ADMINISTRACIÒ de FLUIDS i VASOACTIUS en DRA

XXXI Reunió Anual de la Societat Catalana de Nefrologia

Dr. A. Roglan
SMI. Hospital de la Santa Creu i Sant Pau. UAB.

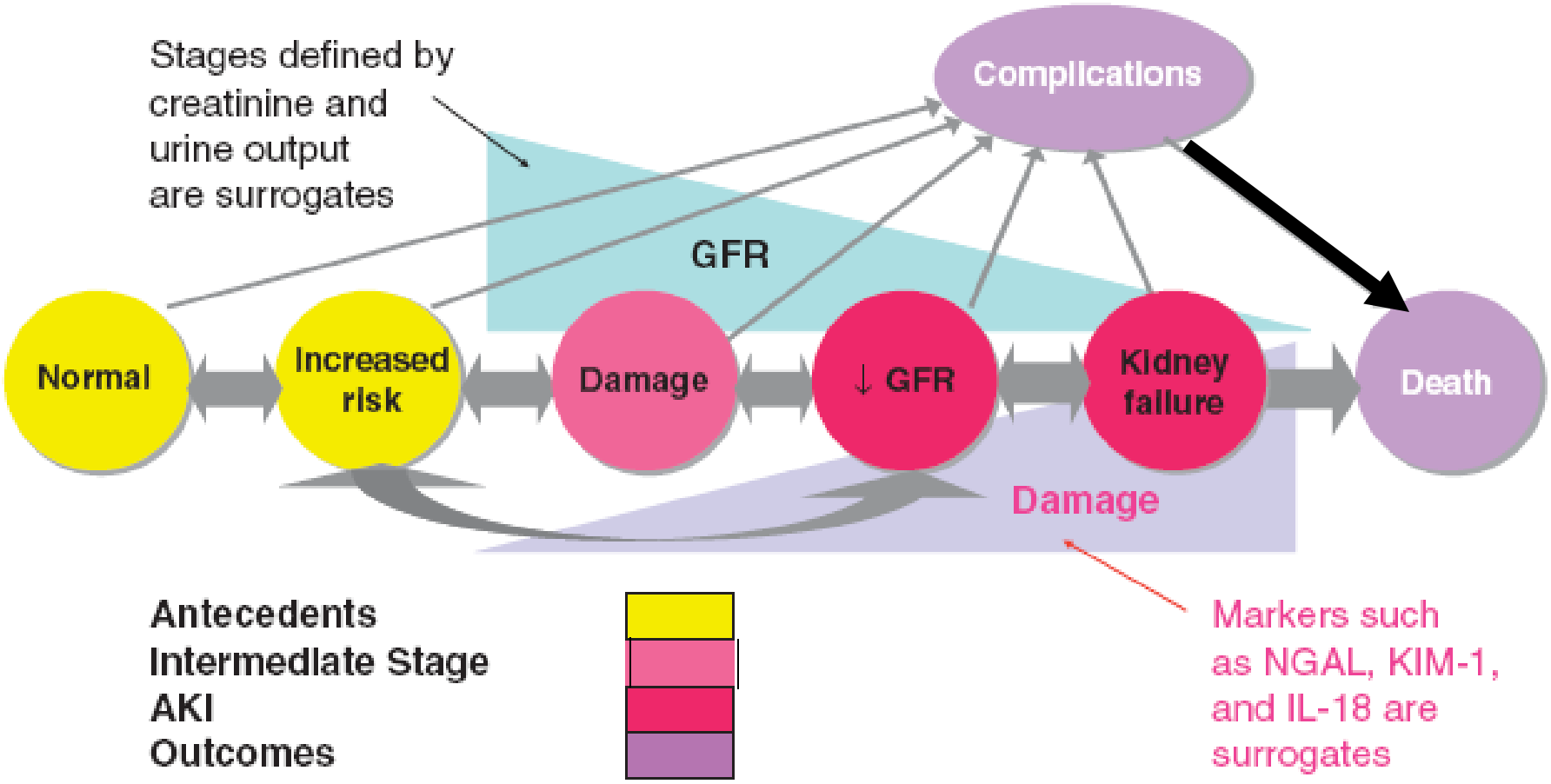
HOSPITAL DE LA SANTA CREU I SANT PAU
UNIVERSITAT AUTÒNOMA DE BARCELONA

XXXI REUNIÓ ANUAL DE LA SOCIETAT CATALANA DE NEFROLOGIA
10, 11 i 12 DE JUNY 2015
Hospital Moisès Broggi, Sant Joan Despí

PREVENCIÓ DRA segons AKIN-KDIGO

Section 2: AKI Definition

Kidney International Supplements (2012) **2,** 19–36; doi:10.1038/kisup.2011.32



FLUIDOTERAPIA

- La fluidoterapia es la “Piedra angular” del tratamiento de la sepsis/shock **-Hipovolemia sintomàtica**

- La resucitación precoz agresiva con fluidos puede mejorar la hipoxia tisular, la progresión a SDMO y mejorar el pronóstico

- La EGDT en el manejo de la sepsis ha demostrado mejorar el pronóstico de estos pacientes

- La EGDT también se ha demostrado eficaz en el manejo de pacientes sometidos a cirugía mayor.

Marik et al. Annals of Intensive Care 2011, 1:1

Objectiu

- **Euvolemia/estabilitat HEMODINÁMICA**
  - **TAm 65-75 mmHg**
  - **TAm 85-95 mmHg: no millor supervivència**
    Mes complicacions: ESTUDI SEPSIS-TAM

Balanç hídric positiu inicial
¡¡¡ NECESARI I INEVITABLE !!!

CORRECCIÓN VOLEMIA

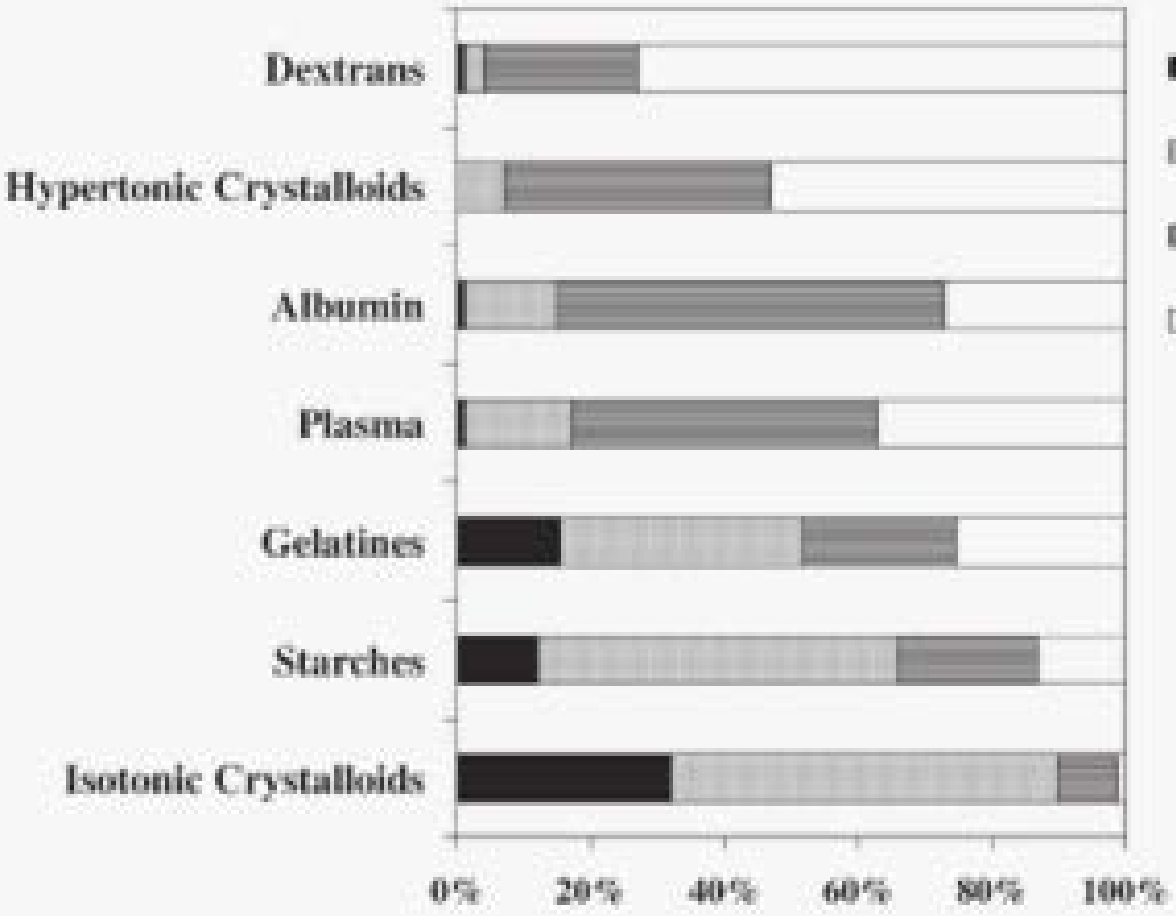
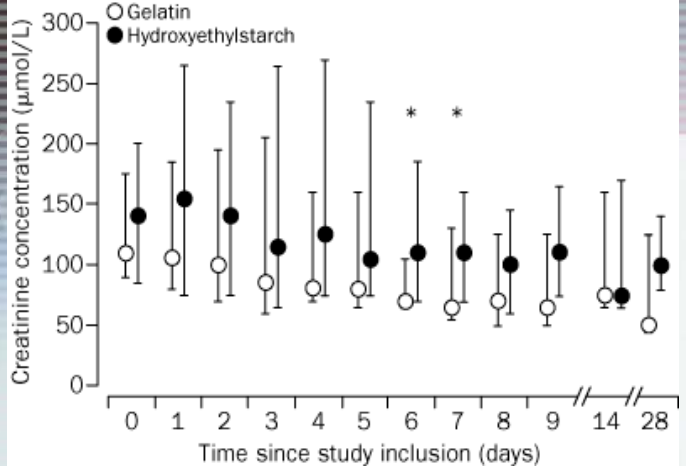
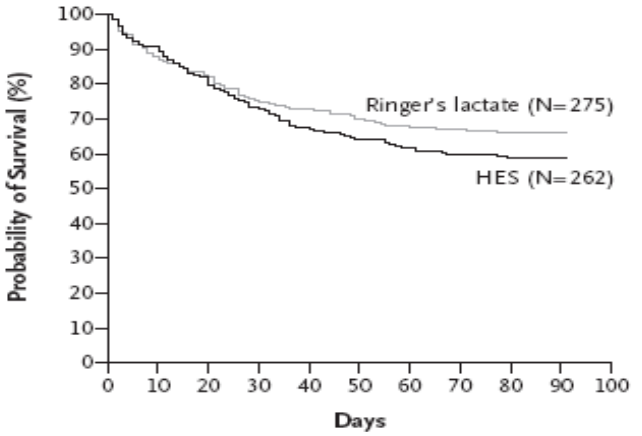


Fig. 1 Type of plasma volume expanders used in the ICU. Percentages based on 577 respondents

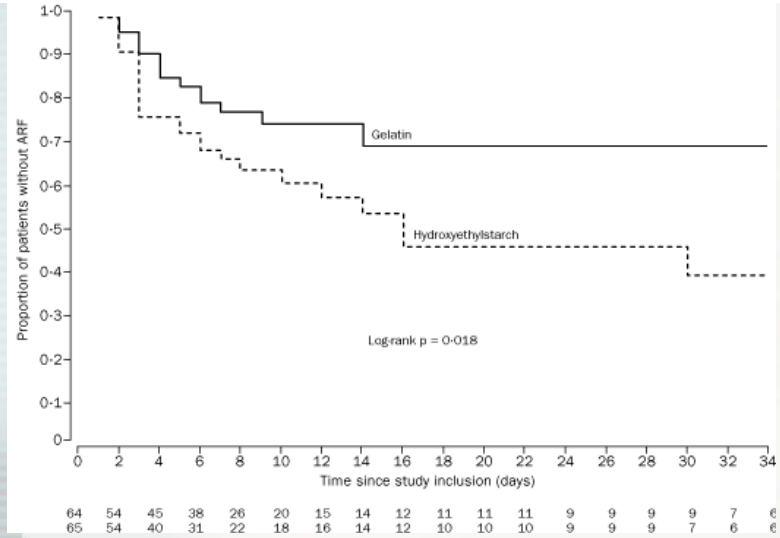
Schortgen F (CRYCO) ICM 2004; 30:2222-9

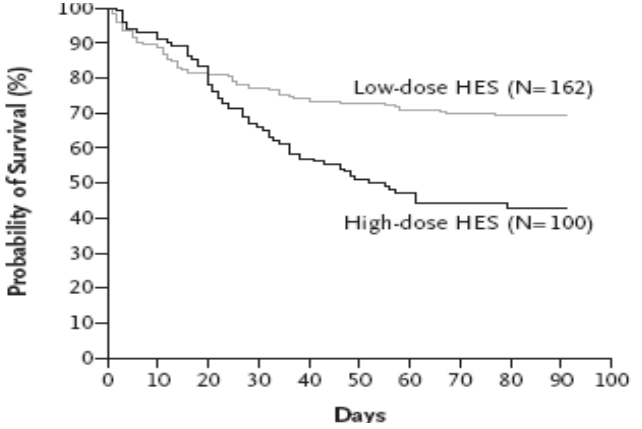


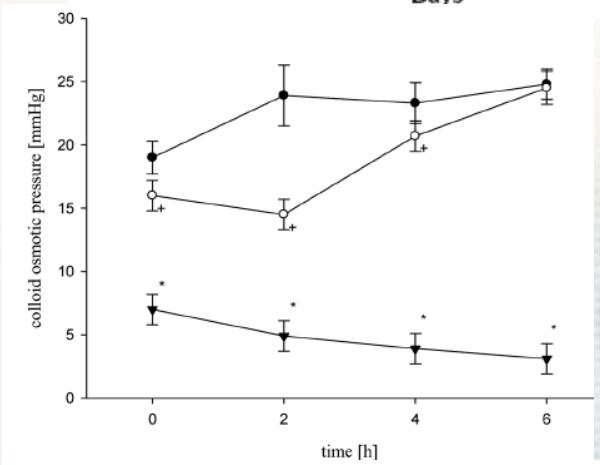
Schortgen F et al. *Lancet* 2001; 357:911-6



Brunkhorst et al. NEJM 2008; 358:125-39







Intensive Care Med (2010) 36:392–411
DOI 10.1007/s00134-009-1678-y

Am J Respir Crit Care Med Vol 181. pp 1128–1155, 2010
DOI: 10.1164/rccm.200711-1664ST

Hüter L et al

The NEW ENGLAND JOURNAL of MEDICINE

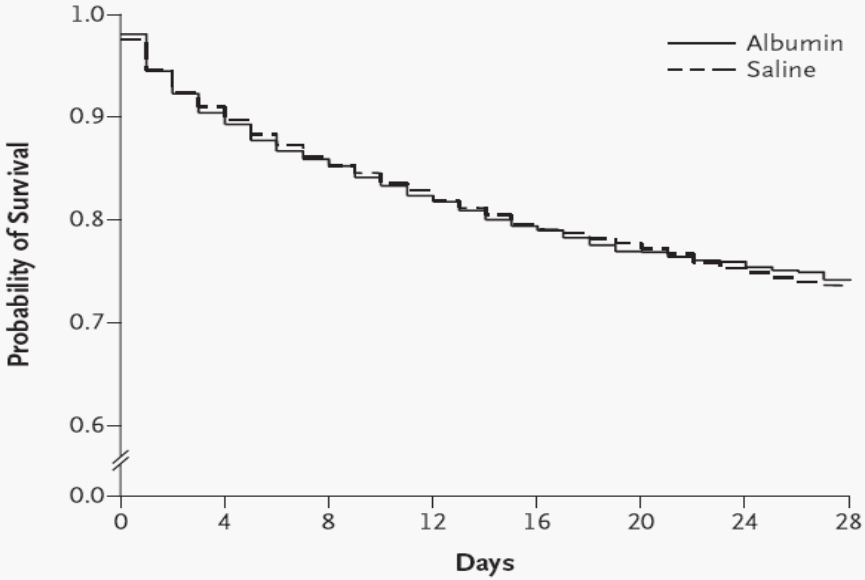
N Engl J Med 2004;350:2247-56.

ORIGINAL ARTICLE

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit

The SAFE Study Investigators*

- ✓ 6997 pacientes críticos, randomización 1:1
  - ✓ albúmina
  - ✓ s. salino



Estudi ALBIOS, en sepsis: 1818 pac.

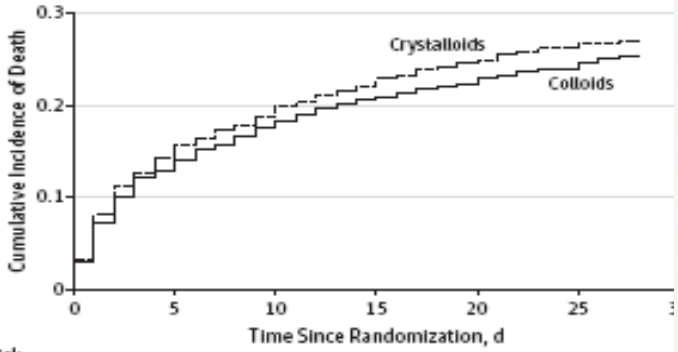
In sepsis, albumin provided hemodynamic advantages. In septic shock: hemodynamic-fluid balance advantages, and survived significantly more at 90 days. No differences in organ dysfunction and degree were observed.

NEJM 2014;370 (15):1412-21

Effects of Fluid Resuscitation With Colloids vs Crystalloids on Mortality in Critically Ill Patients Presenting With Hypovolemic Shock The CRISTAL Randomized Trial

JAMA. 2013;310(17):1809-1817. doi:10.1001/

Figure 2. Cumulative Incidence of Death Within First 28 Days After Randomization



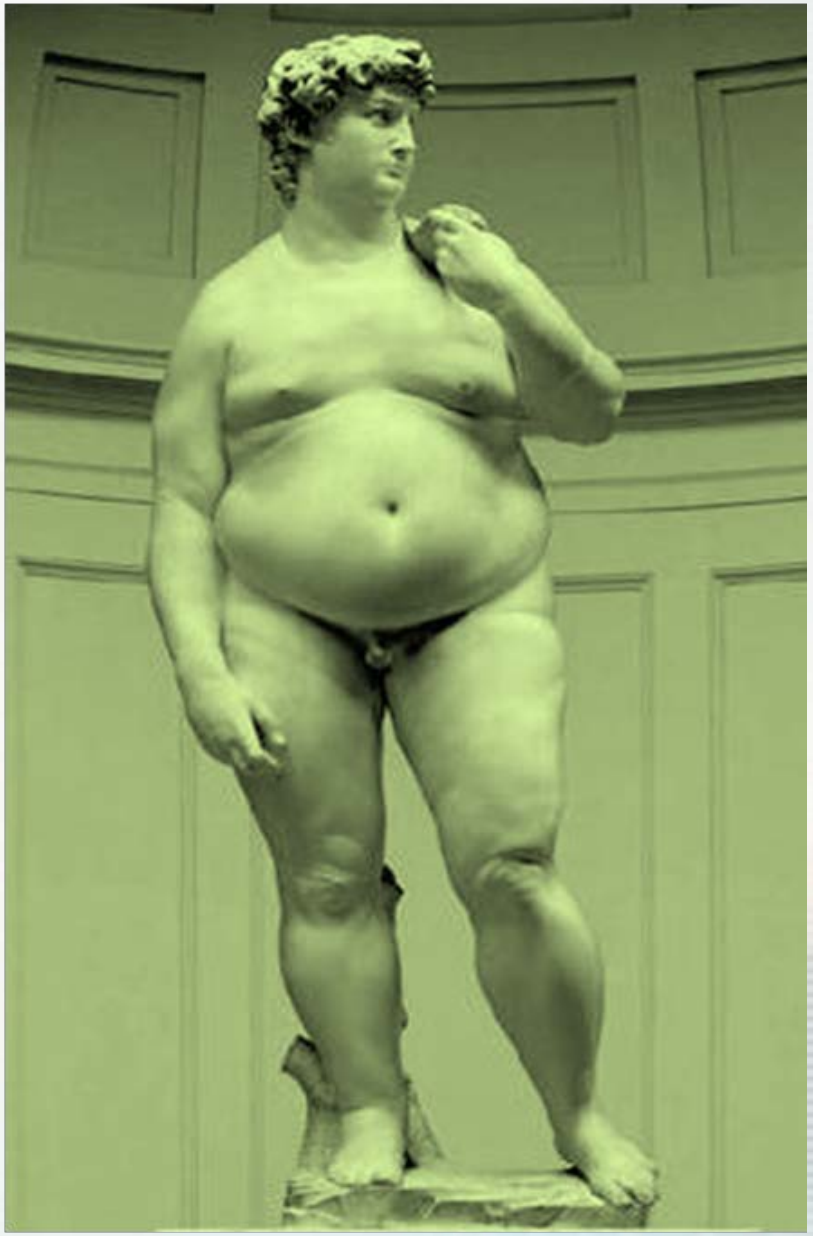
No. at risk

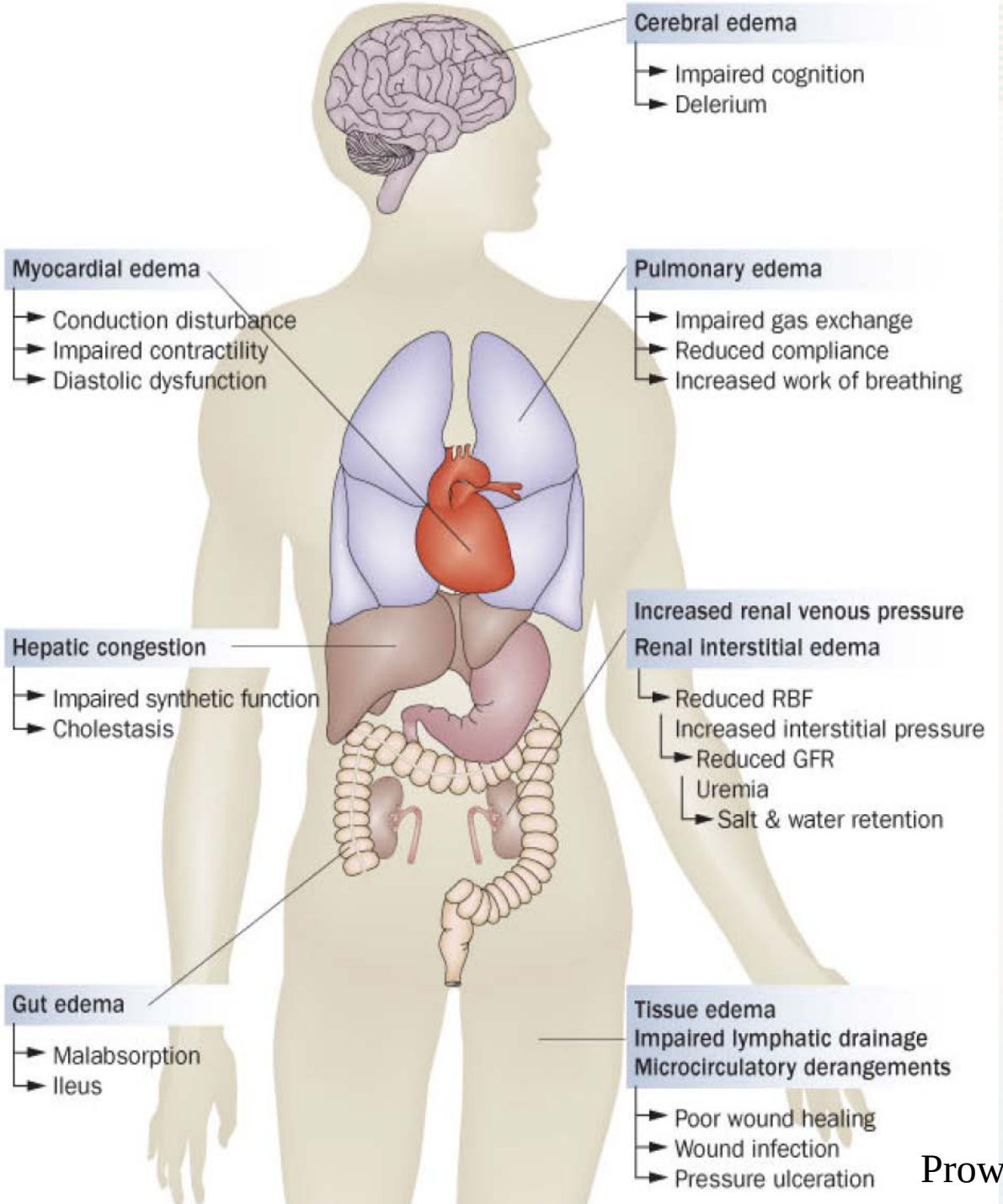
Colloids	1414	1233	1167	1124	1099	1076
Crystalloids	1443	1239	1172	1124	1089	1064

Table 4. Mortality Outcomes in Patients With Sepsis

	Colloids Group, No.		Crystalloids Group, No.		
	Patients	Deaths	Patients	Deaths	HR (95% CI)
28-d Mortality					
Entire population	774	215	779	226	0.95 (0.78-1.14)
HES vs isotonic saline	375	105	557	157	0.97 (0.76-1.25)
Gelatins vs isotonic saline	152	40	557	157	0.90 (0.63-1.27)
HES vs Ringer solution	375	105	37	12	0.84 (0.46-1.53)
Gelatins vs Ringer solution	152	40	37	12	0.77 (0.40-1.47)
Albumin vs isotonic saline	59	19	557	157	1.16 (0.72-1.87)
90-d Mortality					
Entire population	774	252	779	286	0.87 (0.73-1.03)
HES vs isotonic saline	375	120	557	197	0.89 (0.71-1.11)
Gelatins vs isotonic saline	152	47	557	197	0.84 (0.61-1.16)
HES vs Ringer solution	375	120	37	16	0.71 (0.42-1.20)
Gelatins vs Ringer solution	152	47	37	16	0.67 (0.38-1.18)
Albumin vs isotonic saline	59	22	557	197	1.07 (0.69-1.67)

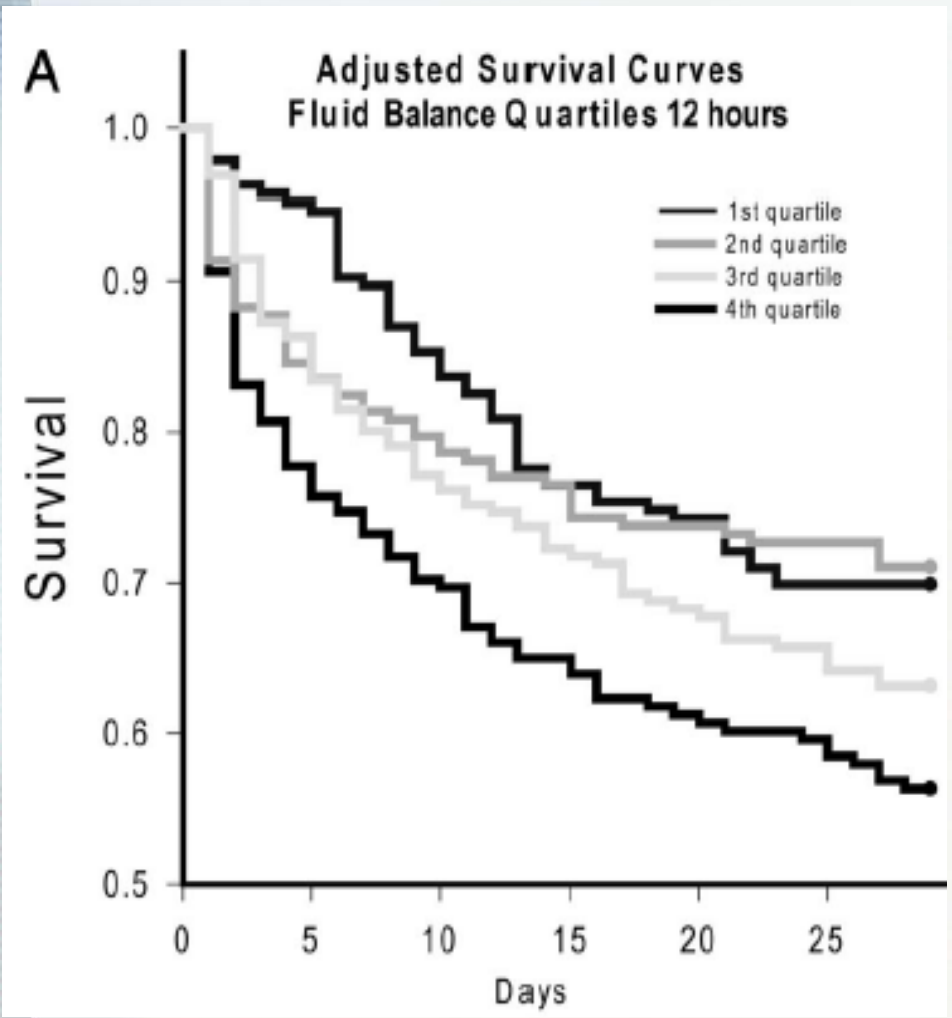
CONCLUSIONS AND RELEVANCE Among ICU patients with hypovolemia, the use of colloids vs crystalloids did not result in a significant difference in 28-day mortality. Although 90-day mortality was lower among patients receiving colloids, this finding should be considered exploratory and requires further study before reaching conclusions about efficacy.

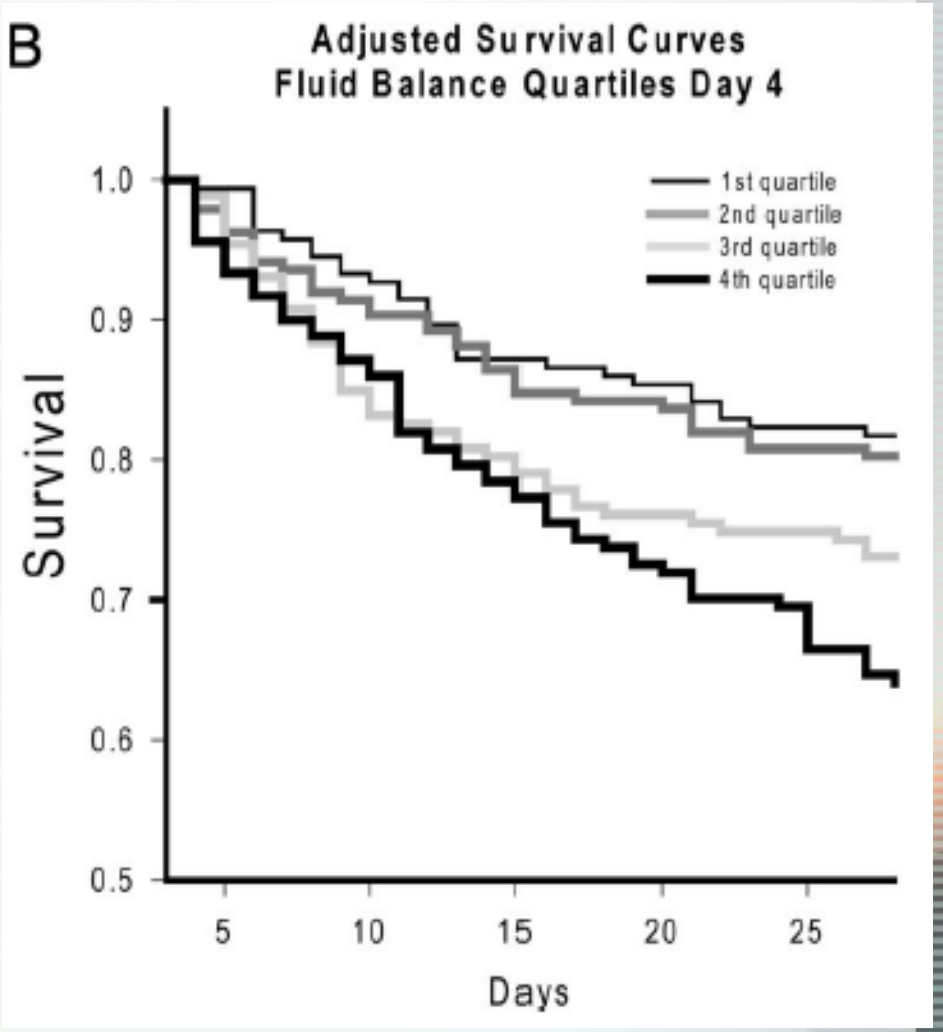




Prowle Nat Rev Nephrol 2010;6:107-15

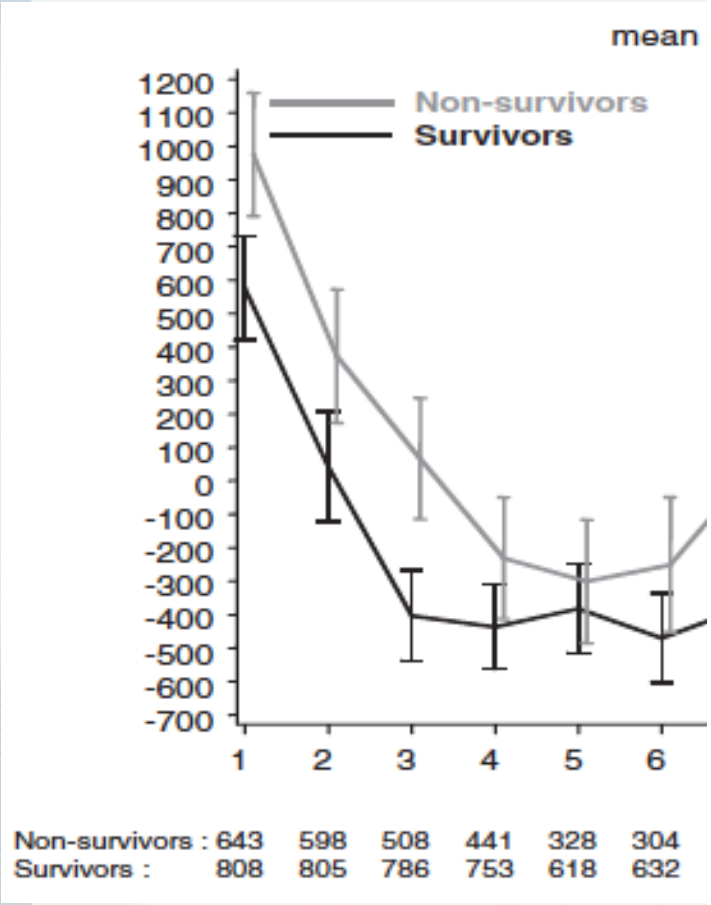
Fluid Balance and Survival

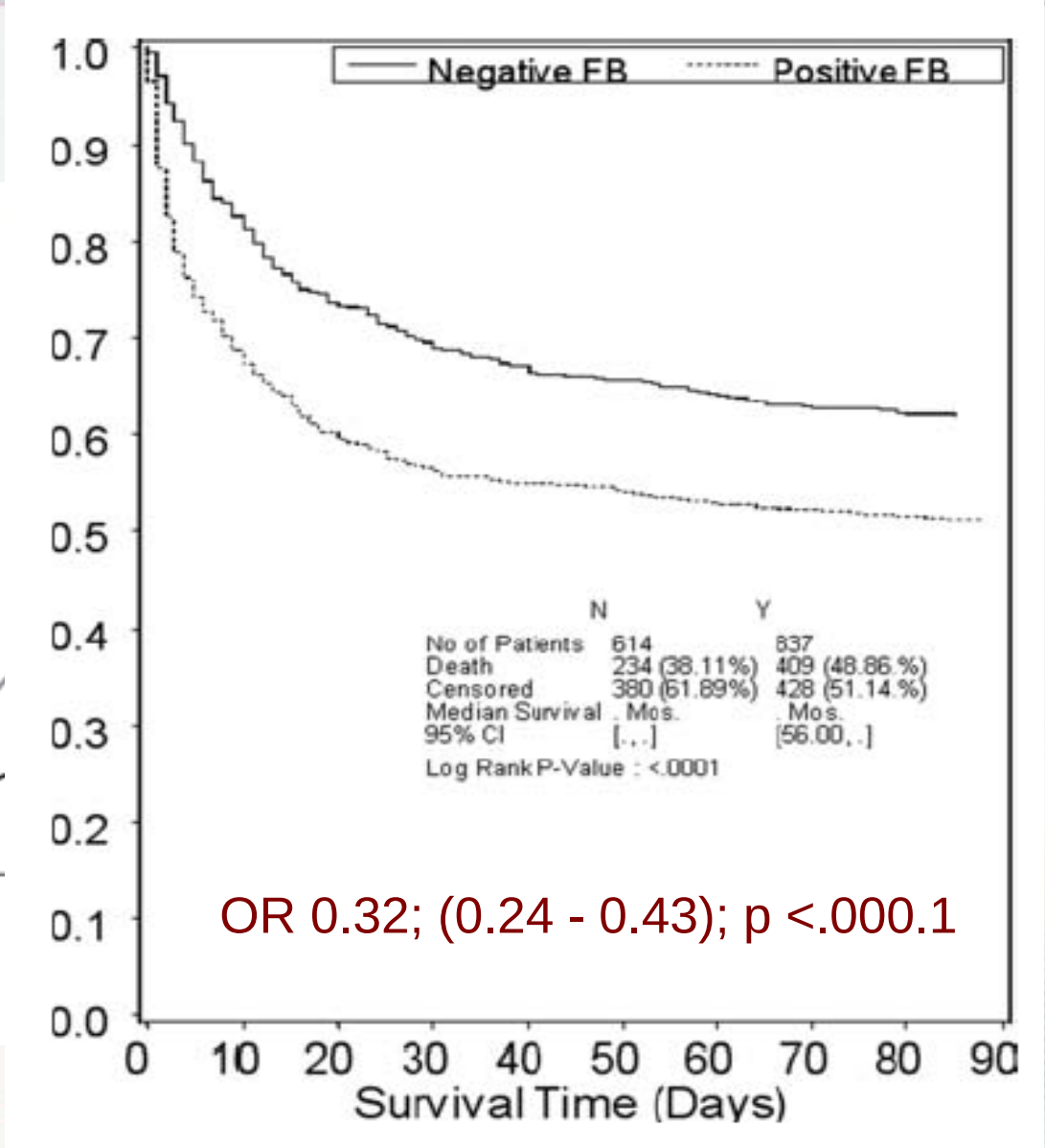




Boyd JH CCM 2011; 39:259-65

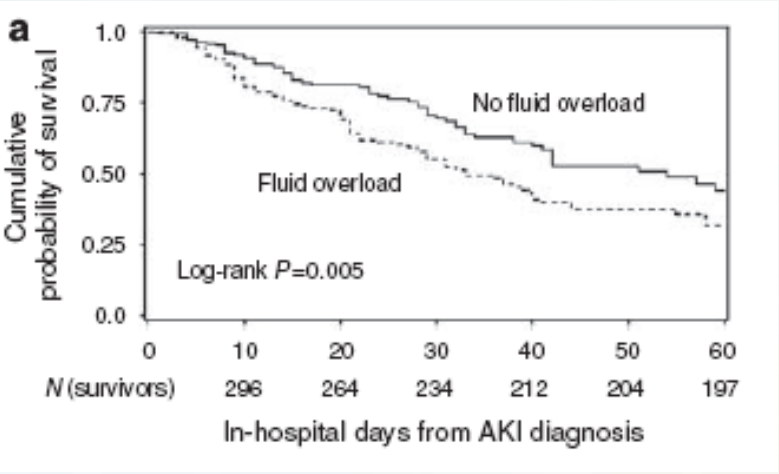
RENAL Study Investigators

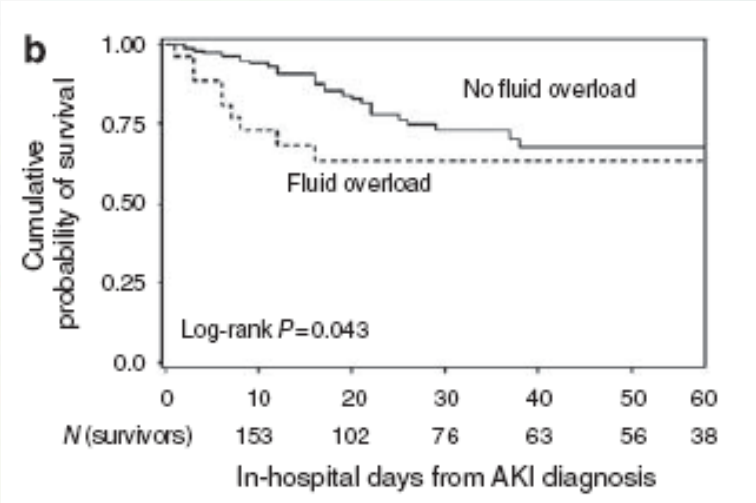


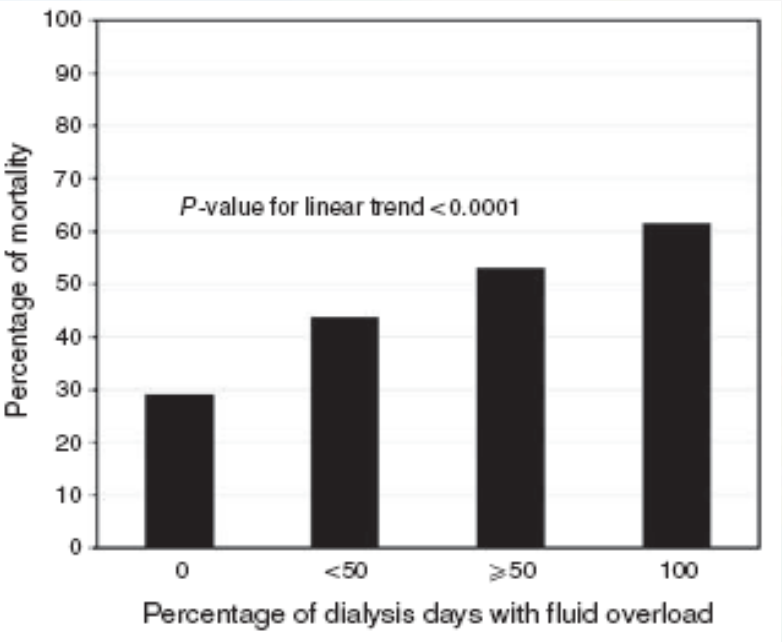


Bellomo R CCM 2012; 40: 1753–60

Fluid accumulation, survival and recovery of kidney function in critically ill patients with acute kidney injury







Bouchard J Kidney Int 2009; 76, 422–7

Fluid overload at initiation of renal replacement therapy is associated with lack of renal recovery in patients with acute kidney injury

Michael Heung[1,*], Dawn F. Wolfgram[2,*], Mallika Kommareddi[1], Youna Hu[3], Peter X. Song[3] and

Risk for renal recovery within 1 year of dialysis initiation

Predictor	Hazard ratio	95% CI	P-value
% FO at initiation (per 1%)	0.97	(0.95–1.00)	0.024
≥1 comorbidity	0.51	(0.30–0.89)	0.018
Baseline serum creatinine (per 1 mg/dL)	0.56	(0.37–0.87)	0.009
Use of vasopressors	0.49	(0.28–0.85)	0.011
Time between consult and initiation (per day)	0.84	(0.72–0.98)	0.025

Conclusions. In patients with AKI, a higher degree of fluid overload at RRT initiation predicts worse renal recovery at 1 year.

Nephrol Dial Transplant (2012) 27: 956–96

Post-renal: Congestive Kidney Failure and Renal Tamponade

Tomado de J. Kellum

Carrega de volum

- **No es un test, es un tractament**
- **Infinitament mes fàcil administrar volum que extraure'l**
- **Monitoritzar el pes: es EL mètode para controlar balanç.**
- **Al cab d'uns dies hauria de ser menor al del ingrés**

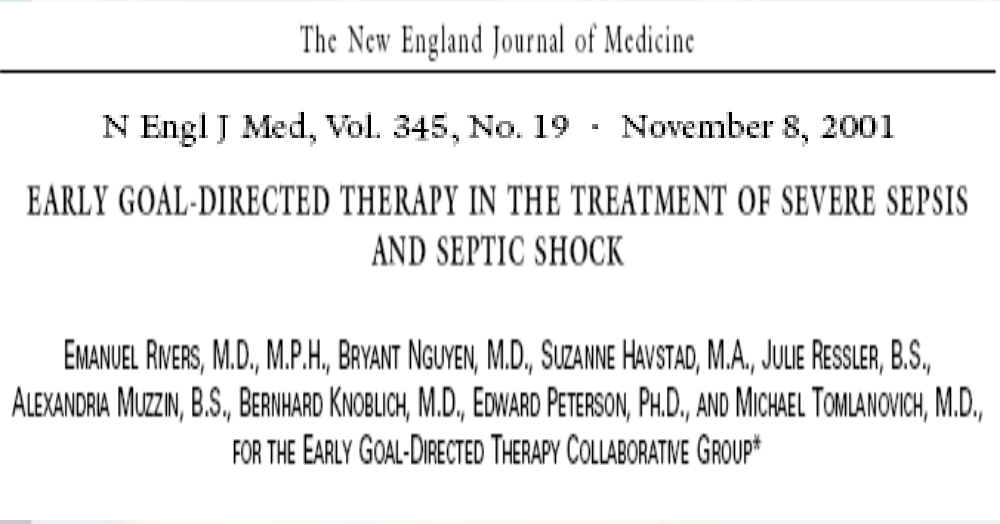
ESCENARIS i administració de fluids

- **1:** URGÈNCIA**: evident pèrdua de volum**

  Signes inicials: alteració FE Na^+

  Signes tardans: TA, FC, oligúria, estat mental, perfusió perifèrica....

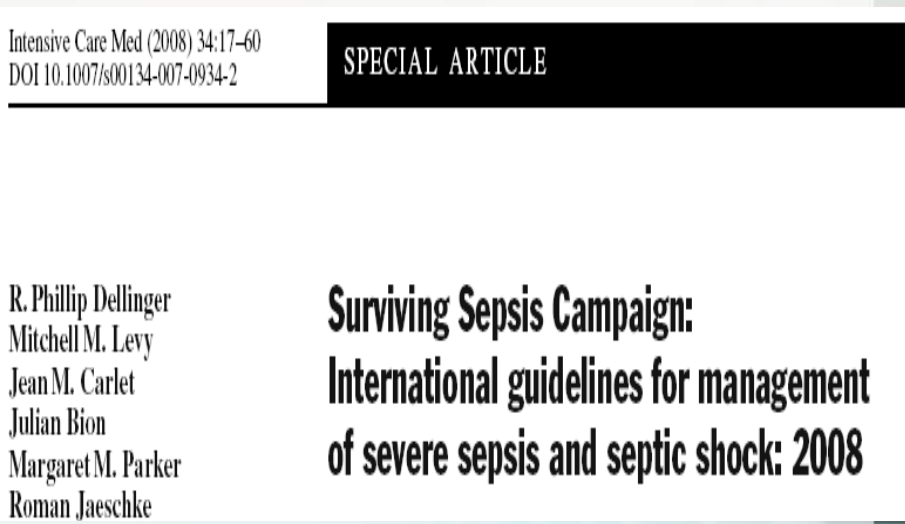
- **2:** URGÈNCIA**: sepsis greu o shock sèptic**


The New England Journal of Medicine

N Engl J Med, Vol. 345, No. 19 · November 8, 2001

EARLY GOAL-DIRECTED THERAPY IN THE TREATMENT OF SEVERE SEPSIS AND SEPTIC SHOCK

EMANUEL RIVERS, M.D., M.P.H., BRYANT NGUYEN, M.D., SUZANNE HAVSTAD, M.A., JULIE RESSLER, B.S., ALEXANDRIA MUZZIN, B.S., BERNHARD KNOBLICH, M.D., EDWARD PETERSON, PH.D., AND MICHAEL TOMLANOVICH, M.D., FOR THE EARLY GOAL-DIRECTED THERAPY COLLABORATIVE GROUP*


Intensive Care Med (2008) 34:17–60
DOI 10.1007/s00134-007-0934-2

SPECIAL ARTICLE

R. Phillip Dellinger
Mitchell M. Levy
Jean M. Carlet
Julian Bion
Margaret M. Parker
Roman Jaeschke

Surviving Sepsis Campaign: International guidelines for management of severe sepsis and septic shock: 2008

ESCENARIS i administració de fluids

- **3: UCI:** Responders vs Non-responders

Table 1—*Studies of Fluid Responsiveness in Septic Patients

Study	Fluid Challenges, No.	Responders, %	Test Used
Tavernier et al,[33] 1998	35	60	dDown (SPV)
Sakka et al,[35] 1999	57	46	ITBVI
Michard et al,[32] 2000	40	40	PPV
Feissel et al,[34] 2001	19	53	ΔVpeak
Michard et al,[36] 2003	66	48	GEDVI
Feissel et al,[37] 2004	39	41	ΔIVC
Vieillard-Baron et al,[39] 2004	66	30	SVC collapsibility
Barbier et al,[40] 2004	20	50	ΔIVC
Perner and Faber,[41] 2006	30	47	SVV
Feissel et al,[38] 2007	28	64	ΔPplet
Osman et al,[31] 2007	150	43	CVP/PAOP

Durairaj Chest 2008; 133:252-63

METODOLOGIA

MACROCIRCULACIÓ

- Contorn - Forza del pols
- Mesura de flux: ETT/ETE
- “P. L. R”
- Maniobra d’oclusió telespiratoria

- Radiologia toràcica a peu de llit

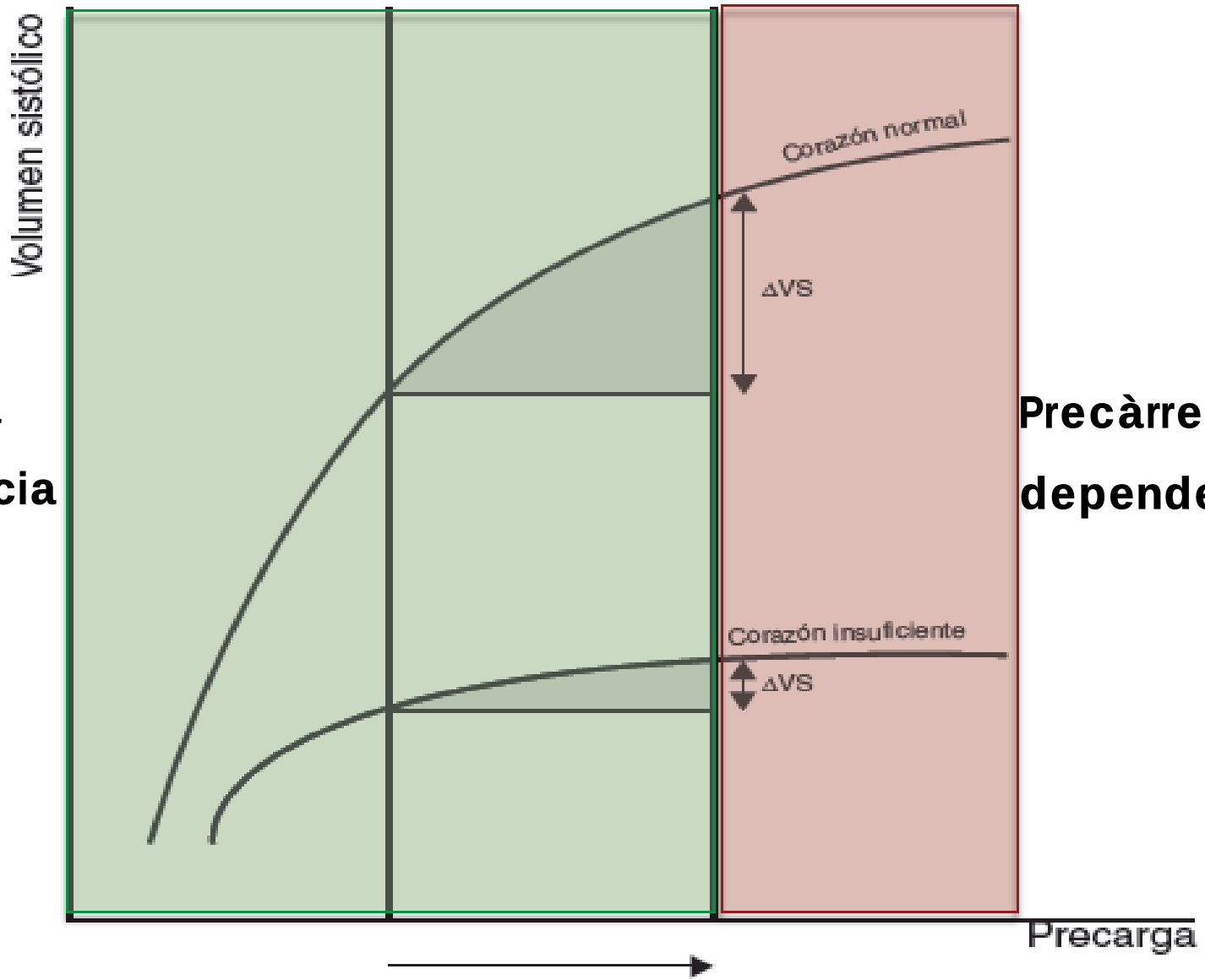
- Catèter de Swan-Ganz

MICROCIRCULACIÓ
estudi FENICE

- Perfusió tissular: Tonometría, microdiálisis, O_2 transcutani, pH tisular.

Fonaments fisiològics: Llei de Frank-Starling

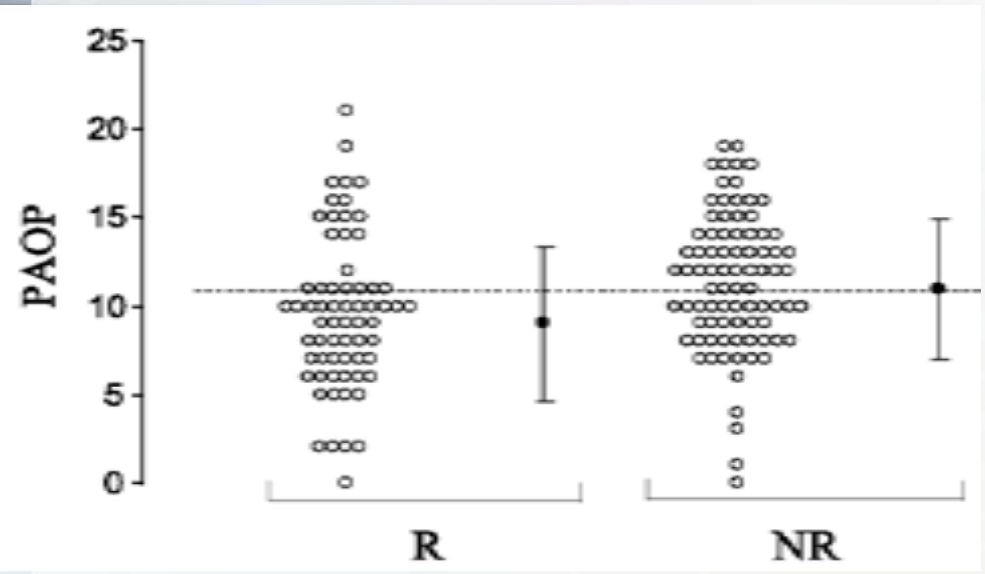
Precàrrega dependència



Precàrrega no dependent

Sabatier Med Intensiva 2012; 36(1): 45-55

MARCADORS ESTÁTICS DE PRECARGA



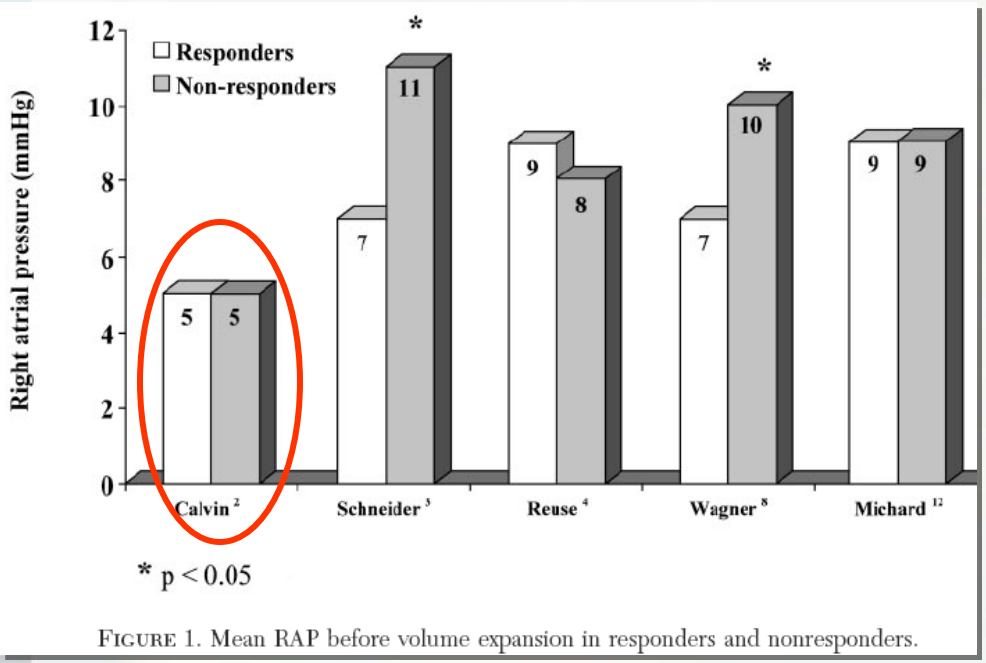


FIGURE 1. Mean RAP before volume expansion in responders and nonresponders.

Predicting Fluid Responsiveness in ICU Patients* : A Critical Analysis of the Evidence

Frédéric Michard and Jean-Louis Teboul *Chest* 2002;121;2000-2008

Table 3—*PAOP Before Volume Expansion in Responders and Nonresponders

Source	PAOP, mm Hg	
	Responders	Nonresponders
Calvin et al[2]	8 ± 1	7 ± 2
Schneider et al[3]	10 ± 1	10 ± 1
Reuse et al[4]	10 ± 4	10 ± 3
Diebel et al[6]	14 ± 7	7 ± 2†
Diebel et al[7]	16 ± 6	15 ± 5
Wagner and Leatherman[8]	10 ± 3	14 ± 4†
Tavernier et al[9]	10 ± 4	12 ± 3
Tousignant et al[11]	12 ± 3	16 ± 3†
Michard et al[12]	10 ± 3	11 ± 2

*Values are expressed as mean ± SD, except for the study of Schneider et al[3] (mean ± SEM).
†$p < 0.05$ responders vs nonresponders.

Osman CCM 2007:35:64-8

MARC. DINÀMICS: RESPOSTA VOLUM

- **Aportar volum i observar efecte en Vol. Sistólic / G. C. (corba Frank-Starling)**
- **Canvis hemodinámics: interacció cor - pulmó en Vent. mecànica.**
- **“Passive Leg Raising”**

PREDIR "RESPONDERS": Ona de pols

Δ up: depends on afterload

Δ down: depends on preload

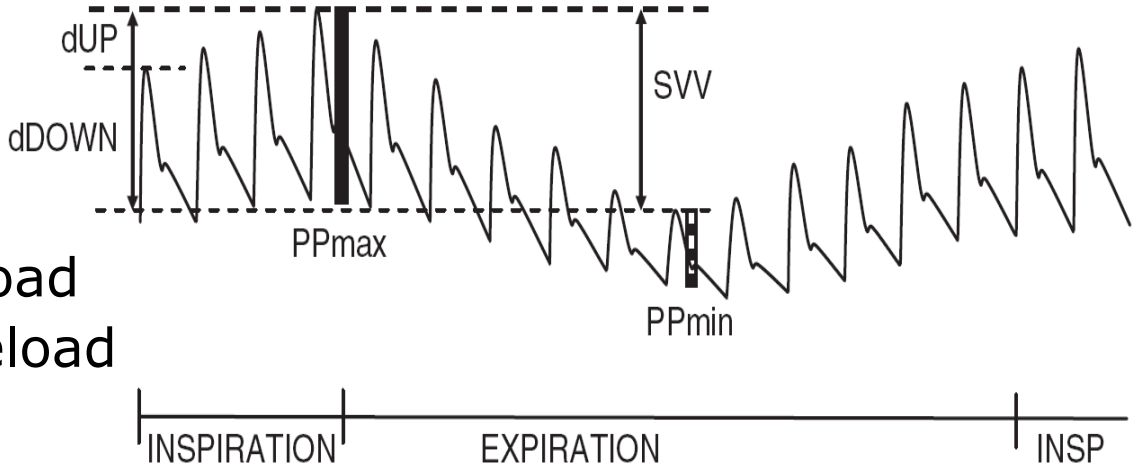
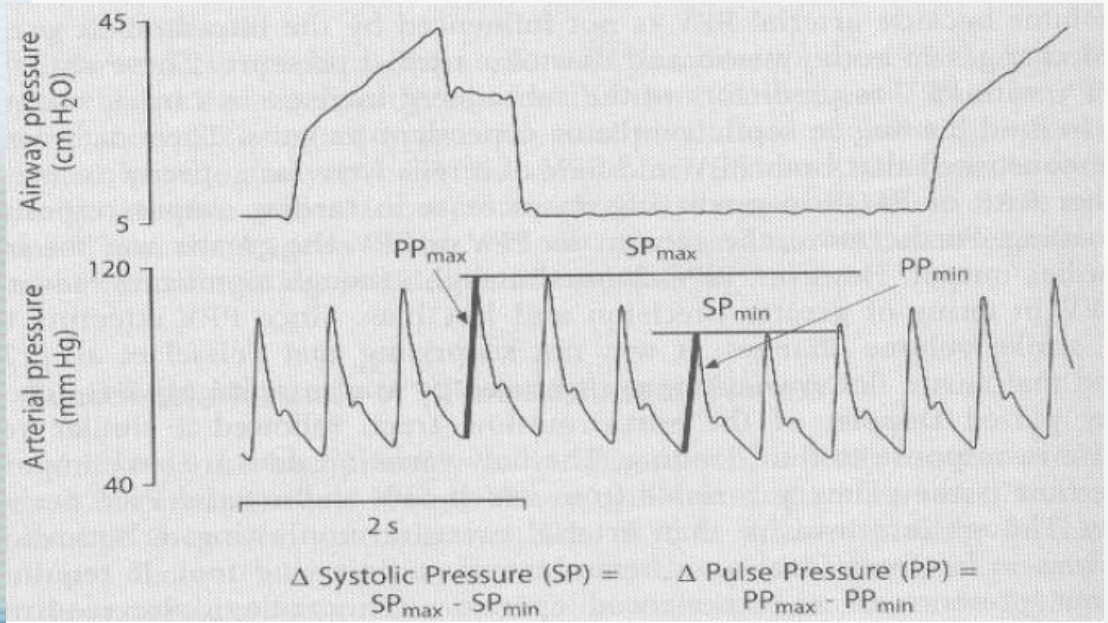


FIGURE 5. Relationship of arterial pressure wave and passive respiration. Compared to end-expiration, the systolic pressure and pulse pressure rise during inspiration (INSP), then fall during expiration.

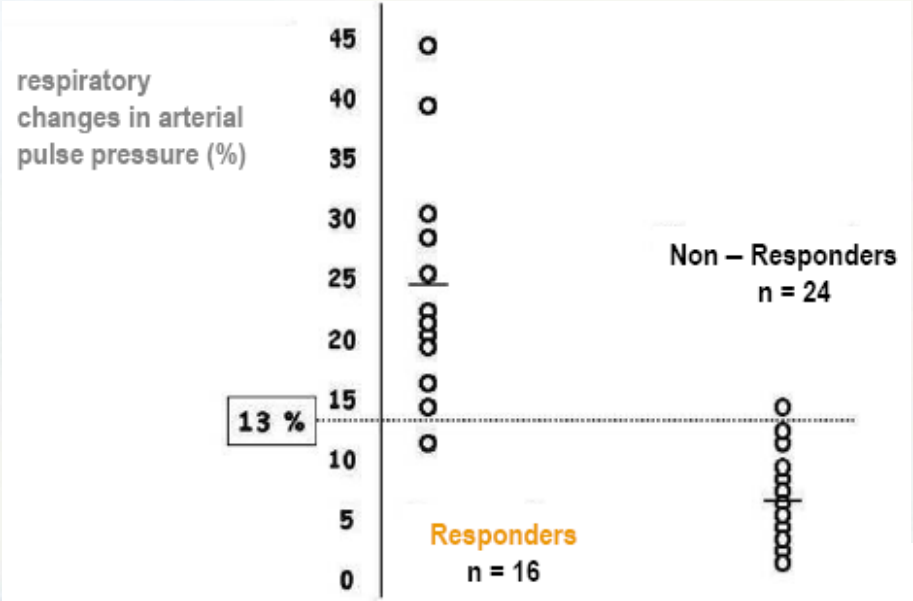


De Backer D. ICM 2005; 31:517-23

Kramer A. Chest 2004; 126:1563-8

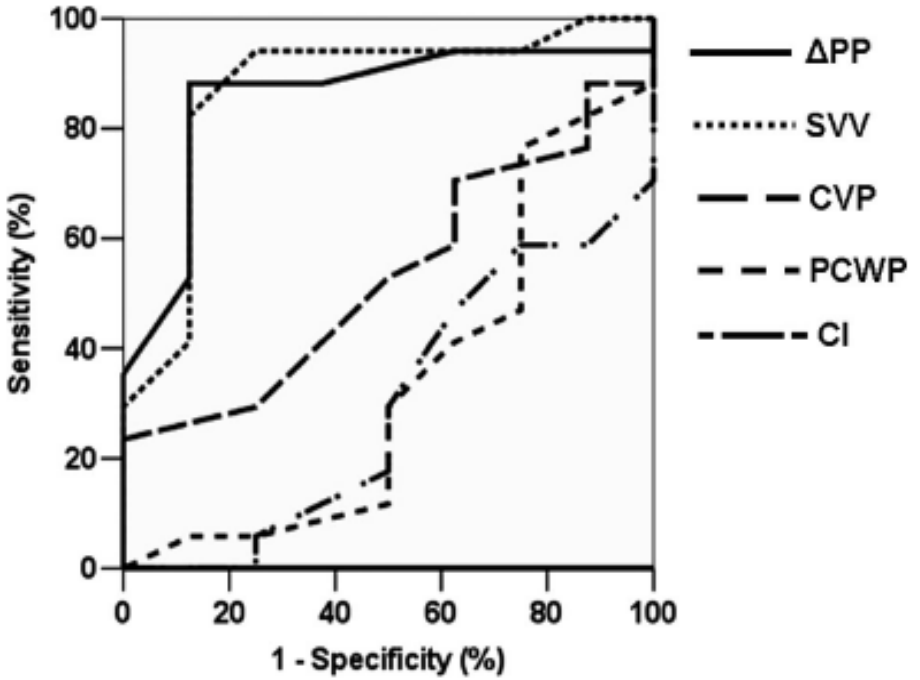
VOLEMIA/GC per CONTOR - FORÇA DE POLS

- **1 Contorn de pressió arterial**
  PRAM: Pressure Recording Analitical Method
  VIGILEO-FLO TRAC
- **2 Contorn mes dilució: Força**
  Termodil. transpulmonar (PICCO)
  LiDCO



PPV ⩾ 13% identifica "responders"

Michard et al, Am J Respir Crit Care Med 162, 2000



The Ability of Stroke Volume Variations Obtained with Vigileo/FloTrac System to Monitor Fluid Responsiveness in Mechanically Ventilated Patients

Cannesson M et al (Anesth Analg 2009;108:513–7)

VOLUME MANAGEMENT IN CRITICALLY ILL PATIENTS: NEW INSIGHTS

M Rezende et al **Clinics 2006; 61:345-50**

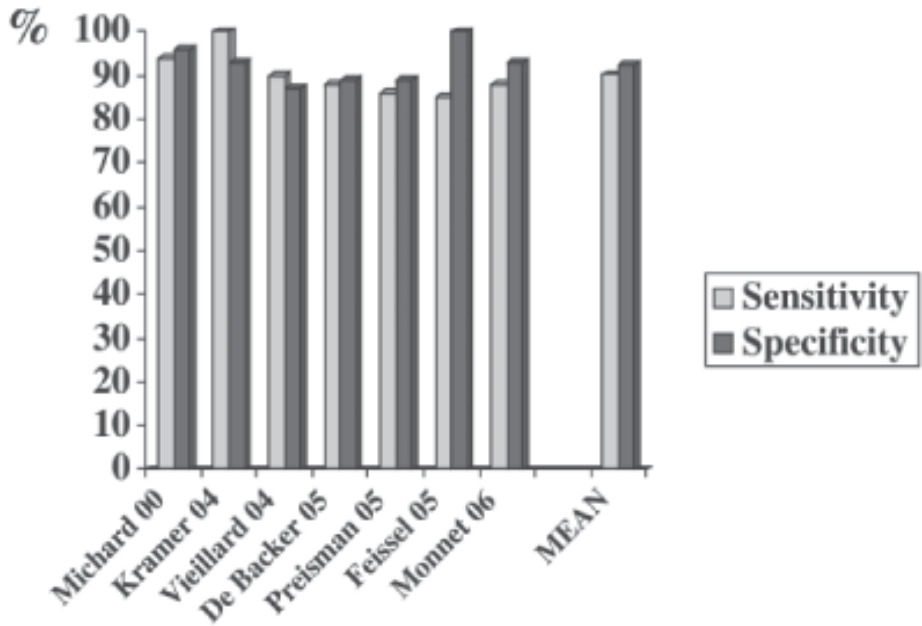


Figure 1 - Sensitivity and specificity of arterial pulse pressure variation (ΔPP) for discriminating between responders and nonresponders to fluid administration.

Pediatr Crit Care Med. 2008 May;9(3):341-2. Tibby S et al

Transpulmonary thermodilution: finally, a gold standard for pediatric cardiac output measurement.

LIMITACIONS:

Monitors de ona de pols

SVV/PPV: validats en VM (V_T↑), sense arrítmia cardíaca

Tots paràmetres: Sense validesa en BCPIAo

Dilució transpulmonar (TDTP)

TDER: escassa interferència en TDTP

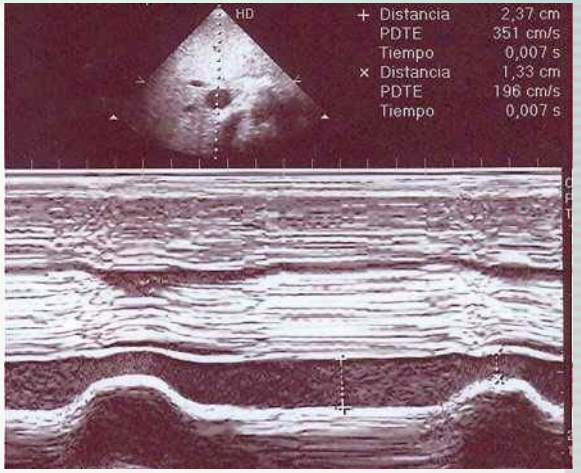
Tto. liti: contraindica dilució liti

Relaxants: interfereixen dilució liti

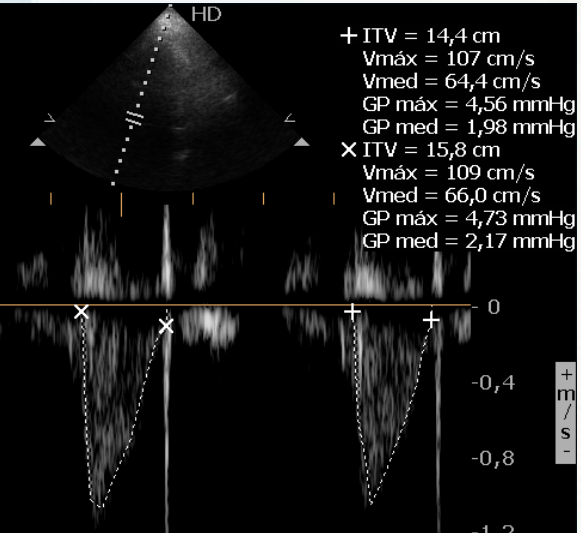
Injecció perifèrica: Validada en liti, no recomanada en altres TDTP

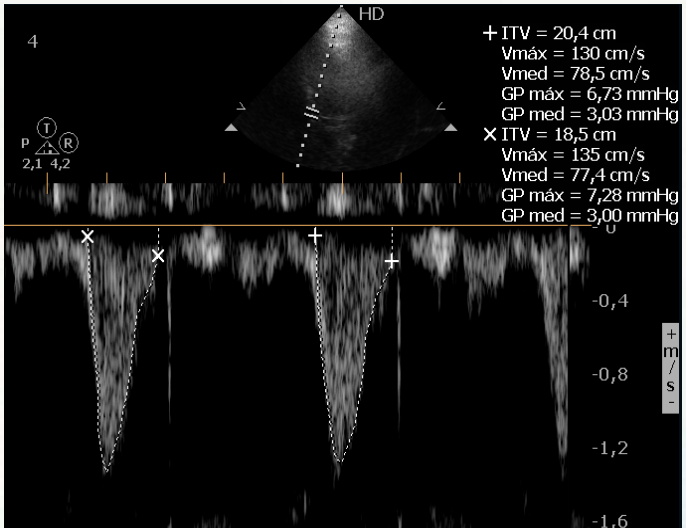
PREDIR RESPONDERS

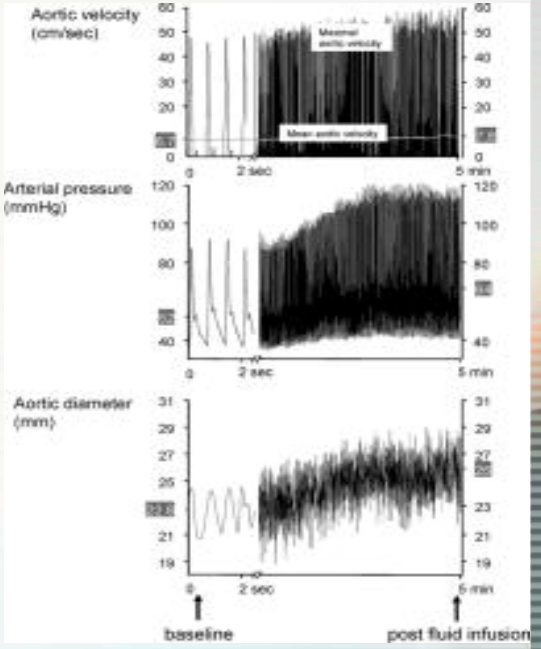
- **ECOCARDIOGRAFÍA TT: canvis en diàmetre VCI amb respiració.**



- **ECOCARDIOGRAFÍA TT/TE: canvis en el flux Aòrtic.**

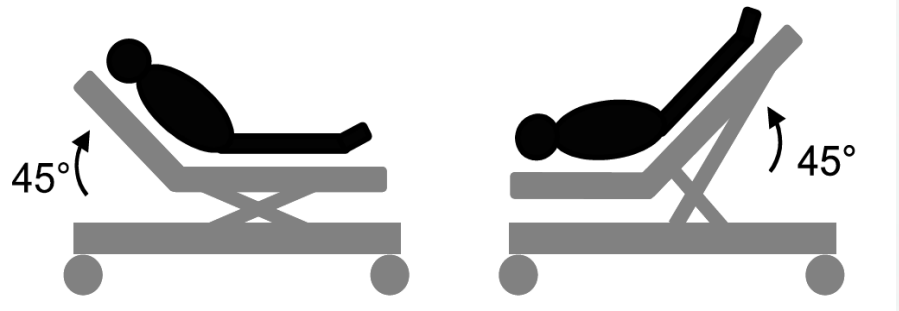






Monnet X. CCM 2007; 35:477-82

PREDIR RESPONDERS: P.L.R.



Monnet and Teboul ICM 2008; 34:659-63

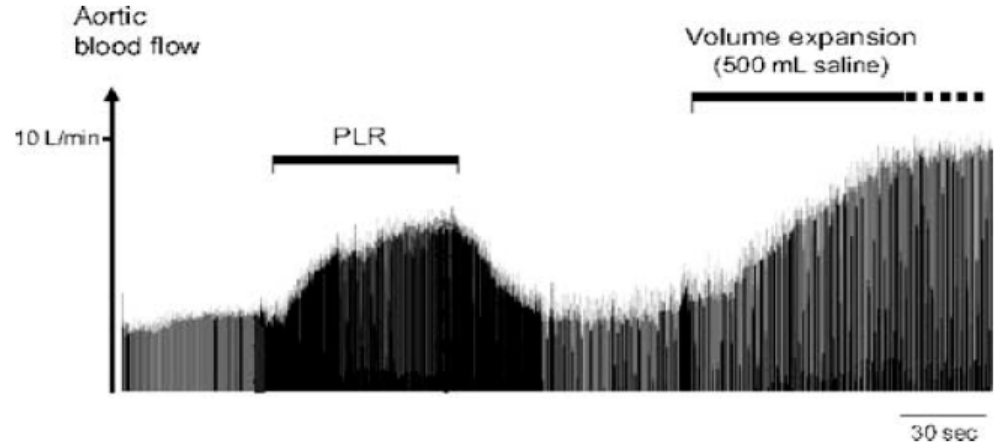
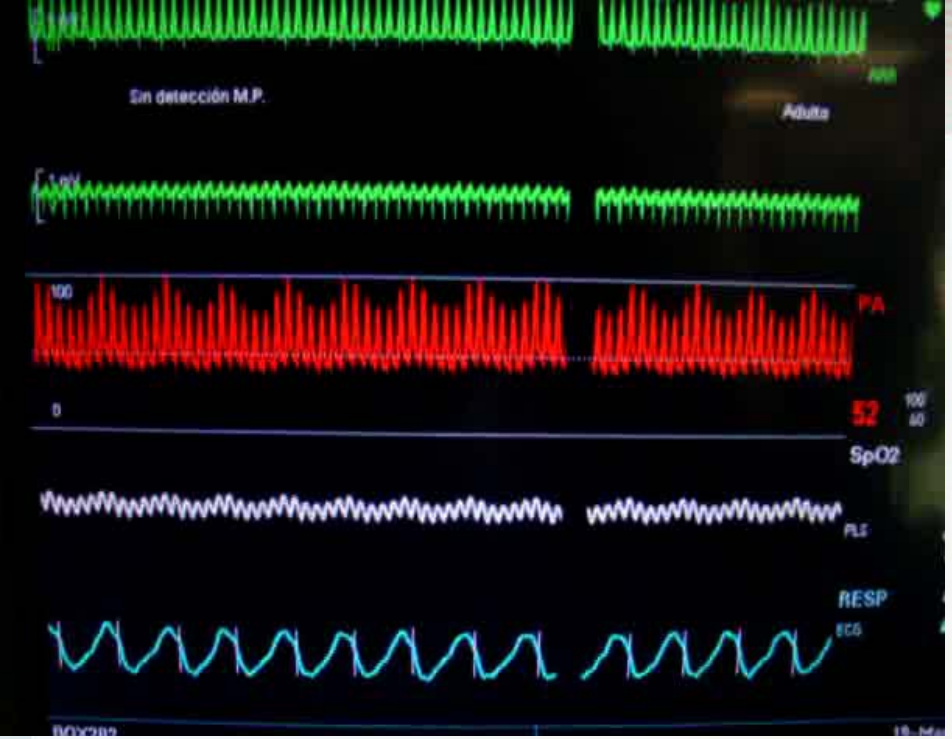


Fig. 3 Typical waveform of aortic blood flow during a passive leg raising (*PLR*) test and volume expansion in a patient with preload reserve. In this patient with an acute circulatory failure the increase in aortic blood flow observed during PLR can predict the positive response to volume expansion

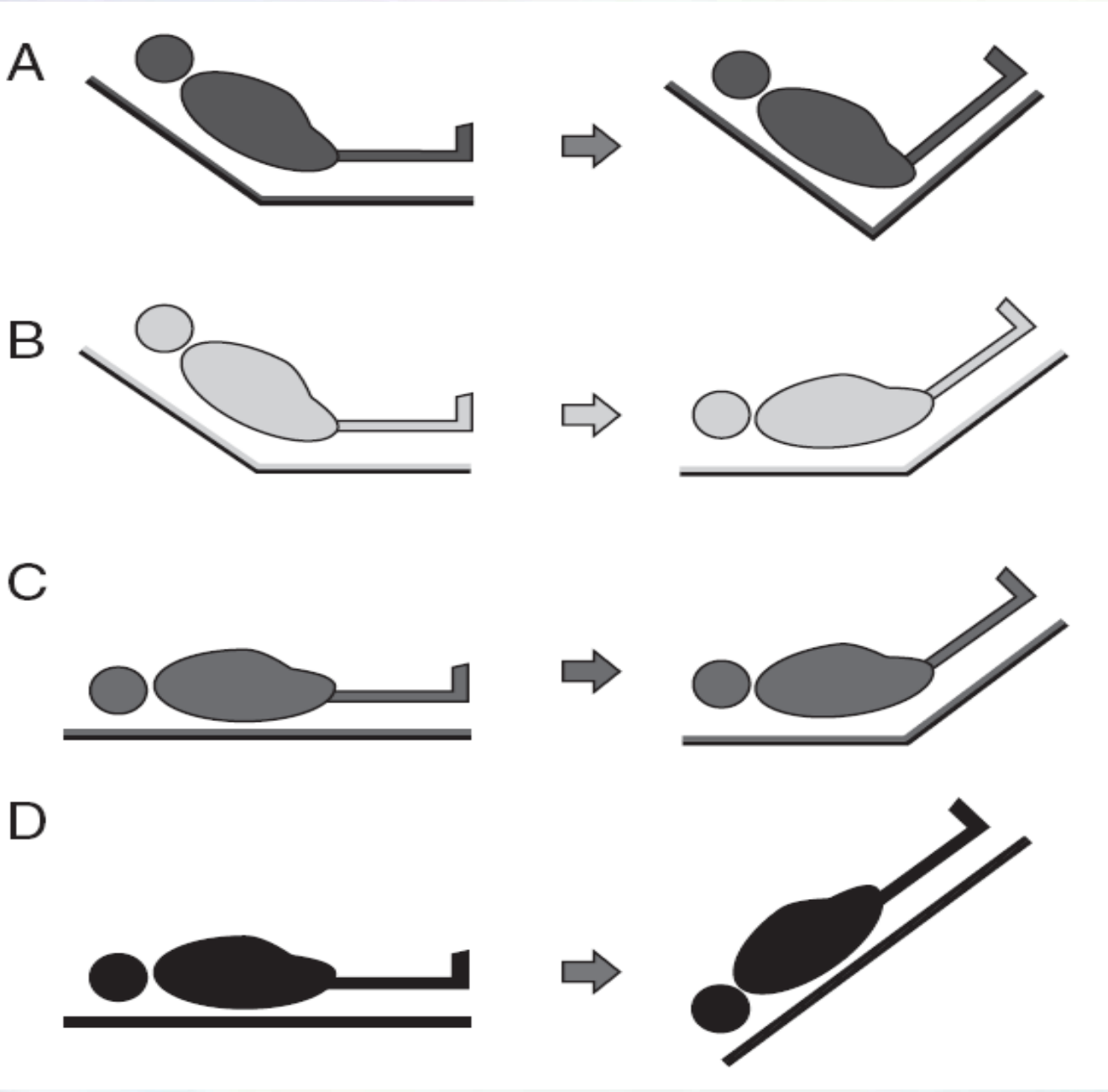
TABLE 12.3 Hemodynamic Effects of the Trendelenburg Position in Hypovolemic ICU Patients

Parameter	Supine	Legs Up, Head Down	Change %	Change p	Change Effect
Mean arterial blood pressure (mm Hg)	64	71	11	<.001	↑
Wedge pressure (mm Hg)	4.6	7.2	57	<.001	↑
Cardiac index (L/min · m^2)	2.1	1.9	9	NS	↔
Systemic vascular resistance (dyne · sec/cm^5 · m^2)	2347	2905	24	<.001	↑

Sing R. Ann Emerg Med 1994;23:564.



Els canvis dinàmics produits per “PLR” no s’afecten per arrítmies ni per respiració espontània



En HTE

No en HTE
Si ↑ PIA

No en HTE

No en HTE

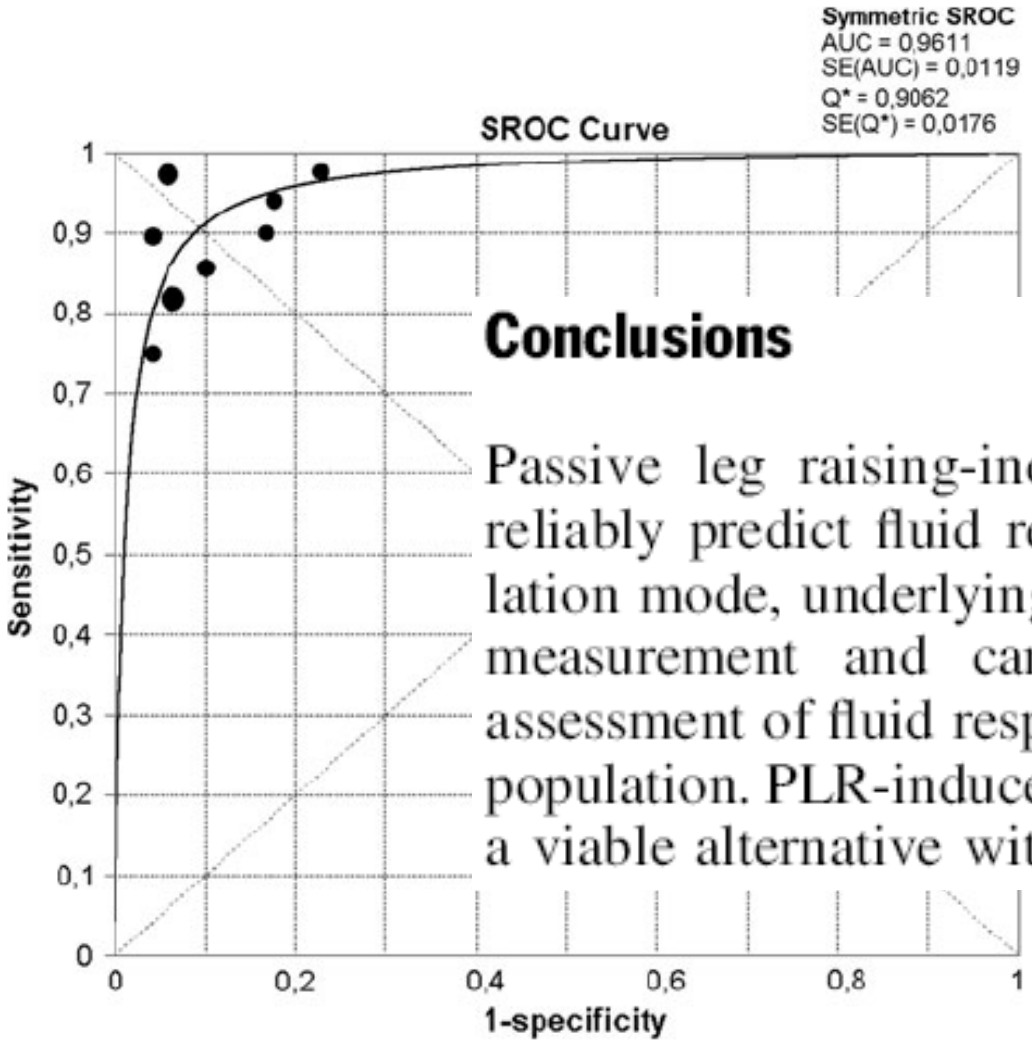
Limitacions "P.L.R"

- **Risc d'aspiració: Buidat gàstric**
- **PIC elevada (realitzar test A)**
- **Sd. compartimental abd (PIA elevada) realitzar test B**
- **Si: mitges de compressió elàstica, *shock* hemorràgic i cardiogénic poden disminuir la resposta al test**

Fabio Cavallaro
Claudio Sandroni
Cristina Marano
Giuseppe La Torre
Alice Mannocci
Chiara De Waure
Giuseppe Bello

Diagnostic accuracy of passive leg raising for prediction of fluid responsiveness in adults: systematic review and meta-analysis of clinical studies

Intensive Care Med (2010) 36:1475–1483



Conclusions

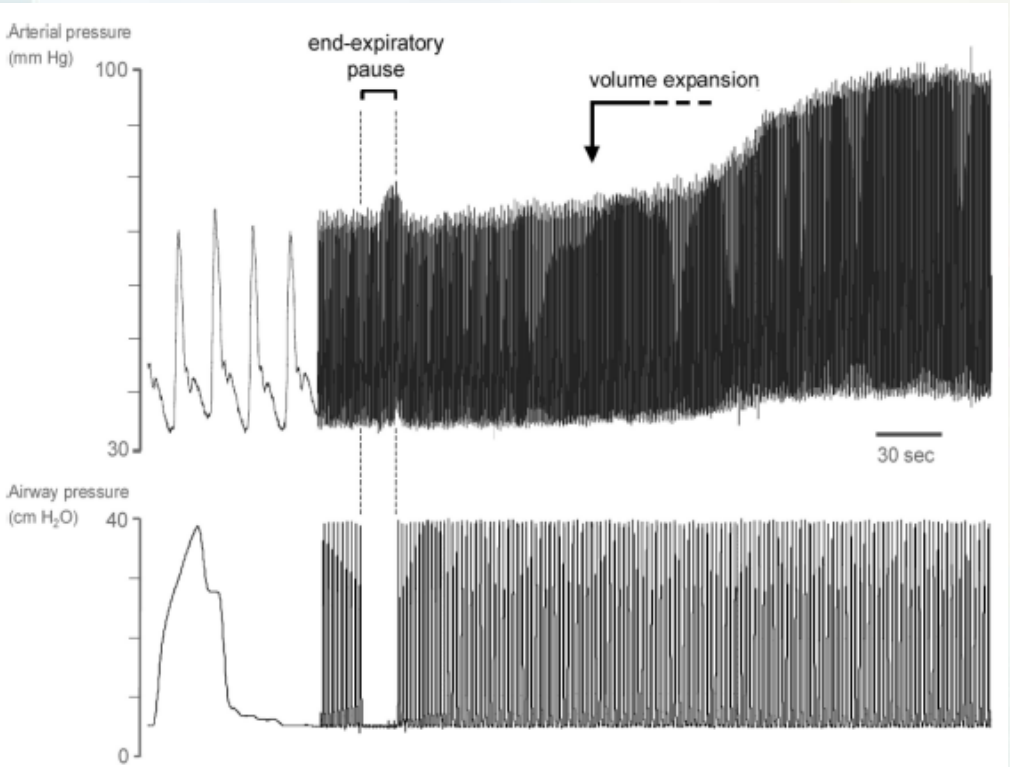
Passive leg raising-induced changes in cardiac output reliably predict fluid responsiveness regardless of ventilation mode, underlying cardiac rhythm and technique of measurement and can be recommended for routine assessment of fluid responsiveness in the majority of ICU population. PLR-induced changes in pulse pressure can be a viable alternative with lower predictive ability.

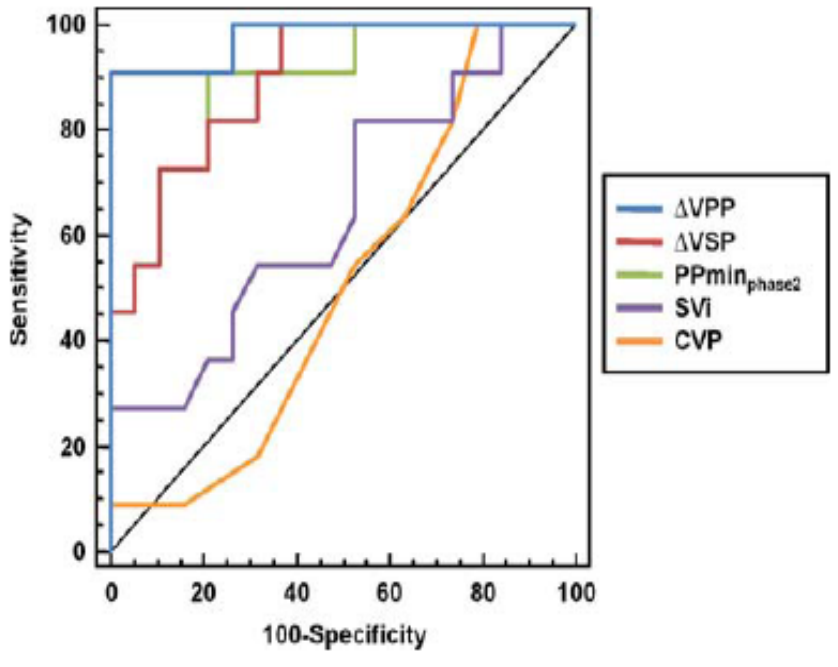
Arterial pressure changes during the Valsalva maneuver to predict fluid responsiveness in spontaneously breathing patients

Manuel Ignacio Monge García

Intensive Care Med (2009) 35:77–84

The present study demonstrates that arterial pressure waveform variations induced by a VM reliably predict fluid responsiveness in spontaneously breathing patients.





Monnet X CCM 2009; 37: 951-6

Vascular Pedicle Width in Lung Edema

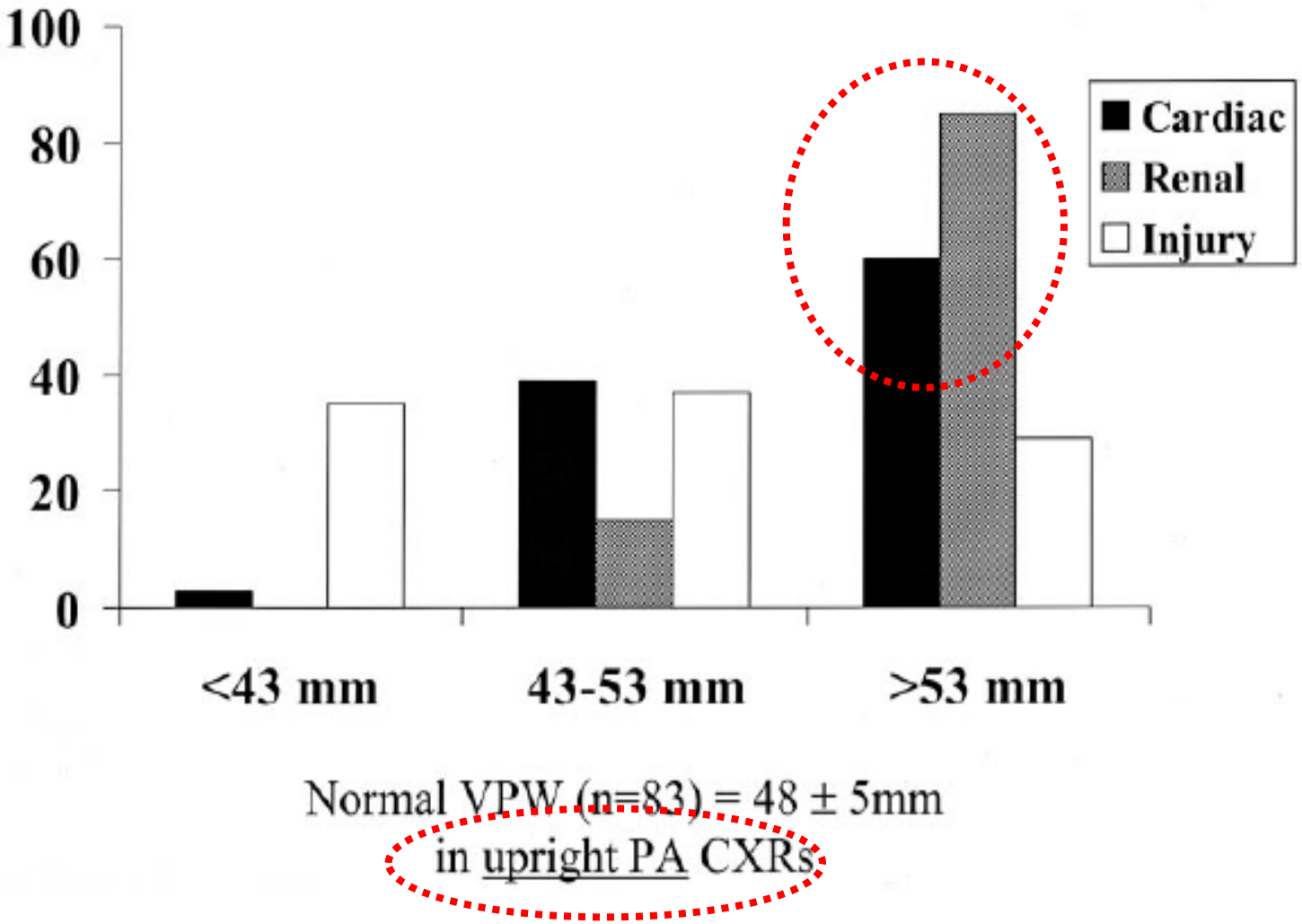


FIGURE 2. Measurements of the VPW are significantly larger in patients with pulmonary edema due to congestive heart failure ($p < 0.01$) or renal failure ($p < 0.001$) compared to patients with pulmonary edema due to acute lung injury. PA = posteroanterior. Reproduced with permission from Milne et al.[8]

MISSATGE: VOLUM en SEPSIS

For the first 6 h of severe sepsis, infuse fluids liberally, targeting SvO_2 or $ScvO_2 > 70\%$

Subsequently, do not use "maintenance" fluids

Judge the intravascular volume daily (at least)

For new hypotension, tachycardia, or unexplained oliguria, ascertain the cause and consider a fluid challenge:

When fluid challenge is of low risk, administer 500 to 1,000 mL of crystalloid;

When the risk of fluid challenge is not trivial (ALI/ARDS; oliguria; right ventricular dysfunction), use a dynamic predictor to guide fluid boluses

PLR for those with some measure of cardiac output;

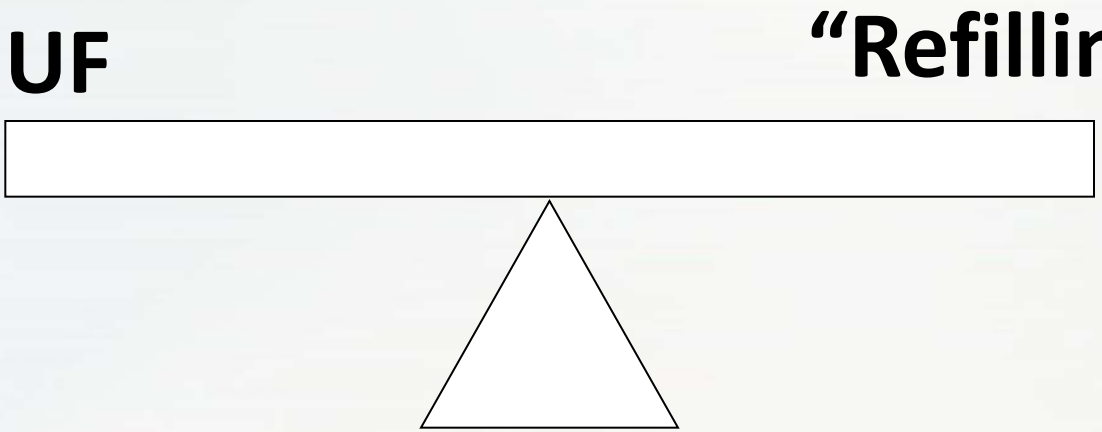
PPV for those with regular rhythm and lack of spontaneous breathing;

Change in Pra for those with substantial inspiratory effort

Reassess the patient frequently because the hemodynamic state changes often

Durairaj Chest 2008;133:252-63

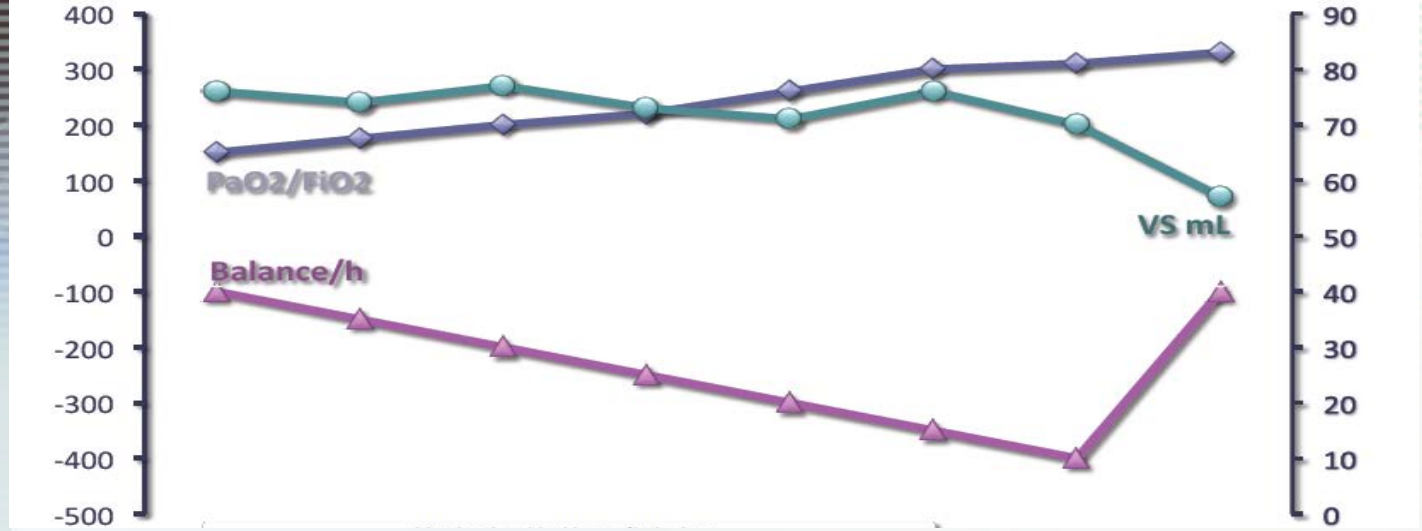
En deshidratació (UF)



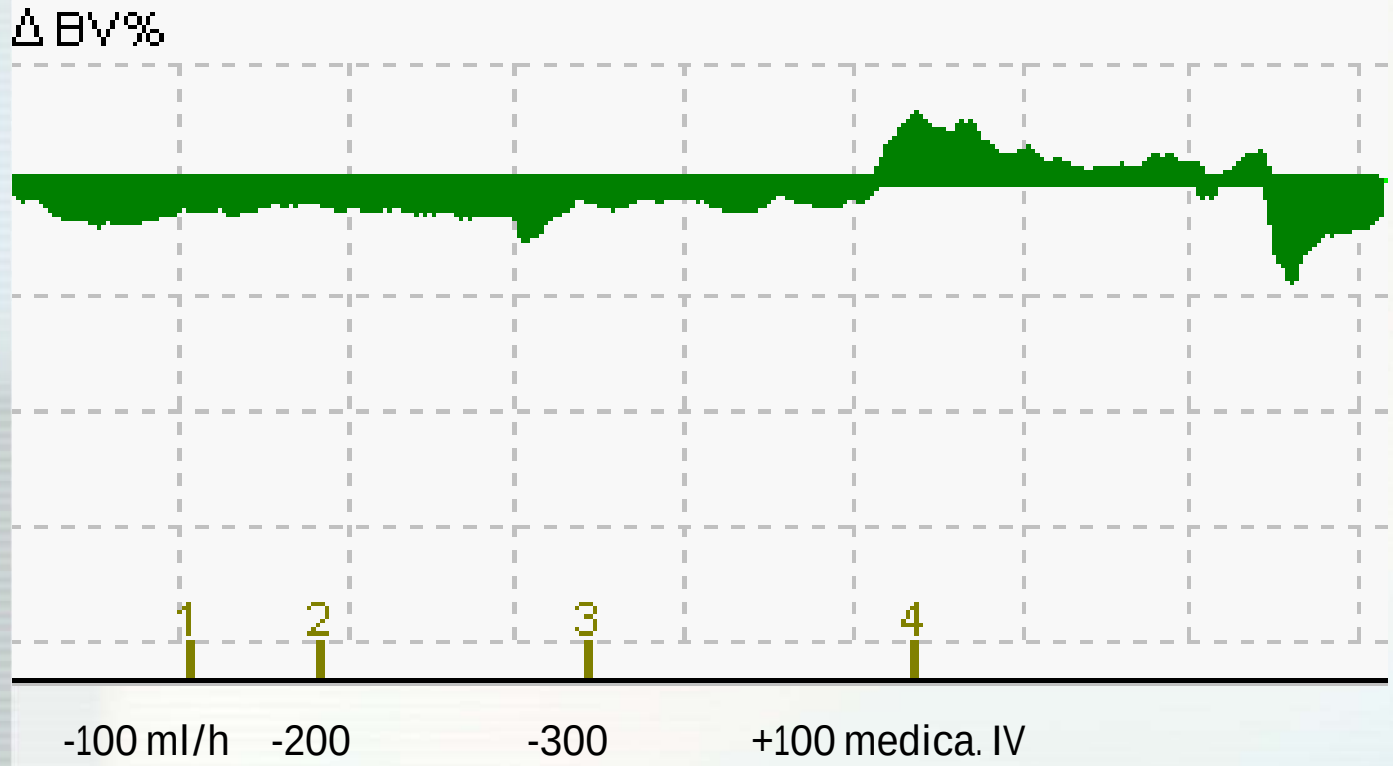
La pressió arterial depèn de dos mecanismes:

- Preservació del volum sanguini
- Compensació cardiovascular

Sí refilling pobre, pot necessitar monitorització o NA

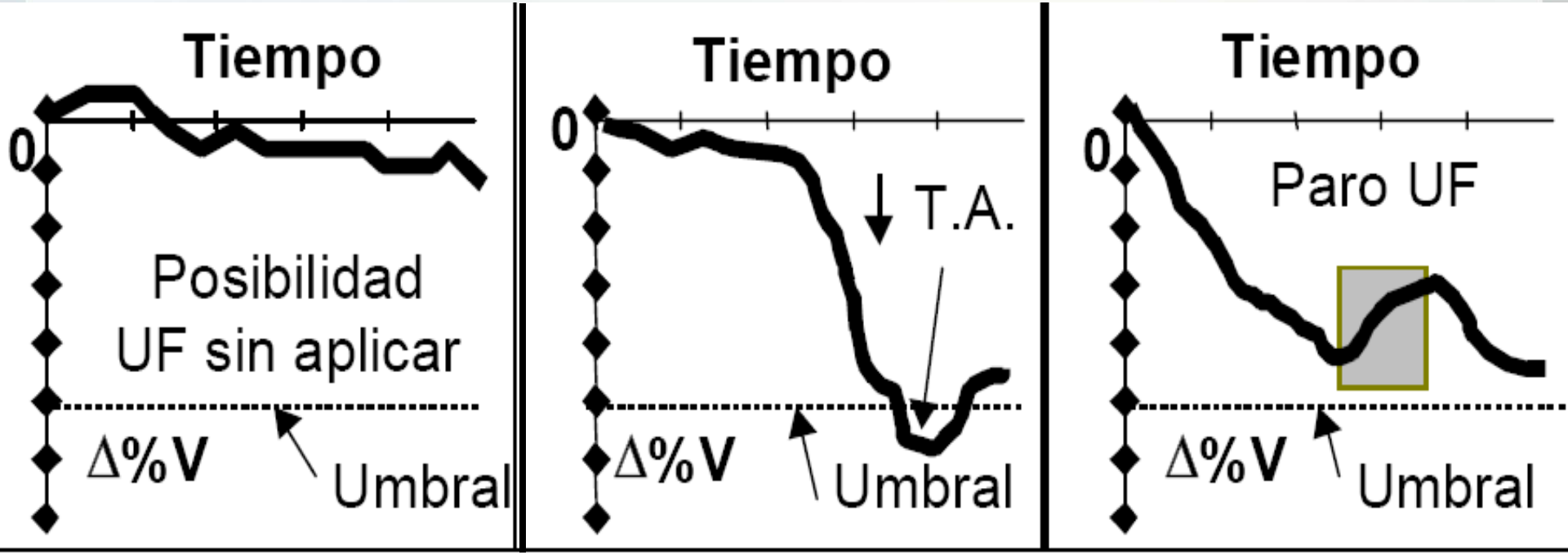


Deshidratación guiada por VS



Deshidratación guiada por Hto “on line”

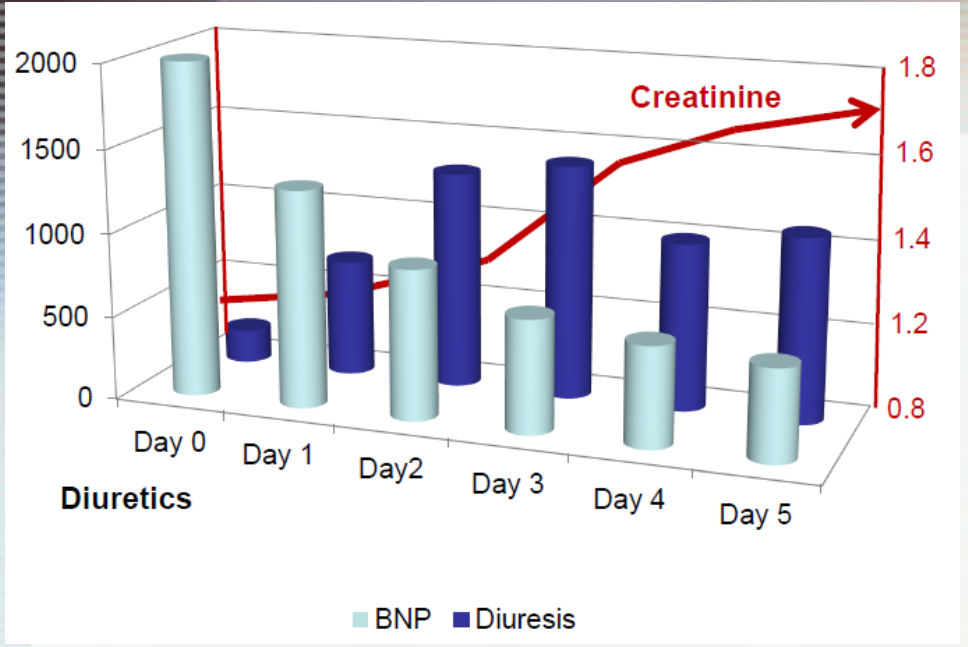
Monitorización hematocrito on-line

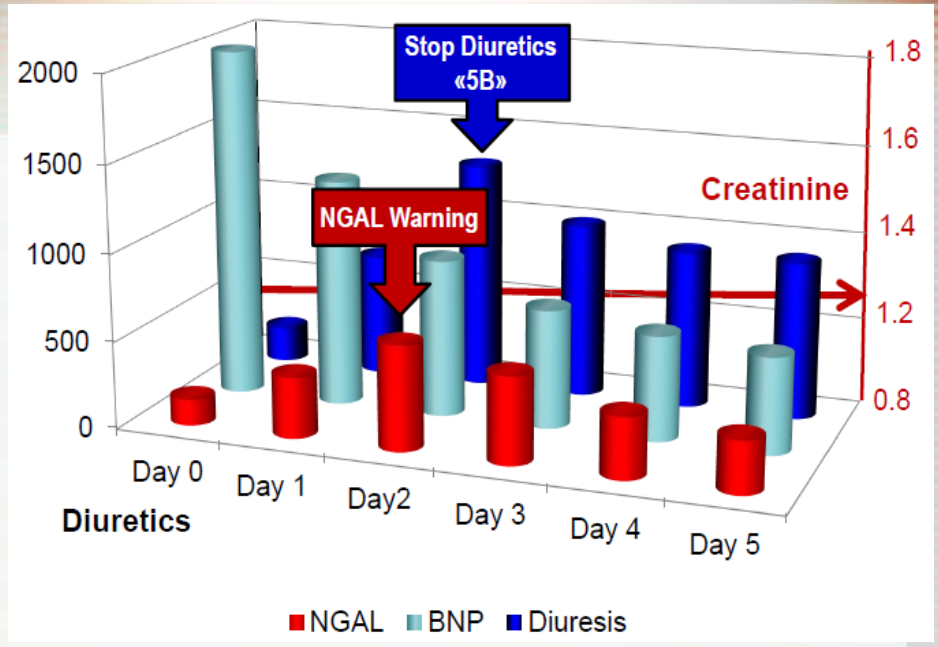


UF insuficiente

UF excesiva

Stop balance negativo

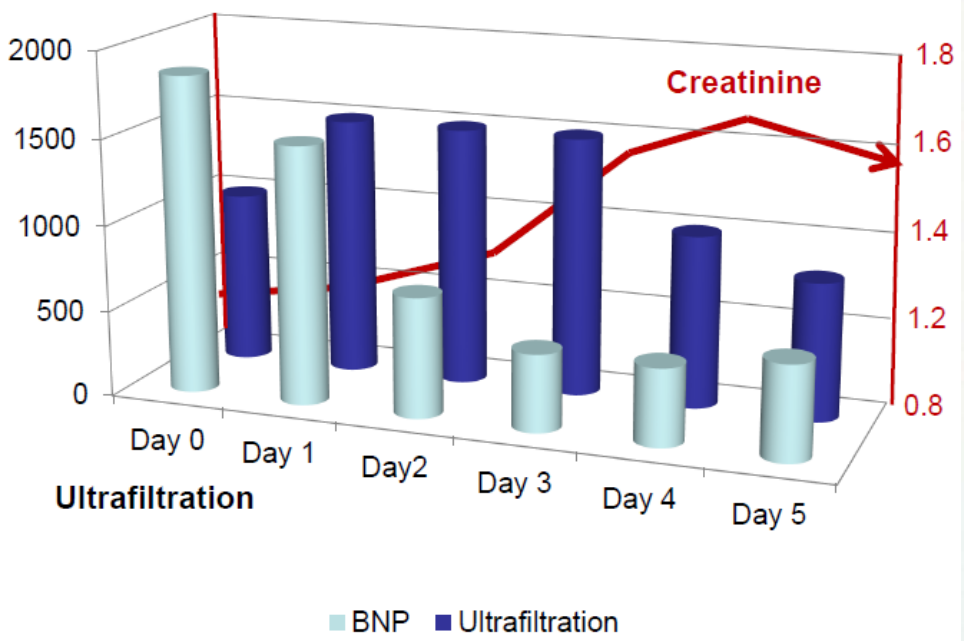


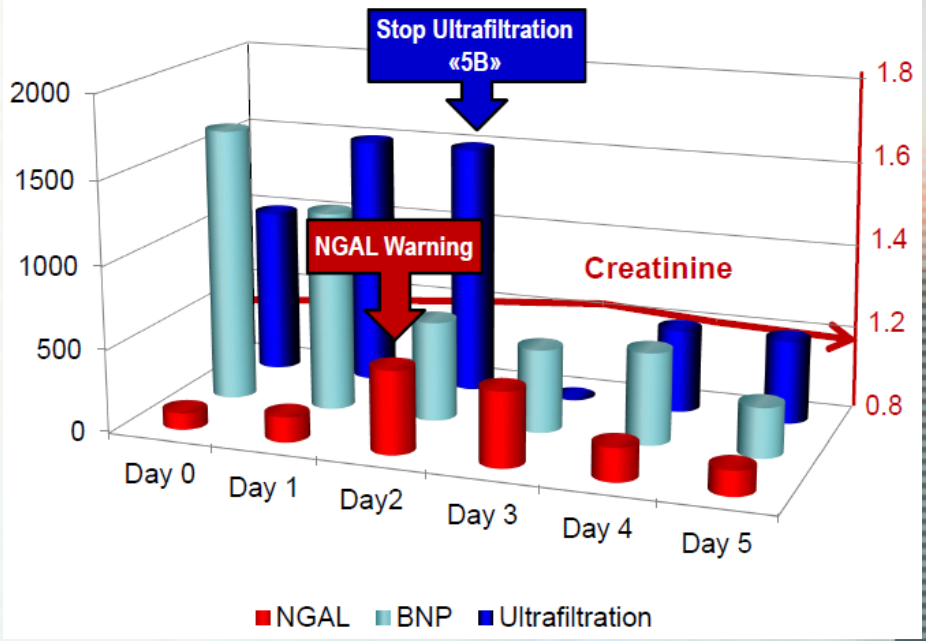


Extracorporeal Ultrafiltration in Heart Failure and Cardio-Renal Syndromes

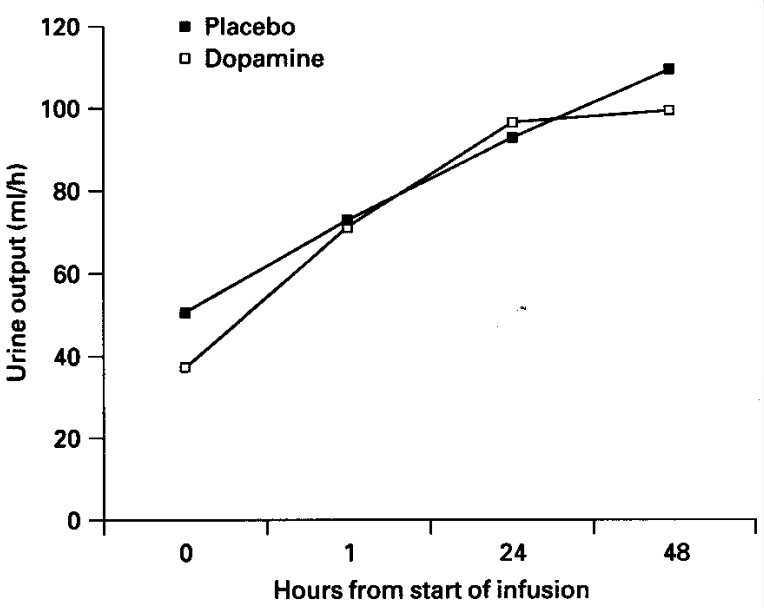
MR Costanzo, C Ronco, et al.

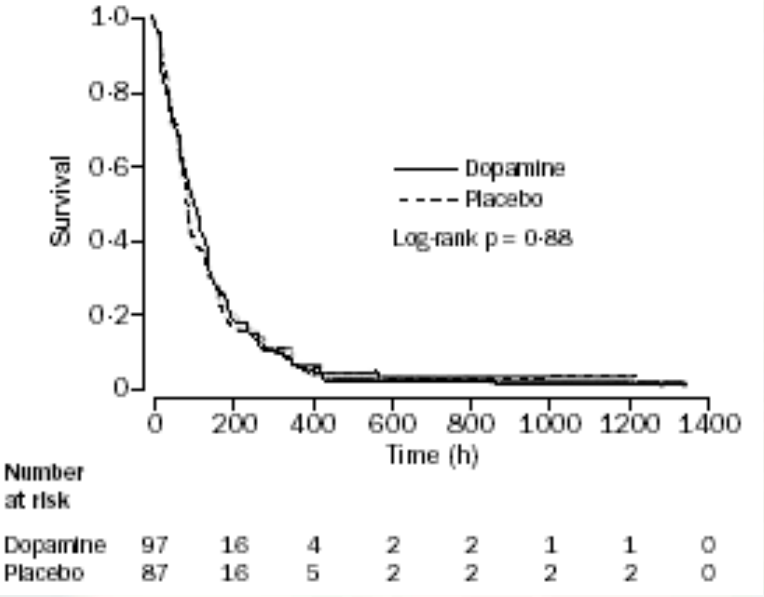
Seminars in Nephrology, Vol 32, No 1, January 2012, pp 100-

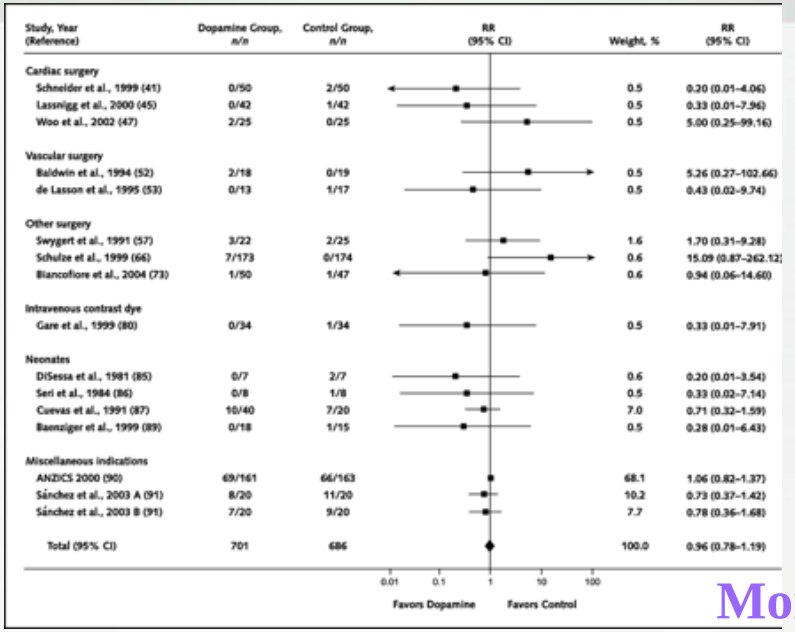




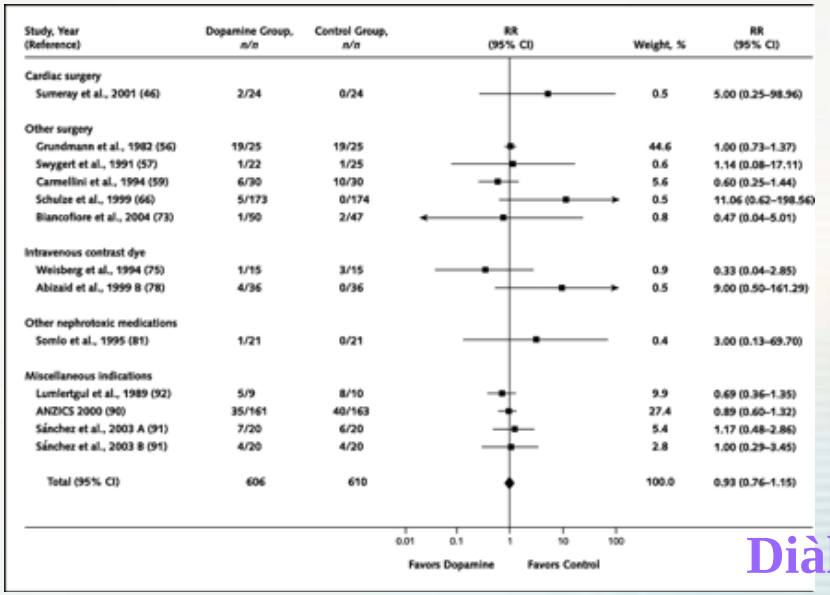
DOPAMINA a dosi diürètica







Mortalitat

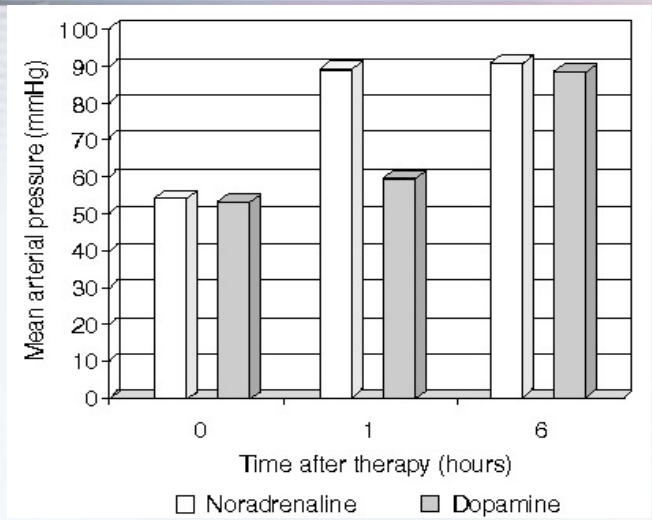


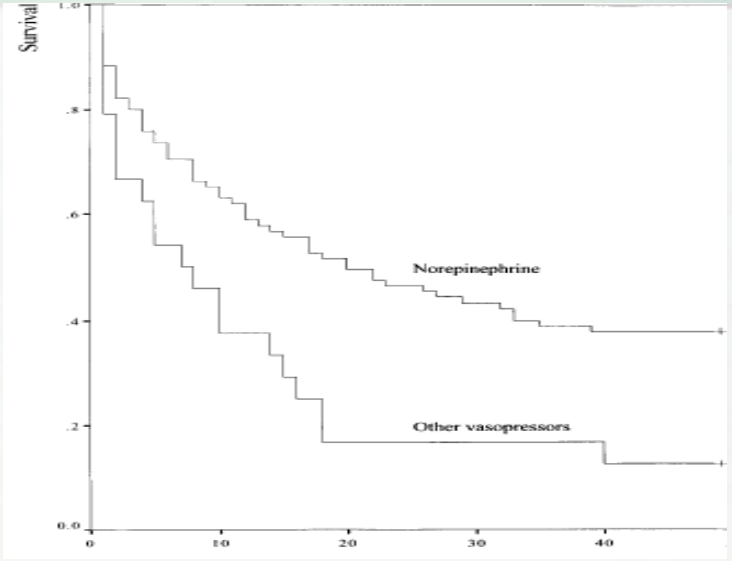
Diàlisis

ANZICS *Lancet* 2000;350, 2139-43

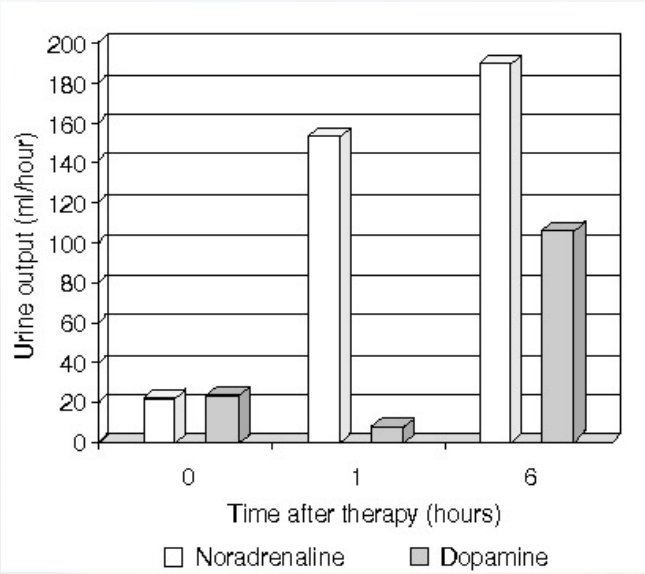
Friedrich *Ann Intern Med* 2005; 142: 510-24

AMINAS PRESORAS

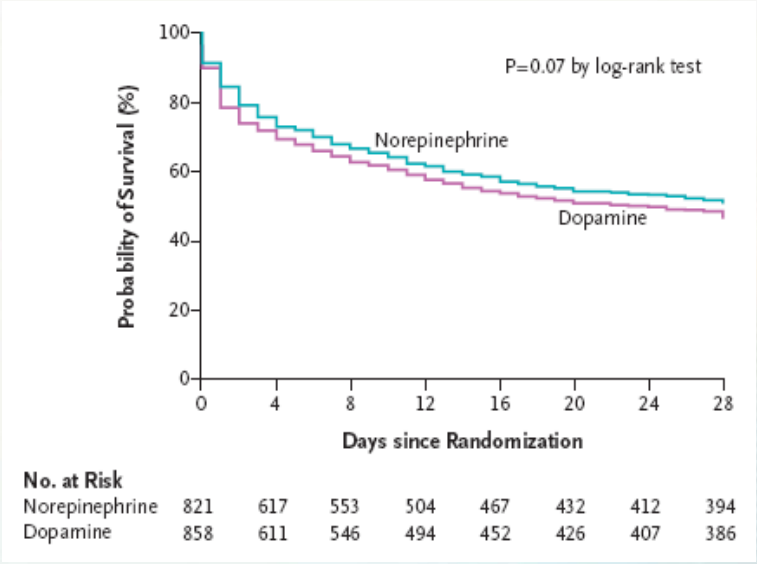




Martin C et al *CCM* 2000; 28:2758-65



Martin C et al. *Chest* 1993; 103:1826-31



De Backer D. et al *NEJM* 2010; 362:779-89

Vasopressina i shock sèptic

Low-dose vasopressin did not reduce mortality rates as compared with norepinephrine

Rusell et al NEJM 2008; 358-877-87

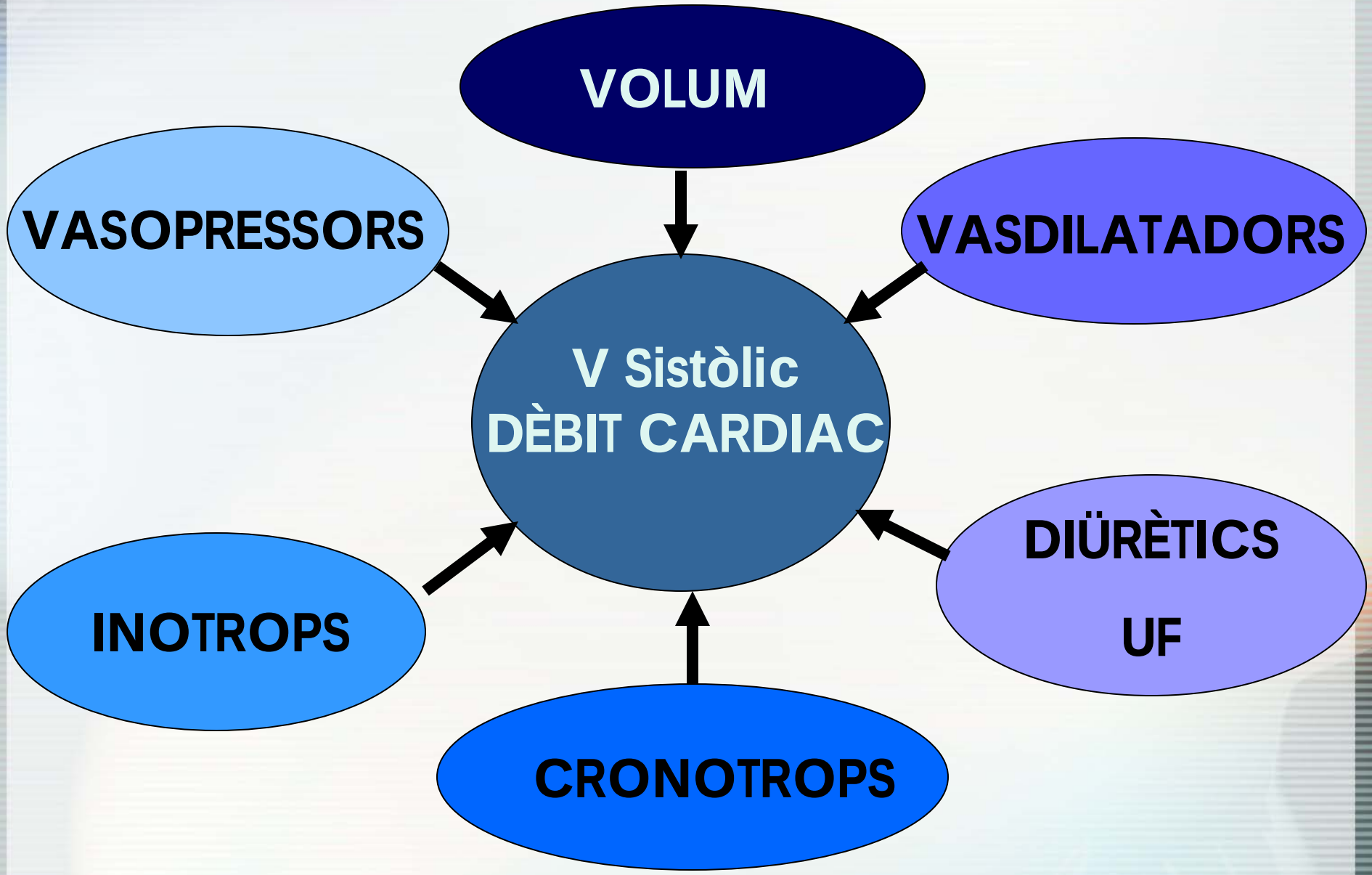
The Vasopressin and Septic Shock Trial did not find a difference between low-dose vasopressin and norepinephrine vs. norepinephrine alone in hemodynamic support. However, vasopressin may be beneficial in the less severe septic shock subgroup. Inpatients who were also treated with corticosteroids, vasopressin, compared with norepinephrine, were associated with significantly decreased mortality. Epinephrine, phenylephrine and terlipressin can be used safely in the ICU

Holmes Curr Opin Crit Care 2009; Juny 17 Epub ahead

There is a statistically significant interaction between vasopressin and corticosteroids. Low-dose vasopressin and corticosteroids was associated with decreased mortality and organ dysfunction compared with norepinephrine and corticosteroids.

Rusell CCM 2009: 37:1126-7

DECISSIONS TERAPÈUTIQUES



MISSATGE amb Vasopressors

- **Conèixer els POSIBLES fàrmacs a emprar**
- **Decidir en funció d'objectius**

GRACIAS por su atención

Preguntas ??