

Sustained, Low-efficiency, Daily Dialysis (SLEDD) in the Critically Ill Patient

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Sustained, low-efficiency, daily dialysis (SLEDD) is a form of renal replacement therapy for the critical care setting. The slow continuous removal of solute and water tends to offer greater hemodynamic stability than a conventional hemodialysis treatment. SLEDD is a newer technique of renal replacement therapy that utilizes conventional hemodialysis equipment, but with similar therapeutic goals as Continuous Renal Replacement Therapy (CRRT).

SLEDD techniques combine the advantages of CRRT and Intermittent Hemodialysis (IHD) by using conventional hemodialysis machines with blood flow rates (BFR) between 50-200 and dialysate flow rates (DSF) of 200-400. Dialysis time varies anywhere from 6 to 12 hours or can be done continuously. The possible variations and adaptations of blood flow, ultrafiltration rate and duration of dialysis time as a function of needs of the patient are practically unlimited, which makes SLEDD applicable to the critically ill patient. Clinical trials comparing SLEDD to other forms of CRRT have failed to demonstrate a survival difference when adjusting for disease severity. The benefit is in being able to use one type of machine for any renal replacement therapy, instead of one machine for hemodialysis and a different machine for CRRT. Further, in contrast to hemofiltration or hemodiafiltration, the SLEDD is less complex and does not require substitution fluid and involvement by the pharmacy.

Several economic evaluations have shown SLEDD to be less expensive than CRRT. The main source of savings is in conventional dialysis supplies, versus CRRT equipment supplies, i.e. bloodlines, kidneys and dialysate, versus industrially produced sterile substitution fluid. A hospital did a cost analysis of a CRRT treatment for an episode of acute renal failure, lasting an average of 9.3 days with a replacement of the extracorporeal circuit every 2.5 days. The cost of consumables (hemofilter, blood and fluid lines and replacement fluid) per episode (9.3 days) of acute renal failure was \$1,614. The replacement fluid alone cost \$880.00. The equivalent cost for treatment with conventional dialysis machines was \$672.00, assuming 10 daily treatments.

In CRRT, when unable to use heparin, regional citrate (RC) used to be the anticoagulant of choice. Citrate acts as an anticoagulant by binding the calcium. RC anticoagulation requires the infusion of citrate into the arterial line and often calcium infusion in either the venous line or in a peripheral vein. RC is costly, the set-up is complex and it requires additional staff involvement. Calcium needs to be replaced and ionized calciums need to be closely followed. With prolonged RC use, metabolic alkalosis, hypernatremia and hypocalcaemia have been reported.

Citrasate®, a new acid bath/concentrate, matches very well with SLEDD as the renal replacement therapy of choice for the critically ill patient. Citrasate® contains a small amount of citrate, which anti-coagulates the extracorporeal circuit. Citrasate® causes no significant decline in calcium or magnesium. The half-life of citrate is very short, which allows it to be quickly metabolized by the muscle and liver. Citrasate® has also been successfully used on liver transplant patients without any problem of accumulation. Citrasate® can provide successful dialysis without heparin, a better dialysis treatment, reduced blood loss and a reduction in acidosis.

The use of Citrasate® in SLEDD or conventional hemodialysis treatments is an excellent alternative for an anticoagulant when heparin cannot be utilized; i.e. heparin-induced thrombocytopenia (HIT), bleeding risks, trauma and impending/post surgery procedures.

In summary, SLEDD is an increasingly utilized renal replacement therapy that facilitates efficient detoxification and has a favorable cardio-vascular tolerability profile for the critically ill patient. The technically simple, conventional, hemodialysis equipment is easier to operate, supplies are less expensive and one has more flexibility in planning patient therapies.

Note: With a higher dialysate flow rate more citrate, in relation to the blood, passes through the dialyzer, thus providing more anticoagulation. With SLEDD treatments, longer clot free runs have been achieved when the dialysate flow exceeds the blood flow rate by at least 75%.