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## **How to Control BP Fluctuation in HD Patients**

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In patients with end-stage renal disease treated with hemodialysis (HD), hypertension is common and often poorly controlled. Volume excess is one of many factors mediating hypertension in this population. Rapid removal of volume during HD results in blood pressure (BP) fluctuation necessarily. It causes several unique problems in assessing and treating hypertension. There are two types of BP variability. The first is inter-dialytic variability (between HD sessions) and the second is intra-dialytic variability (during HD session).

BP obtained before or after HD display a J- or U-shaped association with cardiovascular events and survival, but elevated BP detected by home or ambulatory BP monitoring is clearly associated with shorter survival. In addition, BP variabilities may be associated with adverse events. Several studies have linked inter-dialytic BP variability to all-cause and cardiovascular mortality. Taken together, ambulatory BP monitoring may be most reliable in HD patient. However, it has not been concluded if using ambulatory BP monitoring vs. in-center measurements to guide treatment decisions improves BP control and/or clinical outcomes.

Similar results have been demonstrated for intra-dialytic BP variability and clinical outcomes. A recent study reported U-shaped association between change in systolic BP and all-cause mortality. Post-dialytic drops in systolic BP between -30 and 0 mmHg were associated with greater survival, but large decreases of systolic BP (more than -30 mmHg) and any increase in systolic BP (over 0 mmHg) were related to increased mortality.

Achieving adequate BP level along with minimizing fluctuation is specialized issue in HD patient. Non-pharmacologic measures to ensure water and sodium balance by achieving dry weight and decreasing daily sodium intake are fundamental in this population. Bio-impedance analysis and blood volume monitoring may be helpful to estimate volume state and to adjust dry weight. Antihypertensive agents, with the exception of diuretics, further help in achieving optimum BP. Current evidence suggest that the use of agents was associated with reduced cardiovascular risk. The choice of a specific antihypertensive drug should be based on the co-morbid conditions of the patient, the pharmacologic characteristics of the agent including risk of hyperkalemia and dialyzability, and chronological consideration with HD therapy. Of importance, the need of increasing the number of antihypertensive drugs, should be each time balanced against reappraisal of the non-pharmacologic measures.