

Apneic Anesthesia During Robotic Tracheal Resection: Traversing the Challenges of Anesthetic and Venovenous ECMO Management in a New Era

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Disclosures

- No disclosures or conflicts of interest



Background

- Tracheal resection historically relied on open surgical techniques
- Advancing surgical technologies now allow for robotic assisted minimally invasive resection of primary tracheal tumors
- New challenges of management include:
 - Prolonged apneic phase
 - Absence of cross-field ventilation
 - Maintenance of anesthesia
 - Management and troubleshooting of VV ECMO

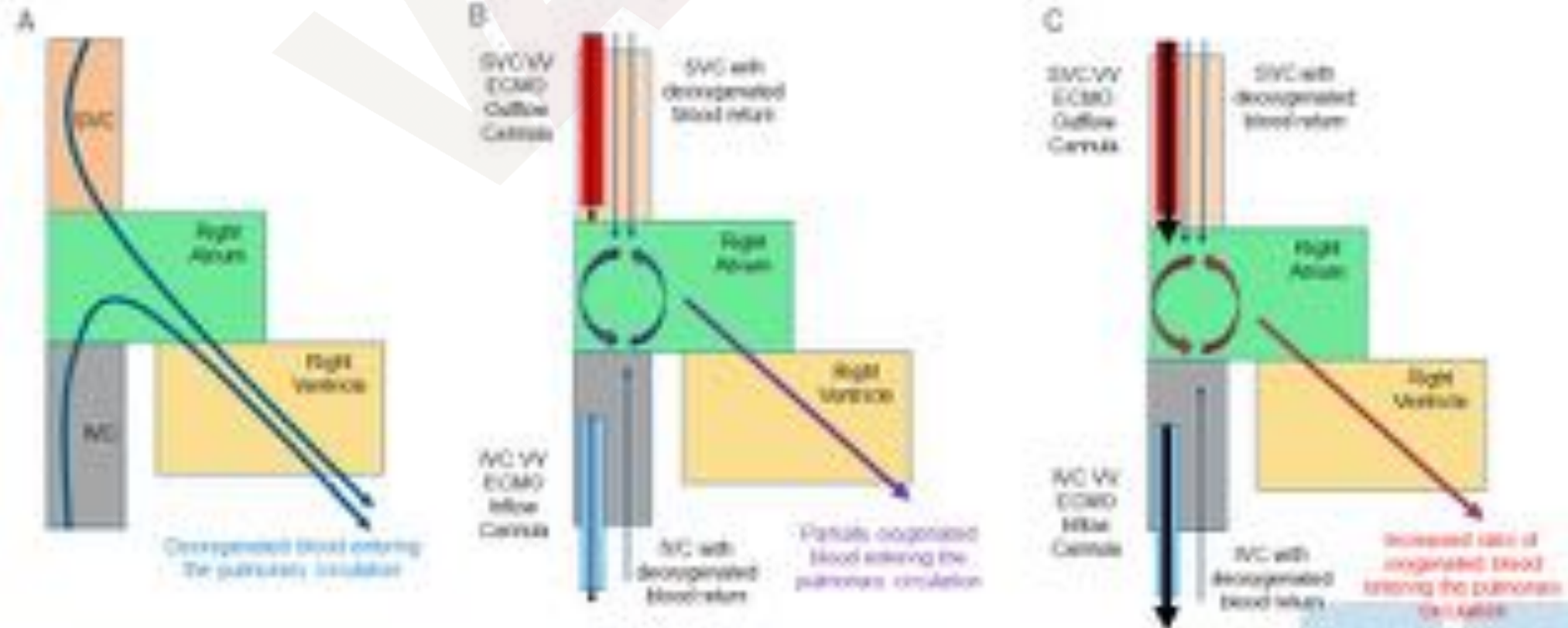
Case Description

- 28 year old male with no PMHx
- Presented with hypoxemic respiratory failure and diagnosed with mucoepidermoid carcinoma in distal trachea
- Taken to OR for robotic assisted distal tracheal resection following bronchoscopic tumor debulking.
- Induced and single lumen ETT placed
- Anesthesia maintained using TIVA- propofol and fentanyl
- Arterial and central venous access obtained
- VV ECMO cannulation- outflow distal SVC, inflow proximal IVC
- Patient positioned in left lateral decubitus position
- Mechanical ventilation discontinued

Case Description

- Flows maintained at 4.5L-5L/min given 1.8m² BSA
- During posterior airway wall anastomosis, BIS decreased, pH dropped to 6.8. Flows constant
- ECMO circuit pH sampled, 7.39
- Discussion with surgical team determined robotic arm compression of SVC resulted in induced SVC syndrome.
- Mechanical pressure relieved
- Surgical resection successful, ECMO rapidly weaned, patient extubated in OR
- Uneventful post-operative course

Discussion

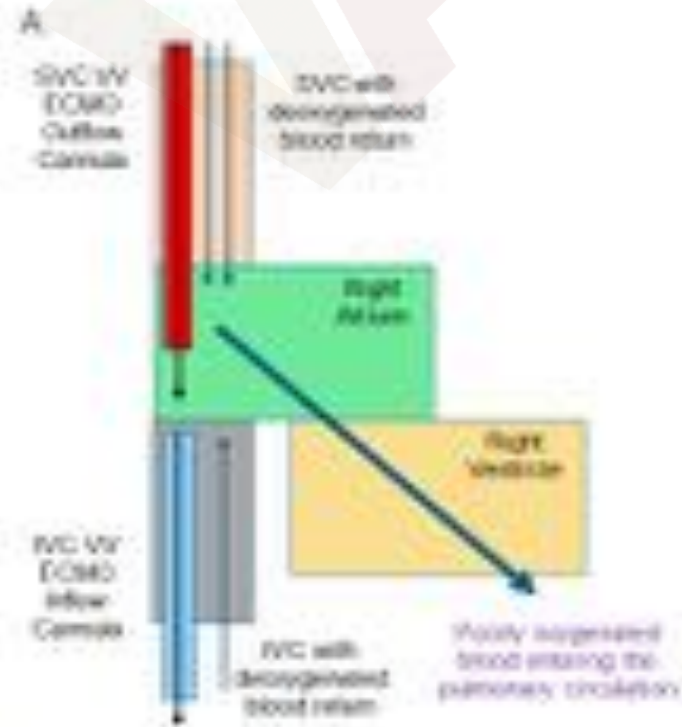


Normal pattern of venous blood flow into the pulmonary circulation for gas exchange.

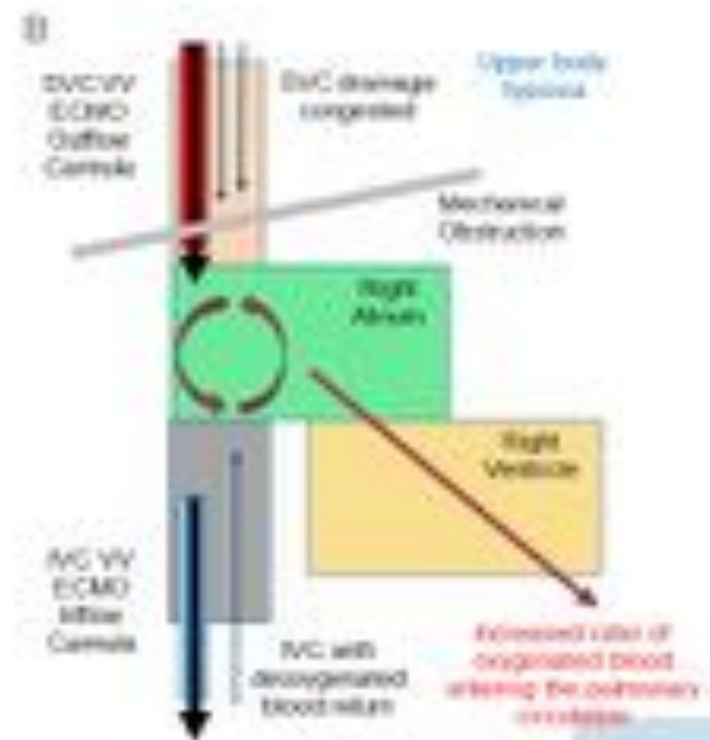
The VV ECMO circuit drains deoxygenated blood from the IVC via the inflow cannula and returns oxygenated blood into right atrium via the SVC outflow cannula. Deoxygenated blood mixes with the returned oxygenated blood and enters the pulmonary circulation for further gas exchange.

During sustained aortic flow, VV ECMO flow approaches cardiac output and increases the ratio of oxygenated blood to deoxygenated blood that enters the pulmonary circulation.

Discussion



If the inflow and/or the outflow canulas of the VV ECMO circuit become malpositioned, oxygenated blood mixing does not occur, resulting in systemic hypoxia.



Mechanical obstruction during surgical procedures can create an SVC syndrome and upper body hypoxia due to prolonged inadequate venous drainage.

Key Takeaways

- Robotic Assisted Tracheal resection decreases patient morbidity and mortality but requires VV ECMO
- Optimizing patient acid base status is critical intraoperatively
- Understanding VV ECMO physiology is required
- Troubleshooting VV ECMO issues requires rapid recognition and management by anesthesiologist



- **References:**

- 1. Rosskopfova P, Perentes JY, Ris HB, Gronchi F, Krueger T, Gonzalez M. Extracorporeal support for pulmonary resection: current indications and results. *World J Surg Oncol*. 2016 Feb 2;14:25. doi: 10.1186/s12957-016-0781-0. PMID: 26837543; PMCID: PMC4736123.
- 2. Campos JH. An update on robotic thoracic surgery and anesthesia. *Curr Opin Anaesthesiol*. 2010 Feb;23(1):1-6. doi: 10.1097/ACO.0b013e3283336547. PMID: 19844177.
- 3. Bartlett RH. Physiology of Gas Exchange During ECMO for Respiratory Failure. *J Intensive Care Med*. 2017 May;32(4):243-248. doi: 10.1177/0885066616641383. Epub 2016 Apr 3. PMID: 27040797.





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