Emergency Hemodialysis Using Lactate-Buffered Dialysate

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Dear Sir,

Jensen et al. [1] have recently described a triple-pump dialysis system using a lactate-buffered dialysate. We have extensively been using such a dialysis fluid over the past 5 years, with a double-pump system, in 1,473 hemodialysis sessions in the intensive care unit (n = 585) or in the nephrology department (n = 888) for acute renal failure, as well as emergency dialysis in chronic renal failure patients.

Our equipment, identical to that used by Tam et al. [2], consists of a BSM-22 blood module (Hospal) coupled to a venous pressure module (VPM; Hospal), used under bio-filtration mode. The blood flows at 250 ml/min, and is connected to a double-lumen central catheter or to two single-lumen femoral catheters. Dialysate flow is controlled by the other pump, and circulates countercurrently through a standard blood tubing set whose pump segment is located upstream of the dialyzer, its internal diameter allowing for a maximum flow of 5 liters/h. A standard extension peritoneal dialysis connecting device enables a linkage between the 5-liter peritoneal fluid bag and the dialysate tubing set inlet side. We initially chose a regenerated cellulose hollow-fiber dialyzer, then switched to cellulose diacetate which is more biocompatible [3], the surface being 1 m2 and the ultrafiltration coefficient 4.8 ml/min/mm Hg (Ambio-50wet; Asahi Medical). Performances are sufficient for a low dialysate flow, urea clearance being close to the dialysate rate flow, priming volume is small (59 ml), the low permeability avoids excessive loss of amino acids seen with high-flux membranes [4]; it is also inexpensive. The low coefficient rate limits the spontaneous ultrafiltration rate at a fixed 800 ml/h. The dialyzer outgoing fluid is collected in a graduated container allowing a volume determination at each bag change. When < 800 ml/h has to be lost by the patient, a compensation is regularly made up using a prediluting 200-ml isotonic serum NaCl (0.9%) flush, or iso-tonic sodium bicarbonate (1.4%) which in addition buffers dialysate acidity (pH = 5.5) [5]. Forced convection improves the efficiency of dialysis, and compensation allows for flushing the circuit to prevent and detect partial clotting, especially when the usual initial single 3075 Axa calcic nadroparin injection is contraindicated. The 5-liter intermittent peritoneal dialysis solution bag (Dienal 1.36% glucose; Baxter) is set, before and during utilization, on standard continuous ambulatory peritoneal dialysis bag heaters (bw03; Baxter). The dialysate volume used for each session was usually 30 liters, convection being 4 liters, the total hemodiafiltration volume is close to the total body water, and to the urea volume distribution, of a 70-kg patient. Each session was managed by a specifically assigned hemodialysis nurse. This ‘low-flow venovenous intermittent hemodiafiltration’ may, if necessary, be performed daily or can use larger dialysate...
volumes to maintain patient’s urea at the desired level, for instance in hyper-catabolic states. 
Pure ultrafiltration, used for acute fluid overload pulmonary edema, or in refractory left ventricular failure, is very fast to set up under usual double-pump single-needle mode, without dialysate, only by outlet drainage of dialyzer.

No major complication could be attributed to this technique. Some rare circuit coagulations were observed, most of the time when a ‘no-heparin’ technique was used. These occurrences were favored by intravascular coagulation states, the very weak heparinization forced us to transfuse at the end of the dialysis session. Chills were usually due to an insufficiently reheated dialysate; 4 g NaCl and 1-1.5 g KC1 per 5-liter bag were usually added to dialysate, because of frequent post-dialytic hyponatremia (125-130 mmol/l), the potassium-free dialysate predisposing to hypokalemia. In case of diabetes mellitus, hyperglycemia is constant, due to a glucose transfer from the dialysate, that can be contained by 4 U/h continuous intravenous standard insulin stopped 30 min before the end of the session. The glucose transferred from the dialysate also constitutes an energetic supply that may be beneficial in most cases. Lactate buffer may have caused fears of worsening lactacidemia and acidosis in case of hepatic failure or shock, as reported when lactate-buffered solutions were used as replacement fluid during hemofiltration [5]. Indeed, lactate blood level rose in some patients with high predialytic levels, but not enough (10-20%) in our experience to be of any significant clinical or metabolical consequence.

This double-pump hemodialysis saves investment, training and management, because it only requires equipment used daily in our department. It can be promptly set up at any bed equipped with a plug in the hospital. It offers sterile single-use dialysate and hydraulic circuit, along with a light maintenance technique and a urea clearance about 80 ml/min. Efficiency can be improved by using an independent dialysate pump (three-pump system) providing larger flows. The blood module can then be used with a narrow single-lumen catheter, implying a slight reduction of the clearance. However, a continuous technique [6] and a bicarbonate-buffered dialysate [7] seem able to improve even more the quality of dialysis, the patient’s tolerance, and perhaps survival rate of multiorgan failure patients.

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