

**EFFECT OF NEPHROLOGY REFERRAL
ON THE INITIATION OF HAEMODYALYSIS
AND MORTALITY IN ESRD PATIENTS**

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Abstract: Late nephrology referral of patients with chronic kidney disease (CKD) has been suggested as increasing mortality after the initiation of dialysis. The aim of this study was to assess the impact of nephrology referral on the initiation of haemodialysis (HD) and mortality during HD treatment in end-stage renal disease (ESRD) patients who have died in our institution over a five-year period.

We studied data from all 117 patients on HD treatment in our institution who died (after 90 days of HD treatment) in the period between 01.01. 2002 and 31.12. 2006. Early (ER) and late referral (LR) were defined by the time of follow-up by a nephrologist greater than or less than 6 months, respectively, before the initiation of haemodialysis.

Out of a total of 117 patients, 37.6% (44 patients) started HD in the ER group and 62.4% (73 patients) in the LR group. At the start of HD, LR patients were older, had a higher proportion of temporary catheters and had a significantly lower levels of haemoglobin and diuresis. Creatinine clearance was less in the LR (7.67 ± 3.86 ml/min/1.73 m²) vs. the ER group (8.70 ± 3.62 ml/min/1.73 m²), but not significantly different. Cardiovascular disease (CVD), defined by a history of myocardial infarction, cerebral vascular disease, peripheral arteriopathy, and/or heart failure, was also significantly more common among LR patients compared to ER (56%; 27%, $p = 0.002$). During the haemodialysis treatment, the LR group had significantly lower levels of

haemoglobin and haematocrit. CVD accounted for about 64% of deaths observed in the LR group. According to echocardiography data, there were no significant differences in the left ventricular mass index (LVMI) between the LR and ER groups at the time of dialysis initiation, but during haemodialysis treatment the LR group had significantly greater LVMI than the ER group ($232,96 \pm 92,48 \text{ g/m}^2$ vs. $184,09 \pm 51,74 \text{ g/m}^2$; $p = 0,031$). The time until death in months during dialysis treatment was significantly different between the LR and ER group, (69.51 ± 64.03 vs. 113.27 ± 89.03 , $p = 0.0025$).

LR patients experienced a greater degree of anaemia and a high prevalence of CVD at the time of dialysis initiation. Our data suggest that the anaemia, CV damage and progression of left ventricular hypertrophy (LVH) in the LR patients during haemodialysis treatment are associated with poor survival on haemodialysis.

Key words: early/late nephrology referral; haemodialysis; mortality; left ventricular mass index.

Introduction

Morbidity and mortality remain high among patients on dialysis compared to subjects of a similar age in the general population, despite advances in technology and improved understanding of treatment strategies. The population starting on dialysis is increasingly older and has more associated cardiovascular risk factors, which condition a greater likelihood of negative outcomes in terms of morbidity and mortality [1]. Strikingly, cardiovascular mortality remains elevated in dialysis patients and is about 10 to 20 times higher than among those in the general population, and accounts for more than 50% of deaths in the first year of dialysis [2]. Factors involved in this high rate of mortality on dialysis are multiple, including the quality of dialysis, nutritional status, comorbidity, age, ethnicity, prevalence of diabetes and, perhaps not sufficiently taken into account, duration and quality of predialysis care [3].

Publications to date have described the status of patients at the time of dialysis initiation relative to the time of referral. Problems with these analyses include the retrospective nature of the studies, the lack of reasons given for early vs. late referral, and non-uniform definitions of "early" vs. "late" referral [4].

The detrimental effects of late nephrological referral have been highlighted during the past decades in all countries. They include lack of adequate intervention to slow the progression of renal failure, lack of prevention of uraemic complications and of timely creation of vascular access, higher morbidity, increased duration of hospitalization, altered quality of life, untoward emotional and socio-economic consequences for the patients, and undue extra costs for the community [4, 5]. Late referral patients do not benefit from such progress, especially from the renoprotective and cardioprotective strategies that constitute the basis of optimal therapy of patients with CKD today [6].

Delayed nephrology referral seems to remain an important public health problem, even in those European countries where all patients have access to the healthcare system [7]. Although there is no limitation to acceptance of patients on dialysis in our country, there is little evidence about the proportion of patients with predialysis nephrological care and its impact on their mortality later, when treated by dialysis. Recent data have shown that the number of late referrals with ESRD in our country is extremely high [8] and that the early mortality rate during the first month after initiating haemodialysis is associated with late referral [9].

A large number of patients started dialysis after admission to our hospital over the past years and were followed thereafter at the haemodialysis centre within the hospital, which made it possible to assess the impact of nephrology referral upon mortality.

Patients and methods

To assess the influence of the timing of nephrology referral on the initiation of haemodialysis therapy and on mortality in haemodialysis patients, we studied all the haemodialysis patients who died after 90 days of haemodialysis treatment in our Department of Nephrology in the period between 01.01.2002 and 31.12.2006.

The primary end-point was to assess the impact of nephrology referral on the initiation of haemodialysis therapy. Clinical and laboratory data at the start of dialysis were extracted from patients' hospital charts. For every patient we recorded: gender, age at first dialysis, ethnicity, cause of ESRD, timing of nephrology referral, initial vascular access and prior cardiovascular events. The patients were classified into 2 groups according to the timing of nephrology referral and were categorized as late referral (LR – less than 6 months follow-up by a nephrologist until initiation of dialysis) or early referral (ER-more than 6 months follow-up by a nephrologist until initiation of dialysis). Renal function at the time of initiation of dialysis was estimated according to the Cockcroft-Gault formula. Laboratory variables measured at the beginning of HD were: levels of haemoglobin, haematocrit, red blood cells (RBC), white blood cells (WBC), urea, creatinine, residual diuresis, cholesterol, triglyceride, HDL (high-density lipoprotein cholesterol), LDL (low-density lipoprotein cholesterol), potassium, calcium, phosphorus and albumin. Cardiovascular disease (CVD) at the time of initiation of dialysis was defined by a positive history of myocardial infarction, cerebral vascular disease (cerebral infarction and haemorrhage), the presence of congestive heart failure or peripheral vascular disease. Patients devoid of any of these events were classified as CVD (not) and those with at least one of these four categories of events were classified as CVD (yes).

The secondary end-point was to assess the influence of nephrology referral on mortality in haemodialysis patients. Laboratory variables measured monthly were extracted from patients' haemodialysis charts: levels of haemoglobin, haematocrit, red blood cells, white blood cells, platelets, ferritin, urea, creatinine, cholesterol, triglyceride, HDL (high-density lipoprotein cholesterol), LDL (low-density lipoprotein cholesterol), potassium, calcium, phosphorus and albumin. C-reactive protein (CRP) was determined every 3 months, and parathyroid hormone (PTH) was determined every 6 months. Single-pool spKt/V was calculated monthly, using a second-generation formula Daugirdas 2 and the PCR (protein catabolic rate) was calculated using the formula with interdialytic rise in blood urea. Mean values of the parameters until death were calculated and included in the analysis.

Echocardiography was performed at the initiation of haemodialysis therapy and during haemodialysis treatment. For the patients who had repeated echocardiography assessments during the haemodialysis treatment, mean values of echocardiography measurements were used. Left ventricular (LV) mass was calculated by the Devereux and Reichek method [10], LV mass index (LVMI) was calculated by dividing this value by the body surface area (BSA).

Statistical Analysis

Statistical analysis was performed using the statistical software Statistica for Windows 6.0. Results are expressed as mean \pm SD with a p value of less than 0.05 taken to indicate statistical significance. Groups (late and early referrals) were compared using Student's t test and χ^2 test. Correlations were performed using Spearman rank order analysis.

Results

One hundred and seventeen patients (65 males and 52 females) on HD treatment died in our Department of Nephrology in the period between 01.01.2002 and 31.12.2006. Their mean age at the start of haemodialysis was 54.35 ± 14.63 years (range 17–81 years). The duration of haemodialysis treatment in months until death was 85.96 ± 76.72 , ranging from 3 to 302 months. Overall, 44 patients (37.6%) were referred at least 6 months prior to their first dialysis, whereas 73 patients (62.4%) were referred later, less than 6 months prior to their first dialysis. Among the 44 early referral patients, 24 patients (54.5%) had predialysis nephrological care of 6–12 months, 6 patients (13.6%) 13–24 months, 8 patients (18.2%) 25–36 months and 6 patients (13.6%) > 36 months.

The distribution of primary renal disease differed between the groups. Nephroarteriosclerosis (19; 26%) and undetermined renal disease (15; 20.5%) were more frequent in the LR group, whereas pyelonephritis (9; 20.5%), miscellaneous (9; 20.5%) and chronic glomerulonephritis (8; 18.2%) were more frequent in the ER group. The proportion of diabetes mellitus was similar in the two groups (17; 23.3% and 10; 22.7%). Permanent vascular access had rarely been created in LR patients. Only 4 of the LR patients (5.5%) had a functional radial arterial-venous fistula at the first HD treatment vs. 28 of the ER patients (64%).

The overall proportion of CVD (yes) patients was also significantly higher among LR patients (41 patients; 56%), than in ER patients (12 patients; 27%, Chi-square $p = 0.002$).

Comparison between early and late referrals at start of dialysis:

Table 1 shows the clinical and laboratory characteristics of patients at the onset of haemodialysis. Age at the first HD differed between the two groups, LR patients (56.97 ± 14.88) were significantly older than ER patients (50.00 ± 13.43), $p = 0.0122$. There were no significant differences for SBP and DBP between LR and ER group. Creatinine clearance was less in the LR (7.67 ± 3.86 ml/min/1.73 m²) vs. ER group (8.70 ± 3.62 ml/min/1.73 m²), but not significantly different. Blood haemoglobin level and diuresis were significantly lower in patients referred < 6 months than in those followed for a longer time. There were no significant differences in the remaining laboratory parameters.

Correlation analysis showed that the months of nephrological follow-up correlated significantly with haemoglobin ($R = 0.207$, $p = 0.04$), creatinine clearance ($R = 0.241$, $p = 0.01$) and inversely with age ($R = -0.248$, $p = 0.007$) and creatinine ($R = -0.248$, $p = 0.01$).

Table 1 – Табела 1

*Comparasion between early and late referrals at haemodialysis onset
Сїоредба меѓу рано и доцна уїаїїени їациенїии їри инициїаїиїа
на хемодиїализаїиїа*

	Late referrals N = 73	Early referrals N = 44	p
Age at HD onset (years)	56,97 ± 14,88	50,00 ± 13,42	0,0122
SBP (mmHg)	172,38 ± 31,55	161,32 ± 28,84	ns
DBP (mmHg)	97,68 ± 17,18	93,80 ± 16,59	ns

	Late referrals N = 73	Early referrals N = 44	P
Haemoglobin (g/L)	77,51 ± 14,30	85,42 ± 18,48	0,0219
Haematocrit	0,23 ± 0,04	0,26 ± 0,06	0,0107
RBC (x10¹²/L)	2,67 ± 0,48	2,91 ± 0,76	ns
WBC (x10⁹/L)	8,61 ± 3,75	7,19 ± 2,65	ns
Creatinine (µmol/L)	974,80 ± 407,86	849,62 ± 248,25	ns
Diuresis (ml)	831,30 ± 415,11	1273,52 ± 598,92	0,0002
Ccr (ml/min/1.73m²)	7,66 ± 3,86	8,70 ± 3,62	ns
Triglyceride (mmol/L)	1,58 ± 0,80	1,44 ± 0,54	ns
Cholesterol (mmol/L)	4,71 ± 1,12	5,29 ± 1,54	ns
HDL (mmol/L)	0,94 ± 0,40	1,01 ± 0,38	ns
LDL (mmol/L)	3,00 ± 0,83	3,38 ± 1,22	ns
Potassium (mmol/L)	5,49 ± 1,03	5,50 ± 0,92	ns
Calcium (mmol/L)	2,01 ± 0,30	2,02 ± 0,32	ns
Phosphorus (mmol/L)	2,02 ± 0,68	2,00 ± 0,62	ns
Albumin (g/L)	35,20 ± 6,91	37,91 ± 4,36	ns

SBP – systolic blood pressure;
DBP – diastolic blood pressure;
Ccr – creatinine clearance

Comparison between early and late referrals during dialysis treatment until death

Table 2 shows the mean of laboratory parameters during the haemodialysis treatment until death of patients and comparison between the two groups. The LR group had significantly lower levels of haemoglobin and haematocrit. There were also significant differences in serum levels of platelets and calcium between the two groups. There were no significant differences in the remaining laboratory parameters.

Correlation analysis showed that the months of nephrological follow-up correlated significantly with haemoglobin ($R = 0.211$, $p = 0.02$) and inversely with LV mass ($R = -0.332$, $p = 0.026$).

The time until death in months during dialysis treatment was significantly different between the LR and ER groups (69.51 ± 64.03 vs. 113.27 ± 89.03 , $p = 0.0025$) (Figure 1). CVD accounted for about 64 % (47 patients) of deaths observed in the LR group and 50% (22 patients) in the ER group.

Table 2 – Табела 2

*Comparison between early and late referrals during haemodialysis treatment
(follow-up until death)*

*Споредба међу рано и доцна упућени пацијенти во шекоји
на хемодијализнојо лекување (до смртниојо исход)*

	Late referrals N = 73	Early referrals N = 44	P
BMI	23,94 ± 4,28	23,52 ± 5,07	ns
SBP (mmHg)	142,14 ± 26,19	133,07 ± 23,25	ns
DBP (mmHg)	80,46 ± 14,75	74,24 ± 15,45	ns
Haemoglobin (g/L)	94,26 ± 15,23	101,18 ± 13,25	0,01580
Haematocrit	0,28 ± 0,04	0,31 ± 0,04	0,00324
RBC (x10 ¹² /L)	3,10 ± 0,50	3,33 ± 0,45	0,01576
Ferritin (µg/l)	636,25 ± 464,09	575,91 ± 422,16	ns
WBC (x10 ⁹ /L)	7,02 ± 2,70	7,36 ± 5,57	ns
Platelets (x10 ⁹ /L)	194,97 ± 59,64	166,99 ± 57,00	0,01558
spKt/V	1,15 ± 0,23	1,21 ± 0,24	ns
PCR (g/kg/24h)	0,97 ± 0,14	1,02 ± 0,18	ns
Creatinine (µmol/L)	809,95 ± 205,34	820,81 ± 175,55	ns
Potassium (mmol/L)	5,83 ± 0,60	5,88 ± 0,59	ns
Calcium (mmol/L)	2,24 ± 0,13	2,29 ± 0,16	0,04246
Phosphorus (mmol/L)	1,44 ± 0,33	1,50 ± 0,44	ns
Albumin (g/L)	36,27 ± 3,73	37,39 ± 3,14	ns
Triglyceride (mmol/L)	1,89 ± 0,92	1,90 ± 0,94	ns
Cholesterol (mmol/L)	4,36 ± 1,06	4,47 ± 1,17	ns
HDL (mmol/L)	0,94 ± 0,27	0,99 ± 0,29	ns
LDL (mmol/L)	2,52 ± 0,81	2,63 ± 1,08	ns
CRP (mg/l)	38,01 ± 40,69	29,84 ± 26,69	ns
iPTH	187,01 ± 283,53	201,12 ± 251,17	ns

*Comparison between early and late referrals according
to echocardiographic parameters:*

Table 3 shows the echocardiographic parameters before the initiation of dialysis and during haemodialysis treatment. There were no significant differences in the LVMI between the LR and ER groups at the time of dialysis initiation, but during the haemodialysis treatment the LR had significantly greater LVMI than the ER. The ejection fraction was greater in the ER, but the

difference was significant only in the echocardiographic measurements before initiation of dialysis.

Table 3 – Табела 3

Echocardiographic parameters at baseline and during follow-up
Ехокардиографски параметри – пред започнувањето
и во текот на хемодијализното лекување

	Late referrals (n = 73)	Early referrals (n = 44)	p
Baseline			
LVmass	358,66 ± 133,62	324,04 ± 83,80	ns
LVMI (g/m²)	199,69 ± 65,63	179,35 ± 47,74	ns
EF (%)	62,70 ± 12,31	69,68 ± 9,24	0,016411
Follow-up			
LVmass 2	407,57 ± 147,25	315,91 ± 94,96	0,015837
LVMI 2 (g/m²)	232,96 ± 92,48	184,09 ± 51,74	0,031512
EF 2 (%)	57,68 ± 13,24	59,19 ± 12,45	ns

LVmass = left ventricular mass

LVMI = left ventricular mass index

EF = ejection fraction

Discussion

There are a number of studies that have evaluated the hypothesis that early referral to a nephrologist has an impact on the prolongation of time to haemodialysis initiation and better survival as compared to late referral. The problem of the persistence of late referral for CKD appears universal, as shown by studies from the United States [11, 12, 13], Australia [14], Japan [15] and Europe. [5, 16, 17, 18, 19, 20, 21]. Despite the different definitions of late referral used in these studies (ranging from 1 to 6 months), it is clear that about a third of the patients starting chronic dialysis therapy are in a high risk group caused by late referral, both in Europe and the USA. Stack *et al.* reported that in the USA more than 52.2% of patients have their first encounter with a nephrologist within 1 year before dialysis therapy initiation [11]. The findings of the Japanese study showed that 47% of patients had their first contact with a nephrologist within 6 months before dialysis therapy [15]. In the French study, Jungers *et al.* reported that late referral (< 6 months before dialysis) did not change significantly over the four three-year periods (1989–1991, 1992–1994, 1995–1997 and 1998–2000) and remains around 30% [5]. In many of the previous studies, late referral has been defined as a patient being seen by a nep-

hrologist less than one month [22], four months [18], or six months [21] before initiation of dialysis. "Timely referral", however, remains a poorly-defined term, because there are inconsistencies in the definitions used for early versus late nephrology referral. Our study used a cut-off point of 6 months before the beginning of dialysis, as have most recent studies. The data from our study show that the rate of late referrals for dialysis is extremely high, 62.4 % when compared to data from other studies. In our country, in a previous study, the prevalence of late referrals was incredibly high, 79.5% compared to early ones, 20.5%(8). The causes for this late referral are several, among which we highlight the lower socio-economic status and the lack of appropriate communication between primary care physicians and nephrologists.

The unfavourable consequences of late referral are many and have been well documented by numerous investigators: more severely abnormal laboratory markers and poorer clinical status at the time of dialysis initiation [23, 24, 25], lack of permanent vascular access and need for a central catheter [23, 26, 16, 18], considerably longer hospitalization [5, 18, 20], higher short-term and higher long-term mortality [5, 11, 12, 13, 16, 19]. In our study, patients from the LR group were generally older and more frequently required a temporary catheter as a first vascular access. These data are in agreement with those reported by other investigators [18, 20, 21, 23]. While the optimal level of glomerular filtration rate for starting dialysis remains controversial, several studies have examined the association between nephrology referral and the benefits of better

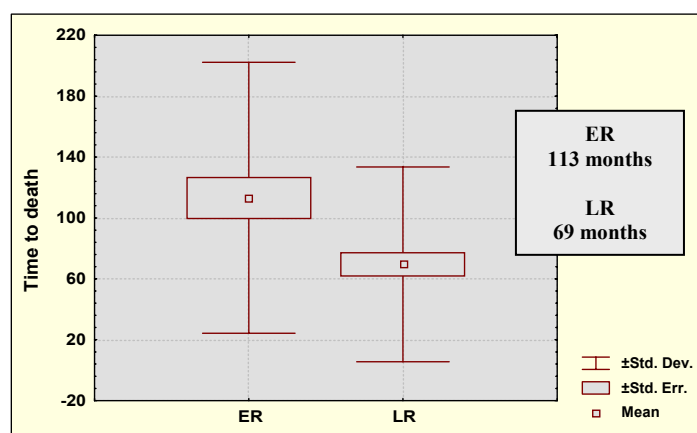


Figure 1 – Time until death in months during dialysis treatment (follow-up until death)
 Слика 1 – Времејраење на хемодијализнојо лекување во месеци
 (до смртниој исход)

residual renal function at the time of dialysis initiation [5, 11], but the differences between the early and late referred groups in this respect are surprisingly

small. We found that residual creatinine clearance was not significantly different between the groups and ranged from 8.70 ml/min in the ER group to 7.67 ml/min in the LR group, but the residual diuresis was significantly different. Although creatinine clearance at the time of dialysis initiation was shown to be similar in the two groups, it was not possible to exclude the benefits of the initiation of dialysis at an earlier stage of the natural history of the renal disease, especially with greater residual diuresis which decreased the risk of pressure and volume overload, the main determinants of LVH in ESRD patients.

When comparing the course of laboratory parameters, the LR group had significantly lower levels of haemoglobin and haematocrit, both at the time of dialysis initiation and during the dialysis treatment until death. Several studies have shown that the late referral patients present a greater degree of anaemia than early referral patients, as a result of the use of rHuEPO in the ER patients before initiation of dialysis [13, 17, 20]. In our study, neither the LR nor the ER patients were treated with rHuEPO in the predialysis period, but during the dialysis treatment correction of anaemia with rHuEPO has been achieved in all of them continually in the last ten years. With respect to anaemia, two interesting points were apparent among ER and LR patients. In the first, we suppose that the better control of anaemia in the ER group in the predialysis period could be the result of the regular nephrology care, optimal iron supplementation, and initiation of dialysis before the development of gastrointestinal complications. In the second, during the dialysis treatment, when correction of anaemia with rHuEPO was achieved in all patients, poor control of anaemia in the LR group was multifactorial and the effect of regular predialysis nephrology care could be a subject for debate. Anaemia is an independent risk factor for the development of cardiovascular disease in dialysis patients and in CKD patients not yet on dialysis [27, 28, 29]. We also found that the overall proportion of CVD (yes) patients was significantly higher among LR patients compared to ER patients at the time of dialysis initiation. Evidence has been provided that the CV comorbidity at the beginning of dialysis affects the survival of patients on dialysis [5, 30]. Our baseline and follow-up echocardiographic measurements show that the LR group had greater LVMI than the ER group, but this was significant only during dialysis treatment. LVH was present before reaching ESRD and its progression over time was reported in the majority of the studies [31, 32]. Progression of LVH in CKD patients is multifactorial, the principal etiological factors being the high LV afterload and anemia [33]. In this respect, our results suggest that in LR patients anaemia is a risk factor for the high prevalence of CVD at the start of haemodialysis and the progression of LVMI during haemodialysis treatment.

Several studies that compared the long-term survival [11, 12, 13, 16, 19, 21] of patients on dialysis with respect to the pattern of predialysis nephrological care used variable definitions of late referral (ranging from 1

month to 4 or 6]. In all of these studies, except that by Roubicek *et al.* [18], a detrimental consequence of late referral on patients' mortality was found. Knowing that CV comorbidity at the beginning of dialysis affects the survival of patients on dialysis, no evidence has been provided that the duration of regular predialysis nephrological care could influence the development of CV disease or the length of survival after the start of dialysis. Interestingly, Jungers *et al.* analysed data from two studies, one with 1057 patients [21] and a second with 1391 patients [5], and observed that the prevalence of major CV disease was more than double in patients who were referred less than 6 months, and nearly twice as high even in those followed 6–35 months compared to patients followed at least 3 years before beginning dialysis. They also observed that 5-year mortality on dialysis was significantly higher in patients with late referral than in those followed at least 3 years before dialysis.

The design of our study is somewhat different from the studies referred to above, because we analysed the survival time in a group of 117 incident dialysis patients who died with regard to their predialysis nephrological care. The results show that the time until death in months during dialysis treatment was significantly different between the groups and ranged from 69 months in the LR groups to 113 months in the ER group.

However, the study has limitations. Firstly, it is an observational and retrospective study, a limitation that is shared by most of the studies published on this issue. The data obtained from medical records on predialysis follow-up were incomplete for some patients. A randomised study of early vs. late referral impact upon dialysis morbidity and mortality would be the best possible choice, but ethically inadmissible [25]. Secondly, we studied patients who started dialysis treatment in different periods of time, beginning in 1979 and up to 2006, during which nephrology referral and dialysis therapy evolved dramatically. And thirdly, baseline echocardiography was performed before the initiation of dialysis, but there was a variable interval between the next echocardiographic examinations in different patients, leading to possible minor changes in those with shorter intervals between the two examinations.

We conclude that late referral to a nephrologist is a common and serious problem in our country and is associated with poor or sub-optimal predialysis care. Late referrals experience a greater degree of anaemia and have a higher prevalence of CVD at the time of dialysis initiation. Our data suggest that anaemia, CV damage and the progression of LVH in late referrals during haemodialysis therapy is associated with poor survival. Attempts to reduce mortality in haemodialysis patients should support the concept of early predialysis nephrological care of chronic renal failure patients.

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Резиме

ВЛИЈАНИЕТО НА НЕФРОЛОШКОТО СЛЕДЕЊЕ НА ИНИЦИЈАЦИЈАТА НА ХЕМОДИЈАЛИЗАТА И МОРТАЛИТЕТОТ КАЈ ПАЦИЕНТИТЕ СО ТЕРМИНАЛНА БУБРЕЖНА БОЛЕСТ

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Доцното упатување на болните со хронична бубрежна слабост кај нефролог е асоцирано со зголемен морталитет по започнување со хемодијализно (ХД) лекување. Целта на оваа студија беше да се процени влијанието на нефролошкото следење врз иницијацијата на ХД и врз морталитетот во текот на ХД лекување кај пациенти со терминална бубрежна болест.

Во студијата беа опфатени сите 117 пациенти на ХД, лекувани во нашата институција, кои завршија со смртен исход (по 90 дена од започнувањето со ХД), во текот на 5-годишниот период, од 01.I 2002 до 31.XII 2006 година. Рано упатени (РУ) болни се сметаа оние кои биле упатени кај нефролог пред повеќе од шест месеци од започнувањето со ХД, додека доцна упатени (ДУ) се пациенти упатени кај нефролог пред помалку од шест месеци од започнувањето со ХД.

Од сите 117 починати пациенти, 37.6% (44 пациенти) започнале ХД лекување како РУ, додека 62.4% (73 пациенти) како ДУ. При започнувањето со ХД, ДУ пациенти биле на постара возраст, имале повисок процент на привремен васкуларен пристап, и имале сигнификантно пониски вредности на хемоглобин и диуреза. Клиренсот на креатининот бил понизок кај ДУ (7.67 ± 3.86 ml/min/1.73 m²), наспроти на РУ (8.70 ± 3.62 ml/min/1.73 m²), но сигнификантно незначаен. Кардиоваскуларни болести (КВБ): миокарден инфаркт, церебрална васкуларна болест, периферна артериопатија и/или срцева слабост биле сигнификантно позачестени кај ДУ наспроти РУ (56%; 27%, $p = 0.002$). Во текот на хемодијализното лекување, ДУ имаа сигнификантно понизок хемоглобин и хематокрит. Кај ДУ пациенти КВБ во 64%

беа причина за смрт. Во текот на започнувањето со ХД немаше сигнификантна разлика во ехокардиографски дијагностицирана левокоморна (ЛК) маса меѓу двете групи, додека во текот на ХД лекување, ДУ имаа сигнификантно поголема ЛК маса наспроти на РУ пациенти ($232,96 \pm 92,48 \text{ g/m}^2$ нс. $184,09 \pm 51,74 \text{ g/m}^2$; $p = 0,031$). РУ пациенти имаа сигнификантно подолго времетраење на ХД лекување од 113 месеци, додека кај ДУ тоа беше само 69 месеци ($p = 0.0025$).

Доцна упатени пациенти при иницијација на ХД покажуваат повисок степен на анемија и позачестена преваленца на КВБ. Нашите податоци сугерираат дека анемијата, КВБ и прогресијата на левокоморната хипертрофија се асоцирани со пократко преживување кај ДУ пациентите.

Клучни зборови: рано/доцна упатување кај нефролог, хемодијализа, левокоморна маса.

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