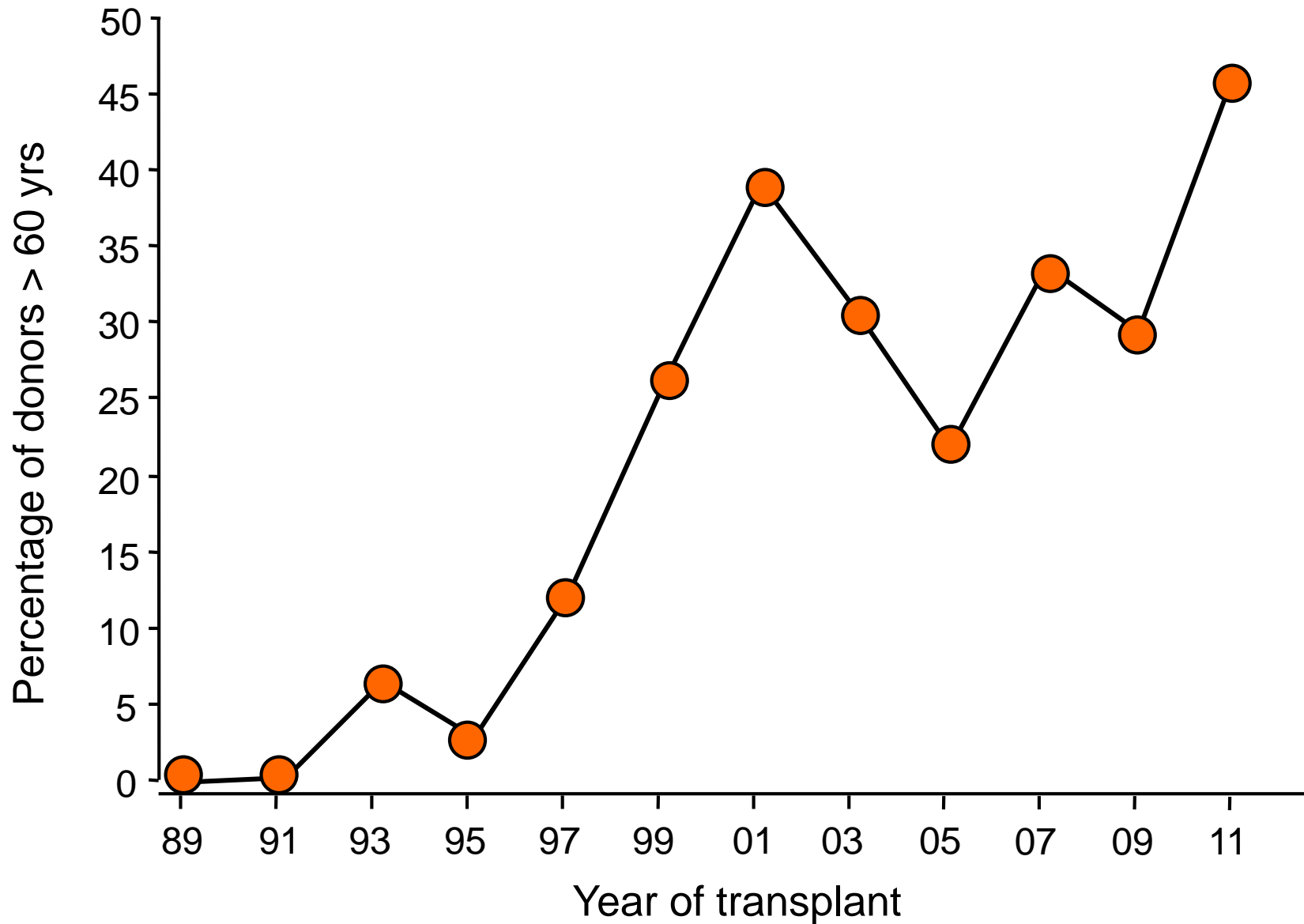


Hypothermic machine perfusion in kidney transplantation

Milano, March 15th 2019

Camillo Carrara, MD
Unità di Nefrologia e Dialisi
Ospedale Papa Giovanni XXIII, Bergamo



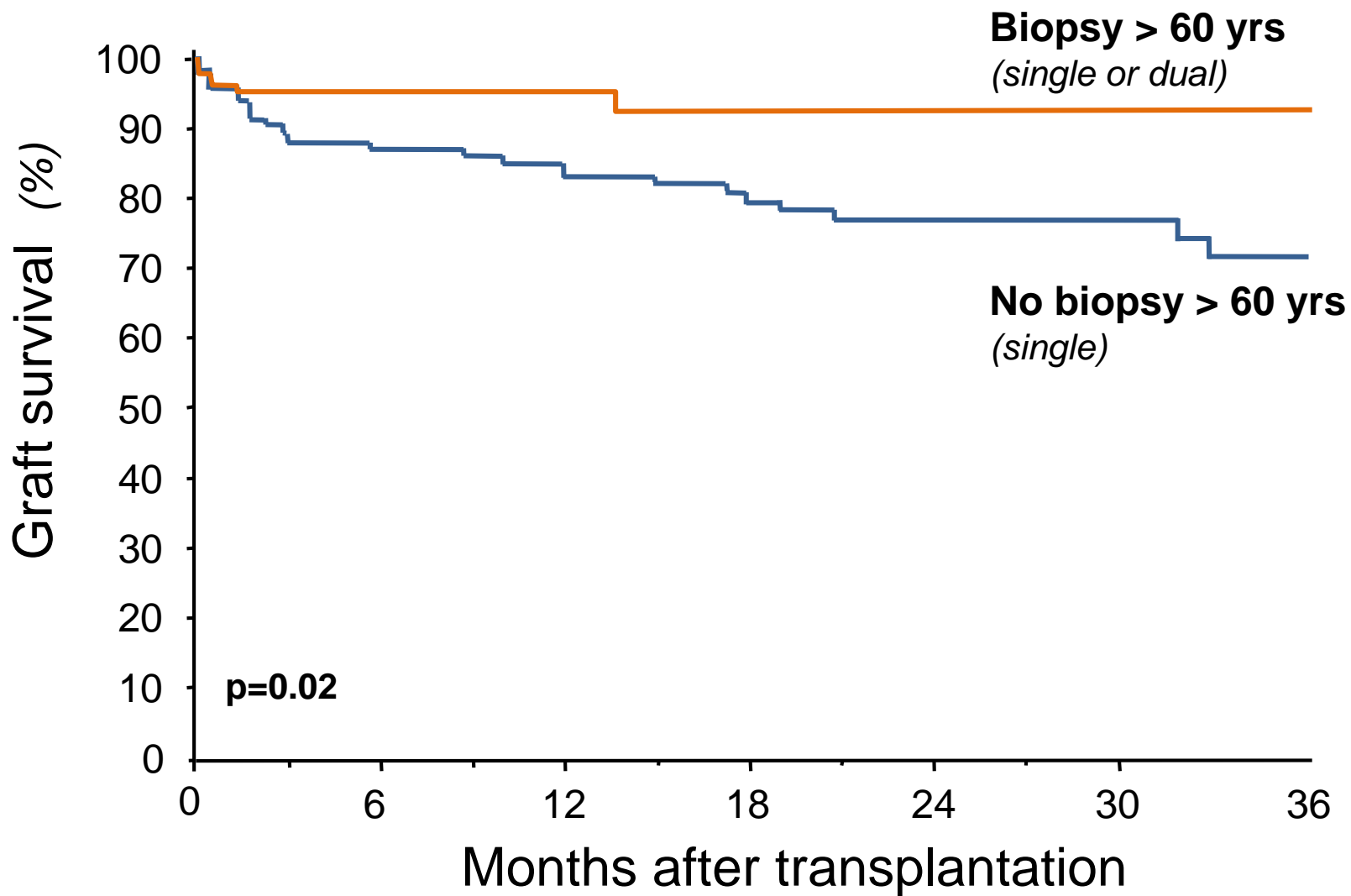
Renal Transplant Unit, Bergamo

Kidney transplant from old donor

- Increased risk of delayed graft function (DGF)
- High rate of graft failure
- Reduced long term graft survival



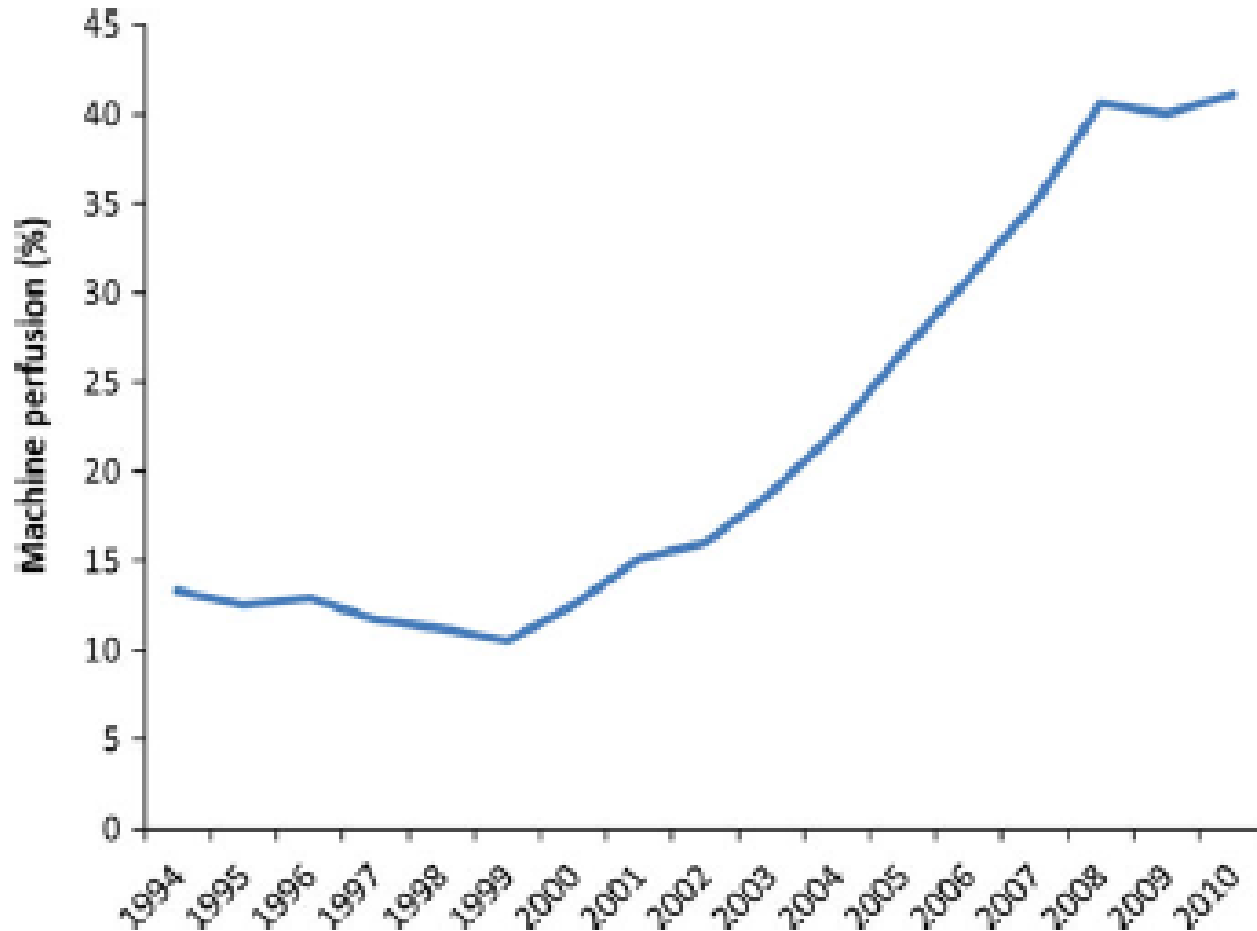
PRE-IMPLANTATION BIOPSY

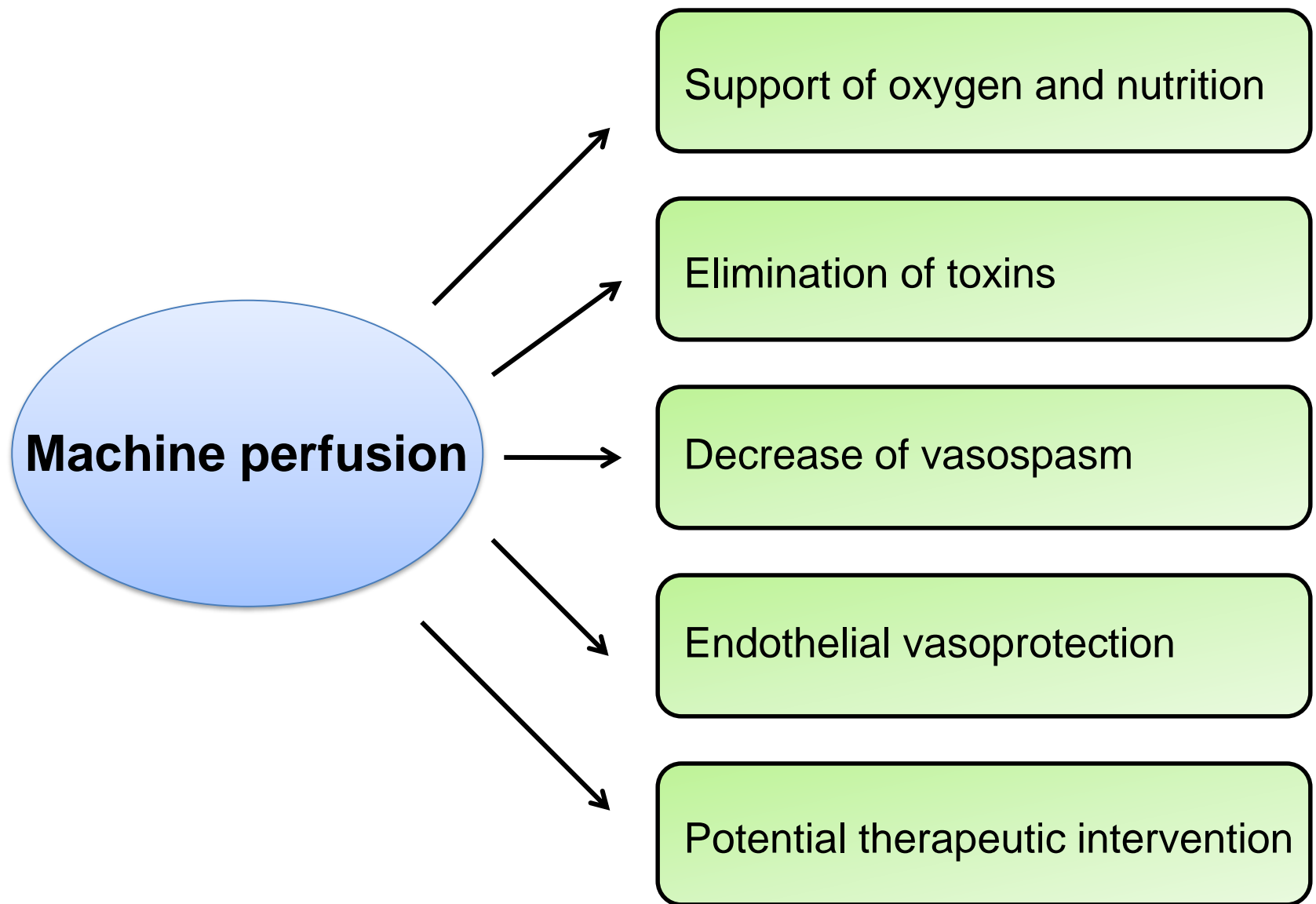


“Static cold storage have been the standard for more than 40 years”



Percentage of deceased donor kidneys preserved by hypothermic machine perfusion in USA





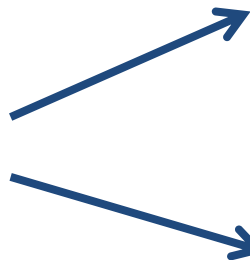
N Engl J Med, 2009

Machine Perfusion or Cold Storage in Deceased-Donor Kidney Transplantation

Cyril Moers, M.D., Jacqueline M. Smits, M.D., Ph.D., Mark-Hugo J. Maathuis, M.D., Ph.D., Jürgen Treckmann, M.D., Frank van Gelder, Bogdan P. Napieralski, Margitta van Kasterop-Kutz, Jaap J. Homan van der Heide, M.D., Ph.D., Jean-Paul Squifflet, M.D., Ph.D., Ernest van Heurn, M.D., Ph.D., Günter R. Kirste, M.D., Ph.D., Axel Rahmel, M.D., Ph.D., Henri G.D. Leuvenink, Ph.D., Andreas Paul, M.D., Ph.D., Jacques Pirenne, M.D., Ph.D., and Rutger J. Ploeg, M.D., Ph.D.*



366 kidney pairs



Cold
storage
(CS)



Machine
perfusion
(MP)

Hypothermic machine perfusion versus cold storage: DGF

Univariate comparison:

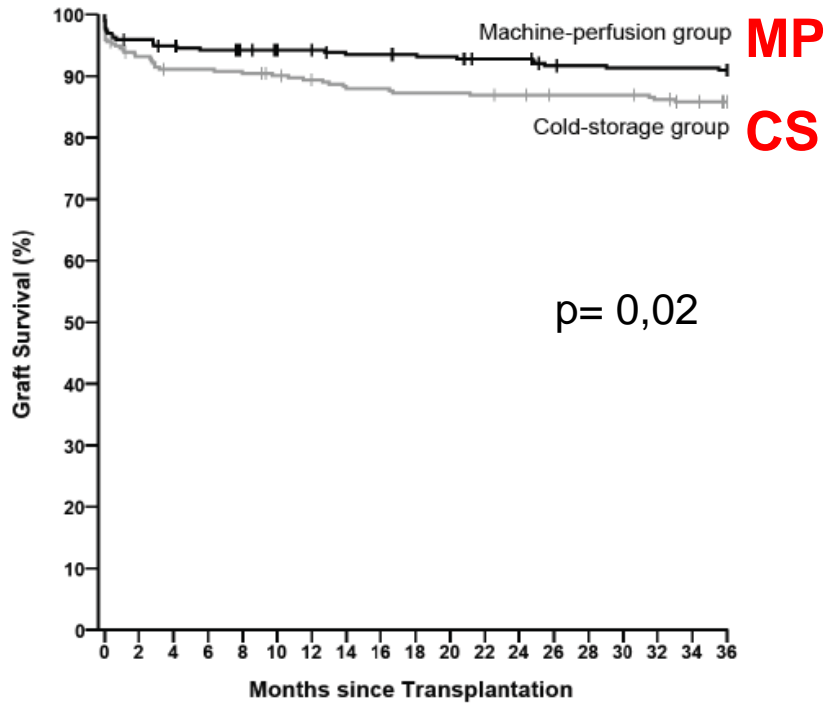
Variable	MP arm	CS arm	p-value
DGF	20.8% (70 / 336)	26.5% (89 / 336)	0.046

n = 672 recipients total
2-sided McNemar test

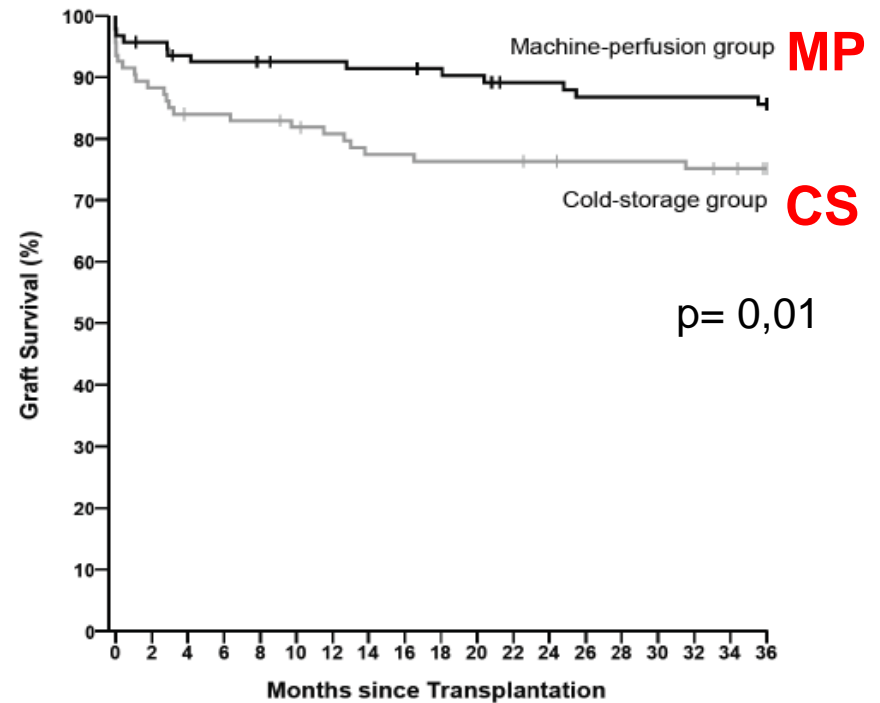
Logistic regression analysis:

	OR (95% CI)	p-value
MP vs. CS	0.57 (0.36–0.88)	0.01

Hypothermic machine perfusion and 3-year graft survival



Brain death donors



Expanded criteria donors

**A PROSPECTIVE STUDY TO COMPARE EARLY GRAFT FUNCTION OF
RECIPIENTS OF SINGLE OR DUAL KIDNEY ORGANS
STORED IN ICE COLD SOLUTION U OR PULSED PERFUSION
(PREDICTION Study)**

Running title: Pulsed perfusion for marginal kidneys

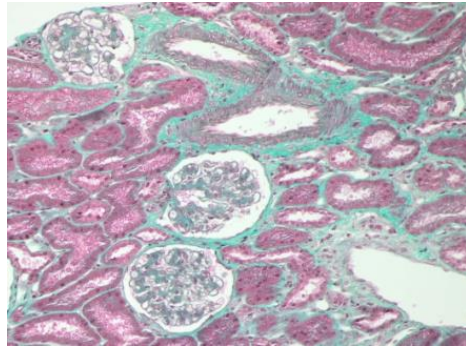
Recipients baseline characteristics

		MP (<i>n</i> =20)
Gender	<i>M/F</i>	15/5
Age	<i>years</i>	63.6 ± 7.9
Body Weight	<i>kg</i>	67.8 ± 10.4
BMI	<i>kg/m²</i>	23.9 ± 3.0
Systolic BP	<i>mmHg</i>	132.6 ± 28.5
Diastolic BP	<i>mmHg</i>	72.7 ± 12.0
Hypertension	<i>n</i>	19
PRA > 20%	<i>n</i>	0
Type of TX	<i>single/dual</i>	6/14

Donors and kidneys baseline characteristics

		MP (n=20)
Gender	(M/F)	11/9
Age	(y)	70.4 ± 6.5
Body weight	(kg)	74.7 ± 11.2
BMI	(kg/m ²)	26.5 ± 4.9
KDPI score	(%)	93.3 ± 8.4
KDRI score (%)	(%)	1.90 ± 0.41
Biopsy Score	(0-7)	4.4 ± 1.4
Mean Cold ischemia time	(h)	19.8 [17.8 to 22.8]
Cold ischemia time R	(h)	20.0 [18.0 to 22.0]
Cold ischemia time L	(h)	20.5 [18.0 to 25.0]
Cold ischemia time > 24h	(n)	5 (25%)

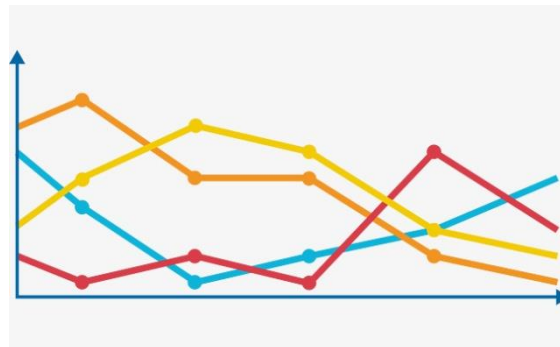
1. Morpho-functional study



HISTOLOGIC SCORE

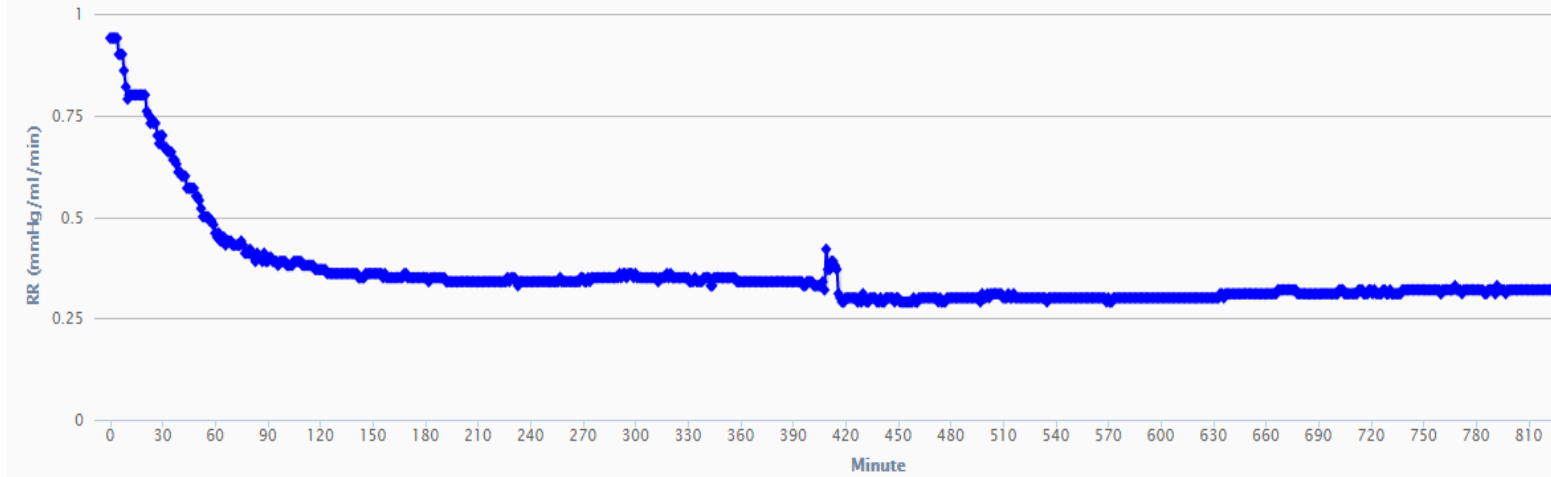
RENAL RESISTANCES

correlations

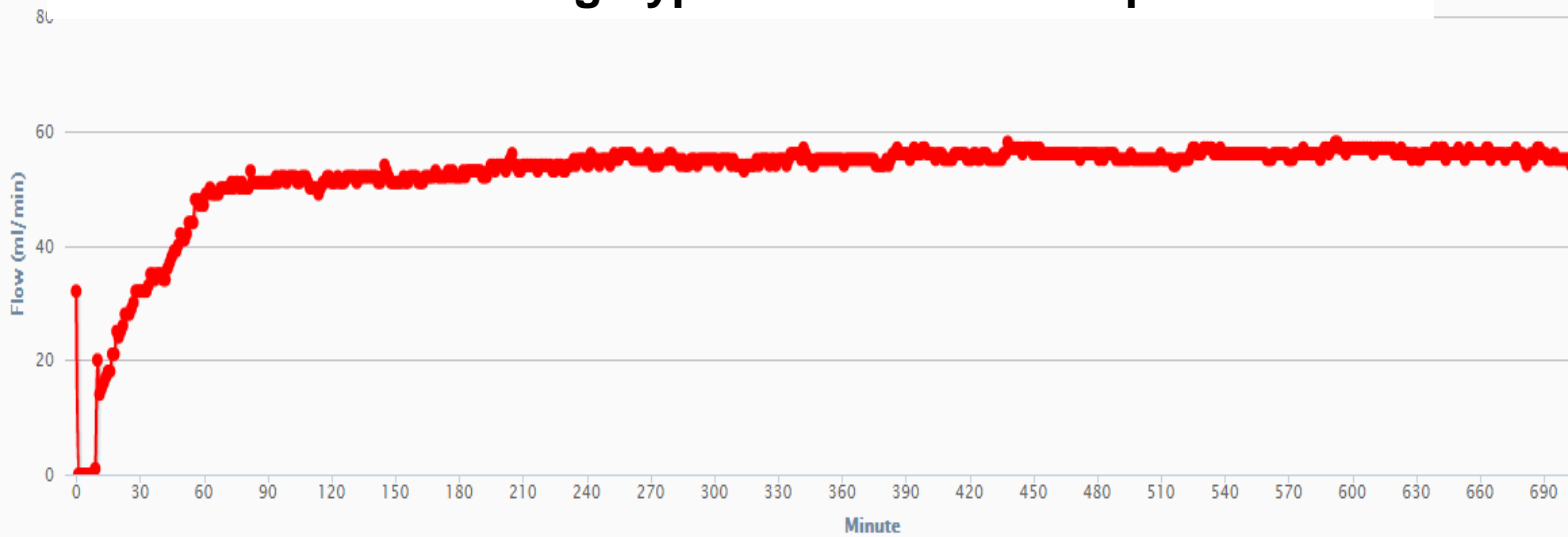


6-MONTHS GFR

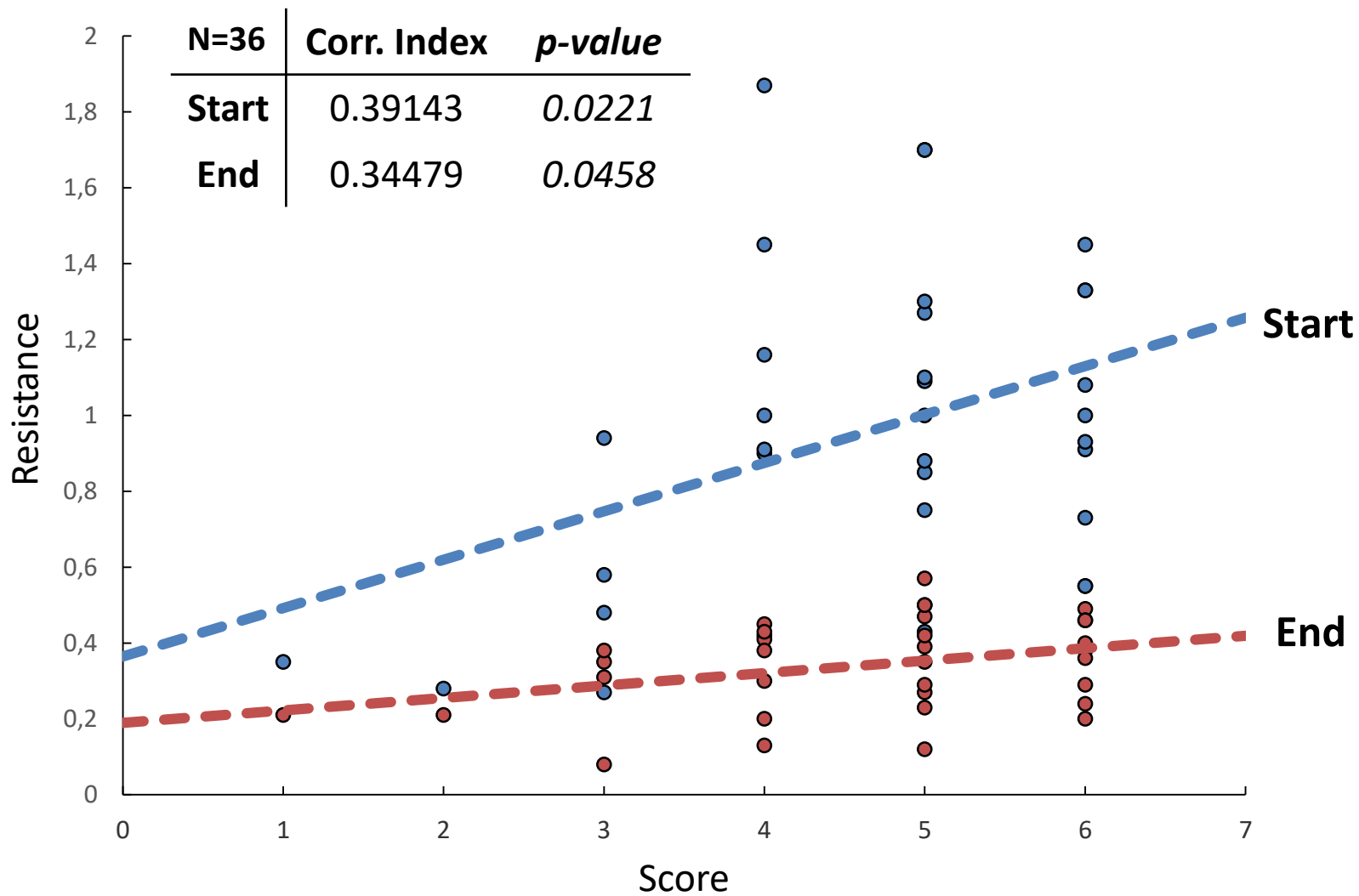
Renal resistance trend during hypothermic machine perfusion



Renal flow trend during hypothermic machine perfusion



Correlations histologic score - renal resistance



2. Matched-cohort study



20 MP



40 CS

Matching criteria:

- gender
- age (+/- 5 years)
- type of transplant (single or double)
- who underwent the same immunosuppressive regimen

Recipients baseline characteristics

		MP (n=20)	CS (n=40)	p-value
Gender	(M/F)	15/5	30/10	1.0000
Age	(y)	63.6 ± 7.9	64.5 ± 6.4	0.6323
Body Weight	(kg)	67.8 ± 10.4	76.8 ± 14.2	0.7945
BMI	(kg/m ²)	23.9 ± 3.0	23.9 ± 3.2	0.9874
Systolic BP	(mmHg)	132.6 ± 28.5	137.2 ± 15.0	0.5232
Diastolic BP	(mmHg)	72.7 ± 12.0	77.3 ± 8.4	0.1230
Hypertension	(n)	19 (95%)	39 (98%)	0.6111
PRA > 20%	(n)	0 (0%)	1 (2.5%)	0.4758
Type of TX	(single/dual)	6/14	12/28	1.0000

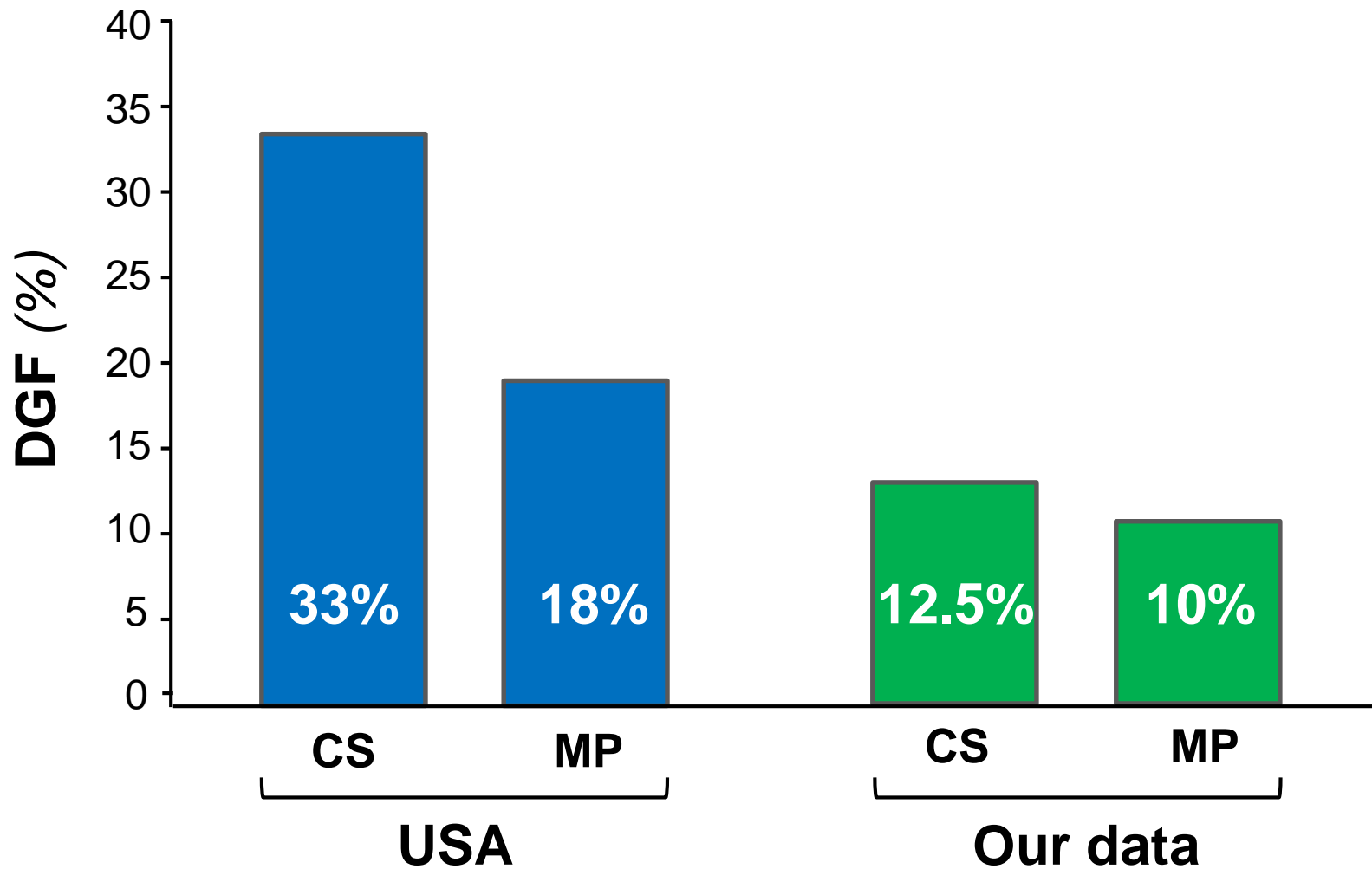
Donors and kidneys baseline characteristics

		MP (n=20)	CS (n=40)	p-value
Gender	(M/F)	11/9	15/25	0.1972
Age	(y)	70.4 ± 6.5	69.5 ± 7.9	0.6719
Body weight	(kg)	74.7 ± 11.2	74.4 ± 17.0	0.9465
BMI	(kg/m ²)	26.5 ± 4.9	26.6 ± 4.7	0.9183
KDPI score	(%)	93.3 ± 8.4	93.7 ± 11.7	0.8831
KDRI score	(%)	1.90 ± 0.41	1.93 ± 0.39	0.7241
Biopsy Score	(0-7)	4.4 ± 1.4	4.2 ± 1.1	0.4822
Mean Cold ischemia time	(h)	19.8 [17.8 to 22.8]	18.3 [17.0 to 20.0]	0.1341
Cold ischemia time R	(h)	20.0 [18.0 to 22.0]	18.0 [16.0 to 19.5]	0.0487
Cold ischemia time L	(h)	20.5 [18.0 to 25.0]	19.0 [18.0 to 21.0]	0.2145
Cold ischemia time > 24h	(n)	5 (25%)	2 (5%)	0.0229

Adverse events (MP vs CS)

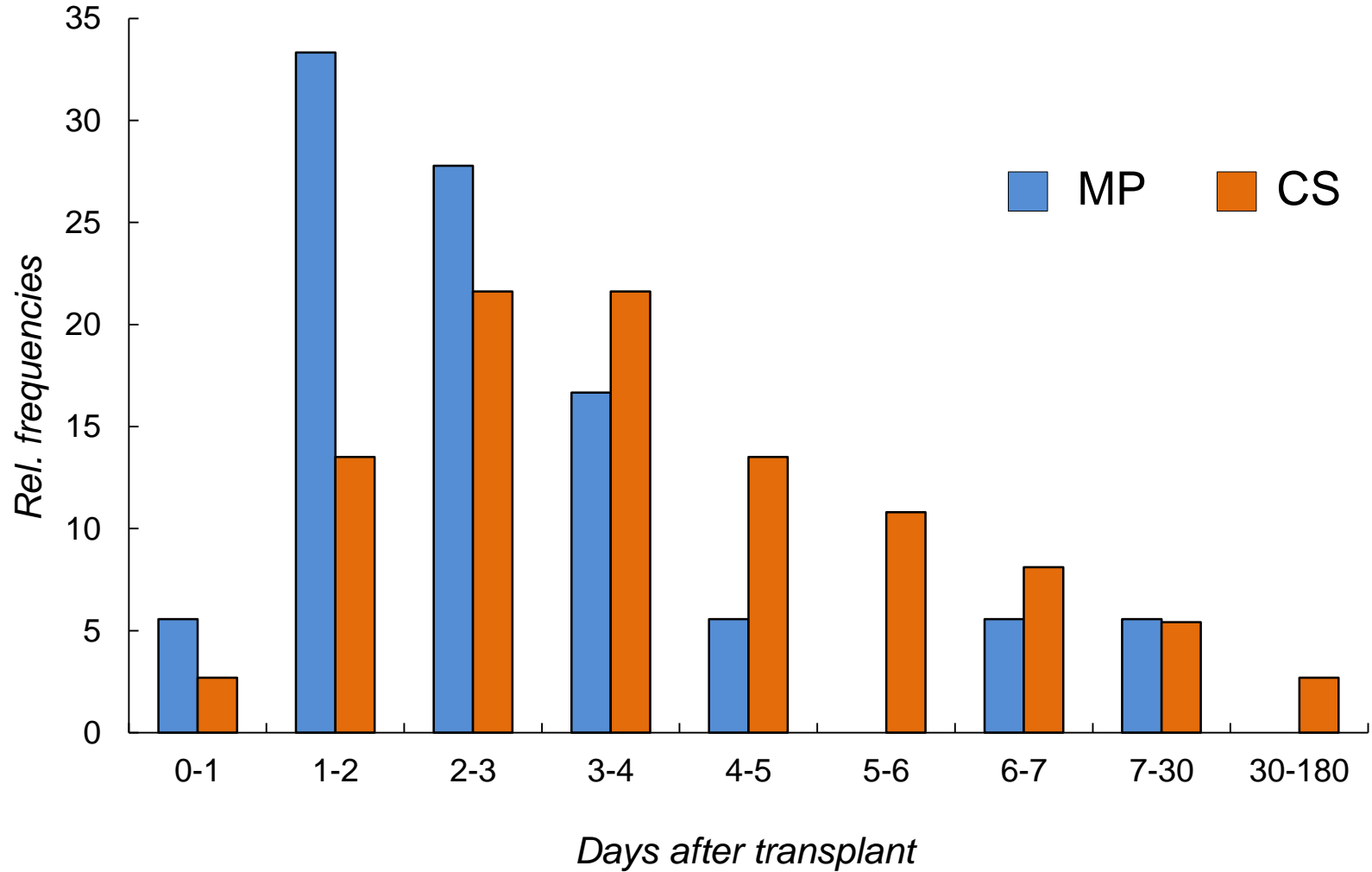
	MP (<i>n</i> =20)	CS (<i>n</i> =40)	<i>p</i> -value
DGF	2 (10%)	5 (12.5%)	0.7761

Prevalence of DGF in renal transplants from old donors



Stratta RJ, *Ann Surg*, 2006
Mezrich JD, *CJASN*, 2012
Gallinat A, *NDT*, 2012

Creatinine halving



Renal resistances correlate with histological scores and gradually decrease during hypothermic pulsatile perfusion

Renal resistances reduction is greater in kidneys with higher histological score

Despite prolonged ischemia times perfused kidneys have a faster functional recovery that might translate in lower incidence of DGF, less need of dialysis, and shorter hospitalisations

Grazie per l'attenzione!



RM3 Waters Medical Systems



*These slides belong to
Camillo Carrara, M.D.
Mario Negri Institute for Pharmacological
Research, Bergamo, Italy.*

*Using these slides is only authorized
when mentioning the source*