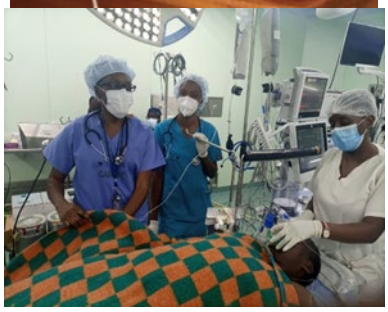
INTERNATIONAL PERSPECTIVES IN EMERGENCY, TRAUMA AND CRITICAL CARE NURSING

STUDENT JOURNAL



4th Edition

October 2024

Contents

Welcome

Welcome to our fourth edition of this journal. We are really pleased that the journal has been so well received, increasingly colleagues are asking for copies and to be added to the distribution list. Every September, the world marks World Sepsis Day, and this edition is dedicated to sepsis care, a leading cause of mortality worldwide. Sepsis remains a global public health problem, with almost 50 million cases and 11 million sepsis-related deaths, with the highest burden felt in low-income countries (LICs) (World Health Organization (WHO), 2024a). The main challenge is that as a syndrome and not a disease, the range of signs and symptoms seen can make it difficult to diagnose in its early stages. In consequence, health professionals always need to rule out sepsis rather than rule it in, using the question 'Could it be sepsis?' (Sepsis Trust, 2024).

In this edition, we have included two articles on critical care practice that give new insights and guidance into sepsis care. These include the use of vasopressors in septic shock and the managing anti-microbial stewardship in relation to sepsis care in critical care.

We have also included a new section on electrocardiograms as this is an area of assessment which is of crucial importance for Emergency and Trauma and Critical Care Nurses. These have been included as one of the roles of this journal is to support continuing professional development. In addition, selected abstracts from Critical Care Nurses Association of Zambia 2nd Scientific Conference, in Livingstone, Southern Province in July 2024.

This edition has been dedicated to one special student, Memory Nalwamba, who tragically died in August 2024. Memory was one of Nursing Now Challenge Fellows who successfully completed a quality improvement project on improving infection prevention and control practices in the operating theatres at St Francis Mission Hospital, which was published in the second edition of this journal. Memory went onto study her BSc (Hons) Professional Practice (Adult Critical Care) with Birmingham City University, and we are pleased we are able to publish another piece of her work on the preventing anti-microbial resistance in critical care units. Memory will be awarded her Bachelor of Science posthumously by Birmingham City University in October 2024.

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A New Dawn: Malawi's Critical Care Nurses Unite for Professional Growth

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On May 30th, 2023, during the 76th World Health Assembly, the World Health Organization adopted a resolution titled *"Integrated Emergency, Critical, and Operative Care for Universal Health Coverage and Protection from Health Emergencies"* (Tadesse, et al. 2023). This resolution was a response to the significant gaps identified in global health systems during the COVID-19 pandemic. Through this resolution, the World Health Organization urges countries and professional organizations to invest in and implement strategies that improve emergency, critical, and operative care in their respective health systems. In low- and middle-income countries, including Malawi, the importance of emergency and critical care services has become increasingly evident. These services are now recognized as essential, rather than a luxury (Chang, et al., 2016).

It is within this context that critical care nurses in Malawi decided to establish an Association to complement the government's efforts to improve critical care services in the country. Malawi, a landlocked country with a population of 20 million, faces a double burden of non-communicable and communicable diseases that often lead to critical illness (Gundo et al., 2019; Olds et al., 2023; Valera et al., 2020). Non-communicable diseases (NCDs) such as hypertension, heart failure, cancer, and stroke are prevalent among people aged 40 years and above. Among individuals younger than 40, common conditions include mental health disorders, burns, epilepsy, asthma, and trauma. In the paediatric population, sickle cell disease, rheumatic heart disease, and type 1 diabetes are the prevalent NCDs. Trauma accounts for 40% of all NCD-related visits, with road traffic injuries and assaults being the most common causes (Olds et al., 2023; Chokhotho et al., 2022; Mulima et al., 2021). In addition, infectious diseases, especially those that are associated with HIV are the leading cause of hospital admission (Allain, et al., 2017).

Despite this high disease burden, Malawi faces significant challenges in critical care, including inadequate resources, a shortage of well-trained professionals, and limited pre-hospital care, among other issues (Sonenthal et al., 2022; Gundo et al., 2023). However, the country is implementing several strategic initiatives that have led to improvements, such as increased life expectancy and reduced maternal, under-five, infant, and neonatal mortality rates. Key initiatives include the Health Sector Strategic Plan (HSSP III) 2023-2030, Community-Based Health Services (CBHS), Primary Health Care (PHC), and the Emergency and Critical Care Strategy (ECCS), a framework that is designed to strengthen emergency and critical care services. The country also adopted Emergency Triage Assessment and Treatment (ETAT) and is developing ETAT Plus to enhance the care of critically ill children in hospitals (Johansson et al., 2020). These gains can be further enhanced through the formation of professional organizations that support the implementation of emergency and critical care services.

Given Malawi's growing population and disease burden, the critical role of nurses in delivering quality critical care services cannot be overstated. Despite their pivotal role in caring for critically ill patients, there has been no professional Association specifically tailored to meet the needs of critical care nurses in the country. Inspired by international trends and learning from neighbouring countries like Tanzania and Zambia, Malawian critical care nurses decided to form the Association of Critical Care Nurses in Malawi (ACCNM). On April 7th, 2021, the nurses created a WhatsApp group to facilitate communication and discussions on the Association's structure and activities. Through this platform, they agreed that the primary aim of the Association would be *"to provide a platform for professional development, collaboration, and advocacy within the critical care nursing community."* A draft constitution was then developed, and input was solicited from both local and international experts. The Director of Nursing and Midwifery Services in the Ministry of Health was also informed about the proposed formation of the Association.

Until recently, Malawi's critical care nurses received their training outside the country. However, Kamuzu University of Health Sciences has introduced both undergraduate and postgraduate programs in critical care nursing, which is expected to increase membership of the ACCNM as the number of locally trained nurses grows. The Association is set to be launched during this year's National Organization of Nurses and Midwives

in Malawi (NONM) Research and Biennial Conference, scheduled for November 29th-30th in the capital city, Lilongwe. The establishment of ACCNM is a critical step in advancing the professional development of nurses and improving patient care outcomes. By providing a unified platform for collaboration, education, advocacy, and support, the Association will play a pivotal role in enhancing the care of critically ill patients and their families across the country.

References

Allain, T. J., Aston, S., Mapurisa, G., Ganiza, T. N., Banda, N. P., Sakala, S., ... & Peterson, I. (2017). Age related patterns of disease and mortality in hospitalised adults in Malawi. PLoS One, 12(1), e0168368. doi:10.1371/journal.pone.0168368

Chang, C. Y., Abujaber, S., Reynolds, T. A., Camargo, C. A., & Obermeyer, Z. (2016). Burden of emergency conditions and emergency care usage: new estimates from 40 countries. Emergency Medicine Journal, 33(11), pp 794-800. http://dx.doi.org/10.1136/emermed-2016-205709

Chokotho, L., Croke, K., Mohammed, M., Mulwafu, W., Bertfelt, J., Karpe, S., & Milusheva, S. (2022). Epidemiology of adult trauma injuries in Malawi: results from a multisite trauma registry. Injury Epidemiology, 9(1), pp 14. https://doi.org/10.1186/s40621-022-00379-5

Gundo, R., Mearns, G., Dickinson, A., & Chirwa, E. (2019). Contextual issues that influence preparedness of nurses for critical care nursing practice in Malawi. Malawi Medical Journal, 31(2), pp 138-143. https://dx.doi.org/10.4314/mmj.v31i2.6

Mulima, G., Purcell, L. N., Maine, R., Bjornstad, E. C., & Charles, A. (2021). Epidemiology of prehospital trauma deaths in Malawi: a retrospective cohort study. African journal of emergency medicine, 11(2), pp 258-262. https://doi.org/10.1016/j.afjem.2021.03.011

Olds, P., Kachimanga, C., Talama, G., Mailosi, B., Ndarama, E., Totten, J., Musinguzi, N., Hangiwa, D., Bukhman, G., & Wroe, E. B. (2023). Non-communicable disease burden among inpatients at a rural district hospital in Malawi. Global Health Research and Policy, 8(1), pp 4. https://doi.org/10.1186/s41256-023-00289-z

Sonenthal, P.D., Nyirenda, M., Kasomekera, N., Marsh, R.H., Wroe, E.B., Scott, K.W., Bukhman, A., Connolly, E., Minyaliwa, T., Katete, M., Banda-Katha, G., Mukherjee, J.S., & Rouhani, S.A. (2022). The Malawi emergency and critical care survey: a cross-sectional national facility assessment. EClinical Medicine, 44. https://doi.org/10.1016/j.eclinm.2021.101245

Tadesse, L., Abdullah, N. H., Awadalla, H. M. I., D'Amours, S., Davies, F., Kissoon, N., ... & Reynolds, T. (2023). A global mandate to strengthen emergency, critical and operative care. Bulletin of the World Health Organization, 101(4), pp 231. doi: http://dx.doi.org/10.2471/BLT.23.289916

Varela, C., Young, S., Groen, R. S., Banza, L., Mkandawire, N., Moen, B. E., & Viste, A. (2020). Deaths from surgical conditions in Malawi-a randomised cross-sectional Nationwide household survey. BMC Public Health, 20, pp 1-8. https://doi.org/10.1186/s12889-020-09575-8

Use of Vasopressors in patients with Septic Shock

Itumeleng Michael

It is internationally recognised that septic shock (SS) is the most common and life-threatening complication of sepsis with high mortality rate accounting up to two third amongst other types of shocks (Scheeren et al, 2019). Cecconi et al, (2018) highlighted that the high mortality rate is attributed to circulatory, cellular and metabolic abnormalities. Circulatory systemic vasodilatation caused by sepsis leads to SS unresponsive to fluid resuscitation, which require vasopressor administration (Thompson et al, 2019). This corrects vascular tone and acts as systemic vasoconstrictor; thus, improving mean arterial pressure (MAP) (Dalimonte et al, 2020).

The World Health Organisation (WHO) (2017) pointed out that sepsis is a global health priority, and that countries need to focus on prevention, diagnosis and management (Cecconi et al, 2018). However, while it is prevalent in all countries, the majority of worldwide deaths (up to 90%) occur in low-income countries (LICs). Although international guidelines have been developed, they need to be adapted for use in LIC (Wentowski et al, 2018). In consequence, in many LICs the limited resources result in late recognition and response in treating sepsis which increases complicates and may lead to SS (Molau et al, 2021). This paper focuses on critical review of the literature to increase critical care nurses' knowledge and understanding, of the use of vasopressors to reduce complications and delays in response.

Literature Search

The literature review used the Cumulative Index to Nursing and Allied Health Literature (CINAHL) and PUBMED electronic data to search for articles from 2018 to 2024. Keywords searched included vasopressors, septic shock and management or administration. Inclusion criteria included research articles on use of vasopressors in adult patients in SS, peer reviewed, in English, from 2018 to 2024 .Exclusion criteria included articles before 2018, not peer reviewed, not full text, not published in English, studies involving children and neonates and non-research articles. 10 articles were identified for inclusion (figure 1).

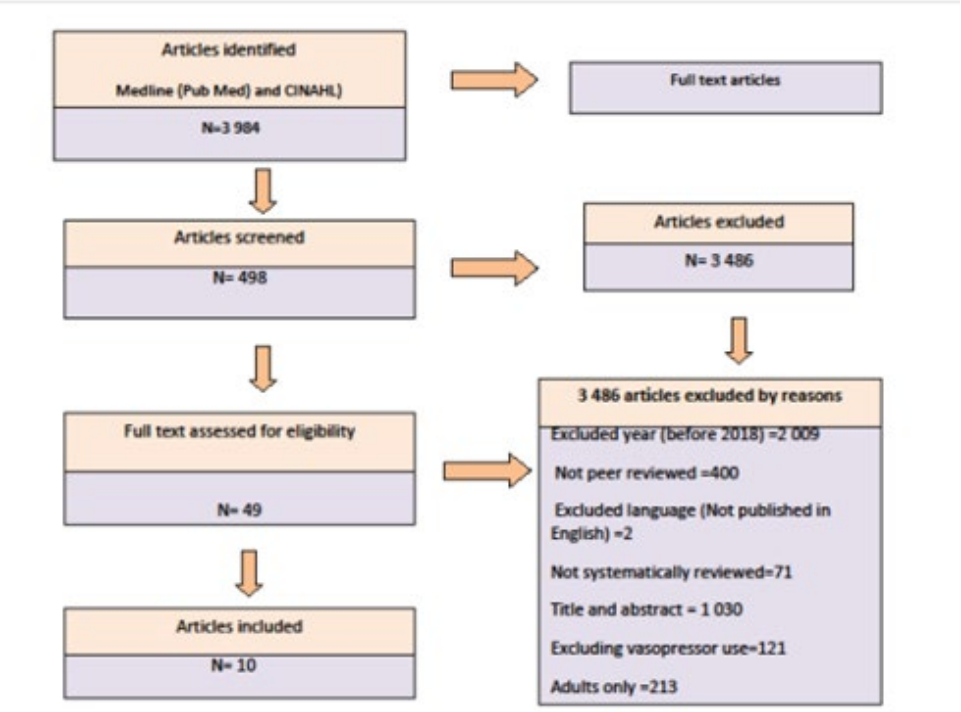


Figure 1: Literature search

Discussion

The Sepsis Survival Campaign (SSC) (2018) guidelines published evidenced based recommendations, this included initiation of vasopressors to maintain MAP of 65mmHg when fluid resuscitation alone fails (Sanchez et al, 2023). While Russeli, (2021) argued MAP targets need to be individualised particularly for patients with chronic hypertension, with a target MAP of 80 to 85 mmHg: this has been identified as helping to prevent the

incidence of acute kidney injury. This is supported by Ammar et al, (2021) who argue that fluid effects fade within 30 to 60 minutes; therefore, use of vasopressor is a necessity. Studies by Tong et al, (2023) and Sanchez et al, (2023) pointed out, that use of vasopressors increased cardiac output (CO), preload and improved tissue oxygen saturation by improving capillary perfusion. Therefore, initial assessment and past medical history are important when managing patients presenting with SS a target MAP must be identified and documented in the medical notes.

SSC (2018) guidelines identified there was some evidence regarding early initiation of vasopressors via peripheral access route whilst awaiting preferred administration of vasopressors via central venous catheter (CVC). However, Lewis et al, (2019) dismissed the need for CVC initially thought to be a crucial component of SS treatment. Nevertheless, it is a cause for concern, that there is no consensus on the maximum time of infusion via peripheral access potentially leading to variations of practice. For example, Utarian et al, (2019) suggests peripheral access use for a short period of time up to 2 hours, while Teja et al, (2022) increased the timeframe to 72 hours, provided close monitoring insertion site was maintained. Teja et al, (2022) go on to argue that peripheral access is more likely to cause extravasation if precaution measures are not followed. However, in practice it has shown that use of CVC is usually rarely used in LIC as they are expensive. In addition, relatives may be requested to purchase such items which further delays treatment. Another contributory factor is clinicians' limited knowledge on CVC placement, which means when equipment is available it may not be used (Evans, 2021). As a result, peripheral access is often the route of choice, however, in the absence of consensus it is suggested that these be changed every 72 hours to prevent local tissue ischaemia.

Vasopressors response varies due to a range of physiological factors and diagnosis, response is based on cardiac heart rate, contractility and potent vasculature tone which are dependent on adrenergic receptors distribution being alpha and beta (Manolopoulos et al, 2020). Chawla et al, (2019) concurred and expanded further that it is important to consider that genetics and pre-existing medication may also lead to differing responses. In consequence, there is need to individualise VP administration (Allen et al 2019) (Table 1).

Article	Current use of vasopressors in septic shock. (Scheeren et al, 2019)	Recent updates in the pharmacological management of sepsis and septic shock: A systematic review focused on fluid resuscitation, vasopressors and corticosteroids. (Allen et al, 2019)	Early initiation of NE in patients with septic shock: A propensity score based. (Xu et al, 2022)
Are the results Valid?	Yes. Approved by ethics committee and detailed research strategy approach stated.	Yes. Systematic review of literature was done.	Yes. Systematic review of literature and ethics approval.
Findings	Achieving MAP equivalent to 65mmHg through early initiation of fluid and NE	Patient response to therapy differs. There is need to individualise VP administration	Administration of NE within 3 hours resulted in longer survival time and reduced invasive mechanical ventilation
Will they help in LMICS?	Advocating for NE availability in LICs aids early initiation.	Yes. Response to intervention is influenced by specific factors.	Yes. LICs experience high mortality rate and has low bed capacity against high ICU admission demand.
Method used	Survey questionnaire	Systematic review limited to randomised controlled trials	Retrospective observational cohort study.
Is the method appropriate?	Yes. It allows data collection from large population.	Yes. It enabled in-depth data search and reduced biasness	Yes. Extraction of patient document database revealed real SS management practice
Limitations	Did not use log-file/IP address analyses to prevent multiple responses	All studies were from HICs; therefore, cannot be generalised	Patient data analysis was from 2008 to 2019 with several surviving sepsis campaign guidelines revisions.

Table 1: CASP analysis

There are several vasopressors that could be used to treat SS. The SSC (2018) recommends the use of Norepinephrine (NE) as the first line treatment (Scheeren et al, 2019) (Table 1). This is supported by Lu et al, (2021) who found that NE is superior to dopamine, as it has more alpha-adrenergic receptors than beta adrenergic receptors. This increases MAP by increasing CO, preload and contractility without causing tachycardia. Additionally, it decreases myocardial oxygen consumption of which sepsis increases oxygen consumption 12-fold (Tong et al, 2023). Unfortunately, in LICs despite its advantages, it is often unavailable due to high costs (Jozwiak, 2022).

Suzuki et al, (2022) found that NE is more potent with minimal arrhythmias whereas, dopamine caused tachycardia and arrhythmias particularly atrial fibrillation (AF) leading to myocardial infarction. Nevertheless, dopamine has been identified as a potential alternative to NE for use in patients with bradycardia. It binds to alpha 1 and beta 1 adrenergic receptors and dopanergic (DA) 1 and 2. This increases cardiac contractility and stroke volume while augmenting renal perfusion by improving creatinine clearance and urine output with DA 1 and 2 (Tong et al, 2023). Dopamine is dose dependent, result in high doses needed to increase systemic vascular resistance thereby increasing MAP (Evans, 2021). Another alternative is epinephrine, a second line vasopressor that has both beta 1 and 2 adrenergic receptors, but it has more beta 1 than NE. Beta 1 adrenergic receptors cause hyperglycaemia, tachycardia and tachyarrhythmia whilst beta 2 adrenergic receptors cause hyperlactatemia due to local ischaemia in the peripheral tissues (Russell, 2019). In LICs it is the most affordable and available vasopressor.

Critical Care Nurses (CCNs) must have the knowledge to safely administer and monitor patients undergoing vasopressor therapy, they need to recognise the onset of adverse effects such as tachyarrhythmias, metabolic acidosis, hyperglycaemia and digital ischaemia (Li et al, 2018). Once a vasopressor infusion has been commenced, it is crucial that the CCN titrates the infusion in response to MAP. With limited numbers of CCNs expertise and knowledge in LICs it is essential that CCNs provide ongoing mentorship and support for other nurses, demonstrating how to implement patient safety initiatives.

SS is a complication of sepsis, and the inclusion of vasopressors aims to correct the hypo-perfusion to decrease the extent and duration which are associated with poor outcome if prolonged (Munroe et al, 2022). It is important to note, that often concurrent fluid resuscitation and vasopressors administration is used (Ruslan, 2021; Li et al, 2020). While it is accepted that fluid resuscitation can be undertaken in any setting e.g. clinical, ward area etc, to increase both regional blood flow and improve arterial pressure (Ospina-Tascon et al, 2020). However, the initiation of a vasopressor infusion needs specialist care and monitoring that can only be given in a high dependency or critical care unit. Vasopressors increase preload and end diastole volume (EDV) thereby increasing contractions. The heart adjusts the force of its contraction in response to the preload. Kuhtz-Buschbeck et al, (2018) illustrate that myocardial fibre length increases to generate maximum force during contraction resulting in increased CO.

The challenge is when to stop fluid resuscitation and initiate vasopressor therapy, as vasopressors should only be administered once the patient has received sufficient volume. However, the response to fluid resuscitation varies and can be affected by pre-existing conditions such as heart failure or renal disease. Therefore, during fluid resuscitation parameters such as checking capillary refill time (CRT), urine output (aiming for > 0.5ml/kg/hr) and skin mottling score can be used to evaluate the response (Hariri et al, 2019). However, skin mottling is usually difficult to measure in people with dark skin tone, so CRT and urine output are more accurate, and should be used in addition, to MAP monitoring (Divatia, 2024; Jog et al, 2023). These fundamental measures can be used to accurately assess perfusion in all settings.

Ruslan, (2021) argues that use of vasopressor(s) within 6 hours improved mortality rate. The challenge in LIC is the delay in initiating vasopressors attributed to lack of preparedness, resources and long procurement processes. Access to NE in SS would enable physiological targets such as MAP to be achieved, this would prevent potential complications of prolonged periods of hypotension (Shi et al, 2020; Hamzaoui et al, 2020). Current guidelines recommend the dose for NE is 0.25 to 0.5 ug/kg/min (Tong et al, 2023). As such, availability will be measured against maximum dose which is 0.5 ug/kg/min over 24 hours. These will require appropriately 20 ampoules for a patient estimated to be 70 kilograms. Similarly, impact of the project will be measured by targeting timeframe of 1 to 3 hours NE initiation depending on patient presentation and response to fluid resuscitation. However, in LIC settings, with limited numbers of patients who develop SS may not warrant the investment in a relatively expensive drug.

In conclusion, there is a need for an individualised approach based on vasopressors therapy pharmacology and patient response to treatment. 90% of mortality due to sepsis is found in the African continent. Therefore,

it could be argued that NE is cost effective in reducing mortality. There is an urgent need for LICs to develop and adopt guidelines suitable for the health systems in which they work. This critical review of the literature has highlighted the advantages of using vasopressor therapy and in particular NE. However, it has also revealed the challenges faced by LICs trying to develop and implement appropriate guidelines when current evidence on research from high income countries.

REFERENCES

Allen, JM., Field, C., Shoulders, BR., Voils, SA. (2019) Recent updates in the pharmacological management of sepsis and septic shock: A systematic review focused on fluid resuscitation, vasopressors and corticosteroids. *Annals of Pharmacotherapy*, 53(4), pp. 385-395 https://doi.org/10/1177/1060028018812940

Ammar, MA., Ammar, AA., Wieruszewski, PM., Bissell, BD., Long, MT et al. (2022) Timing of vasoactive agents and corticosteroids initiation in septic shock. *Annals of Intensive Care,* 12(47), pp. 1-10 https://doi.org/10.1086/s13613-022-01021-9

Cecconi, M., Evans., L., Levy, M., Rhodes, A. (2018) Sepsis and septic shock. *Seminar*, 10141, pp. 75-87 https://doi.org/10.1016/s0140-6739(18)30696-z

Chawla, LS., Ostermann, M., Forni, L., Tidmarsh, GF. (2019) Broad spectrum vasopressors: A New approach to the initial management of septic shock? *Critical Care*, 23, pp. 124 https://doi.org/10.1186/s13054-019-2420-y

Dalimonte, MA., Degrado, JR., Anger, KE. (2020) Vasoactive agents for adult septic shock: An update and review. *Journal of Pharmacy Practice*, 33(4) pp. 523-532 https://doi.org/10.1177/0897190019844124

Divatia, JV. (2024) Skin mottling in dark-skinned Indians patients with severe septic shock: A window to the circulation or a door closed? *Indian Journal of Critical Care Medicine*, 28(1), pp. 18-19 https://doi.org/10.5005/jp-journals-10071-24633

Evans, L., Rhodes, A., Alhazzani, W., Antonelli, M., Coppersmith, CM et al. (2021) Surviving sepsis campaign: International guidelines for management of sepsis and septic shock 2021. *Intensive Care Medicine*, 47, pp. 1181-1247 https://doi.org/10.1007/s00134-021-06506-y

Hamzaoui, O., Shi, R. (2020) Early norepinephrine use in septic Shock. *Journal of Thoracic Disease*, 12(1), pp. 10-18 https://doi.org/10.21037/jtd.2019.12.50

Hariri, G., Joffre, J., Leblanc, G., Bonsey, M., Lavillegrand, J et al. (2019) Narrative review: Clinical assessment of peripheral tissue perfusion in septic shock. *Annals of Intensive Care*, 9, pp. 2-9 https://doi.org/10.1186/s13613-019-0511-1

Jog, SA., Narasimham, VL., Rajhans, PA., Akole, PV., Pawar, B et al. (2023) Mottling in septic Shock: Ethnicity and skin colour matters. *Indian Journal of Critical Care*, 27(12), pp. 902-909

Jozwiak, M. (2022) Alternatives to norepinephrine in septic shock: Which agents and when? *Journal of Intensive Medicine*, 2, pp. 223-232 https://doi.org/10.1016/j.jointm.2022.05.001

Kuhtz-Buschbeck, JP., Drake-Holland, A., Noble, MIM., Lohff, B., Schaefer, J. (2018) Rediscovey of Otto Franks' contribution to science. *Journal of Molecular and Cellular Cardiology,* 119, pp. 96-103 https://doi.org/10.1016/j.yjmcc.2018.04.017

Lewis, T., Merchan, C., Altshuler, D., Papadopoulos, J. (2019) Safety of the peripheral administration of vasopressor agents. *Journal of Intensive Care Medicine*, 34(1), pp. 26-33 https://doi.org/10.1177/0885066616686035

Li, Y., Li, H., Zhang, D. (2020) Timing of norepinephrine initiation in patients with septic shock: A systematic review and meta-analysis. *Journal of Critical Care*, 24, pp. 488 https://doi.org/10.1186/s130154-020-03204-x

Lu, X., Xu, X., Wu, Y (2021) Norepinephrine was superior in death risk reducing and haemodynamics compared to dopamine in treatment of patients with septic shock. *Pteridines*, 32, pp. 5-10 https://doi.org/10/1515/pteridines-2021-0002

Manolopoulos, PP., Boutsikos, I., Boutsikos, P., Iacovidou, N., Ekmektzogoglou, K. (2021) Current use of and advances in vasopressors and inotropes support in shock. *Journal of Emergency and Critical Care Medicine*, 4(20), pp. 1-13 https://dx.doi.org/10.21037/jeccm.2019.12.03

Molau, HA., Bayisa, TB., Worku, Y., Lazarus, JJ., Woldeyes, E. (2021) Prevalence and outcome of sepsis and septic shock in intensive care unit in Addis Ababa, Ethiopia: A prospective observational study. *African Journal of Emergency Medicine*, 11, pp. 188-195 https://doi.org/10.1016/j.afjem.2020.10.001

Munroe, ES., Hyzy, RC., Semier, MW., Shankar-Hari, M., Young, PJ. (2022) Evolving management practices for early sepsis-induced hypo-perfusion: A narrative review. *American Journal of Respiratory and Critical Care Medicine*, 207(10), pp. 1283-1299 https://doi.org/10.1164/rccm.202209-1831CI

Ospina-Tascon, GA., Hernandez, G., Alvarez, I., Tapia, C., Manzaho, NR., Sanchez-Ortiz, AI et al. (2020) Effects of early start of norepinephrine in patients with septic shock: a propensity score-based analysis. *Critical Care*, 24, pp. 52 https://doi.org/10.1186/s13054-020-2756-3

Ruslan, MA., Baharuddin, KA., Noor, NM., Yazid, MB., Noh, AYM et al. (2021) Norepinephrine in septic shock: A systematic review and meta analysis. Western Journal of Emergency Medicine, 22(2), pp. 196-203 https://doi.org/10.5811/westjem.202010.47825

Russeli, MA., Baharuddin, KA., Noor, NM., Yazid, MB., Noh, AYM et al. (2021) Norepinephrine in septic shock: A systematic review and meta-analysis. *West J Emerg Med*, 22(2), pp. 196-203 https://doi.org/10.5811/westjem.2020.10.47825

Russell, JA. (2019) Vasopressor therapy in critically ill patients with shock. I*ntensive Care Medicine,* 45, pp. 1503-1517 https://doi.org/10.1007/s00134-019-05801-z

Sanchez, C., Pinsky, MR., Sinha, S., Mishra, RC., Lopa, AJ et al. (2023) Fluids and early vasopressor management of septic shock: Do we have the right answers yet. *The Journal of Critical Care Medicine,* 9(3), pp. 138-147 https://doi.org/10.2478/jccm-2023-0022

Scheeren, TWL., Bakker, J., De-Baker, D., Annane, D., Asfar, P. (2019) Current use of vasopressors in septic shock. *Annals of Intensive Care*, 9, pp. 12-20 https://doi.org/10.1186/s13613-019-0498-7

Shi, R., Hamzaoui, O., Vita, ND., Monnet, X., Teboul, J. (2020) Vasopressors in septic shock: which, when and how much. *Annals of Translational Medicine*, 8(12), pp. 794 https://doi.org/10.21037/atm.2020.04.24

Suzuki, R., Uchino, S., Sasabuchi, Y., Lefor, AK., Sanui, M, (2022) Dopamine use and its consequences in the intensive care unit: A cohort study utilising the Japanese intensive care patient database. *Critical Care*, 26, pp. 90 https://doi.org/10.1186/s13054-022-03960-y

Teja, B., Bosch, NA., Wijeysundera, DN., Wijeyssundera, HC., Saski, R et al. (2019) First line vasopressor uses in septic shock and route of administration. *Ann Am Thorac Soc*, 19(10), pp. 1713-1721 https://doi.org/10.1513/AnnalsATS.20223-2220C

Thompson, K., Venkatesh, B., Finfer, S. (2019) Sepsis and septic shock: Current approaches to management. *International Medicine Journal*, 49(2), pp. 160-170 https://doi.org/10.1111/imj.14199

Tong, X., Xue, X., Liu, A. (2023) Early administration of multiple vasopressors is associated with better survival with sepsis: A propensity score weighed study. *European Journal of Medical Research,* 28, pp. 229 https://doi.org/10.1186/s40001-023-01229-w

Wentowski, C., Nishith, M., Nielsen, ND. (2018) Sepsis in 2018: A review. *Anaesthesia and Intensive Care Medicine,* 20(1), pp. 6-13 https://doi.org/10.1016/j.mpaic.2018.11.009

Xu, F., Zhong, R., Shi, S., Zeng, Y. (2022) Early initiation of norepinephrine in patients with septic shock: A propensity score based. *The American Journal of Emergency Medicine*, 54, pp. 287-296 https://doi.org/10.1016/j.ajem.2022.01.063

Role of Antimicrobial Stewardship in Sepsis Management in Intensive Care Unit in Low Income Countries

Memory Nalwamba

Tribute: Published posthumously in memory of Memory Nalwamba

The World Health Organization (WHO) (2024) declared sepsis as a global health burden, with an anticipated 48.9 million cases and 11 million sepsis-related deaths worldwide, accounting for 20% of all fatalities, according to a data report from the year 2017. However, there is inadequate data from Low and Low-middle income countries (LIC/LMIC) that include Zambia, meaning the numbers could be more (WHO, 2024). Sepsis definition continues evolving, this is due to advancements in the understanding of the aetiology and clinical symptoms (NICE, 2024). Therefore, Sepsis is currently defined as a life-threatening condition from a dysregulated host response to infection, resulting in multi organ failure and death when treatment is delayed (WHO, 2024). The risk of death rises by 7.6% for every hour when sepsis therapy is not initiated (Evans et al., 2021). Consequently, managing sepsis in the intensive care unit (ICU) is challenging, especially in Low and Low-middle income countries (LIC/LMIC), where resources are frequently limited and the health care system is over stretched (Hijazi, 2019; WHO, 2024). It is a cause for concern that an often-neglected component of sepsis management is the rising in antimicrobial resistance (AMR) (WHO, 2023). Therefore, implementation of antimicrobial stewardship (AMS) practices enhances patient outcomes, reduce and lower AMR resulting in lower associated financial and human costs (Ackers et al., 2020). This paper explores the importance of AMS in managing sepsis within ICUs in LIC and highlights professional relevance to current practice in relation to sepsis management and prevention of AMR.

Literature Search

A focused literature search was carried out using electronic databases including CINAHL, PubMed, Cochrane and Medline. Inclusion criteria included peer reviewed articles; articles published in English. Exclusion criteria included articles in languages other than English, non-peer reviewed and articles published more than 10 years previously. To facilitate the search, independent keywords were used, these included “Sepsis” or “antimicrobial stewardship” AND or “Antimicrobial resistance” AND “Low-income countries” “change management”. Boolean operators were used to connect the terms. The search identified 580 potential articles which met the inclusion criteria, however, after screening, this was reduced to 17 articles, which was included in the synthesis.

Discussion

Currently Zambia, like other LICs in Sub-Saharan Africa (SSA), faces the critical health challenges of sepsis and AMR, resulting in high morbidity and mortality (WHO, 2023). It is important to state that AMS and sepsis care requires a multidisciplinary approach, this is reflected in Zambia’s National Action Plan (NAP) to combat AMR (WHO, 2017). Ranjit et al (2021) point out patients admitted to the ICU are susceptible to sepsis due to the nature of the primary pathology before admission to ICU and the use of broad-spectrum antibiotic coupled with invasive procedures. Therefore, Critical Care Nurses (CCN) must have the have situational awareness and knowledge to initiate measures to prevent associated complications (Sole et al., 2020).

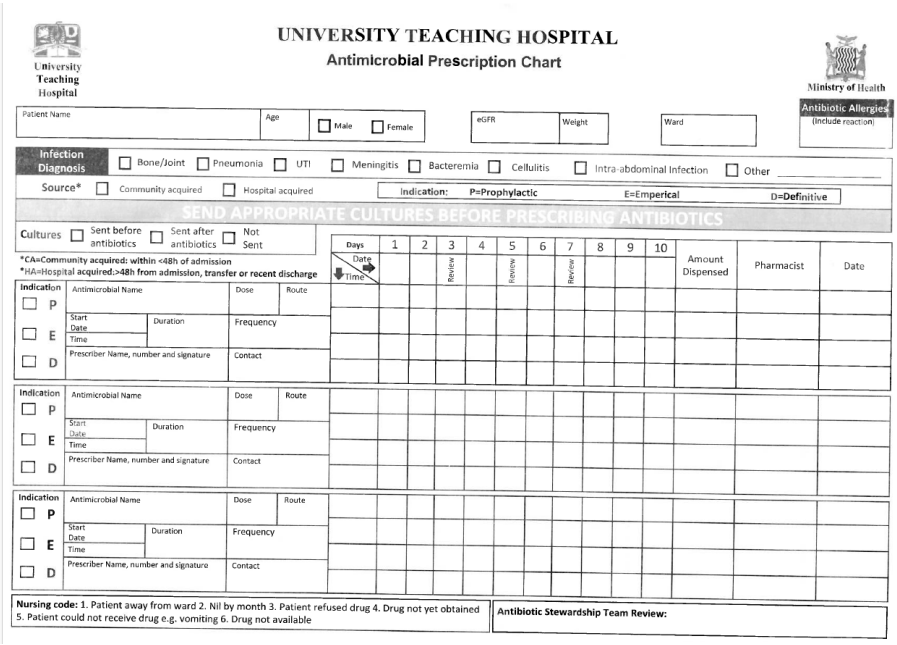
Sepsis in ICU requires complex management as it needs to balance treatment of sepsis but while recognising the challenges of rising AMR and limited resources (Schultz et al., 2019). However, as Andrews et al (2014) study in Zambia, found implementation of standardized international sepsis treatment guidelines resulted in a significant increase in mortality rates, as their study did not recognise the differences in physiological differences. Therefore, it is important that the evidence is context specific and the ‘one size fits all’ approach to the implementation of evidence is not appropriate.

Currently, AMR is a global emergency needing urgent attention from all health-care providers. Nowbuth et al’s (2022) systematic review on AMR in Zambia reported a significantly high rate of resistant microorganisms in a range of clinical settings. Most of studies used were from Lusaka, while some Provinces yielded no AMR data. This is a cause for concern as a complete understanding of the overall status in the country is essential develop appropriate and effective policies for practice. Only when LICs have effective strategies for

surveillance will the situation Murray et al (2019) found that AMR is a leading cause of death globally, with the highest burden in low-resource settings be addressed. AMR continues to rise rapidly and there is an urgent need to highlight the need for AMS strategies to suit local settings. The lack of documentation and regulation of antimicrobial treatment limits the ability to combat this global burden. AMR stewardship interventions must have the ability to mitigate AMR as well as improve patient outcomes (Satterfield, 2020).

AMR stewardship consists of coordinated evidence-based interventions formulated to enhance governance in the use of antibiotics (WHO, 2023). In sepsis management, these include use of empirical therapy according to guidelines, de-escalation of therapy, switching from intravenous to oral treatment. Therapeutic drug monitoring, use of restricted antibiotics and use of bedside consultations to significantly improve clinical decision making to reduce complications and costs. However, antimicrobial treatment is misused because compliance is variable due to families having to purchase medications, a belief that antimicrobials cure everything (WHO, 2023). As a result, healthcare professionals often argue that they should be given prophylactically e.g. all ventilated patients need antibiotics, a myth that needs to be dispelled.

Critical Care Units see large numbers of patients with sepsis, and it is crucial that blood cultures are taken prior to antimicrobial administration, then broad spectrum antibiotics are often prescribed and continued until the sensitivities are identified. Critically ill patients often require multiple antimicrobial regimens and there is increasing evidence of AMR, it is therefore essential that AMS is implemented across disciplines and departments providing all levels of healthcare. However, with limited laboratory services in LICs to collect and analyse microbiology data, a situation compounded by health systems with inadequate infrastructure and human resource to address the AMR (Asiimwe et al., 2021). However, to combat the rising AMR and incorrect / overuse of antimicrobials requires a comprehensive strategic oversight, which includes AMS guidelines, a dedicated multidisciplinary AMS team / committee, adequate diagnostic, human and IT resources (Mendelson et al, xxx). To maximise compliance with AMS it is essential that all staff correctly complete documentation and that hospital records are detailed. In this paper, antimicrobial prescribing and administration will be used to illustrate one-way critical care nurses can safeguard their patients and check that escalation and de-escalation of care are evidenced. As Mittal et al (2023) argues poor documentation and poor antimicrobial prescribing must be addressed. For effective AMS, dedicated multi-disciplinary prescription charts have been shown to improve compliance in practice (Mittal et al., 2023). However, underutilisation of AMS prescription charts is a missed opportunity to address the rising AMR by embedding AMS into all patients care and promote multidisciplinary working. Therefore, an example of an AMS prescription chart is given in figure 1.



UNIVERSITY TEACHING HOSPITAL

Antimicrobial Prescription Chart

University Teaching Hospital

Ministry of Health

Patient Name | Age | Male | Female | eGFR | Weight | Ward | Antibiotic Allergies (Include reaction)

Infection Diagnosis: Bone/Joint | Pneumonia | UTI | Meningitis | Bacteremia | Cellulitis | Intra-abdominal Infection | Other

Source* Community acquired | Hospital acquired

Indication: P=Prophylactic E=Emperical D=Definitive

SEND APPROPRIATE CULTURES BEFORE PRESCRIBING ANTIBIOTICS

Cultures: Sent before antibiotics | Sent after antibiotics | Not Sent

*CA=Community acquired: within <48h of admission

*HA=Hospital acquired:>48h from admission, transfer or recent discharge

Days 1 2 3 4 5 6 7 8 9 10 | Amount Dispensed | Pharmacist | Date

Date / Time

Indication P / E / D | Antimicrobial Name | Dose | Route | Start Date / Time | Duration | Frequency | Prescriber Name, number and signature | Contact

Review | Review | Review

Nursing code: 1. Patient away from ward 2. Nil by month 3. Patient refused drug 4. Drug not yet obtained 5. Patient could not receive drug e.g. vomiting 6. Drug not available

Antibiotic Stewardship Team Review:

Figure 1: Example Antimicrobial Prescription Chart

While doctors may prescribe the antimicrobials, it is critical care nurses who administer antimicrobials and therefore must take the responsibility for accurate and complete documentation. They are also in a prime position to initiate reviews based on patient records and results (Mula et al., 2019). Therefore, the advantages of using a dedicated AMS prescription chart includes continuing across the patient journey, which will annotate appropriate antimicrobials to be used, it also, prevents prolonged used as each drug needs to be reviewed every 7 days. The regular review prevents waste of scare resources, particularly as some antimicrobials are expensive. This also, prompts practitioners to review, change, stop and think about the organism as it indicates to clinicians when repeat cultures are due again minimising extended overuse of antimicrobials. In the fight to prevent rising AMR such tracking enables hospitals to review antimicrobials used and adjust AMS prescribing guidelines accordingly.

The Surviving Sepsis Campaign (Society of Critical Care Medicine, 2021) recommends empirical antibiotic therapy for sepsis and septic shock, are in contrast to AMR policies, which aim to use targeted antibiotics and reduce overall patient exposure to antimicrobials (WHO, 2023)**.** Clinicians should consider the indications of broad-spectrum antibiotics administration as well as the strategies for reducing antimicrobial use, which includes de-escalation and stopping when no longer required. ICUs are clinical settings in which AMR is commonly found, in consequence, it is crucial that AMS strategies are implemented, and compliance is measured. The use of dedicated antimicrobial prescription charts is one way to improve and assess the effectiveness of AMS strategies as well improve patient care.

In conclusion, this paper has demonstrated the urgent for the design and implementation of AMS strategies to protect current patients and reduce rising AMR. With ICUs often admitting patients with sepsis who require antimicrobials, critical care nurses are in the unique position of leading the multi-disciplinary team to only use antimicrobials when needed and to de-escalate the use of broad-spectrum antimicrobials when no longer needed. The use of a standardised antimicrobial prescription chart and regimen which is used by doctors, pharmacists and nurses provide a conduit for shared professional decision making. However, to do this, critical care nurses need the knowledge and clinical decision-making skills to understand when to use antimicrobials and when they are no longer needed.

References

Ackers, L., Ackers-Johnson, G., Seekles, M., Odur, J. and Opio, S., (2020). Opportunities and challenges for improving anti-microbial stewardship in low-and middle-income countries; lessons learnt from the maternal sepsis intervention in Western Uganda. *Antibiotics.* 9(6): pp 315. doi: 10.3390/antibiotics9060315.

Andrews, B., Muchemwa. L., Kelly, P., Lakhi, S., Heimburger, DC., Bernard, GR. (2014) Simplified severe sepsis protocol: a randomized controlled trial of modified early goal-directed therapy in Zambia. *Crit Care Med*. 42(11): pp 2315-24. doi: 10.1097/CCM.0000000000000541..

Asiimwe, BB., Kiiru, J., Mshana, SE., et al. (2021). Protocol for an interdisciplinary cross-sectional study investigating the social, biological and community-level drivers of antimicrobial resistance (AMR): Holistic Approach to Unravel Antibacterial Resistance in East Africa (HATUA). *BMJ Open.* 11: e041418. doi:10.1136/bmjopen-2020-041418

Evans, L., Rhodes, A., Alhazzani, W., Antonelli, M., Coopersmith, C.M., French, C., Machado, F.R., Mcintyre, L., Ostermann, M., Prescott, H.C. and Schorr, C. (2021). Surviving sepsis campaign: international guidelines for management of sepsis and septic shock. *Critical Care Med.* 49(11): e1063-e1143.

Hijazi, K., Joshi, C. and Gould, I.M., (2019). Challenges and opportunities for antimicrobial stewardship in resource-rich and resource-limited countries. *Expert Review of Anti-infective Therapy*. 17(8): pp621-634. doi: 10.1080/14787210.2019.1640602

Mendelson, M., Morris, AM., Thursky, K., Pulcini, C. (2020). How to start an antimicrobial stewardship programme in a hospital. *Clin Microbiol Infect.* 26(4): pp447-453. doi: 10.1016/j.cmi.2019.08.007.

Mittal, N., Deswal, H., Mittal, R., Sharma, S. and Kaushik, P., (2023). An educational program on antimicrobial resistance and stewardship for staff nurses in a public tertiary care hospital in India. *Infection, Disease & Health*. 28(3): pp 202-210.

Mula, CT., Vernon. S., Muula. AS. (2019). The examination of nurses' adherence to the 'five rights' of antibiotic administration and factors influencing their practices: a mixed methods case study at a tertiary hospital, Malawi. *Malawi Medical Journal.* 31(2): pp 126-132

Murray, CJL et al. (2019). Global burden of bacterial antimicrobial resistance in 2019: a systematic analysis. *Lancet*. 399(10325): pp 629 - 655

Nowbuth, A.A., Asombang, A.W., Tazinkeng, N.N., Makinde, O.Y. and Sheets, L.R., 2023. Antimicrobial resistance from a One Health perspective in Zambia: a systematic review. *Antimicrobial Resistance & Infection Control*. 12(1): pp 15.

National Institute for Health and Care Excellence. (2024). Suspected sepsis: recognition, diagnosis and early management. NICE guideline 51. www.nice.org.uk

Ranjit, S. and Kissoon, N. (2021). Challenges and solutions in translating sepsis guidelines into practice in resource-limited settings. *Translational Pediatrics*. 10(10): pp 2646.

Satterfield, J., Miesner, A.R. and Percival, K.M., 2020. The role of education in antimicrobial stewardship. *Journal of Hospital Infection.* 105(2): pp 130-141.

Schultz, M.J., Dünser, M.W., Dondorp, A.M., Adhikari, N.K., Iyer, S., Kwizera, A., Lubell, Y., Papali, A., Pisani, L., Riviello, E.D. and Angus, D.C., 2019. Current challenges in the management of sepsis in ICUs in resource-poor settings and suggestions for the future. Sepsis management in resource-limited settings. Spinger.

Society of Intensive Care Medicine. (2021). Surviving Sepsis Campaign Guidelines 2021. https://www.sccm.org/Clinical-Resources/Guidelines/Guidelines/Surviving-Sepsis-Guidelines-2021

Sole, M.L., Klein, D.G. and Moseley, M.J., 2020. Introduction to Critical Care Nursing E-Book: Introduction to Critical Care Nursing E-Book. Elsevier Health Sciences.

World Health Organization. (2017). Zambia: Multi-Sectoral National Action Plan on Antimicrobial Resistance 2017-2027. www.who.int

World Health Organization. (2023). Antimicrobial resistance. www.who.int

World Health Organization. (2024). Sepsis. www.who.int

Lessons from Practice: Ventilator Waveforms

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This case study is about patient X, aged 10-year-old female, with bodyweight of 25kg, who was admitted in the intensive care unit? ward with a history of large atrial septal defect (ASD) and Cor–triatriatum sinistrum (CTS) since birth. ASD is one of the most common types of congenital heart defects occurring in about 25% in children (Gloan et al., 2018). CTS is a condition in which a thin fibro muscular membrane is subdividing either left or right atrium into 3 chambers (Bacco et al., 2022), patient x had the membrane in the Left Atrium. In contrast ASD is a hole in the heart between the upper chamber's atria of the heart, the hole increases the amount of blood that flows through the lungs causing shortness of breath, fatigue, swelling of legs, heart palpitations (Alkashkari et al., 2020). This aligns with pre-operative clinical presentations of patient X presented in the hospital. However patient X had a large ASD that led to surgical intervention of ASD closure which was done on 30th /11/2023. Patch closure of the large ASD and resection of the membrane that was dividing the LA was done.

During the cardiac surgery, Patient X was intubated with a size 6mm and was sedated with propofol 13ml / hour (Dose formulation 10mg/ml) which causes respiratory depression. According to Choudhury et al 2017, Intubation helps maintain a definitive airway for the safe conduct of cardio pulmonary bypass, enhances adequate oxygen supply and allows adequate ventilation while the surgical team works on repairing the heart defect .In addition to that Patient X was put on Pressure controlled ventilation –Volume guaranteed (PCV-VG), this is a controlled ventilation mode combining the advantages of volume control and clinical benefits of pressure control ventilation (Li et al .,2020).

In contrast, volume control ventilation was not used because it delivers a preset tidal volume with constant flow during preset inspiratory time and may cause high peak pressures and that's expose patient to risk of barotrauma (Schick et al., 2021). As such in paediatric patient like patient x they have small airways and small-bore ET tubes, this may cause high airway resistance because gas distribution in the lungs may not be optimal during VCV (Rocha et al., 2021). In spite of that with uncuffed ET tubes with constant flow and high inspiratory pressures may cause airway leaks leading to poor oxygenation to the patient. As such PCV-VG was opted to control the risk factor, optimize good ventilation and oxygenation and compensate for any changes in Patient's x compliance, with consistent tidal volumes to patient x.

Ventilator waveform /Ventilator settings

Patient x had a normal ventilator wave form. In PCV -VG a preset tidal volume is delivered with lowest possible pressure using a decelerating flow (Li et al., 2020).

The first breath delivered to Patient x is a volume –controlled breath, which is visible on the screen short with a square flow waveform and shark fin pressure wave form for the very first breath. According to Liu et al., 2021 patient's compliance is determined from this volume breath and the inspiratory pressure level it is then established for the subsequent PCV-VG breaths, which are characterized by a decelerating wave form and square pressure waveform. As such, patient x had a normal wave form with adequate set pressure, flow and volume with decelerating flow waveform and consistent tidal volume providing good oxygenation and ventilation (with end tidal carbon dioxide of 37 which is normal because normal C02 ranges from 35 to 45) to patient x at a lower peak inspiratory pressure compared to VCV. Lastly, according to Boules et al., 2012 reported that any dramatic change like spikes on pressure wave form or fluctuations on flow or tidal volume

like in Patient X would indicate that has airway resistance, poor compliance with low peak inspiratory and expiratory pressures, not adequate flow and a need to increase tidal volume or PEEP or respiratory rate to maximize oxygenation. Figure 1 shows the ventilator set parameters for patient X to help maximize oxygenation.

Figure 1: Ventilator Settings

Parameter	Set	Rationale
Mode	Patient X was put on PCV-VG	Patient X undergoing cardiac surgery with Cardiopulmonary bypass which can result in shortfall in oxygen delivery relative to demand (Wang et al., 2021). Hence this mode was preferred because it helps deliver a constant desired tidal volume in a decelerating pattern, promoting consistent ventilation and better oxygenation, reducing the risk volutrauma or hypoventilation, as shown on the above waveform.
PEEP	5	Patient had undergone CPB for 3hours/50 minutes which interrupts normal pulmonary circulation that can cause Lung collapse (Tanner et al., 2020). As such patient x was put with PEEP of 5 to help maintain positive pressure in the lungs at the end of each breath, preventing alveolar collapse during expiration and improve oxygen exchange and lung compliance.
TIDAL VOLUME	200	Patient x weighs 25kgs and the set tidal volume was adequate to achieve sufficient ventilation (6-8mls/ kg).
RESPIRATORY RATE	18	Patient x RR was set at 18 to achieve an appropriate balance between providing adequate ventilation and preventing respiratory alkalosis or acidosis. However, Patient had respiratory alkalosis which can lead to vasoconstriction reducing blood flow to vital organs leading to hypoxia (PH-7.54, pc02 23.3, HC03 22), hence RR was reduced to 16 (after 1 hour PH 7.37, Pco2 39.4, p02 92 & HC03 22.9)
PRESSURE MAX (Pmax)	30	Maximum pressure was set in patient x, to avoid excessive pressure to small alveoli limiting barotrauma/lung injury

Conclusion

PCV-VG is the preferred mode post cardiac surgery because it allows control over airway pressures and volume minimizing the risk of volutrauma and barotrauma like in patient X while providing effective ventilation, with a normal waveform.

References

Alkashkari, W., Albugami, S. and Hijazi, Z.M. (2020) 'Expert Review of Cardiovascular Therapy Current practice in atrial septal defect occlusion in children and adults', *Expert Review of Cardiovascular Therapy*, 00(00), pp. 1–15. Available at: https://doi.org/10.1080/14779072.2020.1767595.

Bacco, L., Dalonzo, M., Repossin, A., Zannin, F., Muneretto, C. and Benussi, S. (2022)' Treatment of non-restrictive Cor-triatriatum sinister during Concomitant Cardiac Surgery,' *The Cardiothoracic Surgeon*, 30(15), pp 1-5.

Boules, N. and Ghobrial, H, H. (2012),' Efficiency of the newly introduced Ventilator mode Pressure controlled Ventilation –Volume Guaranteed in thoracic surgery with one lung ventilation,' *Journal of Anaesthesia,* 27(11), pp 113-1119.

Choudhury, A., Gupta, N., Magoon, R. and Malhotra. (2017) 'Airway management of the cardiac surgical patients: Current perspective', *Annals of Cardiac Anaesthesia*, pp. S26–S35. Available at: https://doi.org/10.4103/0971-9784.197794.

Gloan, L., Legendre, A., Iserin, L. and Ladouceur, M. (2018),' Pathophysiology and Natural History of Atrial Septal Defect,' *Journal of Thoracic Disease,'* 10(24), pp 1-9

Rocha, A., Habre, W. and Albu, G. (2022) 'Novel ventilation techniques in children', *Journal of Anaesthesia*, pp. 286–294. Available at: https://doi.org/10.1111/pan.14344.

Tanner, T. and Mai, T. (2020) 'Pulmonary Complications of Cardiac Surgery', *Lung*, 198(6), pp. 889–896. Available at: https://doi.org/10.1007/s00408-020-00405-7.

Li, J., Cai, B., Yu, D., Liu, M., Wu, X. and Rong, J. (2020) 'Pressure-Controlled Ventilation-Volume Guaranteed Mode Combined with an Open-Lung Approach Improves Lung Mechanics, Oxygenation Parameters, and the Inflammatory Response during One-Lung Ventilation*: A Randomized Controlled Trial*', 2020.

Liu, H., Cao, Y., Zhang, L., Liu, X. and Gu, E. (2021) 'Pressure-Controlled Volume-Guaranteed Ventilation Improves Respiratory Dynamics in Paediatric Patients during Laparoscopic Surgery: *A Prospective Randomized Controlled Trial*', pp. 2721–2728.

Schick, V., Dusse, F., Eckardt, R., Kerkhoff, S., Commotion, S., Hinkelbein, J., Mathes, A. (2021) 'Comparison of Volume-Guaranteed or -Targeted, Pressure-Controlled Ventilation with Volume-Controlled Ventilation during Elective Surgery: A Systematic Review and Meta-Analysis', (Vcv),12 (1), PP, 1-4.

Wang, Y., Wei, Y., Chen, X., Zhang, L., Zhou, M. and Wang, J. (2021) 'Comparison between pressure-controlled ventilation with volume-guaranteed mode and volume-controlled mode in one-lung ventilation in infants undergoing video-assisted thoracoscopic surgery', *Journal of Anaesthesia*,'10(10), pp. 2514–2520. Available at: https://doi.org/10.21037/tp-21-421

Selected Abstracts from Critical Care Nurses Association of Zambia (CCNAZ) 2nd Scientific Conference

The 2nd Critical Care Nurses Association of Zambia (CCNAZ) scientific conference was held in Livingstone, Southern Province from 25th – 27th June 2024. The theme of the conference was the essential role of critical care nurses in the achievement of universal health coverage (UHC). It is internationally recognised that critical care services need to be integrated into healthcare systems if UHC is to be achieved. Improving care to critically ill patients in clinics, emergency departments, wards, and intensive care units, should increase survival rates and reduce the risk of complications. This increases the possibility of patients returning to their families and communities, to contribute to the economy, thereby improving the overall health of communities and protecting future generations.

Critical care nurses are the backbone of all healthcare systems, providing expert care to patients during their most vulnerable moments. Their dedication, knowledge, and compassion enhance the level of care, regardless of individuals background or circumstances. This conference, will discuss, debate, and demonstrate the importance of recognising and integrating critical care nurses into healthcare systems to improve patient outcomes and also for advance the goal of UHC.

During the conference a range of speakers talked about the advances that have taken place in critical care units. Concurrently, to this a team developed a national orientation training package for Registered Nurses working in critical care units.

Next year the conference will be held in Ndola, Copperbelt Province and we look forward to seeing you there.

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Strategies in Decreasing Medication Administration Errors

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Introduction: Medication administration errors (MAE) are those that actually reach patients and remain a threat to patient's safety (Hua-fe Wang et al 2015). The cost of medication errors was estimated at 2 billion Euros in one of the countries (representing 3% of the total national healthcare expenditure) (WHO European Region 2022). Henceforth the need for decreased MAE to patients.

Aim: To assess the effect of interventions designed to reduce MAE

Method: Systematic review using PUBMED electronic database which retrieved 12 journals from 2014 to 2024. Keywords used interventions, medication errors, nursing.

Findings: The rate of medication errors in critical care units is higher than that inpatient wards because of patients with complex diseases and rapidly changing physiology, higher number of intravenous medication and higher staff workloads. MAE is under reported, and most studies are inconclusive as needs direct observation.

Conclusion: Decreasing MAE is a multi-disciplinary approach which needs efforts of all health care workers, however there are strategies to reduce medication errors including following 5 rights, verification of medication during transfers, follow up clarity with the prescriber, clear labelling of drugs, documentation and proper storage of drugs. There should be ongoing of training nurses on medication error and be encouraged in transparent reporting.

References:

Wang, H., Jin, J., Feng, X., Huang, X., Zhu, L., Zhao, X., Zhou, Q. (2015). Quality improvements in decreasing medication administration errors made by nursing staff in an academic medical centre hospital. D*ove Medical Press*. 11, pp. 393- 406 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4354453/

Keers, RN., Williams, SD., Cooke, J., Walsh, T., Ashcroft, DM. (2014). Impact of interventions designed to reduce Medication Administration Errors in Hospitals: A Systematic Review. *Drug Saf.* 37(5):317-32. doi: 10.1007/s40264-014-0152-0.

World Health Organization. (2022). Key facts about medication errors (MEs) in the WHO European Region. https://cdn.who.int/media/docs/librariesprovider2/country-sites/medication-error-wpsd-final.pdf?sfvrsn=e5853e2a_1&download=true

Sepsis Prevention Using Ventilator Care Bundles in the ICU

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Overview and Background: Worldwide, sepsis continues to be the primary cause of mortality and morbidity in intensive care units (ICUs); this is particularly evident to patients on mechanical ventilation. Sepsis cases are estimated to be 19.5% worldwide, with 30% of patients in the ICU. Between 2008 and 2009 Malawi recorded a 22% mortality rate using the Systemic Inflammatory Response (SIRS) criteria, while sepsis accounted for 27% of hospital deaths. Since sepsis is frequently caused by ventilator-associated infections, preventive measures need to be prioritised. Ventilator Care bundles which are Set of evidence-based practices are recommended to reduce these infections and enhance patient outcomes.

Aim: To evaluate the effectiveness of ventilator care bundles on the prevention of sepsis in mechanically ventilated patients in the ICU

Method: A systematic review using PubMed and CIHNAL databases, with the following keywords: ventilator care bundles, sepsis prevention, mechanically ventilated patients, ICU encompassing literature published between 2019 and 2024.

Results: Sepsis incidence in patients on mechanical ventilation is significantly reduced when ventilator care bundles are implemented. Further, a higher reduction in sepsis rates is associated with a high level of adherence to bundle components, particularly head of bed elevation and oral care using chlorhexidine.

Discussion: It is evident that ventilator care bundles are recommended for sepsis prevention in the ICU and that adherence to them is necessary to get the best results. Future research should focus on enhancing consistency and efficacy across ICU settings.

References

Hamilton, S., Jenning, A., Foster, A. (2020) Development and Evaluation of a Quality Improvement Framework for Healthcare. *International Journal for Quality in Health Care.* 32(7): pp456-403.doi.org/10.1093/intqhc/mzaa075

Kayambankadzanja, R.K., Schell, C., Namboya, F., Phiri, T., Katha, G., Mndolo, S., Bauleni, A., Castegren, M., Baker T. (2020) The Prevalence and Outcomes of Sepsis in Adult Patients in Two Hospital in Malawi. A*merican Journal of Tropical Medicine & Hygiene*. 102(4): pp 986-901. Doi:10.4269/astmh.19-0320

Rudd, K.E., Johnson, S.C., Agesa, K.M., Shackleford, K.A., Tsoi, D., & Kievlan, D.R. et al (2020) Global Regional and National Sepsis Incidence and Mortality 1990-2017 Analysis for The Global Burden of Disease Study. *Lancet*. 398 (10219), pp 200-211.

Enhancing Knowledge and Skills of ICU Nurses on Wound Care: A Quality Improvement Project at a Leading Referral Hospital in Zambia

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Introduction: Wounds are a global problem. On average, 70% of patients in ICU have surgical/trauma conditions. Previous hospital wound care audit has shown lack of consistency and aseptic technique is not followed during wound care. Survey identified infected wounds and prolonged wound recovery. Negative Pressure Wound Therapy (NPWT) is new concept.

Aims:

1. To enhance knowledge and skill among ICU nurses regarding wound care
2. To prevent infection and promote recovery.

Method: Plan-Do-Study-Act (PDSA) model was used to implement the project. Planning included observations on wound care practices and identification of gaps requiring attention. Then a detailed plan was made on how to implement the project. The 'Do' part involved developing and delivering a training package on wound care. 10 RCCN attended training and included pre and post training tests. Also, during the study period, patients requiring NPWT were identified using an inter-disciplinary team approach, whereby patients' wounds were assessed and NPWT commenced where appropriate.

The study element included analysing and presenting the results from the training to the ICU team. The final stage (Act) involved making recommendations, which included further training, the need for RCCNs to be trained in complex wound assessment and management.

Results / Findings: Results of the tests administered during training are being analysed and will be compared with those of the last post test results to determine impact. However, confidence levels had increase from only 15% of nurses being confident before training to 95% post training.

11 patients requiring NPWT were identified, with 3 patients still on treatment at the current time. Out of the 11 patients, there have been 8 positive outcomes and 3 mortalities. Patients that died were due to other co-morbidities or complications due to critical illness including such as pulmonary embolism.

Discussion / Conclusion: Enhancing knowledge and skill of RCCNs on complex wound care through use of NPWT is essential as an effective means of managing wounds on the unit. The use of NPWT reduced dressing changes and optimises wound bed preparation, exudate, management and infection control and contributed to eventual wound closure.

References

Phan, T.D., Le, T.T., Ha, H.T. (2020) Nurses' knowledge, practice, and confidence after the training program on wound care at the agriculture general hospital in Vietnam. *Open Journal of Nursing*.10(06):646–656.

Pirani, S. (2020) Implementation of a wound care education project to improve the wound care competency among psychiatric nurses: A quality improvement project and feasibility study. *J Psychiatry Ment Health Nurse*. 27, pp. 709–717.

Family-Witnessed Resuscitation in the Emergency Department in a Low-Income Country

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Background: Cardiac arrest is often a sudden and traumatic event. Family-witnessed resuscitation was first recommended by the American Heart Association over two decades ago. Since then, several global professional bodies have identified a range of potential benefits for relatives; however, it remains contentious. For nurses working in emergency departments (EDs) in low-income countries, the evidence for and experience of family-witnessed resuscitation is limited. This article critically appraises the literature relating to the perceptions of medical professionals and critically ill patients with their families about communication, family presence and their involvement during resuscitation in the ED.

Aim: To explore and appraise literature delineating the perceptions of medical professionals and families about their presence and involvement during resuscitation in the ED.

Method: Focused literature search; A literature search was conducted using Medline, PubMed, CINAHL, and the Cochrane Library. The initial search identified 51 articles, of which 34 met the inclusion criteria.

Results: Three themes relating to family-witnessed resuscitation in the ED were identified by a focused literature search. These were: leadership and communication, limitation of policies and guidelines and relatives' views.

Discussion / Conclusion: Outcome of resuscitation varies due to differences in emergency care organisation, quality, availability, and allocation of resource. The recommendations from this review will be used to develop emergency and trauma nursing practice guidelines in Zambia, a low-income country in sub-Saharan Africa.

References

Bossaert, L.L., Perkins, G.C., Askitopoulou, H., et al. (2015). Resuscitation and End-of-life Decisions Section Collaborators. European Resuscitation Council guidelines for resuscitation 2015: Section 11. The ethics of resuscitation and end-of-life decisions. *Resuscitation.* 95: pp302–311. https://doi.org/10.1016/j.resuscitation.2015.07.033

Carter, C., Notter, J. (2023). Evaluation of an international health partnership to capacity build emergency, trauma and critical care nurse education and practice in Zambia: an experience from the field. *Int Nurs Rev*. 70(3): pp266–272. https://doi.org/10.1111/inr.12813

Assessing The Nurse's Knowledge on the Use of Linet Critical Care Beds and the Relationship with the Occurrence of Low Back Pain

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Background: This was a small-scale exploratory study of 36 nurses working in a Critical Care Unit (CCU) at a tertiary hospital in Zambia. Low Back Pain (LBP) is an emerging public health problem affecting nurses worldwide and one of the leading causes of work-related absenteeism and disability. Globally it is estimated that approximately 619 million people are affected with LBP, with a projected prevalence of 843 million cases by 2050 (Muhammed., et al., 2019).

Aim: The study assessed the nurse's knowledge on the use of Linet fully motorized beds and the relationship with the occurrence of Low Back Pain (LBP).

Method: A self-administered structured questionnaire was developed. Sections included:

- Knowledge and confidence levels of nurses regarding the use of Linet beds.
- Musculoskeletal pain amongst respondents.

Results/Findings: 25 (69%) reported some form of musculoskeletal pain or damage, with LBP being the most prevalent. Overall using the Linet bed was deemed as improving injuries, time management, patient safety, positioning, ventilator care and chest care. However, it was cause for concern, that respondents had positive feedback, in practice the effect use was variable.

Discussion/Conclusion: We found that the prevalence of musculoskeletal injuries in nurses working in ICU was high. Use of critical care profiling beds can improve care and working conditions including health and safety for nurses in practice. However, the beds need to be effectively used, and adequate training needs to be given on an ongoing basis and in the induction of all new staff.

References:

Mekonnen, T.H. (2019). Work-Related Factors Associated with Low Back Pain Among Nurse Professionals in East and West Wollega Zones, Western Ethiopia, 2017: A Cross-Sectional Study. *Pain Ther.* 8(2): 239-247. DOI: 10.1007/s40122-019-0129-x

Use of Oxygen Therapy in Clinical Practice: Evaluation Following the National Train the Trainer Workshops

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Background: Oxygen is classed as an essential drug by the World Health Organisation (WHO); however, the incorrect use of oxygen can cause harm and unnecessary loss of life (WHO, 2023). Oxygen therapy is an essential component of patient care (WHO, 2023). Advances in healthcare and the increasing complexity in patient needs, has meant nurses are expected to provide higher levels of care to acutely ill patients on wards. In consequence, oxygen therapy (also termed supplementary oxygen) is now used in clinical settings to treat a range of conditions, for example, pneumonia, Covid-19 (WHO, 2021). Therefore, nurses must have the knowledge and skills to safely administer oxygen and monitor the outcomes of interventions.

Aim: To evaluate the national train the trainer's workshop

Results: 76 participants were selected and completed the train the trainers' workshop from 19 hospitals. Of these, 17 (22%) were registered critical care nurses. The main themes that emerged included more information on specific conditions e.g. CVA, post-operative cases, more emergency skills, including airway procedures and suctioning and for many more information on how to care for children and neonates requiring oxygen.

The Ministry of Health recognised the importance of this project and requested that all participants take the training back to their hospitals and cascade the information with others. This was seen as an inexpensive and a way of rapid dissemination. A total of 672 healthcare workers completed the cascade training within hospitals.

Conclusion: Overall, this project achieved much more than was expected, with all participants undertaking cascade training within their hospitals. For many of the nurses who are 'patient facing' this was the first time they had had the opportunity to attend a national training workshop with peers. It has also given them the chance to form their own networks and community of practice. For registered critical care nurses, it was an opportunity to position themselves and be recognised as the experts that they are. The training materials will be incorporated into the national orientation training package for Registered Nurses and a formal evaluation is underway.

References

O'Driscoll, B.R., Howard. L.S., Earis. J., et al. (2017). British Thoracic Society Guideline for oxygen use in adults in healthcare and emergency settings. *BMJ Open Resp Res*. 4: e000170.

Peterson, M.E., Mattingly, A.S., Merrell, S.B., Asnake, B.M., Ahmed, I., Weiser, T.G. (2022). Pulse oximeter provision and training of non-physician anaesthetists in Zambia: a qualitative study exploring perioperative care after training. *BMC Health Serv Res.* 22(1):1395.

World Health Organization. (2023). Oxygen. https://www.who.int/health-topics/oxygen#tab=tab_1

Effective and Simple Interventions to Improve Outcomes for Pre-Term Infants Worldwide: The Figo Prem Prep-5 Initiative

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Introduction: WHO defines preterm as a baby born after 24 weeks but before 37 weeks completed gestation age. In Low-income countries, pre terms are. 80% of these pre-terms are born in Low Income countries with low resources as compared to High Income Countries and suffer from complications of prematurity which includes intraventricular haemorrhage, necrotising enterocolitis, chronic lung disease, developmental delays and cerebral palsy.

Methods: A Systematic Review of 43 articles from PubMed and Cochrane conducted for High Income Countries (HIC) on implementation of FIGO (The International Federation of Gynaecology and Obstetrics) Prem prep-5 on preterm through administration of ante natal steroids and intra partum magnesium sulphate, At delivery, delayed cord clamping. Postnatally early feeding with breast milk and Kangaroo care.

Results: Delayed cord clamping Showed a reduction in neonatal deaths (adjusted RR 0.73, 95% CI.54-0.98) and if done for 45 seconds or more showed decreased need for vasoactive drugs (RR 0.21, 95% CI 0.07-0.59) reduced incidence of anaemia before age of 12 months and improvement in developmental outcomes aged up to 4 years. Training of ward nurses and midwives increase the average time for cord clamping from 13 -62 seconds

Breast milk fed within an hour of delivery showed a reduction in feed intolerance, late onset sepsis, retinopathy of prematurity, necrotizing enterocolitis and improved neurological outcomes. Donor milk can be given, however, there are concerns with dietary and immune values which may not match exactly if it has been expressed at a different gestation age different from that baby and has been through storage processes. Enhanced bonding with mother was also seen.

Antenatal corticosteroids such as dexamethasone in high- risk pregnancy <34 weeks such as in eclampsia showed a reduction in respiratory distress**.** Magnesium Sulphate 4g IM then 1g infusion given in active preterm labour before 34 weeks gestation showed a reduction in cerebral palsy and respiratory distress. Continuous Skin to skin care for at least 8 hours per day for warmth, improves cardiac stability (heart rate and respiratory rate) and reduces mortality by 30% and postnatal depression

Discussion: Consideration for LICs, WHO and UNICEF have established program to promote breast feeding such as Baby Friendly Hospital Initiative (BFHI) for small and sick neonates. Though LICs have a higher rate of breast feeding, only 37 % breastfeed exclusively for 6 months. Health care providers are required to work towards preventing aggressive promotion of breast milk substitutes promoted by international code of marketing of breast milk substitutes and consideration of Acceptable, Feasible, Affordable, Sustainable, Safe (AFASS) However, complex interventions such as caffeine citrate admiration, CPAP or mechanical ventilation should be offered wherever available.

Conclusion & Recommendations: Prematurity remains a global contributing factor to neonatal mortality rate. Therefore, low-cost preparation care bundles recommended for care of preterm neonates are feasible. There is access to cheap heat stable drugs that are listed on the WHO s Essential medicines formulary, the other three interventions require no drugs or additional medical equipment and can be implemented with minimal resources.

References

Hall, M., Valencia, C., Soma-Pillay, P., Luyt, K., Jacobson, B., Shennan, A. (2024) Effective and simple interventions to improve outcomes for preterm infants worldwide: The FIGO PremPrep-5 initiative. International journal of Gynaecology and Obstetrics, 165(3), pp.929-935. https://doi.org/10.1002/ijgo.15269

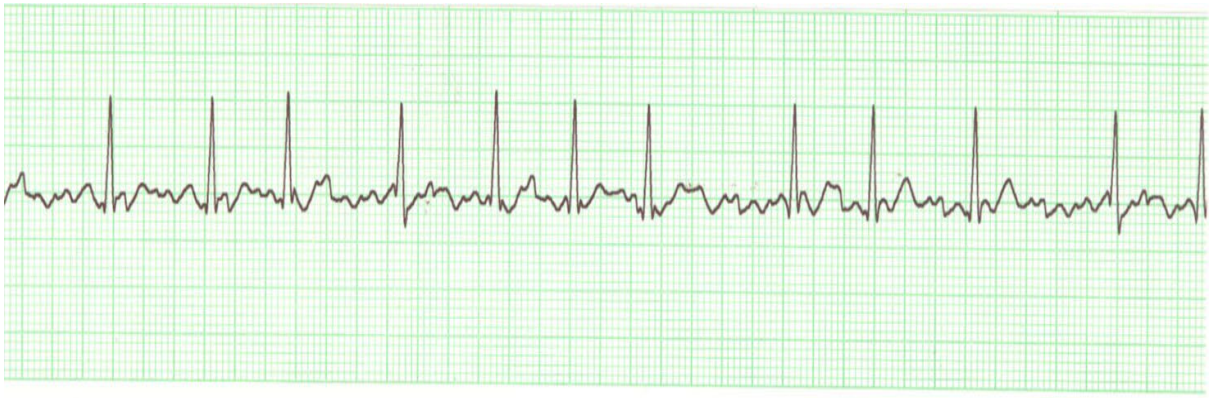
UNICEF The Baby Friendly Initiative (2024) Skin-to-Skin contact. Available at: Skin-to-skin contact - Baby Friendly Initiative (unicef.org.uk)

World Health Organisation. (2023) Born too soon, decade of action on preterm births. Available at: http://www.who.int/publications/item/97889240073890

Electrocardiogram Quiz

Mr Phiri is a 55-year-old male, who has been admitted to the intensive care unit with septic shock due to community-acquired pneumonia. He has a past medical history of poorly controlled hypertension and Type 2 Diabetes. On admission to ICU, he was intubated and ventilated, has a fever (39ºC), hypotension (BP 85/55 mmHg), tachycardia (HR 120 bpm), and altered mental status. Initial treatment included broad-spectrum antibiotics, aggressive fluid resuscitation, and vasopressor support to maintain perfusion.

On day 2 of the ICU stay, while still requiring vasopressors and mechanical ventilation, the patient's heart rate and rhythm changed and has become hemodynamically unstable, with systolic blood pressure dropping to 75 mmHg. The cardiac rhythm is as follows:



What is the cardiac rhythm?

What is the cardiac rate?

Describe the rhythm.

What is the expected nursing management?

Electrocardiogram Quiz Answers

What is the Rhythm? Atrial Fibrillation (AF) (acute onset)

Describe the rhythm: AF is a characterised as an irregular and often rapid heart rhythm. It can be acute or chronic. In this case, it is an acute onset AF which is the most common arrhythmia affecting critically unwell patients, particularly those with septic shock. It can lead to worsening haemodynamic instability, heart failure, thromboembolic events e.g. stroke, and increased mortality (Johnston et al., 2022). Key Characteristics:

- Irregular Heartbeat
- Tachycardia
- Risk of blood clot formation due to pooling of blood in the ventricles due to poor contractility.

What is the cardiac rate? 100 beats per minute

What is the expected nursing management?

A-E assessment to assess if the patient is hemodynamically stable or unstable. In this case the patient is unstable and requires immediate intervention. If not already commenced, continuous cardiac monitoring must be initiated, due to the risk of deterioration.

Call for expert help from a Physician Anaesthetist and Cardiologist.

Potential treatment of unstable AF includes:

- Emergency electrical cardioversion using a synchronized DC shock.
- Medications: In the absence of cardioversion, drugs like amiodarone (if available) or digoxin can help stabilize the rhythm.
- Once the patient is sable, the focus should be rate or rhythm control, managing any underlying condition, and preventing thromboembolism.

Rate Control:

- Beta-blockers (e.g., propranolol or metoprolol, if available) or calcium channel blockers (e.g., verapamil or diltiazem) are used to slow the heart rate.
- Digoxin can also be used, especially in patients with heart failure or when other medications are not available.

To prevention the risk of stroke, anticoagulant treatment is crucial but needs careful monitoring. These may include:

- Warfarin is commonly used but it requires frequent International Normalized Ratio (INR) monitoring.
- Aspirin: Low-dose aspirin is sometimes used, although it is less effective than proper anticoagulation.
- Direct Oral Anticoagulants (DOACs): Newer agents like rivaroxaban or apixaban are easier to manage (do not require INR monitoring), however, these drugs are expensive

Identify and treat the underlying cause e.g. infection, sepsis, electrolyte imbalances, hyperthyroidism.

References:

Bloe, C. (2022). ECG of the month. British Journal of Cardiac Nursing. 17(12): 1-1.

Johnston, B.W., Chean, C.S., Duarte, R., Hill, R., Blackwood, B., McAuley, D.F., Welters, I.D. (2022). Management of new onset atrial fibrillation in critically unwell adult patients: a systematic review and narrative synthesis. *Br J Anaesth*. 128(5): pp 759-771. doi:10.1016/j.bja.2021.11.016.