



SPECIAL ARTICLE

Blood purification in the critically ill patient. Prescription tailored to the indication (including the pediatric patient)



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High volume;
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children

Abstract We maintain a dynamic position on extracorporeal blood purification therapies (EBPT). Continuous therapies are of choice in the hemodynamically unstable patient. We recommend their early introduction in the course of the disease, and starting with a dose of 30–35 mL/kg/h. Above all, however, daily re-evaluation is required of the hemodynamic and metabolic situation and water balance of our patients in order to allow dynamic dose adjustment. Some data suggest that continuous EBPT can favorably influence the clinical course of our patients, even in the absence of acute kidney injury. The potential usefulness of hemofiltration at doses higher than the conventional doses (continuous ultrafiltration >50 mL/kg/h or pulses of at least 4 h a day to more than 100 doses mL/kg/h) for achieving blood purification has also been commented. We review the possible indications of this technique, together with the peculiarities of implementing these therapies in children.

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PALABRAS CLAVE

Depuración
extracorpórea;
FRA;

Depuración de la sangre en el enfermo crítico. Prescripción adaptada a la indicación (incluido el paciente pediátrico)

Resumen Creemos que las técnicas de depuración extracorpórea deben seguir un planteamiento dinámico. Las técnicas continuas son de elección en los pacientes

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Depuración en pediatría

hemodinámicamente inestables. Recomendamos un inicio precoz en el curso de la enfermedad y comenzar con una dosis de 30-35 ml/kg/h. Pero, sobre todo, deberemos hacer una reevaluación diaria de la situación del paciente (hemodinámica, metabólica y del estado hidroelectrolítico) para ajustar la dosis de forma dinámica. Algunos datos evidencian que las técnicas de depuración extracorpórea continuas pueden influir favorablemente en la evolución del paciente crítico, independientemente de su función renal. Se comenta también la potencial utilidad de usar dosis de depuración superiores a las convencionales (hemofiltración superior a 50 ml/kg/h o pulsos de al menos 4 h diarias de más de 100 ml/kg/h). Revisamos, asimismo, otras posibles indicaciones de las técnicas de depuración extracorpórea, así como las peculiaridades de su aplicación en pediatría.

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Introduction

Acute kidney injury (AKI) is a common and serious problem for the intensive care unit (ICU) patient. In a study undertaken by the Nephrointensive Care Working Group of the Spanish society of intensive care (SEMICYUC) that covered 43 ICUs,¹ the reported incidence for AKI was 5.6% (a figure that increased up to 8.6% when coronary patients were excluded) and in a high percentage of patients, AKI developed as a component of the multiorgan dysfunction syndrome (MODS) (up to 93% in this study).

For the last 25 years we have witnessed dramatic changes in the way we manage extracorporeal blood purification therapies (EBPT) in the critically ill. Probably the key of these changes remains in a change in the goals pursued with the treatment and is reflected mainly by a shift from the classic view of purification² to a more preemptive role in the critically ill patient (CIP), when we aim now to minimize the negative impact of AKI in the evolution of MODS. This new focus (that we prefer to refer to as "renal support" instead of the more limited concept of "renal purification") explains also why continuous extracorporeal blood purification therapies (CEBPT) have positioned in the last years as a cornerstone in the field of EBPT in the ICU. In the above mentioned Spanish study¹ 38% of the patients with AKI received EBPT and 84% continuous modalities were used.

This preference can be explained by different circumstances^{3,4}: there is a good hemodynamic tolerance when a CEBPT is used (being the best alternative when hemodynamic instability precludes the use of an intermittent (IHD) modality); it is "slow", progressive and continuous and therefore avoids the abrupt changes in intravascular volume and electrolyte concentrations that take place during IHD; since it contributes to a lower but continuous elimination of fluid it gives us more room for the administration of parenteral nutrition and intravenous medication, besides providing for a selective removal from the interstitial space; the circuits have a small extracorporeal priming volume and show a lower activation of the complement system (mainly because the use of more biocompatible membranes); and finally because of the low rate of complications reported with its use. And besides all these facts, CEBPT can be safely applied by nursing staff with regular ICU training without requiring specialized staff for IHD.

In this review we will develop an update of the different scenarios where EBPT can be indicated and will distinguish between pure renal indications from other possible "non renal" scenarios for its use.

Indications and timing of renal EBPT (Table 1)

The classic scenario for initiation of an EBPT, as collected in the Kidney Disease Outcomes Quality Initiative guidelines (KDIGO)⁵ and the European Renal Best Practice (ERBP) position statement on the KDIGO,⁶ makes reference to the urgent indication when the electrolyte abnormalities, acid-base balance, azotemia and fluid overload compromise life.

- Initiate EBPT when life-threatening fluid overload, electrolyte and acid-base misbalances are present that cannot be corrected in a conservative way. (Not Graded)
- When deciding on the initiation of an EBPT, the clinical context for each individual case must be taken into consideration as well as lab-test trends and how these can be modified by the EBPT, instead of a fixed value for a specific blood marker (i.e. urea or creatinine). (Not Graded)

In any case, the ideal timeframe to initiate EBPT in the critically ill AKI patient is still undecided and a matter of continuous debate. It still remains controversial whether a "precocious vs late" indication could impact mortality or renal recovery in our patients. Furthermore, the terms precocious and late are subjective and as such are defined in different ways in the published studies. Right now a recommendation can not be made because we lack a clear reference, however, there is a trend to initiate them early based on several studies with methodology limitations and seems more clear that avoiding its use or delaying its initiation has some impact on mortality and can increase ICU stay.⁷⁻¹⁰

An additional problem remains in the impossibility to estimate the chances for AKI recovery regardless of the EBPT use and this makes harder the decision about when (or if) initiate the treatment.¹¹ Several renal biomarkers might be useful if prove to be able to detect which patients will most probably recover before¹² or after¹³ the initiation of the EBPT. In this context, it is possible that a furosemide test could be useful in predicting which patients will advance

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