	4.69
	Postgraduate	1	1.56

Table 4: Antenatal care and treatment pathway

Variable	Category	Count	Percentage
Antenatal registration	Registered	49	76.56
	Not registered	15	23.44
Antenatal visits	0	17	26.56
	1	8	12.50
	2-3	11	17.18
	>3	28	43.75
Primary treatment	Received primary treatment	59	92.18
	Not received primary treatment	0	0.00
	Not known	5	7.82
Type of facility/treatment	Only primary care	2	3.13
	Specialty care	56	87.50
	Died within hour	6	9.37
	Not received/Not known	0	0.00

Table 5: Period of survival / hospital stay

Period of survival / hospital stay	Count	Percentage
Nil / brought dead	5	7.82
Within 1 hour	1	1.56
1-6 hours	9	14.06
6-24 hours	21	32.82
1-3 days	11	17.18
3-7 days	10	15.63
7-30 days	7	10.93

More than 1 month	0	0.00
Total	64	100.00

Table 6: Delivery circumstances and pregnancy outcome

Variable	Category	Count	Percentage
Place of delivery	Home	1	1.56
	Government hospital / PHC	2	3.13
	Tertiary health centre	39	60.94
	Private clinic	4	6.25
	Undelivered / unintervened	18	28.12
Mode of delivery	Vaginal	24	37.50
	Caesarean section	18	28.12
	Abortion	4	6.25
	Undelivered	18	28.13
Delivery/ intervention carried out by	Traditional birth attendant	1	1.56
	Lady health worker / Midwife / ANM	2	3.12
	Doctor	43	67.19
	Undelivered / unintervened	18	28.13
Pregnancy outcome	Live birth	36	56.25
	Still birth	6	9.38
	Abortion	4	6.25
	Undelivered / IUDs	18	28.12

Table 7: Obstetric profile and associated medical history

Variable	Category	Count	Percentage
Parity/ gravida	1	33	54.10
	2	16	26.23
	3	9	14.75
	4 and above	3	4.92
Pregnancy status at death	First trimester	1	1.56
	Second trimester	7	10.94
	Third trimester	10	15.62
	Postnatal period	46	71.88
Past medical history	No history	8	12.50
	Eclampsia	21	32.81
	Anaemia	23	35.94
	Tuberculosis	1	1.56
	Suspected H1N1	2	3.12
	AIDS	1	1.56
	Other / not known	8	12.50

Table 8: Cause of death relevant to preventability

Cause of death	Count	Percentage
Direct causes	47	73.43
Haemorrhage	18	28.12
Pre-eclampsia / eclampsia	12	18.75
Sepsis	8	12.50
Unsafe abortion	4	6.25
Other direct causes	5	7.81
Indirect causes	17	26.57
Anaemia	5	7.81
Jaundice	3	4.69
Heart disease	1	1.56
HIV/AIDS	1	1.56
Pulmonary embolism	0	0.00
Other medical causes	7	10.94
Total	64	100.00

Table 9: Documented contributory and potentially avoidable factors

Factor/domain	Documented finding	Count	Percentage
Geographic vulnerability	Rural residence	43	67.19
Socioeconomic vulnerability	Socioeconomic class V	36	56.25
Educational vulnerability	Illiterate deceased women	28	43.75
Occupational vulnerability	Wage labourers	29	45.31
Antenatal care gap	No antenatal visit	17	26.56
Early death after admission	Death within 24 hours of hospitalization	31	48.44
Critical timing	Postnatal period	46	71.88

Medical contributory factor	Anaemia as past medical history	23	35.94
Obstetric contributory factor	Eclampsia as past medical history	21	32.81
Leading direct cause	Haemorrhage	18	28.12
Hypertensive cause	Pre-eclampsia/eclampsia	12	18.75
Infective cause	Sepsis	8	12.50
Preventable direct cause	Unsafe abortion	4	6.25

Discussion

The present medico-legal autopsy-based study included 64 maternal deaths over a period of two years. The institutional maternal mortality ratio was 370.56 per 100,000 live births. This relatively high value may be due to the tertiary referral nature of the hospital, where complicated and critically ill patients are often referred from peripheral facilities. Similar high values have been reported in tertiary care and autopsy-based studies, where referred complicated cases formed a major proportion of maternal deaths. [10-19]

Most maternal deaths occurred in young women, especially in the age group of 21-25 years. Similar findings were reported by Jain and Maharahaje, Verma et al., Kaur et al., Bangal et al., Zaman and Ara, Hazarika et al., Chagalmarai et al. and Sethi et al. [12-19] This indicates that maternal death commonly affects women in the active reproductive period, which increases its social and family impact.

Rural residence, lower socioeconomic class, wage labour occupation and illiteracy were prominent background factors in the present study. These findings are consistent with previous studies that reported higher maternal mortality among rural, poor and less educated women. [12-19] Such factors may not be direct causes of death but act as important contributory conditions by influencing nutrition, anaemia, awareness of danger signs, access to transport, timely referral and utilization of antenatal care.

Antenatal registration was present in 76.56% of cases; however, 26.56% had no antenatal visit. This shows that registration alone is not enough unless effective antenatal care is received. Ganatra et al. reported that lack of antenatal care increased the risk of maternal death, while Iyengar et al. emphasized deficient care-seeking and inadequate antenatal care in pregnancy-related deaths. [5,6] In the present study, anaemia and eclampsia were common associated histories, both of which can often be detected and managed during antenatal care.

Nearly half of the deaths occurred within 24 hours of hospitalization. This suggests that many women reached the tertiary care centre in critical or moribund condition. Early death after admission has also been reported by Jain and Maharahaje, Verma et al., Zaman and Ara, Jadhav et al. and Bangal et al. [12,13,16,20,21] From a medico-legal perspective, such cases require careful evaluation of referral timing, transport, treatment records, condition at admission and sequence of events before death.

Most deaths occurred in the postnatal period. Park has noted that a large proportion of maternal deaths occur during the postpartum period, especially within the first 24 hours. [3] Similar predominance of postpartum deaths has been observed by Purandareet al., Kaur et al., Iyengar et al., Bangal et al. and the MY-HEART Orissa study. [6,14,21-23] This highlights the need for careful postpartum monitoring, especially for haemorrhage, eclampsia, sepsis and anaemia-related deterioration.

Direct obstetric causes accounted for 73.43% of deaths. Haemorrhage was the leading cause, followed by pre-eclampsia/eclampsia and sepsis. Similar predominance of direct causes has been reported in several maternal mortality studies. [10-15,21,24] Haemorrhage, hypertensive disorders and sepsis are important from the viewpoint of avoidability because timely antenatal risk detection, blood transfusion, skilled obstetric care, emergency intervention and postpartum monitoring may reduce mortality.

Unsafe abortion accounted for 6.25% of deaths. Although the proportion was lower than haemorrhage and hypertensive disorders, it remains an important preventable cause. Park includes unsafe abortion among the direct causes of maternal death. [3] The United Nations Human Rights report also emphasized unsafe abortion as a preventable contributor to maternal mortality. [25]

The present study shows that medico-legal autopsy has value beyond determining the final medical cause of death. It assists in reconstructing the circumstances of death by correlating autopsy findings with hospital records, inquest papers, treatment history and clinical course. The important contributory and potentially avoidable factors observed in the present study were rural background, low socioeconomic status, illiteracy, inadequate antenatal care, anaemia, hypertensive disorders, early death after hospitalization, postnatal period, haemorrhage, sepsis and unsafe abortion.

Conclusion

Maternal deaths in the present study were commonly associated with young reproductive age, rural residence, lower socioeconomic status, poor educational status, inadequate antenatal care and early death after hospitalization. Most deaths occurred in the postnatal period. Anaemia and eclampsia were important associated conditions.

Direct obstetric causes, especially haemorrhage, pre-eclampsia/eclampsia and sepsis, were the major causes of death. These findings suggest that many deaths were associated with potentially avoidable factors such as inadequate antenatal risk detection, anaemia, delay in referral, delayed definitive care, postpartum complications and preventable direct obstetric causes. Medico-legal autopsy, along with treatment records and inquest documents, is valuable for identifying contributory and avoidable factors in maternal deaths.

Limitations

The present study was conducted at a single tertiary care centre; therefore, the findings may not represent the true community-level pattern of maternal deaths.Only cases brought for medico-legal autopsy and fulfilling the inclusion criteria were included, so maternal deaths not subjected to autopsy were not represented.Some information depended on hospital records, inquest papers and history from relatives or investigating officers; therefore, incomplete documentation may have affected some variables.As the study was autopsy-based, it mainly describes contributory and potentially avoidable factors among maternal deaths and cannot establish population-level risk factors.

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