Intérêts et limites de l'hémodialyse nocturne

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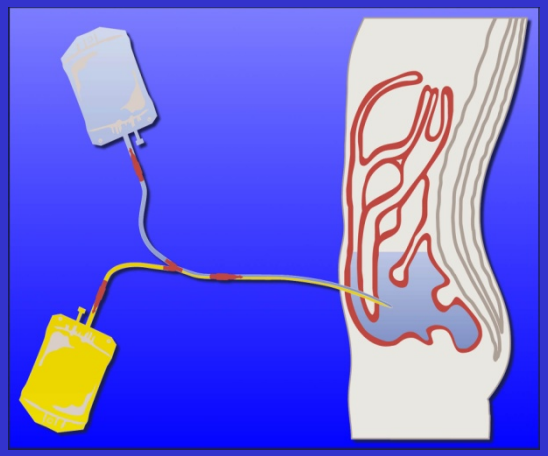
Néphrologie-Transplantation

CHU Liège -Université de Liège

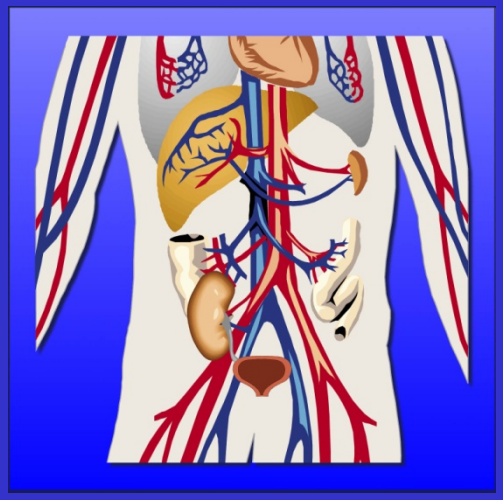
Journée mondiale du rein 14 mars 2013

Université de Liège

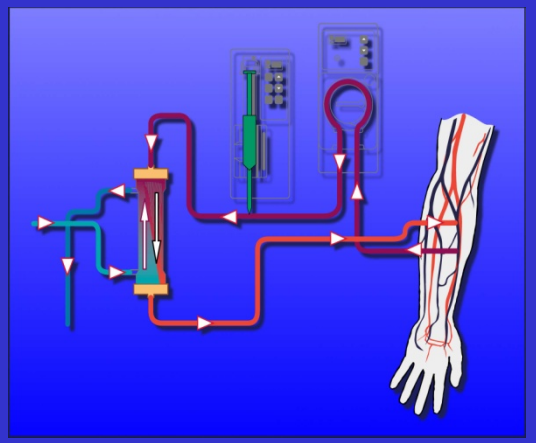
Quelle thérapie de remplacement du rein ?



Dialyse péritonéale



Transplantation



Hémodialyse

Chaque thérapie a ses avantages et inconvénients.
La décision doît être prise par le médecin en accord avec son patient bien informé.

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Survie d'un patient au XXIième siècle

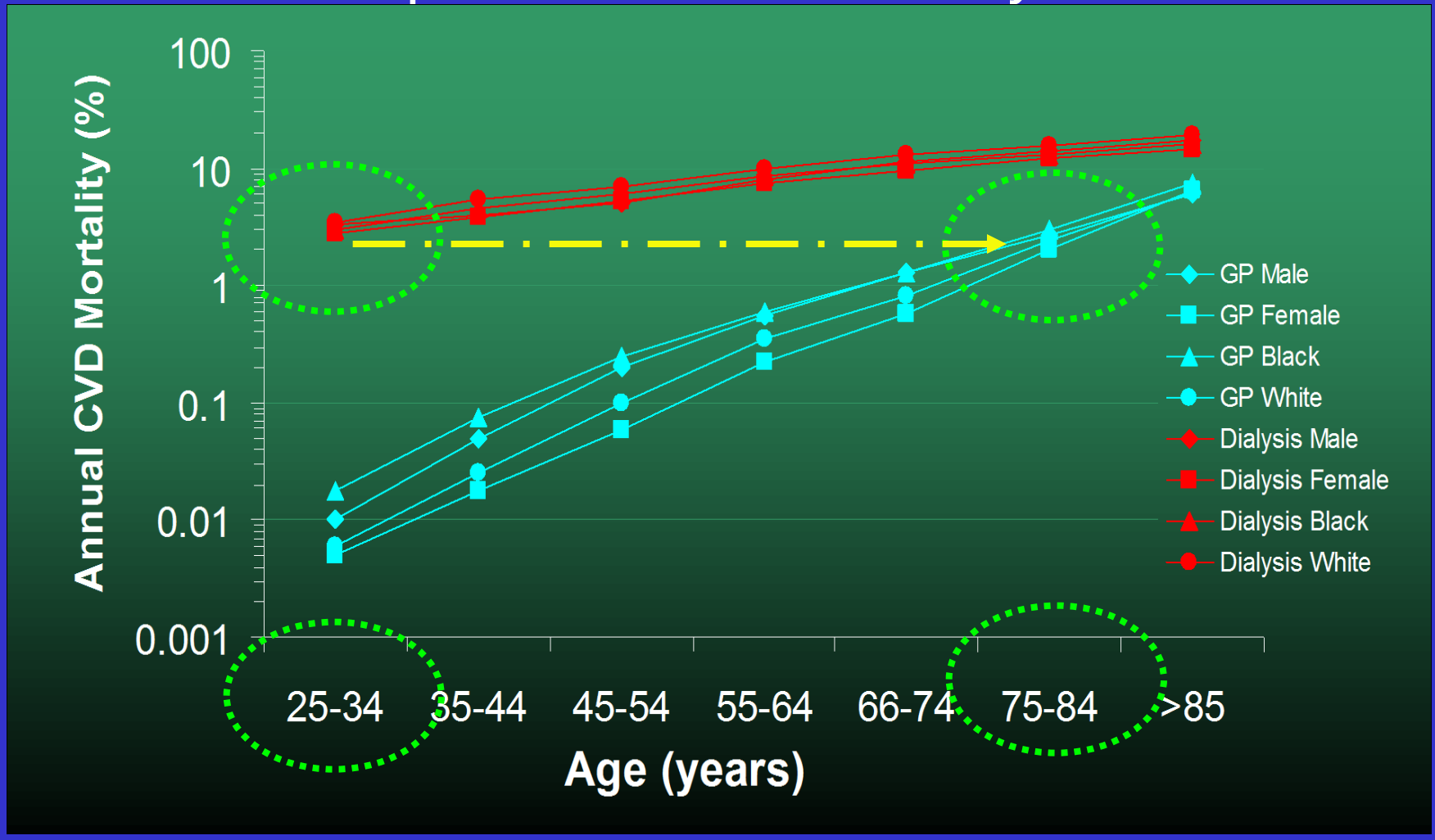
Dans la population générale

- A 40 ans, espérance de vie: environ 40 ans
- A 65 ans, espérance de vie de plus ou moins 20 ans

En Dialyse

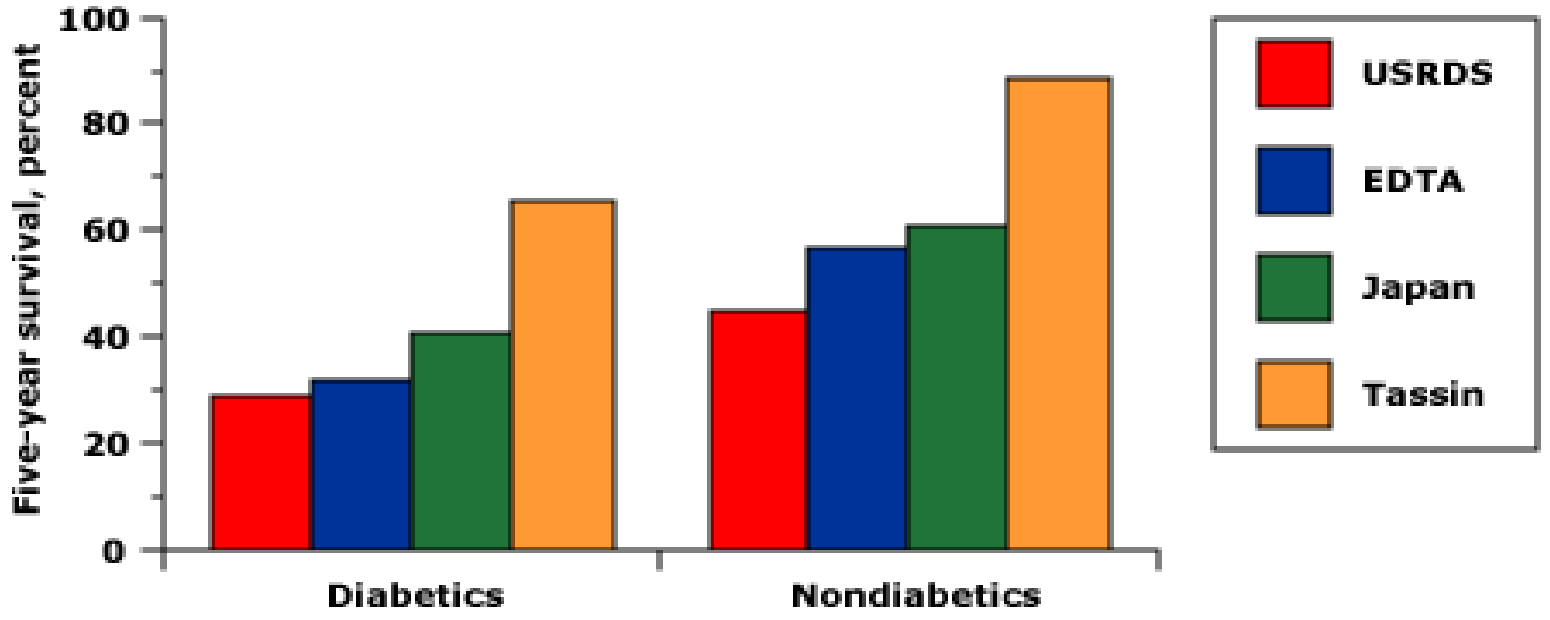
- A 40 ans, espérance de vie d'environ 8 ans
- A 65 ans, espérance de vie de plus ou moins 4 ans
- Mauvaise QOL

Cardiovascular Mortality:
General Population vs ESRD Dialysis Patients



RN Foley, PS Parfrey, and MJ Sarnak; Clinical epidemiology of cardiovascular disease in chronic renal disease AJKD, 1998 32(5):S112-S119

Comparison of survival on dialysis between countries and between diabetic and nondiabetic patients



Five year patient survival rates after the institution of maintenance hemodialysis in the United States (from the US Renal Data System), Europe (from the European Dialysis and Transplant Association), Japan, and Tassin, France. Survival was lowest in the United States and highest in nondiabetics and in Tassin where the patients were more intensively dialyzed.

Data from Hull, AR, Parker, TF III, Am J Kidney Dis 1990; 15:375, and Charra, B, Calemard, E, Ruffet, M, et al, Kidney Int 1992; 41:1286.

Mortalité en HD

Reste élevée malgré les interventions médicales (« épidémiologie inverse ») et les progrès technologiques →

Recherche de solutions: augmentation des performances par

- Propriétés des membranes
- Débit sanguin optimal
- Qualité du bain de dialyse
- HDF
- Temps ou fréquence de la dialyse

Evolution de la durée d'une séance d'HD

- En 1965, durée de 25 à 40h/sem (en 3 séances)
- En 1975, diminution à 12 à 15h
- Dans les années 1990, parfois proposition de 7 à 8h/semaine.
- Les raisons en étaient la prescription du traitement par HD basée surtout sur l'évolution du Kt/V de l'urée (reflet de l'apport en protéines et l'efficacité du retrait des toxines urémiques) et l'amélioration des performances des membranes.

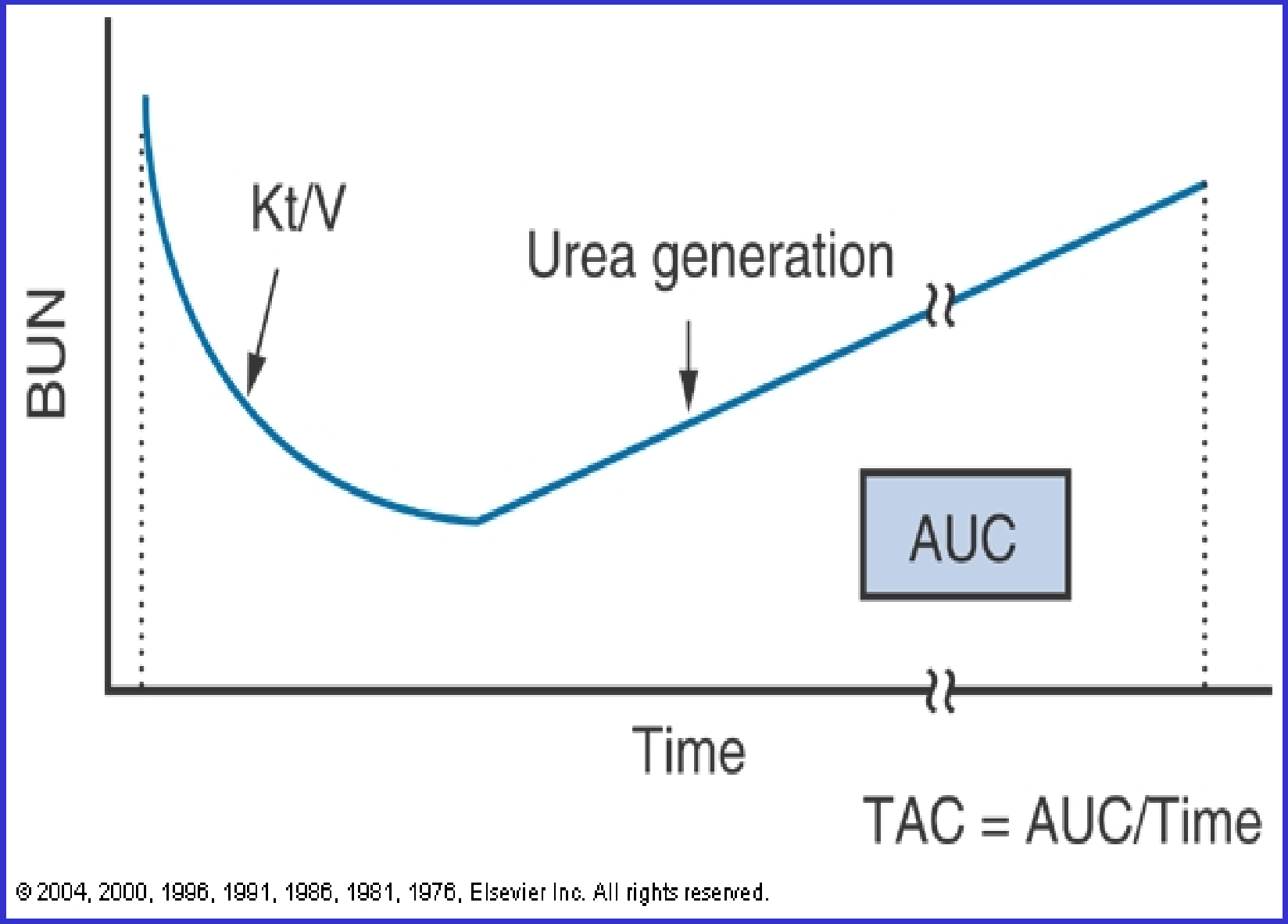
Critères de dialyse adéquate

A court et moyen termes

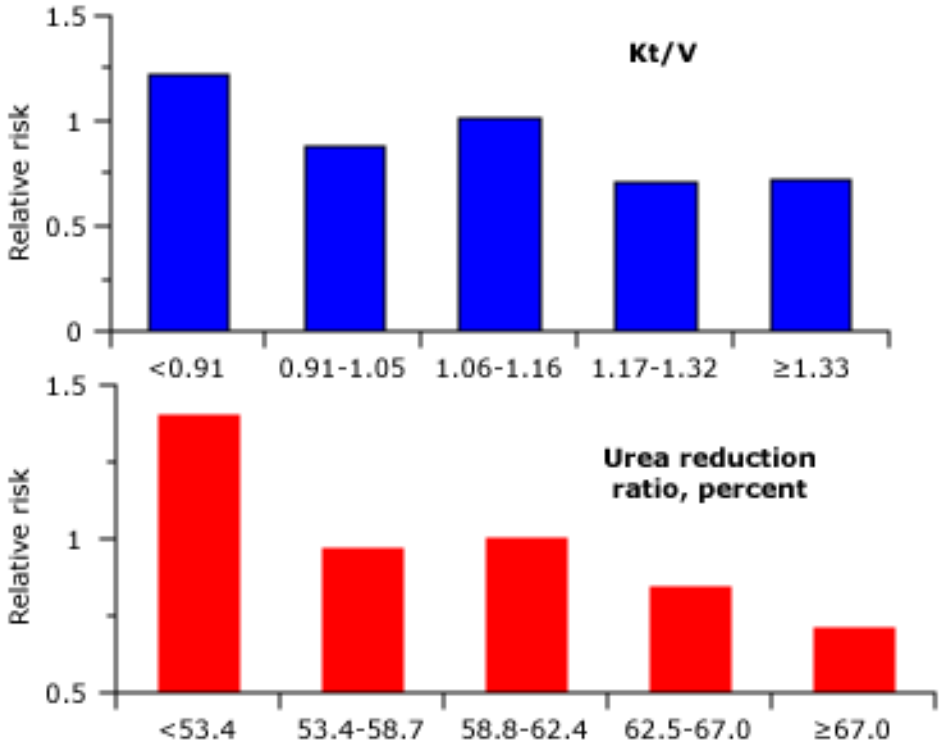
- Disparition de la symptomatologie urémique
- Restauration d ’une qualité de vie acceptable
- Normalisation de la P.A.
- Maintien d ’un bon état nutritionnel
- Dose de dialyse correcte (Kt/V sp urée $\geq$ 1,2)
- Correction des désordres hydro-électrolytiques
- Correction de l ’anémie (Hb > 10 g%)

A long terme

- Longévité quasi normale
- Ralentissement du phénomène de vieillissement
- Prévention des complications cardiovasculaires, osseuses, …



Relative risk of mortality by dialysis dose



The relative risk of mortality by delivered dose of dialysis as measured by quintiles of Kt/V (top panel) or urea reduction ratio (bottom panel, in percent) among a random sample of 2311 patients on dialysis for more than one year at the end of 1990. Increasing the dialysis dose improved survival with apparent maximum benefit at a Kt/V of 1.3 and urea reduction ratio of 70.

Data from Held, PJ, Port, FK, Wolfe, RA, Kidney Int 1996; 50:550.

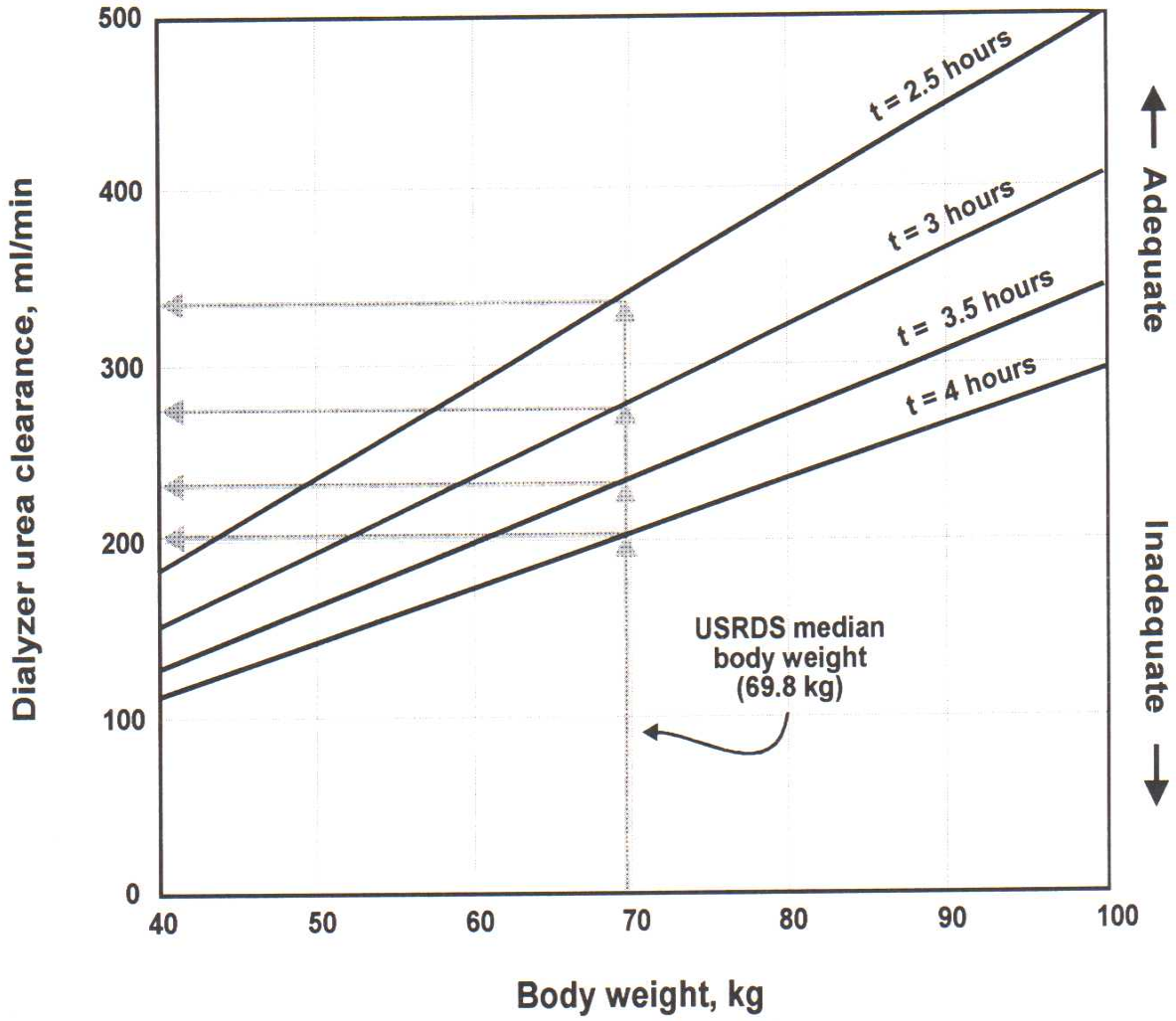
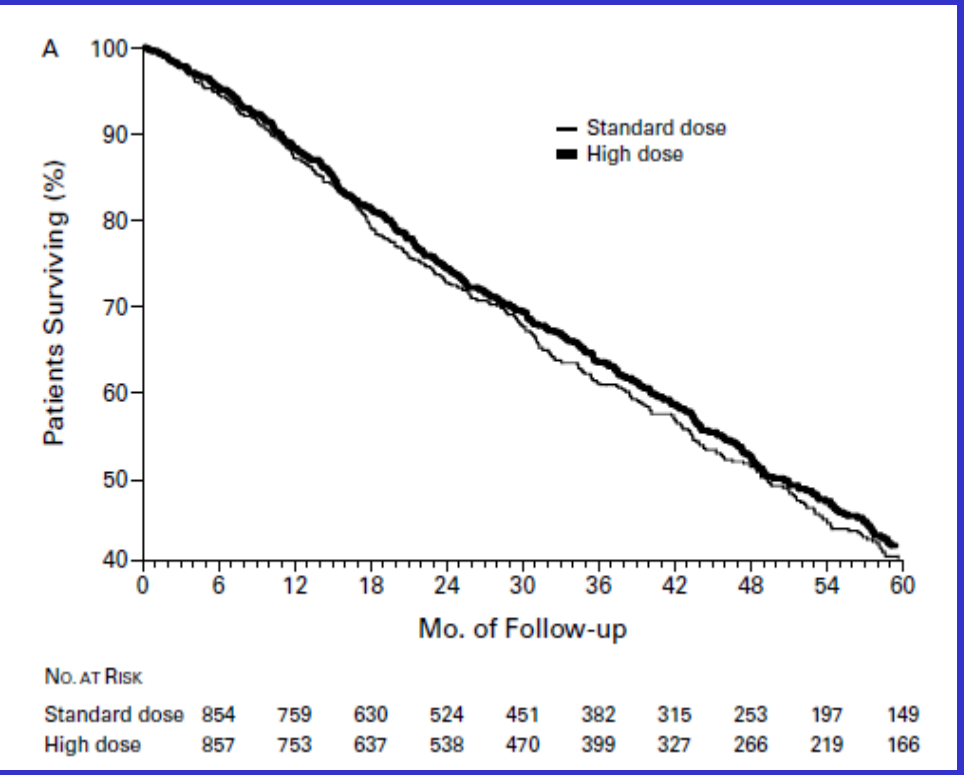


Figure 3. Dialyzer urea clearance required to provide Kt/V = 1.2 at various treatment lengths. Any clearance above the time line for a given body weight will provide $Kt/v \geq 1.2$. Thus, for a patient weighing 69.8 kg, a clearance of 202 ml/min for 4 hours or 336 ml/min for 2.5 hours will provide Kt/V = 1.2. A blood flow rate of 400 ml/min and access recirculation of 10% are assumed.

Replacement of renal function by dialysis. C. Jacobs et al., 4th Ed., Kluwer academic publishers, Dordrecht, 1996.

EFFECT OF DIALYSIS DOSE AND MEMBRANE FLUX IN MAINTENANCE HEMODIALYSIS

GARABED EKNOYAN, M.D., GERALD J. BECK, PH.D., ALFRED K. CHEUNG, M.D., JOHN T. DAUGIRDAS, M.D., TOM GREENE, PH.D., JOHN W. KUSEK, PH.D., MICHAEL ALLON, M.D., JAMES BAILEY, M.D., JAMES A. DELMEZ, M.D., THOMAS A. DEPNER, M.D., JOHANNA T. DWYER, D.SC., R.D., ANDREW S. LEVEY, M.D., NATHAN W. LEVIN, M.D., EDGAR MILFORD, M.D., DANIEL B. ORNT, M.D., MICHAEL V. ROCCO, M.D., GERALD SCHULMAN, M.D., STEVE J. SCHWAB, M.D., BRENDAN P. TEEHAN, M.D., AND ROBERT TOTO, M.D., FOR THE HEMODIALYSIS (HEMO) STUDY GROUP*



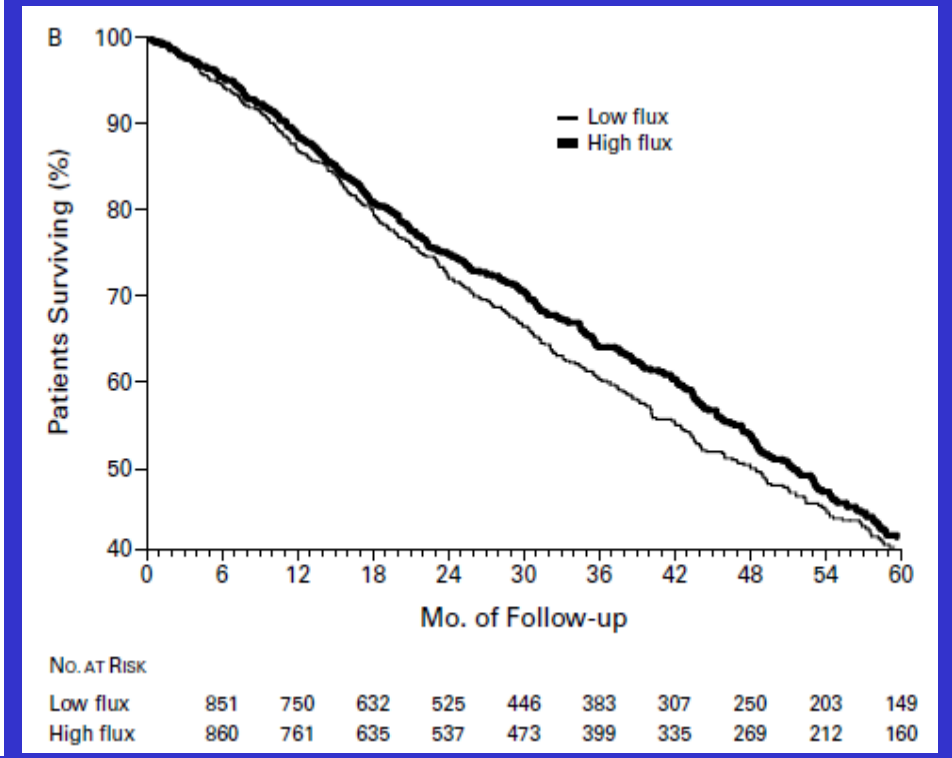


Figure 1. Survival Curves for the Treatment Groups.

After adjustment for the base-line factors, mortality in the high-dose group was 4 percent lower (95 percent confidence interval, −10 to 16; P=0.53) than that in the standard-dose group (Panel A), and mortality in the high-flux group was 8 percent lower (95 percent confidence interval, −5 to 19; P=0.23) than that in the low-flux group (Panel B).

Conclusions Patients undergoing hemodialysis thrice weekly appear to have no major benefit from a higher dialysis dose than that recommended by current U.S. guidelines or from the use of a high-flux membrane. (N Engl J Med 2002;347:2010-9.)

Longer treatment time and slower ultrafiltration in hemodialysis: Associations with reduced mortality in the DOPPS

R Saran[1], JL Bragg-Gresham[2], NW Levin[3], ZJ Twardowski[4], V Wizemann[5], A Saito[6], N Kimata[7], BW Gillespie[8], C Combe[9], J Bommer[10], T Akiba[7], DL Mapes[2], EW Young[11] and FK Port[2]

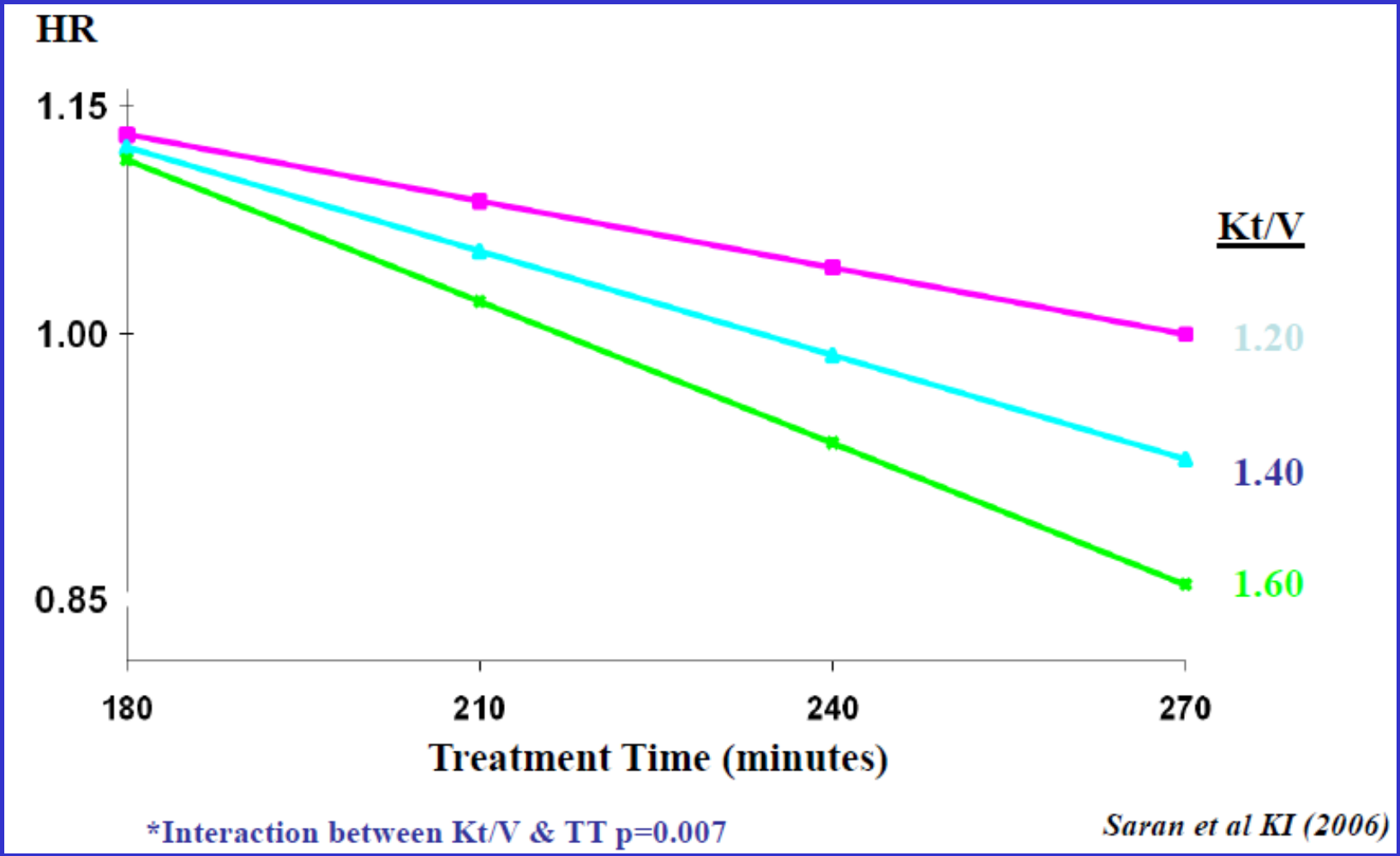
KI 2006 Dialysis Outcome and Practice Pattern Study

Table 3 | Associations between ultrafiltration rate (UFR) and treatment time (TT) and mortality

	UFR > 10 ml/h/kg		TT > 240 min	
Outcome	RR	*P*-value	RR	*P*-value
All-cause mortality				
Unadjusted	1.01	0.75	0.68	< 0.0001
Adjusted[a]	1.09	0.02	0.81	0.0005
Cardiopulmonary mortality				
Unadjusted	1.00	0.97	0.73	< 0.0001
Adjusted[a]	1.04	0.41	0.84	0.03

[a]Based on Cox regression, adjusted for: age, sex, race, ethnicity, time on dialysis, 14 summary comorbid conditions, living status, height, weight, *Kt/V*, blood flow, residual renal function, and catheter use as vascular access, TT (in UFR model), and UFR (in TT model). Stratified by geographical region and phase of study. Accounts for facility clustering.

Relation entre risque de mortalité et durée de traitement selon le KT/V (DOPPS)



Longer dialysis session length is associated with better intermediate outcomes and survival among patients on in-center three times per week hemodialysis: results from the Dialysis Outcomes and Practice Patterns Study (DOPPS)

Francesca Tentori[1,2], Jinyao Zhang[1], Yun Li[1,3], Angelo Karaboyas[1], Peter Kerr[4], Rajiv Saran[5], Juergen Bommer[6], Friedrich Port[1], Takashi Akiba[7], Ronald Pisoni[1] and Bruce Robinson[1,5]

Nephrol Dial Transplant (2012) 27: 4180–4188

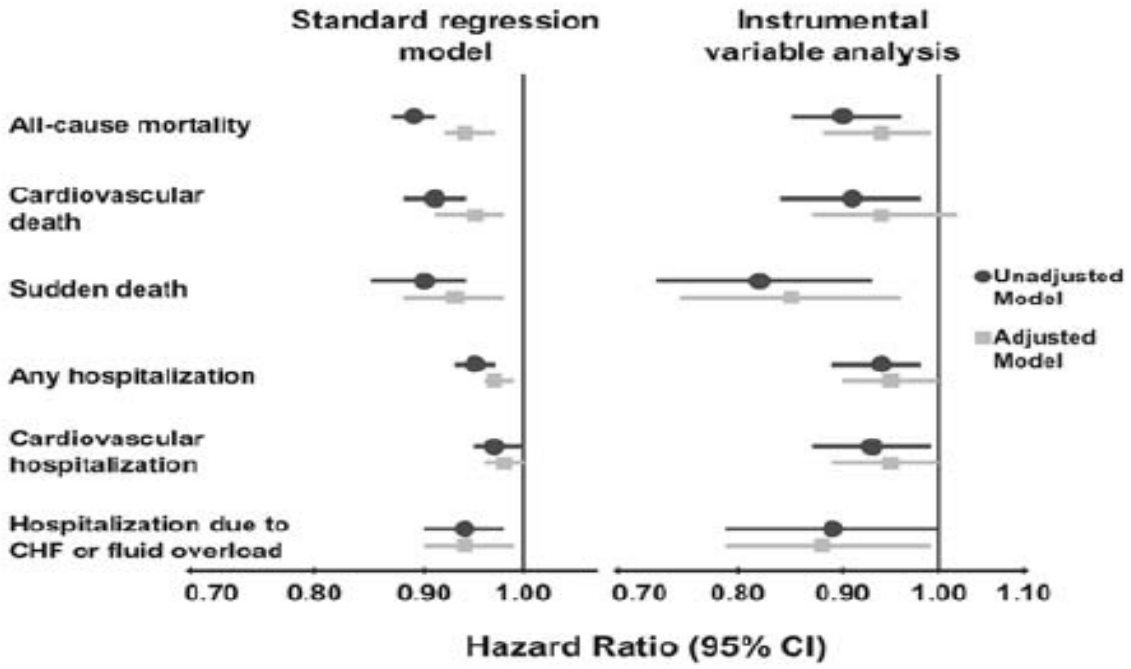


Fig. 3. Association between prescribed TT (per 30 min longer) and risks of mortality and hospitalization. Adjusted model: adjusted for age, sex, race, time on dialysis, BMI, 13 summary comorbid conditions, residual kidney function, prescribed blood flow rate and catheter use, stratified by country and phase of study and accounted for facility clustering. CHF, congestive heart failure.

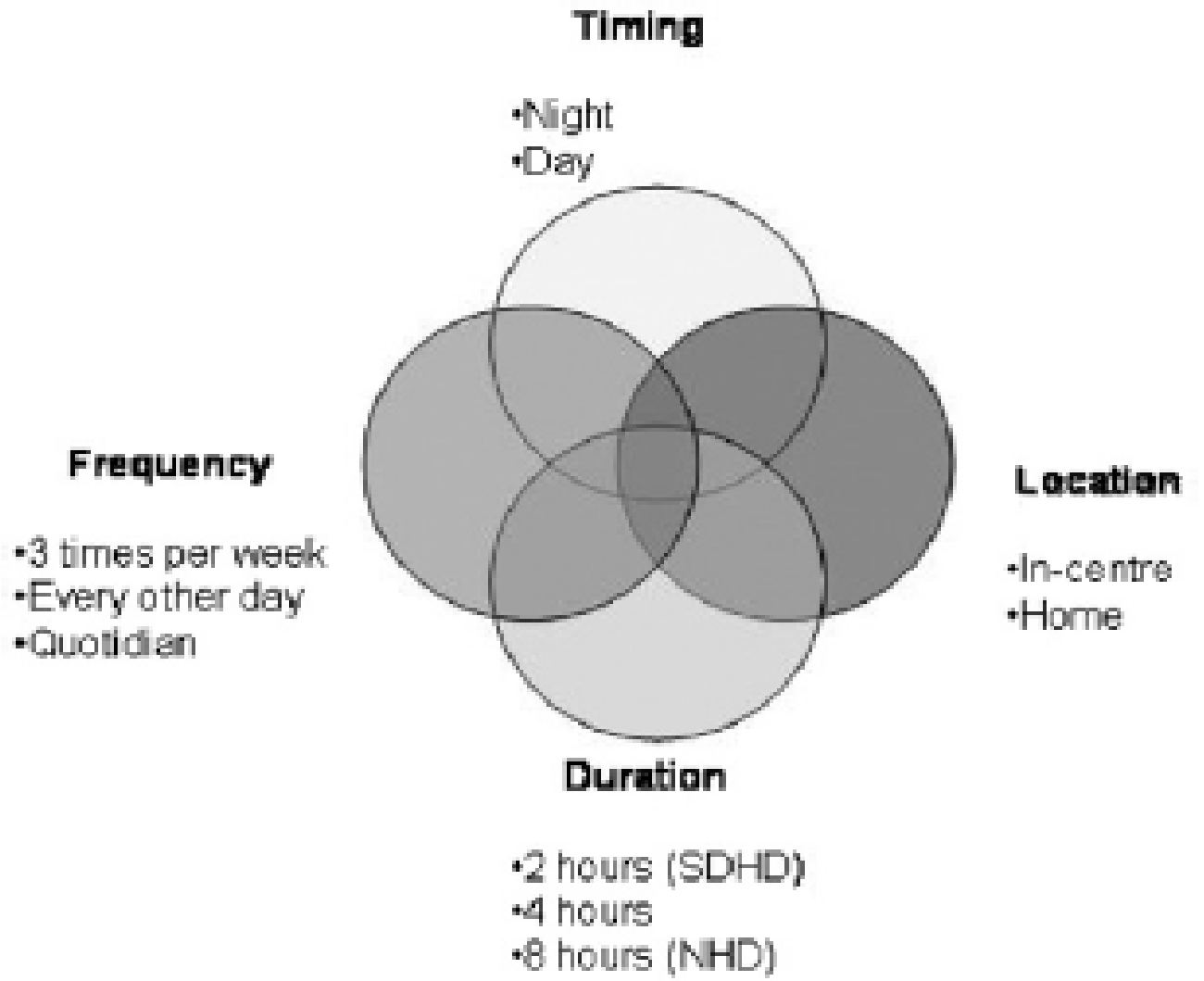


Figure 1. Methods of dialysis intensification. Abbreviations: NHD, nocturnal hemodialysis; SDHD, short daily hemodialysis. Adapted from Pereira, Sayegh, and Blake[2]

AJKD 2009

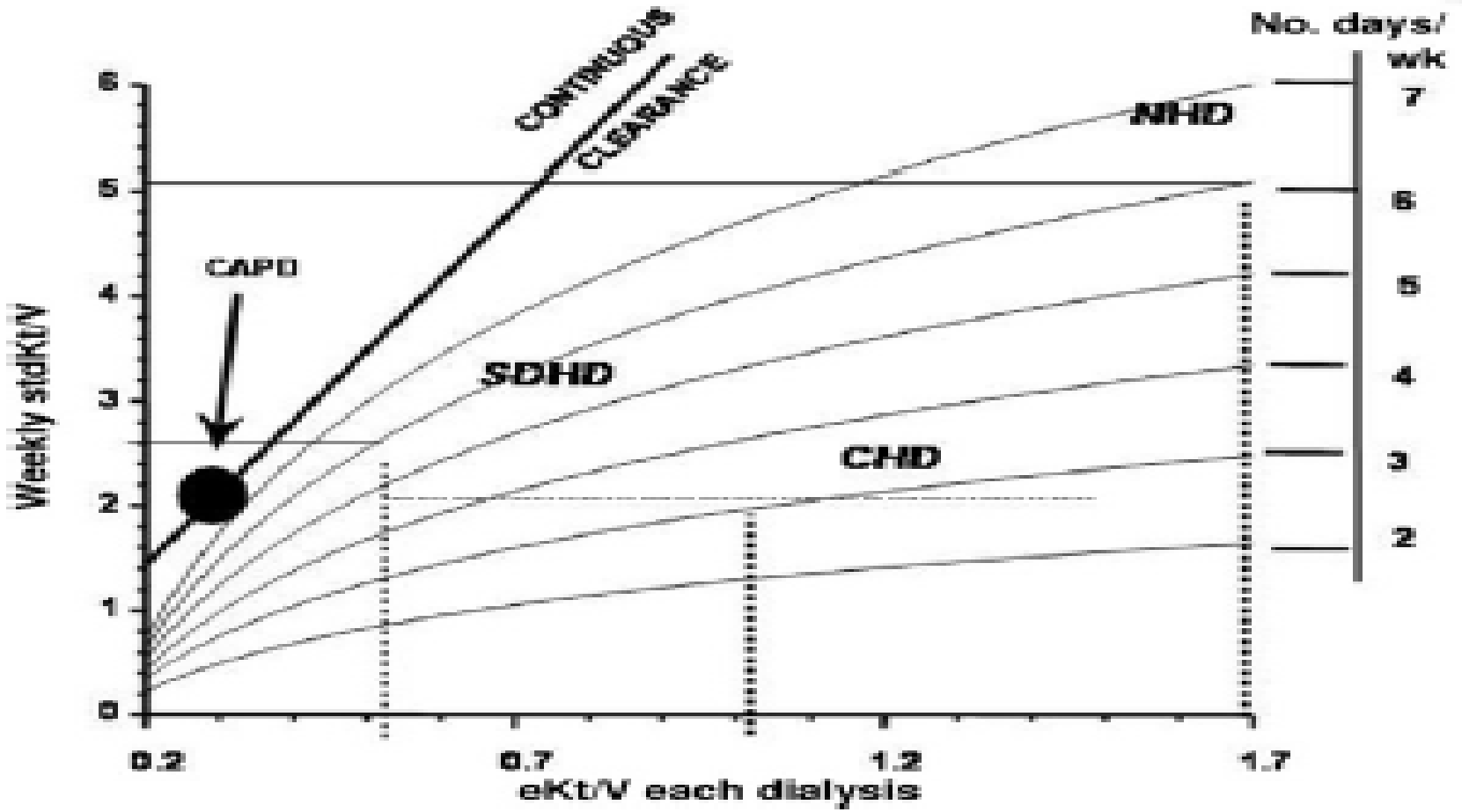


Figure 2. Relationship between weekly standardized Kt/V (stdKt/V) and equilibrated Kt/V (eKt/V) across dialysis modalities and schedules. With increasing frequency of therapy, lower eKt/V is required per dialysis session to achieve a similar stdKt/V. Abbreviations: CAPD, continuous ambulatory peritoneal dialysis; CHD, conventional hemodialysis; NHD, nocturnal hemodialysis; SDHD, short daily hemodialysis. Adapted from Gotch[18] with permission

Pourquoi proposer une hémodialyse chronique la nuit en centre au CHU de Liège en 2006?

- But principal:

  - Permettre des activités diurnes difficiles à mener lors de l'HD de jour (école, travail, gestion du ménage,..)

- Buts accessoires:

- Se rapprocher de la physiologie et donc tenter de mieux contrôler le milieu intérieur de façon douce et par là améliorer la QOL et mortalité.

- Permettre aussi une alimentation élargie

Hémodialyse nocturne au CHU de Liège

Généraliste, Le 28.09.2006

- 3X8h, débit sanguin 200 ml/min, débit de dialysat 300-400 ml/min
- **Constatation**: Amélioration du contrôle de la PA, de la phosphatémie, des besoins en EPO, de l'appétit, de la qualité du sommeil, de la fatigue, du taux de PRL et de la testostérone.
- Une vingtaine de patients ont testé le système, la moitié a été greffé
- Un cinquième ne s'est pas habitué (impression d'être tous les jours à l'hôpital, qualité du sommeil mauvaise)
- A réserver aux patients qui ne peuvent (veulent) pas de l'HD à domicile.

Prescription du traitement par HD

N ENGL J MED 363;19 NEJM.ORG NOVEMBER 4, 2010

Treatment time	Usual treatment time is about 4 hours. Longer treatment times allow more fluid removal with less risk of intradialytic hypotension, and the removal of compartmentalized solutes such as phosphate is increased; nevertheless, increased dialysis time has limited effects on removal of many solutes because of decreasing plasma concentrations.

Meilleure stabilité hémodynamique
Soustraction plus importante des Phosphates

Home Hemodialysis, Daily Hemodialysis, and Nocturnal Hemodialysis: Core Curriculum 2009

Jeffrey Perl, MD, FRCP(C), and Christopher T. Chan, MD, FRCP(C)

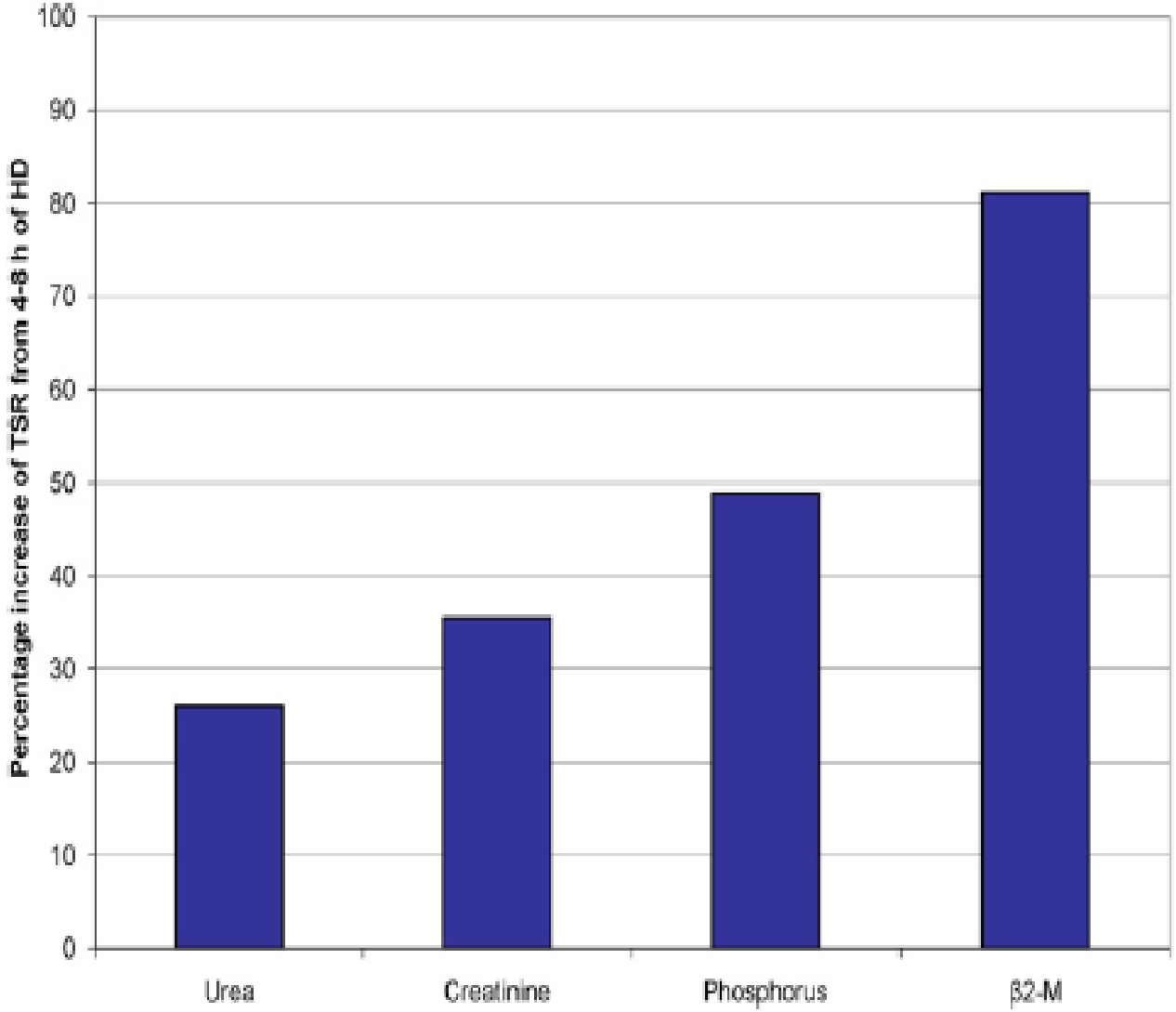


Figure 3. Relative increase in total solute removal (TSR) associated with a change from 4 to 8 hours of hemodialysis (HD): middle molecules versus small solutes. The impact of changes in TSR on conversion from 4 to 8 hours of HD is greater for middle molecules, such as phosphorus and β_2-microglobulin (β_2-M), compared with small solutes, such as urea and creatinine. Source: Eloot et al.[29]

Survie en HD longue

Nephrol Dial Transplant (2012) 27: 4307–4313

- Laurent et al 1998 vs HD conventionnelle: 76% de survie à 5ans
- The long HD study (Ok et al 2011)
- Lacson et al 2012

Comparison of 4- and 8-h dialysis sessions in thrice-weekly in-centre haemodialysis

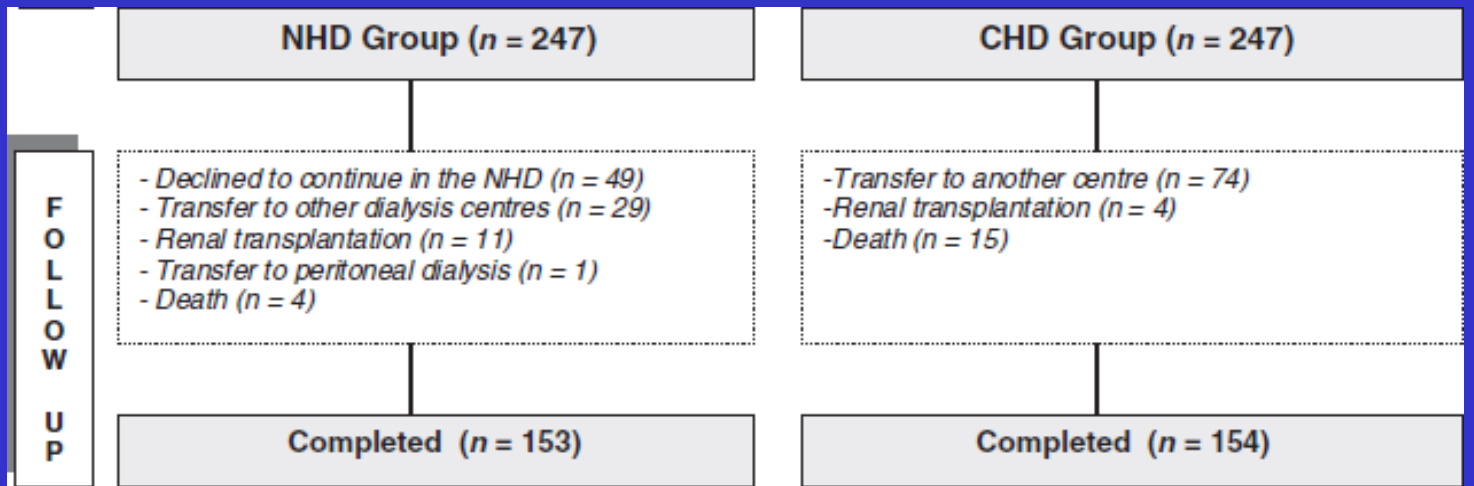
Ercan Ok[1], Soner Duman[1], Gulay Asci[1], Murat Tumuklu[2], Ozen Onen Sertoz[3], Meral Kayikcioglu[4], Huseyin Toz[1], Sıddık M. Adam[5], Mumtaz Yilmaz[1], Halil Zeki Tonbul[6], Mehmet Ozkahya[1] and On behalf of the 'Long Dialysis Study Group'

Nephrol Dial Transplant (2011) 26: 1287–1296

Methods. Two-hundred and forty-seven HD patients who agreed to participate in a thrice-weekly 8-h in-centre nocturnal HD (NHD) treatment and 247 age-, sex-, diabetes status- and HD duration-matched control cases to 4-h conventional HD (CHD) were enrolled in this prospective controlled study. Echocardiography and psychometric measurements were performed at baseline and at the 12th month. The primary outcome was 1-year overall mortality.

Use of antihypertensive medications and erythropoietin declined in the NHD group. In the NHD group, left atrium and left ventricular end-diastolic diameters decreased and left ventricular mass index regressed. Both use of phosphate binders and serum phosphate level decreased in the NHD group. Cognitive functions improved in the NHD group, and quality of life scores deteriorated in the CHD group.

Conclusions. Eight-hour thrice-weekly in-centre NHD provides morbidity and possibly mortality benefits compared to conventional 4-h HD.



Comparison of 4- and 8-h dialysis sessions in thrice-weekly in-centre haemodialysis

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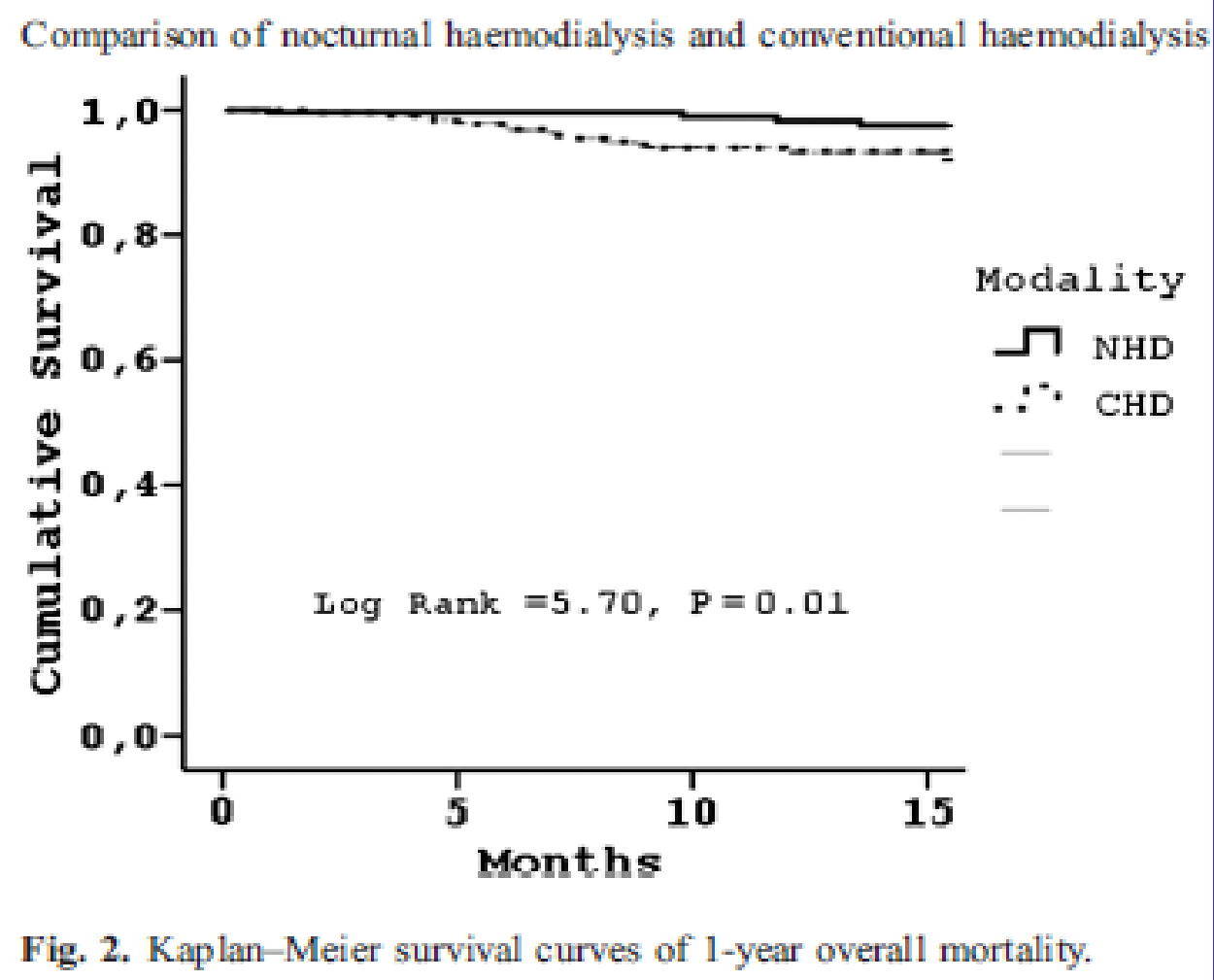


Fig. 2. Kaplan–Meier survival curves of 1-year overall mortality.

Comparison of 4- and 8-h dialysis sessions in thrice-weekly in-centre haemodialysis

Ercan Ok[1], Soner Duman[1], Gulay Asci[1], Murat Tumuklu[2], Ozen Onen Sertoz[3], Meral Kayikcioglu[4], Huseyin Toz[1], Sıddık M. Adam[5], Mumtaz Yilmaz[1], Halil Zeki Tonbul[6], Mehmet Ozkahya[1] and On behalf of the 'Long Dialysis Study Group'

Comparison of nocturnal haemodialysis and conventional haemodialysis

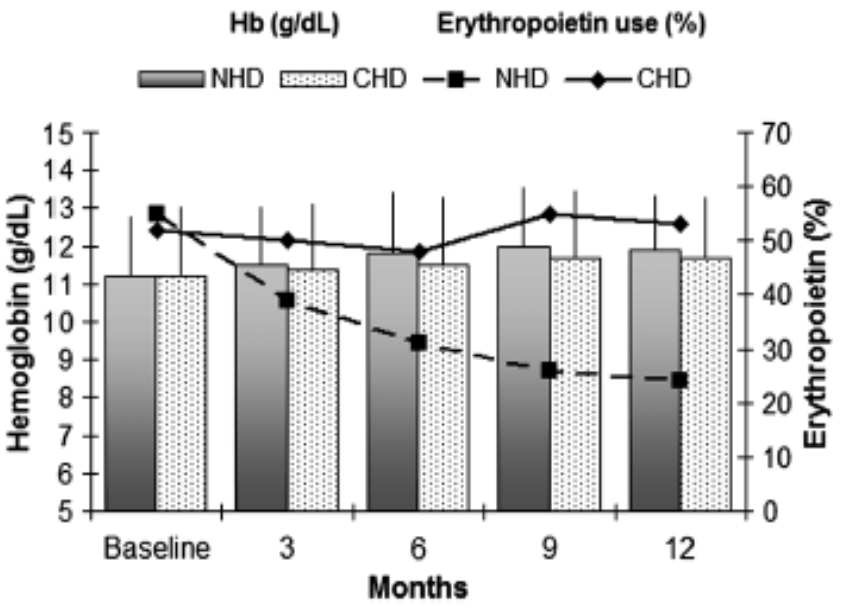


Fig. 4. Mean haemoglobin levels and erythropoietin use during the study period. Mean haemoglobin levels were not different between the groups except at the 9th month (higher haemoglobin level in the NHD group, P = 0.03) together with a decrease in erythropoietin use in the NHD group compared to the CHD group (P < 0.001 at 6, 9 and 12th months).

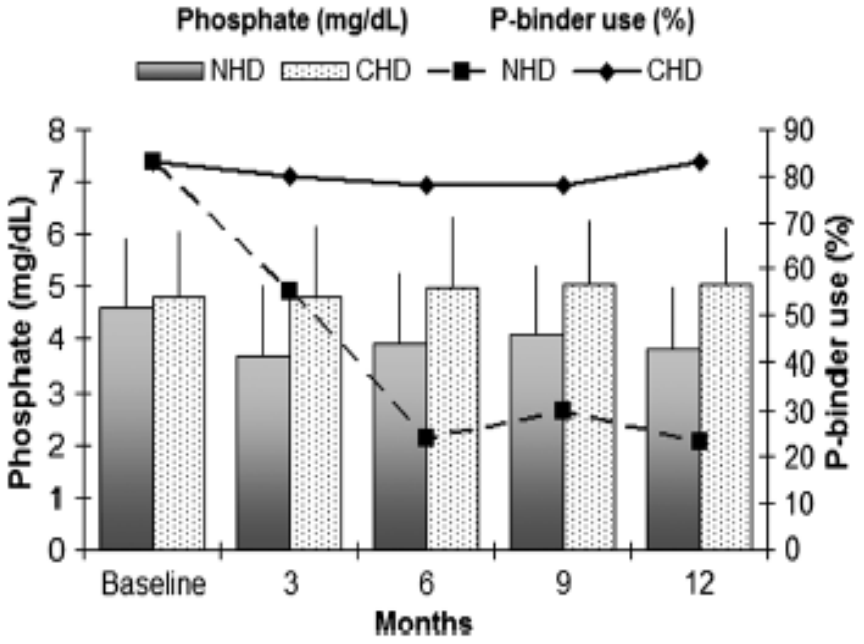


Fig. 3. Mean serum phosphate level and use of Ca-based phosphate binders during the study period. During the follow-up, there were significant differences in the mean serum phosphate level and phosphate binder usage between the two groups (*P < 0.001 between the groups at 3, 6, 9 and 12 months).

Survival with Three-Times Weekly In-Center Nocturnal Versus Conventional Hemodialysis

Eduardo Lacson Jr.,* Jianglin Xu,* Rita S. Suri,† Gihad Nesrallah,† Robert Lindsay,† Amit X. Garg,† Keith Lester,* Norma Ofsthun,* Michael Lazarus,* and Raymond M. Hakim*

*Fresenius Medical Services, Fresenius Medical Care North America, Waltham, Massachusetts; and †Division of Nephrology, University of Western Ontario, London, Ontario, Canada

J Am Soc Nephrol 23: 687–695, 2012.

evaluated survival and clinical changes associated with converting from conventional hemodialysis (mean=3.75 h/treatment) to in-center nocturnal hemodialysis (mean=7.85 h/treatment). All 959 consecutive patients who initiated nocturnal hemodialysis for the first time in 77 Fresenius Medical Care facilities

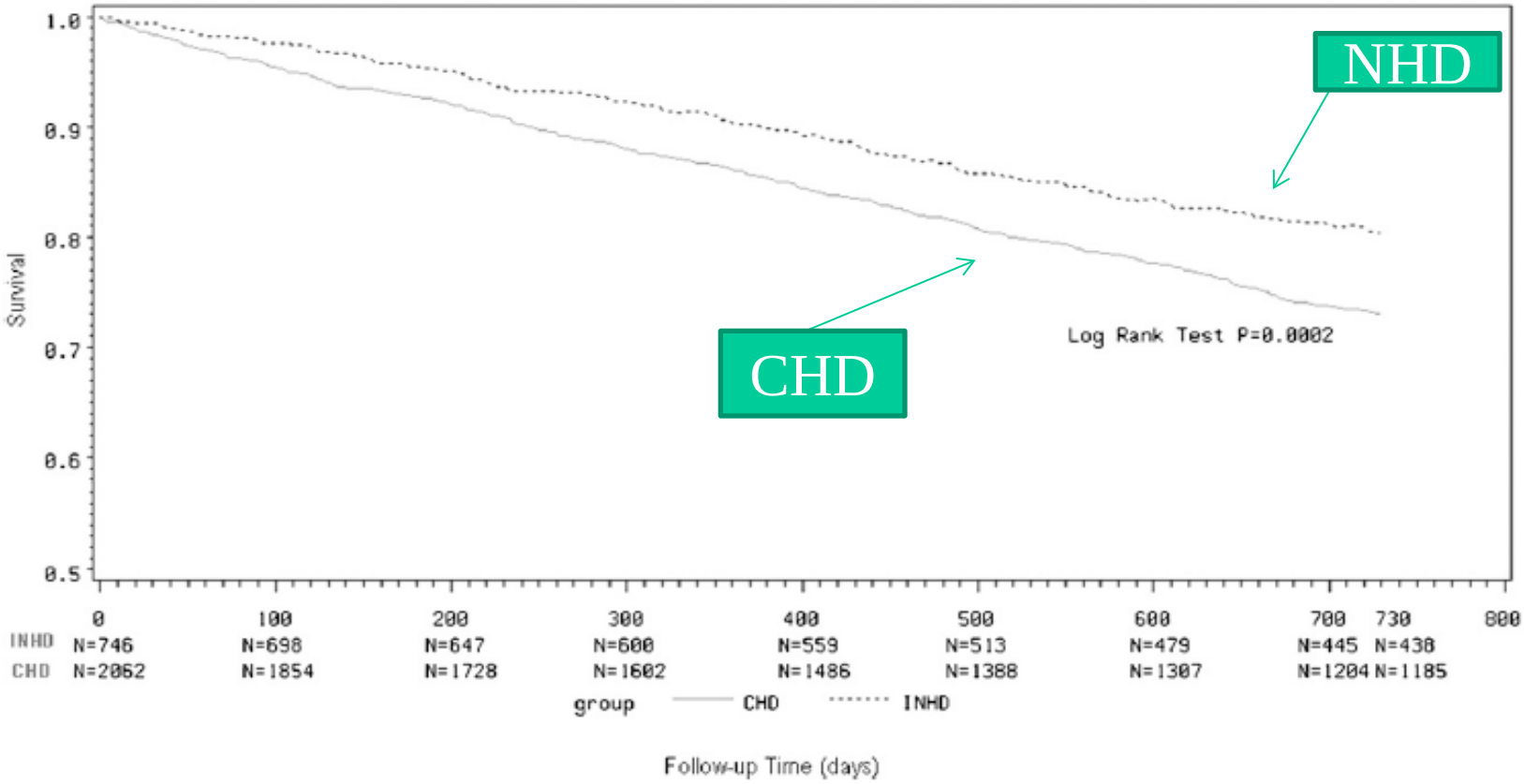


Figure 2. Enhanced INHD survival. Kaplan–Meier 2-year survival curves comparing patients on INHD (broken line) with patients on CHD (solid line).

Comparison of the Alternative Schedule Hemodialysis Regimens With Conventional Hemodialysis Based ond Preliminary or Confirmed Evidence

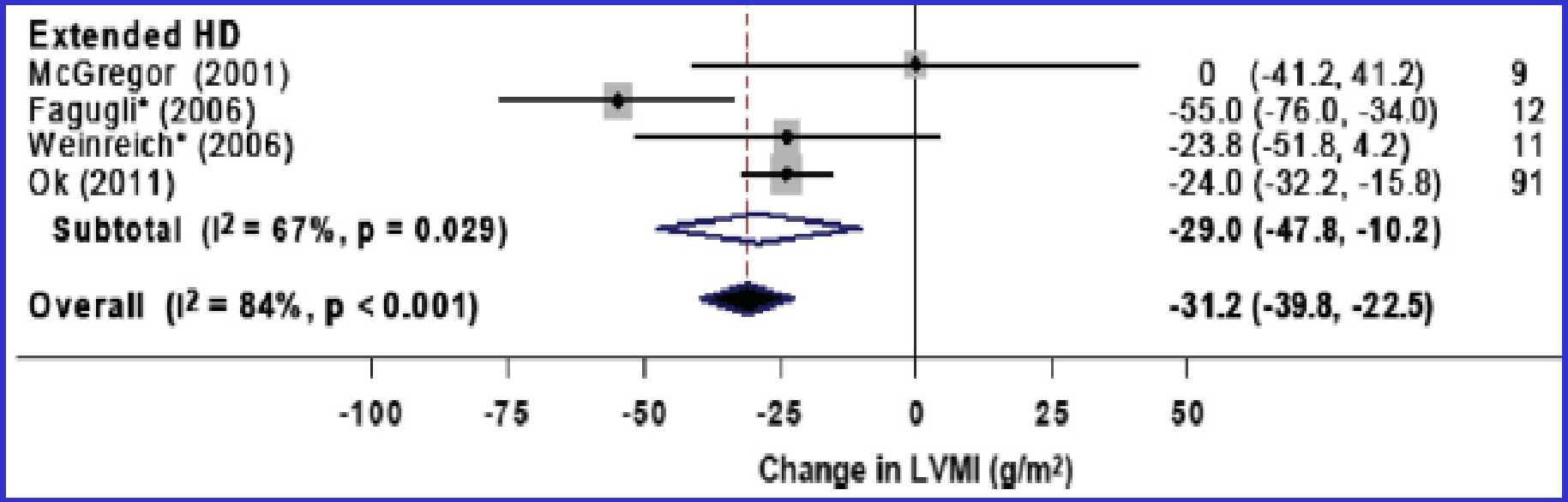
	Conventional Hemodialysis		*Intermittent Long (or Nocturnal)*
Smal molecule clearance using conventional kinetics (eKt/V)	+		++
Smal molecule clearance using dose measure favoring frequency (e.g., stdKt/V)	+		++
Middle molecule clerance	+	→	+++
Middle molecule clearance using stdKt/V	+	→	+++
Phosphate control	±	→	+++
Improved BP control with fewer or no medications	+	→	+++
Regression of LVH	-		++?
Improved endothelial function	-		?
Decrease in sympathetic nervous system activity	-		?
HR variability	-		?
Exercise capacity	-		?
Quality of life	+	→	+++
Cognitive function	+	→	?
Dietetic freedom	-		+++
Nutrition	+	→	++
Anemia control/ESA dose	-		++?
Sleep apnea improvement	-		?
Patient survival	+	→	+++

BP, blood pressure; LVH, left ventricular hypertrophi; HR, heart rate; ESA, erythropoiesis stimulating agent; -, none; ± negligible; +, very low; ++, low; +++, medium; ++++, high; + (+), variable between + and ++; ?, no data; ++ (?), weak data

A. Pierratos - Ed.William L. Henrich : Principles and Practice of Dialysis, Fourth Edition. Philadelphia 2009, 135-148.

Effect of Frequent or Extended Hemodialysis on Cardiovascular Parameters: A Meta-analysis

Paweena Susantitaphong, MD,[1,2,3] Ioannis Koulouridis, MD,[1,2] Ethan M. Balk, MD, MPH,[2,4] Nicolaos E. Madias, MD,[1,2] and Bertrand L. Jaber, MD, MS[1,2]



Conclusions: Conversion from conventional to frequent or extended HD is associated with improvements in cardiac morphology and function, including LVMI and LV ejection fraction, respectively, and several blood pressure parameters, which collectively might confer long-term cardiovascular benefit. Trials with long-term clinical outcomes are needed.

Am J Kidney Dis. 59(5):689-699.

Survie en HD nocturne >4X/sem

Nephrol Dial Transplant (2012) 27: 4307–4313

- Pauly et al 2013
- Nesrallah et al 2012

Nephrol Dial Transplant (2013) 28: 44–47
doi: 10.1093/ndt/gfs419
Advance Access publication 30 November 2012

Survival comparison between intensive hemodialysis and transplantation in the context of the existing literature surrounding nocturnal and short-daily hemodialysis

Robert P. Pauly

Division of Nephrology and Transplant Immunology, University of Alberta, Edmonton, Alberta, Canada

Table 1. Unadjusted survival of NHD versus deceased and living donor transplant recipients [21]

	Survival				
	3 months (%)	6 months (%)	1 year (%)	3 years (%)	5 years (%)
NHD	99.4	99.4	96.4	90.3	84.5
DTX	98.1	96.8	95.9	92.2	86.2
LTX	98.7	98.5	97.7	94.9	91.3

NHD, nocturnal hemodialysis; DTX, deceased donor transplantation; LTX, living donor transplantation.

Intensive Hemodialysis Associates with Improved Survival Compared with Conventional Hemodialysis

Gihad E. Nesrallah,*† Robert M. Lindsay,* Meaghan S. Cuerden,* Amit X. Garg,*†‡ Friedrich Port,§ Peter C. Austin,‖¶ Louise M. Moist,*‡ Andreas Pierratos,** Christopher T. Chan,** Deborah Zimmerman,†† Robert S. Lockridge,‡‡ Cécile Couchoud,§§ Charles Chazot,‖‖ Norma Ofsthun,¶¶ Adeera Levin,*** Michael Copland,*** Mark Courtney,††† Andrew Steele,‡‡‡ Philip A. McFarlane,** Denis F. Geary,** Robert P. Pauly,††† Paul Komenda,§§§ and Rita S. Suri*

The intensive hemodialysis group received a mean (SD) 4.8 (1.1) sessions per week with a mean treatment time of 7.4 (0.87) hours per session; the conventional group received three sessions per week with a mean treatment time of 3.9 (0.32) hours per session.

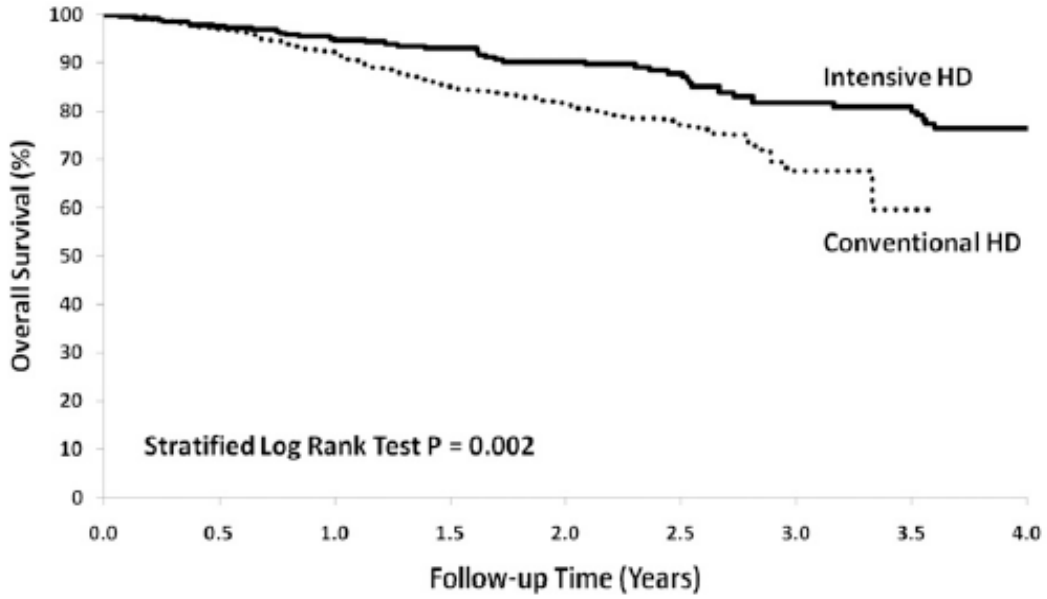


Figure 2. Kaplan–Meier plot for intensive and conventional hemodialysis. Two-sided *P*=0.002 by log-rank test, stratified by matched set and country. HD, hemodialysis.

. In conclusion, there is a strong association between intensive home hemodialysis and improved survival, but whether this relationship is causal remains unknown.

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Comparison of the Alternative Schedule Hemodialysis Regimens With Conventional Hemodialysis Based ond Preliminary or Confirmed Evidence

	Conventional Hemodialysis	*Intermittent Long (or Nocturnal)*	*Daily Nocturnal*
Smal molecule clearance using conventional kinetics (eKt/V)	+	++	++++
Smal molecule clearance using dose measure favoring frequency (e.g., stdKt/V)	+	++	++++
Middle molecule clerance	+	+++	++++
Middle molecule clearance using stdKt/V	+	+++	++++
Phosphate control	±	+++	++++
Improved BP control with fewer or no medications	+	+++	++++
Regression of LVH	-	++?	+++
Improved endothelial function	-	?	+++
Decrease in sympathetic nervous system activity	-	?	+++
HR variability	-	?	++
Exercise capacity	-	?	++
Quality of life	+	+++	+++
Cognitive function	+	?	+++
Dietetic freedom	-	+++	++++
Nutrition	+	++	++
Anemia control/ESA dose	-	++?	++
Sleep apnea improvement	-	?	+++
Patient survival	+	+++	++ (?)

BP, blood pressure; LVH, left ventricular hypertrophi; HR, heart rate; ESA, erythropoiesis stimulating agent; -, none; ± negligible; +, very low; ++, low; +++, medium; ++++, high; + (+), variable between + and ++; ?, no data; ++ (?), weak data

A. Pierratos - Ed.William L. Henrich : Principles and Practice of Dialysis, Fourth Edition. Philadelphia 2009, 135-148.

Intérêt de l'HD nocturne fréquente (Rocco et al KI 2011)

- Nocturnal trial (Rocco MV Kidney Int 2011)
- Randomization 6 times per week nocturnal dialysis (>=6 h per session; N=45) vs. standard 3 times per week daily (N=42).
- Total dialysis time per week 30.8 vs. 12.6 hours
- 1.8 fold increase in Weekly KT/V (4.7 vs. 2.6)

- No difference in mortality and LVM.
- No effect on Alb, ePCR or muscle mass (Kaysen KI 2012)
- Significantly lower predialysis phosphorus, blood pressure and number of anti-HTA medicines.
- Trend to higher number of access failures and access procedures in frequent dialysis arm.

Reduction of residual urine

In-center Nocturnal Hemodialysis: Another Option in the Management of Chronic Kidney Disease

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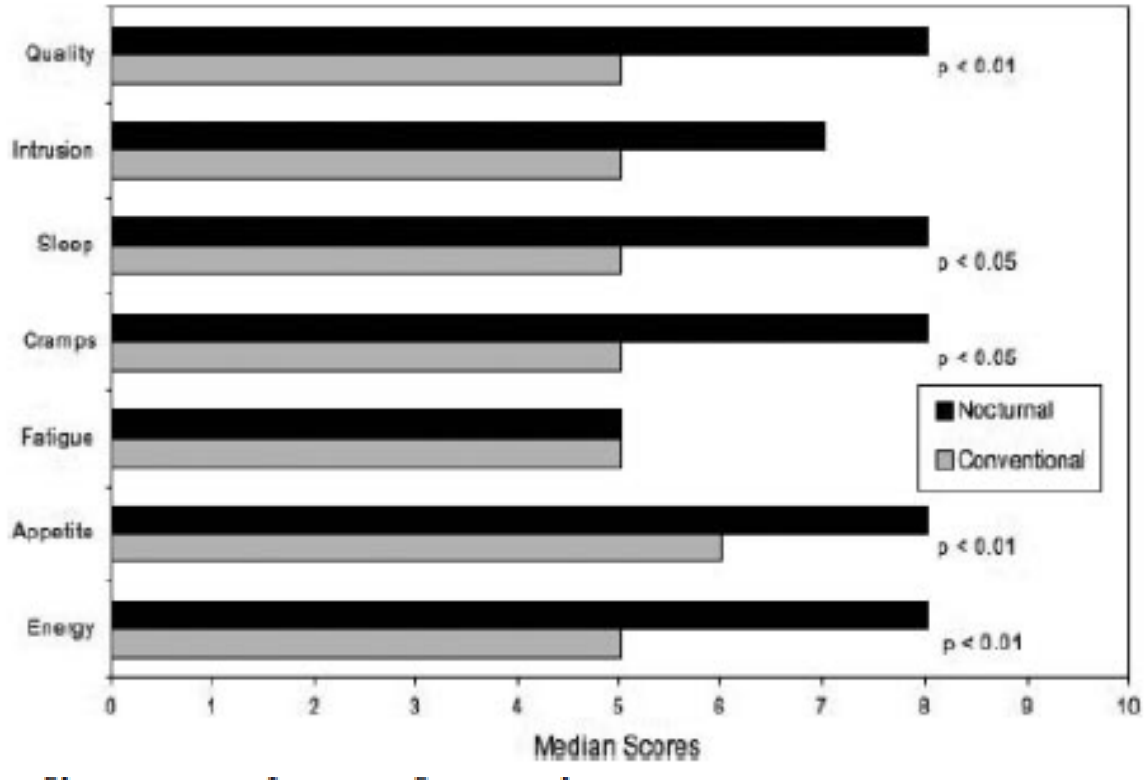
few patients are candidates for HNHD because of physical, psychological, medical, or social barriers, and some patients believe that the potential benefits do not merit the perceived lifestyle intrusion (18).



Quality-of-life questionnaire (n = 23)

Conclusions: INHD offers an effective form of HD for long-term dialysis patients who are unable to perform home HD.

Clin J Am Soc Nephrol 4: 778–783, 2009. doi: 10.2215/CJN.05221008

Conclusions

- HD nocturne offre l'avantage de récupérer du temps en journée
- Elle est douce, proche de la DP en terme de bouleversement métabolique
- Pratiquée 3X/sem, elle offre actuellement un plus par rapport à l'HD conventionnelle.
- Faut-il augmenter en plus la fréquence? Alors il s'agit d'une HOME dialysis, mais risque de problèmes d'abord vasculaire, de réduction de la diurèse, augmentation du coût, sans bénéfice supplémentaire majeur.

Merci pour votre attention