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Original Research Paper

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PIRRT (PROLONGED INTERMITTENT RENAL REPLACEMENT THERAPY) AND SLED (SUSTAINED LOW EFFICIENCY DIALISIS)

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KEYWORDS :

INTRODUCTION

Patients with kidney disorders, both acute kidney disorders (GGA) and chronic kidney disease (CKD), continue to grow. New patients keep coming to the dialysis unit to get dialysis services. Often we find these patients in severe pain with unstable hemodynamics, making conventional hemodialysis impossible. For this reason, we are required to learn other dialysis techniques as a development of the techniques we have used so far. One of the options is the SLED technique (Sustained low efficiency dialysis). In 1998 Marshal et al at the University of Arkansas, USA, reported on the SLED (Sustained Low Efficiency Dialysis) technique performed with hybrid techniques. The first clinical report on SLED was published in Kidney International magazine, volume 60, Year 2001. Marshal et al, managed 37 GgGA patients in critical condition using the SLED technique. At that time they used a regular dialysis machine, but slowed down Qd and Qb, and prolonged tD. This is probably the first report to suggest that the SLED technique has an efficiency close to that of CRRT.

Hybrid dialysis is the combination or grafting (hybrid) of IHD and CRRT techniques. Each modality has disadvantages and advantages. In IHD, the hemodia-filtration process occurs in a short period of 4 to 5 hours every day or every other day. In addition, IHD has advantages in the efficiency and accuracy of the dialysis and ultrafiltration process. The disadvantage of simultaneous filtration and dialysis in a short period of time is that the patient's hemodynamics may become unstable. In CRRT, hemofiltration occurs slowly and continuously for 24 hours, thus stabilizing the patient's hemodynamics. The disadvantage is that the dialysis process is only effective if the filtration is at least 35 cc/min. This results in a very large volume of fluid replacement (substitution) required (>40 liters/day), which is expensive. In the last decade there has been rapid progress in the development of machines and membranes for dialysis therapy. Advances in this field have resulted in various modifications, including more biocompatible membranes, bicarbonate dialysis and smart machines that can ultrafiltration as well as sodium bicarbonate prolofiling capabilities have led to the development of various IHD modalities.

Hybrid dialysis combines the advantages of both CRRT and IHD. In hybrid dialysis, the hemodialysis process is performed, but the efficiency is reduced by slowing down the dialysis flow (Qd) and blood flow (Qb) so that the risk of hemodynamic disturbances is reduced. However, to achieve sufficient efficiency, the dialysis time (tD) is made longer (6 to 12 hours). Another advantage is that hybrid dialysis is not performed for 24 hours, allowing the patient time for other diagnostic or therapeutic procedures.

In the literature, several other terms are also known, namely: Slow Continous Dialysis (SCD), "Go-Slow dialysis", "Nocturnal dialysis", Sustained Low Efficiency Daily Dialysis (SLEDD), Sustained Low Efficiency Daily Dia-Filtration (SLEDD-f), or extended daily dialysis (EDD). Basically, all dialysis techniques mentioned above have the same principle, namely: hybrid dialysis (Marshal & Golper, 2007; Tolwani et al., 2007).

In summary, the following terms are used for clinical use:

a) SLED (Sustained low efficiency dialysis). The effort to stabilize the patient's hemodynamics is to reduce Qb and Qd. By reducing Qb and Qd, the dialysis and ultrafiltration processes become inefficient but the patient's hemodynamics stabilize. To improve dialysis adequacy, tD (Time-dialysis) is extended. Dialysis is performed daily or as needed. Profiling of sodium, temperature, and bicarbonate levels of the dialysate fluid is usually done. This technique prioritizes filtration over dialysis. Its effectiveness and stability are comparable to CVVH. If SLED is performed daily, it is referred to as SLED-D (Daily).

b) EDD (extended-daily dialysis). When hemodynamics is stable enough. Qd and Qb are normal or low but UF-rate is lowered (slow ultrafiltration). To achieve UF-goal, tD is extended as needed. This technique is used when dialysis (high ureum) is needed in addition to filtration. UF-rate is minimized to stabilize hemodynamics. Dialysis is performed every day or every night (Nocturnal dialysis).

In 2011, in Seminars in Dialysis, March-April 2011 issue and Nephrology Dialysis and Transplantation (NDT) volume 26, 2011, Marshal proposed changing the nomenclature of hybrid dialysis to **Prolonged Intrmittent Renal Replacement Therapy (PIRRT)**,

Marshal proposed changing the nomenclature to **Prolonged Intermittent Renal Replacement Therapy (PIRRT)** for the following reasons:

1. Intermittent dialysis has high efficiency in short time (<12 hours) but hemodynamically unstable. The main process is dialysis.
2. CVVH has low efficiency with long time (24 hours) but more stable hemodynamics. the main process is hemofiltration.
3. Hybrid dialysis is a combination of intermittent dialysis and CVVH, where the efficiency is low but the time is long (6-12 hours).
4. Advanced machines have been developed to enable new techniques such as CVVHD (where dialysis is performed in addition to filtration). HDF (where in addition to dialysis, filtration is also performed). Or ARRT (Accelerated Renal Replacement Therapy), which is a CVVHD system where the efficiency is increased but the time is shortened. In this peritoneal dialysis technique, the CPD (Continous Peritoneal Dialysis) technique is similar to CAPD but the time is shortened (<24 hours).

On the basis of the above, Marshal uses the term Prolonged Intermittent (PIR), which means that the treatment is more than 6 hours and is performed intermittently (not continuously for 24 hours). In addition, the PIRRT nomenclature also explains whether the process is dialysis (D) or filtration (F).

The PIRRT nomenclature is not yet in general use, but Marshal adapted the term PIRRT because it can better explain the issue of efficiency and duration of action.

Sled Therapy Techniques

a. Dialysis Machine

The machine used for SLED technique is a regular dialysis machine.Basically, any dialysis machine that can slow down blood flow (Qb) and dialysis flow (Qd) can be used for SLED.It is even better if the machine can manage sodium and bicarbonate profiling and dialysis fluid temperature profiling.Profiling is particularly useful when the patient is unstable or has a very low systolic blood pressure.

b. Duration of Dialysis

The duration of dialysis depends on the patient's needs, ranging from 6 to 12 hours.The more hemodynamically unstable the patient, the smaller the ultrafiltration that can be done every hour (UR-rate).As a result, the longer the dialysis time required.In a study conducted by Flieser & Kielstein (2004), it was reported that SLED performed for 12 hours every day was as efficient as CVVH performed for 24 hours.

c. Blood flow (Qb), dialysis flow (Qd) and Ultrafiltration rate (UFR)

Blood flow (Qb) is kept as low as possible to keep the patient's hemodynamic condition stable but to avoid blood clots in the dialysis channel or artificial kidney. Flow is usually set at 100-150 cc/min. Dialysis flow (Qd) should be between 100-300 cc/min. In some machine brands, Qd cannot be reduced to <300 cc/min.In this situation, the dialysis time should be at least 8 hours.Ultrafiltration rate (UFR) depends on the patient's hemodynamic condition. If the patient's condition is very unstable, the UFR is started very low (0-100 cc/h) and then increased after the hemodynamic condition is more stable.Ultrafiltration target (UF goal) depends on the needs. If the filtration needs are many while the patient is unstable, it should be done every day (SLED or EDD).

d. Anticoagulant

SLED can be performed without anticoagulant (free heparin), the possibility of clotting when SLED is performed without heparin is 26-46% depending on how low the Qd is. If heparin is used, a bolus of 1000-2000 units of regular heparin is usually given followed by 500-1000 units/hour.Monitoring with APTT, should be 1.5 times compared to before. When heparin is used, the possibility of clotting is 17-26%. If the dialyzer is to be reused, heparin should be used. Low molecule heparin can also be used, especially in patients with heart problems who are already using low molecule heparin. The use of citrate anticoagulants is considered to have advantages, but the price is expensive so it is rarely used.

e. Dialysate Fluid Composition

The dialysate fluid used is as commonly used for Bicarbonate hemodialysis. usually contains.0-4.0 mEq/liter Potassium, 1.5-2.5 mEq Calcium and 24-35 mmol/liter Bicarbonate.

f. Dialyzer (Artificial Kidney)

The dialyzer used is the same as that used in IHD. In the first report on the use of SLED technique by Marshal et al (2001), they used F8 low-flux polysulfone. (FMC-NA) while Berbece (2006) used 1.4 m2 polythersulfone (Bellco Diales 140). Roesli et al (2007) in Bandung used F8 HPS 1.8 m2 polysulfone (FMC-AG), with re-use (3 to 5 times). It is not recommended to use Cellulose Acetate dialyzers, especially when intending to re-use.

- IHD and SLED circuits are essentially the same
- The amount of Qd and Qb is adjusted according to needs
- In SLED, sodium, bicarbonate or dialysate temperature profiling is usually also performed
- The ultrafiltration rate is adjusted according to the patient's hemodynamics

The results of a review conducted by fliser & kielstein (2005) of studies comparing the use of SLED (hybrid dialysis) with CVVH (CRRT), reported that this technique is increasingly used to manage GgGA patients admitted to the ICU, they concluded that when compared with CVVH, SLED has advantages:

SLED has the following advantages:

1. Toxin removal efficiency (solute removal) can be comparable to IHD or CVVH.
2. Hemodynamic stability is comparable to CVVH.
3. Heparin utilization is much lower when compared to CVVH
4. Easy to perform and can be performed by dialysis nurses
5. Much lower operational cost
6. Possibility to perform at night, leaving the patient free during the day to perform other diagnostic or therapeutic procedures.

Case Example

Patient ID : Ms. AP 43 years old.

Diagnosis: CKD ec diabetic nephropathy on regular HD 2 times/ week Hospitalized in ICU a /i hypotension, hyperglycemia and overhydration?

General condition: weak, samnolen, restless, shortness. Available data : BP: 110/60 mmHg, N: 60 x/min RR: 26x/min Sat O2 85%.

Laboratory results: ureum 173, creatinine 10.24 Potassium 4.8 Mg/dl Sodium 142 Mg/dl Hemoglobin 8.9 Kgd 321 Mg/dl

Hemodialysis was performed with:Fresenius 4008B machine F8HPS artificial kidney (113 ml, 1.8 m2) tD: 4 hours, UFG: 200 (target UFG 2000ml/4h), Qb "150/min, Qd: 500ml/min, Sodium dialysate 140 mmol/L. dialysate temperature: 36,5.C 15 minutes of hemodialysis, blood pressure dropped to 80/34, pulse 51 x/min Hemodialysis was stopped. The doctor gave Dobutamine 5 mcg/kgBB/min. After waiting for 1 hour, the blood pressure reached 97/34 pulse 51x/min RR 26 x/min then it was decided to perform hemodialysis with SLED technique. SLED program: tD: 6 hours, Qb: 120 ml/min, Qd 300ml/min dialysate temperature: 35.5 sodium dialysate 145 UFG first hour: 3000 ml/6h (500ml/h). Bicarbonate :35 Hemodialysis with SLED technique completed. This case showed that patients who could not be treated with conventional hemodialysis could be successfully treated with SLED technique. Post SLED laboratory results: ureum: 50.0 cretinin: 3.03 sodium 143.0 blood sugar : 111mg/dl

CONCLUSIONS

In 1998, Marshal et al, at the University of Arkansas in the United States, reported a SLED (Sustained Low-Efficiency Dialysis) technique that was performed using a hybrid technique (Marshal et al, 2000, 2002). Basically, the hybrid technique combines the conventional hemodialysis process that is carried out quickly but causes unstable cardiovascular conditions with the hemofiltration technique, which is slow, less efficient but hemodynamically stable. Then, in 2011, in the March-April 2011 issue of Seminars in Dialysis and Nephrology Dialysis and Transplantation (NDT), volume 26, 2011. Marshal proposed changing the nomenclature of hybrid dialysis to Prolonged Intermittent Renal Replacement Therapy (PIRRT), Marshal used the term Prolonged (the time is extended but less than 12 hours) Intermittent means the action is not carried out continuously for 24 hours. In addition, the PIRRT nomenclature also describes whether the process is dialysis (d) or filtration (f). SLED is widely used in acute renal failure patients admitted to the ICU

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