KSN 2017 Abstract

Peritoneal dialysis: Principle and prescription

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Peritoneal dialysis (PD) has been widely used as one of the major renal replacement therapies for end-stage renal disease (ESRD) patients. A new PD fluid is instilled into the peritoneal cavity via peritoneal catheter after the previously instilled fluid has been drained out. Exchange of solutes and water between the body and the peritoneal fluid occurs during PD. PD system has three major components – 1) peritoneal fluid compartment, 2) peritoneal microcirculation and 3) peritoneal membrane. Basic mechanism employed in PD lies in diffusion and convection for removing uremic toxins, and ultrafiltration (UF) for water removal. PD fluid contains a high concentration of glucose, which generates an osmotic gradient between the peritoneal fluid and peritoneal microcirculation, resulting in water movement into the peritoneal cavity. There is a wide inter-individual variation in the speed of solute and water transport through the peritoneal membrane. Peritoneal equilibration test (PET) and other tests for the assessment of the peritoneal solute and water transport are pivotal for the prescription of PD. Fast transporters are likely to dissipate osmotic gradient earlier than slow transporters because they absorb glucose more rapidly through the peritoneal membrane. Suspected factors determining the peritoneal solute transport rate (PSTR) are age, diabetes, comorbidity, peritonitis, chronic inflammation and frequent use of bioincompatible PD fluid containing high glucose and glucose degradation products (GDP). Interleukin-6 (IL-6), vascular endothelial growth factor (VEGF), nitric oxide(NO), cancer antigen 125 (CA125) and transforming growth factor-b (TGF-b) have been associated with PSTR.

We have seen remarkable technical advances in the prevention of peritonitis by allowing less chance of contamination during PD fluid exchange (connectology), along with the development of diagnosis and management protocols. Automated PD facilitating fluid exchange during sleep provide improved quality of life for the patients. Continuous flow PD (CFPD) through potential application of sorbents is also under intensive research.

However, long-term PD is associated with progressive loss of UF capacity, resulting in ultimate discontinuation of PD. This is related to the inflammation, new vessel formation (neoangiogenesis) and fibrotic thickening of the peritoneal membrane (PM). Bioincompatible PD fluid, along with peritonitis, is the major contributor to the PM change. IL-6, VEGF, TGF-b, connective tissue

growth factor (CTGF) are suspected as mediators of the PM injury. There has been recent development of newer biocompatible fluids characterized by neutral pH, non-glucose or low GDP fluid. Further research will follow in order to develop a more biocompatible PD fluid.