

Utility of World Society of Emergency Surgery Sepsis Severity Score in Predicting Outcomes of Intra-abdominal Infections

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Abstract

Background: Intra-abdominal infections are classified as simple or complicated. Many tools have been studied to predict risk factors and outcomes of patients with intra-abdominal infections. None of these tools has been adopted for patient care at the Kenyatta National Hospital (KNH), Kenya. **Objective:** To determine the utility of the World Society of Emergency Surgery (WSES) Sepsis Severity Score in predicting short-term outcomes of patients managed for complicated intra-abdominal infections. **Methods:** We conducted a hospital-based prospective cohort study. Patients aged 18 years and above with complicated intra-abdominal infections were recruited. Data were obtained on demographics, condition at admission, time to source control, origin of infection, immune suppressants and complications. IBM SPSS version 21.0 was used to obtain means and standard deviations while logistic regression was used for associations. **Results:** A sepsis severity score of 6.5, best

predicted mortality having a sensitivity of 80% and a specificity of 20.9% were obtained. For each unit increase in the WSES scores, the odds of mortality were 2.1, organ dysfunction 2.2, CCU admission 2.1.

Conclusion: Our sepsis severity score has demonstrated good performance in our adult population, and also ability to predict adverse outcomes other than mortality in patients managed for intra-abdominal sepsis.

Keywords: WSES, Sepsis, Sepsis severity score, Intra-abdominal infections

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Introduction

Infectious processes in the abdomen may be grouped as either complicated or simple (1,2). When the infectious process involves an intra-abdominal organ without extending to the peritoneum, it is classified as simple, and complicated if the intra-abdominal infection extends beyond organ of origin (3,4). Management of complicated intra-abdominal infection generally involves patient resuscitation, risk assessment, source control, antimicrobial therapy and re-evaluation of patient response in order to adjust management strategy (1,5-7). Prognostication for intra-abdominal infections can use either disease-specific tools such as Mannheim Peritonitis Index (MPI), which is specific to peritonitis, or disease non-specific scoring systems often used in critical care units (CCUs) such as Acute Physiology and Chronic Health Evaluation (APACHE) score (10-12). The World Society of Emergency Surgery (WSES) sepsis severity score is specific for complicated intra-abdominal infections cIAI, but its performance in predicting

outcomes of patients with cIAI at Kenyatta National Hospital (KNH) has not been assessed (3,8,13). The goal of this study was to assess the performance of the new tool in our setup and advise on its applicability. Early identification of patients' risk or prognostic factors helps in assessing the severity and deciding the aggressiveness in managing patients with cIAI (5,8,9).

Methods

This was a hospital-based, prospective cohort study carried out at KNH general surgical and critical care units after obtaining ethical approval (P561/08/2018) and registration certificate from KNH Research Resource Centre. Respondents consented before the questionnaire was administered, and patients aged 18 years and above diagnosed with cIAI were consecutively recruited until the desired sample size of 173 was reached. Relevant preoperative and intra-operative data constituting WSES risks were collected using an abstraction tool at the time of recruitment. A WSES sepsis severity score was

calculated for each recruited patient based on observed WSES risk factors. Additional data on complications were collected during hospital stay in the index admission up to the time of discharge or 30 days.

Data were entered, cleaned and analyzed using IBM SPSS version 21.0. Demographic data were analyzed and presented as means, frequency and range. Identified risk factors were presented in a table as frequencies and proportions while WSES score for each patient was presented on bar chart. Direct logistic regression demonstrated effect of WSES scores on outcomes, while Receiver Operating Characteristics (ROC) was used to generate cutoff values. Results were considered significant at $p < 0.05$.

Results

We recruited 173 patients: 104(60.1%) were males and 69(39.9%) females, ranging in age between 18 and 75 years; only 8(4%) were aged above 70 years. Fifty-eight (33.5%) patients had severe sepsis at admission, 55(31.7%) had secondary peritonitis caused by small bowel perforation, and 47(27.1%) due to large bowel perforation. It took more than 24 hours to obtain infection source control in 84(49%) patients. Risk of healthcare associated infection was present in 28(16%) patients and immune suppression risk in 8(4%) patients (Table 1).

Table 1: WSES score stratification and their frequency

Observed risk	WSES scored risks	Risk score	No. of patients (n=173)
Condition of patient at admission	Severe sepsis	3	58
	Septic shock	5	17
	None of the above	0	98
Primary organ of origin of intra-abdominal infection	Small bowel perforation	3	55
	Large bowel perforation	2	47
	Postoperative peritonitis	2	26
	Other sources	0	45
Time taken before infection source control	Less than 24 hours	0	89
	More than 24 hours	3	84
Risk of health care associated infection	Present	2	28
	Absent	0	145
Immune suppression risk	Present	3	8
	Absent	0	165
Patient age	More than 70 years	2	8
	18 to 70 years	0	165

The WSES score had a range of 0 to 18. Most (72.3%) of the patients had a cumulative score of 6 and below, with the highest cumulative score of 3 in 39(22.5%) patients (Fig. 1).

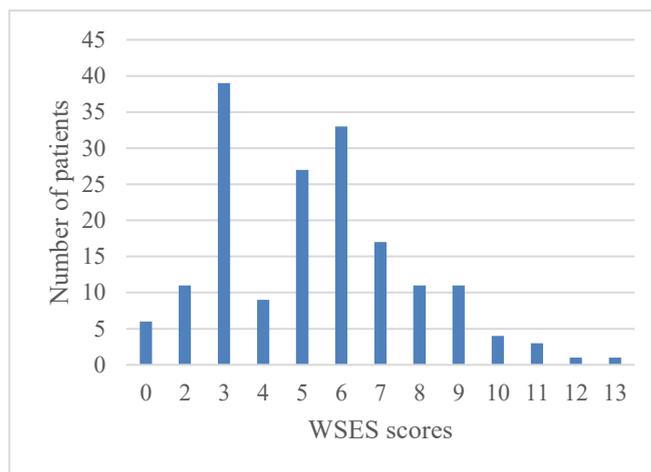


Figure 1: Distribution of WSES sepsis severity scores

Postoperative pain, surgical site infection and organ dysfunction occurred in 97(56%), 84(48.5%) and 58(33.5%) patients respectively (Table 2).

Table 2: Patient outcomes during up to 30 days post operatively

Observed complication	Patients (n=173)	Frequency (%)
Postoperative pain	97	56
Surgical site infection	84	48.5
Organ dysfunction	58	33.5
Postoperative CCU admission	47	27
Wound dehiscence	37	21
Mortality	20	12.8
Fistula	17	9.8
Length of stay (more than 30 days)	17	9.8
Burst abdomen	4	2

Direct logistic regression tested the ability of the score to predict outcomes for each outcome independently. It was highly significant in predicting organ dysfunction, critical care unit admission, mortality and wound dehiscence (all $p < 0.001$), with high Wald statistics (Table 3).

The receiver operating characteristic (ROC) curve showed that the best cutoff point for predicting mortality in this study was a sepsis severity score 6.5 having a sensitivity of 80 % and a specificity of 20.9 % (Table 4 and Fig. 2).

Table 3: Ability of WSES sepsis severity score to predict sample outcomes of patients with complicated intra-abdominal infection

Outcomes / Variable	B	S.E.	Wald	OR
<i>Organ dysfunction</i>				
WSES	.795	.127	38.966	2.2.14
Constant	-5.259	.792	44.142	0.005
<i>CCU admission</i>				
WSES	.746	.124	35.996	2.108
Constant	-5.445	.818	44.270	0.004
<i>Mortality</i>				
WSES	0.722	.147	24.194	2.060
Constant	-6.872	1.151	35.633	0.001
<i>Dehiscence</i>				
WSES	.412	.089	21.160	1.509
Constant	-3.736	.607	37.867	0.024

Table 4: ROC curves for sample outcomes

Outcome	Area under curve	ROC cut-off	Sensitivity (%)	Specificity (%)
Mortality	0.874	6.5	80.0	20.9
Organ dysfunction	0.862	5.50	84.5	27.8
CCU admission	0.854	5.50	83.0	33.3
Dehiscence	0.785	5.50	81.1	37.5
SSI	0.679	3.50	84.5	51.7
Pain	0.668	4.5	78.4	42.1

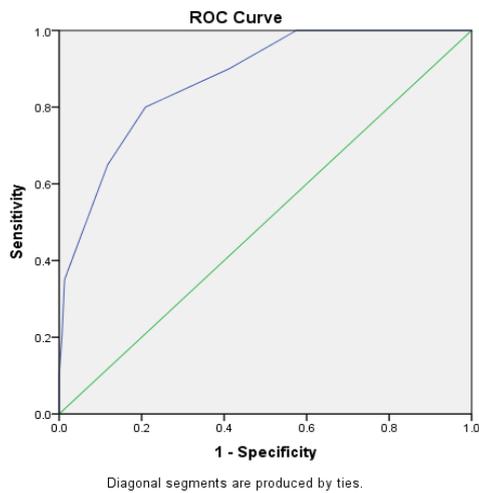


Figure 2: Mortality ROC

Discussion

The male to female ratio was 1.5:1, with a mean age of 38.9 years (SD 14.8). These figures differ from the findings of Wabwire and Saidi who found a ratio of 4:1 with a mean age of 32.2 years while carrying out a stratified outcome of peritonitis using the MPI score in KNH. This difference may have been as result of their smaller sample size (70) and age range difference (13–59years) (14). The ratio of male to female from the WISS

study was 1.3:1, mean age 51.2 years (range 18–99 years) (8).

Fifty-eight (33.5%) and 17(9.8%) patients were admitted with severe sepsis and septic shock respectively compared with 12.3% and 5% in the WISS study. The commonest primary source of intra-abdominal sepsis was perforated appendix 28(16.2%), followed by duodenal perforation 27(15.6%). This was comparable to the findings of Wabwire and Saidi (14). Findings by Green et al. also showed the commonest causes of abdominal sepsis to be appendicitis and perforated ulcers (15). About half (49%) of patients had their infection source controlled later than 24 hours compared with 51.9% in the WISS study, which is comparable (8). Sixteen percent were at risk of healthcare associated infection, 4% were immune suppressed compared with 12.5% and 9% in the WISS study respectively (8). Four percent of our patients were aged above 70 years.

Fifty-six percent of our patients had inadequate pain control, 48% had surgical site infection. Wabwire et al. (14) found a surgical site infection rate of 45.7% (14). Observed mortality within one-month follow-up was 12.8% excluding patients who exceeded the duration of follow-up in our study. This was comparable to findings of other authors (8,14,15). We had 58(33.5%) patients with organ dysfunction, 47(27%) were admitted in the critical care unit, 37(21%) had wound dehiscence, 17(9.8%) had fistula,17(9.8%) had hospital stay longer than 30 days while 4(2%) developed burst abdomen.

The ROC curve was used to determine the cutoff values, and the area under the curve was examined for significance. For mortality, the area under the curve was 0.874, which was statistically significant in predicting mortality ($p < 0.001$), sensitivity 80% and specificity of 20.9%. The WSES score cutoff value for predicting mortality was 6.5 compared with the WISS study at 5.5 (8). The difference may be as a result of our smaller sample size (173) compared with 4,533 patients in the WISS study. ROC curves for other outcomes arrived at cutoff of 5.5 for predicting SSI, wound dehiscence, critical care unit admission and organ dysfunction ($p < 0.05$). Direct logistic regression demonstrated that each outcome had statistically significant relationship with the WSES score such that for each unit increase in the WSES scores, the odds of mortality was 2.1; organ dysfunction 2.2; CCU admission 2.1; wound dehiscence and burst abdomen 1.5; pain, fistula and SSI 1.2 ($p < 0.05$).

Limitations

This was a single center study and the results may not be applicable to all facilities in the country. The smaller sample size may have underpowered the correlation between WSES sepsis severity score and morbidity outcomes. However, when each outcome of morbidity was evaluated using analysis of variance, the power for outcomes (Table 2) was in excess of 90% and probability of type 2 error less than 10%.

Patients (17 [9.8%]) who stayed for longer than 30 days may have developed other uncaptured outcomes that could not be included in our analysis. Intention to treat analysis showed that the number that exceeded 30 days follow-up did not affect observed outcomes significantly.

Conclusion

The WSES sepsis severity score has demonstrated good performance in our adult population. It has also demonstrated ability to predict adverse outcomes other than mortality in our adult population managed for intra-abdominal sepsis. This tool may help in early prognosis of patients with intra-abdominal sepsis and guide aggressiveness of management to mitigate predicted adverse outcomes.

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