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ORIGINAL ARTICLE

Impact of Delayed Presentation on Outcomes of Adult Emergency Abdominal Surgery.

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ABSTRACT

Background: Delayed presentation in emergency abdominal surgery is a clinically important exposure because acute abdominal pathology may progress from localized inflammation or obstruction to perforation, gangrene, contamination, sepsis and organ dysfunction. Emergency abdominal surgery has a substantial morbidity burden, and outcomes are strongly influenced by baseline physiological risk, operative severity and access to timely surgical care[2,3].

Objective: To determine the association between delayed presentation, defined as hospital presentation more than 48 hours after symptom onset, and 30-day postoperative outcomes in adult patients undergoing emergency abdominal surgery.

Material and Methods: This prospective observational study was conducted in the Department of General Surgery, Mardan Medical Complex, Mardan, Pakistan, from July 2023 to September 2023. Adults aged 18 years or above undergoing emergency abdominal surgery were classified as early presenters within 48 hours or delayed presenters after 48 hours. The primary outcome was 30-day postoperative morbidity. Secondary outcomes included surgical-site infection, ICU admission, length of hospital stay, reoperation and mortality. Group comparisons and multivariable logistic regression were performed.

Results: A total of 150 patients were included, comprising 64 early presenters and 86 delayed presenters. Delayed presentation was associated with older age, higher diabetes burden, higher ASA III/IV status and more rural residence. Delayed presenters had higher perforation, gangrene, contaminated or dirty wound classification and open surgery. Morbidity, surgical-site infection, ICU admission and hospital stay were significantly higher in delayed presenters. Delayed presentation remained independently associated with morbidity with adjusted OR 2.38, 95% CI 1.14-4.96, p=0.021.

Conclusion: Presentation after 48 hours was associated with advanced operative pathology and worse short-term postoperative outcomes. Early referral, community awareness, emergency triage strengthening and protocol-based emergency surgery pathways may reduce preventable morbidity.

Keywords: delayed presentation; emergency abdominal surgery; acute abdomen; surgical morbidity; surgical-site infection; postoperative outcomes.

INTRODUCTION

Emergency abdominal surgery remains one of the most demanding fields of general surgery because patients commonly present with evolving physiology, incomplete optimization and diseases that may progress rapidly if definitive management is delayed. Conditions such as acute appendicitis, hollow viscus perforation, intestinal obstruction, incarcerated hernia, biliary sepsis and bowel ischemia may deteriorate from localized pathology into peritoneal contamination, sepsis, shock and organ dysfunction. The distinction between early and late presentation is therefore not merely a difference in clock time but may represent a transition from a controllable disease process to an advanced intra-abdominal catastrophe[4,5]. Global emergency surgery evidence shows that postoperative outcomes are strongly influenced by baseline severity, surgical safety systems and health-system capacity. Mortality after emergency abdominal surgery is higher in low- and middle-resource settings, where timely operative care, ICU capacity and perioperative support may be limited[2,3]. These global findings are relevant to local surgical units in Pakistan because tertiary hospitals frequently receive patients from remote districts after multiple healthcare contacts, delays in transport or incomplete referral pathways. Delayed presentation occurs through a chain of patient-level and system-level events. Some patients delay seeking care because symptoms are ignored, self-treated, misinterpreted or initially managed by informal providers. Further delay may occur during referral, transport, diagnostic assessment, financial clearance, blood arrangement, theatre access or specialist review. The three-delays framework remains useful in surgical care because outcome is affected not only by what happens in the operating room but also by how quickly the patient reaches an adequately resourced surgical team[14,15,16,17]. The biological plausibility linking delay with adverse outcomes is strong. Untreated appendicitis may progress from luminal obstruction to venous congestion, bacterial overgrowth, gangrene and perforation[4,5,18,19]. Prolonged intestinal obstruction can progress to bowel ischemia, necrosis and perforation[6]. Delayed management of perforated peptic ulcer and other hollow viscus perforations increases peritoneal contamination, septic burden and the need for extensive operative intervention[7,8,20]. These pathophysiological changes increase operative difficulty and raise the likelihood of open surgery, bowel resection, stoma formation, peritoneal lavage, prolonged operative time and contaminated or dirty wound classification. The downstream postoperative burden is clinically important because surgical-site infection, prolonged hospitalization, ICU admission, reoperation and mortality are closely related to contamination, physiological instability and operative complexity[9,10,11]. Risk stratification models such as the ACS NSQIP surgical risk calculator and POSSUM demonstrate that baseline physiology and operative severity contribute strongly to postoperative morbidity and mortality[12,13]. However, time from symptom onset to hospital presentation is potentially modifiable through public awareness, peripheral referral protocols, early imaging and faster emergency theatre pathways. The present study was therefore designed to evaluate whether presentation more than 48 hours after symptom onset was associated with adverse postoperative outcomes in adult patients undergoing emergency abdominal surgery. The manuscript follows STROBE principles for observational research[1].

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MATERIAL AND METHODS

This prospective observational study was conducted in the Department of General Surgery at Mardan Medical Complex, Mardan, Pakistan, from July 2023 to September 2023. The hospital is a tertiary care teaching facility serving a mixed urban and predominantly rural population in Khyber Pakhtunkhwa. It provides

emergency general surgical services, consultant-led surgical cover, intensive care support with limited bed capacity and operating theatre access for emergency cases.

All adult patients aged 18 years or above admitted under the general surgery service who underwent emergency abdominal surgery during the study period were assessed for eligibility. Patients were included if they had acute abdominal pathology requiring emergency operative management, complete operative and anaesthesia records, and outcome assessment available at discharge or within 30 days. Patients were excluded if the operation was trauma-only outside the planned protocol, elective or unrelated specialty surgery, duplicate admission, incomplete documentation, or if they left against medical advice before meaningful outcome assessment.

The primary exposure was delayed presentation. Early presentation was defined as hospital presentation within 48 hours of symptom onset, while delayed presentation was defined as presentation more than 48 hours after symptom onset. Symptom onset was recorded from patient or attendant history and cross-checked with emergency department documentation where available. The 48-hour cut-off was selected because progression to complicated pathology is clinically more likely after prolonged delay in acute abdominal disease[14,15]. Data were collected using a structured proforma. Baseline variables included age, sex, residence, diabetes mellitus and ASA physical status classification. Clinical and operative variables included symptom duration, primary diagnosis, operative findings, wound classification, surgical approach, stoma formation and operative time. Outcome variables included 30-day postoperative morbidity, surgical-site infection, ICU admission, length of hospital stay, reoperation and mortality. The primary outcome was 30-day postoperative morbidity, defined as any documented postoperative complication occurring before hospital discharge or within 30 days of surgery. Secondary outcomes were surgical-site infection, ICU admission, hospital stay, reoperation and mortality. Surgical-site infection was defined using standard clinical criteria within 30 days of surgery, including purulent drainage, positive culture or surgeon diagnosis requiring antibiotics or procedural intervention[9,10]. ICU admission was defined as postoperative admission to intensive care for haemodynamic instability, respiratory failure or close monitoring. Data were analyzed using SPSS version. Continuous variables were assessed for distribution and summarized as mean with standard deviation or median with interquartile range. Categorical variables were summarized as frequency and percentage. Group comparisons were performed using chi-square or Fisher exact test for categorical variables and independent t-test or Mann-Whitney U test for continuous variables, according to distribution. Multivariable logistic regression was used to identify independent predictors of postoperative morbidity. Adjusted odds ratios with 95% confidence intervals were reported, and p-value less than 0.05 was considered statistically significant. The study was approved by the Institutional Ethics Committee of Mardan Medical Complex, approval number MMC/IRB/2023/147, dated 28 August 2023. Patient confidentiality was maintained through anonymized extraction and secure data storage. A waiver of individual informed consent was obtained because the study used routine clinical data and posed no additional risk.

RESULTS

A total of 183 patients were initially assessed for eligibility during the study period. Thirty-three patients were excluded, including 14 with incomplete medical records, 8 who left against medical advice, 6 with trauma-only procedures, 3 with elective procedures and 2 with duplicate admissions. The final analysis included 150 adult emergency abdominal surgery patients, comprising 64 patients who presented within 48 hours and 86 patients who presented after 48 hours. The mean age of the entire cohort was 44.6 ± 16.1 years. Patients in the delayed presentation group were significantly older than early presenters. There was no significant difference in sex distribution between the two groups. Diabetes mellitus was significantly more frequent among delayed presenters, and a higher proportion of delayed presenters had ASA III/IV status, indicating poorer baseline physiological condition. Rural residence was also significantly more common among delayed presenters.

Operative findings showed substantially greater disease severity among delayed presenters. Perforation, gangrenous bowel or appendix and contaminated or dirty wounds were all significantly more frequent in the delayed group. Open surgery was performed more often in delayed presenters, and median operative time was longer, reflecting greater technical complexity and more advanced disease at operation.

The primary outcome of 30-day postoperative morbidity occurred in 50 patients overall. Morbidity was significantly higher in delayed presenters than early presenters. Surgical-site infection and ICU admission were also significantly increased among delayed presenters. Median hospital stay increased from 4 days in

Table 1: Baseline characteristics of emergency abdominal surgery patients

Variable	Early presentation ≤48h (n=64)	Delayed presentation >48h (n=86)	p-value
Age, years	39.6 ± 14.8	48.3 ± 16.2	0.001
Male sex	60.9%	64.0%	0.701
Diabetes mellitus	12.5%	25.6%	0.049
ASA III/IV	15.6%	31.4%	0.027
Rural residence	32.8%	55.8%	0.005

Table 2: Operative findings and intraoperative characteristics

Variable	Early presentation ≤48h	Delayed presentation >48h	p-value
Perforation	18.8%	37.2%	0.015
Gangrenous bowel/appendix	9.4%	24.4%	0.019
Contaminated/dirty wound	28.1%	50.0%	0.007
Open surgery	43.8%	70.9%	0.001
Stoma formation	4.7%	14.0%	0.060
Operative time, median	65 min	95 min	<0.001

Table 3: Postoperative outcomes

Outcome	Early presentation ≤48h	Delayed presentation >48h	p-value
30-day morbidity	21.9%	41.9%	0.011
Surgical-site infection	9.4%	23.3%	0.028
ICU admission	7.8%	22.1%	0.019
Hospital stay, median	4 days	7 days	<0.001
Reoperation	3.1%	8.1%	0.302
Mortality	1.6%	5.8%	0.196

Table 4: Multivariable predictors of postoperative morbidity

Predictor	Adjusted OR	95% CI	p-value
Delayed presentation >48h	2.38	1.14-4.96	0.021
ASA III/IV	2.76	1.21-6.28	0.016
Contaminated/dirty wound	3.31	1.55-7.04	0.002
Diabetes mellitus	1.89	0.82-4.34	0.134

Table 5: Emergency surgery interpretation matrix

Finding	Clinical interpretation	Suggested service response
Higher rural residence in delayed group	Access and referral barriers may contribute to late presentation	Community awareness, peripheral referral triggers, transport coordination
More perforation and gangrene	Disease progressed before definitive surgery	Earlier diagnosis, rapid imaging and theatre prioritization
Higher SSI and ICU admission	Delayed disease increases postoperative burden	Antibiotic protocols, sepsis care, wound surveillance and ICU prioritization
Longer hospital stay	Delay increases bed occupancy and cost	Audit delay points and monitor time-to-surgery indicators

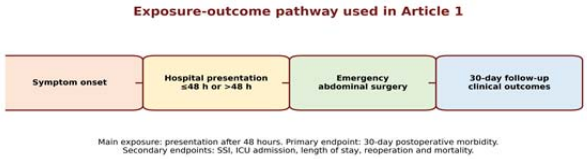

Figure 1: Exposure-outcome pathway used in this emergency abdominal surgery study.

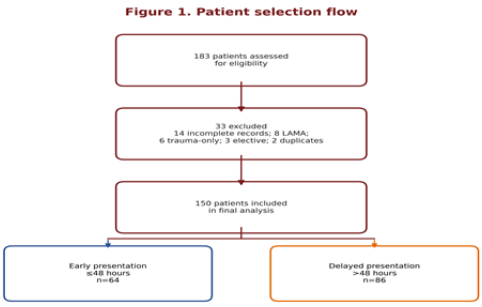

Figure 2: Patient selection flow diagram for the emergency abdominal surgery cohort.

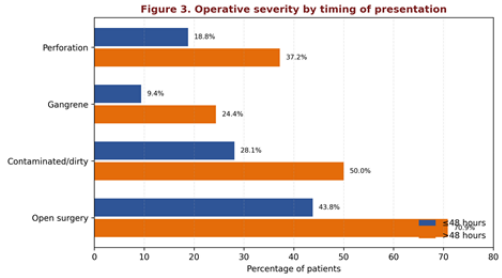

Figure 3: Operative severity by timing of presentation.

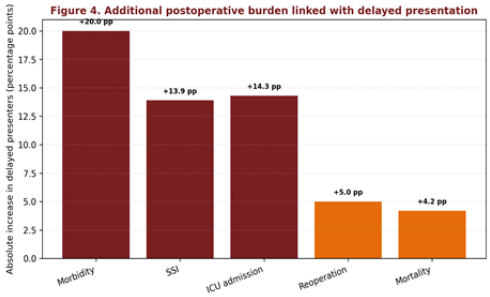

Figure 4: Absolute increase in postoperative burden among delayed presenters.

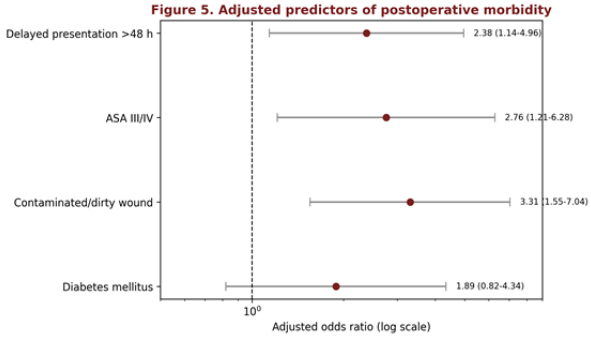

Figure 5: Forest plot of adjusted predictors of postoperative morbidity.

early presenters to 7 days in delayed presenters. Reoperation and mortality were numerically higher in the delayed group but did not reach statistical significance.

DISCUSSION

This prospective observational study found that delayed presentation beyond 48 hours was significantly associated with worse short-term postoperative outcomes in adult emergency abdominal surgery patients. Delayed presenters had higher postoperative morbidity, surgical-site infection, ICU admission and prolonged hospital stay. The adjusted model confirmed that delayed presentation remained independently associated with morbidity even after accounting for baseline physiological risk and wound contamination.

The findings are consistent with the biological progression of acute abdominal disease. In appendicitis, delay increases the chance of gangrene and perforation[4,5,18,19]. In intestinal obstruction, prolonged delay can lead to ischemia, necrosis and perforation[6]. In hollow viscus perforation and intra-abdominal infection, delay increases contamination and septic burden[7,8,20]. These processes explain why delayed presenters in this study had significantly higher rates of perforation, gangrene and contaminated or dirty wounds.

The higher rate of open surgery among delayed presenters is also clinically meaningful. Advanced intra-abdominal contamination, friable tissues, necrosis and haemodynamic instability reduce the feasibility of minimally invasive approaches. Open surgery and longer operative time increase tissue trauma and infection risk, particularly in contaminated fields. Surgical-site infection is a major driver of morbidity, cost and prolonged stay after surgery[9,10,11].

The baseline pattern suggests that delayed presentation is not randomly distributed. Patients in the delayed group were older, had more diabetes mellitus and were more likely to have ASA III/IV status. This creates a double-hit situation in which disease is more advanced and patient physiological reserve is lower. Established surgical risk tools confirm that both physiological derangement and operative severity contribute strongly to postoperative outcomes[12,13]. Rural residence was significantly more frequent in delayed presenters, emphasizing that late presentation is often a health-system access problem rather than simple patient neglect. Rural patients may face longer travel distances, fewer specialist services, lower health literacy, financial constraints and referral bottlenecks. Similar patterns have been reported in emergency surgery settings from other low-resource environments[14,15,16,17].

The resource implications are substantial. ICU admission was almost three times higher in delayed presenters, and hospital stay increased by a median of three days. In a busy public-sector surgical unit, this translates into higher bed occupancy, nursing workload, antibiotic exposure and cost. Surgical safety systems, including checklist use, sepsis pathways and emergency laparotomy audit, may reduce avoidable harm when embedded into emergency surgical care[21,22,23,24,25]. Mortality was numerically higher in delayed presenters but not statistically significant. This is likely due to the small number of deaths and limited statistical power for mortality analysis. However, mortality is only one dimension of surgical outcome. The significant increases in morbidity, infection, ICU use and hospital stay are sufficient to show clinically important harm associated with delayed presentation.

This study has limitations. It was conducted at a single centre, which may limit generalizability. Symptom onset was partly dependent on patient or attendant recall. The study was powered for morbidity but not for rare outcomes such as mortality and reoperation. Nevertheless, the prospective design, complete 30-day follow-up and adjusted analysis support the internal validity of the findings. The practical message is clear: delayed presentation is a modifiable risk factor. Community awareness should focus on warning symptoms such as persistent abdominal pain, vomiting, distension, fever and signs of peritonitis. Peripheral facilities should

use referral triggers for suspected acute abdomen. Tertiary hospitals should strengthen triage, resuscitation, imaging access, antibiotic timing and theatre prioritization to reduce preventable morbidity.

CONCLUSION

Delayed presentation more than 48 hours after symptom onset is independently associated with increased postoperative morbidity in adult emergency abdominal surgery patients. It is also associated with more advanced operative pathology, higher surgical-site infection, increased ICU admission and prolonged hospital stay. Early recognition, timely referral and protocol-based emergency surgical pathways are essential to reduce preventable complications.

DECLARATIONS: Conflict of interest: The authors declare no conflict of interest.

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Ethical approval: Approved by the Institutional Ethics Committee of Mardan Medical Complex, approval number MMC/IRB/2023/147, dated 28 August 2023.

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