Critical Rounds

Vol 3 | Issue 36 | 2022

Critical Rounds Newsletter
VOL 3 | Issue 36 | 2022

Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you **"Critical Rounds Newsletter"** which contain latest and interesting news in the field of Critical Care .

This issue contains :

1. Oxygen Reserve Index's potential to identify hyperoxia in critically ill patients

2. COVID-19 vs. Non–COVID-19 Critical Illness Survivors: A 6-Month Comparison

3.Clinical endpoints and biomarkers of septic shock: A responsiveness to plasma exchange.

4.A case report on theophylline toxicity mimicking septic shock

free to contact us at medicalservices@microlabs.in
Looking forward to your valuable feedback

Best Regards,
Medical Team, Micro Labs Limited

Critical Rounds

Vol 3 | Issue 36 | 2022

1.Oxygen Reserve Index's potential to identify hyperoxia in critically ill patients

Introduction:

Oxygen Reserve Index(ORI) is a new non-invasive, continuous, and real-time parameter for measuring PaO2 levels in the range of 100 to 200 mmHg. It monitors oxygenation in real time and reveals a declining trend in PaO2, alerting doctors about changes in oxygenation status early.[1] In the critical care unit, hyperoxia is linked to increased morbidity and mortality. Traditional noninvasive oxygen saturation assessments using pulse oximeters are unable to identify hyperoxia. ORI is a continuous noninvasive measurement that can identify hyperoxia and is obtained using a multi-wave pulse oximeter.[2] This study's main objective was to see how accurate ORI was in detecting PaO2 > 100 mmHg. The capacity of ORI to identify PaO2 > 120 mmHg, the ability of SpO2 to detect PaO2 > 100 mmHg and PaO2 > 120 mmHg, and the link between ORI and PaO2 in the ICU were all secondary objectives.

The ability of Oxygen Reserve Index to diagnose hyperoxia is relatively low and that SpO2

Methods:

This was a single-center observational research in the neurological ICU. Patients required to be 18 years old, admitted to the medical-surgical neurological ICU, have arterial access, a pulse oximetry sensor on the patient's middle or index finger, connected to a Radical-7 pulse oximeter, and have a blood gas measurement every 6 hours according to the local procedure. For 3 days, data was gathered every 6 hours. The following information was collected: demographics, cause for ICU admission, Simplified Acute Physiology Score; ventilatory settings, neurological status data, hemodynamic data, and widely used medicines.

Results:

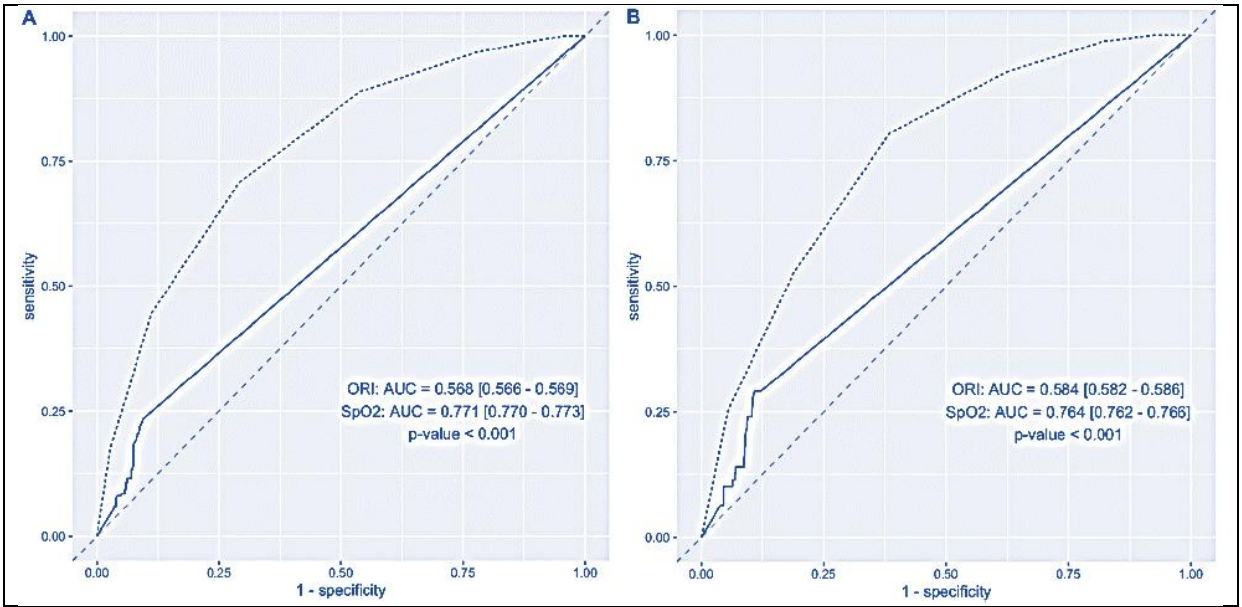
In 62 individuals, 696 ORI and PaO2 values were taken at the same time. The correlation between ORI and PaO2 was r= 0.13 when repeated measurements were taken. The area under the receiver operating characteristic curve (AUROC) for detecting PaO2 > 100 mmHg was 0.567 (95 % confidence interval = 0.566–0.569), with a sensitivity of 0.233 (95 percent CI = 0.230–0.235) and a specificity of 0.909 (95 % CI = 0.907–0.910). The AUROC score for detecting a PaO2 > 100 mmHg with SpO2 was 0.771 (95 % CI = 0.770–0.773), with a sensitivity of 0.715 (95 % CI = 0.712–0.718) and a specificity of 0.700 (95 % CI = 0.697–0.703). For identifying PaO2 > 120 mmHg, the diagnostic performance of ORI and SpO2 was AUROC = 0.584 (95 % CI = 0.582–0.586) and 0.764 (95% CI = 0.762–0.766), respectively. The AUROC for SpO2 was substantially greater than the AUROC for ORI (p 0.01). Sedation, norepinephrine infusion, arterial partial pressure of carbon dioxide, haemoglobin level, and perfusion index had no effect on diagnostic performance.

Discussion:

Critical Rounds
Vol 3 | Issue 36 | 2022

The findings of this study based on a large number of simultaneous PaO2 and ORI measurements in a neuro-ICU population, show that: I ORI's ability to detect hyperoxia

(defined as PaO2 > 100 mmHg or PaO2 > 120 mmHg) was low; (ii) SpO2's diagnostic performance for detecting hyperoxia was better than ORI's; and (iii) ORI and PaO2 were poorly correlated.[2] In the ICU, ORI has rarely been examined. The only study that looked at ORI in the ICU revealed that utilising an ORI-based approach reduced hyperoxia significantly. Patients with ORI monitoring were more likely to be ventilated with a FiO2 of 0.21 in this research, which likely achieved the main result. According to the findings of current investigation, ORI does not appear to be suitable for identifying hyperoxia in the ICU. Furthermore, there appear to be significant individual differences.[3]



Receiving operating characteristics (ROC) curves. A Abilites of Oxygen Reserve Index (ORI) and pulse oxyemtry (SpO2) to predict oxygen partial pressure (PaO2) > 100 mmHg. B Abilites of Oxygen Reserve Index (ORI) and pulse oxyemtry (SpO2) to predict oxygen partial pressure (PaO2) > 120 mmHg

Conclusion:

The findings indicate that ORI's ability to diagnose hyperoxia in a specific cohort of brain-injured patients admitted to a neurointensive care unit is limited, and that SpO2 is a better indicator

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Critical Rounds
Vol 3 | Issue 36 | 2022

2. COVID-19 vs. Non–COVID-19 Critical Illness Survivors: A 6-Month Comparison

Introduction:

The coronavirus disease pandemic of 2019 (COVID-19) has had a huge influence on world health. SARS-CoV-2 infection causes a wide range of symptoms, from asymptomatic to life-threatening sickness. The severely ill population is expected to be particularly sensitive to COVID-19's long-term effects, although the effects of COVID-19 may be comparable to those of other disorders.[1] Long-term deficits in physical, cognitive, and/or psychological function, as well as health-related quality of life, have previously been described by survivors of critical diseases.[1,2] The study's primary objective was to compare mortality or new impairment in mechanically ventilated patients with acute respiratory failure admitted to ICUs with COVID-19 to non–COVID-19 patients six months following admission. The secondary goal was to compare survivors' functional results in the two groups.

There was no difference in new disability for patients requiring mechanical ventilation for acute respiratory failure due to COVID-19 compared with non–COVID-19.

Methods:

Two prospective observational studies included critically ill patients with COVID-19 and non–COVID-19. Patients with COVID-19 were eligible if they were above the age of 18, had a positive laboratory PCR test for SARSCoV-2, were hospitalised to the ICU, and received Mechanical ventilation for 24 hours. Global health with the World Health Organization's Disability Assessment Schedule (WHODAS 2.0 12L), health status with the EQ-5D-5 level (EQ-5D-5L), anxiety and depression with the Hospital Anxiety and Depression Scale (HADS), screening for post-traumatic stress with the Impact of Events-6, cognitive function with the Montreal Cognitive Assessment-BLIND, and activities of daily living with the Montreal Cognitive Assessment-BLIND were all evaluated at 6 months in responders. The follow-up cohort was contacted by mail first for opt-out consent, and then by phone.

Results:

Electronic medical records were used to acquire demographic, intervention, and hospital outcome data. The World Health Organization Disability Assessment Schedule 2.0 was used to contact survivors for functional results. There were 120 critically sick patients with COVID-19 and 199 critically ill patients without COVID-19 who met the inclusion criteria. COVID-19 patients were older (62 years vs. 58 years; P = 0.019) and had a lower Acute Physiology and Chronic Health Evaluation II score (17 vs.19; P=0.011). Despite the fact that patients with COVID-19 had a longer time of ventilation (12 vs. 4.8 d; P,0.001), 180-day mortality was equal in both groups (32.5 % vs. 35.2 %; P = 0.715). At 180 days, the rates of mortality or new disability were similar (62.4 % vs. 66 %; P = 0.583).

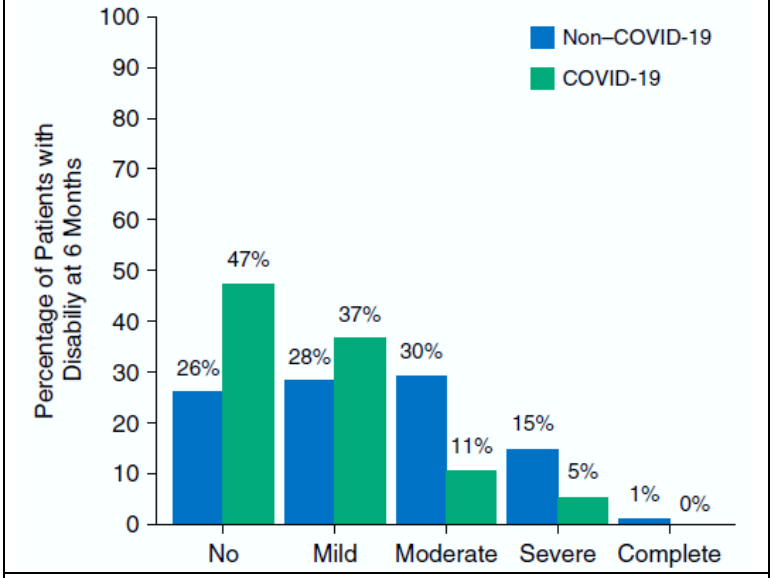
Critical Rounds
Vol 3 | Issue 36 | 2022

Discussion:

Researchers found that at 6 months, the incidence of new disability, the severity of disability, health-related quality of life, psychological function, and cognitive function were similar.

between COVID-19 and non–COVID-19 survivors in this study of patients mechanically ventilated for acute respiratory failure.

In a recent study of 478 hospitalised patients with COVID-19, 142 patients were severely sick, and around half were mechanically ventilated.[3] After COVID-19 severe illness, the recent investigation have found chronic symptoms, weakness, and a worse health-related quality of life.[4] Despite greater duration of mechanical ventilation and length of stay in the ICU in survivors of COVID-19 critical illness, the rate of beginning of new impairment is not different from the rate of onset of new disability in survivors of non–COVID-19 acute respiratory failure, according to this study.



Proportion of patients developing no (WHODAS,5%), mild (5%<WHODAS,25%), moderate (25%<WHODAS,50%), or severe (50%<WHODAS,96%)disability.

Conclusion:

At 6 months, there was no difference between COVID-19 patients with acute respiratory failure requiring mechanical ventilation and non–COVID-19 patients in terms of the incidence of new disability, the degree of disability, psychological function, cognitive function, or health-related quality of life.

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Critical Rounds
Vol 3 | Issue 36 | 2022

3.Clinical endpoints and biomarkers of septic shock: A responsiveness to plasma exchange.

Introduction:

Sepsis is a life-threatening illness characterised by several physiological and metabolic abnormalities. For the first time, the Third International Consensus (Sepsis-3) defines sepsis as "organ dysfunction induced by a dysregulated host response to infection," highlighting the critical involvement of the innate and adaptive immune responses in the development of the clinical condition.[1] In a recent randomised controlled study (RCT), therapeutic plasma exchange (TPE) showed rapid but individually varied hemodynamic improvement and reduced mortality in patients with septic shock. One trial, which was underpowered and comprised a diverse range of patients in terms of illness severity and beginning time, also revealed a trend toward better survival. As a result, it's still uncertain if TPE can help patients survive septic shock. TPE, used as an adjuvant therapy in patients with early (24 h (hrs) after shock start) and severe (norepinephrine (NE) dosage > 0.4 g/ kg/min) septic shock, was related with a quick and considerable reduction in catecholamine need in an uncontrolled investigation, according to the researchers.[2] Researchers performed a multivariate mixed effects analysis of the primary objective, NE reduction, to determine which patients benefited the most with adjunctive TPE.

Adjunctive therapeutic plasma exchange is associated with the removal of injurious mediators and repletion of consumed protective factors leading to preserved hemodynamic stabilization in septic shock

Methods:

This was an open-label, prospective bi-center randomised controlled experiment. Researchers assessed 1321 patients admitted to both hospitals' critical care units (ICUs). The presence of septic shock as defined by SEPSIS-3 and the inclusion criteria listed below. Patients were included if they had (1) septic shock, (2) started using vasopressors during the previous 24 hours, and (3) had substantial systemic hypotension requiring norepinephrine (NE) dosages of 0.4 g/kg/min despite sufficient intravenous fluid resuscitation TPE has to be done within 6 hours of the randomization procedure being completed. biochemical secondary endpoints included absolute and relative changes in procalcitonine (PCT), antithrombin III (AT-III), protein C, a disintegrin and metalloproteinase with a thrombospondin type 1 motif, member 13 (ADAMTS13) activity, von Willebrand Factor Antigen (vWF:Ag), Angiopoietin-2 (Angpt-2) and soluble angiopoietin receptor (sTie-2), between randomization and 6 hours after randomization.

Results:

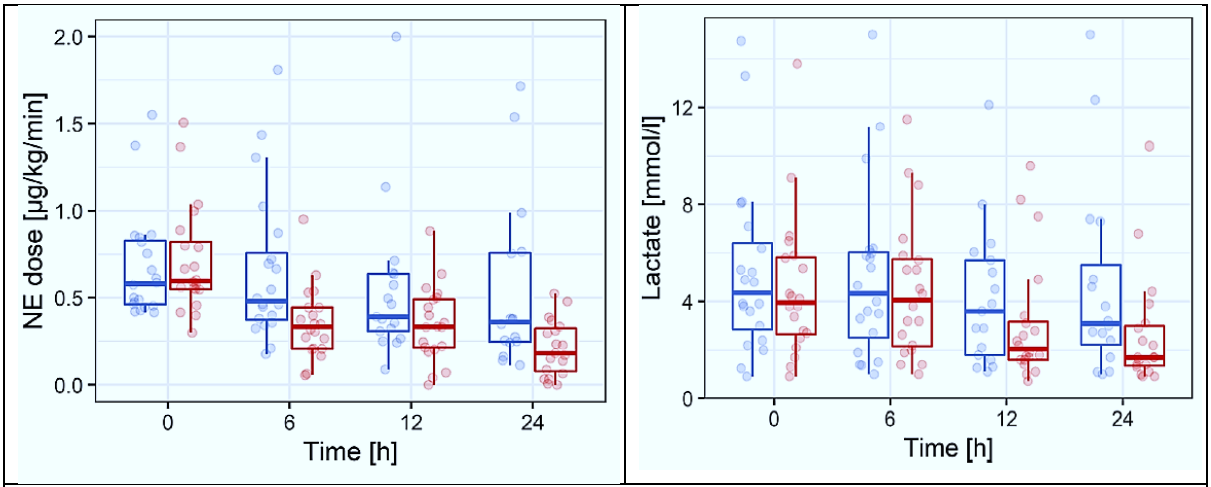
Over the first 24 hours, TPE had a constant impact on NE dose reductions (SOC group: estimated NE dose reduction of 0.005 g/kg/min per hour; TPE group: 0.018 g/kg/min per hour, $p = 0.004$). Similarly, serum lactate levels in the TPE group declined steadily throughout the first 24 hours, but lactate levels in the SOC group increased ($p = 0.001$). The TPE group showed a decrease in biomarkers and disease mediators (such as PCT ($p = 0.037$), vWF:Ag ($p=0.001$),

Critical Rounds
Vol 3 | Issue 36 | 2022

Angpt-2 (p = 0.009), and sTie-2 (p = 0.005), as well as a repletion of depleted protective factors (such as AT-III (p = 0.026), Protein C (p = 0.012), and ADAMTS-13 (p = 0.008).

Discussion:

Early TPE in patients with septic shock leads to hemodynamic stabilisation, according to this prospective randomised bi-centric study. The main outcome revealed a 50% decrease in NE at 6 hours following randomization in the TPE group. This early hemodynamic stabilisation was also relevant to further vasoactive and inotropic medications administered, was maintained 24 hours after randomization, and was followed by a decrease in blood lactate, indicating shock reversal in the TPE group. Although there was no difference in NE dosage across groups after 24 hours, this impact might be masked by the SOC group's greater mortality in the first 48 hours following randomization. These findings back up previous findings from non-randomized studies.[3,4] Improved fluid balances have been found consistently with additive TPE therapy, supporting this notion.



Modulation of TPE effect on norepinephrine dose and lactate concentrations. A continuous effect of TPE on the reduction in NE doses and lactate concentrations over the initial 24 h

Conclusion:

Adjunctive TPE is linked to the elimination of harmful mediators and the replenishment of depleted protective factors, resulting in hemodynamic stability in refractory septic shock. Researchers discovered that baseline lactate concentration might be used to guide the design of larger RCTs that would assess TPE in terms of concrete endpoints in the future.

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Critical Rounds
Vol 3 | Issue 36 | 2022

4.A case report on theophylline toxicity mimicking septic shock

Introduction:

Patients with asthma and chronic obstructive pulmonary disease are given theophylline as a bronchodilator (COPD). Theophylline can have a variety of cardiovascular, neurologic, metabolic, musculoskeletal, and gastrointestinal effects depending on the amount and method of administration. Arrhythmias, seizures, hyperglycemia, and rhabdomyolysis are just a few of the consequences that can occur with theophylline toxicity, therefore emergency department clinicians should become knowledgeable with how to manage them.[1] Theophylline is a seldom used COPD therapy with a restricted therapeutic index and a toxidrome that resembles septic shock. Acute changes in organ function can lead to accumulation and clinical toxicity since it is removed by both hepatic and renal ways.[2] here is a case of a 77-year-old woman who was hospitalised to the critical care unit with sepsis-like symptoms after falling on the medical ward.

Researchers recommend the practise of therapeutic drug monitoring of theophylline in any patient who is unstable, decompensating, or showing symptoms of systemic toxicity.

Case Presentation:

A 77-year-old lady with severe COPD (FEV1), asthma, moderate CHF, coronary artery disease (CAD), osteoporosis with compression fractures, and gastroesophageal reflux disease (GERD) reported to the emergency department with an acute exacerbation of COPD (AECOPD). Table 1 lists prescription drugs. Patient was admitted to the clinical teaching unit under the supervision of the Internal Medicine Team, who began conventional AECOPD therapy with supplementary oxygen, corticosteroids, bronchodilators, and antibiotics for community-acquired pneumonia. Theophylline and other home medications were continued. Patient's dyspnea and orthopnea persisted during the first week in hospital, but gradually improved. A little increase in serum creatinine exacerbated the situation. Patient was found down next to bed on day 9 of the hospital stay, and a "code blue" was called, bringing the Intensive Care Team to bedside. The patient was put in a c-spine collar and was found to have a frontal laceration, indicating that she had fallen out of bed. Initially, the patient was hypertensive (blood pressure of 187/100 mmHg), tachycardic (160 bpm), and tachypneic, with increased work of breathing. The patient was also agitated, thus hydralazine, haloperidol, and ketamine were administered. A head CT was conducted, and any acute intracranial process was ruled out. Patient rapidly became hemodynamically unstable, thus moved to the ICU. Despite volume resuscitation, the patient remained more hypotensive in the ICU and required vasopressor treatment to maintain a mean arterial pressure greater than 65 mmHg.Initial blood tests A leukocytosis, a mildly increased troponin, a lactate of 3.2 mmol/L, an acute kidney injury (AKI), and an arterial blood gas with an anion gap metabolic and respiratory acidosis were all important parameters. Patient was started on meropenem and vancomycin after the initial diagnosis of aspiration/hospital acquired pneumonia progressing to septic shock. A CT scan of the chest revealed only minor bilateral subsegmental pulmonary embolisms and no

Critical Rounds
Vol 3 | Issue 36 | 2022

indications of pneumonia. Other septic tests, including as sputum and blood microbiology, were negative for bacterial infection. Patient remained hemodynamically unstable and exhibited a gradual increase in anion gap despite substantial fluid resuscitation and vasopressor treatment. As a result, researchers expanded differential diagnosis to include various etiologies, with theophylline poisoning being proposed as a possible cause The blood theophylline level was 176 mol/L at the time, confirming the diagnosis of theophylline poisoning. Researchers started continuous renal replacement therapy (CRRT) set to deliver continuous veno-venous hemodiaultrafiltration with AKI, unstable hemodynamics, and signs of theophylline toxicity in conjunction with a regional toxicology specialist. In addition, for the pulmonary embolism, Patient was started on an infusion of unfractionated heparin, and antibiotics were restricted and then terminated since infection was judged a less likely cause of decompensation. While on CRRT, the patient's serum theophylline was rapidly cleared, and the hemodynamics improved over the next three days. Patient was admitted to the ICU for 5 days before being moved to the clinical teaching unit team on day 14. Patient was later discharged.

Discussion:

This case is presented to highlight a rare but crucial septic shock mimicker. The patient was taken to the hospital for a COPD exacerbation and developed respiratory distress, altered mental status, hemodynamic instability that necessitated vasopressor support, tachycardia, leukocytosis, and an increased lactate level. Other common sepsis mimickers to maintain on the broad differential include hypovolemia, pulmonary embolism, pancreatitis, diabetic keto acidosis, and adrenal insufficiency, according to the researchers.[2] Long et al. conducted a review in that looked at similar issue and identified allergy, aspiration, bowel obstructions, thyroid storm, intestinal ischemia, vasculitis, withdrawal, and spinal cord injury as probable sepsis mimics. Furthermore, researchers understood that hazardous intake can mimic a septic patient without specifically mentioning theophylline.[3]

Indication	Medications
COPD/asthma	Salbutamol 5 mg four times daily as needed
	Ipratropium 0.5 mg four times daily
	Theophylline 600 mg daily
CHF/CAD	Ramipril 10 mg daily
	ASA 80 mg daily
	Atorvastatin 20 mg daily
	Amlodipine 5 mg daily
Osteoporosis	Alendronate 70 mg weekly
	Vitamin D 1,000 units daily
	Calcium carbonate (dose not specified)
GERD	Pantoprazole 40 mg daily
Pain	Acetaminophen with caffeine and codeine as needed

Table 1: Home Medications

Conclusion:

This case report is intended to remind clinicians to keep a broad differential diagnosis in mind when assessing a patient who does not respond to initial measures, as well as to recommend therapeutic drug monitoring of theophylline for any patient who is unstable, shows signs or symptoms of toxicity, or has changes in renal or hepatic function in the case of acute illness.

Critical Rounds
Vol 3 | Issue 36 | 2022

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