The year 2015 was exciting for the field of mechanical circulatory support (MCS). Close to 101 articles were published in the 5 journals listed above with topics related to MCS. Overall, the survival of patients on MCS continues to improve, our knowledge about the impact of MCS on the human physiology is expanding and programs continue to develop innovative approaches to deal with adverse events. Moreover, the field of cardiac recovery is growing with newer studies testing novel cellular therapies during MCS support. Below is a summary of what was published in 2015 in the 5 journals cited followed by a comprehensive list.

**MCS OUTCOMES**
Registries and single center analyses demonstrated improvement in the outcomes of patients on MCS, especially on patients with short duration of heart failure (< 1 month). However several characteristics can have a negative impact in survival like the severity of end-organ dysfunction calculated by the sequential organ failure assessment (SOFA) and also high BNP levels after implantation. The neutrophil-to-lymphocyte ratio (NLR), a marker of subclinical inflammation, was found to be an independent predictor of postoperative mortality (OR = 1.12, CI [1.02-1.31], p = 0.021) and of postoperative right ventricular (RV) failure (OR = 1.117, CI [1.04-1.20], p = 0.003). Patients with high Doppler blood pressure (> 90 mmHg) had a higher risk of intracranial hemorrhage and aortic insufficiency. And obesity remains a risk factor for heart failure readmissions after left ventricular assist device (LVAD) implantation.

RV failure remains a common complication after LVAD implantation. In a single center analysis, patients with RV dysfunction requiring RVAD had worst survival compared to patients with RV failure treated with milrinone. Lesser tricuspid annular plane systolic excursion and smaller left atrial diameter are independent predictors of the need for RVAD after LVAD implantation.

Patients undergoing tricuspid valve procedures (repair/replacement) at the time of LVAD implantation had similar survival and readmission rates compared to patients without tricuspid valve procedures, and the tricuspid valve procedures were found to protect against further regurgitation.

Patients with pump thrombosis undergoing pump exchange with a subcostal approach (with motor exchange only) were found to have a better 1 year survival compared to sternotomy (100% vs 63%).

**EFFECTS OF MCS ON PHYSIOLOGY**

*Platelet function*
Bleeding is a frequent complication during mechanical support. The causes are multifactorial; however acquired von-Willebrand syndrome affecting platelet function remains an area of interest. A recent analysis demonstrated that MCS affects platelet functionality increasing the intra-platelet reactive oxygen species generation, mitochondrial damage, and platelet apoptosis. The degree of platelet dysfunction varies depending on the type of continuous flow device and could be associated with clinical events including major bleeding, infections, systemic inflammatory response syndrome, and RV failure. Another study found that platelet dysfunction measured by the mitochondrial membrane potential was identified in patients who developed a systemic inflammatory response syndrome after LVAD implantation.

*Aorta and aortic valve*
The lack of pulsatile flow has been associated with vascular changes in patients with MCS. Recent data demonstrated that patients with LVADs were found to have increased aortic wall thickness, vessel stiffness, collagen and smooth muscle content accompanied by a reduction in elastin and mucinous ground-substance content.

The opening and closing of the aortic valve remains an area of attention. A recent study showed that the opening of the aortic valve during exercise at 3 months after implantation was a protective factor for the development of aortic insufficiency and was associated with lower readmissions rates, suggesting the hypothesis that cardiac rehabilitation could have an impact in outcomes. Uriel et al demonstrated that the effects of ramp studies in the aortic valve opening depends on the type of continuous LVAD (axial vs centrifugal) and the parameter slopes are different for each type of LVAD.

**MANAGEMENT OF SIDE EFFECTS**
Several case reports for the treatment of adverse events were published including the utilization of intraventricular thrombolysis and tandem heart for pump thrombosis, particle embolization for epistaxis, left stellate ganglion blockade before surgical ganliolysis for refractory ventricular tachycardia, octreotide for recurrent GI bleeding, and interventional thrombectomy of a basilar artery thrombus.
CARDIAC RECOVERY
Stempien-Otero et al. published in the Journal of the American College of Cardiology the results of 6 patients with ischemic cardiomyopathy who underwent epicardial injections of autologous CD34+, CD34-, bone marrow mononuclear cells and a saline control immediately before LVAD implantation. (101) Contrary to preclinical models that showed increased vascularity with stem cell therapy, in this study the histological analysis demonstrated decreased density of endothelial cells in the myocardium injected with stem cells compared to the myocardium injected with saline. Several limitations could have been related to these results including the very limited sample size, the dose and mechanistic model of stem cell delivery and also a very advanced heart failure population with poor chances for recovery. These results should not be interpreted as a lack of cardiac recovery with stem cell therapy during MCS support; moreover these data will complement and be used to improve the experimental models to test the effects of adjuvant therapies for myocardial recovery.

ASAIO JOURNAL

January - February
1. Ryan TD, Jefferies JL, Zafar F, Lorts A, Morales DLS. The Evolving Role of the Total Artificial Heart in the Management of End-Stage Congenital Heart Disease and Adolescents. ASAIO J 2015; 61:8–14

March – April

May - June
19. ♦♦ 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
20. ♦♦ Doersch KM, Tong CW, Gongora E, Konda S, Sareyyupoglu B. Temporary left ventricular assist device through an axillary access is a promising approach to


July - August


29. Sato T, Seguchi O, Iwashima Y et al. Serum Brain Natriuretic Peptide Concentration 60 Days After Surgery as a Predictor of Long-Term Prognosis in Patients Imпланted With a Left Ventricular Assist Device. ASAIO J 2015;61; 373-378.


September - October


November - December


 Implanted Left Ventricular Assist Devices. ASAIO J. 2015;21(11):648-651

Journal of Thoracic and Cardiovascular Surgery

January - February

March - April

May – June

July - August
63. Smedira NG. Adding a new dimension to our understanding of continuous-flow physiology J Thorac Cardiovasc Surg 2015;150:207-8

September – October

November - December
72. Masaki Tsukashita, Hiroo Takayama, Koji Takeda, et al. Effect of pulmonary vascular resistance before left ventricular assist device implantation on short- and long-


Journal of Cardiac Failure

January – February


March - April


May - June


July – August


September – October


November – December


Circulation: Heart Failure

January


March


May


sites, and left ventricular assist device implanting centers. Circ Heart Fail. 2015;8:629-635


94. Kapur NK, Jumean M, Halin N, Kieman 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

July


September


Journal of the American College of Cardiology

March – April

101. Stempien-Otero, MD; Deri Helterline, MS; Tabitha Plummer, Stephen Farris, MD; Andrew Prouse, MD; Nayak Polissar, PhD; Derek Stanford, PhD; Nahush A. Mokadam, MD. Mechanisms of Bone Marrow-Derived Cell Therapy in Ischemic Cardiomyopathy With Left Ventricular Assist Device Bridge to Transplant. J Am Coll Cardiol. 2015;65(14):1424-1434. See also the Editorial comment: Timothy D. Henry, MD, y Heidi J. Reich, MD, y Andreas M. Zeiher. MDz Of Mice and Men - The Best Laid Scheme? J Am Coll Cardiol. 2015;65(14):1435-1437.