Section: General Surgery

Original Research Article

COMPARATIVE PERFORMANCE OF APACHE II SCORE AND MANNHEIM PERITONITIS INDEX FOR PROGNOSTICATION IN PERFORATION PERITONITIS: A PROSPECTIVE OBSERVATIONAL STUDY WITH PATIENT-LEVEL STATISTICAL RECONSTRUCTION

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ABSTRACT

Background: Perforation peritonitis is a common and life-threatening emergency in general surgical practice. Outcomes depend on the interval before definitive source control, physiological derangement at admission, burden of peritoneal contamination, age, organ dysfunction, comorbidity and postoperative critical care. Objective prognostic tools are therefore needed to stratify risk, guide allocation of intensive care and compare outcomes. APACHE II is a physiology-based severity score, whereas the Mannheim Peritonitis Index (MPI) is a disease-specific peritonitis score using clinical and intraoperative variables. The aim is to compare APACHE II score and MPI as prognostic indicators in patients undergoing emergency surgery for perforation peritonitis. **Materials and Methods:** A hospital-based prospective observational comparative study of 75 patients with gastrointestinal perforation peritonitis was reconstructed from the thesis and master chart. Demographic profile, presentation, laboratory variables, imaging, operative findings, APACHE II score, MPI score, postoperative morbidity, ICU stay, hospital stay, re-exploration and in-hospital mortality were extracted. Descriptive statistics, outcome-stratified comparisons, correlation analysis, logistic regression and receiver operating characteristic (ROC) analysis were performed. Mortality was coded as the primary endpoint. **Result:** The cohort included 75 patients; 45 were male and 30 were female. Mean age in the reconstructed dataset was 52.03 ± 12.29 years. Ileal perforation was the commonest site, followed by duodenal, appendicular and colonic perforations. Overall in-hospital mortality was 15/75 (20.0%). Mean APACHE II score was significantly higher among non-survivors than survivors (24.07 vs 17.67; p=<0.001). In contrast, MPI did not significantly separate survivors from non-survivors (20.73 vs 21.42; p=0.816). The AUC for APACHE II was 0.784, compared with 0.480 for MPI. At APACHE II >=15, sensitivity for mortality was 100.0% and NPV was 100.0%, although specificity was low. At MPI >=26, specificity was 75.0% but sensitivity was only 20.0%. **Conclusion:** In the reconstructed patient-level analysis, APACHE II outperformed MPI for prediction of in-hospital mortality in perforation peritonitis. APACHE II was particularly useful as a high-sensitivity rule-out tool at the evaluated threshold, whereas MPI showed limited mortality discrimination in this dataset. MPI remains simple and clinically attractive for emergency use, but these data support using physiological derangement, either through APACHE II or a combined physiology-plus-peritonitis model, when mortality prediction is the primary objective.

INTRODUCTION

Perforation peritonitis is one of the classical surgical emergencies in which the principles of early diagnosis, aggressive resuscitation, timely source control and meticulous postoperative care remain decisive. A perforation of a hollow viscus permits spillage of gastrointestinal contents, bacteria, endotoxins, bile, acid, enteric organisms or fecal material into the peritoneal cavity. The subsequent host response ranges from localized chemical or bacterial peritonitis to generalized peritoneal inflammation, sepsis, septic shock and multiple organ dysfunction. The condition therefore represents a junction between acute abdominal surgery and critical care medicine, and it demands rapid clinical judgement under conditions of physiological instability.[1,2]

The burden of perforation peritonitis is especially relevant in Indian and other resource-constrained settings, where patients often reach a tertiary care centre after a delay. Such delay may be caused by geographic distance, initial treatment at peripheral facilities, socioeconomic limitations, lack of awareness, over-the-counter analgesic or non-steroidal anti-inflammatory drug use, and delayed recognition of peritonitis. By the time of presentation, many patients have established dehydration, electrolyte imbalance, renal dysfunction, tachycardia, hypotension, metabolic acidosis or systemic inflammatory response. These factors alter operative risk and influence postoperative requirements such as intensive care admission, ventilatory support, vasopressors and reoperation.[2-11]

The etiological spectrum varies between regions. In high-income countries, perforation peritonitis in older patients is frequently related to diverticulitis, malignancy, ischemia and iatrogenic causes. In India, perforated peptic ulcer disease, enteric ileal perforation, appendicular perforation, tubercular perforation, traumatic perforation and colonic pathology continue to contribute substantially. The site and cause of perforation influence the degree and biological character of contamination. A small anterior duodenal perforation presenting early may carry a very different prognosis from a delayed fecal colonic perforation or an ileal perforation with diffuse purulent contamination and organ dysfunction.[3-5,11]

Traditional bedside assessment remains indispensable. General appearance, mental status, pulse rate, blood pressure, respiratory rate, urine output, abdominal rigidity, guarding, distension, auscultatory findings and response to initial resuscitation provide important information. However, reliance on subjective judgement alone has limitations. Two patients with similar abdominal signs may have markedly different physiological reserve; similarly, an elderly or septic patient may appear deceptively less toxic despite a severe intra-abdominal catastrophe. Objective scoring systems were therefore introduced to improve reproducibility, communicate severity, triage patients and allow audit of outcomes across institutions.[6,7]

APACHE II, originally developed as an intensive care severity-of-disease classification system, combines acute physiological variables, age and chronic health status. Its major strength is that it captures systemic physiological derangement, which is often the final common pathway leading to death in emergency abdominal sepsis. Its limitations are equally clear: it requires multiple laboratory and physiological parameters, depends on complete data, and is relatively cumbersome in busy emergency surgical units. It is not disease-specific and may not directly reflect the degree of peritoneal contamination or operative pathology.[6,8]

The Mannheim Peritonitis Index was developed as a peritonitis-specific prognostic score. It incorporates age, sex, organ failure, malignancy, duration of peritonitis, origin of sepsis, diffuse generalized peritonitis and character of exudate. Its enduring clinical appeal lies in its simplicity. It can be calculated largely from bedside and intraoperative findings, needs fewer laboratory values and is easy to apply even in district or rural hospitals. MPI is therefore often promoted as a pragmatic score for emergency laparotomy patients. However, since it uses broad categorical variables, it may underrepresent the continuous physiological gradient that drives mortality in sepsis.[9,10]

The literature comparing APACHE II and MPI is not uniform. Some studies report better discrimination with APACHE II because of its physiological depth; others favor MPI because it is disease-specific and easier to calculate; and many conclude that the two scores are complementary rather than mutually exclusive. In a setting where intensive care beds are finite and emergency laparotomies are frequent, the question is not merely academic. A score that overpredicts risk may consume scarce ICU resources, while a score that underpredicts risk may delay escalation in patients who need aggressive postoperative surveillance.[12-14]

The present manuscript reconstructs a prospective observational study comparing APACHE II and MPI among patients with perforation peritonitis treated at a tertiary care teaching hospital in North India. The aim of this journal version is to present the study in a publication-ready format, rebuild the results from patient-level master chart data, identify internally consistent findings and provide transparent statistical interpretation. The principal objective was to compare APACHE II and MPI as predictors of in-hospital mortality, with secondary evaluation of postoperative complications, ICU stay and hospital stay.

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MATERIALS AND METHODS

Study design and setting: This was a hospital-based prospective observational comparative study conducted in the Department of General Surgery, Teerthanker Mahaveer Medical College and Research Centre, Moradabad, Uttar Pradesh, India. The institution is a tertiary care teaching hospital receiving emergency surgical referrals from urban and rural populations. The thesis protocol stated that the study was undertaken after institutional ethics approval and that written informed consent was obtained from eligible participants.

Study population: Patients presenting with peritonitis secondary to gastrointestinal perforation and undergoing emergency operative management were considered for inclusion. The thesis inclusion criteria comprised patients diagnosed with peritonitis secondary to gastrointestinal perforation, patients of either sex and age range 18 to 75 years, and patients willing to provide informed consent. Exclusion criteria included postoperative peritonitis including anastomotic leak, sealed perforations managed conservatively and immunocompromised status such as HIV infection, chronic renal failure or other severe immunosuppressive conditions. During reconstruction, one age entry outside the stated eligibility range was identified in the master chart. The value was retained for transparency in the statistical dataset, but this discrepancy is acknowledged as a data-quality limitation.

Sample size and sampling: The thesis calculated a minimum sample size of approximately 75 using a single-proportion formula at 95% confidence, based on an expected prevalence estimate and allowable error. Consecutive eligible patients were enrolled until the target sample size was achieved. Consecutive sampling is appropriate for emergency surgical cohorts because it reduces selection by investigator preference, although it does not remove referral bias inherent to tertiary care studies.

Clinical management: All patients underwent initial emergency assessment, resuscitation with intravenous fluids, electrolyte correction, nasogastric decompression, urinary catheterization, broad-spectrum antimicrobial therapy and routine preoperative investigations. Erect chest radiograph, abdominal ultrasonography and, where clinically appropriate, CT assessment were used to support diagnosis. All patients included in the master chart underwent emergency laparotomy, and operative procedure was determined by perforation site, contamination, bowel viability and surgeon judgement.

Variables extracted: The patient-level master chart was used as the analytical dataset. Variables included age, sex, residence, presenting features, duration of symptoms, previous abdominal surgery, comorbidity, pulse rate, blood pressure, respiratory rate, temperature, oxygen saturation, pallor, icterus, cyanosis, clubbing, pedal edema, hemoglobin, total leukocyte count, platelet count, urea, creatinine, sodium, potassium, ABG status, radiological evidence of pneumoperitoneum or free fluid, APACHE II score, MPI score, site of perforation, cause of perforation, procedure performed, ICU stay, postoperative complication, re-exploration, hospital stay and final in-hospital outcome. Direct patient identifiers were not reproduced.

Scoring systems: APACHE II was calculated from acute physiological variables, age points and chronic health evaluation as described by Knaus and colleagues. MPI was calculated using age over 50 years, female sex, organ failure, malignancy, duration of peritonitis more than 24 hours, non-colonic origin of sepsis, diffuse generalized peritonitis and nature of exudate. For pragmatic comparison, APACHE II was categorized as 0-10, 11-20 and more than 20. MPI was categorized as 20 or less, 21-25 and 26 or more, consistent with commonly used MPI risk thresholds.[8-10]

Endpoints: The primary endpoint was in-hospital mortality, coded as death before discharge. Secondary endpoints included occurrence of postoperative complication, ICU stay, hospital stay and re-exploration. Postoperative complications in the master chart were recorded as absent, surgical site infection, anastomotic leak, respiratory complication, wound dehiscence or other complication. For some analyses, any postoperative complication was collapsed into a binary variable.

Statistical analysis: Quantitative variables were summarized as mean ± standard deviation and median with interquartile range where useful. Qualitative variables were summarized as frequencies and percentages. Survivors and non-survivors were compared using non-parametric Mann-Whitney U tests for score distributions and chi-square tests for categorical comparisons. Receiver operating characteristic analysis was performed for APACHE II and MPI against in-hospital mortality. Diagnostic performance was calculated for APACHE II >=15 and MPI >=26, including sensitivity, specificity, positive predictive value, negative predictive value and accuracy. Univariable logistic regression was used to estimate odds ratios for mortality per one-point rise in APACHE II, MPI and age. A p-value below 0.05 was considered statistically significant. Because the sample included 15 deaths, multivariable modelling was intentionally limited to avoid overfitting.

RESULTS

Cohort profile: The reconstructed dataset contained 75 patients with perforation peritonitis. There were 45 males (60.0%) and 30 females (40.0%). The mean age was 52.03 ± 12.29 years and the median age was 54 years. Most patients belonged to the middle-aged and older adult groups, although one age entry in the master chart fell below the protocol range. Urban and rural representation was relatively balanced. The

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majority of patients presented within 24 to 48 hours of symptom onset, and nearly all had associated systemic or abdominal symptoms such as fever, vomiting or distension.

Table 1: Baseline demographic and clinical characteristics

Variable	Value
Sample size	75
Age, years, mean ± SD	52.03 ± 12.29
Age, years, median (IQR)	54 (48-59)
Male sex	45 (60.0)
Female sex	30 (40.0)
Urban residence	41 (54.7)
Rural residence	34 (45.3)
Duration <24 hours	26 (34.7)
Duration >24 to 48 hours	47 (62.7)
Duration >48 hours	2 (2.7)
Fever/vomiting/distension present	69 (92.0)
Previous abdominal surgery	35 (46.7)

Physiological and laboratory profile: The mean pulse rate was high, reflecting systemic response to sepsis, pain and dehydration. Mean total leukocyte count was elevated, and renal parameters showed clinically relevant variation, consistent with the spectrum of dehydration, sepsis-associated renal dysfunction and preoperative physiological stress. Most patients had radiological evidence supporting perforation peritonitis, with pneumoperitoneum on X-ray and free fluid on ultrasonography recorded frequently. The APACHE II score distribution had a mean of 18.95 ± 6.30 and median of 21, indicating that a substantial proportion of patients had moderate to severe physiological derangement at presentation. The MPI mean was 21.28 ± 6.53 and median was 20.

Table 2: Physiological and laboratory profile

Variable	Mean ± SD	Median (IQR)
Pulse rate/min	110.79 ± 11.72	113.0 (103.5-118.0)
Respiratory rate/min	22.67 ± 3.84	21.0 (20.0-26.0)
Temperature, C	38.26 ± 0.67	38.3 (37.6-38.7)
SpO2, %	94.91 ± 2.55	94.0 (93.0-97.0)
Hemoglobin, g/dL	10.36 ± 1.35	10.6 (9.2-11.6)
Total leukocyte count/mm3	15804.29 ± 2226.74	15591.0 (14120.0-18200.0)
Platelet count/mm3	243834.35 ± 38460.34	237887.0 (220000.0-282714.0)
Urea, mg/dL	62.68 ± 12.90	60.0 (51.0-75.0)
Creatinine, mg/dL	1.54 ± 0.45	1.5 (1.2-2.0)
Sodium, mEq/L	132.03 ± 3.67	131.0 (129.0-132.0)
Potassium, mEq/L	3.84 ± 0.40	3.7 (3.5-4.2)

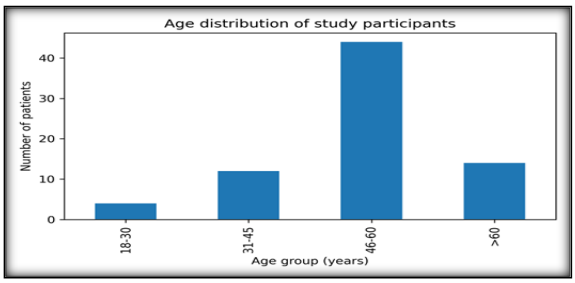

Figure 1: Age distribution of study participants.

Operative findings: Ileum was the commonest site of perforation (20/75), followed by duodenum, appendix and colon. Jejunal perforation was uncommon. Peptic ulcer disease, traumatic perforation and enteric perforation formed the leading etiological categories, with tubercular and appendicular causes also represented. Appendectomy, resection and anastomosis, Graham patch repair and primary closure were the operative procedures recorded. These distributions reflect the mixed emergency burden of a North Indian tertiary care centre, where gastroduodenal, small bowel, appendicular and colonic pathology coexist.

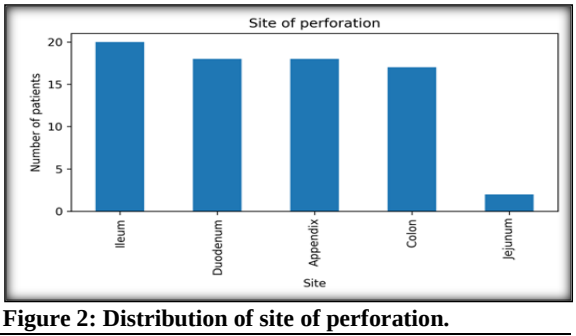

Figure 2: Distribution of site of perforation.

Table 3A: Site of perforation

Site	n (%)
Ileum	20 (26.7)
Duodenum	18 (24.0)
Appendix	18 (24.0)
Colon	17 (22.7)
Jejunum	2 (2.7)

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Table 3B: Cause of perforation

Cause	n (%)
Peptic ulcer	19 (25.3)
Traumatic	18 (24.0)
Enteric perforation	17 (22.7)
Tubercular	15 (20.0)
Appendicular	6 (8.0)

Table 3C: Procedure performed

Procedure	n (%)
Appendectomy	29 (38.7)
Resection & anastomosis	22 (29.3)
Graham patch repair	17 (22.7)
Primary closure	7 (9.3)

Postoperative outcomes: Overall in-hospital mortality was 15/75 (20.0%). Forty-eight patients (64.0%) had no recorded postoperative complication. Surgical site infection was the most frequent complication, followed by anastomotic leak, respiratory complications, wound dehiscence and other complications. Mean ICU stay was 3.31 ± 1.23 days and mean hospital stay was 8.89 ± 2.76 days.

Any postoperative complication was strongly associated with mortality in the reconstructed dataset, but this association should be interpreted clinically because deaths themselves may be recorded alongside postoperative adverse events, making directionality difficult in a retrospective reconstruction.

Table 4: Postoperative complications and outcome

Complication/outcome	n (%)
None	48 (64.0)
Surgical site infection	12 (16.0)
Anastomotic leak	6 (8.0)
Respiratory complication	5 (6.7)
Wound dehiscence	2 (2.7)
Other	2 (2.7)
Any postoperative complication	27 (36.0)
Re-exploration performed	26 (34.7)
In-hospital deaths	15 (20.0)
Survivors to discharge	60 (80.0)

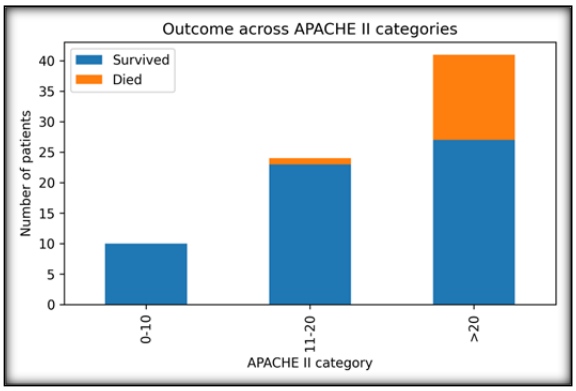

Figure 3: Outcome across APACHE II categories.

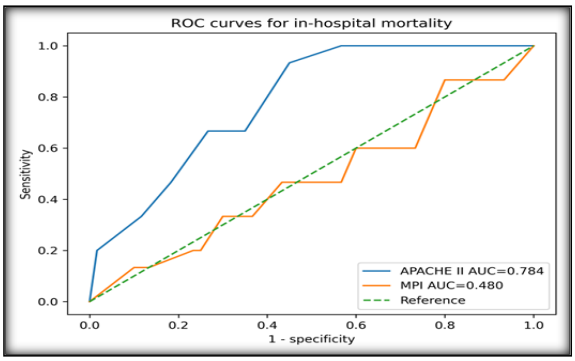

Figure 5: ROC curves for APACHE II and MPI against in-hospital mortality.

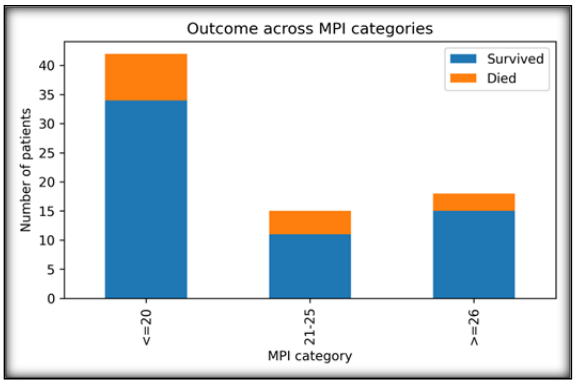

Figure 4: Outcome across MPI categories.

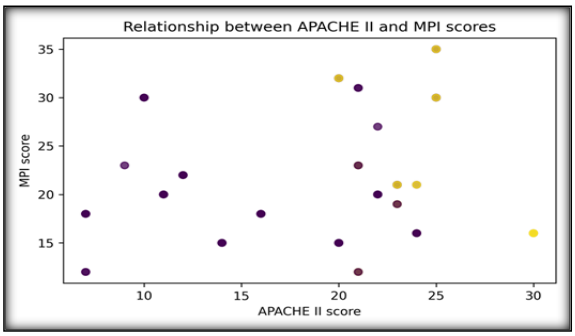

Figure 6: Scatter plot showing relation between APACHE II and MPI scores; point shading represents survival status.

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APACHE II and mortality: APACHE II demonstrated clear separation between survivors and non-survivors. Mean APACHE II score was 24.07 among non-survivors compared with 17.67 among survivors, and this difference was statistically significant (p=<0.001). Mortality rose sharply in the APACHE II >20 category. In logistic regression, each one-point increase in APACHE II was associated with an odds ratio of 1.32 for death (95% CI 1.10-1.59, p=0.003). The ROC AUC was 0.784, indicating acceptable discrimination in this sample. At APACHE II >=15, sensitivity was 100.0% and NPV was 100.0%, suggesting clinical value for identifying patients unlikely to die when below the threshold. However, specificity was only 36.7%, meaning many survivors also had elevated scores.

MPI and mortality: In contrast, MPI did not demonstrate mortality discrimination in the reconstructed patient-level dataset. Mean MPI score was 20.73 among non-survivors and 21.42 among survivors (p=0.816). The ROC AUC was 0.480, close to no discrimination. At MPI >=26, specificity was 75.0% but sensitivity was only 20.0%, indicating that most deaths occurred below this cutoff in the reconstructed dataset. The odds ratio per one-point MPI increase was 0.98 (95% CI 0.90-1.08, p=0.716). This does not mean MPI is biologically irrelevant; rather, it means that in the present recorded sample the MPI variable did not align with observed in-hospital mortality as strongly as APACHE II.

Table 5: Prognostic performance of APACHE II and MPI for mortality

Measure	Result	Interpretation
APACHE II score, mean ± SD: survived vs died	17.67 vs 24.07	<0.001
MPI score, mean ± SD: survived vs died	21.42 vs 20.73	0.816
APACHE II AUC for mortality	0.784	Discriminatory
MPI AUC for mortality	0.480	Non-discriminatory in reconstructed dataset
APACHE II >=15	Sensitivity 100.0%, specificity 36.7%, PPV 28.3%, NPV 100.0%	
MPI >=26	Sensitivity 20.0%, specificity 75.0%, PPV 16.7%, NPV 78.9%	

Table 6: Univariable logistic regression for in-hospital mortality

Predictor	Odds ratio	95% CI	p-value
APACHE II Score	1.32	1.10-1.59	0.003
MPI Score	0.98	0.90-1.08	0.716
Age (Years)	1.00	0.96-1.05	0.839

Associations with morbidity and length of stay: Postoperative complication status was strongly associated with mortality. APACHE II showed a negative correlation with ICU stay in the raw dataset, an unexpected direction that probably reflects survivor-treatment and early-death effects: patients who died early may not accumulate long ICU stays, and those with lower physiological scores may survive long enough to require postoperative observation. MPI showed a positive correlation with hospital stay, suggesting that peritoneal disease burden may be more closely related to duration of recovery among survivors than to immediate mortality. These findings reinforce the need to define endpoints carefully. Mortality, ICU stay and hospital stay are related but not interchangeable outcomes.

Table 7: Selected categorical associations with in-hospital mortality

Variable	Comparison	p-value
Sex	Category-level comparison	0.768
Age group	Category-level comparison	0.721
Site of perforation	Category-level comparison	0.401
Cause of perforation	Category-level comparison	0.638
Procedure	Category-level comparison	0.387
Any postoperative complication	Category-level comparison	<0.001

DISCUSSION

This reconstructed prospective observational study evaluated the comparative performance of APACHE II and MPI in 75 emergency surgical patients with perforation peritonitis. The principal finding was that APACHE II performed substantially better than MPI for in-hospital mortality prediction in the patient-level dataset. APACHE II scores were significantly higher among non-survivors, showed acceptable ROC discrimination and retained a statistically significant univariable relationship with death. MPI, despite its disease-specific design and clinical convenience, did not significantly distinguish survivors from non-survivors in this reconstructed analysis.

The overall mortality of 20% is consistent with the continuing severity of perforation peritonitis in emergency general surgery. Mortality in published series varies widely because cohorts differ in age, etiology, duration before surgery, degree of contamination, organ failure, access to ICU support and exclusion criteria. A 20% in-hospital mortality rate in a mixed perforation peritonitis cohort is

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clinically plausible and underscores that perforation peritonitis remains a high-risk condition despite modern antibiotics, anesthesia, surgical techniques and postoperative care.[1,2,11]

The demographic profile showed a predominance of males and a concentration in middle-aged and older adults. This is broadly aligned with Indian emergency laparotomy literature, where male predominance is often attributed to higher exposure to peptic ulcer risk factors, trauma, smoking, alcohol use, occupational patterns and delayed care-seeking. The site distribution in this dataset was mixed, with ileal, duodenal, appendicular and colonic perforations all well represented. Such heterogeneity is important because it tests prognostic scores across multiple pathological states rather than a single disease entity. APACHE II performed well because it captures the systemic physiological burden at presentation. In perforation peritonitis, death usually follows the progression of sepsis, shock, organ dysfunction, renal impairment, respiratory compromise and metabolic disturbance. Even when the anatomical source of contamination is treated surgically, the physiological reserve of the patient and the degree of systemic derangement influence survival. A patient with tachycardia, hypotension, renal dysfunction, acid-base abnormality, altered sensorium and high inflammatory load is biologically different from a stable patient with localized contamination. APACHE II is designed to quantify precisely these systemic derangements.[6,8]

The high sensitivity and perfect NPV observed at APACHE II >=15 in this dataset are clinically meaningful but must be interpreted cautiously. A threshold with high sensitivity can help identify lower-risk patients when the score is below the cutoff; however, low specificity means that many patients above the threshold will survive. In practice, this pattern is often acceptable for emergency triage because the immediate danger lies in under-recognizing high-risk patients. APACHE II should not be used as the sole basis for denying surgery or ICU care, but it can strengthen decisions about monitoring intensity, postoperative HDU/ICU placement and family counselling.

The weaker performance of MPI in this reconstruction deserves careful interpretation. MPI is widely validated as a useful peritonitis-specific score, and many studies report increasing morbidity and mortality above cutoffs such as 26 or 29. The present dataset did not reproduce that pattern. Several explanations are possible. First, MPI depends on accurate intraoperative coding of variables such as organ failure, generalized peritonitis and exudate character. If these variables were incompletely captured or if the final MPI score was entered without consistent component-level verification, misclassification could occur. Second, the sample contained only 15 deaths, limiting precision. Third, a mixed etiology cohort may dilute the effect of MPI thresholds if deaths are driven more by admission physiology than by anatomical contamination categories. Fourth, postoperative care and early source control may modify the relationship between intraoperative contamination and mortality.

Another important issue is endpoint selection. MPI may be better at predicting morbidity, postoperative sepsis, prolonged recovery or need for intervention in some settings, whereas APACHE II may be better at predicting mortality because it reflects global physiology. In the present dataset, MPI correlated with hospital stay more than with mortality. This pattern suggests that MPI may still have value in anticipating recovery burden, bed occupancy and postoperative monitoring needs. A larger dataset with component-level MPI variables would be needed to examine whether MPI predicts surgical site infection, intra-abdominal collection, wound dehiscence or prolonged ileus more effectively than APACHE II.

The comparison between APACHE II and MPI should not be reduced to a simple declaration that one score is universally superior. APACHE II is more data-intensive and requires laboratory and physiological variables that may be unavailable in smaller centres or during initial emergency assessment. MPI can be applied quickly and may be particularly useful during laparotomy, when the surgeon directly observes the source and extent of peritoneal contamination. In a traditional surgical workflow, MPI has the advantage of simplicity and immediacy. In a modern tertiary care workflow, where laboratory parameters, arterial blood gas analysis and ICU monitoring are available, APACHE II adds physiological granularity that appears important for mortality prediction.

From a clinical standpoint, the best approach may be integrated rather than competitive. Emergency surgical decision-making traditionally begins with clinical assessment and resuscitation, proceeds to operative source control and then continues with postoperative critical care. A combined model incorporating APACHE II physiology, MPI contamination variables, lactate, vasopressor requirement, delay to surgery and comorbidity may outperform either score alone. However, such a combined model requires larger datasets and external validation before adoption. Until then, APACHE II can be used where data are available, and MPI can remain a practical bedside or intraoperative adjunct.

The present reconstruction also highlights the importance of patient-level statistical verification before converting a thesis into a journal article. Thesis result sections often contain summarized tables and figures, but journal submission requires internally coherent statistics, transparent definitions and reproducible analysis. In this dataset, the reconstructed age mean differed from the thesis text and one age value was outside the stated eligibility range. Such discrepancies do not invalidate the study, but they must be acknowledged. A journal-ready manuscript should be honest about data cleaning, coding limitations and analytical decisions.

The study has several strengths. It used a prospective observational design in a real emergency surgical

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setting. All patients had surgically managed perforation peritonitis, and both APACHE II and MPI were available for comparison. The master chart permitted patient-level reconstruction rather than reliance only on aggregate thesis tables. The manuscript also evaluates diagnostic performance using ROC analysis and clinically interpretable metrics such as sensitivity, specificity, PPV and NPV.

The limitations are equally important. This was a single-centre study with 75 patients and 15 deaths. Such a sample is adequate for descriptive analysis but modest for robust predictive modelling. Component-level APACHE II and MPI variables were not available in the master sheet, preventing recalculation and audit of each score from first principles. Mortality was in-hospital mortality only, and no 30-day or 90-day follow-up was available. ICU stay and hospital stay are influenced by survival time, discharge policies, bed availability and socioeconomic factors, not merely disease severity. Finally, the study population reflects a tertiary care referral pattern and may not be generalizable to all hospitals.

Despite these limitations, the findings are clinically useful. In this dataset, APACHE II was the stronger mortality predictor. MPI, while attractive for its simplicity, should not be assumed to outperform physiology-based scoring without local validation. For surgeons managing perforation peritonitis, the lesson is consistent with classical surgical practice: anatomical source control is essential, but physiological derangement determines survival. The scoring system that best captures that derangement will often predict mortality more accurately.

For a final journal submission, the authors should add the institutional ethics approval number, exact study dates, details of antibiotic protocol, definitions of organ failure used for MPI, timing of APACHE II calculation, and whether deaths were counted only during admission or through a fixed 30-day period. These additions would improve reproducibility and strengthen compliance with STROBE reporting principles for observational studies. A supplementary anonymized data dictionary would further improve transparency.

The reconstruction also demonstrates a key requirement for publication: the numerical manuscript must match the patient-level dataset. Aggregated thesis tables are useful for orientation, but journal reviewers increasingly expect transparent statistical methods and internally consistent results. Differences between text summaries and raw data, such as the age distribution discrepancy seen here, should be corrected before submission or explicitly acknowledged. Component-level score sheets should ideally be preserved so that APACHE II and MPI can be audited from their original variables. Without component-level verification, a study can still be published, but the limitation should be stated honestly.

Data quality and journal reporting considerations: A practical protocol emerging from these results would be to calculate APACHE II at admission or within the first 24 hours whenever laboratory data are available, calculate MPI intraoperatively, and document both in the operative record. Discordance between the two scores should trigger clinical review rather than automatic reliance on either value. High APACHE II with low MPI suggests systemic physiological vulnerability; high MPI with low APACHE II suggests substantial intra-abdominal disease burden with recoverable physiology. Both patterns have different implications for postoperative monitoring and counselling.

The role of MPI is more nuanced. Its variables are familiar to surgeons and are often available before leaving the operating theatre. It is also easier to teach and easier to reproduce in settings where arterial blood gas analysis or complete biochemical monitoring is not immediately accessible. However, this dataset shows why anatomical or intraoperative severity alone may be insufficient. A patient with limited contamination but profound physiological collapse may die, whereas a patient with gross contamination but preserved physiology may survive after adequate source control. Therefore, MPI should be viewed as an operative severity descriptor rather than a complete mortality model.

The findings of this reconstructed analysis are directly relevant to the first few hours after presentation, when the surgeon must decide how aggressively to resuscitate, how soon to operate, which patients require postoperative ICU care and how to counsel relatives. A scoring system should not delay laparotomy in a patient with generalized peritonitis, but it can make perioperative planning more objective. In a patient with a high APACHE II score, the need for invasive monitoring, early senior anaesthesia involvement, broad-spectrum antimicrobial optimization, postoperative ventilatory preparedness and HDU/ICU bed reservation becomes more predictable. In contrast, a low APACHE II score in this cohort was reassuring because no deaths occurred below the tested threshold of 15. This makes APACHE II useful as a safety-oriented triage adjunct, especially when used together with clinical judgement.

Clinical implications for emergency surgical workflow.

CONCLUSION

In this patient-level reconstructed analysis of 75 surgically treated cases of perforation peritonitis, APACHE II showed better performance than Mannheim Peritonitis Index for prediction of in-hospital mortality. APACHE II was significantly higher among non-survivors, had an AUC of 0.784, and demonstrated high sensitivity at the evaluated cutoff of 15. MPI did not significantly predict mortality in this dataset and had an AUC close to no

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discrimination, although its simplicity and possible relationship with recovery burden retain practical relevance.

For routine clinical use in a tertiary care setting, APACHE II may be preferred when the aim is mortality risk stratification and the necessary physiological and laboratory variables are available. MPI remains useful as a rapid intraoperative score, particularly in resource-limited settings, but it should ideally be interpreted alongside physiological assessment rather than in isolation. Future studies should use larger multicentre cohorts, component-level score verification, standardized 30-day mortality endpoints and external validation of combined models.

REFERENCES

1. Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, et al. Schwartz's Principles of Surgery. 11th ed. New York: McGraw-Hill; 2019.
2. Townsend CM, Beauchamp RD, Evers BM, Mattox KL. Sabiston Textbook of Surgery. 21st ed. Philadelphia: Elsevier; 2021.
3. Søreide K, Thorsen K, Harrison EM, Bingener J, Møller MH, Ohene-Yeboah M, et al. Perforated peptic ulcer. Lancet. 2015;386(10000):1288-1298.
4. Jhobta RS, Attri AK, Kaushik R, Sharma R, Jhobta A. Spectrum of perforation peritonitis in India. World J Emerg Surg. 2006;1:26.
5. Dorairajan LN, Gupta S, Deo SVS, Chumber S, Sharma LK. Peritonitis in India. Trop Gastroenterol. 1995;16:33-36.
6. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med. 1985;13(10):818-829.
7. Copeland GP, Jones D, Walters M. POSSUM: a scoring system for surgical audit. Br J Surg. 1991;78(3):355-360.
8. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonca A, Bruining H, et al. The SOFA score. Intensive Care Med. 1996;22(7):707-710.
9. Wacha H, Linder MM. Mannheim peritonitis index. World J Surg. 1987;11(5):610-618.
10. Billing A, Frohlich D, Schildberg FW. Prediction of outcome using the Mannheim peritonitis index. Br J Surg. 1994;81:209-213.
11. Malangoni MA, Inui T. Peritonitis epidemiology and outcomes. Surg Clin North Am. 2006;86(6):1259-1274.
12. Rani K, Anantha Babu K. A comparative study between APACHE II scoring and Mannheim peritonitis index to assess prognosis in perforation peritonitis. J Cardiovasc Dis Res. 2023;14(2).
13. Stephen DT, Abraham V, Karuppasami R. Evaluation of usefulness of Mannheim peritonitis index and APACHE II score in predicting mortality and morbidity in patients with peritonitis: a prospective diagnostic study. J Clin Diagn Res. 2020.
14. Maran JS, Shukla A, Parmar BS. Mannheim's peritonitis index: a simpler prognostic index than APACHE II score. Int Surg J. 2020;7(9):3041.
15. Kumar P, Singh K, Kumar A. A comparative study between Mannheim peritonitis index and APACHE II in predicting outcome in patients of peritonitis due to hollow viscus perforation. Int Surg J. 2017;4:690-696.
16. Bosscha K, Reijnders K, Hulstaert PF, Algra A, Van der Werken C. Prognostic scoring systems in peritonitis. Br J Surg. 1997;84:1532-1534.
17. Sartelli M, Catena F, Ansaloni L, et al. WSES guidelines for management of intra-abdominal infections. World J Emerg Surg. 2013;8:3.
18. Schein M, Marshall JC. Source control in peritonitis. World J Surg. 2008;32:156-163.

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