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Hemodialysis: principle and prescription

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Patients with end-stage renal disease are neither able to clear waste products and excess body water enough nor to replenish body buffers. Therefore, they should be given regular dialysis therapy [hemodialysis (HD) and peritoneal dialysis] or kidney transplantation in order to sustain life, though true and complete replacement of renal function is not provided by dialysis.
Among a variety of kidney functions, including clearance of solutes and water, control of electrolyte and blood pressure, and synthesis or activation of various hormones, dialysis therapy basically clears solute and water from the body. Solute is cleared by either diffusion or convection from the intravascular compartment. Fluid removal occurs via a hydrostatic pressure gradient across the membrane, and we call it as hydrostatic ultrafiltration.
The amount of dialysis that a patient receives affects morbidity and mortality. Therefore, we need to prescribe optimal amount of dialysis and should monitor whether the prescribed dialysis dose is sufficiently delivered to the patients. Although we should consider various factors for the 'adequate dialysis', it should help ESRD patients to be fully rehabilitated, to have a satisfactory nutritional intake and a sufficient production of RBCs, to maintain normal blood pressure, and so on. Among those, we only have a parameter on small-molecular-weight solute clearance yet. The preferred method of measuring delivered dialysis is the equilibrated or singlepool Kt/V. Since some studies suggest that Kt/V $\geq$1.2 is associated with decreased mortality, it has been recommended by clinical practice guidelines to target a singlepool Kt/V of 1.4 for obtaining a minimum Kt/V $\geq$1.2. However, we need to remember that the dialysis prescription may be modified for individual patients in order to provide optimal fluid, electrolyte, and acidbase balance; to maintain hemodynamic stability during dialysis; and to address disorders of mineral metabolism. In addition, clinical outcomes should be monitored, including rehabilitation and quality of life.
High efficiency refers to standard cellulosic membranes with a larger surface area, thus we expect higher Kt/V with high efficiency dialysis. In comparison, high flux (HF) refers to more porous noncellulosic membranes with increased permeability, particularly to larger molecules. HF dialysis may have a number of longterm benefits, including enhanced ß2-microglobulin clearance, improved lipid profiles, and, with biocompatible membranes, less stimulation of neutrophils and monocytes. However, we don't have any evidence that HF dialysis improves survival, except possibly among patients who have been on

dialysis for many years. Hemodiafiltration (HDF) is a form of renal replacement therapy that utilizes convective in combination with diffusive clearance. Compared with standard HD, HDF removes more middle-molecular-wieght solutes. If adequate convection volumes are achieved, maintenance online HDF may reduce the risk of all-cause and cardiovascular mortality compared with standard incenter HD.
In this session, we will look over the principle and prescription of HD and HDF.