



Dialysis

Kidney disease

The kidneys are a pair of bean-shaped organs, located in the upper abdominal area of the human body. The kidney is an essential organ for maintaining the health of the body. Its main functions are to: 1) remove waste from the body, 2) maintain overall fluid and salt balance, 3) control blood pressure, 4) adjust the amount of red blood cells, and 5) maintain healthy bones.

In this way, the kidneys play an important role in human life. However, should the function of the kidneys gradually decrease due to aging, diabetes, high blood pressure, and arteriosclerosis, a patient may be diagnosed with chronic kidney disease (CKD), and require treatment depending on the condition of disease progression. Currently, approximately 13.3 million patients suffer from CKD, which is said to be a new national disease.

Treatment of CKD involves the combination of numerous methods, including lifestyle improvements, diet, treatment for high blood pressure, and pharmacotherapy. In serious cases, kidney function drops to 15% or less and renal replacement therapy including dialysis or renal transplant must be initiated.

Dialysis treatment

One renal replacement therapy is hemodialysis. This therapy circulates blood outside the body through an artificial filter to remove waste and excess water accumulated in the blood due to renal failure.

The prototype of the dialysis membrane used in treatment was invented by Thomas Graham in the mid-19th century. Doctor John Abel first applied the membrane as a substitute for the kidney in 1913, and successfully performed extracorporeal hemodialysis on animals. Initially, blood coagulation during extracorporeal circulation was a major challenge. However, anticoagulants have been developed subsequently, and the procedure could be performed on the human body.

Since the end of World War II, dialysis technology dramatically improved. Downsizing of devices prompted the enlargement of the dialysis membrane area. During the process, multilayer dialyzers and hollow fiber dialyzers were developed. After a number of improvements, this became the standard therapy up to now.

Principles of hemodialysis

The principle of dialysis is to place a semipermeable membrane between the blood and a dialysate to remove toxins in the blood by diffusing them into the dialysate. In doing so, water and other substances are moved to adjust the amount of water and replenish deficiencies in the blood. A medical device equipped with this dialysis membrane is called a dialyzer. It substitutes the kidney's filtration function, and acts as a substitute kidney for patients with decreased kidney function. Dialysis that used this mechanism is called hemodialysis, and it is performed at medical institutions including clinics.

Peritoneal dialysis and remote monitoring

Another renal replacement therapy is peritoneal dialysis that uses the peritoneum lining of the organs in the abdomen as a dialysis membrane. In this procedure, the abdomen is filled with

dialysate via catheter and the blood is purified in the body. As this can be performed at home, patients have to visit hospitals only about once a month. As such, patients can undergo dialysis treatment while continuing working without major lifestyle changes.

There are two different types of peritoneal dialysis. The first is continuous ambulatory peritoneal dialysis (CAPD), in which the bag containing dialysate is manually changed 3-5 times a day. The other is automatic peritoneal dialysis (APD) which mechanically changes dialysate at night. APD can reduce the burden of replacing dialysate during the day and allow patients more freedom of action.

The most recent technological innovations in APD allow medical staff to remotely monitor a patient's status at their home using mobile communications functions, and allow doctors to change prescriptions from hospitals.



Automatic peritoneal dialysis (APD) at home enables remote monitoring by medical staff

Paradigm shift in therapy selection

The number of dialysis patients in Japan is said to be about 330,000, and continues to increase, largely due to an aging population and increasing incidence of diabetes, which is one of the main causes for dialysis. Technological progress has improved prognosis and reduced complications such as infections. Moreover, increased treatment options such as CAPD and APD, in addition to hemodialysis, have allowed patients to choose treatments that best fit their lifestyles.

And, in Japan, the ratio of patients receiving hemodialysis to peritoneal dialysis is 97:3, which is showing the significant imbalance. This is attributed to the fact that peritoneal dialysis was not fully explained to patients because medical staff were uneasy about the procedure due to a lack of experience, and patients were concerned about self-management at home.

In recent years, there has been a call for "shared decision making" in which patients and their families fully participate in therapy selection, and we are shifting into an era where we select treatments that suit our lives and values.*

* Japan Society for Peritoneal Dialysis: Symposium in October 2017

Technological innovation that applies digital technology is set to continue in the dialysis field, such as APD remote monitoring. It is expected that medical fees and devices that offer innovative treatment will be evaluated in light of the values they offer.