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Early Identification of Sepsis in the Emergency Department: A Retrospective Audit of Compliance with NICE Guidelines

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ABSTRACT

Background: Sepsis can adversely affect the health of hospitalized cases, resulting in elevated morbidity and death rates. It results in major problems for healthcare systems worldwide, resulting in about 11 million mortalities each year. Sepsis Early Alert Tools (SEATs) have emerged as pivotal in expediting the recognition and management of this life-threatening condition.

Aim: To assess the impact of implementing a Sepsis Early Alert Tool (SEAT) in the Emergency Department (ED) on compliance with the National Institute for Health and Care Excellence (NICE) protocols for early identification and management of sepsis.

Patients and Methods: This was a retrospective audit performed in the ED, evaluating compliance with the NICE protocols for the early identification and management of sepsis prior to and following the implementation of the SEAT.

Results: A total of 115 cases have been involved (65 pre-SEAT, 50 post-SEAT). Post-SEAT implementation significantly increased antibiotic administration within 60 minutes of triage (44% vs. 24.6%, p=0.03) and collection of two blood culture sets prior to antibiotics (44% vs. 18.5%, p=0.003). Sequential Organ Failure Assessment scores were lower post-SEAT (2.1 ± 0.77 vs. 2.6 ± 0.66, p≤0.001). Length of stay and mortality showed no significant differences.

Conclusion: SEAT implementation improved key sepsis care processes and early recognition, aligning ED practice more closely with NICE guidelines.

Key words: Sepsis, Sepsis Early Alert Tool (SEAT), Emergency Department, NICE Guidelines.

INTRODUCTION

Sepsis can adversely affect the health of hospitalized cases, resulting in elevated morbidity and death rates. It results in major problems for healthcare systems worldwide, resulting in about 11 million mortalities each year [(1)]. The Emergency Department (ED) triage is the 1st point of contact for recognizing symptoms and signs of sepsis [(2)].

Early detection of sepsis and interventions are crucial in avoiding deterioration, in addition to reducing prolonged length of stay and death in this population. Early detection and prompt, suitable interventions were shown to reduce death and enhance patient results [(3)].

Sepsis Early Alert Tools (SEAT) have emerged as pivotal in expediting the recognition and management of this life-threatening condition. These tools leverage advancements in technology and clinical data analysis to identify cases at risk for sepsis more effectively, thus improving the timeliness of therapeutic interventions such as antibiotic administration [(4, 5)].

The focus is on advancing the implementation of early goal-directed sepsis bundle care. Items like the obtaining of blood lactate, the antibiotic administration, blood cultures, and intravenous fluids are recommended to be performed during the 1st three hours of initial symptoms of sepsis [(6)].

The management of sepsis depends on the prompt administration of antibiotics, the regulation of the infection source, and the giving of intravenous fluids. Whereas optimum treatment remains a subject of continuous debate, the prompt administration of fluids and antibiotics was related to enhanced results and remains the standard of care. The elements of sepsis management are bundled with aims for particular caregiving within the first hour(s) of sepsis identification [(7)]. Proof for the enhancement of outcome measures [intensive care unit (ICU) transfer, hospital length of stay (LOS), mortality, and intensive care unit LOS] was limited but indicated a tendency toward [(8)].

Our study aims to assess the effect of implementing a SEAT in the ED on compliance with the National Institute for Health and Care Excellence (NICE) protocols for early identification and management of sepsis.

PATIENTS AND METHODS

This study was a retrospective audit carried out in the ED, evaluating compliance with the NICE protocols for the early identification and management of sepsis prior to and following the implementation of the SEAT. Information was collected for two distinct periods: the pre-SEAT phase and the post-SEAT phase.

Inclusion Criteria: Adult cases (≥eighteen years old) presenting to the ED. Clinically suspected or confirmed sepsis and initial sepsis recognition occurred in the ED.

Exclusion Criteria: Cases whose main cause for intensive care unit admission was associated with an underlying disorder instead of an acute infective episode,

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such as worsening of chronic airway disease necessitating respiratory support.

Methods

Information was retrospectively collected from patient records for the pre-SEAT and post-SEAT implementation periods.

The following variables were extracted for each patient:

Demographics: Age and sex.

Admission Characteristics: Triage acuity score and source of admission.

Sepsis Characteristics: Suspected source of infection (e.g., respiratory, urinary, skin/soft tissue), initial serum lactate and creatinine levels, Sequential Organ Failure Assessment (SOFA) score variables (FiO2, PaO2, platelet count, type of mechanical ventilation, GCS (Glasgow Coma Scale), MAP-mean arterial pressure, serum bilirubin and creatinine concentration), serum lactate concentration, LDH (lactate dehydrogenase) concentration, WBC (white blood cells count), PCT (procalcitonin) concentration, CRP (C-reactive protein) concentration, albumin concentration, IL-6 (interleukin-6) concentration, organ dysfunction, systolic blood pressure, administration of intravenous fluids or vasopressors, and Acute Physiology and Chronic Health Evaluation (APACHE) III score.

Process of Care Metrics: Time from triage to antibiotic administration, administration of antibiotics within sixty minutes of triage, administration of antibiotics within sixty minutes of severe sepsis detection, collection of 2 sets of blood cultures before administration of antibiotics, and the appropriateness of the initial antibiotic choice based on local guidelines.

Outcomes: Total hospital length of stay and in-hospital death.

Ethical Considerations

This research has been approved by the local Institutional Review Board of Emergency department, Ismailia General Hospital. As a retrospective audit of existing, de-identified information, the requirement for individual patient consent has been waived by the IRB. All case information was anonymized before analysis to ensure confidentiality and was stored securely in accordance with data protection regulations. The study participants were not recognized by name in any report or publication regarding this research. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical Analysis

Information was examined utilizing the Statistical Package for Social Sciences (SPSS) software program. Continuous parameters have been presented as mean ± standard deviation (SD) and compared among the pre-SEAT and post-SEAT groups utilizing independent t-tests. Categorical parameters have been presented as numbers (N) and percentages and were compared utilizing the Chi-square test or Fisher's exact test, as appropriate. A p-value above 0.05 shows non-significant outcomes, a p-value below 0.05 shows significant outcomes, and a P-value below 0.001 is highly significant.

RESULTS

Table (1): Demographics and Admission Characteristics.

Variables	Pre-SEAT N=65		Post-SEAT N=50		P value
	Mean	±SD	Mean	±SD	
Age (years)	56.36	8.59	53.9	7.09	0.1
Triage Score	2.43	0.28	2.52	0.21	0.06
	N	%	N	%	
Sex					
Male	36	55.4%	25	50%	0.566
Female	29	44.6%	25	50%	
Admission source					
Direct from ED	57	87.7%	39	78 %	0.165
From ward	8	12.3%	11	22 %	

P-value above 0.05: Not significant, ED: Emergency Department

Table (**1**) compares baseline demographic and clinical features between the pre-SEAT and post-SEAT groups. There were statistically insignificant variances in age (56.36 ± 8.59 vs. 53.9 ± 7.09 years, p=0.1) or triage scores (2.43 ± 0.28 vs. 2.52 ± 0.21, p=0.06) between groups. The distribution of sex was similar, with roughly equal proportions of males and females in both groups (p=0.566). Admission sources also did not differ significantly, with most patients admitted directly from the emergency department in both groups (87.7% vs. 78%, p=0.165).

Table 2: Sepsis Source and Severity Scores.

Variables	***Pre-SEAT N=65***		***Post-SEAT N=50***		***P value***
	N	*%*	*N*	*%*	
Sepsis source					
Respiratory	44	67.7%	27	54%	0.134
Urinary	3	4.6%	11	22%	**0.005**
Skin/soft tissue	6	9.2%	1	2%	0.11
Other/unknown	12	18.5%	11	22%	0.638
	Mean	±SD	Mean	±SD	
Lactate (mmol/L)	2.45	0.45	2.31	0.38	0.08
Creatinine (υmol/L)	95.8	24.5	92.4	12.32	0.37
SOFA score	2.6	0.66	2.1	0.77	**≤0.001**
APACHE III score	48.4	12.41	44.3	9.8	**0.06**

SOFA: Sequential Organ Failure Assessment, APACHE: Acute Physiology and Chronic Health Evaluation.

Table (**2**) shows the comparison between pre-SEAT and post-SEAT groups regarding sepsis sources and clinical parameters. There was a statistically significant elevation in the percentage of urinary sepsis sources in the post-SEAT group (22% vs. 4.6%, p=0.005). Respiratory, skin/soft tissue, and other/unknown sepsis sources didn't vary significantly among groups. Lactate and creatinine levels were comparable, with no significant differences observed. However, the SOFA score was significantly lower in the post-SEAT group (2.1 ± 0.77 versus 2.6 ± 0.66, p ≤ 0.001), indicating reduced organ dysfunction. The APACHE III score showed a trend toward reduction in the post-SEAT group, but this was statistically insignificant (p-value equal to 0.06).

Table 3: Antibiotic Administration and Blood Culture Practices.

	Pre-SEAT N=65		**Post-SEAT N=50**		**P value**
Antibiotics given within 60 min of triage (%)					
N (%)	16	24.6%	22	44%	**0.03***
Median time from triage to antibiotics (min)					
Mean ±SD	101.3	27.4	92.1	23.1	**0.06****
Antibiotics within 60 min of first recognition of severe sepsis (%)					
N(%)	44	67.7%	35	70%	**0.79****
Two sets of blood cultures prior to antibiotics (%)					
N(%)	12	18.5%	22	44%	**0.003***
Appropriateness of antibiotic choice (%)					
N(%)	38	58.5%	37	74%	**0.08****

:** Significant, *:** In-Significant, **SD:** Standard deviation.

Table 3 compares antibiotic administration metrics among the pre-SEAT and post-SEAT groups. There was a significant elevation in the proportion of cases having antibiotics within sixty minutes of triage in the post-SEAT group (44% vs. 24.6%, p-value equal to 0.03). The median period from triage to antibiotics was shorter in the post-SEAT group, although this variance didn't reach statistical significance (92.1 ± 23.1 min versus 101.3 ± 27.4 min, p-value equal to 0.06). The percentage of cases having antibiotics within sixty minutes of first detection of severe sepsis was similar between groups (70% vs. 67.7%, p=0.79).

The number of cases who had 2 sets of blood cultures drawn before antibiotics was significantly elevated in the post-SEAT group (44% vs. 18.5%, p-value equal to 0.003). The appropriateness of antibiotic choice improved post-SEAT (74% vs. 58.5%), though this variance was statistically insignificant (p-value equal to 0.08).

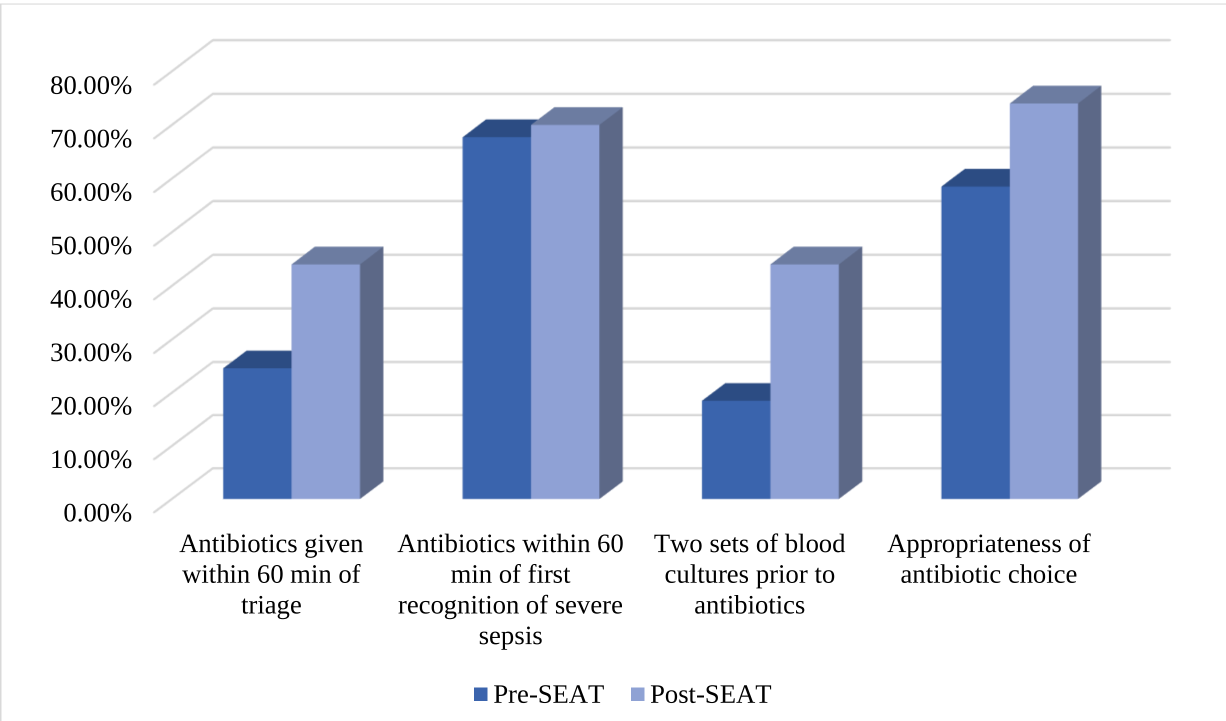

Figure (1): Antibiotic Administration and Blood Culture Practices.

Table 4: Clinical Outcomes.

	Pre-SEAT N=65		**Post-SEAT N=50**		**P value**
	Mean	±SD	Mean	±SD	
Length of stay	7.7	0.5	7.3	1.6	**0.06**
	N	%	N	%	
Died	8	12.3%	5	10%	**0.7**

Table 4 shows patient outcomes comparing the pre-SEAT and post-SEAT groups. The mean length of stay was slightly reduced in the post-SEAT group (7.3 ± 1.6 days) in comparison with the Pre-SEAT group (7.7 ± 0.5 days), although this variance was statistically insignificant (p-value equal to 0.06). Mortality rates were similar between groups, with insignificant variance observed (10% post-SEAT vs. 12.3% pre-SEAT, p=0.7).

DISCUSSION

Our outcomes demonstrated that there were statistically insignificant variances in age (56.36 ± 8.59 vs. 53.9 ± 7.09 years, p=0.1) or triage scores (2.43 ± 0.28 vs. 2.52 ± 0.21, p=0.06) between groups. The distribution of sex was similar, with roughly equal proportions of males and females in both groups (p=0.566). Admission sources also did not differ significantly, with most patients admitted directly from the emergency department in both groups (87.7% vs. 78%, p=0.165).

In line with **Idrees *et al*.** [9] who aimed to assess the influence of introducing a Sepsis Early Alert Tool in the Emergency Department, reported an insignificant variance has been observed between pre- and post-SEAT groups concerning age, sex, triage scores, and admission sources.

As well, **Romero *et al*.** [10] aimed to discover the number of cases having sepsis prior to and following protocol implementation and the effect of sepsis protocols on triage evaluation, management in the emergency department, and time to antibiotic administration. They reported an insignificant variance has been observed among pre- and post-sepsis guideline groups concerning age and sex; nevertheless, there was significant variance among the 2 groups concerning triage scores.

Our outcomes demonstrated that there was a statistically significant elevation in the percentage of urinary sepsis sources in the post-SEAT group (22% vs. 4.6%, p=0.005). Respiratory, skin/soft tissue, and other/unknown sepsis sources didn't vary significantly among groups. Lactate and creatinine levels were comparable, with no significant differences observed. However, the SOFA score was significantly lower in the post-SEAT group (2.1 ± 0.77 versus 2.6 ± 0.66, p ≤ 0.001), indicating reduced organ dysfunction. The APACHE III score showed a trend toward reduction in the post-SEAT group, but this was statistically insignificant (p-value equal to 0.06).

In line with **Idrees *et al.*** [9] reported a significant variance has been observed among the 2 groups concerning SOFA score, as it was significantly reduced in the post-SEAT group (p-value equal to 0.005). Nevertheless, an insignificant variance has been observed among the 2 groups concerning lactate and creatinine levels. Also, there is no significant difference regarding APACHE III score (p>0.05).

As well, **Kalich *et al*.** [11] aimed to define the effect of an antibiotic-specific sepsis bundle on the timely administration of suitable antibiotics and reported an insignificant variance has been observed among the 2 groups concerning lactate; however, an insignificant variance has been observed among the 2 groups concerning urinary sepsis sources (p>0.05).

In contrast, **Ferrer *et al*.** [12] aimed to assess the effect of a multifaceted educational intervention to enhance antibiotic therapy, reported that there was a statistically insignificant variance in the percentage of urinary sepsis sources among both groups; also, the SOFA score wasn't significantly different. Nevertheless, the APACHE II score was significantly reduced in the post group (p-value equal to 0.001).

Our results showed that there was a significant elevation in the proportion of cases having antibiotics within sixty minutes of triage in the post-SEAT group (44% vs. 24.6%, p-value equal to 0.03). The median period from triage to antibiotics was shorter in the post-SEAT group, although this variance didn't reach statistical significance (92.1 ± 23.1 min versus 101.3 ± 27.4 min, p-value equal to 0.06). The percentage of cases having antibiotics within sixty minutes of first detection of severe sepsis was similar between groups (70% vs. 67.7%, p=0.79). The number of cases who had 2 sets of blood cultures drawn before antibiotics was significantly greater in the post-SEAT group (44% versus 18.5%, p-value equal to 0.003). The appropriateness of antibiotic choice improved post-SEAT (74% vs. 58.5%), though this variance was statistically insignificant (p-value equal to 0.08).

In line with **Romero *et al*.** [10] who documented that 86.6 percent of cases in the pre-group had intravenous antibiotics in comparison with 100 percent in the post-group. The comparison of mean period to intravenous antibiotics between the pre- and post-groups showed a statistically significant decrease of 230 minutes in the post-group.

As well, **Shah *et al*.** [13] aimed to assess the effect of a sepsis screening tool implemented in an academic medical center emergency department on compliance with the 3-hour sepsis bundle and reported that the proportion of cases administered antibiotics within sixty minutes was significantly greater in the post-group in comparison with the pre-group (p-value below 0.001). However, the average period on antibiotics was shorter in the post-group compared to the pre-group (p-value below 0.001).

Moreover, **Schinkel *et al*.** [14] aimed to assess the implementation of a sepsis performance enhancement program in the Emergency Department involving a dedicated sepsis response team and examined the treatment and results of sepsis cases prior to and following. They reported that the proportion of cases administered antibiotics within sixty minutes was significantly greater in the post-group in comparison with the pre-group (p-value below 0.001). The number of cases who had 2 sets of blood cultures drawn before antibiotics was significantly greater in the post group in comparison with the pre group (p-value below 0.001). However, the time to antibiotics was shorter in the post-group than the pre-group (p-value below 0.001).

Our outcomes demonstrated that the mean length of stay was slightly reduced in the post-SEAT group (7.3 ± 1.6 days) in comparison with the pre-SEAT group (7.7 ± 0.5 days), although this variance was statistically insignificant (p-value equal to 0.06). Mortality rates were comparable between groups, with insignificant variance observed (10% post-SEAT vs. 12.3% pre-SEAT, p=0.7).

In line with **Shah *et al*.** [(13)] they reported that there was insignificant variance among pre- and post-groups regarding length of hospital stay and mortality rates (p-value above 0.05).

As well, **Ferrer *et al*.** [(12)] reported that there was insignificant variance among pre- and post-groups regarding length of hospital stay and mortality rates (p-value above 0.05).

Moreover, **Schinkel *et al*.** [(14)] reported an insignificant variance has been observed among pre- and post-groups concerning mortality rates (p-value above 0.05); nevertheless, there was a significant variance regarding length of hospital stay (p=0.033).

CONCLUSION

Our results demonstrated that the post-Sepsis Early Alert Tool group had a significantly greater proportion of urinary sepsis presentations and a notably lower SOFA score, suggesting earlier recognition and reduced organ dysfunction at presentation. Process-of-care metrics improved following SEAT introduction, with a significant elevation in the proportion of cases having antibiotics within sixty minutes of triage and in the performance of 2 sets of blood cultures before administration of antibiotics. Overall, SEAT implementation appears to have strengthened early sepsis identification and initial management processes in the ED, aligned care more closely with evidence-based sepsis bundles, and may contribute to improved patient outcomes over time.

DECLARATIONS

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Competing interests: None.

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