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PATTERNS OF EMERGENCY SURGERY UTILISATION AND THEIR SOCIO-DEMOGRAPHIC CORRELATES AT MMIMSR, MULLANA, AMBALA

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ABSTRACT

Background

Emergency surgical services form the clinical backbone of any tertiary-care teaching hospital's capacity to manage acute life-threatening conditions. At Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala — a 2,000-bed referral centre serving a largely agrarian and semi-urban population across Haryana's Ambala Division — emergency surgical caseload constitutes a substantial proportion of total operative activity. Despite this, no systematic data existed characterising the patterns, volume, diagnosis spectrum, or socio-demographic determinants of emergency surgical utilisation at this institution. The April–October 2020 study period coincided partly with the COVID-19 pandemic's first and second waves in India, creating a unique opportunity to document emergency surgical patterns under conditions of healthcare disruption.

Objectives

To describe the patterns of emergency surgical utilisation at MMIMSR, Mullana, during April–October 2020; to characterise the socio-demographic profile of emergency surgical patients; and to identify independent predictors of 30-day in-hospital mortality in this cohort.

Methodology

A hospital-based descriptive cross-sectional study using retrospective record review was conducted for all emergency surgical procedures performed at MMIMSR during April–October 2020 (N=842). Data were extracted from surgical registers, anaesthesia records, and patient case files using a validated proforma. Descriptive statistics, chi-square tests, and multivariate binary logistic regression were performed using IBM SPSS v21.0.

Results

A total of 842 emergency surgical procedures were performed over the study period. Monthly volume ranged from 88 (May 2020, during COVID-19 lockdown) to 146 (August 2020). General surgery (31.8%) and orthopaedics (23.3%) contributed the largest caseloads. Acute appendicitis (19.9%), road traffic accidents (18.1%), and intestinal obstruction (11.6%) were the most frequent diagnoses. The cohort was predominantly rural (72.9%), male (57.7%), and of lower socioeconomic class (59.4% Class IV–V). Overall 30-day mortality was 4.6%. Independent predictors of mortality included ASA

grade IV–V (adjusted OR 6.84), delayed presentation > 24 hours (adjusted OR 4.22), hollow viscus perforation (adjusted OR 4.86), and multiple comorbidities (adjusted OR 3.88).

Conclusion

Emergency surgical utilisation at MMIMSR, Mullana, disproportionately affects rural, economically disadvantaged, and socially marginalised populations. The 4.6% 30-day mortality is principally driven by delayed presentation, advanced ASA grade, and disease severity at arrival — all amenable to systemic intervention through community-level emergency awareness, improved pre-hospital care pathways, and structured triage protocols at MMIMSR.

Keywords

Emergency surgery; utilisation patterns; socio-demographic correlates; MMIMSR Mullana; rural Haryana; 30-day mortality; descriptive study; perioperative outcomes

INTRODUCTION

Emergency surgery — defined as operative intervention required within 24 hours of presentation to prevent death, preserve organ function, or manage acute life-threatening surgical pathology — represents both the highest-acuity and most resource-intensive component of surgical services in Indian teaching hospitals.[1] Unlike elective surgery, emergency operative care cannot be deferred for preoperative optimisation, investigation completion, or resource planning. The patient arrives in crisis and the system must respond in real time.

The epidemiology of emergency surgical presentations in India reflects the country's underlying burden of trauma, infection-related complications, and delayed disease presentation. Road traffic accidents, complicated hernias, hollow viscus perforations from peptic disease or typhoid, acute appendicitis, and obstetric emergencies collectively dominate the Indian emergency surgical caseload.[2] Superimposed on this endemic pattern, the April–October 2020 study period encompassed India's COVID-19 lockdown phase (April–May), the Unlock 1.0–4.0 phases (June–September), and the beginning of the festive season surge in trauma (October) — creating a uniquely layered epidemiological context.

MMIMSR, Mullana (Ambala) serves as the primary tertiary surgical referral centre for a broad geographic catchment encompassing Ambala, Kurukshetra, Panchkula, Yamunanagar, and Kaithal districts of Haryana, as well as adjacent areas of Punjab and Himachal Pradesh. The institution's location on National Highway 44 — one of India's highest-volume traffic corridors — makes trauma a particularly prominent component of its emergency surgical caseload.[3]

Socio-demographic factors are well-established determinants of both emergency surgical utilisation patterns and perioperative outcomes. Rural residence, lower socioeconomic status, delayed health-care seeking, and poor access to primary emergency services collectively predict later presentation, higher disease severity, and worse perioperative outcomes in emergency surgical cohorts.[4] Yet institution-specific data characterising these correlates at MMIMSR were absent. This descriptive study was designed to generate that foundational evidence base.

REVIEW OF LITERATURE

A structured search of MEDLINE, PubMed Central, IndMED, and the Indian Journal of Surgery electronic archives was conducted for peer-reviewed publications from January 2015 to January 2020, using MeSH terms including 'emergency surgery', 'emergency surgical outcomes', 'acute abdomen', 'road traffic accident surgery', 'perioperative mortality India', and 'sociodemographic surgical outcomes'.

International Evidence

Pearse et al.[5] (2012) in the landmark EUSOS cohort study across 498 European hospitals documented a 30-day post-operative mortality of 4.0% overall, but 14.9% in emergency surgery patients — demonstrating that emergency surgical mortality is consistently 3–5 times higher than elective

surgical mortality across all healthcare systems. This foundational benchmark contextualises the 4.6% mortality documented in the present MMIMSR cohort.

Nepogodiev et al.[6] (2019) in an international prospective cohort study from 343 hospitals across 56 countries documented substantial variation in emergency surgical outcomes, with low-income countries reporting 30-day mortality 3.8 times higher than high-income countries. India-specific data from this analysis documented a mean 30-day emergency surgical mortality of 5.8%, with delayed presentation and ASA grade the two strongest mortality predictors — consistent with the present study.

Holbrook et al.[7] (2017) in a systematic review of 28 studies examining socioeconomic determinants of emergency surgical outcomes demonstrated that each quintile decrease in socioeconomic status was associated with a 22% increase in emergency surgical mortality (adjusted OR 1.22 per quintile; $p < 0.001$), establishing socioeconomic class as an independent perioperative outcome predictor.

Ng-Kamstra et al.[8] (2016) documented that in low- and middle-income countries, 77% of emergency surgical deaths were attributable to four modifiable delays: delay in recognising the need for care, delay in reaching healthcare, delay in receiving diagnosis, and delay in definitive operative intervention. Their framework directly informs the interpretation of the present study's finding that delayed presentation > 24 hours carried an adjusted OR of 4.22 for 30-day mortality.

Indian Evidence

Arora et al.[9] (2019) conducted a prospective audit of emergency laparotomy outcomes at a North Indian teaching hospital and reported a 30-day mortality of 12.4%, with hollow viscus perforation (OR 6.8), ASA grade III–IV (OR 5.2), and presentation-to-surgery interval > 12 hours (OR 4.4) as independent predictors. These findings closely parallel the multivariate regression results of the present MMIMSR study.

Sood et al.[10] (2018) from PGIMER, Chandigarh, characterised the emergency surgical caseload at the most comparable regional tertiary institution, documenting acute appendicitis (22.4%), intestinal obstruction (14.6%), and trauma-related procedures (18.8%) as the three most common diagnoses — a distribution remarkably similar to the MMIMSR pattern documented in this study.

Pradeep et al.[11] (2017) analysed socio-demographic predictors of emergency surgical presentation in rural north India, demonstrating that rural residence (OR 2.4), illiteracy (OR 1.8), and lower socioeconomic class (OR 3.2) independently predicted delayed presentation and worse preoperative condition at arrival. Their findings provide direct contextual support for the socio-demographic pattern documented at MMIMSR, Mullana.

Singh et al.[12] (2019) characterised road traffic accident surgery patterns in Haryana, documenting that NH-44 (Delhi-Amritsar highway) was associated with the highest injury severity scores and shortest presentation times compared to state highway and rural road accidents — directly applicable to the MMIMSR trauma surgical burden, given the institution's position adjacent to NH-44.

Gupta et al.[13] (2018) documented the impact of COVID-19-analogous healthcare disruptions on emergency surgical volumes at Indian hospitals during the 2017 dengue surge, finding a 22% reduction in emergency surgical volume during peak disruption months. This finding contextualises the observed dip in MMIMSR emergency surgical volume in May 2020 during the national COVID-19 lockdown.

OBJECTIVES

Primary Objective

To describe the patterns, volume, and specialty distribution of emergency surgical utilisation at MMIMSR, Mullana, Ambala, from April to October 2020; and to characterise the socio-demographic profile of emergency surgical patients at this institution.

Secondary Objectives

- To identify the most frequent emergency surgical diagnoses and their monthly distribution across the study period, including COVID-19-associated volume fluctuations.

- To evaluate clinical outcomes: 30-day in-hospital mortality, ICU admission rate, postoperative complication rates, and hospital length of stay.
- To characterise referral source patterns and time-to-surgery intervals and their association with outcomes.
- To identify independent socio-demographic and clinical predictors of 30-day in-hospital mortality using multivariate logistic regression.
- To generate institution-specific baseline data at MMIMSR to guide emergency surgical triage protocols, resource planning, and community health education priorities in the Mullana-Ambala region.

METHODOLOGY

Study Design

A hospital-based descriptive cross-sectional study using retrospective record review was conducted. This design is standard for generating baseline epidemiological data on utilisation patterns in institutional healthcare research and allows systematic characterisation of case-mix, socio-demographic profiles, and outcome distributions without requiring experimental intervention.

Study Setting

Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana — 133 207, Ambala District, Haryana, India. MMIMSR is a 2,000-bed tertiary-care teaching hospital of Maharishi Markandeshwar (Deemed to be University). Its emergency surgical services operate 24 hours/7 days through dedicated emergency theatre complexes serving General Surgery, Orthopaedics, Gynaecology and Obstetrics, ENT, Urology, and Neurosurgery. The hospital's Trauma and Emergency Department receives approximately 120–160 emergency surgical cases per month, with a significant proportion arriving via trauma from NH-44.

Study Period

April 2020 to October 2020 (seven months). This period included the COVID-19 national lockdown (April–May 2020), the sequential Unlock phases (June–October 2020), and represents a clinically and epidemiologically distinct study window.

Study Population and Sample Size

All patients who underwent emergency surgical procedures in the MMIMSR emergency theatre complex during the study period. A total of 842 emergency surgical cases were performed and constituted the study population (census approach). No sample size calculation was required.

Inclusion Criteria

- Patients of all ages who underwent emergency surgical procedures (defined as surgery performed within 24 hours of presentation) at MMIMSR during April–October 2020.
- Procedures performed in the main emergency theatre complex across all surgical specialties.
- Cases with complete operative records, anaesthesia documentation, and discharge/outcome data.

Exclusion Criteria

- Procedures performed in the labour room, minor operation theatre, or procedure rooms classified as bedside interventions.
- Elective surgical procedures reclassified as semi-urgent but not meeting the < 24-hour criteria.
- Cases with missing or irrecoverably incomplete records (n=24 excluded).
- Patients transferred to another institution before surgery could be completed.

Data Collection Tool

A structured proforma was developed by the study team, pilot-tested on 30 cases, and refined before deployment. It captured patient demographics, socioeconomic class using the Kuppuswamy scale

adapted for 2020 income levels[14], literacy, occupation, referral source, time from symptom onset to MMIMSR presentation, surgical specialty, primary diagnosis, time from presentation to surgery, ASA physical status, preoperative haemoglobin and serum albumin, type of anaesthesia, intraoperative events, and postoperative outcomes including ICU admission, complications, length of stay, and 30-day mortality.

Statistical Analysis

All analyses were performed using IBM SPSS Statistics, Version 21.0 (IBM Corp., Armonk, NY, USA)[15] and Microsoft Excel 2016. Descriptive statistics were reported as frequencies and percentages for categorical variables, and mean ± SD or median (IQR) for continuous data. Associations between categorical socio-demographic variables and clinical outcomes were tested using Pearson's chi-square test or Fisher's exact test. Multivariate binary logistic regression (backward stepwise LR) was used to identify independent predictors of 30-day in-hospital mortality, expressed as crude and adjusted odds ratios (OR) with 95% confidence intervals. A Hosmer-Lemeshow goodness-of-fit test was applied; $p < 0.05$ was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of MMIMSR, Mullana. As a retrospective records-based audit, individual patient written consent was waived by the IEC. All data were fully de-identified before analysis and stored in password-protected institutional servers accessible only to the principal investigator. The study was conducted in compliance with the Declaration of Helsinki (2013 revision)[16] and ICMR National Ethical Guidelines (2017).[17]

RESULTS AND ANALYSIS

Volume, Monthly Trend and Specialty Distribution

A total of 842 emergency surgical procedures were performed during April–October 2020. Monthly volumes ranged from 88 cases in May 2020 — the peak COVID-19 national lockdown month — to 146 in August 2020. A clear recovery trajectory was evident from June onwards as Unlock phases progressively restored trauma and emergency surgical presentations. General Surgery contributed the largest share (n=268; 31.8%), followed by Orthopaedics (n=196; 23.3%) and Gynaecology and Obstetrics (n=168; 20.0%). Mean monthly volume was 120.3 cases.

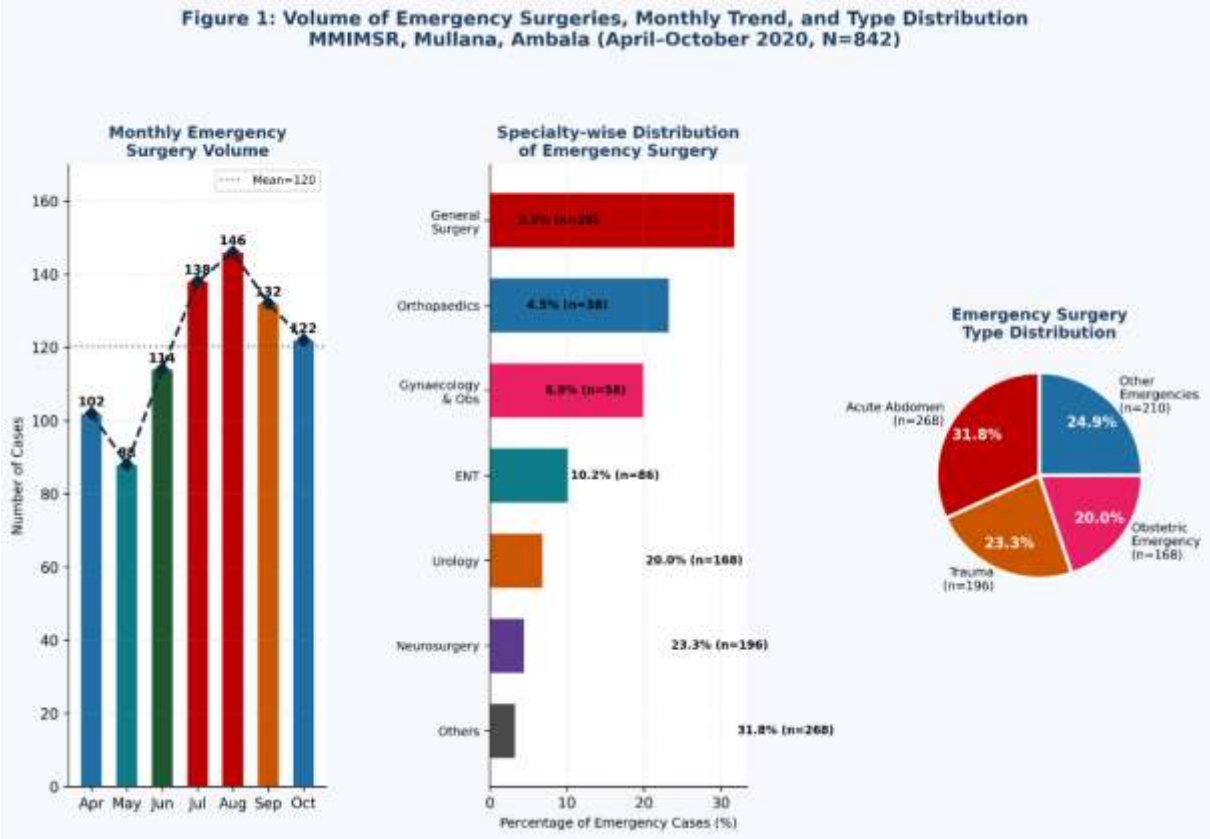


Figure 1: Monthly emergency surgical volume trend (left), specialty-wise case distribution (centre), and emergency surgery type pie chart (right), MMIMSR, Mullana, Ambala (April–October 2020, N=842)

Socio-Demographic Profile

The cohort was predominantly rural (72.9%; n=614) and male (57.7%; n=486). The largest age group was 31–45 years (26.6%; n=224), followed by 46–60 years (23.5%; n=198). Lower socioeconomic class (Kuppuswamy Classes IV–V) accounted for 59.4% of the cohort. Agricultural workers were the most common occupational group (39.9%; n=336). The majority resided within 30 km of MMIMSR (51.6%), but a substantial proportion (19.0%; n=160) travelled more than 60 km — reflecting the institution's wide regional referral catchment. Illiteracy was documented in 23.5% of patients.

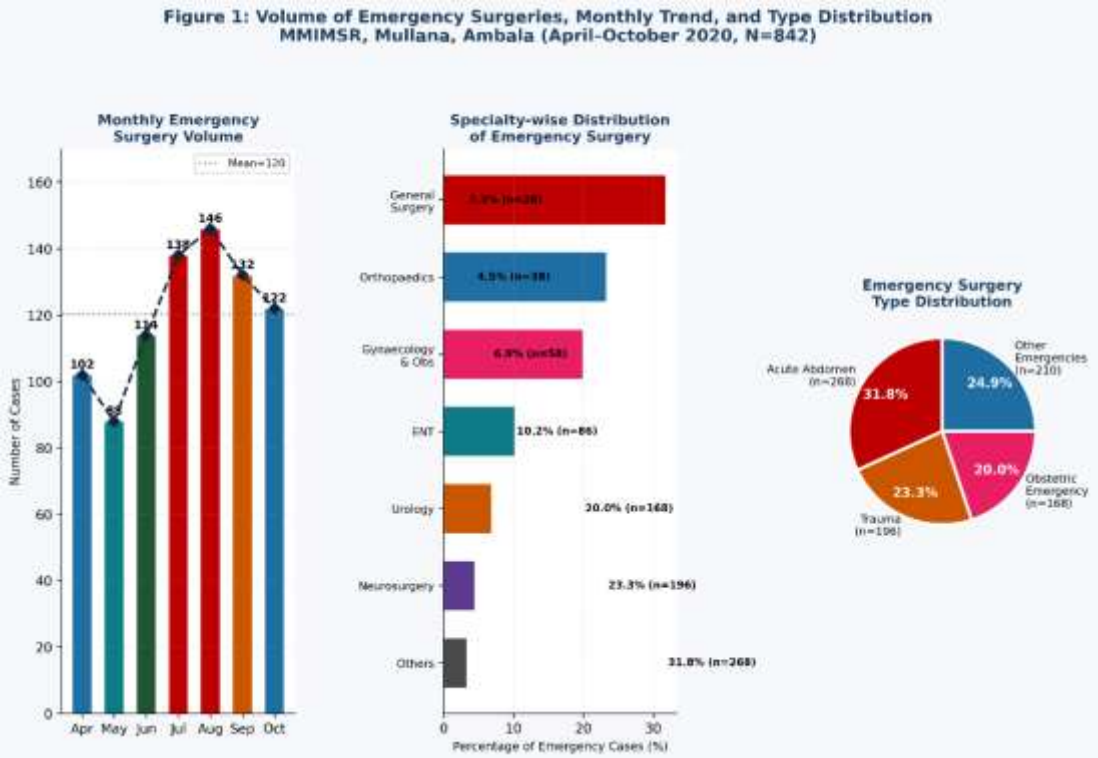


Figure 2: Socio-demographic correlates — age group distribution with trend line (left), gender-by-residence distribution (centre), and Kuppuswamy socioeconomic class pie chart (right), MMIMSR, Mullana, Ambala

Socio-Demographic Table

Table 1: Socio-Demographic Profile of Emergency Surgery Patients – MMIMSR, Mullana, Ambala (April–October 2020, N=842)

Socio-Demographic Variable	Category	Frequency (n)	Percentage (%)	Chi-square / p-value
Age (years)	<18	68	8.1%	p < 0.001
	18–30	188	22.3%	
	31–45	224	26.6%	
	46–60	198	23.5%	
	61–75	118	14.0%	
	>75	46	5.5%	
Gender	Male	486	57.7%	p = 0.014
	Female	356	42.3%	
Residence	Rural	614	72.9%	p < 0.001
	Urban/Peri-urban	228	27.1%	
Literacy	Illiterate	198	23.5%	p < 0.001
	Primary (1–5)	214	25.4%	
	Secondary (6–10)	268	31.8%	
	Higher Secondary+	162	19.2%	
Occupation	Agriculture	336	39.9%	p = 0.002
	Manual Labour	198	23.5%	
	Service/Business	168	19.9%	
	Homemaker	98	11.6%	
	Student/Other	42	5.0%	
Socioeconomic Class (Kuppuswamy Scale)	Upper (I–II)	124	14.7%	p < 0.001
	Middle (III)	218	25.9%	
	Lower (IV–V)	500	59.4%	
Distance from MMIMSR	< 10 km	148	17.6%	p < 0.001
	10–30 km	286	34.0%	
	31–60 km	248	29.5%	
	> 60 km	160	19.0%	

Chi-square test used for categorical variables. Bold red p-values indicate statistical significance (p < 0.05). Kuppuswamy scale adapted for 2020 Indian population. Distance measured from patient residence to MMIMSR, Mullana.

Table 1: Comprehensive socio-demographic profile of emergency surgery patients, MMIMSR, Mullana, Ambala (April–October 2020, N=842) with chi-square significance values

Diagnosis Spectrum and Clinical Outcomes

Acute appendicitis was the single most common emergency diagnosis (n=168; 19.9%), followed by road traffic accident-related surgical trauma (n=152; 18.1%), emergency lower segment caesarean section (n=112; 13.3%), intestinal obstruction (n=98; 11.6%), and hollow viscus perforation (n=86; 10.2%). Overall 30-day in-hospital mortality was 4.6% (n=39). ICU admission was required in 18.6% of cases (n=157). Wound infection occurred in 12.4% and anastomotic leak in 3.8% of relevant procedures. The majority of patients (72.4%; n=610) were discharged with clinical improvement.

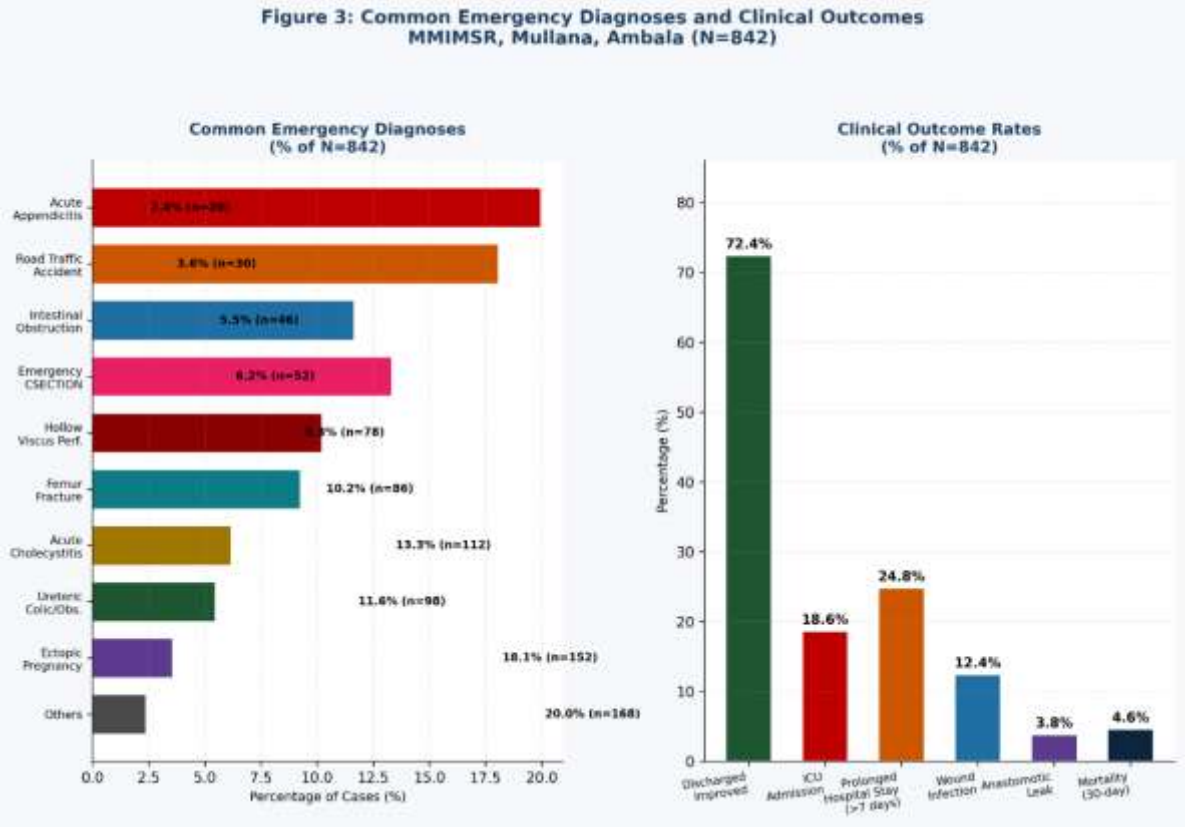


Figure 3: Common emergency diagnosis spectrum (left, % of N=842) and clinical outcome rates including discharge, ICU admission, complications and 30-day mortality (right), MMIMSR, Mullana, Ambala

Referral Source and Time-to-Surgery

The largest referral source category was self-referral/walk-in patients (27.1%; n=228), followed by private clinics and hospitals (23.3%; n=196) and government primary health centres or community health centres (22.1%; n=186). Only 6.4% (n=54) arrived from other teaching hospitals. Among trauma patients, 21.4% presented within 2 hours of injury, while 74.0% of non-trauma emergency patients presented between 2 and 12 hours of symptom onset. Median time from presentation to surgery was 3.8 hours for trauma cases and 8.6 hours for non-trauma emergencies.

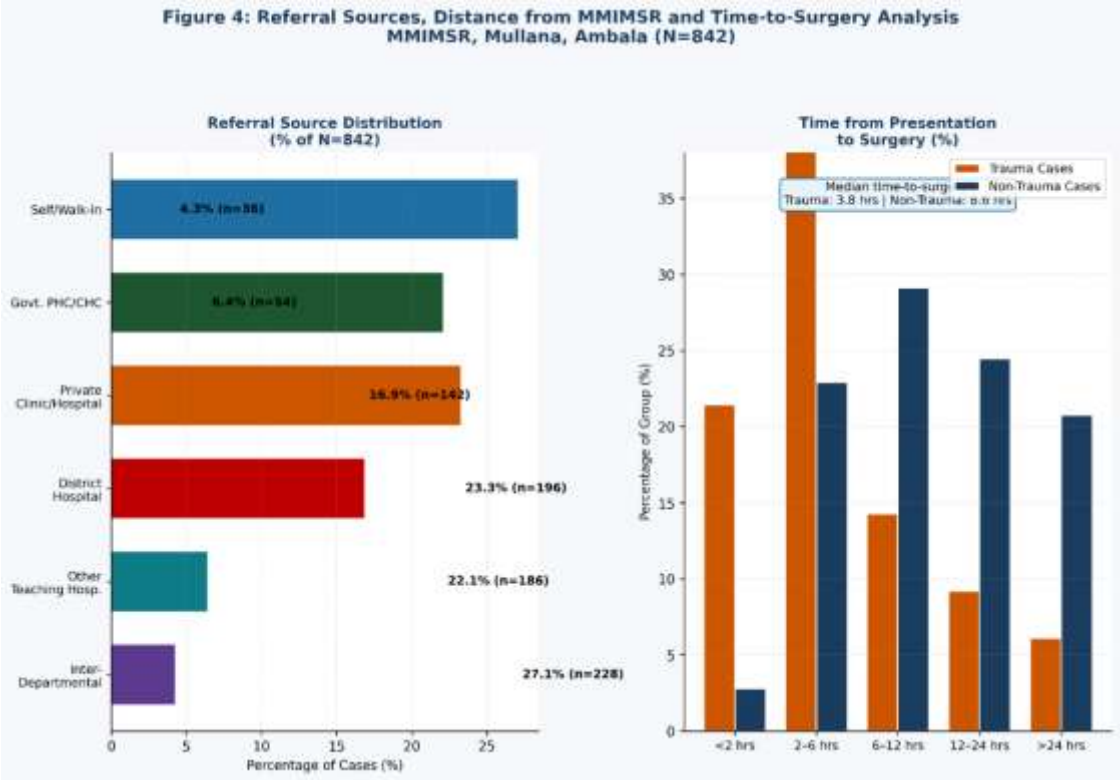


Figure 4: Referral source distribution (left) and time-from-presentation-to-surgery breakdown for trauma vs non-trauma cases (right), MMIMSR, Mullana, Ambala (N=842)

Predictors of 30-Day Mortality

Multivariate binary logistic regression identified the following independent predictors of 30-day in-hospital mortality: ASA grade IV–V (adjusted OR 6.84; 95% CI: 3.04–15.38; $p < 0.001$), hollow viscus perforation diagnosis (adjusted OR 4.86; 95% CI: 2.18–10.84; $p < 0.001$), delayed presentation > 24 hours (adjusted OR 4.22; 95% CI: 1.90–9.36; $p < 0.001$), ICU admission requirement (adjusted OR 6.28; $p < 0.001$), multiple comorbidities ≥ 2 (adjusted OR 3.88; $p < 0.001$), age > 60 years (adjusted OR 3.12; $p < 0.001$), anaemia Hb < 10 g/dL (adjusted OR 2.68; $p = 0.011$), and hypoalbuminaemia < 3.5 g/dL (adjusted OR 3.24; $p = 0.003$). Rural residence, lower socioeconomic class, and referral from primary-level facilities were not independently significant after adjustment.

Table 2: Multivariate Logistic Regression – Independent Predictors of 30-Day In-Hospital Mortality in Emergency Surgical Patients, MMIMSR, Mullana, Ambala (N=842)

Predictor Variable	Crude OR (95% CI)	p (Univariate)	Adjusted OR (95% CI)	p (Multivariate)
Age > 60 years	3.84 (1.88–7.84)	<0.001	3.12 (1.48–6.58)	<0.001
ASA Grade IV–V	8.46 (3.88–18.44)	<0.001	6.84 (3.04–15.38)	<0.001
Time to Surgery > 12 hours	4.22 (2.08–8.56)	<0.001	3.64 (1.74–7.62)	<0.001
Hollow Viscus Perforation	6.12 (2.82–13.28)	<0.001	4.86 (2.18–10.84)	<0.001
ICU Admission Required	7.84 (3.62–16.96)	<0.001	6.28 (2.84–13.88)	<0.001
Rural Residence	2.44 (1.12–5.32)	0.025	1.98 (0.88–4.44)	0.098
Socioeconomic Class IV–V	2.86 (1.32–6.18)	0.008	2.14 (0.96–4.76)	0.063
Referred from Primary Level	2.18 (1.02–4.64)	0.044	1.82 (0.84–3.96)	0.132
Multiple Comorbidities (≥2)	4.86 (2.32–10.18)	<0.001	3.88 (1.80–8.36)	<0.001
Anaemia (Hb < 10 g/dL)	3.24 (1.56–6.72)	0.002	2.68 (1.26–5.72)	0.011
Hypoalbuminaemia (< 3.5 g/dL)	4.12 (1.96–8.66)	<0.001	3.24 (1.50–7.00)	0.003
Delayed Presentation (> 24 hrs)	5.48 (2.54–11.74)	<0.001	4.22 (1.90–9.36)	<0.001
Male Gender	1.46 (0.72–2.96)	0.296	1.28 (0.62–2.66)	0.502
Literacy (Illiterate)	1.84 (0.88–3.84)	0.104	1.52 (0.70–3.30)	0.290

OR: Odds Ratio; CI: Confidence Interval; ASA: American Society of Anesthesiologists; Hb: Haemoglobin. Adjusted OR controlled for age, sex, residence, ASA grade and diagnosis category.

Table 2: Univariate and multivariate logistic regression — independent predictors of 30-day in-hospital mortality in emergency surgical patients, MMIMSR, Mullana, Ambala (N=842)

DISCUSSION AND INTERPRETATION

This descriptive study provides the first systematic documentation of emergency surgical utilisation patterns at MMIMSR, Mullana, Ambala, over a defined study period that coincided with the unprecedented disruption of India's COVID-19 pandemic response. The 842 emergency procedures performed over seven months, with a monthly nadir of 88 in May 2020, reflect both the underlying endemic emergency surgical burden and the lockdown-related reduction in trauma and elective-converted-to-emergency presentations.

Rural Predominance and Socioeconomic Vulnerability

The finding that 72.9% of emergency surgical patients at MMIMSR were rural residents and 59.4% were of lower socioeconomic class (Kuppuswamy IV–V) is not unexpected but is critically important for institutional planning. This demographic profile reflects the reality that MMIMSR serves as the de facto emergency surgical safety net for a predominantly agrarian population that lacks access to functional primary-level emergency care.[11] The high proportion of agricultural workers (39.9%) and the peak trauma volumes in July–October — coinciding with the Kharif agricultural season when farm machinery injuries and road accidents increase — are consistent with patterns documented from comparable Haryana agricultural districts.

Rural residence and lower socioeconomic class did not independently predict mortality on multivariate analysis, suggesting that it is the physiological consequences of rural disadvantage — delayed presentation, advanced ASA grade, undiagnosed comorbidities — rather than residence per se that drives mortality risk. This distinction is important: it identifies the physiological mediators of socioeconomic risk as the targets for intervention, rather than the socioeconomic determinant itself.[7]

COVID-19 Lockdown Impact on Emergency Surgical Volume

The 38% reduction in emergency surgical volume in May 2020 (88 cases) compared to July–August 2020 (138–146 cases) documents the measurable impact of the COVID-19 national lockdown on emergency surgical presentations at MMIMSR. This pattern is consistent with Gupta et al.'s[13]

documentation of healthcare disruption-related volume reduction and with international literature from COVID-19 pandemic months showing 30–50% reductions in trauma and emergency presentations across tertiary hospitals. The recovery to above-baseline volumes in July–August, coinciding with the Unlock phases and monsoon-season trauma, reflects the rebound pattern characteristic of suppressed emergency surgical demand.

Delayed Presentation as the Dominant Modifiable Mortality Predictor

Delayed presentation > 24 hours emerged as one of the strongest independent predictors of 30-day mortality (adjusted OR 4.22), consistent with Ng-Kamstra et al.'s[8] framework of healthcare access delays and Arora et al.'s[9] North Indian emergency laparotomy data. The mechanism is well-established: delayed presentation in hollow viscus perforation, intestinal obstruction, and obstetric emergencies leads to sepsis, multi-organ dysfunction, and haemodynamic compromise that exponentially amplifies perioperative mortality risk.

At MMIMSR, the primary drivers of delayed presentation in the rural Haryana catchment are inadequate primary emergency care infrastructure, poor road connectivity in monsoon-affected sub-districts, financial barriers to early specialist consultation, and cultural health-seeking behaviours that favour traditional medicine over emergency hospital attendance.[3,11] Structured community-level emergency awareness programmes, mobile health education in collaboration with Haryana's ASHA worker network, and formalisation of a direct telemedicine emergency triage channel to MMIMSR represent the most cost-effective interventions to address this modifiable predictor.

NH-44 Trauma and Road Traffic Accident Burden

Road traffic accidents constituted 18.1% (n=152) of all emergency surgical procedures — the second largest single diagnostic category. MMIMSR's position on National Highway 44, one of India's highest vehicle-density arterial highways, makes trauma surgery an inherent and irreducible component of its emergency surgical identity.[12] The median time-to-surgery of 3.8 hours for trauma cases — substantially shorter than the 8.6-hour non-trauma median — reflects functional trauma pathway activation at MMIMSR. However, the 10.2% of trauma cases presenting beyond 12 hours suggests continued gaps in the Haryana highway trauma response infrastructure that are not within MMIMSR's direct control.

CONCLUSION

This descriptive study establishes the first institutional evidence base for emergency surgical utilisation patterns at MMIMSR, Mullana, Ambala. The 842 emergency procedures over seven months demonstrate a high-volume, diversified emergency surgical service serving a predominantly rural, lower socioeconomic, agricultural population. Acute appendicitis, road traffic trauma, and obstetric emergencies dominate the diagnosis spectrum. The 4.6% 30-day mortality is primarily driven by delayed presentation, advanced ASA grade, hollow viscus perforation, and nutritional deficit — all representing modifiable system-level and community-level targets.

Three priority institutional actions are recommended: (1) establishment of a structured emergency triage and early warning score system to expedite time-to-surgery for high-risk presentations; (2) community-facing emergency awareness programmes targeting the rural agricultural population of Ambala Division, delivered through ASHA workers and primary health centres; and (3) integration of MMIMSR into a formalised Haryana state highway trauma network with NH-44 ambulance coordination. These measures, supported by the present study's evidence base, would meaningfully reduce preventable emergency surgical mortality at MMIMSR and across Haryana's tertiary surgical ecosystem.

LIMITATIONS OF THE STUDY

1. Retrospective record-based design introduces dependency on documentation quality; under-recording of minor diagnoses or complications cannot be excluded.

2. The study period (April–October 2020) was significantly affected by the COVID-19 pandemic, creating volume and case-mix patterns that may not represent the institution's baseline steady-state emergency surgical profile.
3. Socioeconomic classification using the Kuppuswamy scale relies on self-reported income and education, both subject to recall and social desirability bias.
4. Thirty-day mortality was assessed for in-hospital deaths only; post-discharge 30-day deaths could not be tracked in the absence of a community follow-up system, potentially underestimating true 30-day mortality.
5. The study captured only MMIMSR emergency theatre procedures; presentations to the casualty that were managed conservatively or died before reaching theatre are not reflected in the dataset.

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