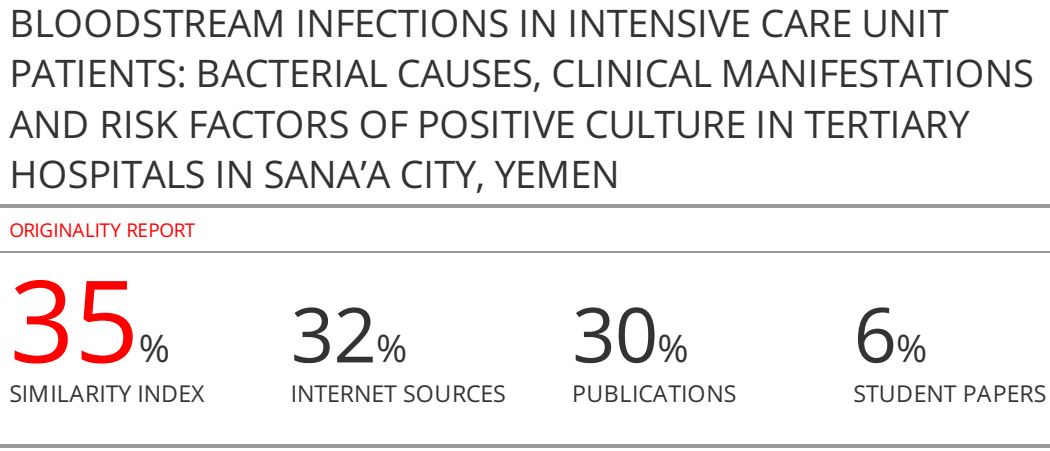
**Original Research Article**

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**BLOODSTREAM INFECTIONS IN INTENSIVE CARE UNIT PATIENTS: BACTERIAL CAUSES, CLINICAL MANIFESTATIONS AND RISK FACTORS OF POSITIVE CULTURE IN TERTIARY HOSPITALS IN SANA’A CITY, YEMEN.**

**ABSTRACT**

**Background and Aims**: Bloodstream infections (BSIs) are among the major infections in critically ill patients. This study was conducted to investigate the clinical manifestationsand septic organisms in the intensive care units of university hospitals inSana'a, Yemen. Also to compare clinical characteristics, mortality and risk factors for positive case versus negative case for bacterial growth among sepsis patients.

**Subjects and methods**: From January 1 to April 30, 2022, a cross-sectional study was undertaken on sepsis patients hospitalized inintensive care units at four hospitals in Sana'a, Yemen. A well-structured questionnaire was used to collect specific medical data for each subject. Patients suspected of having sepsis underwent tests such as blood culture, complete blood count, and C-reactive protein. Gram staining was used to identify organisms, and the VITEK II Bacterial Bioprinting System was used to study them. This study included 145 Intensive Care Unit (ICU) patients who displayed one or more indications of sepsis.

**Results:** Of the 145 ICU patients with suspected sepsis, 87 (60%) had culture-confirmed sepsis. The bulk of the identified bacteria (57.5%) were Gram-negative. In the ICU, the most prevalent sepsis agents are *E. coli* (23%), *Klebsiella*species (12.6%), and Burkholderiacepacia (7%). The most common Gram-positive pathogens are *Staphylococcus epidermidis* (27.6%) and *S. aureus* (10.3%). Significant positive culture outcomes were found with rapid onset of sepsis (*OR* = 3.3, *p* = 0.002), decreased urination (*OR* = 2.2, *p* = 0.02), older patients (*OR* = 4, *p* = 0.001), and death (*OR* = 7.8). The commonest symptoms among the cases were fever (66.9%),increased heart rate (67.6%), confusion (62.8%), and respiratory distress (52.4%); the mortality rate was 29%.

**Conclusion**:Gram-negative bacteria were the most common cause of sepsis, and substantial positive culture results were associated with early onset, decreased urination, older patients, and death. Sepsis's incidence, mortality, and morbidity rates in Yemen are likely underestimated because it is infrequently reported as a primary diagnosis (typically as a consequence of cancer or another illness). More research into the frequency and risk factors of sepsis in ICUs is recommended.

**Keywords**: Bacteria, Blood culture, Bloodstream infections (BSIs), Gram-negative, Gram positive, ICUs,Sepsis

**INTRODUCTION**

Bloodstream infections (BSIs) are among the most common acquired illnesses in Intensive Care Unit(ICU) patients. BSIs might be the result of bacterial bloodstream diffusion from a localized illness (secondary BSI) or the only recognized infectious process (primary BSI)1.In an international assessment evaluating the prevalence and consequences of infections in intensive care units, BSIs were found in 15% of infected patients and were the third most commonly seen illness 1. In view of the developing health-care-system organization, the traditional classification of BSIs as community-acquired or hospital-acquired is being revisited. A growing proportion of patients with advanced age and many co-morbidities are treated as outpatients, since health care services are shifting from hospitals to the community via various out-of-hospital institutions 2,3.The severity of the disease, the disruption of anatomical barriers (i.e., use of invasive equipment and surgery), and a compromised immune response are just a few of the risk factors for developing BSI in patients in critical care units 4. Additional risk factors for catheter-related BSIs in patients with central venous catheters (CVC) include insufficient sterile method adoption, operator inexperience, insertion site colonization, contamination of the catheter hub, and duration of catheter installation 5-7.Risk factors for BSIs brought on by resistant bacteria have been identified in a number of observational studies8. The risk of BSI brought on by resistant microbes is generally enhanced by prior antibiotic exposure, hospitalization, stays in nursing homes and long-term care institutions, and other risk factors for healthcare-associated BSI9,10.Additionally, being extremely young or old, having a weaker immune system as a result of diseases like cancer or diabetes, serious trauma, and burns are risk factors for ICU sepses11-14. Numerous species, including bacteria, viruses, and fungi, can result in sepsis11. The lungs, brain, urinary tract, skin, and abdominal organs are typical sites for the main infection12. A recently published multinational observational research13 of 1,156 ICU patients worldwide revealed data on hospital-acquired BSIs. Gram-positive microbes made up 33.4% of all BSI-causing pathogens, whereas Gram-negative ones made up 56.8%. Although sepsis guidelines advise getting blood cultures before beginning antibiotic treatment, infection in the blood is not necessary for the diagnosis. Finding the potential site of the infection can be aided by medical imaging. Anaphylaxis, adrenal insufficiency, low blood volume, heart failure, and pulmonary embolism are further potential explanations of comparable signs and symptoms12.

This study was conducted to investigate the clinical manifestations, and septic organisms in intensive care units of university hospitals, Sana'a, Yemen. Also to compare clinical characteristics, mortality, and risk factors for positive cases versus negative cases for bacterial growth among sepsis patients.

**SUBJECTS AND METHODS**

**Study design and subjects:** In this cross-sectional study, ICU patients admitted to ICUs at Al Kuwait, Al Gumhory, Al Sabeen, and ALThawra hospitals in Sana'a city between initial admission and first January 1 through April 30 in 2022. During the study period, patients who had suspected sepsis and were admitted for at least 72 hours were included.

**Diagnosis of sepsis:** According to international criteria, sepsis was suspected based on the presence of clinical indications or risk factors and was confirmed as sepsis if a blood culture was positive 15.

**Questionnaire:** Face-to-face interviews with the patients' family were used to gather vital and socio-demographic information using a standard questionnaire. Clinicians used standardized instruments to capture the clinical characteristics of individuals with sepsis. All patients' guardians provided written consent after being informed of the study's objectives.

**Ethic approval:** The Research and Ethics Committee of the Faculty of Medicine and Health Sciences at Sana'a University, Sana'a, Yemen, approved all the methods used in this study (Approval No. UGR/SU-223).

**Laboratory investigations:**

Standard microbiological procedures were followed when conducting laboratory examinations 16. Trained nurses took blood samples under aseptic conditionsthat were used for laboratory tests on complete blood counts, C-reactive proteins, and blood cultures. Blood was inoculated into a BacT/Alert PF plus culture bottle (BIOMERIEUX, France, LOT 4053532) with at least 1 ml (usually 5 ml in adult patients) and allowed to incubate until the BacT/Alert instrument (BACTEC 9050, Becton Dickinson) flagedit as positive or negative for culture.All positive samples were sub-cultured on blood agar, MacConkey agar, and choclate agar, and they were all incubated at 37 °C for 24-48 hours. To distinguish between gram-positive and gram-negative bacteria, gram-staining was used. To suspend the bacterium in 3.0 ml of sterile saline in a test tube, enough pure culture colonies were employed. According to the instructions in the product information manuals (BIOMERIEUX), pure bacterial suspension was added to the bacterial specific identification and sensitivity testing kit device and analyzed by the VITEK II system for bacterial bio-typing and antibiotic susceptibility (results of patterns will be published in a separate article). Gram-negative bacteria were identified using a VITEK ® GN ID identification card (lot 2410933203), while gram-positive bacteria were identified using a VITEK ® GP ID identification card (lot 2420938203). All treatments were carried out for standard therapeutic and diagnostic purposes.

**Statistical analysis:**Data were analyzed using EPI-Info version 6.0 (CDC, USA). Categorical variables were shown in frequencies. Associations between independent and dependent variables were tested using Pearson's chi-square with the odds ratio (OR) and 95% confidence interval (CI) reported. Fisher's exact test was used where appropriate. A p value < 0.05 was considered significant.

**RESULTS**

The study is set out in 3 tables, and Table 1 shows the gender and ages of the sepsis patientswho were tested for bacterial septicemia. Male patients were 59.3% and female patients 40.7%, and 38.8% were children under 15 years of age, with a mean ± SD of total age equal to 34.3 ± 28.5 years, and ages ranged from 1 month to 90 years (Table 1). Of the 145 ICU patients with suspected sepsis, 87 (60%) had culture-confirmed sepsis. The bulk of the identified bacteria (57.5%) were Gram-negative. In the ICU, the most prevalent sepsis agents are *E. coli* (23%), *Klebsiella* species (12.6%), and *Burkholderiacepacia* (7%). The most common Gram-positive pathogens are *Staphylococcus epidermidis* (27.6%) and *S. aureus* (10.3%) (Table 2). Significant positive culture outcomes were found with rapid onset of sepsis (*OR* = 3.3, *p* = 0.002), decreased urination (*OR* = 2.2, *p* = 0.02), older patients (*OR* = 4, *p* = 0.001), and death (*OR* = 7.8). The commonest symptoms among the cases were fever (66.9%), increased heart rate (67.6%), confusion (62.8%), and respiratory distress (52.4%); the mortality rate was 29% (Table 3).

**DISCUSSION**

Sixty percent of ~~our~~ patient sample had sepsis with a culture that was positive, which is comparable to the 40–70% range reported in the majority of other investigations 17–21. Additionally, the scope of ~~our~~ investigation is greater than that of Sigakis*et al*.'s 22 study, where only 11% of samples were positive for cultures. This may be due to Sigakis*et al*.'s study22 involving patients from all hospital units rather than only the ICU, as was the case in our analysis.Additionally, earlier studies used culture results from samples taken before presentations or prospectively over the course of more than 24 hours, and results may be influenced by infection from an earlier or later hospital stay. A feature of our study that helps to better isolate the impact of a sepsis episode is the restriction of cultures to samples collected during the first 24 hours afterfulfilling sepsis criteria.

When compared to the findings for neonatal sepsis, our study's culture-confirmed sepsis rate was high (60%). Studies from underdeveloped nations found varying percentages of culture-confirmed neonatal sepsis, including 62.8% in Pakistan 23, 57% in Yemen24, 45.9% in Egypt 25, 44.7% in Ethiopia26, 24% in Tanzania27, and 12.6% in Nepal28. The proportion of newborn with sepsis varies between nations for a number of reasons, including sample size and the various methods employed.

A recent international observational research that included 1,156 ICU patients worldwide provided data on hospital-acquired BSIs 13. In the current investigation, 34.5% of the total number of BSI-causing bacteria were Gram-negative and 28.3% were Gram-positive. In the current study, 24 (16.6%) of all septicemia-related ICU patients had Coagulase-negative *staphylococci* (CoNS) (Table 2). In newborns, coagulase-negative staphylococci (CoNS) are the most frequent bacteria responsible for late-onset sepsis. They frequently exhibit multiple forms of antibiotic resistance, and their capacity to produce biofilm is thought to be the primary factor determining their pathogenicity. A lower host inflammatory response was linked to CoNS sepsis with biofilm-forming strains, which may have limited the immune system's ability to fight the infection 29.

*S. aureus* was implicated in septicemia in the present investigation in 9 (6.2%) of all septicemia ICU patients (Table 2). *S. aureus* is a Gram-positive, facultative anaerobic pathogen that can be acquired in both hospitals and the community. It is a component of the skin's microbiota and is typically isolated from moist regions like the axillae and anterior nares30. Many *S. aureus* strains, which were once opportunistic, are now aggressively pathogenic and responsible for a wide spectrum of disorders, from skin and wound infections to serious conditions like BSIs and soft-tissue and bone infections30,31.*Streptococcus pneumoniae* was implicated in 5 (3.4%) of the total septicemia patients in the ICU in the current investigation (Table 2). *Streptococcus pneumoniae* can enter the bloodstream through a number of different routes, including lymphatic vessels, endothelium and epithelial cell injury, and direct invasion of endothelial cells. All three mechanisms most likely help infected patients' bloodstream invasion 15. Twenty (13.8%) of the total number of septicemia ICU patients in the current study had E. coli septicemia (Table 2). Most frequently commensal, *E. coli* are Gram-negative, facultative anaerobes that can produce potentially lethal toxins, including *enterohemorrhagicverotoxins*, such *E. coli O157:H7*, which can lead to hemolytic uremic syndrome and renal failure32.In the current study, 11 (7.6%) of all the ICU patients with septicemia were caused by *Klebsiella pneumoniae* (Table 2). Despite being a rare sepsis-causing bacteria, Klebsiella pneumoniae is widely known for its severe consequences and high mortality. Due to a probable immune system decline, *K. pneumoniae-*caused bacteremia is more common and has a worse prognosis in patients with underlying illnesses. Therefore, it is crucial to control underlying illnesses to reduce the death rate from sepsis caused by *K. pneumoniae*33.

*Burkholderiacepacia* was the etiology of septicemia in our investigation in 6 (4.1%) of all septicemia ICU patients (Table 2). *B. cepacia* (Bcc) is an aerobic, catalase-producing, Gram-negative bacillus that is normally of moderate virulence and is not thought to be a normal component of the human flora. It can have a serious impact on children who are immunocompromised, such as those who have cancer, congenital heart disease, or a history of prematurity. In children with cystic fibrosis (CF) and chronic granulomatous disease (CGD), significant bacteremia is seen in some cases. Immunocompetent people are rarely impacted, however nosocomial infections have been reported as a result of tainted drugs, fluids, antiseptics, and medical supplies. Examples include ultrasound gel, contaminated sodium chloride, pure water, and 5% dextrose. The methods of transmission are nebulization, flushing orogastric tubes, and humidifying oxygen delivery equipment 34.In the current study, *Haemophilusinfluenzae*caused septicemia in 5 (3.4%) of the total septicemia ICU patients (Table 2). Hi has a multitude of virulence factors thatprovide resistance against complement and cause infections including bacteremia, meningitis, epiglottitis, and septic arthritis. The infection is common in patients with neoplasm, asplenia, alcohol use disorder, human immunodeficiency virus infection, chronic pulmonary disease, long-term steroid use, or an underlying viral lung infection35.Two(1.4%) of the total number of ICU patients with septicemia were affected by *Enterobacter*(Table 2). *Enterobacter*is a genus of Gram-negative, facultatively anaerobic, opportunistic infections that express a wide range of ESBLs and carbapenemases, including KPC, OXA, and MBLs36. This pathogen also has endotoxins 36.In the current study, *Acinetobacterbaumannii* was discriminated forsepticemia in 4 (2.8%) of the total septicemia ICU patients (Table 2). The most common resistant *Acinetobacter*species is *A. baumannii*, a Gram-negative, facultative anaerobic, oppor­tunistic pathogen. It has a thick cell wall that enables it to resist dry conditions, high temperature, and pH and nutrient changes, surviving for up to 5 months on inanimate objects37. *A. baumannii*is naturally resistant to many antibioticsdue to both poor membrane penetration and active efflux pumps. Over-expression of the AdeABC and AbeM efflux pumps causes broad resistance to cephalosporins, fluoroquinolones, aminoglycoside, and tigecycline, and also provides resistance to ammonia-based disinfectants38. Furthermore, *A. bauman­nii*isolates produce an exo-polysaccharide, leading to biofilm formation, and express a powerful, epithelial cell-targeting cytotoxin that facilitates colonization39.

*Pseudomonas aeruginosa*was discriminated forsepticemia in 3 (2.1%) of the total septicemia ICU patients (Table 2). *P. aeruginosa* is a facultative anaerobic, Gram-negative, rod-shaped, opportunistic bacteria surviving in microaerobic states, for instance, the thick mucus of lungs of cystic fibrosis patients. The ubiquity and survival capacity of antimicrobial solutions of acetate-buffered benzalkonium chloride in extreme environments are major determinants of outbreaks of nosocomial infections. Its outer-membrane porins make it impermeable and resistant to many antibiotics40,41.*Chryseobacteriumindologenes* was discriminated forsepticemia in 1 (0.7%) of the total septicemia ICU patients (Table 2).C. indologenes is anon-glucose-fermenting, oxidase-positive, Gram-negative bacillus thatis found in the environment. Human infections usually occur in hospitalized patients, especially those who have received broad-spectrum antibiotics, and are often device associated or occur in patients who have had medical procedures or who have underlying medical conditions42.

In the current study, patients in ICUs have different risk factors for BSI devel­opment, the most common risk factors were diabetic miletus (35.9%), younger age (33.8%), old age (33.1%), and kidney disorders (31.7%), followed by major trauma (26.9%), asthma (18.6%)and burns (15.9%). However less frequently with myeloma, cancer, autoimmune disorder, immunocomparamized and chronic obstructive pulmonary disease(Table 3). These results are similar to thosereported by the CDC for risk factors of contracting septicemiaamong ICUs patients43. In another study conducted byTimsitand Laupland4; found that patients in ICUs have different risk factors for BSI devel­opment, including greater severity of illness, disruption of anatomical barriers (i.e, use of invasive devices orsurgery), and impaired immunological response4. Also, several studies reported that patients with a central vein catheter (CVC) have additional risk factors for catheter-related BSIs (inadequate adoption of a sterile technique, inexperience of the operator, site of insertion, colonization of the insertion site, contamination of the catheter hub, and duration of catheter placement)5-7.

When comparing a positive culture with a negative culture, considering clinical features, there was a high rate of positive culture with rapid onset of sepsis symptoms (77.6%) with an associated *odds ratio* of 3.3, *confidence interval* = 1.5–7.2,*p* = 0.002, while there was no significant association with other clinical manifestations (Table 3). This may reflect a higher bacterial load leading to a rapid onset of septicemia symptoms.While there was a high rate of positive cultures with decreased urination (68.3%), there was no association between positive blood cultures and other clinical manifestations such as high or low blood pressures, increased heart rate, or increased breathing rate (*OR* = 2.2, *CI*=1.1-4.3, *p* =0.02;Table 3). With regard to septicemia risk factors, there was a high proportion of positive cultures in older patients (64.6%), with an associated *OR* of 4, *CI*=1.1-9.9, and *p* =0.001 (Table 3).

Approximately40% of our patients with clinically diagnosedsepticemia had a negative culture.The negative culture could also be a result of sampling error or testing error (false-negative), but this is rare22. Negative culture results may also reflect issues unique to the microorganism, such as viral or fungal origin, a non-infectious source of symptoms, or genetic differences. Studies have shown that only about 1% of environmental bacteria are currently culturable44,45;only half of the bacterial species inhabiting the human mouth have been characterized, and the colonic flora is suspected to be mostly unidentified22. Infection by any of these non-culturable organisms would result in culture negative sepsis. Similar to other studies, as prior antibiotic use was associated with culture negative sepsis, antibiotics may have sterilized the cultures46,47. This suggests that pre-sepsis antibiotics may either sterilize the cultures or select for a non-culturable infection. Another possibility is toxemia ofvery low-grade or intermittent bacteremia. Further study is needed to determine why most septic patients have negative cultures and how best to treat them. Despite these reasons for negative cultures, obtaining cultures isimportant as, when positive, the sensitivities will affect the class of antibiotic and treatment duration.Considering the prognosis, there was a high rate of positive culture with death (88.1%) with an*OR* equal to 7.8, *CI* = 2.8–21.5, *p*< 0.001 (Table 3). Our findings on the difference in case-by-case mortality for all sepsis patients differ from several other studies in which there is a similar mortality rate in both diagnostic groups (positive culture vs. negative culture). On the other hand, Sigakis*et al.* found a higher mortality rate in culture-negative patients22

**LIMITATIONS OF THE STUDY**

**CONCLUSIONS**

BSIs are among the leading causes of infections in ICU patients. Gram-negative bacteria were the most common cause of sepsis, and substantial positive culture results were associated with early onset, decreased urination, older patients, and death. Sepsis's incidence, mortality, and morbidity rates in Yemen are likely underestimated because it is infrequently reported as a primary diagnosis (typically as a consequence of cancer or another illness). More research into the frequency and risk factors of sepsis in ICUs is recommended.Clinicians should be aware of the risk factors for BSI for global management of critically ill patients, from monitoring measures to source control and appropriate antibiotic therapy. The epidemiology of severe sepsis in developing countries may differ significantly from developed countries, warranting greater interest in future studies in developing countries to understand this problem.

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**CONFLICT OF INTEREST**

No conflict of interest is associated with this work.

**AUTHOR CONTRIBUTIONS**

First author Eshtiaq A. Al-Yousafi did the fieldwork for this study as part of a Ph.D in the Department of Medical Microbiology. Additional authors assisted with data analysis, drafting and reviewing the manuscript, and giving final clearance to the study.

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Table 1: Sex and ages of sepsis patients, tested for bacterial sepcitemia (n=145)

|  |  |
| --- | --- |
| **Characteristics** | **N (%)** |
| **Gender** | |
| Male | 86 (59.3) |
| Female | 59 (40.7) |
| **Age groups in Years** | |
| <15 | 49 (33.8) |
| 15 -24 | 8 (5.5) |
| 25 -34 | 15 (10.3) |
| 35-44 | 14 (9.7) |
| 45 -54 | 11 (7.6) |
| ≥55 | 48 (33.1) |
| **Total** | **145 (100)** |
| **Mean** | **34.3 years** |
| **SD** | **28.5 years** |
| **Mode** | **0.01 years** |
| **Median** | **35 years** |
| **Min –Max** | **0.01-90 years** |
| **SD err** | **2.36** |
| **T test** | **14.5** |
| **P** | **< 0.000** |

**SD= Standard Division??????**

##### Table 2: Frequency and percentage of isolated bacterial species from sepsis cases (145 ICU sepsis patients)

|  |  |  |
| --- | --- | --- |
| **Micro-organisms** | **N (%)** | **% positive culture** |
| **Gram positive Bacteria** | 41 (28.3) | 47.1 |
| Coagulase negative *Staphylococcus* | 24 (16.6) | 27.6 |
| *Staphylococcus aureus* | 9 (6.2) | 10.3 |
| *Streptococcus pneumoniae* | 5 (3.4) | 5.7 |
| Enterococci species | 2 (1.4) | 2.3 |
| *Streptococcus pyogens* | 1 (0.7) | 1.1 |
| **Gram negative bacteria** | 50 (34.5) | 57.5 |
| *E. coli* | 20 (13.8) | 23 |
| *Klebsiella species* | 11 (7.6) | 12.6 |
| *Burkholderiacepacia* | 6 (4.1) | 7 |
| *Haemophilusinfluenzae* | 5 (3.4) | 5.7 |
| *Acinetobacterbaumannii* | 4 (2.8) | 4.6 |
| *Pseudomonas aeruginosa* | 3 (2.1) | 3.4 |
| *Chryseobacteriumindologenes* | 1 (0.7) | 1.1 |
| ***Candida albicans*** | **3 (2.1)** | **3.4** |
| ***Plasmodium falciparum*** | **1 (0.7)** | **1.1** |
| **Negative blood culture** | 58 (40) | 66.7 |
| **Mixed bacterial (2 different isolates)** | 7 (4.8) | 8 |
| **Total positive culture** | **87 (60)** | **100** |

Table 3: Associated clinical manifestations of sepsis patients and associated disorders, with positive culture for bacteria among sepsis ICUs patients in Sana’a tertiary hospials.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **clinical manifestations** | **Total**  **N=145** | **\*Postive culture**  **N=87** | ***OR*** | **95% *CI*** | ***X2*** | ***p*** |
|  | **N (%)** | **N (%)** |
| **Onset** | |  |  |  |  |  |
| Rapid (less than 3 hours) | 49 (33.8) | 38(77.6) | 3.3 | 1.5-7.2 | 9.4 | 0.002 |
| Prolonged (several days) | 96 (66.2) | 49 (51.04) | 0.3 | 0.013-0.3 | 9.4 | 0.002 |
| Fever | 97 (66.9) | 61 (62.9) | 1.4 | 0.7-2.9 | 1.01 | 0.31 |
| Low body temperature | 25(17.2) | 11(44) | 0.4 | 0.1-1.06 | 3.2 | 0.07 |
| Chills | 32 (22.1) | 23 (71.9) |  |  |  |  |
| Faint | 20 (13.8) | 14(70) | 0.5 | 0.22-1.1 | 2.8 | 0.09 |
| Skin rash | 14 (9.7) | 8 (57.1) | 0.87 | 0.28-2.6 | 0.05 | 0.81 |
| **Blood pressure** | |  |  |  |  |  |
| Increased heart rate | 98 (67.6) | 57 (58.2) | 0.78 | 0.38-1.6 | 0.42 | 0.5 |
| Normal blood pressure | 97 (66.9) | 44 (45.4) | 0.09 | 0.03-0.26 | 26 | <0.001 |
| High blood pressure | 19 (13.1) | 12 (63.2) | 1.2 | 0.4-3.2 | 0.09 | 0.7 |
| Low blood pressure | 29 (20) | 13 (44.8) | 0.46 | 0.2-1.05 | 3.3 | 0.06 |
| Increased breathing rate | 76 (52.4) | 48 (63.2) | 1.3 | 0.7-2.5 | 0.66 | 0.41 |
| Decreased urination | 82 (56.6) | 56 (68.3) | 2.2 | 1.1-4.3 | 5.4 | 0.02 |
| Absent or almost no urine output | 39 (26.9) | 21 (53.8) | 0.7 | 0.3-1.4 | 0.81 | 0.35 |
| Sharp pain | 59 (40.7) | 29 (49.2) | 0.46 | 0.2-0.9 | 4.8 | 0.02 |
| Confusion | 91 (62.8) | 53(58.2) | 0.8 | 0.41-1.6 | 0.31 | 0.57 |
| Odema | 46 (31.7) | 22 (47.8) | 0.47 | 0.23-0.97 | 4.1 | 0.04 |
| **Risk factors** |  |  |  |  |  |  |
| Younger Age | 49 (33.8) | 29(59.2) | 0.9 | 0.47-1.9 | 0.02 | 0.88 |
| Old age | 48 (33.1) | 31(64.6) | 4.0 | 1.1-9.9 | 9.9 | 0.001 |
| Major trauma | 39 (26.9) | 18(46.2) | 0.4 | 0.2-0.92 | 4.3 | 0.03 |
| Asthma | 27 (18.6) | 12 (44.4) | 0.4 | 0.19-1.6 | 3.3 | 0.06 |
| Chronic obstructive pulmonary disease | 9 ( 6.2) | 7 (77.8) | 2.4 | 0.49-12.2 | 1.2 | 0.26 |
| Myeloma | 3 (2.1) | 1(33.3) | 0.32 | 0.28-3.6 | 0.97 | 0.34 |
| Burns | 23 (15.9) | 15 (65.2) | 1.3 | 0.51-3.3 | 0.31 | 0.57 |
| Diabetic Miletus | 52 (35.9) | 28 (53.8) | 0.44 | 0.2-0.8 | 5.5 | 0.01 |
| Cancer | 3 (2.1) | 1 (33.3) | 0.2 | 0.02-2.1 | 2.1 | 0.14 |
| Kidney disorders | 46 (31.7) | 25 (54.3) | 0.81 | 0.4-1.7 | 0.2 | 10.6 |
| Immuno-comparamized | 7 (4.8) | 4 (57.1) | 0.88 | 0.19-4.1 | 0.02 | 0.87 |
| Autoimmune disorder | 5 (3.4) | 4 (80) | 2.7 | 0.2-25 | 0.86 | 0.36 |
| **Prognosis** | |  |  |  |  |  |
| Cure | 103 (71) | 50 (48.5) | 0.1 | 0.04-0.3 | 19 | <0.001 |
| Death | 42 (29) | 37 (88.1) | 7.8 | 2.8-21.5 | 19 | <0.001 |

\*Culture-confirmed sepsis, N, number of suspected sepsis; n, number of culture-confirmed septic cases; OR, odds ratio; CI, confidence interval, X2, chi square,