Association of Interleg BP Difference with Overall and Cardiovascular Mortality in Hemodialysis

Szu-Chia Chen,*† Jer-Ming Chang,‡† Yi-Chun Tsai,* Jer-Chia Tsai,*§ Ho-Ming Su,§§ Shang-Jyh Hwang,* and Hung-Chun Chen*‡

Summary
Background and objectives An interarm BP difference has been associated with atherosclerosis and adverse cardiovascular outcomes. This study investigated whether an interleg BP difference was associated with peripheral vascular disease and overall and cardiovascular mortality in hemodialysis patients.

Design, setting, participants, & measurements This study enrolled 210 hemodialysis patients from December 2006 to January 2007. Bilateral leg BPs were measured simultaneously by an ankle-brachial index (ABI)–form device before hemodialysis.

Results The mean follow-up period was 4.4±1.5 years. ABI <0.9 and high brachial-ankle pulse wave velocity were independently associated with an interleg difference in systolic BP of ≥15 mmHg or diastolic BP of ≥10 mmHg. Furthermore, this difference was an independent predictor for overall mortality (hazard ratio [HR], 3.36; 95% confidence interval [CI], 1.68–6.72; P<0.01) and cardiovascular mortality (HR, 4.84; 95% CI, 1.84–12.71; P<0.01) after adjustment for demographic, clinical, and biochemical parameters. After further adjustment for ABI <0.9 and brachial-ankle pulse wave velocity, the relation remained significant to overall mortality (HR, 2.91; 95% CI, 1.28–6.64; P=0.01) and cardiovascular mortality (HR, 3.15; 95% CI, 1.05–9.44; P=0.04).

Conclusions A difference in systolic BP of ≥15 mmHg or diastolic BP of ≥10 mmHg between legs was associated with peripheral vascular disease and increased risk for overall and cardiovascular mortality in hemodialysis patients. Detection of an interleg BP difference may identify hemodialysis patients at increased risk of peripheral vascular disease and overall and cardiovascular mortality.


Introduction

A BP difference between arms is sometimes encountered in various populations, such as people with hypertension, diabetes, or peripheral vascular disease (1–4). An appreciation of the presence of an interarm BP difference is vital for the accurate diagnosis and management of hypertension in primary care. Several studies have reported that an interarm BP difference is associated with subclavian stenosis, peripheral artery disease, and pre-existing coronary artery disease (5–7). Furthermore, an interarm BP difference is strongly associated with increased cardiovascular mortality and all-cause mortality (2,7,8).

An interarm BP difference is also sometimes found in patients with CKD. Moreover, this difference is associated with increased all-cause mortality in this population (9). The importance of a BP difference between arms is already recognized (1–4). However, measurement of BP in the arm with blood access is inappropriate in hemodialysis patients. The hypotheses that an association exists between an interleg BP difference and that peripheral vascular disease and an interleg BP difference is a useful predictor for overall and cardiovascular mortality in hemodialysis patients have not been examined. Accordingly, in this study, we investigated the relationship between an interleg BP difference and peripheral vascular disease in hemodialysis patients. Furthermore, we also examined whether an interleg BP difference could predict overall and cardiovascular mortality in such patients.

Materials and Methods

Study Patients and Design

This study was conducted at one dialysis clinic in a regional hospital in Taiwan. All routine hemodialysis patients in this hospital were included except 6 patients refusing ankle-brachial index (ABI)–form device examinations, 4 patients with atrial fibrillation, 2 patients with bilateral below-knee amputation, and 13 patients with inadequate image visualization. Ultimately, we enrolled 210 patients (93 males and 117 females) from December 2006 to January 2007 and followed up until transfer, death, or March 2012. During the period of follow-up, 35 patients transferred to other hospitals. There was no significant difference in comorbidities, laboratory data, and medications between transfer and nontransfer patients except higher
mean arterial pressure and shorter follow-up period in
transfer patients. The protocol was approved by our insti-
tutional review board and all enrolled patients gave writ-
ten informed consent.

Hemodialysis
All patients underwent routine hemodialysis three
times a week using a Toray 321 machine (Toray Medical
Company, Tokyo, Japan). Each hemodialysis session
was performed for 3–4 hours using a dialyzer with a
blood flow rate of 250–300 ml/min and dialysate flow
of 500 ml/min.

Assessment of ABI and Brachial-Ankle Pulse Wave Velocity
The values of ABI and brachial-ankle pulse wave velocity
(PWV) were measured 10–30 minutes before hemodialysis.
The ABI and brachial-ankle PWV were measured using an
ABI-form device, which automatically and simultaneously
measured BPs in both arms and ankles using an oscillo-
metric method (10–16). Occlusion and monitoring cuffs
were placed tightly around the upper arm without blood
access and both sides of the lower extremities in the supine
position. ABI was calculated by the ratio of the ankle sys-
tolic BP (SBP) divided by the arm SBP and the lower value
of the ankle SBP was used for the calculation. For measuring
brachial-ankle PWV, pulse waves obtained from the
brachial and tibial arteries were recorded simultaneously
and the transmission time, which was defined as the
time interval between the initial increase in brachial
and tibial waveforms, was determined. The transmis-
sion distance from the arm to each ankle was calculated
according to body height. The brachial-ankle PWV value
was automatically computed as the transmission dis-
ance divided by the transmission time. After obtaining bi-
lateral brachial-ankle PWV values, the higher one was used
for later analysis. The ABI and brachial-ankle PWV meas-
urements were done once in each patient. Because the ABI
and brachial-ankle PWV were noninvasive and reliable di-
agnostic tools for peripheral vascular disease (11,13), pa-
tients with ABI <0.9 or increased brachial-ankle PWV
were considered to have peripheral vascular disease in
this study.

Collection of Demographic, Medical, and Laboratory Data
Demographic and medical data, including age, sex,
smoking history (ever versus never), and comorbid con-
titions, were obtained from medical records and inter-
views with patients. The body mass index was calculated
as the ratio of weight in kilograms divided by the square
of height in meters. Laboratory data were measured from
fasting blood samples using an autoanalyzer (D-68298
Mannheim COBAS Integra 400; Roche Diagnostics GmbH).
High-sensitivity C-reactive protein (CRP) (Dade Behring
Marburg GmbH) was measured by commercially available
kits. Blood samples were obtained within 1 month of
enrollment. Kt/V was evaluated monthly as a marker of
dialysis efficiency and was determined according to the
Gotch procedure (17). In addition, information regarding
patient medications, including aspirin, angiotensin con-
verting enzyme inhibitors, angiotensin II receptor block-
ers, β-blocker, calcium channel blockers, and hepatic
hydroxymethyl glutaryl-CoA reductase inhibitors (statins),
during the study period was obtained from medical re-
cords.

Statistical Analyses
Statistical analysis was performed using SPSS 15.0
software for Windows (SPSS Inc, Chicago, IL). Data are
expressed as percentages, mean ± SD, or median (25th–75th
percentile) for interleg BP difference, duration of dialysis,
triglyceride, and high-sensitivity CRP. The differences
between groups were checked by the chi-squared test
for categorical variables, by the independent t test for con-
tinuous variables with approximately-normal distribu-
tion, or by the Mann–Whitney U test for continuous
variables with skewed distribution. Multiple logistic re-
gression analysis was used to identify the factors associ-
ated with an interleg difference in SBP of ≥15 mmHg or
diastolic BP (DBP) of ≥10 mmHg. Significant variables in
univariate analysis were selected for multivariate analy-
sis. Time to overall and cardiovascular mortality and cova-
rates of risk factors were modeled using the Cox
proportional hazards model. The association between an
interleg difference in SBP of ≥15 mmHg or DBP of ≥10
mmHg and overall and cardiovascular mortality was as-
essed by a modified stepwise procedure in four modeling
steps. The first model consisted of age and sex. The second
model consisted of adding clinical risk factors. The third
step was adding biochemical factors. The final step was
entering ABI <0.9 and brachial-ankle PWV into the
model. A significant improvement in model prediction
was based on the −2 log-likelihood ratio statistic, which
followed a difference in likelihood ratio, and the P value
was based on the incremental value compared with the
previous model. A difference was considered significant
if the P value was <0.05.

Results
The mean age of the 210 patients was 59.3±13.1 years.
The prevalence of interleg SBP difference ≥15 mmHg or
DBP difference ≥10 mmHg was 26.2%. The comparison of
baseline characteristics between patients with and without
an interleg SBP difference ≥15 mmHg or DBP difference
≥10 mmHg is shown in Table I. Compared with patients
with an interleg SBP difference <15 mmHg and DBP <10
mmHg, patients with an interleg SBP difference ≥15
mmHg or DBP difference ≥10 mmHg were found to
have an older age, higher prevalence of diabetes mellitus
(DM), higher prevalence of a history of hypertension,
higher pulse pressure, higher prevalence of ABI <0.9
(P<0.001), higher brachial-ankle PWV (P<0.001), lower
HDL cholesterol, and lower creatinine. The value of ABI
was lower (0.92±0.21 and 1.14±0.12, respectively) and
brachial-ankle PWV (2246.7±688.9 and 1802.1±430.5
cm/s, respectively) was higher in patients with an interleg
SBP difference ≥15 mmHg or DBP difference ≥10 mmHg
(both P<0.001). Figure I illustrates the distribution of
the interleg SBP and DBP differences in study patients. There
were 18.6% and 13.8% of patients with an interleg differ-
ence in SBP of ≥15 mmHg and DBP of ≥10 mmHg, re-
spectively.
Table 1. Comparison of baseline characteristics between patients with and without an interleg difference in SBP of ≥15 mmHg or DBP of ≥10 mmHg

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>All Patients (n=210)</th>
<th>Interleg SBP Difference &lt;15 mmHg and DBP &lt;10 mmHg (n=155)</th>
<th>Interleg SBP Difference ≥15 mmHg or DBP Difference ≥10 mmHg (n=55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference in SBP (mmHg)</td>
<td>6.5 (3–12)</td>
<td>5.0 (3–8)</td>
<td>20.0 (8–35)</td>
</tr>
<tr>
<td>Difference in DBP (mmHg)</td>
<td>3.0 (2–6)</td>
<td>3.0 (1–4.5)</td>
<td>10.0 (5–15.25)</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>59.3±13.1</td>
<td>57.6±13.5</td>
<td>64.0±10.9</td>
</tr>
<tr>
<td>Male sex</td>
<td>44.3</td>
<td>43.9</td>
<td>45.5</td>
</tr>
<tr>
<td>Duration of dialysis (yr)</td>
<td>5.5 (3.4–8.4)</td>
<td>5.6 (3.4–8.5)</td>
<td>4.7 (3.2–8.1)</td>
</tr>
<tr>
<td>Smoking history</td>
<td>25.2</td>
<td>24.5</td>
<td>27.3</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>38.6</td>
<td>31.6</td>
<td>58.2</td>
</tr>
<tr>
<td>Hypertension</td>
<td>71.0</td>
<td>67.1</td>
<td>81.8</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>28.6</td>
<td>25.8</td>
<td>36.4</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>9.0</td>
<td>7.1</td>
<td>14.5</td>
</tr>
<tr>
<td>Mean arterial pressure (mmHg)</td>
<td>101.5±17.1</td>
<td>100.5±16.4</td>
<td>104.4±18.7</td>
</tr>
<tr>
<td>Pulse pressure (mmHg)</td>
<td>66.1±17.2</td>
<td>62.6±15.0</td>
<td>75.7±19.4</td>
</tr>
<tr>
<td>ABI &lt;0.9</td>
<td>13.8</td>
<td>3.2</td>
<td>43.6</td>
</tr>
<tr>
<td>Brachial-ankle PWV (cm/s)</td>
<td>1919.1±545.9</td>
<td>1802.1±430.5</td>
<td>2246.7±688.9</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>23.9±3.6</td>
<td>23.8±3.5</td>
<td>24.0±3.9</td>
</tr>
<tr>
<td>Laboratory parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin (g/dl)</td>
<td>3.83±0.28</td>
<td>3.85±0.27</td>
<td>3.79±0.32</td>
</tr>
<tr>
<td>Fasting glucose (mg/dl)</td>
<td>119.3±54.2</td>
<td>115.0±52.6</td>
<td>131.6±57.2</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>132 (91.75–213.25)</td>
<td>130 (86–203)</td>
<td>137 (97–218)</td>
</tr>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>184.5±41.8</td>
<td>187.1±43.2</td>
<td>177.4±36.8</td>
</tr>
<tr>
<td>HDL cholesterol (mg/dl)</td>
<td>46.5±14.7</td>
<td>48.6±15.4</td>
<td>40.0±10.1</td>
</tr>
<tr>
<td>LDL cholesterol (mg/dl)</td>
<td>88.1±26.5</td>
<td>88.7±27.4</td>
<td>86.4±24.1</td>
</tr>
<tr>
<td>Hemoglobin (g/dl)</td>
<td>9.9±1.1</td>
<td>9.9±1.1</td>
<td>10.1±1.2</td>
</tr>
<tr>
<td>Creatinine (mg/dl)</td>
<td>10.3±2.3</td>
<td>10.5±2.3</td>
<td>9.7±2.1</td>
</tr>
<tr>
<td>Phosphorous (mg/dl)</td>
<td>4.9±1.2</td>
<td>4.8±1.2</td>
<td>5.0±1.2</td>
</tr>
<tr>
<td>Calcium-phosphorous product (mg²/dl²)</td>
<td>47.6±12.0</td>
<td>47.7±11.8</td>
<td>49.3±12.4</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>7.6±1.5</td>
<td>7.6±1.5</td>
<td>7.8±1.7</td>
</tr>
<tr>
<td>High-sensitivity CRP (mg/L)</td>
<td>0.28 (0.11–0.74)</td>
<td>0.25 (0.1–0.61)</td>
<td>0.35 (0.16–0.85)</td>
</tr>
<tr>
<td>Kt/V (Gotch)</td>
<td>1.30±0.24</td>
<td>1.31±0.24</td>
<td>1.27±0.25</td>
</tr>
<tr>
<td>Cardio-thoracic ratio &gt;50%</td>
<td>44.3</td>
<td>40.6</td>
<td>54.5</td>
</tr>
<tr>
<td>Medications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aspirin use</td>
<td>12.4</td>
<td>11.6</td>
<td>14.8</td>
</tr>
<tr>
<td>ACEI and/or ARB use</td>
<td>19.6</td>
<td>20.6</td>
<td>16.7</td>
</tr>
<tr>
<td>β-blocker use</td>
<td>19.0</td>
<td>19.5</td>
<td>17.1</td>
</tr>
<tr>
<td>Calcium channel blocker use</td>
<td>35.9</td>
<td>36.1</td>
<td>35.2</td>
</tr>
<tr>
<td>Statin use</td>
<td>28.7</td>
<td>28.4</td>
<td>29.6</td>
</tr>
</tbody>
</table>

Data are presented as percentages, mean ± SD, and median (interquartile range), unless otherwise indicated. SBP, systolic BP; DBP, diastolic BP; ABI, ankle-brachial index; PWV, pulse wave velocity; CRP, C-reactive protein; ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin II receptor blocker.

aP<0.001 compared with patients with interleg SBP difference <15 mmHg and DBP <10 mmHg.

bP<0.05 compared with patients with interleg SBP difference <15 mmHg and DBP <10 mmHg.

Determinants of an Interleg SBP Difference ≥15 mmHg or DBP Difference ≥10 mmHg

Table 2 shows the determinants of an interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg in our study patients. In the univariate regression analysis, an interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg was found to be significantly associated with old age, DM, hypertension, high pulse pressure, ABI <0.9, high brachial-ankle PWV, low HDL cholesterol, and low creatinine. In the multivariate analysis, ABI <0.9 (odds ratio [OR], 18.35; P<0.01), high brachial-ankle PWV (per 10 cm/s) (OR, 1.01; P<0.01), and low HDL cholesterol (OR, 0.96; P=0.01) were independently associated with an interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg.

To avoid colinearity, we also used the higher value of the ankle SBP to calculate the ABI and still found that ABI <0.9 (5.7%) was significantly associated with an interleg difference in SBP of ≥15 mmHg or DBP of ≥10 mmHg (OR, 6.63; P=0.01) after the multivariate analysis.

Risk of Overall Mortality

The mean follow-up period was 4.4±1.5 years in all patients. During the period of follow-up, 41 deaths were
recorded in these 210 patients (19.5%), including fatal cardiovascular events (n=22), malignancy (n=3), infectious disease (n=10), gastrointestinal bleeding (n=2), and others (n=4). Table 3 displays the HRs of an interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg for overall mortality with and without adjustment for demographic, clinical, biochemical risk factors as well as ABI <0.9 and brachial-ankle PWV. An interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg was associated with overall mortality in the age- and sex-adjusted model (HR, 3.30; 95% confidence interval [CI], 1.76–6.18; P<0.01) and in the multivariable model adjusting for age, sex, DM, and a history of hypertension, coronary artery disease, and cerebrovascular disease (HR, 3.09; 95% CI, 1.62–5.91; P<0.01). This relation remained significant after further adjustment for mean arterial pressure, pulse pressure, albumin, log triglyceride, total cholesterol, hemoglobin, creatinine, phosphorous, calcium-phosphorous product, and log high-sensitivity CRP (HR, 3.36; 95% CI, 1.68–6.72; P<0.01). This relation was attenuated after further adjustment for ABI <0.9 and brachial-ankle PWV, but still remained significant (HR, 2.91; 95% CI, 1.28–6.64; P=0.01).

**Risk of Cardiovascular Mortality**

Twenty-two cardiovascular deaths were documented during the follow-up period, including heart failure (n=14), myocardial infarction (n=5), and ventricular fibrillation (n=3). A Cox proportional hazards regression analysis of an interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg for cardiovascular mortality is shown in Table 3. An interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg was associated with cardiovascular mortality in the multivariable model after adjustment for age and sex (HR, 4.71; 95% CI, 1.96–11.30; P<0.01) and in the multivariable model after adjustment for age, sex, DM, a history of hypertension, coronary artery disease, and cerebrovascular disease (HR, 4.92; 95% CI, 1.98–12.24; P<0.01). The relation was still significant after further adjustment for mean arterial pressure, pulse pressure, albumin, log triglyceride, total cholesterol, hemoglobin, creatinine, phosphorous, calcium-phosphorous product, and log high-sensitivity CRP (HR, 4.84; 95% CI, 1.84–12.71; P<0.01). This relation was attenuated after further adjustment for ABI <0.9 and brachial-ankle PWV, but still remained significant (HR, 3.15; 95% CI, 1.05–9.44; P=0.04). Figure 2 illustrated the Kaplan-Meier curves for overall and cardiovascular survival (both log-rank P<0.01) in all patients subdivided according to interleg SBP difference ≥15 mmHg or DBP difference ≥10 mmHg.

**Predictive Values of an Interleg Difference in SBP of ≥15 mmHg or DBP of ≥10 mmHg, ABI <0.9, and Brachial-ankle PWV in Relation to Overall and Cardiovascular Mortality**

The incremental values of an interleg difference in SBP of ≥15 mmHg or DBP of ≥10 mmHg, ABI <0.9, and brachial-ankle PWV in the prediction of overall and cardiovascular mortality are shown in Table 4. The addition of an interleg difference in SBP of ≥15 mmHg or DBP of ≥10 mmHg to a model adjusted for demographic, clinical, and biochemical risk factors significantly improved the prognostic values of overall (P<0.01) and cardiovascular mortality.
mortality ($P<0.01$). Similarly, the addition of ABI < 0.9 to the same model also significantly improved the prognostic values of overall ($P=0.03$) and cardiovascular mortality ($P<0.01$). However, brachial-ankle PWV had no significant incremental values in predicting overall ($P=0.65$) and cardiovascular mortality ($P=0.62$).

**Discussion**

In this study, using a simultaneous measurement technique, we evaluated the association between an interleg BP difference and peripheral vascular disease and whether an interleg BP difference could predict overall and cardiovascular mortality in hemodialysis patients over a follow-up period of 4.4 years. We found that an interleg difference in SBP of $\geq 15$ mmHg or DBP of $\geq 10$ mmHg was independently associated with ABI < 0.9 and high brachial-ankle PWV and increased overall and cardiovascular mortality in patients with hemodialysis. The addition of an interleg BP difference and ABI < 0.9 but not brachial-ankle PWV to a traditional model adjusted for demographic, clinical, and biochemical risk factors could significantly improve the predictive values for overall and cardiovascular mortality.

The ABI < 0.9 and brachial-ankle PWV are markers of peripheral artery occlusive disease and arterial stiffness, respectively (18–22). Lower ABI is reported to be associated with generalized atherosclerosis (e.g., common carotid artery intima-media thickness and the degree of stenosis in the intracranial internal carotid artery and middle cerebral artery) (23, 24). Previous studies had also showed low ABI or ABI < 0.9 had a significant correlation with the interarm difference in SBP of $\geq 15$ mmHg or DBP of $\geq 10$ mmHg (1, 6, 25). Our study also revealed that ABI < 0.9 and high brachial-ankle PWV were significantly associated with an interleg difference in SBP of $\geq 15$ mmHg or DBP of $\geq 10$ mmHg. Thus, measuring bilateral leg BP in hemodialysis patients may be helpful in detection of existing peripheral artery occlusive disease or increased arterial stiffness.

Previous studies reported that a difference in SBP of $\geq 10$ mmHg or $\geq 15$ mmHg or DBP of $\geq 10$ mmHg between arms was strongly associated with increased cardiovascular events and all-cause mortality in hypertensive patients (2, 7, 8). Agarwal et al. also evaluated the prognostic importance of interarm SBP difference in chronic renal failure patients and found that an interarm SBP difference of $\geq 10$ mmHg conferred an increased overall mortality (9). Our study also showed that an interleg BP difference was significantly correlated with poor overall and cardiovascular survival in hemodialysis patients. One potential explanation is that unequal limb atherosclerosis might be the cause contributing to an interarm or interleg BP difference, and the interarm or interleg BP difference might then have prognostic value for overall and cardiovascular mortality as worsened atherosclerosis (8, 26). In fact, our study showed that an interleg difference in SBP of $\geq 15$ mmHg or DBP of $\geq 10$ mmHg was significantly associated with peripheral vascular disease indicated by ABI < 0.9 and increased brachial-ankle PWV. Furthermore, even after adjusting ABI < 0.9 and brachial-ankle PWV, the relation between an interleg BP difference and overall and cardiovascular mortality still remained significant. Hence, some nonatherosclerotic mechanisms might be responsible for the correlation between an interleg BP difference and mortality. Further studies are required to elucidate the mechanisms. However, many unfavorable survival factors in our patients with an interleg BP difference, such as old age, DM, hypertension, wide pulse pressure, low HDL cholesterol, and low creatinine, might partially explain the association between an interleg BP difference and overall and cardiovascular mortality in this study.

Previous reports demonstrated that a lower ABI was more prevalent in the ESRD population and was responsible for significant morbidity and mortality in these patients (14–16, 27, 28). ABI measurement has been proposed as a screening test, but is not routinely undertaken in hemodialysis patients. Its measurement requires time, specialized equipment, experience, and training (29), whereas bilateral leg BP measurement in hemodialysis patients can be easily done in the supine position before, during, or after hemodialysis. Furthermore, our study

| Table 3. Relation of an interleg difference in SBP of $\geq 15$ mmHg or DBP of $\geq 10$ mmHg to overall and cardiovascular mortality using the Cox proportional hazards model |
|---------------------------------|-----------------|-----------------|
| Interleg BP Difference          | Overall Mortality | Cardiovascular Mortality |
|                                 | HR (95% CI)     | P               | HR (95% CI)     | P               |
| Unadjusted                      | 3.94 (2.11–7.35) | <0.01           | 5.73 (2.40–13.68) | <0.01           |
| Age and sex adjusted            | 3.50 (1.76–6.18) | <0.01           | 4.71 (1.96–11.30) | <0.01           |
| Multivariate adjusted model 1   | 3.09 (1.62–5.91) | <0.01           | 4.92 (1.98–12.24) | <0.01           |
| Multivariate adjusted model 2   | 3.36 (1.68–6.72) | <0.01           | 4.84 (1.84–12.71) | <0.01           |
| Multivariate adjusted model 3   | 2.91 (1.28–6.64) | 0.01            | 3.15 (1.05–9.44)  | 0.04            |

Multivariate model 1 is adjusted for age, sex, diabetes mellitus, hypertension, coronary artery disease, and cerebrovascular disease. Multivariate model 2 comprises model 1 as well as mean arterial pressure, pulse pressure, albumin, log triglyceride, total cholesterol, hemoglobin, creatinine, phosphorous, calcium-phosphorous product, and log high-sensitivity CRP. Multivariate model 3 comprises model 2 as well as ABI < 0.9 and brachial-ankle PWV. HR, hazard ratio; CI, confidence interval; SBP, systolic BP; DBP, diastolic BP; ABI, ankle-brachial index; PWV, pulse wave velocity; CRP, C-reactive protein.
demonstrated that an interleg BP difference was a useful prognostic factor in hemodialysis patients. Therefore, routine BP measurements in both legs should be taken in patients receiving hemodialysis.

In this study, BP was determined using a noninvasive cuff-oscillometric method, but not an invasive method. The oscillometric method was not a popular one to measure BP in daily clinical practice. Hence, although the measurement
Peripheral vascular disease and overall and cardiovascular survival in hemodialysis patients was investigated. A simple method of identifying patients at increased risk of overall and cardiovascular survival in hemodialysis patients was evaluated. Moreover, this difference could predict poor survival in dialysis. Hence, the clinical utility of the interleg BP difference is appropriate in hemodialysis patients, it is easier to obtain in other populations; thus, the interarm BP difference should be still a more suitable prognostic factor than the interleg BP difference in patients without hemodialysis. Hence, the clinical utility of the interleg BP difference in nonhemodialysis patients may be limited.

Our results demonstrated that an interleg BP difference was significantly correlated with ABI <0.9 and high brachial-ankle PWV. Moreover, this difference could predict poor overall and cardiovascular survival in hemodialysis patients. Detection of an interleg BP difference may provide a simple method of identifying patients at increased risk of peripheral vascular disease and overall and cardiovascular mortality in hemodialysis patients.

Disclosures
None.

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