ANKLE-BRACHIAL INDEX AND SKIN PERFUSION PRESSURE: WHICH IS THE STRONGER PREDICTOR OF LIFE PROGNOSIS AMONG MAINTENANCE-PHASE HEMODIALYSIS PATIENTS?

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INTRODUCTION AND AIMS:

End-stage renal disease (ESRD) patients undergoing hemodialysis (HD) therapy often face any of the following comorbidities: advanced age, diabetes mellitus, hypertension, dyslipidemia, inflammation, malnutrition, oxidative stress, and vascular calcification, all of which play a role in the development of accelerated atherosclerosis. Because of arterial rigidity associated with calcification in HD patients, it is difficult to diagnose peripheral arterial disease (PAD) based on ankle-brachial blood pressure index (ABI) in this population. However, this method is still a gold standard to detect PAD. Meanwhile, skin perfusion pressure (SPP) has been reported to be the most useful noninvasive test for identifying PAD in HD patients. The aim of this study was to determine the predictive effect of ABI and SPP among HD patients in terms of life prognosis, including indications of potential vascular-related death.

METHODS:

ESRD patients undergoing maintenance HD therapy at the Kidney Center of Niigata Rinko Hospital in 2010 were enrolled as participants of this study. Based on ABI, those under 0.9 were diagnosed with PAD. PAD was also diagnosed based on decreased SPP, under 50 mmHg, either bilaterally or unilaterally in the plantar of the foot. Biochemical parameters were determined in all participants according to a standard laboratory procedure. Life prognosis and direct cause of death were collected at the end of 2016. Mortality was compared by Kaplan–Meier analysis and log-rank statistical analysis. Frequency analysis was performed with Fisher's exact test.

RESULTS:

1) Of 101 patients undergoing HD (age: 71 ± 1 years; duration of HD: 5.2 ± 0.6 years; female/male ratio: 40/61; diabetes/non-diabetes ratio: 40/61; mean SPP: right 72 ± 2 mmHg, left: 69 ± 3 mmHg), 23 were diagnosed with PAD based on SPP. Based on ABI, 10 patients were diagnosed with PAD. (Table. 1)
2) Fifty-eight patients died during the 6-year follow-up—12 patients from cerebrovascular disease (CVD), 15 from heart disease (ischemic heart disease and heart failure), 4 from infection of PAD, 5 from other infectious disease, 10 from aging, 6 from malignancy, and 6 from other causes.
3) Cumulative overall survival rates were plotted using the Kaplan-Meier method, and the intergroup (with or without PAD) differences were tested with the log-rank test (p = 0.0016 by ABI, p = 0.0002 by SPP). (Figure 1 and Figure 2)
4) According to ABI and SPP, patients with ABI above 0.9 and SPP above 50 mmHg in both feet group 1: n = 74; 34 patients had died) had better life prognosis than those with ABI above 0.9 and SPP under 50 mmHg either bilaterally or unilaterally (group 2: n = 17; 14 patients had died), ABI under 0.9 and SPP above 50 mmHg in both plantar (group 3: n = 4, all patients had died), and ABI under 0.9 and SPP under 50 mmHg either bilaterally or unilaterally (group 4: n = 6, all patients had died). (Figure 3 and Table 2)
5) For those concerned about vascular-related death (CVD with heart disease and PAD), PAD based on SPP presented a more detectable progression (p = 0.0041) than that based on ABI (p = 0.7217).

Table 1 Clinical data

	Total n=101	SPP under 50 n = 23	SPP above 50 n = 78	ABI under 0.9 n = 10	ABI above 0.9 n = 91
Age (year)	71.4 ± 1.0	75.0 ± 1.7	70.4 ± 1.1	72.8 ± 2.5	71.3 ± 1.0
Sex (F/M)	(40 / 61)	(12 / 11)	(28 / 50)	(4 / 6)	(36 / 55)
Diabetes (Yes/No)	(40 / 61)	(14 / 9)	(26 / 52)	(6 / 4)	(34 / 57)
HD duration (year)	5.3 ± 0.6	4.7 ± 0.8	5.4 ± 0.7	5.5 ± 1.1	5.3 ± 0.7
Rt foot SPP(mmHg)	72 ± 2	54 ± 5	77 ± 3	56 ± 8	74 ± 2
Lt foot SPP(mmHg)	69 ± 3	51 ± 6	74 ± 3	52 ± 7	70 ± 3
ABI	1.2 ± 0.0	1.0 ± 0.1	1.2 ± 0.0	0.6 ± 0.1	1.2 ± 0.1
WBC (×103/mm3)	6.1 ± 0.2	6.4 ± 0.6	6.0 ± 0.2	6.1 ± 0.6	6.1 ± 0.2
Hb (g/dl)	10.6 ± 0.1	10.8 ± 0.3	10.6 ± 0.2	10.9 ± 0.5	10.6 ± 0.2
T-P (g/dl)	6.6 ± 0.1	6.5 ± 0.1	6.6 ± 0.1	6.7 ± 0.1	6.6 ± 0.1
Alb (g/dl)	3.5 ± 0.0	3.4 ± 0.1	3.6 ± 0.0	3.5 ± 0.1	3.6 ± 0.0
BUN (mg/dl)	56.2 ± 1.8	52.7 ± 2.9	57.3 ± 2.1	56.4 ± 4.7	56.2 ± 1.9
UA (mg/dl)	7.1 ± 0.2	7.2 ± 0.3	7.0 ± 0.2	7.0 ± 0.5	7.1 ± 0.2
Cre (mg/dl)	8.93 ± 0.32	7.94 ± 0.49	9.23 ± 0.38	8.81 ± 0.93	8.94 ± 0.34
Ca (mg/dl)	8.9 ± 0.3	9.0 ± 0.2	9.0 ± 0.1	8.8 ± 0.9	9.0 ± 0.1
iP (mg/dl)	5.2 ± 0.2	4.8 ± 0.3	5.3 ± 0.2	4.3 ± 0.6	5.3 ± 0.2
Fe (mg/dl)	56 ± 2	50 ± 4	57 ± 3	51 ± 6	56 ± 3
TSAT (%)	26 ± 1	26 ± 2	26 ± 1	26 ± 3	26 ± 1
Ferritin (mg/dl)	182 ± 26	274 ± 87	153 ± 21	359 ± 182	162 ± 21
CRP (mg/dl)	0.51 ± 0.14	1.07 ± 0.52	0.34 ± 0.08	0.66 ± 0.27	0.49 ± 0.15
Anti-coagulant agent (Yes / No)	(55 / 46)	(17 / 6)	(38 / 40)	(8 / 2)	(47 / 44)

Figure 1 ABI and survival curve

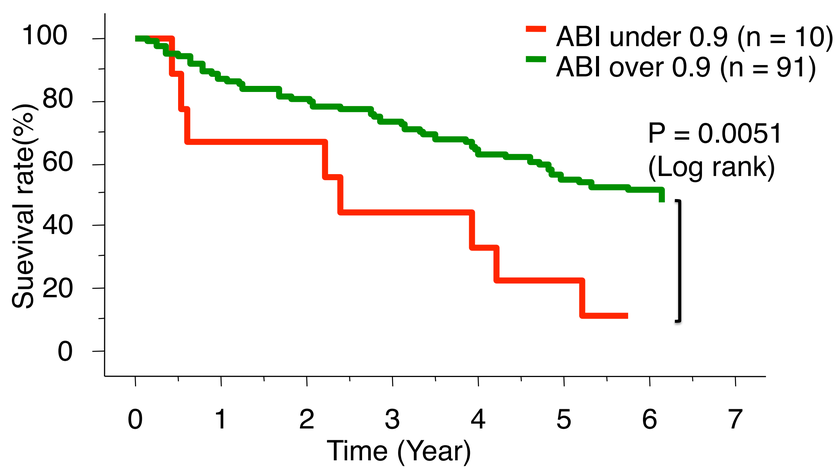

Figure 2 SPP and Suvival curve

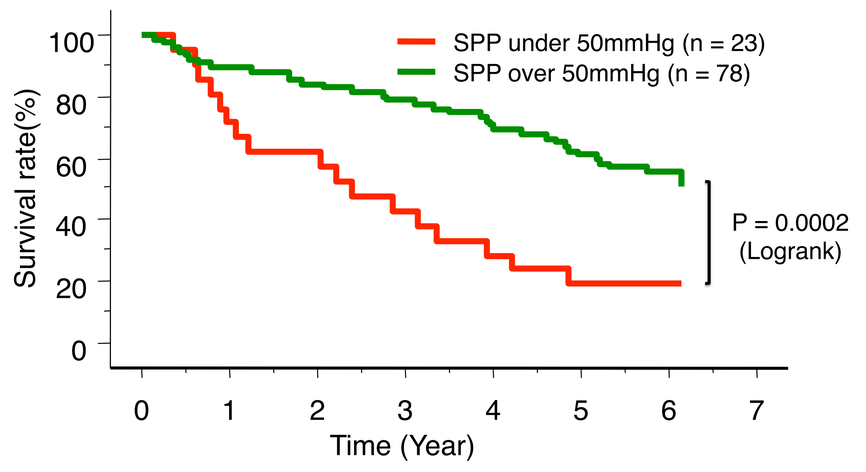

Figure 3 ABI + SPP and survival curve

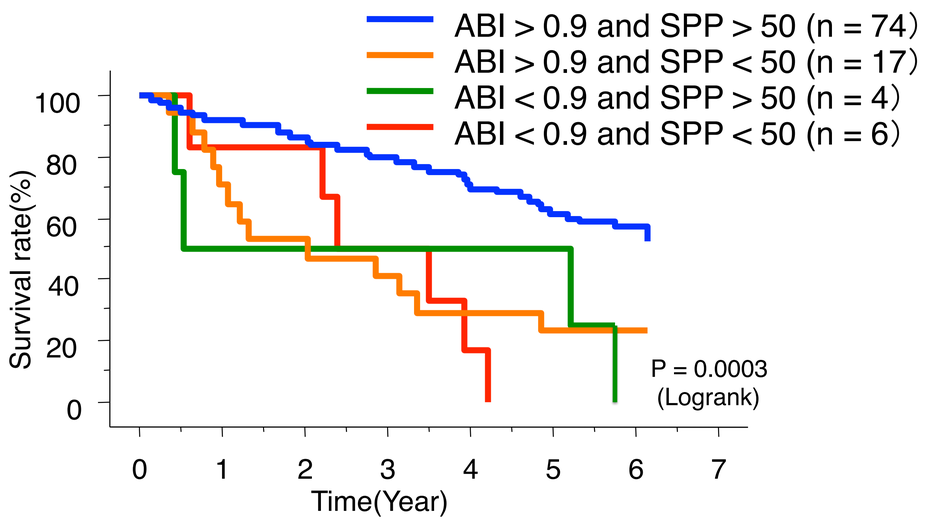

Table 2 Cause of death and ABI + SPP

	Total death	Vascular related death	Other
ABI > 0.9 and SPP > 50 (n = 74)	34	17	17
ABI > 0.9 and SPP < 50 (n = 17)	14	11	3
ABI < 0.9 and SPP > 50 (n = 4)	4	1	3
ABI < 0.9 and SPP < 50 (n = 6)	6	3	3

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