**DIAGNOSTIC AND PROGNOSTIC YIELDS OF AMBULATORY BLOOD PRESSURE MEASUREMENTS IN HAEMODIALYSIS PATIENTS: A 6-YEAR LONGITUDINAL STUDY**

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**Abstract**

**Background:** Blood pressure (BP) control in haemodialysis (HD) patients is essential. Peri-dialytic BP levels do not accurately diagnose hypertension or predict the cardiovascular mortality.

**Methods:** In this study, we recruited 43 adult patients who had been on chronic HD for ≥3 months. Seven-day home BP monitoring (HBPM) (values of Day1 discarded) and 44-h interdialytic ambulatory BP monitoring (iABPM) were performed. Pre- and post-dialysis BP levels were measured during the 6 dialysis sessions prior to iABPM. A 6-year follow-up was carried out to assess all-cause and cardio-vascular mortality.

**Results:** In patients considered as normotensive in pre-dialysis (n=17), masked hypertension was found in 24% and 29% on the basis of iABPM and HBPM, respectively. Conversely, among hypertensive patients in pre-dialysis (n=26), “white-coat” hypertension was noted in 23% either by iABPM or HBPM. After a 6-year follow-up, 25 patients were deceased including 6 patients from CV causes. Day-time systolic BP measured by iABPM was associated with all-cause mortality in an adjusted model for age and gender (p=0.045).

**Conclusion:** In chronic HD patients, 44-h iABPM and 6-day HBPM show a reliable concordance and help to re-classify ~25% of cases miscategorised based on pre-dialysis measurements. Day-time systolic BP levels using iABPM were significantly associated with 6-year all-cause mortality.

**Keywords:** Ambulatory blood pressure monitoring – Arterial hypertension – Haemodialysis – Home blood pressure measurement – Mortality

**Word count:** 3177 words

**Introduction**

In the general population and in patients with chronic kidney disease (CKD), hypertension (HTN) is a major cardiovascular (CV) risk factor1,2. Prevalence is 30-45% in the general population3, but it rises to 70-80% in case of end-stage renal disease (ESRD)4. The CKD-related HTN involves various factors like fluid retention, sympathetic system activation, and vascular stiffness5. Haemodialysis (HD) patients face a 30-fold increased CV risk6, particularly when pre- and post-dialysis systolic blood pressures (SBP) are above 180 mmHg or below 110 mmHg, respectively7,8. Studies suggest a link between high pre-dialysis BP (>160/90mmHg) and long-term mortality in dialysis9–11. However, pre- and post-dialysis BP measurements vary significantly from ambulatory BP monitoring (ABPM)12. Emotional, activity, and positioning influences on BP measurement quality are well-known13, and HD machine calibration can be inconsistent. White coat hypertension (WCH) and masked hypertension (MHT) may only be detected by ambulatory BP measurements, raising doubts about the relationship between pre-dialysis BP and mortality14.

Some studies favour post-dialysis BP15, while others propose the average of both pre- and post-dialysis BP16. Alternative approaches include measuring BP 20 minutes post-dialysis17 or averaging all BP from the second weekly dialysis session18. Another study described a better accuracy in detecting elevated 44-hour BP with intradialytic and scheduled interdialytic BP measurements compared to pre- or post-dialysis BP19. While 44-hour interdialytic ABPM (iABPM) is the gold standard, it is not always well-tolerated. Home blood pressure monitoring (HBPM) is an alternative, but it may lack sensitivity and specificity as a sole diagnostic test20.

Our study aims to (1) compare BP measurement techniques in HD patients, (2) analyse the role of ambulatory BP measurements in identifying uncontrolled BP in patients on antihypertensive drugs, (3) determine the prevalence of MHT or WCH, (4) examine the impact of reducing HBPM days on defining BP status, (5) explore the possibility of reducing 44-hour iABPM to 24 hours, and (6) assess the association between BP measurements and CV and all-cause mortality over a 6-year follow-up.

**Material and methods**

***Patients.*** The present monocentric observational study was approved by the institutional review board of the University of Liège (Protocol # B707201318600) and all experiments were performed in accordance with relevant guidelines and regulations. Informed consent was obtained from all subjects and/or their legal guardian(s). Patients over 18 years of age who had been on chronic HD for at least 3 months in the University of Liege Academic Hospital were recruited between November 2015 and March 2016. Patients with uncontrolled arrhythmia or receiving less than three 4-hour dialysis sessions per week were excluded. Physicians were instructed not to change the patient dry weight or antihypertensive treatment during the period of BP measurements, except in cases of urgent need. The sodium concentration of the dialysate was adjusted to the patient's pre-dialysis natremia before the start of the study and was not changed during the study. Clinical and biological variables were extracted from the computer-based medical records. CV complications were defined as myocardial infarction, coronary artery bypass grafting, angioplasty or stroke.

***BP measurement.*** We first performed 44 hour-iABPM followed by HBPM during 7 days. We collected pre- and post-dialysis BP and weight data measured during the 6 dialysis sessions prior to iABPM. BP values were used for comparisons and correlations between BP measurement techniques.

*Routine BP measurement at the HD centre.* BP was measured in the dialysis unit at the beginning (pre-dialysis) and at the end (post-dialysis) of the session via the oscillometric device integrated into the dialysis machine and collected by the nurses of the unit. We took into account the mean of the pre-dialysis and post-dialysis measurements of the 2 weeks (6 sessions) prior to the implementation of iABPM. The cut-off values for HTN were 140/90 mmHg in pre-dialysis and 130/80 mmHg in post-dialysis according to the KDOQI21.

*Interdialytic-ambulatory BP monitoring.* iABPM was performed on the first or second dialysis session of the week. BP was recorded every 20 minutes during the day and every 30 minutes during the night on standardiseddevices (Spacelabs 90207). The recordingstarted at the end of the session and ended with the start of the next session. Awake periods were defined by the patient. Latest ESH 2018 recommendations were used for defining HTN: ≥ 130/80 mmHg over the 44h, ≥ 135/85 mmHg during the day and ≥ 120/70 mmHg during the night22.

*Home BP monitoring.* Patients were asked to perform two consecutive BP measurements, one minute apart, at rest for at least 5 minutes, in the morning and in the evening with a validated device we provided (Omron M6) during seven days. We then averaged the measurements over 3, 5 and 6 days, not using the first day of data collection. Latest ESH 2018 recommendations were used for defining HTN: ≥ 135/85 mmHg22.

***BP phenotypes.*** We compared pre-and post-dialytic BP measurements with mean daytime BP levels extracted from the ambulatory techniques (44h-iABPM, daytime iABPM and HBPM) and distinguish 4 phenotypes of HTN: normotension (NT) (NT with pre-dialytic BP or post-dialytic BP and NT with ambulatory BP), MHT (NT with pre-dialytic BP or post-dialytic BP and HTN with ambulatory BP ), WCH (HTN with pre-dialytic BP or post-dialytic BP and NT with ambulatory BP) and HTN (HTN with pre-dialytic BP or post-dialytic BP and HTN with ambulatory BP).

***Statistical analysis.*** Continuous variables are presented as means with standard deviation (SD) when the distribution was normal and as median with first quartile (Q1) and third quartile (Q3) when not. Categorical variables are presented as percentages. Due to the sample size, non-parametric statistics were preferred. We used the Mann-Whitney test for comparisons of means between two groups of unpaired patients and the Wilcoxon test to compare two groups with paired data. The comparison of frequencies expressed as percentages was carried out using the chi square test or Fisher's exact test for small groups. The Kruskal-Wallis analysis of variance was used to compare several independent groups, while the Friedman analysis of variance was used for comparisons between paired groups. Spearman correlation was applied to correlate BP values. ROC curves were also performed to compare BP measurement techniques for the diagnosis of HTN using 44-h iABPM as the reference. The inter-rater agreement between HTN/NT categorization made by BP measurement techniques was measured by means of the kappa coefficient (k) (k<0=disagreement; k=0-0.20=very weak agreement; k=0.21-0.40=weak agreement; k=0.41-0.60=moderate agreement; k=0.61-0.80=strong agreement; k=0.81-1=almost perfect agreement). These calculations were performed with STATISTICA v12, JASP 0.17.2.1 and GraphPad Prism 5 and 9. All patients were followed until November 2022. If a patient has received a kidney transplant in the meantime, the follow-up time stops on the date of the transplantation (censoring for survival). Survival, time of death or kidney transplantation were extracted from the computer-based medical records as well as the cause of the death if the patient was deceased. Cardio-vascular death was defined as a death due to sudden death, stroke, pulmonary oedema or myocardial infarction. Survival is represented using the Kaplan-Meier curve. Cox regression models were used to study survival (overall and without CV death) as a function of demographic and clinical parameters and as a function of BP parameters. The hazard ratio (HR), 95% confidence interval and p-value were reported. BP parameters were categorized based on quartiles. The Cox models to study survival were performed first on the quartiles of BP parameters alone and then by adjusting them in relation to the demographic and clinical variables selected (sex, age, body mass index (BMI), dialysis vintage, smoking habits, diabetes, haemoglobin, albumin, CV complication and anti-hypertensive treatment) in a Cox model with stepwise selection. The results are considered significant at the 5% level of uncertainty (p<0.05). Calculations were performed with SAS version 9.4 and figures using R version 4.2.2.

**Results**

The clinical and biological features of our 43-patient cohort at the time of enrolment are presented in **Table 1**. A majority of the 29 patients treated for HTN were on dual or triple therapy. Among the dual therapies, 50% of the combinations included a beta-blocker combined with a calcium antagonist or an angiotensin converting enzyme inhibitor. Among triple therapies, 82% included a beta-blocker.

*The mean BP levels differ according to the technique of measurement*

Mean SBP and mean diastolic BP (DBP) levels obtained by iABPM or HBPM were compared with pre- and post-dialysis SBP and DBP levels, respectively, as well as with a mean of BP pre- and post-dialysis (**Table 2**). We noticed a non-significant decrease between pre- and post-dialysis BP levels. SBP levels measured with 6-day HBPM was not significantly different from those obtained in pre- and post-dialysis but DBP levels in 6-day HBPM were significantly higher than those measured in pre-and post-dialysis. Mean SBP levels in 44h- and daytime iABPM, were significantly lower than the mean pre-dialysis SBP but not significantly different from the post-dialysis SBP levels. Mean DBP levels in 44h- and daytime iABPM were significantly higher than those measured in pre- and post-dialysis. Daytime and 44h-iABPM BP levels were also significantly lower than BP levels measured with 6-day HBPM.

Correlations between BP levels obtained by the different techniques of BP measurement were studied (**Table 3 and Figure S1)**.Pre- and post-dialysis SBP were found to be moderately correlated with daytime iABPM SBP and HBPM SBP (R=0.55; 95%CI: 0.30 to 0.74 and R=0.53; 95%CI: 0.26 to 0.72 respectively for pre-dialysis SBP while R=0.63; 95%CI: 0.40 to 0.79 and R=0.60; 95%CI: 0.36 to 0.77, respectively for post-dialysis SBP). Significant correlations were also found between daytime iABPM DBP and HBPM DBP (R=0.73; 95%CI: 0.54 to 0.85 and R=0.57; 95%CI: 0.32 to 0.75, respectively for pre-dialysis DBP while R=0.76; 95%CI: 0.59 to 0.86 and R=0.58; 95%CI: 0.33 to 0.75, respectively for post-dialysis DBP), as well as between pre- and post-dialysis BP levels for SBP (R=0.40; 95%CI: 0.1 to 0.63) and for DBP (R=0.74; 95%CI: 0.56 to 0.85).

*The categorization of patients as normotensive versus hypertensive differs according to the technique of BP measurement*

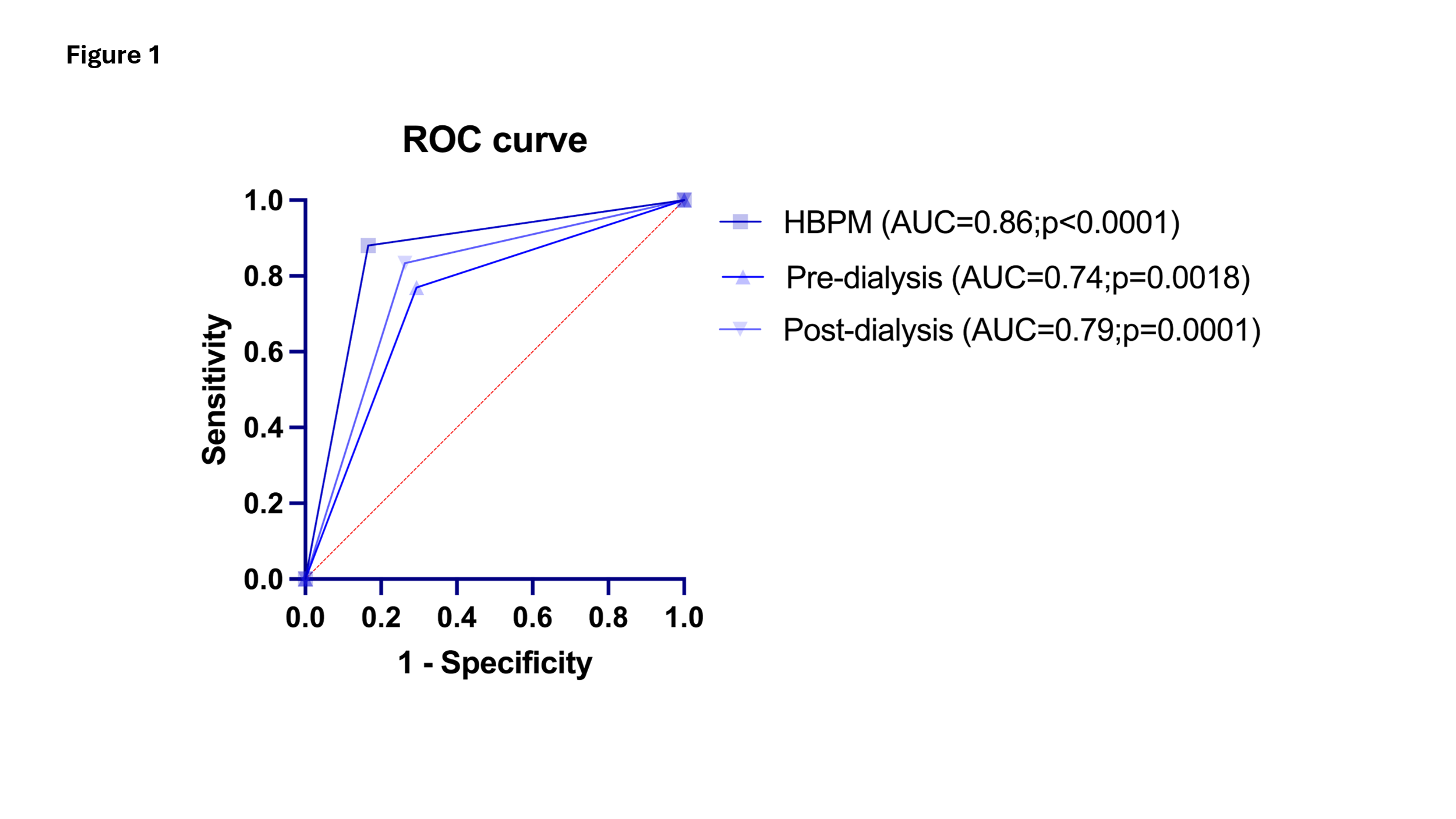
The number and percentages of patients categorised as NT or HTN are summarized in **Table 4** according to each BP measurement technique. ROC curves and area under the curves (AUCs) with 44-h iABPM considered as the reference are displayed in **Figure 1**. The ROC curve analysis showed that HBPM had the strongest predictive value for HTN diagnosis, with an AUC of 0.86 (p = <0.0001). Post-dialysis and pre-dialysis BP measurements demonstrated moderate discriminatory ability, with AUCs of 0.79 (p = 0.0001) and 0.74 (p = 0.0018) respectively.

Pre-dialysis BP measurement underestimated (58.6%) the actual percentage of uncontrolled HTN, compared to ambulatory techniques (65.5%), while post-dialysis BP measurement overestimated it (75.9%). The inter-rater agreement was strong between daytime iABPM BP and 6-day HBPM BP (k: 0.718; 95%CI: 0.509 to 0.926) but moderate between daytime iABPM BP and pre- and post-dialysis BP (k= 0.481; 95%CI: 0.219 to 0.742 and k= 0.578; 95%CI: 0.333 to 0.823 respectively). When looking only to the treated patients, inter-rater agreement was strong between daytime iABPM BP and post-dialysis BP but moderate between daytime iABPM BP and 6-day HBPM BP (k=0.621; 95%CI: 0.342 to 0.901 and k=0.563; 95%CI: 0.256 to 0.869, respectively).

In comparison to pre- and post-dialysis BP, ambulatory techniques of BP measurement allow the identification of 4 BP phenotypes: NT, sustained HTN, WCH and MHT. Number and % of patients in each HTN phenotype according to the technique of ambulatory BP measurement used are summarized in **Table 5.** Focusing on 44-h iABPM and 6-day HBPM, we observed a diagnostic discordance for 6/43 patients both with pre- and post-dialysis BP with agreement in 60% and 57% of cases for MHT, 83% and 80% for NT, 95% and 86% for HTN, 83% and 50% for WCH, respectively. A diagnostic discordance was also found in 6/43 patients when comparing daytime iABPM with 6-day HBPM both with pre- and post-dialysis BP with agreement in 75% and 67% of cases for MHT, 85% and 87% for NT, 95% and 81% for HTN, 71.4% and 43% for WCH, respectively.

Finally, the inter-rater agreement between HTN/NT categorization identified by daytime iABPM and HBPM was measured by means of the kappa coefficient (k) for the three measurement periods: 6, 5 and 3 days (**Table 6**). A decrease of k coefficient is observed as the number of days of HBPM is reduced, with an agreement in 86% of cases (k=0.718; 95%CI: 0.509 to 0.926) when the average is calculated over 6 days decreasing to 79% of cases (k=0.575; 95%CI: 0.331 to 0.819) when this average corresponds to 3 days of measurements.

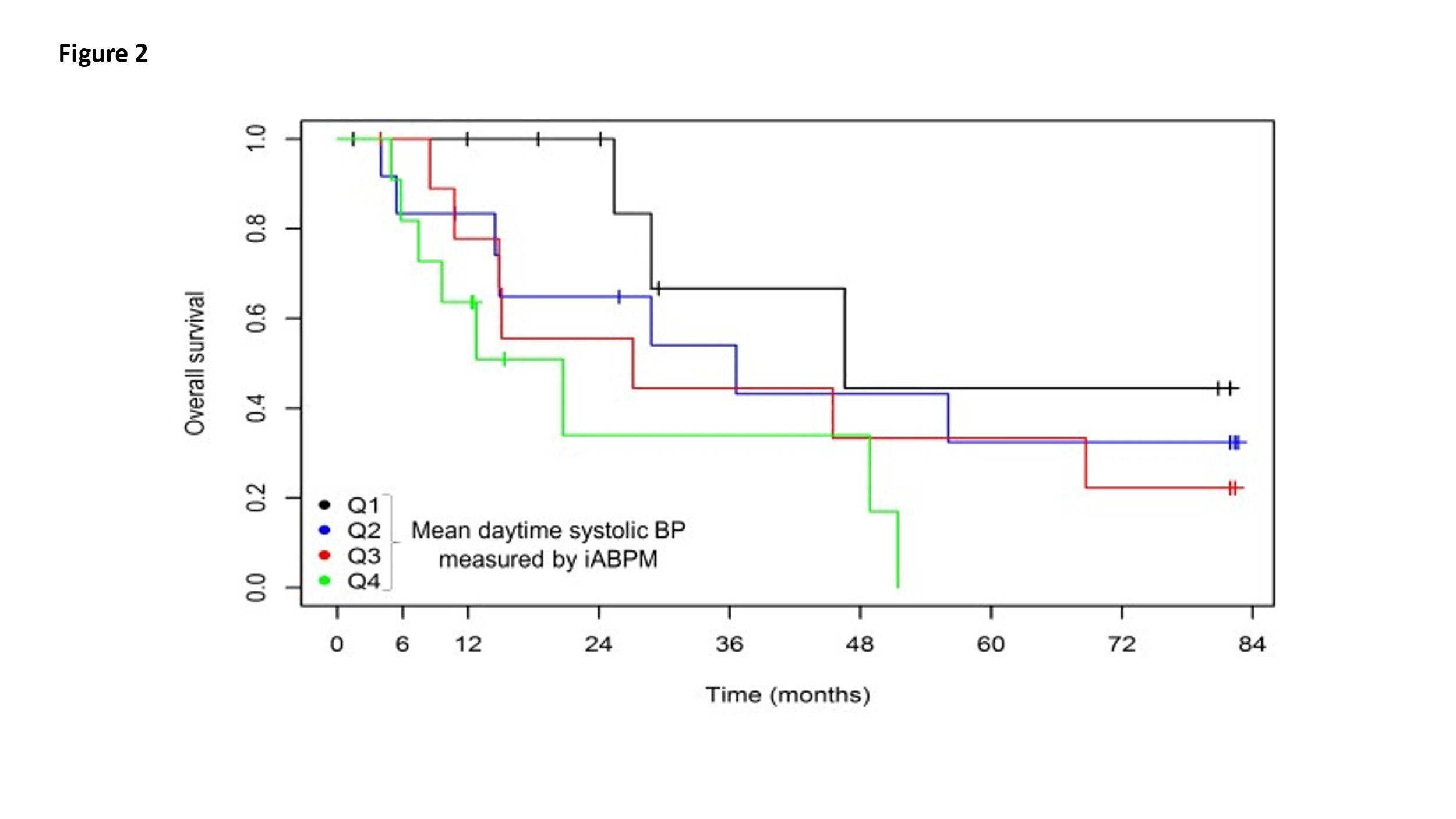
The subdivision of 44-h iABPM into two periods of 24 and 20 hours indicates that during the first 24 hours, 51% of the patients (n=22) were found to be NT and 49% to be HTN (n=21). This distribution is reversed during the next 20 hours, when patients are approaching the next dialysis session. The proportion of NT patients dropped to 37% (n=16), while the proportion of patients with HTN increased to 63% (n=27). Among the patients who were NT in the first 24 hours of monitoring, 15 (68%) remained NT in the second part of the monitoring and 7 (32%) became HTN, whereas most of the patients who were HTN in the first 24 hours, 20 (95%) remained HTN until the next dialysis session (**Figure S2**).



*Day-time systolic BP levels using iABPM is significantly associated with 6-year all-cause mortality*

In November 2022, 25/43 patients (58%) were deceased, including 6 (14%) deaths from cardio-vascular (CV) causes. Eleven (25.6%) patients had been kidney transplanted during the follow-up, and 7 (16.3%) patients were still alive under chronic HD. The median duration of follow-up from baseline BP measurement to the time of death or kidney transplantation or November 2022 was 630 days (345; 1451). The overall survival probability was 80.5% at 1 year, 63.6% at 2 years, 50.3% at 3 years and 28.8% at 5 years. The probability of survival without CV death was respectively 94.9%, 88.2%, 83.0% and 75.5% at 1 year, 2 years, 3 years and 5 years.

In the univariate survival analysis (Kaplan-Meier) for the 6-year all-cause mortality according to the quartiles of mean daytime SBP measured by iABPM (**Figure 2**): female gender, age, diabetes and hypoalbuminemia are identified as significant factors. At the multivariate level with stepwise selection, age and female gender are the only significant risk factors. **Table S1** shows the Cox models of BP parameters (in quartiles) without and with adjustment for age and sex for the 6-year all-cause mortality. Only mean daytime SBP and its load in iABPM were significantly associated with all-cause mortality in the adjusted model for age and sex. Concerning the 6-year CV mortality, no parameters was significant.



**Discussion**

This study shows that the different BP measurement techniques in HD patients lead to significantly different BP values. The ROC curve analysis with 44-h iAPBM considered as the reference shows that HBPM has a stronger predictive value for HTN diagnosis than pre- and post-dialysis BP measurements. Ambulatory BP measurements identify a higher number of treated patients with uncontrolled HTN than pre-dialysis BP measurement, while post-dialysis BP measurement seems to further overestimate this number. Ambulatory BP measurements also help to re-classify ~25% of cases miscategorised with pre-dialysis measurements (cases of MHT or WCH). Decreasing the interval of time for HBPM from 6-day to 3-day increases the discordance with the HTN/NT categorization obtained in daytime iABPM. Shortening iABPM to the first 24 hours or the last 20 hours may not provide sufficient information as showed in this study (**Figure S2**). Finally, only day-time systolic BP levels using iABPM were significantly associated with 6-year all-cause mortality in a model adjusted for age and sex.

While ambulatory measurements are well-established in the general population23, HD patients often rely on peridialytic BP for treatment adjustments, which may lead to intra-dialytic hypotension24. Using peridialytic BP alone for HTN diagnosis and management in HD patients may be inaccurate. It is also important to add that specific recommendations about BP measurement in HD patients are still lacking in recent guidelines published in the HTN field 25,26.

In our study, peridialytic BP moderately predicted interdialytic BP, aligning with earlier research27. iABPM provides a more comprehensive view of interdialytic BP patterns and allows the identification of nocturnal HTN and non-dipping which are more frequent in HD patients28,29. iABPM correlates also better in the literature with LVH30 and with all-cause mortality31, which aligns with our results. Finally, Sarafidis et al. 19 recently reinforced the importance of iABPM in HD patients for identifying MHT and better predicting cardiovascular outcomes. However, iABPM has limitations, making it less commonly used in HD centers32.

HBPM offers an alternative and has demonstrated its superiority over peridialytic BP measurements in predicting organ damage and mortality in the literature 30,31,33. In our study, HBPM has a stronger predictive value for HTN diagnosis than pre- and post-dialysis BP measurements, using 44-h iABPM as the reference (**Figure 1**). It also proved reliability in detecting WCH and MHT. However, carrying out HBPM requires a certain degree of involvement and understanding by the patient. Six-day HBPM shows here the best concordance with daytime iABPM in the categorization of patients as HTN or NT (**Table 6**). We therefore conclude that there is a risk in reducing the duration of HBPM to 3 or 5 days. By contrast, Agarwal et al.18 suggested in 2007 that HBPM performed 2 times per day after the second session of the week for a duration of 4 days would be as effective in detecting LVH as 7-day HBPM.

In terms of prognostic value, daytime SBP measured by iABPM was associated in our study with all-cause mortality over a 6-year follow-up, while HBPM and peridialytic BP showed no such association. In a cohort of 326 patients, Agarwal et al.34 also found a correlation between SBP and all-cause mortality after a mean follow-up of 32 months both in iABPM and HBPM. Similarly, Zoccali et al. 32 highlighted the prognostic value of both iABPM and HBPM in HD patients. By contrast, our study found no significant association between HBPM and mortality, potentially due to the smaller cohort size.

In this study, the sample size limits the generalisation of our observations, and some statistical significance could have been detected on a larger sample size. Notably, the small number of patients deceased from CV cause in our cohort may explain that none of the BP parameters were associated with CV mortality. However, our study still confirms previous findings about the prognostic value of daytime iABPM, while highlighting the challenges of relying solely on HBPM or peri-dialytic BP. We believe this study contributes to the growing evidence that 44-h iABPM remains the most accurate method for assessing BP in this population, while also providing practical insights into HBPM duration.

In conclusion, peridialytic BP inadequately reflects interdialytic BP and CV risk. Both interdialytic ABPM and HBPM offer improved accuracy in BP classification, complementing each other. iABPM assesses nocturnal BP, a robust CV predictor, but may not be universally feasible. The choice between techniques should be personalized, considering dialysis duration and clinical progress. Further research with a larger population is needed to confirm the superiority of iABPM in identifying CV mortality risk and refine clinical practice. The best frequency of its use should also be tested.

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**Author contributions:** JH wrote the paper. JMK and ASR conceived and designed the analysis.PV, CB, PD, BD, SG and PX collected the data. JH, LS and ASR performed the analysis. PD, JMK and FJ revised the manuscript.

**Data availability statement:** The data underlying this article are available in the article and in its online supplementary material.

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**Legend to figures**

**Figure 1.** ROC curve analysis comparing HBPM, pre- and post-dialysis BP measurements with 44-h iABPM considered as the reference.

**Figure 2.** Univariate survival analysis (Kaplan-Meier) for 6-year all-cause mortality according to the quartiles of mean daytime systolic BP measured by iABPM (Q1: <122 mmHg; Q2: 122-136 mmHg; Q3: 136-148 mmHg; Q4: >148 mmHg).

**Tables**

**Table 1.** General characteristics of patients at baseline

|  |  |  |
| --- | --- | --- |
|  | **Mean ± standard deviation or median (Q1-Q3)** | **min-max** |
| n | 43 |  |
| Male/Female (n) | 28/15 |  |
| Age (years) | 68.3 ± 13 | 32 – 87 |
| BMI (kg/m²) | 24.1 ± 3.8 | 18.2 – 33.7 |
| Median dialysis vintage (months) | 18 (8-38) | 2 – 133 |
| Transplant history (n) | 5 (12%) |  |
| Vascular access (AVF/catheter) | 32/11 |  |
| Diabetes (n) | 18 (42%) |  |
| Smoking (%)  -smokers  -ex-smokers | 9 (21%)  7 (16%) |  |
| Weight gain between 2  dialysis sessions (mean of a 2-week period) (kg) | 1.8 ± 0.72 | 0.400 – 3.600 |
| Arterial calcifications (n) | 34 (79%) |  |
| CV complications (n) | 17 (39.5%) |  |
| LVH (n) | 22 (54%) |  |
| Dry weight changes  1 change  2 changes | 10 (24%)  3 (7%) |  |
| Erythropoietin (μg/month) | 110 (50-242.5) | 10 – 800 |
| Hemoglobin (g/dl) | 10.8 ± 1.0 | 8.5 – 13 |
| CRP (mg/l) | 3.3 (1.2-6.4) | 0.6 – 25 |
| Albumin (g/l) | 40.4 ± 3.4 | 34 – 51 |
| Ca x P (mg²/dl²) | 41 ± 13 | 23 – 82 |
| PTH (ng/l) | 175.5 (86.75-275) | 4– 672 |
| Kt/v | 1.38 ± 0.21 | 0.93 – 2.02 |
| Anuric (n) | 8 (19%) |  |
| Treated with anti-hypertensive drugs  Diuretics  Beta blocker  Calcium channel blocker  Angiotensin Converting enzyme inhibitor  Angiotensin II inhibitor  Central action drug  Change of treatment (n)  Number of antihypertensive classes (n)  1  2  3  4  5 | 29 (67%)  17 (59%)  20 (69%)  14 (48%)  11 (38%)  8 (28%)  5 (17%)  1  3 (10%)  11 (38%)  11 (38%)  3 (10%)  1 (4%) |  |

AVF = arteriovenous fistula ; BMI = body mass index ; CRP= C reactive protein ; CV= CV ; LVH= left ventricular hypertrophy; PTH= parathormone

**Table 2.** Mean BP levels and their comparisons according to measurement techniques (n=43)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Pre-dialysis BP** | **Post-dialysis BP** | **Mean of pre and post-dialysis BP** | **44h-iABPM** | **Daytime iABPM** | **6-day HBPM** |
| **SBP** (mmHg) | **142 ± 16** | **137 ± 20** | **140 ± 15** | **133 ± 16** | **136 ± 15** | **140 ± 19** |
| Comparison with pre-dialysis BP |  | P=0.070 | P=0.070 | P=0.0002 | P=0.0042 | P=0.51 |
| Comparison with post-dialysis BP | P=0.070 |  | P=0.070 | P=0.19 | P=0.65 | P=0.24 |
| Comparison with 44h-iABPM | P=0.0002 | P=0.19 | P=0.002 |  | P=0.0002 | P=0.0009 |
| Comparison with daytime iABPM | P= 0.0042 | P=0.65 | P=0.032 | P=0.0002 |  | P = 0.036 |
| Comparison with 6-day HBPM | P=0.51 | P=0.24 | P=0.94 | P=0.0009 | P = 0.036 |  |
| **DBP** (mmHg) | **66 ± 14** | **63 ± 11** | **65 ± 13** | **71 ± 10** | **73 ± 10** | **76 ± 12** |
| Comparison with pre-dialysis BP |  | P=0.12 | P=0.12 | P=0.0009 | P<0.0001 | P=<0.0001 |
| Comparison with post-dialysis BP | P=0.12 |  | P=0.12 | P<0.0001 | P<0.0001 | P<0.0001 |
| Comparison with 44h-iABPM | P=0.0009 | P<0.0001 | P<0.0001 |  | P<0.0001 | P=0.0001 |
| Comparison with daytime iABPM | P<0.0001 | P<0.0001 | P<0.0001 | P<0.0001 |  | P = 0.025 |
| Comparison with 6-day HBPM | P=<0.0001 | P<0.0001 | P<0.0001 | P=0.0001 | P = 0.025 |  |

Wilcoxon test was used for comparisons

iABPM = interdialytic ambulatory blood pressure monitoring ; BP = blood pressure ; DBP = diastolic blood pressure ; HBPM = home blood pressure monitoring ; P= significance level ; SBP = systolic blood pressure

**Table 3.** Correlations between BP levels measured in dialysis and those measured by ambulatory techniques

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n=43 | **SBP pre-dialysis** | **SBP 44h-iABPM** | **SBP daytime iABPM** | **SBP 6-day HBPM** |
| **SBP pre-dialysis** | 1 | R = 0.59  95%CI: 0.34 to 0.76  P < 0.0001 | R = 0.55  95%CI: 0.30 to 0.74  P = 0.0001 | R = 0.53  95%CI: 0.26 to 0.72  P = 0.0003 |
| **SBP post-dialysis** | R = 0.4  95%CI: 0.1 to 0.63  P = 0.0083 | R = 0.57  95%CI: 0.32 to 0.75  P < 0.0001 | R = 0.63  95%CI: 0.40 to 0.79  P < 0.0001 | R = 0.60  95%CI: 0.36 to 0.77  P < 0.0001 |
| n=43 | **DBP pre-dialysis** | **DBP 44h-iABPM** | **DBP daytime iABPM** | **DBP 6-day HBPM** |
| **DBP pre-dialysis** | 1 | R = 0.69  95%CI: 0.49 to 0.82  P < 0.0001 | R = 0.73  95%CI: 0.54 to 0.85  P < 0.0001 | R = 0.57  95%CI: 0.32 to 0.75  P < 0.0001 |
| **DBP post-dialysis** | R = 0.74  95%CI: 0.56 to 0.85  P < 0.0001 | R = 0.74  95%CI: 0.56 to 0.85  P < 0.0001 | R = 0.76  95%CI: 0.59 to 0.86  P < 0.0001 | R =0.58  95%CI: 0.33 to 0.75  P < 0.0001 |

iABPM = interdialytic ambulatory blood pressure monitoring ; DBP = diastolic blood pressure ; HBPM = home blood pressure monitoring ; R= correlation coefficient (Spearman) ; SBP = systolic blood pressure ; P= significance level

**Table 4:** BP status in all patients and in treated patients according to the different techniques of BP measurement and inter-rater agreement for daytime iABPM:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Pre-dialysis** | **Post-dialysis** | **44-h iABPM** | **Daytime iABPM** | **6-day HBPM** |
| **NT** | 17/43 (39.5%) | 19/43  (44%) | 18/43  (42%) | 20/43 (46.5%) | 18/43  (42%) |
| **HTN** | 26/43 (60.5%) | 24/43  (56%) | 25/43  (58%) | 23/43 (53.5%) | 25/43  (58%) |
| Rater agreement with daytime iABPM | k: 0.481  95%CI: 0.219 to 0.742 | K: 0.578  95%CI: 0.333 to 0.823 | k: 0.906  95%CI: 0.779 to 1.000 |  | k: 0.718  95%CI: 0.509 to 0.926 |
| **HTN treated and controlled** | 12/29 (41.4%) | 7/29  (24.1%) | 10/29  (34.5%) | 12/29 (41.4%) | 10/29  (34.5%) |
| **HTN treated and uncontrolled** | 17/29 (58.6%) | 22/29  (75.9%) | 19/29  (65.5%) | 17/29 (58.6%) | 19/29  (65.5%) |
| Rater agreement with daytime iABPM | k: 0.431  95%CI: 0.098 to 0.764 | k: 0.621  95%CI: 0.342 to 0.901 | k: 0.854  95%CI: 0.661 to 1.000 |  | k: 0.563  95%CI: 0.256 to 0.869 |

iABPM = interdialytic ambulatory blood pressure monitoring ; HBPM = home blood pressure monitoring ; HTN = hypertension ; NT = normotension

**Table 5.** BP phenotypes of patients according to the BP measurement technique.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **44-h iABPM** |  |  |  |
| **Pre-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (17)** | 12 (71%) | 5 (29%) | / | / |
| **HTN (26)** | / | / | 20 (77%) | 6 (23%) |
|  | **Daytime iABPM** |  |  |  |
| **Pre-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (17)** | 13 (76.5%) | 4 (23.5%) | / | / |
| **HTN (26)** | / | / | 19 (73%) | 7 (27%) |
|  | **6-day HBPM** |  |  |  |
| **Pre-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (17)** | 12 (71%) | 5 (29%) | / | / |
| **HTN (26)** | / | / | 20 (77%) | 6 (23%) |
|  | **44-h iABPM** |  |  |  |
| **Post-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (19)** | 14 (73.7%) | 5 (26.3%) | / | / |
| **HTN (24)** | / | / | 20 (83.3%) | 4 (16.7 %) |
|  | **Daytime iABPM** |  |  |  |
| **Post-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (19)** | 15 (79%) | 4 (21%) | / | / |
| **HTN (24)** | / | / | 19 (79.2%) | 5 (20.8%) |
|  | **6-day HBPM** |  |  |  |
| **Post-dialysis BP** | **NT** | **MHT** | **HTN** | **WCH** |
| **NT (19)** | 13 (68.4%) | 6 (31.6%) | / | / |
| **HTN (24)** | / | / | 19 (79.2%) | 5 (20.8%) |

iABPM = interdialytic ambulatory blood pressure monitoring; HBPM = home blood pressure monitoring ; HTN = sustained hypertension ; MHT = masked hypertension ; NT = normotension ; WCH = white coat hypertension

**Table 6.** Inter-rater agreement of the HTN/NT categorization between daytime iABPM and HBPM

|  |  |  |  |
| --- | --- | --- | --- |
| **Daytime iABPM** | **k** | **95%CI** | **Agreement** |
| 6-day HBPM | 0.718 | 0.509 to 0.926 | 86.05% |
| 5-day HBPM | 0.670 | 0.448 to 0.891 | 83.72% |
| 3-day HBPM | 0.575 | 0.331 to 0.819 | 79.07% |

iABPM = interdialytic ambulatory blood pressure monitoring ; HBPM = home blood pressure monitoring