



# The incidence & progression of cognitive impairment in hemodialysis patients

## Introduction

- Hemodialysis (HD) patients are at high risk for cognitive impairment due to their high prevalence of hypertension, diabetes, stroke, uremia, and inflammation. The incidence and progression of cognitive impairment in HD patients, however, have not been well described.
- We previously measured the prevalence of cognitive impairment (CI) in a cohort of 338 HD patients in the Twin Cities, and among an age-matched comparison cohort of 101 non-CKD subjects. We found markedly high rates of CI in the HD cohort.
- Here we measure the incidence and pattern of CI progression over one year among the HD and non-CKD survivors.

## Methods

- Cognitive function was measured approximately 12 months after the initial cognitive assessment.
- We used the identical 45 minute neuropsychological battery to measure memory, verbal fluency, and executive function, and used a previously developed algorithm for CI classification into mild, moderate, or severe CI.

- Patients were classified as having incident CI for each level of CI: a) if they were normal at baseline and progressed to any level of CI, or b) they changed levels of CI.
- We classified subjects as having improved cognitive function if they rose  $\geq 1$  level in CI classification, as stable if CI level was unchanged, or as declined if their CI classification fell by  $\geq 1$  level.
- Logistic regression models were used to measure the risk of severe CI in HD patients compared to control patients.

## Results

- The characteristics of the second year cohorts are described in Tables 1 and 2 (with mean age of 71 in HD, and mean age of 70 in the comparison group).
- The mortality rate among the first year cohort was 28.2% (consistent with USRDS estimated mortality rate). Among the surviving HD subjects, 230/277 (83%) of subjects participated in the second year cognitive assessment.
- Incidence rates of CI in HD subjects (Figure 1) were:
  - mild CI: 6.3% (95% CI: 2.7, 9.8)
  - moderate CI: 29.6% (21.9, 37.3)
  - severe CI: 26.4% (19.2, 33.6)

- Among a comparison cohort of 83 non-CKD patients survivors in the same study, the incidence of MCI was higher than that of the HD cohort, but the incidence of moderate and severe CI were markedly lower.
- Overall, 30.4% progressed to a higher (worse) level of CI, 18.7% improved, and 50.9% stayed the same, compared to year 1. Fewer non-CKD subjects progressed (24.1%) as seen in Figure 2.
- The prevalence of moderate and severe CI at year two was similar to year one: 35.7% (29.5, 41.8) had moderate CI, and 41.7% severe CI (35.4, 48.1); only 14.8% had normal cognitive function. For comparison purposes, the baseline (prevalent) rates during year one of moderate CI was 36.4% and severe CI 37%. (Figure 3).
- Age over 75 years was the only factor significantly associated with incident severe CI in HD patients on logistic regression (OR 3.2; 1.03- 9.7;  $P < .05$ , adjusted for dialysis vintage, gender, race, Kt/V, stroke and anemia).
- On logistic regression adjusted for age, the risk of incident severe CI in HD pts vs. the comparison non-CKD cohort was 3.0 (1.1, 8.0);  $P < .03$ . This compares to a 3.5 times risk of prevalent severe CI among the HD vs. the non-CKD subjects in year 1.

Table 1

	Frequency	Percent
Characteristics of Year 2 HD Cohort, N=230		
Age		
50-64	64	27.8
65-74	71	30.87
75-84	76	33.01
85+	17	7.39
Gender		
Female	99	43.04
Male	131	56.96
Race		
White	182	79.13
Nonwhite	48	20.87
Education		
<8 years	35	15.22
9-12 years	90	39.13
>12 years	114	49.57

Figure 1

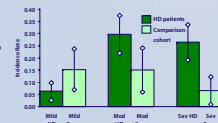


Figure 2

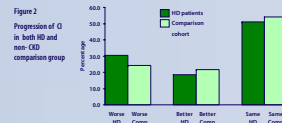
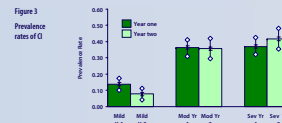


Table 2

	Frequency	Percent
Characteristics of Year 2 Non-CKD comparison cohort, N=83		
Age		
50-64	28	34.94
65-74	28	33.73
75-84	19	22.89
85+	7	8.43
Gender		
Female	49	59.04
Male	34	40.96
Race		
White	75	90.36
Nonwhite	8	9.64
Education		
<8 years	1	1.2
9-12 years	2	2.41
>12 years	80	96.37

Figure 3



## Discussion

- The incidence of both moderate and severe CI were markedly higher in the HD vs. non-CKD patients. This suggests that the high prevalent rates in year one were not the result of an unusually large number of survivors with severe or moderate CI.
- The high (30%) rate of progression of CI emphasizes the need to identify potentially modifiable risk factors for incident CI. These include blood pressure control, Kt/V, anemia, and stroke, and warrant further investigation using a larger cohort.
- Limitations include the high mortality rate with potential survival bias, a small sample size that limited our ability to measure factors associated with incident CI, and the lack of generalizability to other HD cohorts with larger proportions of non-whites.

## Conclusion

- The incidence of severe CI in HD subjects was 26%. More than 30% of HD subjects experienced cognitive decline over one year. Age 75 + significantly increased the risk of incident severe CI. Compared to non-CKD subjects, HD subjects were three times more likely to develop incident CI over one year.