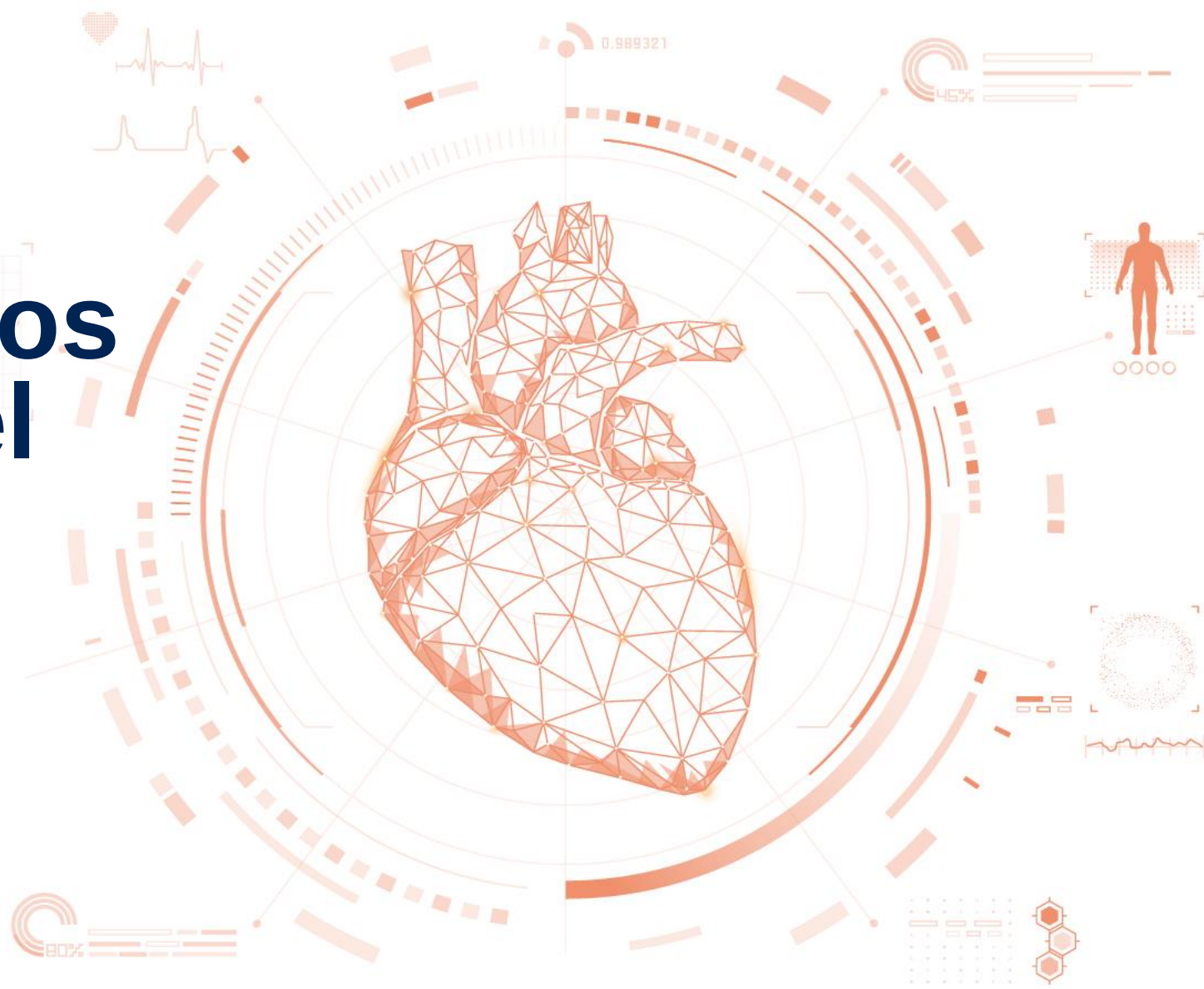


Liderando el conocimiento del mañana

Cardio**Advanced**Forum

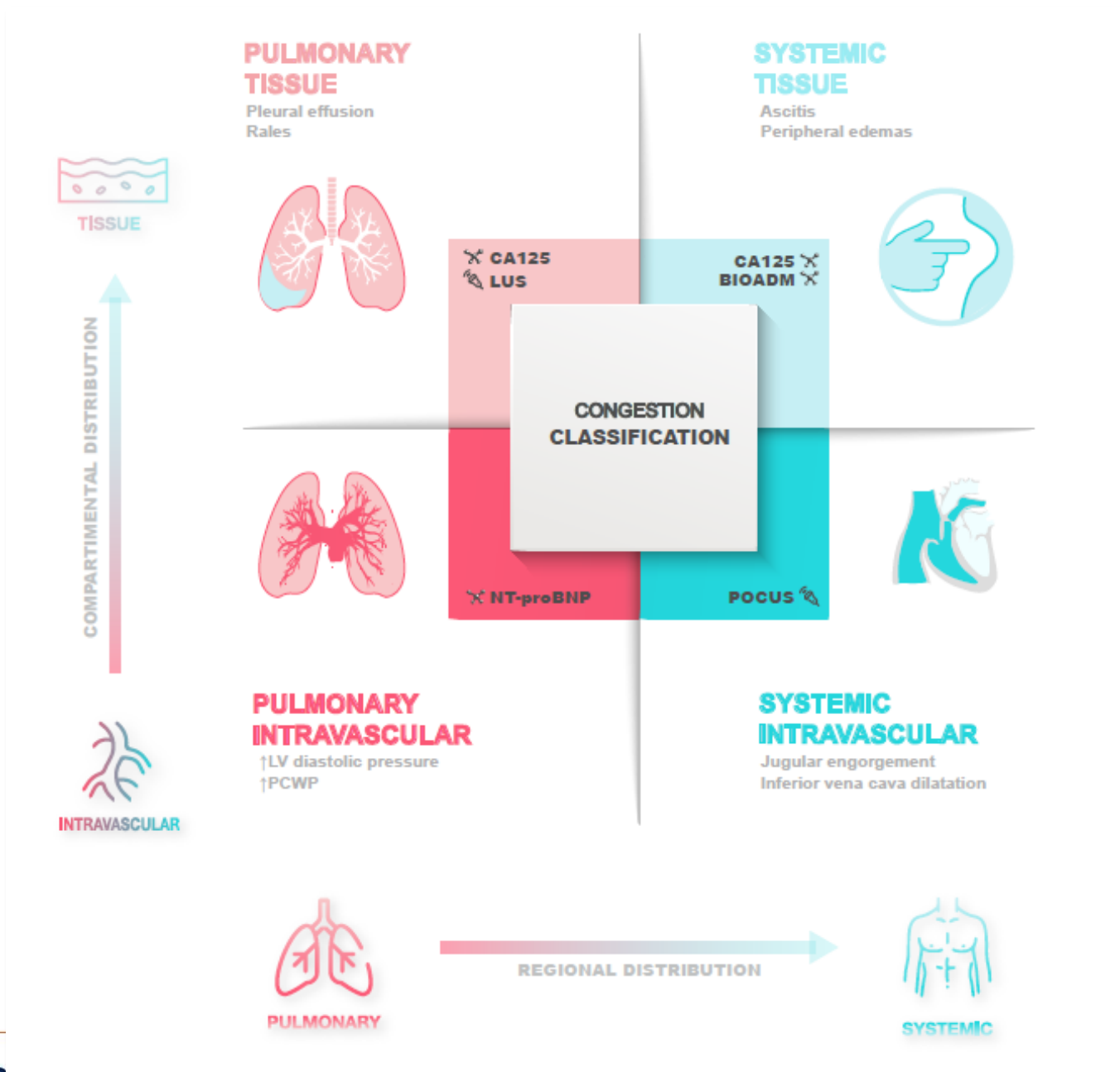
Trucos y consejos para optimizar el tratamiento diurético en IC

Dr. Julio Núñez



1. Fenotipar la sobrecarga hidrosalina de mi paciente con IC

Tratamiento de acuerdo a fenotipos de congestión



Síntomas y signos clínicos ofrecen una rentabilidad limitada

Decongestion: more than meets the eye!

Frederik H. Verbrugge*

Department of Cardiology, Ziekenhuis Oost-Limburg, Genk, Belgium

Problem: Symptoms and signs show low accuracy for assesment of congestion/fluid overload

Discriminative ability of symptoms and signs

Parameter	Sensitivity	Specificity	Comparator	Comment
Clinical evaluation				
<i>Right-sided</i>				
JVP > 8 cm	48%	78%	RAP > 7 mmHg	Difficult in obese patient
Jugular venous reflux	50%	75%	RAP > 7 mmHg	Difficult in obese patient
Hepatomegaly	51%	62%	RAP > 7 mmHg	Difficult in obese patient, non-HF causes
Bilateral leg oedema	94%	10%	RAP > 7 mmHg	Non-HF oedema gives false positive
<i>Left-sided</i>				
Dyspnoea	50%	73%	PCWP > 18 mmHg	Multiple reasons for dyspnoea
Dyspnoea on exertion	66%	52%	PCWP > 18 mmHg	Multiple reasons for dyspnoea on exertion
Orthopnoea	66%	47%	PCWP > 18 mmHg	May be non-cardiac in origin or absent
S3	73%	42%	PCWP > 18 mmHg	Intra-observer variability
Rales	13%	90%	PCWP > 18 mmHg	May be non-cardiac in origin or absent

Fenotipar usando abordaje multiparamétrico



CLINICA
signos y síntomas



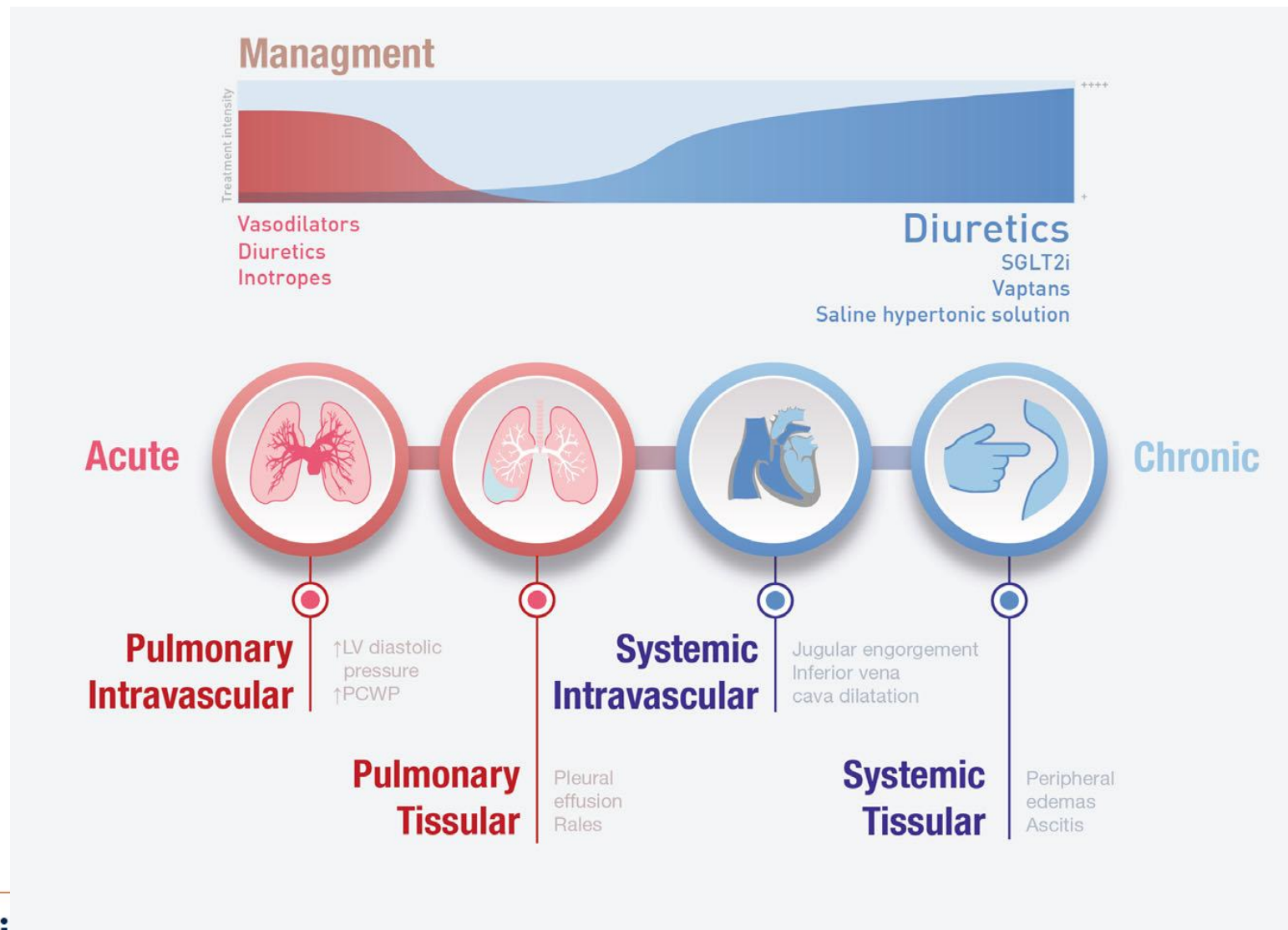
BIOMARCADORES
NT proBNP, CA125



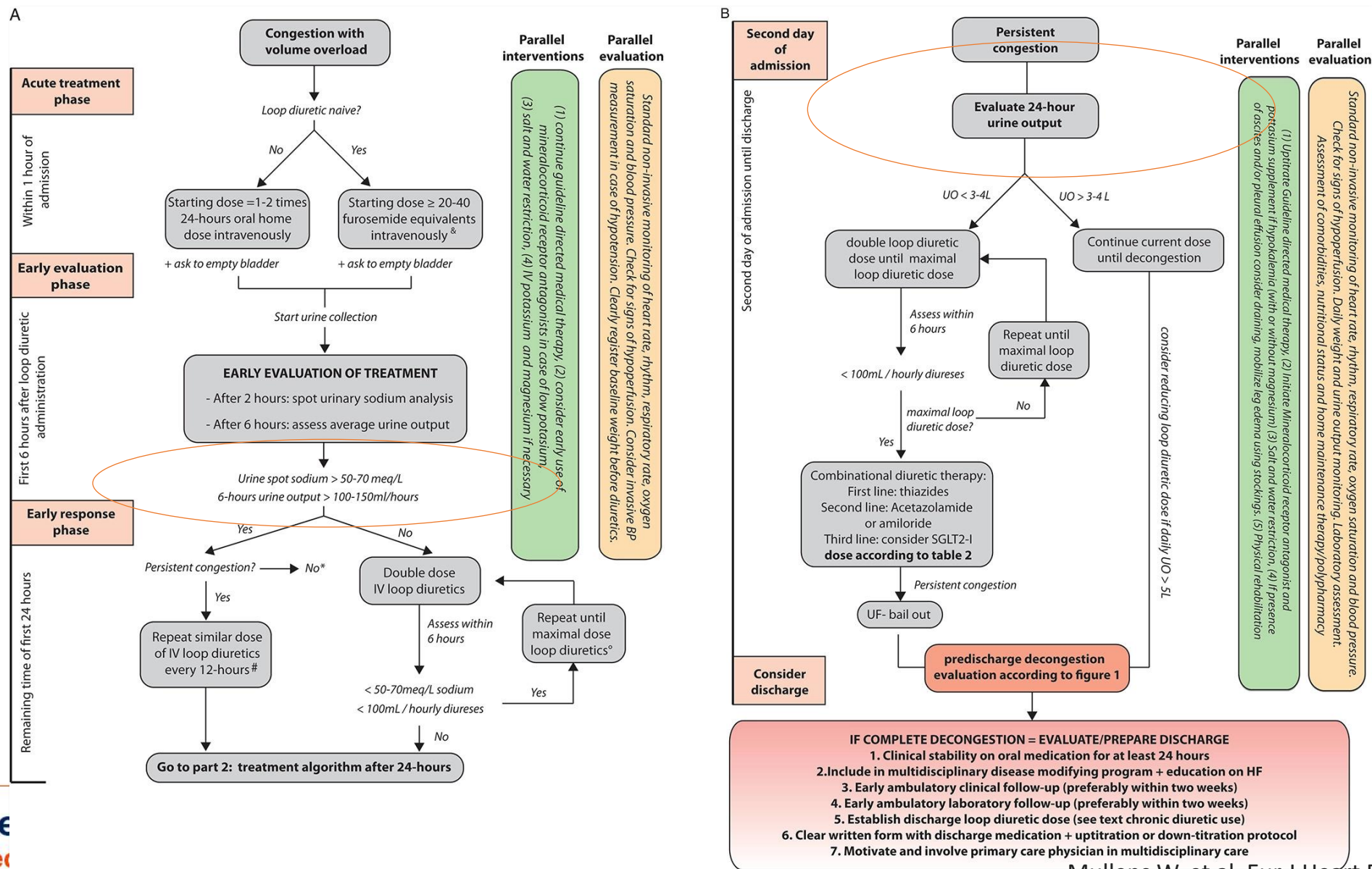
IMAGEN
Ecocardiograma, ecografía pulmonar

Los parámetros clínicos convencionales (signos y síntomas) ofrecen una modesta precisión diagnóstica para la detección y monitorización de la congestión.
Se recomienda adoptar una estrategia en la que se integren **variables clínicas, técnicas de imagen (ecografía) y biomarcadores (péptidos natriuréticos y antígeno carbohidrato 125)**.
Tanto en el ámbito hospitalario como en el ambulatorio.

2. Adecuar intensidad del tratamiento en base al fenotipo



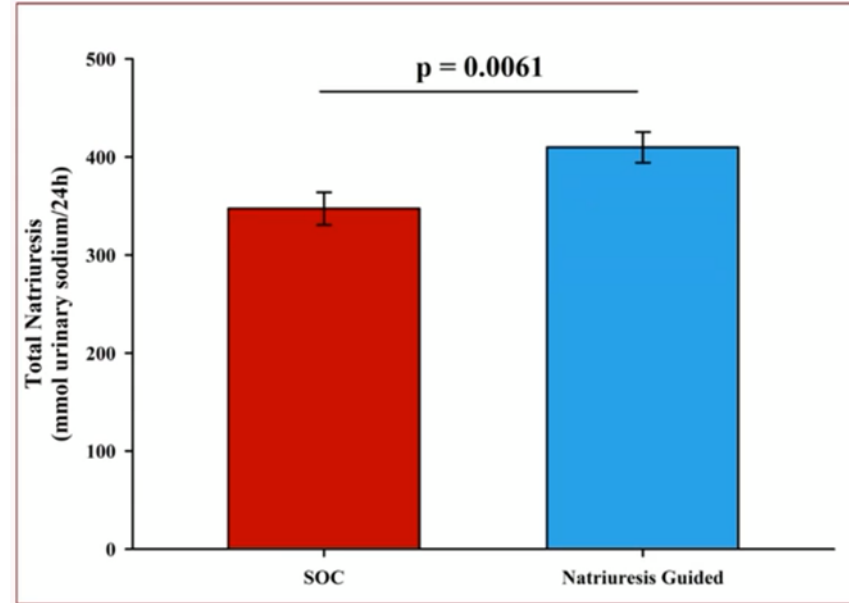
3. Monitorizar y adecuar el tratamiento diurético precozmente (horas)



PUSH-AHF trial

PUSH-AHF trial

1st primary endpoint – 24h natriuresis



Estimated difference: 63 (95% CI:
18-109) mmol urinary sodium

1. Ter Maaten JM, et al. [published online ahead of print, 2023 Aug 28]. *Nat Med*. 2023;10.1038/s41591-023-02532-z

4. Bloqueo secuencial de la nefrona precozmente si respuesta clínica inicial no adecuada

Acetazolamide

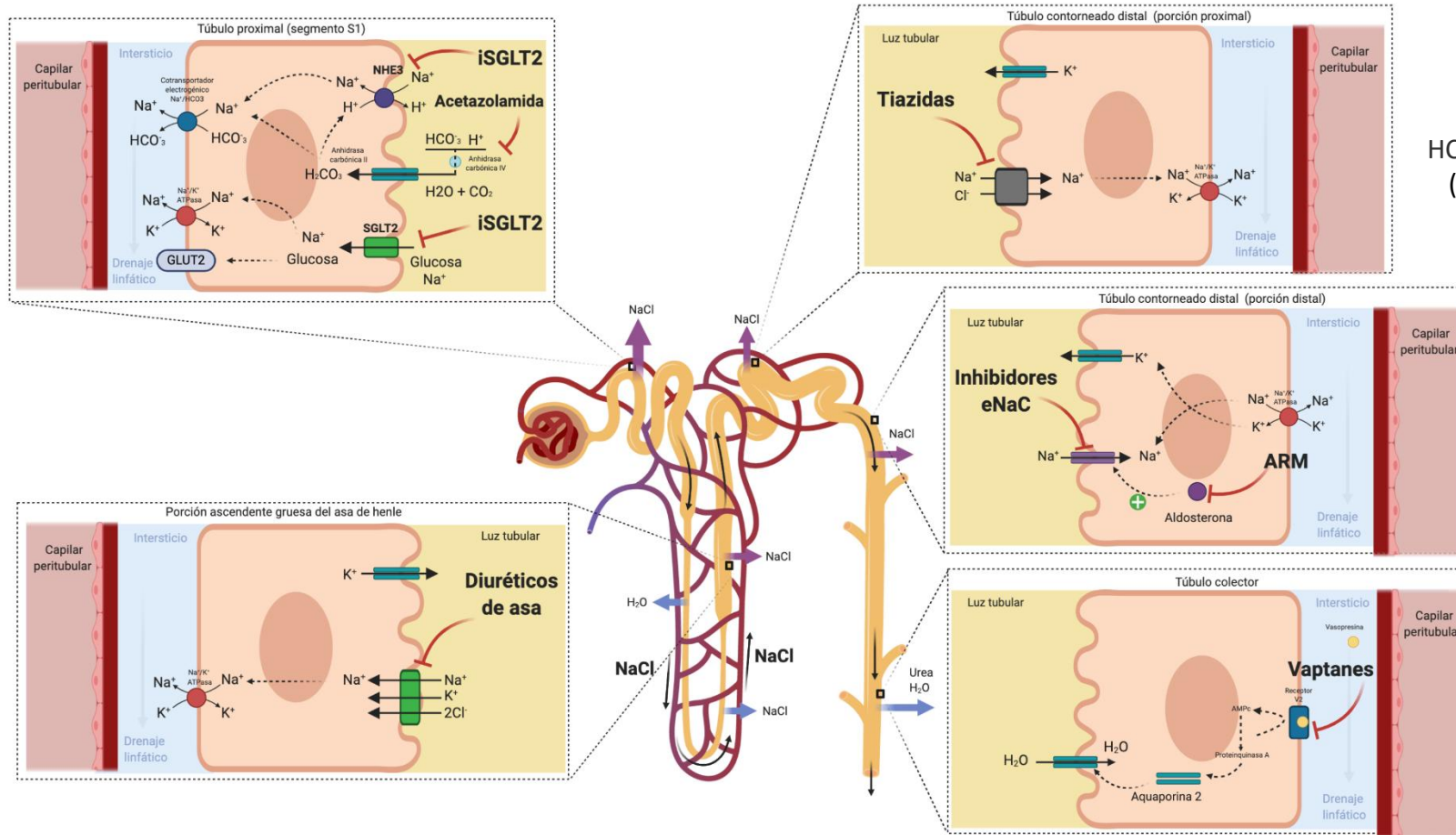
250 -500 mg / day
(ADVOR STUDY)

SGLT2i

Dapagliflozina/empagliflozin
10mg / day

Loop diuretics

Furosemide
Torsemide
Bumetanide



Thiazides

12,5-50 mg / day
HCTZ 25-100 mg / day
(CLOROTIC STUDY)

Spironolactone

50 mg / day
(ATHENA STUDY)

Tolvaptan

Urea
15-30 mg / day
(

Image modified, courtesy of De la Espriella et al. Nephrology

Liderando el conocimiento del mañana

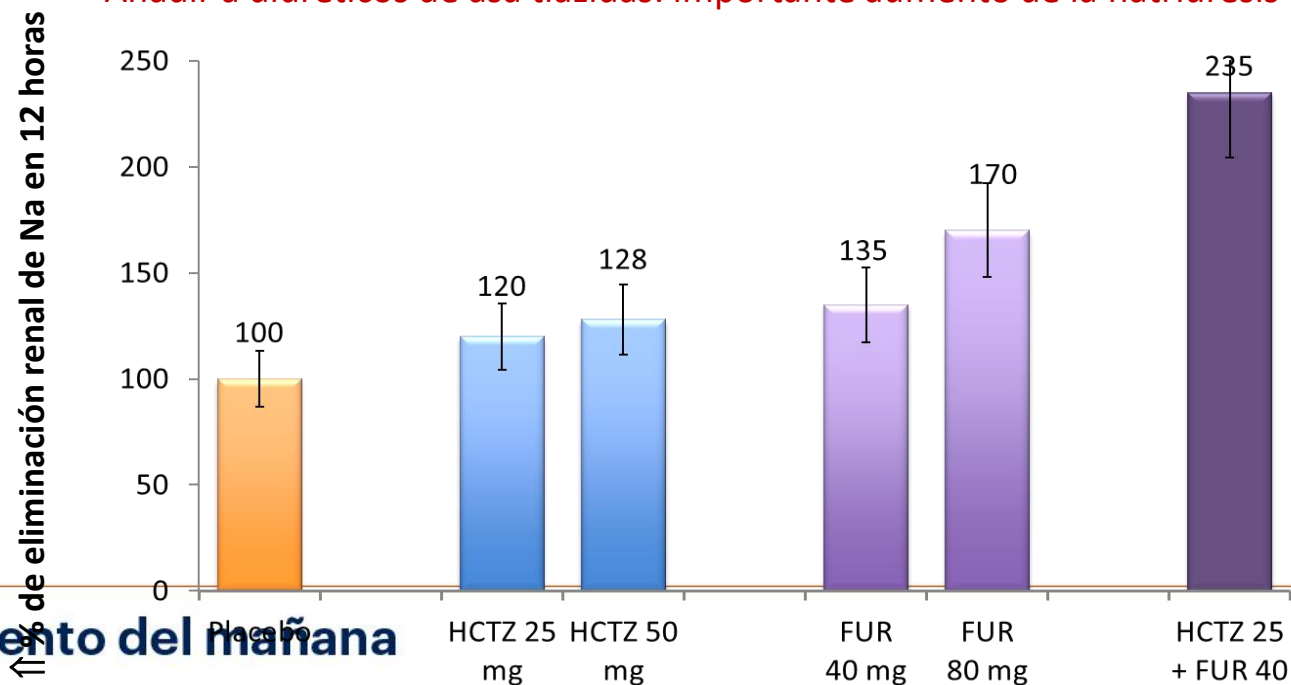
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Felker, G. M., Ellison, D. H., Mullens, W., Cox, Z. L., & Testani, J. M. (2020). Diuretic Therapy for Patients With Heart Failure: JACC State-of-the-Art Review. In *Journal of the American College of Cardiology* (Vol. 75, Issue 10, pp. 1178–1195). Elsevier USA. <https://doi.org/10.1016/j.jacc.2019.12.059>

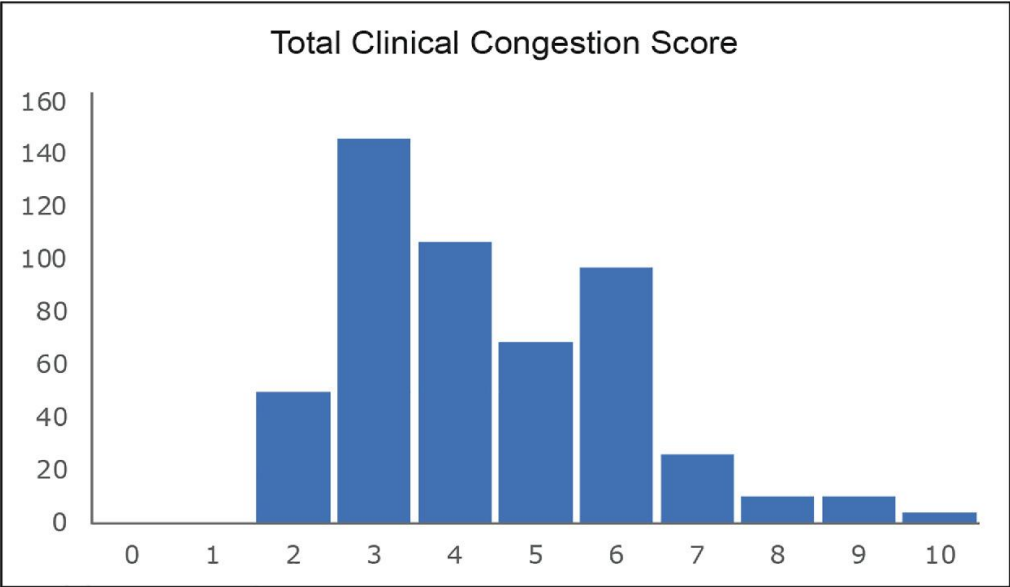
Evidencia experimental

Thiazide-type diuretics	Sodium/chloride cotransporter Distal tubules	Targets distal nephron hypertrophy associated with chronic use of loop diuretics Increases fractional sodium excretion
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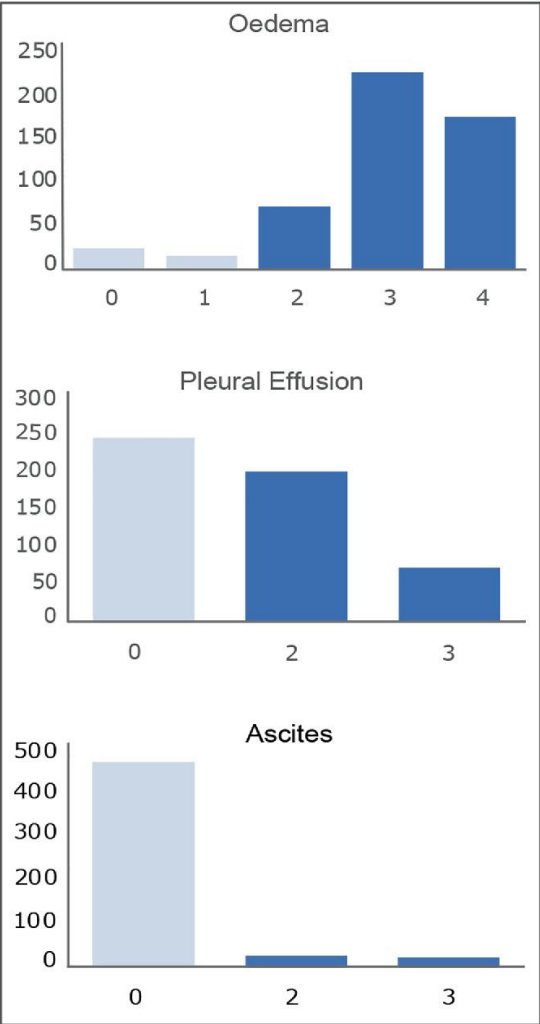
Añadir a diuréticos de asa tiazidas: importante aumento de la natriuresis



Evidencia reciente: ADVOR trial



OEDEMA	No oedema (score 0)	Trace oedema (pitting disappear immediately) (score 1)	Clear pitting oedema (score 2)	Visual deformation above ankle (score 3)	Visual deformation above knee (score 4)
PLEURAL EFFUSION (to be confirmed by chest X-ray or ultrasound if suspected)	No pleural effusion (score 0)	Minor (non-amendable for puncture) pleural effusion (score 2)		Major (amendable for puncture) pleural effusion (score 3)	
ASCITES (to be confirmed by ultrasound if suspected)	No ascites (score 0)	Minor ascites, only detected by echography (score 2)		Significant ascites (score 3)	



Evidencia reciente: ADVOR trial

ORIGINAL ARTICLE

Acetazolamide in Acute Decompensated Heart Failure with Volume Overload

W. Mullens, J. Dauw, P. Martens, F.H. Verbrugge, P. Nijst, E. Meekers, K. Tartaglia, F. Chenot, S. Moubayed, R. Dierckx, P. Blouard, P. Troisfontaines, D. Derthoo, W. Smolders, L. Bruckers, W. Droogne, J.M. Ter Maaten, K. Damman, J. Lassus, A. Mebazaa, G. Filippatos, F. Ruschitzka, and M. Dupont, for the ADVOR Study Group*

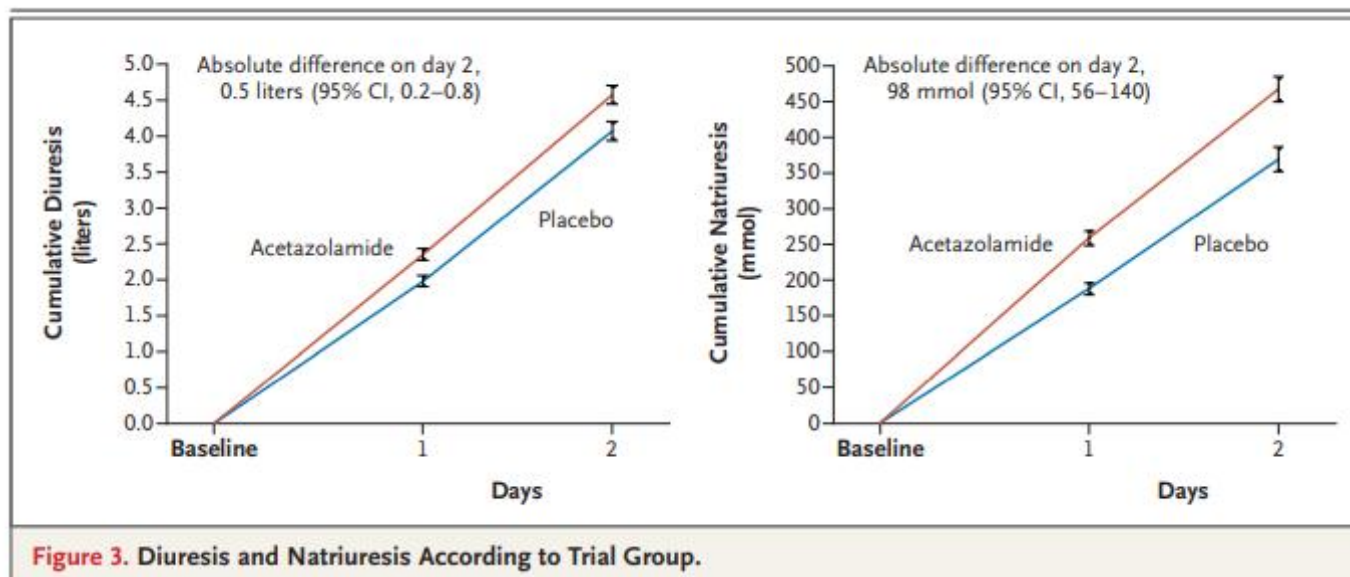
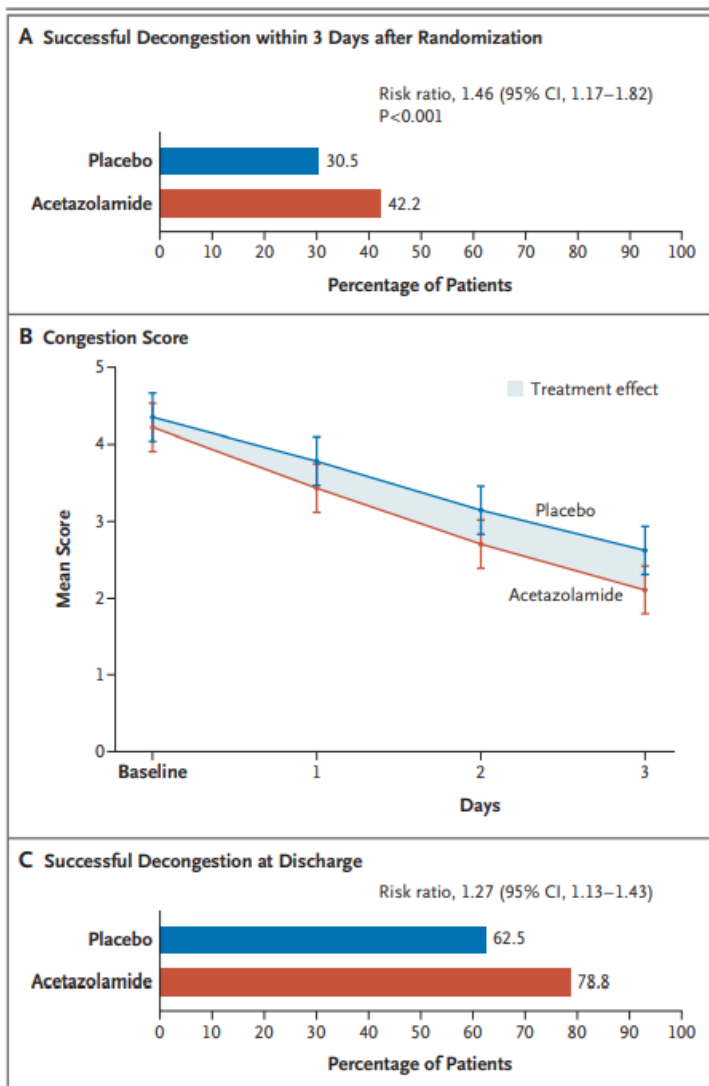
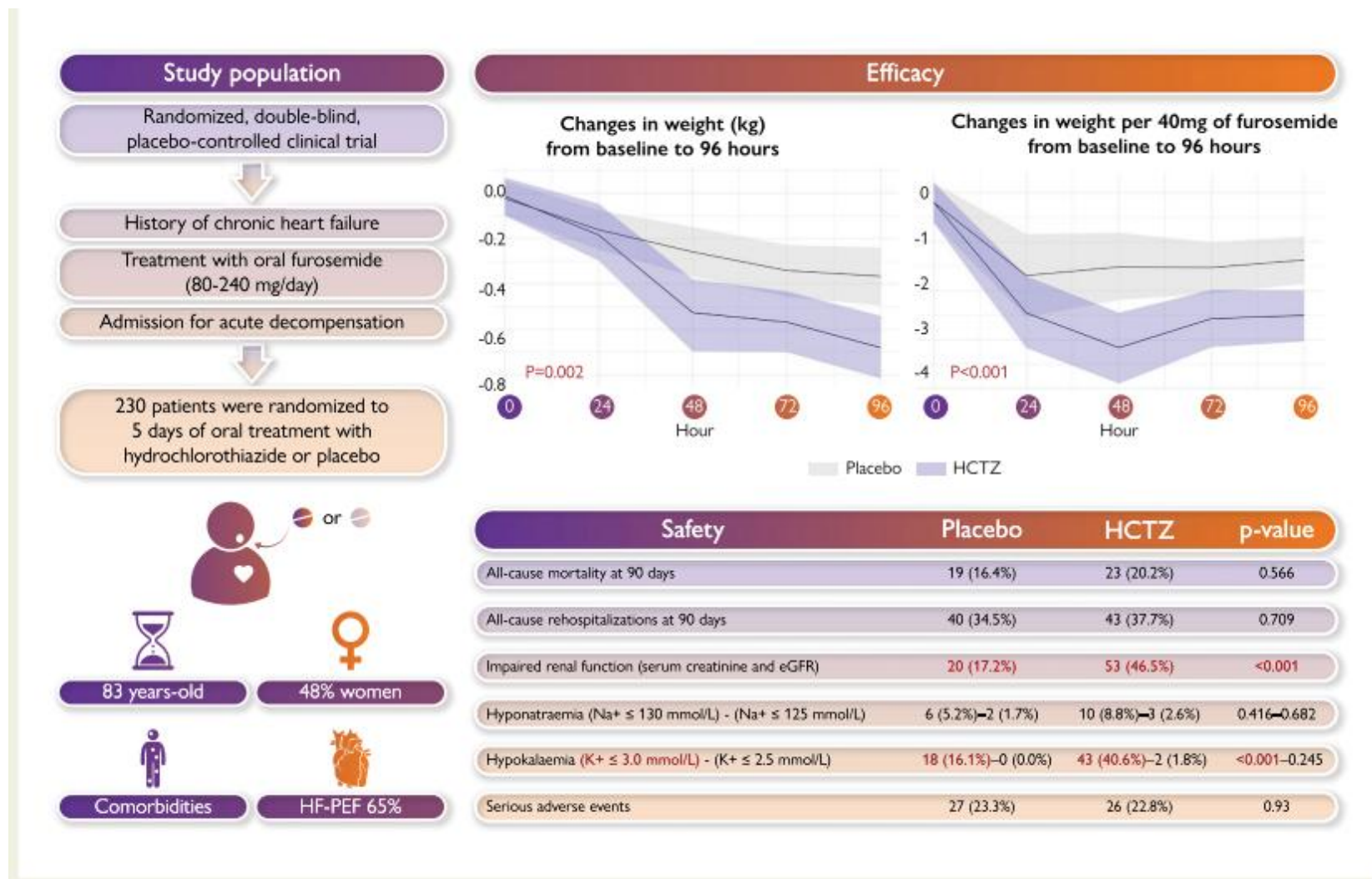


Figure 3. Diuresis and Natriuresis According to Trial Group.

Evidencia reciente: Clorotic trial



European Heart Journal (2022) 00, 1–11
<https://doi.org/10.1093/eurheartj/ehac589>

CLINICAL RESEARCH
 Heart failure and cardiomyopathies

Combining loop with thiazide diuretics for decompensated heart failure: the CLOROTIC trial

Joan Carles Trullàs^{1,2*}, José Luis Morales-Rull³, Jesús Casado⁴, Margarita Carrera-Izquierdo⁵, Marta Sánchez-Martel⁶, Alicia Conde-Martel⁷, Melitón Francisco Dávila-Ramos⁸, Pau Llacer⁹, Prado Salamanca-Bautista¹⁰, José Pérez-Silvestre¹¹, Miguel Ángel Plasín¹², José Manuel Cerqueiro¹³, Paloma Gil¹⁴, Francesc Formiga¹⁵, Luis Manzano¹⁶, and CLOROTIC trial investigators.

5. Usar estrategias más agresivas si paciente tratado crónicamente con diuréticos

Diuretic resistance is omnipresent in HF patients



European Journal of Heart Failure (2019) 21, 137–155
doi:10.1002/ehf.1369

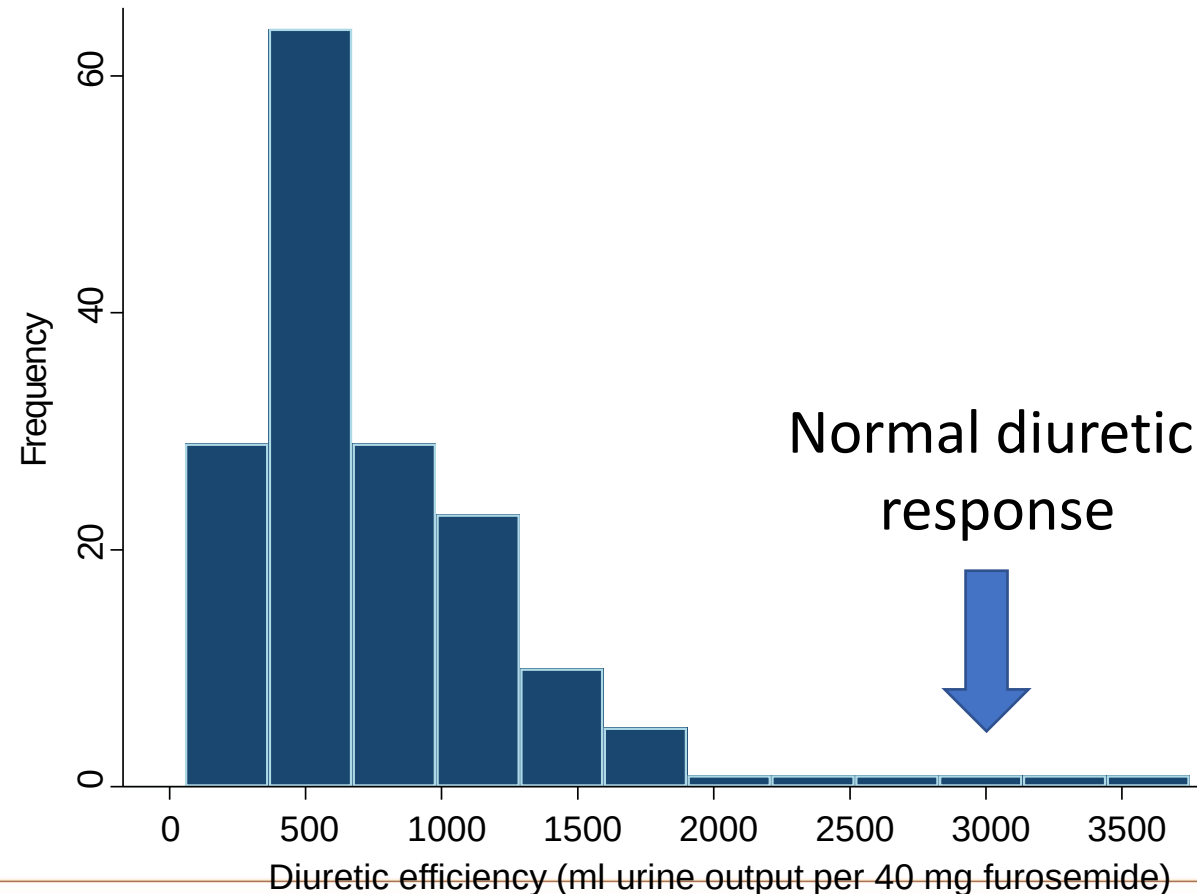
POSITION PAPER

The use of diuretics in heart failure with congestion — a position statement from the Heart Failure Association of the European Society of Cardiology

Wilfried Mullens^{1,2*}, Kevin Damman³, Veli-Pekka Harjola⁴, Alexandre Mebazaa⁵, Hans-Peter Brunner-La Rocca⁶, Pieter Martens^{1,2}, Jeffrey M. Testani⁷, W.H. Wilson Tang⁸, Francesco Orso⁹, Patrick Rossignol¹⁰, Marco Metra¹¹, Gerasimos Filippatos^{12,13}, Petar M. Seferovic¹⁴, Frank Ruschitzka¹⁵, and Andrew J. Coats¹⁶

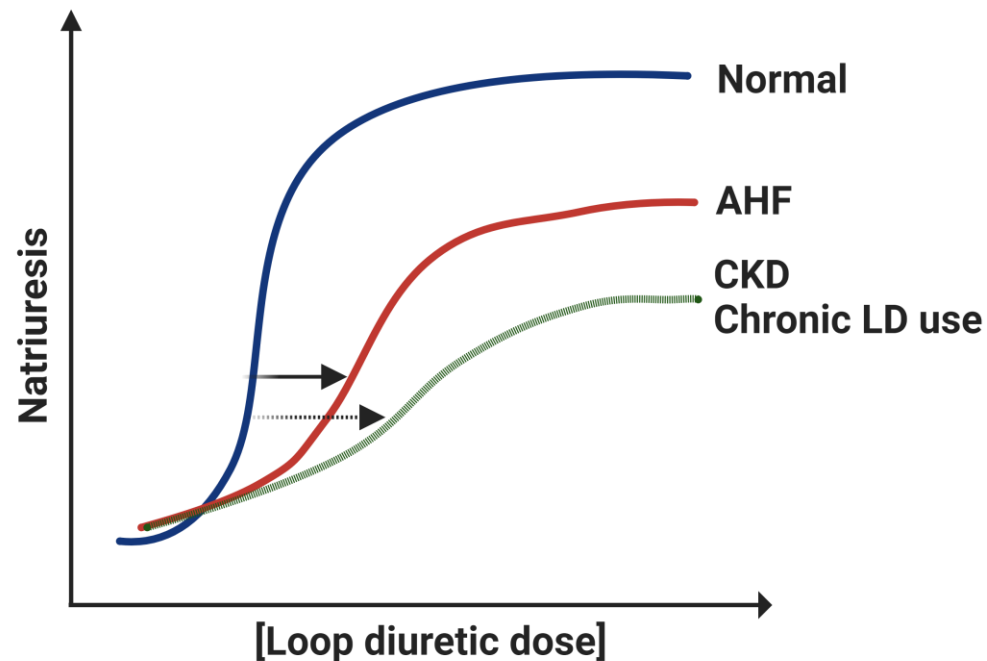
Diuretic response and resistance in heart failure

In achieving euvolaemia, the degree of volume overload and diuretic response will determine the success of therapy.⁶⁵ The capacity of inducing natriuresis or diuresis following diuretic administration is defined as diuretic response. Diuretic resistance is defined as an impaired sensitivity to diuretics resulting in reduced natriuresis and diuresis limiting the possibility to achieve euvolaemia.⁶⁶ Diuretic response should always be interpreted in light of the dose and type of the diuretic agent administered and the degree of volume overload, body composition and kidney function. As loop diuretics

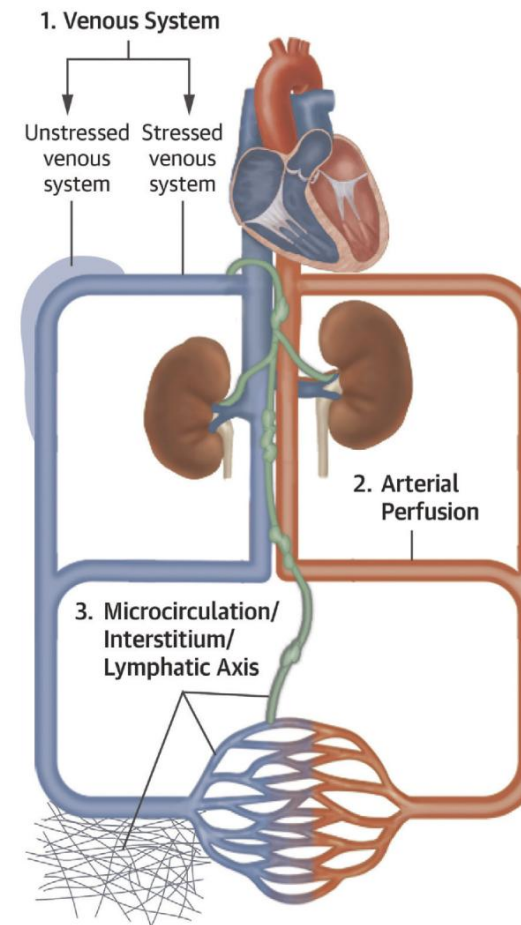


6. Usar estrategias más agresivas si paciente congestivo con enfermedad renal

The blunted LD response in AHF



AHF is a state of renal sodium avidity



Venous Congestion

- Decreases RBF
- Kidney interstitial edema
- Activation RAAS and SNS
- Renal sodium avidity ↑
- Inflammatory pathways

Rx Pullers

Arterial Underfilling

- Decreases RBF
- Activation RAAS and SNS
- Renal sodium avidity ↑
- Ischemic tubular injury
- Inflammatory pathways

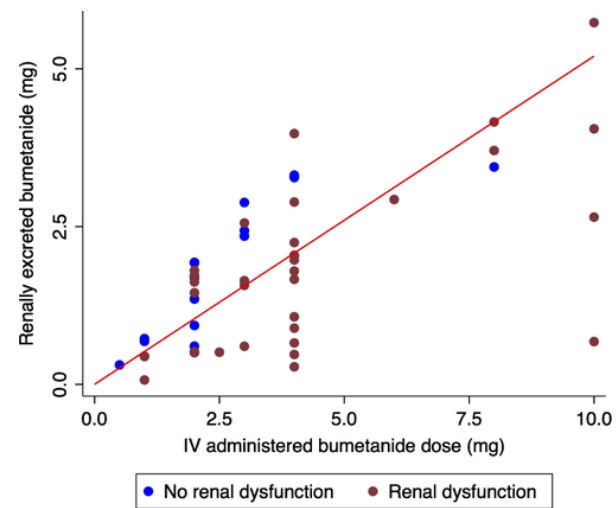
Rx Pushers

Interstitial Overload

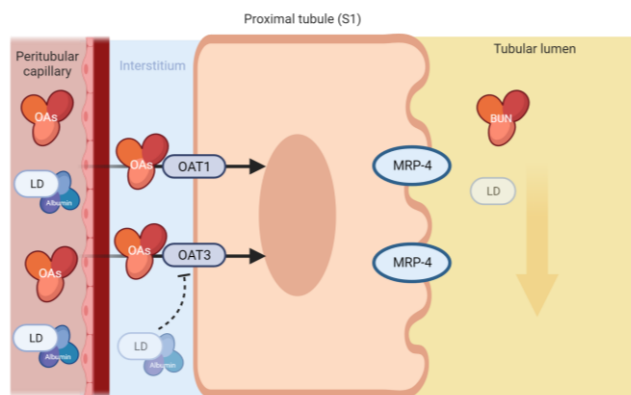
- Decrease lymph removal
- Renal Na presentation ↓
- Renal H₂O presentation ↓
- Renal interstitial pressure ↑

Rx Fluid Shifters

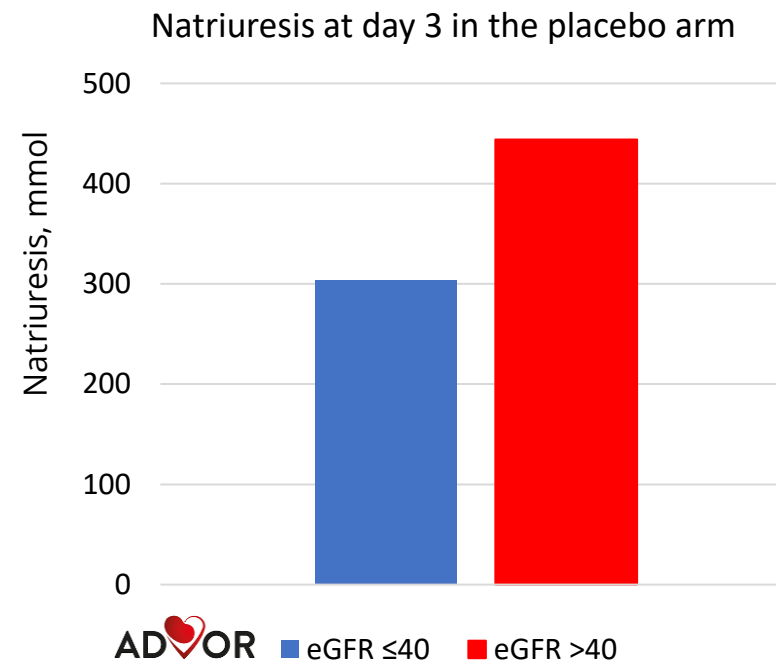
Enfermedad renal crónica



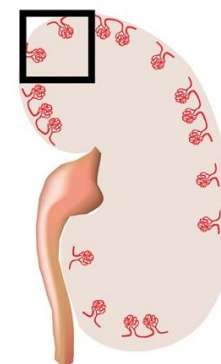
 Chronic kidney disease



Worse tubular diuretic delivery



AD^{OR}  eGFR ≤40  eGFR >40

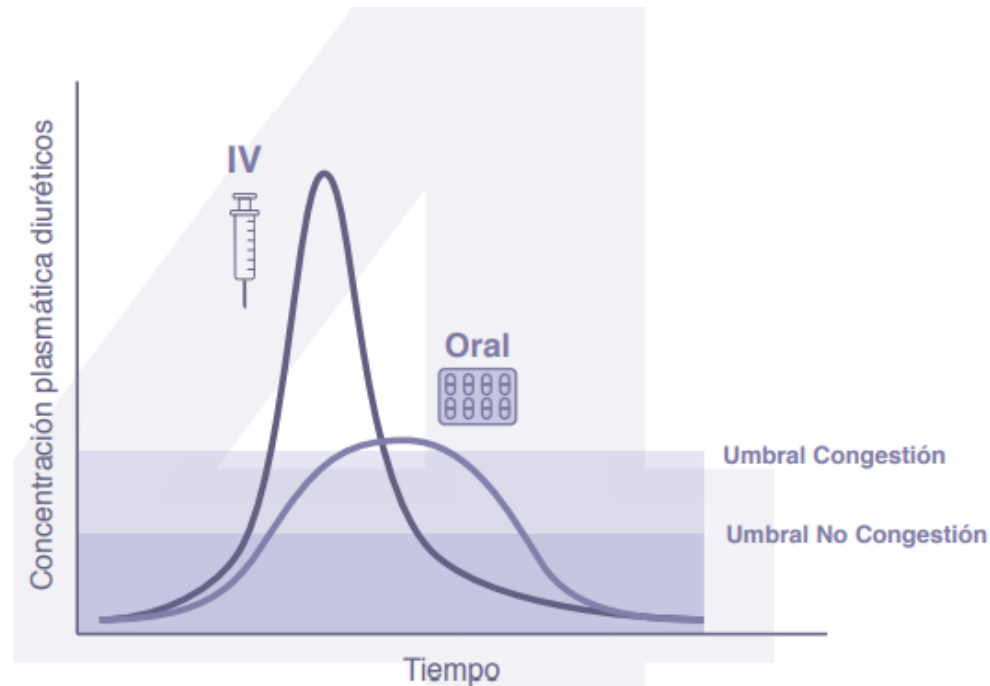


Reduced total nephron mass

total sodium output = GFR x FENa

7. Usar vía parenteral aun en paciente ambulatorio con empeoramiento funcional

Absorción oral de furosemida muy errática y variable



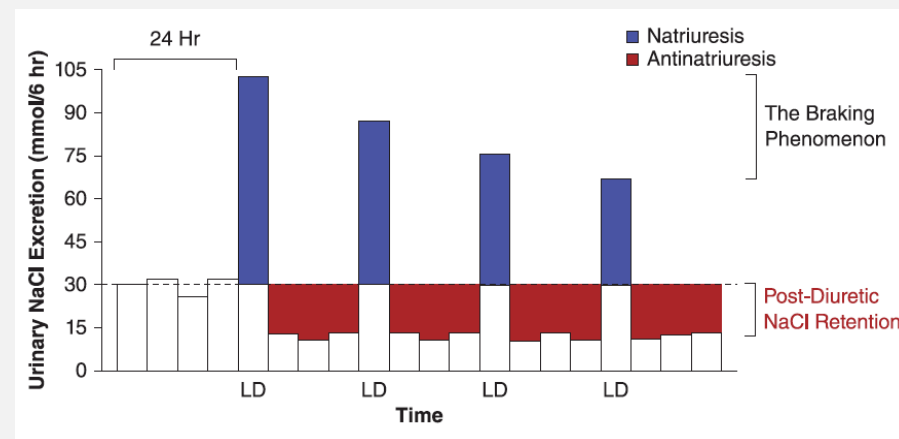
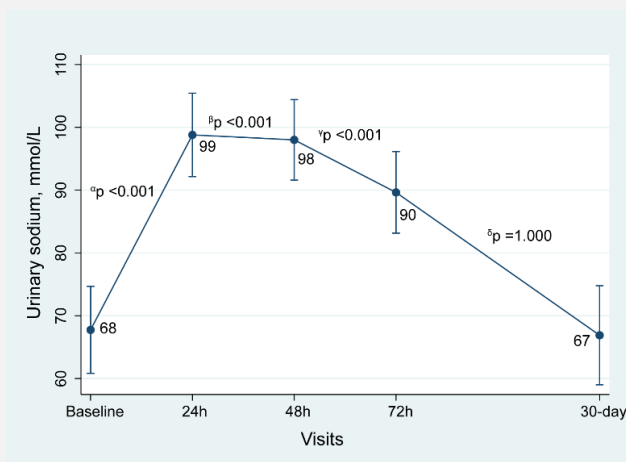
PARENTERAL

Administración ambulatoria de diuréticos de asa subcutáneos



500 mg furosemida en 250 ml salino
2 mg/mL

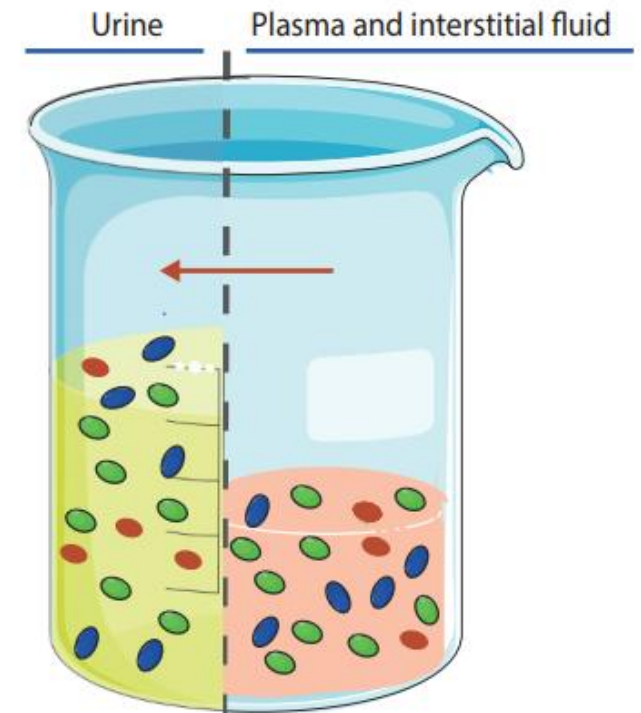
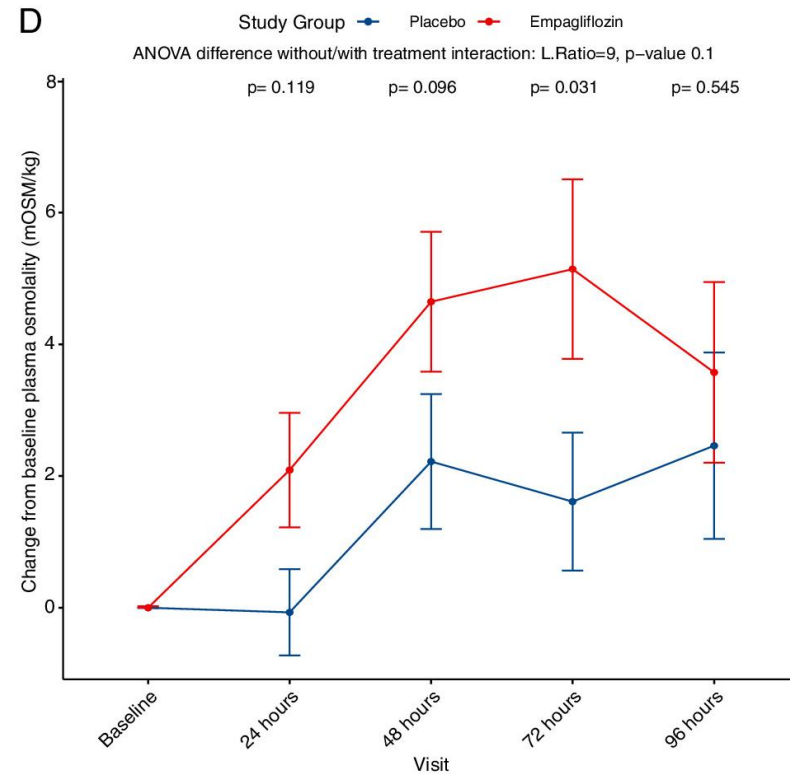
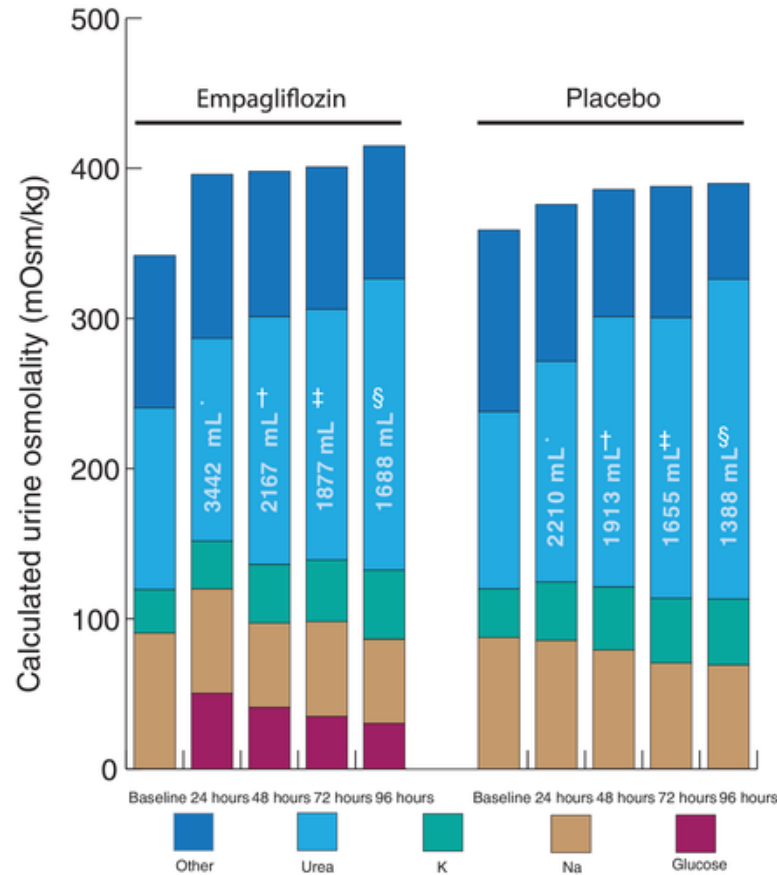
$2 \text{ mg/mL} \times 2.1 \text{ ml/h} = 4.2 \text{ mg/h}$
 $4.2 \text{ mg/h} \times 24 \text{ h} = 100.8 \text{ mg/d}$



Liderando el conocimiento del mañana

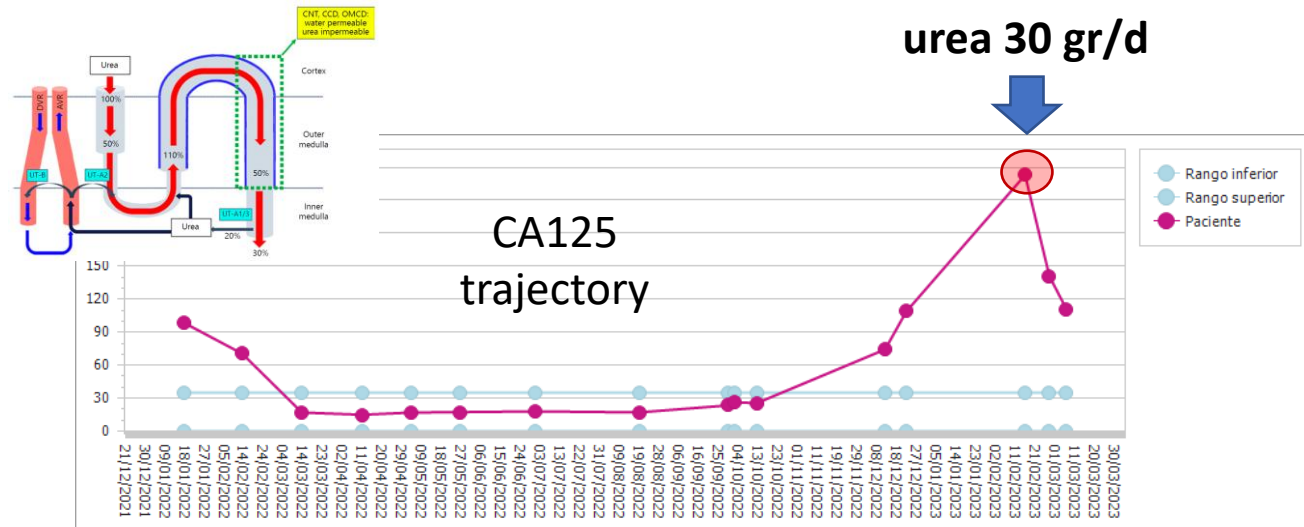
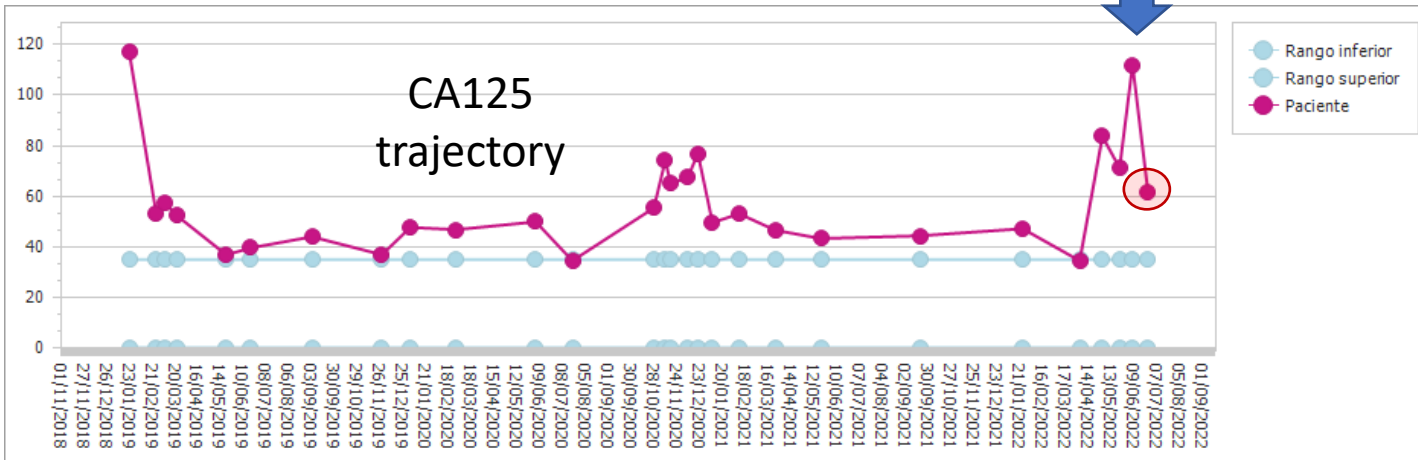
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8. Si predominio de sobrecarga hidrosalina de predominio extravascular ser agresivos asegurando el relleno vascular



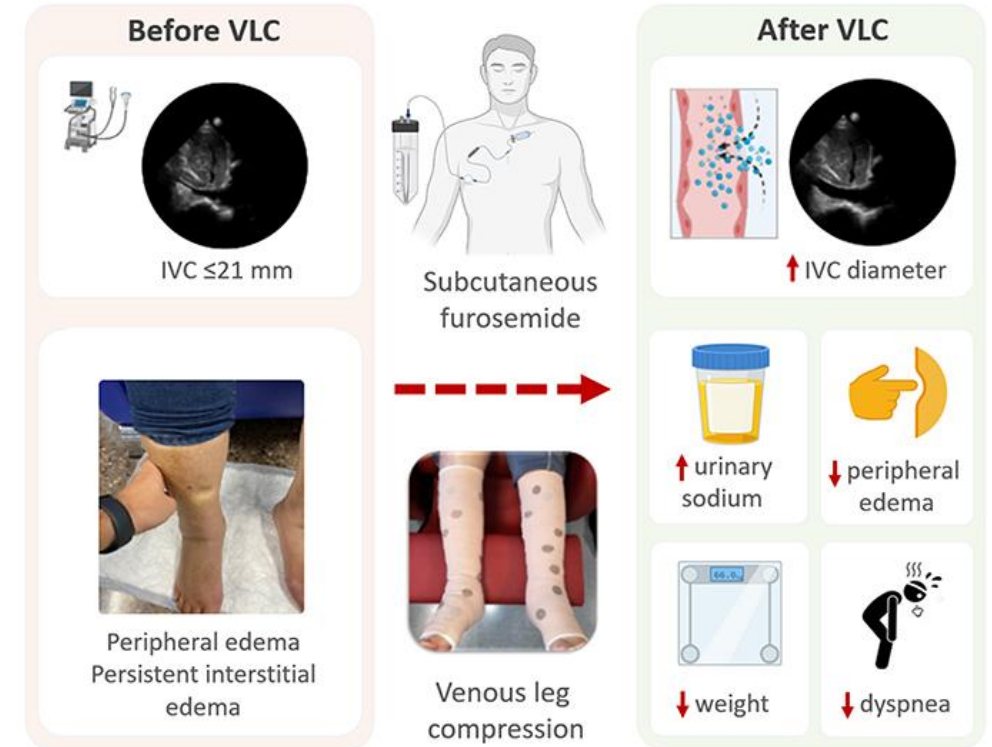
Osmotic diuretics as add-on

Tolvaptan 15 mg/d



* Fixed diuretic dose during the first 3-months of follow-up

Worsening Heart Failure

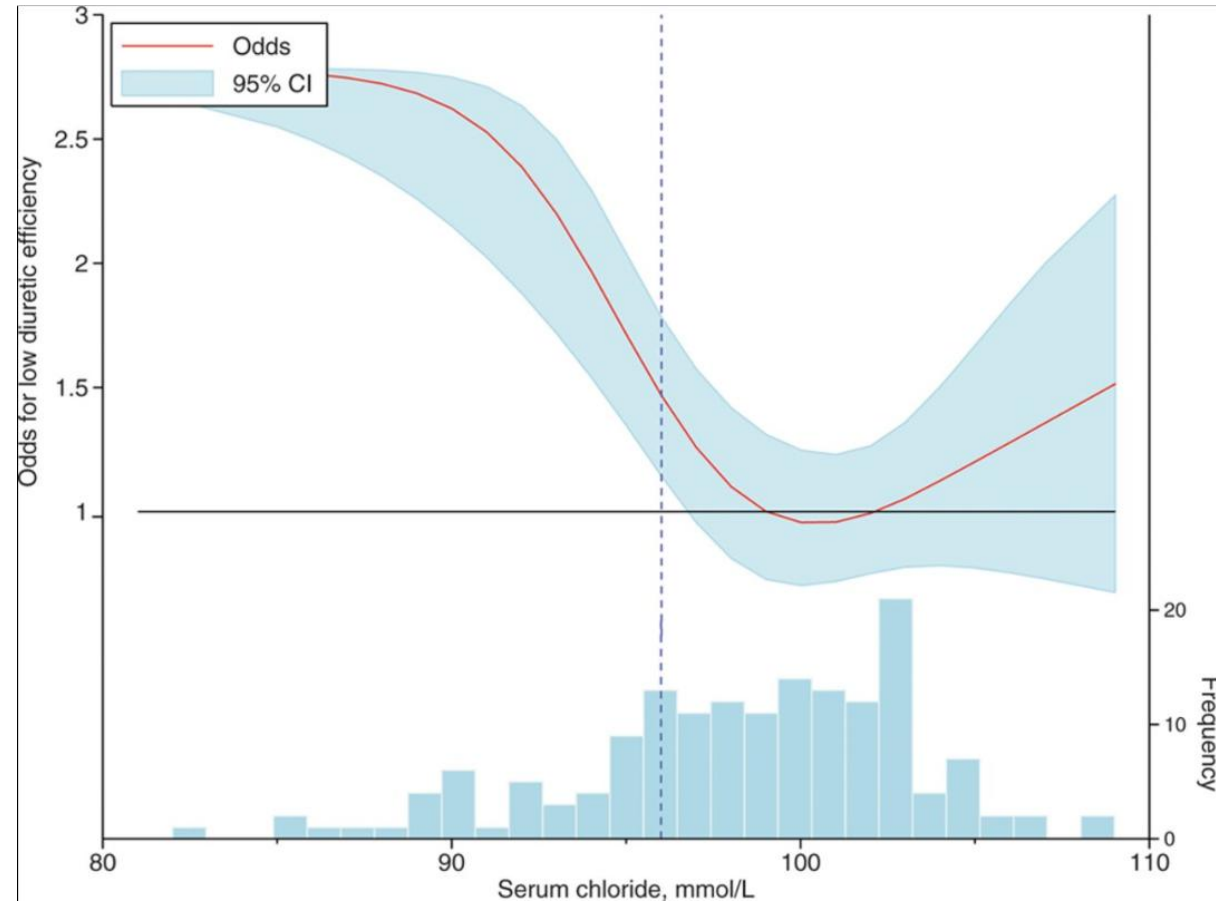


Liderando el conocimiento del mañana

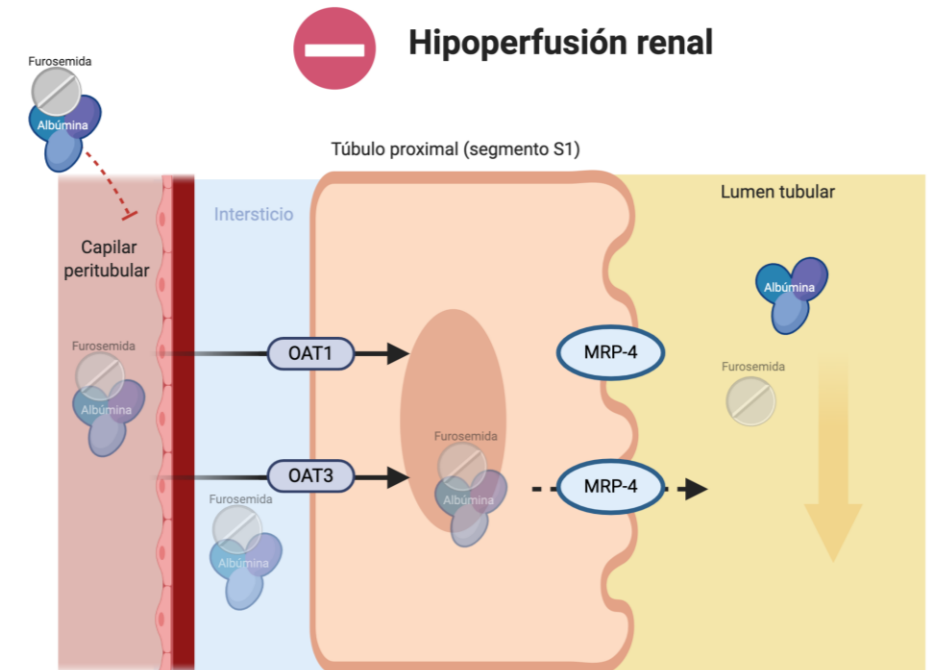
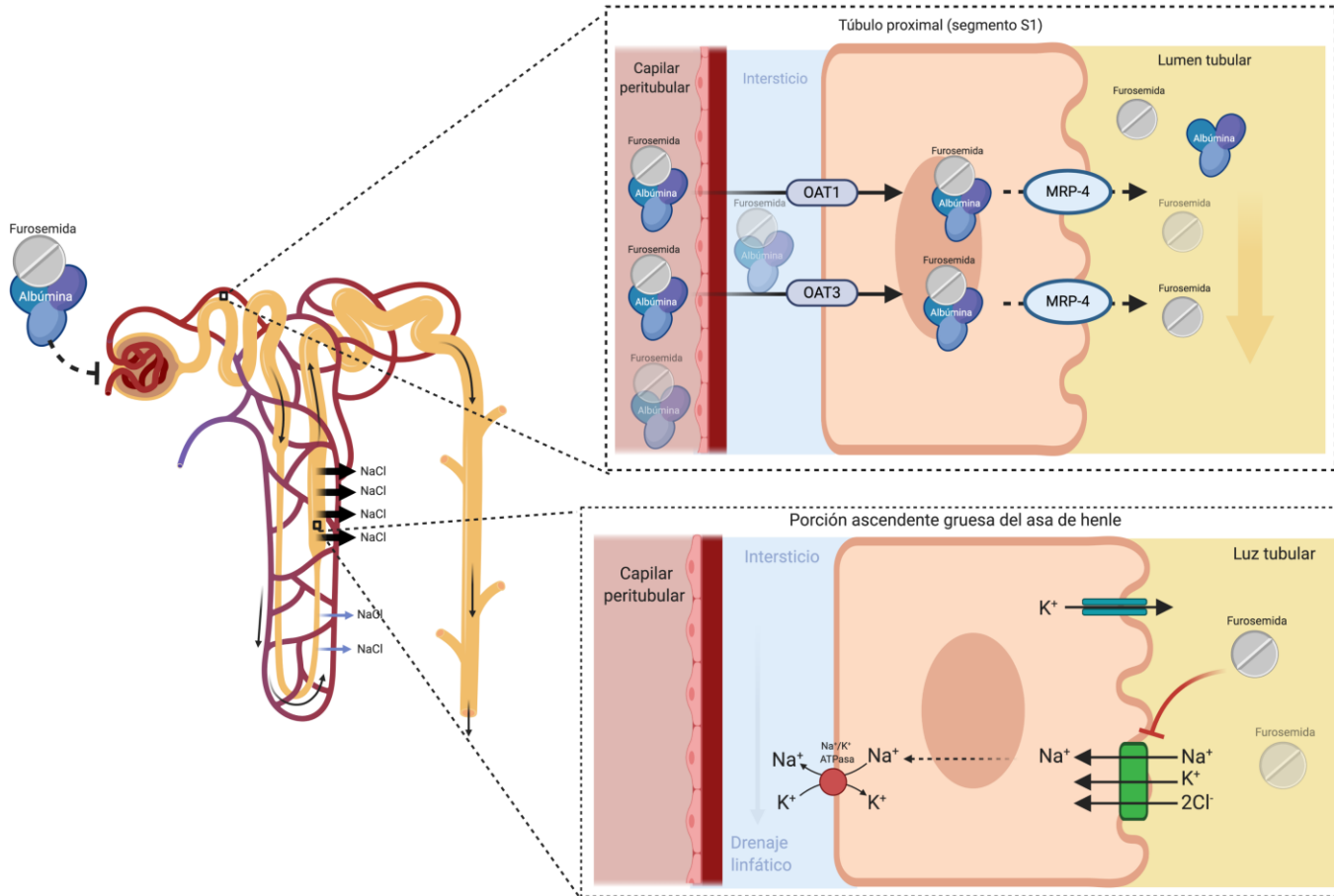
1. De la Espriella R, et al. Int J Cardiol. 2021 Sep 15;339:102-105

2. Rondon-Berrios H. Blood Purif. 2020;49(1-2):212-218.

9. Mide el cloro en plasma: hipocloremia identifica la resistencia diurética

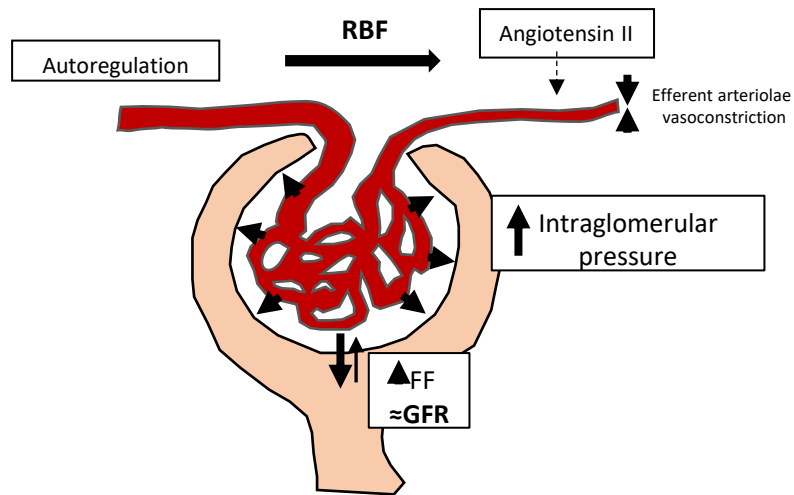


10. Mantener la presión de perfusión

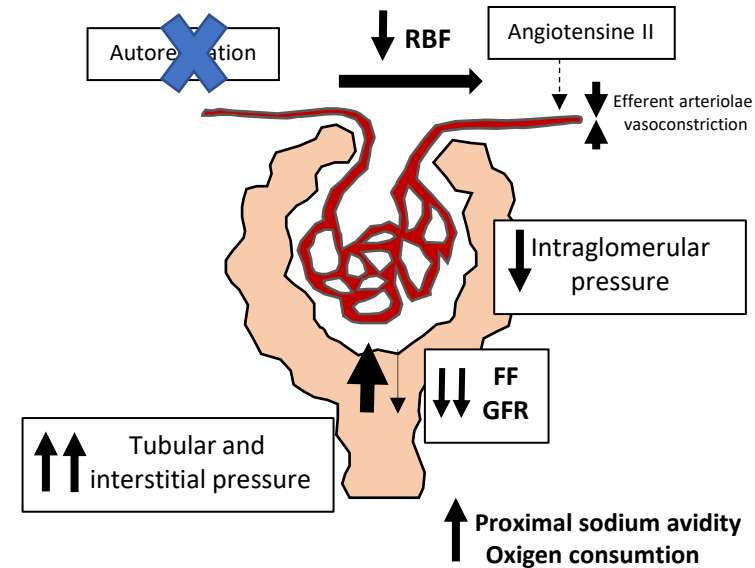


Evitar la hipotensión arterial, especialmente en presencia de congestión venosa

No congestión venosa y PAM 70-150

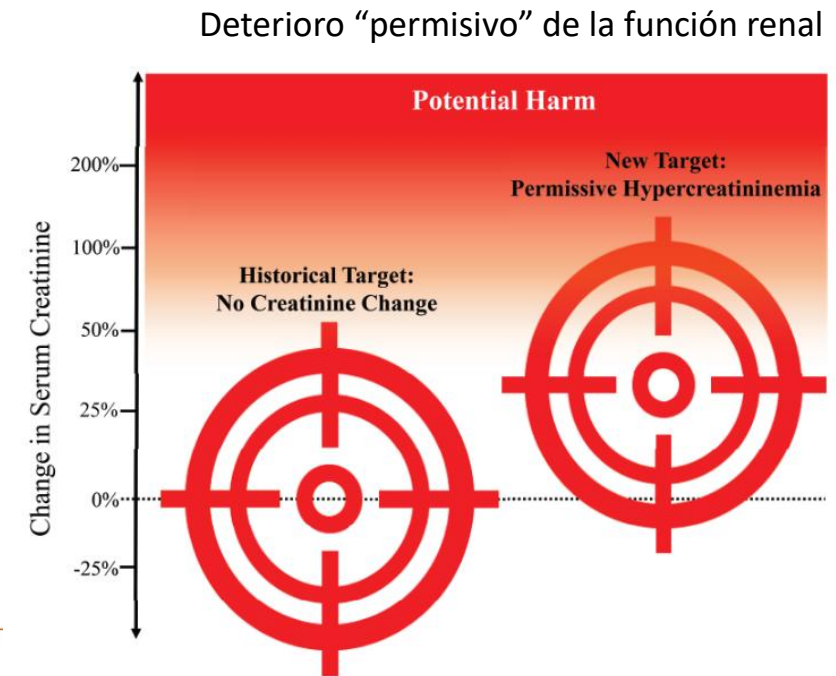
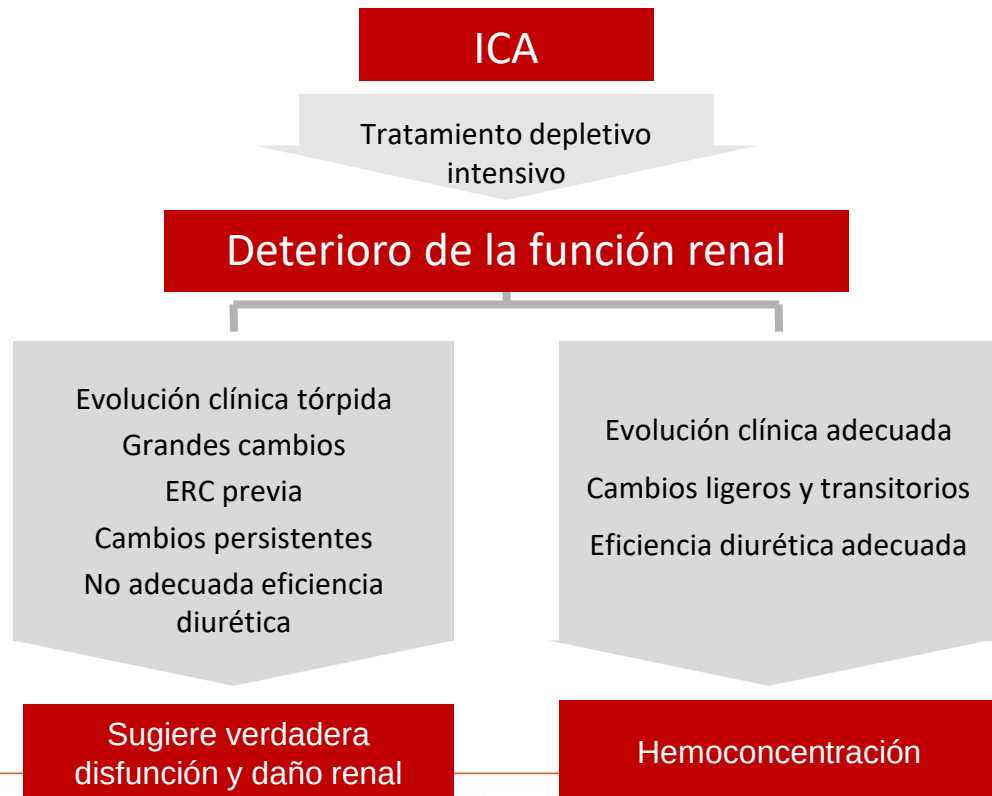


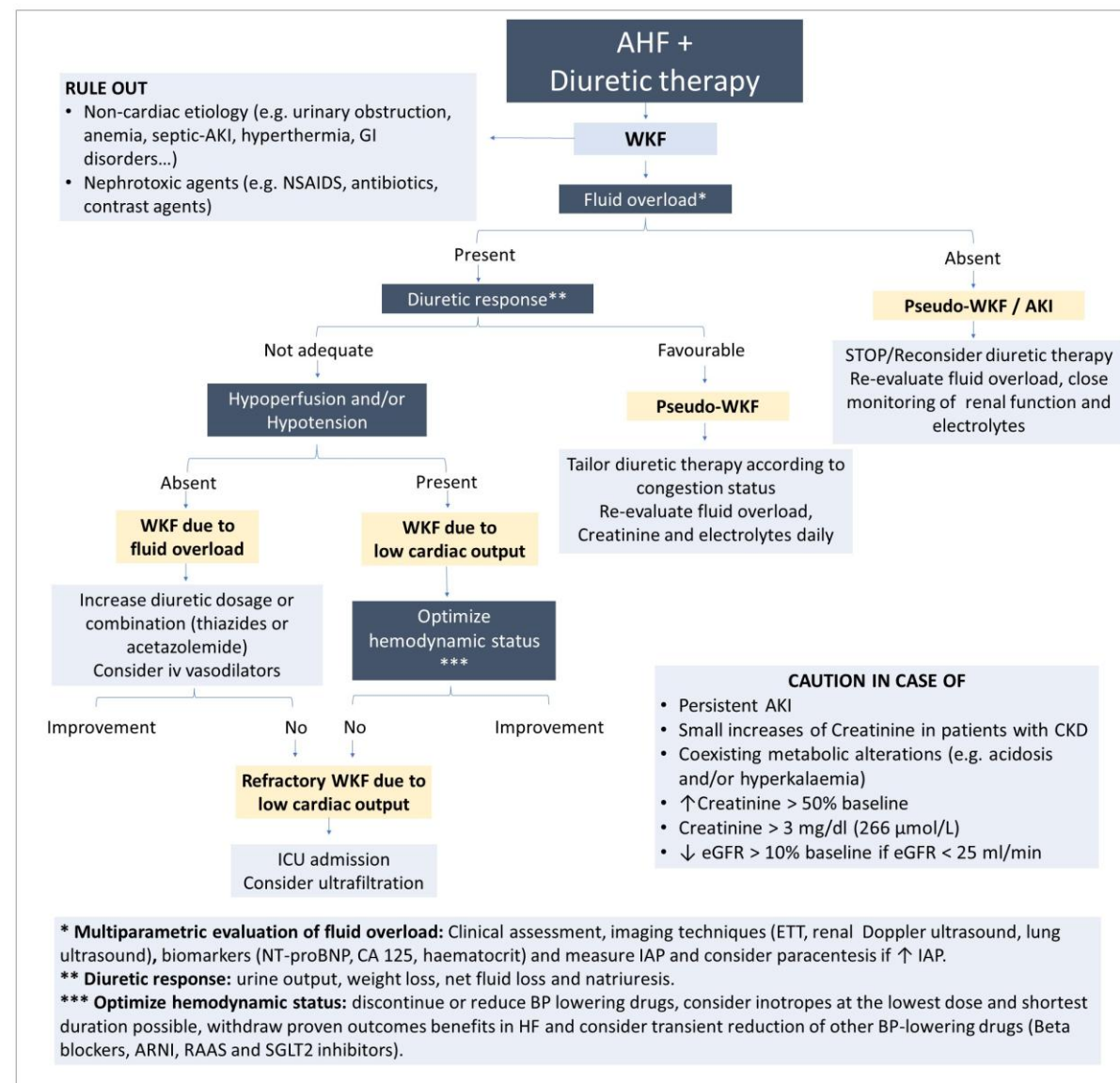
Congestión venosa y PAM <70



PAM alta – PVC baja (VExUS 0) – PP estrecha → **vasodilatadores / diuréticos**
PAM normal/alta – PVC alta (VExUS 2-3) – PP estrecha → **diuréticos +/- vasodilatadores**
PAM baja – PVC alta (VExUS 2-3) → **diuréticos / retira hipotensores / vasopresores?**

11. Interpretar adecuadamente los cambios de función renal que ocurren en pacientes tratado vigorosamente con diuréticos





AHF: acute heart failure; ARNI: angiotensin receptor-neprilysin inhibitors; BP: blood pressure; CA 125: Antigen carboxylyte 125; ETT: transthoracic echocardiography; eGFR: glomerular filtration rate; GI: gastrointestinal; HF: heart failure; IAP: intra-abdominal pressure; ICU: intensive care unit; NT-ProBNP: N-terminal brain natriuretic peptide; RAAS: renin-angiotensin-aldosterone system; SGLT2: sodium-glucose cotransporter-2; WKF: worse renal function. Modified from "Mullens W, et al. Evaluation of kidney function throughout the heart failure trajectory - a position statement from the Heart Failure Association of the European Society of Cardiology. European journal of heart failure. 2020;22(4):584-603.

Figure 4. Approach to worsening kidney function in acute heart failure. Algorithm to guide the correct interpretation of renal function changes in patients with acute heart failure.

