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Bharat Bajantri MD

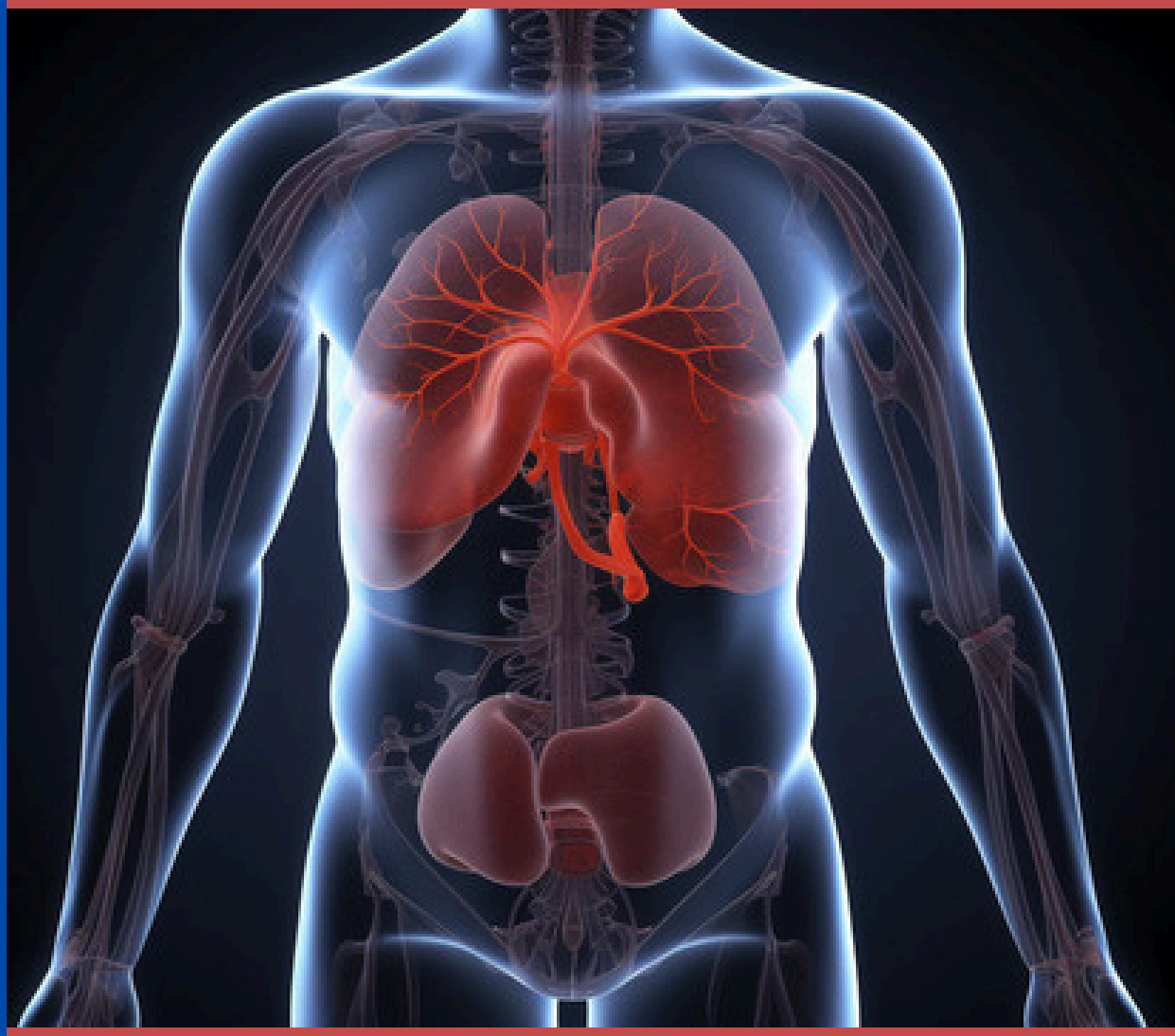
Sarah Ellsworth-Hoffman MLS

Ya Gao MD

Sivaprakash Sivaji DO

Caleb Hoppe PharmD

PULMONARY & CRITICAL CARE INSIDER



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COMPILED AND REVIEWED BY
BHARAT BAJANTRI, MD AND SARAH ELLSWORTH, MLS

VIEWPOINTS:
NON-SHOCKABLE CARDIAC ARREST MANAGEMENT

VIEWPOINTS COMPILED BY BHARAT BAJANTRI, MD.
ADOPTED FROM PULMCC AND CITED ARTICLES.

Improved CPR techniques in nontraumatic out-of-hospital cardiac arrest (OHCA) have the potential to save numerous lives daily, especially given the high prevalence of nonshockable OHCA cases in the United States. Known as "neuroprotective CPR," this method shows promise in enhancing survival rates while preserving neurological function.

Despite decades of modern resuscitation efforts, little headway has been made in treating nonshockable cardiac arrest cases, which represent a significant portion of OHCA incidents. Despite advancements such as automated external defibrillators, survival rates, particularly for asystole cases, remain dismally low. However, recent research suggests that integrating noninvasive CPR adjuncts could markedly improve outcomes by reducing intracranial pressure and bolstering venous return. When administered by EMS crews within 15 minutes of a 9-1-1 call, these adjuncts have demonstrated encouraging results, boasting a ten-fold increase in intact survival. Though conducting randomized controlled trials (RCTs) in this area poses challenges, studies like this one, utilizing propensity-score matching, offer a viable alternative for evaluating interventions.

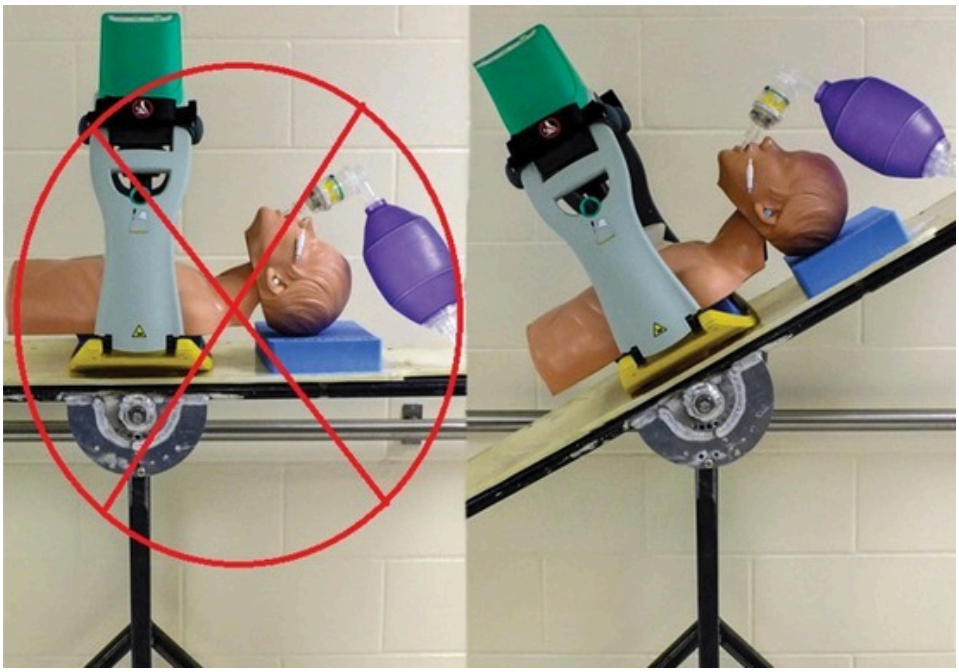


Image retrieved from JEMS 2016

VIEWPOINTS:
NON-SHOCKABLE CARDIAC ARREST MANAGEMENT

VIEWPOINTS COMPILED BY BHARAT BAJANTRI, MD.
ADOPTED FROM PULMCC AND CITED ARTICLES.

The primary aim of the study was to assess whether, in addition to conventional CPR (C-CPR), the prompt implementation of noninvasive circulation-enhancing adjuncts, followed by gradual head and thorax elevation, would correlate with higher survival rates post-out-of-hospital cardiac arrest (OHCA) with nonshockable presentations.

The median Time to CPR for both groups utilizing automated head/thorax-up positioning (AHUP) CPR and C-CPR was 8 minutes. The median time to initiation of AHUP was 11 minutes. Pooling all patients regardless of response time, the collective unadjusted likelihood of survival to hospital discharge for the AHUP-CPR group was 7.4% (28/380) compared to 3.1% (58/1,852) for C-CPR (odds ratio [OR], 2.46 [95% CI, 1.55-3.92]). After propensity score matching, these figures were 7.6% (27/353) versus 2.8% (10/353) (OR, 2.84 [95% CI, 1.35-5.96]). Swift application of AHUP-CPR substantially increased the odds of survival and favorable neurological outcomes.

These results highlight robust associations between prompt AHUP-CPR intervention and increased chances of patient survival, as well as favorable neurological outcomes, compared to C-CPR, in instances of nonshockable OHCA. These findings potentially extend to in-hospital cardiac arrests.

VIEWPOINTS:
TRY AND TRY AGAIN TILL CPAP SUCCEEDS!

VIEWPOINTS COMPILED BY BHARAT BAJANTRI, MD.
ADOPTED FROM PULMCC AND CITED ARTICLES.

CPAP prescriptions are often hindered by poor compliance. Approximately 34% of patients discontinue effective use within six months, and up to 50% stop using CPAP within three years. A large study using data from the French health insurance reimbursement system found over 100,000 individuals who had ceased CPAP treatment. Tracking these patients 26% of patients were able to resume/re-initiate CPAP therapy in the 12 months following initial termination and 17% had resumed and continued CPAP treatment after one year. Factors predicting continuation included being male, having hypertension, and being reviewed by a specialist pulmonologist. The study reported a 38% reduction in mortality risk for those who resumed and continued CPAP, compared to those who discontinued it again. However, these findings should be interpreted with caution due to the potential biases inherent in an observational study design.

Among those who successfully re-initiated CPAP treatment, 65% were still using it one year later. More significant than the overall percentage of patients adhering to treatment is the recognition that there is an opportunity to support patients previously considered lost to treatment. This suggests that re-initiating CPAP, regardless of the time elapsed since discontinuation, may be beneficial. Although these observational findings indicate a mortality benefit from CPAP resumption, it is important to consider the study's limitations, especially since randomized controlled trials have not confirmed a mortality benefit.

ORIGINAL STUDY SUMMARIES:

FUNGAL PNEUMONIAS IN THE ICU: CLINICAL INSIGHTS AND DIAGNOSTIC STRATEGIES

BY YA GAO, MD; SIVAPRAKASH SIVAJI, DO; BHARAT BAJANTRI, MD

Fungal pneumonias present a formidable challenge in clinical practice, particularly in the intensive care unit (ICU) setting. Ongoing refinement of diagnostic and therapeutic strategies is crucial for managing these complex infections. When pneumonia does not resolve with typical treatments, fungal infections, TB, and noninfectious conditions should be considered. Negative results may need invasive diagnostics like bronchoscopy and biopsies due to the low sensitivity of noninvasive testing. Positive results must be evaluated within the clinical context to distinguish between infection and colonization, utilizing fungal consensus criteria to confirm the disease. This mini review highlights significant advancements for diagnostic work up of fungal pneumonias in the ICU.

INVASIVE CANDIDIASIS (IC)

Diagnostic Criteria

The European Organization for Research and Treatment of Cancer and the Mycoses Study Group Education and Research Consortium (EORTC/MSGERC) criteria for diagnosing IC include three main conditions:

1. Candidemia without deep-seated candidiasis (including catheter-associated candidemia)
2. Candidemia with deep-seated candidiasis
3. Deep-seated candidiasis without candidemia

Diagnostic Strategies

Diagnosing deep-seated candidiasis relies on histopathology and sterile site cultures, with non-culture testing being helpful but not standardized:

- Blood cultures are essential for diagnosing candidemia. Typically, 2-4 pairs of bottles (10 mL each for aerobic and anaerobic cultures) are used, with a success rate of up to 90% with four pairs.
- Blood cultures should be collected before starting antifungal therapy to increase diagnostic accuracy.
- Candidemia often involves intravenous catheters, necessitating cultures be obtained from both central and peripheral sites. If only the catheter tip grows yeast without blood culture confirmation, systemic antifungals may not be required.
- Risk-prediction models and non-culture tests such as 1,3-β-D-glucan and T2Candida, are useful for detecting candidemia, especially in cases with false-negative blood culture results.

ORIGINAL STUDY SUMMARIES:

FUNGAL PNEUMONIAS IN THE ICU: CLINICAL INSIGHTS AND DIAGNOSTIC STRATEGIES

BY YA GAO, MD; SIVAPRAKASH SIVAJI, DO; BHARAT BAJANTRI, MD

Defining Proven and Probable IC in the ICU Based on the IC can be categorized as follows:

- Proven IC (requires definitive evidence of Candida in a sterile site) is defined by:
  - Histopathology or direct microscopic examination showing budding cells consistent with Candida.
  - Recovery of Candida by culture from a sterile procedure specimen showing clinical or radiologic infection signs.
  - Positive blood culture for Candida species.
- Probable IC is defined by:
  - At least one clinical criterion (e.g., compatible ocular findings, hepatosplenic lesions, unexplained clinical or radiologic abnormalities).
  - At least one mycological criterion (e.g., positive serum 1,3-β-D-glucan in two consecutive samples, recovery of Candida from an intra-abdominal specimen).
  - At least one host factor (e.g., glucocorticoid treatment, neutrophil abnormalities, impaired gut wall integrity, central vascular access, Candida colonization, hematopoietic stem cell transplantation, or solid-organ transplant).

INVASIVE ASPERGILLOSIS (IA)

Diagnostic Criteria

The EORTC/MSGERC criteria for diagnosing aspergillosis in onco-hematological patients include:

1. Identifying at-risk hosts (e.g., prolonged neutropenia - defined as an absolute neutrophil count (ANC) of less than 500 cells per microliter (μL) for a duration of more than 10 days, graft-versus-host-disease (GvHD), solid organ transplant),
2. Clinical features and imaging signs (e.g. dense, well-circumscribed lesions with or without halo sign, air-crescent sign, cavity or wedge-shaped/segmental consolidation, and
3. Mycological evidence (e.g. direct Aspergillus spp. isolation in respiratory samples, positive galactomannan (GM) in plasma, serum or bronchoalveolar lavage (BAL)).

ORIGINAL STUDY SUMMARIES:

FUNGAL PNEUMONIAS IN THE ICU: CLINICAL INSIGHTS AND DIAGNOSTIC STRATEGIES

BY YA GAO, MD; SIVAPRAKASH SIVAJI, DO; BHARAT BAJANTRI, MD

The **AspICU criteria**, designed to diagnose aspergillosis specifically in ICU patients includes **four conditions** that must all be met:

1. Positive Aspergillus culture from lower respiratory tract specimen (entry criterion)
2. Compatible signs and symptoms (one of the following):
    - Fever refractory to at least 3 days of appropriate antibiotic therapy
    - Recrudescent fever after 48 hours of defervescence while on antibiotics with no other obvious cause
    - Pleuritic chest pain or pleuritic rub
    - Dyspnea
    - Hemoptysis
    - Worsening respiratory insufficiency despite proper antibiotic treatment and ventilatory support
3. Abnormal imaging (via portable chest X-ray or CT lung scan) such as:
    - Presence of dense, well-circumscribed lesion(s) with or without a halo sign
    - Air-crescent sign
    - Cavitary formation
4. Host risk factors (one of the following):
    - Congenital or acquired immunodeficiency
    - Hematological or oncological malignancy treated with cytotoxic agents
    - Solid organ transplant (especially lung)
    - Neutropenia (absolute neutrophil count ≤ 500/mm3) for ≥ 2 weeks
    - Glucocorticoid treatment (prednisone equivalent ≥ 20 mg/day for ≥ 2 weeks)

<u>Diagnostic Testing</u>

Conventional (direct detection):

- Positive culture of Aspergillus species from a lower respiratory tract specimen (e.g., sputum, bronchoalveolar lavage fluid).
- Positive histopathology or direct microscopic examination of a specimen showing dichotomous branching hyphae.

Molecular/Advanced (non-culture-based detection):

- Positive galactomannan antigen in serum or bronchoalveolar lavage fluid.
- Positive Aspergillus PCR in blood or respiratory samples.

ORIGINAL STUDY SUMMARIES:

FUNGAL PNEUMONIAS IN THE ICU: CLINICAL INSIGHTS AND DIAGNOSTIC STRATEGIES

BY YA GAO, MD; SIVAPRAKASH SIVAJI, DO; BHARAT BAJANTRI, MD

Defining Proven and Probable IA in the ICU

Based on the AspICU criteria, IA can be categorized as follows:

- Proven Invasive Aspergillosis: Requires positive histopathological evidence of Aspergillus or a positive culture from a sterile site.
- Probable Invasive Aspergillosis: Requires the presence of host factors, clinical criteria, and at least one microbiological criterion.

Fortún (2022) emphasizes the necessity of fungal detection via blood cultures or histology/culture from sterile sites to confirm IC and IA in the ICU. Maintaining high suspicion in patients with risk factors, clinical features, and mycological evidence (e.g., culture, microscopy, antigen detection, PCR) is recommended.

These studies enhance understanding of fungal pneumonia and invasive fungal diseases, offering crucial guidance for clinicians in diagnosing and managing these conditions, especially in critical care settings.

ARDS UPDATE/GUIDANCE: ORIGINAL LITERATURE REVIEW & SUMMARY

BY CALEB HOPPE, PHARMD, PGY1 PHARMACY RESIDENT WITH BHARAT BAJANTRI, MD.

Background:

Acute respiratory distress syndrome (ARDS), identified in 1967, is a severe lung condition with a hospital mortality rate around 40%. The Berlin Definition (2012) characterized ARDS by disease onset within a week, a P/F ratio under 300 mmHg, diffuse bilateral infiltrates, and other risk factors. This definition has been updated to include patients using any form of non-invasive positive pressure ventilation and incorporates various imaging methods, including ultrasound, beyond x-rays and CT scans.

Literature Review:

Recent guidelines from the European Society of Intensive Care Medicine (ESICM) in 2023 and the American Thoracic Society (ATS) in 2024 have presented updated, yet controversial and conflicting, ARDS treatment strategies. These guidelines revolve around four key areas: corticosteroids, neuromuscular blockade, veno-venous extracorporeal membrane oxygenation (VV-ECMO), and ventilator strategies (including PEEP, plateau pressure, proning, and tidal volume). Below is a summary of the recommendations from each society.

Corticosteroids:

It is likely that ICU patients with ARDS may have comorbid conditions that necessitate the use of corticosteroids such as septic shock, severe community acquired pneumonia (CAP), or COVID-19. Irrespective of this, **corticosteroids are recommended** for all ARDS patients per the ATS as studies have shown a decrease in mortality, reduced duration of mechanical ventilation, and reduced length of stay. However, corticosteroids should be used in caution as they increase the risk of gastrointestinal bleeding and hyperglycemia. Further data is needed to assess the effects of corticosteroids on neuromuscular weakness which may have harmful outcomes. Additionally, the ATS recommends against starting corticosteroids > 14 days after intubation as they have demonstrated unfavorable outcomes. Unfortunately, the above data is in the context of pooled data analyses leading to severe heterogeneity among studies in drug selection, drug dosing, and protocol. ESICM does not make recommendations regarding corticosteroid use in ARDS. **GuARDS and CORT-E2 are two ongoing studies researching the effects of corticosteroids in ARDS.**

ARDS UPDATE/GUIDANCE: ORIGINAL LITERATURE REVIEW & SUMMARY

BY CALEB HOPPE, PHARMD, PGY1 PHARMACY RESIDENT WITH BHARAT BAJANTRI, MD.

Clinical implication: Recent consolidative studies suggests even more liberal glucose control with some studies up to 220 mg/dl without significant adverse effects. Current evidence and recommendations seem to suggest that even if there are no other indications to start steroids, it is reasonable to consider early steroids during ARDS while we frequently cover with empiric antibiotics and prophylaxis for stress ulcers.

Neuromuscular blockade:

Utilizing neuromuscular blockers such as cisatracurium is a common practice in America for ARDS patients. **The ATS recommends neuromuscular blockade for severe ARDS** within 48 hours of intubation based on reduced mortality (relative risk [RR] 0.74), reduced barotrauma (RR 0.55), and increased ventilator-free days (mean difference [MD] 0.89 days). The **ESICM recommends against the use of neuromuscular blockers** based on studies that showed no benefit was found using neuromuscular blockers when compared to light sedation, which is the standard of care in the intensive care unit (ICU) when possible. Additionally, the pooled analysis by ESICM found no difference in mortality among patients with and without neuromuscular blockers (RR 0.8; not statistically significant). Additionally, the risk of neuromuscular weakness and requirement of deep sedation was thought to be detrimental in terms of ICU-acquired weakness (RR 1.16). Significant baseline differences (such as the use of proning) should be noted for the pooled analysis by ESICM.

Clinical implications: The most pragmatic approach for neuromuscular blocker use in ARDS seems to be for ventilator synchrony. It may be reasonable to consider neuromuscular blockers in selected patients who remain ventilator dyssynchronous despite deep sedation that can lead to ventilator associated injury. Although, one can argue the need for personalizing PEEP by evaluation of parameters including dead space, lung compliance, lung stress and strain, ventilation patterns using computed tomography (CT) or electrical impedance tomography (EIT), inflection points on the pressure/volume curve (P/V), and the slope of the expiratory flow curve using airway pressure release ventilation (APRV) etc, none have shown to be superior in the real world bedside experience so far.

ARDS UPDATE/GUIDANCE: ORIGINAL LITERATURE REVIEW & SUMMARY

BY CALEB HOPPE, PHARMD, PGY1 PHARMACY RESIDENT WITH BHARAT BAJANTRI, MD.

VV-ECMO:
VV-ECMO is a resource intensive mechanism to help patients adequately oxygenate. The **ATS recommends VV-ECMO** for patients with a P/F ratio < 80 mmHg, pH < 7.25, and pCO2 ≥ 60 based on decreased mortality (RR 0.76), increased ventilator-free days (MD 8 days), increased vasopressor-free days (MD 8 days) and increased renal replacement-free days (MD 7 days). This was at the expense of increase hemorrhage risk (RR 1.64), but no difference was found in pneumothorax or stroke incidence. The **ESICM guidelines concur** that patients with severe ARDS should receive VV-ECMO based on results from the EOLIA trial.

Clinical implications: Patient selection remains important for good outcomes.

Ventilator Augmentation:
The ATS and ESICM recommend use of a **low tidal volume** of 4 – 8 mL/kg predicted body weight and goal **plateau pressure < 30 cm H2O** to prevent barotrauma. The ATS recommends **proning** for > 12 hours daily, while the ESICM states proning for 16 consecutive hours daily (specifically for patients with a P/F ratio < 150 and PEEP ≥ 5 cm H2O) is beneficial. The ESICM does not make direct recommendations strategies to optimize PEEP, but the ATS recommends a **high PEEP** with minimal recruitment efforts to prevent barotrauma. This recommendation is based on data that higher PEEP targets reduce mortality (RR 0.77), improve oxygenation (MD 63.7 mmHg P/F ratio), and increase ventilator-free days (MD 1.3 days). There is also data to support that high PEEP targets with prolonged recruitment maneuvers increase mortality (RR 1.37), while high PEEP with brief recruitment maneuvers does not affect mortality (RR 1.07; not statistically significant).
Clinical implications: Ideal tidal volume in the wide range is primarily driven my lung compliance and hence the plateau pressures. Reasonable target for plateau pressures remains < 30 cm H2O but increase the goal plateau pressures up to 35 cm H2O in patients with high chest wall compliance.

ARDS UPDATE/GUIDANCE: ORIGINAL LITERATURE REVIEW & SUMMARY

BY CALEB HOPPE, PHARMD, PGY1 PHARMACY RESIDENT WITH BHARAT BAJANTRI, MD.

Duration of prone position has been advocated to be around 12-24hours, however continuing prone positioning for even more prolonged duration to maintain adequate oxygenation while taking precautions to avoid adverse outcomes of prone positioning certainly makes more clinical sense.

Personalization of PEEP has further led to controversies between using the ARDS high/low peep strategy vs open lung approach. We do not have a winner, which makes sense as the strategy for personalization of PEEP also must be personalized. We do have evidence suggesting that the risks of recruitment maneuvers may outweigh the risks but experts have often questioned the methodology of studies and the PEEP values as well as duration of recruitment maneuvers in that study that seemed much aggressive.

Making sure massive transfusion protocols matter!

Background: Patients undergoing massive transfusion protocol (MTP) are at risk for posttransfusion hypocalcemia and hyperkalemia. This prospective study aimed to validate the K/iCa ratio as a predictor of mortality in MTP patients.

Methods: This prospective analysis included adult trauma patients who underwent MTP activation between May 2019 and March 2021 at an urban level 1 trauma center. Serum potassium and ionized calcium (iCa) levels measured within the first hour of MTP initiation were used to calculate the K/iCa ratio.

Results: Out of 300 patients with MTP activation, 110 met the inclusion criteria. The overall mortality rate was 31.8%. There were no significant differences between the elevated K/iCa and lower K/iCa groups regarding prehospital or emergency department initial vitals, shock index, or injury severity. Kaplan-Meier survival analysis showed a significantly higher survival rate for patients with an elevated K/iCa ratio ($P < 0.01$). Multivariable logistic regression indicated that the total number of blood products was significantly associated with an elevated K/iCa ratio (odds ratio, 1.02; 95% CI, 1.01–1.04; $P = 0.01$). Multivariable Cox regression adjusted for confounders confirmed a significant association between the K/iCa ratio and mortality (Hazard Ratio, 4.12; 95% CI, 1.89–8.96; $P < 0.001$).

Conclusion: It also emphasizes the need for careful monitoring of posttransfusion potassium and iCa levels in the MTP setting. It is often recommended to check and correct potassium ionized calcium levels after 4-6 units of PRMC transfusions which often translates to 1 cooler.

Procalcitonin in Cardiovascular ICU... Take it for what it‘s worth!

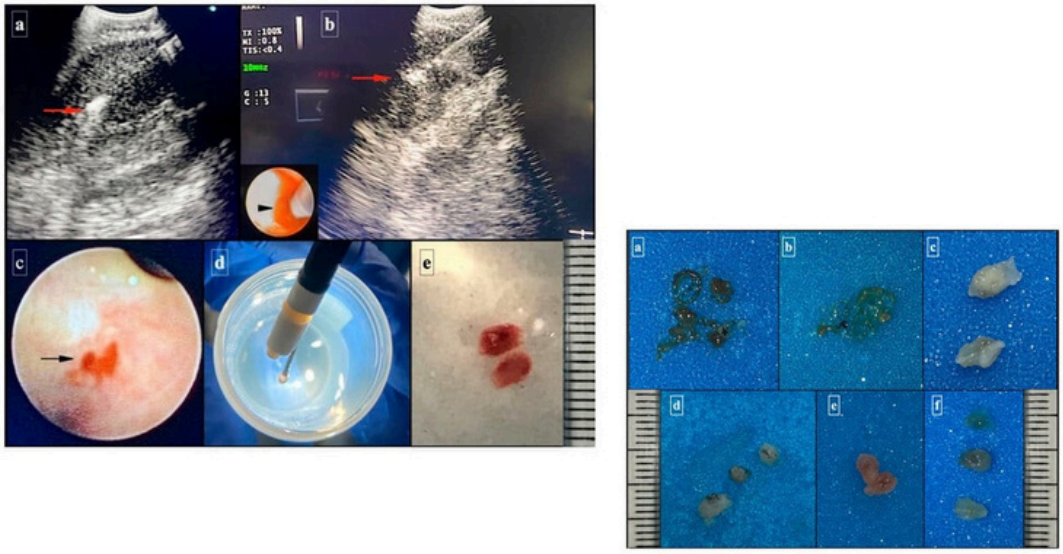
Background and Aims: Infectious complications after cardiac surgery negatively affect patient outcomes. Rapid identification is crucial, and procalcitonin (PCT), a noninvasive blood test, could aid in diagnosing postoperative bacterial infections, although its validity gets criticized for poor specificity. This systematic review and meta-analysis aimed to estimate PCT's accuracy for this purpose.

Results: Eleven studies were included in the review, with 10 studies (2984 patients) in the meta-analysis. All were single-center observational studies, with five having retrospective data. Quality assessment revealed issues, mainly the lack of prespecified thresholds for PCT. The optimal threshold identified was 3 ng/mL, with a mean sensitivity of 0.67, specificity of 0.73, and an AUC of 0.75. PCT's positive predictive value was close to 50% at a high prevalence (30%), and the negative predictive value was always >90% when prevalence was <20%.

Conclusions: The optimal threshold of 3 ng/mL should be confirmed through large, well-designed randomized trials to evaluate its impact on health outcomes and antibiotic use. PCT can help rule out infections after cardiac surgery, especially in cardiovascular intensive care units where overall prevalence of infections is considered low.

EBUS-guided Mediastinal Cryobiopsy (EBUS-MCB)

Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is commonly used for sampling mediastinal nodes but has limitations in diagnosing lymphoma and benign diseases. EBUS-guided mediastinal cryobiopsy (EBUS-MCB) is a newer technique providing larger biopsy samples with acceptable safety. This study aimed to evaluate EBUS-MCB's diagnostic yield in patients with inconclusive rapid on-site evaluation (ROSE). Of 196 patients undergoing EBUS-TBNA, 46 underwent EBUS-MCB due to nondiagnostic or inadequate ROSE. EBUS-MCB confirmed diagnosis in 59.3% of cases with nondiagnostic ROSE, providing additional yield over EBUS-TBNA. Material obtained by EBUS-MCB was adequate for further studies. Minor bleeding was the most common complication. EBUS-MCB could be an additional diagnostic step in inconclusive ROSE cases during EBUS-TBNA, pending larger studies for its incorporation into diagnostic algorithms for mediastinal lesion evaluation.



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