Analysis of the Severity of Septic Shock at the Renaissance University Hospital in N'Djamena (Chad)

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Abstract

Introduction: Septic shock is a severe state of shock frequently encountered in intensive care, associated with high mortality. It is defined as sepsis with persistent hypotension despite adequate vascular filling, associated with the presence of abnormalities in tissue perfusion. The aim was to analyse the severity of septic shock in intensive care.

Patients and methods: This was a cross-sectional with prospective data collection, descriptive and analytical study conducted over a period of 26 months (from April 2022 to May 2024) on patients hospitalized in the Intensive Care Unit of Renaissance University Hospital Centre in N'Djamena. All patients hospitalized in intensive care for septic shock whose severity had been assessed by the SOFA score were included. The variables studied were sociodemographic, clinical, paraclinical, therapeutic and evolutionary. Chi-square was used as a comparison test. The odds ratio and its confidence interval were at 95%. Ethical and administrative considerations were respected.

Results: Of 675 hospitalized patients, 125 were included in the study, representing a hospital prevalence of 18.5%. The median age was 56, with a sex ratio of 2.5. The 60-69 age group accounted for 25.6% (n = 32). Patients from urban areas accounted for 65.6% (n = 82). Hypertension, diabetes and human immunodeficiency virus infection were found in 45.9% (n = 40), 40.2% (n = 35) and 20.6% (n = 18) respectively. Clinically, 107 patients (85.6%) had a Glasgow score ≤8 and 98 patients (78.4%) had a mean arterial pressure < 65 mm Hg. A SOFA score of between 10 and 12 was found in 41.6% (n = 52). Bacteriological tests isolated Pseudomonas aeruginosa in 30.7% (n = 12). In terms of treatment, all patients had received noradrenaline and the probabilistic antibiotic was metronidazole in 68.8% (n = 86). The duration of treatment was ≤48 hours in 59.2% (n = 74). Mortality was 100%.

Conclusion: Septic shock remains 100% fatal in the study. Adapted management measures are needed to reduce this tragedy.

Abbreviation: SOFA: Sepsis-related Organ Failure Assessment

Keywords: Septic shock; Resuscitation; SOFA; Chad

Introduction

Septic shock is a severe state of shock frequently encountered in intensive care, associated with a high mortality rate [1]. Its prognosis depends on the speed and quality of the initial treatment. It is an acute circulatory failure of infectious origin defined by persistent hypotension despite adequate vascular filling, associated with the presence of abnormalities in tissue perfusion [2]. Septic shock is a form of organ failure secondary to infection, which can lead to death [3]. Sepsis and septic shock are major public health issues, with around 31.5 million cases of sepsis and 5.4 million deaths each year worldwide, according to World Health Organisation (WHO) figures published in 2020 [4-6]. Diagnostic criteria for sepsis have evolved over the years, with the development of the Sepsis-related Organ Failure Assessment (SOFA) score and its simplified version, the Quick SOFA (qSOFA) [7]. The latter is used to predict mortality in patients with sepsis in intensive care [8]. Recent studies have shown that sepsis mortality rates vary around the world, ranging from 19.4% in Oceania to 47.2% in Africa [9]. To date, few studies have reported data on septic shock in sub-Saharan Africa. This is why we initiated this study, the aim of which was to conduct an analytical study of the severity of septic shock in the intensive care unit of the Renaissance University Hospital Centre in N'Djamena, based on the SOFA and qSOFA scores.

Patients and Method

This was a cross-sectional with prospective data collection, single-centre, descriptive and analytical case-control study. Cases were patients admitted to the medical intensive care unit for management of septic shock defined according to the SOFA score; controls were patients hospitalized in the medical Intensive Care Unit during the same period for another pathology). The study took place over a period of 26 months (from April 2022 to May 2024) in the Intensive Care Unit of the Renaissance University Hospital Centre in N'Djamena, a level 3 hospital with a hospital capacity of 240 beds. All patients hospitalized for septic shock, aged at least 18 years, with verbal consent and/or legal guardians were included in the study. Septic shock was defined by the presence of clinical (persistent hypotension and/or hypothermia or hyperthermia) and/or laboratory (elevated procalcitonin and/or hyperleukocytosis/neutropenia and/or elevated C-reactive protein) abnormalities. Patients who had experienced hypovolaemic, cardiogenic or anaphylactic shock were not included in the study. The SOFA score was used to assess the degree of organ dysfunction. It takes into account 6 parameters, namely respiratory, haematological, hepatic, cardiac, central nervous system and renal function. It ranges from 0 to 12. In the absence of any pre-existing acute or chronic organ dysfunction, the SOFA score is 0. In septic shock, the SOFA score is greater than or equal to 8. The variables were sociodemographic (age, sex, origin), clinical (history/trauma, mean arterial pressure, Glasgow score, SOFA score), paraclinical (blood culture, urine cytobacteriological examination, skin sample, chest X-ray), therapeutic (antibiotics, noradrenaline, prevention of thromboembolic disease), evolutionary and prognostic (duration of treatment, mortality). The variables were collected on a pre-established form, processed using World and Excel 2016, and then analysed using SPSS V.25 software. The statistical test used to compare the variables was the chi-square with the risk of error set at 5%, the Odds ratio and the linear regression method.

Results

Among 675 hospital admissions during the study period, 125 patients were included, representing a hospital prevalence of 18.5%. The median age was 56 years [±17] with a sex ratio of 2.5 (90 men). The 60-69 age group was present in 25.6% (n = 32). There were 82 patients (65.6%) from urban areas. Comorbidities were represented respectively by arterial hypertension 45.9% (n = 40), diabetes 40.2% (n = 35) and human immunodeficiency virus infection 20.6% (n = 18). All diabetic patients had duration of evolution of more than 10 years. They presented renal complications (72%), cardiac (42%) and ophthalmological (17%).

Concerning hypertension, 33% of patients had chronic renal disease and 46% had left ventricular hypertrophy.

On the infectious level, all patients suffering from HIV were on antiretrovirals. It was noted that 18% of them had a CD4 count lower than 200 and a viral load higher than 100,000 copies.

Clinically, 98 patients (78.4%) had a mean arterial pressure < 65 mm Hg; 85.6% of patients (n = 107) had a coma with a Glasgow score ≤ 8, and 52 patients (41.6%) had a SOFA score between 10 and 12 (Figure 1).

Blood cultures were positive in 65% (n = 39) of cases, with Pseudomonas aeruginosa being isolated in 30.7% (n = 12), followed by *Klebsiella pneumonia* in 20.5% (n = 8). In skin-entry sepsis (Image 1), the organisms identified by microbiological culture were *Staphylococcus aureus* in 4.8% (n = 6) and Streptococcus in 3.2% (n =
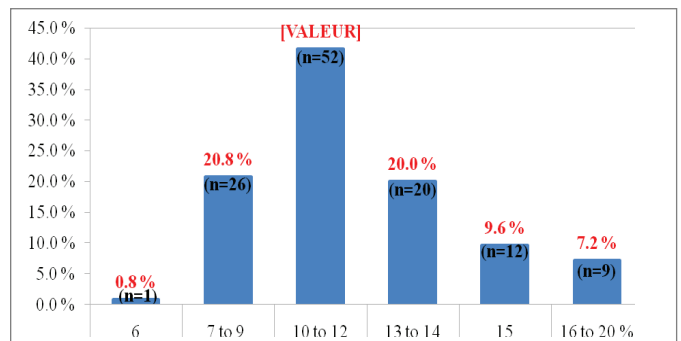

Figure 1: Distribution of patients according to SOFA score.

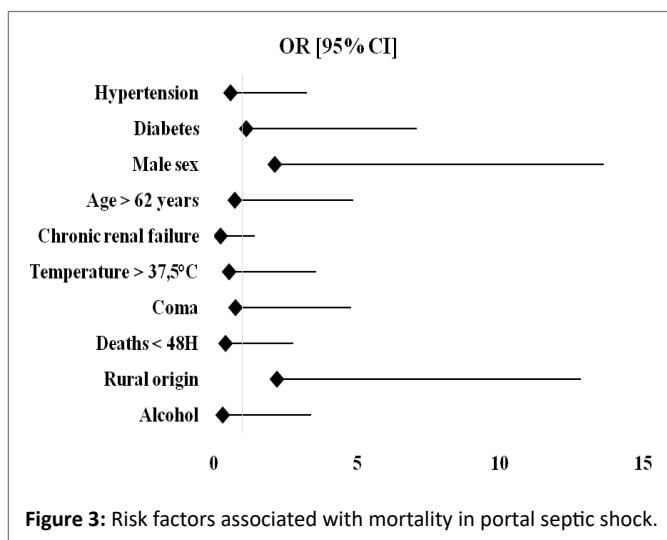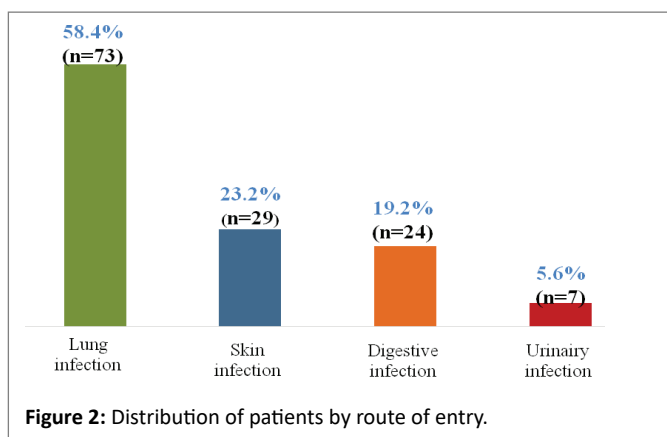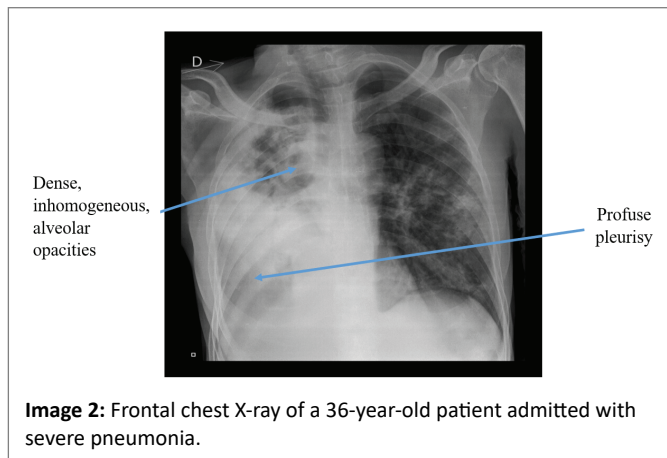**Image 1:** Suppurative wound associated with right buttock pressure sores.

4). Cytobacteriological examination of urine revealed Escherichia coli in 12 patients (9.6%) and Candida albicans in 6 patients (4.8%). Chest X-rays were pathological in 58.4% (n = 73), as shown in image 2.

The infectious route of entry was pulmonary with 58.4% (n = 73) and cutaneous with 23.2% (n = 29) (see Figure 2).

In terms of treatment, all patients had received noradrenaline. Probabilistic antibiotic therapy was metronidazole in 68.8% of cases (n = 86), ceftriaxone in 37.6% (n = 47) and carbapenem in 34.4% (n = 43). Patients died within 48 hours due to multiple organ failure in 59.2% of cases (n = 74). Mortality was 100% and in multivariate analysis, there were statistically significant correlations (p<0.05; chi2; [95% CI]) between mortality and male sex (p<0.0001, chi2; [2.9-8.6]), diabetes (p = 0.006, chi2; [1.28-4.68]) and rural origin (p<0.0005, chi2; [1.8-8.8]) as shown in figure 3.

Discussion

During this analytical study, we demonstrated that the hospital prevalence of septic shock was 18.5%. This prevalence rate is close to that of Guibla in Burkina Faso in 2021 [10], which found 14.2%. In contrast, Metogo in Cameroon in 2019 [11] and Niengo in 2023 in the Republic of Congo [12] report lower frequencies of 9.4% and 12.9% respectively. Mulatua in 2021 in Ethiopia [13] and Kari in Malaysia in 2023 [14] found higher frequencies of 26.5% and 48% respectively. In Europe and the United States, this prevalence varies between 2.5% and 23.4% [15] in intensive care units. The prevalence of septic shock remains high in developing countries where the incidence of infectious diseases remains high, as demonstrated by a meta-analysis carried out in 2019 [16].On average, septic shock affects relatively young subjects,

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Image 2: Frontal chest X-ray of a 36-year-old patient admitted with severe pneumonia.

Figure 2: Distribution of patients by route of entry.

Figure 3: Risk factors associated with mortality in portal septic shock.

with a median age of 56 years. However, shock is more severe in the elderly: in our series, 1/3 of the population included were aged between 60 and 69. One study has shown that the reduced immune defences of elderly patients may explain their increased susceptibility to infection and septic shock [17]. Paradoxically, in a series from Cameroon [11], age under 1 year was statistically correlated with mortality in septic shock (p = 0.0002). There was a male predominance (n = 90) with a sex ratio of 2.5. In our study, male sex was identified

as a mortality factor in septic shock (p<0.0001). Similar results were observed in Africa in the work of Niengo in 2023 in the Republic of Congo [12] and Mulatua in 2021 in Ethiopia [13], which reported a male predominance of 66.1% and 52.7% respectively. In the literature, septic shock has a male face because men tend to produce higher levels of pro-inflammatory cytokines in response to infections, which could amplify the inflammatory response and lead to more rapid organ deterioration. An experimental study on rats shows that endogenous cytokines aggravate shock [10,18].

Regarding comorbidities, only diabetes (n = 32; 40.2%) was identified as a factor in the severity of septic shock in our study. Arterial hypertension (45.9%) and HIV infection (20.6%) had no causal link with severity. Hyperglycaemia promotes a chronic pro-inflammatory state which alters the microcirculation, thus compromising organ perfusion in septic shock. Poor tissue oxygenation exacerbates organ failure, a major feature of septic shock [19]. These comorbidities have been found in numerous African series with relatively different proportions, notably by Mulatua in Ethiopia in 2021, who reported HIV infection at 19.3%, diabetes at 15.6% and hypertension at 8.7% [13]. Infection with the Human Immunodeficiency Virus (HIV) is a comorbidity frequently observed in sub-Saharan Africa [20], unlike in the West where Chronic Obstructive Pulmonary Disease (COPD) occupies this position [21]. According to the literature, the prognosis of septic shock is directly related to the number of pre-existing comorbidities in the patient [15,22]. Nearly 90% of patients had a Glasgow score ≤ 8 and a SOFA score between 10 and 12 in nearly 1/3 of patients. Several studies [11] show that a Glasgow score ≤ 8 and a mean arterial pressure ≤ 65 mmHg are risk factors for mortality from septic shock. Kari reports that a high SOFA score on admission is associated with a high risk of mortality [14]. In another study that included several factors predictive of mortality, it was shown that very low mean arterial pressure was associated with very high mortality in the 28 days following admission to intensive care [23]. Septic encephalopathy due to toxin accumulation, which is generally observed in cases of hepatocellular and/or renal failure, is thought to impair neuronal function when the SOFA score is high [24].

In our series, almost 60% of cases had a pulmonary portal of entry. Mulatua in 2021 in Ethiopia [13] reported pulmonary involvement in 53.1% of cases. In contrast, Niengo in 2023 in the Republic of Congo [12] and Guibla in Burkina Faso in 2021 [10] reported a predominance of peritoneal infections, with 64.3% and 50.8% respectively. Seasonal variations and the origin of medical patients admitted to the Intensive Care Unit may explain this disparity between routes of entry. The same applies to the germs identified. It is true that only 67 patients out of 125 had benefited from a bacteriological examination. The results of the bacteriological examinations were systematically coupled with the antibiogram. In the case of our study, the appropriate antibiotics had been started. But this high mortality is largely due to the late admission of patients to the hospital and therefore a delay in care in a field of non-negligible comorbidities. This is why we made recommendations to improve the conditions of care, namely raising awareness among families to consult quickly and improving the technical platform.

All patients had received medical resuscitation with vasoactive amines. A recent randomised trial showed that early administration of noradrenaline was associated with better shock control [25]. Metronidazole was the probabilistic antibiotic most often used in combination in 68.8% of our series. It was preferred in association because in the pattern of serious infections, resuscitators are used to associating it due to the bacterial ecology in Chad and the experience of the service. This combination of antibiotics has been reported in

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several African studies [12,13]. Elsewhere, carbapenem is the most commonly used antibiotic (55%), followed by tazobactam/piperacillin (20.9%) and vancomycin (17.8%), while metronidazole is used in only 1.1% of cases [26]. Current recommendations are to start an effective and appropriate antibiotic as soon as possible, ideally within the first hour following the onset of documented hypotension [24-28].

The duration of treatment was less than or equal to 48 hours in 59.2% (n = 74) of cases, with 100% mortality. High mortality rates have been observed in Cameroon [11], in the Republic of Congo, where 75% of cases died after the 24th hour, and in Ethiopia, where the mortality rate was 50.9% for cases treated for more than 48 hours [12,13]. The high frequency of mortality observed in the African context could be explained by two reasons: restricted access to healthcare and delayed diagnosis, two critical factors in reducing this mortality. The last wink is hardly avoidable and is linked to co-morbidities that require adequate monitoring.

Conclusion

The very high mortality of septic shock is associated with risk factors such as age, gender and co-morbidities including diabetes and HIV infection. The SOFA score, calculated on the basis of a range of variables, provides an effective way of putting this severity into perspective. Management is a vital and codified emergency, and the prognosis requires the implementation of diagnostic means, especially microbiological culture.

Conflict of Interest

The authors declare no conflicts of interest.

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