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EARLY DETECTION OF SEPTIC SHOCK FOR LIFE SAVING MANAGEMENT IN PATIENTS ADMITTED IN INTENSIVE CARE UNIT IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Aims And Objectives - Sepsis is a fatal syndrome induced by infection and associated with mortality up to 40%. The barrier for early intervention of sepsis is lack of diagnostic tools. qSOFA was developed to have simple scoring system with few variables that are associated with greater predictive ability. The objective of the study is to evaluate the early detection of septic shock in patients admitted in intensive care unit using risk score for early prompt management to prevent mortality. **Materials and Methods:** Prospective observational study for a period of one month was conducted in intensive care unit. qSOFA parameters like respiratory rate, systolic blood pressure, mental status were assessed and risk score was calculated. Data collected were statistically analysed using descriptive statistics and expressed in percentage. **Results:** A total of 51 patients were examined for qSOFA risk score admitted in intensive care unit. The study population consist of 65% males and 35% females. Patients at low risk for septic shock were 26% and patients with high risk for septic shock were 37%. **Conclusion**: Sepsis and septic shock remains a major health problem with worse prognosis. Early detection and prompt appropriate treatment increases the chance of survival.

KEYWORDS: Intensive care unit, Sepsis, Septic shock, qSOFA.

INTRODUCTION

Sepsis is a fatal syndrome of physiologic, pathologic and biochemical abnormalities induced by infection and it is associated with mortality up to 40%.[1,2,3] When sepsis is complicated by organ dysfunction it is termed as severe sepsis which could progress to septic shock.[5] septic shock is defined as sepsis induced hypotension that persists despite adequate fluid resuscitation.[3] Delay in identification of sepsis and treatment leads to increased mortality.[2] Early diagnosis of sepsis and prompt intervention in management, especially antimicrobials and fluid resuscitation will have better outcome.[2] The global incidence of hospital treated sepsis and severe sepsis was 437 and 270 respectively per 100,000 person-years.[4] Hospital mortality for sepsis and severe sepsis was 17 % and 26% respectively.[4]

The most common cause of sepsis is pneumonia, intra abdominal infection and urinary tract infection. Bacteria, both gram positive and gram negative are most common microorganisms responsible for sepsis. Staphylococcus aureus, streptococcus pneumoniae are gram positive and Escherichia coli, klebsiella species, pseudomonas aeruginosa are the gram negative organisms.[1] Respiratory, cardiovascular followed by brain, liver and kidney are the most common organs involved in acute organ dysfunction.[1]

Sepsis is a varied and unexplainable syndrome with no standard for diagnosis. The barrier for early intervention of sepsis is lack of diagnostic tools.[2] Systemic inflammatory response syndrome criteria were considered to be important for diagnosis of sepsis for many years but it yields about 1 in 8 false negative in patients with infection and organ failure.[5] The new sepsis definition focuses on the severity of organ dysfunction in patients with an acute infection than SIRS score.[5] When there was an increase in the sepsis related sequential organ failure assessment (SOFA) score equal to or more than two due to organ dysfunction, it was associated with 10% mortality risk.As SOFA requires laboratory values that may not be available rapidly and time consuming, quick SOFA (qSOFA) was developed that can be easily performed at the bedside.[2,6]

The definition of the surviving sepsis campaign 2016 was used to calculate the qSOFA score. The qSOFA score was the sum of 1 point for a Glasgow Coma Scale (GCS) of 14 or less, 1 point for a systolic blood pressure of 100 mmHg or less, and 1 point for a respiration rate of 22 per minute or more.[7] qSOFA was developed to have

simple scoring system with few variables that are associated with greater predictive ability. It acts as a risk predictor and not part of diagnosis of sepsis. It can be used as surveillance tool in patients not yet recognised to have infection and patients with a positive qSOFA, infection can be considered.[2] There are several studies recently published to validate qSOFA. Rodrigoel et al in his systematic review and meta-analysis concluded that qSOFA is better in predicting mortality.[8] Jean-Louis Vincent et al in his study showed that qSOFA is an effective way of raising suspicion of sepsis for the prompt future action.[6]

Hence, the objective of the present study is to analyse the early detection of septic shock in patients admitted in intensive care unit (ICU) using qSOFA risk score for early prompt management, in- order to prevent mortality in a tertiary care hospital.

MATERIALS AND METHODS

The present study is a prospective observational study done for a period of one month and was conducted in intensive care unit in a tertiary care hospital in India. The study was conducted after obtaining approval from institutional ethical committee (1543/MBBS/2019 dated 22/3/19). Informed written consent was obtained in local vernacular language from all the patients or their care takers, included in the study.

Selection criteria

Patient admitted in ICU with or without assisted device for two days or more than two days of all age group and gender will be included in the study. Patients with multi trauma and patients who underwent surgeries within 30 day period will be excluded from the study.

Study procedure

Patients were screened as per the selection criteria and their demographic details regarding age and gender was obtained. Detailed history regarding smoking and alcohol intake and associated co-morbid conditions was recorded. Physical examination, examination of qSOFA parameters like respiratory rate, systolic blood pressure, mental status and the clinical diagnosis of the patients were recorded. Laboratory parameters like complete blood count, differential count, random blood sugar and renal parameters were recorded from the test reports. All the information was collected in a predesigned proforma. Data obtained were tabulated and statistically analysed using descriptive statistics and expressed in percentage.

RESULTS

A total of 51 patients were examined for qSOFA risk score in the intensive care unit for a period of one month. Among the 51 patients, 33(65%) were males and 18 (35%) were females (Table-1). The mean age of the study population was 38 years and the mean age of male was 35 years and female was 41 years (Table-1). Among 51 patients, 10 (20%) patients were smokers, 9 (17%) patients were alcoholic and 8 (16%) were both alcoholic and smoker (Table-1). The most common co-morbid condition in study population were epilepsy and diabetes mellitus (9.8%) and the least common were malignancy, psychiatric disorder and bronchial asthma (1.9%) (Table-1).

Table 1: Baseline characteristics.

Sr. No.	Variable	Value n (%)
1.	**Total study population** (n)	51
	Males (%)	33 (65%)
	Females (%)	18 (35%)
2.	**Mean age of study population (years)**	
	Mean age	38
	Males (yrs)	35
	Females (yrs)	41
3.	**Personal history**	
	Smoker	10 (20%)
	Alcoholic	9 (17%)
	Both	8 (16%)
	Nil	24 (47%)
4.	**Co-morbidity**	
	Epilepsy	5(9.8%)
	Diabetes mellitus	5(9.8%)
	Hypertension	3(5.9%)
	Coronary artery disease	2 (3.9%)
	Autoimmunity	2(3.9%)
	Psychiatric disorder	1(1.9%)
	Malignancy	1(1.9%)
	Bronchial asthma	1(1.9%)
	No co-morbidity	31(61%)

N is number of patients.

The qSOFA score parameters like respiratory rate, equal to or more than 22 was seen in 24 (47%) patients, systolic blood pressure equal to or less than 100 was seen in 16 (31%) patients and Glasgow coma scale equal to or less than 14 in 19 (37%) patients (Table-2). Patients at low risk for septic shock were 13 (26%) and patients with high risk for septic shock were19 (37%) according to qSOFA risk score (Table-3).

Table 2: qSOFA score.

Sr. No.	Parameters	Value n (%)
1.	**Respiratory rate ≥ 22/min** YES (+1) NO	 24 (47%) 27(53%)
2.	**Systolic blood pressure≤ 100mmhg or less** YES (+1) NO	 16(31%) 35(69%)
3.	**Altered mentation (GCS ≤14)** YES (+1) NO	 19(37%) 32(63%)

N is number of patients, GCS- Glasgow coma scale, qSOFA - quick sequential organ failure assessment

Table 3: qSOFA risk score.

Sr. No.	Variables	Value n (%)
1.	No risk	19 (37.25%)
2.	Low risk (1)	13 (25.5%)
3.	High risk (≥2)	19 (37.25%)

N is number of patients, qSOFA- quick sequential organ failure assessment.

The red blood cell count was less than 4 million per cubic millimetre in 23 (45%) patients, white blood cell count less than 4,000 per cubic millimetre in 3 (6%) of patients and more than 11,000per cubic millimetre in 23(45%) of the patients. Platelet count is less than one lakh per cubic millimetre in 23 (45%) patients. Blood haemoglobin less than 10 was seen in 4 (8%) patients and packed cell volume less than 37 in 30(59%) patients(Table-4). Neutrophils were more than 80% in 20(39%) patients; lymphocytes were less than 20 in 33(65%) patients and eosinophils less than 1 in 6 (12%) patients (Table-5).

Table 4: Complete blood count.

Sr. No.	Variables	Value n (%)
1.	RBC (millions/cu.mm) <4.0 4.0-6.1	 23(45%) 28 (55%)
2.	WBC (per cu.mm) <4000 4000-11000 >11000	 3(6%) 25(49%) 23(45%)
3.	PLC (lakhs/cu.mm) 1.5-4 1.0-1.5 <1.0	 32(63%) 6(12%) 13(25%)
4.	Haemoglobin (g/dl) <10 10-12 >12	 4(8%) 22(43%) 25(49%)
5.	PCV (%) <37 37-52	 30(59%) 21(41%)

RBC- Red blood cell, WBC- White blood cell, PLC- Platelet count, cu.mm- cubic millimetre, g/dl – grams per decilitre, PCV- Packed cell volume, n is number of patients.

Table 5: Differential count.

Sr. No.	Differential count	Value n (%)
1.	Neutrophils (%) <40 40-80 >80	 2(4%) 29(57%) 20(39%)
2.	Lymphocytes (%) <20 20-40 >40	 33(65%) 12(23%) 6 (12%)
3.	Eosinophlis (%) <1 1-6 >6	 6(12%) 24(47%) 21(41%)

N is number of patients

The number of patients with high risk qSOFA score who were admitted in ICU for two days and more than four days were 8(15.6%) (Table-6). Similarly, the number of patients with high risk qSOFA score who were on ventilator in ICU was 8(15.6) and with urinary catheter and venous catheter were 4(8%) and 5(10%) respectively (Table-7).

Table-6 – Stay in ICU and qSOFA risk score.

Sr.No	Variables	No risk n (%)	Low risk n (%)	High risk n (%)
1.	2 days	8 (15.6)	7 (14)	8(15.6)
2.	3 days	5(10)	3(6)	4 (8)
3.	>4 days	6(12)	2(4)	8(15.6)

N is number of patients, ICU- Intensive care unit, qSOFA- quick sequential organ failure assessment

Table 7: Device in assistance and qSOFA risk score.

Sr. No.	Variables	No risk n (%)	Low risk n (%)	High risk n (%)
1.	Venous catheter	16 (31)	8(15.6)	5(10)
2.	Urinary catheter	3 (6)	3(6)	4(8)
3.	Ventilator	0	4(8)	8(15.6)

N is number of patients ,qSOFA- quick sequential organ failure assessment

DISCUSSION

Sepsis has to be identified early for effective and complete treatment to minimize complication. The effective way of raising suspicion of sepsis and a slightly better predictor of mortality is qSOFA.[6,8] The third international consensus definitions for sepsis and septic shock (Sepsis -3) reviewed and updated sepsis definition and it is defined as a life threatening organ dysfunction caused by deregulated host response to infection.[8,9] As the new sepsis definition is dependent on organ dysfunction, sepsis -3 designed a new tool, theqSOFA.[8]

The present study helped to analyse the early prediction of septic shock in ICU patients using qSOFA score in a tertiary care hospital. In the present study 62.75% of patients presented with risk of developing septic shock of which 25.49% were of low risk and 37.25% were of high risk (Table-3). A recent study has shown that 63.5% of the 200 septic shock patients presented with a qSOFA score more than or equal to two.[8] In a study conducted by Muhammad A Baig et al the qSOFA score was highest among patients with septic shock and 84.5% of patients with septic shock scored a high risk score and have concluded that qSOFA score is an effective tool to predict hospital mortality in comparison to SOFA score in patients with sepsis and septic shock.[1]

In a study conducted by Muhammad A Baig the area under the receiver operating curve (AUROC) for predicting mortality, showed that, in patients with severe sepsis and septic shock the qSOFA score was higher than sofa score.[1] Matthew M Churpek et al found that less than one in five patients who later will be transferred to ICU, by the time of suspicion of infection would have met equal to or more than two qSOFA criteria and they also illustrated the importance of score recalculation after initiation of therapy.[10] Their study demonstrated that qSOFA has increased specificity for predicting in-hospital mortality and ICU admission.[7,10] Matthew M Churpek et al concluded in his study that general early warning scores are more accurate than qSOFA for predicting adverse outcomes in emergency department and wards.[10]

In the present study, patients admitted in the ICU were assessed for qSOFA score with or without suspected infection.[12] Adam J et al in his study concluded that

qSOFA scores were associated with in-hospital mortality, ICU admission, hospital admission, and length of stay in hospital among patients admitted in emergency department with and without suspected infection.[11] Whenever an invasive device is used there is a risk for infection called as health care associated infection which can lead to sepsis. It is five to ten times higher in patients in ICU. In the present study 8(15.6%) patients on ventilator had high risk score and 5(10%) patients with venous catheter had high risk score.Hamp DB et al in his study has mentioned that, in an ICU set-up majority of health care associated infection are due to invasive devices. The most common device-associated, health care associated infections are central line associated blood stream infections, ventilator associated pneumonia, and catheter associated urinary tract infection.[12]

The presence of hypotension is associated with the early recognition of septic shock, however this criteria is insufficient as the onset of hypotension is preceded by tissue hypo perfusion in most patients. Blood lactate level helps to detect hypoperfusion.[13] There are no single and specific criteria for the identification of septic shock but several parameters have to be evaluated. Laboratory tests help to distinguish septic shock from other conditions and also help to evaluate and monitor organ function. The pro-inflammatory biomarkers are c-reactive protein and procalcitonin and the biomarker of organ dysfunction is lactate.[13]

Early initiation of treatment for septic shock is important to prevent multi-organ dysfunction.[13] Surviving sepsis campaign has advocated early administration of broad spectrum antibiotic and fluid replacement with crystalloids is the basis for the effective treatment of septic shock. Vasopressors should be regarded as second line treatment and oxygen administration is recommended for maintaining airway via mask or endotracheal intubation.[9,13] Vancomycin is the first line antibiotic therapy but when contraindicated daptomycin and linezolid are considered. Antiviral drugs are initiated in viral origin related sepsis and septic shock. Empirically antifungal should be considered in critically ill neutropenic patients.[9]

Currently, electrochemical biosensors are under investigation for early detection of sepsis related biomarkers like procalcitonin, Interleukin-6 and also for rapid pathogen identification in blood samples which have beneficial effect in rapid diagnosis of sepsis for early management.[14,15,16]

Limitations of the present study are that it is a single centred study and hence multi-centred study is needed to validate the results. The study is done for a short period of time and in a small population. It is a prospective study but not a comparative study, should have been compared with other tools for early detection of sepsis and septic shock in ICU patient. This study shows that early detection of septic shock in the ICU patients using a bedside analysis with qSOFA scoring as a tool may help in immediate therapy thereby improving the outcome and reducing mortality.

CONCLUSIONS

Sepsis and septic shock remains a major health problem with worse prognosis. Early detection and early prompt appropriate treatment increases the chance of survival. qSOFA may be used as a tool to raise suspicion of sepsis and septic shock in intensive care unit for life saving management. Further prospective studies are needed for validation of qSOFA and other methodologies for evaluation of sepsis and septic shock.

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