4. Dialytic Treatment for Chronic Renal Failure. Peritoneal Dialysis—Today and Future—

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In 1861, Graham made up a new word "dialysis". "Dia" means "through", and "luein" means "loosen" in Greece, respectively. In 1877, Wegener described the possibility that peritoneum might be able to transport some solutes to the other side via active and passive forces according to osmotic gradient.

In 1923, Ganter applied such a peritoneal function to clinical use, that is, peritoneal dialysis (PD). Since then, PD had been widely used for the purpose of treatment of end-stage renal diseases (ESRD). Today, PD is performed as intermittent peritoneal dialysis (IPD) and also as continuous ambulatory peritoneal dialysis (CAPD), and is the most important one of many blood clarification methods.

The trends of introductory methods of dialysis treatment

Table 1 shows methods of dialysis made use of

Table 1. Introductory methods of dialysis treatment for end-stage renal disease patients. (PD: peritoneal dialysis, HD: hemodialysis)

Term	Total	P D	H D	Others
1963~ 1965	30 35.9 yrs	30 (100.0%)	0 (0.0%)	0 (0.0%)
1966~ 1970	62 38.8 yrs	61 (98.4%)	1 (1.6%)	0 (0.0%)
1971~ 1975	47 40.7 yrs	42 (89.4%)	5 (10.6%)	0 (0.0%)
1976~ 1977	52 48.7 yrs	25 (48.1%)	27 (51.9%)	0 (0.0%)
1978~ 1979	68 45.7 yrs	21 (30.9%)	42 (61.8%)	5 (7.3%)
1980~ 1981	89 47.3 yrs	13 (14.6%)	74 (83.1%)	2 (2.3%)
1982~ 1983	92 49.9 yrs	19 (20.7%)	66 (71.7%)	7 (7.6%)
1984~ 1985	61 48.7 yrs	23 (37.7%)	34 (55.7%)	4 (6.4%)
Total	501	234 (46.7%)	249 (49.7%)	18 (3.6%)

introduction to dialysis treatment at the Toranomon Hospital. In early years (1963–1970), almost all ESRD patients were introduced to dialysis treatment by IPD because short of hemodialysis equipments. After then, patients were mainly introduced by hemodialysis. Recently, however, a part of patients who have been introduced by PD are gradually increasing because of high age and diversity of original diseases. For example, since 1976 when dialysis treatment had spread all over our country, 45.2% of diabetic patients and 62.5% of lupus nephritides were introduced to dialysis by PD. On the other hand, CAPD was mainly applied for the purpose of better rehabilitation in the report by CAPD research group, however, in our hospital it was performed because of hardness for attendance in the hospital, severe heart disease, and also shunt trouble.

Pathological findings of peritoneum

There happens many complications in peritoneal dialysis treatment. Among them, peritonitis is the most important and frequent one, and in some cases, it may interrupt continuing the therapy. But, little attention has been devoted to peritoneal changes of dialyzed patients.

Case HA, 68 yrs, Male

In 27 years old, he suffered from generalized edema, and moderate proteinuria was pointed out by a doctor. In 67 years old, he felt severe malaise, palpitation, dyspnea, then, consulted a doctor, and was recommended to visit a specialist because of hypertension (210/110), anemia, cardiomegaly, azotemia of BUN by 86 mg/dl. His urine volume was maintained over 2,000 ml/day, however, conservative maneuvers could not alleviate his complaints. He was introduced to peritoneal dialysis treatment, when his BUN and serum creatinine levels reached to 116 mg/dl and 16.0 mg/dl, respectively. He was treated as a out-patient, instead of some episodes of headache, bone fracture of

Table 2. Clinical characteristics and pathological findings of long-term peritoneal dialysis patients.

case	original disease	clinical characteristics				peritonitis	pathological findings			
		dialys. total	period P D	cause of death	B P mmHg	S-Cr mg/dl	fibrous changes		vascular changes	fatty deposition
T O27 F	SLE	6Y 9M	4Y0M	convuls.	160/104	10.0	No	+	++	+ - ++
M I68 M	CGN	2Y 8M	2Y8M	debility	220/110	8.7	Yes	+	++	++
E O34 F	DM	2Y 3M	2Y3M	heartfail	162/ 80	14.4	perforat	++	+	+
H A62 M	CGN	2Y 0M	2Y0M	ileus	210/120	16.0	adhesion	++	++	+
Y K25 F	CGN	3Y 8M	1Y5M	suicide	180/120	17.1	Yes	++	++	+
S F72 M	CGN	4Y 5M	1Y5M	resp. fail	160/ 80	22.0	perforat	+	+	++ - ++
T I56 F	SAGN	10Y11M	1Y5M	infection	164/100	18.9	No	+	+	++
M S54 F	CGN	9M	9M	debility	210/110	15.0	No	±	+	++
Y I24 F	SLE	8M	8M	sepsis	170/ 90	20.1	No	±	+	± - +
G O64 M	CGN	1Y 6M	4M	debility	200/110	15.9	No	±	+	++
M U42 F	CGN	2Y 1M	3M	suicide	180/110	10.5	No	±	+	++

left radius, abdominal pain, and occasional diarrhea. The reasons of continuing inflammatory signs, high ESR and CRP, was not elucidated. One year after the commencement of PD, he complained of severe abdominal pain and diarrhea after a head blow by upset. He died of ileus and general prostration.

Macroscopic findings of bowels showed severe adhesion of intestines and diffuse fibrous thickening of peritoneum, which made up a whole lump and might be a reason of ileus.

Microscopically, sub-serosal fibrosis of peritoneum and sclerotic changes of arteries were quite explicable, however, submucosal fibrotic changes were conspicuous beyond our expectation.

Submucosal fibrotic changes of peritoneum are impartially seen in patients maintained on peritoneal dialysis, not depending upon the existence of peritonitis. Table 2 shows the tendency that such peritoneal lesions increase to the duration of treatment. Though degrees of fatty deposition vary due to original disease, steroid therapy, nutritional state or other factors, cell infiltrations which suggest acute inflammation are not seen in almost all cases. These findings may correlate with so-called sclerosing peritonitis in long-term CAPD patients.¹⁾

In CAPD, efficacy of water removal rate per certain osmolalities decreases in the course of time. This may be explained by changes of mass

transport elicited by the decrement of available surface area and fibrosis of peritoneum due to chronic irritation. These findings, also, may set limits on PD including CAPD as along-term strategy for ESRD patients.

Glucose and lipid metabolism in CAPD patients

Although CAPD is now increasing in number all over the world, there are many clinical problems, especially in glucose and lipids metabolism.²⁾

Table 3 shows blood sugar, glycohemoglobin, and lipids in CAPD patients comparing with in HD patients. There are no statistically significant differences between two groups, however, there seems to be at higher levels in CAPD groups in all parameters. In diabetic patients, such a tendency

Table 3. Glucose and lipids metabolism in chronically dialyzed patients (CAPD: continuous ambulatory peritoneal dialysis, HD: hemodialysis, FBS: fasting blood glucose, TG: triglyceride, HbA: glycohemoglobin).

	CAPD (n: 14)	HD (n: 15)
FBS (mg/dl)	92.1 ± 7.8	82.1 ± 8.5
HbA1 (%)	6.9 ± 0.7	6.4 ± 0.7
HbA1C (%)	6.2 ± 0.6	5.9 ± 0.6
TG (mg/dl)	168.5 ± 80.8	134.9 ± 46.6
T-Chol (mg/dl)	183.3 ± 38.8	174.8 ± 30.3
HDL (mg/dl)	34.4 ± 10.6	34.1 ± 13.8
SUN (mg/dl)	72.4 ± 16.3	65.6 ± 18.4
S-Creat (mg/dl)	13.2 ± 2.3	9.9 ± 1.5

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becomes to be much more manifest comparing with that in non-diabetic patients. Abnormalities in glucose and lipids metabolism are intensely supposed to be related with continuously loaded doses of glucose from dialysis fluid. Although autopsy findings of pancreas does not reveal any abnormality, developments of dialysis fluid not including glucose and techniques of insulin supplement equivalent to loaded dose of glucose are fully requested.

In conclusion, today, PD including CAPD does not necessarily exceed HD in therapeutic results

for ESRD patients. But, there should be particular medical and social indications for PD treatment, for the sake of future spread, therefore, many problems of controversies have to be settled.

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