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# Impact of Dialysis Modality on Ultrasonographic Cardiovascular Parameters in Elderly Patients

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*Cardiovascular complications are the major cause of mortality in end-stage renal disease (ESRD) patients. Some reports show that ultrasonographic parameters for cardiovascular remodeling predict mortality in ESRD patients as well as in the general population. In the present study, we compared long-term longitudinal changes in cardiac parameters between elderly patients on peritoneal dialysis (PD) and those on hemodialysis (HD). We analyzed 19 HD and 7 PD patients who were more than 75 years old at the start of dialysis and who had been treated with the same dialysis modality for more than 4 years. We compared ultrasonographic cardiovascular parameters such as left ventricular mass index (LVMI), left ventricular wall thickness (LVWT), intima media thickness and intima media area (IMA) over the 4 years of PD and HD treatment.*

*As compared with values at the start of dialysis, values for LVMI, LVWT, and IMA were significantly elevated in HD patients after 4 years of treatment. In PD patients, we observed no changes in those parameters over time. Our findings indicate that cardiovascular remodeling is liable to deteriorate in elderly patients on HD, but that cardiac parameters in PD patients remain rather stable.*

**Key words**
Hemodialysis, elderly patients, cardiovascular remodeling, ultrasonography

## Introduction

Cardiovascular complications are frequent and a major cause of mortality in dialysis patients (1). Because the average age of dialysis patients is increasing in developed countries, management of cardiovascular function in those patients is becoming important. Debate about which dialysis modality, peritoneal dialysis (PD) or hemodialysis (HD), is superior with regard to cardiovascular complications has been ongoing (2,3). In addition, evidence is growing that cardiovascular remodeling already exists in pre-dialysis patients (4). Therefore, to elucidate whether cardiovascular parameters deteriorate after the commencement of dialysis and, if so, which dialysis modality has the lesser effect, we analyzed longitudinal data on ultrasonographic cardiovascular function in elderly patients on either PD or HD for 4 years from the start of dialysis.

## Patients and methods

We retrospectively analyzed 19 HD and 7 PD patients more than 75 years of age who were treated using a single dialysis modality for the 4 years following the start of dialysis therapy. Patients were randomly selected from among those whose available data included the parameters of interest. Cardiovascular parameters such as left ventricular mass index (LVMI), left ventricular wall thickness (LVWT: interventricular septum + posterior wall), and intima media thickness (IMT) and intima media area (IMA) of the cervical artery (5) were measured every year by ultrasonography and were compared between the HD and PD groups. In 10 HD and 7 PD patients, daily urinary output was also compared over the 4-year period.

Intragroup and intergroup statistical comparisons used the paired and unpaired *t*-tests respectively. Data are expressed as mean ± standard deviation, and $p < 0.05$ was considered to statistically significant.

## Results

The average age of the study patients at the commencement of dialysis was 78.8 ± 1.2 years for the HD group,

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and 77.5 ± 1.0 years for the PD group. The underlying renal diseases in the patients were diabetic nephropathy (HD/PD: 3/1), chronic glomerular nephritis (5/2), and nephrosclerosis (11/4). No significant differences were observed between the groups in terms of average age, sex, underlying disease, daily urinary volume, and all measured cardiovascular indices.

Table I and Figures 1 and 2 show the comparisons between the groups at the start of dialysis and after 4 years on dialysis therapy. The measured cardiovascular parameters did not change in the PD patients after 4 years as compared with values at the start of dialysis, but LVMI, IMT, and IMA were elevated in the HD patients at the end of the 4-year period. In the HD patients, all of the parameters were higher after 4 years than were those in the PD patients, and the differences in the LVMI and LVWT values reached statistical significance ($p = 0.024$ and $p = 0.001$ respectively).

As shown in Figure 3, daily urinary volume declined significantly faster after the start of dialysis in the HD patients than in the PD patients.

TABLE I Ultrasonographic cardiovascular parameters in patients before and after 4 years on hemodialysis [HD ($n$=7)] or peritoneal dialysis [PD ($n$=19)]

| *Parameter* | | *Year 0* | *Year 4* | p *Value* |
|---|---|---|---|---|
| LVMI (g/m$^2$ BSA) | PD | 188.6±56.3 | 171.2±27.5 | 0.232 |
| | HD | 164.9±39.1 | 189.9±59.2 | 0.012 |
| IVST+PWT (mm) | PD | 20.67±2.21 | 20.01±1.56 | 0.275 |
| | HD | 20.43±3.21 | 21.73±2.77 | 0.100 |
| IMT (mm) | PD | 0.92±0.13 | 0.87±0.25 | 0.442 |
| | HD | 0.82±0.12 | 0.96±0.16 | <0.001 |
| IMA (mm$^2$) | PD | 18.51±5.02 | 19.39±7.31 | 0.556 |
| | HD | 19.97±3.50 | 24.79±4.54 | <0.001 |

LVMI = left ventricular mass index; BSA = body surface area; IVST = interventricular septum thickness; PWT = posterior wall thickness; IMT = intima media thickness; IMA = intima media area.

## Discussion

Management of cardiovascular complications is important in end-stage renal disease (ESRD) patients. The present report shows longitudinal long-term outcomes with respect to cardiovascular remodeling in PD and HD patients. Our findings clearly show that PD is preferable to HD with regard to ultrasonographic cardiovascular parameters in elderly ESRD patients. Because LVMI and IMT have been reported to be prognostic factors for mortality in dialysis patients (6,7) and because patient age is a risk factor for cardiac hypertrophy in the chronic renal disease population (4,8), our results suggest that PD is appropriate for elderly ESRD patients. Although our data do not make clear the reasons for stable cardiovascular parameters in PD patients, possible explanations include these:

- The hemodynamic changes that may affect these parameters during long-term dialysis treatment are reduced in PD.

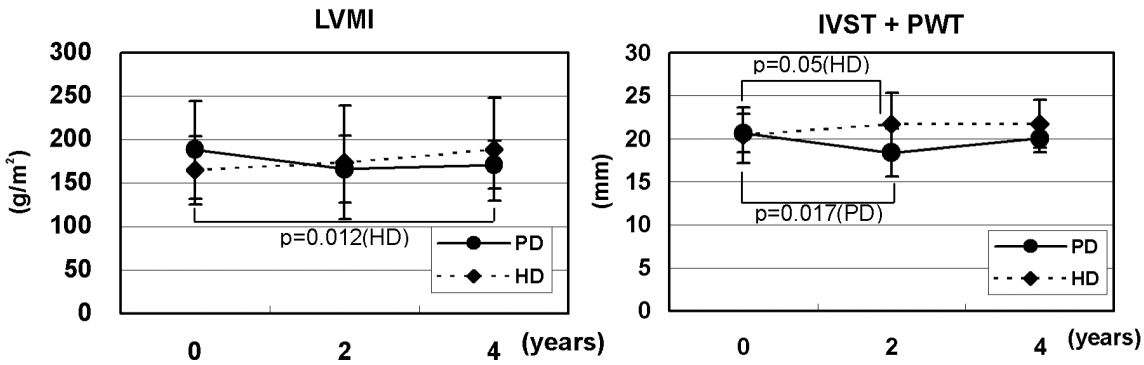


FIGURE 1 Comparison of changes in cardiac hypertrophy between incident peritoneal dialysis (PD) and hemodialysis (HD) patients for 4 years after the start of dialysis. LVMI = left ventricular mass index; IVST = interventricular septum thickness; PWT = posterior wall thickness.

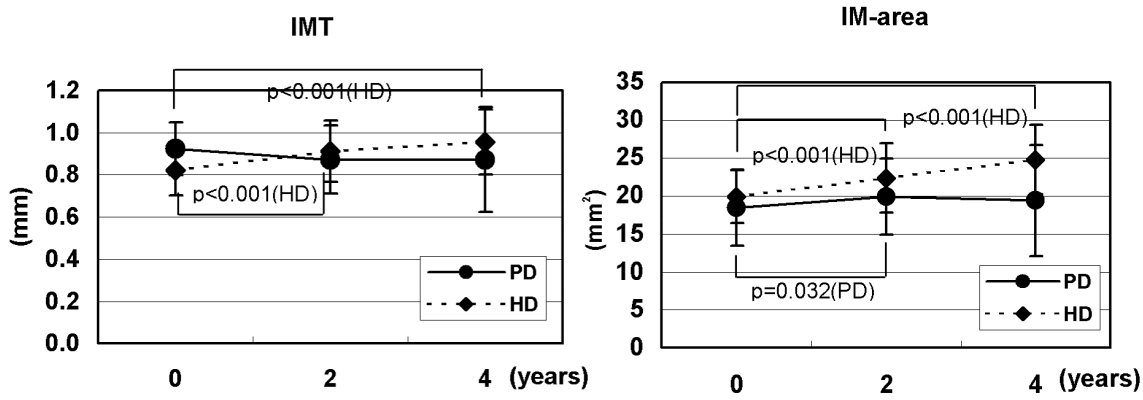


FIGURE 2 Comparison of changes in vascular parameters between incident peritoneal dialysis (PD) and hemodialysis (HD) patients for 4 years after the start of dialysis. IMT = intima media thickness; IM-area = intima media area.

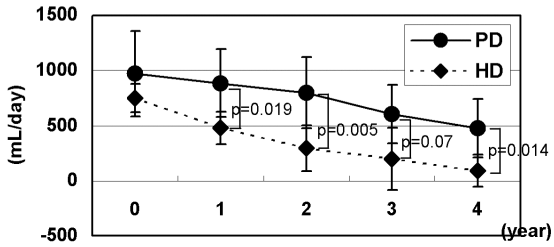


FIGURE 3 Comparison of changes in urinary output between incident peritoneal dialysis (PD) and hemodialysis (HD) patients for 4 years after the start of dialysis.

- Nutrition and inflammatory status are better maintained in PD patients.
- Blood pressure control was better in the PD patients.
- Residual renal function was better maintained in the PD patients.

Above all, residual renal function seems to be critical, as has been previously reported (9). Further studies are warranted to elucidate the mechanisms by which PD can sustain better cardiovascular function.

## Conclusions

Cardiovascular parameters in elderly HD patients, but not in PD patients, are susceptible to deterioration over time.

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