Extracorporeal life support in polytraumatized patients

Major trauma is a leading cause of death, in particular amongst young patients, causing more than 5 million victims every year worldwide. Early causes of death (usually related to severe hemorrhage, pulmonary failure, cardiovascular shock or extensive brain injury) are the most important in determining the poor outcome of severe trauma.

Conventional therapies for post traumatic cardiovascular shock and acute pulmonary failure may sometimes be insufficient and even dangerous.

Fig. 1. The poly-trauma patient's setting during ECLS.

New approaches in trauma care and advanced treatments are needed to modify the actual therapeutic strategy and treatment protocols. Extracorporeal life support (ECLS or ECMO) has proven to be effective in shock status and pulmonary failure, even when standard therapies have failed.

Since the first use of ECLS in a trauma victim, performed by Donald Hill in 1971, many changes and improvements in devices and materials biocompatibility have made the deployment of ECLS safer and easier even in very complex poly-traumatized patients (p.e. anticoagulation can be safely delayed for 48/72 hours and, after, can be maintained at low levels, reducing bleeding complications).

Since 2008 we have applied ECLS as rescue therapy in severe trauma patient, with refractory cardiogenic shock, cardiac arrest and/or pulmonary failure: the rationale for using ECLS in trauma patients is to treat refractory pulmonary and cardiopulmonary failure, provide adequate systemic perfusion, avoid consequent multi organ failure and permit organ recovery (Fig. 1.). Furthermore, we have identified several poly-trauma patient's characteristics as predictors of the ECLS treatment's appropriateness: Injury Severity Score > 63, pH less than 7.01 and Blood Lactate > 14.4mmol/l, were significantly associated with ECLS failure and identified as strong predictors of ECLS unsuitability and failure. The identification of predictors for ECLS unsuitability and failure could result in a better identification of patients with a greater efficacy and a better allocation of resources and cost-effectiveness.

When correctly applied, the ECLS application allows stabilize patients conditions and the normalization of all ABG values is reached after 3.5 ± 1.5 hours [range 2-4] of ECLS start (Fig. 2-A) and a comparable trend was registered in Mean Arterial Pressure, Inotropic Score and Blood Lactate concentration (Fig. 2-B).

From my and similar other experiences reported, the ECLS treatment allows to recover to life approximately the 35-40% of severe poly-traumatized patients with refractory cardiopulmonary failure.

In conclusion, ECLS is a safe and feasible technique for patients with profound and refractory cardiorespiratory failure secondary to trauma. When indicated ECLS should be initiated immediately as a component of the initial poly-trauma patient's treatment and our data have permitted to identify strong predictors of ECLS non-suitability and success in polytraumatized patients: these might be helpful in deciding whether the ECLS should be implanted, explicitly in patients who are severely complex and compromised.

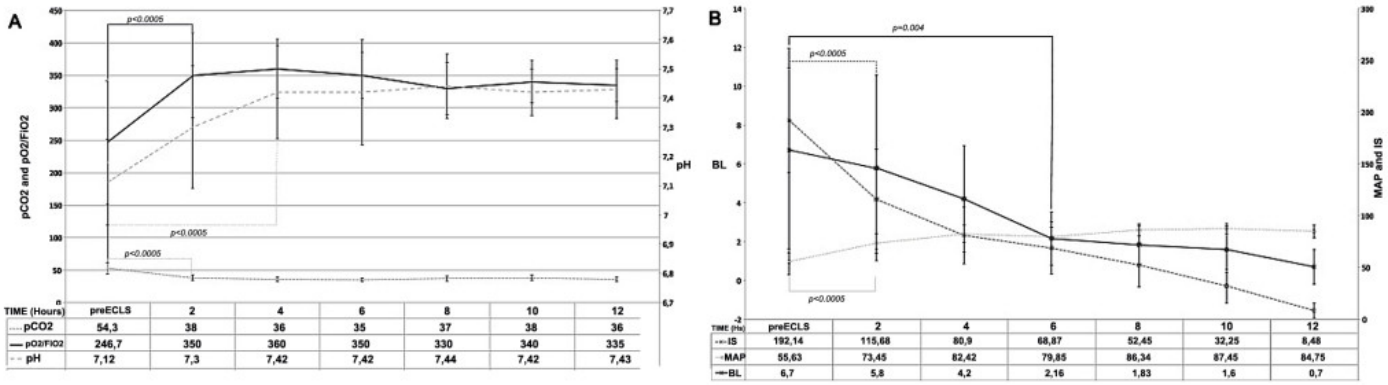

Fig. 2. A: The graph shows the Arterial Blood Gases Analysis Parameters from Pre-ECLS time to 12 hours left. The connection draws (with p value) were between pre-ECLS and the first significant different value for any parameter. The values are express as mean ± SD. (ECLS=Extracorporeal life support; pCO2, pre-ECLS value is the mean of at least 3 evaluations, (mmHg); pO2/FiO2, pre-ECLS value is the mean of at least 3 evaluations; pH, pre-ECLS value is the mean of at least 3

evaluations; p is referred to the first statistically significant variation of each parameter from ECLS-start.)
B: The shows the hemodynamic Parameters from Pre-ECLS time to 12 hours left. The connection draws (with p value) were between pre-ECLS and the first significant different value for any parameter. The values are express as mean ± SD. (ECLS=Extracorporeal life support, pre-ECLS value is the mean of at least 3 evaluations; IS=Inotropic Score, pre-ECLS value is the mean of at least 3 evaluations(?g/kg/min); MAP=Mean arterial pressure, pre-ECLS value is the mean of at least 3 evaluations (mmHg); BL=Blood lactates, pre-ECLS value is the mean of at least 3 evaluations (mmol/l); p is referred to the first statistically significant variation of each parameter from ECLS-start.)

It has proven to be lifesaving in multiply injured patients with refractory cardiopulmonary failure when it is promptly initiated in a specialized Center, as result of extraordinary potential to recovery under ECLS of this condition. Delays in its application, may contribute to further tissues hypoperfusion /anoxic insults just an irreversible intravascular diffuse coagulopathy and death.

In my view, advanced management of polytrauma patients should include ECLS in case of refractoriness of the clinical conditions to conventional treatments and if no predictors of ECLS failure are present.

Future improvements in materials and techniques are expected to make ECLS even easier and safer to manage, leading to a further extension of its use in disastrously injured patients.

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