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EDITORIAL

The dilemma of patient age in decision-making for extracorporeal life support in cardiopulmonary resuscitation

Roberto Lorusso[1*], Alain Cariou[2] and Hans Flaatten[3]

"Time is precious, but truth is more precious than time"
Benjamin Disraeli

Consideration of patient age in the decision-making for starting extracorporeal life support (ECLS) has long been recognised as a dilemma and remains controversial [1–8]. Providing ECLS is resource intensive and a complicated post-implementation course, or eventually proven to be futile, is not uncommon. The institution of temporary mechanical circulatory support is however growing, particularly in the subgroup of patients above 80 years of age (very old), with a close to doubling in use from 2004—7 to 2008—11 year-periods [9]. This demonstrates that ECLS is increasingly considered also for patients previously deemed not eligible for such aggressive treatments. Furthermore, admission of elderly patients to intensive care units for advanced treatments also seems to be increasing [10, 11]. Hence, as a result of recent advances in managing critical illness, advanced age is not considered a contraindication per se to advanced critical care therapies including temporary mechanical circulatory support. The question is, of course, to which extent and, indeed, whether we have actual age limits?

Yu and associates have addressed this controversial issue in their clinical study of in-hospital (IHCA) and out-of-hospital (OHCA) cardiac arrest patients undergoing ECLS as part of cardiopulmonary resuscitation, commonly referred to as ECPR [12].

Obviously, cardiac arrest compared to cardiogenic shock is more challenging and the injury imposed by no-flow and low-flow conditions of the former significantly worse. In addition, cardiac arrest patients have rarely been screened for agreed contraindications to advanced haemodynamic support.

The institution of ECPR for refractory cardiac arrest is usually meant as a bridge to recovery, and in the very old patients this may be the only objective, since more advanced treatment modalities such as heart transplantation or use of durable left ventricular assist devices are at present not a real option. The critical question is, of course, whether these patients have sustained irreversible injury during the cardiac arrest with little or no possibility of recovery. Is there a realistic possibility of an uncomplicated, time- and resource-limited approach in this scenario? The findings of Yu and associates confirm the ominous prognosis of ECPR in the very old patients when a certain time to mechanical support (60 min) has been passed. Age, as negative determinant of ECLS outcome, has been highlighted by previous investigations [1–8], although overall outcomes have never been sufficiently dismal to disqualify the very old patients of access to ECLS, particularly in a cardiac arrest scenario [4]. Indeed, an unfavourable prognosis when ECPR is started after an hour of resuscitation has been previously reported [13, 14] and the study of Yu and associates confirms previous investigations, underlining the strict association of ECPR timing and patient age with regards to ultimate outcome. The time to ECPR plays a critical role irrespective of patient age, with few survivors even in the young patient group after an hour of resuscitation efforts. If time is precious, this is particularly true for the elderly. The relevance of "door-to-support" in cardiogenic shock has been recently highlighted [15] but might be more critical in elderly patients. The decision to proceed

*Correspondence: roberto.lorussobs@gmail.com
[1] Cardio-Thoracic Surgery Department - Heart & Vascular Centre, Maastricht University Medical Center, Maastricht, The Netherlands
Full author information is available at the end of the article

Table 1 Factors to be assessed when managing ECPR in elderly patients

PRO	CON
Very short no-flow time (< 5 min) and immediate CPR by bystanders	Terminal phase of underlying illnesses and/or severe comorbidities (brain, renal, liver, lung)
Limited low-flow time (< 60 min) and quick access to ECLS implant (short door-to-support time)	No rapidly reversible cause of cardiac arrest and/or no possibility of cardiac recovery
Potential for rapid cardiac recovery (within 3–4 days) (recognized and treatable cause, like AMI)	Patient and family opinion (about prolonged support, complications management, cessation, further treatment and investigations, procedures)
Low-threshold for additional intervention and/or ECLS cessation	Severe and profound organ hypoxemia (lactate > 6 mmol/L or pH < 7.0)
Local attitude and resource allocation encouraging quickly decision-oriented (to start or to abstain)	Brain and neurological examination shortly after ECLS implant and thereafter

ECPR extra-corporeal cardiopulmonary resuscitation, *ICU* intensive care unit

to ECPR when IHCA occurs might be less challenging, since the peri-arrest conditions are certainly more favourable, particularly in terms of having patient information available, the quality of cardiopulmonary resuscitation and the time to intervention. Notwithstanding, we definitely need more data and insights mainly for OHCA, and in particular better outcome data in regards to heart-related quality of life and cognition in the very old patient group. The benefit of post-resuscitation care should also be assessed in older patients, since few data are available at this time for management [16].

At present we know that in some patients, and irrespective of age, ECPR might be beneficial in refractory cardiac arrest. The factors invariably associated with positive or negative outcome, however, are only partially known. The study by Yu and associates provides a small, but relevant contribution to resolving this knowledge gap and stimulates further efforts to avoid futile interventions that might negatively impact on mechanical circulatory support programs. Neurological complications on ECLS are often catastrophic with poor outcomes and once manifest should prompt careful consideration of withdrawing ECLS based on the very limited potential of recovery, particularly in the elderly patients. Other factors may play a role in the decision-making for ECPR in the very old patient, including geographical, religious and financial reasons. The study of Yu and colleagues tells us that time is always important, particularly for the elderly patients, but recognition of the diversity of local approaches as well as the limit of therapeutic intervention is most likely more important (Table 1). We need to fully understand treatment capacity and shortcomings. This is a long and perilous road, and future studies will help to elucidate what we can or cannot achieve within current ECPR programs. Team-based action and treatment in medicine is exploding, and this may reduce the time to intervention and bring more elderly patients in front of Shock Team examination, thereby increasing the number of difficult and controversial cases. We need more insights and data, other than time-related predictors, to understand if we should proceed or stop ECPR based on age criteria.

Author details
[1] Cardio-Thoracic Surgery Department - Heart & Vascular Centre, Maastricht University Medical Center, Maastricht, The Netherlands. [2] Medical Intensive Care Unit, Cochin University Hospital (APHP) and Paris Descartes University, Paris, France. [3] Department of Clinical Medicine, University of Bergen/Haukeland University Hospital, Bergen, Norway.

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