Letter to the Editor
Assessing the quality of sepsis management in an African island

Dear Editor,

Sepsis is one of the major causes of death worldwide. In order to reduce mortality from sepsis, some international guidelines recommend the implementation of a bundle of care for sepsis [1]. In one study from the United States, Barbash et al. noted that compliance with "The Severe Sepsis and Septic Shock Management Bundle" (SEP-1) was only 48.9% on average in the years 2016 to 2017 [2]. Unfortunately, such data from low-income and in particular, from African countries, are sparse.

In one of the recent studies, patients who were admitted to the ICU and placed on antibiotics in Mauritius had two to three times higher mortality rate compared to patients in Belgium, despite adjustment for the severity of sepsis using the SOFA score [3]. Moreover, deaths from hospital-acquired infections occurred at an almost ten times higher rate in Mauritius compared to the United States (50% vs 5.8%) [4, 5]. Therefore, it was considered important to assess the compliance rate to the sepsis bundle in Mauritius so as to find the cause for such a high mortality rate. A retrospective, cross-sectional and descriptive study was designed, approved by the Ethics Committee of Mauritius and conducted in one healthcare facility.

From June to October 2018, 109 patients who were admitted to a 600-bed hospital in Mauritius, were evaluated. As per the Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3) [6], 24 patients who had a rise in their baseline SOFA score by at least 2, were considered to have sepsis. Microbiological cultures were taken to confirm the source of sepsis.

The mean age of the patients with sepsis was 58 years while 33% (8/24) were females. None of them received the entire sepsis bundle. The mortality rate was 78% (7/9) among those who developed septic shock in the first 24 hours, 27% (4/15) among those with sepsis but who did not require inotropes in the first 24 hours, and 9.3% (4/43) among those with uncomplicated infections but who did not worsen into sepsis during their admission. Further details regarding the adherence to the sepsis bundle can be found in table 1.

Adequate fluid resuscitation, n (%)*	1 (4.2%)	2 patients did not get any fluids. On average, 1.4L of fluids were administered per patient in the first 24 hours (0.97ml/kg/h).
Blood culture before antibiotics, n (%)	3 (12.5%)	
Antibiotic in the first hour, n (%)†	3 (16%)	37% of patients (7/19) received antibiotics within 3 hours.
Had serum lactate in first 24 hours, n (%)	0 (0%)	Venous lactate level was not being done in the lab routinely.
Mean time interval in minutes between entry to casualty and fluid resuscitation†, ‡	324	
Mean time interval in minutes between entry to casualty and antibiotic administration†	524	
Deaths from sepsis, n (%)	11 (46%)	

*Table 1: * – Defined as receiving > 2 liters in the first 3 hours and > 3 liters in the first 24 hours. † – calculated only for patients with community-acquired sepsis (5 patients developed hospital-acquired sepsis). ‡ – calculated only for patients who received fluids. This study did not assess how many patients were clinically re-evaluated within 6 hours of a diagnosis of sepsis.*

With respect to antimicrobial therapy, 17% (4/24) of patients received an inappropriate antibiotic initially – this can happen especially in the ICU since 68% of organisms isolated there were multi-drug resistant according to a study published in 2020 [3].

The mean turnaround time (measured from the point cultures were ordered by the doctor to when the results were in the patient's folder) was 5.6 days for blood cultures, 4.6 days for cultures of tracheal secretions, 5.8 days for cultures of pus swabs, and 4.0 days for urine cultures. It should be noted that positive gram stains of any cultures including blood cultures were not made available urgently to the treating team (i.e., on the same day the gram stain was carried out).

In order to achieve prompt source control within the recommended 6 to 12 hours, expeditious radiological imaging is mandatory – only 50% (12/24) of the septic patients had an imaging study and all of these 12 patients had their radiological test completed within 48 hours after the onset of sepsis. Amongst those who got an X-ray, CT scan or ultrasound, the mean time taken for the radiological study to be completed was 14 hours while the median time was 5 hours.

Even though several patients were on vancomycin and gentamicin, serum trough levels for dose adjustment were not available for any of these patients.

Moreover, vital signs were inconsistently taken in the emergency department – none of the septic patients had a respiratory rate recorded on arrival, and although 100% of patients had their blood pressures taken, 29% (7/24) did not have their heart rates written down, 17% (4/24) did not have their temperatures checked and 46% (11/24) did not have their oxygen saturations documented. Despite most of the vital signs being taken when the patients reached their wards, their respiratory rates were

still noted to be missing. Similar findings have been reported in Australia, the United States, the Netherlands and the United Kingdom [7, 8].

Several reasons can be given with regards to the poor management of sepsis in the country. For instance, due to a lack of supervision by emergency physicians in our Accident and Emergency Department, there is a chance that antibiotics may be abused by the general practitioners. Therefore, intravenous antibiotics are generally only administered once the patient reaches the ward, but this can lead to significant delays in the treatment of sepsis. Secondly, on account of a scarcity of ventilators to intubate patients in case they develop fluid overload, doctors sometimes prefer to err on the side of caution and may avoid giving fluids to patients. Thirdly, in order to reduce the waiting time of patients in the casualty, nursing officers who work there prefer to leave venipunctures, including the taking of blood cultures, to the ward nurses, which means that cultures are generally taken once antibiotics have been given. Fourthly, despite its advantages, venous serum lactate level is unfortunately not done by our central health laboratory. A meta-analysis by Pan et al. in 2019 suggests repeating lactate levels every 2 hours until the patient has cleared more than 10% of his lactic acidosis - this can be helpful to guide the physician in his / her management of sepsis or septic shock [9]. Finally, although not specifically analyzed in this study, according to the reviewed medical notes, most septic patients are not reassessed by a doctor within 6 hours of admission – hence, deterioration of patients may go unnoticed. As per international recommendations, repeat lactate level and perfusion assessment should be undertaken so as to evaluate for improvements in end-organ perfusion – if no improvement is noted, further fluid resuscitation may be necessary, or vasopressors should be initiated [10]. It should be further highlighted that source control, especially among patients with abscesses, must be completed promptly. A study from the USA demonstrated a drop in mortality by 29% when source control was achieved within 6 hours of the onset of sepsis [11]. In this study in Mauritius, one septic patient with osteomyelitis did not get an amputation, another septic patient with osteomyelitis got his amputation

48 hours later and a third septic patient with a subdiaphragmatic abscess had it drained 48 hours later. Such long waiting times can be associated with more adverse events.

This study was able to identify some of the probable causes of death from sepsis in Mauritius. In order to prevent such deaths from occurring, it is imperative that sepsis be identified early, and that the sepsis bundle be implemented as soon as possible.

After this study was completed, the laboratory started doing vancomycin and gentamicin trough levels (even though turnaround time is still lengthy), is now reporting positive gram stains on blood cultures within 24 hours to the treating team (for some patients) and the turnaround time may have improved slightly through the use of matrix-assisted laser desorption ionization time-of-flight mass spectrometry.

Further improvements should be encouraged e.g., more fluids should be administered during resuscitation, blood cultures should be taken before the start of antibiotics for all patients, antibiotics should be dispensed more rapidly, vital signs should be recorded rigorously, and serum lactate levels should be available for all septic patients.

Keywords: Sepsis, management, Respiratory Rate, Risk Factors

ETHICAL APPROVAL

This study was approved by the Ethics Committee of the Ministry of Health and Wellness of Mauritius.

REFERENCES

[1] Rhodes A, Evans LE, Alhazzani W, et al. Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016. Intensive Care Med. 2017;43(3):304-377. doi:10.1007/s00134-017-4683-6

[2] Barbash IJ, Davis B, Kahn JM. National Performance on the Medicare SEP-1 Sepsis Quality Measure. Crit Care Med. 2019;47(8):1026-1032. doi:10.1097/CCM.0000000000003613

[3] Nuckchady DC, Boolaky SH. The prevalence of multi-drug resistant organisms and their outcomes in an ICU in Mauritius: an observational study. Asian J Med Health. 2020, 21:71-8. doi:10.9734/ajmah/2020/v18i1130270

[4] Nuckchady DC. Incidence, Risk Factors, and Mortality From Hospital-Acquired Infections at a Hospital in Mauritius. Cureus 13(11): e19962. doi:10.7759/cureus.19962

[5] Haque M, Sartelli M, McKimm J, Abu Bakar M. Health care-associated infections - an overview. Infect Drug Resist. 2018;11:2321-2333. Published 2018 Nov 15. doi:10.2147/IDR.S177247

[6] Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). JAMA. 2016;315(8):801–810. doi:10.1001/jama.2016.0287

[7] Shneyderman M, Yin E, Levin A et al. Vital Sign Measurement and Response to Abnormal Measures in Surgical Specialty Clinics. JAMA Netw Open. 2022;5(4):e229491. doi:10.1001/jamanetworkopen.2022.9491

[8] Elliott M. Why is Respiratory Rate the Neglected Vital Sign? A Narrative Review. Int Arch Nurs Health Care 2016;2:050.

[9] Pan J, Peng M, Liao C et al. Relative efficacy and safety of early lactate clearance-guided therapy resuscitation in patients with sepsis: A meta-analysis. Medicine (Baltimore). 2019 Feb;98(8):e14453. doi: 10.1097/MD.0000000000014453.

[10] Dugar S, Choudhary C, Duggal A. Sepsis and septic shock: Guideline-based management. Cleve Clin J Med. 2020 Jan;87(1):53-64. doi: 10.3949/ccjm.87a.18143.

[11] Reitz KM, Kennedy J, Li SR, et al. Association Between Time to Source Control in Sepsis and 90-Day Mortality. JAMA Surg. Published online July 13, 2022. doi:10.1001/jamasurg.2022.2761