

Original Research Article

Clinicopathological and histopathological spectrum of hysterectomy specimens in autopsy

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ABSTRACT

Background: This study evaluated the clinicopathological and histopathological spectrum of hysterectomy specimens at autopsy remains the gold standard for identifying the precise cause of death.

Methods: A retrospective observational study of 28 autopsy hysterectomy cases was conducted between 2024- 2026 (2.5 years) at SMIMER Medical College, Surat, Gujarat. Demographic profiles, obstetric characteristics, and histopathological findings were analyzed using descriptive statistics.

Results: The median age was 31.5 years, with 60.7% (n=17) aged >30 years. Maternal deaths accounted for 67.9% (n=19), while 32.1% (n=9) were non-gestational fatalities. Of the maternal deaths, 42.1% (n=8) collapsed antepartum while undelivered. Direct obstetric causes caused 63.2% (n=12) of maternal deaths, primarily driven by obstetric hemorrhage and morbid placental adherence (17.9%, n=5) and hypertensive disorders (14.3%, n=4). Other causes included spinal anesthesia toxicity (7.1%, n=2), sepsis (3.6%, n=1), indirect medical conditions (connective tissue disease, sickle cell crisis), and non-gestational etiologies (poisoning, cervical malignancy).

Conclusions: Preventable complications, predominantly direct obstetric causes (hemorrhage, preeclampsia) remain leading causes of mortality, particularly in women over 30 years. Microscopic evaluation of hysterectomy specimens is crucial for identifying occult pathology and strengthening maternal death audits.

Keywords: Hysterectomy, Autopsy, Obstetric causes, Histopathology

INTRODUCTION

The epidemiological landscape of maternal and reproductive-age mortality is increasingly complicated by indirect medical co-morbidities as well as non-gestational emergencies.¹⁻⁴ In tertiary referral centers, this complexity is further magnified by high rates of late presentation and referral delays from peripheral or primary maternity facilities, often resulting in patients arriving in irreversible moribund states.^{5,6}

Autopsy examinations, particularly those incorporating detailed histopathological analysis, remain a gold standard for establishing the accurate cause of death and understanding the pathophysiological mechanisms

underlying maternal mortality.⁷⁻¹⁰ In developing countries, where maternal mortality continues to be a major challenge, autopsy-based studies contribute significantly to maternal mortality audits, identify system failures, and guide targeted interventions for improving outcomes.^{5,7,11,12} Histopathological examination provides essential insights into tissue-level changes, vital reactions, and subtle pathological phenomena that cannot be reliably detected through gross examination alone.¹³⁻¹⁵

Autopsy findings not only validate or refute clinical diagnoses but also uncover silent pathology-such as morbid placental adherence (placenta accreta spectrum), subtle uterine segment infarction, anesthetic neurotoxicity, and concealed multi-organ failure.^{13,14,16,17}

Therefore, this study was conducted to analyze the demographic profile, referral dynamics, and detailed histopathological spectrum of 28 female autopsy cases referred over a three-year period (2024-2026) at a tertiary care center, elucidating both direct/indirect obstetric fatalities and non-gestational mortalities in women of reproductive age.

METHODS

A total of 28 hysterectomy specimens received in autopsy section referred for postmortem and histopathological evaluation over a three-year period (2024-2026) were analyzed at Surat Municipal Institute of Medical Education and Research (SMIMER).

Study characteristics

This was a retrospective descriptive analysis of female autopsy cases referred for postmortem and histopathological evaluation over a three-year study period (2024-2026) at a tertiary care medical center. The study cohort comprised reproductive-age females presenting with both obstetric and non-obstetric mortalities.

Inclusion criteria

Cases in which hysterectomy specimen received in autopsy for gross and histopathological examination were included in the study.

Exclusion criteria

Decomposed or autolyzed bodies where histopathological evaluation was non-contributory or inconclusive. Cases in which hysterectomy specimen not received were excluded from the study.

Data collection

This was a retrospective observational study carried out in the Autopsy section of the department of pathology, SMIMER medical college, Surat, Gujarat, India from 2024 to 2026.

All autopsies with hysterectomy specimen were performed according to standard medico-legal protocols. Specimens for histopathological examination were preserved where indicated.

The probable cause of death was established based on the correlation of clinical and postmortem findings and histopathological examination

A structured data abstraction proforma was used to record relevant variables, including demographic characteristics (age, gender, status-rural/urban) and obstetric profile (gestational age or postpartum period, mode of delivery, place of death, and the referral status), and the causes of death.

Data analysis

The collected data were entered into Microsoft excel (Microsoft Corporation, Redmond, WA, USA) and analyzed using descriptive statistics. Results were expressed as frequencies and percentages and presented using tables and graphical representations.

Underlying causes of death were systematically documented and categorized based on histopathological findings and clinical context.

RESULTS

A total of 28 hysterectomy specimens received in autopsy section referred for postmortem and histopathological evaluation over a three-year period (2024-2026) were analyzed.

Age-distribution

The age of the deceased ranged from 19 to 46 years, with a median age of 31.5 years. Categorizing cases according to standard reproductive age brackets demonstrated that, only one case (3.6%) was observed in a patient younger than 20 years followed by the 20-30-year age group (n=10, 35.7%) and the majority of deaths occurred in women aged >30 years (n=17, 60.7%).

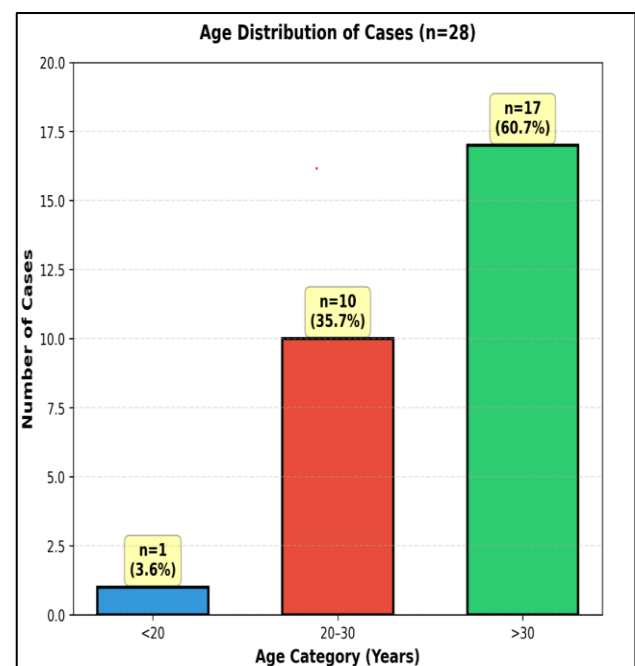


Figure 1: Age distribution of cases, (n=28).

Gestational age and timing of death

Among the 28 cases, 19 deaths (67.9%) were maternal deaths occurring during pregnancy or the postpartum period. The remaining nine cases (32.1%) were non-gestational medical, surgical, toxicological, or

gynecological mortalities occurring in reproductive-age females.

Mode of delivery and obstetric profile

Within the maternal cohort (n=19), eight women (42.1%) remained undelivered at the time of collapse/death. Lower segment cesarean section (LSCS) was performed or actively underway in six cases (31.6%), two cases (10.5%) followed full-term normal vaginal delivery (NVD), and one case (5.3%) occurred in association with medical termination of pregnancy (MTP).

Referral status

Women were referred from peripheral hospitals or private maternity nursing homes to the tertiary care center in a critical or moribund state (n=4, 14.29%). Twenty four patients (85.71%) were admitted as primary cases.

Causes of death and histopathological spectrum

Direct obstetric causes accounted for 63.2% (n=12) of maternal mortalities, while indirect obstetric conditions accounted for 36.8% (n=7).

Table 1: Clinical timing of gestational category.

Clinical timing/state	Gestational category	N	Total, (n=28)
Maternal/ puerperal (n=19)	Pregnant/ postpartum period	19	67.9%
Non-gestational (n=9)	Non-pregnant/ gynecological and systemic	9	32.1%
Total		28	100.0%

Table 2: Mode of delivery.

Mode of delivery / obstetric state	N	Percentage of maternal cohort, (n=19)
Undelivered/ antepartum collapse	8	42.1%
LSCS	6	31.6%
NVD	2	10.5%
Early gestation/ amenorrhea with acute collapse	2	10.5%
Abortion/ MTP-associated	1	5.3%
Total maternal deaths	19	100.0%

Table 3: Parameters of referral status.

Parameters	Category	N	Percentage (%)
Referral status	Transferred/referred from private setups or other hospitals	4	14.29%
	Primary admission/non-referral	24	85.71%

Table 4: Classifications of obstetric state.

Classifications	Underlying clinical cause/ histopathology	N	Percentage of total (n=28)
Direct obstetric	Obstetric hemorrhage/ retained placenta/ placenta percreta/ infarction	5	17.9%
	Hypertensive disorders / severe preeclampsia/ eclampsia	4	14.3%
	Spinal anesthesia toxicity / intraoperative convulsions	2	7.1%
	Puerperal sepsis / acute endometritis	1	3.6%
Indirect obstetric	Autoimmune connective tissue disease (MCTD, AIHA and ILD)	1	3.6%
	Sickle cell crisis in pregnancy	1	3.6%
	Visceral injury/ ruptured bladder	1	3.6%
	Sudden antepartum collapse / intrauterine fetal death	4	14.3%
Non-obstetric/ incidental	Acute toxic ingestion / poisoning	2	7.1%
	Gynecologic malignancy (Invasive cervical squamous cell carcinoma)	1	3.6%
	Perioperative death during hysteroscopy (hypothyroidism / anesthesia)	1	3.6%
	Post-cardiac surgery collapse	1	3.6%
	Post-coital severe haemorrhage in a patient with typhoid fever	1	3.6%
	Non-obstetric systemic pathology	3	10.6%
Total		28	100.0%

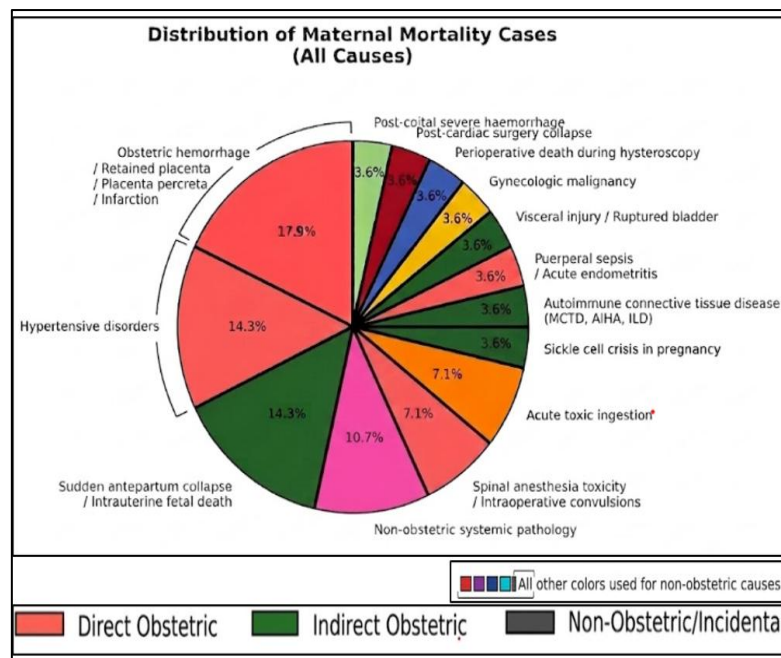


Figure 2: Distribution of maternal mortality cases.

Obstetric hemorrhage and placental pathology

Primary postpartum hemorrhage (PPH) and morbid placental adherence were critical direct contributors. Microscopic evaluation confirmed morbid adherence (placenta percreta), retained placental cotyledons with intrauterine blood clots, lower uterine segment infarction, and placental malperfusion.

Hypertensive disorders of pregnancy and eclampsia

Severe preeclampsia with systemic end-organ involvement and sudden intrapartum eclamptic convulsions accounted for direct fatalities.

Anesthetic and intraoperative complications

Spinal anesthetic systemic toxicity (convulsions following intrathecal bupivacaine administration) occurred during emergency cesarean sections.

Infections and sepsis

Acute endometritis and systemic infectious complications were confirmed upon histopathological sampling.

Indirect maternal causes

Pre-existing medical conditions aggravated during pregnancy included mixed connective tissue disease (MCTD with autoimmune hemolytic anemia and the interstitial lung disease), sickle cell crisis, Ruptured bladder and sudden antepartum intrauterine fetal demises associated with maternal hemodynamic collapse.

Non-obstetric/incidental pathology

Among non-pregnant autopsies, causes comprised chemical poisoning/ingestion of unknown substances (n=2), post-cardiac surgery failure (n=1), invasive cervical squamous cell carcinoma with extensive necrosis (n=1), intraoperative cardiac arrest during diagnostic hysteroscopy for primary infertility (n=1), and post-coital severe hemorrhage in a patient with the typhoid fever (n=1).

DISCUSSION

In this 3-year clinicopathological autopsy audit (2024-2026), 28 female postmortem cases analyzed, comprising 19 maternal deaths (67.9%) and 9 non-gestational mortalities (32.1%). Direct obstetric causes accounted for nearly 2/3rd (63.2%, n=12) of maternal fatalities, with obstetric hemorrhage and hypertensive disorders remaining leading culprits.

These findings align with global surveillance data from developing settings, indicating that preventable direct obstetric complications continue to drive excess maternal mortality despite widespread improvements in institutional delivery coverage.¹⁻⁴ Maternal and reproductive-age mortality remains sensitive barometer of healthcare system efficiency, referral timeliness, and quality of emergency obstetric care (EmOC).^{6,18} Postpartum period is also important interval for maternal mortality and severe morbidity, as documented in systematic review of timing of postpartum complications.¹⁹

Table 5: Comparison of age in different studies.

Age category	Present study 2026 (SMIMER, Surat)	Verma et al ⁵ 2026 (AIIMS Rishikesh)	Gavali et al ⁷ 2024 (BJGMC Pune)	Poflee et al ⁸ 2020 (GMC Nagpur)
Age range (in years)	19-46	20-43	18-38	18-40
<20	3.57%	0.0%	21.67%	4.0%
20-30	35.71%	68.97%	66.67%	87.0%
> 30	60.71%	31.03%	11.66%	9.0%
Total	100.0%	100.0%	100.0%	100.0%

Table 6: Comparison of direct causes of maternal death with other studies.

Direct cause of death	Present study (SMIMER, Surat)	Verma et al ⁵ 2026 (AIIMS Rishikesh)	Gavali et al ⁷ 2024 (BJGMC Pune)	Poflee et al ⁸ 2020 (GMC Nagpur)	Pawar et al ¹⁶ 2025 (GMC Miraj)
Obstetric hemorrhage	41.67%	42.11%	44.12%	28.85%	23.08%
Hypertensive disorders/toxemia of pregnancy	33.33%	21.05%	23.53%	11.53%	20.00%
Puerperal sepsis/ pelvic infection	8.33%	36.84%	17.65%	25.00%	26.15%
Anesthetic and intra-operative complications	16.67%	-	-	-	-
Disseminated intravascular coagulation (DIC)	-	-	5.88%	-	10.76%
Pulmonary thromboembolism	-	-	-	3.85%	9.23%
Abortion-related causes	-	-	2.94%	11.53%	3.08%
Ruptured ectopic pregnancy	-	-	2.94%	1.93%	3.08%
Hepatic diseases of pregnancy (AFLP)	-	-	-	9.62%	1.54%
Other direct causes	-	-	2.94%	7.69%	3.08%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Comparison of age distribution in maternal deaths with other studies

The data compares maternal mortality across age groups between the present study at SMIMER, Surat, and three reference tertiary care studies in India.^{5,7,8}

Shift toward older age in the present study

In comparison studies (Verma et al, Gavali et al and Poflee et al) vast majority of maternal deaths (66.67-87%) occurred in peak reproductive bracket of 20-30 years. In contrast, SMIMER study of distinct shift toward advanced maternal age, with 60.71% of deaths occurring in women over 30 years and only 35.71% in 20-30 age bracket.^{5,7,8}

Hemorrhage as the leading cause

Obstetric hemorrhage was the single largest contributor to direct maternal deaths in the SMIMER cohort (41.67%), closely matching findings from Verma et al (42.11%) and Gavali et al (44.12%), while being notably higher than GMC Nagpur (28.85%) and GMC Miraj (23.08%).^{5,7,8,16}

Elevated burden of hypertensive disorders

Hypertensive disorders/toxemia of pregnancy accounted for 33.33% of direct deaths at SMIMER-the highest proportion reported across all five cohorts (which ranged from 11.53% to 23.53%). Together, hemorrhage and hypertension represented 75.0% of all direct maternal deaths in the present study.^{5,7,8,16}

Lower mortality from puerperal sepsis

Sepsis contributed to only 8.33% of direct deaths at SMIMER, substantially lower than in the reference studies, where infection accounted for roughly a sixth to more than a third of direct deaths (17.65% in Gavali et al up to 36.84% in Verma et al).^{5,7,8,16}

Unique reporting of anesthetic/intraoperative complications

Anesthetic and intraoperative complications accounted for 16.67% of direct maternal deaths in the SMIMER series, a category not reported as an isolated direct cause in any of the four comparison studies.^{5,7,8,16}

Absence of other direct causes

Other recognized etiologies such as early pregnancy complications (abortions, ectopic pregnancies), pulmonary embolism, and acute fatty liver of pregnancy (AFLP) were observed across the reference literature (e.g., abortion causing 11.53% in Poflee et al) but were not identified among the direct deaths in the SMIMER cohort.^{5,7,8,16}

Limitations

Several limitations warrant acknowledgment. The retrospective nature of data collection may introduce incomplete documentation of clinical findings. Autopsy acceptance rates vary across populations due to cultural, religious, and emotional factors, potentially introducing selection bias. Postmortem interval and tissue quality can affect histopathological interpretation. The exclusive focus on tertiary hospital cases may not reflect the cause of death in female in primary and secondary care settings.

However, limitations include the retrospective single-center design, a relatively small sample size (n=28), and the inherent selection bias of a medico-legal autopsy cohort also.

CONCLUSION

This autopsy and clinicopathological study of hysterectomy specimens in autopsy in tertiary care hospitals in India provides comprehensive evidence regarding the true causes, the value of systematic histopathological examination in confirming diagnoses and identifying discrepancies with clinical assessment, and the system-level factors contributing to preventable deaths.

The predominance of deaths in women over 30 years, together with the finding that a large proportion of maternal deaths occurred before delivery, suggests that advanced maternal age and antepartum decompensation constitute an increasingly important. The high frequency of critical referrals, deaths during active resuscitation, and patients brought dead on arrival collectively point to persistent delays in care-seeking, referral, and access to timely emergency obstetric intervention as key modifiable determinants of outcome.

Despite the inherent limitations of a retrospective, single-center design with a modest sample size and the selection bias intrinsic to medico-legal autopsy cohorts, these findings reaffirm the indispensable role of autopsy with histopathological correlation in confirming and refining causes of death, uncovering silent or clinically missed pathology.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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