What's New in MCS Literature Review

May 2015

Kavitha Muthiah, MBChB, FRACP
Fellow in Adult Congenital Heart Disease
Bart's Heart Center, St. Bartholomew's Hospital
London, United Kingdom
E-mail: drkavithamuthiah@gmail.com,
Kavitha.Muthiah2@bartshealth.nhs.uk

Summaries of featured articles:

1. Saeed O, Jermyn R, Kargoli F, Madan S, Mannem S, Gunda S, Nucci C, Farooqui S, Hassan S, McLarty A, Bloom M, Zolty R, Shin J, D'Alessandro D, Goldstein DJ, Patel SR. **Blood pressure and adverse events during continuous flow left ventricular assist device support.** *Circ Heart Fail*. 2015;8:551-556.

In this multicentre retrospective study, the authors correlate doppler derived blood pressure measurements (DOPBP) in 123 continuous flow left ventricular assist device (cfLVAD) supported patients with adverse events (AE) of intracranial hemorrhage, thromboembolic events, or progressive aortic insufficiency. All DOPBP measurements until AE or study end were averaged and categorised as high (>90 mm Hg; n=40), intermediate (80–90 mm Hg; n=52), and controlled (<80 mm Hg; n=31). Thirty percent of patients in the high DOPBP group had one or more of the stipulated AE; patients in this group were significantly more likely to suffer an AE in comparison to the controlled group (adjusted hazard ratio [95% confidence interval], 16.4 [1.8–147.3]; *P*=0.012). Additionally, patients with an AE had a higher DOPBP (90±10 mm Hg) in comparison with those without an AE (85±10 mm Hg; *P*=0.05).

Limitations of this study are: retrospective study design with varied time-intervals of blood pressure measurements; analysis of both centrifugal and axial cfLVAD each with differing afterload dependence which may portend varying effects of blood pressure measurement. Moreover, these results need to be interpreted with the caveat that patients with high DOPBP had higher prevalence of known risk factors for adverse events: worse baseline renal function; lower angiotensin-converting enzyme inhibitor or angiotensin receptor blocker usage; and more prevalent history of hypertension. Nonetheless, this important contribution to literature is the first to document the relationship between high blood pressure and AE.

2. Doersch KM, Tong CW, Gongora E, Konda S, Sareyyupoglu B. **Temporary left ventricular assist device through an axillary access is a promising approach to improve outcomes in refractory cardiogenic shock patients.** *ASAIO J*. 2015;61:253-258.
Accompanying editorial
Maltais S, Stulak JM, Zalawadiya SK. **Mechanical bridge to long-term device implant: The necessary step for better outcomes.** *ASAIO J*. 2015;61:225-226.

Short-term mechanical circulatory support devices (MCSD) are used to provide temporary haemodynamic support in cardiogenic shock (CS), additionally serve as a "bridge to decision" (BTD) for heart transplantation and durable MCSD or "bridge to bridge" (BTB) for durable MCSD. Doersch et al review outcomes in a series of 15 patients supported with the Impella 5.0 (Abiomed, Danvers, MA) via an axillary approach for a median duration of 9 days (range 5-30days).

The majority of patients recovered from CS (93%), were mobilized (67%) and were extubated (73%) while on support. The 30 day and discharge mortality was 27% and 33% respectively.

Echo derived ejection fractions, cardiac output and central hemodynamic parameters of pulmonary artery pressure and pulmonary capillary wedge pressures improved significantly both during Impella support and after removal compared with before initiation.

This study highlights the feasibility of early ambulation following CS with Impella support. Additionally, favourable functional haemodynamics permit successful bridge to decision and explant following recovery from CS. The study is limited by its small numbers and the paucity of information regarding blood product requirements and evidence of haemolysis, which is known to occur with Impella support. Moreover, no comparison group is studied.

In advancing future direction in the management of patients in CS, prospective randomised studies comparing the Impella with other forms of temporary support such as extra-corporeal membrane oxygenation would be of benefit.

3. Mondal NK, Sorensen EN, Feller ED, Pham SM, Griffith BP, Wu ZJ. **Comparison of intraplatelet reactive oxygen species, mitochondrial damage, and platelet apoptosis after implantation of three continuous flow left ventricular assist devices: Heartmate II, Jarvik 2000, and HeartWare.** *ASAIO J*. 2015;61:244-252.

It is known that oxidative stress is contributory to pathophysiology of cardiac remodelling, with intraplatelet oxidative stress additionally affecting platelet function. Mondal et al have studied 26 patients and elegantly demonstrate the differences in markers of platelet oxidative stress in three types of continuous flow left ventricular assist device supported patients: HeartWare; HeartMate II and Jarvik 2000.

Intraplatelet reactive oxygen species (ROS) generation, mitochondrial damage, and platelet apoptosis were compared between device types before and after the implantation at every week up to 1 month. The authors report the significant elevation of intraplatelet ROS, mitochondrial damage, and platelet apoptosis significantly in the HeartWare group in comparison with the other two device groups after implantation. Additionally, adverse events of major bleeding, infections, systemic inflammatory response syndrome and right ventricular failure were found to be more common among the HeartWare group than others.

Long term data is not reported; the patterns of persistence in elevation of these markers in the HeartWare compared to the other devices may have long term implications on antiplatelet and anticoagulation use. Future direction in the field would be to study and correlate the elevation in markers of oxidative stress to both functional and haemodynamic parameters of remodelling.

List of MCS literature:

Circulation Heart Failure

1. Kiernan MS, Joseph SM, Katz JN, Kilic A, Rich JD, Tallman MP, Van Buren P, Lyons JJ, Bethea B, Eckman P, Gosev I, Lee SS, Soleimani B, Takayama H, Patel CB, Uriel N, Evolving Mechanical Support Research Group I. **Sharing the care of mechanical circulatory support: Collaborative efforts of patients/caregivers, shared-care sites, and left ventricular assist device implanting centers**. *Circ Heart Fail*. 2015;8:629-635
2. Oliveira GH, Al-Kindi SG, ElAmm C, Qattan MY, Deo S, Medalion B, Benatti RD, Osman MN, Ginwalla M, Park SJ, Simon DI. **Platelet inhibition with ticagrelor for left ventricular assist device thrombosis**. *Circ Heart Fail*. 2015;8:649-651
3. Kapur NK, Jumean M, Halin N, Kiernan MS, DeNofrio D, Pham DT. Ventricular square-wave response: **Case illustrating the role of invasive hemodynamics in the management of continuous-flow left ventricular assist device dysfunction**. Circ Heart Fail. 2015;8:652-654

ASAIO Journal

1. Benton CR, Sayer G, Nair AP, Ashley K, Domanski MJ, Henzlova MJ, Anyanwu AC, Pinney SP. **Left ventricular assist devices improve functional class without normalizing peak oxygen consumption**. ASAIO J. 2015;61:237-243
2. Tsiouris A, Paone G, Nemeh HW, Brewer RJ, Borgi J, Hodari A, Morgan JA. **Lessons learned from 150 continuous-flow left ventricular assist devices: A single institutional 7 year experience**. ASAIO J. 2015;61:266-273
3. Giridharan GA, Koenig SC, Soucy KG, Choi Y, Pirbodaghi T, Bartoli CR, Monreal G, Sobieski MA, Schumer E, Cheng A, Slaughter MS. **Hemodynamic changes and retrograde flow in LVAD failure**. ASAIO J. 2015;61:282-291
4. Giridharan GA, Koenig SC, Soucy KG, Choi Y, Pirbodaghi T, Bartoli CR, Monreal G, Sobieski MA, Schumer E, Cheng A, Slaughter MS. **Left ventricular volume unloading with axial and centrifugal rotary blood pumps**. ASAIO J. 2015;61:292-300
5. Zerdzitzki M, Schmid C, Hirt S, Wendl C, Schlachetzki F, Camboni D. **Successful interventional thrombectomy of a basilar artery thrombus in a long-term LVAD patient**. ASAIO J. 2015;61:e17-18
6. Sindermann JR, Holthaus AJ, Schepers M, Schluter B, Martens S, Scherer M. **False-positive hepatitis c testing in long-term LVAD support**. ASAIO J. 2015;61:e19

The following journals did not contain LVAD related articles in May 2015:

1. Journal of Thoracic and Cardiovascular Surgery
2. Journal of the American College of Cardiology
3. Journal of Cardiac Failure
4. European Journal of Heart Failure