Nocturnal hemodialysis in Germany: A case control study

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Introduction and Aims:

Nocturnal in-center hemodialysis (NHD) is a convenient choice in order to administer longer treatment hours. In highly selected patients NHD improves markers of treatment quality such as serum phosphate, hemoglobin and blood pressure (*1,2*). Given the higher cost of this modality and the lack of data from controlled trials this study was initiated to evaluate the effect of NHD as compared to standard therapy in a real-world setting. Here we present data on treatment parameters and outcome from a large cohort of chronic NHD patients matched with controls for a similar risk profile.

Methods :

Patients who were on chronic, thrice-weekly in-center hemodialysis for more than 90 days as of Jan.1, 2008 were eligible. NDH was defined as treatments lasting more than 7 hours. Patients were matched 1:1 for age, gender and diabetic status. To avoid center bias, controls were drawn randomly from all renal units in Germany associated with the QiN or QuasyNeT registries, respectively. QiN and QuasyNeT together comprise the majority of hemodialysis patients in Germany. Data collection is mandatory as part of a national quality-improvement program. The observation period was from 1/1/2008 until 9/30/2009. A two-tailed p<0,05 was considered significant. All calculations were made with the R statistics program.

Results:

There were 688 patients available for analysis who met the criteria for NHD. The average age was 50,0 years, 24% of patients were women and 17 % were diabetic (Table 1a). Significant differences between NHD and SHD, which may influence patient outcome remained after matching. The average time on dialysis before the observation period (dialysis burden) was longer in NHD than in SHD (6,69 vs. 6,06 years; p<0,01), and the average weight post dialysis at the beginning of observation was higher by 3,88 kg in NHD patients (78,99 vs. 75,11kg; p < 0,05). Consistent with longer treatment times on NHD (447,7 vs. 283,0 min; p<0,05) the average Kt/V was higher in NHD. Transferrin saturation (TSAT) was lower in NHD patients, but hemoglobin (Hb) was similar in both groups. Phosphate (Phos) and calcium (Ca) were lower in NHD, but no difference was found for PTH and alkaline phosphatase between NHD and SHD. Creatinine and albumin were significantly higher in NHD than in SHD (Table 1b).These differences persisted throughout the observation period (Figure 1 A, B). For albumin there was a small decrease over time (21 months) in both groups, but reaching statistical significance only in NHD patients (in NHD: from 40,61 to 39,78 g/L; p<0,014, in SHD: from 39,64 to 39,41 g/L; p=n.s.). There were no significant trends for Hb, TSAT, Phos, Ca, PTH and Creat.

Table 1a	NHD	SD	SHD	SD	P
N Pat.	688		683		
Age [y]	50,00	13,92	50,18	13,95	n.s.
Females [%]	24,13		24,16		n.s.
Diabetes Mellitus [%]	17,15		17,72		n.s.
Weight [kg]	78,99	18,33	75,11	16,14	< 0,005
Dialysis Burden [y]	6,69	6,29	6,06	6,36	0,003
Comorbidities:					
Cerebrovascular Disease [%]	9,22		15,83		< 0,005
Peripheral Vascular Disease [%]	17,60		20,42		n.s.
Coronary Disease [%]	32,79		29,17		n.s.
Other Heart Disease [%]	17,21		28,19		< 0,005
Valvular Heart Disease [%]	20,08		24,70		n.s.
Malignancy [%]	11,99		12,45		n.s.
Chronic Infections [%]	8,28		11,78		0,039
Other Comorbidities [%]	16,60		24,66		0,002

Table 1b	NHD	SD	SHD	SD	P
Kt/V sp	1,96	0,58	1,53	0,44	<0,001
e Kt/V	1,80	0,55	1,35	0,39	<0,001
std Kt/V	2,61	0,35	2,27	0,29	<0,001
Hb	11,86	1,15	11,73	1,19	n.s.
Ferritin	549,96	345,66	621,28	431,36	n.s.
Transferrin	1,78	0,38	1,75	0,38	<0,001
TSAT	25,08	11,89	26,82	12,67	<0,005
CRP	10,23	16,31	10,94	19,05	n.s.
Calcium	2,23	0,21	2,24	0,24	<0,05
PTH	29,70	27,17	32,41	28,61	n.s.
Alk Phos	100,35	79,33	96,86	66,31	n.s.
bone AP	49,53	37,88	66,73	86,88	n.s.
Phos	1,74	0,48	1,88	0,61	<0,001
Creatinine	10,17	2,53	9,64	2,94	<0,005
Albumin	40,61	4,28	39,80	4,52	<0,005
T Protein	68,66	5,00	68,47	4,80	n.s.
Cholesterol	175,45	45,77	174,93	42,02	n.s.
HCO3	21,89	2,85	22,07	2,99	n.s.
HbA1C	6,27	1,16	6,21	1,27	n.s.

Table 1a: Charcteristics of patients who were on NHD as of 1/1/08, and of controls matched for age, gender and diabetes. **Dialysis Burden:** from first dialysis to 1/1/08; **Coronary disease:** includes MI, CABG, PCI; **Comorbidities**: were assessed once a year and results closest to the start of observation were used.

Table 1b: Laboratory parameters in the first three months after the start of observation: **NHD**: nocturnal hemodialysis; **SHD**: standard (daytime) hemodialysis. **Kt/V sp**: single pool Kt/V; **eKt/V**: equilibrated Kt/V; **std Kt/V**: standardized (weekly) Kt/V **Hb**: hemoglobin, **TSAT**: transferrin saturation, **CRP**: C-reactive protein, **PTH**: parathyroid hormone, **Alk Phos**: alkaline Phosphatase, **boneAP**: bone specific AlkPhos, **Phos**: serum phosphate; **Alb**: serum albumin; **T Protein**: total serum protein, **HCO3**: bicarbonate, **HbA1C**: glycosylated hemoglobin

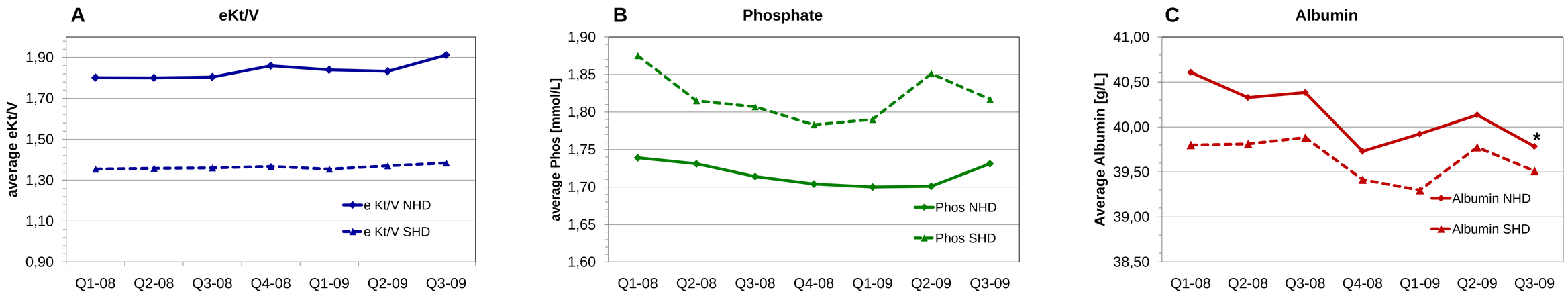

Figure 1 A, B, C: Change of selected laboratory parameters over time: Significant differences, which were present at the beginning persisted throughout the 21 month observation period. There were no significant trends over time except for a small decrease of albumin in NHD (*).

Conclusions:

In this large case control study NHD was associated with higher Kt/V and nutritional parameters such as phosphate, albumin and creatinine at the beginning of observation. In contrast to previous reports no improvement was found in the course of the study for hemoglobin or phosphate control. This may be due to optimized conditions, which could not be significantly improved. Differences between groups might also be due to a higher prevalence of comorbidities in the SHD group. This cohort will be followed for a longer period providing long-term outcome data, which are currently scarce with this form of dialysis.

References: **1**) Bugeja, A. et al. (2009). Clin J Am Soc Nephrol **4(4): 778-783**; Cravedi, P et al. (2009). Int J Artif Organs **32(1): 12-9.**

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