

Echocardiographic Evaluation of Biventricular Function during ECMO

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Abstract:

Extra corporeal membrane oxygenation (ECMO) is an evolving therapy with increasing utilization across the world. According to the ELSO registry, ECMO centers in the mid 2000s numbered at approximately 130 with about 2000 reported cases to 305 centers with 7368 cases in the year 2016. Currently, the exact role of ECMO is yet to be fully delineated with respect to patient selection, timing, indications and contra-indications. There are two main ECMO modes, Venovenous and Venovenous-arterial. We collected data for both cannulation strategies. In what follows, we describe our institutional experience in adult ECMO in the interval of 2009 to 2016 covering 265 patients over multiple intensive care units and varying settings. As we are a regional referral center for this patient population, we included both transfers and in house referrals. After obtaining IRB approval, we retrospectively reviewed the charts of all 265 ECMO patients and reported echocardiographic (both transthoracic and transesophageal) findings in the peri-ECMO period. Specifically we collected left and right ventricular ejection fraction and/or systolic function at three time points: pre ECMO cannulation, during ECMO cannulation, and post ECMO decannulation when available. Cardiac function while on ECMO was determined by the study performed in the middle of the time

interval of ECMO cannulation. We sought to answer the following questions in our analysis: 1) what is the mortality overtime in patients placed on ECMO 2) Do the interval assessments of LV and RV function prognosticate (with respect to mortality)? In total, 129 of 265 patients survived. Survival was defined as being alive 30 days after ECMO cannulation. On the whole, VV ECMO survival was 53.13% versus 41.36% for VA ECMO (P = 0.11).

For ventricular function Grades 1 through 5 were used to represent akinetic, severely depressed (EF < 30%), moderate (EF 31-40%), mild (EF 41-50%), and normal (EF >50 %) ventricular function with 1 being worst and 5 being normal. Overall for both VA and VV ECMO, in patients that survived, LV function showed improvement comparing pre and post-ECMO (3.63 vs 4.31 [P <0.000]). Similarly RV function showed improvement comparing pre and post-ECMO (3.25 vs 4.13 [P <0.0001]). This improvement was nearly a full grade improvement, showing some clinical significance. In patients that survived on VA ECMO only, the difference in pre and post LV and RV function is even more marked: LV pre: 3.12 LV post: 3.95 and RV pre: 2.86 RV post: 3.95 (P Values < 0.0006). Patients who survived on V-A ECMO had statistically significantly higher post LV and RV function as compared to those who died: LV: 3.83 vs 2.77 (P < 0.0001) and RV: 3.87 vs 3.15 (P = 0.008). No differences were noted in LV or RV echocardiographic findings for patients while on ECMO.

Our ECMO experience suggests that while mortality is high, echocardiography can be useful in prognostication. Statistically and clinically significant differences were noted in patients that survived and those that did not. These findings, if corroborated, may assist in decision making and ECMO utilization.