A.S.O. "S.Croce e Carle"
Cuneo

S.C. Endocrinologia, Diabetologia e Metabolismo
S.S. Malattie Metaboliche e Diabetologia
S.C. Nefrologia

con richiesta di Patrocinio a:
- Associazione Medici Endocrinologi (AME) Piemonte e Valle d'Aosta
- Associazione Medici Diabetologi (AMD) Piemonte e Valle d'Aosta
- Ordine dei Medici Chirurghi e Odontoiatri della Provincia di Cuneo
- Società Italiana di Nefrologia (SIN)

DIABETE IN OSPEDALE:
il paziente
con insufficienza renale

Sabato, 25 Gennaio 2014

Centro Incontri della Provincia
Corso Dante, n. 41
12100 CUNEO

Come utilizzare il diuretico

Roberto Boero

S.C. Nefrologia e Dialisi
Ospedale Martini
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A.S.L. TO1
Azienda Sanitaria Locale
Torino

Quasi tutti i pazienti con diabete mellito e malattia renale cronica dovrebbero essere trattati con un diuretico...

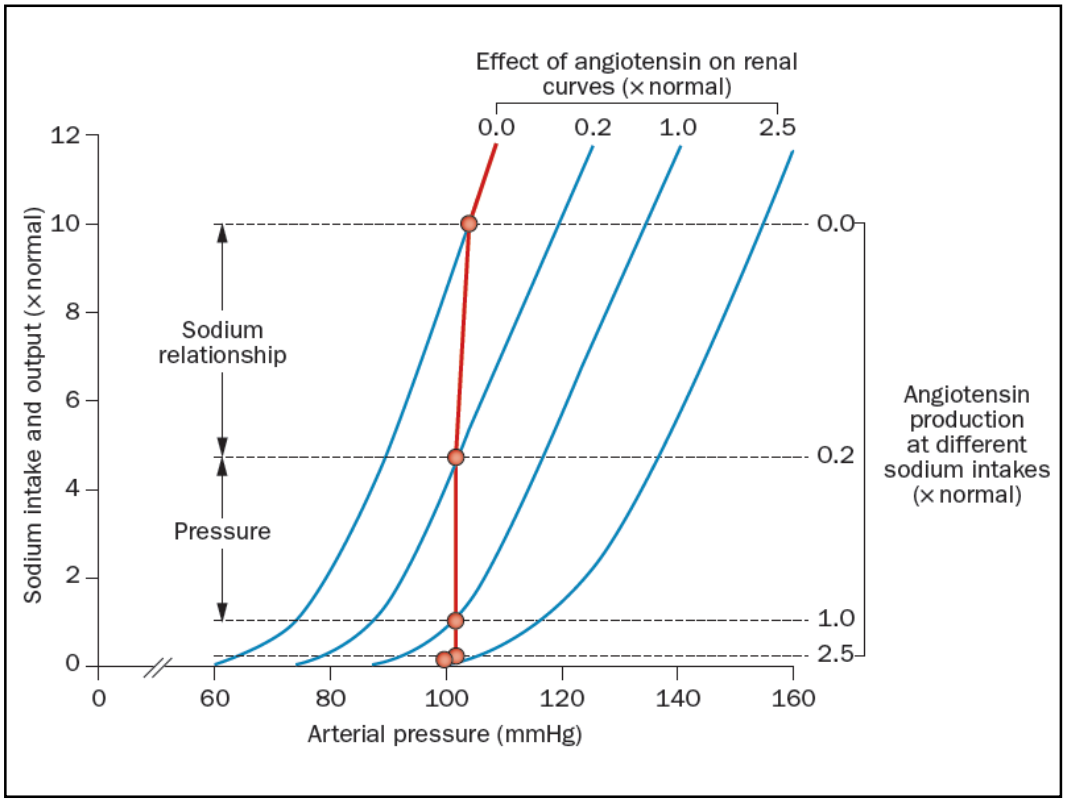
anche se in molti casi questo potrebbe essere evitato

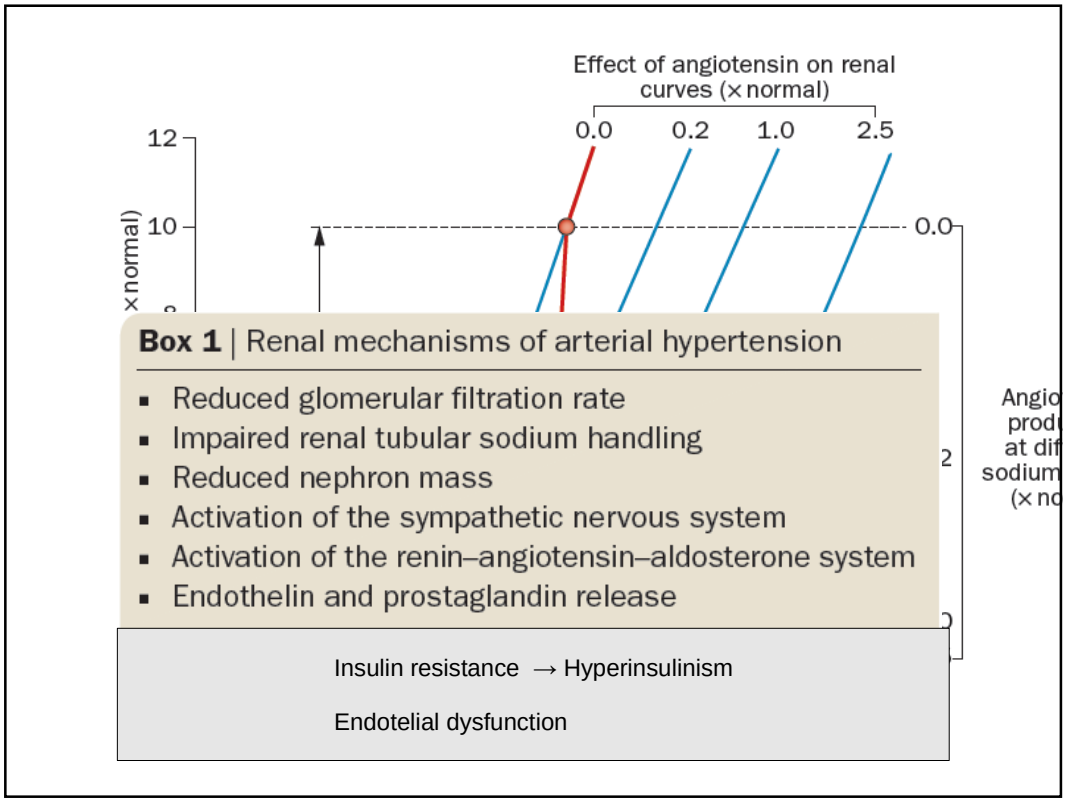
Perchè utilizzare un diuretico in un paziente con diabete e Malattia Renale Cronica (MRC)

- Controllo dell'ipertensione arteriosa
- Riduzione della proteinuria
- Controllo della potassiemia

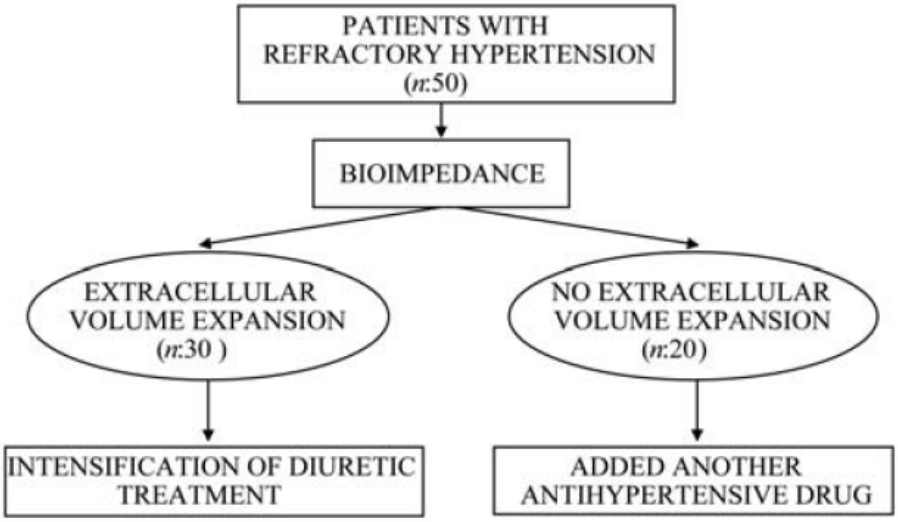
Perchè utilizzare un diuretico in un paziente con diabete e MRC

- Controllo dell'ipertensione arteriosa
  - L'espansione del volume extracellulare è frequente nell'iperteso diabetico
  - E' associata alla resistenza alla terapia antipertensiva
- Riduzione della proteinuria
- Controllo della potassiemia


Effect of angiotensin on renal curves (× normal)
0.0
0.2
1.0
2.5
Sodium intake and output (× normal)
12
10
8
6
4
2
0
Sodium relationship
Pressure
0.0
0.2
1.0
2.5
Angiotensin production at different sodium intakes (× normal)
0
60
80
100
120
140
160
Arterial pressure (mmHg)


Effect of angiotensin on renal curves (× normal)
0.0
0.2
1.0
2.5
12
10
0.0
Box 1 | Renal mechanisms of arterial hypertension
Reduced glomerular filtration rate
Impaired renal tubular sodium handling
Reduced nephron mass
Activation of the sympathetic nervous system
Activation of the renin–angiotensin–aldosterone system
Endothelin and prostaglandin release
Insulin resistance → Hyperinsulinism
Endotelial dysfunction

Utility of bioimpedance spectroscopy (BIS) in the management of refractory hypertension in patients with chronic kidney disease



Nephrol Dial Transplant (2012) 27 (Supple 4): iv31–iv35

Utility of bioimpedance spectroscopy (BIS) in the management of refractory hypertension in patients with chronic kidney disease

Baseline characteristics	ECV expansion ($n = 30$ patients)	No ECV expansion ($n = 20$ patients)	P-value
Age (years)	68 ± 10.6	68.6 ± 10.3	NS
Gender (% men)	22 (73)	12 (60)	NS
DM (%)	20 (66)	9 (45)	>0.01
BMI (kg/m^2)	32.2 ± 5.6	30.5 ± 5.2	NS
SBP (mmHg)	169.2 ± 8.1	164.2 ± 8.7	NS
DBP (mmHg)	84.9 ± 9.3	84.5 ± 9.9	NS
No antihypertensive drugs	3.9 ± 1	3.7 ± 0.5	NS
Antihypertensive class (%)			
ACE inhibitors or ARB	29 (96)	18 (90)	NS
β-Blockers	20 (66)	13 (65)	NS
Calcium channel blockers	24 (80)	17 (85)	NS
Diuretics	30 (100)	20 (100)	NS
Others	14 (46)	11 (55)	NS
eGFR (mL/min/1.73 m^2)	47.9 ± 20.9	54.9 ± 24.5	NS
Urinary albumin/creatine ratio (mg/g)	745 ± 901	328 ± 450	<0.01
Sodium 24-h urine (mEq)	170 ± 35	178 ± 31	NS
Plasma aldosterone (ng/dL)	22.1 ± 8.9	16.4 ± 9.4	0.06
Plasma aldosterone/plasma rein activity	22.3 ± 11.8	15.7 ± 11.8	NS

Nephrol Dial Transplant (2012) 27 (Supple 4): iv31–iv35

Utility of bioimpedance spectroscopy (BIS) in the management of refractory hypertension in patients with chronic kidney disease

Table 1. Bioimpedance spectroscopy. Baseline data of resistant hypertensive CKD patients with and without volume expansion

Baseline characteristics	ECV expansion ($n=30$)	No ECV expansion ($n=20$)	P-value
Hydration status	1.9 ± 1.2	0.2 ± 0.38	<0.01
Total body water (L)	40.5 ± 8.1	36.2 ± 7.7	0.05
Intracellular water (L)	20.9 ± 4.5	19.3 ± 4.5	NS
Extracellular water (L)	19.6 ± 3.8	16.9 ± 3.4	0.06
IC/EC index	1.0 ± 0.1	1.1 ± 0.2	NS
Lean mass index (kg/m^2 SC)	16.1 ± 3.1	15.2 ± 3.2	NS
Fatmass index (kg/m^2 SC)	15.4 ± 4.5	15.2 ± 6.4	NS
Phase angle	5.2 ± 0.7	5.6 ± 0.9	NS

Nephrol Dial Transplant (2012) 27 (Supple 4): iv31–iv35

Utility of bioimpedance spectroscopy (BIS) in the management of refractory hypertension in patients with chronic kidney disease

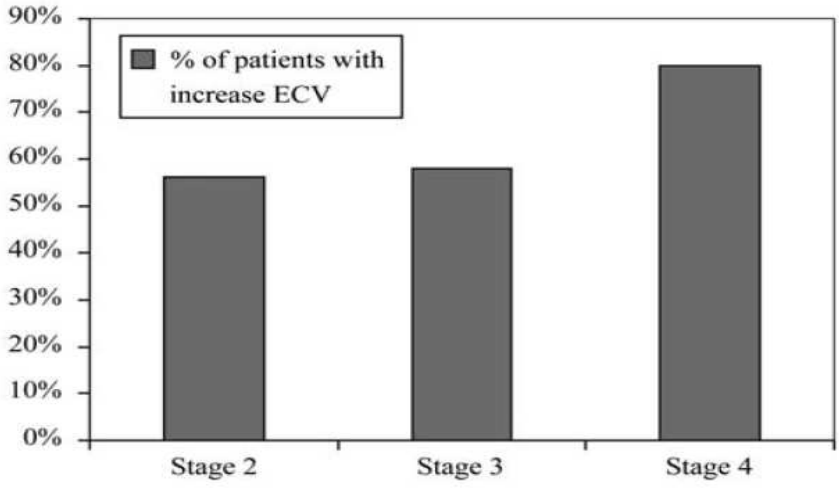
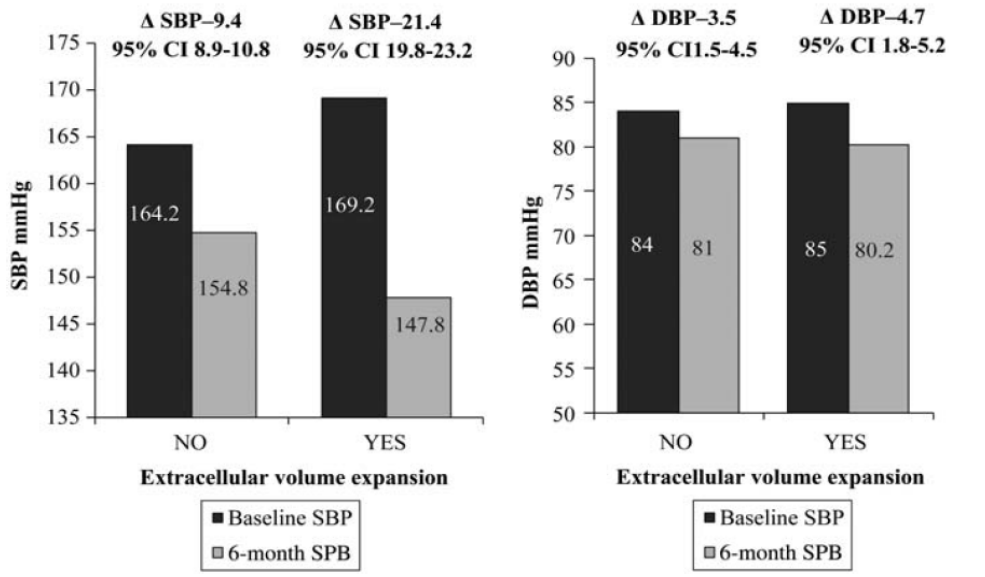


Fig. 2. Percentage of patients with ECV expansion in the different stages of CKD.

Nephrol Dial Transplant (2012) 27 (Supple 4): iv31–iv35

Utility of bioimpedance spectroscopy (BIS) in the management of refractory hypertension in patients with chronic kidney disease



Nephrol Dial Transplant (2012) 27 (Supple 4): iv31–iv35

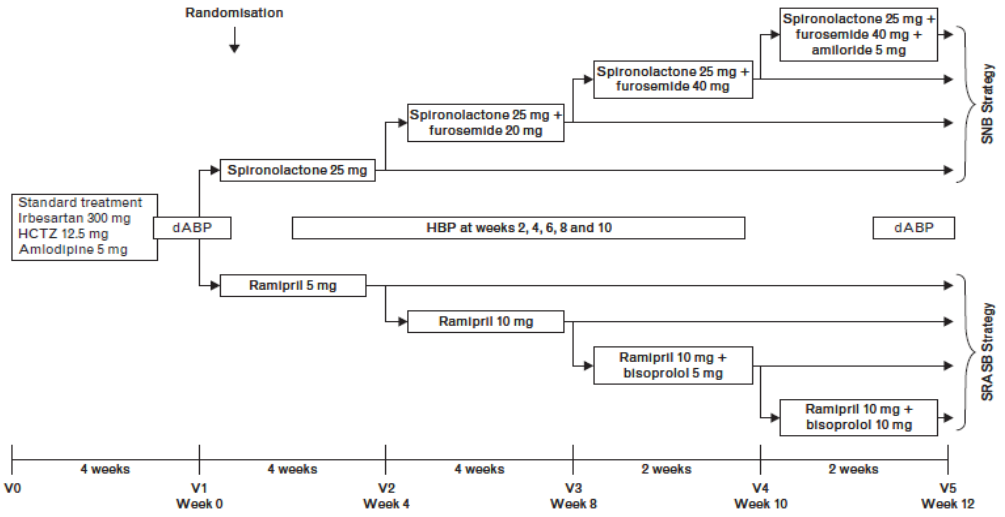
Multivariable logistic regression analysis of baseline predictors of Resistant Hypertension at month 6

(n = 300 patients with non-dialysis CKD)

Parameter	OR	95% CI	p
Age, years	1.00	0.98–1.03	0.770
Male gender	0.57	0.32–1.01	0.054
Body mass index	1.01	0.96–1.05	0.881
Diabetes	1.97	1.18–3.28	0.009
History of CVD	1.21	0.71–2.07	0.477
Left ventricular hypertrophy	1.41	0.81–2.44	0.224
eGFR, ml/min/1.73 m^2	0.98	0.97–1.01	0.062
Proteinuria, g/24 h	1.29	1.07–1.56	0.009
Urinary sodium, mmol/24 h	1.00	0.99–1.01	0.369

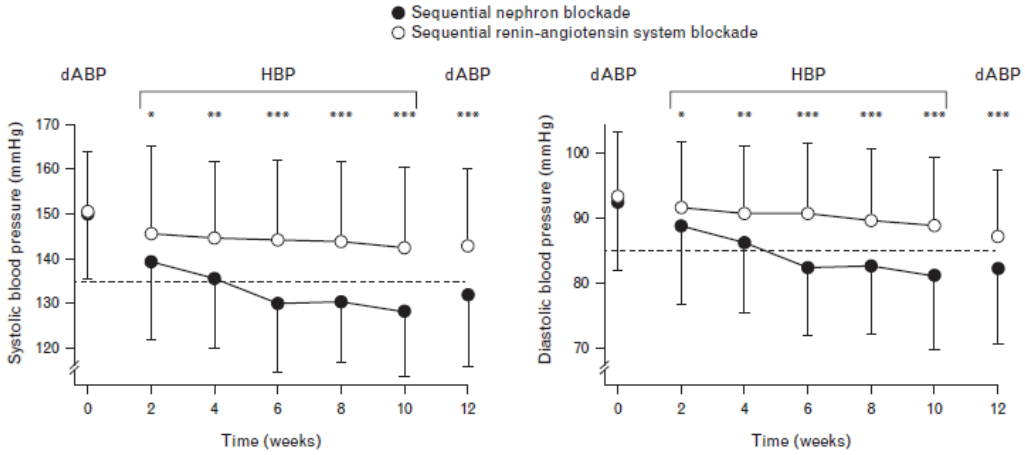
Kidney Blood Press Res 2011;34:58–67

Sequential nephron blockade versus sequential renin angiotensin system blockade in resistant hypertension: a prospective, randomized, open blinded endpoint study



Journal of Hypertension 2012, 30:1656–1664

Sequential nephron blockade versus sequential renin angiotensin system blockade in resistant hypertension: a prospective, randomized, open blinded endpoint study



Journal of Hypertension 2012, 30:1656–1664

Sequential nephron blockade versus sequential renin angiotensin system blockade in resistant hypertension: a prospective, randomized, open blinded endpoint study

TABLE 3. Change from baseline clinical characteristics and laboratory parameters after 12 weeks of treatment with sequential nephron blockade or sequential renin–angiotensin system blockade

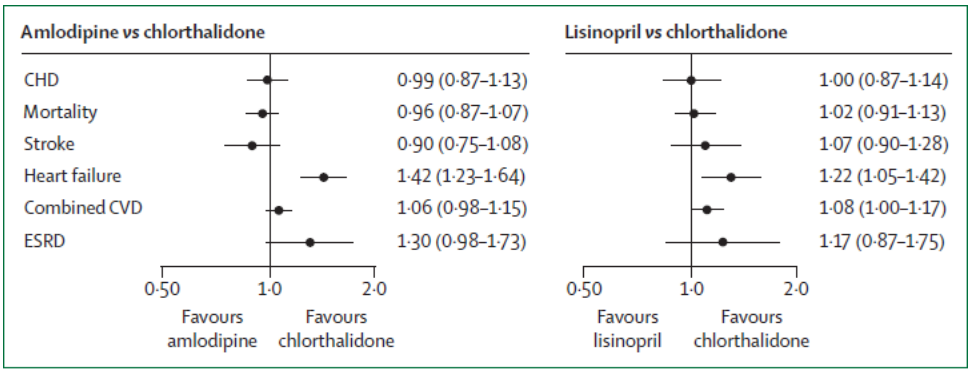
	SNB group $n=85$	SRASB group $n=82$	P value between the two groups
Body weight (kg)	−0.5 (−2.6 to 0.7)	0.0 (−1.2 to 1.0)	0.06
Plasma creatinine (μmol/l)	10 (4–18)	2 (−2 to 8)	<0.0001
Plasma sodium (mmol/l)	−2 (−4 to −1)	0 (−2 to 1)	<0.0001
Plasma potassium (mmol/l)	0.3 (0.3–0.6)	0.0 (−0.2 to 0.3)	<0.0001
Plasma uric acid (μmol/l)	45 (5–79)	16 (−11 to 37)	0.0001
Plasma proteins (g/l)	1 (−2 to 4)	−1 (−3 to 2)	0.08
Urinary sodium/creatinine (mmol/mmol)	0.5 (−1.7 to 2.6)	−0.8 (−3.8 to 2.8)	0.13
Blood glucose (mmol/l)	0.1 (−0.4 to 0.5)	0.0 (−0.3 to 0.2)	0.46
Plasma cholesterol (mmol/l)	0.0 (−0.5 to 0.4)	0.0 (−0.3 to 0.1)	0.19
Plasma triglycerides (mmol/l)	0.0 (−0.1 to 0.4)	0.0 (−0.1 to 0.1)	0.36

Data are median (interquartile range). SNB, sequential nephron blockade; SRASB, renin–angiotensin system blockade.

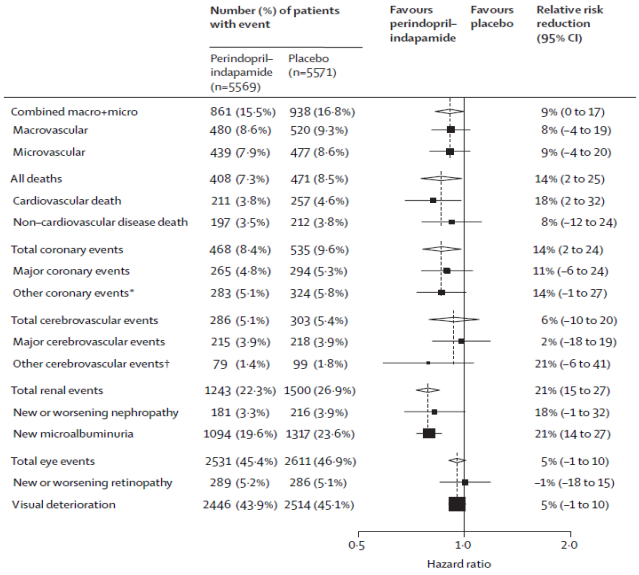
Journal of Hypertension 2012, 30:1656–1664

Relative risk for major outcomes with chlorthalidone versus amlodipine and lisinopril in patients with diabetes

Analysis of data from the diabetes subgroup of patients with hypertension assessed by ALLHAT



Effects of a fixed combination of perindopril and indapamide on macrovascular and microvascular outcomes in patients with type 2 diabetes mellitus (the ADVANCE trial): a randomised controlled trial

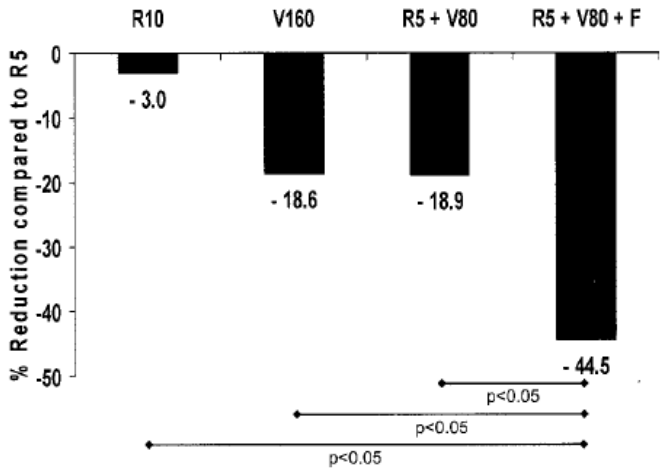


Lancet 2007; 370: 829–40

Perchè utilizzare un diuretico in un paziente con diabete e MRC

- ✓ Controllo dell'ipertensione arteriosa
- ✓ Riduzione della proteinuria
- ✓ Controllo della potassiemia

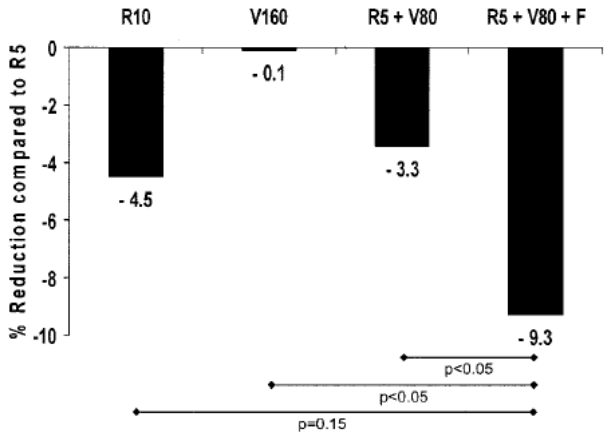
Diuretic and Enhanced Sodium Restriction Results in Improved **Antiproteinuric** Response to RAS Blocking Agents



J Am Soc Nephrol 16: 474-481, 2005

Diuretic and Enhanced Sodium Restriction Results in Improved Antiproteinuric Response to RAS Blocking Agents

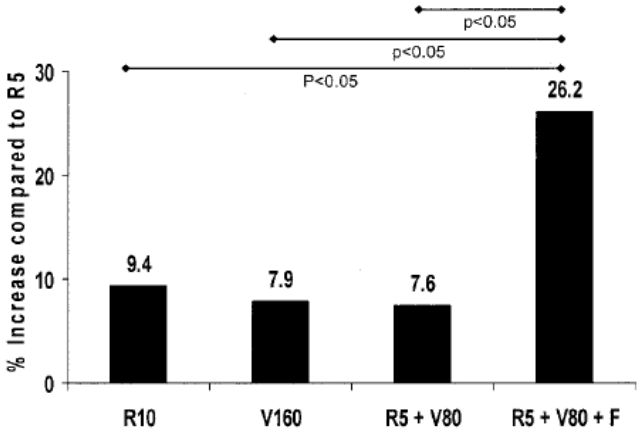
Systolic BP



J Am Soc Nephrol 16: 474-481, 2005

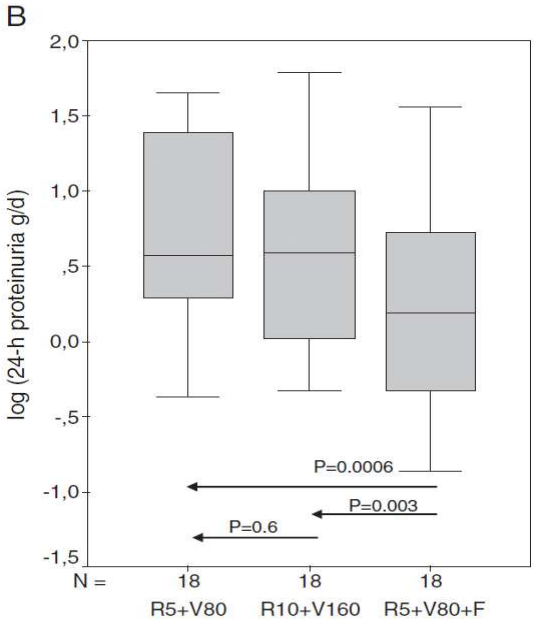
Diuretic and Enhanced Sodium Restriction Results in Improved Antiproteinuric Response to RAS Blocking Agents

Increase of serum creatinine



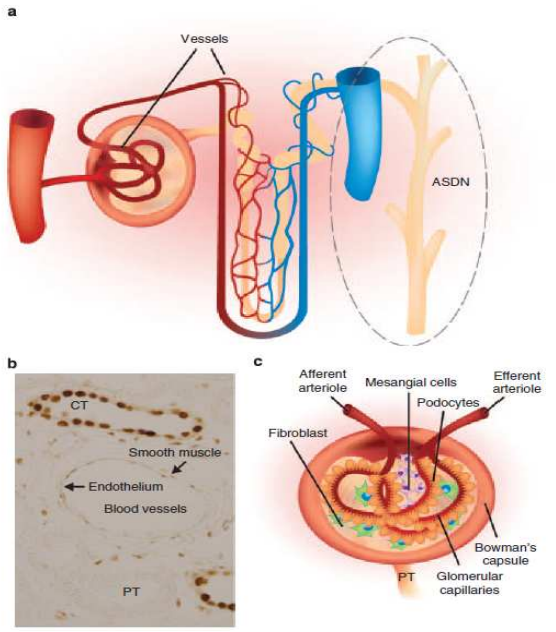
J Am Soc Nephrol 16: 474-481, 2005

Diuretic uptitration with half dose combined ACEI + ARB better decrease proteinuria than combined ACEI + ARB uptitration



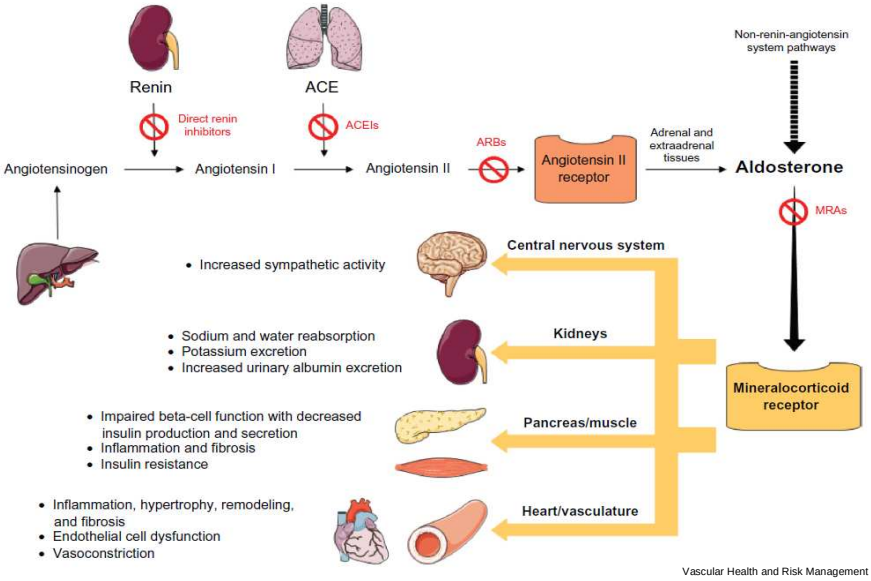
Nephrol Dial Transplant (2010) 25: 2218–2224

Mineralocorticoid receptor expression in the kidney



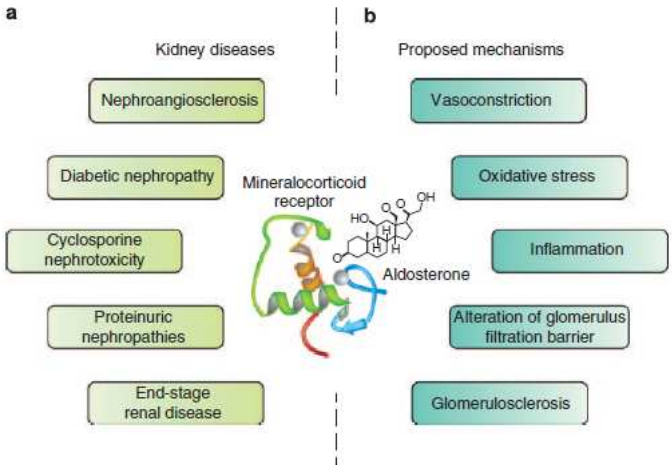
Kidney International (2011) 79, 1051–1060

Activation of the mineralocorticoid receptor



Vascular Health and Risk Management 2013:9 321–331

Implication of aldosterone and the mineralocorticoid receptor (MR) in renal pathophysiology



Kidney International (2011) 79, 1051–1060

Mineralocorticoid receptor blockade **in addition** to angiotensin converting enzyme inhibitor or angiotensin II receptor blocker treatment: An emerging paradigm in diabetic nephropathy

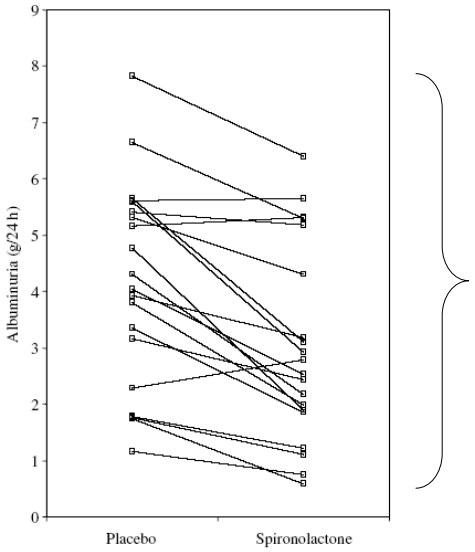
Reference	Standard treatment	Studied MRB	Design	N	Duration
Schjoedt et al. [8]	ACEI or ARB	Spironolactone 25 mg	Cross-over	22	2 months (each phase)
Rossing et al. [9]	ACEI or ARB	Spironolactone 25 mg	Cross-over	21	2 months (each phase)
Schjoedt et al. [10]	ACEI or ARB	Spironolactone 25 mg	Cross-over	20	2 months (each phase)
van den Meiracker [11]	ACEI or ARB	Spironolactone 50 mg	Cluster-randomized	59	1 year
Epstein et al. [12]	Enalapril	Eplerenone 50–100 mg	Cluster-randomized	177	12 weeks
Saklayen et al. [13]	Lisinopril-losartan	Spironolactone 25–50 mg	Cross-over	30	3 months (each phase)
Mehdi et al. [14]	Lisinopril 80 mg	Spironolactone 25 mg	Cluster-randomized	54	48 weeks
Nielsen et al. [15]	ACEI or ARB	Spironolactone 25 mg	Cross-over	21	2 months (each phase)

Reference	Albuminuria assessment	Standard treatment				Combined treatment				Combined to standard treatment albuminuria ratio
		Albuminuria	eGFR[c]	BP	Dropout %	Albuminuria	eGFR[c]	BP	Dropout %	
Schjoedt et al. [8]	mg/24 h (geometric mean)	831	85	144/72	5[a]	584	81	136/69	5[a]	0.70
Rossing et al. [9]	mg/24 h (geometric mean)	1566	74	138/71	5[a]	1067	71	132/67	5[a]	0.68
Schjoedt et al. [10]	mg/24 h (geometric mean)	3718	64	143/81	0	2510	62	137/77	0	0.68
van den Meiracker [11]	UACR: mg/g (geometric mean)	769	74	S.[d]	3	318	59	S.[d]	17	0.41
Epstein et al. [12]	UACR: mg/g (median)	259	72	N.S.[e]	2	124[b]	66[b]	N.S.[e]	8[b]	0.48
Saklayen et al. [13]	UPCR: mg/g (mean)	1570	55	149/78	N/A	790	54	142/77	N/A	0.50
Mehdi et al. [14]	UACR: mg/g (geometric mean)	691	64	N.S.[e]	0	529	52	N.S.[e]	7	0.77
Nielsen et al. [15]	mg/24 h (geometric mean)	90	78	135/65	0	35	72	133/64	0	0.39

European Journal of Internal Medicine xxx (2013) xxx–xxx

Changes in albuminuria upon **spironolactone** treatment in 20 patients with diabetic nephropathy and nephrotic range albuminuria

on top of ongoing antihypertensive treatment, including an angiotensin-converting enzyme inhibitor or an angiotensin II receptor blocker in maximally recommended doses.



Kidney International (2006) 70, 536–542

Long-term effects of addition of mineralocorticoid receptor antagonist to angiotensin II receptor blocker in patients with diabetic nephropathy: a randomized clinical trial

Losartan (50-100 mg) +Spironolattone 25 mg vs Losartan + Enalapril (30-40 mg)

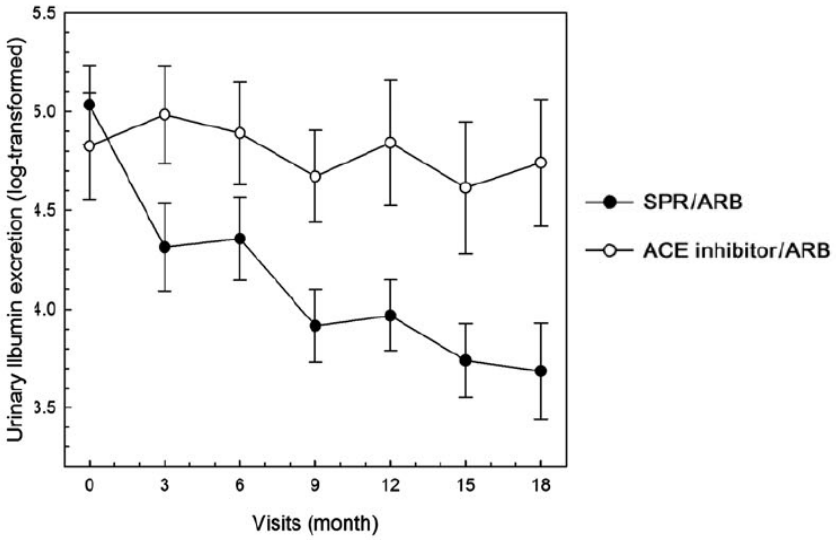
Table 1. Baseline characteristics of the trial participants

	SPR/ARB	ACE inhibitor/ARB	P-value
n	74	62	
Age (years)	57.80 ± 8.91	58.33 ± 9.33	0.729
UAE (mg/24 h)	112.0 (63.5, 317.3)	95.0 (50.0, 330.0)	0.727
Albuminria[a]			0.796
Microalbuminuria	54 (73.0%)	44 (71.0%)	
Marcoalbuminria	20 (27.0%)	18 (29.0%)	
Serum creatinine (μmol/L)	92.82 ± 23.87	99.01 ± 24.75	0.152
eGFR (mL/min/1.73 m^2)	73.75 ± 16.78	69.13 ± 19.69	0.131

Nephrol Dial Transplant (2013) 28: 2823–2833

Long-term effects of addition of mineralocorticoid receptor antagonist to angiotensin II receptor blocker in patients with diabetic nephropathy: a randomized clinical trial

Losartan (50-100 mg) +Spironolattone 25 mg vs Losartan + Enalapril (30-40 mg)



Nephrol Dial Transplant (2013) 28: 2823–2833

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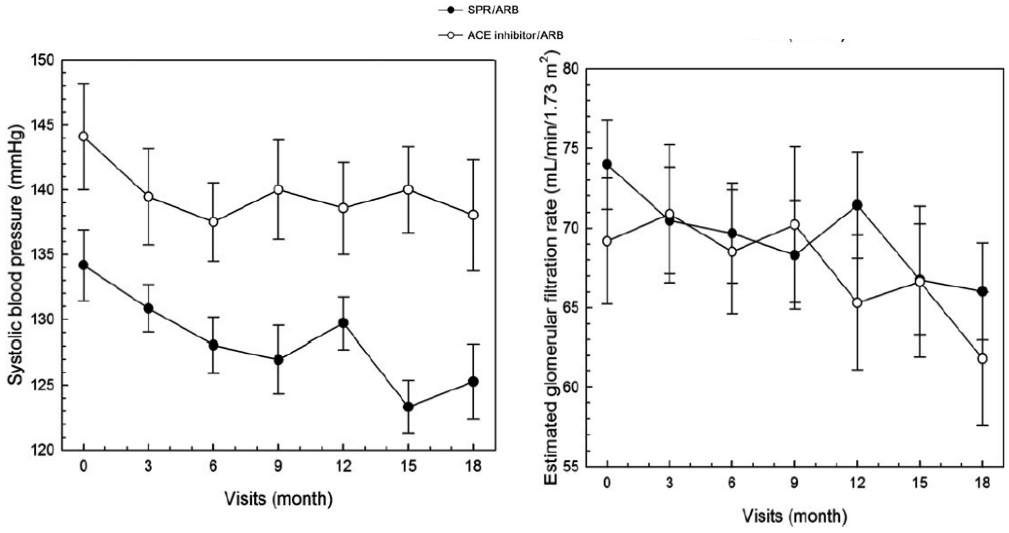


Nephrol Dial Transplant (2013) 28: 2823–2833

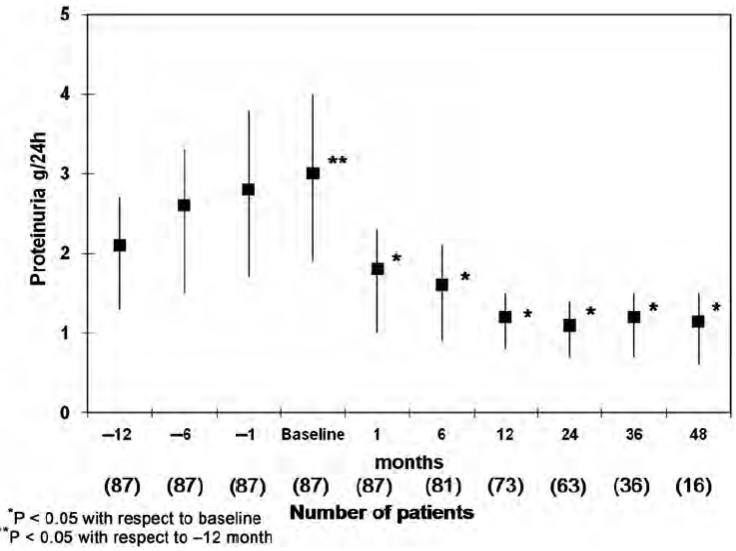
Renoprotective effects of mineralocorticoid receptor blockers in patients with proteinuric kidney diseases

Variable	Patients ($n = 87$)
Age (years)	58 ± 15 (22–81)
Gender (M/F) (%)	68/32
SCr (mg/dL)	1.5 ± 0.6 (0.4–3.3)
eGFR (mL/min/1.73 m^2)	60 ± 34.4 (19.2–212)
Proteinuria (g/24 h)	3 ± 2 (1–10.4)
MAP (mmHg)	99.8 ± 10.5 (68.3–125.3)
Serum potassium (mEq/L)	4.6 ± 0.5 (3.5–5.7)
BMI (kg/m^2)	29.3 ± 4.4 (20.7–42.4)
Treatment (%)	
ACEI	17 (20)
ARB	49 (56)
ACEI+ARB	21 (24)

Spironolactone, at a dose of 25 mg/day, was added to baseline treatment in all cases.

Nephrol Dial Transplant (2013) 28: 405–412

Renoprotective effects of mineralocorticoid receptor blockers in patients with proteinuric kidney diseases



Nephrol Dial Transplant (2013) 28: 405–412

Renoprotective effects of mineralocorticoid receptor blockers in patients with proteinuric kidney diseases

14 patients (16%) discontinued the treatment with MRB (13 spironolactone, 1 eplerenone) due to persistent hyperkalaemia (>5.5–6 mEq/L) in spite of therapeutic measures in 10 patients,

and clinically relevant acute decrease in renal function (>30% increase in baseline serum creatinine values) in 3.

All patients except one (12/13) who discontinued MRB due to hyperkalaemia or acute renal function decrease had an eGFR < 60 mL/min/1.73 m_2 at baseline.

Nephrol Dial Transplant (2013) 28: 405–412

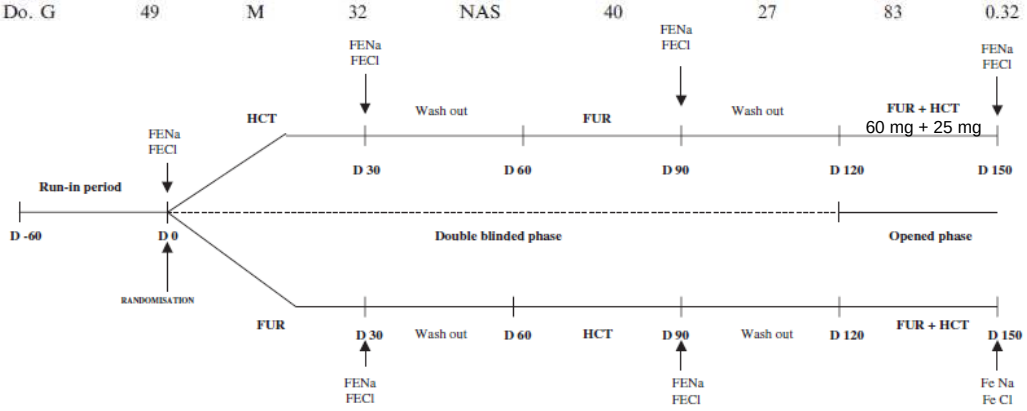
Perchè utilizzare un diuretico in un paziente con diabete e MRC

- ✓ Controllo dell'ipertensione arteriosa
- ✓ Riduzione della proteinuria
- ✓ Controllo della potassiemia

A randomized trial of furosemide vs hydrochlorothiazide in patients with chronic renal failure and hypertension

Table 1. Clinical data of the patients at entry in the study

Patients	Age	Sex	BMI	Renal disease	Cockcroft clearance	GFR	RPF	FF
Pa. R.	56	M	34	Diabetes	33	16	95	0.17
Va. D	51	M	24	PKD	37	41	126	0.33
We. R.	71	M	28	PKD	27	29	79	0.37
Le. JC	53	M	26	NAS	35	17	63	0.27
Me. M	40	M	24	Und	32	12	57	0.21
Me. JP	55	M	37	NAS	40	36	178	0.20
Do. G	49	M	32	NAS	40	27	83	0.32



Nephrol Dial Transplant (2005) 20: 349–353

A randomized trial of furosemide vs hydrochlorothiazide in patients with chronic renal failure and hypertension

Table 3. Serum and urine parameters during the study

	Basal state	FUR	HCTZ	Combined regimen (FUR + HCTZ)
Weight (kg)	85 ± 10	85 ± 11	84 ± 9	83 ± 9
24 h diuresis (ml)	1850 ± 560	2085 ± 760	1960 ± 510	2135 ± 410
Serum Na^+ (mmol/l)	140 ± 2	140 ± 3	138 ± 3	140 ± 2
Serum K^+ (mmol/l)	4.7 ± 0.5	4.7 ± 0.6	4.5 ± 0.7	4.2 ± 0.6[a]
Serum Cl^- (mmol/l)	107 ± 3	107 ± 3	105 ± 3	102 ± 4[a]
Serum HCO_3^- (mmol/l)	25 ± 4	26 ± 5	25 ± 3	28 ± 6
Serum urea (mg/dl)	84 ± 12	114 ± 30[b]	132 ± 36[b]	174 ± 72[b,c]
Serum creatinine (mg/dl)	2.79 ± 1.09	3.13 ± 1.2[b]	3.29 ± 1.7[b]	3.83 ± 1.62[b,c]
Serum uric acid (mg/dl)	7.3 ± 2.2	8.7 ± 2.6[b]	9.5 ± 3.1[b]	10.9 ± 2.6[b,c]
Serum glucose (mg/dl)	89 ± 20	94 ± 21	94 ± 18	96 ± 19
24 h urinary urea (g)	20 ± 6	21 ± 4	20 ± 5	22 ± 7
24 h urinary Na^+ (mmol)	70 ± 32	60 ± 26	68 ± 28	60 ± 18
24 h urinary K^+ (mmol)	50 ± 18	60 ± 20	63 ± 15	65 ± 18
24 h urinary protein (mg)	839 ± 998	698 ± 1057[b]	538 ± 622[b]	705 ± 533[b]

[a] $P < 0.05$ combined regimen *vs* basal, FUR and HCTZ.
[b] $P < 0.05$ FUR, HCT and combined regimen *vs* basal.
[c] $P < 0.05$ combined regimen *vs* FUR and HCTZ.

Nephrol Dial Transplant (2005) 20: 349–353

Ambulatorio per la nefropatia diabetica

K^+ su siero (mEq/l)

Inizio osservazione	Fine osservazione	p
59 (± 26)	48.8 (± 23)	<0.0001
1.53 (± 1.76)	0.87 (± 0.95)	<0.0001
4.7 (± 0.5)	4.8 (± 0.6)	n.s.

ACE-i o ARB	91	72%
ACE+ARB	32	25%
1 diuretico	108	85%
2 diuretici Ansa o tiazidico Ansa+tiazidico	23	21%

R. Boero, dati non pubblicati

Quasi tutti i pazienti con diabete mellito e malattia renale cronica dovrebbero essere trattati con un diuretico...

anche se in molti casi questo potrebbe essere evitato

Excess dietary sodium and inadequate potassium intake by hypertensive patients in Italy: results of the MINISAL-SIIA study program

Ferruccio Galletti[a], Enrico Agabiti-Rosei[b], Giampaolo Bernini[c], Roberto Boero[d], Giovambattista Desideri[e], Francesco Fallo[f], Francesca Mallamaci[g], Alberto Morganti[h], Maurizio Castellano[b], Pietro Nazzaro[i], Bruno Trimarco[j], Pasquale Strazzullo[a], on behalf of the MINISAL-GIRCSI Program Study Group

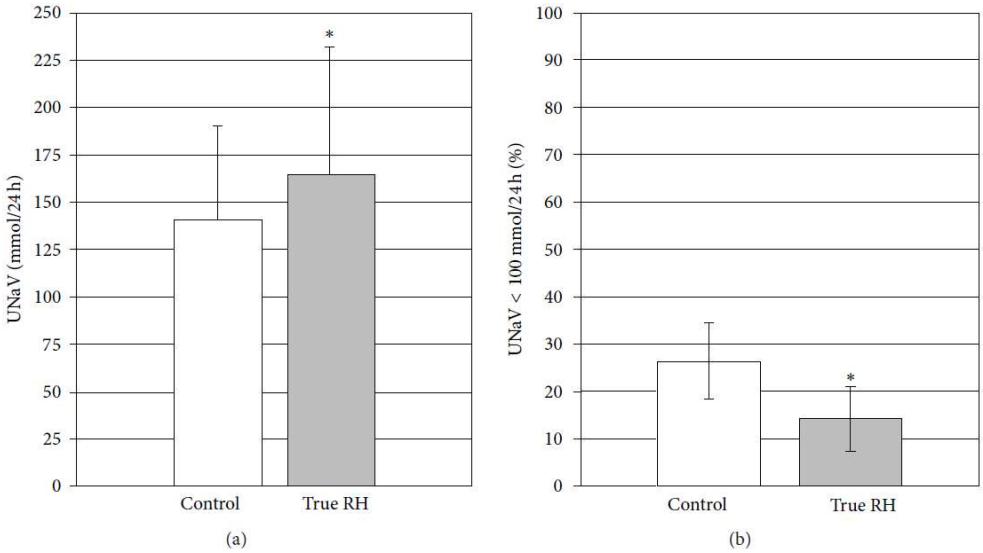
TABLE 4. Age-adjusted, sex-specific 24-h urinary sodium, potassium, and creatinine excretion and urine volume by quartiles of BMI

	Sodium (mmol/24 h)		Potassium (mmol/24 h)		Creatinine (mg/24 h)		Urine volume (ml/24 h)	
BMI quartiles	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**	**Mean**	**95% CI**
Men ($n=631$)								
I ($n=157$)	165.3	154.0–176.5	62.2	58.1–66.2	1397.4	1309.3–1485.5	1954.6	1848.0–2161.2
II ($n=158$)	163.7	152.6–175.0	60.9	56.9–65.0	1420.8	1333.2–1508.4	1839.9	1733.9–1945.9
III ($n=158$)	173.6	162.4–184.8	65.4	61.3–69.4	1475.6	1388.0–1563.2	1865.6	1759.6–1971.6
IV ($n=158$)	185.6	174.3–196.8	64.4	60.3–68.4	1583.0	1495.1–1670.9	1831.9	1725.6–1938.2
P for trend		0.006		0.264		0.002		0.021
Women ($n=601$)								
I ($n=151$)	124.5	114.9–134.1	53.7	49.6–57.8	928.8	859.0–998.7	1897.7	1785.7–2009.7
II ($n=152$)	126.9	117.4–136.5	53.0	48.9–57.1	905.2	835.6–974.7	1866.9	1755.4–1978.4
III ($n=149$)	148.1	138.4–157.7	56.7	52.6–60.9	985.7	915.4–1056.1	1849.9	1737.2–1962.6
IV ($n=149$)	151.8	142.1–161.4	59.9	55.8–64.1	1056.3	986.0–1126.5	1823.3	1717.7–1936.0
P for trend		<0.001		0.020		0.004		0.347

For men: I quartile (BMI range): 19.3–25.1; II quartile: 25.1–27.4; III quartile: 27.4–30.1; IV quartile: 30.1–45.0; for women: I quartile (BMI range): 16.2–23.9; II quartile: 23.9–26.9; III quartile: 26.9–30.7; IV quartile: 30.7–45.2.

Journal of Hypertension 2014, 32:48–56

Mean urinary sodium excretion and prevalence of low-salt diet (UnaV < 100mmol/die, %) in CKD patients with controlled BP and with true Resistant Hypertension



International Journal of Hypertension 2013,

A Randomized Trial of Dietary Sodium Restriction in CKD

Table 1. Baseline characteristics of LowSALT CKD study participants (n=20)

Characteristic	Value
Age (yr)	68.5±11.0
Men	15 (75)
Diabetes mellitus	9 (40)
Number of antihypertensive medications	3.15±1.09
Renin-angiotensin system blockade	6 (30)
α-blocker	16 (80)
β-blocker	7 (35)
Calcium antagonist	14 (70)
Diuretic	8 (40)
Weight (kg)	85.8±12.9
BMI (kg/m^2)	29.3±4.1
BP (mmHg)	
24-h systolic BP	151.3±13.3
24-h diastolic BP	81.7±7.8
24-h mean arterial pressure	104.5±8.1
Maximum systolic BP	206.2±24.8
Urinary sodium (mmol/24 h)	126 (78, 188)
Proteinuria (mg/24 h)	586 (136, 1600)
Albuminuria (mg/24 h)	327 (22, 1100)

Data are presented as n (%), mean ± SD, or median (interquartile range).

J AmSoc Nephrol 24: 2096–2103, 2013

A Randomized Trial of Dietary Sodium Restriction in CKD

Table 2. Values during low salt and high salt periods (n=20)

Characteristics	n	High Salt	Low Salt	Δ (High Salt – Low Salt)	P
24-h systolic BP (mmHg)	20	154.6±11.9	144.9±13.1	9.7 [4.5 to 14.8]	<0.001
24-h diastolic BP (mmHg)	20	83.3±9.0	79.4±9.4	3.9 [1.3 to 6.4]	<0.01
24-h mean arterial pressure (mmHg)	20	106.7±8.7	100.9±9.7	5.8 [2.6 to 9.1]	<0.01
Maximum systolic BP (mmHg)	20	212.7±25.7	198.9±26.6	13.8 [0.5 to 27.1]	0.04
Extracellular volume (L)	18	20.0±3.7	19.2±3.7	0.8 [0.4 to 1.2]	<0.01
Weight (kg)	20	86.4±12.6	86.0±12.2	0.4 [0.0 to 0.8]	0.03
Plasma renin (pmol/L)	20	16.5 (8.5–47.0)	64.5 (32.0–117.5)	−48 (−70.5, −23.5)	<0.001
Plasma aldosterone (mU/L)	20	33.3 (25.0–58.8)	87.1 (29.8–133.5)	−53.8 (−74.7, −4.8)	<0.001
Proteinuria (mg/24 h)	19	835 (185–1600)	493 (123–1300)	342 (62, 300)	<0.01
Albuminuria (mg/24 h)	19	291 (40–1000)	143 (16–889)	148 (24, 111)	<0.001
PWV (m/s)	16	11.1±2.3	10.5±2.5	0.5 [−0.2 to 1.2]	0.13
AI (%)	19	28.9±8.8	27.2±11.5	1.7 [−2.6 to 6.0]	0.42
Sodium excretion (mmol/24 h)	19	168 (146–219)	75 (58–112)	93 (88, 107)	<0.001
Potassium excretion (mmol/24 h)	19	57±18	57±21	0 [−6 to 6]	0.91
Energy intake (from diet history)	20	6600±1400	6800±1500	−200 [−700 to 300]	0.32
Sodium intake (from diet history)[a]	20	53 (43–66)	56 (48–63)	3 (−5, 3)	0.31

Data are presented as the mean ± SD, median (interquartile range), or mean [95% confidence interval]. The change between interventions was analyzed using the paired t test with normally distributed data and the Wilcoxon signed-rank test for non-normal data.
[a]Does not include sodium from study medication.

J AmSoc Nephrol 24: 2096–2103, 2013

A Randomized Trial of Dietary Sodium Restriction in CKD

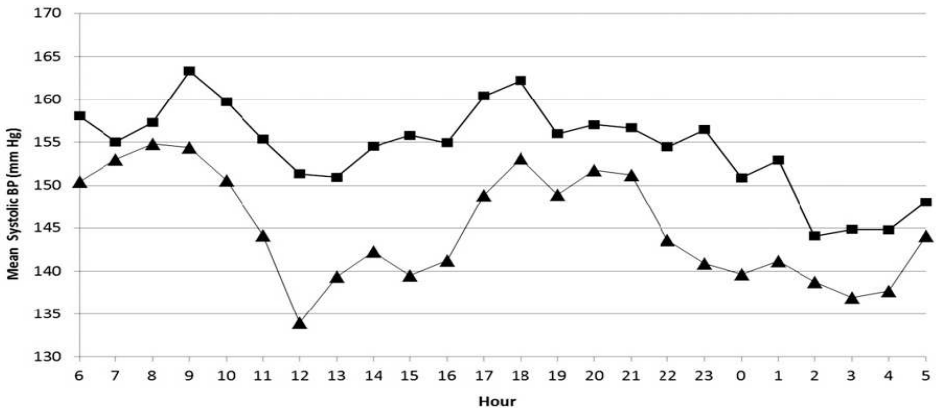
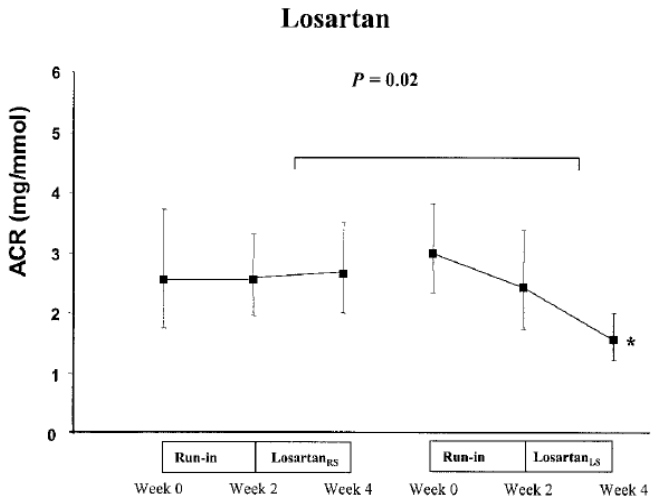


Figure 3. Comparison of mean systolic BP values over 24 hours during high (■) and low (▲) salt periods. Systolic BP was reduced consistently during the day (06:00–22:00 hours) and night (22:00–6:00 hours) periods.

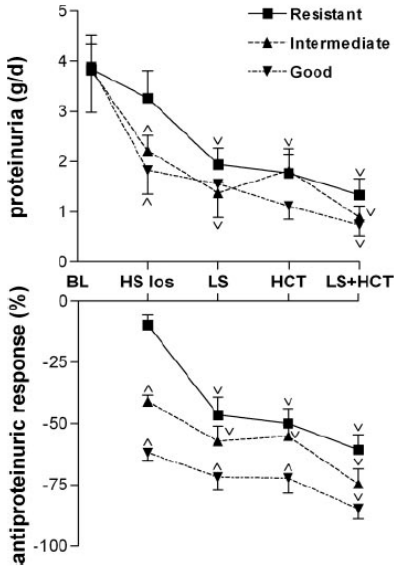
J AmSoc Nephrol 24: 2096–2103, 2013

A Low-Sodium Diet Potentiates the Effects of Losartan in Type 2 Diabetes



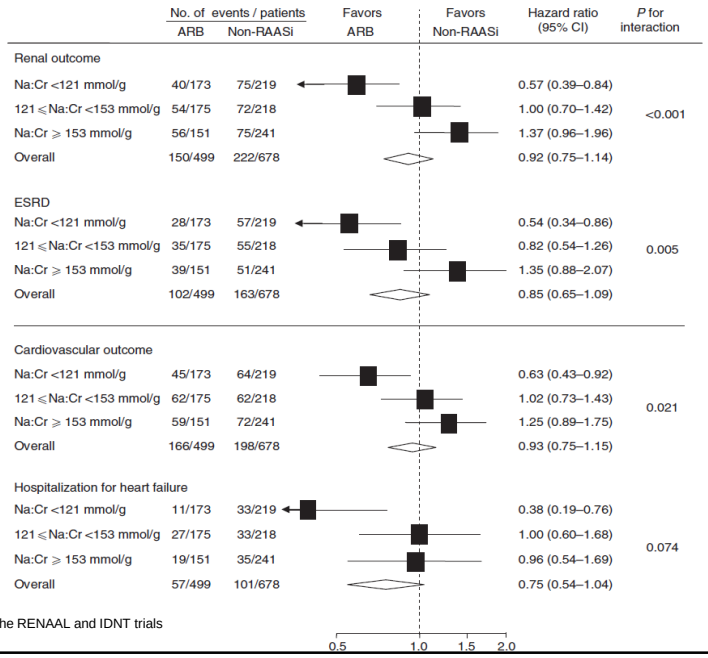
Diabetes Care 25:663–671, 2002

Effects of Dietary Sodium and Hydrochlorothiazide on the Antiproteinuric Efficacy of Losartan



J Am Soc Nephrol 19: 999–1007, 2008.

Effect of ARB treatment vs. non-RAASi–based treatment on the risk for renal and cardiovascular outcomes according to tertiles of 24-h urinary sodium/creatinine ratio



Post-hoc analysis of the RENAAL and IDNT trials

Kidney International (2012) 82, 330–337

Sommario e Conclusioni

- L'espansione del volume extracellulare e quindi il trattamento con diuretici hanno un ruolo chiave nell'ipertensione arteriosa.
- I diuretici potenziano l'effetto antiproteinurico della modulazione del RAS.
- Gli antagonisti dell'aldosterone riducono la proteinuria ma per il rischio di iperpotassiemia non vanno impiegati con eGFR <60 ml/min.
- L' associazione tra diuretici dell'ansa e tiazidici è utile per ridurre la potassiemia anche con GFR ridotto.
- La “normalizzazione” dell'apporto sodico riduce significativamente la pressione arteriosa e la proteinuria ed è il primo provvedimento da adottare.