Factors Associated With Withdrawal From Maintenance Dialysis: A Case-Control Analysis

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Background: Little is known about differences in the clinical course between patients receiving maintenance dialysis who do and do not withdraw from dialysis therapy.

Study Design: Case-control analysis.

Setting & Participants: US patients with Medicare coverage who received maintenance hemodialysis for 1 year or longer in 2008 through 2011.

Predictors: Comorbid conditions, hospitalizations, skilled nursing facility stays, and a morbidity score based on durable medical equipment claims.

Outcome: Withdrawal from dialysis therapy.

Measurements: Rates of medical events, hospitalizations, skilled nursing facility stays, and a morbidity score.

Results: The analysis included 18,367 (7.7%) patients who withdrew and 220,443 (92.3%) who did not. Patients who withdrew were older (mean age, 75.3 ± 11.5 [SD] vs 66.2 ± 14.1 years) and more likely to be women and of white race, and had higher comorbid condition burdens. The odds of withdrawal among women were 7% (95% CI, 4%-11%) higher than among men. Compared to age 65 to 74 years, age 85 years or older was associated with higher adjusted odds of withdrawal (adjusted OR, 1.61; 95% CI, 1.54-1.68), and age 18 to 44 years with lower adjusted odds (adjusted OR, 0.36; 95% CI, 0.32-0.40). Blacks, Asians, and Hispanics were less likely to withdraw than whites (adjusted ORs of 0.36 [95% CI, 0.35-0.38], 0.47 [95% CI, 0.42-0.53], and 0.46 [95% CI, 0.44-0.49], respectively). A higher durable medical equipment claims-based morbidity score was associated with withdrawal, even after adjustment for traditional comorbid conditions and hospitalization; compared to a score of 0 (lowest presumed morbidity), adjusted ORs of withdrawal were 3.48 (95% CI, 3.29-3.67) for a score of 3 to 4 and 12.10 (95% CI, 11.37-12.87) for a score ≥7. Rates of medical events and institutionalization tended to increase in the months preceding withdrawal, as did morbidity score.

Limitations: Results may not be generalizable beyond US Medicare patients; people who withdrew less than 1 year after dialysis therapy initiation were not studied.

Conclusions: Women, older patients, and those of white race were more likely to withdraw from dialysis therapy. The period before withdrawal was characterized by higher rates of medical events and higher levels of morbidity.

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The end-of-life experience for patients receiving maintenance dialysis is a timely area of study. Although annual rates of dialysis therapy initiation have been relatively stable during the past decade,[1] dialysis patients now live longer than ever before.[2] These developments have recently fostered a keen interest in issues such as conservative care for end-stage renal disease (ESRD),[3-6] palliative care in nephrology,[7-12] and withdrawal from dialysis therapy.[13-19]

Elective withdrawal from dialysis therapy is a critically important care option.[20-23] Withdrawal from dialysis therapy is a cause of death in approximately 10% to 20% of patients in western countries, and it appears to be increasing.[24] While several seminal studies have examined the factors associated with dialysis therapy withdrawal,[14,15,25,26] nearly all appear to have used data assessed primarily at the time of dialysis therapy initiation. However, except in the case of incident patients who experience early withdrawal,[18] this approach may not fully capture the clinical scenarios that characterize the dialysis therapy withdrawal experience. In real-life clinical environments, the decision to withdraw from dialysis therapy probably reflects bedside realities such as increasing comorbid condition burden, increasing disability, and increasing use of health care proximal to the withdrawal decision.

We therefore designed a study to examine clinical events in the period preceding withdrawal in patients receiving maintenance hemodialysis. Using a large sample from a national registry of patients receiving dialysis, we sought to characterize patients who withdrew from dialysis therapy and contrast them with patients who did not withdraw. Specifically, we examined rates of medical events, time spent in the hospital and in skilled nursing facilities, and putative markers of morbidity drawn in part from claims for durable medical equipment use in the period preceding withdrawal to determine how patients who withdraw might differ from those who do not. We hypothesized that the period before withdrawal would be characterized by increasing rates of medical events, institutionalization, and other markers that potentially signal morbidity.

Methods

Data Sources

The US Renal Data System (USRDS) ESRD database was used for this study. The USRDS ESRD database consists of data

from the ESRD Medical Evidence Report, the ESRD Death Notification form, and Medicare Parts A and B claims. From Medicare, which insures the majority of patients who receive maintenance dialysis, we used billing claims data to determine the presence of comorbid conditions, derive the Liu comorbidity index,[27] and generate a putative marker of morbidity based in part on claims for durable medical equipment use (further described in the next section).

Study Design

The present study used a case-control design. Case patients were individuals who withdrew from hemodialysis therapy between January 1, 2008, and December 31, 2011. For each patient who withdrew, we created an index date, defined as the date of withdrawal. We then identified hemodialysis patients who did not withdraw and created their respective index dates, defined as the calendar date on which dialysis duration was within ±30 days of dialysis therapy duration among patients who withdrew. By matching based on a similar dialysis therapy duration (ie, time between dialysis therapy initiation and the index date), we identified appropriate nonwithdrawal controls for the patients who withdrew.

All patients were required to have received hemodialysis for at least 1 year as of the index date (because our intention was to study prevalent hemodialysis patients who had ample exposure to the dialysis experience), to have been insured by Medicare Parts A and B for at least 9 months, and to have been 18 years or older. To assess factors associated with withdrawal, we compared patient demographic factors, comorbid conditions, and other indicators of health (described more fully in later paragraphs) between withdrawers and nonwithdrawers. This group was matched only on dialysis therapy duration (the minimum criteria required to create an informative comparison between withdrawers and nonwithdrawers) and is henceforth referred to as the match 1 group.

Because we hypothesized that patient factors such as age, sex, and race might be highly associated with comorbid conditions, hospitalization days, and other markers of potential morbidity such as use of durable medical equipment, we undertook a second more comprehensively matched analysis. For this analysis, we explicitly matched each withdrawal patient with 4 nonwithdrawal patients, selected at random, on the basis of age (<1 year difference), race, sex, cause of ESRD, and dialysis therapy duration (<1 year difference), thereby creating what we term the match 2 group. Controls could be matched to 1 case patient only.

To create both contrasts, we looked back 9 months preceding the index date to determine patterns of medical events, hospitalizations, skilled nursing facility stays, and the morbidity score to create a comprehensive picture of medical status in the months preceding the index date. Visual inspection of the data suggested that 9 months represented an acceptable tradeoff between a too-short observation period (eg, 3 months) and an overly long one (eg, 12 months). That is, patterns observed in the data between 12 and 9 months before the index date appeared similar to patterns observed between 9 and 6 months before the index date.

Determination of Withdrawal

Details of our definition of dialysis therapy withdrawal appear in Item S1. In brief, the presence of code 104 in the first or second position of question 12 on the USRDS Death Notification form plus an answer "yes" to question 14 ("Was discontinuation of renal replacement therapy after patient/family request to stop dialysis?") was required. We also required death 1 or more days after withdrawal to eliminate patients who likely faced imminent death and did not truly withdraw (as withdrawal is commonly understood). To take into account possible misclassification of patients who did not withdraw as withdrawers, we performed sensitivity analysis in which we required 5 days of survival after withdrawal.

Medical Events, Institutionalizations, and Other Putative Markers of Morbidity

Medical events assessed were hospitalizations for myocardial infarction, congestive heart failure, stroke, amputation/critical limb ischemia, sepsis, pneumonia, vascular access infection, gastrointestinal bleeding, or fracture; relevant codes used to identify these events are listed in Table S1. Of these, the subset of hospitalizations for myocardial infarction, stroke, amputation/critical limb ischemia, sepsis, or fractures constituted "major medical events." Medical events were identified from inpatient claims for each month during the 9-month period preceding the index date. Event rates were calculated on a monthly basis; numbers of institutionalized days were calculated on a monthly basis. Events were considered on an individual basis; for example, for hospitalization for a fracture resulting in a subsequent myocardial infarction, each event was counted individually.

To create a morbidity score that might reflect difficult-to-define phenomena such as disability, we used a variation of a previously developed claims-based algorithm.[28] A complete description of the method appears in Item S2. Briefly, potential markers of morbidity from the durable medical equipment files were chosen by first limiting to those with prevalence >1% and further limiting to those with an association with mortality, hospitalization, or fracture. Proportional hazards models were used to investigate the association of these markers with mortality, hospitalization, and fracture. The morbidity score for each patient was created by taking parameter estimates from the adjusted proportional hazards model, multiplying the parameter estimates by 10, rounding to integer, and summing the markers present in each patient. Relevant diagnosis codes appear in Table S2. Given the nature of durable medical equipment, the mean monthly morbidity score was calculated iteratively using data during the previous 3 months. For purposes of modeling (described