Best solutions in PD

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Bio**in**compatibility of conventional PD fluid's could be acute (acidic pH ; high glucose concentration ; hyperosmolality ; lactate buffer) and/or chronic (GPD's and AGE's). The hierarchy of importance of each factor of bio**in**compatibility is discussed. Nevertheless together, these membrane toxicities (cytotoxicity, vasculopathy, cellular dysfunction) impact on membrane function both first, by neoangiogenesis (more pores, more small pores) inducing hyperpermeability to the solutes, that is too rapid loss of glucose (reduced osmotic conductance, less UF mL/gr of delivered glucose) and preserved uremic toxins clearance (normal or/even « high » dialytic urea removal) and later, by fibrosis with loss of membrane permeability.

Biocompatible (multichamber) PD fluid's are ph neutral and contain low or very low GPD's. The very low GPD's PD fluid's have quite similar levels in their glucose « hypertonic » solutions (4.25%) than the icodextrin glucose sparing solution (icodextrin, despite being « glucose free » contains GPD's). Bicarbonate as buffer appears of importance in case of hepatopathy, metabolic disease, dialysis post cardiac surgery (lactate monitoring to improve outcome), reduced muscle mass (« babies »)…

Icodextrin provides real advantages during very long dwells (>10-12hours), beyond UF improvement, sodium balance and uremic purification are of potential impacts. Long day dwell icodextrin don't deliver any dextrose (risk of hypoglycemia in fasting infants?). Icodextrin could be associated to side effects (hypersensitivity).

Optimisation of the exchange permeability (especially the glucose osmotic conductance optimisation, that is more mL of UF per gramme of glucose delivered) applying new PD fluid's should be considered as an alternative to the acidic icodextrin prescription « for all ». Patient acidosis, even « mild » (<22mmol/L bicar) play a contributory role in the occurrence of morbidities and enhanced mortality. Very low GPD's PD fluid's are associated with a decreased peritonitis rate, with a decreased decline of residual renal function, and with an improved growth rate in children. Nevertheless, the relative hierarchy of importance of the bio**in**compatible factors (GPD's, AGE's, pH, glucose, hyperosmolality, lactate…) is not clear.

Between 1980 and nowdays,the prevalence rate of End stage renal disease increased 600%,from 290 to 1738 per million,with a vaste majority ending on hemodialysis,an extracorporal treatment where soulte removal is achieved across a semi-permeable capillary membrane.the "far from ideal" low flux hemodialysis that was and still internationally used is achieved by "diffusion" or movememt down concentration gradient,so larger molecules are not removed due to their slow speed diffusion although a small percentage could be retained by adsorption caracteristic of certain Artificial kidney.b2 microglobulin is one of these solutes with 11 500 daltons and responsible for the HD- related amyloidosis.other middle molecule is leptin involved in decreased appetite and malnutrition.

For a "state of the art" HD session,two important key elements are required:
1/A sophisticated machine with high sensor detectors(for arterial and venous blood pressure inntervalls,air trap notification, heparine infusion and continuous kt/v measurement...),
2/And a proper *biocompatible(with less complements and leucocytes activation and no inflammatory reaction induction) *and a synthetic high flux capillary membrane(with large pores that allow purification of medium to high toxic solutes).

Currently,the use of high flux synthetic membrane is commonly used in many western countries and thus after recommendation from KDOQI work group:toxins removal is achieved by diffusion and convection -a positive pressure is used to drive water across a high flux membrane and solutes are dragged with its movement.
Specific indication to high flux dialyzers include:reducing amyloidosis,improving control of hyperphastemia and anemia,and better reducinf cardiovascular events.

Highly pure replacement fluid is infused as substitution volume.
So attention must be given to the chemical and microbial quality of water and concentrates to comply with European Pharmacopeia in water,with microbial count <100 CFU/ml and endotoxin measurement <0.25 EU/ml.

Practical Bedside Prescription for hemodialysis

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Hemodialysis efficacy depends directly from the treated extracorporeal blood volume that is both, the achieved blood flow (up to and more than150 mL/min/m^2 or 5mL/min/kg BW) and the dialysis session time (at least 240 min if three sessions per week dialysis regime).

The principles of the blood purification are a combinaison of a diffusive process (related and proportional to the blood flow, the solute gradient of concentration and the dialysis membrane characteristics i.e. area and permeability), of a convective mass transport (related to the ultrafiltration flow only a fraction of the blood flow, the pressure gradient and the membrane characteristics), and of dialysis membrane absorption. In HD or HDF, the diffusive dose is given by the ureaKt/V (> 1.4). In HDF, the convective dose is determined by the convective volume achieved over a session (in HDF postdilution >12L/m^2) and the quality of this convective volume (β_2 m extraction coefficient >80% and limited albumine loss). HDF is superior to HD in terms of tolerance and outcome allowing both to a complete dialysis dose (diffusive and convective) and to dialysis fluids purity (chek for endotoxins level). The dialysis membrane characteristics contribute to the optimal dialysis prescription (surface area, residual blood volume, hydraulic and molecular permeability, loss of nutriments).

Dry weight determination and it's achievement at the end of the dialysis session are major goals for dialysis adequacy in terms of volume control. Both the interdialytic weight gain (at the best lower than 4 % BW) and the amount of weight loss per session (less than 1.5% BW per hour) are related to the cardiovascular morbidity and mortality, independently from their clinical tolerance.

The dialysate should be ultrapur (endotoxins < 0.005UI/mL i.e. « not detectable) to limit the risk of patient systemic inflammation (high micro CRP ; enhanced β_2 m generation) due to the backfiltration of contaminate dialysate, backfiltration occuring especially applying high flux membranes for HD. Dialysate temperature is usually lower than 37° (usually 36°) and there is a tendency to lower the sodium dialysate concentration (140-136 mmol/L) with bicarbonate buffered dialysate.

All thogether, dialysis time per week is the major key point of optimal dialysis.

Practical Bedside Prescription for Peritoneal dialysis

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Peritoneal dialysis (excepted continuous flow technology) only provides for a maximum of 8 to 12 GFR equivalency. CAPD is continuous over the entire day. APD can be prescribed as limited to an overnight dialysis session usually 8 to 10 hours duration, with an overday empty or filled abdominal cavity, with a « mid day » additive exchange and with an evening session (2 to 4 hours) before the overnight PD session, all cycles together conducting up to a maximum of 15 GFR equivalency.

Beside the dialysis solution choice (one choice can not fit for all the aims) the delivered fill volume and the allowed dwell time are the majors parameters of an adequate PD prescription.

The fill volume determines the percentage of wetted peritoneal membrane, therefore the recruitment of the capillary endothelial pores for peritoneal dialysis exchanges. A fill volume of 1400-1500 mL/m^2 fully recruit the peritoneal dializer, but this large volume is almost only tolerated at rest in supine position after progressive accustomisation in children aged more than 2 years. An objective tolerance assessment is recommanded to limit the riks of a too high intraperitoneal pressure, IPP upper limit 15-18 cm in supine position. A small fill volume is nearly half of the patient individually tolerated large volume.

The duration of the PD cycle is the filling time, the dwell time and the draining time but often dwell time is ambiguously confused with the entire cycle time, fact of more importance in APD than in CAPD. The duration of the in and out PD cycle times are directly correlated to the peritoneal catheter function and are driven by the pressures gradient. As an exemple, 1500 mL needs 8-10 minutes to be filled, and 15-20 minutes to be drained, that is a lot of time for a short duration APD cycle. The peritoneal equilibrium test gives an approach of the patient individual dwell time to apply depending on the patient need (UF and/or purification): short (favoring UF) is nearly the APEX time, long (favoring purification process) is 3-4 times the short time.

The cycle prescription should consider the patient dialysis needs : a short and small cycle favors UF (more free sodium water than solute coupled water), a long and large cycle favors purification process (solutes and solute coupled water). A too long cycle conducts to dialysate reabsorption that is water and sodium delivered to the patients (100mL reabsorption may charge the patients with 13 mmol sodium). A too high IPP should be avoided, therefore a lage fill should be secured by IPP measurement.