

CV Risk Assessment in Dialysis Patients:

Does Pre-Dialysis Blood Pressure Assessment Really Matter?

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Volume status tightly relates to survival in haemodialysis (HD) patients. Since both hypervolemia and hypovolemia are associated with an increased risk of death, maintaining a normovolemic status in this population is a constant challenge. Alborzi et al. revealed that 44-hour interdialytic blood pressure (BP) is superior to peri-dialytic BP in risk prediction for all-cause and cardiovascular mortality. Therefore, ambulatory blood pressure monitoring (ABPM) is set as the gold standard for BP evaluation in HD patients. ABPM also identifies 'white-coat' hypertension, masked hypertension and abnormal nocturnal dipping patterns, all of which are associated with adverse outcomes.

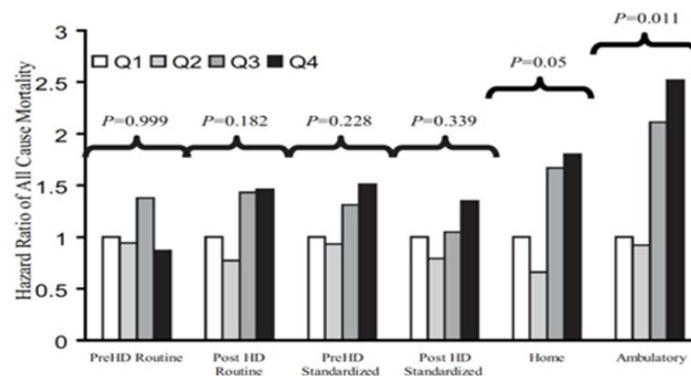


Figure 1. Ambulatory BP monitoring (ABPM) is considered the gold-standard method for BP evaluation

The importance of pre-dialysis blood pressure for CV risk assessment

A systematic review showed that pre-dialysis BP measurements are not sufficiently precise estimates of interdialytic ambulatory BP. Higher pre-dialysis BP values are related to increased intravascular volume, withholding of antihypertensive medications before treatment, the "white coat" effect and the lack of a standardized measurement procedure. However, pre-, post- and intradialytic blood pressure measurements remain clinically important in assessing and managing hemodynamic stability during the haemodialysis sessions. There is data to suggest that pre-dialysis systolic blood pressure (SBP) has prognostic importance as well. Port et al. showed that the pre-dialysis SBP below 110mmHg strikingly increases the risk of all-cause mortality. The authors stratified patients according to the presence of coronary artery disease and heart failure and observed similar findings in all groups. The study by Li et al. included both incident and prevalent HD patients who had at least one pre-dialysis SBP measurement within the prior three months. They stratified patients by the different SBP categories and observed that subjects with SBP below 120mmHg clearly had the poorest outcomes in terms of all-cause mortality. More recently, a French research group added to this observation by finding a U-shaped relationship between SBP and clinical outcomes. The reference point was 150 to 160 mmHg and consistent pre-dialysis BP below this level was associated with a gradual increase in both all-cause mortality and cardiovascular mortality. The Dialysis Outcomes and Practice Patterns

Study (DOPPS) also found that lower pre-dialysis SBP, referring to the reference values of 130-139 mmHg, was associated with an increased mortality risk. A study from Korea showed a similar reverse J-shaped relationship with all-cause mortality, using the reference value of pre-dialysis SBP of 130-140 mmHg in haematology patients.

In terms of diastolic blood pressure (DBP) and mortality, there is an inverse relationship - the lower the DBP, the greater the risk of mortality. The decrease in DBP could be explained by the increased arterial pulse pressure, which is indicative of greater arterial stiffening. All these studies show a counter-intuitive perspective on BP in dialysis patients compared to the general population.

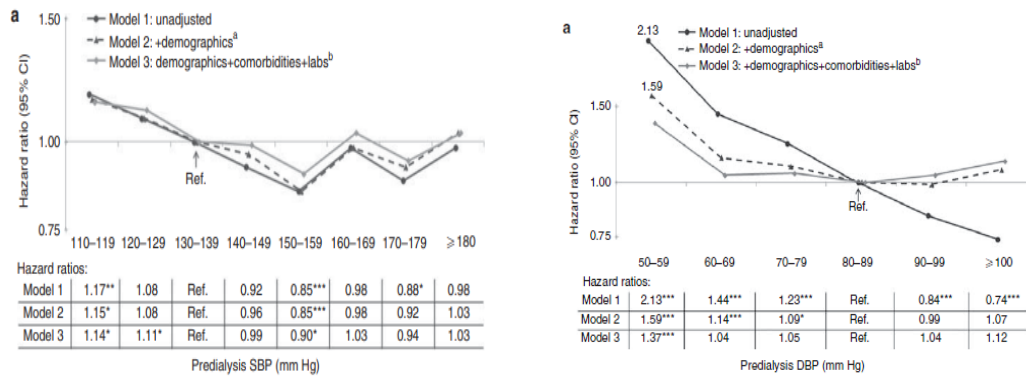


Figure 2. Predialysis SBP, DBP and mortality risk – conclusions from the DOPPS study

Blood pressure, volume status and cardiovascular risk in HD patients

A low pre-dialysis SBP may indicate that these patients have significant cardiac comorbidity. It has been speculated that poor heart function may be the underlying cause of the association between a low SBP and an increased risk of mortality. Another possibility is that modelling did not account for residual confounding. Also, pre-dialysis BP may increase with hypervolemia. Chazot et al. examined 380 HD patients using the probing dry weight to lower the volume status of the patient. This caused a gradual decline in the pre-dialysis SBP over 52 weeks. Looking at the pre-dialysis SBP relating to all-cause mortality, the results were again similar - a lower pre-dialysis SBP was associated with the poorest survival pattern as compared to hypertensive patients with SBP 170 mmHg. The study's other findings strongly imply that the patient's volume status may be a substantial confounder of pre-dialysis BP and that having a considerable decrease in pre-dialysis SBP among hypervolemic individuals is related to positive clinical outcomes.

The Monitoring Dialysis Outcomes (MONDO) initiative also found that the relationship between pre-dialysis SBP and outcome depends on pre-dialysis fluid status. Low pre-dialysis SBP appears unfavourable in patients with fluid overload or fluid depletion, but not in normovolemic patients. Also, post-dialysis fluid depletion is associated with a survival benefit. Looking at the relationship between pre-dialysis SBP and its peridialytic change in HD patients concerning all-cause mortality, Zhang et al. observed similar findings. Research showed that pre-dialysis SBP below 140 mmHg posed a gradual increase in the risk of all-cause mortality. Concerning the peridialytic change of SBP, calculated as the post-haemodialysis SBP minus the pre-haemodialysis BPP, it was observed that a peridialytic SBP rise combined with high pre-HD SBP was associated with poorer survival. These findings imply that intradialytic hypertension and patient volume overload may significantly confound the interpretation

of the relationship between pre-dialysis SBP and clinical outcomes in HD patients. As a result, the pre-dialysis SBP value is crucial, but there is also a significant association between pre-dialysis SBP variability and clinical results.

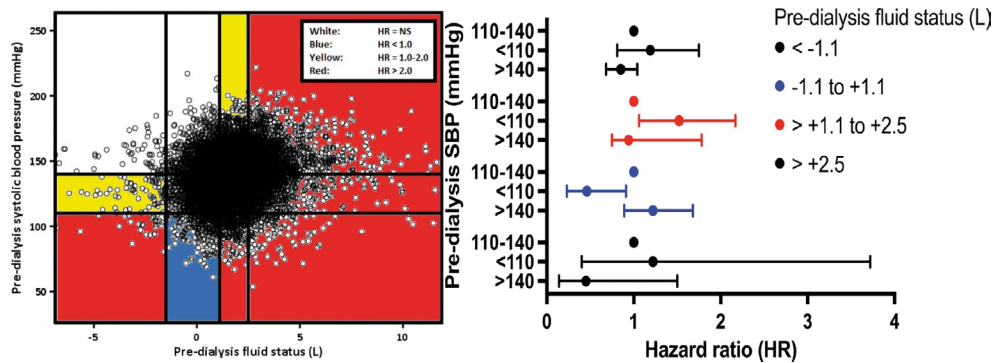


Figure 3. The association of the combination of pre-dialysis SBP and pre-dialysis fluid status with mortality - the MONDO study

The DECIDE study by Shafi et al. examined the variability of pre-dialysis SBP over monthly intervals to day 181 following the commencement of dialysis. This study displayed a significant association between pre-dialysis SBP variability and clinical outcomes, such as all-cause mortality, cardiovascular mortality, and cardiovascular events. This relationship persisted independent of the degree of model adjustments. Modifiable variables such as obesity, high calcium-phosphorus product, and low haemoglobin, were linked to higher pre-dialysis BP fluctuation. Greater fluid removal, achieving the prescribed dry weight during dialysis, higher haemoglobin, and anti-hypertensive regimens without beta blockers or RAS blockers, were all related to reduced BP variation. All these findings suggest the need for additional research in this area, highlighting SBP fluctuation as a significant treatment target in HD patients.

Key points

1. Ambulatory blood pressure monitoring is considered the gold standard for BP evaluation in HD patients. When unavailable, interdialytic home BP should be considered in patient assessment.
2. Pre-dialysis BP measurements are still clinically important for assessing and managing hemodynamic stability during the HD session.
3. Pre-dialysis SBP has substantial prognostic importance as studies showed a U-shaped or reversed J shape relationship with mortality.
4. Pre-dialysis SBP should be interpreted in light of volume status and its predictive value may change depending on the patient's fluid status.
5. Between-visits pre-dialysis SBP variability showed important prognostic information in HD patients.

Further reading

- (1) Alborzi P, Patel N, Agarwal R. Home blood pressures are of greater prognostic value than hemodialysis unit recordings. *Clin J Am Soc Nephrol.* 2007;2(6):1228-34. doi: 10.2215/CJN.02250507.
- (2) Port FK, Hulbert-Shearon TE, Wolfe RA, et al. Predialysis blood pressure and mortality risk in a national sample of maintenance hemodialysis patients. *Am J Kidney Dis.* 1999;33(3):507-17. doi: 10.1016/s0272-6386(99)70188-5.
- (3) Li Z, Lacson E Jr, Lowrie EG, Ofsthun NJ, Kuhlmann MK, Lazarus JM, Levin NW. The epidemiology of systolic blood pressure and death risk in hemodialysis patients. *Am J Kidney Dis.* 2006;48(4):606-15. doi: 10.1053/j.ajkd.2006.07.005.
- (4) Hannedouche T, Roth H, Krummel T,; French Observatory. Multiphasic effects of blood pressure on survival in hemodialysis patients. *Kidney Int.* 2016;90(3):674-84. doi: 10.1016/j.kint.2016.05.025.
- (5) Robinson BM, Bieber B, Pisoni RL, Port FK. Dialysis Outcomes and Practice Patterns Study (DOPPS): its strengths, limitations, and role in informing practices and policies. *Clin J Am Soc Nephrol.* 2012;7(11):1897-905. doi: 10.2215/CJN.04940512
- (6) Jhee JH, Park J, Kim H, et al. The Optimal Blood Pressure Target in Different Dialysis Populations. *Sci Rep.* 2018;8(1):14123. doi: 10.1038/s41598-018-32281-w.
- (7) Dekker M, Konings C, Canaud B, et al. Pre-dialysis fluid status, pre-dialysis systolic blood pressure and outcome in prevalent haemodialysis patients: results of an international cohort study on behalf of the MONDO initiative. *Nephrol Dial Transplant.* 2018;33(11):2027-2034. doi: 10.1093/ndt/gfy095.
- (8) Zhang H, Preciado P, Wang Y, et al. Association of all-cause mortality with pre-dialysis systolic blood pressure and its peridialytic change in chronic hemodialysis patients. *Nephrol Dial Transplant.* 2020;35(9):1602-1608. doi: 10.1093/ndt/gfz289
- (9) Shafi T, Sozio SM, Bandeen-Roche KJ,; DEcIDE Network Patient Outcomes in End Stage Renal Disease Study Investigators. Predialysis systolic BP variability and outcomes in hemodialysis patients. *J Am Soc Nephrol.* 2014;25(4):799-809. doi: 10.1681/ASN.2013060667