# Study of Clinical Course and Outcome in Patients Admitted with Sepsis using 'SOFA and qSOFA' Scoring Systems at a Tertiary Care Centre

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## Abstract

**Introduction**: Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection. The task force in the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) formulated the SOFA score based on six parameters of respiration, coagulation, liver, central nervous system, kidneys and cardiovascular systems representing the major organs of the body. A new score, the qSOFA score (q for quick) was formulated using respiratory rate, systolic blood pressure and altered sensorium. This score was intended to be used at the bedside and without laboratory investigations. **Aims and Objectives**: To study the clinical course & outcome in patients admitted with sepsis using 'sofa & qsofa' scoring systems at a tertiary care centre. **Materials and Methods**: This is a prospective observational study, done between a periods between August 2017 to December 2019 in patients admitted to the Medical Intensive Care Unit of a tertiary care hospital. The total number of patients studied was 180. The SOFA and qSOFA scores were calculated for each patient on admission and after 72 hours. The comorbidities like diabetes and hypertension were also recorded. The clinical features and outcome was correlated with the SOFA and the qSOFA scores. **Results**: There were 31 deaths (17.22%) out of a total of 180. The highest number of deaths occurred with SOFA scores between 11 to15 which was 16 deaths (51.6%). The highest number of deaths occurred with the qSOFA score 2 which were 24 deaths (77.4). Higher SOFA and qSOFA scores did not always correlate with increased mortality, probably because of other factors like associated comorbidities. **Conclusion**: This study confirmed the usefulness of SOFA and qSOFA scores to predict mortality and for screening of patients with sepsis. Nevertheless, mortality prediction needs assessment of many other factors such as concomitant comorbidities, infecting organism, site of sepsis, etc, along with SOFA and qSOFA scores. Hence, we should assess the SOFA and qSOFA scores of patients in sepsis and with it also assess the role of clinical history and examination and comorbidities along with other factors, for a complete understanding of the patient.

**Keywords:** Sepsis, Sequential Organ Failure Assessment (SOFA), quick Sequential Organ Failure Assessment (qSOFA)

## 1. Introduction

Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection[1].Organ dysfunction is denoted by an increase in the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score of 2 points or more[1]. Previously used scores like the Acute Physiologic and Chronic Health Evaluation (APACHE), Simplified Acute Physiologic Score (SAPS), Mortality Prediction Model (MPM) were cumbersome and tedious. So the need for a new simple objective yet reliable and valid score for sepsis were acutely felt. In view of this, the task force in the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) formulated the SOFA

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score based on six parameters of respiration, coagulation, liver, central nervous system, kidneys and cardiovascular systems representing the major organs of the body[2]. A new score, the qSOFA score (q for quick) was formulated using respiratory rate, systolic blood pressure and altered sensorium. This score was intended to be used at the bedside and without laboratory investigations. Although, this is less robust than SOFA, it is simple and quick.

## 2. Materials and Methods

The study was conducted in a Medical Intensive Care Unit of a tertiary care hospital as a single centre prospective observational study, with the approval of the Institutional Ethics Committee. A total of 180 patients admitted August 2017 to December 2019 was enrolled after proper written and informed consent. Outcomes were discharge, recovery and death. Patients having sepsis

above 18 years of age with non-surgical conditions were accepted for the study. The patients were assessed for their clinical signs and symptoms, physical examination, past history, comorbidities and laboratory investigations were done. The SOFA and qSOFA scores were calculated on admission and after 72 hours. All patients were given standard of care according to his/her underlying disease status and requirements. Data was compiled and analysed by appropriate statistical tests and results were tabulated and inference will be drawn.

## 3. Data Collection Tools

### 3.1 Sequential [Sepsis-Related] Organ Failure Assessment Score[a]

| System | Score | | | | |
|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 |
| **Respiration** | | | | | |
| $PaO_2/FIO_2$, mm Hg (kPa) | ≥400 (53.3) | <400 (53.3) | <300 (40) | <200 (26.7) with respiratory support | <100 (13.3) with respiratory support |
| Coagulation | | | | | |
| Platelets, ×10³/μL | ≥150 | <150 | <100 | <50 | <20 |
| Liver | | | | | |
| Bilirubin, mg/dL (μmol/L) | <1.2 (20) | 1.2–1.9 (20–32) | 2.0–5.9 (33–101) | 6.0–11.9 (102–204) | >12.0 (204) |
| Cardiovascular | MAP ≥70 mm Hg | MAP <70 mm Hg | Dopamine <5 or dobutamine (any dose)[b] | Dopamine 5.1–15 or epinephrine ≤0.1 or norepinephrine ≤0.1[b] | Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[b] |
| Central nervous system | | | | | |
| Glasgow Coma Scale score[c] | 15 | 13–14 | 10–12 | 6–9 | <6 |
| | | | | | |

| Renal | | | | | |
|---|---|---|---|---|---|
| Creatinine, mg/dL (μmol/L) | <1.2 (110) | 1.2–1.9 (110–170) | 2.0–3.4 (171–299) | 3.5–4.9 (300–440) | >5.0 (440) |
| Urine output, mL/d | | | | <500 | <200 |

Abbreviations: FIO$_2$, fraction of inspired oxygen; MAP, mean arterial pressure; PaO$_2$, partial pressure of oxygen.

[a]Adapted from Vincent, et al[2].

[b]Catecholamine doses are given as μg/kg/min for at least 1 hour.

[c]Glasgow Coma Scale scores range from 3–15; higher score indicates better neurological function.

## 3.2 qSOFA (Quick SOFA) Criteria

Respiratory rate ≥22/min
Altered mentation
Systolic blood pressure ≥100 mm Hg
Each criterion has 1 point for positive value

# 4. Results

The results of our study are as shown in Figure 1.

As depicted in Figure 1, the maximum number of patients were in the age group of 41 to 60 years which was 67 (37.2%), followed by >60 years which was 59 (32.8%), followed by 21 to 40 years which was 54 (30%).

According to Figure 2, out of 180 patients with a minimum age of 21 and a maximum age of 75, there were 92 females (51.1%) and males 88 (48.9%).
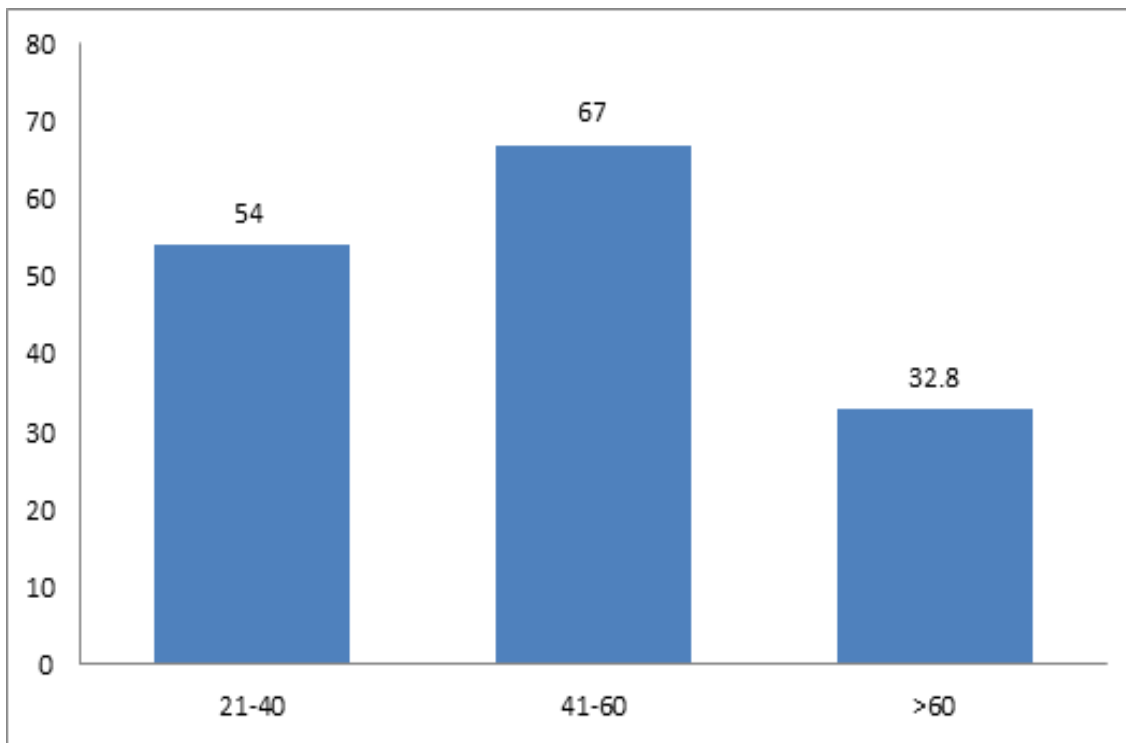


**Figure 1.** Age Distribution.
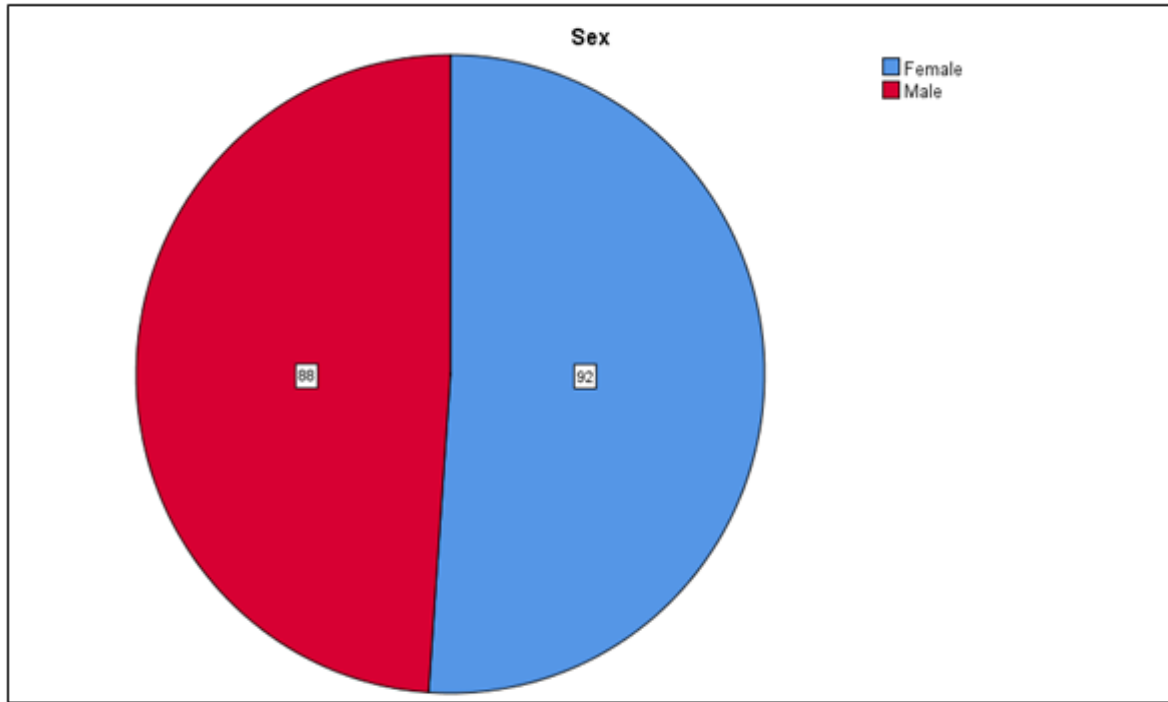
**Figure 2.** Sex Distribution.

**Table 1.** Symptoms

| Symptom | Number | Percent |
|---------|--------|---------|
| Fever | 95 | 52.8% |
| Breathlessness | 82 | 45.6% |
| Abdominal Pain | 78 | 43.3% |
| Altered Sensorium | 78 | 43.3% |

**Table 2.** Association of Comorbidities with mortality

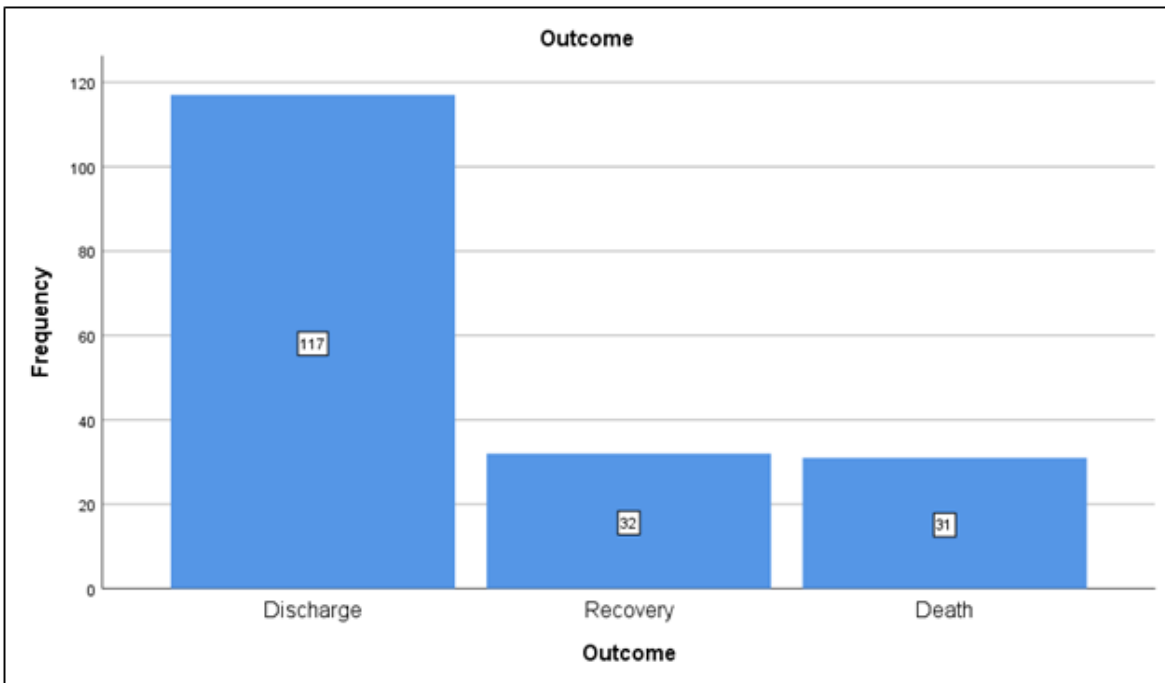| Comorbidity | Number | Percent | Deaths | Death Percent |
|-------------|--------|---------|--------|---------------|
| Hypertension | 91 | 50.6% | 18 | 19.7% |
| Diabetes Mellitus | 148 | 82.2% | 26 | 17.5% |
| Ischemic Heart Disease | 55 | 30.55% | 6 | 10.9% |

**Figure 3.** Outcomes.

As given in Table 1, the most common presentation was of fever 95 (52.8%), followed by breathlessness 82 (45.6%), followed by abdominal pain 78 (43.3%), followed by altered sensorium 78 (43.3%).
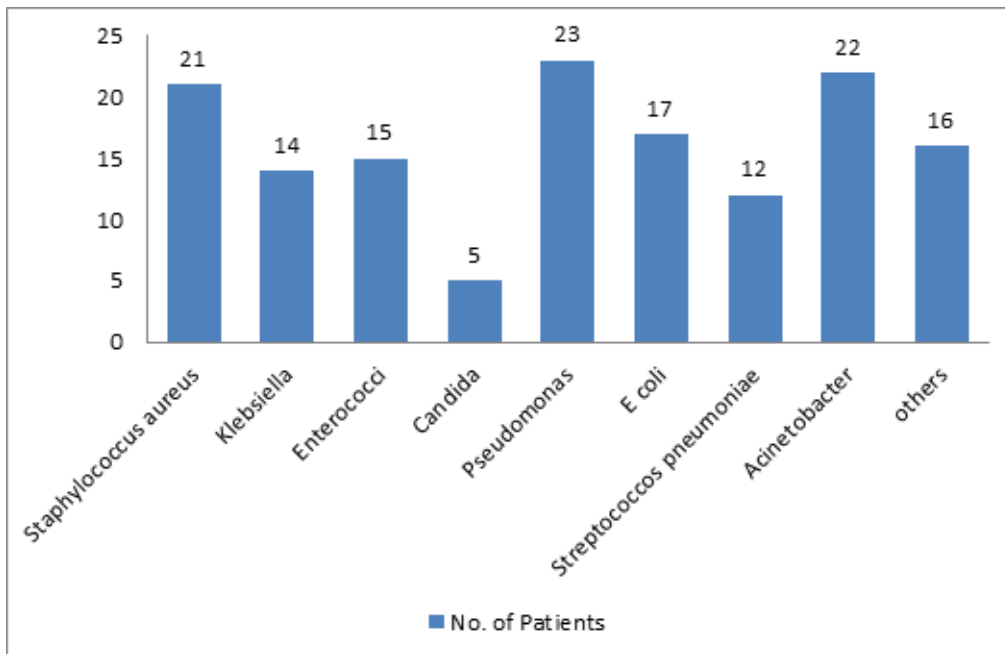


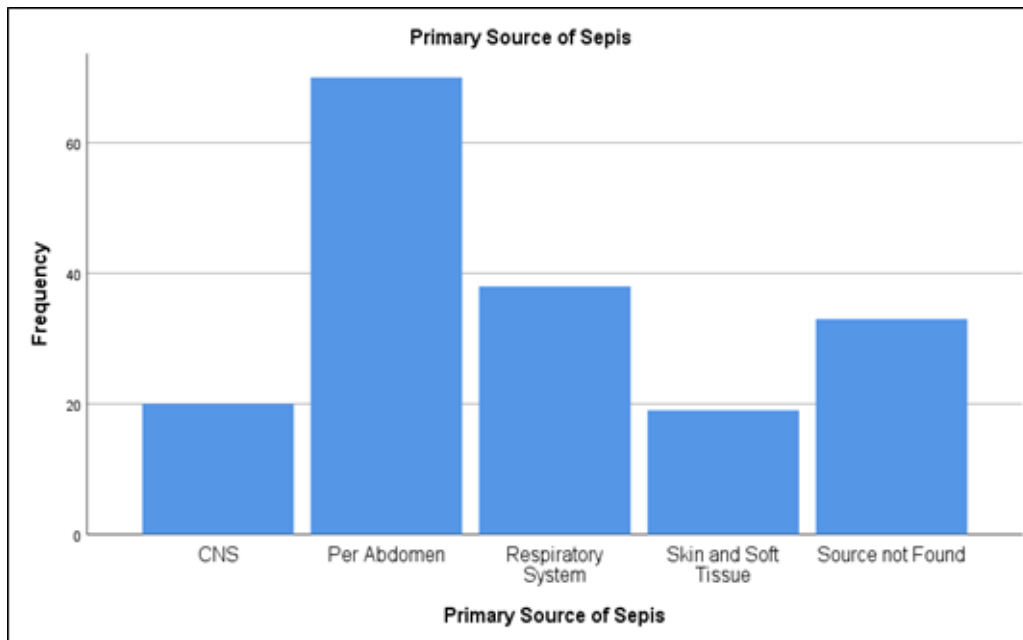**Figure 4.** Organisms recovered on blood culture.

**Figure 5.** Primary source of sepsis.

There were 117 (65%) discharges, 32 (17.8%) recovered patients and 31 (17.2%) deaths (Figure 3).

According to Table 2, hypertension was present in 91 (50.6%), diabetes mellitus was present in 148 (82.2%), and ischemic heart disease in 55 (30.55%). 18 patients with hypertension had death as an outcome. Of the patients with diabetes, 26 patients died. 6 patients with ischemic heart disease died.

In our study, 108 (60%) patients had a leucocyte count >11000/cuml while 18 (10%) patients had peucopenia with leucocyte <4000/cuml.

In our study, Blood cultures of 145 (80.55%) patients turned out to be positive.

The organism recovered on blood culture (Figure 4), was *Staphylococcus aureus* 21 (14.48%), *Klebsiella* 14 (9.65%), *Enterococci* 15 (10.34%), *Candida* 5

**Table 3.** Distribution of SOFA scores

| SOFA Score | Number (On Admission) | Percent (On Admission) | Number (After 72 Hours) | Percent (After 72 Hours) |
|---|---|---|---|---|
| 0-5 | 58 | 32.2 | 81 | 45.0 |
| 6-10 | 40 | 22.2 | 49 | 27.2 |
| 11-15 | 67 | 37.2 | 48 | 26.7 |
| 16-20 | 15 | 8.3 | 2 | 1.1 |
| **Total** | **180** | **100.0** | **180** | **100.0** |

**Table 4.** Distribution of qSOFA scores

| qSOFA | Number (On Admission) | Percent (On Admission) | Number (After 72 Hours) | Percent (After 72 Hours) |
|-------|-----------------------|------------------------|-------------------------|--------------------------|
| 0 | 29 | 16.1 | 48 | 26.7 |
| 1 | 67 | 37.2 | 66 | 36.7 |
| 2 | 71 | 39.4 | 52 | 28.9 |
| 3 | 13 | 7.2 | 14 | 7.8 |
| **Total** | **180** | **100.0** | **180** | **100.0** |

**Table 5.** Association of SOFA score with mortality

| SOFA Score | Deaths Number (Percent) |
|------------|-------------------------|
| 0-5 | 0 (0) |
| 6-10 | 9 (29) |
| 11-15 | 16 (51.6) |
| 16-20 | 6 (19.4) |
| **Total** | **31 (100)** |

**Table 6.** Association of qSOFA score with mortality and Deaths

| qSOFA | Deaths Number (Percent) |
|-------|-------------------------|
| 0 | 0 (0) |
| 1 | 0 (0) |
| 2 | 24 (77.4) |
| 3 | 7 (22.6) |
| **Total** | **31 (100)** |

(3.44%), *Pseudomonas* 23 (15.86%), *E. coli* 17 (11.72%), *Streptococcos pneumonia* 12 (8.27%), *Acinetobacter* 22 (15.17%) and others 16 (11.03%).

The source of sepsis (Figure 5), was deemed to be central nervous system 20 (11.1%), per abdomen 70 (38.9%), respiratory system 38 (21.1%), skin and soft tissue 19 (10.6%) and source not found 33 (18.3%).

As given in Table 3, maximum patients had SOFA scores 11 to 15 on admission which was 67 (37.2%). After

72 hours, maximum patients were in between SOFA scores 0 to 5 which was 81 (45%).

According to Table 4, maximum q SOFA score was 2 on admission which was 71 (39.4%), whereas maximum number of patients had qSOFA score of 1 after 72 hours which was 66 (36.7%).

Of the 31 deaths, 16 (51.6%) had SOFA scores 11 to 15 the highest for any group (Table 5).

For qSOFA, maximum deaths had a score of 2 which was 24 (77.4%) (Table 6).

Thus prediction of mortality needs assessment of many factors such as concomitant comorbidities, infecting organism, site of sepsis, etc., along with SOFA and qSOFA scores.

## 5. Discussion

We evaluated SOFA and qSOFA scores in patients with sepsis admitted in a tertiary care centre. We compared our results with various local and international studies. In the current study it was found that females outnumbered males. However, the results of Garbero, *et al.*[3] depicted male predominance. In our study, the mean age was found to be around 50.08±16.091 years. However, the mean age according to the study of Garbero, *et al.*[3], was 58.78±20.60 years which was more as compared to the current study. Our study has amortality was 17.2%, while Raith, *et al.*[4] reported a mortality of 18.7%. The result of this study compared favorably to the current study. In a study conducted by Finkelsztein, *et al.*[5], blood cultures were positive in 67%. In the current study, 80.55% patients had positive blood cultures. In the current study, hypertension, diabetes and ischemic heart disease were present in 50.6%, 82.2% and 30.55% whereas, in a study by Gupta, *et al.*[6], the corresponding values were 59.52%, 32.14% and 25%. The results of Na, *et al.*[7], showed that, the most common cause of sepsis infection was pneumonia, however, in the current study, it was found that the most common source of sepsis infection was per-abdomen. In our study, the mortality for SOFA scores 0-5, 6-10, 11-15 and 16-20 groups are 0.0%, 29%, 51.6% and 19.4%; while Gupta, *et al.*[3] reported a mortality of 58.9%, 86.4%, 87.5% for SOFA score groups of 0-6, 7-12 and 13-18 respectively. In a study conducted by Raith, *et al.*[4], 54% patients had a qSOFA score of 2 or more, while in our study, 84% had a qSOFA score of 2 or more.

## 6. Conclusion

We studied 180 patients and found that most patients in our study were in the age groups 41-60. Most patients in our study were females (51.1%). The most common presentation was fever. There were 31 deaths in our study. There were 91 patients with hypertension, 148 with diabetes mellitus and 55 with ischemic heart disease. Blood cultures of 80.55% patients turned out to be positive. The most common organism isolated was Pseudomonas. The commonest site of sepsis in our study was per abdomen. Maximum patients had a SOFA score between 11-15 in our study which was 67. Maximum patients had a qSOFA score of 2 in our study which was 71. Most of the deaths occurred in SOFA scores 11-15 (16 deaths). Most deaths occurred with a qSOFA score of 2 (24 deaths). Thus, we should assess the SOFA and qSOFA scores of patients in sepsis and with it also assess the role of clinical history and examination and comorbidities along with other factors like concomitant comorbidities, infecting organism, site of sepsis, etc. for a complete understanding of the patient. These findings have important implications for clinicians at the bedside, hospitals, and countries implementing these scoring systems in practice.

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