Original Article

Implementation of Sepsis Protocol for Timely Antibiotic Administration in the Emergency Department

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Background: Sepsis is a common condition in the emergency department and a leading cause of death for patients in Thailand. The implementation of a sepsis protocol can prevent death by facilitating appropriate management and ensuring that antibiotics are received within one hour of sepsis diagnosis. Such a protocol has been in use at Srinagarind Hospital, but there have not yet been any studies conducted to evaluate its effectiveness.

Objective: To evaluate the effectiveness of the Srinagarind Sepsis Protocol in terms of whether patients received appropriate antibiotics within one hour after presentation with sepsis.

Materials and Methods: This was a retrospective cohort study that reviewed the medical records of 192 sepsis patients in the Srinagarind Hospital emergency department from January 2016 to December 2018.

Results: Overall, sepsis patients received antibiotics within one hour of diagnosis in 136 cases (70.8%). Prior to protocol implementation, only 56.3% of patients received antibiotics within this time frame, a figure that rose to 87.2% after implementation. The percentage of patients in whom sepsis bundles were completed within three hours also increased after protocol implementation.

Conclusion: The treatment protocol allowed patients to receive appropriate antibiotic treatment within one hour and sepsis bundles to be completed within 3 hours of sepsis identification.

Keywords: Sepsis, Septic Shock, Antibiotics, Nurses, Emergencies

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Sepsis is a common condition in the emergency department (ED) and a leading cause of death for patients in the intensive care unit (ICU) in Thailand and around the world. In 2016, the Thailand National Health Security Office (NHSO) reported 151,179 cases of sepsis with 38,582 deaths, making the death rate 25.52%[(1)].

In the majority of cases, death from sepsis can be prevented with appropriate management. Receiving antibiotics within one hour of diagnosis is strongly recommended in order to reduce the mortality rate in sepsis patients[(2)]. In 2016, the Thailand Hospital Indicator Project (THIP)[(3)] revealed that the target of 80% of patients receiving timely antibiotic treatment was not being met.

A previous study[(4)] found that the use of a sepsis workup and treatment (SWAT) protocol reduced the delay in administering antibiotics in the ED. As of June 1, 2017, Srinagarind Hospital has implemented a SWAT protocol for treating patients with sepsis, according to which a dedicated form is used to record important treatment information. This study was conducted to evaluate the effectiveness of this protocol and the duration to antibiotic administration in Srinagarind Hospital's ED.

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Materials and Methods

This was a retrospective cohort study. The sample consisted of 192 patients over 18 years of age at Srinagarind Hospital's ED who fulfilled the criteria for sepsis diagnosis[(5,6)] from January 2016 to December 2018. Patients were excluded if they had been referred from another hospital having already received antibiotics or were undergoing chemotherapy. Ethics approval was provided by the Khon Kaen University Ethics Committee for Human Research (HE601374).

The sample size was calculated based on a cohort study binary data formula without continuity correction. In order to achieve a significance level of 5% and power of test of 0.8, we determined that a sample size of 1,927 would be required. Statistical analysis was performed using SPSS for Windows version 16.0 (SPSS Inc., Chicago, IL, USA). Categorical data were presented as percentages, and

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continuous data were presented using mean and standard deviation. Univariable analysis was performed using a two-sample t-test for numerical data and a Pearson's correlation for data relationships between the two groups.

The patients were classified into two groups: (1) the pre-protocol group, consisting of patients who were diagnosed with sepsis and were admitted to the Srinagarind Hospital ED before June 1, 2017, and (2) the post protocol group, consisting of patients diagnosed with sepsis after June 1, 2017.

Results

One hundred ninety-two subjects were divided into two groups and examined. Patient characteristics are shown in Table 1. The mean age of the patients in the pre protocol group was 60.7±17.6 years, and 51.0% (n = 98) of them were male. The number of patients with diabetes mellitus differed significantly between the two groups (p = 0.042). The respiratory system was the most common locus of infection in both groups (p = 0.027).

The most common sepsis screening criteria score in the pre-protocol group was 3 (55.2% of patients) and in the post-protocol group was 4 (41.7% of patients). The qSOFA score of most (74.0%) patients in the pre-protocol group was 1. A total of 15.6% and 41.7% of patients were diagnosed with septic shock in the pre- and post-protocol group, respectively (p<0.001). Lactate levels, before and after implementation of the protocol, were 21.5 mg/dL and 25 mg/dL, respectively. The median time to antibiotic administration before and after protocol implementation was 57.6 minutes and 33.6 minutes, respectively (Table 2).

One hundred thirty-six (70.8%) of the 192 patients with septic shock in our study received antibiotics within one hour of diagnosis (Table 3). This figure was significantly higher in the post-protocol group than in the pre-protocol group (p<0.001). Sepsis bundles, including measuring lactate levels and administering crystalloid, were also completed within 3 hours of sepsis identification at a higher rate than in the pre-protocol group.

Discussion

Sepsis is a common condition in the ED with a high mortality rate. The 2016 Guidelines for Management of Sepsis and Septic Shock are used to indicate treatment and reduce mortality among sepsis patients. In the ED at Srinagarind Hospital, SWAT guidelines have been developed and applied in the form of the Srinagarind Sepsis Protocol, which determines treatment methods to be employed in the first 3 hours after diagnosis, which include measurement of lactate levels, blood collection for culture before antibiotic treatment, providing adequate fluids for patients with low blood pressure, the broad-spectrum use of antibiotics, and

Table 1. Characteristics of the subjects

	Pre protocol n = 96, (%)	Post protocol n = 96, (%)	p-value
Sex: male	49 (51.6)	49 (51.0)	0.941
Age (years), mean ± SD	60.7±17.6	66.3±15.7	0.022*
Comorbidities			
Diabetes mellitus	17 (17.7)	29 (30.2)	0.042*
Hypertension	21 (21.9)	31 (32.3)	0.104
Lung disease	2 (2.1)	1 (1.0)	1.000
Chronic kidney disease	13 (13.5)	9 (9.4)	0.365
Cerebrovascular disease	7 (7.3)	13 (13.5)	0.156
Malignancy	19 (19.8)	14 (14.6)	0.339
Liver disease	9 (9.4)	5 (5.2)	0.267
Others	25 (26.0)	40 (41.7)	0.022*
Infection risk			
None	50 (52.0)	55 (57.3)	0.469
Had received antibiotics within the past 90 days	28 (29.2)	30 (31.3)	0.753
Hemodialysis	4 (4.2)	1 (1.0)	0.368
Immunosuppression	2 (2.1)	4 (4.2)	0.683
Others	9 (9.4)	5 (5.2)	0.267
Locus of infection			
Respiratory system	66 (68.8)	51 (53.1)	0.027*
Gastrointestinal system	21 (21.9)	23 (24.0)	0.731
Genitourinary system	6 (6.3)	12 (12.5)	0.137
Skin and soft tissue	2 (2.1)	9 (9.4)	0.058
Bone and joint	0 (0.0)	1 (1.0)	1.000
Central nervous system	2 (2.1)	0 (0.0)	0.497
Others	1 (1.0)	2 (2.1)	1.000

* Statistical significance

Table 2. Clinical presentation of the subjects

Clinical presentation	Pre protocol n = 96, (%)	Post protocol n = 96, (%)	*p*-value
Sepsis screening criteria scores			<0.001*
1	1 (1.0)	0 (0.0)	
2	23 (24.0)	4 (4.2)	
3	53 (55.2)	32 (33.3)	
4	16 (16.7)	40 (41.7)	
5	2 (2.1)	20 (20.8)	
6	1 (1.0)	0 (0.0)	
qSOFA score			<0.001*
0	2 (2.1)	0 (0.0)	
1	71 (74.0)	18 (18.8)	
2	19 (19.8)	71 (74.0)	
3	4 (4.2)	7 (7.3)	
Septic shock	15 (15.6)	40 (41.7)	<0.001*
Lactate measurement	62 (64.6)	90 (93.8)	<0.001*
Lactate level (mg/dL), mean ± SD	21.5±26.8	25.0±21.7	
Time to antibiotics (hour) (IQR)	0.96 (0.7,1.5)	0.56 (0.36,0.8)	<0.001*
Use of vasopressor	3 (3.1)	10 (10.9)	0.036

* Statistical significance

Table 3. Outcome of SWAT in Srinagarind Hospital

Variables	Pre protocol n = 96, (%)	Post protocol n = 96, (%)	*p*-value
Time to antibiotics in 1 hour	54 (56.3)	82 (87.2)	<0.001*
Sepsis bundles completed in 3 hours			
Measured lactate level	52 (86.7)	88 (97.8)	0.008*
Obtained blood cultures	96 (100.0)	96 (100.0)	
Administered crystalloid	75 (79.8)	92 (97.9)	<0.001*
Death	5 (5.3)	0 (0.0)	0.059

* Statistical significance

the administration of antibiotics within one hour of sepsis identification.

The present study found that the implementation of the SWAT protocol significantly increased the percentage of patients who received antibiotics within 60 minutes of diagnosis, which is similar to the results of previous studies[7,8]. The creation of treatment protocols is based on human factor engineering, which is the present study and application of theoretical understanding of physical, cultural and psychological factors in finding information about behavior. To design tools, systems and the environment for reducing impaired behavior, the establishment of this protocol can reduce human error.

The present study found that lactate measurement, the provision of adequate fluids for patients with low blood pressure, and blood culture collection before antibiotics, increased significantly after implementation of the protocol, which is in accordance with the findings of a previous study[9,10].

The authors also found that the application of the protocol led to a reduced mortality rate, which is consistent with the results of previous studies in Thailand[11,12]. There is a significant relationship between antibiotics received and improved results, including survival in the hospital, return of organ failure, and shorter hospitalization periods[13]. However, this study was limited in that it was a retrospective study and data were collected from medical records (resulting in incomplete data) and were gathered from only one hospital.

Conclusion

The implementation of a treatment protocol for patients with sepsis resulted in more patients receiving appropriate antibiotics within one hour of diagnosis. It also allowed for better compliance with the guidelines for treating patients with sepsis in the first 3 hours, including measurement of lactate levels, the provision of adequate use of fluid for patients with low blood pressure, and the collection of blood cultures.

What is already known on this topic?

Sepsis is a common condition in the ED with a high mortality rate. Mortality can be prevented with appropriate management, including the administration of antibiotics within one hour of sepsis diagnosis.

What this study adds?

The implementation of a treatment protocol for patients with sepsis increased the number of patients who received antibiotics within one hour and for whom sepsis bundles were completed within 3 hours of sepsis identification.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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การใช้แนวปฏิบัติการรักษาภาวะพิษเหตุติดเชื้อเพื่อการได้ยาปฏิชีวนะในเวลาที่เหมาะสมในแผนกฉุกเฉิน

วัชระ รัตนสีหา, ศิรินาถ เหิรเมฆ, กมลวรรณ เอี้ยงฮง, ดนุ เกษรศิริ, กรกฎ อภิรัตน์วรากุล, วัชรพงศ์ พุทธิสวัสดิ์

ภูมิหลัง: ภาวะพิษเหตุติดเชื้อเป็นภาวะที่พบได้บ่อยในแผนกฉุกเฉินและเป็นสาเหตุการเสียชีวิตที่สำคัญในประเทศไทย การใช้แนวปฏิบัติการรักษาภาวะพิษเหตุติดเชื้อสามารถลดอัตราการเสียชีวิตได้โดยการได้ยาปฏิชีวนะในเวลา 1 ชั่วโมงหลังได้รับการวินิจฉัย โรงพยาบาลศรีนครินทร์มีการนำแนวปฏิบัติการรักษาภาวะพิษเหตุติดมาใช้แต่ยังไม่มีการศึกษาถึงประสิทธิภาพ

วัตถุประสงค์: เพื่อประเมินประสิทธิภาพแนวปฏิบัติการรักษาภาวะพิษเหตุติดเชื้อของโรงพยาบาลศรีนครินทร์ในการได้ยาปฏิชีวนะในเวลา 1 ชั่วโมงหลังได้รับการวินิจฉัย

วัสดุและวิธีการ: การศึกษาจากเหตุไปหาผลแบบย้อนหลังด้วยการทบทวนเวชระเบียนของผู้ป่วยภาวะพิษเหตุติดเชื้อที่โรงพยาบาลศรีนครินทร์จำนวน 192 ราย ระหว่างเดือนมกราคม พ.ศ. 2559 ถึง เดือนธันวาคม พ.ศ. 2561

ผลการศึกษา: ผู้ป่วยภาวะพิษเหตุติดเชื้อได้รับยาปฏิชีวนะภายในระยะเวลา 1 ชั่วโมง จำนวน 136 ราย (ร้อยละ 70.8) ในกลุ่มหลังการใช้แนวปฏิบัติการรักษาภาวะพิษเหตุติดเชื้อได้รับยาปฏิชีวนะภายในเวลา 1 ชั่วโมงเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกับกลุ่มก่อนใช้แนวปฏิบัติการรักษาจากร้อยละ 56.3 เป็น 87.2 และร้อยละของผู้ป่วยที่สามารถบรรลุแนวทางการรักษาภายใน 3 ชั่วโมงในกลุ่มหลังการใช้แนวปฏิบัติการรักษามีจำนวนเพิ่มขึ้น

สรุป: แนวปฏิบัติการรักษาภาวะพิษเหตุติดเชื้อ ช่วยให้ผู้ป่วยได้รับยาปฏิชีวนะที่เหมาะสมภายในเวลา 1 ชั่วโมงและสามารถบรรลุแนวทางการรักษาภาวะพิษเหตุติดเชื้อ ภายใน 3 ชั่วโมงได้