ANTE
Associazione Nazionale Tecnici Emodialisi

XXX Corso Nazionale ANTE - Dialisi e Tecnologia
"Presente e futuro della Nefrologia Italiana"

Bagno di dialisi e rischio aritmico in dialisi

Dott. Paolo Fabbrini
Nefrologia e Dialisi

Regione Lombardia
ASST Nord Milano

DIALISI E FATTORI DI RISCHIO PER EVENTI ARITMICI

PAZIENTE UREMICO

FATTORI DI RISCHIO TRADIZIONALI:

-ALTERAZIONI ELETTROLITICHE

-CARDIOPATIA ISCHEMICA

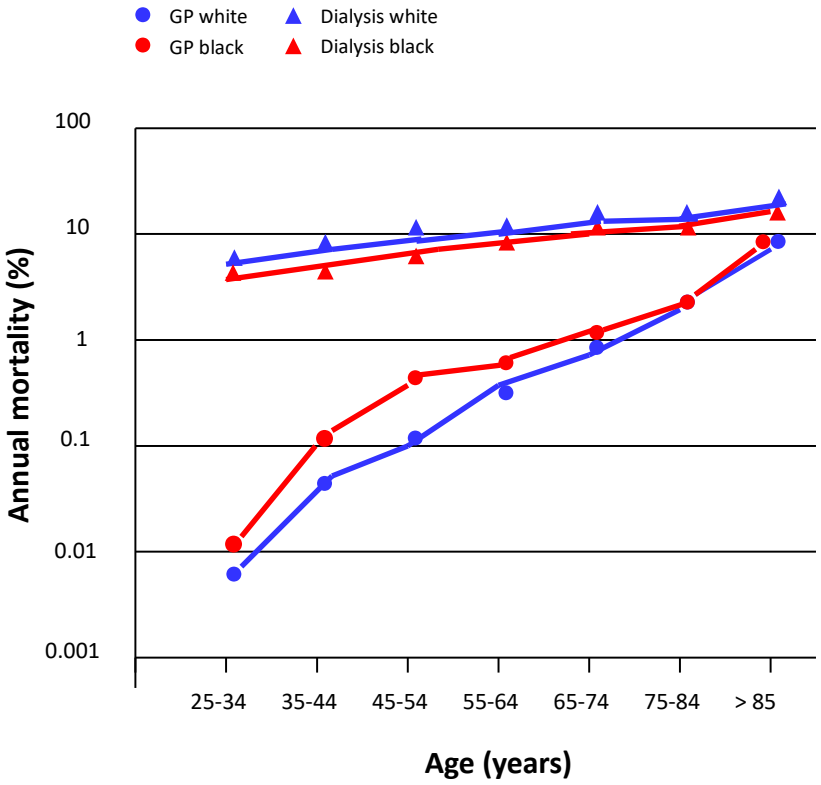
-CARDIOPATIA DILATATIVA

FATTORI DI RISCHIO NON TRADIZIONALI:

FATTORI COLLEGATI ALL'UREMIA

DIALISI E FATTORI DI RISCHIO PER EVENTI ARITMICI

Mortalità CV nella popolazione generale e nei pazienti in trattamento dialitico

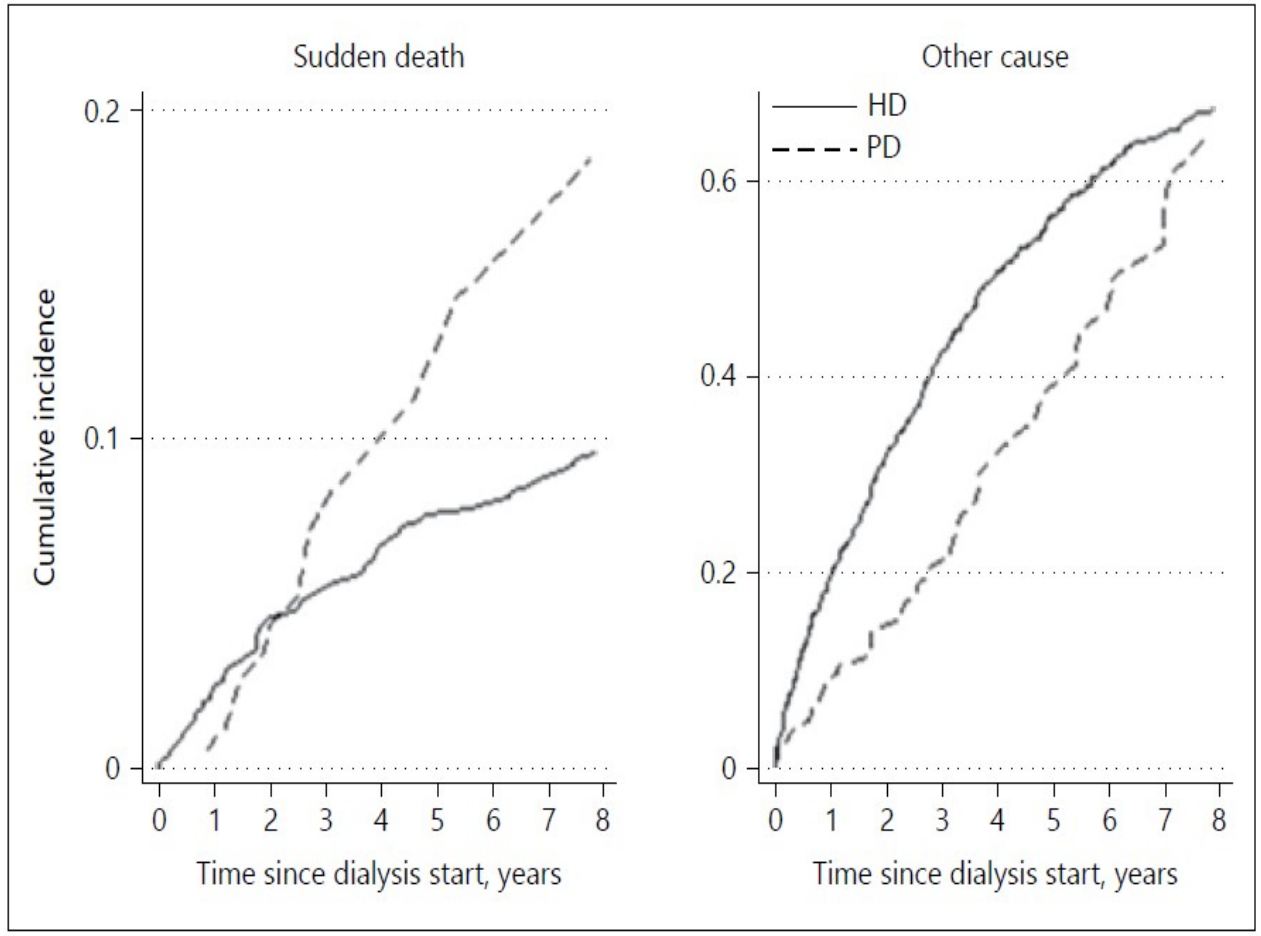


Cardiovascular Mortality by race and target population (Annual mortality, %)

	All	White	Black	Diabetic	Non diabetic
GP	0.28	0.29	0.23	0.80	0.26
HD	9.12	11.18	6.68	11.09	7.78
PD	9.24	10.76	6.07	13.22	7.09
RTR	0.54	0.53	0.56	1.11	0.39

Foley et al. *J Am Soc Nephrol 1998; 9:* s16 – s23.

DIALISI E FATTORI DI RISCHIO PER EVENTI ARITMICI



Original Paper

Blood Purification

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Sudden Death in End Stage Renal Disease: Comparing Hemodialysis versus Peritoneal Dialysis

NON CI SONO SWITCH ELETTROLITICI IN DIALISI PERITONEALE MA AD ESEMPIO LA MORTALITÀ PER MORTE IMPROVVISA O LA PREVALENZA DI ALTRE ARITMIE E' AUMENTATA RISPETTO ALLA POPOLAZIONE GENERALE , AL PARI DELLA MORTALITÀ CARDIOVASCOLARE

DIALISI E FATTORI DI RISCHIO PER EVENTI ARITMICI

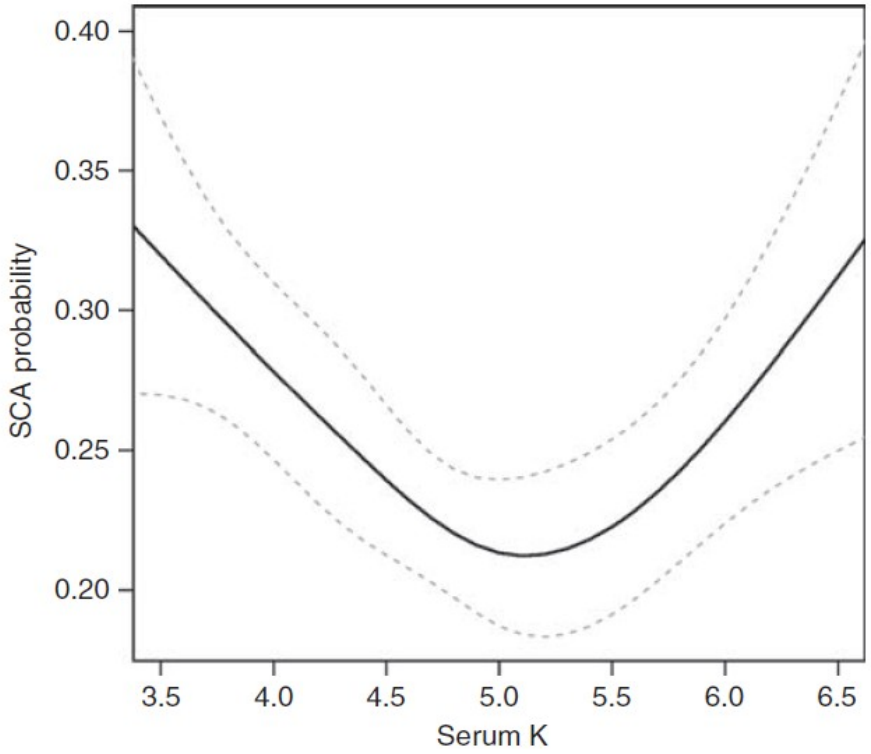
FATTORI DI RISCHIO TRADIZIONALI:

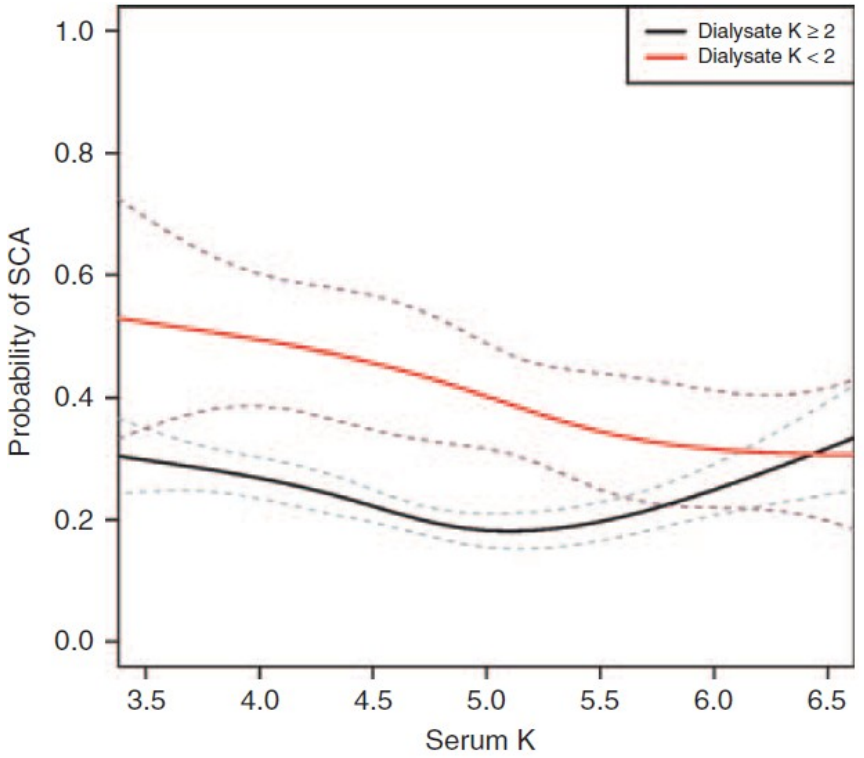
-ALTERAZIONI ELETTROLITICHE
-CARDIOPATIA ISCHEMICA
-CARDIOPATIA DILATATIVA

Modifiable risk factors associated with sudden cardiac arrest within hemodialysis clinics

Patrick H. Pun[1,2], Ruediger W. Lehrich[1], Emily F. Honeycutt[2], Charles A. Herzog[3] and John P. Middleton[1]

[1]Duke University Medical Center, Division of Nephrology, Department of Medicine, Durham, North Carolina, USA; [2]Duke Clinical Research Institute, Duke University Medical Center, Durham, North Carolina, USA and [3]Cardiovascular Special Studies Center, United States Renal Data System, Minneapolis, Minnesota, USA

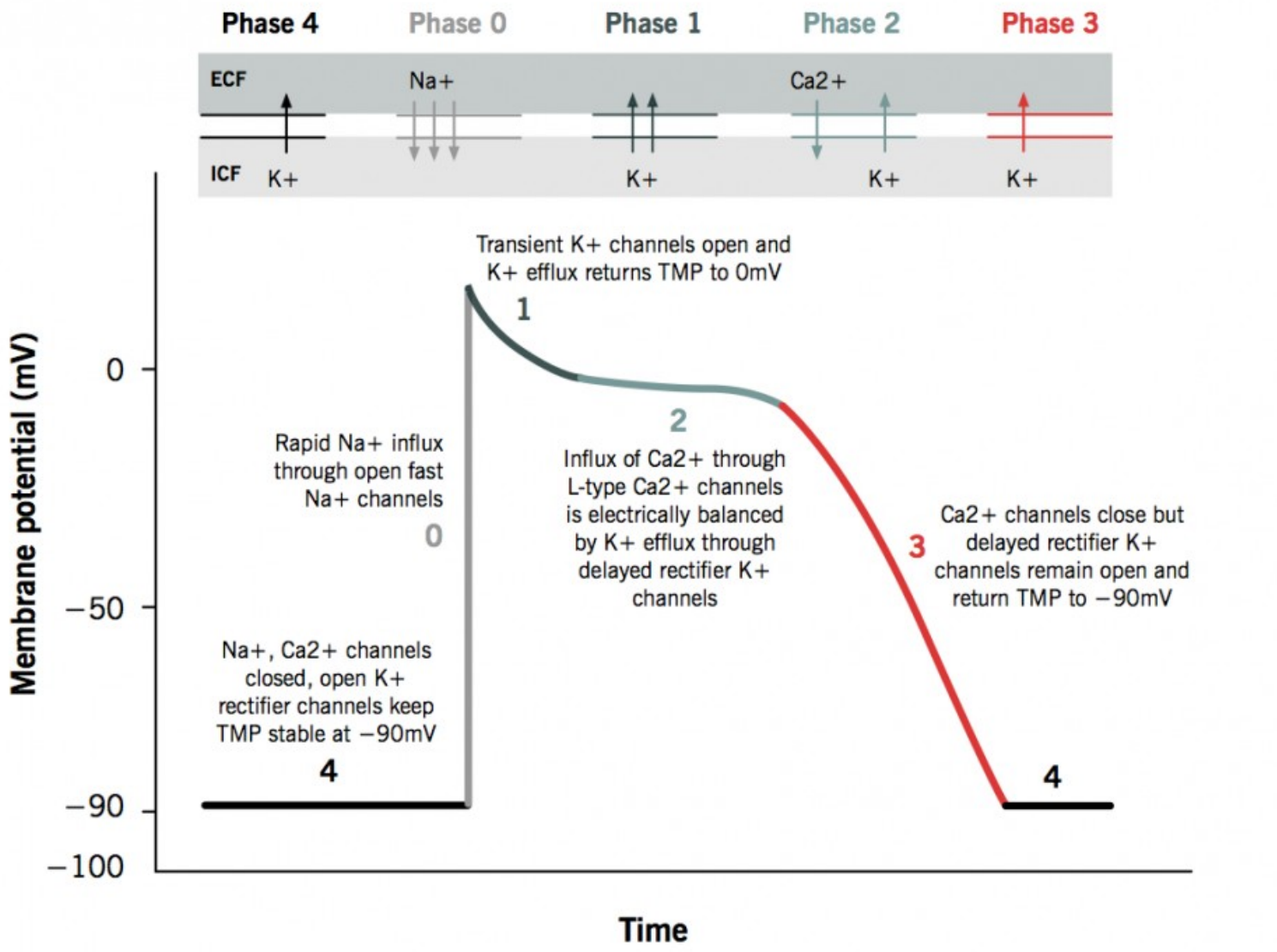




BAGNO DI DIALISI E RISCHIO ARITMICO

DIALISATO:

Na+d
K+d
Ca++d
Mg++d



BAGNO DI DIALISI E RISCHIO ARITMICO

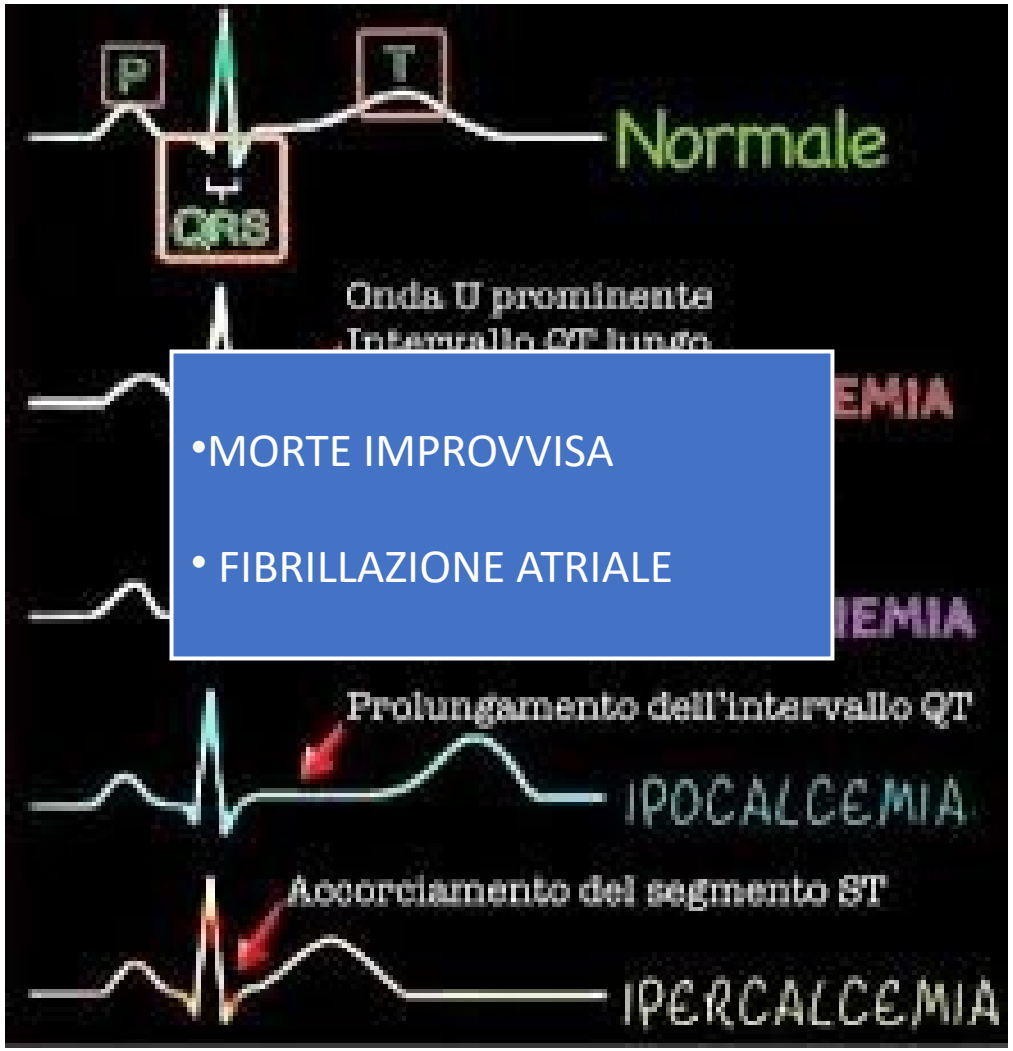
INSITO NEL CONCETTO DI INSUFFICIENZA RENALE TERMINALE IN EMODIALISI ABBIAMO ALMENO 3 SITUAZIONI:

-VALORI DI ELETTROLITI ALTERATI PRIMA DEL TRATTAMENTO DIALITICO

-CORREZIONE RAPIDA (ORE) DELLE ALTERAZIONI ELETTROLITICHE

-POTENZIALI SHIFT ECCESSIVI/INSUFFICIENTI TRA VALORI ELEVATI E NORMALI/INFERIORI AI LIMITI DI NORMA

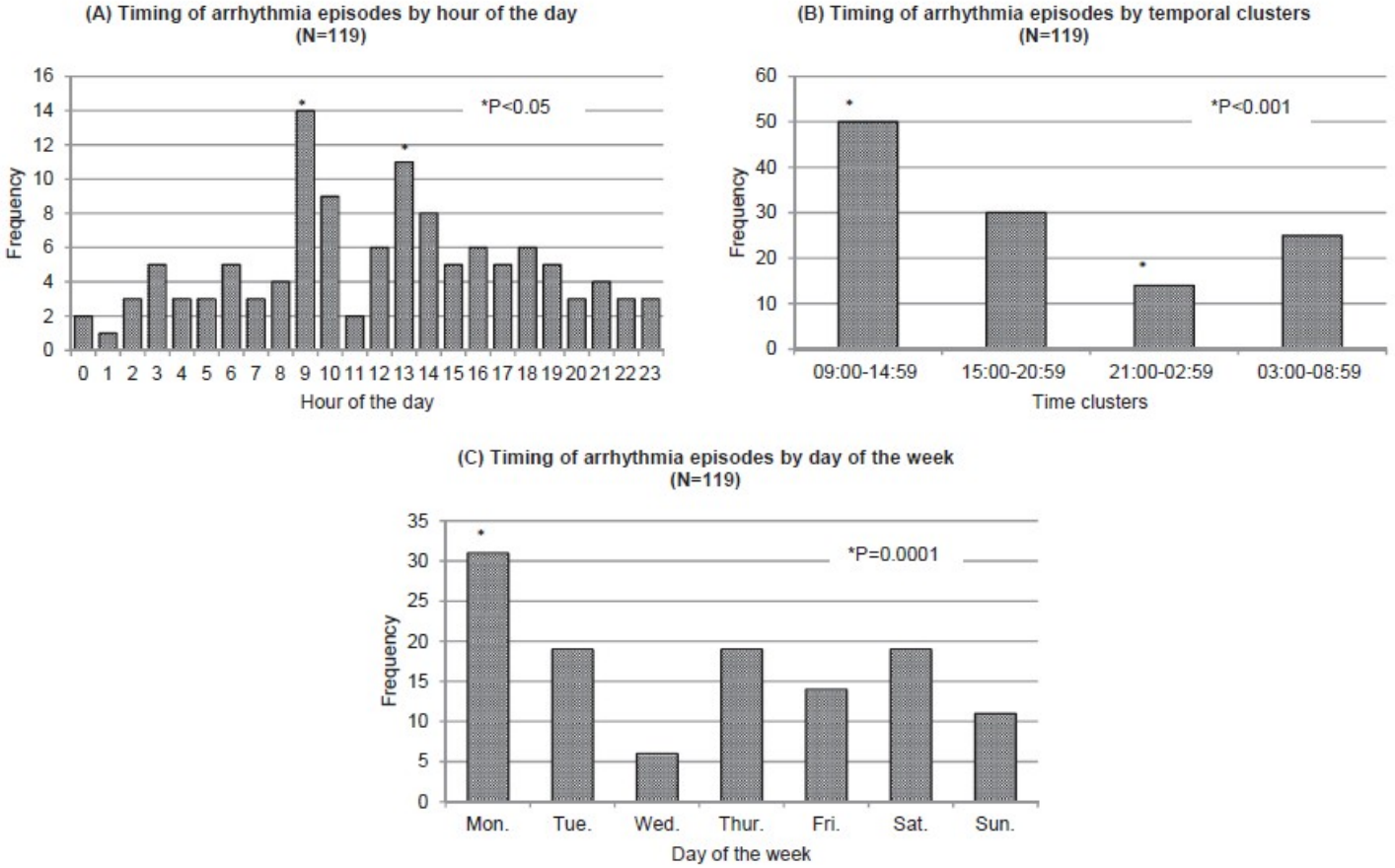
Tutte le alterazioni elettrolitiche severe portano a modificazioni dell'ECG



MORTE IMPROVVISA IN DIALISI

Sudden Cardiac Arrest in Hemodialysis Patients with Wearable Cardioverter Defibrillator

ChingpingWan, M.D., M.S.H.C.P.M.,∗ Charles A. Herzog, M.D.,†
Wojciech Zareba, M.D., Ph.D.,‡ and Steven J. Szymkiewicz,
M.D.∗



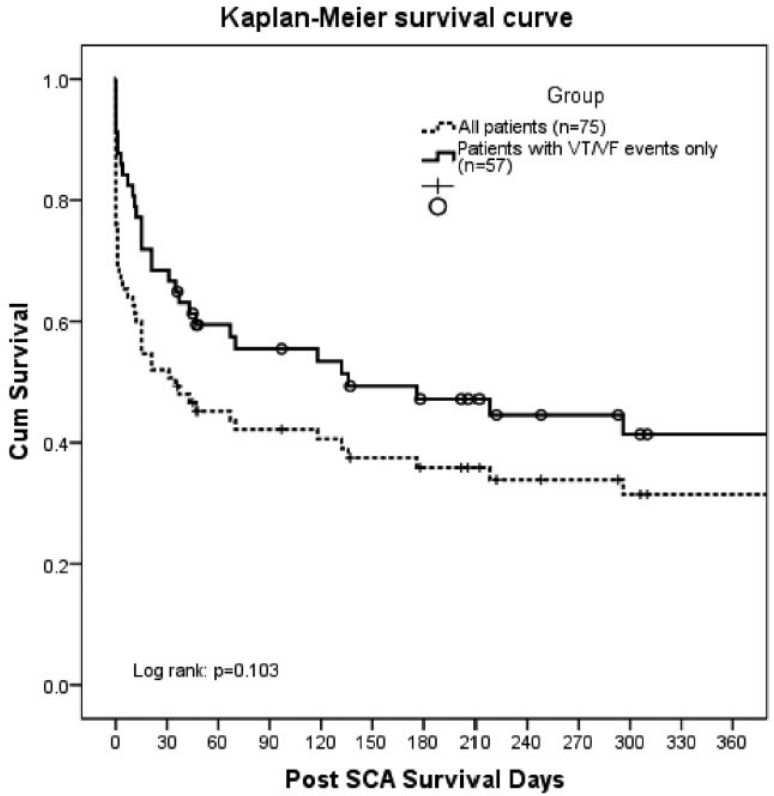
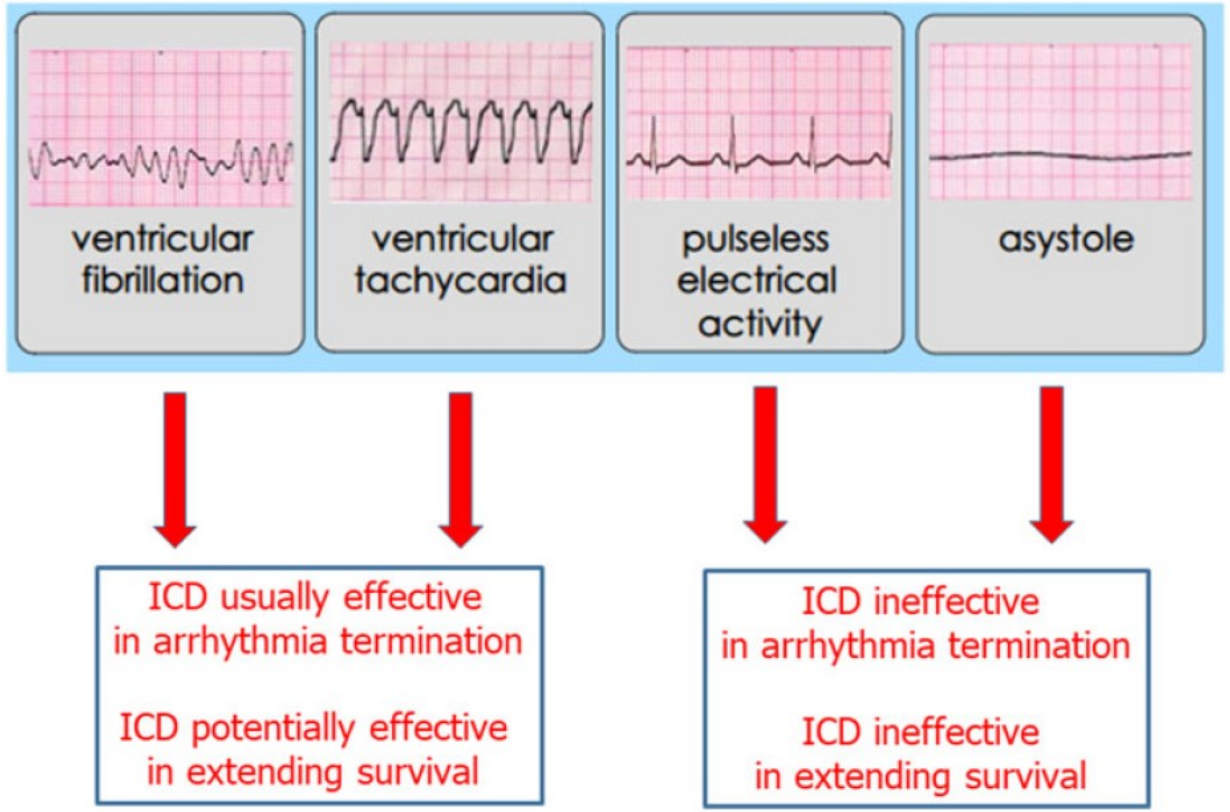


Figure 3. Kaplan–Meier survival curve.

MORTE IMPROVVISA IN DIALISI

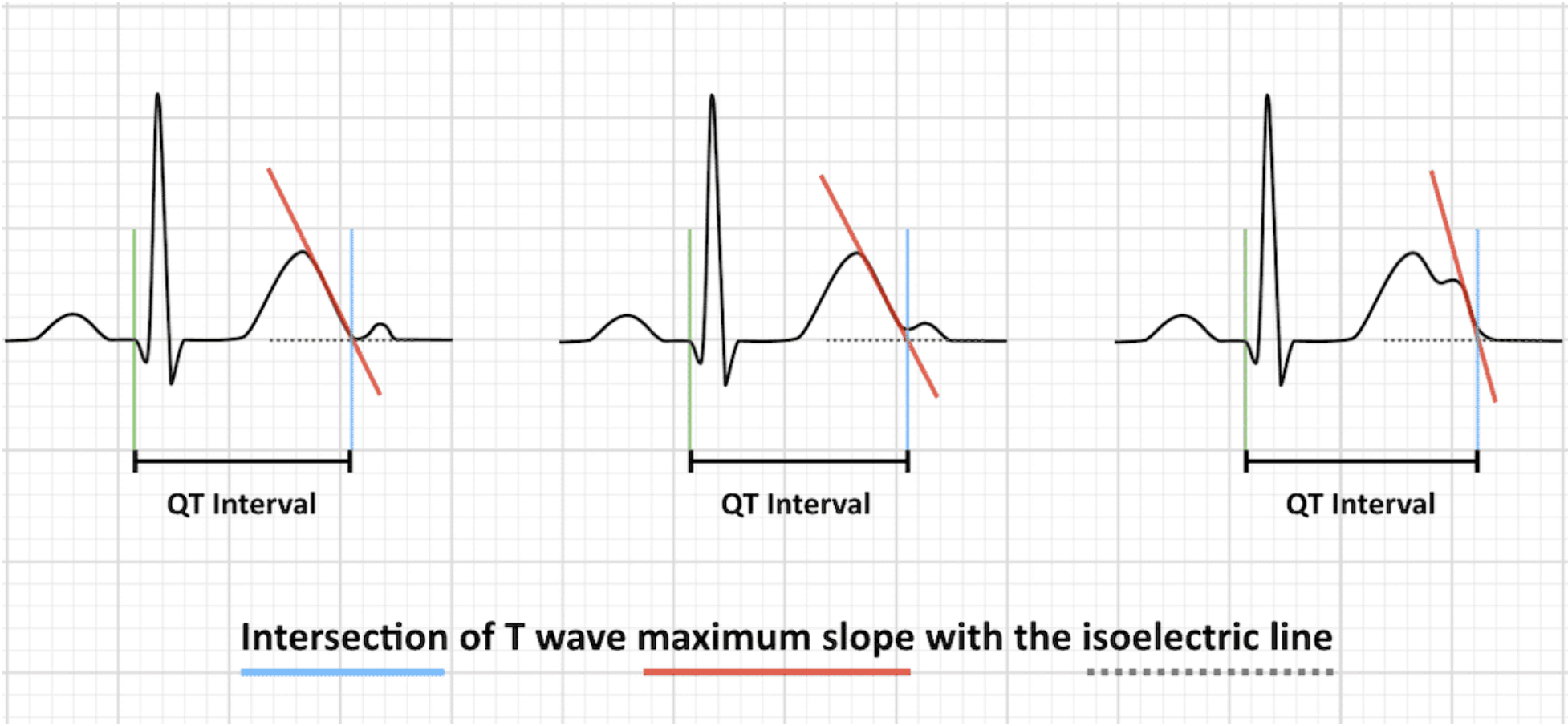


Non sempre un device è in grado di intervenire, soprattutto se le alterazioni elettrolitiche sottostanti sono molto gravi l'intervento diviene inefficace

Sudden cardiac death in dialysis patients: different causes and management strategies-EUDIAL Working Group of ERA-EDTA

BAGNO DI DIALISI E RISCHIO ARITMICO

CI SONO EVIDENZE CHE CI SPINGONO A PRESCRIVERE UN BAGNO DI DIALISI A MINOR RISCHIO ARITMICO?



BAGNO DI DIALISI E RISCHIO ARITMICO

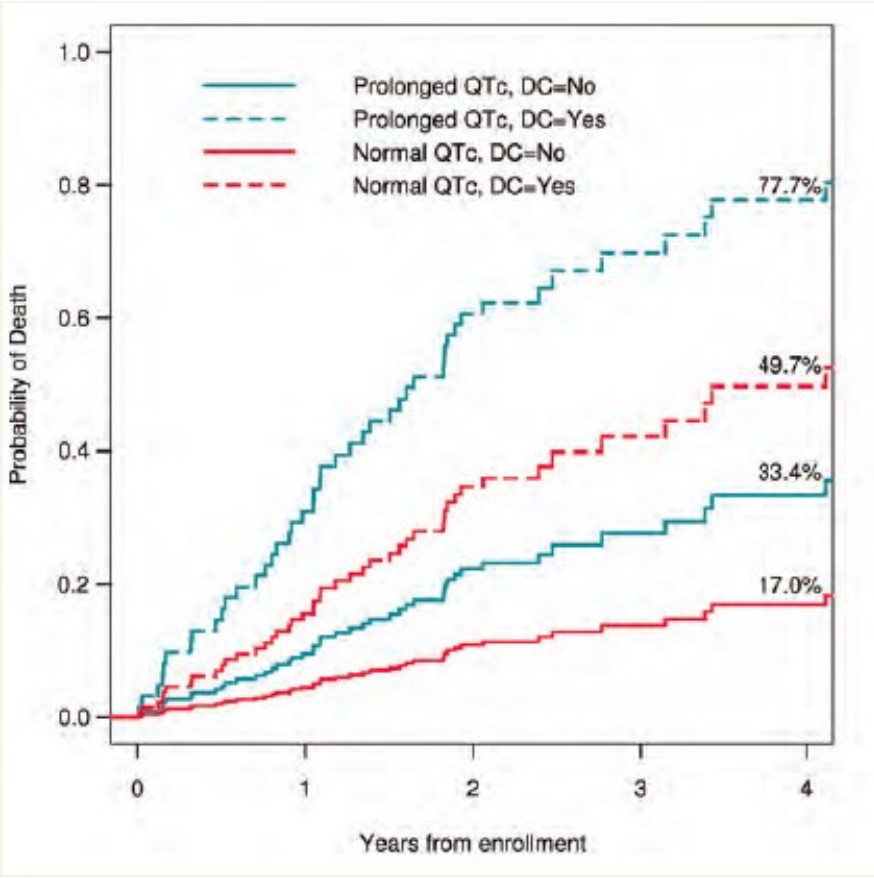
A case series of chronic haemodialysis patients: mortality, sudden death, and QT interval

Simonetta Genovesi[1,3]*, Emanuela Rossi[2], Michela Nava[1], Hilary Riva[1], Silvia De Franceschi[1], Paolo Fabbrini[3], Maria Rosa Viganò[3], Federico Pieruzzi[1,3], Andrea Stella[1,3], Maria Grazia Valsecchi[2], and Marco Stramba-Badiale[4]

Patients characteristics	Median (*n*)	IQR (%)
Age (years)	71.3	62.9–76.6
Haemodialysis duration (years)	3.0	1.3–7.8
Gender (male)	79	64.8

Table 3 Causes of death in patients with normal and prolonged QTc interval

Cause of death	Normal QTc (*n* = 78) *n* (%)	Prolonged QTc (*n* = 44) *n* (%)	Total (*n* = 122) *n* (%)
Cardiovascular	**6 (7.7)**	**14 (31.8)**	**20 (16.4)**
Sudden	2 (2.6)	10 (22.7)	12 (9.8)
Non-sudden	4 (5.1)	4 (9.1)	8 (6.6)
Non-cardiovascular	**19 (24.3)**	**12 (27.3)**	**31 (25.4)**
Sepsis	2 (2.6)	5 (11.4)	7 (5.7)
Neoplasia	4 (5.1)	3 (6.8)	7 (5.7)
Cachexia	10 (12.8)	3 (6.8)	13 (10.7)
Other	3 (3.8)	1 (2.3)	4 (3.3)
Total events	**25 (32.0)**	**26 (59.1)**	**51 (41.8)**



BAGNO DI DIALISI E RISCHIO ARITMICO

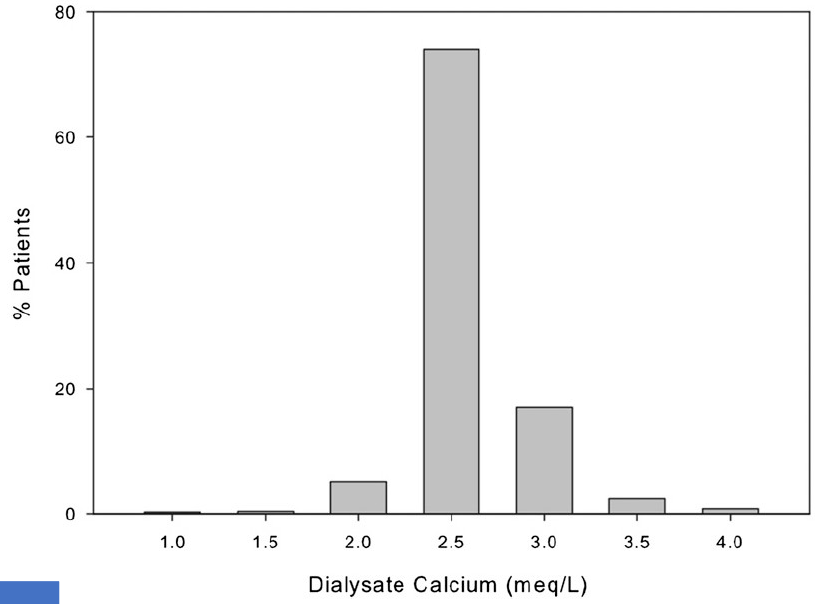
Dialysate Calcium Concentration and the Risk of Sudden Cardiac Arrest in Hemodialysis Patients

Patrick H. Pun,[*†] *John R. Horton,*[†] *and John P. Middleton**

Table 2. Unadjusted and adjusted associations between relevant factors related to calcium homeostasis and risk of sudden cardiac arrest

Parameter	Unadjusted OR (95% CI)	*P* Value	Adjusted[a] OR (95% CI)	*P* Value
Predialysis corrected serum calcium (per 1 mg/dl increase)	1.10 (1.00–1.20)	0.05	1.10 (1.00–1.30)	0.05
Dialysate calcium<2.5 meq/L	2.00 (1.40–2.80)	<0.001	2.00 (1.40–2.90)	<0.001
Serum-to-dialysate calcium gradient (per 1 meq/L increase)	1.40 (1.10–1.60)	<0.001	1.40 (1.10–1.80)	0.002
QT medication exposure	1.20 (1.00–1.50)	0.06	1.00 (0.80–1.30)	0.80

[a]Adjusted for history of coronary artery disease or congestive heart failure; number of years on dialysis; prescription of calcium-containing medication, vitamin D, antiarrhythmic medication, angiotensin-converting enzyme inhibitor/angiotensin receptor blocker, and β-blockers; potassium dialysate assignment and percent fluid removed during treatment; and serum potassium, bicarbonate, creatinine, albumin, and hemoglobin values.



This case-control study among 43,200 hemodialysis patients occurred between 2002 and 2005;
510 patients who experienced a witnessed sudden cardiac arrest were compared with 1560 matched controls.

BAGNO DI DIALISI E INTERVALLO QT

Electrolyte concentration during haemodialysis and QT interval prolongation in uraemic patients

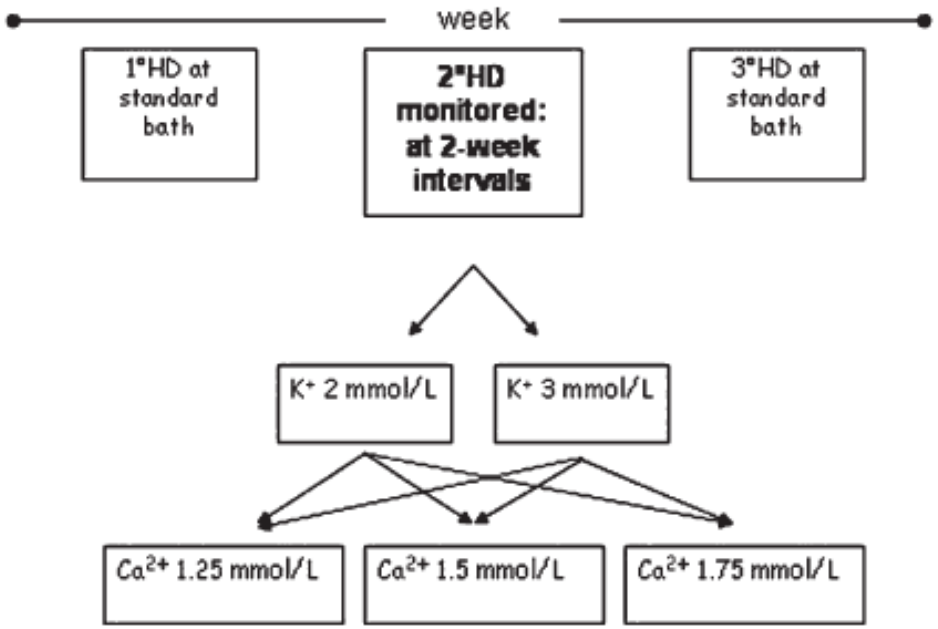


Table 1 Demographic and clinical characteristics of study subjects

Number of patients (males %)	16 (62.5)
Age (years: mean ± SD)	65.7 ± 9.7
Causes of ESRD (*n*)	
Glomerulonephritis	3
PKD	3
DM	2
Pyelonephritis	2
Kidney cancer	1
HT nephroscelrosis	1
Multiple myeloma	1
Unknown	3
Time of dialysis (month, mean ± SD)	76.5 ± 73.9
Ultrafiltration volume (L/h mean ± SD)	0.72 ± 0.13

ESRD, end-stage renal disease; PKD, polycystic kidney disease; DM, diabetes mellitus; HT, arterial hypertension.

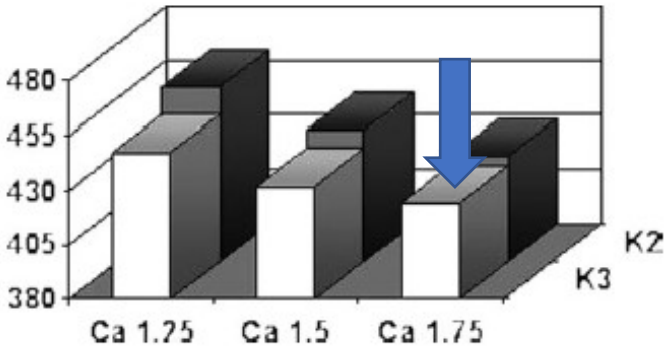
Genovesi S. et al Europace (2008) 10, 771–777

BAGNO DI DIALISI E INTERVALLO QT

Table 3 QT interval corrected for heart rate (QTc, ms) modifications according to dialysis bath (mmol/L)

	Pre-HD	I h	II h	III h	IV h	Post-HD
K^+ 2 Ca^{2+}1.25	434 ± 14	442 ± 18*	448 ± 20*	458 ± 19*	460 ± 26*	452 ± 19*
K^+ 2 Ca^{2+}1.5	427 ± 22	430 ± 24	432 ± 25	439 ± 25**	440 ± 28*	435 ± 25
K^+ 2 Ca^{2+}1.75	428 ± 25	424 ± 24	424 ± 23	428 ± 22**	428 ± 24**	432 ± 26
K^+ 3 Ca^{2+}1.25	427 ± 19	425 ± 20	432 ± 24	444 ± 28*	447 ± 24*	449 ± 26*
K^+ 3 Ca^{2+}1.5	423 ± 24	424 ± 22	426 ± 22	430 ± 20**	432 ± 24	438 ± 28
K^+ 3 Ca^{2+}1.75	430 ± 27	425 ± 28	423 ± 29	424 ± 26**	424 ± 28**	425 ± 32**

*$P < 0.05$ vs. Pre-HD (one-way analysis of variance).
**$P < 0.05$ vs. K^+ 2 Ca^{2+} 1.25 (two-way analysis of variance).



Una combinazione di K + 3 e Ca ++ 1.75 risultava la meno “aritmogena possibile” almeno sul parametro QT, preso in considerazione in questo studio

BAGNO DI DIALISI E INTERVALLO QT

Bilancio del potassio e battiti ectopici ventricolari (PVC) in AFB e AFBk

Tecnica dialitica	K^+ rimosso (mEq/L)	PVC (n/h)
AFB	**88.0**	**424**
AFBk	**92.0**	**308**
P	**NS**	**< 0.05**

Santoro et al. *G Ital Nefrol* 2006; 23: 552-559

BAGNO DI DIALISI E INTERVALLO QT

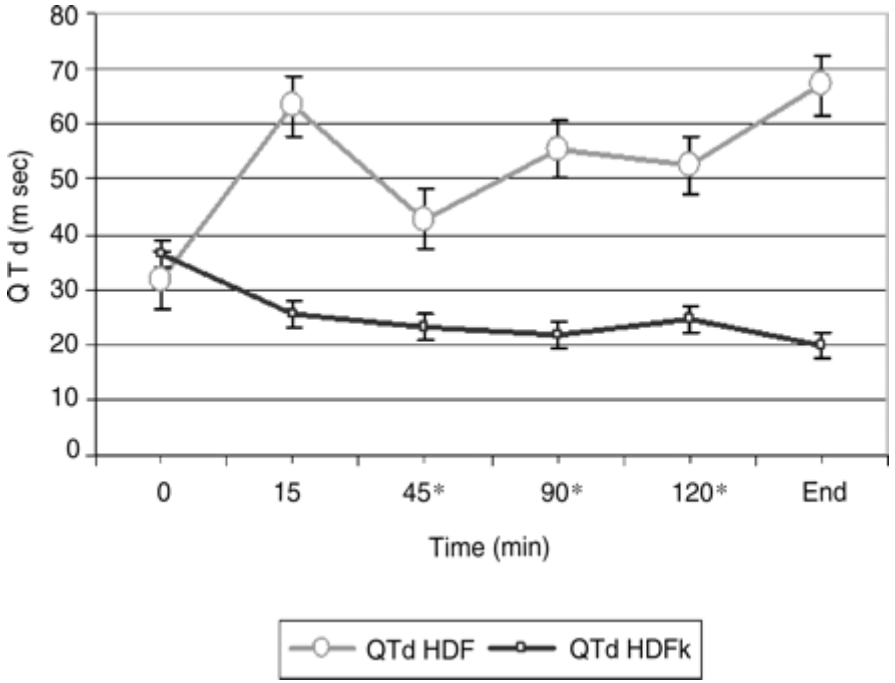
Changes induces by HD in arrhytmic dialized patients

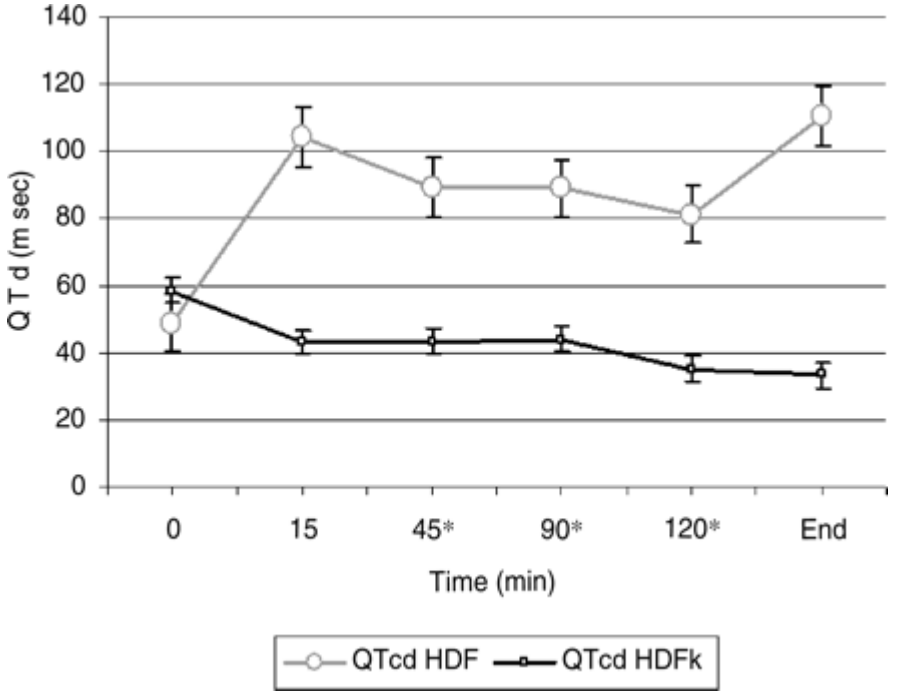
ECG parameters	Hemodialysis treatment	
	Constant K AFB	Profiled K AFB
QTc, ms, mean (SD)		
Pre HD	432.6 ± 41.3	434.6 ± 40.6
2 hr after start HD	460.3 ± 43.7	449.3 ± 40.1
Post HD	456.8 ± 24.4 ¤	448.8 ± 24.2 ¤
QTd, ms, median (range)		
Pre HD	67.0 (18- 82)	65.0 (35 – 80)
2 hr after start HD	80.0 (40 – 140)	60.0 (20 – 80)
Post HD	66.6 (25 – 81)	65.0 (48 – 75)
PVC, n/24 hr, median (range)	444.5 (23 – 13,565) ¤	163.5 (21 – 900) ¤
Grade I-II n° of pts (%)	7 (58.3)	12 (100)
Grade III – IVa - IVb n° of pts (%)	5 (41.7)	0

¤ p = 0.039

Munoz et al. *Hemodialysis International* 2008; 12: 108-113.

BAGNO DI DIALISI E INTERVALLO QT



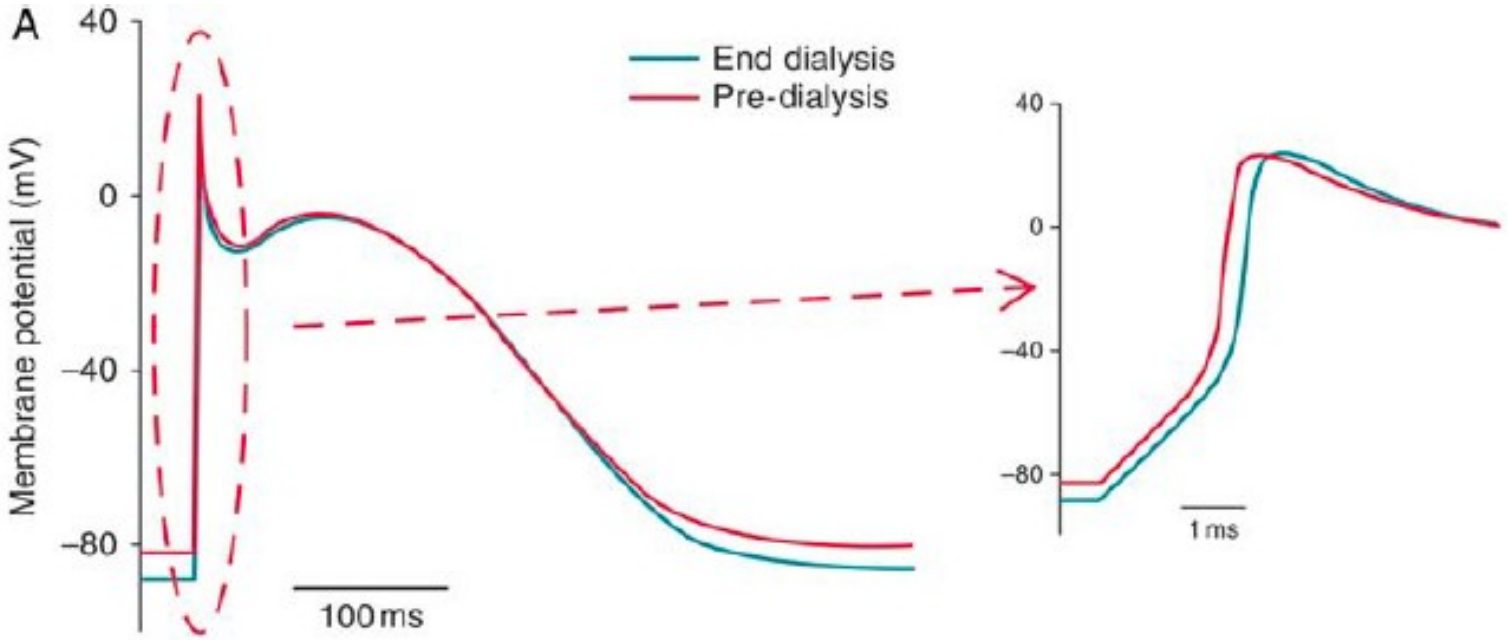


La emodiafiltrazione a potassio variabile tende a mantenere la dispersione del QTd e QTdc pressochè costante (40 msec), rispetto alla metodica tradizionale (tra 40 e 115 msec).

Buemi et al. *Nephrol Dial Transplant* 2005; 20: 1148 - 1154

BAGNO DI DIALISI E RISCHIO ARITMICO

CI SONO EVIDENZE CHE CI SPINGONO A PRESCRIVERE UN BAGNO DI DIALISI A MINOR RISCHIO ARITMICO?



L'ONDA P è una analisi "non convenzionale " elettrocardiografica, che correla con la possibilità di insorgenza di una aritmia sovraventricolare, in poche parole è un omologo del QT. Questo parametro muta durante il trattamento dialitico in modo significativo

MODIFICAZIONI DELL'ONDA P CORRELANO COL RISCHIO DI SVILUPPARE FIBRILLAZIONE ATRIALE

BAGNO DI DIALISI E ONDA P

Alterations of atrial electrophysiology induced by electrolyte variations: combined computational and P-wave analysis

Stefano Severi[1], Daniela Pogliani[2,3], Giulia Fantini[1], Paolo Fabbrini[3], Maria Rosa Viganò[3], Eleonora Galbiati[2], Giuseppe Bonforte[4], Antonio Vincenti[5], Andrea Stella[2,3], and Simonetta Genovesi[2,3]*

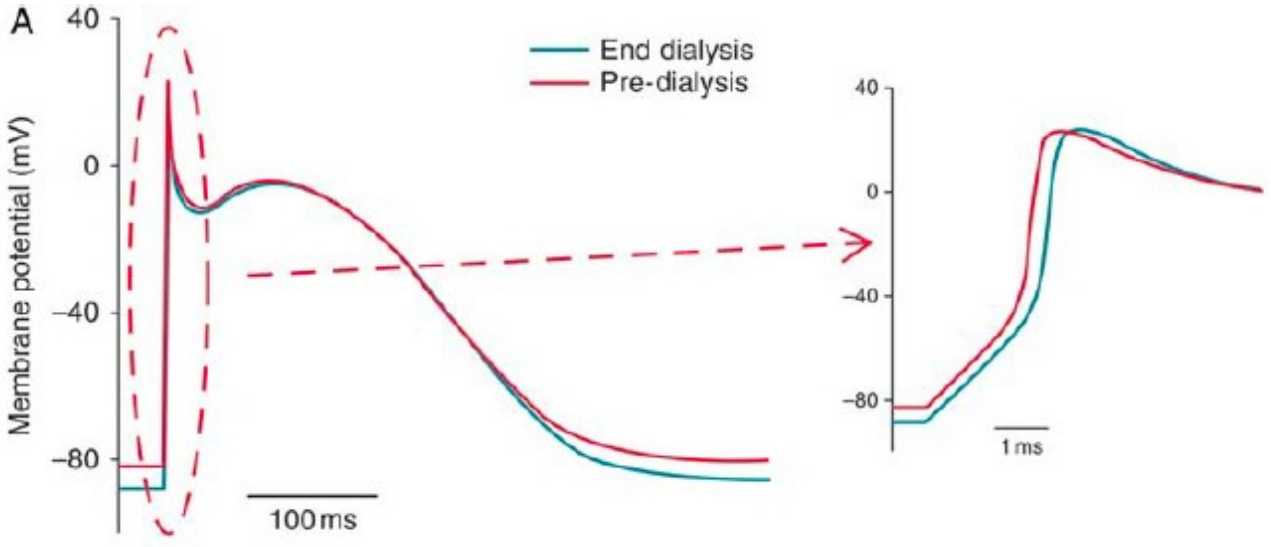
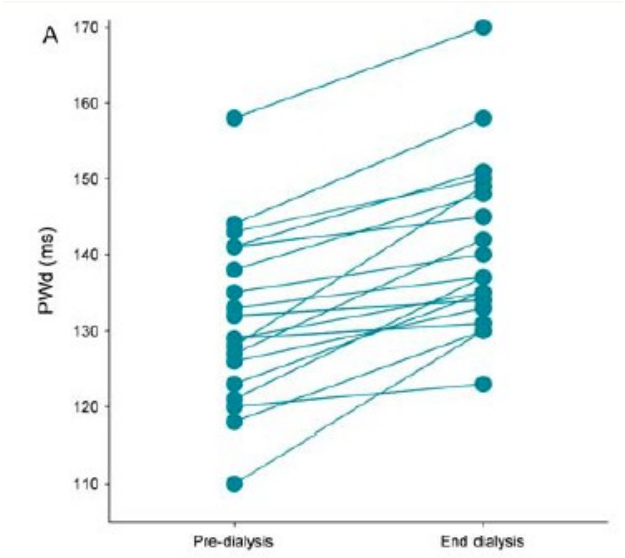
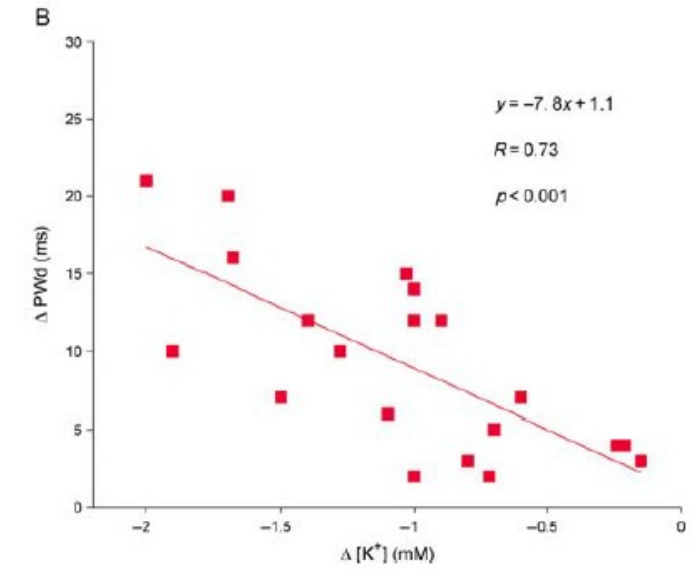


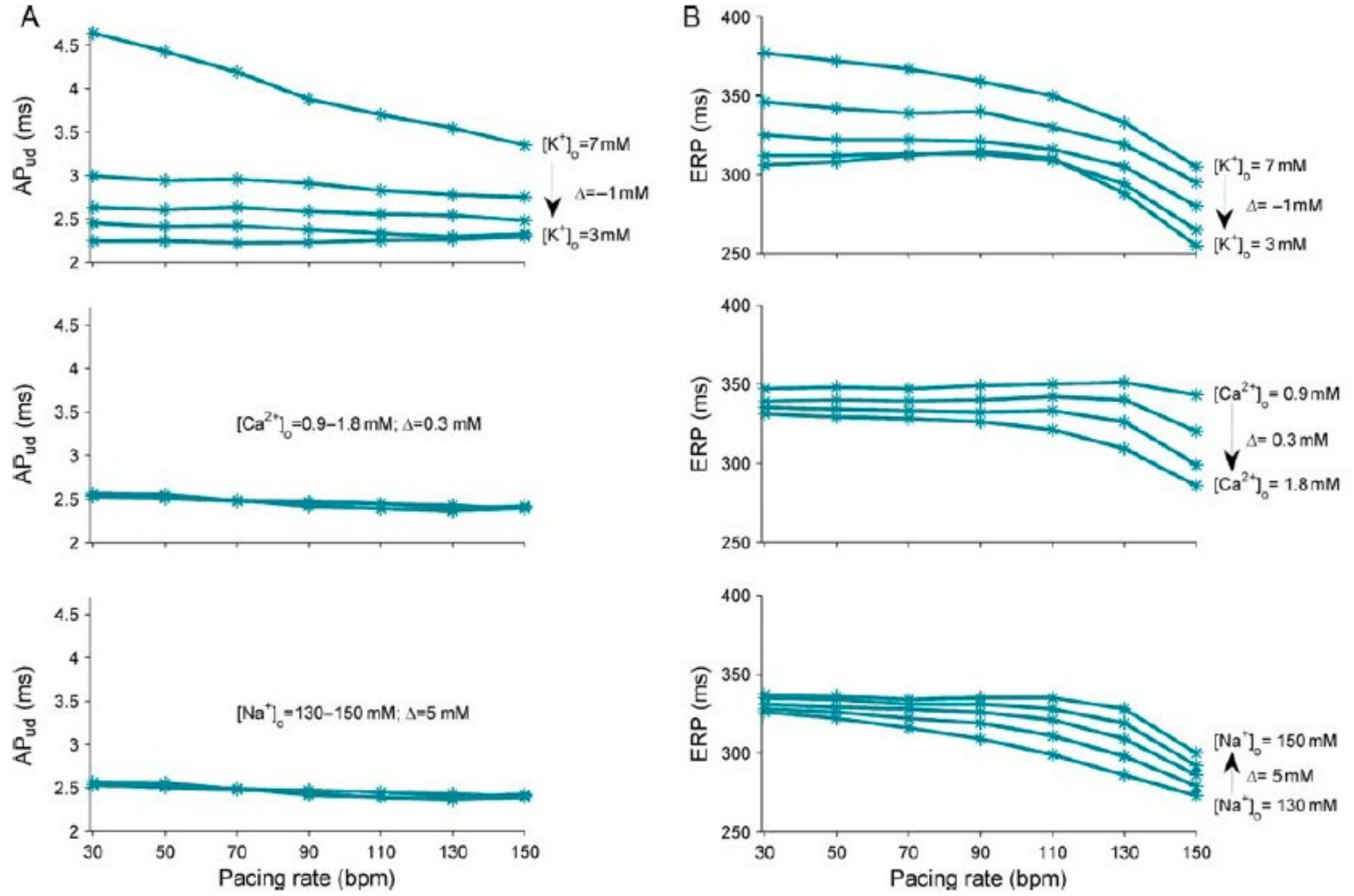
Table 1 Haemodialysis-induced changes in electrolyte concentrations and haemodynamic variables

	Pre-dialysis	End dialysis	*P*-value
HR (bpm)	72 ± 13	71 ± 14	NS
SBP (mmHg)	138 ± 17	135 ± 18	NS
DBP (mmHg)	75 ± 13	70 ± 15	NS
$[K^+]_o$ (mM)	4.9 ± 0.5	3.9 ± 0.4	<0.001
$[Na^+]_o$ (mM)	139.8 ± 3.4	141.6 ± 3.1	<0.05
$[Ca^{2+}]_o$ (mM)	1.18 ± 0.09	1.30 ± 0.07	<0.001
$[Mg^{2+}]_o$ (mM)	0.92 ± 0.08	0.86 ± 0.05	<0.05
pH	7.39 ± 0.04	7.45 ± 0.04	<0.001
HCO_3^- (mM)	23.5 ± 3.6	28.5 ± 2.1	<0.001

BAGNO DI DIALISI E ONDA P

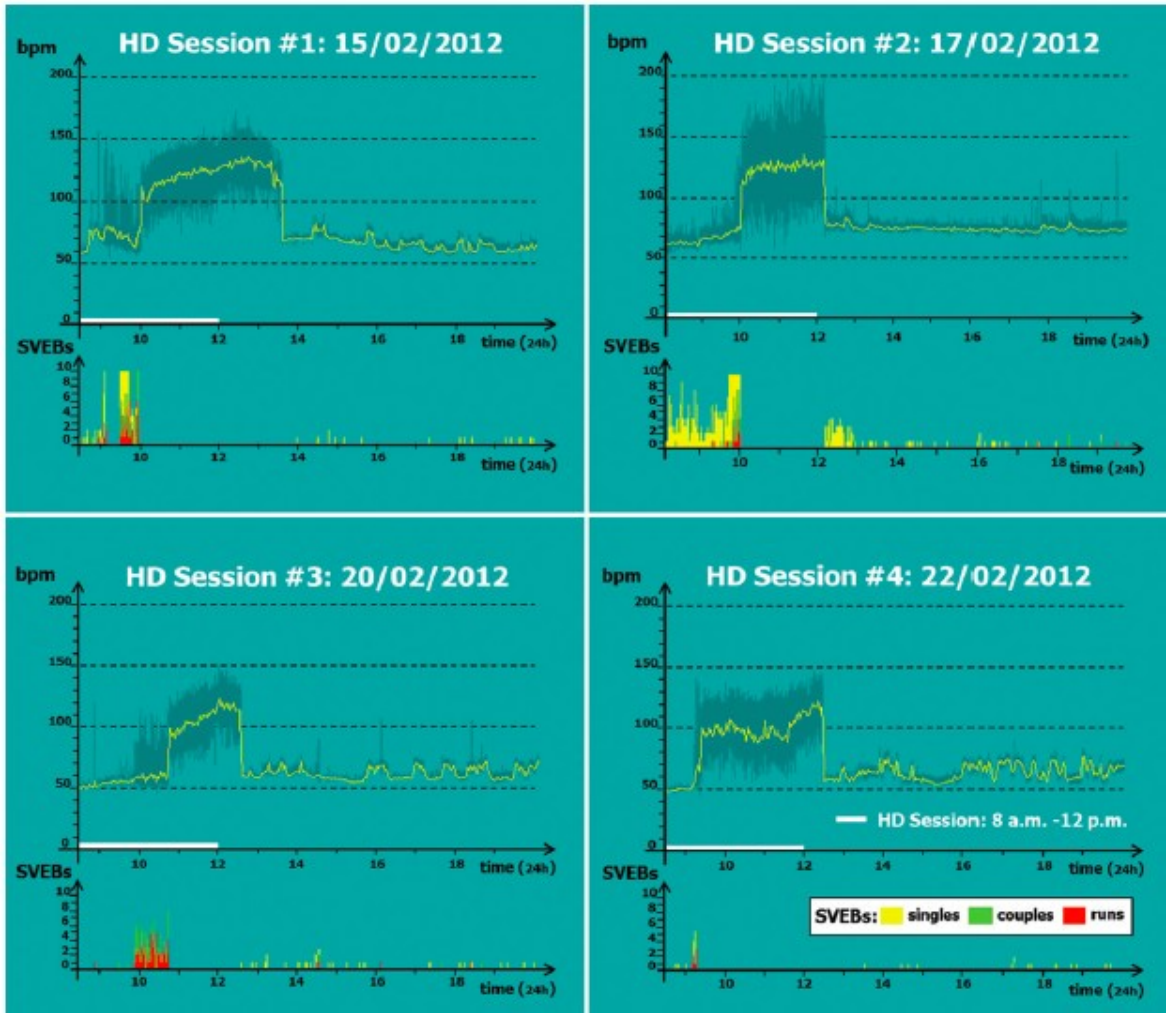


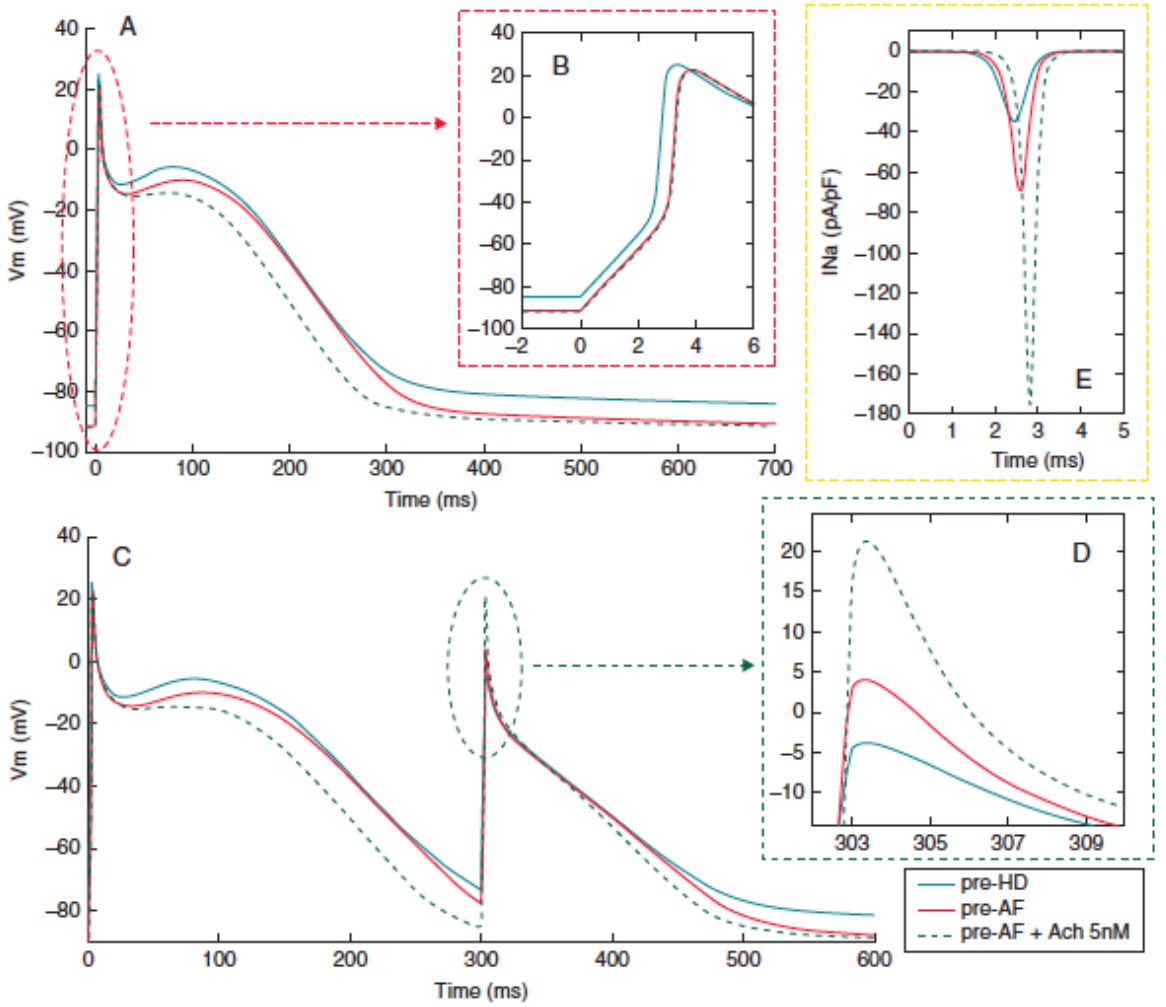




BAGNO DI DIALISI E ONDA P

Recurrent intradialytic paroxysmal atrial fibrillation: hypotheses on onset mechanisms based on clinical data and computational analysis





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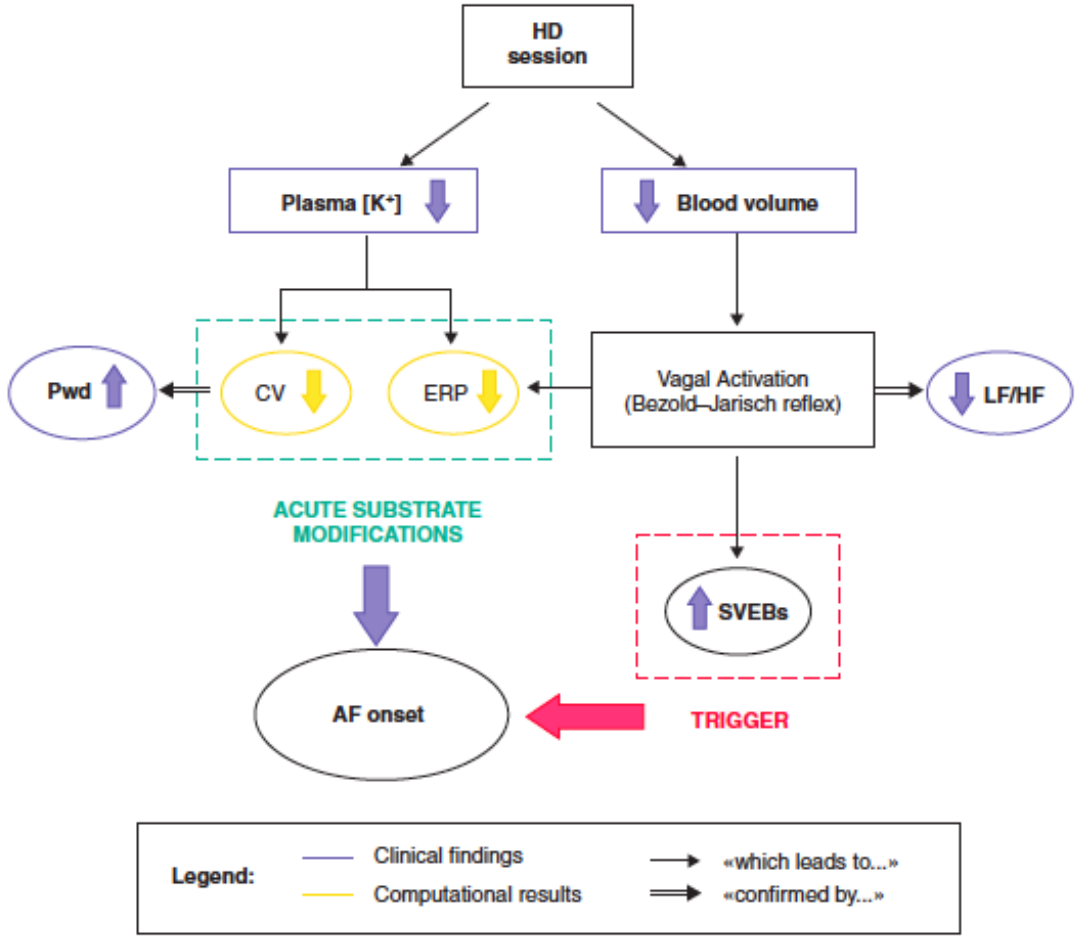

Figure 3 Schematic diagram of the mechanisms involved in atrial onset during HD sessions. AF, atrial fibrillation; HD, haemodialysis; CV, conduction velocity; ERP, effective refractory period; Pwd, P-wave duration; SVEBs, supraventricular ectopic beats; LF/HF, low frequency/high frequency ratio.

Recurrent intradialytic paroxysmal atrial fibrillation: hypotheses on onset mechanisms based on clinical data and computational analysis

Antonio Vincenti[1], Elisa Passini[2†], Paolo Fabbrini[3], Maria Carmen Luise[4], Stefano Severi[2], and Simonetta Genovesi[3,4*]

CONCLUSIONI

TAKE HOME MESSAGES:

-IL BAGNO DI DIALISI VA PERSONALIZZATO

-LO SWITCH ELETRROLITICO DI POTASSIO E CALCIO HA UN RUOLO IMPORTANTE NEL MODIFICARE IL POTENZIALE DI AZIONE DELLA CELLULA MIOCARDICA

-UN BAGNO IDEALE DEVE QUINDI RIDURRE IL PIÙ POSSIBILE L'IMPATTO DI QUESTE VARIAZIONI RIDUCENDO SIA IL RISCHIO DI UNA CORREZIONE ECCESSIVA (ES IPOKALIEMIA A FINE DIALISI) CHE DI UNA CORREZIONE INEFFICACE

-NELLA PRESCRIZIONE DIALITICA OLTRE CHE IL VALORE ASSOLUTO DI VARUAZIONE DEGLI ELETTROLIYI È NECESSARIO CONSUDERARE ANCHE IL FATTORE TEMPO NELL'OTTENERE LA RIDUZIONE