



# Out of body: Next generation life support

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## Abstract

**Background:** A male patient with ankylosing spondylitis on tofacitinib presented with severe bacterial pneumonia that rapidly progressed to refractory acute respiratory distress syndrome (ARDS)

**Key words:** Acute respiratory distress syndrome (ARDS); High-Flow Nasal Oxygen (HFNO)

## 1. Case 1

### 1.1. Clinical Presentation

A 35-year-old male with Ankylosing Spondylitis, managed long-term with the JAK inhibitor Tofacitinib, presented with a five-day history of fever and cough. He was diagnosed with severe bacterial pneumonia that quickly evolved into ARDS.

### 1.2. Initial Management & Deterioration

- First-line Therapy: High-Flow Nasal Oxygen (HFNO) and self-awake proning.
- Clinical Course: Rapid respiratory exhaustion and worsening infiltrates.
- Escalation: Endotracheal intubation and mechanical ventilation.
- Failure of Conventional Rescue: Refractory hypoxemia despite optimized PEEP and prone positioning.
- He was initiated on hemoperfusion using HA 380 filter to mitigate biotrauma

### 1.3. Initiation of Extracorporeal Support

- Indication: Refractory hypoxemia and declining systemic hemodynamics.
- Intervention: VA-ECMO initiated within 6 hours of failed prone ventilation.
- Rationale: Simultaneous support for pulmonary gas exchange and hemodynamic stabilization.

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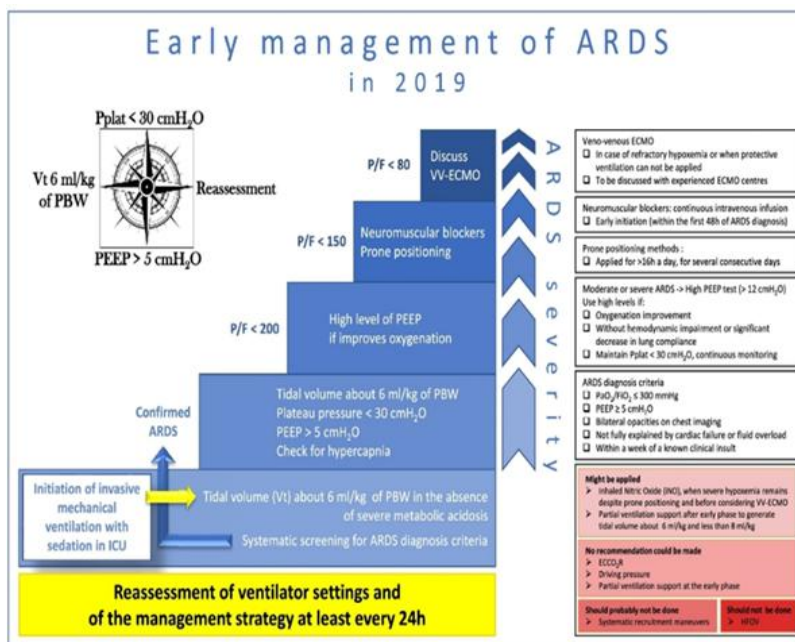


Image Source: Laurent Papazian et al. Springer Nature Link. 2019;9(6)

### 1.4. The Physiological Conflict: North-South Syndrome

- Clinical Finding: Evidence of differential hypoxia (Harlequin Syndrome).
- Mechanism: Competitive flow between the native cardiac output (deoxygenated) and ECMO return (oxygenated), leading to upper body desaturation.
- Need for Adaptation: Transition from VA to a hybrid configuration.

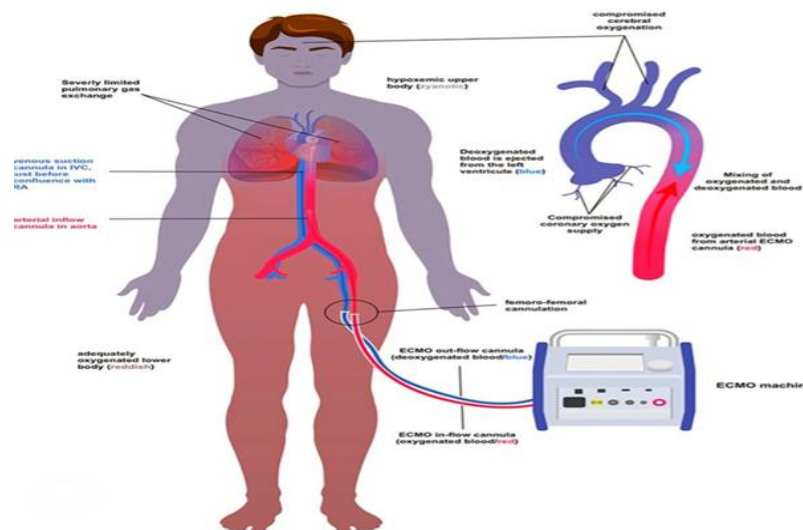


Image Source: Simon A. Amacher. Frontiers et al. Frontiers in Cardiovascular Medicine. 2021

- Following VAV transition target pao2 and systemic organ perfusion were successfully maintained.
- Bronchoscopy done – clot present in right lower lobe – profuse bleed. Et tube changed.

- Clinical stability was evidenced by normalized lactates, adequate urine output, preserved neurological status.
- Patient was successfully stabilized and transferred via ground ambulance to Heart Lung transplant unit, Kauvery hospital vadapalani for further management
- Brochoalveolar lavage pneumonia panel – influenza b, *klebshiella pneumonia*, *staphylococcus aureus*. Antibiotics are modified as organisms.
- Patients gradually weaned from VAV to VV ECMO.
- Patients’ lung mechanics gradually improved. VV ECMO sweep gas and fio2 gradually reduced and successfully decannulated.
- Right now, tracheostomised on bipap support

**1.5. Goals on VV ECMO**

- To replace pulmonary function (oxygenation and decarboxylation)
- To allow lungs to rest
- To allow healing of the lungs
- VV ECMO and native circulation
- Physiologically neutral
- No effects on hemodynamic parameters

**VA ECMO**

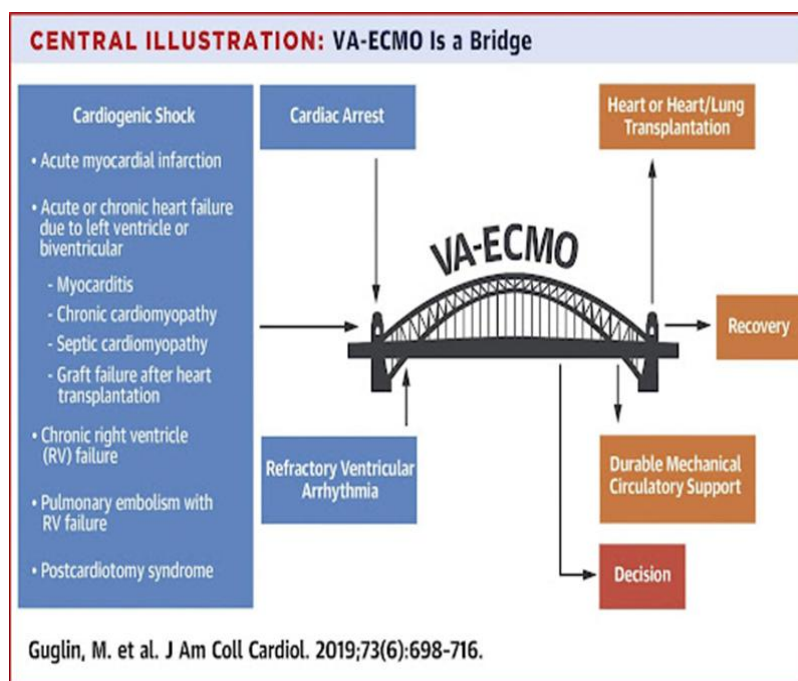


Image Source: : Maya Guglin et al. JACC Journals.2019;73(6)

## 2. Case 2

A 59-year male with a comorbidity of type 2 DM, S HTN since 12 years.

### 2.1. Presenting complaints

- Breathlessness Grade 4 MMRC for 2 days
- Decreased urine output for 2 days.
- Fever for 2 days.
- Cough with expectoration 4 days
- He was initially taken to NLC hospital and referred here for further management.
- Brought to ER on 21/12/25 AT 4 AM.

### 2.2. Examination

Lean built, drowsy, not responding to painful stimuli, tachypneic (RR – 50)

Auscultation - CVS-S1S2+, RS- B/L basal crackles+, P/A- soft, distended.

### 2.3. Vitals

BP - 60mmHg

PR - 140/min, NSR

SPO2 - 70 % with NRBM 15LO2

### 2.4. Pocus in ER

- Adequate LV function, LVH+
- IVC- 0.8cm > 50 % collapsible
- Lungs- Bilateral B profile [ anterior to posterior]
- Abdomen- no significant findings
- DVT screening- B/L femoral, popliteal- Negative

### 2.5. Management in ER

- ABG PH- 6.84 pco<sub>2</sub>-12 po<sub>2</sub>- 40 lac 14 hco<sub>3</sub>- 6 ( severe metabolic acidosis)
- Intubated put on PRVC mode ( TV- 360 ml , fio<sub>2</sub>-100 % , RR-26/mt, PEEP- 8)
- Refractory shock - fluid bolus approximately 30 ml/kg given. Simultaneously started on vasopressors infusion. Worsening shock requiring triple vasopressors- Nora-drenaline, Vasopressin, Adrenaline

### 3. Working diagnosis

- Septic shock (source- lung)
- Severe ARDS

### 4.1. Sepsis definition

- Sepsis – dysregulated immune response to infection resulting in organ dysfunction.
- Septic shock - Hypotension not responding to fluids . Need for vasopressors to maintain map of 65 mmhg or more and a lactate > 2mmol/l

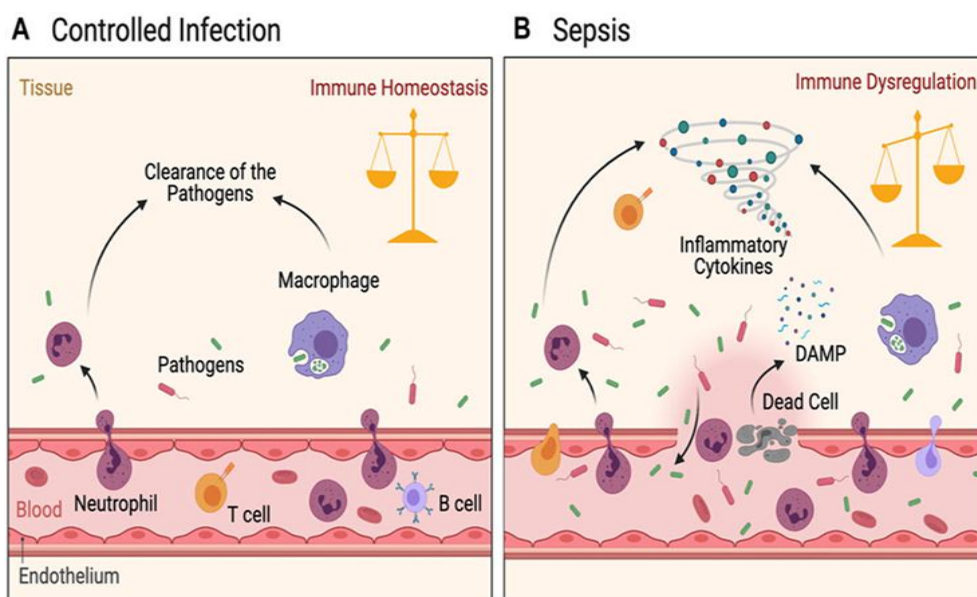


Image Source: Jian Chen et al. *Frontiers*. 2021;(12)

### 4.2. Sepsis

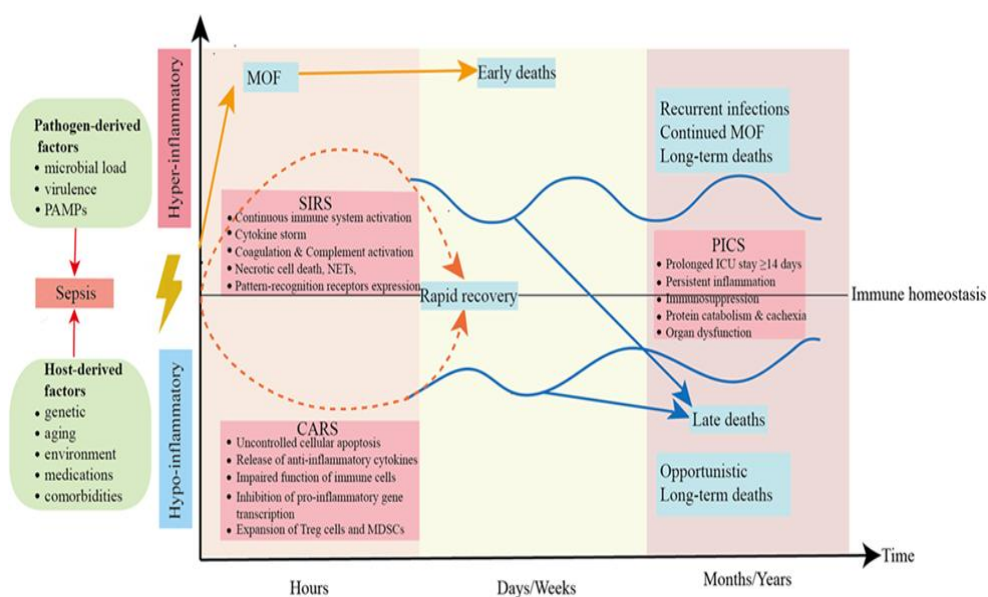


Image Source: Min Cao et al. *Cell Death Discovery*. 2023

## 5. Management

- IV antibiotics (cefoperazone+sulbactam, azithromycin, oseltamivir
- Stress dose steroids
- Triple vasopressors support
- Shifted to ICU.
- Patient continued to be anuric
- Refractory shock
- Severe ARDS
- Too sick to be transported from ER to ICU (spo2 78 % on 100 % fio2). Post recruitment with a peep of 35 cmh20 spo2 increased to 95%.
- High risk consent for transport obtained.
- Shifted to ICU

## 6. ICU management

### 6.1. Day 1

#### Investigations

- Tc 34,000
- Procalcitonin > 100
- Prone ventilation initiated. Post proning pf ratio improved spo2- 95 % on fio2- 60 %. Prone responder
- Underwent 24 hours of proning

### 6.2. Day 2

- Persistent shock still on triple vasopressors
- Had undergone one session of sled.
- Shock in sepsis secondary to excessive pro inflammatory mediators.
- Role of hemoperfusion. What does SSC 2021 say about it.

59. For adults with sepsis or septic shock we suggest against using polymyxin B hemoperfusion.	<b>Weak, low quality of evidence</b>	<b>NEW from previous:</b> "We make no recommendation regarding the use of blood purification techniques"
60. There is insufficient evidence to make a recommendation on the use of other blood purification techniques.	<b>No recommendation</b>	

Image Source: Image extracted from The surviving sepsis campaign bundle:(2021 Update) – My Sepsis

**HA380 Disposable Hemoadsorption Cartridge**

**Treatment Principle**  
Cytokine storm is an umbrella term encompassing several disorders of immune dysregulation characterized by constitutional symptoms, systemic inflammation, and multi-organ dysfunction that can lead to multi-organ failure.<sup>1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100</sup>  
HA380 disposable hemoadsorption cartridge is filled with neutral macroporous resin, mainly adsorbing molecules from 10 to 60 kDa.<sup>1</sup> Because of the accurate 3D macroporous structure and over 54000 m<sup>2</sup> adsorption surface area of the resin,<sup>1</sup> HA380 hemoadsorption therapy can provide a new regimen in controlling inflammatory cytokines storms,<sup>1</sup> improving hemodynamics,<sup>1,2</sup> preventing further organ damage and complications,<sup>1,2</sup> as well as shortening the ICU stay and hospital stay.<sup>1,2</sup>

**HA380 delivers superior adsorption capacity with more than 7 soccer fields of surface area, outperforming standard hemoadsorption technologies.**

**Adsorption Therapy Applications**  
According to clinical practices, hemoadsorption therapy can be applied in the listed conditions.

**PRODUCT SPECIFICATIONS**

<b>Indication</b>	Septic/sepsis conditions & Multi-organ dysfunction
<b>Targeted Molecules</b>	Inflammatory biomarkers such as cytokines, DAMPs, damage-associated molecular patterns (DAMPs)
<b>Size Range of Removed Compounds</b>	10-60 kDa
<b>Blood Volume</b>	300 mL
<b>Blood Volume</b>	120 mL
<b>Fluid Volume for Rinsing and Priming the Circuit</b>	3000 mL of Saline (3% NaCl about 1L)
<b>Substrate Composition</b>	Styrene-divinylbenzene copolymer
<b>Effective Surface Area</b>	54,000m <sup>2</sup>

**Multiple Therapy Operation Modes & Flexible Choices<sup>1</sup>**  
Hemoadsorption therapy can be used alone or in conjunction with CRRT/HDF.<sup>1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100</sup>

**Clinical Data<sup>1-10</sup>**

Other flexible modes have been used based on clinical practices such as HF+CRRT/ECMO, please refer to the references.<sup>1-10</sup>

**References**  
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**For detailed information, please visit [www.jafarion.com](http://www.jafarion.com)**

Image Source: Bottom Section: Jafron’s HA380 product catalogs.

**7. Subsequent course**

- Patient gradually weaned off from vasopressors
- Endotracheal c/s- Elizabeth meningoseptica kingae. Antibiotics adjusted as per susceptibility reports
- Had a difficult weaning (failed 3 SBT trials).
- Extubated successfully by day 8 of ICU admission.



## 8. Case 3

### 8.1. Clinical Presentation

- Patient Profile: 28-year-old female.
- Pertinent History: Past history of Pulmonary TB.Recent LSCS (4 months ago).
- Chief Complaints: Fever (5 days).Acute Shortness of Breath (2 days).
- Initial Management: Respiratory distress led to intubation at an outside facility before transfer.

### 8.2. Emergency Department Status

- Hemodynamics: Profound shock requiring triple vasopressors to maintain MAP.
- Invasive Monitoring: Central and arterial lines secured upon arrival.
- Laboratory Findings: TC: 24,000 cells/mm<sup>3</sup> (Significant leukocytosis).Procalcitonin: >100 ng/mL (Indicative of severe bacterial sepsis).Lactate: Rising/Worsening (Signal of tissue dysoxia).

### 8.3. Radiographic & Empiric Therapy

- CT Chest: Right upper lobe (RUL) consolidation.Differential Diagnosis:Bacterial Pneumonia (Gram-positive vs. Gram-negative).
- Empiric Coverage: Immediate initiation of broad-spectrum antibiotic coverage (GP + GN coverage).

### 8.4. Clinical dilemma

- Refractory Shock Status: Despite optimal antibiotic therapy and fluid resuscitation, the patient remained vasopressor dependent.

- Complications: Persistent high dose catecholamines with worsening metabolic acidosis (rising lactates).
- Decision Point: Consideration of Extracorporeal Blood Purification (EBP) to modulate the hyperinflammatory response.

#### **8.5. Intervention: Hemoperfusion**

- Procedure: One session of Hemoperfusion (HP) initiated.
- Rationale: Removal of middle-molecular-weight inflammatory cytokines.
- Reduction of the "cytokine storm" to restore vascular sensitivity to vasopressors.
- Interruption of the sepsis-induced organ failure cascade.
- Clinical Response & Recovery Hemodynamic Shift: Decrease in vasopressor requirements following the HP session.
- Metabolic Improvement: Stabilization and subsequent clearance of serum lactates.
- Respiratory Progress: Improved lung mechanics and gas exchange.
- Outcome: Successful weaning from mechanical ventilation and titration off all vasopressor support.