Introduction

• In patients with end-stage renal disease (ESRD), the critical and immediate need for renal replacement therapy can overshadow the persistent risk of cardiovascular events and death. However, cardiovascular disease-related morbidity and mortality is greater in ESRD patients compared to the general population; published estimates suggest the risk is many times greater.1,2 This is probably related to the vast constellation of underlying conditions that contribute to the deterioration of the circulatory system, including high blood pressure and diabetes-related episodes of intradialytic hypervolemia with attendant tissue hypoxia, all superimposed on a background of vascular disease, diabetes, and autonomic nervous system dysfunction.

• Chronic hypervolemia through excessive fluid accumulation between dialysis treatments is yet another physical insult on the cardiovascular system of vulnerable dialysis patients. Thus, the potential associations between intradialytic weight gain (IDWG) and cardiovascular events and death were studied.

Objective

The primary goal of the current study was to estimate the association between fluid accumulation (IDWG) and specific cardiovascular endpoints, hospitalization events, and death in patients with ESRD.

Methods

Patients

• The current study examined electronic medical records of US patients incident to in-center hemodialysis (1 Jan 2007-31 Dec 2008) who remained on the modality for 180 days and hadMedicare as their primary insurer (Figure 1).

• Patients included in the analysis were treated at dialysis facilities located across the US within a large dialysis organization.

Analytics

• Relative (rel) and absolute (abs) IDWG were assessed over dialysis days 91-180 (to provide opportunity for initial equilibration to dialysis).

• Cross-sectional associations with covariates estimated using contingency tables and chi-square testing.

• Outcomes were identified through US Renal Data System claims data and were considered as those occurring after another dialysis day 181 until death, care transfer, morbidity change, or end of study period (31 Dec 2008).

• Longitudinal associations were estimated using proportional hazards regression.

Exposure

• IDWG (gains) was defined as the amount of fluid gained between dialysis sessions, from the end of the pre-dialysis period to the beginning of the next.

• Absolute IDWG was calculated as the pre-dialysis weight from one treatment minus the post-dialysis weight from the previous dialysis treatment.

Outcomes

• The patient outcome studied during the analysis period were: hospitalization for heart failure/fluid overload

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• Compared to measures of absolute IDWG, relative IDWG measures demonstrated more potent associations with the outcomes studied (Figure 2).

• There was a strong incremental dose-response association between relative IDWG and the patient outcomes considered (Figure 3).

• IDWG—in absolute or relative terms—was associated with poorer outcomes, and relative IDWG may be the more clinically relevant parameter for future studies and in clinical practice.

• Greater fluid accumulation was associated with greater prevalence of intradialytic hypertension (Figure 4). In a related analysis, Calavrese et al have shown that intradialytic hypertension was strongly associated with greater risk of death and cardiovascular events.

• These findings may be due in part to hypertension and the cardiovascular strain associated with fluid overload. An alternative mechanism might include myocardial stunning associated with high ultrafiltration rates during dialysis.

Conclusions

• These study results demonstrate an increased risk of myocardial infarction and heart failure/fluid overload for patients undergoing hemodialysis with greater fluid accumulation (IDWG).

• All-cause death and cardiovascular death were also highly associated with fluid accumulation.

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Figure 1. Study Design

Table 1. Characterization of Cardiovascular Comorbidities at Study Baseline

Table 2. Incidence Rates and Cumulative Incidence of Outcomes

Results

Figure 2. Association of IDWG and Cardiovascular Events

Figure 3. Relative IDWG and Events During At-Risk Period

Figure 4. Association between IDWG and Intradialytic Hypotension

Discussion

• Compared to measures of absolute IDWG, relative IDWG measures demonstrated more powerful associations with the outcomes studied (Figure 2).

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