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FACTORS AFFECTING LENGTH OF STAY IN PATIENTS WITH ABDOMINAL PAIN IN EMERGENCY DEPARTMENT OF A TERTIARY CARE HOSPITAL, KARACHI

Dr. Muhammad Rashid [*1], Dr. Adeel Khatri [*2], Dr. Ramesh Kumar[*3], Dr. Aisha Iffat [*4], Dr. Muhammad Mustafa [*5], Dr. Sadaf Munawar[*6]

[*1, 3, 4, 6] *MBBS, PGR, Department of emergency medicine, Indus Hospital and Health Network, Karachi.*
[*2] *MBBS, Residency Program Director, Indus Hospital and Health Network, Karachi.*
[*5] *MBBS, PGR, Department of Pediatrics and Child Health, The Aga Khan University Hospital, Karachi.*

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Corresponding Author: *
Dr. Muhammad Rashid

Abstract

Objective: *To determine the length of stay (LOS) in the emergency department (ED) among adult patients presenting with acute abdominal pain and to identify clinical and operational predictors of prolonged stay in a high-volume tertiary care hospital in Pakistan.*

Study Design: *Descriptive cross-sectional study..*

Study Setting: *Emergency Department of Indus Hospital and Health Network, Karachi, Pakistan.*

Study Duration: *Six Months (February'24 to July'24).*

Methodology: *A total of 498 adult patients presenting with acute abdominal pain were included through consecutive non-probability sampling. Data regarding demographics, clinical presentation, diagnostic investigations, consultations, and ED processes was collected. Prolonged LOS was defined as more than 6 hours. Statistical analysis was performed using logistic regression to identify predictors of prolonged stay.*

Results: *The median ED LOS was 5.2 hours (IQR: 3.2–7.6), with 42.4% of patients experiencing prolonged stay. Significant independent predictors of prolonged LOS included inter-departmental consultations (aOR up to 28.66), multiple rounds of blood testing (aOR up to 17.76), use of whole-abdomen ultrasonography (aOR 3.63), and higher pain scores (aOR 1.60 per unit increase) ($p<0.05$). Demographic variables and shift timing were not significantly associated. The model showed good predictive ability (AUC = 0.87).*

Conclusion: *Prolonged ED LOS in patients with acute abdominal pain is primarily driven by operational factors such as multiple consultations, repeated laboratory testing, and imaging delays. Optimizing workflow and promoting efficient diagnostic strategies may help reduce ED overcrowding and improve patient outcomes.*

INTRODUCTION

Emergency department (ED) overcrowding is problem worldwide and it hits low- and middle-income countries (LMICs) hardest where it limits how efficiently acute care can be delivered.[1] One well-recognised consequence is prolonged ED length of stay (LOS) which has become standard indicator of emergency care quality.[2] Beyond resource burden

this imposes longer stays have been linked to slower recovery and higher in-hospital mortality across several acute conditions [3] and in patients with acute abdominal pain specifically prolonged LOS independently predicts worse outcomes.[4]

Acute abdominal pain is one of commonest reasons patients come to ED accounting for roughly 8–10% of all visits worldwide. Because its differential diagnosis cuts across surgical hepatobiliary urological gynaecological and medical causes working it up often means pulling in several specialties and ordering repeated rounds of laboratory and imaging tests.[5] Every one of these steps can add time in department. Studies from other countries have found that inter-departmental consultation repeat blood testing and abdominal imaging are among strongest drivers of prolonged ED stay in this group [6, 7] whereas structured diagnostic pathway has been shown to shorten LOS and improve patient flow.[8] In United Kingdom National Health Service has pushed for four-hour LOS ceiling as marker of quality care [9] though six-hour threshold is more commonly used in resource-limited settings for both clinical and practical reasons.[2]

Pakistan's constrained health infrastructure makes ED overcrowding especially heavy burden in public-sector tertiary hospitals. At Indus Hospital and Health Network free-of-cost tertiary care centre in Karachi ED sees more than 400 patients day against just 300 admitting beds serving catchment of roughly 2.4 million people and urgent care infrastructure that might relieve this pressure is still underdeveloped.[10] Yet no published Pakistani study has looked specifically at what drives prolonged ED LOS in patients with acute abdominal pain. Most of available evidence comes from high-income or Southeast Asian settings whose case-mix and resources look quite different from local environment.[11]

We therefore set out to determine ED length of stay in adult patients presenting with acute abdominal pain at high-volume tertiary care ED in Karachi and to identify which clinical and operational factors independently predict prolonged stay in this population.

METHODOLOGY:

We conducted this descriptive cross-sectional study in the Department of Emergency Medicine at Indus Hospital and Health Network (IHHN) free-of-cost 24-bed tertiary care ED in Karachi that handles more than 400 patients per day. Data collection ran for six months after approval from IHHN Institutional Review Board (Ref no: IHHN_IRB_2022_12_012, Dated: 30-Sept-2023) and CPSP. Patients were enrolled by consecutive non-probability sampling.

Sample size was calculated with World Health Organization calculator using mean ED length of stay of 210 ± 79 minutes from previously published data margin of error of 10 minutes and 95% confidence level; this gave minimum requirement of 240 patients. Because recruitment continued for full six-month window final analytical sample reached 498 patients which gave planned multivariable analysis extra statistical power.

Eligible patients were adults of either sex, ages 14 to 65 years, presenting to ED with acute abdominal pain of less than 48 hour's duration. We defined acute abdominal pain as recent-onset unpleasant abdominal sensation of any character i.e, burning, aching, Cramping, stabbing, shooting, crushing or throbbing localized to one or more of standard nine abdominal quadrants, diagnosed by on-duty emergency physician with at least two years of ED experience. We excluded pregnant women, patients with history of recent trauma or RTA, those referred from facilities and anyone with recent abdominal surgery.

After triage and stabilisation per departmental protocol, we obtained written informed consent in English or Urdu before collecting any data. Data were recorded on coded pre-tested proforma and stored on institutional REDCap server accessible only to principal investigator. We captured age sex time and date of ED arrival and disposition comorbidities (diabetes mellitus hypertension ischaemic heart disease chronic kidney disease cerebrovascular accident HIV infection and malignancy of more than six months' duration) Manchester Triage System acuity level numerical pain score (0–10) temperature anatomical location of pain number of inter-departmental consultations (none one more than one) number of rounds of blood testing (none one more than one) abdominal

imaging performed (ultrasonography plain radiography in various projections and computed tomography) shift timing ED provisional diagnostic category and final disposition. Primary outcome defined priority was stay beyond six hours from ED arrival to disposition consistent with quality indicators used internationally in resource-limited settings.[2]

We analysed data in IBM SPSS Statistics version 24 (IBM Corp. Armonk NY USA). Shapiro–Wilk test was used to check normality of continuous variables; non-normally distributed variables are summarised as median with interquartile range and categorical variables as frequency and percentage. We first examined factors associated with prolonged length of stay using univariable binary logistic regression then entered all variables with univariable p-value <0.10 along with clinically relevant covariates into multivariable binary logistic regression model. We report adjusted odds ratios (aOR) with 95% confidence intervals and exact p-values and assessed model discrimination using area under receiver operating characteristic curve (AUC).12 Two-sided p<0.05 was taken as statistically significant. SPSS output sheet has been retained and is available for editorial review on request.

RESULTS:

The final analysis included 498 patients presenting to ED with acute abdominal pain. Median age was 30 years (IQR: 26–55) and 339 (68.1%) were female. Median ED length of stay was 5.2 hours (IQR: 3.2–7.6); 211 patients (42.4%) stayed longer than six-hour cut-off for prolonged stay. Median pain score at presentation was 6 (IQR: 6–7) and median Manchester triage acuity level was 2 (IQR: 2–3). Table I presents full sociodemographic and clinical profile of cohort.

Most patients needed no specialist consultation (353/498 70.9%); 125 (25.1%) required one and 20 (4.0%) required more than one. Blood testing was common: 257 patients (51.6%) had one round and 120 (24.1%) had more than one round while 121 (24.3%) had none. Among radiological investigations erect abdominal radiography was most frequent (157/498 31.5%) followed by whole-abdomen ultrasonography (145/498 29.1%) and supine abdominal radiography (121/498 24.3%); computed tomography of abdomen was ordered in just 10 patients (2.0%). Medical gastrointestinal conditions made up largest provisional diagnostic category (199/49840.0%) followed by surgical gastrointestinal conditions (144/498 28.9%) and hepatobiliary disease (66/498 13.3%).

On univariable logistic regression prolonged length of stay was significantly associated with higher pain score temperature triage acuity level consultation requirement blood testing rounds whole-abdomen ultrasonography erect abdominal radiography and supine abdominal radiography. Strongest unadjusted associations were for more than one consultation versus none (OR: 43.10; 95% CI: 5.70–326.08; p<0.001) more than one round of blood testing versus none (OR: 36.33; 95% CI: 17.24–76.56; p<0.001) and whole-abdomen ultrasonography (OR: 7.08; 95% CI: 4.57–10.98; p<0.001). Sex age and shift timing showed no significant association in univariable analysis. Table II reports full univariable estimates.

In multivariable model operational variables remained main independent predictors of prolonged length of stay (Table III). Relative to patients needing no consultation those needing one consultation had significantly higher adjusted odds of prolonged stay (aOR: 2.45; 95% CI: 1.43–4.17; p=0.001) and this rose sharply for more than one consultation (aOR: 28.66; 95% CI: 3.46–237.56; p=0.002). Blood testing showed same pattern: one round was independently associated with prolonged stay (aOR: 3.71; 95% CI: 1.78–7.72; p<0.001) and more than one round carried even stronger association (aOR: 17.76; 95% CI: 7.61–41.44; p<0.001). Each one-point rise in pain score independently raised adjusted odds of prolonged stay by 60% (aOR: 1.60; 95% CI: 1.30–1.97; p<0.001) and whole-abdomen ultrasonography remained independently associated with prolonged stay as well (aOR: 3.63; 95% CI: 2.14–6.16; p<0.001).

Sex shift timing triage acuity level erect abdominal radiography and supine abdominal radiography all dropped out as independent predictors after adjustment. Final model discriminated well with area under receiver operating characteristic curve of 0.87 which supports consultation burden repeat laboratory testing ultrasonography use and pain

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severity as main determinants of delayed disposition in this patient group.

TABLE 1: SOCIODEMOGRAPHICS AND CLINICAL CHARACHTERISTICS OF PATIENTS WITH ACUTE ABDOMINAL PAIN (N=498)

Variable	Overall (n=498)
Age (years) median (IQR)	30.0 (26.0–55.0)
Female n (%)	339 (68.1)
Male n (%)	159 (31.9)
ED length of stay (hours) median (IQR)	5.2 (3.2–7.6)
Prolonged LOS (>6 hours) n (%)	211 (42.4)
Pain score (0–10) median (IQR)	6.0 (6.0–7.0)
Temperature (°F) median (IQR)	98.0 (98.0–98.0)
Triage acuity level median (IQR)	2.0 (2.0–3.0)
Consultations n (%)	
None	353 (70.9)
One	125 (25.1)
More than one	20 (4.0)
Rounds of blood testing n (%)	
None	121 (24.3)
One	257 (51.6)
More than one	120 (24.1)
Shift timing n (%)	
Morning	313 (62.9)
Night	185 (37.1)
Imaging performed n (%)	
Ultrasonography whole abdomen	145 (29.1)
X-ray abdomen erect	157 (31.5)
X-ray abdomen supine	121 (24.3)
CT scan abdomen	10 (2.0)
ED provisional diagnosis n (%)	
Medical GI conditions	199 (40.0)
Surgical GI conditions	144 (28.9)
Hepatobiliary tract disease	66 (13.3)
Genitourinary conditions	43 (8.6)
Gynaecological conditions	46 (9.2)
Others	6 (1.2)

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TABLE 2: UNIVARIABLE LOGISTIC REGRESSION FOR FACTORS ASSOCIATED WITH PROLONGED ED LENGTH OF STAY (>6 HOURS).

Predictor	OR (95% CI)	p-value
Female vs male	0.72 (0.49–1.06)	0.094
Age per year	1.00 (0.99–1.01)	0.432
Pain score per point	1.89 (1.59–2.24)	<0.001
Temperature per °F	1.60 (1.19–2.16)	0.002
Triage acuity level per level	0.56 (0.43–0.74)	<0.001
Consultation: >1 vs none	43.10 (5.70–326.08)	<0.001
Consultation: one vs none	4.65 (3.00–7.19)	<0.001
Blood testing: >1 rounds vs none	36.33 (17.24–76.56)	<0.001
Blood testing: one round vs none	6.08 (3.18–11.59)	<0.001
Night vs morning shift	0.89 (0.61–1.28)	0.526
Ultrasonography whole abdomen	7.08 (4.57–10.98)	<0.001
X-ray abdomen erect	3.35 (2.26–4.97)	<0.001
X-ray abdomen supine	2.63 (1.73–4.01)	<0.001

TABLE 3: MULTIVARIABLE LOGISTIC REGRESSION FOR INDEPENDENT PREDICTORS OF PROLONGED ED LENGTH OF STAY (>6 HOURS).

Predictor	aOR (95% CI)	p-value
Consultation: >1 vs none	28.66 (3.46–237.56)	0.002
Consultation: one vs none	2.45 (1.43–4.17)	0.001
Blood testing: >1 rounds vs none	17.76 (7.61–41.44)	<0.001
Blood testing: one round vs none	3.71 (1.78–7.72)	<0.001
Night vs morning shift	0.76 (0.46–1.24)	0.269
Female vs male	1.06 (0.64–1.76)	0.815
Pain score per point	1.60 (1.30–1.97)	<0.001
Triage acuity level per level	1.10 (0.76–1.61)	0.611
Ultrasonography whole abdomen	3.63 (2.14–6.16)	<0.001
X-ray abdomen erect	2.23 (0.92–5.42)	0.077
X-ray abdomen supine	1.02 (0.39–2.68)	0.965

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DISCUSSION:

The biggest single finding was how much multidisciplinary consultation slowed ED throughput. Patients needing more than one consultation had markedly higher odds of prolonged LOS (aOR: 28.66; 95% CI: 3.46–237.56; p=0.002) and even single consultation more than doubled odds (aOR: 2.45; 95% CI: 1.43–4.17; p=0.001). This matches findings from Dadeh and Phunyanantakorn [6] who reported unadjusted odds ratio of 71.82 (95% CI: 5.67–909.51) for two or more specialist consultations in similar cohort of patients with abdominal pain and from Brick et al. [7] who found that consultation stretched tertiary care ED stay from 11.1 to 15.9 hours (p=0.011). plausible mechanism is sequential queueing: each consultation means waiting for senior review bedside assessment admission or discharge plan and often more tests ordered by receiving team. At free-of-cost public-sector facility serving roughly 2.4 million people with daily ED census above 400 against just 300 admitting beds. Even small consultation delays cascade downstream and add materially to overcrowding effect seen across many health systems.[13]

Repeat phlebotomy showed similarly strong dose-response pattern. One round of blood testing nearly quadrupled odds of prolonged LOS (aOR: 3.71; 95% CI: 1.78–7.72; p<0.001) and more than one round pushed odds up almost eighteen-fold (aOR: 17.76; 95% CI: 7.61–41.44; p<0.001). This lines up

with multihospital longitudinal study by Li et al. [11] where median ED LOS climbed with each added test-order episode from 5.6 hours for single episode to 40.7 hours for seventeen. Here delay from repeat phlebotomy is compounded by turnaround time of busy centralised public-sector laboratory; each extra round means several more hours of monitored bed occupancy before disposition can even be reconsidered. In practical terms ordering tests in hypothesis-led sequential way rather than reflexively repeating panels at multiple time points could meaningfully cut ED throughput time for this group.

The independent link between formal whole-abdomen ultrasonography and prolonged LOS (aOR: 3.63; 95% CI: 2.14–6.16; p<0.001) needs careful unpacking. At our centre ultrasonography means transferring patient to radiology suite waiting on sonographer availability and then waiting again for report – all steps outside ED's direct workflow. That sits at odds with interventional literature: Durgun et al. [12] in randomised controlled trial published in this journal found that point-of-care ultrasound (POCUS) performed by emergency physicians during initial evaluation halved number of differential diagnoses considered and significantly cut LOS in both admitted and discharged patients (p=0.049 and p=0.003 respectively). national modelling study on small bowel obstruction estimated POCUS-first algorithm could save roughly 507 000 ED bed hours year while also cutting unnecessary radiation exposure.[14] What this tells us is that ultrasonography itself is not problem; issue is where and how it is accessed. Building emergency-physician-led POCUS into abdominal pain workflow is therefore realistic evidence-based fix for resource-limited tertiary care settings.

Higher pain severity at presentation independently predicted prolonged stay: each one-point rise on numerical pain scale raised adjusted odds of prolongation by 60% (aOR: 1.60; 95% CI: 1.30–1.97; p<0.001). This probably reflects diagnostic uncertainty and procedural intensity that come with severe abdominal pain which triggers wider workup more aggressive imaging surgical opinion and repeated reassessment all of which add measurable time in ED.[4] Manchester triage acuity by contrast was strong unadjusted predictor (OR: 0.56; 95% CI: 0.43–0.74; p<0.001) that lost significance after adjustment (aOR: 1.10; 95% CI: 0.76–1.61; p=0.611). That makes sense given what triage acuity is designed to do: flag urgency of physician contact not predict complexity of downstream workup. Once consultation laboratory and imaging use are accounted for its prognostic value is largely absorbed into those variables. Sex age and shift timing showed no independent association either which hints that staffing levels stayed fairly consistent across day though that is not same as saying staffing was optimal. Plain abdominal radiographs attenuated after adjustment too consistent with how quickly they can be obtained and their limited downstream diagnostic weight compared with cross-sectional or ultrasound imaging.[15]

Together these findings point to small set of operational levers that can actually be changed. At Irish university hospital multidisciplinary quality-improvement project introduced structured acute abdominal pain pathway with predefined imaging protocols and parallel-process workflow and cut ED LOS from 1532 to 1216 minutes (p<0.01).[8] Similar gains seem achievable here through three practical steps: protocolised consultation framework with mandatory time-to-response standards ED-Embedded POCUS run by trained emergency physicians and rationalised laboratory bundle ordered at initial triage rather than piecemeal. Predictive modeling of ED throughput is also emerging as tool that could eventually flag in real time which patients are at high risk of prolonged stay so that operational steps can be taken early.[12] diagnostic mix in this cohort dominated by medical (199/498 40.0%) and surgical (144/498 28.9%) gastrointestinal conditions with hepatobiliary disease making up further 66/498 (13.3%) also supports building structured short-stay observation pathway next to ED approach already proposed as one answer to overcrowding locally.[10]

This study has real strengths: adequately powered sample of 498 patients prospective and comprehensive capture of clinical and operational covariates through coded electronic database and multivariable model with good discrimination (AUC: 0.87). As far as we know this is first dedicated look at what drives ED length of stay in patients with acute abdominal pain from Pakistani

tertiary care setting filling gap in local evidence that has been noted before.[16]

There are limitations too. Being single-centre descriptive cross-sectional study limits how far these findings generalize beyond comparable low- and middle-income tertiary care EDs and we did not capture unmeasured confounders such as real-time ED census on-call team responsiveness individual physician practice patterns ward bed availability or laboratory turnaround time. [17] Wide confidence interval around adjusted odds ratio for more than one consultation (95% CI: 3.46–237.56) reflects how few patients fell into that stratum (20/498 4.0%) so it should be read with some caution even though direction and size of association still look clinically meaningful. Diagnostic categories were recorded as ED provisional diagnosis at disposition and were not checked against final inpatient diagnosis. And we did not track downstream patient-centred outcomes like 72-hour ED re-attendance in-hospital morbidity or mortality which future longitudinal work should pick up. [3, 18]

CONCLUSION:

In this cross-sectional study of adult patients presenting with acute abdominal pain to high-volume tertiary care ED in Karachi median ED length of stay was 5.2 hours and 42.4% of patients exceeded six-hour prolonged-stay threshold. After adjustment handful of modifiable operational factors not patient demographics independently drove prolonged stay: burden of inter-departmental consultation repeat phlebotomy and formal whole-abdomen ultrasonography along with higher pain severity at presentation. That triage acuity and plain radiography both faded after adjustment suggests that once downstream diagnostic workload is accounted for presenting illness severity and basic imaging add little independent prognostic value for total ED stay in this population.

CONFLICT OFF INTEREST:

Nil

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