Università
degli Studi
della Campania
Luigi Vanvitelli

XIII congresso nazionale
simeu
GENOVA 30 MAG - 1 GIU 2024

INSUFFICIENZA RENALE ACUTA IN PS

Prof. Mauro Giordano

[redacted]

Oliguria < 0,5ml /kg /6h

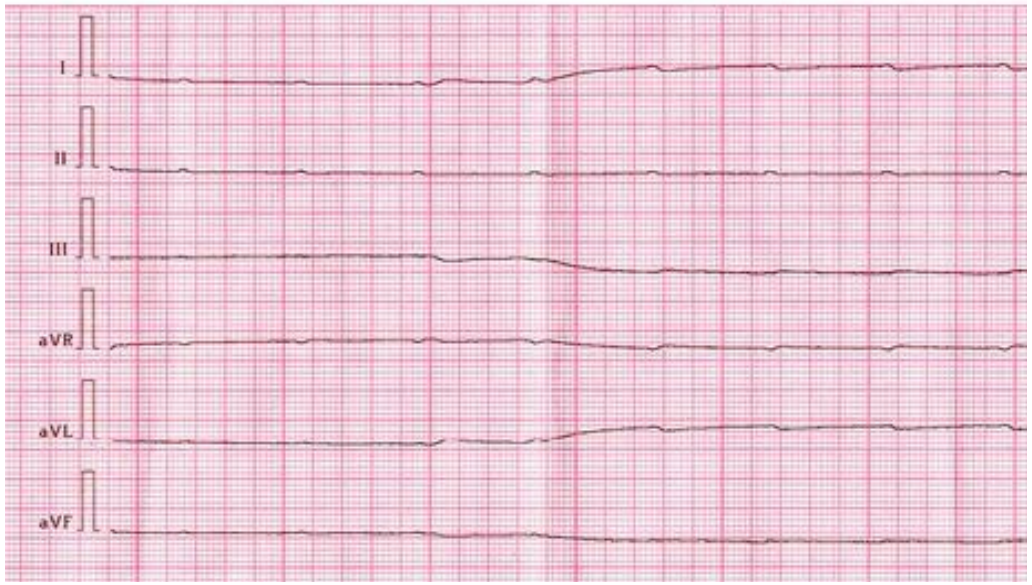
< 210 ml in 6h

RAFFAELE di 69 aa

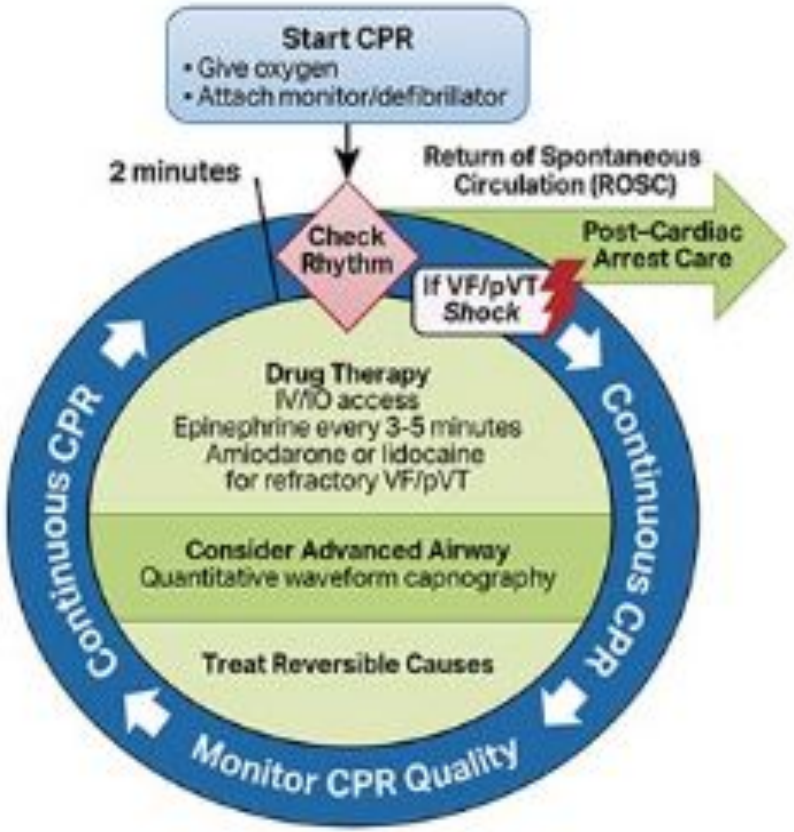
mentre era in attesa per una visita ambulatoriale in ospedale,

va in **arresto cardiaco**

Caos, portato immediatamente in Shock Room del PS, ASISTOLIA...



START RCP…



Si somministra ADRENALINA 1 mg ev, per un totale di 4 mg

Sopraggiungono i rianimatori
Si procede a rapida intubazione orotracheale in FiO2 100%.

Durante RCP si riesce ad eseguire EGA VENOSO…

T's of ACLS

Causes	Signs	Treatment
Tamponade (Cardiac)	-Rapid heart rate -Narrow QRS -JVD -No pulse -Muffled heart sounds	-Pericardiocentesis -Thoracotomy
Toxins	-Prolonged QT interval	-Based on overdose agent -Supportive care
Tension Pneumothorax	-Slow heart rate -Narrow QRS -Unequal breathing -JVD -Tracheal deviation	-Needle decompression -Insertion of a chest tube
Thrombosis (Pulmonary)	-Rapid heart rate -Narrow QRS -Shortness of breath -Decreased oxygen -Chest pain	-Embolectomy -Fibrinolytic therapy -Anticoagulant therapy
Thrombosis (Coronary)	-Abnormal ECG	-Angioplasty -Stent placement -Coronary bypass surgery

H's of ACLS

Causes	Signs	Treatment
Hypovolemia	-Rapid heart rate -Narrow QRS -Blood loss	-Obtain IO/IV Access -Administer fluid/blood -Use fluid challenge
Hypoxia/ Hypoxemia	-Slow heart rate -Cyanosis	-Ensure airway is open -Ventilate -Ensure oxygen supply is adequate
Hydrogen Ion Excess (Acidosis)	-Low amplitude QRS complex	-Atriel blood gas -Provide adequate ventilations -Sodium bicarbonate (metabolic)
Hypokalemia/ Hyperkalemia	U wave (Hypokalemia) -Peaked T waves & a widened QRS (Hyperkalemia)	(respiratory) -Sodium bicarbonate (metabolic)
Hypothermia	-Shivering -Previous exposure to cold temperatures	-Active warming measures -Temperature should be above 30°C

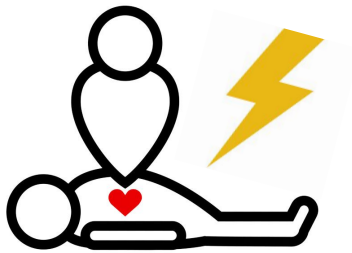
pH	7.25
pCO2	45
pO2	29
Na^+	131
K^+	**11.3**
Ca^{++}	1.29
Hb	9.5
HCO_3^-	7
Glu	210

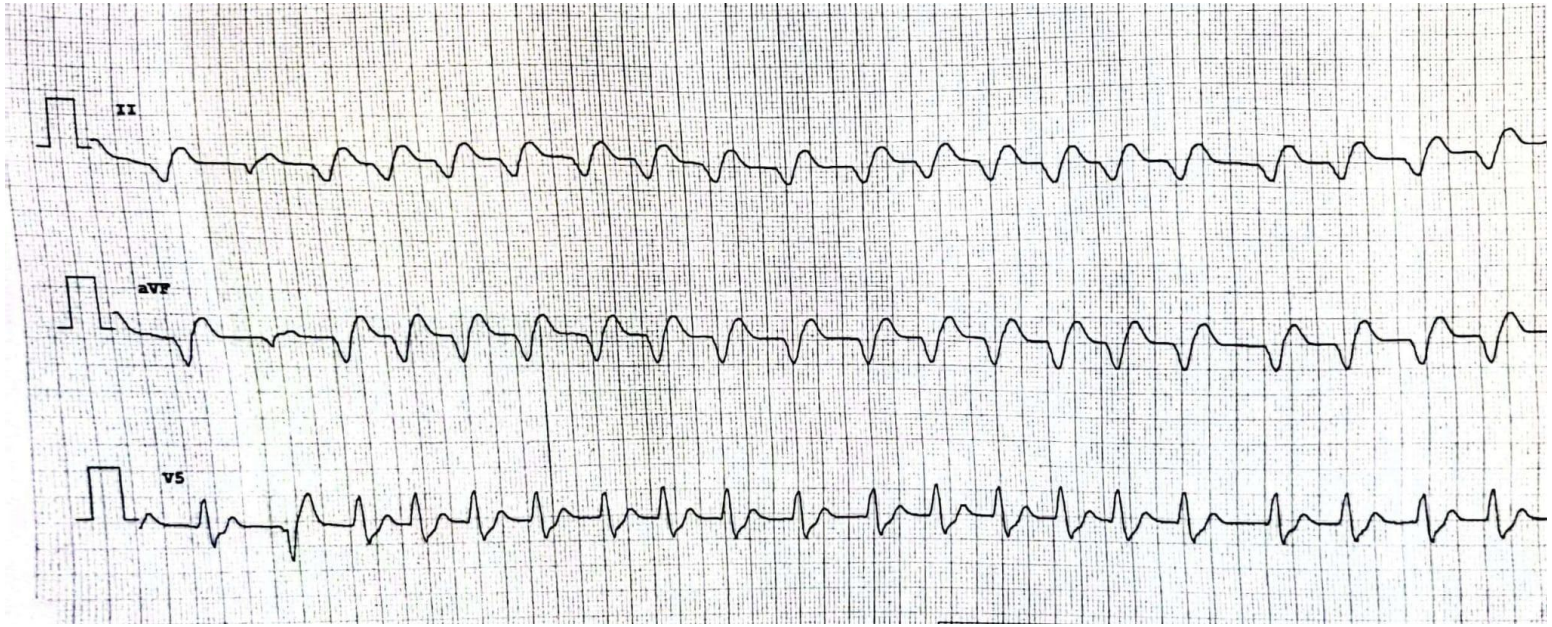
Si somministra :

- **1 fl Calcio Cloruro in bolo x3**
- **3 fl Bicarbonato in bolo + 10 fl in infusione rapida in 500 NaCl 0.9%**
- **500 cc Sol Glucosata 5% + 8 UI Insulina R in infusione rapida**

Dopo circa 20 min di RCP, comparsa di polso carotideo.

HR 30, 40, 50, 60, GCS 3, anisocoria, ECG:





Ecocardio bedside: ventricolo sinistro ipocinetico; FE 30%.

VCI 30 mm fissa. Sezioni destre non dilatate.

[redacted]

Dopo circa 30 min controllo EGA ARTERIOSO

pH	7.15
pCO2	35
pO2	441
Na^+	131
K^+	**8.4**
Cl^-	107
Ca^{++}	1.92
HCO_3^-	12.7
Lac	5.3

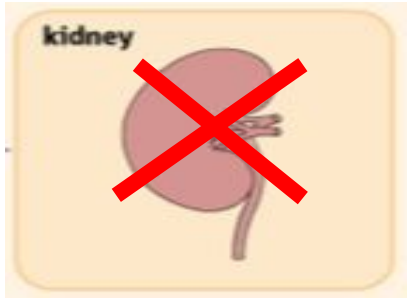
ABG for GFR?
The HCMA Index Evaluating Formula

$$(pH \times HCO_3^-) / (Cl^-)$$

normal: (7.35 x 24 mmol)/ 95 mmol = 1.8

(7.15 x 12,7) / 107 = 0.9: AKI !

Giordano M. et al, Emergency 2018



Stabilizzato e ricoverato in Terapia Intensiva

ESAME EMOCROMOCITOMETRICO				
WBC	10,9		10*3/uL	[4,4 - 11,3]
NEUTROFILI	54,6		%	[43,0 - 80,0]
LINFOCITI	37,7		%	[20,5 - 45,5]
MONOCITI	4,9	*	%	[5,5 - 11,7]
EOSINOFILI	2,5		%	[0,9 - 2,9]
BASOFILI	0,3		%	[0,2 - 1,0]
NEUT#	6,0		#	[2,0 - 7,5]
LIMPH#	4,1	*	#	[1,0 - 4,0]
MONO#	0,50		#	[0,20 - 1,00]
EOS#	0,30		#	[0,00 - 0,50]
BASO#	0,00		#	[0,00 - 0,20]
RBC	4,33	*	10*6/uL	[4,50 - 5,90]
HGB	10,1	*	gr/dL	[14,0 - 17,5]
HCT	32,4	*	%	[40,0 - 52,0]
MCV	74	*	fL	[80 - 99]
MCH	23,4	*	pg	[27,0 - 32,0]
MCHC	31,2	*	g/dL	[32,0 - 36,0]
PLT	272		10*3/uL	[140 - 300]
PCT	0,201		%	[0,150 - 0,500]
MPV	7,40		#	[6,00 - 11,00]
PDW	17,8		%	[11,00 - 18,00]
TEMPO DI PROTROMBINA				
INR	1,17			0.80-1.22
PT	76		%	[70 - 120]
PTT	26,2		s	[20,0 - 36,0]
FIBRINOGENO	411		mg/dL	[150 - 450]
D-DIMERO	1782	*	ng/mL	[< 255]

Esame		Risultato			
AZOTEMIA	49	49		mg/dL	[10 - 50]
GLICEMIA	252	252	*	mg/dL	[80 - 110]
CREATININA	1,71	1,71	*	mg/dL	[0,67 - 1,20]
BILIRUBINA TOTALE		0,37		mg/dL	[0,03 - 1,20]
BILIRUBINA DIRETTA		0,12		mg/dL	[0,00 - 0,25]
BILIRUBINA INDIRETTA		0,25		mg/dL	[0,00 - 0,75]
SODIO		132	*	mmol/L	[135 - 146]
POTASSIO	8,1	8,1	*	mmol/L	[3,5 - 5,1]
CLORO	108	108	*	mmol/L	[98 - 107]
PROTEINE TOTALI		7,1		g/dL	[6,6 - 8,7]
GOT		23		[IU]/L	[0 - 40]
GPT		17		[IU]/L	[0 - 41]
COLINESTERASI		3261	*	[IU]/L	[5320 - 12920]
AMILASI		115	*	[IU]/L	[28 - 100]
CALCIO	12,5	12,56	*	mg/dL	[8,60 - 10,20]
PROTEINA C REATTIVA		0,71	*	mg/dL	[0,00 - 0,50]
ALBUMINA		3,27	*	g/dL	[3,50 - 5,20]
TROPONINA I		< 0.100		ng/mL	[0,00 - 0,16]
MIOGLOBINA		90	*	ng/mL	[28 - 72]

- **RAFFAELE di 69 aa**

- **Anamnesi & Terapia:**
- diabete mellito
- Insufficienza Renale Cronica 3b
- cirrosi epatica - SPIRONOLATTONE
- ipertensione arteriosa - ACE INIBITORI
- FA permanente in terapia anticoagulante,
- Lombosciatalgia – **KETOROLAC!**

DIAGNOSI: INSUFFICIENZA RENALE ACUTA SU CRONICA

ABG for GFR?
The HCMA Index Evaluating Formula

TAKE HOME MESSAGE #1

$$pH \times [HCO_3^-] / [Cl^-]$$

normal: (7.35 x 24 mmol)/ 95 mmol = 1.85 (VN > 1,5)

AKI: (7.30 x 13 mmol)/ 107 mmol = **0.9!**

Giordano M. et al, Emergency 2018

Canadian Society of Nephrology/ Société canadienne de néphrologie CSN/SCN

CANADIAN JOURNAL OF KIDNEY HEALTH AND DISEASE
Journal canadien de la santé et de la maladie rénale

[redacted]

The Clinical Epidemiology and 30-Day Outcomes of Emergency Department Patients With Acute Kidney Injury

Canadian Journal of Kidney Health and Disease
Volume 4: 1–13

DOI: 10.1177/2054358117703985
journals.sagepub.com/home/cjk
SAGE

Frank Xavier Scheuermeyer[1,2], Eric Grafstein[2,3], Brian Rowe[4,5], Jay Cheyne[1,2], Brian Grunau[1,2], Aaron Bradford[1,2], and Adeera Levin[2,6]

What this adds

Overall, 5.5% of all emergency department patients had acute kidney injury. One-third of acute kidney injury patients were discharged home, the majority with no renal-specific follow-up.

OFFICIAL JOURNAL OF THE INTERNATIONAL SOCIETY OF NEPHROLOGY

kidney INTERNATIONAL supplements

KDIGO GUIDELINES

Kidney Disease Improving Global Outcome

Table 11 | Definitions of AKI, CKD, and AKD

	Functional criteria	Structural criteria
AKI	Increase in SCr by 50% within 7 days, *OR* Increase in SCr by 0.3 mg/dl (26.5 μmol/l) within 2 days, *OR* Oliguria	No criteria
AKD	AKI, *OR* GFR <60 ml/min per 1.73 m^2 for <3 months, *OR* Decrease in GFR by $\geqslant 35\%$ or increase in SCr by $>50\%$ for <3 months	Kidney damage for <3 months

Koeze et al. BMC Nephrology (2017) 18:70
DOI 10.1186/s12882-017-0487-8

BMC Nephrology

RESEARCH ARTICLE Open Access

Incidence, timing and outcome of AKI in critically ill patients varies with the definition used and the addition of urine output criteria

J. Koeze*, F. Keus, W. Dieperink, I. C. C. van der Horst, J. G. Zijlstra and M. van Meurs

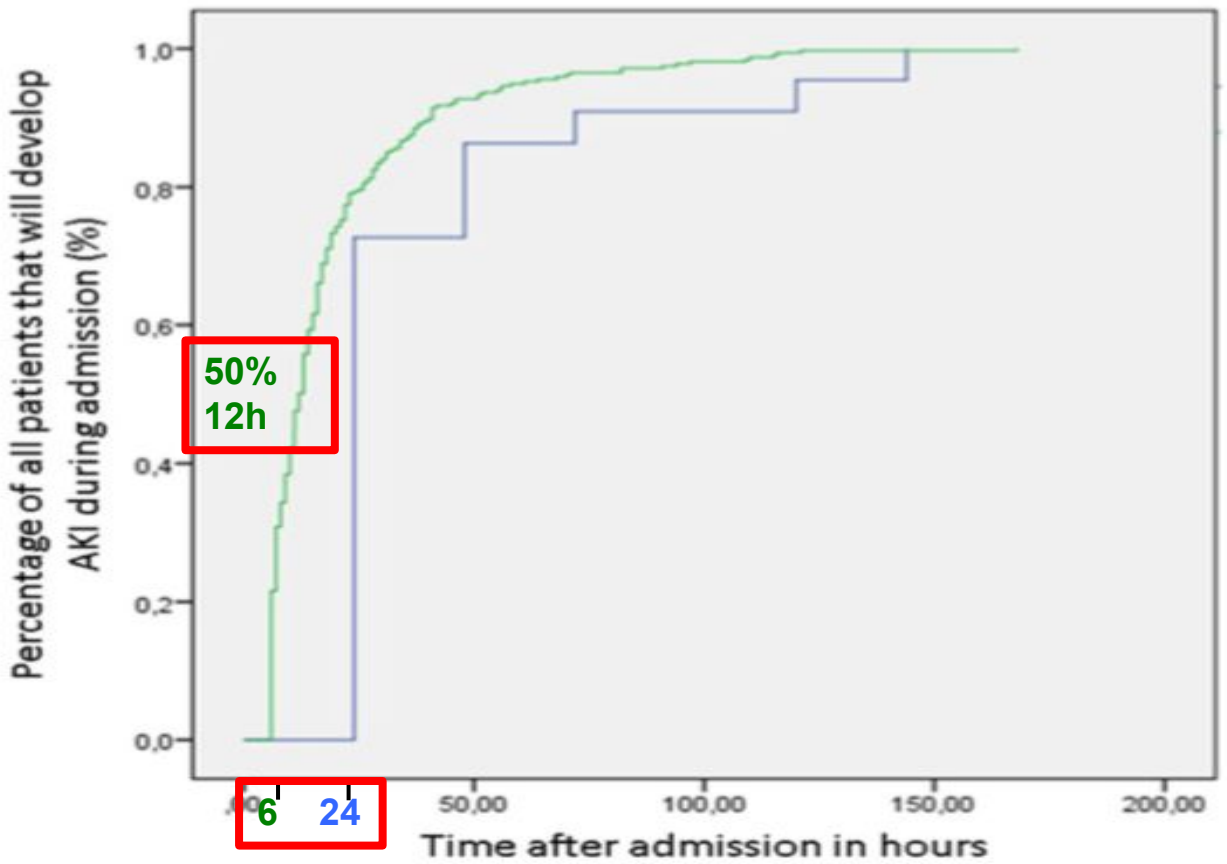


Fig. 2 Proportions of patients who develop AKI according to RIFLE definition during ICU admission. Proportions of patients who develop AKI according to RIFLE definitions based on urine output criteria (green line) and serum creatinine criteria (blue line) plotted against the time in hours since admission to the ICU. Only patients without AKI at ICU admission who developed AKI within the first week of ICU admission are included in this graph

Koeze J, BMC Nephrology 2017

original article http://www.kidney-international.org

see commentary on page 699

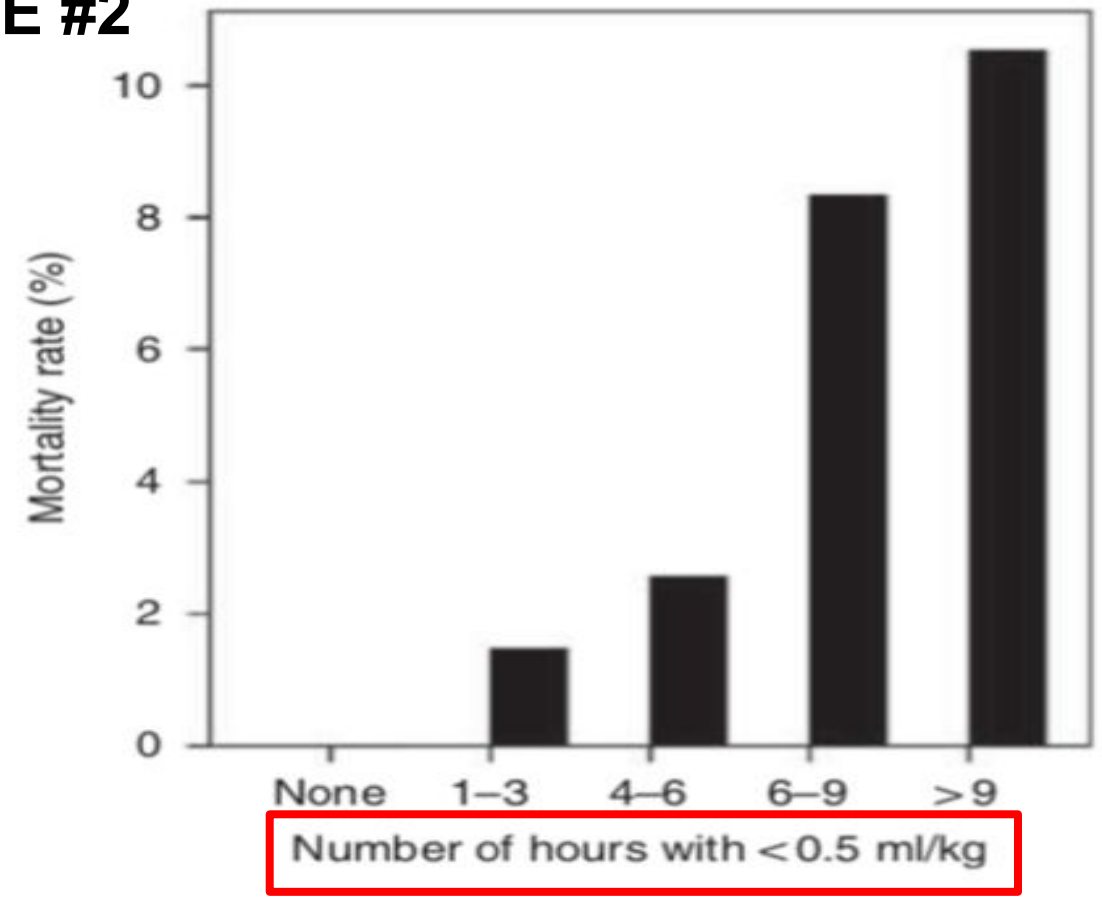
Oliguria is an early predictor of higher mortality in critically ill patients

Etienne Macedo[1,2], Rakesh Malhotra[2], Josée Bouchard[2,3], Susan K. Wynn[2] and Ravindra L. Mehta[2]

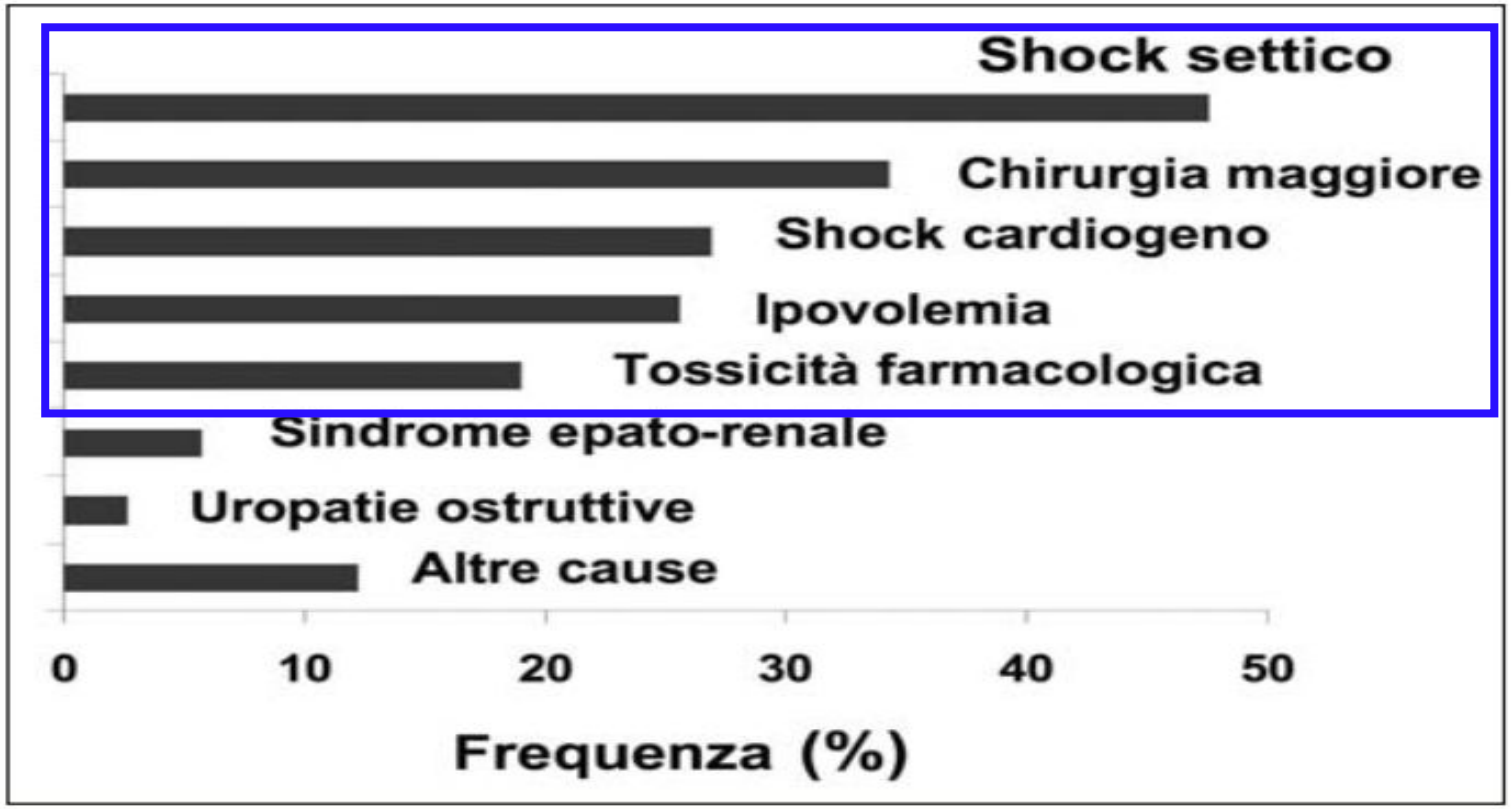
[1]University of Sao Paulo, Sao Paulo, Brazil; [2]University of California, San Diego, San Diego, California, USA and [3]Université de Montréal, Montréal, Quebec, Canada

TAKE HOME MESSAGE #2

TIMING !



Eziopatogenesi AKI



Kellum JA, et Al. Crit Care Med 2006

TAKE HOME MESSAGE #3

Oliguria si, ma...

- Diarrea
- Vomito
- Emorragia
- Shock

- Edema polmonare acuto
- Scompenso cardiaco
- Cirrosi epatica
- SIADH

FULL

Segni di sovraccarico di volume

- Cava piena
- Edemi declivi
- Dispnea

EMPTY

Physical Examination

Signs of intravascular volume depletion

The following may be noted:

- Tachycardia
- Orthostatic hypotension
- Decreased skin turgor
- Dry mucous membranes

ARTICLE IN PRESS

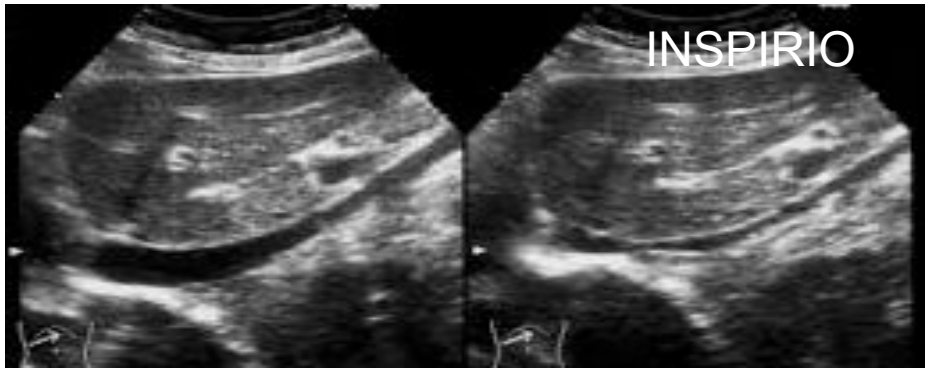
[Contemporary Reviews in Critical Care Medicine]

CHEST

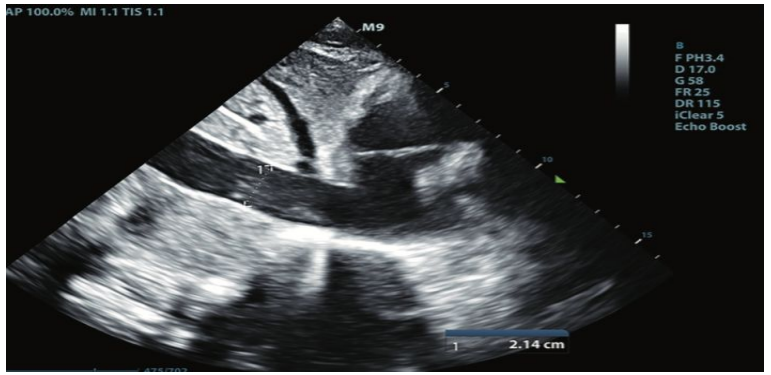
Fluid Management in Acute Kidney Injury

Marlies Ostermann, PhD; Kathleen Liu, MD; and Kianoush Kashani, MD

EMPTY



FULL



YES FLUID
NO DIURETIC

NO FLUID
YES DIURETIC

Should colloid solutions be used in patients with AKI or those at risk of AKI?

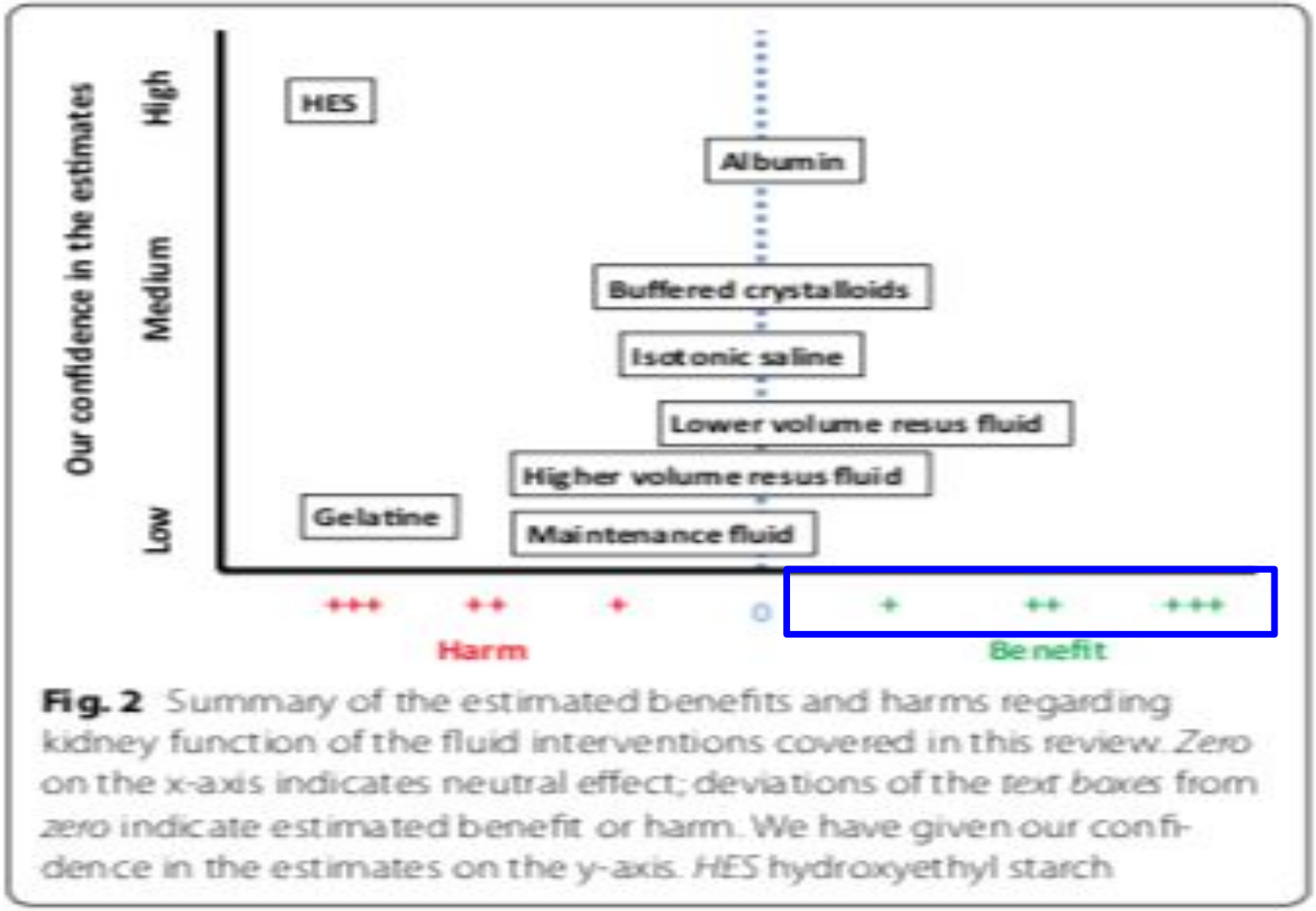


Fig. 2 Summary of the estimated benefits and harms regarding kidney function of the fluid interventions covered in this review. *Zero* on the x-axis indicates neutral effect; deviations of the *text boxes* from *zero* indicate estimated benefit or harm. We have given our confidence in the estimates on the y-axis. *HES* hydroxyethyl starch

Intensive Care Med (2017) 43:730–749
DOI 10.1007/s00134-017-4832-y

CONFERENCE REPORTS AND EXPERT PANEL

Prevention of acute kidney injury and protection of renal function in the intensive care unit: update 2017

Expert opinion of the Working Group on Prevention, AKI section, European Society of Intensive Care Medicine

M. Joannidis[1*], W. Druml[2], L. G. Forni[3], A. B. J. Groeneveld, P. M. Honore[4], E. Hoste[5], M. Ostermann[6], H. M. Oudemans-van Straaten[7] and M. Schetz[8]

TAKE HOME MESSAGE #4

CRYSTALLOIDS ONLY !

Volume expansion

Recommendations

1. We *recommend* controlled fluid resuscitation in volume depletion, while, however, avoiding volume overload (Grade 1C).
2. We *recommend* against the use of starches (Grade 1A) as harm has been shown and *suggest* not using gelatine or dextrans for fluid resuscitation (Grade 2C).
3. We *recommend* correction of hypovolaemia/dehydration using isotonic crystalloids in patients receiving intravascular contrast media (Grade 1B).
4. We *recommend* regular monitoring of chloride levels and acid–base status in situations where chloride-rich solutions are used (BPS).
5. We *suggest* the use of balanced crystalloids for large volume resuscitation (Grade 2C).
6. We *suggest* using human serum albumin if a colloid is deemed necessary for the treatment of patients with septic shock (Grade 2C).
7. We *suggest* prophylactic volume expansion with crystalloids to prevent AKI by certain drugs (specified below) (BPS).
8. We *suggest* not delaying urgent contrast-enhanced investigations or interventions for potential preventative measures (BPS).

SOLUZIONE SALINA FISIOLOGICA (NaCl 0,9%; 9g/L) *(ma non troppo… attenzione Na+)*

Na^+ mmol/L	154
K^+ mmol/L	-
Cl^- mmol/L	154
HCO^-_3 mmol/L	-
Lattati mmol/L	-
pH	4,5-7,0
Osmolarità mosmol/L	308

Contemporary Reviews in Critical Care Medicine

RINGER LATTATO
(attenzione epatopatici)

Na^+ mmol/L	131
K^+ mmol/L	5
Cl^- mmol/L	112
Ca++ mmol/L	4
Lattati mmol/L	28
pH	5,5-7.0
Osmolarità mosmol/L	278

ELETTROLITICA REIDRATANTE III
(attenzione carico di K+)

Na^+ mmol/L	140
K^+ mmol/L	10
Cl^- mmol/L	103
Ca++ mmol/L	5
Acetato (HCO^-_3)mmol/L	47
pH	5,0-7,0
Osmolarità mosmol/L	312

ALBUMINA 20%
(the best..)

Na^+ mmol/L	130
K^+ mmol/L	-
Cl^- mmol/L	77
HCO^-_3 mmol/L	-
Lattati mmol/L	-
pH	6.7-7.3
Osmolarità mosmol/L	309

GLUCOSATA 5% (attenzione all'acqua libera)

Na^+ mmol/L	**-**
K^+ mmol/L	-
Cl^- mmol/L	-
HCO^-_3 mmol/L	-
Lattati mmol/L	-
pH	3.5-6.5
Glucosio mmol/L	252
Osmolarità mosmol/L	278

Intensive Care Med (2017) 43:730–749
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CONFERENCE REPORTS AND EXPERT PANEL

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Diuretics

Recommendations

1. We *recommend* against loop diuretics given solely for the prevention of acute kidney injury (Grade 1B).
2. We *suggest* using diuretics to control or avoid fluid overload in patients that are diuretic-responsive (Grade 2D).

FUROSEMIDE
Bolus 20-40 mg e.v.
Continuous Infusion 5-20 mg/h
Onset 30 min

Fluid Management in Acute Kidney Injury

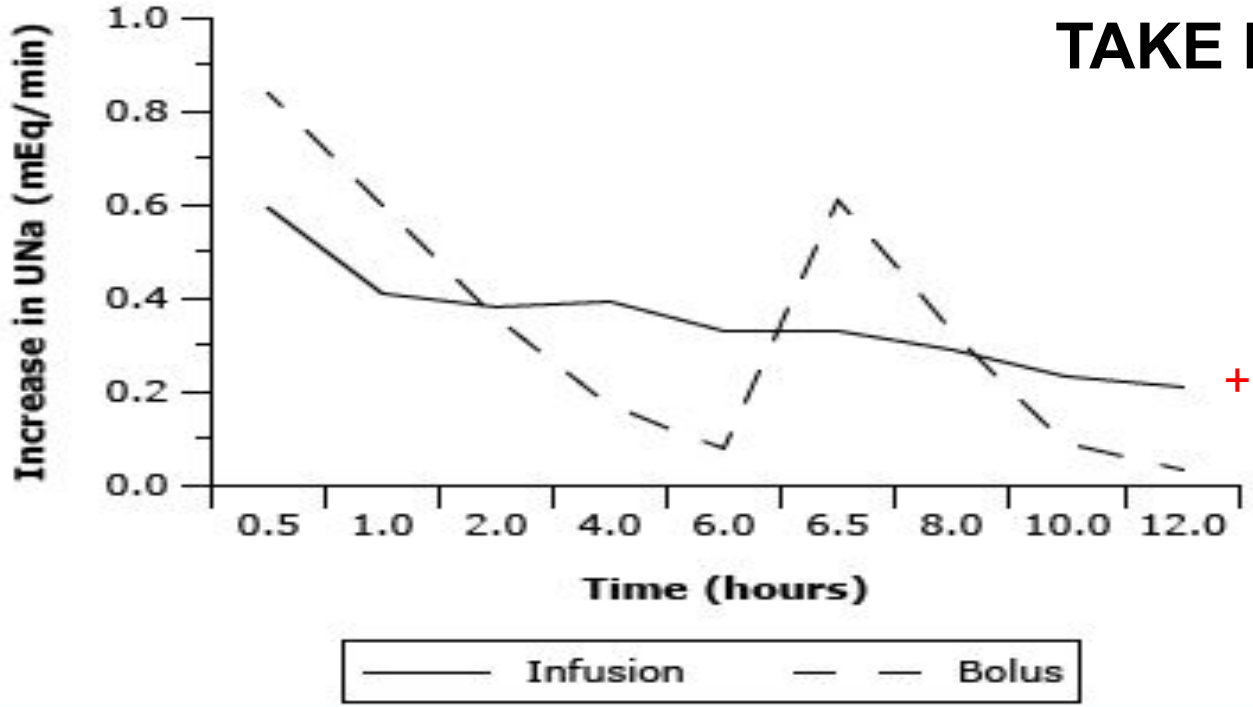
Marlies Ostermann, PhD; Kathleen Liu, MD; and Kianoush Kashani, MD

Fluid Management in Specific Types of AKI

AKI in Congestive Cardiac Failure

Patients with cardiac disease are at high risk of AKI due to multiple reasons, including impaired cardiac output, renal congestion due to right ventricular dysfunction, and potential drug nephrotoxicity. In this situation, fluid therapy is only indicated in the case of true intravascular fluid depletion. Support with inotropes and vasopressors is more commonly needed, often in combination with diuretic agents and fluid removal.

Diuresis in continuous versus bolus loop diuretic therapy

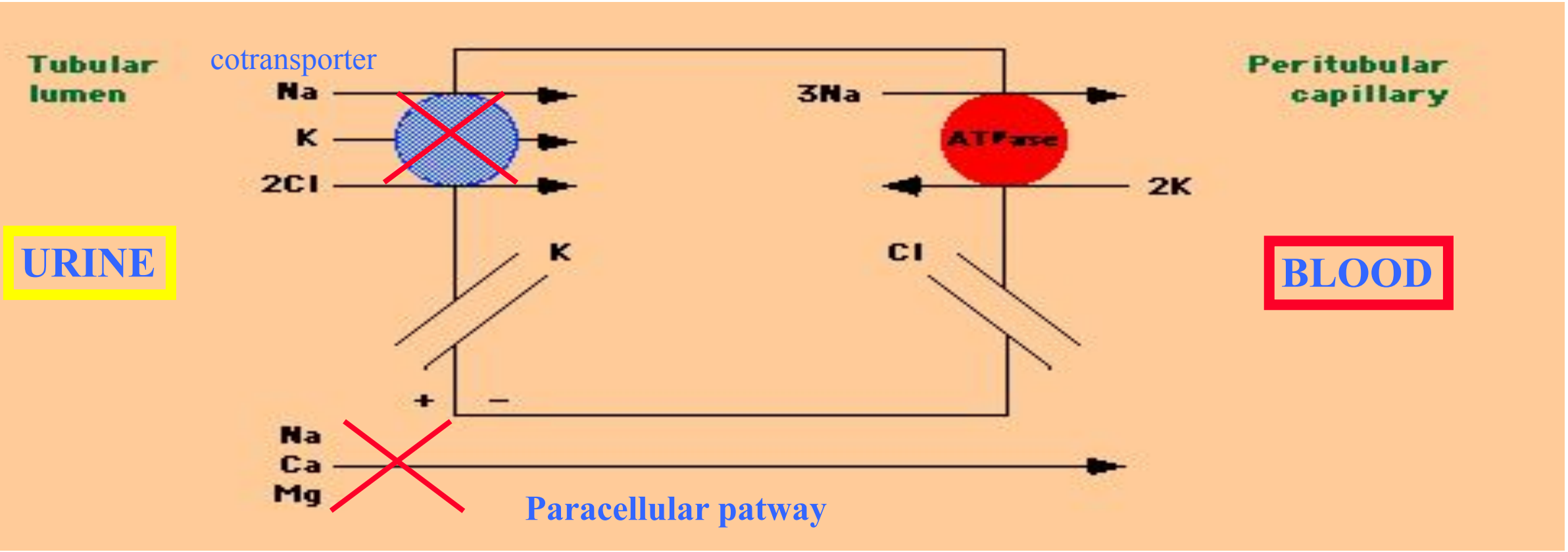


TAKE HOME MESSAGE #4

+30%

Rudy DW, Ann Int Med 1991

Effects of Furosemide on Loop of Henle



↑ Ur Na+

↑ Ur K+

↑ Ur Ca++

↑ Ur Mg++

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[Contemporary Reviews in Critical Care Medicine]

CHEST

Fluid Management in Acute Kidney Injury

Marlies Ostermann, PhD; Kathleen Liu, MD; and Kianoush Kashani, MD

ALBUMIN
10 g e.v.
(50 ml/20%)

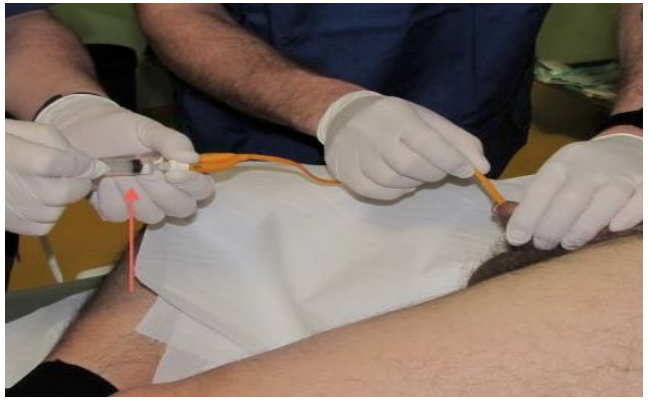
FUROSEMIDE
Bolus 20 mg e.v.
Continuous Infusion 5 mg/h
Onset 30 min

AKI in Liver Disease

Patients with liver disease are at high risk of AKI, mainly due to splanchnic vasodilation and relative intravascular hypovolemia.[59,60] Volume expansion in combination with vasoconstrictors is an important component of resuscitation. Several studies have confirmed that the combination of a vasopressin analogue and albumin has a beneficial effect on renal function.[61,62]

Fluid Management in Acute Kidney Injury

Marlies Ostermann, PhD; Kathleen Liu, MD; and Kianoush Kashani, MD



Obstructive AKI

In obstructive AKI, resolution of obstruction and correction of intravascular hypovolemia are the mainstay of treatment. Although diuresis is the expected response to any relief of urinary obstruction, it is generally limited to the period necessary to excrete excess fluid solutes that may have accumulated while obstructed (physiological diuresis).[63] When diuresis continues beyond correction of fluid status due to a degree of nephrogenic diabetes insipidus, the condition becomes pathologic postobstructive diuresis. In this situation, patients need volume fluid resuscitation to keep up with diuresis. Although buffered crystalloid solutions are the preferred fluids, additional electrolyte supplementation is occasionally necessary.

REAL WORLD ?

Giuseppina Codice 3 Azzurro

47aa, giunge in PS per **caduta accidentale (TRAUMA)**

Parametri vitali:
PA 110/60 mmHg
FC 70 bpm
SpO2 94% in aa
TC 39.3°C
GCS 15

EO: nulla di rilevante

Anamnesi:

Astenia ed ipotensione, distrofia miotonica di Steinert, diabete mellito di tipo II, FA.

Terapia domiciliare:
Pantoprazolo 40 mg, ASA 100 mg, Flecainide 50 mg, Metformina 800 mg x3

Quali esami ?

LAB

Emocromo
Elettroliti
Funzione renale
Glicemia
Mioglobina
CPK

IMAGING

RX bacino, RX femore
TC cranio

Caos in PS…

	T0	T6	T12	T24	T36
Hb	14	13.6	11.8	11.4	12
WBC	9.6	9.6	6.7	6.4	6.3
Glu	333	203	107	101	161
Crea	**1.98**	**2.47**	**4.42**	**6.24**	**4.97**
GFR	**29**	**22**	**11**	**7**	**10**
Azotemia	31	40	51	71	100
Sodio	135	147	138	143	147
Potassio	3.4	2.1	3.8	4.4	3.4
Mioglobina	**354**	**271**	**251**	**160**	**131**
CPK	**1200**	**1090**	**761**	**531**	**460**

NaCl 0.9% 500 cc x3

Oliguria

Aumento della diuresi

RHABDOMYOLYSIS
(Urine > 1 ml/Kg/h)

TAKE HOME MESSAGE #6

Management

- Either lactated Ringer's solution or saline (0.9% or 0.45%) is an acceptable fluid for resuscitation in rhabdomyolysis. A starting rate of 400 mL/hour can be initiated, with goal-directed therapy of urine output of 1 mL/kg/hour to 3 mL/kg/hour, and up to 300 cc/hour.
- Clinical studies evaluating the efficacy of sodium bicarbonate and/or diuretic use (mannitol, loop diuretics) for prevention of rhabdomyolysis-induced AKI are limited by a lack of appropriate control groups, standardized definitions, retrospective design, and low statistical power. Given these significant limitations, the use of sodium bicarbonate or diuretics for prevention of AKI in rhabdomyolysis is not recommended.
- Hyperkalemia, hyperphosphatemia, and hypocalcemia are electrolyte abnormalities most commonly encountered when treating rhabdomyolysis. Correcting biochemical equilibrium and electrolytes during rhabdomyolysis should proceed meticulously to avoid complications from treatment. Hyperkalemia is the electrolyte abnormality that requires timely correction to reduce risk of cardiac arrhythmia.
- There is no role for RRT (either continuous (CRRT) or intermittent) in rhabdomyolysis to prevent AKI.

Source Citation

Kodadek L, Carmichael Ii SP, Seshadri A, Pathak A, Hoth J, Appelbaum R, Michetti CP, Gonzalez RP. Rhabdomyolysis: an American Association for the Surgery of Trauma Critical Care Committee Clinical Consensus Document. Trauma Surg Acute Care Open. 2022 Jan 27;7(1):e000836. doi: 10.1136/tsaco-2021-000836. PMID: 35136842; PMCID: PMC8804685.

Giuseppe Codice 4 VERDE

67aa, giunge in PS per epigastralgia e **alvo diarroico** da circa 2 mesi associato calo ponderale (circa 7kg)

In anamnesi
ipertensione arteriosa in trattamento con:

cardura 4 mg,
moduretic 5mg+50 mg,
bisoprololo 5 mg,
bivis 40 mg+10 mg

Day1: Giuseppe Codice VERDE

Si eseguono gli esami ematochimici i quali non evidenziano acuzie in atto **senza** però ricevere la **creatinina**.

Visto il sospetto clinico per neoplasia, si richiede un TC addome senza MDC.

Ma cosa succede nel frattempo..

La richiesta viene rimandata indietro dal radiologo di turno, il quale consiglia fortemente di eseguire invece una TC addome con MDC per il quesito diagnostico.

La richiesta viene modificata da un altro collega,

credendo di aiutare il medico di turno,

impegnato in quel momento con un altro paziente.

Day1: Giuseppe Codice VERDE

Dalla TC con MDC emerge una distensione delle anse intestinali con enhancement contrastrografico, ispessimento delle pareti del retto e del sigma contratto

Il paziente viene quindi dimesso
con indicazione ad eseguire
una colonscopia e visita gastroenterologica, asap.

Day 4: a volte ritornano…

Il sig Giuseppe,

dopo soli 4 giorni si ripresenta in PS astenico con oliguria

Oliguria < 0,5ml /kg /6h

Day 4: a volte ritornano…

Si ripetono tempestivamente gli esami ematochimici:

- **Crea 11**
- **Azotemia 221**
- **Potassio 2.8 ?**

Day 4: a volte ritornano...

Il paziente ha sviluppato una Post contrast Acute Kidney Injury
viene quindi monitorato con :

- Ega ed esami ematochimici seriati per il controllo degli elettroliti e del pH
- Posizionamento di catetere vescicale per valutare la diuresi
- ECG e controlli seriati dei P.V.
- Viene sospesa la somministrazione di **bivis e moduretic**
- Inizia immediatamente **terapia infusionale** reidratante

Day 9: a volte ritornano…

Dopo 5 giorni di degenza otteniamo:

- **Crea 1,64**
- Azotemia 39
- K 3,0
- Na 135

Giuseppe viene quindi dimesso

Definizione

La definizione di **Post-contrast Acute Kidney Injury (PC-AKI)**
un improvviso deterioramento della funzionalità renale **entro 48 ore** dalla somministrazione intravascolare di mezzo di contrasto iodato.

È da applicare a quelle situazioni in cui altre cause di AKI possono essere ragionevolmente escluse.

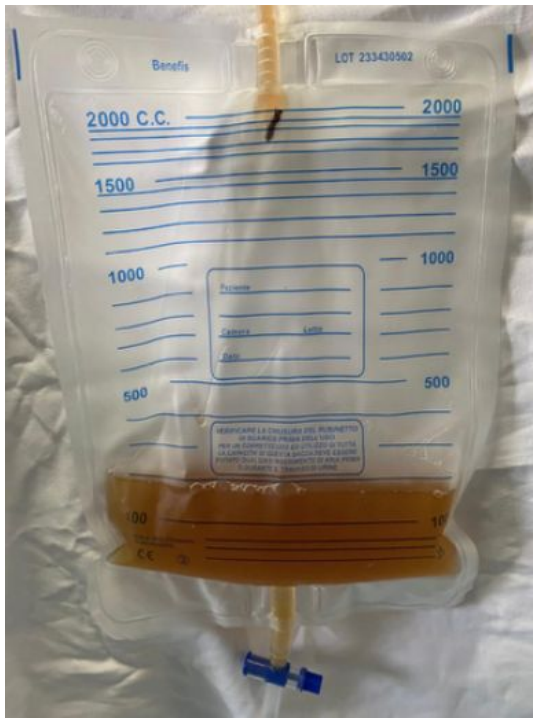
Evidence review for preventing contrast-induced acute kidney injury. Acute kidney injury: prevention, detection and management. Evidence review A. London: National Institute for Health and Care Excellence (NICE); 2019 Dec. PMID: 35099864.

NON SOLO VOLUME
PROGNOSI OLIGURIA IN PS:

TAKE HOME MESSAGE #7

Na+ < 135

SODIEMIA



Na+ > 135

Question Time

QUANDO CHIEDERE CONSULENZA NEFRO PER DIALISI URGENTE ?

ANURIA (< 100 ml/24h)

ANURIA CON IPERPOTASSIEMIA > 7 MEQ/L

ANURIA CON EDEMA POLMONARE ACUTO CHE NON RISPONDE AI DIURETICI

ANURIA CON UREA > 250 MG/DL OBNUBILATO

Dialysis

Indications:

- **Fluid overload** that is refractory to diuretics.
- **Hyperkalemia** (serum potassium concentration >7.5 mEq/L).
- **Signs of uremia** such as pericarditis, neuropathy, or an otherwise unexplained decline in mental status.
- Metabolic acidosis (pH <7.1)

Hemodialysis can remove 25 to 50 meq of potassium per hour

Payen D, Crit Care 2008

Il pessimista si LAMENTA del vento
L'ottimista ASPETTA che il vento cambi …

L'URGENTISTA E' UN MARINAIO AGGIUSTA LE VELE !