

Nutrition and the Kidney Kidney Transplantation

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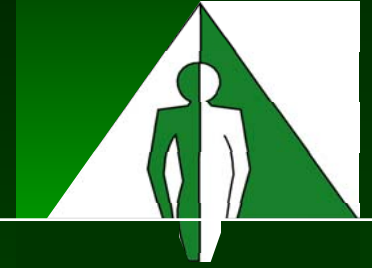
Nutrition and Kidney Transplantation



condition	renal function	nutritional key issues
pre-transplantation	end-stage CRF	nutritional state risk factor for surgery
perioperative	transition	perioperative catabolic stress
rejection	ARF	(steroid induced) catabolic stress
post-transplantation	→ CRF	weight gain diabetes (steroids) hyperlipidemia ? hyperhomocysteinemia

Kidney Transplantation

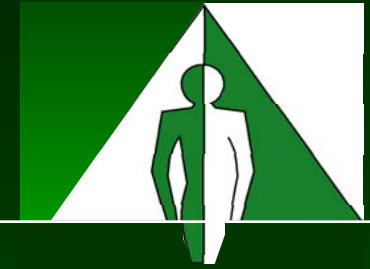
Risk Factor Obesity before Transplantation



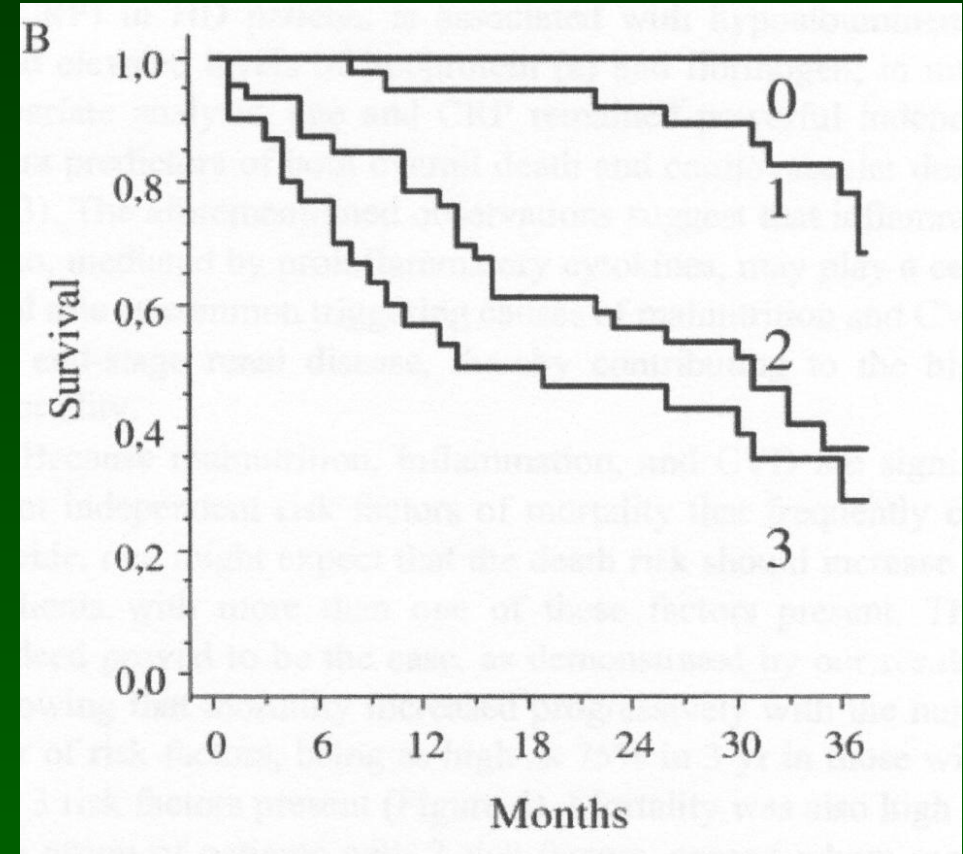
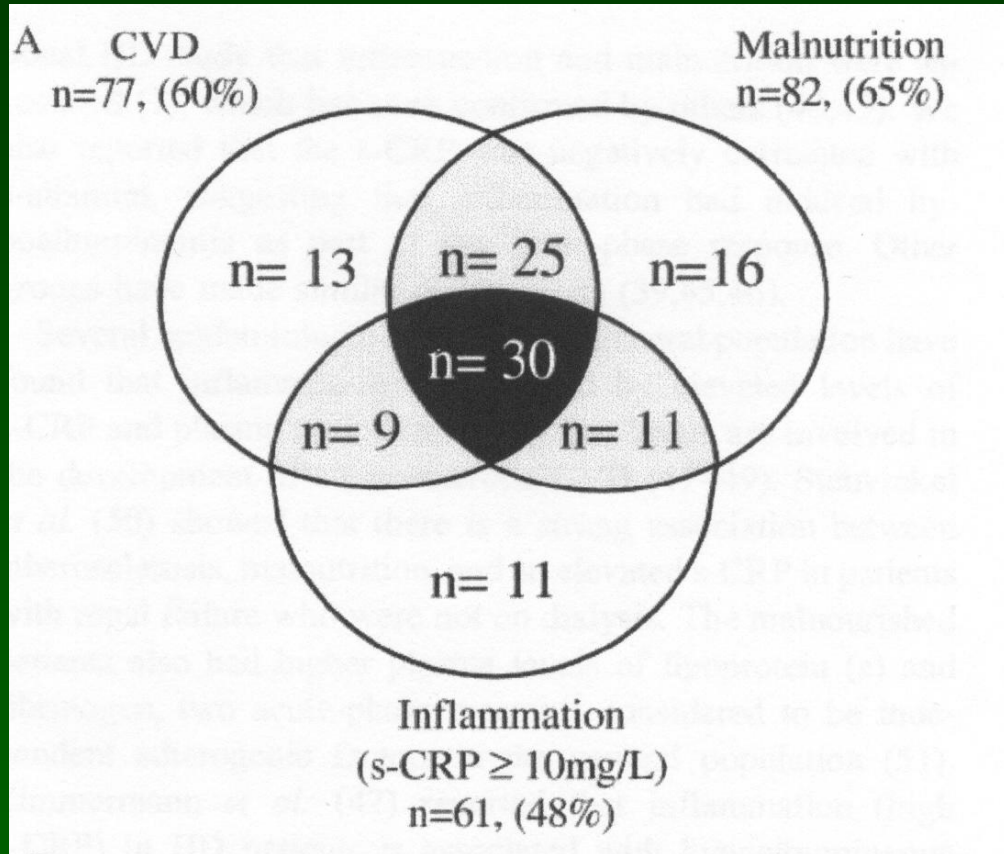
	obese	non-obese	p
mortality	11%	2%	<0.01
immediate graft function	38%	64%	<0.01
1-year graft survival	66%	84%	<0.05
wound complications	20%	2%	<0.01
ICU admissions	10%	2%	<0.01
reintubations	16%	2%	<0.03
new-onset diabetes	12%	0%	<0.02

Mortality in Hemodialysis Patients

Risk Factors Cardiovascular Disease, Malnutrition



Qureshi AR et al, J Am Soc Nephrol 2002,13(Suppl1):S28-36



Incidence of cardiovascular disease continues to be high after Tx

Kasiske BL et al, J Am Soc Nephrol 1996, 7:158-65

Kidney Transplantation

Mortality after Graft Failure



1016 deaths (21%) in 4741 patients, follow-up 15 ± 11 months on HD for graft failure
36% cardiac causes, 17% infectious causes

	all cause mortality annual hazard ratio (95% CI)
older patients	1.04 (1.03-1.04)
women	1.31 (1.10-1.56)
patients of white race	1.94 (1.32-2.84)
patients with diabetes	1.76 (1.43-2.16)
peripheral vascular disease	1.94 (1.54-2.43)
congestive heart failure	1.26 (1.05-1.53)
smokers	1.35 (1.01-1.81)
first transplant recipients	1.32 (1.02-1.69)
private insurance	0.67 (0.49-0.93)
higher serum albumin	0.73 per g/dL higher (0.64-0.83)

acute rejection, antibody induction, donor source, duration of graft survival
and the maximal GFR during Tx did not predict all-cause mortality.

Nutrition and Kidney Transplantation

Nutrition immediately posttransplant



Problems

protein catabolism

insulin resistance

insulin secretion reduced

hypomagnesemia

hypophosphatemia

surgical trauma, prednisone, infection

surgical trauma, prednisone, infection

tacrolimus (cyclosporine)

tacrolimus, cyclosporine

tubular loss, prednisone, diuretics

cyclosporine, persistent HPT

Nutrition

protein / amino acids

1.3 - 1.5 (2.0) g·kg⁻¹·d⁻¹

energy

1.3 - 1.5 REE

35 kcal·kg⁻¹·d⁻¹

electrolytes

monitor and supplement

vitamins / trace elements

supplement

ESPEN Guideline: Toigo G, Clinical Nutrition 2000, 21:281-291

van den Ham EC et al, Blood Purif 2002, 20:139-44

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Stable chronic phase



Problems

obesity
physical inactivity
cardiovascular disease
diabetes
bone disease

inactivity, prednisone, hyperphagia
muscle wasting (prednisone, pretranspl. malnutrition)
hyperlipidemia (tacrolimus, CyA), pretranspl. morbidity
prednisone, tacrolimus, pretranspl. morbidity
persisting HPT, prednisone

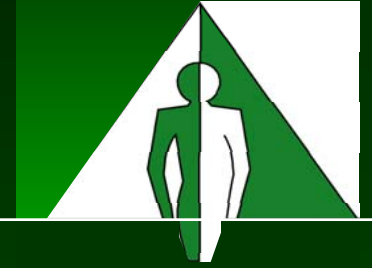
Nutrition

protein
energy
lipid intake
electrolyte
calcium

$0.8-1.0 \text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$
 $25 \text{ kcal}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$
 $\leq 30\%$ of total energy
according to GFR and co-morbidity
liberal supplements

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Acute Rejection



Problems

protein catabolism
insulin resistance
insulin secretion reduced

prednisone, infection
prednisone, infection
tacrolimus (cyclosporine)

Nutrition

protein / amino acids
energy

1.3 - 1.5 (2.0) $\text{g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$
1.3 - 1.5 REE
35 $\text{kcal}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$

ESPEN Guideline: Toigo G, Clinical Nutrition 2000, 21:281-291

ASPEN Guideline: August D, J Parent Enteral Nutr 2002, 26:74SA-75SA

Nutrition and Kidney Transplantation

Posttransplant Obesity (KTx 1984-86)



retrospective chart review of 115 KTx patients during 5 years post-KTx

pre KTx	21% overweight, mean 103.4 ± 1.9 % Metropolitan relative weight
1 yr after KTx	43% overweight, 57% weight gain >10% black 14.6% vs white 9.0% ($p=0.043$) female 12.1% vs 9.5% (n.s.)
5 yr after KTx	women continued weight gain (21.0%), men stable (10.%)
weight gain correl.	<u>positively</u> with African ethnicity, female gender, cholesterol, TG <u>negatively</u> with age <u>not</u> with cumulative pred dose, rejection history, pre-KTx obesity, time on HD pre-KTx, graft function, or donor source

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Posttransplant Obesity (KTx 1993-1998)



retrospective chart review of 974 patients \geq 12 months after KTx

after 24 months only 10.6 % stable weight (\pm 2.0 kg)

month 0 - 12 + 10.3 kg (-23 to +75)

month 12 - 24 + 1.7 kg

month 24 - 36 - 0.2 kg

multivariate analysis

black ethnicity
female gender
low income
younger age
no rejection

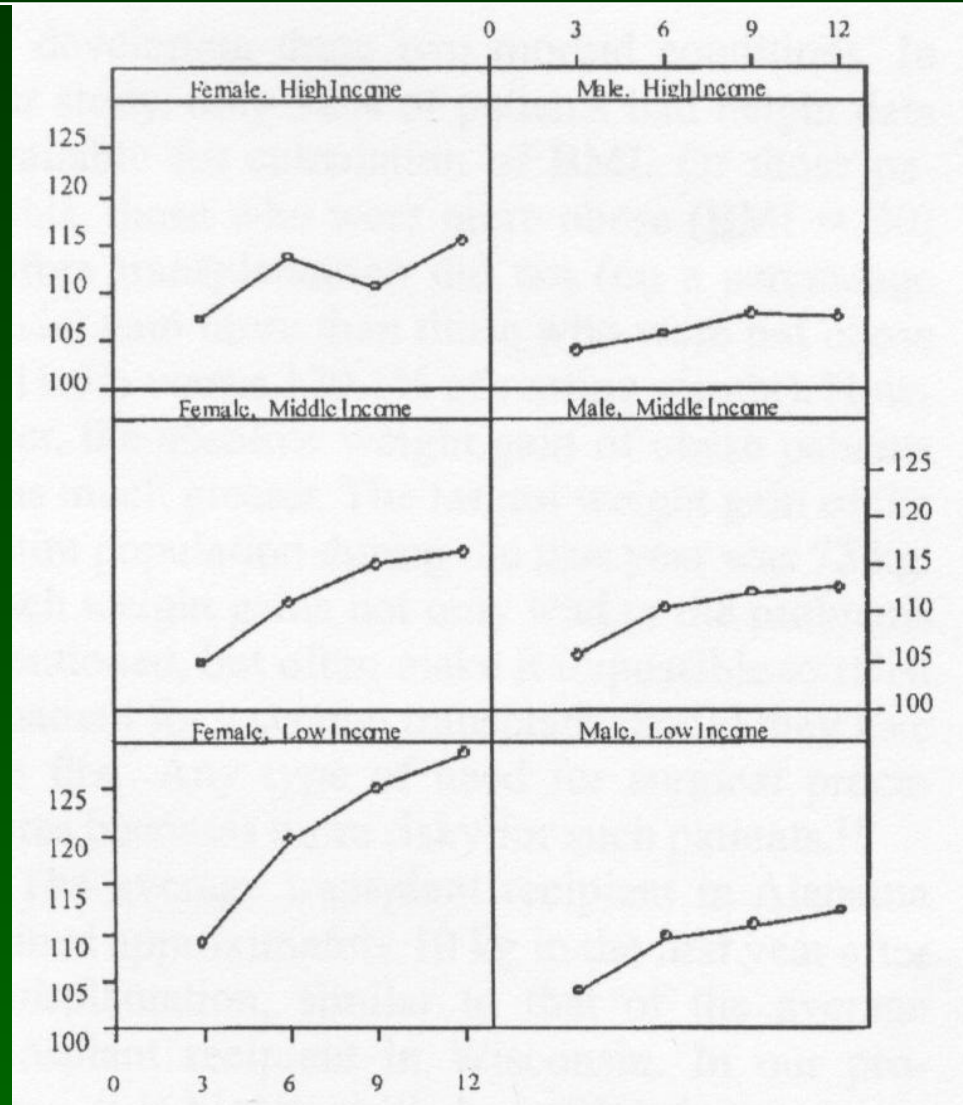
associated with weight gain (12 m)

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Posttransplant Obesity (KTx 1993-1998)



Time course of weight gain



Clunk JM et al,
Am J Kidney Dis 2001

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Posttransplant Increase in Fat Mass

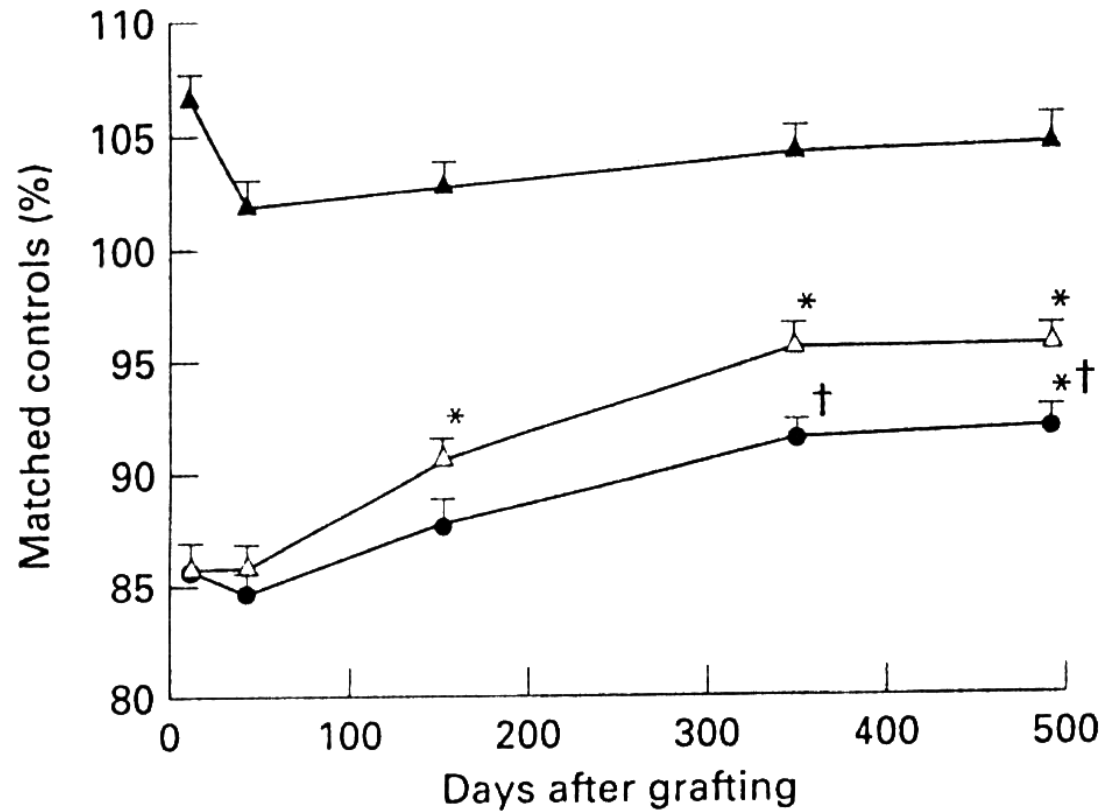


author	months after KTx	fat mass of renal transplant recipients		
		m+f	female	male
Steiger 1995	16	+2.7±2.1 kg	+0.1±0.8 kg	+4.9±1.5 kg
Isiklar 1998	6	+59%		
van den Ham 2000	>100	na	37.9 %	24.0 %
El Haggan 2002	12	±0	+2.1 kg	-1.3 kg

all analyses by DEXA

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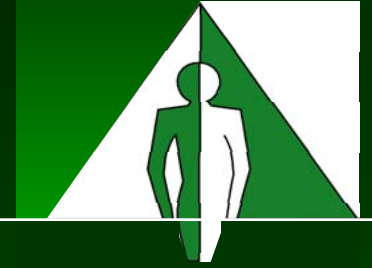
Early Posttransplant Lean Body Mass



regional lean body mass \triangle head+neck, \blacktriangle trunk, \bullet arms+legs

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Prednisone and Body Composition / Weight



Hoy 1986

high pred dose associated with higher protein breakdown

Zuercher 1990

pred use associated with loss of limb LBM and increase in FM

Johnson 1993

no association between weight gain and cumulative pred dose

Steiger 1995

pred dose correlated pos. with POx, CHOx, but neg. with FOx

v. d. Ham 2000

no pred effect on FM, LBM

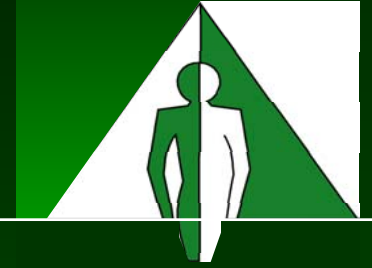
El Haggan 2002

pred dose associated with inadequate LBM gain

pred dose associated with bone loss

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Nutritional Intervention - Diet



Lopes IM et al, Nutrition 1999, 15:7-10

23 patients, BMI 31.7 ± 4.2 kg/m², 39 ± 30 months after KTx, all on pred (4.3 ± 3.3 mg/d)

intervention: 6 months step one diet (AHA)

result: weight loss 3.2 ± 2.9 kg

loss of fat mass ($p < 0.05$; BIA, TSF, near-infrared interactance)

Barbagallo CM et al, Nephron 1999, 82:199-204

78 patients, BMI 24.3 ± 3.8 kg/m², 57 ± 37 months after KTx, all on pred (5-17.5 mg/d)

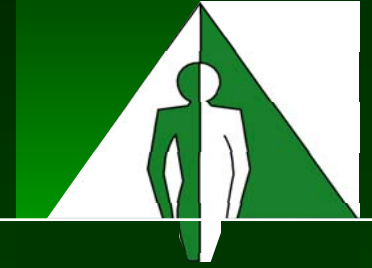
intervention: 10-12 weeks step one diet (AHA), after a 24 week surveillance period
with only general nutrition advice

result: no weight change

reduction in plasma chol, TG, LDL-Chol by 6.5-10% (< 0.02)

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Not just Drugs and Diet ...



... but also exercise !!

van den Ham EC et al, Transplantation 2000, 69:1591-8

cross sectional study, 77 KTx patients

(> 2 years after KTx; n=21 10 mg Pred, n=27 5 mg Pred, n=21 no Pred)

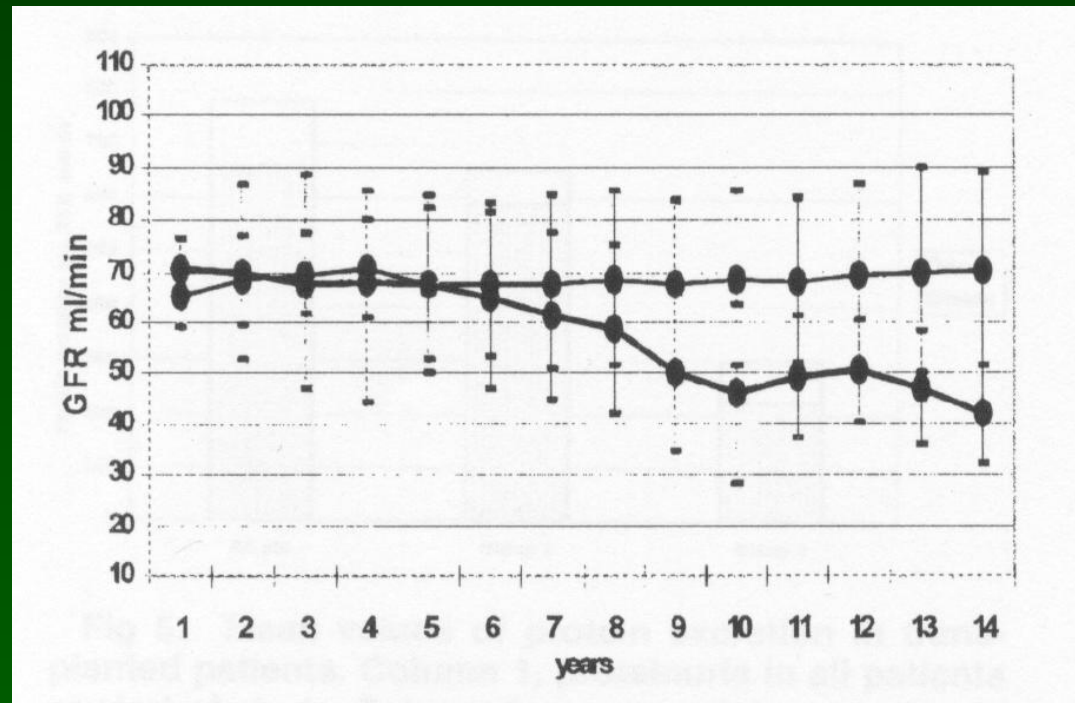
females	leisure time activity associated	pos. with % LBM neg. with absolute fat mass
males	occupational activity associated	pos. with % LBM, neg. with % fat mass

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Nutrition and Graft Function



48 KTx patients instructed to eat a normocaloric diet
low in protein ($0.7\text{-}0.8\text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$), sodium (3g/d), fat ($\leq 30\%$ total energy)

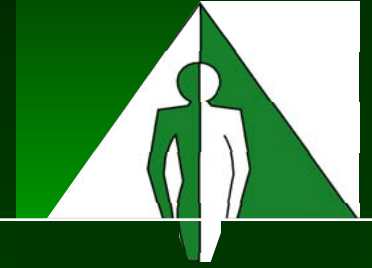


stable GFR in compliant group ($n=30$), protein intake $0.73\pm 0.11\text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$
decreasing GFR in non-compliant group ($n=18$), protein intake $1.4\pm 0.23\text{ g}\cdot\text{kg}^{-1}\cdot\text{d}^{-1}$

Bernardi A et al, Am J Kidney Dis 2003, 41(Suppl2):S146-52

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Magic Bullets ?



Ducloux D et al, J Am Soc Nephrol 2000, 11:134-137

follow-up study, 21.2 months (range 14-26 months), 207 KTx patients

153/207 (70%) total homocysteine (tHcy) above normal

tHcy higher in cardiovascular event patients (31.5 ± 10.3 vs 17.8 ± 7.5 $\mu\text{mol/L}$, $p < 0.001$)

relative risk for cardiovascular complications	tHcy	1.06 (1.04-1.09)
	age	1.55 (1.09-2.19)
	s-creatinine	1.34 (1.08-1.66)

Hagen W et al, Kidney Int 2001, 78:S253-7

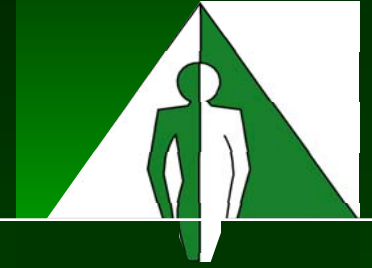
follow-up study 2.26 ± 0.66 years, 189 KTx patients

only s-creatinine ($p < 0.0001$),

but neither MTHFR 677C-->T/1298A-->C genotypes nor hyperhomocysteinemia

independently associated with patient or graft survival following KTx

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Multidisciplinary approach for successful management

- nephrologist
- surgeon
- dietitian
- clinical pharmacologist
- physiotherapist
- nurse
- pharmacist

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