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ORIGINAL RESEARCH

Utilising the Emergency Surgical Score (ESS) to assess Post-Operative Outcomes by predicting Morbidity and Mortality in Emergency Laparotomies

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ABSTRACT

Introduction: Emergency laparotomies encompass a broad spectrum of urgent surgical procedures, often associated with significant mortality and morbidity. These procedures, performed in response to both traumatic and non-traumatic events, are particularly critical due to their time-sensitive nature. Despite the advancements in surgical care, the mortality rate for emergency laparotomies remains substantially higher compared to elective surgeries, with global disparities in surgical outcomes, particularly in low-income countries. Current tools for risk assessment, such as the ACS-NSQIP, fall short in accurately predicting outcomes for patients undergoing emergency general surgery (EGS), leading to the development of the Emergency Surgery Score (ESS) as a more tailored predictive scoring. **Background:** The Emergency Surgical Score (ESS) was introduced in 2016 as a risk assessment tool designed for patients undergoing Emergency abdominal surgery. It has since been validated as a predictor of not only 30-day mortality but also complications happening in the postoperative period and the need for high-dependency intensive care. **Data Analysis:** This study involved 131 patients who underwent emergency laparotomies at B.L.D.E.(D.U)'s Shri B.M.Patil Medical College Hospital and Research Centre, Vijayapura, between August 2022 and June 2024. Patients were assessed using the ESS, and their postoperative outcomes were categorised as fair, ICU admission required, or mortality. The analysis focused on demographic variables, comorbidities, presenting illnesses, and laboratory findings, comparing these factors with the ESS and postoperative outcomes. **Results:** The study population comprised 35 females and 96 males, with a higher ESS score correlating with increased age and male sex. Patients with an ESS score above 15 had significantly higher mortality rates, especially those over 60 years. The ESS effectively predicted outcomes, with higher scores indicating a need for more intensive postoperative care and a higher likelihood of mortality. The ESS's predictive ability was evident across various patient characteristics and comorbidities, highlighting its utility in clinical settings. **Discussion:** The ESS has proven to be a valuable tool in predicting postoperative outcomes in emergency laparotomy patients. Its ability to stratify patients by risk allows for better resource allocation, informed patient counselling, and potentially improved postoperative care. The correlation between higher ESS scores and adverse outcomes underscores the importance of this tool in managing high-risk surgical patients. This study reaffirms the ESS's role in guiding clinical decisions, particularly in resource-constrained settings where surgical outcomes may be poorer. **Conclusion:** The ESS is an accurate predictor of morbidity and mortality in patients undergoing emergency laparotomy. Its use can significantly enhance the preoperative assessment process, leading to better patient outcomes through targeted interventions and appropriate resource allocation. As surgical care continues to evolve, the ESS stands out as a critical tool in managing the complexities of emergency general surgery.

Keywords- emergency abdominal surgeries; surgical scoring; GI surgery; mortality;

INTRODUCTION

Emergency laparotomy is a large group of sensitive operations performed on a variable population. In general, it can be divided into trauma and non-traumatic laparotomy. The most common non-traumatic procedures include laparotomy for bowel

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obstruction and obstruction, while trauma laparotomy is performed to control bleeding and peritoneal effusion after trauma. The average mortality after acute laparotomy in various studies is between 10 and 18%, which is higher than elective operations [1].

Emergency surgery is a unique challenge based on physical complexity, age and asso ciated conditions and is often associated with increased complications a nd death. There are only a few reliable tools available for predicting the risks associated with emergency surgeries. A recently introduced tool is the Emergency Surgical Score (ESS), which incorporates three main variables, 10 disease-related factors, and nine laboratory parameters, totalling 29 variables overall. [2].

Because patients undergoing emergency laparotomy are very heterogeneous, the risk of postoperative complications or mortality is not uniformly distributed across patient populations. Providing individualized care and reducing post-operative side effects, the structure and delivery of post-operative care should be tailored to the individual's needs. To this end, efforts have been made to identify subgroups of high-risk patients and to identify patients at greatest risk of morbidity and mortality [3,4,5].

Every surgeon ideally needs a dependable and straightforward scoring system for assessing emergency surgeries. Accurate outcome predictions enable the clinical team to make better-informed decisions regarding whether surgery or supportive care is the most appropriate treatment option for the patient. Significant reduction of morbidity and mortality after acute laparotomy has been the focus of many national and international evaluation and quality improvement programs [6].

The Emergency Surgical Score (ESS) is the sole risk assessment tool available for emergency surgical patients, and it has been proven to accurately predict the likelihood of postoperative mortality, morbidity, and complications, including infections. [7-9].

MATERIALS AND METHOD

Study design- Prospective observational Study.

Proposed study period- August 2022 - June 2024

Place of study - Shri.B.M.Patil Medical College Hospital and Research Center, Vijayapura.

Total number of patients-131

Statistical analysis involved data entry into Microsoft Excel (Microsoft, Redmond, WA), application of IBM SPSS Statistics, version 20 (IBM Corp., Armonk, NY), and comparing categorical variables by chi-square and Fisher's exact tests. Independent sample t-tests were performed for normally distributed continuous variables, and non-normally distributed variables were compared using Mann-Whitney U tests. Results will be presented as Mean (Median) ±SD, counts, percentages, and diagrams. Categorical variables will be compared using the Chi-square test. $P<0.05$ will be considered statistically significant.

SOURCE OF DATA

All patients admitted under the Department of General Surgery at B.L.D.E.(D.U)'S Shri B.M.Patil Medical College Hospital and Research Centre, Vijayapura, from August 2022 to August 2024 and emergency laparotomy for emergency abdominal conditions.

Inclusion criteria were Age >18 years, patients who were taken up for emergency laparotomy, and Patients who were feasible to follow up to the 30th postoperative day. Exclusion criteria were Age less than 18 years, Patients undergoing chemotherapy or radiotherapy, Patients not viable for the follow-up to the 30th postoperative day, and Immunocompromised patients. All patients included in the study underwent a standard preoperative assessment and optimization process for emergency laparotomy.

This evaluation comprised a thorough medical history, physical examination, and blood tests (complete blood count, kidney function tests with electrolytes, prothrombin time-international normalized ratio (PT-INR), liver function tests including alkaline phosphatase (ALP), and serum albumin) to aid in patient management and Emergency Surgery Score (ESS) calculation prior to initiating fluid resuscitation. Radiological assessments, such as chest X-rays, abdominal X-rays, and contrast-enhanced computed tomography (CT) of the abdomen, were performed as necessary. ESS was calculated preoperatively. After completing the diagnostic workup and stabilizing the patient through resuscitation, the patient was taken for emergency laparotomy. Intraoperative findings were documented.

Postoperatively, patients were closely monitored both clinically and with relevant laboratory and radiological tests until discharge. They were further followed up through physical visits to the outpatient department (OPD) or the ward, or through telephone interviews weekly for 30 days. For every emergency laparotomy case, data on mortality, postoperative ICU admission, re-operations, and readmissions within 30 days were recorded. All postoperative complications occurring within 30 days of the surgery were documented and appropriately managed.

With the necessary investigations as required under Emergency surgical score (ESS), the patient is given a score of 29 pre-operatively.

EMERGENCY SURGICAL SCORING (ESS)

Variable	Points
Demographics	
Age > 60 years	2
White race	1

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Transfer from outside emergency department	1
Transfer from an acute care hospital inpatient facility	1
Comorbidities	
Ascites	1
BMI < 20 kg/m²	1
Disseminated cancer	3
Dyspnea	1
Functional dependence	1
History of COPD	1
Hypertension	1
Steroid use	1
Ventilator requirement within 48 hrs preoperatively	3
Weight loss > 10% in the preceding 6 months	1
Laboratory values	
Albumin < 3.0 U/L	1
Alkaline phosphatase > 125 U/L	1
Blood urea nitrogen > 40 mg/dL	1
Creatinine > 1.2 mg/dL	2
International normalized ratio > 1.5	1
Platelets < 150 x 10^3/μL	1
SGOT > 40 U/L	1
Sodium > 145 mg/dL	1
WBC < 4.5 x 10^3/μL	1
WBC > 15 and ≤ 25 x 10^3/μL	1
WBC > 25 x 10^3/μL	2
Maximum Score	29

RESULTS

The study included 131 patients, distributed across different age groups and categorised by sex.

The findings in table no.1 highlight a predominance of male patients across all age groups, with the highest male representation in the 18-37 and 58-77 age brackets. Male patients consistently outnumber female patients in every age group, particularly among younger (80% male in 18-37 years) and older adults (72% male in 58-77 years).Females were less frequently represented across all groups, with no female patients in the 78-97 years category.

TABLE -1: AGE DISTRIBUTION AND DEMOGRAPHICS.

Age Distribution	Females	Males	Total
18-37	9	37	46
38-57	13	23	36
58-77	13	33	46
78-97		3	3
Grand Total	**35**	**96**	**131**

Table 2 compares the outcomes (Fair, Morbidity, Mortality) for various diagnoses based on two groups: those with ESS scores greater than 15 and those with ESS scores between 0 and 14. Here's a summary:

ESS Score > 15: This group generally has worse outcomes. Diagnoses like Large Bowel Obstruction, Mesenteric Ischaemia, and Superior Mesenteric Artery Thrombosis have high mortality rates.

ESS Score 0 to 14: Most patients in this group tend to have fair outcomes, especially in cases of Hollow Viscus Perforation and Small Bowel Obstruction, which have relatively high "fair" outcomes with lower morbidity and mortality.

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Diagnosis	ESS Score > 15 (n=24)	ESS Score 0 to 14 (n=107)	Fair	Morbidity	Mortality
Acute Intestinal Obstruction	1 (33%)	2 (67%)	1	0	0
Blunt Abdomen Trauma	4 (33%)	8 (67%)	7	1	0
Hollow Viscus Perforation	5 (8.1%)	57 (92%)	52	5	5
Large Bowel Obstruction	4 (57%)	3 (43%)	2	2	3
Mesenteric Ischaemia (Gangrenous Bowel)	3 (60%)	2 (40%)	1	1	3
Necrotizing Pancreatitis	1 (100%)	0 (0%)	0	0	1
Obstructed Hernia	0 (0%)	7 (100%)	6	1	0
Penetration Abdominal Injury	0 (0%)	1 (100%)	1	0	0
Sealed Off Hollow Viscus Perforation	1 (100%)	0 (0%)	0	0	1
Small Bowel Obstruction	1 (4.5%)	21 (95%)	19	1	2
Stab Injury	2 (40%)	3 (60%)	3	1	1
Strangulated Recurrent Inguinal Hernia	0 (0%)	2 (100%)	2	0	0
Superior Mesenteric Artery Thrombosis	2 (67%)	1 (33%)	0	0	3

IMAGE-2 -OUTCOMES, ESS SCORES AND DIAGNOSIS.

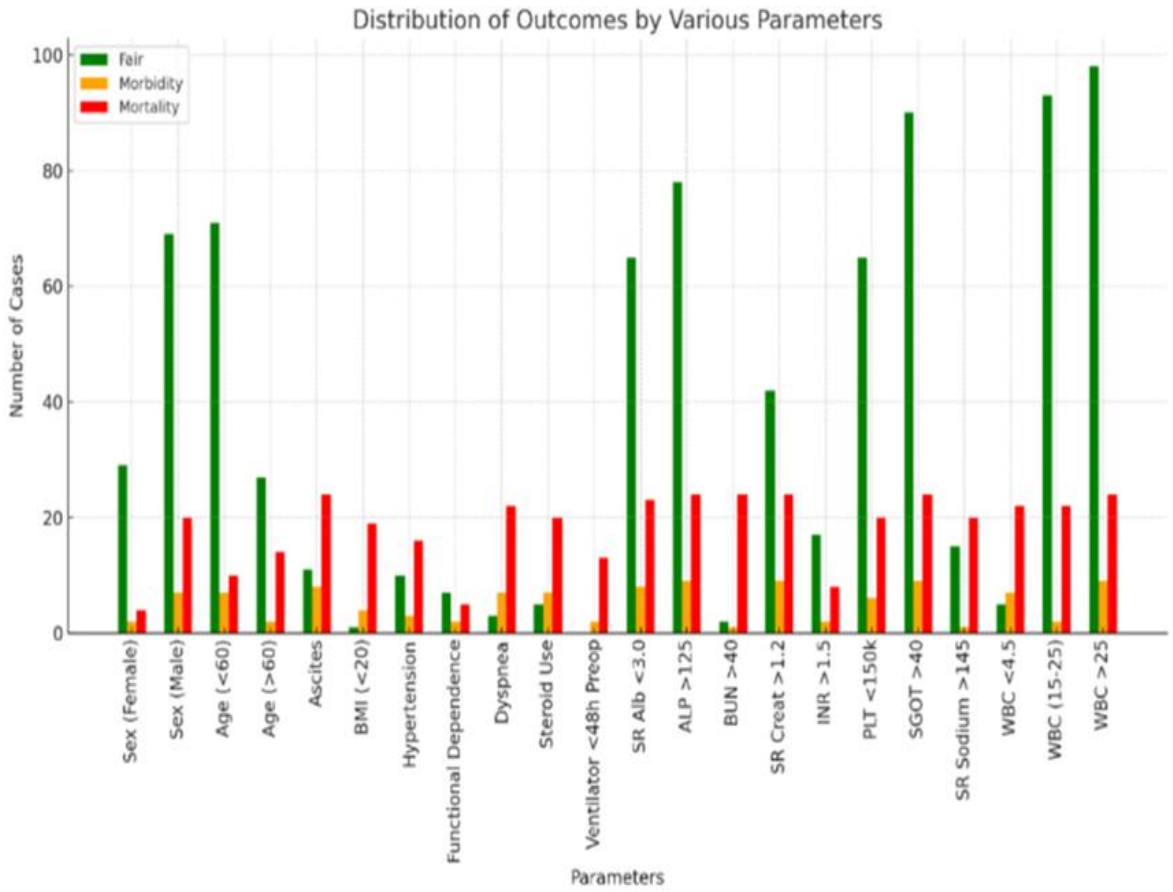

FIGURE-3 OUTCOMES VS ESS PARAMETERS

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Sex: No significant difference between male and female patients across the outcomes (p=0.5). **Age**: A statistically significant difference was observed (p=0.015). Patients over 60 years had a higher mortality rate (33%) compared to those under 60 (11%). **Ascites**: Strongly associated with mortality, with 56% of patients with ascites falling into the mortality group (p<0.001). **BMI**: Low BMI (<20 kg/m²) is significantly associated with mortality, with 79% of these patients falling into the mortality group (p<0.001). **Hypertension**: There is a strong correlation with mortality, with 55% of hypertensive patients in the mortality group (p<0.001). **Functional Dependence**: Significant association with poorer outcomes, including higher mortality (p=0.040). **Dyspnea and Steroid Use**: Both are strongly associated with higher mortality (p<0.001).**Ventilator Use Within 48 Hours Pre-Op**: Nearly all patients requiring preoperative ventilation fell into the mortality group (87%, p<0.001). **Laboratory Values**: Low serum albumin, high BUN, elevated serum creatinine, and hypernatremia were significantly associated with higher mortality rates (p-values ranging from <0.001 to 0.004). **White Blood Cell (WBC) Count**: Both extremely low (<4.5) and very high (>15 and <25) WBC counts were associated with higher mortality (p<0.001**). Fair outcome**: All patients with fair outcomes had an ESS score between 0-14 (100**%). Morbidity**: 89% of morbidity cases occurred in patients with ESS scores over 15. **Mortality**: 96% of mortality cases were in patients with ESS scores greater than 15 (p<0.001).

TABLE 3- OUTCOMES AND INDIVIDUAL PARAMETERS.

Characteristic	**Fair**, N = 98[1]	**Morbidity**, N = 9[1]	**Mortality**, N = 24[1]	**p-value**[2]
SEX				
F		2 (5.7%)	4 (11%)	0.5
M		7 (7.3%)	20 (21%)	
AGE				
Less than 60 years		7 (8.0%)	10 (11%)	**0.015**
More than 60 years		2 (4.7%)	14 (33%)	
OPD				NA
Yes		9 (6.9%)	24 (18%)	
ASCITIS	11 (26%)	8 (19%)	24 (56%)	**<0.001**
BMI(<20KG/M2)	1 (4.2%)	4 (17%)	19 (79%)	**<0.001**
CANCER	2 (67%)	1 (33%)	0 (0%)	0.3
HISTORY OF COPD	1 (50%)	1 (50%)	0 (0%)	0.2
HYPERTENSION	10 (34%)	3 (10%)	16 (55%)	**<0.001**
FUNCTIONAL DEPENDENCE	7 (50%)	2 (14%)	5 (36%)	**0.040**
DYSPNEA	3 (9.4%)	7 (22%)	22 (69%)	**<0.001**
STEROID USE	5 (16%)	7 (22%)	20 (63%)	**<0.001**
VENTILATOR WITHIN 48HOURS PREOP	0 (0%)	2 (13%)	13 (87%)	**<0.001**
WEIGHT LOSS MORE THAN 10% WITHIN 6 MONTHS	1 (100%)	0 (0%)	0 (0%)	**>0.9**
SR ALB <3.0	65 (68%)	8 (8.3%)	23 (24%)	**0.004**
ALP>125	78 (70%)	9 (8.1%)	24 (22%)	**0.011**
BUN>40	2 (7.4%)	1 (3.7%)	24 (89%)	**<0.001**
SR CREAT>1.2MG/DL	42 (56%)	9 (12%)	24 (32%)	**<0.001**
INR>1.5	17 (63%)	2 (7.4%)	8 (30%)	**0.2**
PLT <150 * 103	65 (71%)	6 (6.6%)	20 (22%)	**0.3**
SGOT>40U/L	90 (73%)	9 (7.3%)	24 (20%)	**0.4**
SR SODIUM >145MMOL/L	15 (42%)	1 (2.8%)	20 (56%)	**<0.001**
WBC <4.5				
No	5 (15%)	7 (21%)	22 (65%)	**<0.001**
Yes	93 (96%)	2 (2.1%)	2 (2.1%)	
WBC >15 AND <25				
No	93 (96%)	2 (2.1%)	2 (2.1%)	**<0.001**
Yes	5 (15%)	7 (21%)	22 (65%)	
WBC >25				NA
No	98 (75%)	9 (6.9%)	24 (18%)	
OUTCOME				**<0.001**
Fair	0 (0%)	98 (100%)		

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Morbidity	1 (11%)	8 (89%)	
Mortality	23 (96%)	1 (4.2%)	

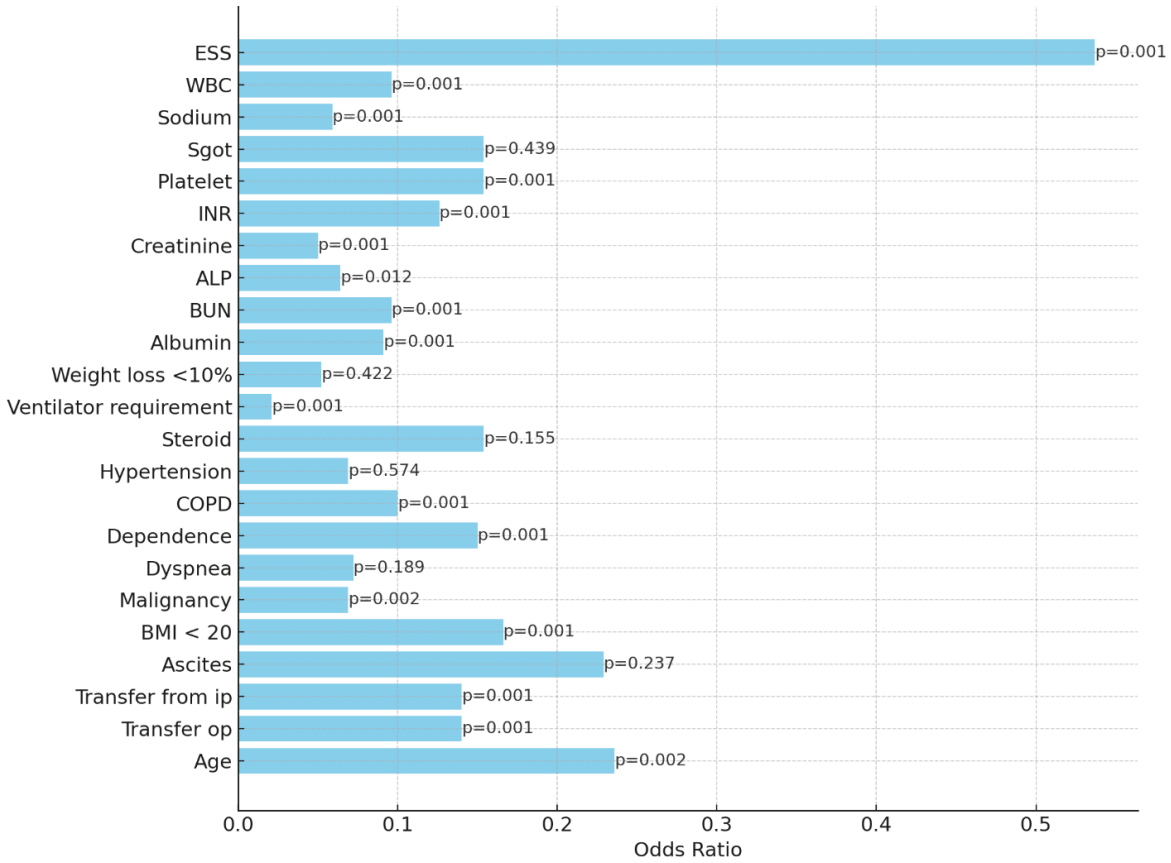

FIGURE-4: PARAMETERS VS ODDS RATIO.

Figures (5 and 6)highlight how different conditions (AKI, Pneumonia, SSI) are associated with varying patient characteristics and outcomes. SSI stands out due to its strong association with higher ESS scores, while AKI is more linked with severe comorbidities and laboratory abnormalities. Pneumonia tends to present with moderate ESS scores, similar to AKI and is associated with a range of patient characteristics such as low BMI, steroid use, and respiratory symptoms like dyspnea. The condition does not show the same level of severe comorbidities or laboratory abnormalities as AKI or the high ESS scores associated with SSI.

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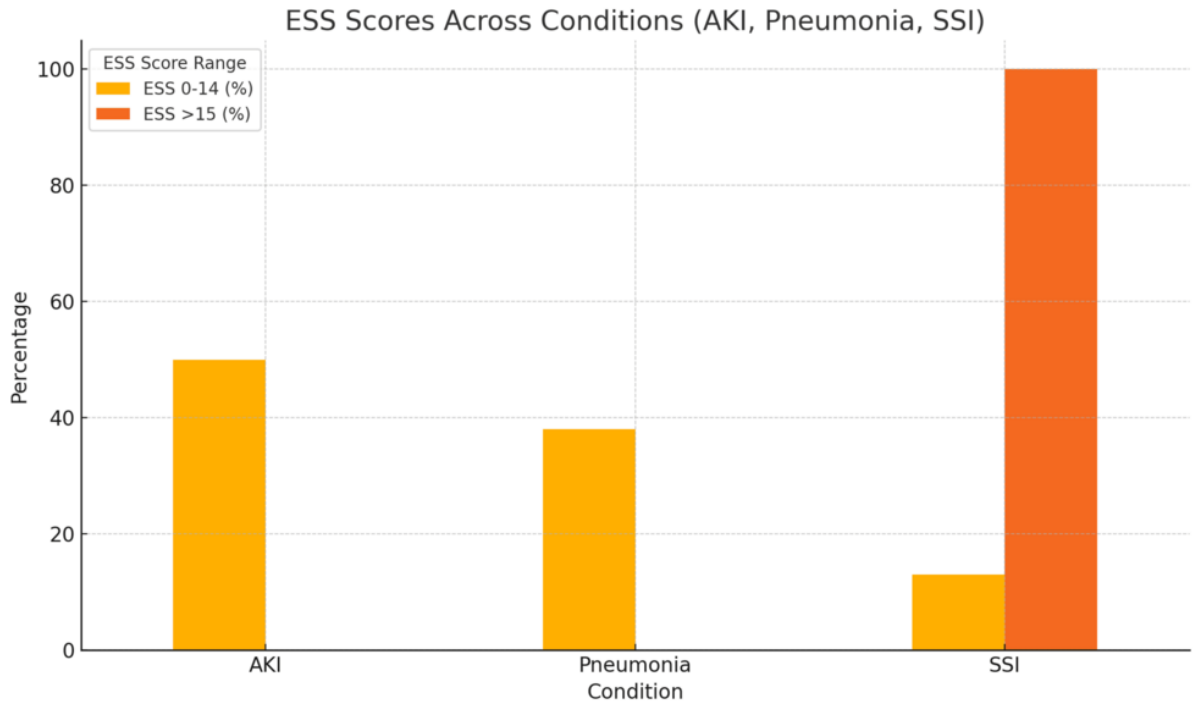

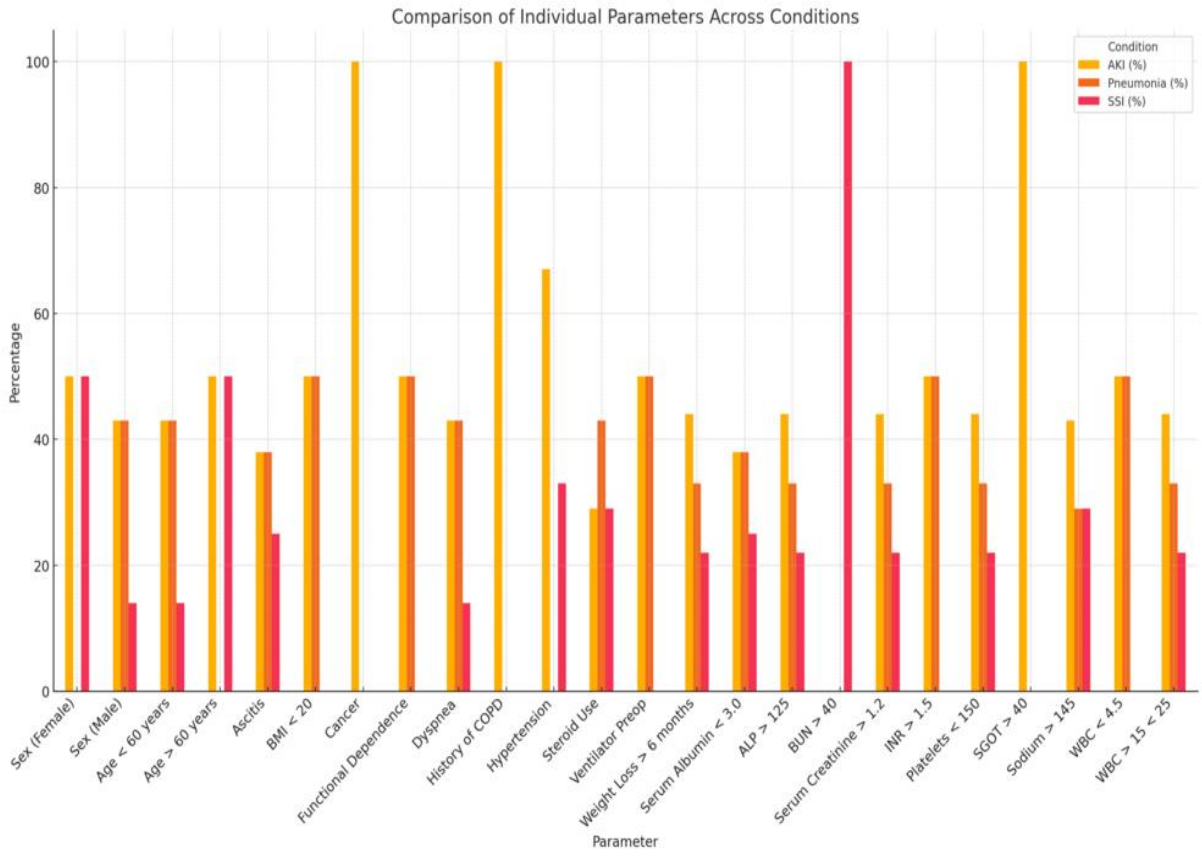

DISCUSSION

In this study, we demonstrate that ESS serves as a risk factor for postoperative morbidity and can accurately predict 30-day postoperative morbidity in patient emergencies. These findings further support using the ESS as a bedside risk assessment tool for patients undergoing emergency abdominal surgery and a benchmark tool for quality assessment and improvement.

Assessing the severity of a disease condition is critical for prioritising early treatment, as it helps reduce morbidity and mortality. Higher severity scores typically indicate more significant risks of morbidity and mortality, meaning that these patients may require more intensive care than those with lower scores.

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This observational study aimed to classify patients undergoing exploratory laparotomy for emergency surgical conditions by calculating their Emergency Surgery Score (ESS) and evaluating its predictive value.

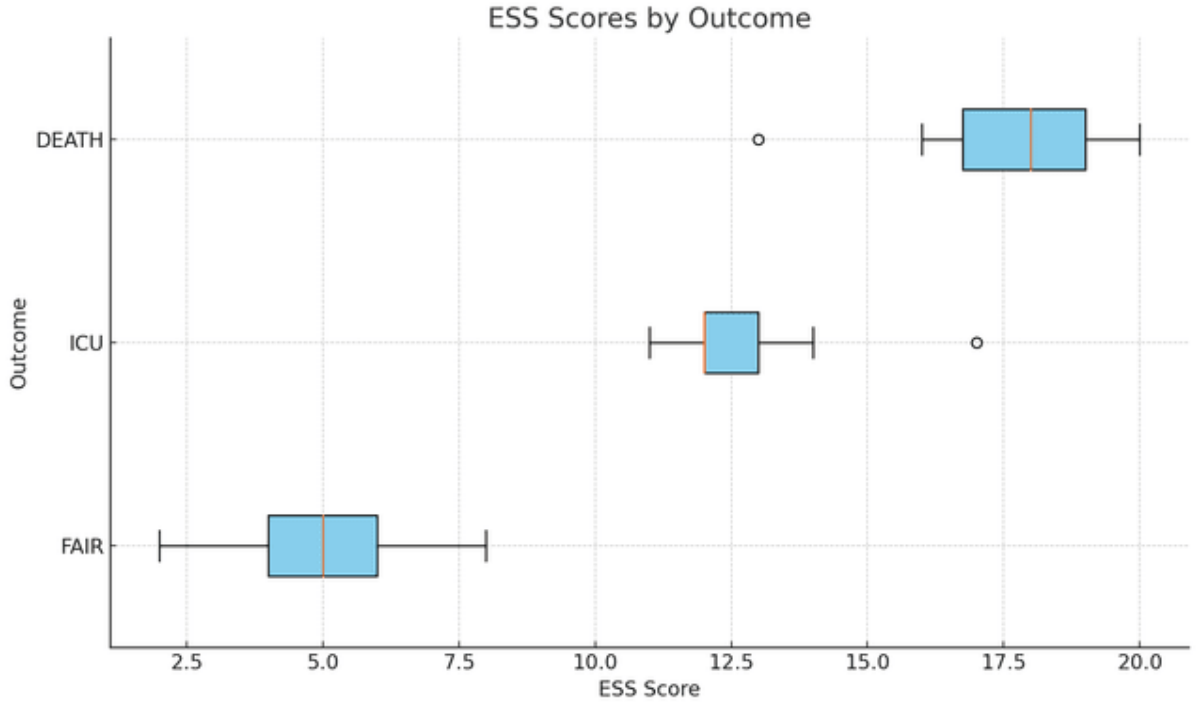
Age as a determinant factor

In a study by Bhoumick et al. [10], the mean age of patients was 40.60 years. Maximum cases were in the third and fifth decades (25% each). Maximum mortality was observed in the fifth decade (40%).

John Bohnen examined the impact of age as a risk factor for mortality in cases of abdominal sepsis. His study revealed that patients under 50 years of age had a mortality rate of 17%, while those over 50 years had a significantly higher death rate of 45%. [11]. In their study, less than 40 years old had a mortality of 10%, while more than 40 years old had a mortality of 40%. Pointing et al. and Frank B. Cerra et al. investigated the effects of sepsis and found that the average age of non-survivors was higher than that of survivors. [11].According to Kalra D et al. [12]. The average age of the patients was 37.74 years. Among survivors, the mean age was 34.77 years, while for non-survivors, it was significantly higher at 59.5 years. Most cases occurred in the 4th decade of life (26%), followed by the 3rd decade (20%). The highest mortality rates were seen in the 8th decade (50%), followed by the 7th decade (40%).In our study, Mortality was notably higher in patients over 60 years of age. Specifically, 33% of those over 60 years old had mortality, compared to only 11% of those under 60.

ESS and its Outcomes

Similarly, in a study done by Bhoumick et al. [10]. Patients admitted with an ESS score between 3 and 5 experienced a 25% mortality rate (one out of four patients). The highest mortality, 66.67%, was observed in those with an ESS score greater than 7. The average ESS score across all patients was 6.15, with survivors having a score of 5.06, while non-survivors had a higher mean score of 9.4. Notably, there were no deaths among patients with an ESS score between 0 and 6.



In our study, the ESS scores for patients with fair outcomes ranged between 2.5 and 7.5, with a median score of around 5.0.This suggests lower ESS scores are associated with favourable outcomes, indicating a lower risk of complications or death.Patients requiring ICU admission have ESS scores ranging from approximately 10 to 15, with a median score of around 12.5.This indicates that moderate ESS scores predict patients needing intensive care but not necessarily resulting in death. The ESS scores for dying patients range from approximately 15 to 20, with a median score of around 17.5. Higher ESS scores are strongly associated with mortality, as indicated by this category's upper range of scores.

In 2012, Sangji et al [13]. introduced and validated the ESS scoring system based on a study of 19,552 emergency laparotomy cases. They found that the mortality rate rose from 0% for patients with a score of 0 to 11, reaching 100% at a score of 22. The system demonstrated a c-statistic of 0.86. Peponis et al. [14]. also worked on ESS and reported that ESS correlated well with mortality (c-statistic = 0.84); 0.4%, 39%, and 100% mortality at scores of 1, 11, and 22, respectively. Kaafarani et al. recently confirmed the effectiveness of the ESS in a prospective multi-

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centre study for predicting 30-day mortality, which was 14.8% overall. The ESS provided a gradual and accurate prediction of 30-day mortality, with 3.5%, 50.0%, and 85.7% of patients with ESS scores of 3, 12, and 17, respectively, dying after surgery. The c-statistic was 0.84. The study concluded that the ESS is valuable for perioperative counselling of patients and families, triaging patients to the ICU, and benchmarking the quality of emergency general surgery (EGS) care [15].

ESS and ICU admissions

In a 2015 study conducted by Banerjee et al., it was found that 70% of patients undergoing emergency laparotomy required admission to a high-dependency unit or critical care. [16]. The Emergency Laparotomy Collaborative (ELC) and the Emergency Laparotomy Pathway Quality Improvement Care (ELPQuiC) bundle project recommend that all patients should be admitted to the ICU following an emergency laparotomy. [17] .In our study, 6.8% of the patients undergoing emergency laparotomy were admitted to the ICU post-laparotomy.

ESS and morbidity

In our study, the majority of cases had acute kidney injury, which was readmitted in ICU (44.4%) following patients with breathlessness who were diagnosed with Pneumonia (33.3%), and last were two patients who had surgical site infection (22.2%) compared to the study done by Bhoumick et al. [10].The most common postoperative complication was surgical site infection, occurring in 50% of patients. This was followed by lower respiratory tract infections (LRTI), which affected 45% of patients. Sepsis and wound dehiscence were observed in 25% of patients each. Additionally, 15% of patients developed acute kidney injury (AKI) postoperatively, while 10% experienced complications such as anastomotic leak, disseminated intravascular coagulation (DIC), and thrombocytopenia.

LIMITATIONS

This review has several limitations. It primarily focuses on predicting 30-day postoperative events without addressing long-term outcomes following discharge. Many of the conclusions in the reviewed studies are based on retrospective data collected from national databases, which raises the possibility of missing or incomplete patient data. Additionally, most studies did not specify the types of surgeries performed, nor did they provide detailed numbers or percentages, leaving a significant gap in information.

A notable limitation is the inclusion of race, specifically the designation of being from the white race, as a variable in calculating the Emergency Surgery Score (ESS). The rationale for this variable in risk stratification is unclear and warrants further investigation. In our study, this parameter could not be utilised. Moreover, the review did not account for important aspects such as reoperation and readmission rates in acute abdomen cases.

To better assess the effectiveness of ESS as a predictive tool, further prospective studies are necessary, mainly to evaluate its utility in real-time clinical settings.

CONCLUSION

This study emphasizes the importance of comprehensive preoperative assessment, considering factors such as age, BMI, comorbidities, and specific laboratory values. High Emergency Surgical score (ESS) indicate an increased risk, necessitating heightened vigilance and possibly more intensive monitoring and intervention strategies. The data also advocate for personalized approaches in managing patients with high ESS scores, particularly in older populations and those with significant comorbid conditions. The ESS can be used as a predictor of 30-day complications in patients who have undergone emergency laparotomy, thereby improving the quality of surgical care.

Additionally, the ESS can serve as a tool for counselling patient attendees about outcomes and probable complications. The study shows a good correlation between ESS scores and outcomes, which can be applied to critically ill patients to predict postoperative morbidity and mortality. This high specificity, being a preoperative scoring system, validates its use in emergency laparotomies

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