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Association of Quick Sepsis-Related Organ Failure Assessment (qSOFA) to predict Severity in Patients with Pneumonia

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Abstract

Background: *qSOFA is generally useful in predicting the outcome in populations in the general emergency department (ED) in sepsis and most common types of infections to cause sepsis are respiratory like pneumonia or genitourinary like a urinary tract infection. In this study we are evaluating whether qSOFA can predict severity in pneumonia patients during initial assessment.*

Aims & Objectives: *To evaluate the association of the qSOFA score to predict admission to the intensive care unit (ICU) and length of hospital stay in patients with pneumonia.*

Method: *This retrospective study was done at Kempegowda Institute of Medical Sciences and Research Centre, Bengaluru in the Department of Medicine. A total of 50 patients admitted for pneumonia were screened and the qSOFA score was calculated according to initial assessment data, further the admission status and length of stay was also recorded for study.*

Results: *A total of 50 patients were included in the study out of which 30(60%) male and 20 (40%) female patients and the male to female ratio was 1.5:1.Mean age of the participants was 56.60 years. Women subjects were five years younger than males with little variation in dispersion (SD). All the patients had fever and cough with expectoration at the time of presentation. Confusion or disorientation was noticed among 36% of the patients at presentation. It was observed that with increasing qSOFA score disorientation and pulmonary complications tend to increase. All those who needed ICU care had a score of 2 or more and there was significantly increased duration of hospitalization with qSOFA more than 2 (15 days more in score 3 compared to score 1). qSOFA score predictability in ICU admission showed sensitivity of 100% and specificity of 35.5% with positive predictive value of 75% and negative predictive value of 100%.*

Conclusion: *qSOFA score showed good predictive performance for ICU admission and in assessing the duration of stay in hospital and hence the severity of pneumonia.*

Introduction

Pneumonia is defined as an acute infection of the pulmonary parenchyma, presenting with an acute infiltrate in the chest X-ray[1,2].

Despite on-going advances in medical treatment, the burden of disease of pneumonia remains significant[3]. Even in developed countries, the incidence of pneumonia is still as high as 9.7 per 1000 persons, with a hospitalisation rate of 46.5% and 30-day mortality of 12.9% in patients with community-acquired pneumonia.[3]

The case fatality rate increases to over 50% in patients with pneumonia-related sepsis/septic shock[3]. Therefore, early diagnosis of patients with pneumonia-associated sepsis/septic shock seems paramount.

In 2016, the Society of Critical Care Medicine and the European Society of Intensive Care Medicine concluded that sepsis should be defined as life-threatening organ dysfunction caused by a dysregulated host response to infection and the Organ dysfunction is represented by an increase in the Sequential [sepsis-related] Organ Failure Assessment (SOFA) score of 2 points or more, which is associated with an in-hospital mortality greater than 10%.[4] The most common types of infections to cause sepsis are respiratory like pneumonia or genitourinary like a urinary tract infection.

However, calculation of SOFA scores requires sequential laboratory work-up and is therefore not useful for bedside screening of patients with suspected sepsis. Therefore, the consensus committee has proposed the quick sequential organ failure score (qSOFA)—which is based on rapidly assessable vital parameters, including respiratory rate, mental status, and systolic blood pressure.[4]

The qSOFA model included Glasgow Coma Scale (GCS) score of 13 or less, systolic blood pressure of 100 mm Hg or less, and respiratory rate of 22/min or more (1 point each; score range, 0-3). A score ≥2 is associated with poor outcomes due to sepsis.[5]

The aim of this study is to evaluate the association of the qSOFA score to predict admission to the intensive care unit (ICU) and length of hospital stay in patients with pneumonia and hence the severity.

Materials & Methods

- In a retrospective analysis, admission data in 2018 from Medicine Dept of the KIMS Hospital, were screened to identify 50 patients admitted for pneumonia.

- The following clinical data were recorded; time since start of symptoms, history of fever, history of delirium and risk factors for pneumonia (chronic obstructive pulmonary disease (COPD), diabetes mellitus, liver disease, chronic renal failure, severe cardiac disease, immunosuppression, active neoplasia, smoking, alcoholism).

- In addition, vital parameters were recorded (first recorded value), Glasgow coma scale score was calculated, ABG values, CXR showing multilobar involvement and need for ionotropes, for assessing severity, as well as need for ICU admission. Also the whole duration of hospital stay.

- qSOFA score is calculated from the initial vital parameters assessment.

- Threshold values: qSOFA is considered positive when the patient scored two or more points.

Inclusion Criteria: All adult patients of 16 years or older presenting with the diagnosis of pneumonia were eligible for study.

Exclusion Criteria: Patients with incomplete data sets for the calculation of qSOFA were excluded.

Results

Patients' Demographics: Of the patients with a diagnosis of pneumonia, 50 with complete datasets to calculate the qSOFA score were identified and were eligible for study inclusion. Of the total patients included,30(60%) were male and 20 (40%) were female patients and the male to female ratio was 1.5:1.
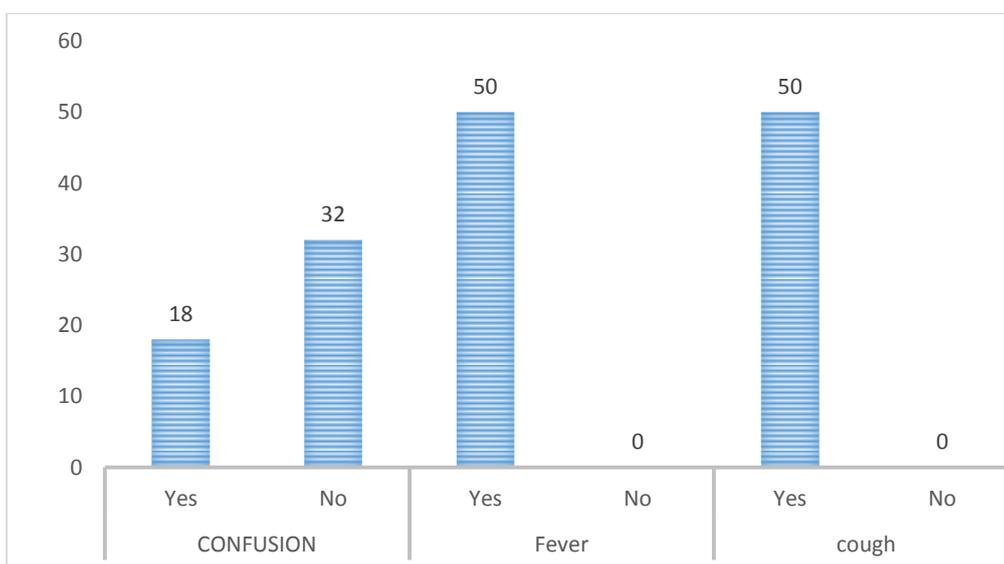
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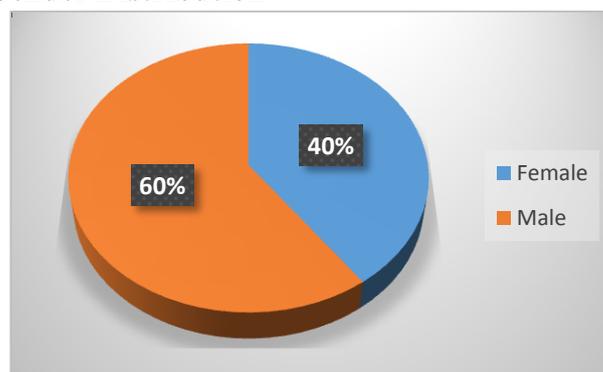
Mean age of the participants was 56.60 years. Women subjects were five years younger than males with little variation in dispersion (SD).

SEX(0=F,1=M)	N	Mean AGE IN YEARS	Std. Deviation
Female	20	53.20	15.109
Male	30	58.87	14.998
Total	50	56.60	15.150
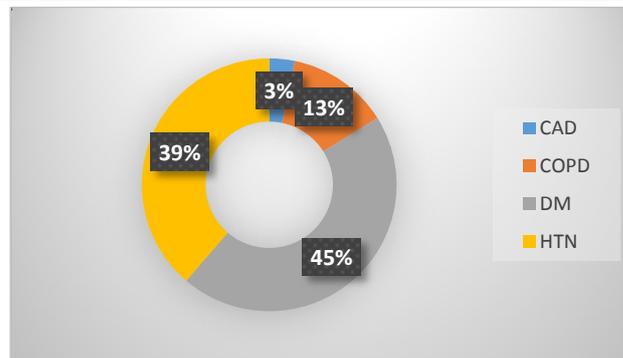
Frequency distribution of comorbidities among the study subjects, as seen below lifestyle disorders like DM and Hypertension were common comorbidities among the study participants.

Distribution of presenting symptoms among study subjects: All the patients had fever and cough with expectoration at the time of presentation. Confusion or disorientation was noticed among 36% of the patients at presentation.

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qSOFA Assessment: qSOFA score was positive in 44 patients (88%). Patients with a positive qSOFA score did not differ significantly in respect to age, sex, or risk factors for pneumonia from patients with a negative qSOFA score.

Distribution of qSOFA score according to severity of illness

		qSOFA Score			Total	Fisher exact test
		1	2	3		P value
CONFUSION	Yes	0	0	18	18	<0.001
	No	6	26	0	32	
CHEST XRAY MULTILOBAR	Yes	2	12	12	26	0.25
	No	4	14	6	24	
ICU/MICU CARE	Yes	0	15	18	33	<0.001
	No	6	11	0	17	
IONOTROPE	Yes	0	9	8	17	0.13
	No	6	17	10	33	

Difference of qSOFA score was studied in different parameters indicating severity of illness.

It was observed that with increasing qSOFA score disorientation and pulmonary complications tend

to increase. All those who needed ICU care, had score 2 or more. Inotropic support was needed in 17 patients and all of them had score more than or equal to 2. In all the patients with severe illness symptoms qSOFA score was more than or equal to 2. The difference was statistically significant

for confusion and ICU admission. Similar trend was observed for pulmonary findings and inotrope requirement also. Due to lower sample size the difference observed was not statistically significant.

Distribution of qSOFA score according to clinical parameters of study subjects

qSOFA		AGE IN YEARS	FEVER(No: of Days)	Resp Rate	SPO2	GCS	PH	PO2	Days of Hospitalization
1	N	6	6	6	6	6	6	6	6
	Mean	57.33	5.33	22.67	93.50	15.00	7.40	83.63	5.83
	SD	18.875	1.751	5.007	3.886	0.000	0.05	2.68	.753
2	N	26	26	26	26	26	26	26	26
	Mean	57.27	5.50	27.38	88.00	15.00	7.39	71.19	13.46
	SD	14.842	1.631	3.806	5.824	0.000	0.08	12.16	2.687
3	N	18	18	18	18	18	18	18	18
	Mean	55.39	5.33	31.89	81.11	13.61	7.37	60.22	20.00
	SD	15.178	1.237	5.378	12.170	.502	0.09	8.99	2.249
Total	N	50	50	50	50	50	50	50	50
	Mean	56.60	5.42	28.44	86.18	14.50	7.39	68.73	14.90
	SD	15.150	1.486	5.388	9.380	.735	0.08	12.70	5.120
ANOVA test – F value		.087	.076	10.632	5.942	122.078	.277	12.857	88.592
P value		.917	.927	**<0.001**	**0.005**	**<0.001**	.759	**<0.001**	**<0.001**

No difference was observed in age, duration of pyrexia and Ph distribution of 3 score categories. Again the investigations like SPO2, GCS and PO2 indicating severe illness showed statistically

significant worsening in values with increasing qSOFA score. This was also supported by significantly increased duration of hospitalization (15 days more in score 3 compared to score 1).

Distribution of qSOFA categories according to clinical parameters

qSOFAcat		AGE IN YEARS	FEVER(No : of Days)	RESPIRATORY RATE	SPO2	GCS	PH	PO2	Days of Hospitalization
Negative	N	6	6	6	6	6	6	6	6
	Mean	57.33	5.33	22.67	93.50	15.00	7.40	83.63	5.83
	SD	18.88	1.75	5.01	3.89	0.00	0.05	2.68	0.75
Positive	N	44	44	44	44	44	44	44	44
	Mean	56.50	5.43	29.23	85.18	14.43	7.38	66.70	16.14
	SD	14.83	1.47	4.99	9.49	0.76	0.09	12.16	4.10
t test statistic		0.02	0.02	9.13	4.44	3.30	.191	11.370	37.158
p value		0.901	0.881	0.004	0.040	0.076	.664	.001	0.001

Distribution of study subjects according to qSOFA category and severity of illness

		qSOFA cat		Fischer's exact test statistic	P value
		Negative	Positive		
CONFUSION	Yes	0	18	3.80	0.08
	No	6	26		
CHEST XRAY MULTILOBAR	Yes	2	24	0.95	0.41
	No	4	20		
ICU/MICU CARE	Yes	0	33	13.25	0.001
	No	6	11		
IONOTROPE	Yes	0	17	3.51	0.08
	No	6	27		

Predictive value of qSOFA score

qSOFA predictability in ICU admission showed Sensitivity of 100%, Specificity of 35.5% and a Positive predictive value of 75% and

For the use inotropes showed sensitivity of 100%, specificity of 18.2% and Positive predictive value of 38.6% and negative predictive value of 100%.

Discussion

qSOFA is generally useful in predicting the outcome prediction abilities in populations in the general emergency department (ED) or intensive care unit (ICU) . This score is a modified version of the Sequential (Sepsis-related) Organ Failure Assessment score (SOFA) called the quick SOFA (qSOFA) score. The qSOFA model included Glasgow Coma Scale (GCS) score of 13 or less, systolic blood pressure of 100 mm Hg or less, and respiratory rate of 22/min or more (1 point each; score range, 0-3). A score ≥2 is associated with poor outcomes due to sepsis. Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection. The most common types of infections to cause sepsis are respiratory like pneumonia or genitourinary like a urinary tract infection.

This study analysed the predictive performance of qSOFA to assess severity in ED patients with pneumonia in regard to ICU admission and length of hospital stay and the need for ionotropes. And our results show that qSOFA score of more than 1(ie, positive) observed significant worse course of illness among the study subjects. This was supported by high sensitivity and NPV (100%) in predicting ICU admission and inotropic support requirement.

As qSOFA requires only a clinical examination its predictive capability for assessing severity in condition like pneumonia in hospitals in resource-limited settings in low-and middle-income countries (LMICs) like India with many primary health centres, which often do not have the laboratory capacity or financial resources to routinely perform a complete blood count test and blood chemistry among all patients with suspected pneumonia will help in identifying critical patients and further can even help in considering transferring a patient to a higher or tertiary healthcare centre.

Limitations of the Study

First, we included a population admitted to a single center. Second, specificity was lower and the scoring system needs to be tested by large sample studies for further validation.

Conclusions

qSOFA predicts, length of hospitalisation, and ICU admission in ED patients presenting with pneumonia and has the advantage of being a pure bedside test. As it requires no laboratory testing, it may be more practical in hospitals with less facilities.

Acknowledgement

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