



Echocardiography in critical care and mechanical circulatory support: pearls and pitfalls

Tuesday 10 July 2018

Answers to the unanswered questions during the live

How do you manage haemorrhagic stroke in ECMO patients?

- We use the following:
 - Neurology consultation and implement stroke pathway
 - Neurosurgical consult if indicated.
 - Respiratory ECMO and/or percutaneous right-sided support we stop the anticoagulation
 - Cardiac support – consider getting the patient off extracorporeal support asap, or downgrade to right-sided with no anticoagulation if possible, in general aiming to minimise amount of anticoagulation and duration of ECMO.
- Monitor using heparin levels rather than APTT/ACT/other.

What is the role of levosimendan during weaning?

What is the current role of levosimendan during weaning from VAECMO?

- One of a choice of inotropic agents that can be used. Advantages (theoretical rather than proven)
- Include effects on systolic and diastolic function. Data regarding neutral energetics are not proven.
- Can minimise duration of central venous access which can be an advantage for step-down, and can commence concomitant anti-heart failure medications whilst receiving the drug.
- Provided the patient does not have a low SVR and will tolerate levosimendan, we do use it. For this we would not load the patient, but start the infusion around 24-48 hours prior to our anticipated decannulation. We would then do an informal weaning study once the levosimendan dose was complete, and if satisfactory, plan the formal weaning study and decannulation within the next 24 hours.

What is best to monitor in serial echoes to evaluate readiness for weaning –

VTI EF TDI MAPSE strain?

- Ejection fraction is not very helpful due to load and inotropy dependence, as well as the phenotypic variation of patients that makes giving a specific value difficult (but serial changes/ direction of change under similar loading and inotropic circumstances can be helpful)
- Right and left VTIs (serial) are helpful, but they must be taken in context of each other, together with tIVT.
- Alterations in the degree/severity of AV valve regurgitation are extremely helpful
- MAPSE can be helpful in determining whether there is post-ejection shortening that has developed de novo which may imply ischaemia, and can be detected even with suboptimal echocardiographic windows. Its absolute value is not helpful however.
- Strain and strain rate imaging – can be helpful, but this is more a research observation – we will get back to you with the absolute numbers, and how to use it when we have completed our latest study



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- Radiographic and lung US imaging are helpful in determining the adequacy of pulmonary function when considering decannulation/downgrading – although this can be challenging

Do you use estimation of TAPSE and MAPSE?

- Yes – but of limited value. Changes in TAPSE may indicate alterations in RV systolic function. MAPSE – most of value when looking at timing of events rather than the actual value. It is, however important to look at the long axis function of the heart (MAPSE very helpful where there are suboptimal windows) in conjunction with transmitral Doppler as there can be significant reduction in long axis function in the presence of a normal EF, and when this is taken into account this may help with your determining how to support the heart.

What do you think of the use of milrinone in RV failure like in this case?

- Milrinone is useful and we do use it for RV dysfunction in our ECMO patients at the time of weaning.
- Where there is a combination of high PVR plus significant RV dysfunction, provided the SVR is not low we would consider its use, or possibly levosimendan.
- Addition of an inhaled pulmonary vasodilator can be helpful, but not required when on ECMO.

Why didn't you do a biopsy?

- Not required in this case. Once the patient was on ECMO (around the time of arrest) high dose steroids were commenced. Myocardial recovery began within 24 hours. A biopsy was considered at this time, however, moving the patient to the catheter lab when on ECMO is a significant risk to the patient, with questionable benefit. Also, we would not undertake any interventional procedure on a patient receiving ECMO unless it was definitely going to change our management. These discussions/decisions are, of course all undertaken in a multidisciplinary manner with our cardiomyopathy team.

How do you find the fine line balance in these acutely decompensated hearts on MCS with intropes who remain profoundly tachycardiac with or without transient arrhythmias (AF/flutter)?

- Arrhythmias: AF is generally better tolerated than A. Flutter, and we would cardiovert anything other than paroxysms, attempting to achieve sinus rhythm. We use amiodarone to manage rate and/or prevent new arrhythmias.
- Once on MCS, the answer to your question then diverges depending on the support. If left-sided/right sided support only, then we would aggressively treat arrhythmias in order to optimise contralateral heart function. If arrhythmia is limiting the patient's ability to wean, we would have a low threshold (in particular in flutter) considering EP intervention. Of course, we would also try to reposition any lines that may be precipitating an arrhythmia to be less arrhythmogenic (in particular flutter with right atrial cannulae)



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- Tachycardia in these patients is interesting. Each one is evaluated on an individual patient basis, as most frequently the tachycardia is an appropriate response of the heart to a limited and fixed low stroke volume in order to increase the cardiac output. We would not aim to slow the patient's heart rate unless we could demonstrate that doing so would benefit the haemodynamics. This is done using echocardiography to measure the tIVT, and how the right and left hearts fill and empty. If you want to know more, I can send you some information as to how to do this.
- Bradyarrhythmias: we would consider trans-oesophageal pacing if the arrhythmia was contributing to the patient's haemodynamics – for example HOCM with associated mitral regurgitation in the presence of persistent pulmonary oedema.

Do you take into consideration ivc variation for pasp measurement?

- No. The patients are monitored intensively, and we can measure the right atrial pressure directly

Suggested readings:

1- Focus Cardiac Ultrasound Core Curriculum and Core Syllabus of the EACVI. European Heart Journal 2018

2- 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure

3- European Resuscitation Council guidelines for resuscitation 2015

4- Indications and complications of VA-ECMO for Cardiac failure. Mehta H. et al. 2015. ACC

<https://www.acc.org/latest-in-cardiology/articles/2015/07/14/09/27/indications-and-complications-for-va-ecmo-for-cardiac-failure>

5- Pulmonary hypertension in the Critically Ill. Michelle Chew et al. 2011.

6- Predictors of successful weaning from ECMO after assistance from refractory cardiogenic shock. Aissaoui N, Combes A. et al. Intensive Care Medicine. 2011

7- Two dimensional strain rate and tissue Doppler myocardial velocities. Analysis by Echocardiography of hemodynamic and functional changes of the failed left Ventricle during different degrees of extracorporeal life support. Aissaoui N. JASE. 2012.