



PROGRAMMA

1° CONVEGNO NAZIONALE CONGIUNTO SIN - SID

La Malattia Renale Diabetica (DKD):

**Presente e Futuro dell'Approccio
Integrato Nefro-Diabetologico**

TEAM WORK FOR WORK SUCCESS

RIMINI, 2 OTTOBRE 2019



La scelta della terapia dialitica nel nefropatico diabetico

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Trapianto**

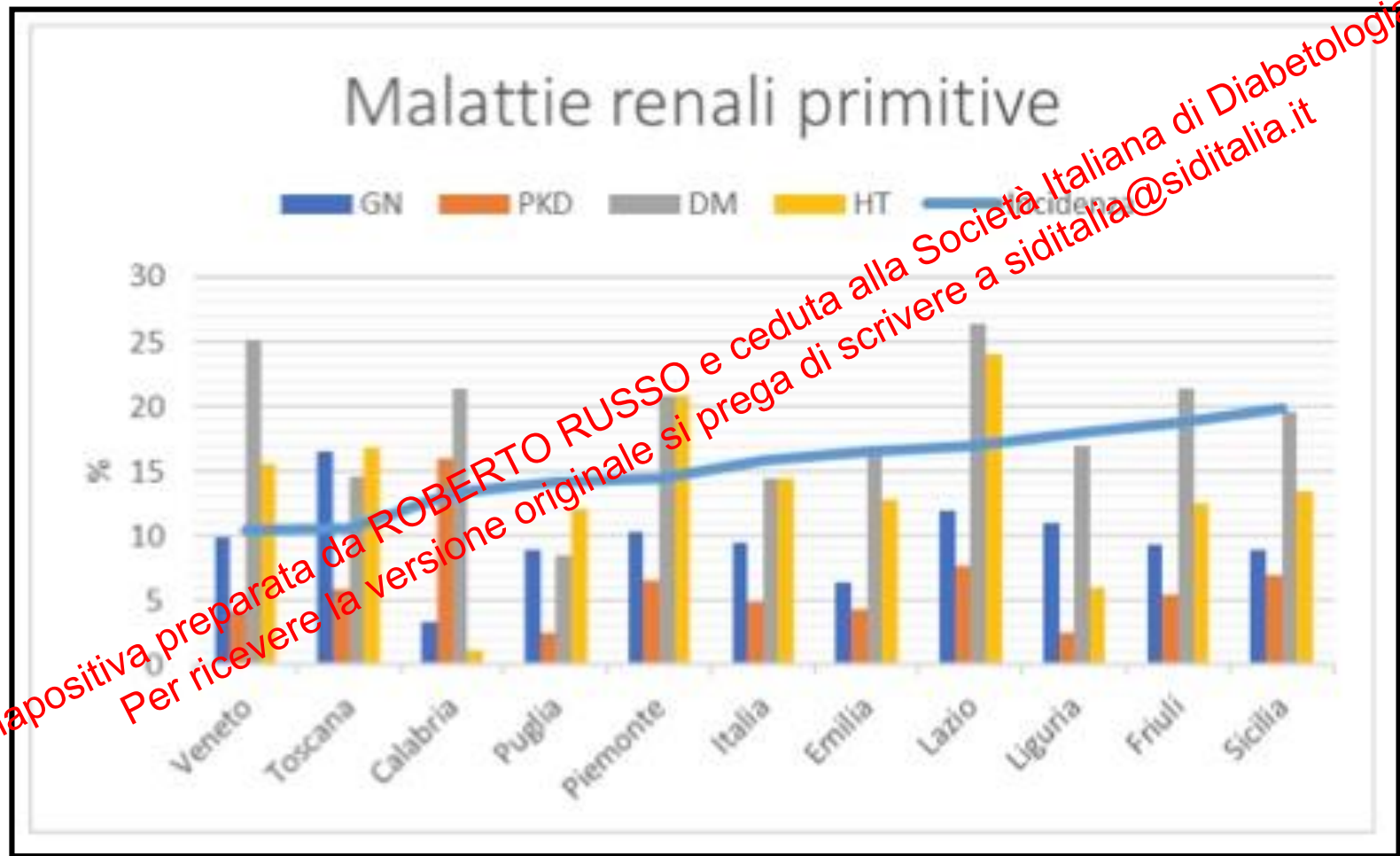
Azienda Ospedaliero

Universitaria Policlinico di Bari

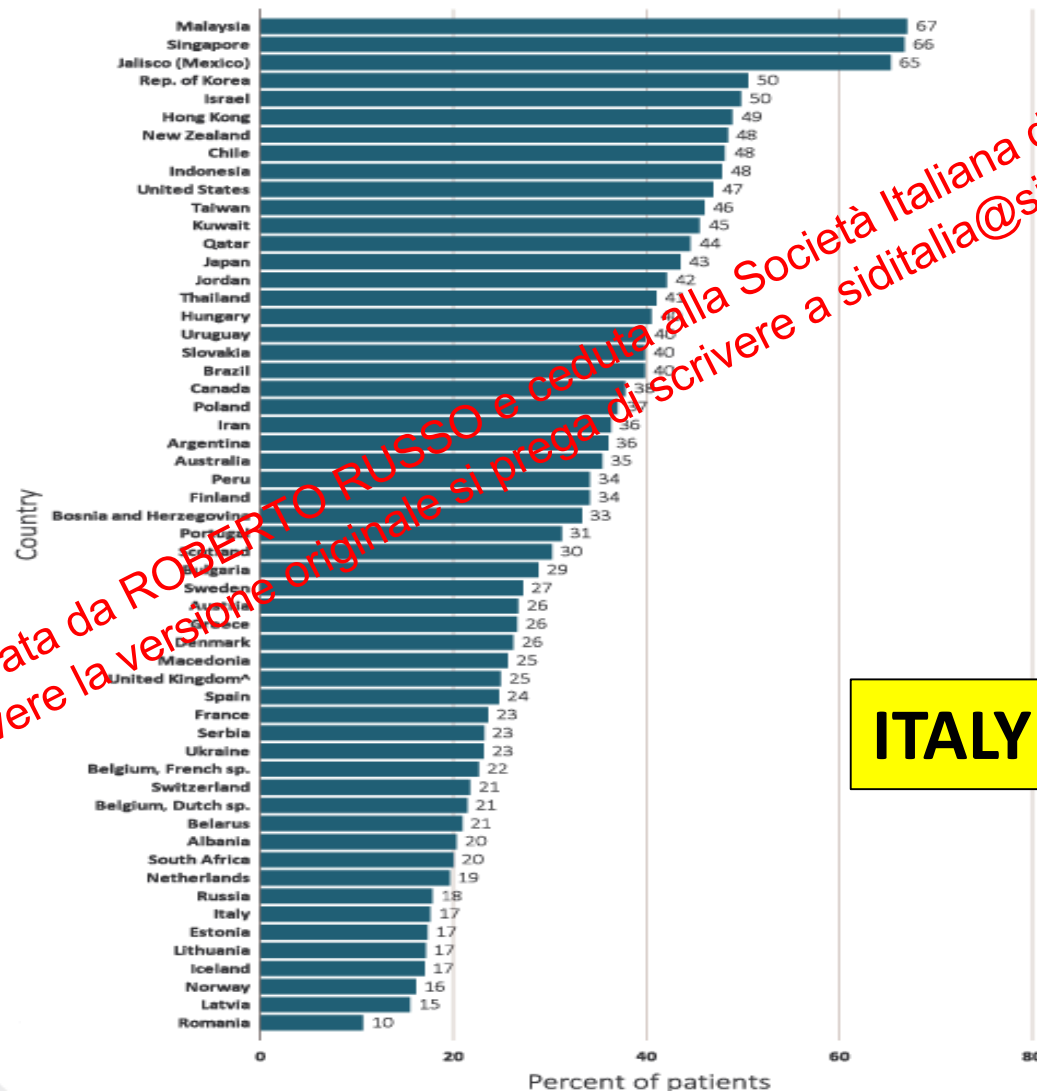
Diabetes is the most common cause of end-stage kidney diseases in most countries

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Registro Italiano Dialisi e Trapianto



Incidence of treated ESRD due to diabetes – International comparison



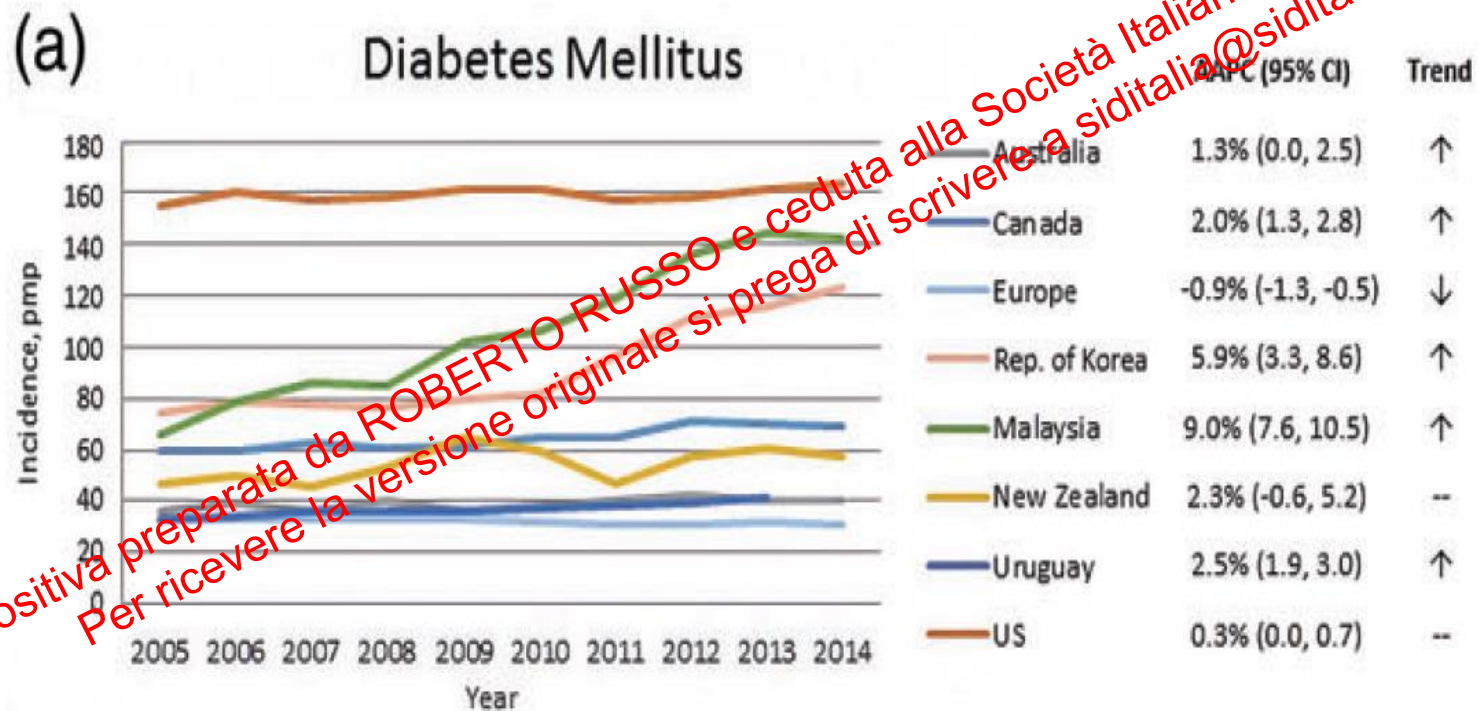
ITALY 17%

Percent of patients

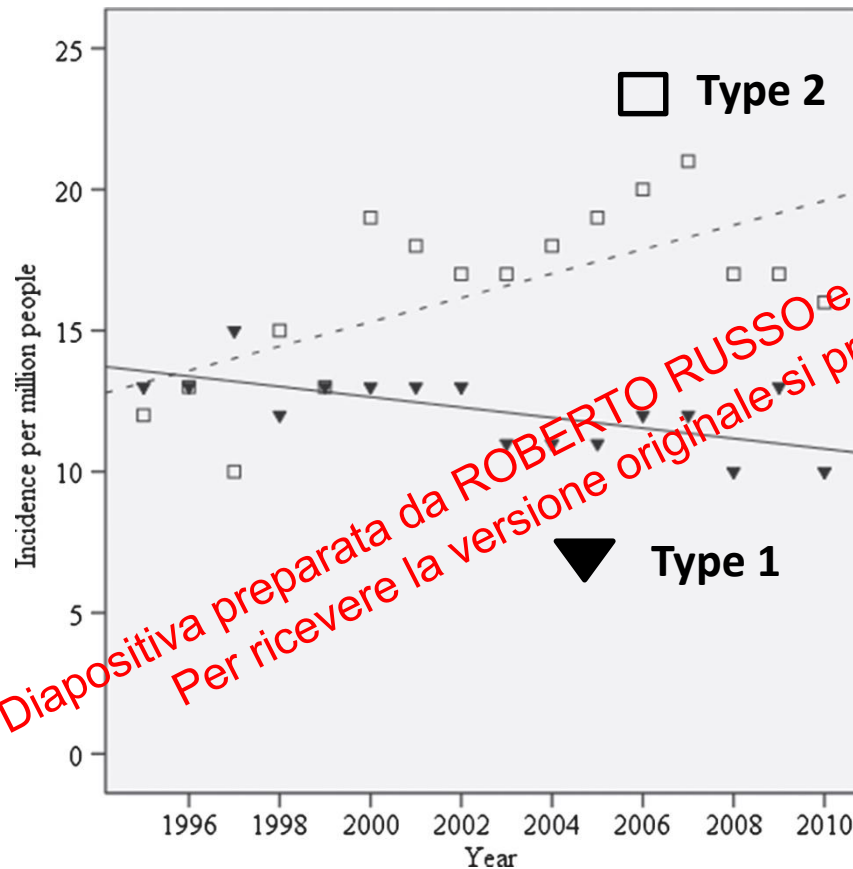
USRDS 2018

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International comparison of trends in patients commencing renal replacement therapy by primary renal disease

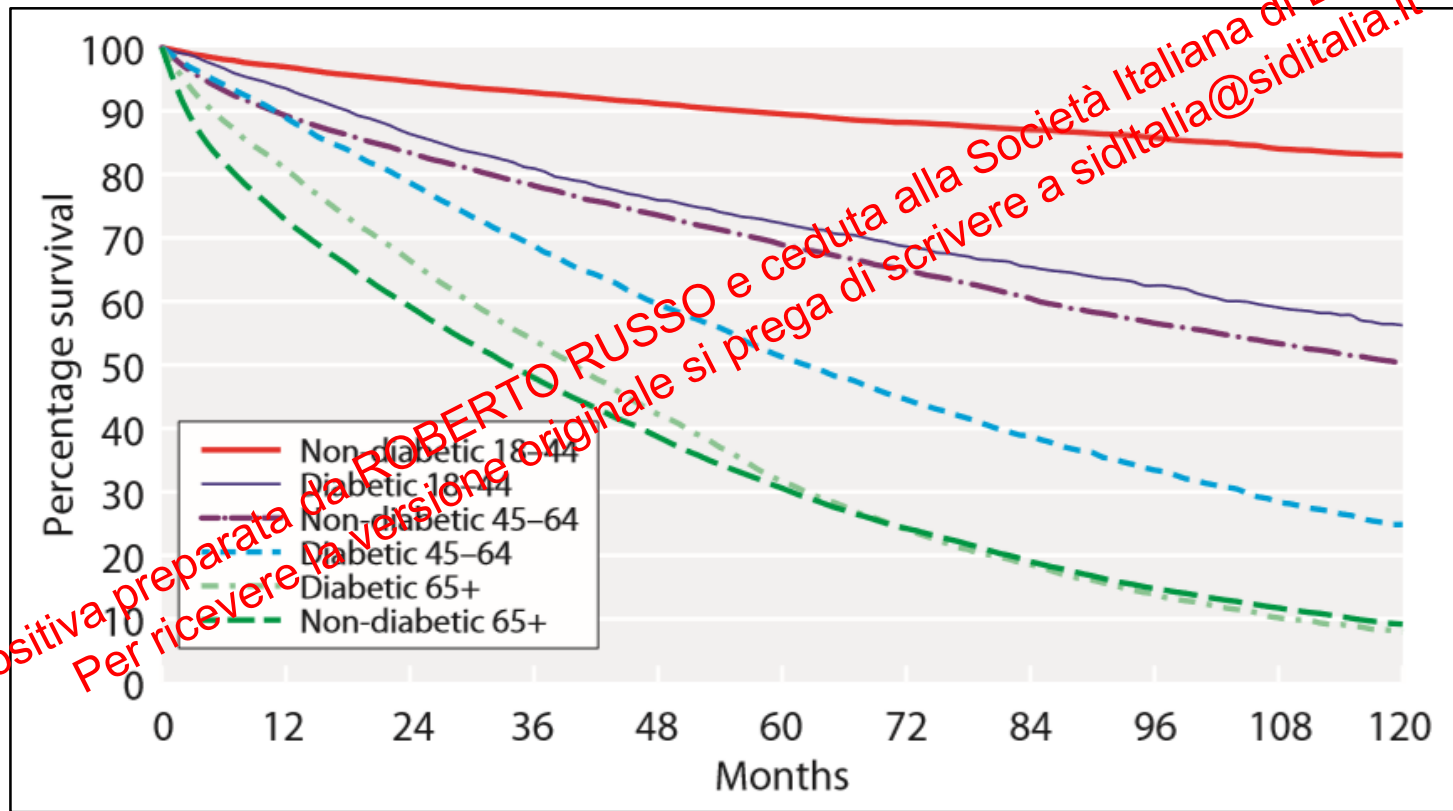


Renal replacement therapy trends due to diabetes

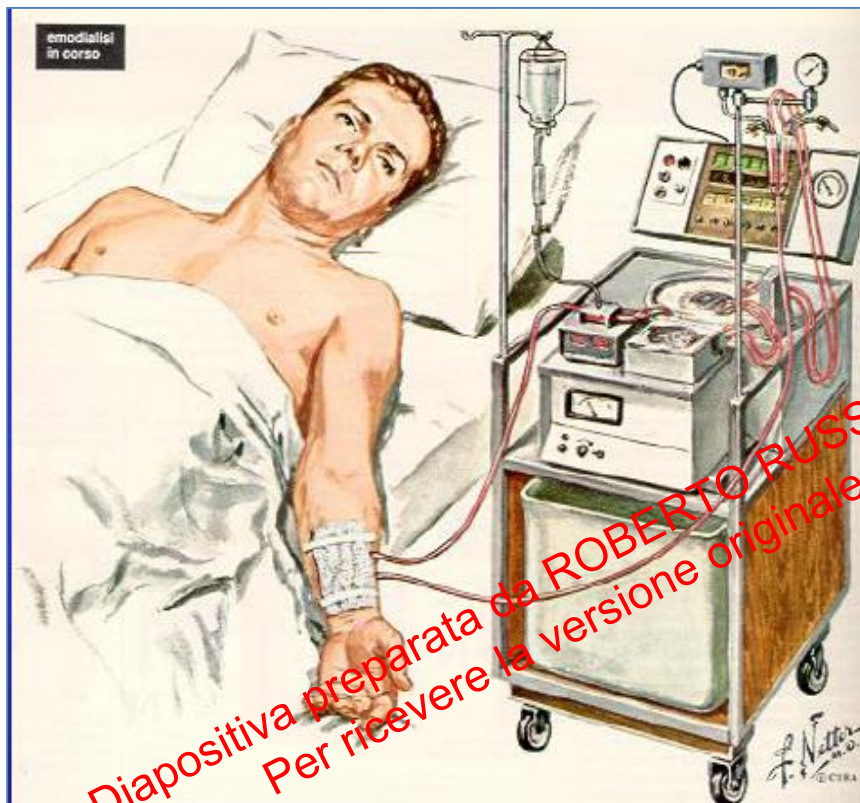


In patients with **type 1 diabetes** there is a significant decrease in need for RRT over the years while for patients with **type 2** there was an increase in the need of RRT

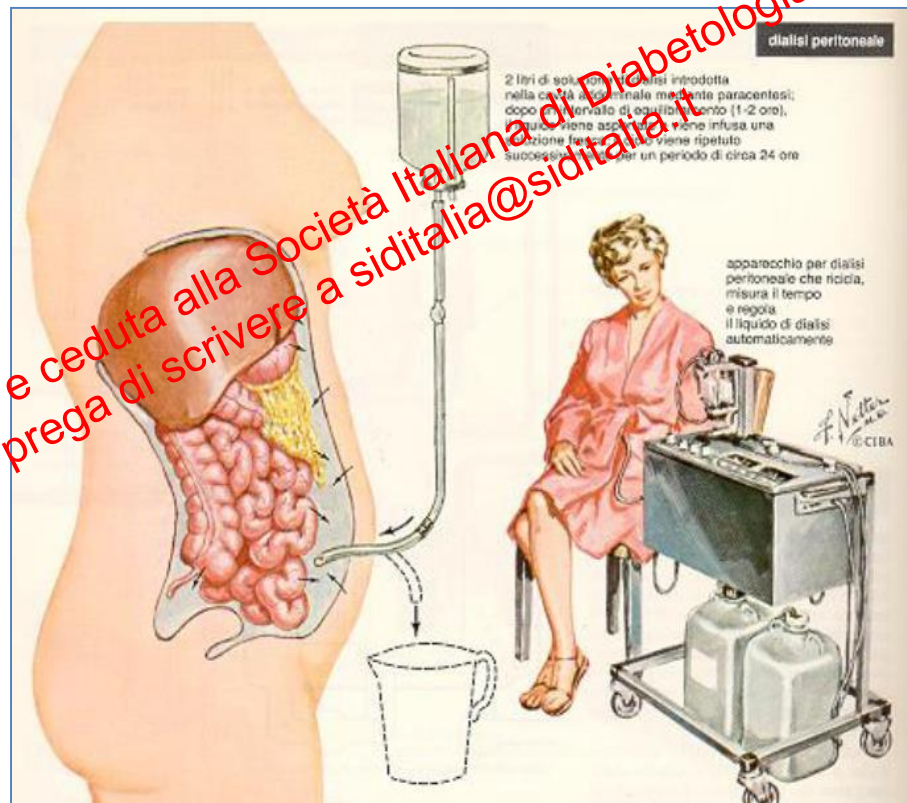
Survival in diabetic compared to non-diabetic patients is worse for all RRT



The question on optimal choice of dialysis modality remains a matter of debate



Hemodialysis (HD)



Peritoneal Dialysis (PD)

Controversy on survival data

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Dialysis modality choice in diabetic patients with end-stage kidney disease: a systematic review of the available evidence

Early mortality (<6 months)

Author	Publication Year	N Patients Included Intervention Group (PD)	N Patients Included Comparison Group (HD)	Outcome and subpopulation	Type of analysis*	Time period at risk	Effect Measure	Value Effect Measure	Lower Bound Confidence Interval	Upper Bound Confidence Interval
Early mortality (<6 months)										
Collins	2002	2805	26049	Death rates per 1 000 diabetic patients years	as treated	0-6 months	Relative Risk	2.17	1.43	3.33
Collins	2002	2805	26049	Death rates per 1 000 diabetic patients years	as treated	6-12 months	Relative Risk	1.22	1.11	1.33
Ganesh	2003	1844	12905	Death in diabetic patients with CAD	intention-to-treat analysis	0-6 months	Relative Risk	1.03	0.9	1.18
Ganesh	2003	4651	28392	Death in diabetic patients without CAD	intention-to-treat analysis	0-6 months	Relative Risk	1.04	0.92	1.17
Ganesh	2003	4651	28392	Death in diabetic patients without CAD	intention-to-treat analysis	6-12 months	Relative Risk	1.37	1.18	1.58
Ganesh	2003	1844	12905	Death in diabetic patients with CAD	intention-to-treat analysis	6-12 months	Relative Risk	1.32	1.16	1.49
Heaf	2014	916	1822	Death in diabetic 2008-2010	intention-to-treat analysis	0-6 months	Hazard Ratio	0.48	0.32	0.73
Heaf	2014	916*	1822*	Death in diabetic >= 65 yrs, 2000-2010	intention-to-treat analysis	0-6 months	Hazard Ratio	0.33	0.17	0.63
Liem	2007	928*	1615*	Death in diabetic patients aged 40 yrs	intention-to-treat analysis	3-6 months	Hazard Ratio	0.40	0.23	0.84
Liem	2007	928*	1615*	Death in diabetic patients aged 50 yrs	intention-to-treat analysis	3-6 months	Hazard Ratio	0.53	0.34	0.68
Liem	2007	928*	1615*	Death in diabetic patients aged 60 yrs	intention-to-treat analysis	3-6 months	Hazard Ratio	0.71	0.48	0.83
Liem	2007	928*	1615*	Death in diabetic patients aged 70 yrs	intention-to-treat analysis	3-6 months	Hazard Ratio	0.95	0.64	1.04
Lukowsky	2013	740	13885	Death in diabetic patients	as treated	0-9 months	Hazard Ratio	0.62	0.48	0.84
Stack	2003	2090	17217	Death in diabetic patients with congestive heart failure	intention-to-treat analysis	0-6 months	Relative Risk	1.14	1.01	1.28
Stack	2003	4404	24085	Death in diabetic patients with no congestive heart failure	intention-to-treat analysis	0-6 months	Relative Risk	0.93	0.82	1.07
Winkelmayer	2002	274	951	Death in diabetic patients > 65 years	intention-to-treat analysis	0-3 months	Relative Risk	NS		
Winkelmayer	2002	274	951	Death in diabetic patients > 65 years	intention-to-treat analysis	3-6 months	Relative Risk	NS		

In favour of HD in red - in favour of PD in green

Dialysis modality choice in diabetic patients with end-stage kidney disease: a systematic review of the available evidence

Medium term mortality (6-18 months)

Author	Publication Year	N Patients Included Intervention Group (PD)	N Patients Included Comparator Group (HD)	Outcome and subpopulation	Type of analysis*	Time period at risk	Effect Measure	Value Effect Measure	Lower Bound Confidence Interval	Upper Bound Confidence Interval
Collins	2002	2805	26049	Death rates per 1 000 diabetic patients years	as treated	12-18 months	Relative Risk	1.56	1.41	1.72
Ganesh	2003	4651	28392	Death in diabetic patients without CAD	intention-to-treat analysis	12-18 months	Relative Risk	1.57	1.34	1.85
Ganesh	2003	1844	12905	Death in diabetic patients with CAD	intention-to-treat analysis	12-18 months	Relative Risk	1.35	1.17	1.54
Heaf	2014	916	1822	Death in diabetic 2000-2010	intention-to-treat analysis	6-12 months	Hazard Ratio	0.76	0.52	1.11
Heaf	2014	916*	1822*	Death in diabetic patients >= 65 yrs, 2000-2010	intention-to-treat analysis	6-12 months	Hazard Ratio	0.81	0.49	1.32
Liem	2007	928*	1615*	Death in diabetic patients aged 40 yrs	intention-to-treat analysis	6-15 months	Hazard Ratio	0.59	0.44	0.81
Liem	2007	928*	1615*	Death in diabetic patients aged 50 yrs	intention-to-treat analysis	6-15 months	Hazard Ratio	0.72	0.56	0.83
Liem	2007	928*	1615*	Death in diabetic patients aged 60 yrs	intention-to-treat analysis	6-15 months	Hazard Ratio	0.87	0.71	1.09
Liem	2007	928*	1615*	Death in diabetic patients aged 70 yrs	intention-to-treat analysis	6-15 months	Hazard Ratio	1.07	0.85	1.33
Lukowsky	2013	740	13885	Death in diabetic patients	as treated	0-12 months	Hazard Ratio	0.81	0.63	1.05
Stack	2003	2090	17217	Death in diabetic patients with congestive heart failure	intention-to-treat analysis	6-12 months	Relative Risk	1.37	1.20	1.57
Stack	2003	4404	24085	Death in diabetic patients with no congestive heart failure	intention-to-treat analysis	6-12 months	Relative Risk	1.31	1.16	1.49
Stack	2003	2090	17217	Death in diabetic patients with congestive heart failure	intention-to-treat analysis	12-18 months	Relative Risk	1.5	1.29	1.75
Stack	2003	4404	24085	Death in diabetic patients with no congestive heart failure	intention-to-treat analysis	12-18 months	Relative Risk	1.39	1.21	1.61
Termorshuizen	2003	70*	111*	Death in diabetic patients aged > 60 yrs	intention-to-treat analysis	3-24 months	Hazard Ratio	0.78	0.40	1.54
Termorshuizen	2003	70*	111*	Death in diabetic patients aged > 60 yrs	as treated	3-24 months	Hazard Ratio	0.69	0.32	1.49
Termorshuizen	2003	70*	111*	Death in diabetic patients aged < 60 yrs	as treated	3-24 months	Hazard Ratio	0.10	0.12	0.78
Termorshuizen	2003	70*	111*	Death in diabetic patients aged < 60 yrs	intention-to-treat analysis	3-24 months	Hazard Ratio	0.16	0.04	0.70
Weinhandl	2010	3086*	3099*	Death in DM patients over 18 years	intention-to-treat analysis	0-12 months	Hazard Ratio	<1		
Weinhandl	2010	3086*	3099*	Death in DM patients over 18 years, from day 90	intention-to-treat analysis	90-12 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in DM patients over 18 years	as treated	0-12 months	Hazard Ratio	<1		
Weinhandl	2010	3086*	3099*	Death in DM patients over 18 years, from day 90	as treated	90-12 months	Hazard Ratio	NS		
Winkelmayer	2002	274	951	Death in diabetic patients > 65 years	intention-to-treat analysis	6-9 months	Relative Risk	>1		
Winkelmayer	2002	274	951	Death in diabetic patients > 65 years	intention-to-treat analysis	9-12 months	Relative Risk	>1		

In favour of HD in red - in favour of PD in green

Dialysis modality choice in diabetic patients with end-stage kidney disease: a systematic review of the available evidence

Late term mortality (>18 months)

Author	Publication Year	N Patients Included Intervention Group (PD)	N Patients Included Comparator Group (HD)	Outcome and subpopulation	Type of analysis*	Time period at risk	Effect Measure	Value Effect Measure	Lower Bound Confidence Interval	Upper Bound Confidence Interval
Collins	2005	2805	26049	Death rates per 1 000 diabetic patients years	as treated	36-42 months	Relative Risk	1.56	2.17	1.11
Collins	2002	2805	26049	Death rates per 1 000 diabetic patients years	as treated	42-48 months	Relative Risk	2.17	1.43	3.33
Ganesh	2003	4651	28392	Death in diabetic patients without CAD	intention-to-treat analysis	18-24 months	Relative Risk	1.39	1.11	1.75
Ganesh	2003	1844	12905	Death in diabetic patients with CAD	intention-to-treat analysis	18-24 months	Relative Risk	1.31	1.09	1.57
Heaf	2014	916	1822	Death in diabetic patients 2000-2010	intention-to-treat analysis	36-48 months	Hazard Ratio	1.32	0.91	1.19
Heaf	2014	916*	1822*	Death in diabetic patients >= 65 yrs, 2000-2010	intention-to-treat analysis	36-48 months	Hazard Ratio	1.32	0.78	2.24
Heaf	2014	916	1822	Death in diabetic patients 2000-2010	intention-to-treat analysis	48-60 months	Hazard Ratio	1.11	0.81	1.53
Heaf	2014	916*	1822*	Death in diabetic patients >= 65 yrs, 2000-2010	intention-to-treat analysis	48-60 months	Hazard Ratio	1.62	0.93	2.83
Liem	2007	928*	1615*	Death in diabetic patients aged 40 yrs	intention-to-treat analysis	>15 months	Hazard Ratio	1.06	0.88	1.26
Liem	2007	928*	1615*	Death in diabetic patients aged 50 yrs	intention-to-treat analysis	>15 months	Hazard Ratio	1.17	1.00	1.35
Liem	2007	928*	1615*	Death in diabetic patients aged 60 yrs	intention-to-treat analysis	>15 months	Hazard Ratio	1.29	1.12	1.48
Liem	2007	928*	1615*	Death in diabetic patients aged >65 yrs	intention-to-treat analysis	>15 months	Hazard Ratio	1.42	1.23	1.65
Stack	2003	2090	17217	Death in diabetic patients with congestive heart failure	intention-to-treat analysis	18-24 months	Relative Risk	1.39	1.12	1.72
Stack	2003	4404	24085	Death in diabetic patients with no congestive heart failure	intention-to-treat analysis	18-24 months	Relative Risk	1.32	1.09	1.6
Termorshuizen	2003	70*	111*	Death in diabetic patients aged < 60 yrs	as treated	24-48 months	Hazard Ratio	2.22	0.85	5.56
Termorshuizen	2003	70*	111*	Death in diabetic patients aged > 60 yrs	intention-to-treat analysis	24-48 months	Hazard Ratio	1.52	0.67	3.33
Termorshuizen	2003	70*	111*	Death in diabetic patients aged < 60 yrs	as treated	24-48 months	Hazard Ratio	1.67	0.37	7.69
Termorshuizen	2003	70*	111*	Death in diabetic patients aged > 60 yrs	intention-to-treat analysis	24-48 months	Hazard Ratio	2.44	0.76	7.69
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years	intention-to-treat analysis	12-24 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90	intention-to-treat analysis	12-24 months	Hazard Ratio	>1		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years	as treated	12-24 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90	as treated	12-24 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years	intention-to-treat analysis	24-36 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90s	intention-to-treat analysis	24-36 months	Hazard Ratio	>1		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years	as treated	24-36 months	Hazard Ratio	>1		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90	as treated	24-36 months	Hazard Ratio	>1		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, as treated analysis	as treated	36-48 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90	intention-to-treat analysis	36-48 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years	as treated	36-48 months	Hazard Ratio	NS		
Weinhandl	2010	3086*	3099*	Death in diabetic patients over 18 years, from day 90	intention-to-treat analysis	36-48 months	Hazard Ratio	NS		

In favour of HD in red - in favour of PD in green

Biases in Research Studies

- Differences in PD and HD practices
- Renal function at the start of dialysis
- Vascular access used in HD patients
- Period of observation
- Methodology of data management
- Type of statistical analysis

There are not evidence-based arguments in favour or against a particular dialysis modality as first treatment in patients with diabetes and ESKD

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Pros and Cons of Dialysis Treatments

Hemodialysis

Advantages

Work very fast

- In Center Hemodialysis
 - Total time per week 12h
 - Is social
- Home hemodialysis
 - Can do dialysis on your schedule
 - Can do more dialysis
 - Once monthly clinic visit

Disadvantages

Risk of low BP, infection, bleeding

- In center Hemodialysis
 - Transportation to center
 - Schedule may be not flexible
 - May miss half day of work 2-3 time/week
 - Travel can be difficult
- Home Hemodialysis
 - Require significant patient involvement and technical expertise



Peritoneal Dialysis

Advantages

- Done at home or anywhere
- Can travel relatively easily
- Once monthly clinic visit
- Fluid removal is slower
- Better tolerated
- Less dietary restriction
- ICPD
 - Done overnight
 - Does not interfere with work
- CAPD
 - Can be done in resource limited areas or areas without power

Disadvantages

- Requires PD Catheter
- Requires significant patient involvement and technical expertise
- Fluid removal is done with dextrose (can cause high blood sugars)
- Filter is biologic (favorable abdominal conditions)
- Fluid in abdomen may be uncomfortable
- CCPD
 - Requires cyclor and power
- CAPD
 - Need to do multiple exchange



Home Dialysis



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Renal replacement therapy in Europe: a summary of the 2013 ERA-EDTA Registry Annual Report with a focus on diabetes mellitus

Table 4. Percentages of RRT modalities among prevalent patients on 31 December 2013, unadjusted, by DM as the cause of ESRD for countries/regions providing individual patient data

	All				DM				Other causes of ESRD				Unknown/missing cause of ESRD			
	HD	PD	Tx	Other	HD	PD	Tx	Other	HD	PD	Tx	Other	HD	PD	Tx	Other
Austria	45	5	51	0	60	4	36	0	40	5	55	0	45	5	50	0
Belgium																
Galicia	44	8	48	0	65	11	26	0	37	8	56	0	49	9	42	0
Region of Murcia	51	5	44	0	71	6	23	0	46	6	48	0	52	4	44	0
Valencia Region	53	6	41	0	71	7	22	0	47	6	46	0	59	6	35	0
Sweden	33	9	57	0	45	12	43	0	29	8	63	0	43	12	45	0
The Netherlands	35	6	59	0	55	7	38	0	33	6	62	0	32	5	63	0
UK																
England ^a	42	7	51	0	59	9	32	0	37	6	58	0	45	8	47	0
Northern Ireland ^a	42	5	53	0	66	6	28	0	36	5	59	0	46	9	45	0
Scotland	40	5	54	0	59	6	35	0	35	5	60	0	48	5	47	0
Wales	39	6	54	0	55	7	39	0	34	7	60	0	46	5	49	0
All countries	49	6	45	0	66	8	27	0	45	5	50	0	51	6	41	0

DM patients treated with PD 10,8%

Number and percentage of prevalent ESRD receiving HD, PD and a Transplant by primary cause of ESRD in USA, 2016

Primary Cause of ESRD	HD			PD		TX	
Diabetes	278,409	211,695	76.0	19,205	6.9	47,509	17.1
Hypertension	186,115	135,279	72.6	14,174	7.6	36,760	19.7
Glomerulonephritis	114,155	45,363	39.7	8,911	7.8	59,881	52.5
Cystic Kidney	34,987	10,907	31.2	2,600	7.4	21,480	61.4
Other/Unknown	110,311	54,713	49.6	6,167	5.6	49,431	44.8
Total	724,075	457,957	63.2	51,057	7.1	215,061	29.7

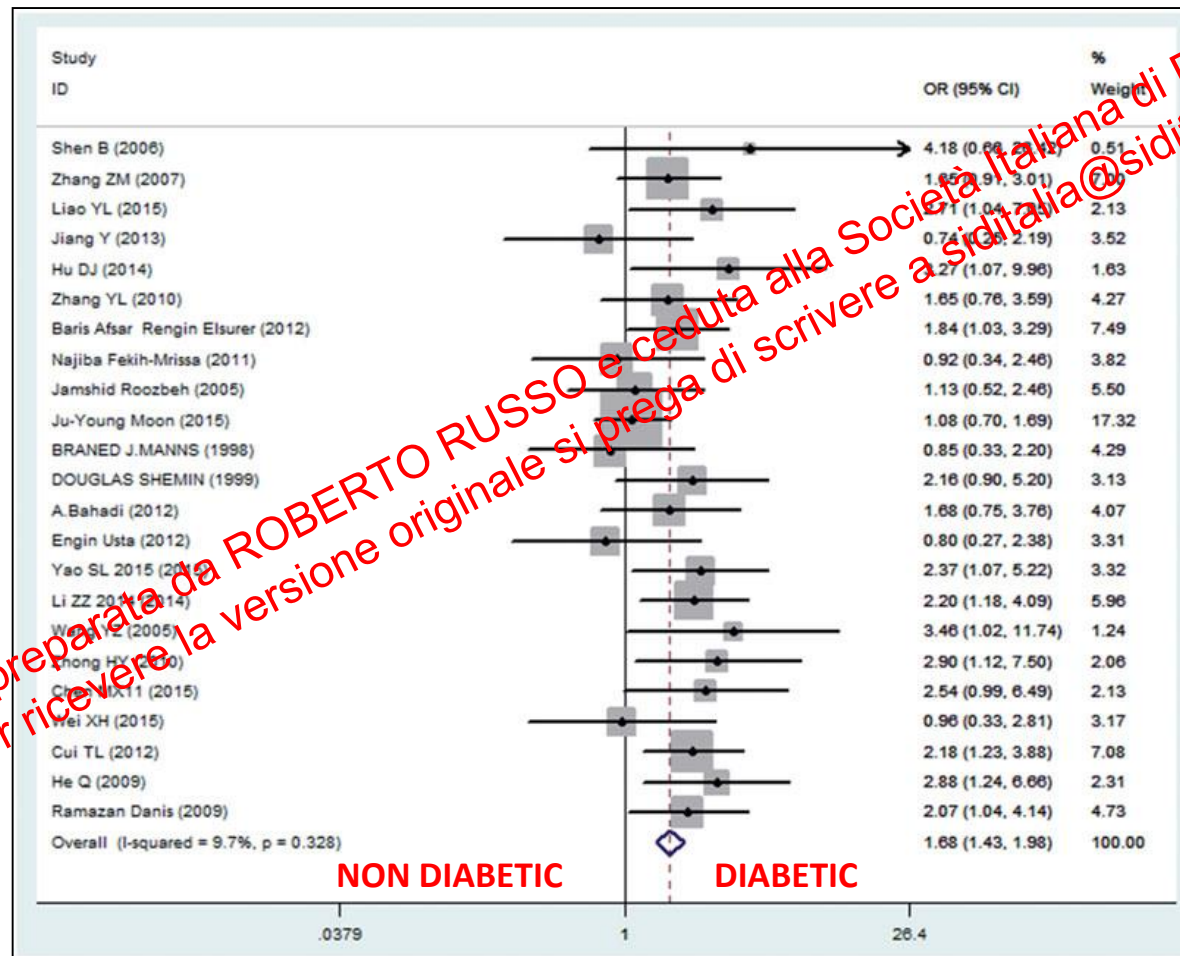
DM patients treated with PD 8,3%

HD in diabetics

Main clinical problems

- **Vascular access** (advanced calcific atherosclerosis, worse access survival, more steal syndrome, proximal anastomosis)
- **Intradialytic hypotension** (autonomic dysfunction, polyneuropathy, vascular damage, impaired left ventricular compliance)

Patients with DM have worse Arteriovenous Fistula survival rates



Predictors of steal syndrome in hemodialysis patients



- The strongest predictive factor was DM (odds ratio: 6.7; 95% confidence interval: 2.5-17.9).
- Being diabetic is the factor most predictive of having steal syndrome.

Diabetes is a risk factor for catheter-related bacteremia

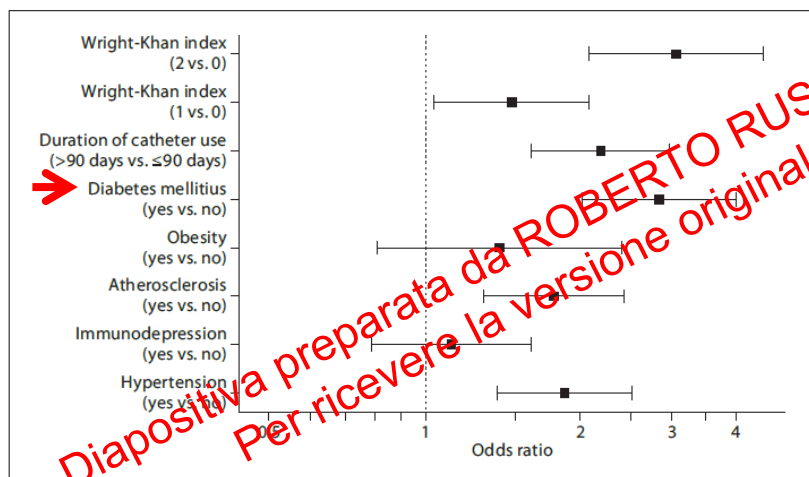


Fig. 4. Univariate risk analysis of factors associated with an increased risk of bacteremia with DCath.

Table 4. Multivariate analysis to assess the relative importance of the different risk factors associated with the presence of bacteremia episodes

Variables	OR	95% CI
Previous history of bacteremia	2.70	1.56–4.68
Diabetes mellitus	2.37	1.65–3.39
Catheter use >90 days	1.85	1.35–2.55
Hypertension	1.49	1.08–2.04

Recurrent Circulatory Stress: The Dark Side of Dialysis

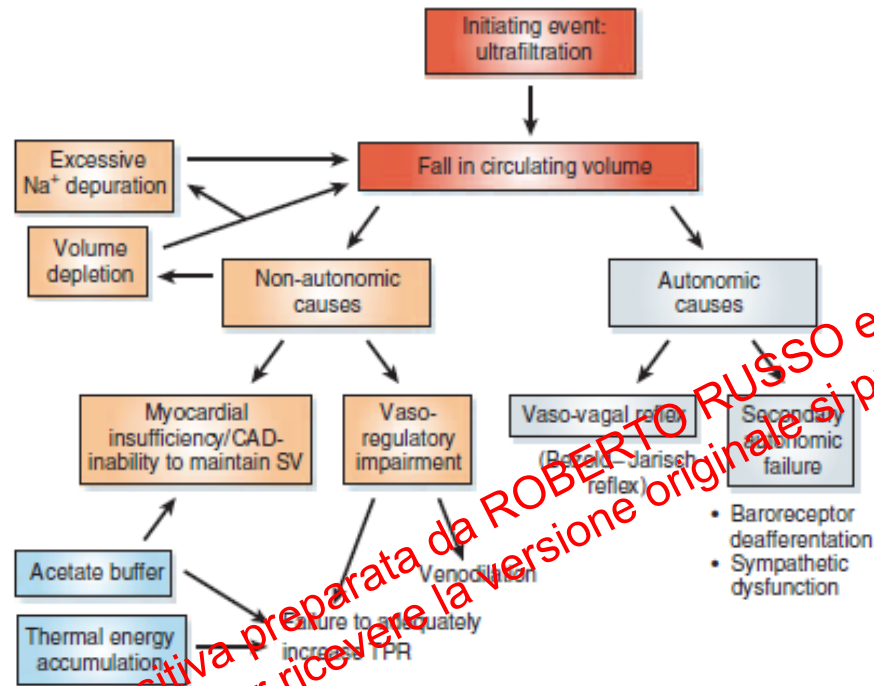


Figure 1 | Physiological responses to hemodialysis that might be involved in the pathogenesis of IDH. IDH, intradialytic hypotension.

- **Myocardial Ischemia**
 - Cardiac failure
 - Arrhythmias
- **Brain Ischemia**
 - Cognitive Impairment
 - Depression
- **Gut Ischemia**
 - Endotoxemia
- **Muscle Ischemia**
 - Wasting
- **Kidney Ischemia**
 - Loss of RRF
- **Retina Ischemia**
 - Blindness

PD in diabetics

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CAPD



APD



Potential advantages of PD in diabetics

- Less dialysis-induced hypotension, coronary ischemia and arrhythmia; better sustained blood pressure control
- Better preservation of residual renal function
- No need for vascular access
- No systemic anticoagulation important for patients with significant DM retinopathy and a tendency for retinal hemorrhage
- Advantages in lifestyle (home-based continuous therapy)

Peritoneal Dialysis is not associated with Myocardial Stunning

	Systolic BP (mmHg)	Diastolic BP (mmHg)	MAP (mmHg)
Drain start	158±23	93±10 ^b	118±13 ^a
Drain end	157±22	89±10 ^b	116±12 ^a
Fill start	157±25 ^a	88±11 ^b	115±11 ^a
Fill end	169±29 ^a	97±11 ^c	124±16 ^a

MAP = mean arterial pressure.

^a $p = 0.02$

^b $p = 0.002$

^c $p = 0.001$.

All changes were statistically significant other than the change in systolic BP from start to end of the drainage period.

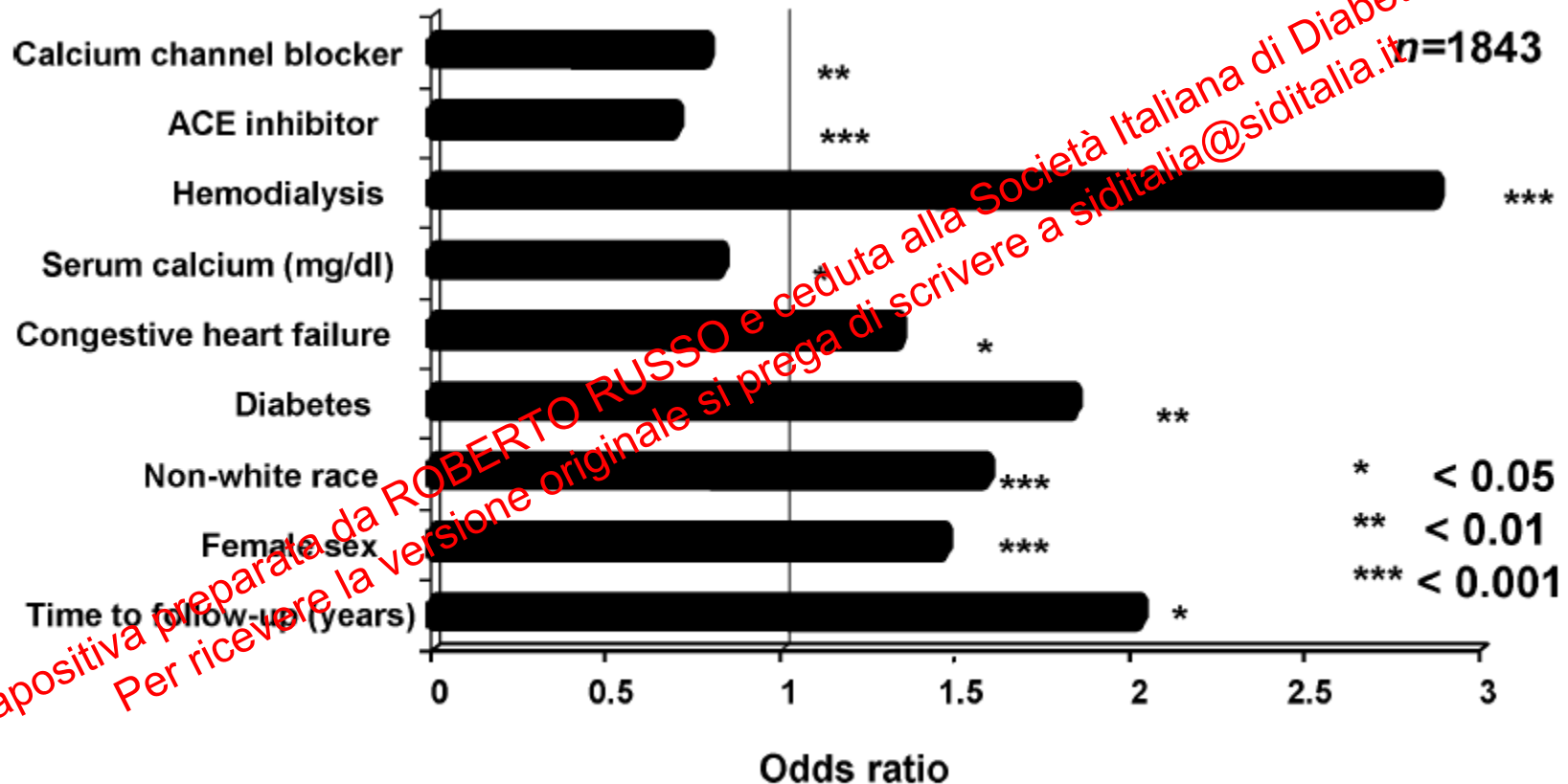
Echcardiography: Low frequency of Regional Wall Motion Abnormalities

Better Preservation of Residual Renal Function in Patients on Peritoneal Dialysis

Reference	Patients (n)		Glomerular filtration rate				Rate of decline		Difference in rate of GFR decline HD/PD
	HD	PD	Baseline HD	PD	At 12 months HD	PD	HD	PD	
Rottembourg <i>et al.</i> , 1983 (3)	25	25	4.3	4.4	2.0	3.8	6.0	1.2 ^a	80
Cancarini <i>et al.</i> , 1986 (4)	75	86	5.0	4.5			5.8	2.9	50
Lysaght <i>et al.</i> , 1991 (5)	57	58	4.2	5.1			7.0	2.2	65
Lang <i>et al.</i> , 2001 (6)	40	103	7.9	7.4	3.8	6.0	5.8	1.8 ^a	69
Jansen <i>et al.</i> , 2002 (7)	30	15	5.9	6.4	1.9	3.5	9.4	5.0 ^a	69
			(unadjusted)						
	279	243	5.1	5.8	1.4	2.2	10.7	8.1 ^a	24
			(adjusted)						

HD = hemodialysis; GFR = glomerular filtration rate.
^a Rates of decline not given in published study, but calculated for this table based on GFR values at 0, 6, and 12 months after the start of dialysis.

Better Preservation of Residual Renal Function in Patients on Peritoneal Dialysis



· Relative risk of loss of residual renal function. ACE = angiotensin-converting enzyme.

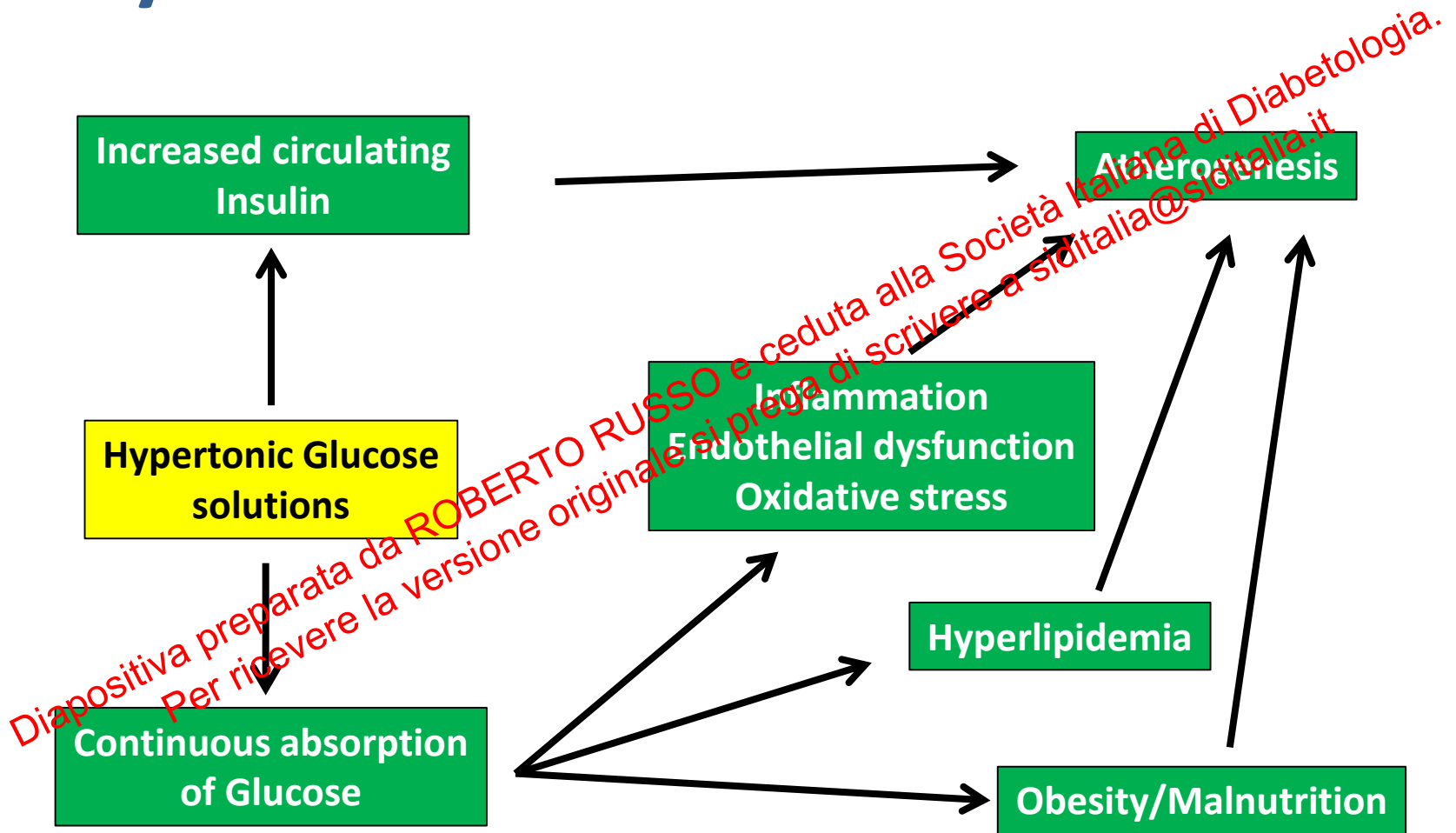
Progressive DM retinopathy and PD

Retinopathy stage	Within 6 months of dialysis start [n/N (%)]			After 6–12 months of treatment [n/N (%)]		
	HD	PD	p Value	HD	PD	p Value
Simple	6/30 (20)	0/6 (0)	NS	5/23 (22)	0/4 (0)	NS
Inactive proliferative	3/38 (8)	0/18 (0)	NS	7/27 (26)	0/18 (0)	0.031
Pre-proliferative	2/10 (20)	0/2 (0)	NS	4/10 (40)	—	—
Proliferative	8/35 (23)	0/5 (0)	NS	2/19 (11)	0/5 (0)	NS
TOTAL	19/111 (17)	0/31 (0)	0.007	18/79 (23)	0/27 (0)	0.003

Potential disadvantages of PD in diabetics

- Glucose absorption from dialysate:
 - ✓ **Hyperglycemia**
 - ✓ **Weight gain**
 - ✓ **Hypertriglyceridemia**
 - ✓ **Peritoneal membrane changes**
- Exposure to advanced glycosylated end products (AGEs) and glucose degradation products (GDPs)

Glucose absorption may exacerbate systemic metabolic abnormalities

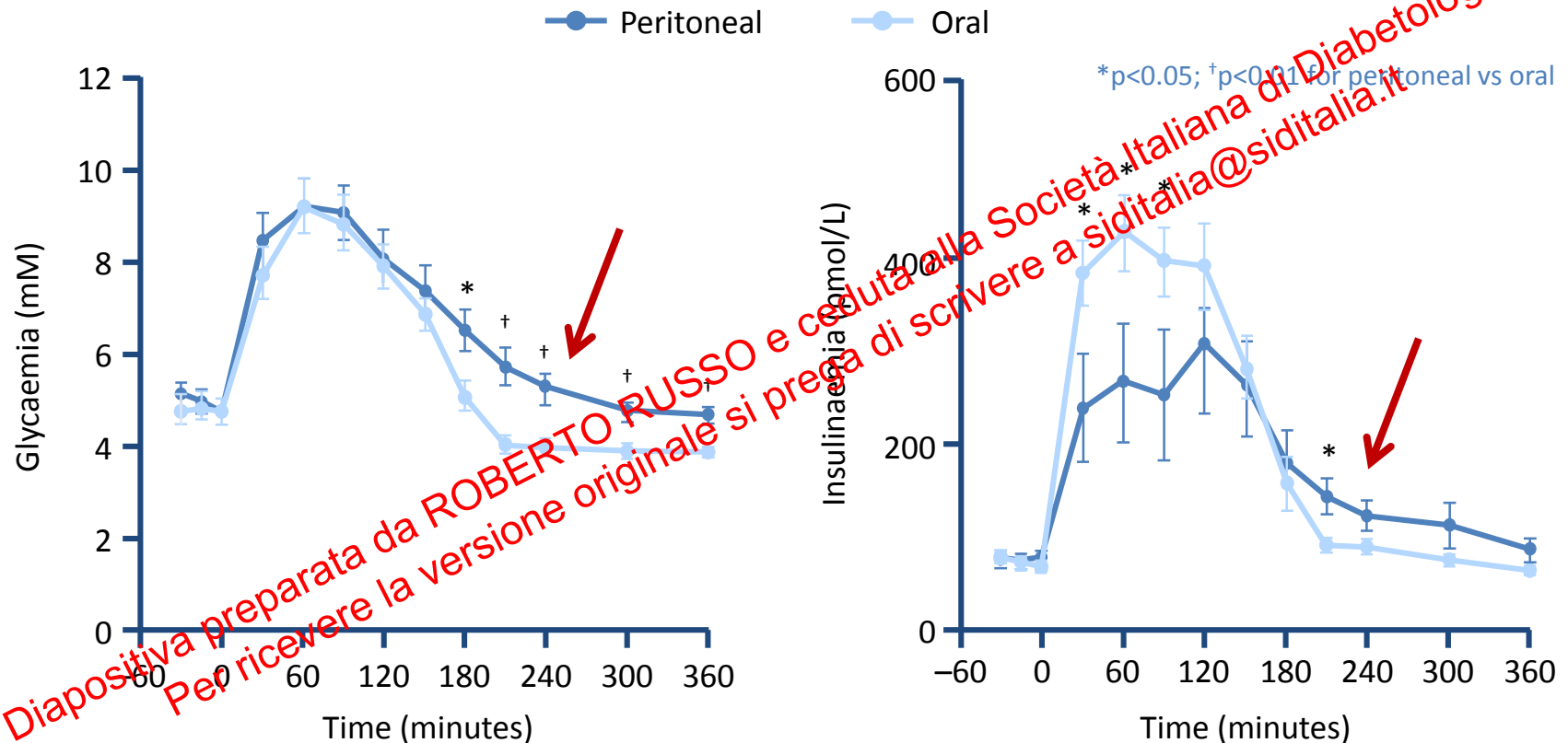


Glucose absorption and PD

	Icodextrin	2.5% dextrose	1.25% dextrose
CHO per 2 L	150 g	45.3 g	77.2 g
% Adsorbed per 8 hour dwell	25%	86%	86%
Approx. g of CHO adsorbed per dwell	37.5	39	66
Approximate Kcal dwell	150	156	266

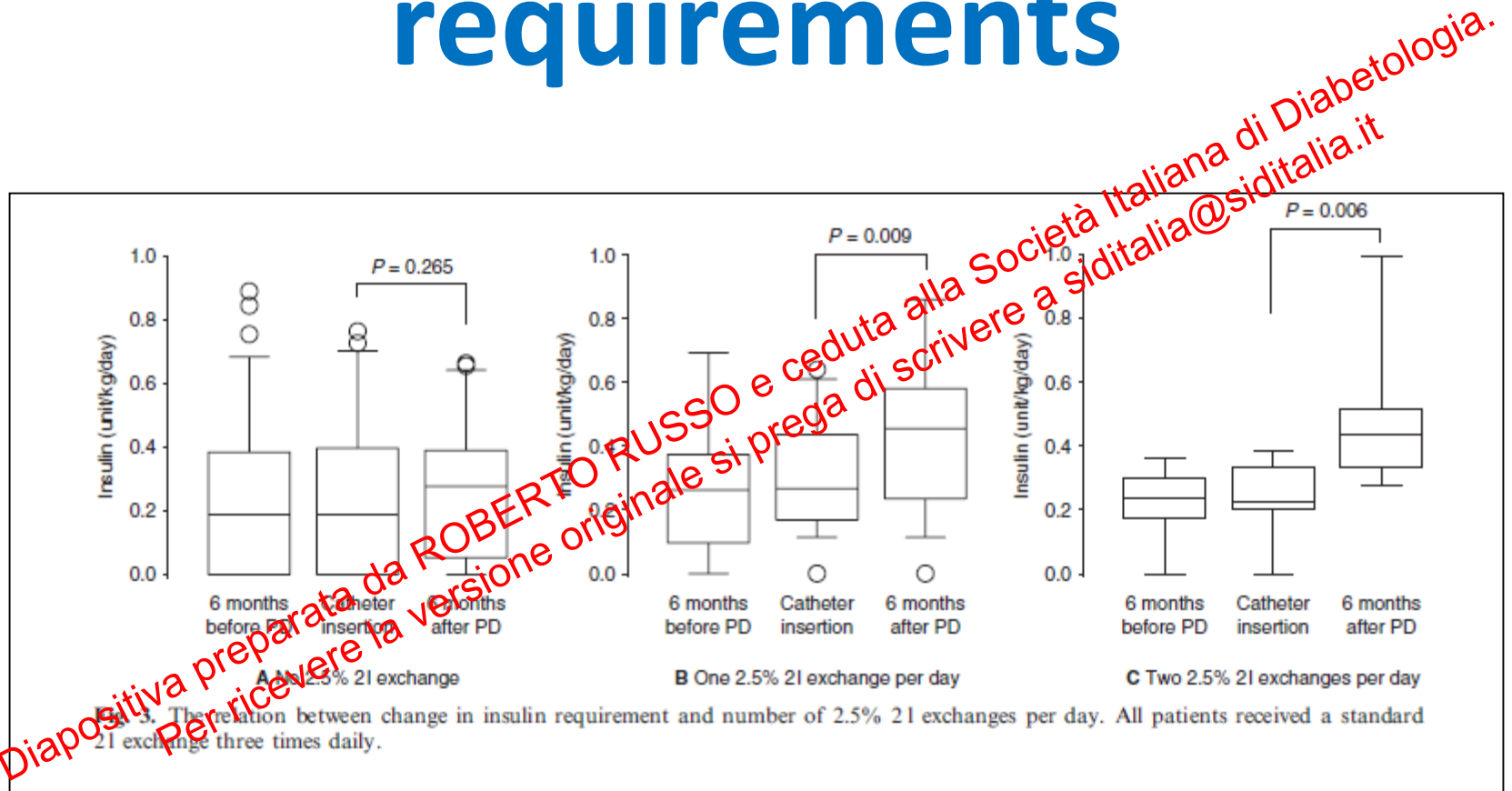
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Evolution of Glycemia and Insulinemia after a peritoneal and an oral glucose load



Diabetic CAPD patients given oral (50 g) or peritoneal (2 L, 3.86%) glucose in separate studies (N=9)

Glucose bags and insulin requirements

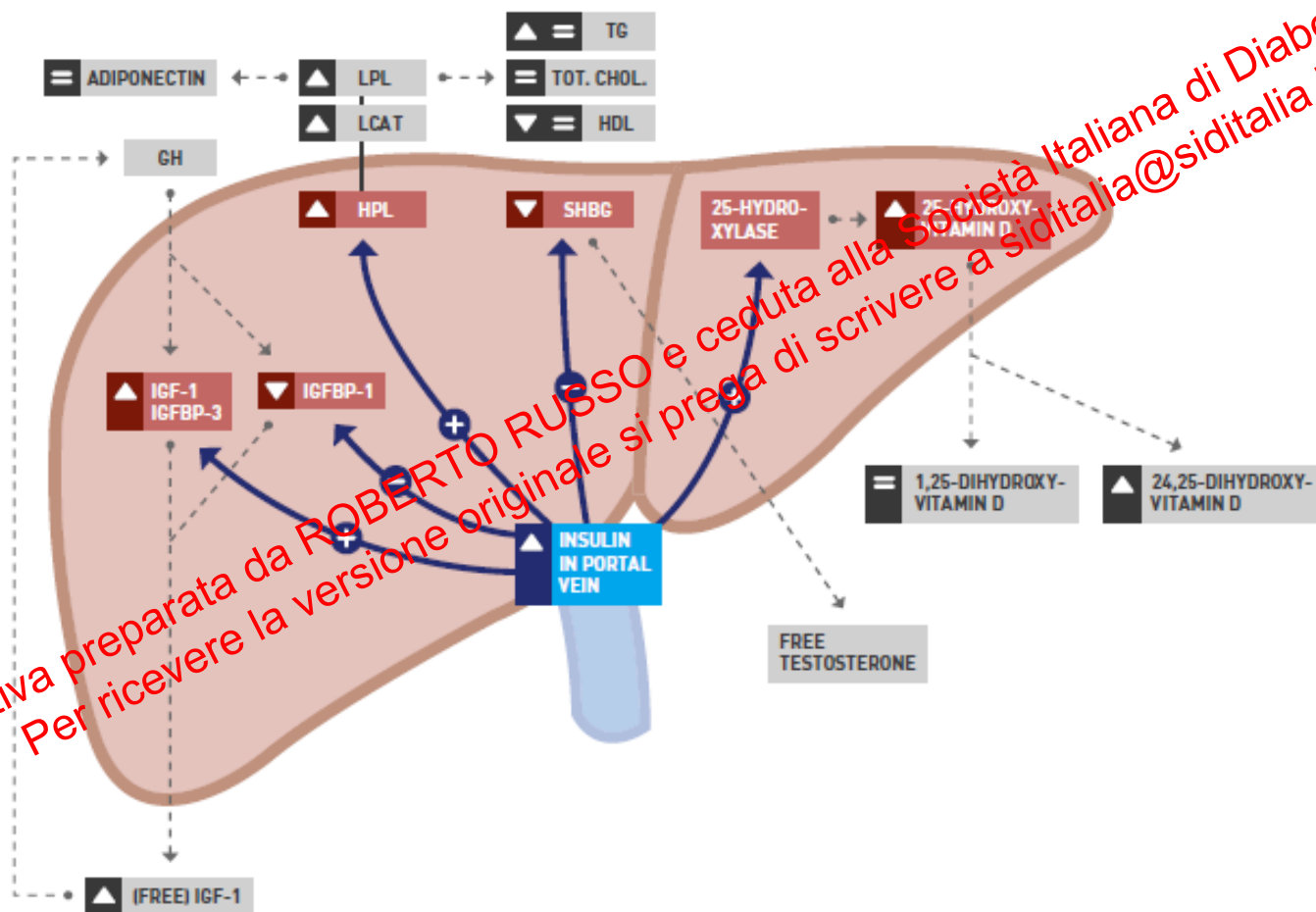


Intraperitoneal insulin administration



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Effects of increased concentrations of insulin in the portal vein

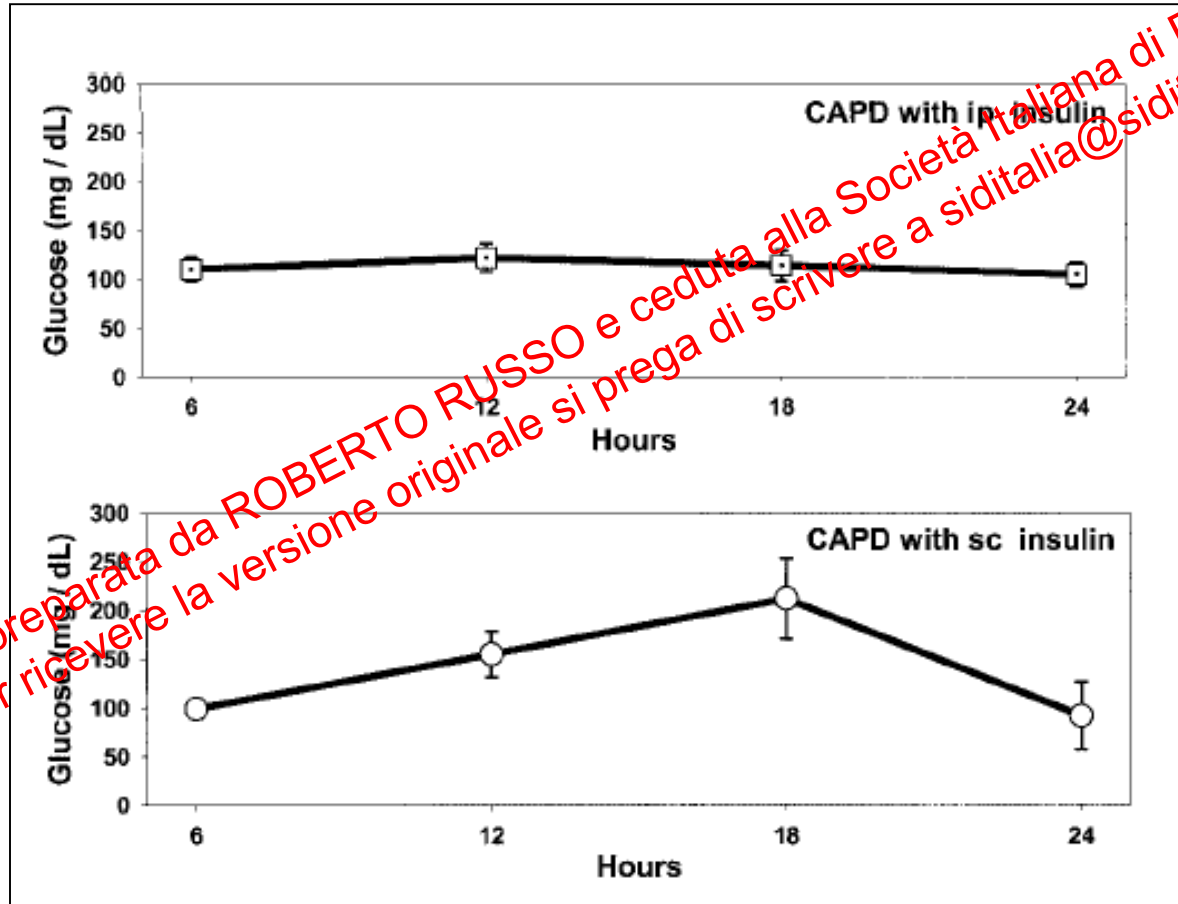


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Benefits of intraperitoneal insulin administration vs subcutaneous treatment

- Lower mean plasma glucose and lower peripheral free-insulin
 - ✓ More physiological utilization of insulin
- Ideal delivery route for insulinization of the liver
 - ✓ Mimics the physiological portal-systemic circulation insulin gradient
 - ✓ Avoidance of peripheral hyperinsulinemia
 - ✓ Decreased insulin resistance
- Allows for improved glucose controlled with intensive insulin therapy with lower peripheral serum insulin levels

Diurnal blood glucose profile in CAPD patients



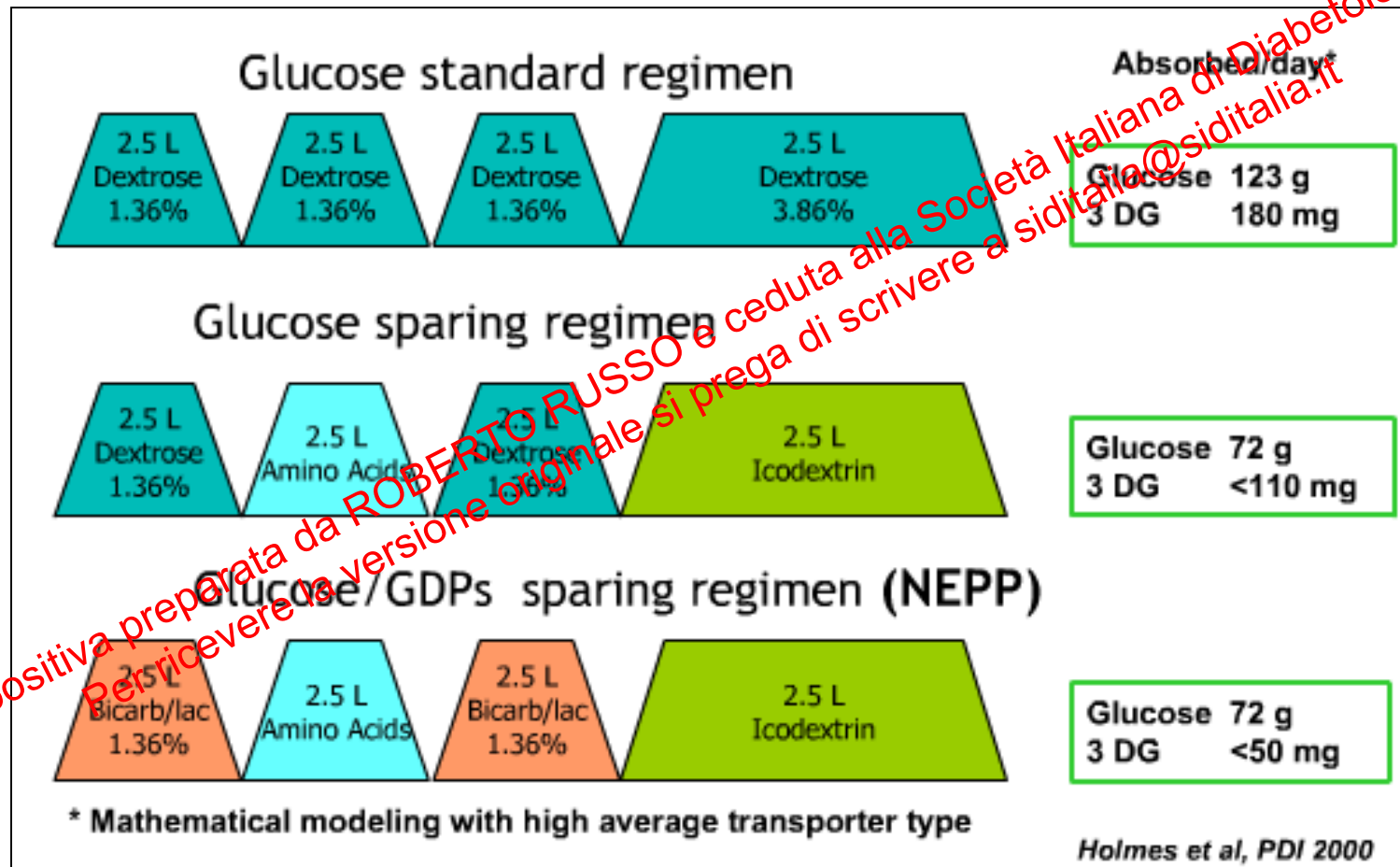
PD Solution Formulations

PD Solution	Osmotic Agent	Osm, mOsm/L	pH	No. of Chambers	Lactate, mmol/L	Bicarbonate, mmol/L	GDP Content
Conventional							
Dextrose based (various manufacturers)	Glucose	345-484	5.5	1	35-40	0	High
Glucose sparing							
Extraneal (Baxter)	Icodextrin	282-366	5.5	1	40	0	Low
Nutrineal (Baxter)	Amino acids	365	6.5	1	40	0	Low
Neutral pH, low GDP							
Balance (FMC)	Glucose	358-511	7.0	2	35	2.5	Low
BicaVera (FMC)	Glucose	358-511	7.4	2	0	34	Low
Gambrosol Trio (Gambro)	Glucose	357-483	6.3	3	40	0	Low
Physioneal (Baxter)	Glucose	344-583	7.4	2	10 or 15	25	Medium
Fixioneal (Baxter)	Glucose	345-484	7.4	2	10 or 15	25	Medium

Abbreviations: GDP, glucose degradation product; Osm, osmolality; PD, peritoneal dialysis.

Solution combinations

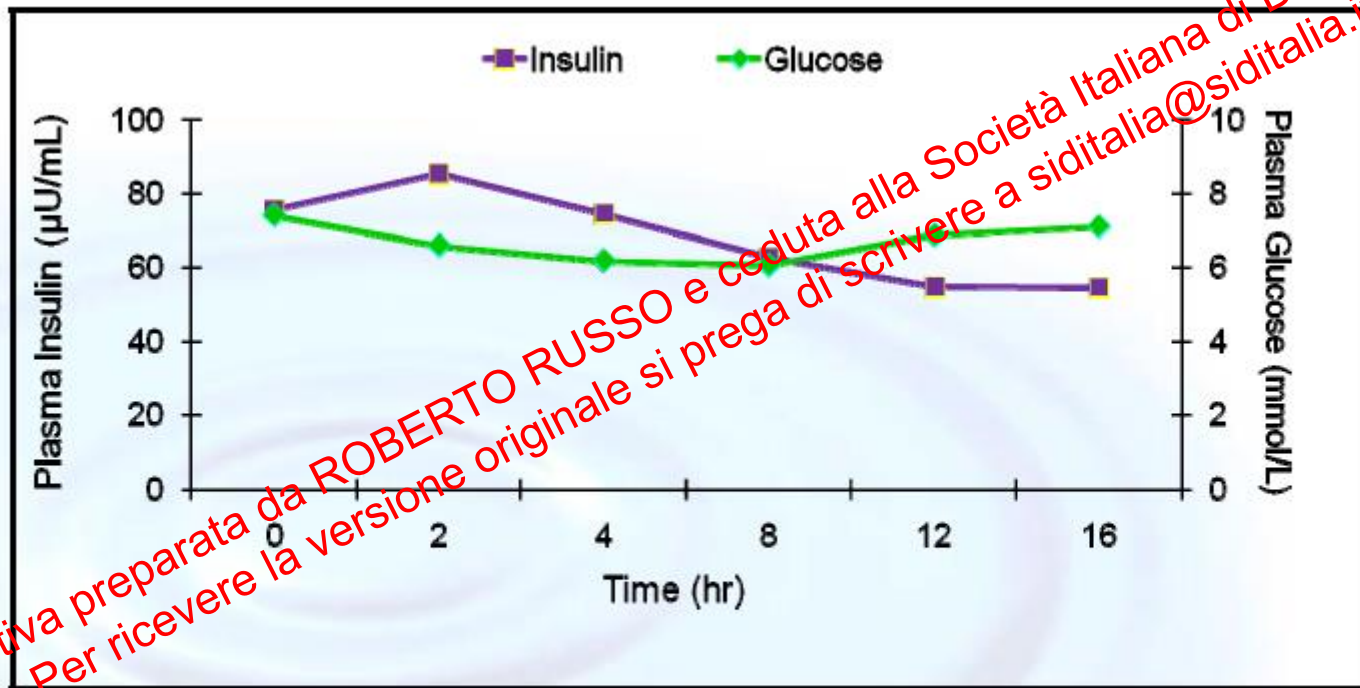
Potential Clinical Benefits



Potential Benefits of Icodextrin in the Treatment of End-Stage Renal Disease Patients with Diabetes

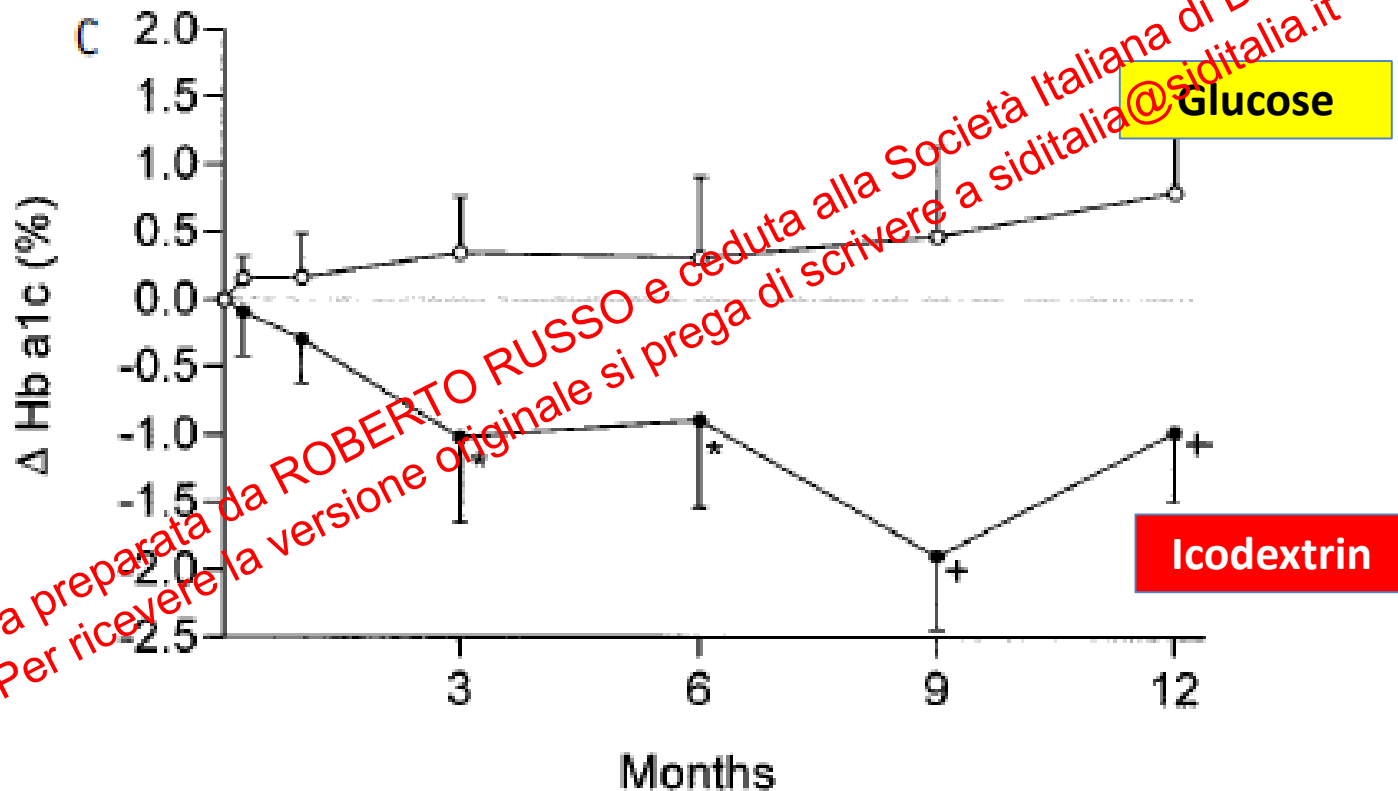
- Increase in ultrafiltration volume (in the presence and absence of peritonitis)
- Better blood pressure control
- Increase in solute clearance
- **Better glycemic control**
- **Less requirement for insulin**
- Better control of hyperlipidemia
- Better preservation of residual renal function

Absence of hyperglycemic and hyperinsulinemic effects when using Icodextrin during the long dwell



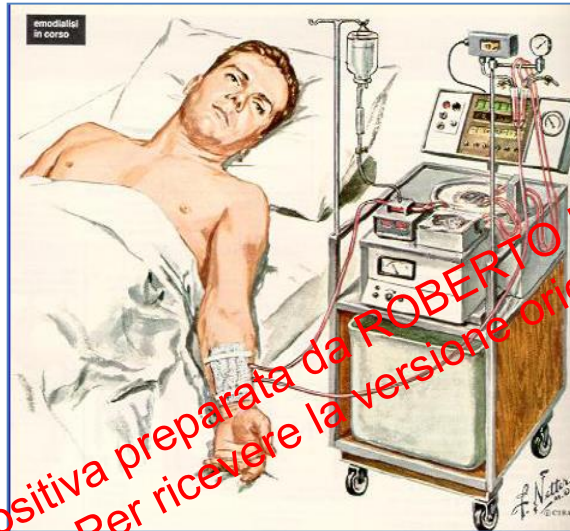
Gokal R et al. *Kidney International* (2002) 62, S62–S71

Glycated hemoglobin (Hb a1c) in diabetic patients using icodextrin based dialysis solution for the long dwell

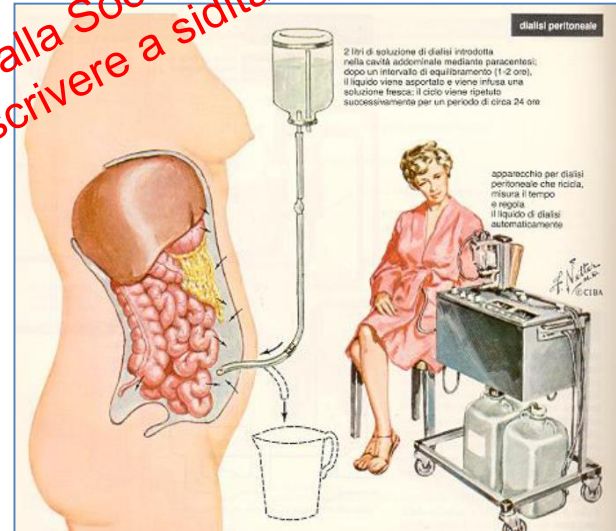


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Should patients with diabetes and CKD stage 5 start with peritoneal dialysis or haemodialysis as first modality?



Hemodialysis



Peritoneal Dialysis

Hemodialysis or Peritoneal Dialysis ?

	Hemodialysis	Peritoneal dialysis
Survival		
Intradialytic hypotension		
Residual renal function		
Systemic anticoagulation		
Glucose absorption		
Insulin requirement		
Dyslipidemia		

Conclusions

- There is an absence of evidence of superiority of one modality over another in patients with diabetes and CKD stage 5
- In absence of such evidence, modality selection should be governed by patient preference after unbiased patient information

**XX Convegno
del Gruppo di Progetto di Dialisi Peritoneale
della Società Italiana di Nefrologia**

Condividere una dialisi peritoneale di eccellenza



Tempio di Apollo Sosiano o in Circo - Acquerello su carta Arches Grain Fin

Roma, 26-28 Marzo 2020

Ergife Palace Hotel

**Grazie per
l'attenzione**

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