Section: Forensic Medicine

Original Research Article

AUTOPSY-BASED STUDY OF PATHOLOGICAL FINDINGS IN MATERNAL DEATHS AT A TERTIARY CARE CENTRE

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Received : 10/01/2025
Received in revised form : 19/02/2025
Accepted : 05/03/2025

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DOI: 10.70034/ijmedph.2025.1.375

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (1); 2005-2011

ABSTRACT

Background: Maternal death is an important medico-legal and public health event. Autopsy helps in establishing the exact cause of death, documenting pathological findings and assisting in maternal death review. The aim is to study the causes of death and pathological findings in maternal deaths brought for medico-legal autopsy at a tertiary care centre.
Materials and Methods: The present autopsy-based prospective cross-sectional study was conducted in the Department of Forensic Medicine and Toxicology at a 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, histopathology reports and relevant laboratory reports. Data were analysed using frequencies and percentages.
Results: A total of 64 maternal deaths were included. Maternal autopsies constituted 9.54% of total female autopsies and 13.53% of autopsies among females of reproductive age group. The majority of deaths occurred in the age group of 21-25 years (50.00%), among rural residents (67.19%), women from socioeconomic class V (56.25%), wage labourers (45.31%) and illiterate women (43.75%). Most deaths occurred in the postnatal period (71.88%). Direct causes accounted for 73.43% of deaths and indirect causes for 26.57%. Haemorrhage was the leading cause of death (28.12%), followed by pre-eclampsia/eclampsia (18.75%), sepsis (12.50%) and unsafe abortion (6.25%). Organ involvement was most commonly seen in kidneys and adrenal glands (56.25%), followed by liver (50.00%), lungs (42.18%) and multi-organ involvement (42.18%).
Conclusion: Direct obstetric causes, particularly haemorrhage, hypertensive disorders and sepsis, were the major causes of maternal deaths. Medico-legal autopsy remains essential for accurate cause-of-death certification, documentation of pathological organ involvement and strengthening maternal death review.
Keywords: Maternal death, autopsy, forensic medicine, haemorrhage, eclampsia, sepsis, histopathology.

INTRODUCTION

Maternal death is one of the most tragic and preventable events in medical practice. Pregnancy and childbirth are physiological processes, but they may be complicated by life-threatening conditions such as 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 quality of antenatal care, emergency obstetric care, referral system 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. India also contributed substantially to the global burden of maternal mortality.[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 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 medico-legal questions regarding cause of death, sequence of events, treatment received, delay, negligence, avoidability and responsibility. The medico-legal study of death forms an important component of forensic thanatology and determination of the cause and mechanism of death is one of the essential functions of the forensic expert.[4]

Autopsy provides valuable information regarding the pathological changes in various organs and helps in accurate death certification. Maternal autopsies are especially useful for identifying causes such as haemorrhage, eclampsia, sepsis, disseminated intravascular coagulation, hepatic injury, renal pathology, pulmonary changes, cardiac lesions and uterine abnormalities. Panchabhai et al. emphasized that autopsy is an important tool in maternal mortality evaluation from a tertiary health-care perspective.[5] Dinyain et al. also reported that autopsy-certified maternal mortality studies help in identifying the true pattern of direct and indirect causes of maternal deaths and may reveal discrepancies between clinical and autopsy diagnoses.[6]

Socioeconomic status is also an important background factor in maternal deaths. In the present study, socioeconomic classification was done according to the modified B. G. Prasad classification used during the study period.[7] The present study was therefore undertaken to analyse maternal deaths brought for medico-legal autopsy at a tertiary care centre, with special emphasis on cause of death, uterine findings, organ involvement and pathological findings.

Aim: To study the causes of death and pathological findings in maternal deaths brought for medico-legal autopsy at a tertiary care centre.

Objectives

1. To study the burden of maternal deaths among female autopsies.
2. To study the sociodemographic profile of maternal deaths brought for medico-legal autopsy.
3. To determine the direct and indirect causes of maternal deaths.
4. To study gross autopsy findings, especially uterine and adnexal findings.
5. To study organ-wise autopsy and histopathological involvement.
6. To study organ involvement in cases of hypertensive disorders of pregnancy.

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 VDGMCH, Latur.

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 the tertiary care centre 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.[3]

Exclusion Criteria

1. Deaths due to unnatural causes such as suicide, homicide, accident and burns.
2. Decomposed bodies.
3. Deaths not fulfilling the definition of maternal death.

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.

A detailed external and internal post-mortem examination was performed. Special attention was given to the uterus, cervix, vagina, adnexa, lungs, heart, liver, spleen, kidneys, adrenal glands, brain and pituitary gland. Organs were preserved in 10% formalin for histopathological examination wherever required. Viscera and other samples were preserved for chemical analysis or microbiological examination wherever indicated. Final cause of death was determined after correlation of history, hospital records, autopsy findings and ancillary reports.

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 a cumulative 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. Among the included cases, routine maternal deaths constituted 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. This shows that most maternal deaths occurred among young women in the reproductive age group. [Table 2]

In relation to sociodemographic profile, most maternal deaths were observed among Hindu women, followed by Buddhist and Muslim women. The majority of cases belonged to rural areas and nuclear families [Table 3]. 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 4]

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 [Table 5]. Regarding hospital stay and treatment-related profile, nearly half of the maternal deaths occurred within 24 hours of hospitalization. Most cases had received primary treatment, and the majority had received specialty care before death [Table 6]. 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. Live birth was the most common pregnancy outcome, followed by undelivered/IUD cases. [Table 7]

In relation to obstetric profile, 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 8]. On autopsy examination of the uterus, most cases showed normal uterine findings. Among abnormal findings, Couvelaire uterus was the most common, followed by sepsis, uterine injuries, rupture uterus, inversion uterus and unicornuate uterus. In some cases, the uterus was absent for examination due to operative procedures. [Table 9]

Organ-wise autopsy and histopathological findings showed that kidneys and adrenal glands were the most commonly involved organs, followed by liver, lungs, heart, uterus and adnexa. Multi-organ involvement was also observed in a substantial proportion of cases. [Table 10] Among deaths due to hypertensive disorders of pregnancy, liver involvement was the most common organ pathology, followed by kidney involvement, lung involvement and multi-organ involvement [Table 11]. 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 12]

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-wise distribution of maternal deaths

Age group	Count	Percentage
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
Total	64	100.00

Table 3: Sociodemographic profile of maternal deaths

Variable	Category	Count	Percentage
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 4: Socioeconomic status, occupation and education of deceased

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	24.44
	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 5: Antenatal registration and antenatal visits

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	43.76

Table 6: Hospital stay and treatment-related profile

Variable	Category	Count	Percentage
Period of survival / hospital stay	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
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 7: Delivery profile 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
Pregnancy outcome	Live birth	36	56.25
	Still birth	6	9.38
	Abortion	4	6.25
	Undelivered / IUDs	18	28.12

Table 8: Obstetric profile and past 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	35.45
	Tuberculosis	1	1.56
	Suspected H1N1	2	3.12
	AIDS	1	1.56
	Other / not known	8	12.50

Table 9: Autopsy findings of uterus

Uterine finding	Count	Percentage
Normal	39	60.93
Sepsis	4	6.25
Couvelaire uterus	6	9.38
Unicornuate uterus	1	1.56
Rupture uterus	2	3.12
Inversion uterus	1	1.56
Injuries	4	6.25
Absent for examination	7	10.95
Total	64	100.00

Table 10: Organ involvement on autopsy and histopathology

Organ involved	Count	Percentage
Brain and pituitary gland	14	21.88
Heart	25	39.06
Lungs	27	42.18
Liver	32	50.00
Spleen	18	28.13
Kidneys and adrenal glands	36	56.25
Uterus and adnexa	25	39.06
Multi-organ involvement	27	42.18

Table 11: Organ involvement in hypertensive disorders of pregnancy

Organ involved	Count	Percentage
Brain and pituitary gland	9	42.85
Heart	12	57.14
Lungs	13	61.90
Liver	19	90.47
Spleen	5	23.80
Kidneys	16	76.19
Adrenal glands	5	23.80
Multi-organ involvement	13	61.90

Table 12: Cause of death

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	10.92
Total	64	100.00

DISCUSSION

The present autopsy-based study included 64 maternal deaths over a period of two years. The cumulative 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 cases are commonly referred. Similar high mortality ratios have been reported in tertiary care and autopsy-based studies by Panchabhai et al. and Dinyain et al.[5,6]

In the present study, maternal autopsies constituted 9.54% of all female autopsies and 13.53% of autopsies among reproductive-age females. This highlights the medico-legal importance of maternal death autopsy. Autopsy helps in confirming the cause of death, identifying pathological organ involvement and detecting discrepancies between clinical and post-mortem diagnosis. Panchabhai et al. and Dinyain et al. also emphasized the value of autopsy in maternal death evaluation.[5,6]

Most deaths occurred in the age group of 21-25 years, followed by 16-20 years. This shows concentration of maternal mortality in young reproductive-age women. 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., where most maternal deaths occurred in younger age groups.[8-15]

The majority of deaths were among rural women, women from lower socioeconomic class, wage labourers and illiterate women. These findings are comparable with earlier studies, which reported higher maternal mortality among rural, poor and less educated women.[8-15] These factors may contribute indirectly through poor nutrition, anaemia, delayed health-seeking, transport difficulty and poor utilization of antenatal care.

Although 76.56% of mothers were antenatally registered, 26.56% had no antenatal visit and only 43.76% had more than three visits. This suggests that registration alone is insufficient unless quality antenatal care is provided. Ganatra et al. and Iyengar et al. reported that lack of adequate antenatal care and delayed care-seeking were important contributors to maternal mortality.[16,17]

Nearly half of the deaths occurred within 24 hours of hospitalization, indicating that many women reached the tertiary care centre in a critical condition. Similar early deaths after admission were reported by Jain and Maharahaje, Verma et al., Zaman and Ara, Jadhav et al. and Bangal et al.[8,9,12,18,19] This may reflect delayed decision-making, delayed transport, delayed referral or late arrival after irreversible complications.

Most deaths occurred in the postnatal period, accounting for 71.88% of cases. Park has noted that a large proportion of maternal deaths occur in the postpartum period, especially within the first 24 hours.[3] Similar predominance of postpartum deaths was reported by Purandare et al., Kaur et al., Iyengar et al., Bangal et al. and the MY-HEART Orissa study.[10,17,18,20,21] The postpartum period is particularly dangerous because of postpartum haemorrhage, sepsis, eclampsia, embolic complications and anaemia-related decompensation.

Anaemia and eclampsia were the most common associated medical histories. Anaemia was present in 35.45% of cases and eclampsia in 32.81%. Similar importance of anaemia and hypertensive disorders has been reported in previous studies.[10,12,13,18-20] Anaemia lowers maternal physiological reserve and increases the risk of fatal outcome from haemorrhage, sepsis and cardiac failure.

On autopsy, Couvelaire uterus was the most common abnormal uterine finding. Other findings included sepsis, uterine injuries, rupture uterus and inversion uterus. Organ-wise involvement was most commonly seen in kidneys and adrenal glands, followed by liver, lungs and multi-organ involvement. Among hypertensive disorder-related deaths, liver and kidney involvement were predominant. These findings are consistent with autopsy-based observations by Panchabhai et al. and Dinyain et al., where significant organ pathology was documented in maternal deaths.[5,6]

Direct causes contributed 73.43% of maternal deaths, while indirect causes contributed 26.57%. Haemorrhage was the leading cause, followed by pre-eclampsia/eclampsia, sepsis and unsafe abortion. Similar predominance of direct causes has been reported in several maternal mortality studies.[5,6,8-10,14,18,22] Haemorrhage can rapidly lead to shock, disseminated intravascular coagulation and multi-organ failure, especially in anaemic mothers. Hypertensive disorders remain important preventable causes when detected early through regular antenatal care. Sepsis and unsafe abortion also remain important causes because they are largely preventable with timely and appropriate care.

The present study confirms the importance of medico-legal autopsy in maternal death evaluation. Autopsy not only establishes the cause of death but also documents pathological changes and assists in maternal death review. The findings indicate that many maternal deaths were due to potentially preventable causes such as haemorrhage, hypertensive disorders, sepsis and anaemia.

CONCLUSION

Direct obstetric causes, particularly haemorrhage, pre-eclampsia/eclampsia and sepsis, were the major causes of maternal deaths in the present study. Most deaths occurred among young women, rural residents, women from lower socioeconomic class and women in the postnatal period. Anaemia was an important associated and indirect contributor. Autopsy revealed significant uterine and multi-organ pathology, especially renal, hepatic, pulmonary and uterine involvement. In hypertensive disorders of pregnancy, liver and kidney involvement were

prominent. Medico-legal autopsy is therefore an essential tool for accurate cause-of-death certification, documentation of pathological organ changes, confirmation or modification of clinical diagnosis and strengthening of maternal death review.

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. The sample size was limited to 64 cases. Some information depended on hospital records, inquest papers and history from relatives or investigating officers; therefore, incomplete documentation may have affected some variables. Histopathology, chemical analysis and microbiological reports were available only where indicated or preserved, so complete ancillary investigation correlation was not possible in all cases. As the study was autopsy-based, it mainly describes causes and pathological findings and cannot establish population-level risk factors.

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