The validity of emergency surgery score in predicting mortality and complications in general surgical emergencies

Original Article

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ABSTRACT

Background: Patients who need emergency general surgery (EGS) face an increase in 30-day mortality and complication rates that can be anticipated by emergency surgery score (ESS).

Aim: The study aimed to measure the validity and efficacy of ESS application on EGS patients admitted at Beni-Suef University Hospital to calculate the rates of postoperative mortality, complications, reoperation, and ICU admission.

Patients and Methods: This was a retrospective validation study. The study included 200 patients (older adults and elderly) who were admitted to the general surgery ward for EGS from September 1, 2023 to March 1 2024. The primary outcome was measuring the 30-day mortality rate. However, the secondary outcomes were measuring the occurrence of at least one complication, reoperation, and ICU admission rates. Admitted comorbidities, as well as preoperative laboratory tests, were collected. Surgical outcomes were predicted for patients using ESS calculation. Postoperative outcomes were tracked from the day of surgery to 30 days.

Results: Among patients admitted, total prevalence of 30-day mortality was nine (4.5%), while 30-day complications rate was 27%. There was a significant increase (*P<0.001*) in mortality due to the increase of ESS with an area under the curve (AUC) NELA score (0.846) and confidence interval (CI) (95% CI: 0.717–0.976), and AUC P-POSSUM score of 0.811 and CI (95% CI: 0.734–0.972) with no significant difference between the two scores (*P=0.369*), and AUC P-POSSUM score of 0.811 and CI (95% CI: 0.734–0.972) with no significant difference between the two scores (*P=0.369*). There was a significant increase (*P<0.001*) in the prediction of at least one complication due to the increase of ESS with an AUC NELA score (0.919) and CI (95% CI: 0.88–0.957) and AUC P-POSSUM score (0.927) and CI (95% CI: 0.82–0.945), with no significant difference between the two scores (*P=0.269*). There was a significant increase in ICU readmission due to the increase of ESS (*P<0.001*) with an AUC (0.785) and CI (95% CI: 0.678–0.892).

Conclusion: ESS is a golden key in predicting mortality, complications, and ICU admission among elderly patients who underwent EGS and can be used for frontline decision-making, family and patient guidance, resource allocation, and quality monitoring of elderly surgical care.

Key Words: Emergency general surgery, mortality, score.

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INTRODUCTION

Approximately 27 million emergency general surgery (EGS) hospital admissions occur each year in the Unitec States alone, accounting for a sizable share of all admissions. Individuals undergoing EGS are more likely to experience adverse outcomes[1]. EGS constitutes a benchmark risk factor for predicting mortality and morbidity. After surgery, EGS patients had a six-fold increased risk of death in comparison to non-EGS patients[2]. It has been demonstrated that EGS-associated admissions account for up to 50% of all surgically related fatalities. In the upcoming years, a significant rise in the load associated with EGS is expected. Giving EGS patients the best care possible is still a problem and represents a new area for innovation and research[3].

The Acute Care Surgery (ACS) paradigm has indeed emerged as a promising approach to improve the management of trauma, EGS, and critical care. By integrating these disciplines, ACS aims to enhance the coordination, efficiency, and quality of care for patients with acute surgical conditions[4]. The success of the model hinges upon adhering to guidelines and benchmarks and implementing quality improvement procedures. However, EGS falls short in benchmarking and enhancing quality. Considering the substantial healthcare burden associated with EGS, it is imperative to promote standardization in patient care to ensure better overall results[5].

Recently, the emergency surgery score (ESS) has emerged as a valuable tool for predicting mortality and morbidity in patients undergoing emergency surgery.

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The ESS has been tested and is considered a reliable perioperative mortality risk predictor. It can accurately and progressively forecast 30-day postoperative complications in EGS patients. This scoring system can contribute to enhancing the overall quality of care and decision-making processes in EGS[6]. In scenarios where some variables in the score are absent, the score exhibited resilience in forecasting results. By comparing ESS with other risk-stratification tools, healthcare providers can gain a better understanding of the ACS model's effectiveness in managing EGS patients and identify areas for further improvement. This can ultimately lead to better patient outcomes and a more efficient healthcare system[7].

However, the performance of ESS is crucial for older adults in particular. This is because elderly patients often present with unique challenges and comorbidities that can significantly impact their surgical outcomes. By assessing the ESS's performance in this population, healthcare providers can identify areas for improvement and develop more accurate risk-stratification tools tailored to older adults. Predicting outcomes in elderly patients can indeed be challenging due to some factors, such as the presence of multiple comorbidities, functional status, and frailty. These factors can significantly impact a patient's recovery and overall prognosis after a surgical procedure[8]. As the elderly population in the United States continues to grow in the coming decades, it is indeed crucial to develop and utilize validated tools to predict postsurgical outcomes in this patient population. This will help healthcare professionals make more informed decisions, ultimately improving patient care and outcomes[9]. In this research, ESS was used as predictive power for measuring 30-day mortality, complications, and ICU admission in older patients.

The need for risk-stratification tools and benchmarking in the elderly EGS patient population is indeed crucial for improving patient care and evaluating the performance of surgical services. To the best of our current knowledge, there may not be any validated tools specifically designed for this purpose in Egypt. This study aimed to evaluate the effectiveness of ESS in predicting 30-day mortality, complications, reoperation, and ICU admission. The primary outcome was the prediction of 30-day mortality rate, while the secondary outcomes were predicting occurrence of at least one complication, reoperation, and postoperative ICU readmission.

PATIENTS AND METHODS:

This was a retrospective validation study conducted from March 2024 to April 2024 after the acceptance of the official Scientific Research Ethical Committee of the Beni-Suef Faculty of Medicine. The study took 1 month to collect data from 200 patients (older adults and elderly) who had undergone EGS at Beni-Suef University Hospital from September 1, 2023 to March 1, 2024. Beni-Suef University Hospital is a tertiary referral center that serves the whole governorate and the nearby areas of another four governorates (Fayoum, El Minya, South Giza, and The Red Sea governorates) with a very high flow of patients at Accidents and Emergency Department.

Patient population

A total of 200 patients (older adults and elderly) who were on admission at the general surgery ward for EGS between September 1, 2023 and March 1, 2024, were enrolled in the present study. The study included patients aged 25 years or older, who were on admission for EGS. The analysis included patients who underwent surgery for pathologies related to the abdomen, hepato-biliary system, upper gastrointestinal tract, colorectal, vascular, breast, and endocrine systems, as well as trauma and soft tissue disorders. Patients under the age of 25 and pregnant patients were not included, as the primary focus is on older adults and elderly postsurgical patients. Additionally, patients who were treated conservatively or those who voluntarily refused treatment against medical advice were excluded, as their outcomes may not be directly comparable to those who underwent surgery.

Data collection

All patients' data was retrieved from the patient's files, hospital documents, and surgical archives. Demographic data, including age, sex, residence, way of transfer (outside the emergency department or a primary hospital inpatient facility), BMI was collected. BMI was classified into less than 20, 20–35, or more than 35 kg/m^2.

Comorbidities including (disseminated cancer, prevalence of hypertension, the use of steroids, ascites, dyspnea, prevalence of chronic obstructive pulmonary disease, functional dependence, preoperative 48-h ventilator required, and weight loss during the previous 6 months) were collected.

Preoperative laboratory tests were collected, which included albumin, alkaline phosphatase, and blood urea nitrogen. Patients were also checked for creatinine, international normalized ratio, platelets, aspartate transaminase, sodium, and white blood count.

Emergency surgery score estimation

Following the methodology described by Sangji *et al*.[10], the ESS was estimated for all patients. To compute ESS, a maximum value of 29 points is obtained by summing the scores attributed to each of 22 distinct demographics, comorbidities, and preoperative laboratory parameters. The ESS has a maximum value of 29 and a minimum value of 3, with greater scores indicating worse outcomes. As described by Naar *et al*.[11], missing parameters received the default value of 0, which did not raise the final ESS rating.

Postoperative outcomes

According to the current study, 30-day mortality rate was the primary outcome. Secondary outcomes included the occurrence of at least one complication, reoperating rate, and postoperative ICU readmission rate.

Postoperative data were tracked starting on the day of surgery and continued for 30 days. Studying the score's predictive power for death, the frequency of postoperative complications, ICU hospitalization, and whether the patient underwent another operation for the same admitting diagnosis were the main objectives of the validation process.

Statistical analysis

A logistic regression model was employed to evaluate the ESS as an indicator of 30-day mortality in elderly postsurgical patients.

To further validate the ESS's predictive performance, a receiver operating characteristic (ROC) curve was generated, which produced a c-statistic or area under the curve (AUROC). The AUROC is a widely recognized measure of a test's validity in the literature, with higher AUC values indicating better predictive accuracy[11]. The correlation between the ESS and positive outcomes was classified using a common c-statistic classification system. This system categorizes the strength of the correlation as follows:

Acceptable: an AUROC value between 0.7 and 0.8 is considered acceptable, indicating a reasonably good ability to differentiate between patients with and without a positive outcome.

Excellent: an AUROC value between 0.8 and 0.9 signifies an excellent correlation, suggesting a strong ability to distinguish between patients with and without the positive outcome.

Outstanding: an AUROC value of 0.9 or higher is considered outstanding, which indicates a highly accurate and robust predictive ability for the positive outcome[12]. The outcomes were expressed as a total number of individuals and percentages. At a P value less than 0.05, the significance threshold was established. Version 26 of the SPSS program was used to analyze all the data.

RESULTS:

Patients' demographics, comorbidities, and preoperative laboratory test values

Table 1 shows baseline demographics, comorbidities, and preoperative laboratory test values among the studied patients. The mean age of the studied patients was 59.33±12.78 years ranging from 25 to 94 years. Among the total patients, 37% were aged more than 60 years. There were 53% males and 47% females. Most patients (71%) came from urban areas. Twelve percent of patients transferred outside emergency, while 13% transferred via primary hospital inpatient facility. Nine percent of the studied patients had a BMI of less than 20 kg/m^2.

According to comorbidities among patients, 12.5% had hypertension, 9.5% had functional dependence, 9% had lost weight more than 10% during the last 6 months, 7% had a history of disseminated cancer, 6.5% had dyspnea, 5% had ascites, 4.5% used steroid, 4% had a history of chronic obstructive pulmonary disease, and 2% used ventilator within 48 h preoperatively.

According to laboratory tests, albumin less than 3.0 U/l was detected among 17.5% of patients, alkaline phosphatase more than 125 U/l in 5.5%, blood urea nitrogen more than 40 mg/dl in 5%, creatinine more than 1.2 mg/dl in 14.5%, international normalized ratio more than 1.5 in 5.5%, platelets less than 150×10 U/l in 5%, aspartate transaminase more than 40 U/l in 16.5%, and sodium more than 145 mg/dl in 3%. White blood count was less than 4.5x10/l in 28.5% and more than 25x10/l in 17% of the studied patients.

Table 1: Demographics, comorbidities, and preoperative laboratory test values among patients

Variables	Parameter	Statistics [*n* (%)]
Demographic data		
Age	Mean±SD	59.33±12.78
	Minimum–maximum	25–94
	>60 years	74 (37)
Sex	Male	106 (53)
	Female	94 (47)
Residence	Rural	58 (29)
	Urban	142 (71)
Way of transfer	Outside emergency	24 (12)
	Primary hospital inpatient facility	26 (13)
	Home	150 (75)
BMI (kg/m^2)	<20	18 (9)
Comorbidities	History of disseminated cancer	14 (7)
	HTN	25 (12.5)
	Steroid use	9 (4.5)
	Ascites	10 (5)
	Dyspnea	13 (6.5)
	History of COPD	8 (4)
	Functional dependence	19 (9.5)

	Preoperative ventilator within 48 h	4 (2)
	Weight loss >10% during the last 6 months	18 (9)
Laboratory tests	ALB <3.0 U/l	35 (17.5)
	ALP >125 U/l	11 (5.5)
	BUN >40 mg/dl	10 (5)
	Creatinine >1.2 mg/dl	29 (14.5)
	INR >1.5	11 (5.5)
	Platelets <150×10 U/l	10 (5)
	AST 40 U/l	33 (16.5)
	Sodium >145 mg/dl	6 (3)
	WBC <4.5×10/l	57 (28.5)
	WBC >15–<25×10/l	20 (10)
	WBC >25	34 (17)

ALB, albumin; ALP, alkaline phosphatase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; COPD, chronic obstructive pulmonary disease; HTN, hypertension; INR, international normalized ratio; WBC, white blood cells.

Multivariate logistic regression model for emergency surgery score variables as risk factors for mortality among the studied patients

The multivariate logistic regression model demonstrated that ESS variables were significant risk factor predictors of mortality among the studied patients (*P<0.001*) (Table 2).

Table 2: Emergency surgery score variables as risk factor predictors to mortality

Variables	OR (95% CI)	*P* value
>60 years	1.31 (1.23–1.38)	<0.001
Transferred from outside emergency department	1.40 (1.30–1.49)	<0.001
Transferred from other acute care hospital (inpatient)	1.12 (1.04–1.19)	0.001
BMI <20 kg/m^2	1.60 (1.46–1.70)	<0.001
History of disseminated cancer	1.59 (1.47–1.63)	<0.001
HTN	2.53 (2.35–2.70)	<0.001
Steroid use	1.34 (1.26–1.40)	<0.001
Ascites	2.11 (1.92–2.09)	<0.001
Dyspnea	1.67 (1.56–1.73)	<0.001
History of COPD	1.12 (1.07–1.16)	<0.001
Functional dependence	1.41 (1.31–1.48)	<0.001
Preoperative ventilator within 48 h	2.99 (2.78–3.15)	<0.001
Weight loss >10% during the last 6 months	1.52 (1.39–1.63)	<0.001
ALB <3.0 U/l	1.97 (1.84–2.00)	<0.001
ALP>125 U/l	1.23 (1.14–1.27)	<0.001
BUN >40 mg/dl	1.69 (1.58–1.74)	<0.001
Creatinine >1.2 mg/dl	1.91 (1.90–2.08)	<0.001
INR >1.5	1.77 (1.62–1.80)	<0.001
Platelets <150×10 U/l	1.31 (1.23–1.36)	<0.001
AST; SGOT >40 U/l	1.38 (1.29–1.43)	<0.001
Sodium >145 mg/dl	1.60 (1.45–1.72)	<0.001
WBC <4.5×10/l	1.71 (1.57–1.82)	<0.001
WBC >15–<25×10/l	1.24 (1.17–1.28)	<0.001
WBC >25	1.75 (1.61–1.86)	<0.001

ALB, albumin; ALP, alkaline phosphatase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; COPD, chronic obstructive pulmonary disease; HTN, hypertension; INR, international normalized ratio; WBC, white blood cells.

Diagnosis among the studied patients

Diagnosis at admission is summarized in (Table 3). Complicated gallstone disease, bowel obstruction, appendicitis, complicated peptic ulcer disease, gastrointestinal cancer, superficial or deep-seated soft tissue infection, mesenteric ischemia, polytrauma, abdominal wall hernia, and diverticular disease were presented in 6, 11.5, 28, 5, 5, 18, 3, 15, 8, and 0.5% of the studied patients.

Table 3: Diagnosis at admission among the studied patients

Diagnosis	Prevalence [*n* (%)]
Complicated gallstone disease	12 (6)
Bowel obstruction (nonmalignant)	23 (11.5)
Appendicitis	56 (28)
Complicated peptic ulcer disease	10 (5)
Gastrointestinal cancer	10 (5)
Superficial or deep-seated soft tissue infection	36 (18)
Mesenteric ischemia	6 (3)
Polytrauma	30 (15)
Abdominal wall hernia	16 (8)
Diverticular disease	1 (0.5)

Thirty-day complications prevalence among the studied patients

According to 30-day complication prevalence among the studied patients, the most common complication was bleeding (15%), followed by sepsis (3%), site infection (2%), ventilator requirement more than 48 h (2%), acute kidney injury (2%), myocardial infarction (1%), cardiac arrest (1%), pneumonia (0.5%), and stroke (0.5%). The total prevalence of 30-day complications after surgery was 27% of the total patients (Table 4).

Table 4: Thirty-day complications prevalence among the studied patients

Complications	Prevalence [*n* (%)]
Bleeding	30 (15)
Sepsis	6 (3)
Site infection	4 (2)
Ventilator >48 h	4 (2)
AKI	4 (2)
Myocardial infarction	2 (1)
Cardiac arrest	2 (1)
Pneumonia	1 (0.5)
Stroke	1 (0.5)
Total complications rate	54 (27)

AKI, acute kidney injury.

Postoperative outcomes

According to the postoperative outcomes, it was found that 30-day mortality rate was 4.5% among the studied patients, 27% of patients had at least one complication. Four percent of patients had reoperation for the same admitting diagnosis (Table 5).

Table 5: Postoperative outcomes among patients

Outcomes	Prevalence [*n* (%)]
Primary outcome	
30-day mortality rate	9 (4.5)
Secondary outcomes	
Occurrence of at least 1 complication	54 (27)
Reoperation for the same admitting diagnosis	8 (4)
Admission to ICU after surgery	53 (26.5)

Emergency surgery score as a predictor for 30-day mortality

As shown in (Fig. 1), the 30-day mortality rate increased from 7.1% at ESS of 1 or less to 14.3% in ESS of 6, then increased to 21.4% at score 9. There was a significant increase (*P<0.001*) in mortality due to the increase of ESS with an AUC NELA score (0.846) and CI (95% CI: 0.717–0.976), and AUC P-POSSUM score of 0.811 and CI (95% CI: 0.734–0.972) with no significant difference between the two scores (*P=0.369*), and AUC P-POSSUM score of 0.811 and CI (95% CI: 0.734–0.972) with no significant difference between the two scores (*P=0.369*) (Figs 1,2, Table 6).

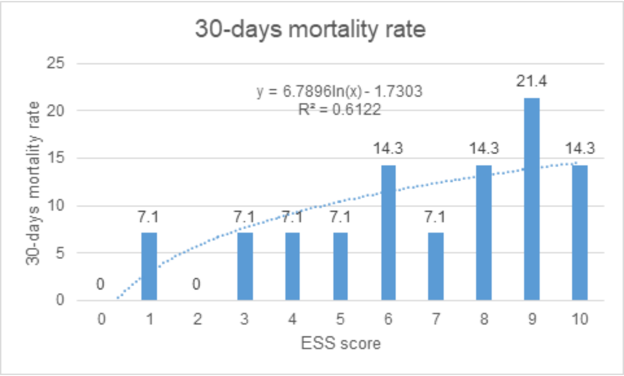

Fig. 1: ESS according to 30-day mortality. ESS, emergency surgery score.

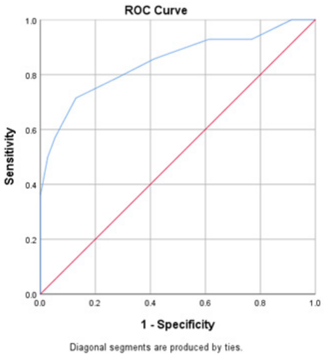

Fig. 2: ROC curve of ESS as a predictor for mortality. ESS, emergency surgery score; ROC, receiver operating characteristic.

Table 6: Predicting value of emergency surgery score as a predictor for mortality among the study patients

			95% CI	
Area	SE[a]	*P* value[b]	Lower	Upper
0.846	0.066	0.000	0.717	0.976

CI, confidence interval.
[a]Under the nonparametric assumption.
[b]Null hypothesis: true area=0.5.

Emergency surgery score as a predictor for at least one postoperative complication

As shown in (Fig. 3), the prediction of at least one complication increased from 1.1% at an ESS of 1 or less to 16.5% at in ESS of 9, then increased to 23.1% at a score of 10. There was a significant increase (*P<0.001*) in the prediction of at least one complication due to the increase of ESS with an AUC NELA score (0.919) and CI (95% CI: 0.88–0.957), and AUC P-POSSUM score (0.927) and CI (95% CI: 0.82–0.945), with no significant difference between the two scores (*P=0.269*) (Table 7, Figs 3 and 4).

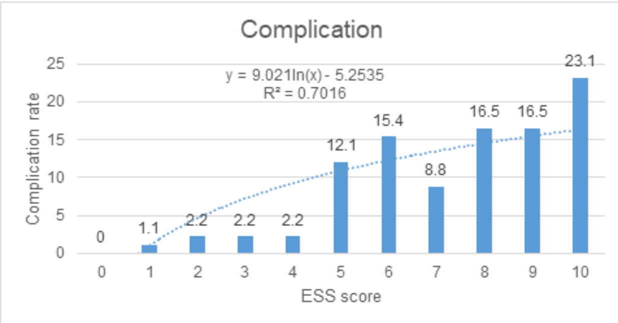

Fig. 3: ESS according to complication rate. ESS, emergency surgery score.

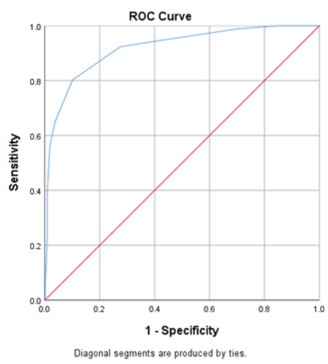

Fig. 4: ROC curve of ESS as a predictor for complications incidence. ESS, emergency surgery score; ROC, receiver operating characteristic.

Table 7: Predicting value of emergency surgery score as a predictor for complications incidence

			95% CI	
Area	SE[a]	*P* value[b]	Lower	Upper
0.919	0.020	0.000	0.880	0.957

CI, confidence interval.
aUnder the nonparametric assumption.
bNull hypothesis: true area=0.5.

Emergency surgery score as a predictor of reoperation for the same admitting diagnosis and postoperative ICU readmission

As shown in (Fig. 5), there was no significant increase (*P<0.001*) in reoperation for the same admitting diagnosis due to the increase of ESS (*P=0.882*) with an AUC (0.49) and CI (95% CI: 0.373–0.607) (Table 8, Fig. 5). On the other hand, there was a significant increase in ICU readmission due to the increase of ESS (*P<0.001*) with an AUC (0.785) and CI (95% CI: 0.678–0.892) (Table 8, Fig. 5).

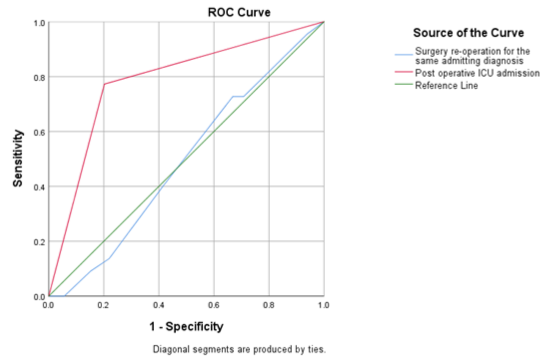

Fig. 5: ROC curve of ESS as a predictor for surgery reoperation for the same admitting diagnosis and postoperative ICU readmission among patients. ESS, emergency surgery score; ROC, receiver operating characteristic.

Table 8: Prediction value of emergency surgery score and surgery reoperation for the same admitting diagnosis and postoperative ICU readmission among patients

				95% CI	
Variables	Area	SE[a]	*P* value[b]	Lower	Upper
Surgery reoperation for the same admitting diagnosis	0.490	0.060	0.882	0.373	0.607
Postoperative ICU readmission	0.785	0.055	0.000	0.678	0.892

CI, confidence interval.
aUnder the nonparametric assumption.
bNull hypothesis: true area=0.5.

DISCUSSION

Due to the current results, it was demonstrated that ESS is a good indicator and predictor for 30-day mortality rate, the development of at least one postoperative complication, as well as it could predict the increase in postoperative ICU admission among patients who underwent EGS. Numerous results align with previous research indicating comparable outcomes. Acute care surgeons may find ESS to be a valuable tool as it is a unique score to EGS patients[1,10,11,13–17].

These results provide credence to the use of ESS as a bedside risk identification tool, which could educate elderly patients' families about the potential dangers associated with EGS. Additionally, ESS may be used as a monitoring technique to assess the standard of treatment provided to patients undergoing EGS[18].

According to a recent interdisciplinary survey, doctors primarily employ risk stratification techniques prior to surgery[19]. There are numerous widely used risk classification techniques that necessitate the calculation of intraoperative factors, including the ASA, ACS–NSQIP, P-POSSUM, and APACHE calculations[20,21]. Similar to ESS, the NEWS score was not specifically created for EGS patients; instead, it exclusively uses preoperative factors in the emergency department[18]. Consequently, ESS is advantageous for EGS patients not only because it was developed using this particular patient population but also because it is more accurate and takes into consideration the severity of the disease at the time of admission. Furthermore, it can be used before the procedure because it only makes use of preoperative factors. Although the ACS–NSQIP Surgical Risk Calculator exhibits strong performance in different surgical scenarios, its EGS performance is not up to par with ESS standards[21–24], most likely as a result of the fact that it excludes factors that directly impact the EGS outcome[25].

In the current study, the most common diagnosis at admission was complicated gallstone disease, bowel obstruction, appendicitis, complicated peptic ulcer disease, gastrointestinal cancer, superficial or deep-seated soft tissue infection, mesenteric ischemia, polytrauma, abdominal wall hernia, and diverticular disease, presented in 6, 11.5, 28, 5, 5, 18, 3, 15, 8, and 0.5% of the studied patients.

In contrast to the current study, Shah *et al*.[26] found that among octogenarians and nonagenarians having EGS, gastrointestinal bleeding was the most prevalent admission diagnosis. Similar to the current findings, Pelavski *et al*.[27] discovered that bowel obstruction and incarcerated hernias were the most prevalent causes for nonagenarians to have EGS. It is reasonable to anticipate that the risk factors correlating best with postoperative outcomes in procedures commonly performed in elderly patients, such as surgery for small bowel obstruction, might be under-represented in the ESS.

In the current study, the 30-day mortality rate increased from 7.1% at an ESS of 1 or less to 14.3% at an ESS of 6, then increased to 21.4% at a score 9. There was a significant increase (*P<0.001*) in mortality due to the increase of ESS with an AUC NELA score (0.846) and CI (95% CI: 0.717–0.976) and AUC P-POSSUM score of 0.811 and CI (95% CI: 0.734–0.972) with no significant difference between the two scores (*P=0.369*).

Christou *et al*.[9] discovered, in line with the current findings, that the 30-day rate of mortality improved steadily with increasing ESS. For instance, ESS values of 1, 6, 11, and 19 were linked to 0, 14, 44, and 100% mortality, respectively. The mortality c-statistic NELA score was 0.81 (95% CI: 0.74–0.88).

The current study agreed with Alburakan *et al*.[1], who found that the death rate rose from 0.3% for ESS of 2 or less to 11.7% for ESS of 7–10 and 30.1% for ESS levels of 10 or higher. The 30-day mortality rate was significantly predicted by ESS, as evidenced by its c-statistic of 0.88 (95% CI: 0.83–0.93).

In the current study, the prediction of at least one complication increased from 1.1% at an ESS of 1 or less to 16.5% at in ESS of 9, then increased to 23.1% at a score 10. There was a significant increase (*P<0.001*) in the prediction of at least one complication due to the increase of ESS with an AUC NELA score (0.919) and CI (95% CI: 0.88–0.957), and AUC P-POSSUM score (0.927) and CI (95% CI: 0.82–0.945), with no significant difference between the two scores (*P=0.269*).

Christou *et al*.[9] agreed with the current findings and found that postoperative complications rates rose step-by-step with increasing ESS; for instance, ESS of 1, 6, 11, and 19 was linked to 5, 29, 89, and 100% complication rates, respectively.

Similarly, Alburakan *et al*.[1] found that the 30-day complications were significantly predicted by ESS, as evidenced by its c-statistic of 0.82 (95% CI: 0.79–0.85).

In the current study, there was a significant increase in ICU readmission due to the increase of ESS (*P<0.001*) with an AUC (0.785) and CI (95% CI: 0.678–0.892).

Christou *et al*.[9] agreed with the current findings and found that ICU admission rates increased steadily with increasing ESS; for instance, there was a correlation between 0, 24, 72, and 100% ICU admittance levels for ESS of 1, 6, 11, and 19.

Similarly, Alburakan *et al*.[1] found that a c-statistic of 0.85 (95% CI: 0.82–0.88) indicated that ESS could predict the rate of postoperative ICU admission.

EGS patients frequently have a different pathophysiologic basis than patients having elective surgical procedures, and many of them need to be admitted to ICU in order to recover[28]. ESS can be helpful as a triage strategy for ICU admission, particularly in nations like Egypt[29]. Every medical facility could modify the earlier suggested ESS cut-off value of more than or equal to 7 to admit a patient to the ICU to suit their unique set of current resources and facilities[14]. Indeed, the ESS can potentially be utilized by smaller facilities with limited ICU bed availability to make informed decisions about patient transfers to healthcare facilities with a higher level of care. This can help ensure that patients with higher surgical risk receive the appropriate intensive care resources they need[30].

The Surgical Apgar Score, similar to the ESS, is another tool designed to assess surgical risk and predict postoperative outcomes. Some studies have explored the potential use of the Surgical Apgar Score as a tool to predict the need for ICU admission. By identifying patients who may require ICU care, these risk assessment tools can aid healthcare providers in making timely and informed decisions about patient transfers and resource allocation[30,31]. Yet, instead of using EGS, the majority of instances involved elective surgery, and their effectiveness was lower than that of ESS (c-statistic=0.76)[30].

According to the study by Gaitanidis *et al*.[32], ESS has higher predictive power than all of these risk assessment tools among older adults (e.g. ESS: AUC 0.81 vs. AUC 0.771–0.784 for P-POSSUM, and ASA classification).

The present study provides a lot of advantages. Missing data received the default value of 0 instead of omitting it. In this way, the study's power and generalizability were increased. This approach allows for a more representative sample, as it includes all eligible patients rather than excluding those with missing data. Additionally, by including patients who did not have access to all ESS data, selection bias was avoided. The selection bias of excluding lower-risk patients was illuminated by enrolling all patients despite missing information, which increases the reliability of the study's findings.

There are also limitations in the current investigation. The study's primary weakness is that it only included EGS patients who had surgery. Consequently, it is not applicable to EGS patients receiving nonoperative care. Another drawback of the study is its retrospective nature. Third, as the database lacked quality-of-life characteristics, therefore meaningful survival was not investigated.

CONCLUSION

In conclusion, ESS is a golden key in predicting mortality, postoperative complications, and ICU admission among elderly patients who underwent EGS. The main preoperative diagnoses presented by those patients are complicated gallstone disease, bowel obstruction, appendicitis, and complicated peptic ulcer disease. The main postoperative complications among elderly patients having EGS are bleeding, sepsis, site infection, ventilator requirement more than 48 h and acute kidney injury. These results provide even more evidence in favor of using ESS for frontline decision-making, family and patient guidance, resource allocation, and quality monitoring of elderly surgical care. More articles are required on how the scoring system can be applied in practice and how it can be used to improve outcomes.

CONFLICT OF INTEREST

There was no conflict of interest.

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