7e CONGRÈS FRANCOPHONE de RÉANIMATION
23e CONGRÈS NATIONAL de RÉANIMATION

le 15,16 et 17 Novembre 2018
HÔTEL MOVENPICK - SOUSSE

PROGRAMME

L’épuration extra-rénale en réanimation

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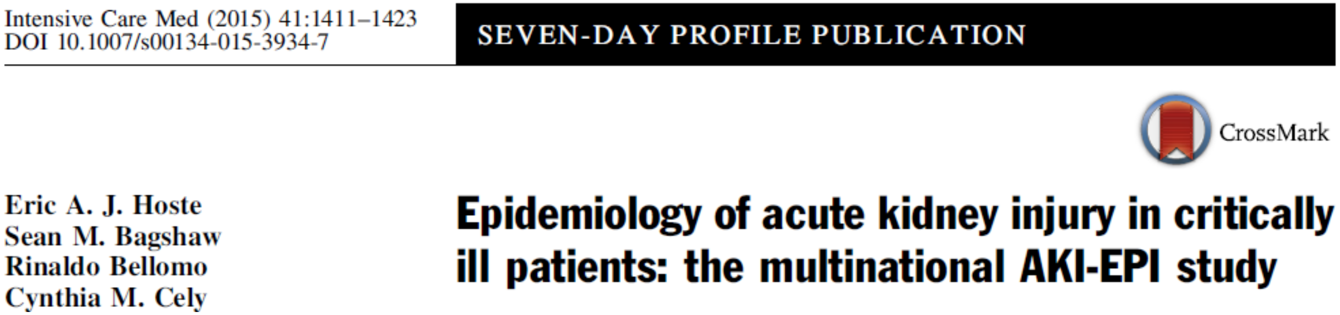
JE SERAI BREF

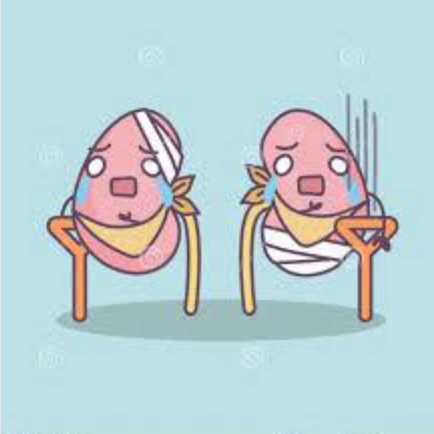


Intensive Care Med (2015) 41:1411–1423
DOI 10.1007/s00134-015-3934-7

SEVEN-DAY PROFILE PUBLICATION

Eric A. J. Hoste
Sean M. Bagshaw
Rinaldo Bellomo
Cynthia M. Cely

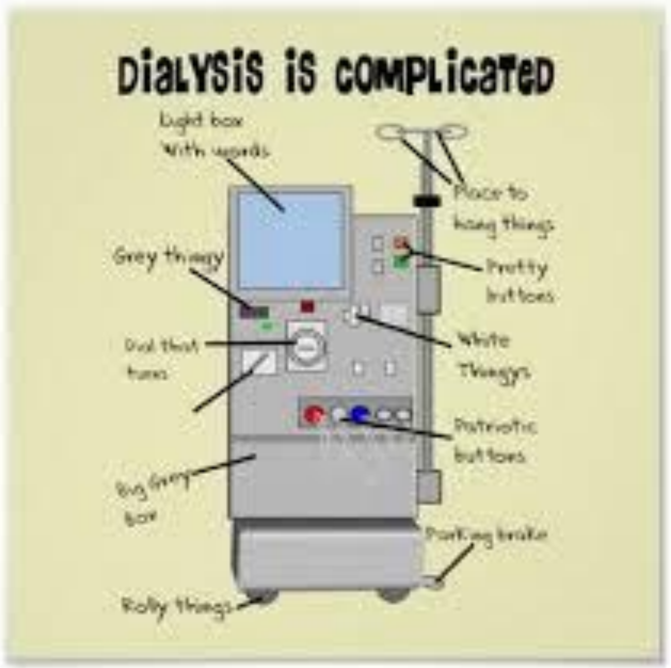
Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study



- Cohorte de 1802 patients, 97 ICU
- Prévalence IRA (KDIGO): 62% (la moitié KDIGO 3)
- les étiologies les plus fréquentes: sepsis (40%) et hypovolémie (37%)
- EER (14% vs 4% en 2005)
- Mortalité en réa: 18% (all patients) vs 7% (sans IRA) vs 27% (IRA)

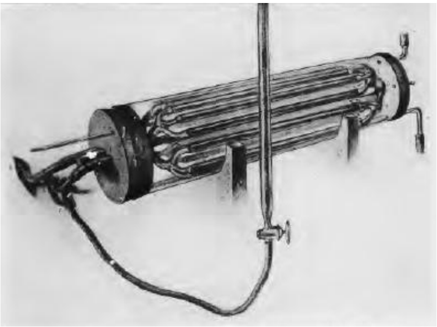
EER en réa → Trouver des réponses à:

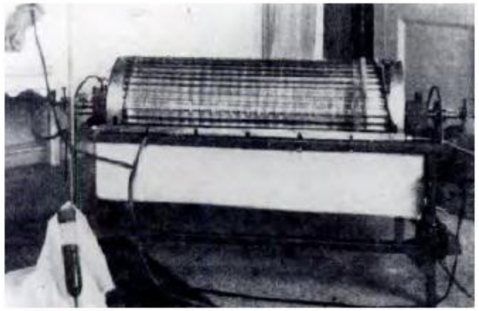
- Pourquoi?
  - Indications rénales
  - Indications non rénales
- Quand? (fast or wait and see)
- Comment?
  - Modalités diffusion/convection
  - Continue/discontinue
  - Dose d’épuration
  - Anticoagulation
  - L’accès veineux


DiaLYSiS iS COMPLiCaTeD
Light box With words
Place to hang things
Grey thingy
Pretty buttons
Dial that turns
White Thingys
Patriotic buttons
Big Grey box
Parking brake
Rolly things

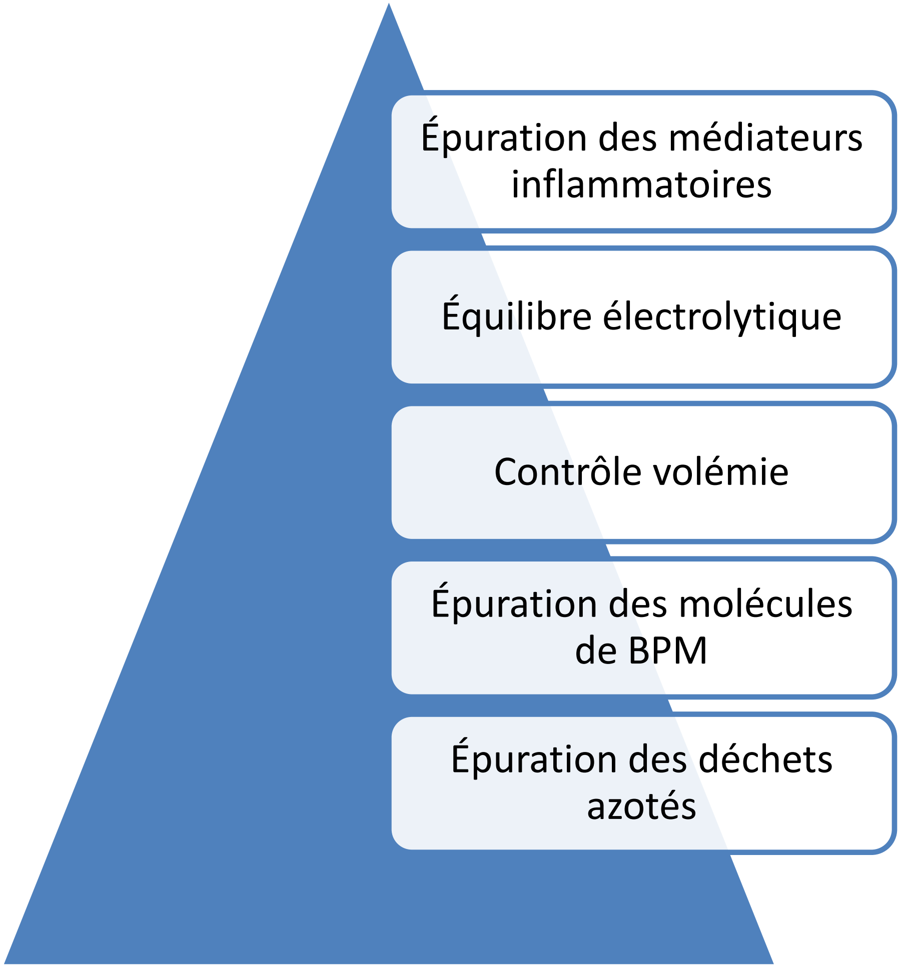
Un peu d'histoire

- Graham T 1854
  - – Principe de la diffusion
- Abell JJ 1914
  - – Première dialyse chez l'animal
- Kolff WJ 1944
  - – Première hémodialyse efficace chez l'Homme
- Kramer P 1977
  - – Première hémofiltration continue





Quand débuter la dialyse?



Épuration des médiateurs inflammatoires

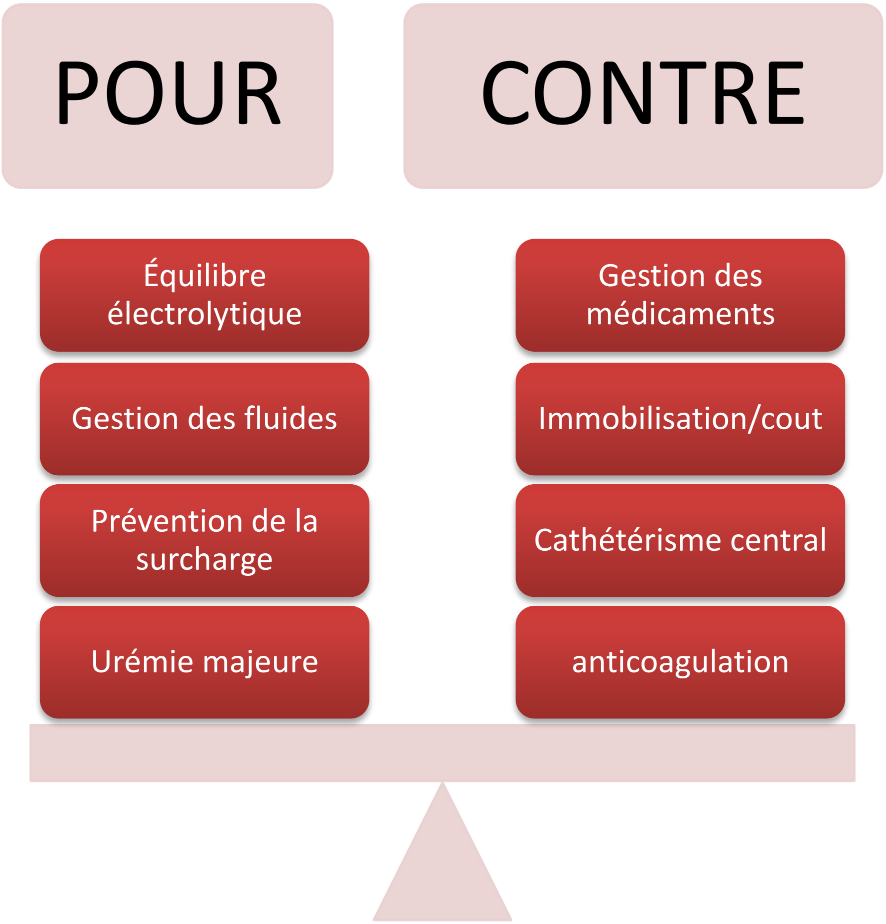
Équilibre électrolytique

Contrôle volémie

Épuration des molécules de BPM

Épuration des déchets azotés

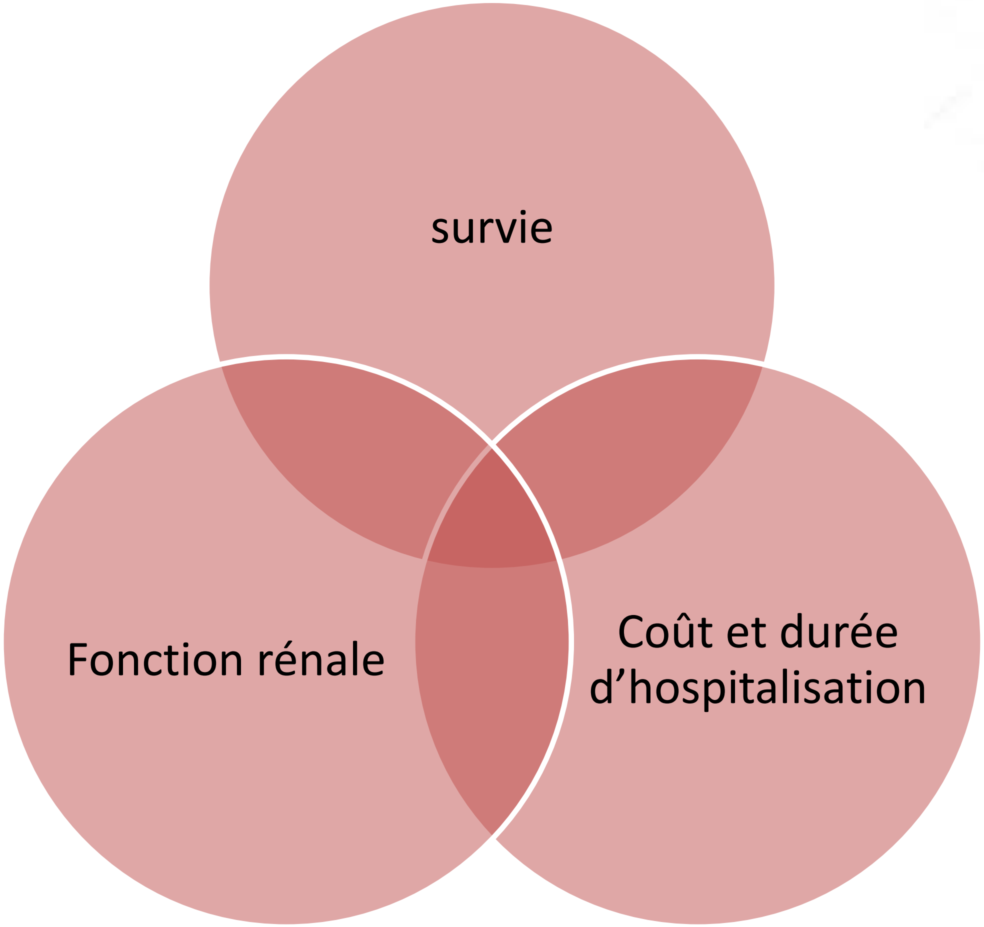
Éventuels avantages de l’hémodialyse



POUR	CONTRE
Équilibre électrolytique	Gestion des médicaments
Gestion des fluides	Immobilisation/cout
Prévention de la surcharge	Cathétérisme central
Urémie majeure	anticoagulation

Y-a-t-il un impact?

HAPPY KIDNEY

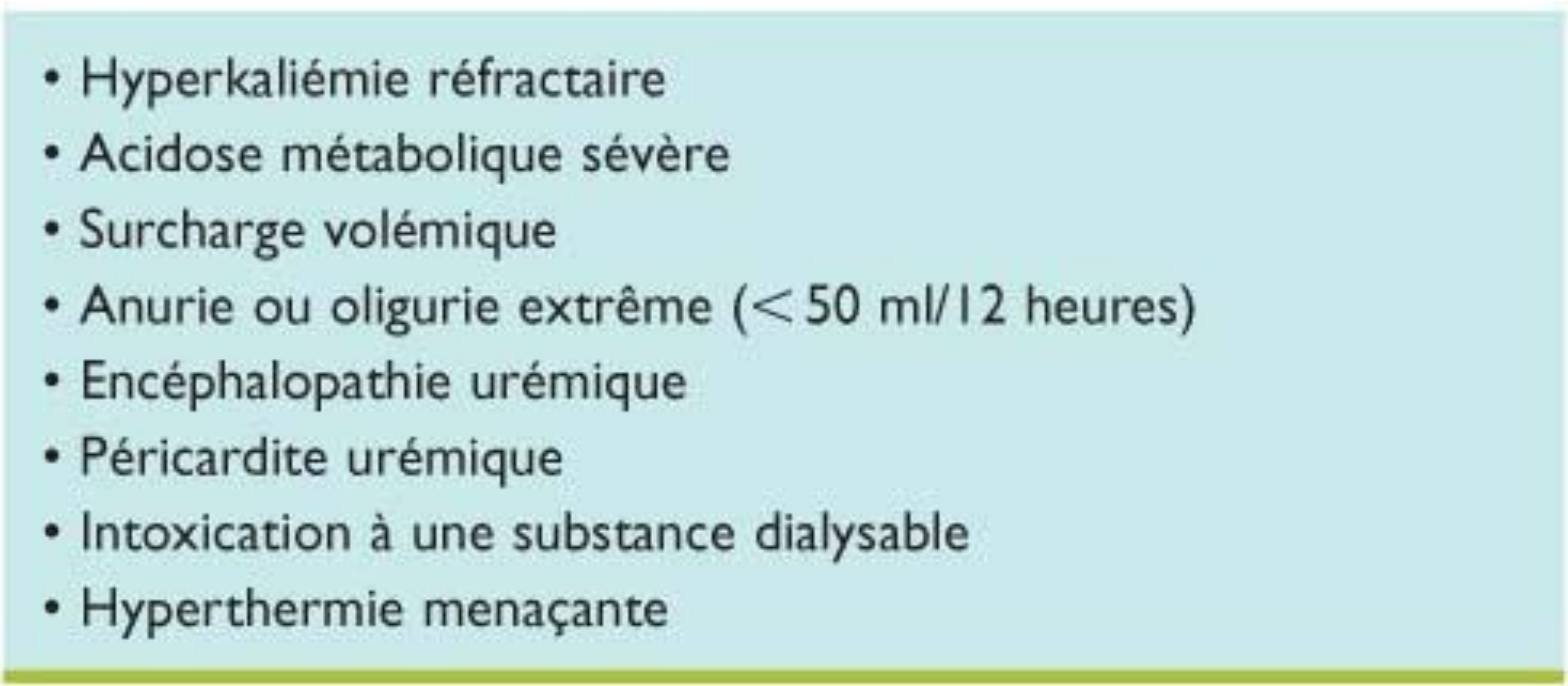


survie

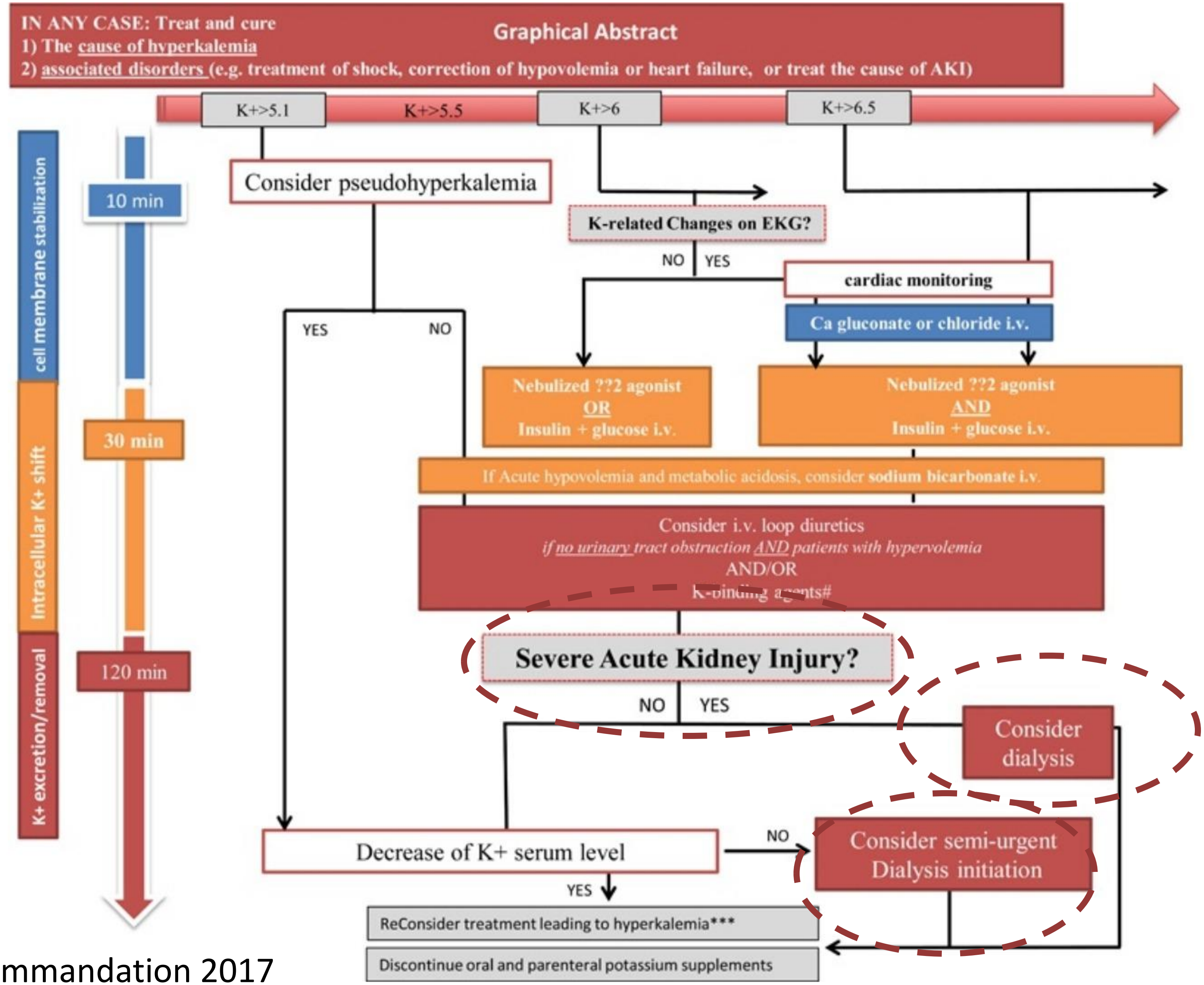
Fonction rénale

Coût et durée d'hospitalisation

Indications formelles



- Hyperkaliémie réfractaire
- Acidose métabolique sévère
- Surcharge volémique
- Anurie ou oligurie extrême (< 50 ml/12 heures)
- Encéphalopathie urémique
- Péricardite urémique
- Intoxication à une substance dialysable
- Hyperthermie menaçante



IN ANY CASE: Treat and cure
1) The cause of hyperkalemia
2) associated disorders (e.g. treatment of shock, correction of hypovolemia or heart failure, or treat the cause of AKI)

Graphical Abstract

K+>5.1

K+>5.5

K+>6

K+>6.5

cell membrane stabilization

10 min

Intracellular K+ shift

30 min

K+ excretion/removal

120 min

Consider pseudohyperkalemia

YES

NO

K-related Changes on EKG?

NO

YES

cardiac monitoring

Ca gluconate or chloride i.v.

Nebulized ??2 agonist
OR
Insulin + glucose i.v.

Nebulized ??2 agonist
AND
Insulin + glucose i.v.

If Acute hypovolemia and metabolic acidosis, consider **sodium bicarbonate i.v.**

Consider i.v. loop diuretics
if no urinary tract obstruction AND patients with hypervolemia
AND/OR
K-binding agents#

Severe Acute Kidney Injury?

NO

YES

Consider dialysis

Decrease of K+ serum level

NO

Consider semi-urgent Dialysis initiation

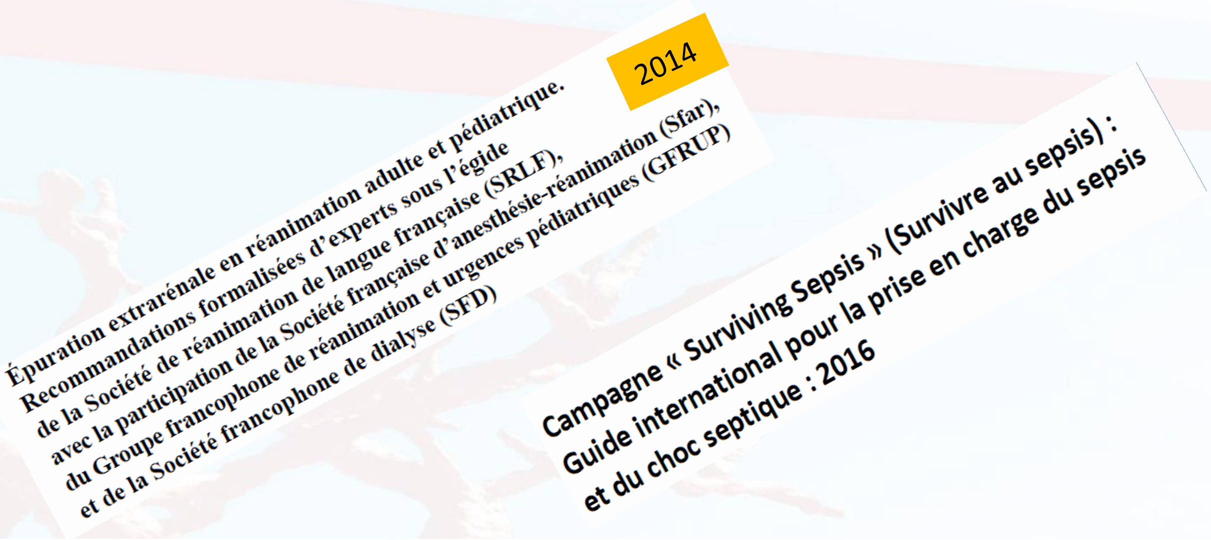
YES

ReConsider treatment leading to hyperkalemia***

Discontinue oral and parenteral potassium supplements

Recommandation 2017

Initiation de la dialyse dans IRA



2014

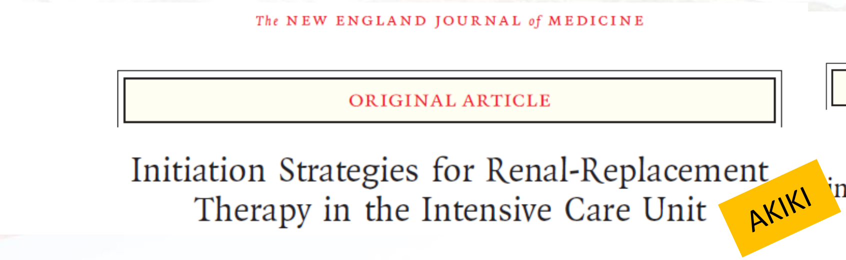
Épuration extrarénale en réanimation adulte et pédiatrique.
Recommandations formalisées d'experts sous l'égide
de la Société de réanimation de langue française (SRLF),
avec la participation de la Société française d'anesthésie-réanimation (Sfar),
du Groupe francophone de réanimation et urgences pédiatriques (GFRUP)
et de la Société francophone de dialyse (SFD)

Campagne « Surviving Sepsis » (Survivre au sepsis) :
Guide international pour la prise en charge du sepsis
et du choc septique : 2016

Avant 2016

2016

2018

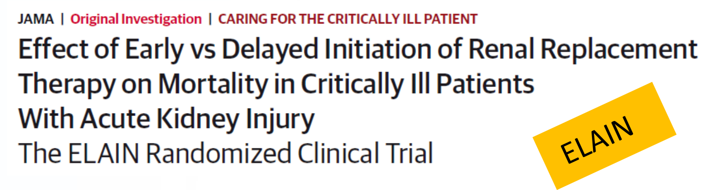


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Initiation Strategies for Renal-Replacement Therapy in the Intensive Care Unit

AKIKI

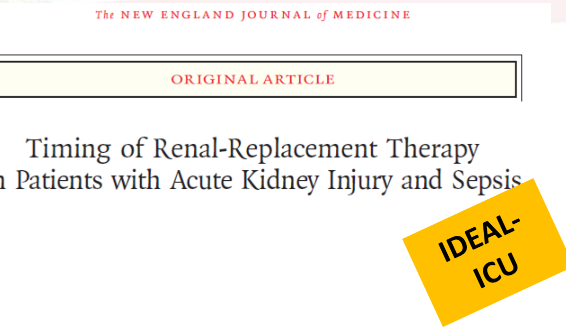


JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Early vs Delayed Initiation of Renal Replacement Therapy on Mortality in Critically Ill Patients With Acute Kidney Injury

The ELAIN Randomized Clinical Trial

ELAIN

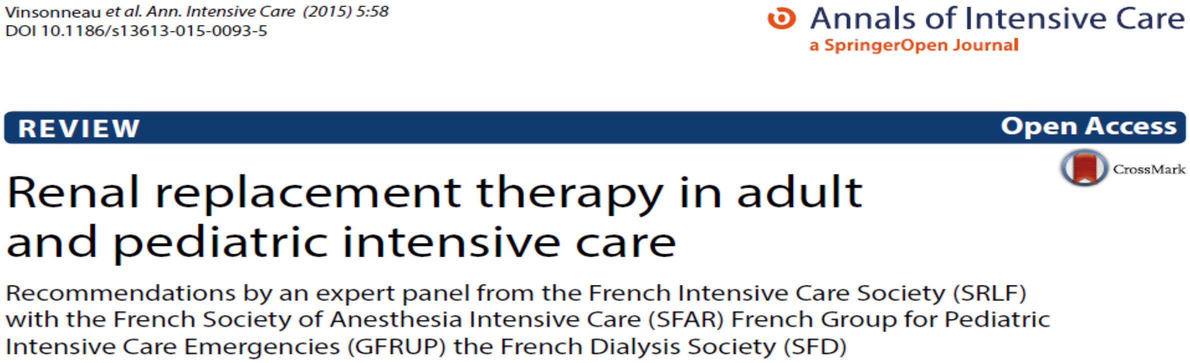


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Timing of Renal-Replacement Therapy in Patients with Acute Kidney Injury and Sepsis

IDEAL-ICU



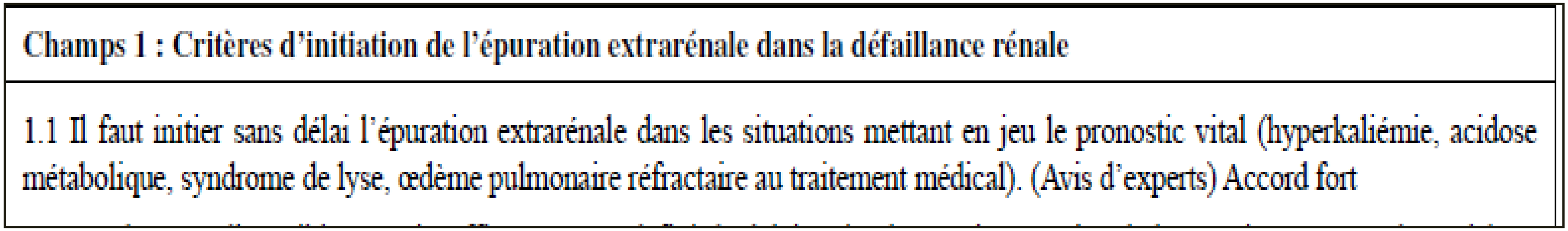
Vinsonneau *et al. Ann. Intensive Care* (2015) 5:58
DOI 10.1186/s13613-015-0093-5

Annals of Intensive Care
a SpringerOpen Journal

REVIEW **Open Access**

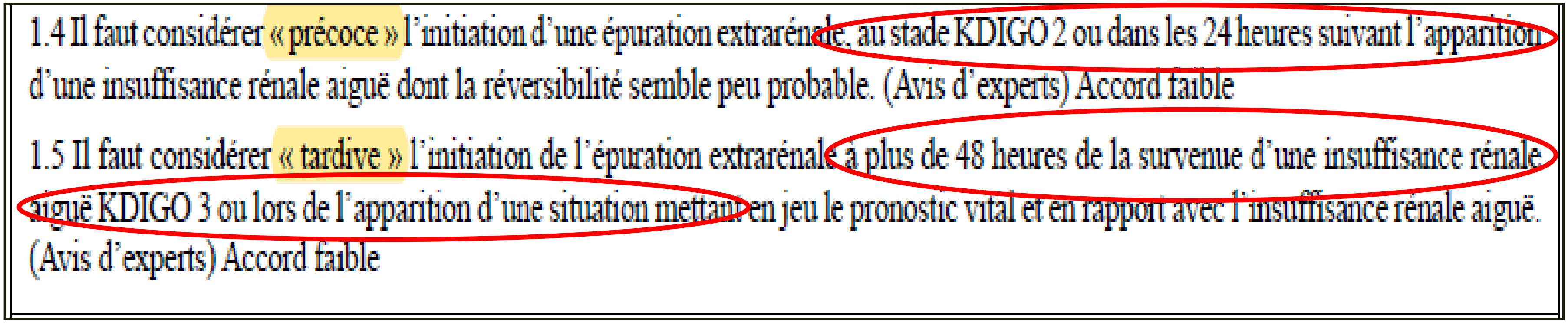
Renal replacement therapy in adult and pediatric intensive care

Recommendations by an expert panel from the French Intensive Care Society (SRLF) with the French Society of Anesthesia Intensive Care (SFAR) French Group for Pediatric Intensive Care Emergencies (GFRUP) the French Dialysis Society (SFD)



Champs 1 : Critères d'initiation de l'épuration extrarénale dans la défaillance rénale

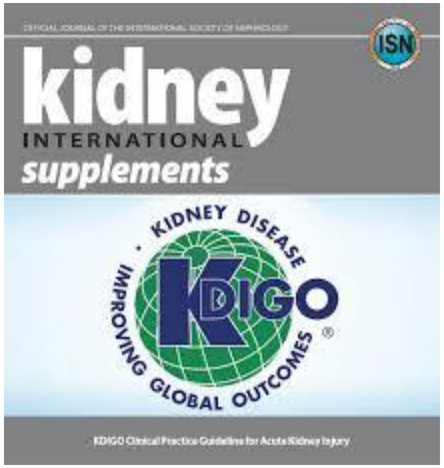
1.1 Il faut initier sans délai l'épuration extrarénale dans les situations mettant en jeu le pronostic vital (hyperkaliémie, acidose métabolique, syndrome de lyse, œdème pulmonaire réfractaire au traitement médical). (Avis d'experts) Accord fort

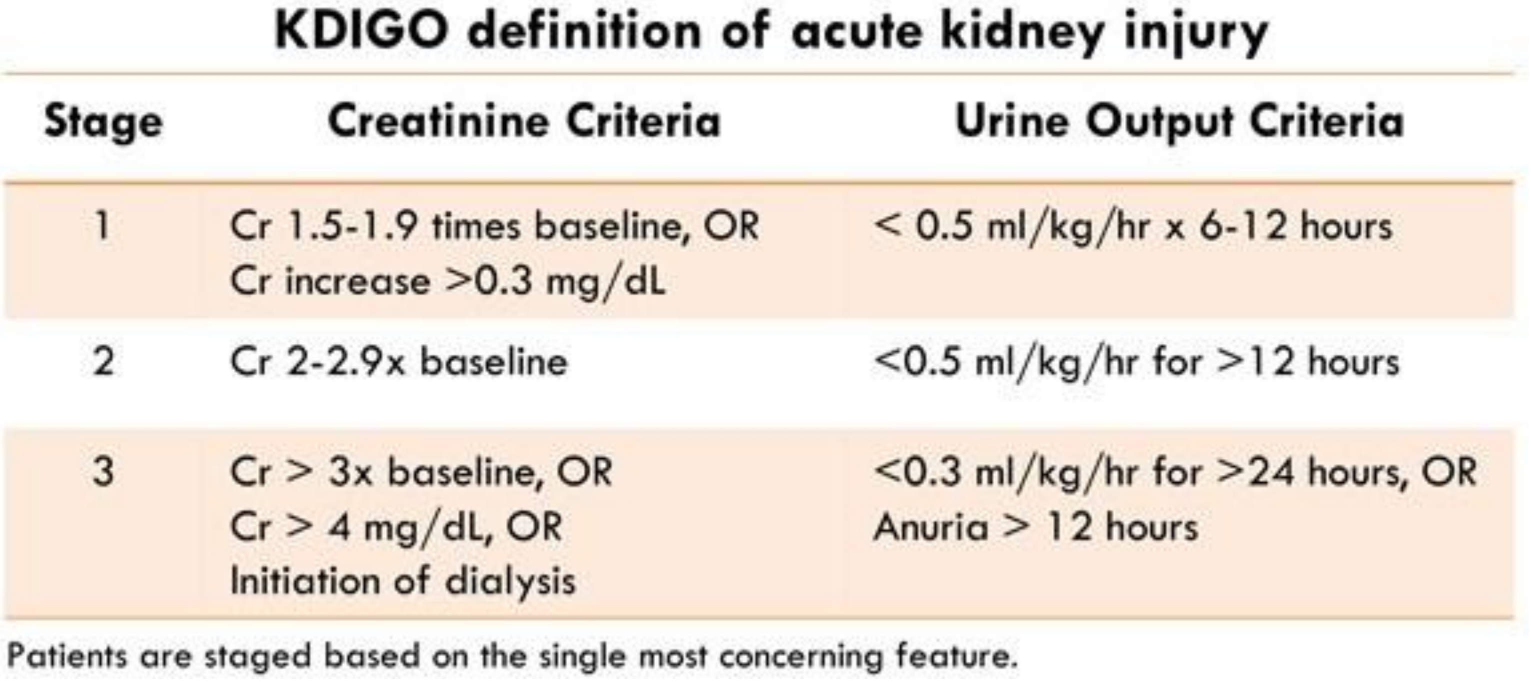


1.4 Il faut considérer « précoce » l'initiation d'une épuration extrarénale, au stade KDIGO 2 ou dans les 24 heures suivant l'apparition d'une insuffisance rénale aiguë dont la réversibilité semble peu probable. (Avis d'experts) Accord faible

1.5 Il faut considérer « tardive » l'initiation de l'épuration extrarénale à plus de 48 heures de la survenue d'une insuffisance rénale aiguë KDIGO 3 ou lors de l'apparition d'une situation mettant en jeu le pronostic vital et en rapport avec l'insuffisance rénale aiguë. (Avis d'experts) Accord faible

KDIGO


ISN
kidney
INTERNATIONAL
supplements
KIDNEY DISEASE
KDIGO
IMPROVING GLOBAL OUTCOMES
KDIGO Clinical Practice Guideline for Acute Kidney Injury



KDIGO definition of acute kidney injury

Stage	Creatinine Criteria	Urine Output Criteria
1	Cr 1.5-1.9 times baseline, OR Cr increase >0.3 mg/dL	< 0.5 ml/kg/hr x 6-12 hours
2	Cr 2-2.9x baseline	<0.5 ml/kg/hr for >12 hours
3	Cr > 3x baseline, OR Cr > 4 mg/dL, OR Initiation of dialysis	<0.3 ml/kg/hr for >24 hours, OR Anuria > 12 hours

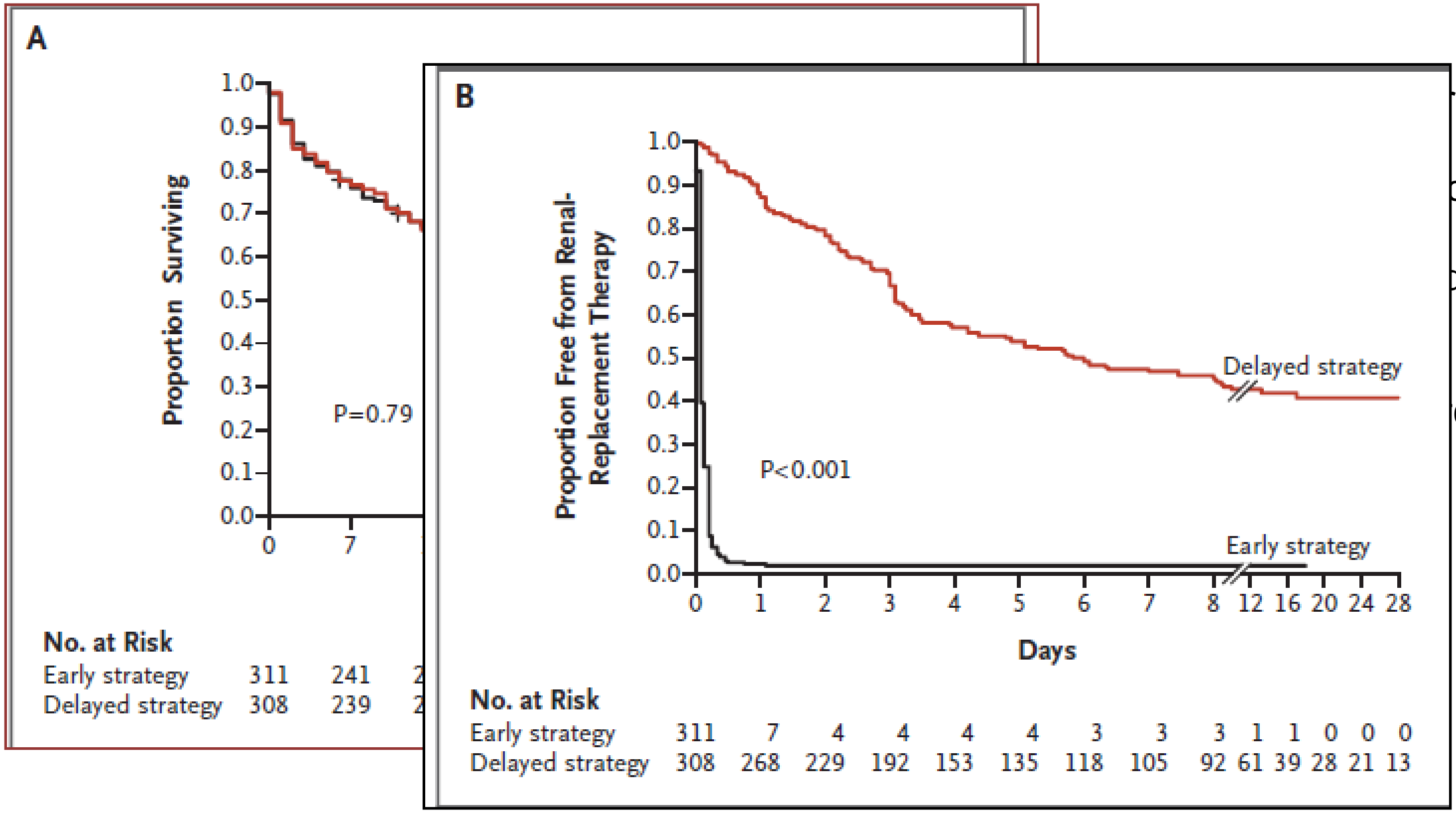
Patients are staged based on the single most concerning feature.

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Akiki study
Mai 2016

Initiation Strategies for Renal-Replacement Therapy in the Intensive Care Unit

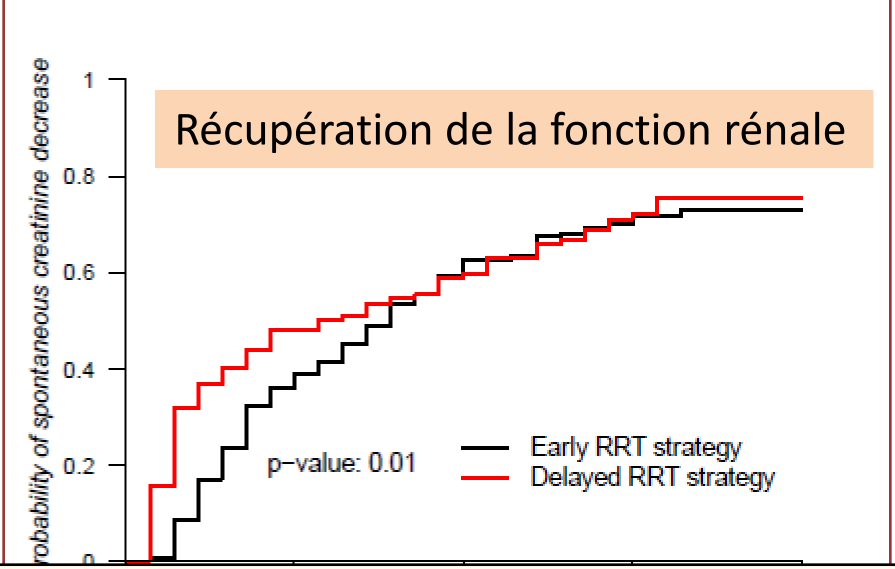


rdive n'aggrave

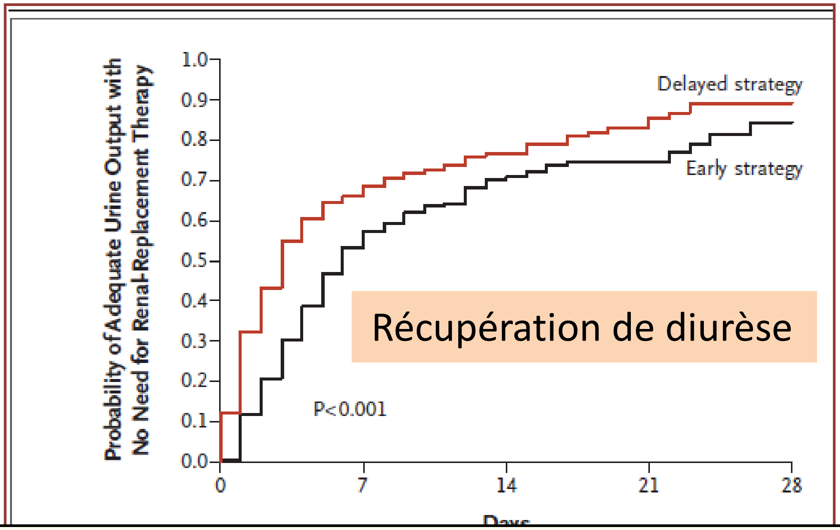
centrique (31ICU)

que bras

rdive (72h)

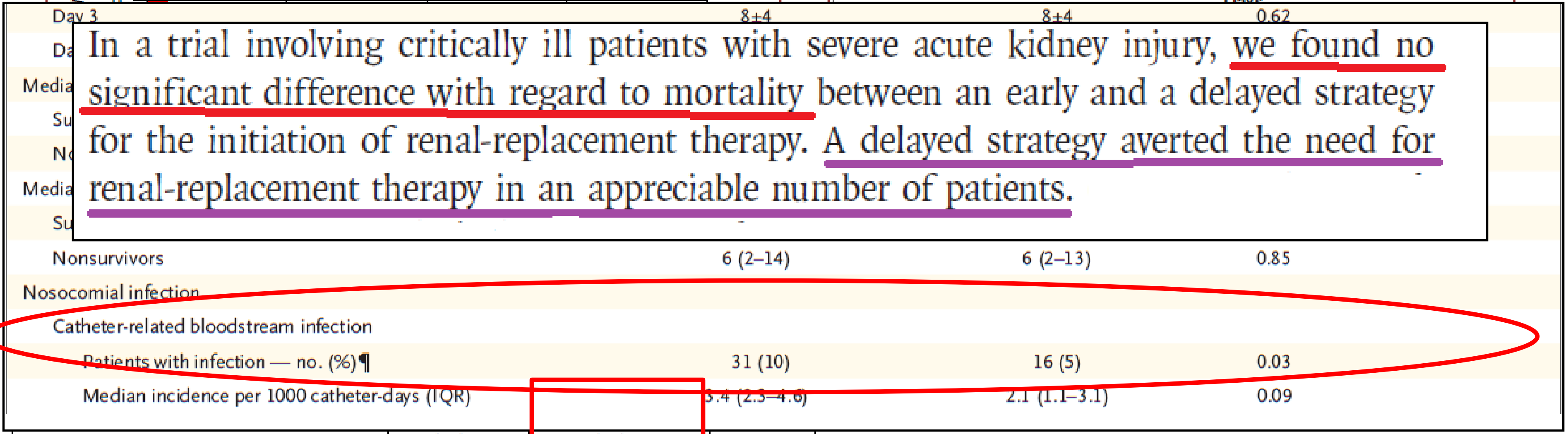


Récupération de la fonction rénale

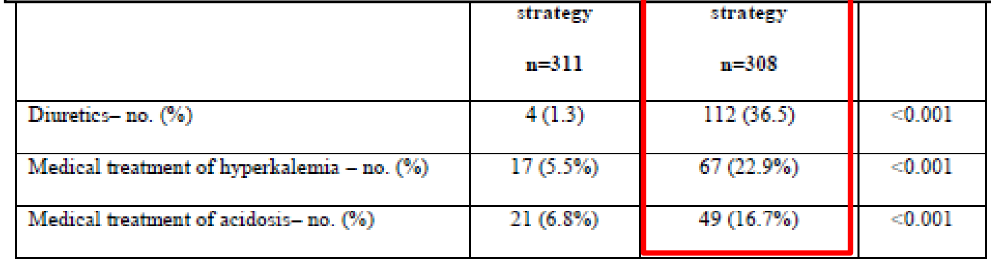


Récupération de diurèse

In a trial involving critically ill patients with severe acute kidney injury, we found no significant difference with regard to mortality between an early and a delayed strategy for the initiation of renal-replacement therapy. A delayed strategy averted the need for renal-replacement therapy in an appreciable number of patients.



Day 3	8±4	8±4	0.62
Da			
Media			
Su			
N			
Media			
Su			
Nonsurvivors	6 (2–14)	6 (2–13)	0.85
Nosocomial infection			
Catheter-related bloodstream infection			
Patients with infection — no. (%)¶	31 (10)	16 (5)	0.03
Median incidence per 1000 catheter-days (IQR)	3.4 (2.3–4.6)	2.1 (1.1–3.1)	0.09



	strategy n=311	strategy n=308	
Diuretics– no. (%)	4 (1.3)	112 (36.5)	<0.001
Medical treatment of hyperkalemia – no. (%)	17 (5.5%)	67 (22.9%)	<0.001
Medical treatment of acidosis– no. (%)	21 (6.8%)	49 (16.7%)	<0.001

Traitement médical associé

Timing of Renal Support and Outcome of Septic Shock and Acute Respiratory Distress Syndrome

AJRCCM 2018

Figure 2: Probability of survival in subgroups of patients: septic shock, ARDS, higher SAPS3 (tertile [78-138]), higher SOFA ([tertile 13-20])

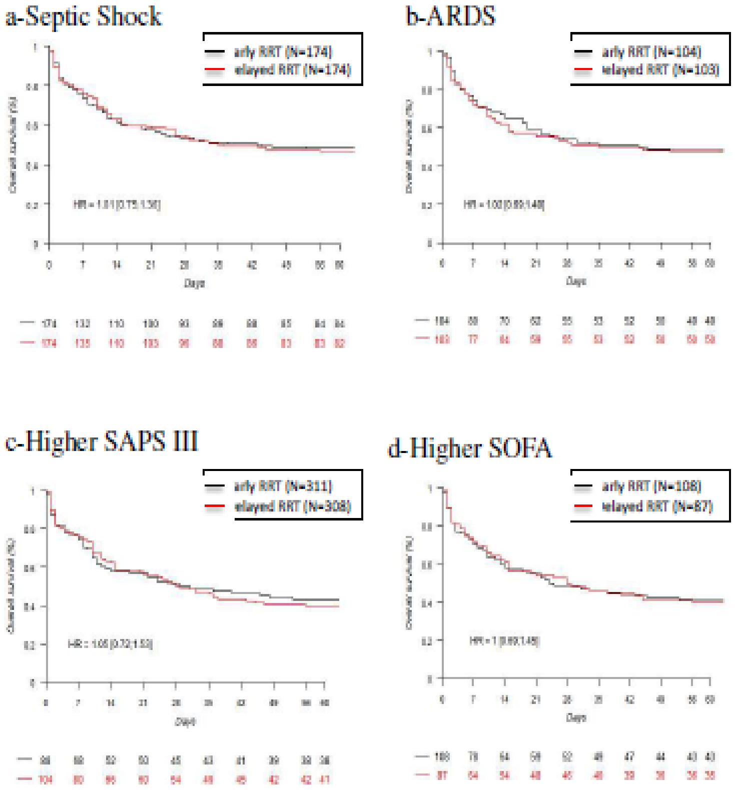


Figure 3: Renal function recovery according to subgroups

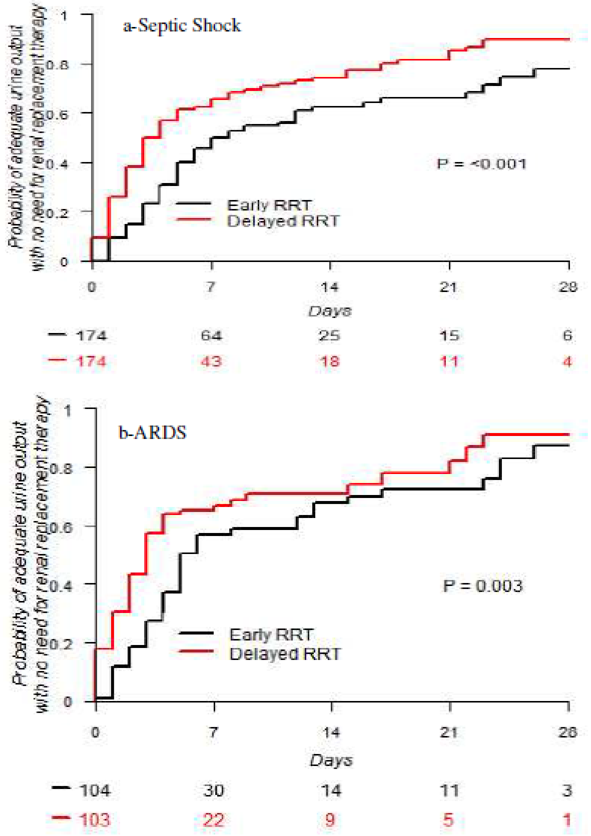
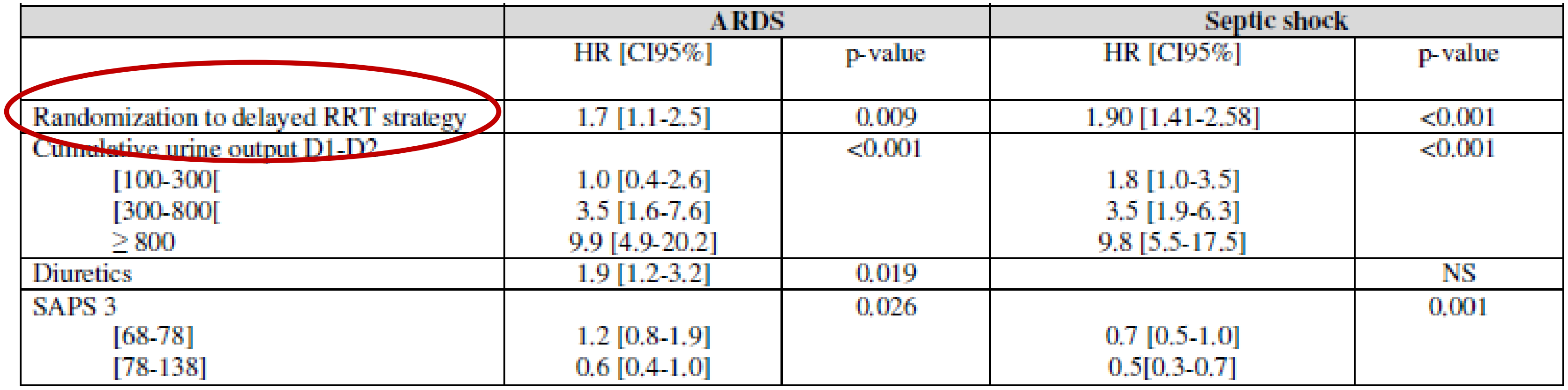
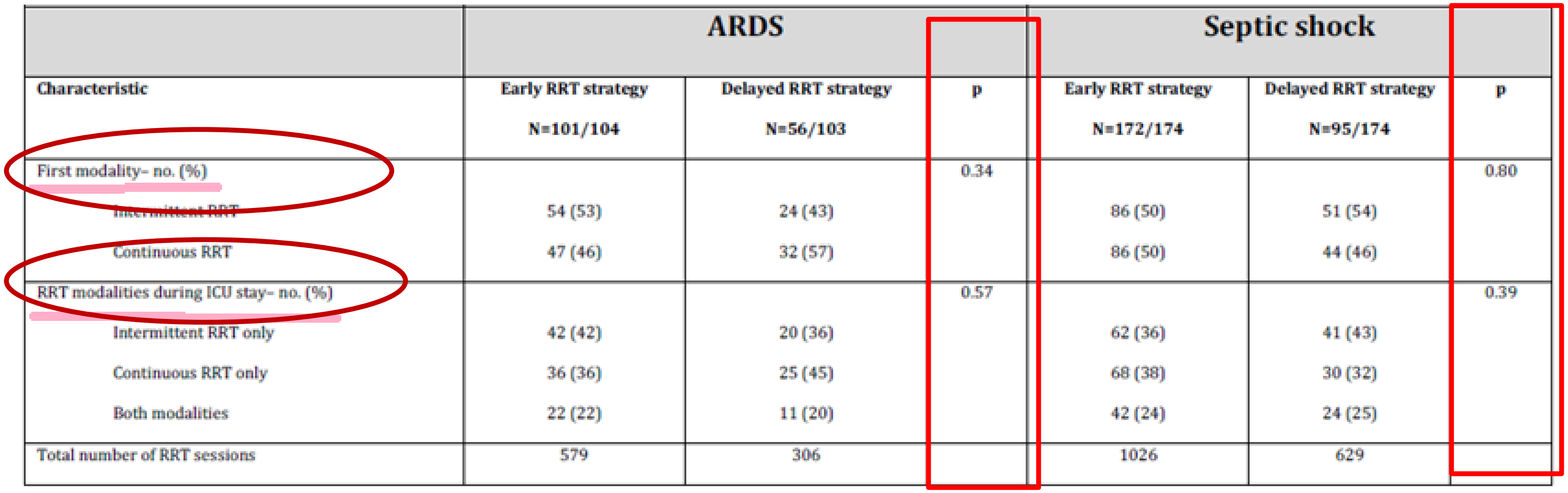


Table 3: Factors independently associated with renal function recovery



	ARDS		Septic shock	
	HR [CI95%]	p-value	HR [CI95%]	p-value
Randomization to delayed RRT strategy	1.7 [1.1-2.5]	0.009	1.90 [1.41-2.58]	<0.001
Cumulative urine output D1-D2		<0.001		<0.001
[100-300[	1.0 [0.4-2.6]		1.8 [1.0-3.5]	
[300-800[	3.5 [1.6-7.6]		3.5 [1.9-6.3]	
≥ 800	9.9 [4.9-20.2]		9.8 [5.5-17.5]	
Diuretics	1.9 [1.2-3.2]	0.019		NS
SAPS 3		0.026		0.001
[68-78]	1.2 [0.8-1.9]		0.7 [0.5-1.0]	
[78-138]	0.6 [0.4-1.0]		0.5[0.3-0.7]	



	ARDS			Septic shock		
Characteristic	**Early RRT strategy** **N=101/104**	**Delayed RRT strategy** **N=56/103**	**p**	**Early RRT strategy** **N=172/174**	**Delayed RRT strategy** **N=95/174**	**p**
First modality- no. (%)			0.34			0.80
Intermittent RRT	54 (53)	24 (43)		86 (50)	51 (54)	
Continuous RRT	47 (46)	32 (57)		86 (50)	44 (46)	
RRT modalities during ICU stay- no. (%)			0.57			0.39
Intermittent RRT only	42 (42)	20 (36)		62 (36)	41 (43)	
Continuous RRT only	36 (36)	25 (45)		68 (38)	30 (32)	
Both modalities	22 (22)	11 (20)		42 (24)	24 (25)	
Total number of RRT sessions	579	306		1026	629	

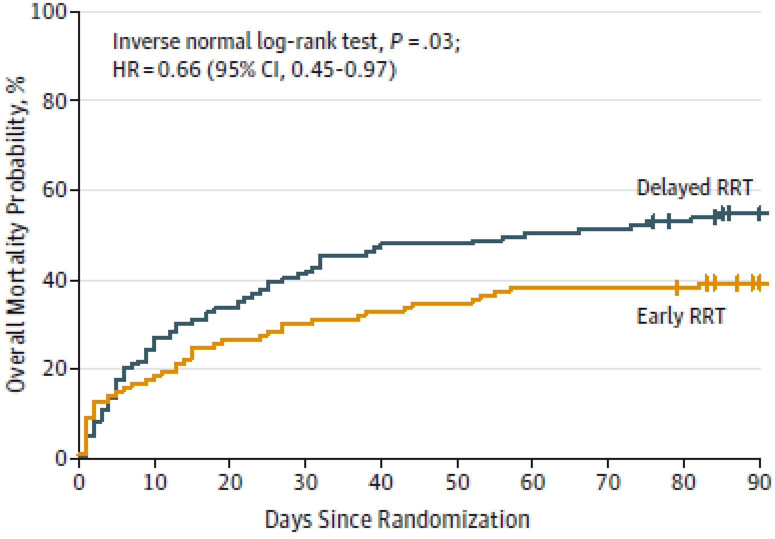
JAMA | Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Effect of Early vs Delayed Initiation of Renal Replacement Therapy on Mortality in Critically Ill Patients With Acute Kidney Injury

The ELAIN Randomized Clinical Trial

Mai 2016

Figure 2. Mortality Probability Within 90 Days After Study Enrollment for Patients Receiving Early and Delayed Initiation of Renal Replacement Therapy (RRT)



No. at risk

Early RRT	112	92	82	78	75	73	69	69	66	55
Delayed RRT	119	90	79	70	63	62	59	58	54	48

- ✓Étude pilote monocentrique
- ✓231 patients Post chirurgie cardiaque
- ✓KDIGO 2 et NGAL 150 ≥ mg/L
- ✓Hypothèse: dialyse précoce améliore le pronostic
- ✓2 bras: précoce (8h) vs tardive (12h KDIGO 3)

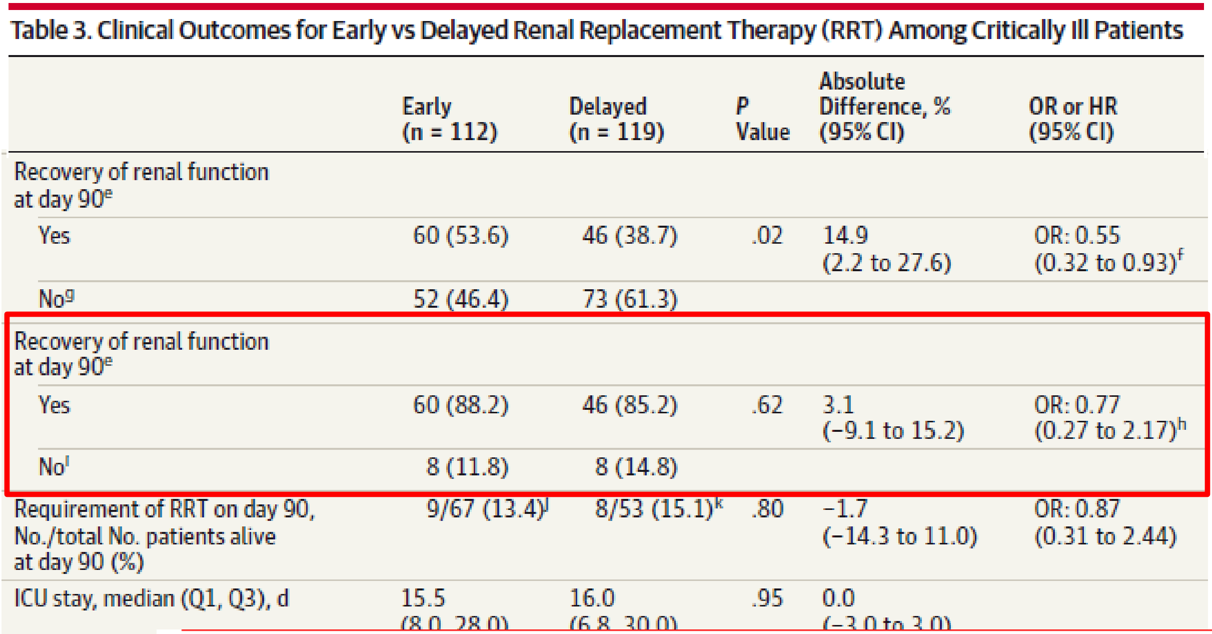
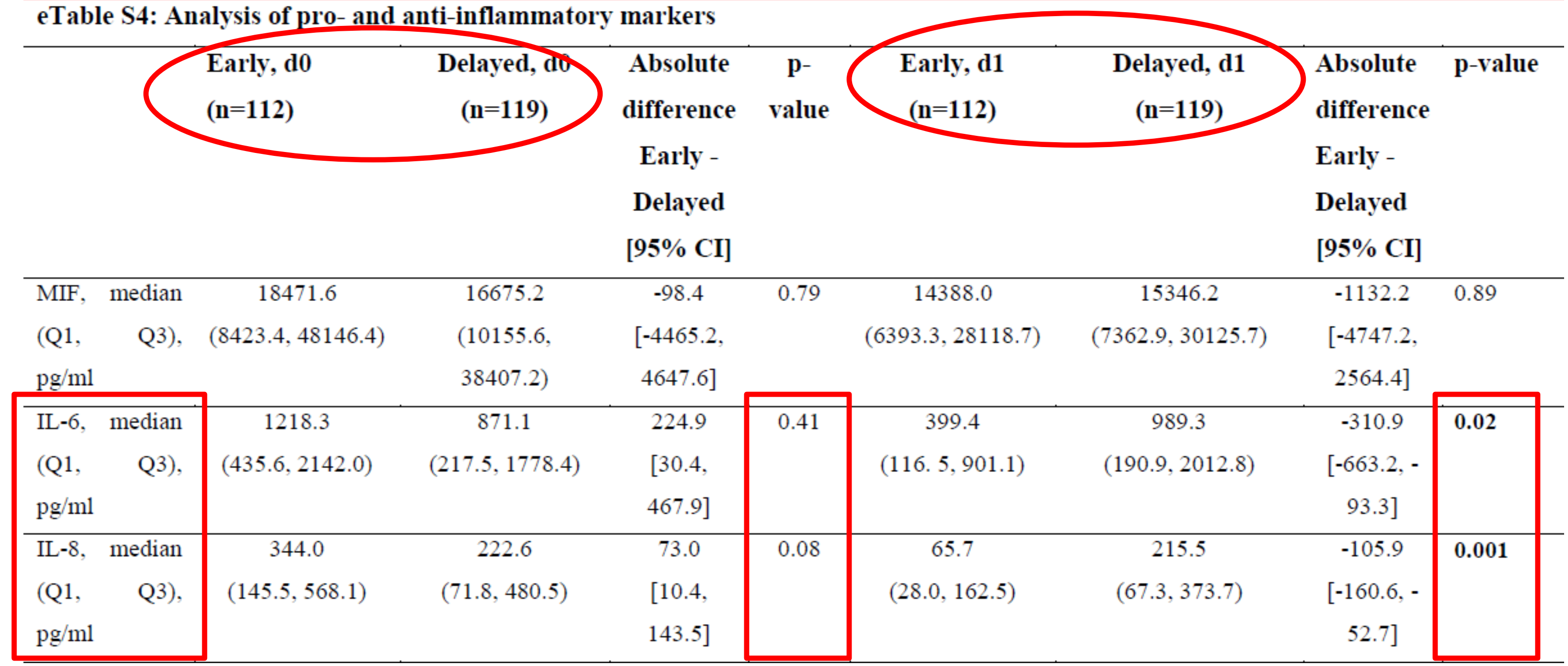


Table 3. Clinical Outcomes for Early vs Delayed Renal Replacement Therapy (RRT) Among Critically Ill Patients

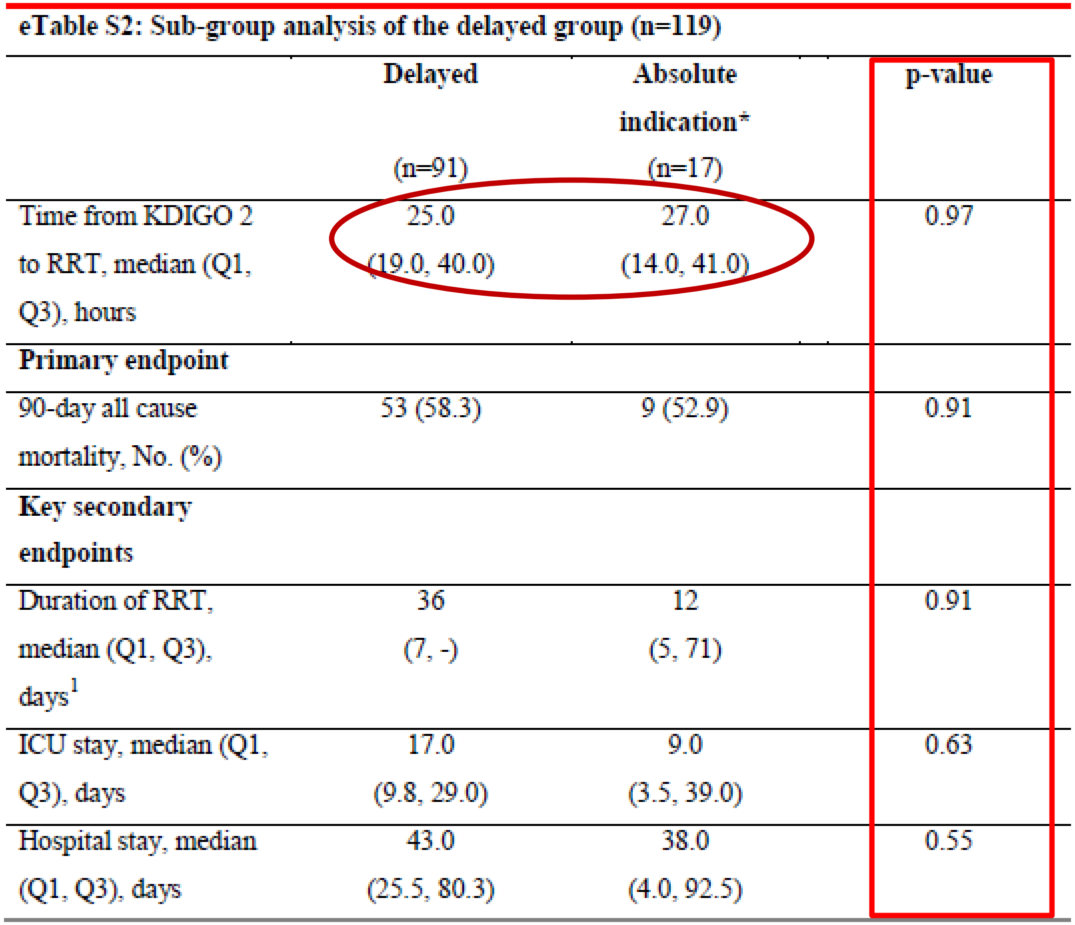
	Early (n = 112)	Delayed (n = 119)	P Value	Absolute Difference, % (95% CI)	OR or HR (95% CI)
Recovery of renal function at day 90[e]					
Yes	60 (53.6)	46 (38.7)	.02	14.9 (2.2 to 27.6)	OR: 0.55 (0.32 to 0.93)[f]
No[g]	52 (46.4)	73 (61.3)			
Recovery of renal function at day 90[e]					
Yes	60 (88.2)	46 (85.2)	.62	3.1 (−9.1 to 15.2)	OR: 0.77 (0.27 to 2.17)[h]
No[i]	8 (11.8)	8 (14.8)			
Requirement of RRT on day 90, No./total No. patients alive at day 90 (%)	9/67 (13.4)[j]	8/53 (15.1)[k]	.80	−1.7 (−14.3 to 11.0)	OR: 0.87 (0.31 to 2.44)
ICU stay, median (Q1, Q3), d	15.5 (8.0, 28.0)	16.0 (6.8, 30.0)	.95	0.0 (−3.0 to 3.0)	
ICU stay, medi					
Hospital stay, r					
Hospital stay, r					
Duration of me median (Q1, Q					



eTable S4: Analysis of pro- and anti-inflammatory markers

	Early, d0 (n=112)	Delayed, d0 (n=119)	Absolute difference Early - Delayed [95% CI]	p-value	Early, d1 (n=112)	Delayed, d1 (n=119)	Absolute difference Early - Delayed [95% CI]	p-value
MIF, median (Q1, Q3), pg/ml	18471.6 (8423.4, 48146.4)	16675.2 (10155.6, 38407.2)	-98.4 [-4465.2, 4647.6]	0.79	14388.0 (6393.3, 28118.7)	15346.2 (7362.9, 30125.7)	-1132.2 [-4747.2, 2564.4]	0.89
IL-6, median (Q1, Q3), pg/ml	1218.3 (435.6, 2142.0)	871.1 (217.5, 1778.4)	224.9 [30.4, 467.9]	0.41	399.4 (116. 5, 901.1)	989.3 (190.9, 2012.8)	-310.9 [-663.2, -93.3]	**0.02**
IL-8, median (Q1, Q3), pg/ml	344.0 (145.5, 568.1)	222.6 (71.8, 480.5)	73.0 [10.4, 143.5]	0.08	65.7 (28.0, 162.5)	215.5 (67.3, 373.7)	-105.9 [-160.6, -52.7]	**0.001**

Analyse du groupe dialyse tardive

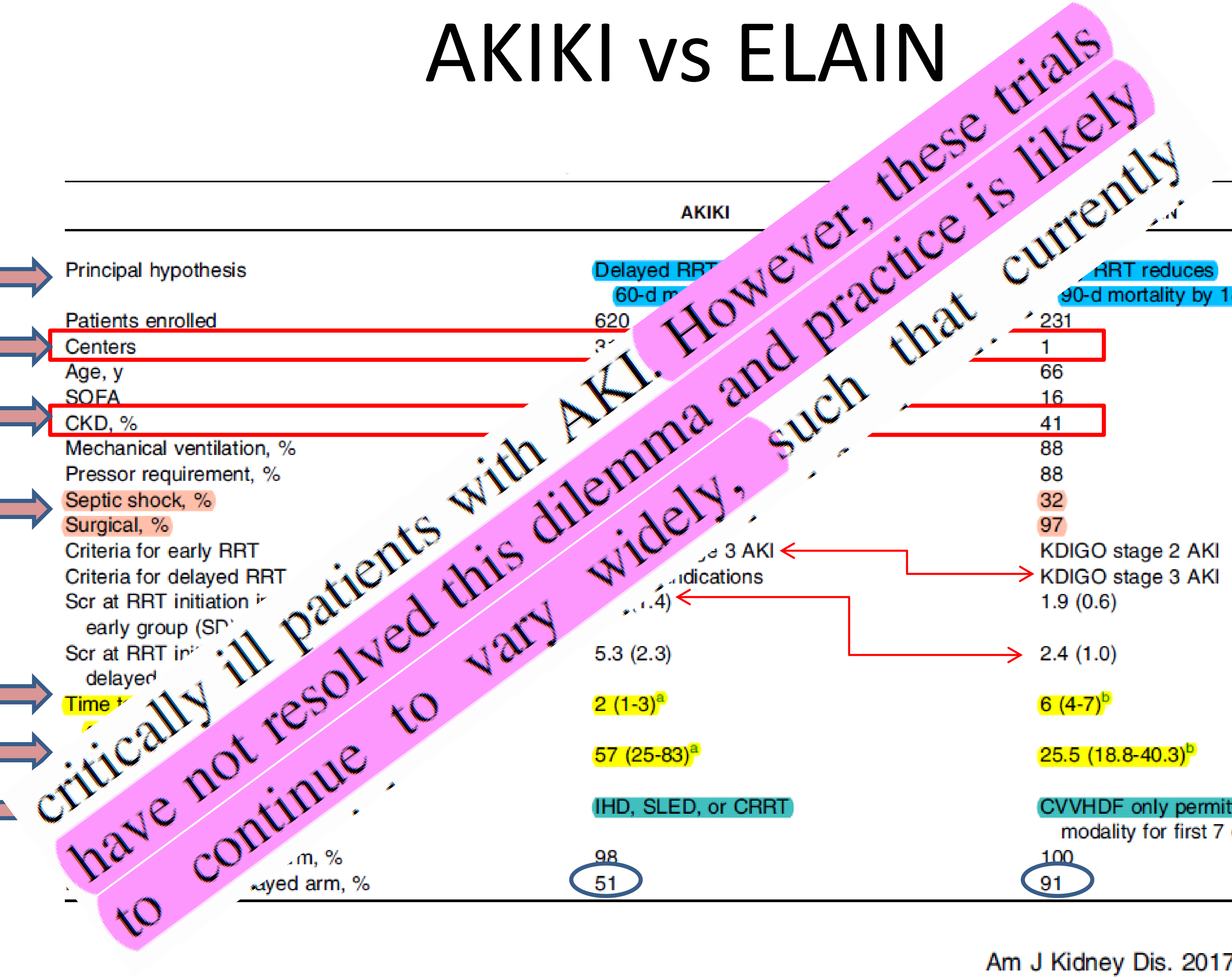


eTable S2: Sub-group analysis of the delayed group (n=119)

	Delayed (n=91)	**Absolute indication*** (n=17)	**p-value**
Time from KDIGO 2 to RRT, median (Q1, Q3), hours	25.0 (19.0, 40.0)	27.0 (14.0, 41.0)	0.97
Primary endpoint			
90-day all cause mortality, No. (%)	53 (58.3)	9 (52.9)	0.91
Key secondary endpoints			
Duration of RRT, median (Q1, Q3), days[1]	36 (7, -)	12 (5, 71)	0.91
ICU stay, median (Q1, Q3), days	17.0 (9.8, 29.0)	9.0 (3.5, 39.0)	0.63
Hospital stay, median (Q1, Q3), days	43.0 (25.5, 80.3)	38.0 (4.0, 92.5)	0.55

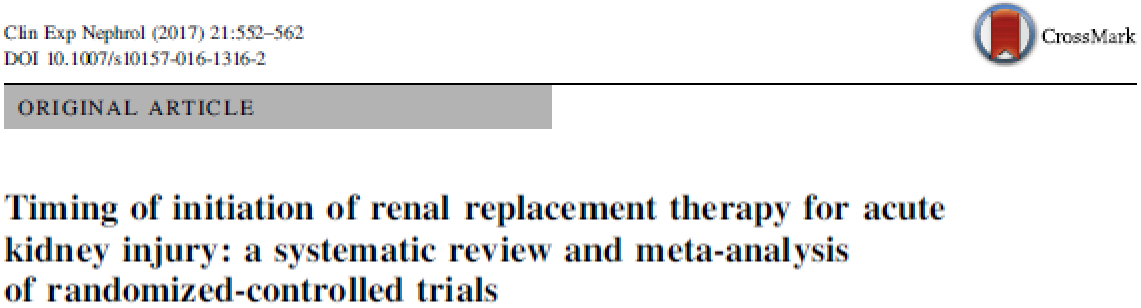
AKIKI vs ELAIN

	AKIKI	
Principal hypothesis	Delayed RRT 60-d m	RRT reduces 90-d mortality by 18%
Patients enrolled	620	231
Centers	3	1
Age, y		66
SOFA		16
CKD, %		41
Mechanical ventilation, %		88
Pressor requirement, %		88
Septic shock, %		32
Surgical, %		97
Criteria for early RRT	3 AKI	KDIGO stage 2 AKI
Criteria for delayed RRT	ndications	KDIGO stage 3 AKI
Scr at RRT initiation i early group (SD	.4)	1.9 (0.6)
Scr at RRT ini delayed	5.3 (2.3)	2.4 (1.0)
Time t	2 (1-3)[a]	6 (4-7)[b]
	57 (25-83)[a]	25.5 (18.8-40.3)[b]
	IHD, SLED, or CRRT	CVVHDF only permitted modality for first 7 d
m, %	98	100
ayed arm, %	51	91



critically ill patients with AKI. However, these trials
have not resolved this dilemma and practice is likely
to continue to vary widely, such that currently

Am J Kidney Dis. 2017;69(1):14-17

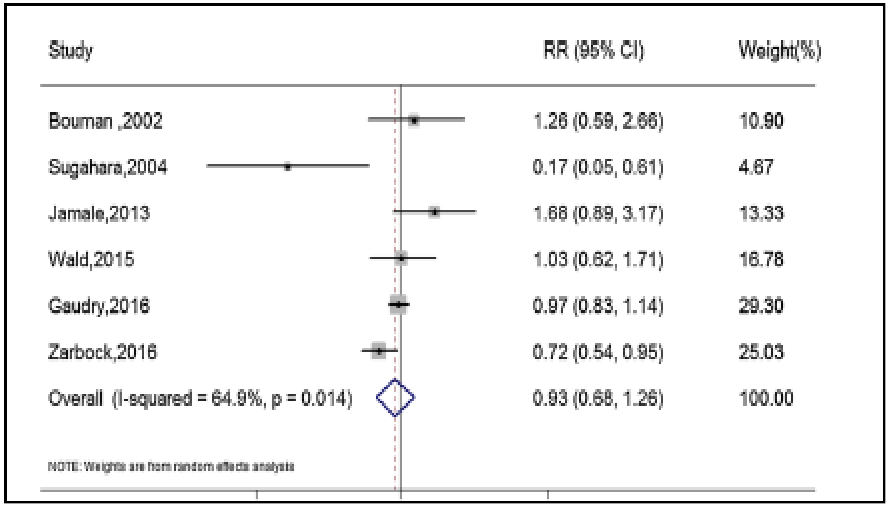


Clin Exp Nephrol (2017) 21:552–562
DOI 10.1007/s10157-016-1316-2

CrossMark

ORIGINAL ARTICLE

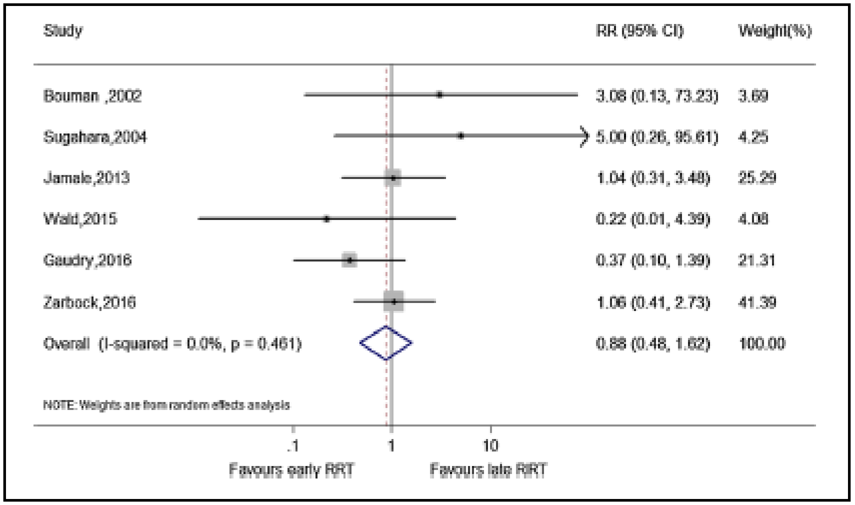
Timing of initiation of renal replacement therapy for acute kidney injury: a systematic review and meta-analysis of randomized-controlled trials



Study	RR (95% CI)	Weight(%)
Bouman ,2002	1.26 (0.59, 2.66)	10.90
Sugahara,2004	0.17 (0.05, 0.61)	4.67
Jamale,2013	1.68 (0.89, 3.17)	13.33
Wald,2015	1.03 (0.62, 1.71)	16.78
Gaudry,2016	0.97 (0.83, 1.14)	29.30
Zarbock,2016	0.72 (0.54, 0.95)	25.03
Overall (I-squared = 64.9%, p = 0.014)	0.93 (0.68, 1.26)	100.00

NOTE: Weights are from random effects analysis

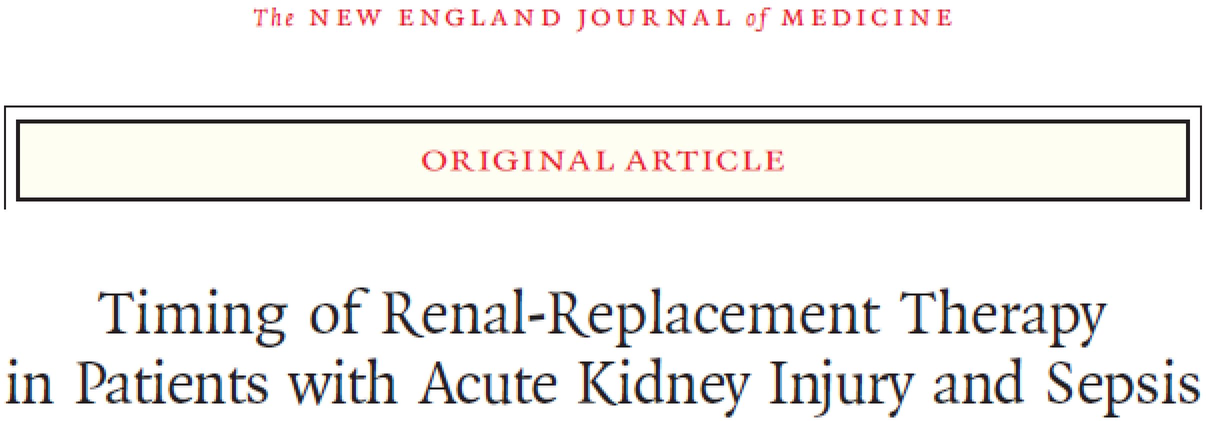
mortalité



Study	RR (95% CI)	Weight(%)
Bouman ,2002	3.08 (0.13, 73.23)	3.69
Sugahara,2004	5.00 (0.26, 95.61)	4.25
Jamale,2013	1.04 (0.31, 3.48)	25.29
Wald,2015	0.22 (0.01, 4.39)	4.08
Gaudry,2016	0.37 (0.10, 1.39)	21.31
Zarbock,2016	1.06 (0.41, 2.73)	41.39
Overall (I-squared = 0.0%, p = 0.461)	0.88 (0.48, 1.62)	100.00

NOTE: Weights are from random effects analysis

Dépendance à l'hémodialyse chronique

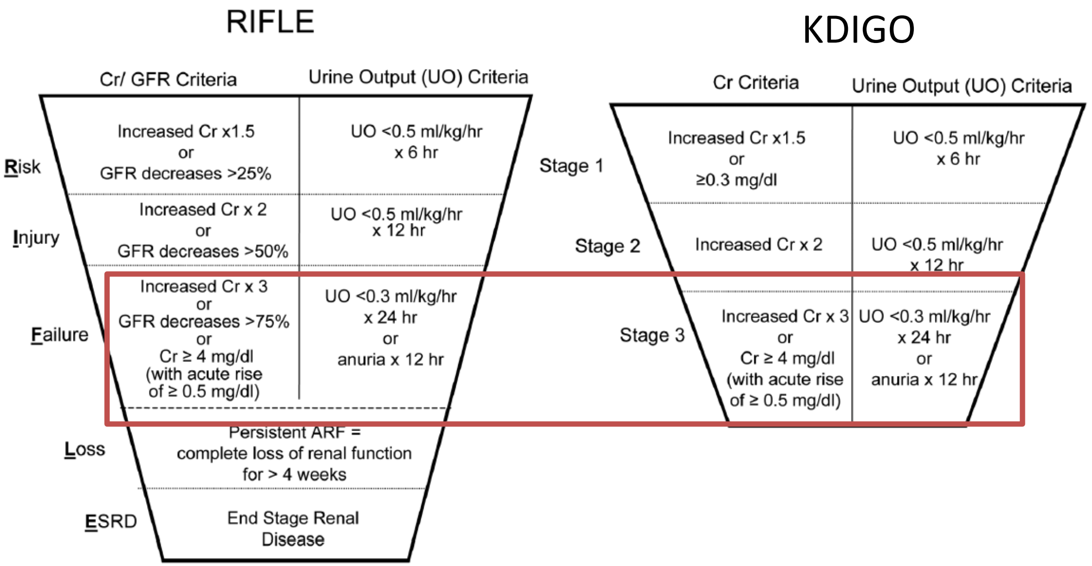


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Timing of Renal-Replacement Therapy in Patients with Acute Kidney Injury and Sepsis

IDEAL-ICU
octobre 2018



RIFLE

Cr/ GFR Criteria | Urine Output (UO) Criteria

Risk: Increased Cr x1.5 or GFR decreases >25% | UO <0.5 ml/kg/hr x 6 hr

Injury: Increased Cr x 2 or GFR decreases >50% | UO <0.5 ml/kg/hr x 12 hr

Failure: Increased Cr x 3 or GFR decreases >75% or Cr ≥ 4 mg/dl (with acute rise of ≥ 0.5 mg/dl) | UO <0.3 ml/kg/hr x 24 hr or anuria x 12 hr

Loss: Persistent ARF = complete loss of renal function for > 4 weeks

ESRD: End Stage Renal Disease

KDIGO

Cr Criteria | Urine Output (UO) Criteria

Stage 1: Increased Cr x1.5 or ≥0.3 mg/dl | UO <0.5 ml/kg/hr x 6 hr

Stage 2: Increased Cr x 2 | UO <0.5 ml/kg/hr x 12 hr

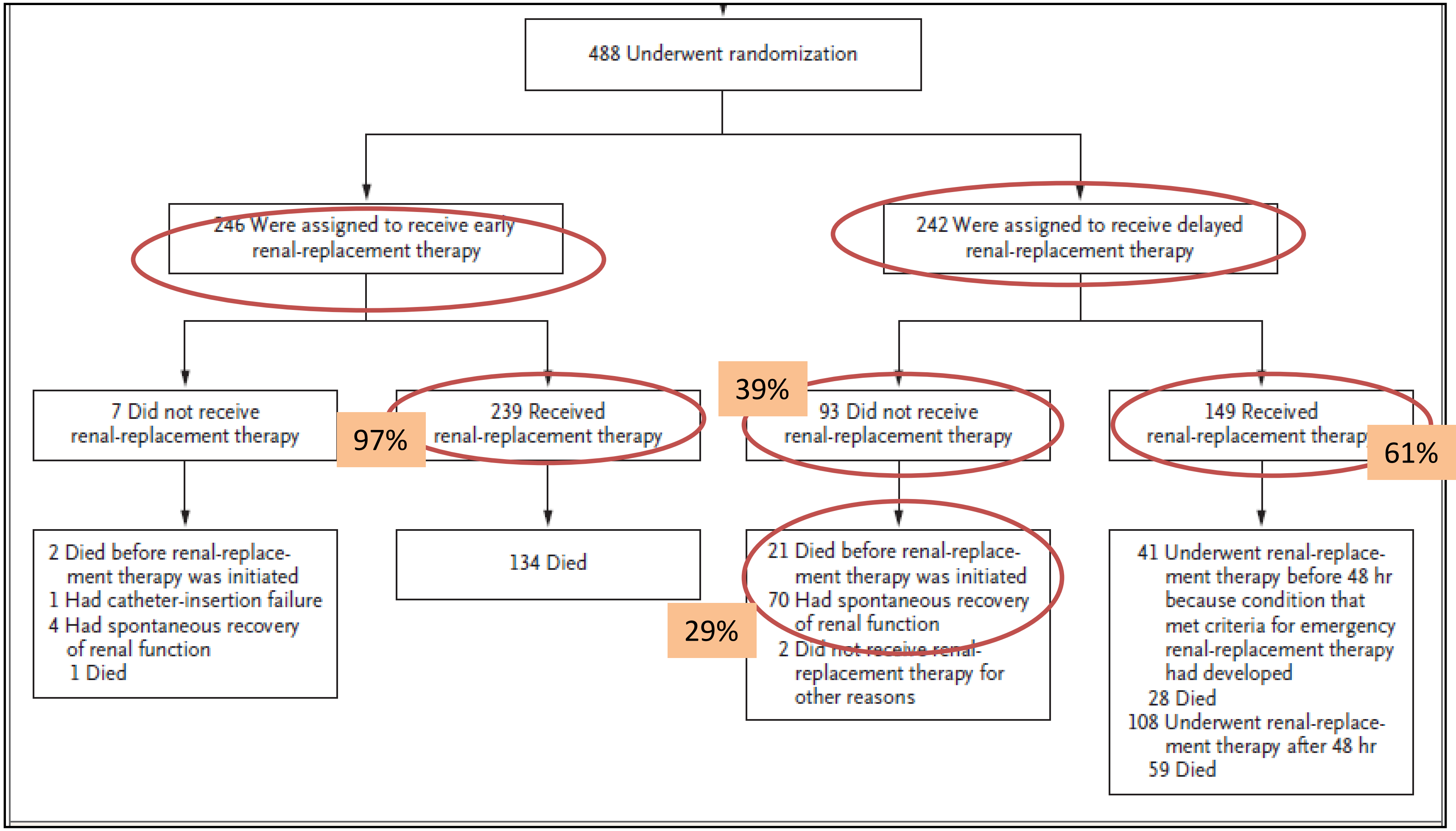
Stage 3: Increased Cr x 3 or Cr ≥ 4 mg/dl (with acute rise of ≥ 0.5 mg/dl) | UO <0.3 ml/kg/hr x 24 hr or anuria x 12 hr

✓RCT multicentrique française
✓29 ICU
✓2012-2016
✓Dialyse précoce (12h) vs tardive (48h)
✓Critères RIFLE (FAILURE)
✓488 patients/ choc septique
✓End point: mortalité à j 90
✓Hypothèse: dialyse précoce améliore la balance hydrique et donc le pronostic

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Timing of Renal-Replacement Therapy in Patients with Acute Kidney Injury and Sepsis



488 Underwent randomization

246 Were assigned to receive early renal-replacement therapy

242 Were assigned to receive delayed renal-replacement therapy

7 Did not receive renal-replacement therapy

97%

239 Received renal-replacement therapy

39%

93 Did not receive renal-replacement therapy

149 Received renal-replacement therapy

61%

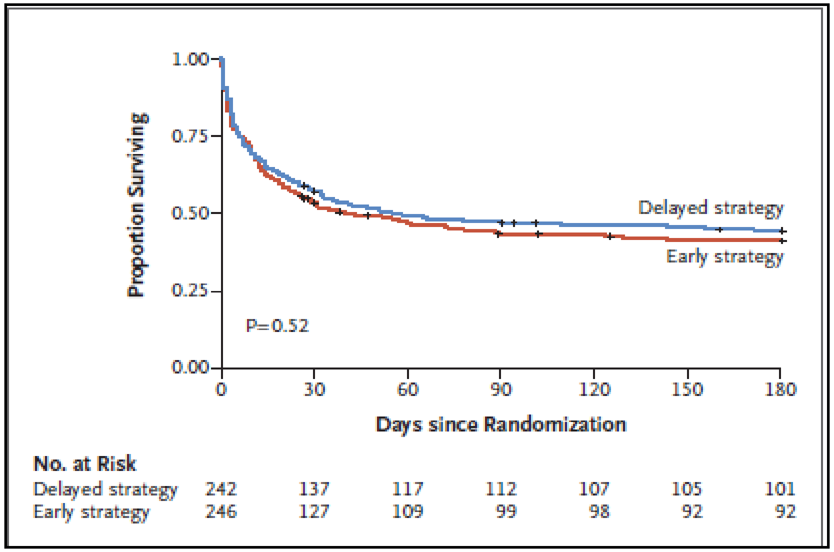
2 Died before renal-replacement therapy was initiated
1 Had catheter-insertion failure
4 Had spontaneous recovery of renal function
  1 Died

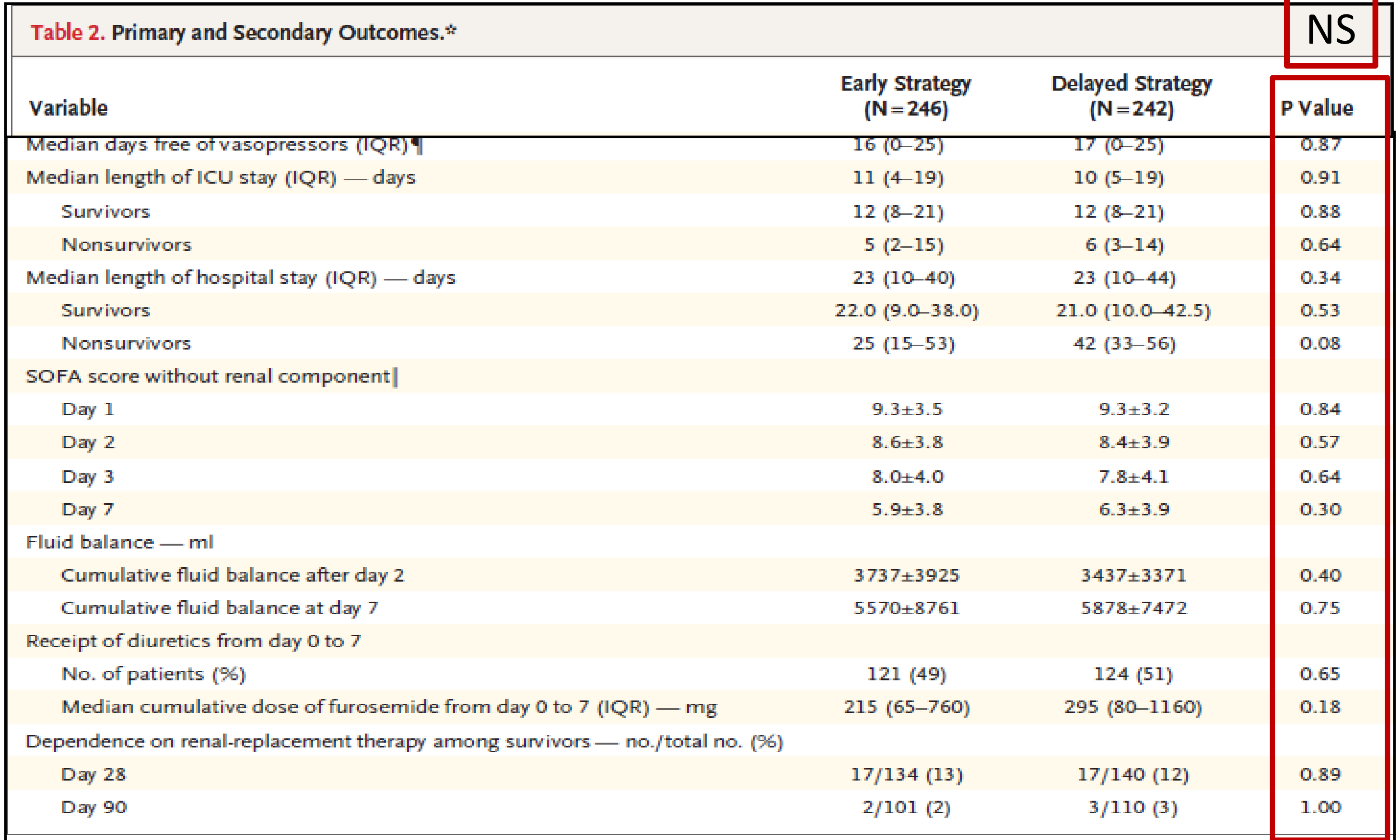
134 Died

29%

21 Died before renal-replacement therapy was initiated
70 Had spontaneous recovery of renal function
  2 Did not receive renal-replacement therapy for other reasons

41 Underwent renal-replacement therapy before 48 hr because condition that met criteria for emergency renal-replacement therapy had developed
  28 Died
108 Underwent renal-replacement therapy after 48 hr
  59 Died

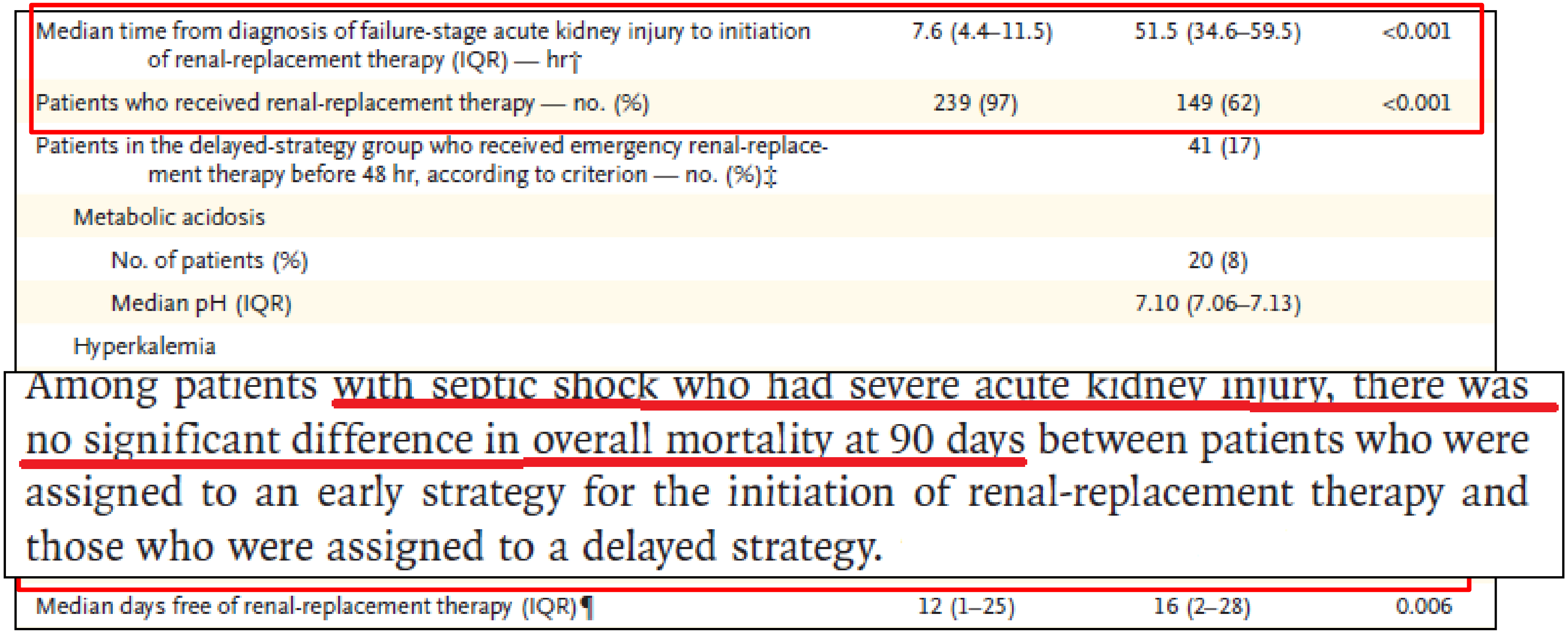




NS

Table 2. Primary and Secondary Outcomes.*

Variable	Early Strategy (N=246)	Delayed Strategy (N=242)	P Value
Median days free of vasopressors (IQR)¶	16 (0–25)	17 (0–25)	0.87
Median length of ICU stay (IQR) — days	11 (4–19)	10 (5–19)	0.91
Survivors	12 (8–21)	12 (8–21)	0.88
Nonsurvivors	5 (2–15)	6 (3–14)	0.64
Median length of hospital stay (IQR) — days	23 (10–40)	23 (10–44)	0.34
Survivors	22.0 (9.0–38.0)	21.0 (10.0–42.5)	0.53
Nonsurvivors	25 (15–53)	42 (33–56)	0.08
SOFA score without renal component‖			
Day 1	9.3±3.5	9.3±3.2	0.84
Day 2	8.6±3.8	8.4±3.9	0.57
Day 3	8.0±4.0	7.8±4.1	0.64
Day 7	5.9±3.8	6.3±3.9	0.30
Fluid balance — ml			
Cumulative fluid balance after day 2	3737±3925	3437±3371	0.40
Cumulative fluid balance at day 7	5570±8761	5878±7472	0.75
Receipt of diuretics from day 0 to 7			
No. of patients (%)	121 (49)	124 (51)	0.65
Median cumulative dose of furosemide from day 0 to 7 (IQR) — mg	215 (65–760)	295 (80–1160)	0.18
Dependence on renal-replacement therapy among survivors — no./total no. (%)			
Day 28	17/134 (13)	17/140 (12)	0.89
Day 90	2/101 (2)	3/110 (3)	1.00



Median time from diagnosis of failure-stage acute kidney injury to initiation of renal-replacement therapy (IQR) — hr†	7.6 (4.4–11.5)	51.5 (34.6–59.5)	<0.001
Patients who received renal-replacement therapy — no. (%)	239 (97)	149 (62)	<0.001
Patients in the delayed-strategy group who received emergency renal-replacement therapy before 48 hr, according to criterion — no. (%)‡		41 (17)	
Metabolic acidosis			
No. of patients (%)		20 (8)	
Median pH (IQR)		7.10 (7.06–7.13)	
Hyperkalemia			

Among patients with septic shock who had severe acute kidney injury, there was no significant difference in overall mortality at 90 days between patients who were assigned to an early strategy for the initiation of renal-replacement therapy and those who were assigned to a delayed strategy.

Median days free of renal-replacement therapy (IQR)¶	12 (1–25)	16 (2–28)	0.006

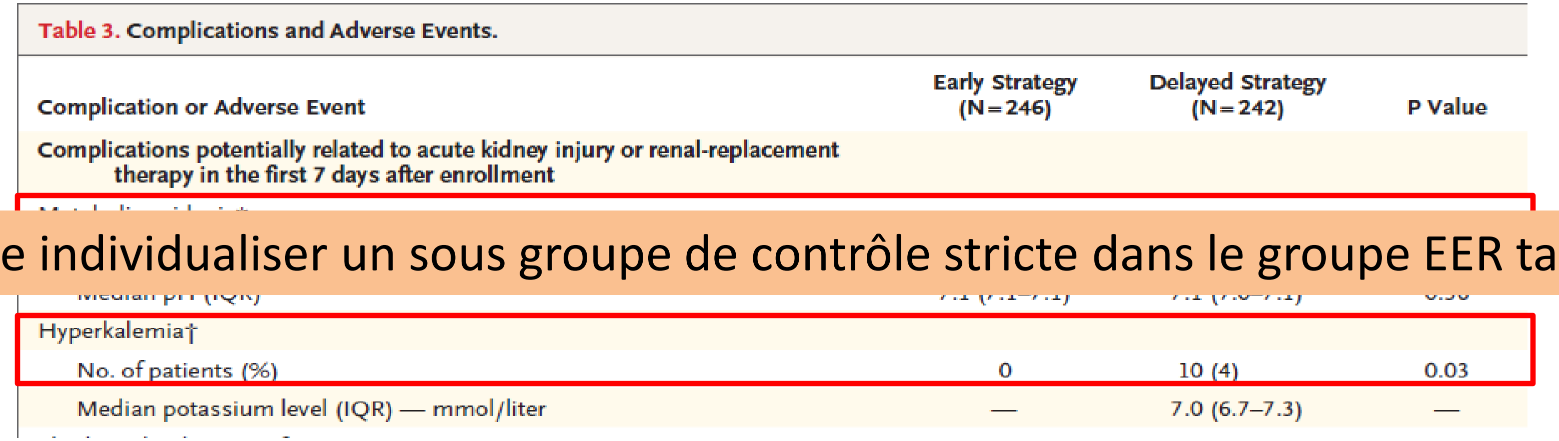


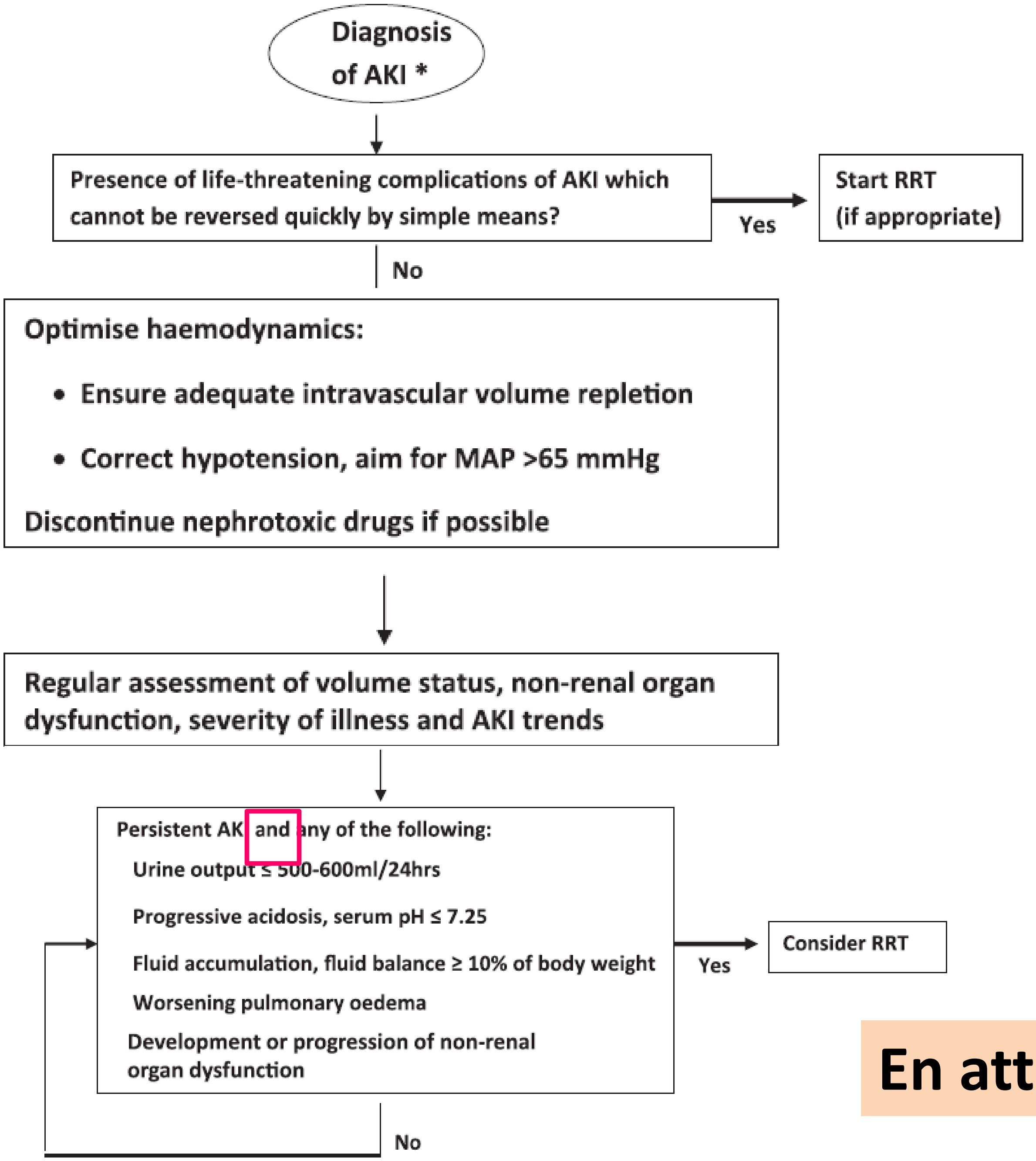
Table 3. Complications and Adverse Events.

Complication or Adverse Event	Early Strategy (N=246)	Delayed Strategy (N=242)	P Value
Complications potentially related to acute kidney injury or renal-replacement therapy in the first 7 days after enrollment			
Hyperkalemia†			
No. of patients (%)	0	10 (4)	0.03
Median potassium level (IQR) — mmol/liter	—	7.0 (6.7–7.3)	—

Peut être individualiser un sous groupe de contrôle stricte dans le groupe EER tardive

Arbre décisionnel

Ostermann et al, NDT, 2012



Diagnosis of AKI *

Presence of life-threatening complications of AKI which cannot be reversed quickly by simple means?

Yes

Start RRT (if appropriate)

No

Optimise haemodynamics:

- Ensure adequate intravascular volume repletion
- Correct hypotension, aim for MAP >65 mmHg

Discontinue nephrotoxic drugs if possible

Regular assessment of volume status, non-renal organ dysfunction, severity of illness and AKI trends

Persistent AK and any of the following:

Urine output ≤ 500-600ml/24hrs

Progressive acidosis, serum pH ≤ 7.25

Fluid accumulation, fluid balance ≥ 10% of body weight

Worsening pulmonary oedema

Development or progression of non-renal organ dysfunction

Yes

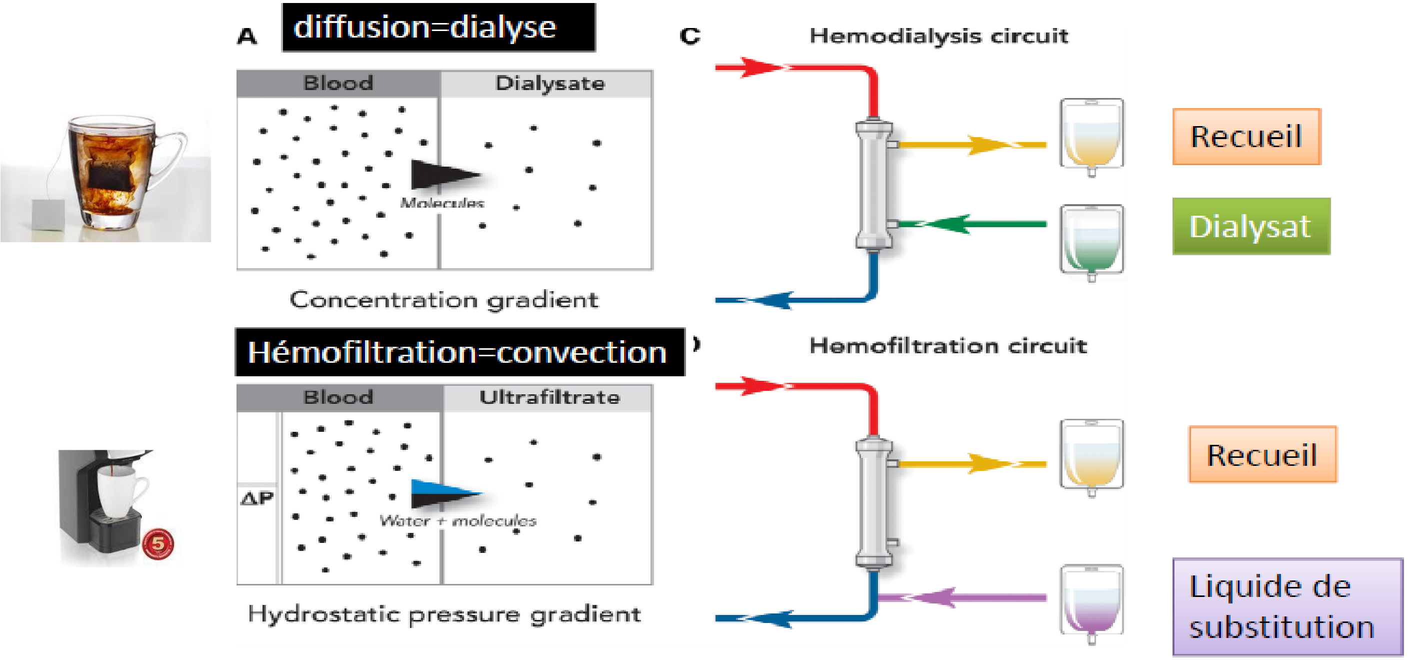
Consider RRT

No

En attendant STAAR-RRT

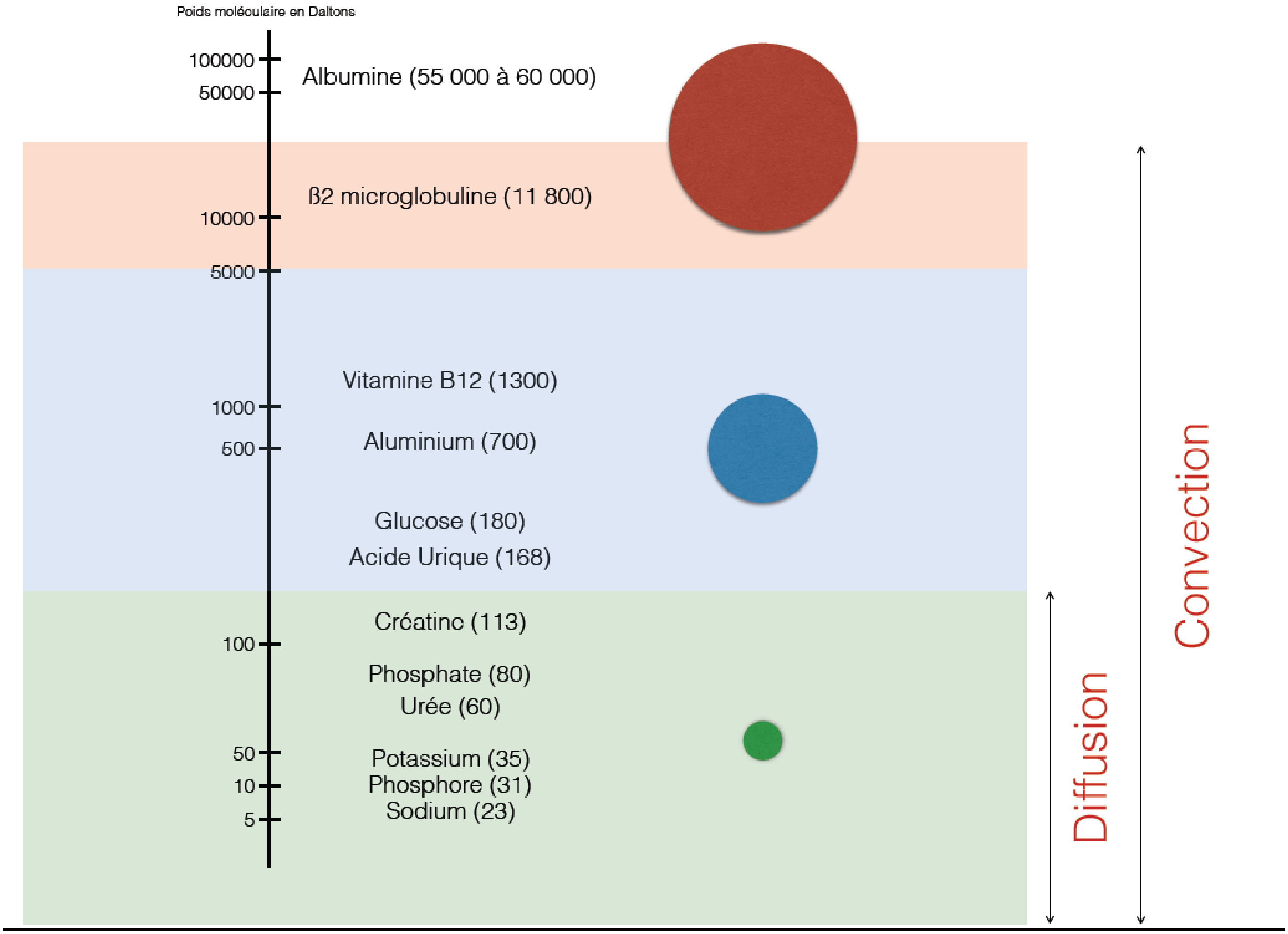
COMMENT DIALYSER?

Techniques d'EER


A
diffusion=dialyse
Blood
Dialysate
Molecules
Concentration gradient
Hémofiltration=convection
Blood
Ultrafiltrate
ΔP
Water + molecules
Hydrostatic pressure gradient
C
Hemodialysis circuit
Recueil
Dialysat
Hemofiltration circuit
Recueil
Liquide de substitution

Rimmelé Anesthesio 2012

Épuration des solutés selon PM


Poids moléculaire en Daltons
100000
50000
10000
5000
1000
500
100
50
10
5
Diffusion
Convection

Albumine (55 000 à 60 000)

ß2 microglobuline (11 800)

Vitamine B12 (1300)

Aluminium (700)

Glucose (180)

Acide Urique (168)

Créatine (113)

Phosphate (80)

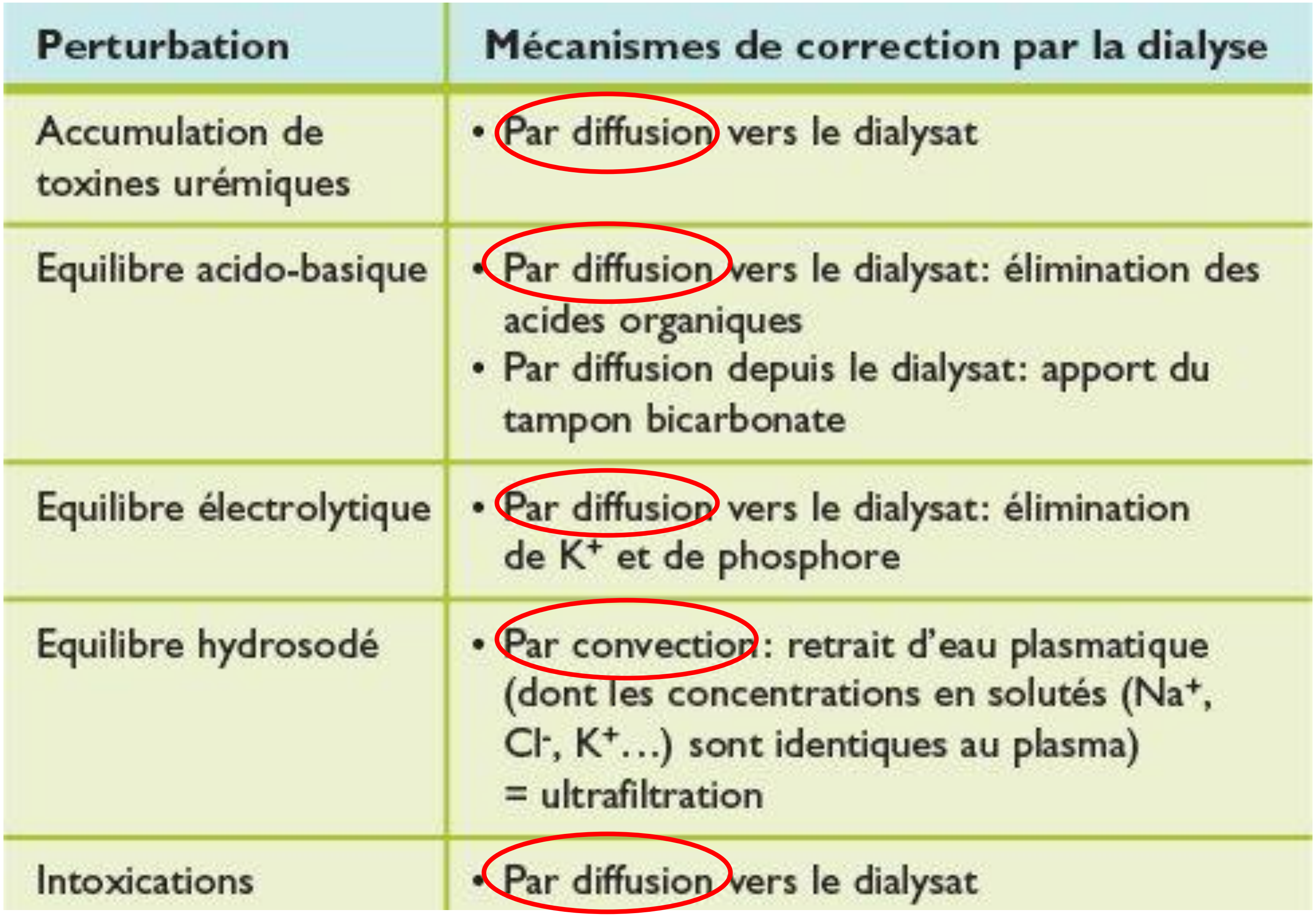
Urée (60)

Potassium (35)

Phosphore (31)

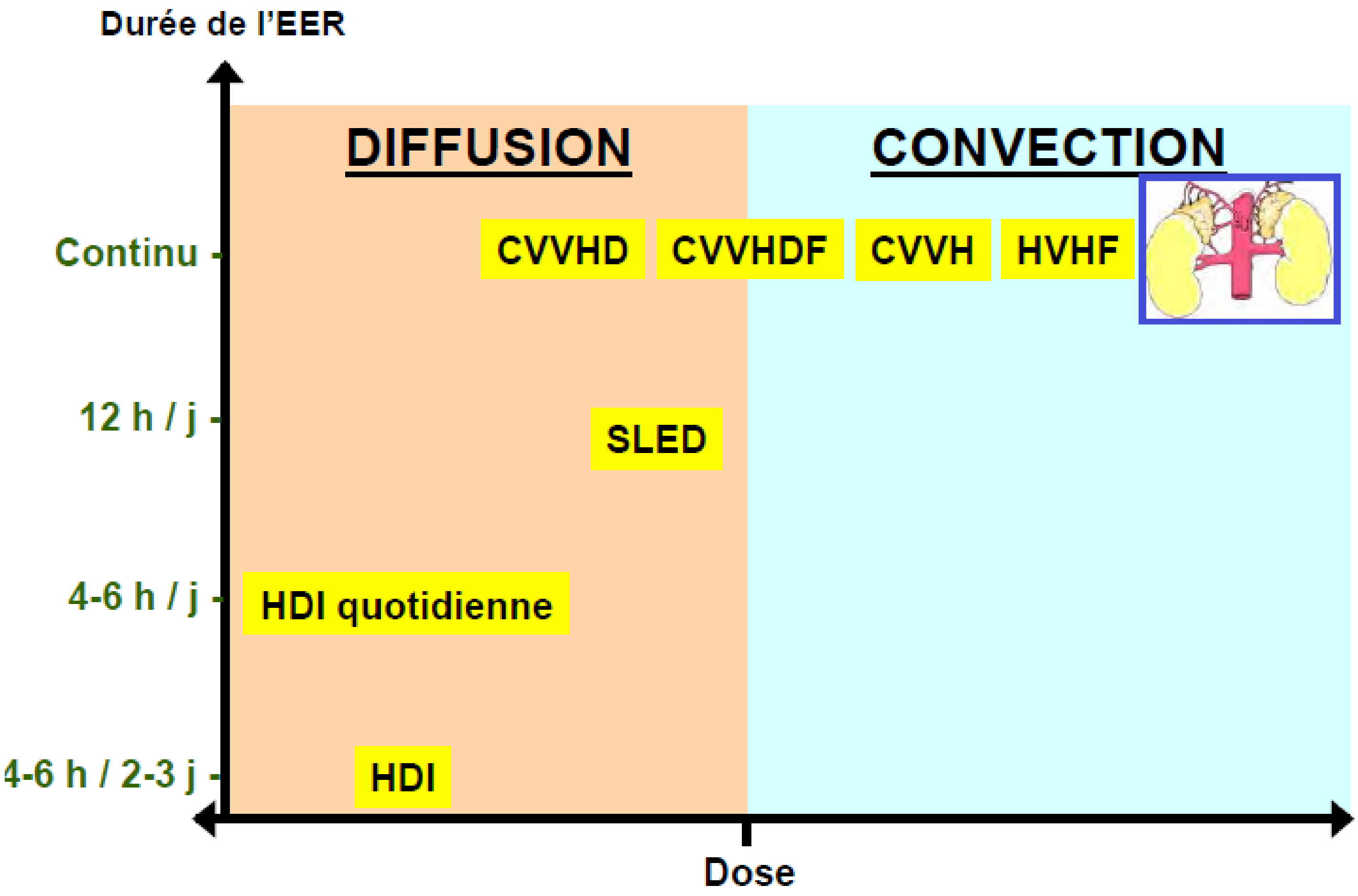
Sodium (23)

Diffusion/convection



Perturbation	Mécanismes de correction par la dialyse
Accumulation de toxines urémiques	• Par diffusion vers le dialysat
Equilibre acido-basique	• Par diffusion vers le dialysat: élimination des acides organiques • Par diffusion depuis le dialysat: apport du tampon bicarbonate
Equilibre électrolytique	• Par diffusion vers le dialysat: élimination de K^+ et de phosphore
Equilibre hydrosodé	• Par convection: retrait d'eau plasmatique (dont les concentrations en solutés (Na^+, Cl^-, K^+…) sont identiques au plasma) = ultrafiltration
Intoxications	• Par diffusion vers le dialysat

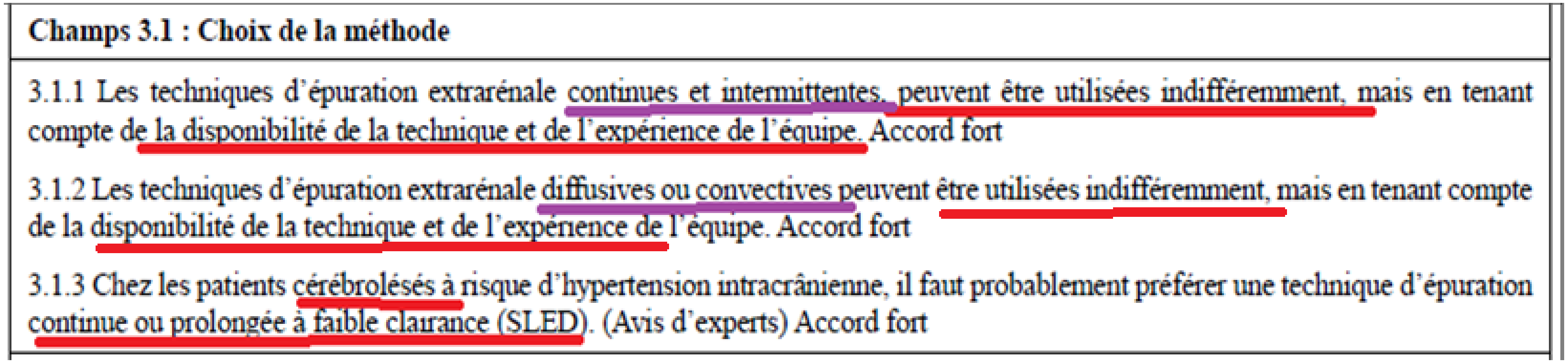
Durée de l'EER


Durée de l'EER
DIFFUSION
CONVECTION
Continu
12 h / j
4-6 h / j
4-6 h / 2-3 j
CVVHD
CVVHDF
CVVH
HVHF
SLED
HDI quotidienne
HDI
Dose

INTERMITTENTE OU CONTINUE

	Hémodialyse intermittente	**EER continue**
	Diffusion Clairance élevée des petites molécules	Convection et/ou diffusion lente Clairance réduite des petites et moyennes molécules
Durée du traitement	Courte	Longue Gène la mobilisation du patient
Stabilité hémodynamique	Peut être plus difficile	Oui
Contrôle de la surcharge	Plus compliqué	aisé
Nutrition	Plus compliquée	aisée
Charge de travail	faible	Plus importante
Coût	Relativement faible 30 DT	Plus important 1500 DT

Ce que disent les recommandations?



Champs 3.1 : Choix de la méthode

3.1.1 Les techniques d'épuration extrarénale continues et intermittentes, peuvent être utilisées indifféremment, mais en tenant compte de la disponibilité de la technique et de l'expérience de l'équipe. Accord fort

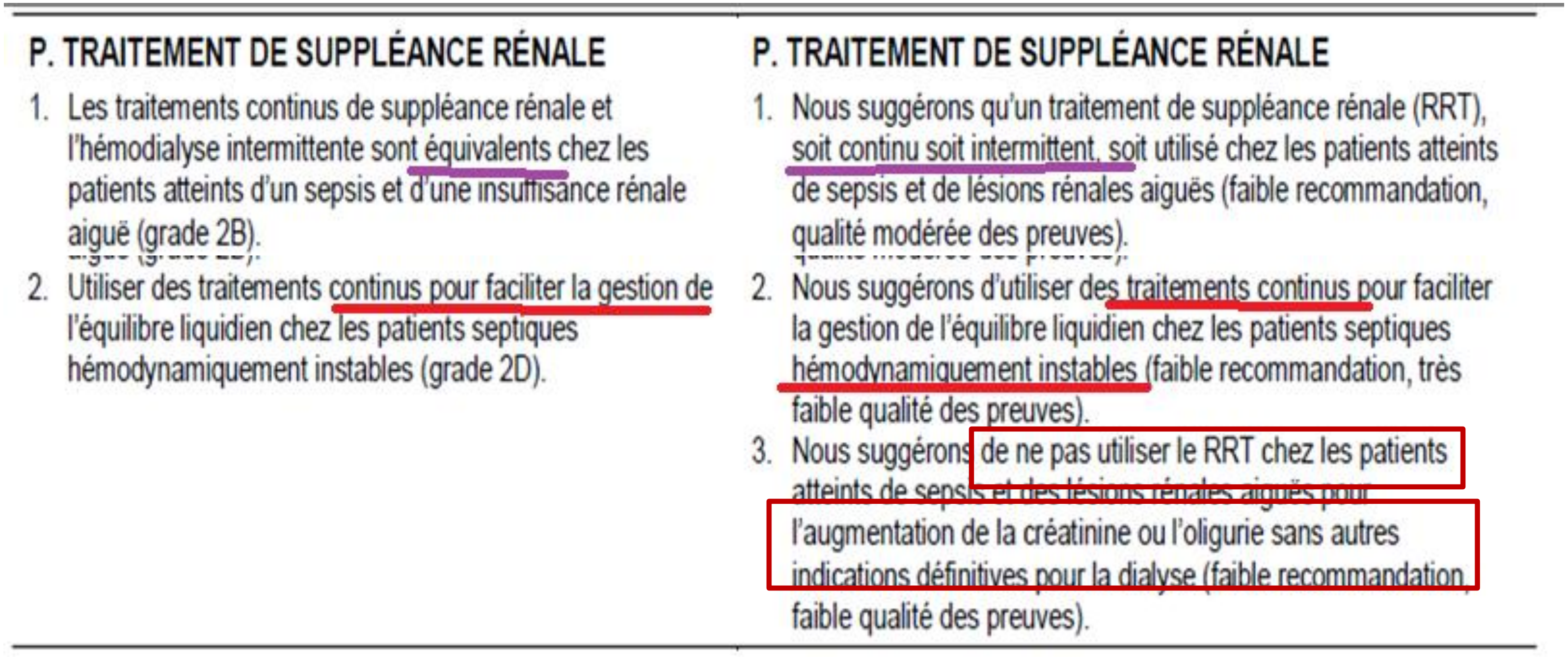
3.1.2 Les techniques d'épuration extrarénale diffusives ou convectives peuvent être utilisées indifféremment, mais en tenant compte de la disponibilité de la technique et de l'expérience de l'équipe. Accord fort

3.1.3 Chez les patients cérébrolésés à risque d'hypertension intracrânienne, il faut probablement préférer une technique d'épuration continue ou prolongée à faible clairance (SLED). (Avis d'experts) Accord fort

RFE

2012

2016



P. TRAITEMENT DE SUPPLÉANCE RÉNALE

1. Les traitements continus de suppléance rénale et l'hémodialyse intermittente sont équivalents chez les patients atteints d'un sepsis et d'une insuffisance rénale aiguë (grade 2B).
2. Utiliser des traitements continus pour faciliter la gestion de l'équilibre liquidien chez les patients septiques hémodynamiquement instables (grade 2D).

P. TRAITEMENT DE SUPPLÉANCE RÉNALE

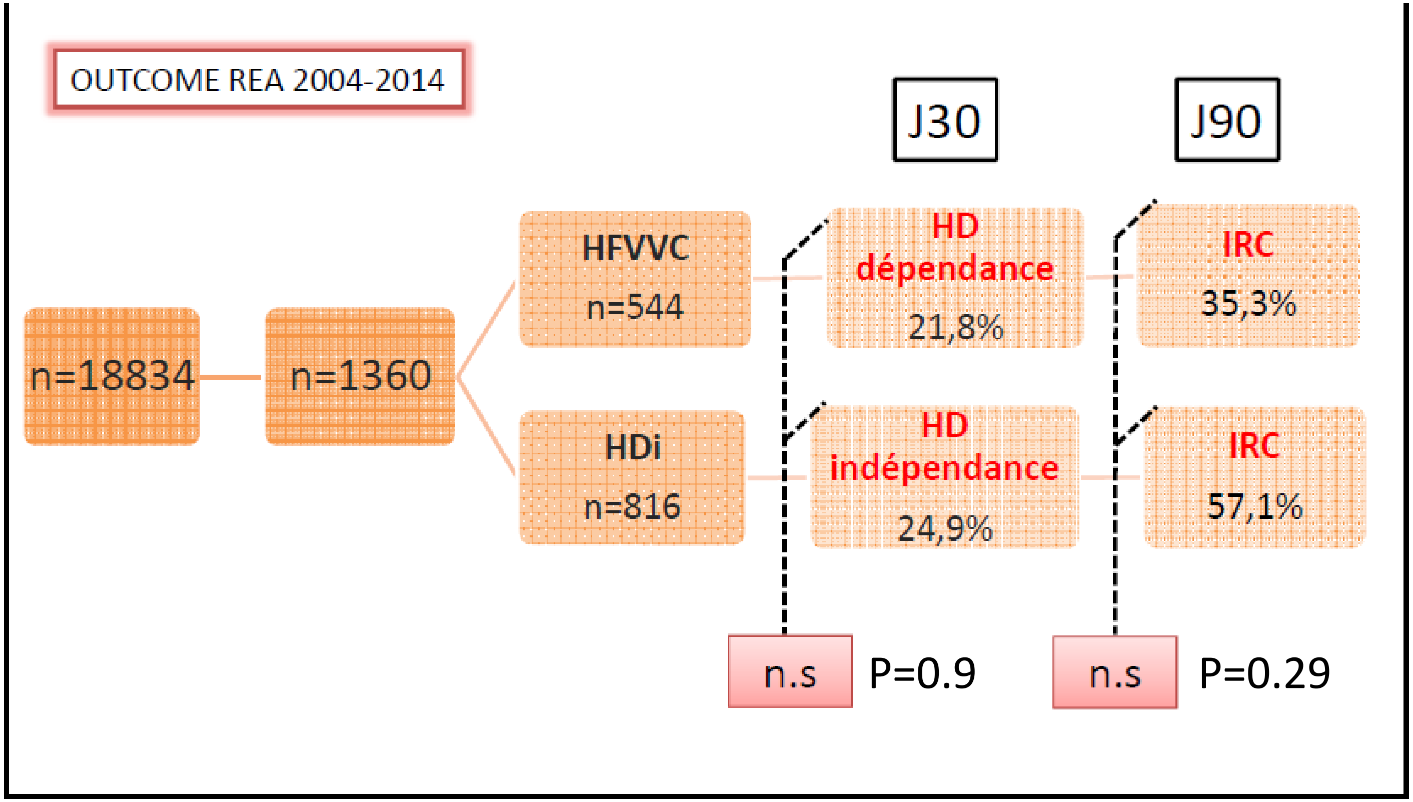
1. Nous suggérons qu'un traitement de suppléance rénale (RRT), soit continu soit intermittent, soit utilisé chez les patients atteints de sepsis et de lésions rénales aiguës (faible recommandation, qualité modérée des preuves).
2. Nous suggérons d'utiliser des traitements continus pour faciliter la gestion de l'équilibre liquidien chez les patients septiques hémodynamiquement instables (faible recommandation, très faible qualité des preuves).
3. Nous suggérons de ne pas utiliser le RRT chez les patients atteints de sepsis et des lésions rénales aiguës pour l'augmentation de la créatinine ou l'oligurie sans autres indications définitives pour la dialyse (faible recommandation, faible qualité des preuves).

SSC

Intensive Care Med (2016) 42:1408–1417
DOI 10.1007/s00134-016-4404-6

ORIGINAL

Continuous renal replacement therapy versus intermittent hemodialysis in intensive care patients: impact on mortality and renal recovery



OUTCOME REA 2004-2014

J30

J90

n=18834

n=1360

HFVVC
n=544

HDi
n=816

HD dépendance
21,8%

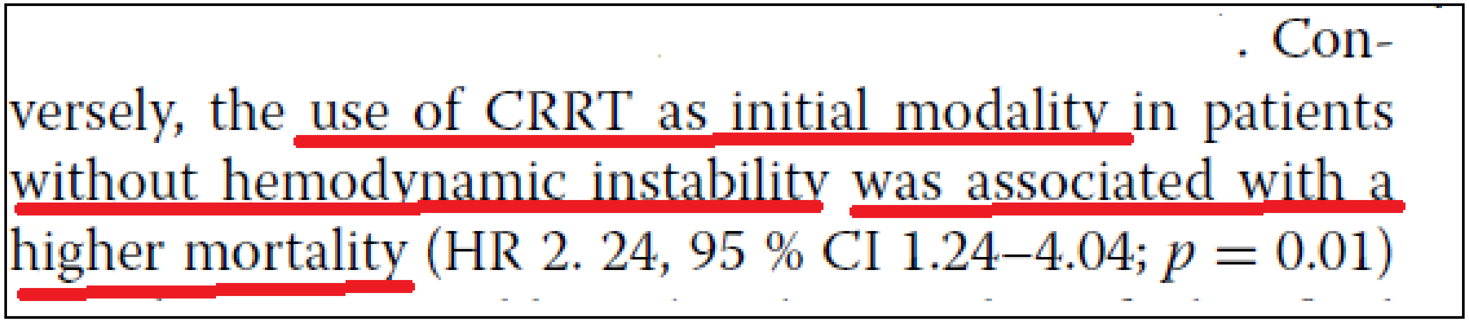
HD indépendance
24,9%

IRC
35,3%

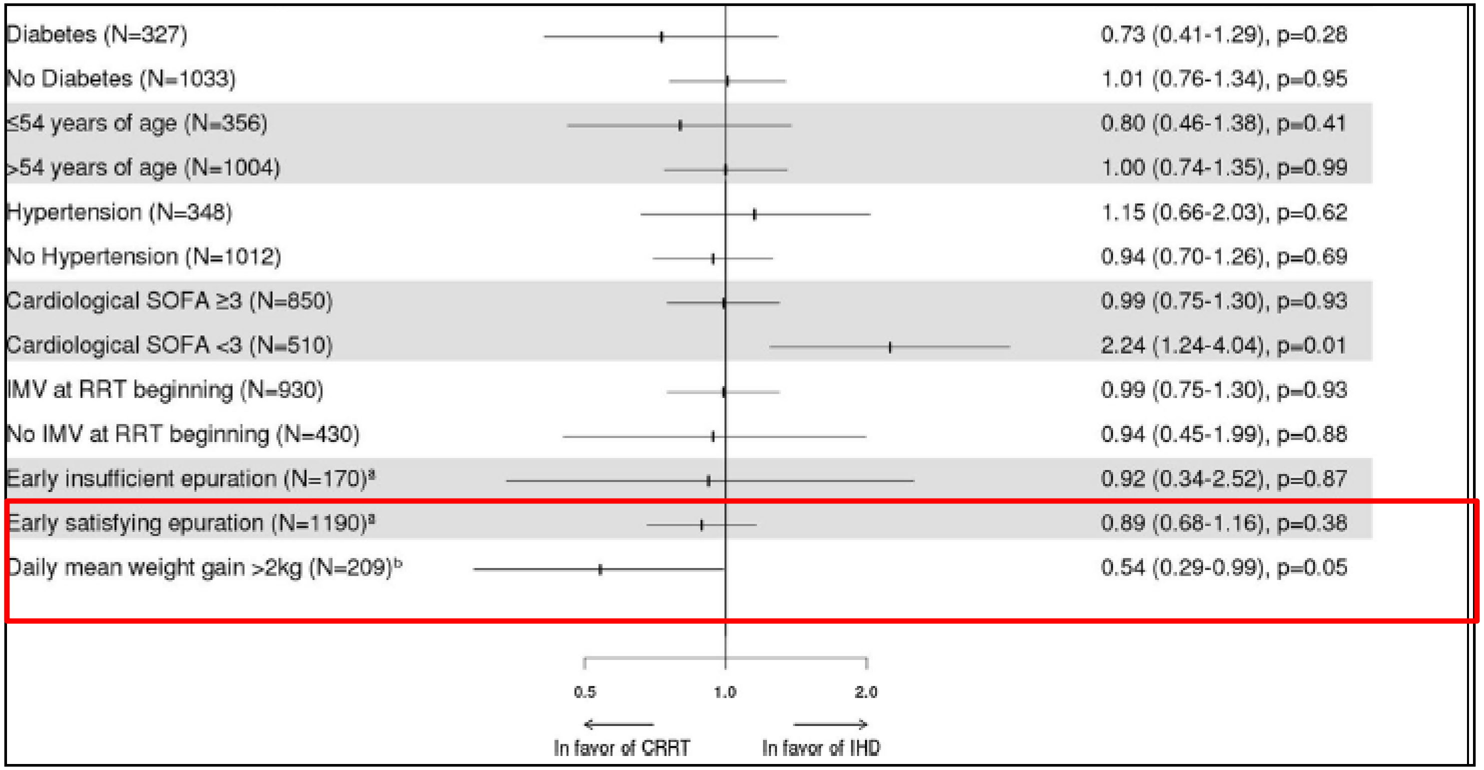
IRC
57,1%

n.s P=0.9

n.s P=0.29



. Conversely, the use of CRRT as initial modality in patients without hemodynamic instability was associated with a higher mortality (HR 2. 24, 95 % CI 1.24–4.04; $p = 0.01$)



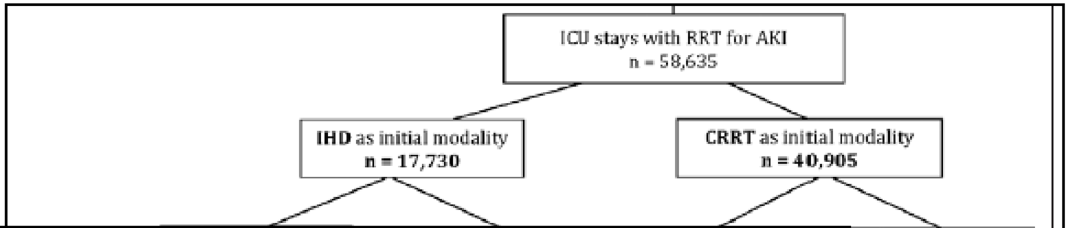
CRRT est meilleur si gain de poids≥ 2kg

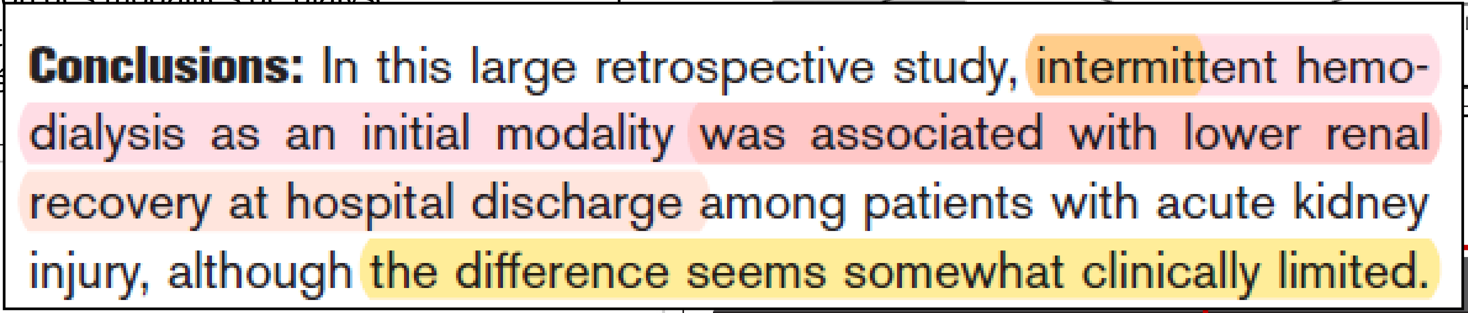
Renal Replacement Therapy Modality in the ICU and Renal Recovery at Hospital Discharge*

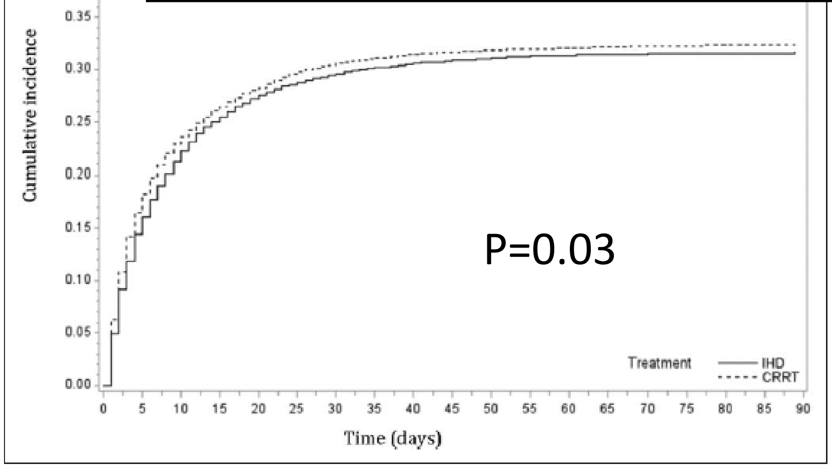
Critical Care Medicine 2018

Martin Bonnassieux, MD[1,2]; Antoine Duclos, MD, PhD[3]; Antoine G. Schneider, MD, PhD[4];
Aurélie Schmidt, MS[5]; Stève Bénard, PharmD[5]; Charlotte Cancalon, MS[5]; Olivier Joannes-Boyau, MD[6];
Carole Ichai, MD, PhD[7,8]; Jean-Michel Constantin, MD, PhD[9]; Jean-Yves Lefrant, MD, PhD[10];
John A. Kellum, MD, FACP, MCCM[11]; Thomas Rimmelé, MD, PhD[1,2]; for the AzuRéa Group

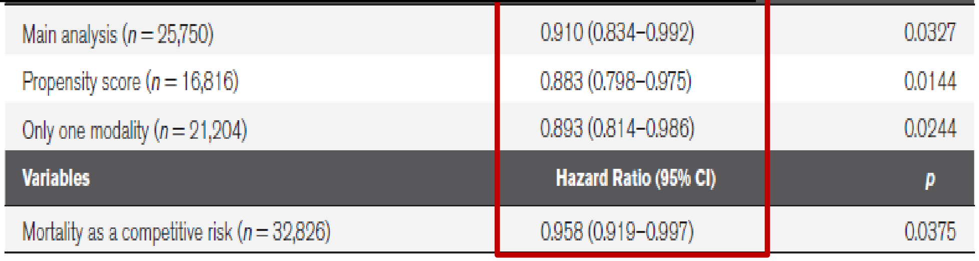
- étude rétrospective multicentrique française (291)
- Tous les patients ayant eu une IRA avec EER
- 58,635 / 25,750 patients survivants à la sortie de réa
- Évaluation des modalités de dialyse
  (intermit
- Mortalité


ICU stays with RRT for AKI
n = 58,635
IHD as initial modality
n = 17,730
CRRT as initial modality
n = 40,905
Dead at hospital discharge
n = 24,854


Conclusions: In this large retrospective study, intermittent hemodialysis as an initial modality was associated with lower renal recovery at hospital discharge among patients with acute kidney injury, although the difference seems somewhat clinically limited.



P=0.03



		p
Main analysis (n = 25,750)	0.910 (0.834–0.992)	0.0327
Propensity score (n = 16,816)	0.883 (0.798–0.975)	0.0144
Only one modality (n = 21,204)	0.893 (0.814–0.986)	0.0244
Variables	**Hazard Ratio (95% CI)**	**p**
Mortality as a competitive risk (n = 32,826)	0.958 (0.919–0.997)	0.0375

La dose dialyse

--> **EER continue** (Hémofiltration)

✓**débit effluent** ou **débit de réinjection**
dose exprimée en **ml/kg/heure**

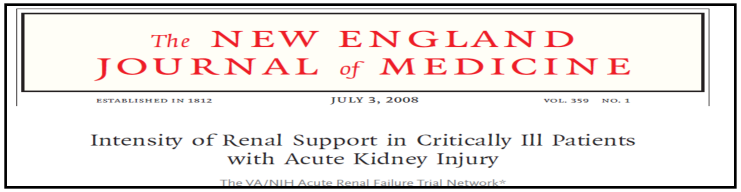
--> **Hémodialyse intermittente**:

✓**Durée séance**
✓**Fréquence**: nombre de séances / semaine

Taux de réduction de l'urée par séance (**TRU %**)
ou **Kt/V urée** (par séance ou cumulée/semaine)

Dose de dialyse optimale

ATN
2008



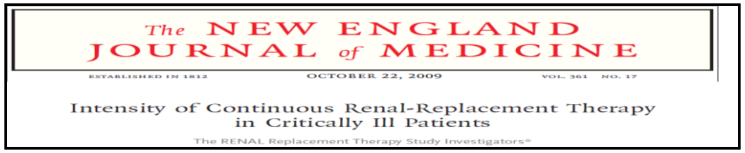
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 3, 2008 VOL. 359 NO. 1

Intensity of Renal Support in Critically Ill Patients with Acute Kidney Injury

The VA/NIH Acute Renal Failure Trial Network*

RENAL
2009

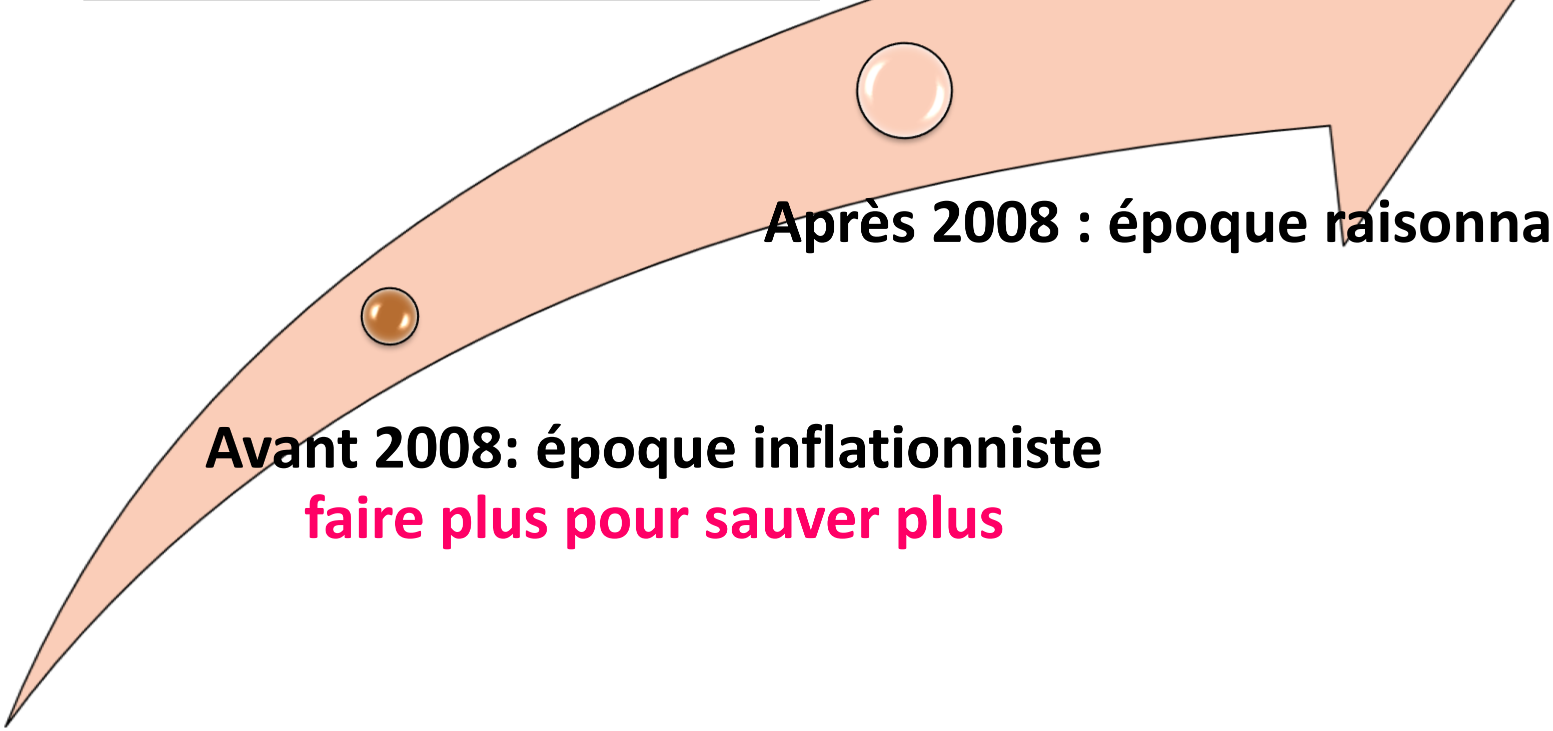


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 22, 2009 VOL. 361 NO. 17

Intensity of Continuous Renal-Replacement Therapy in Critically Ill Patients

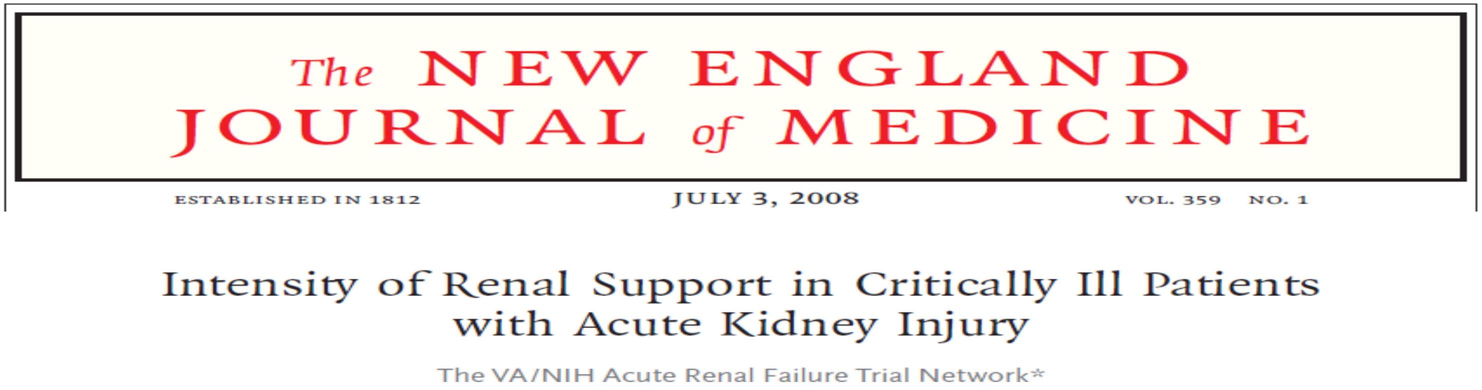
The RENAL Replacement Therapy Study Investigators*



Après 2008 : époque raisonnable

Avant 2008: époque inflationniste

faire plus pour sauver plus



The NEW ENGLAND JOURNAL of MEDICINE

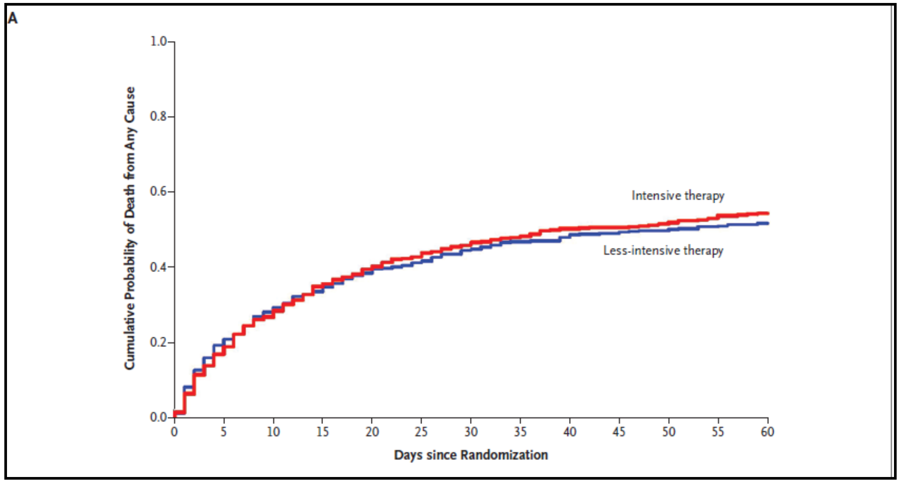
ESTABLISHED IN 1812 JULY 3, 2008 VOL. 359 NO. 1

Intensity of Renal Support in Critically Ill Patients with Acute Kidney Injury

The VA/NIH Acute Renal Failure Trial Network*

ATN

- Étude multicentrique (27 centres)
- Deux **stratégies** de prise en charge randomisées
  - EER intense : HDI 6 / semaine ou CVVHDF (35 mL/kg/h)
  - EER moins intense : HDI 3 / semaine ou CVVHDF (20 mL/kg/h)
- **1124** patients



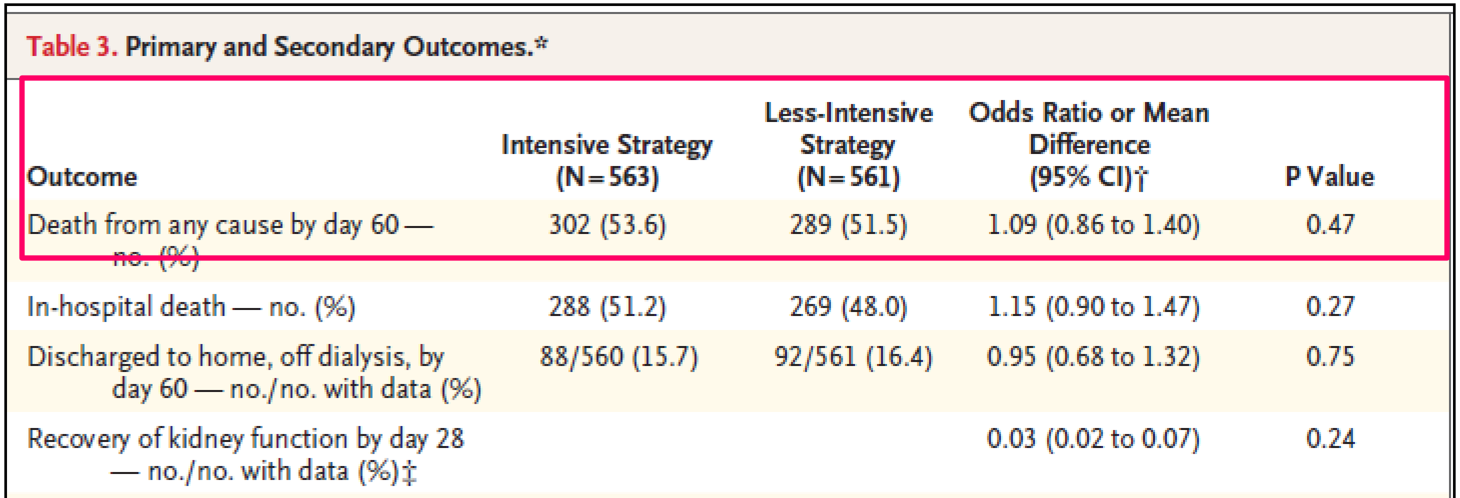


Table 3. Primary and Secondary Outcomes.*

Outcome	Intensive Strategy (N=563)	Less-Intensive Strategy (N=561)	Odds Ratio or Mean Difference (95% CI)†	P Value
Death from any cause by day 60 — no. (%)	302 (53.6)	289 (51.5)	1.09 (0.86 to 1.40)	0.47
In-hospital death — no. (%)	288 (51.2)	269 (48.0)	1.15 (0.90 to 1.47)	0.27
Discharged to home, off dialysis, by day 60 — no./no. with data (%)	88/560 (15.7)	92/561 (16.4)	0.95 (0.68 to 1.32)	0.75
Recovery of kidney function by day 28 — no./no. with data (%)‡			0.03 (0.02 to 0.07)	0.24

The NEW ENGLAND JOURNAL of MEDICINE

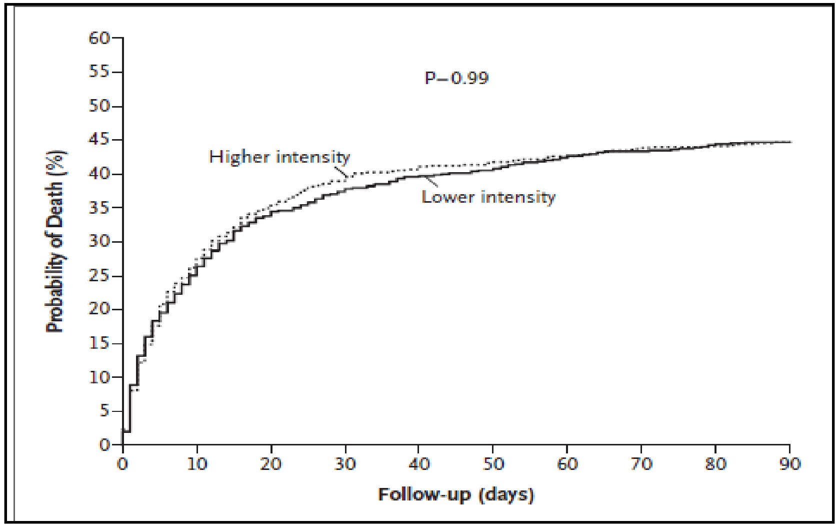
ESTABLISHED IN 1812 OCTOBER 22, 2009 VOL. 361 NO. 17

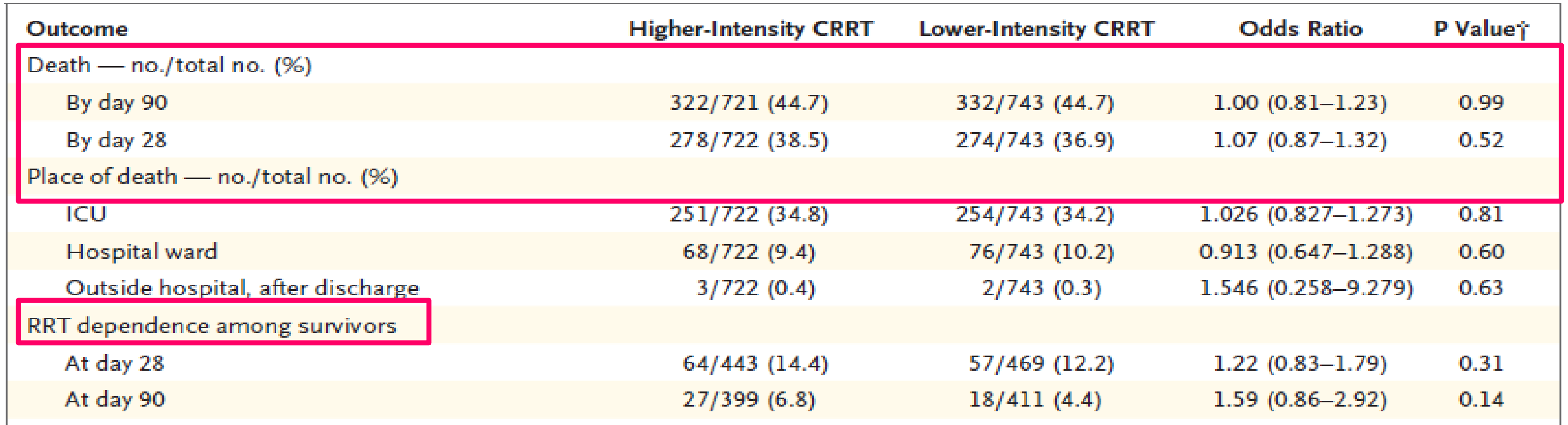
RENAL

Intensity of Continuous Renal-Replacement Therapy in Critically Ill Patients

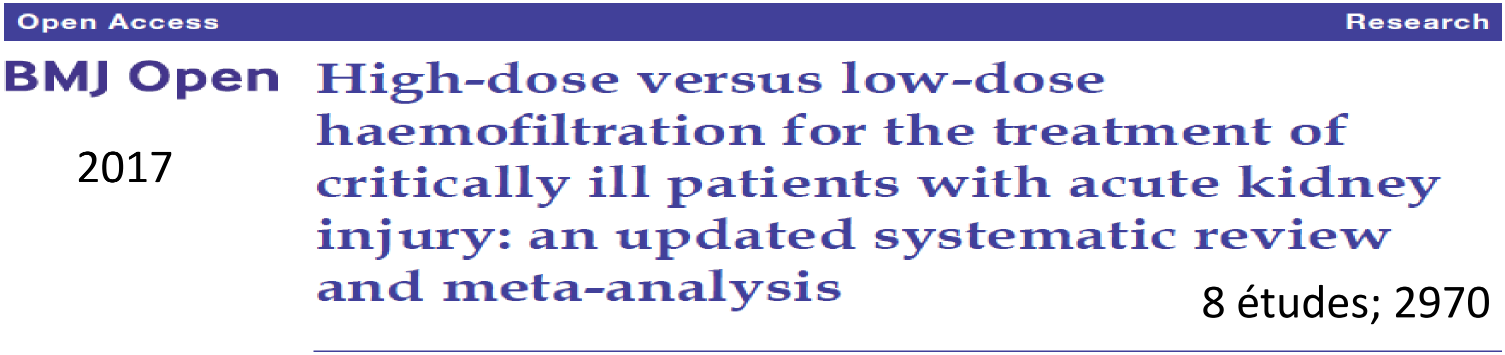
The RENAL Replacement Therapy Study Investigators*

- Étude multicentrique (35 ICU)
- Australie/ new Zélande
- 1500 patients
- 2 stratégie en CRRT: 25 ou 40ml/kg/h





Outcome	Higher-Intensity CRRT	Lower-Intensity CRRT	Odds Ratio	P Value†
Death — no./total no. (%)				
By day 90	322/721 (44.7)	332/743 (44.7)	1.00 (0.81–1.23)	0.99
By day 28	278/722 (38.5)	274/743 (36.9)	1.07 (0.87–1.32)	0.52
Place of death — no./total no. (%)				
ICU	251/722 (34.8)	254/743 (34.2)	1.026 (0.827–1.273)	0.81
Hospital ward	68/722 (9.4)	76/743 (10.2)	0.913 (0.647–1.288)	0.60
Outside hospital, after discharge	3/722 (0.4)	2/743 (0.3)	1.546 (0.258–9.279)	0.63
RRT dependence among survivors				
At day 28	64/443 (14.4)	57/469 (12.2)	1.22 (0.83–1.79)	0.31
At day 90	27/399 (6.8)	18/411 (4.4)	1.59 (0.86–2.92)	0.14



Open Access Research

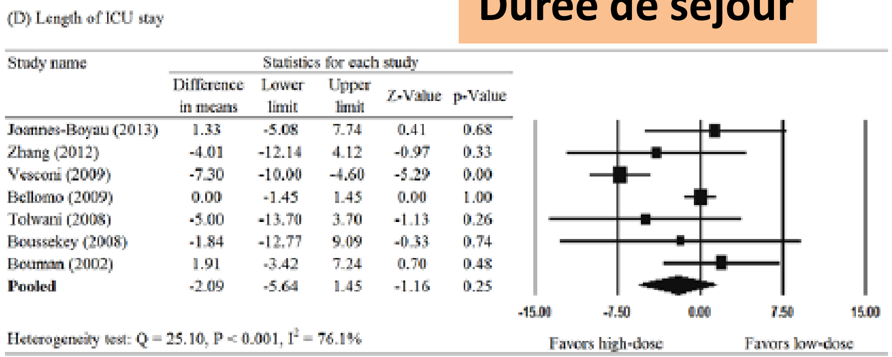
BMJ Open

High-dose versus low-dose haemofiltration for the treatment of critically ill patients with acute kidney injury: an updated systematic review and meta-analysis

2017

8 études; 2970 patients

Durée de séjour

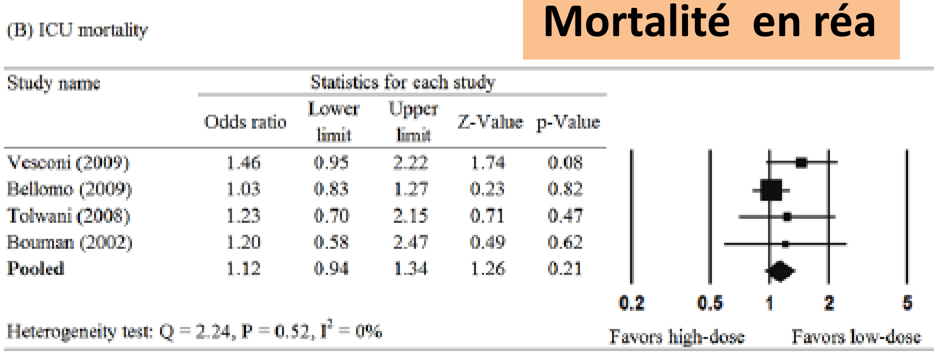


(D) Length of ICU stay

Study name	Statistics for each study				
	Difference in means	Lower limit	Upper limit	Z-Value	p-Value
Joannes-Boyau (2013)	1.33	-5.08	7.74	0.41	0.68
Zhang (2012)	-4.01	-12.14	4.12	-0.97	0.33
Vesconi (2009)	-7.30	-10.00	-4.60	-5.29	0.00
Bellomo (2009)	0.00	-1.45	1.45	0.00	1.00
Tolwani (2008)	-5.00	-13.70	3.70	-1.13	0.26
Boussekey (2008)	-1.84	-12.77	9.09	-0.33	0.74
Bouman (2002)	1.91	-3.42	7.24	0.70	0.48
Pooled	-2.09	-5.64	1.45	-1.16	0.25

Heterogeneity test: Q = 25.10, P < 0.001, I^2 = 76.1%

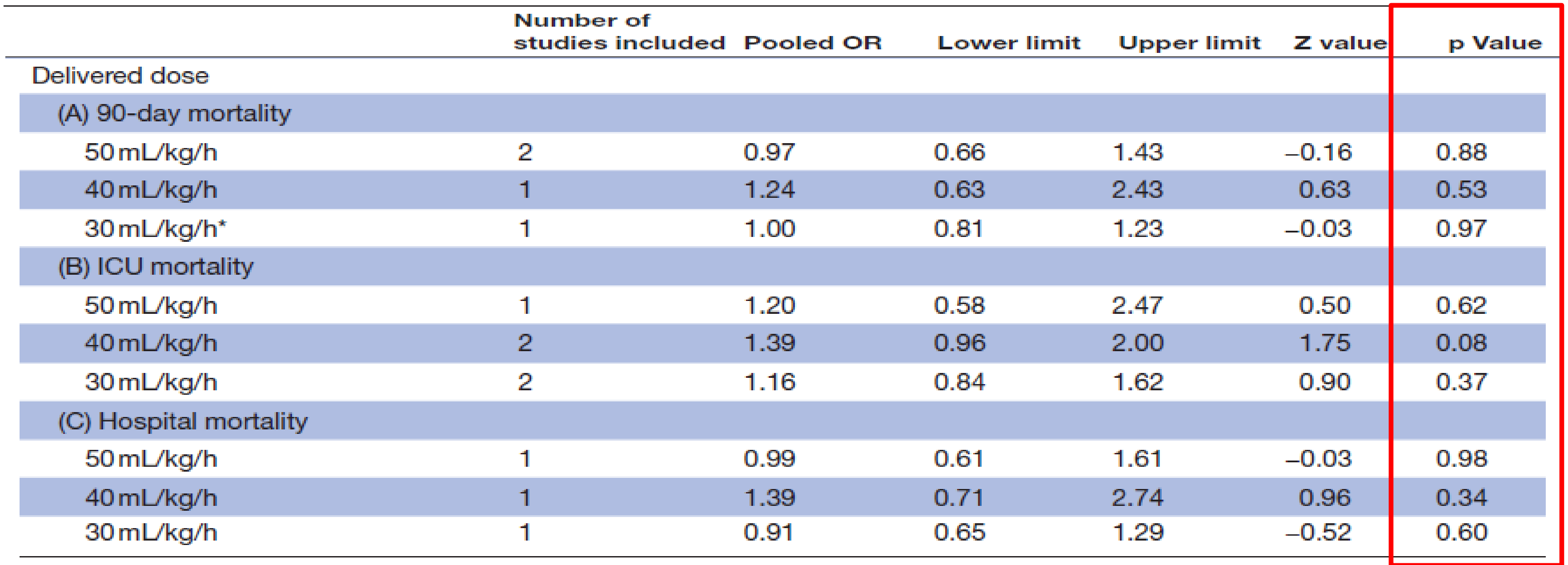
Mortalité en réa



(B) ICU mortality

Study name	Statistics for each study				
	Odds ratio	Lower limit	Upper limit	Z-Value	p-Value
Vesconi (2009)	1.46	0.95	2.22	1.74	0.08
Bellomo (2009)	1.03	0.83	1.27	0.23	0.82
Tolwani (2008)	1.23	0.70	2.15	0.71	0.47
Bouman (2002)	1.20	0.58	2.47	0.49	0.62
Pooled	1.12	0.94	1.34	1.26	0.21

Heterogeneity test: Q = 2.24, P = 0.52, I^2 = 0%



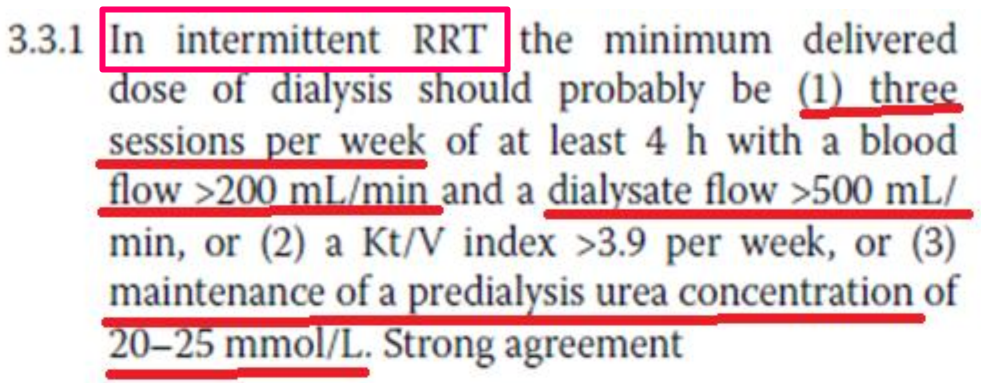
	Number of studies included	Pooled OR	Lower limit	Upper limit	Z value	p Value
Delivered dose						
(A) 90-day mortality						
50 mL/kg/h	2	0.97	0.66	1.43	–0.16	0.88
40 mL/kg/h	1	1.24	0.63	2.43	0.63	0.53
30 mL/kg/h*	1	1.00	0.81	1.23	–0.03	0.97
(B) ICU mortality						
50 mL/kg/h	1	1.20	0.58	2.47	0.50	0.62
40 mL/kg/h	2	1.39	0.96	2.00	1.75	0.08
30 mL/kg/h	2	1.16	0.84	1.62	0.90	0.37
(C) Hospital mortality						
50 mL/kg/h	1	0.99	0.61	1.61	–0.03	0.98
40 mL/kg/h	1	1.39	0.71	2.74	0.96	0.34
30 mL/kg/h	1	0.91	0.65	1.29	–0.52	0.60

Vinsonneau *et al. Ann. Intensive Care* (2015) 5:58
DOI 10.1186/s13613-015-0093-5

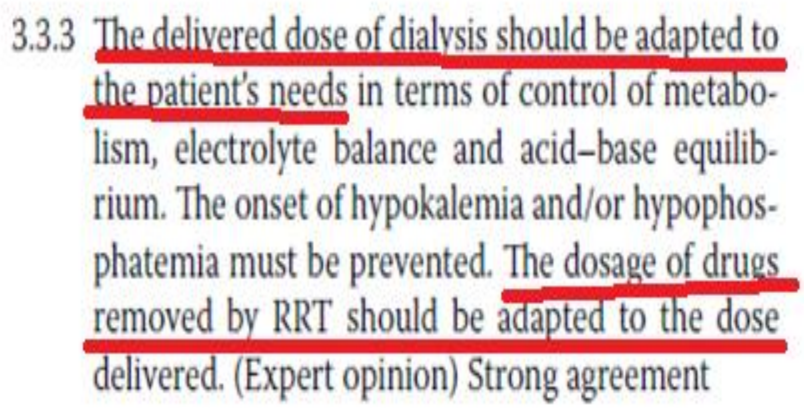
Annals of Intensive Care
a SpringerOpen Journal

REVIEW **Open Access**

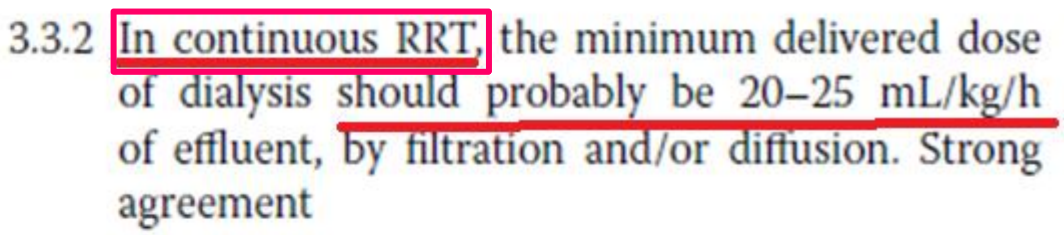
Renal replacement therapy in adult and pediatric intensive care



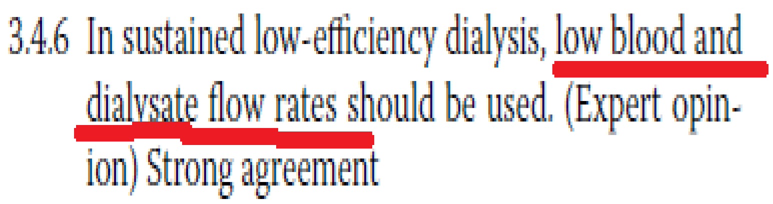
3.3.1 In intermittent RRT the minimum delivered dose of dialysis should probably be (1) three sessions per week of at least 4 h with a blood flow >200 mL/min and a dialysate flow >500 mL/min, or (2) a Kt/V index >3.9 per week, or (3) maintenance of a predialysis urea concentration of 20–25 mmol/L. Strong agreement



3.3.3 The delivered dose of dialysis should be adapted to the patient's needs in terms of control of metabolism, electrolyte balance and acid–base equilibrium. The onset of hypokalemia and/or hypophosphatemia must be prevented. The dosage of drugs removed by RRT should be adapted to the dose delivered. (Expert opinion) Strong agreement



3.3.2 In continuous RRT, the minimum delivered dose of dialysis should probably be 20–25 mL/kg/h of effluent, by filtration and/or diffusion. Strong agreement



3.4.6 In sustained low-efficiency dialysis, low blood and dialysate flow rates should be used. (Expert opinion) Strong agreement

Dose de dialyse recommandée

Quelle voie d’accès choisir?

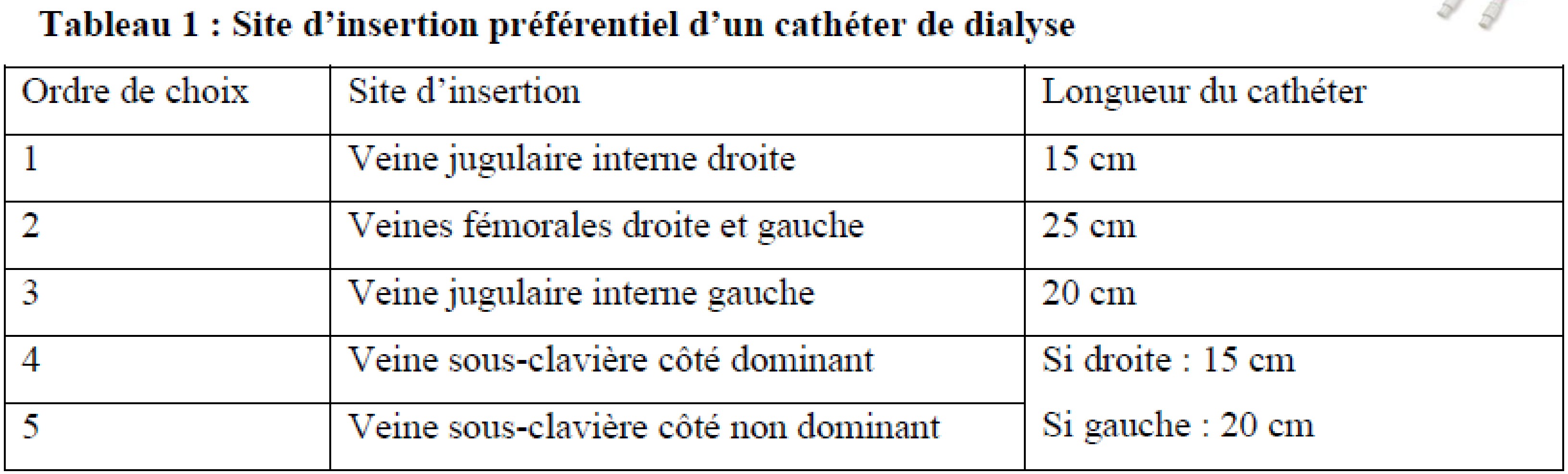
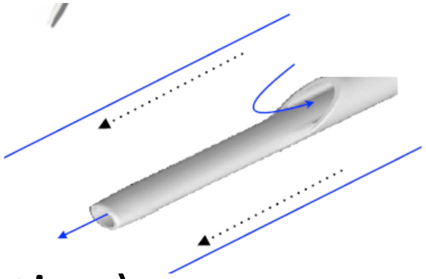


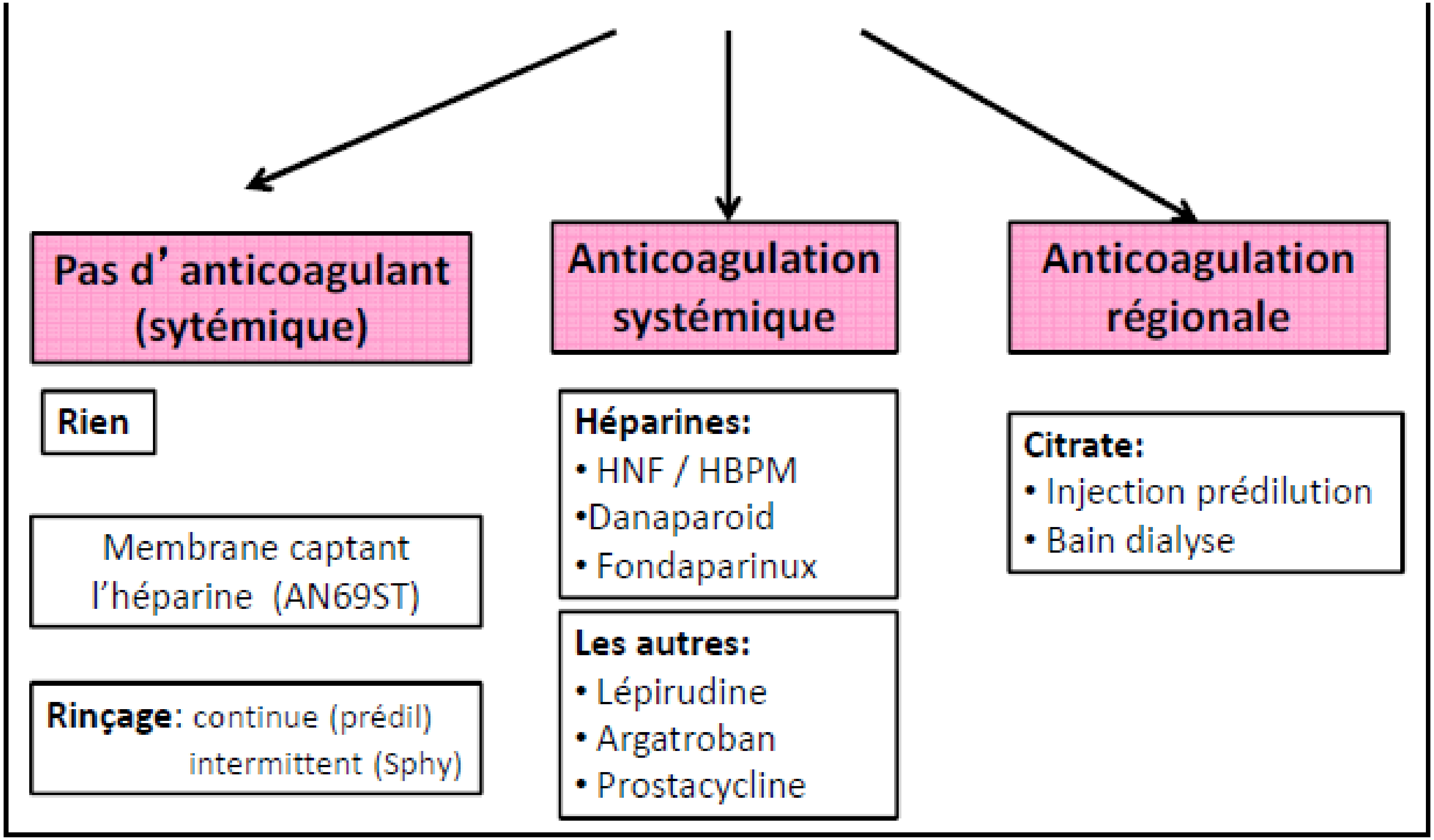
Tableau 1 : Site d’insertion préférentiel d’un cathéter de dialyse

Ordre de choix	Site d’insertion	Longueur du cathéter
1	Veine jugulaire interne droite	15 cm
2	Veines fémorales droite et gauche	25 cm
3	Veine jugulaire interne gauche	20 cm
4	Veine sous-clavière côté dominant	Si droite : 15 cm Si gauche : 20 cm
5	Veine sous-clavière côté non dominant	

- Diamètre externe (12-16 Fr soit 4-5.3 mm)
- Extrémité: canon de fusil
- Distance orifice proximal-distal: 2-3 cm (recirculation)
- Déconseiller l’inversion des voies (embolie gazeuse)
- Mise en place écho-guidée



Comment prévenir la coagulation du circuit?



Pas d' anticoagulant (sytémique)

Rien

Membrane captant l'héparine (AN69ST)

Rinçage: continue (prédil)
intermittent (Sphy)

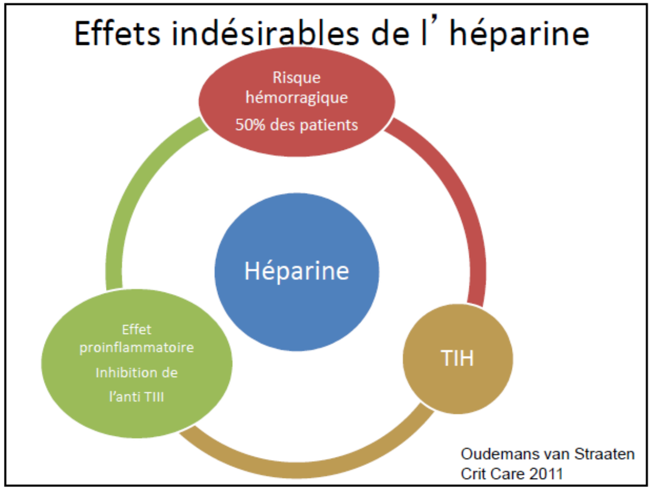
Anticoagulation systémique

Héparines:
- HNF / HBPM
- Danaparoid
- Fondaparinux

Les autres:
- Lépirudine
- Argatroban
- Prostacycline

Anticoagulation régionale

Citrate:
- Injection prédilution
- Bain dialyse



Effets indésirables de l’héparine

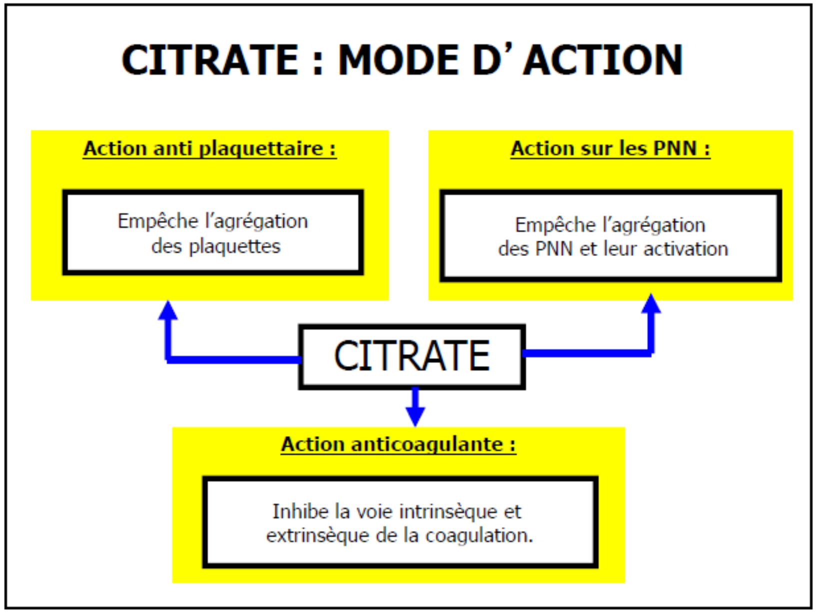
Héparine

Risque hémorragique
50% des patients

TIH

Effet proinflammatoire
Inhibition de l’anti TIII

Oudemans van Straaten
Crit Care 2011



CITRATE : MODE D’ACTION

CITRATE

Action anti plaquettaire :
Empêche l’agrégation des plaquettes

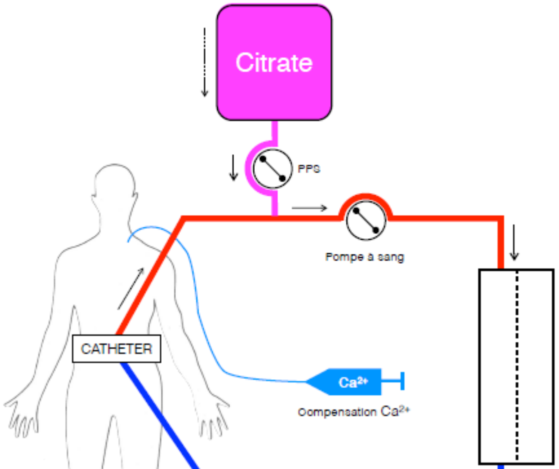
Action sur les PNN :
Empêche l’agrégation des PNN et leur activation

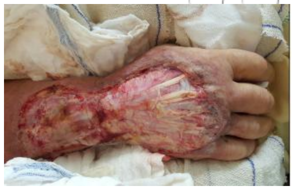
Action anticoagulante :
Inhibe la voie intrinsèque et extrinsèque de la coagulation.

L’anticoagulation en CRRT

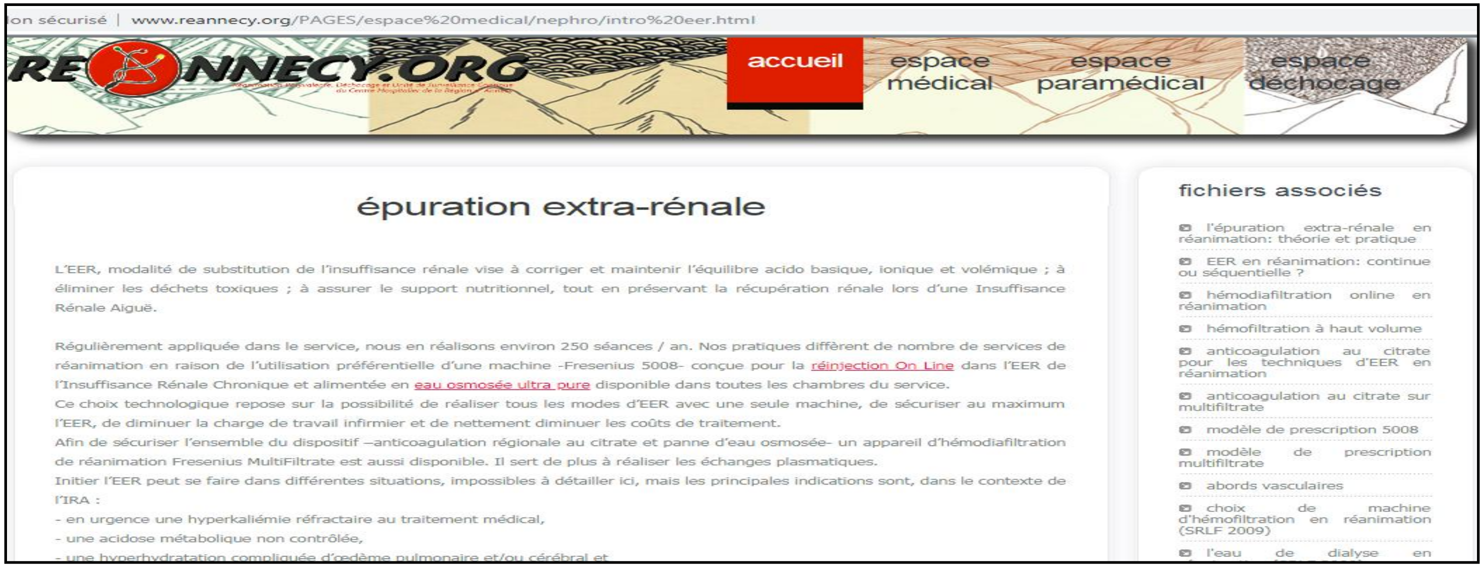
Prismocitrate 18/0

- Anticoagulation régionale au citrate est fortement recommandée (recommandations d’experts)
  - Une augmentation de la demi-vie des hémofiltres
  - Une optimisation de la dose d’épuration
  - Une meilleure stabilité des MDCS administrés
  - Une diminution des complications hémorragiques
  - Qq complications métaboliques (surdosage en citrate)
  - CI: situations de dysfonction mitochondriales (IHC)
  - mais apport continu de calcium (++KVC),
  - contrôle strict du calcium ionisé en post filtre (≈ 0,3 mmol/l) et en plasmatique (≈1 mmol/l)
  - **Expertise de l’équipe**


Citrate
PPS
Pompe à sang
CATHETER
Ca²⁺
Compensation Ca²⁺



Dialyse= travail d'équipe apprentissage/compétences techniques


on sécurisé | www.reannecy.org/PAGES/espace%20medical/nephro/intro%20eer.html
REANNECY.ORG
accueil
espace médical
espace paramédical
espace déchocage

épuration extra-rénale

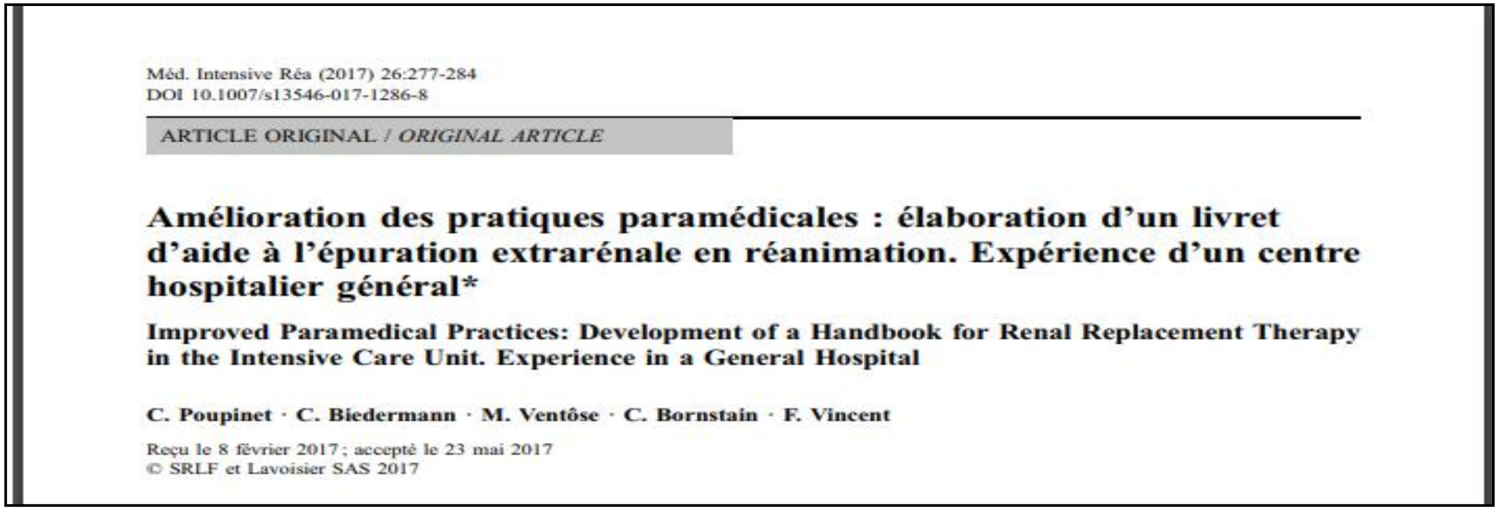
L'EER, modalité de substitution de l'insuffisance rénale vise à corriger et maintenir l'équilibre acido basique, ionique et volémique ; à éliminer les déchets toxiques ; à assurer le support nutritionnel, tout en préservant la récupération rénale lors d'une Insuffisance Rénale Aiguë.

Régulièrement appliquée dans le service, nous en réalisons environ 250 séances / an. Nos pratiques diffèrent de nombre de services de réanimation en raison de l'utilisation préférentielle d'une machine -Fresenius 5008- conçue pour la réinjection On Line dans l'EER de l'Insuffisance Rénale Chronique et alimentée en eau osmosée ultra pure disponible dans toutes les chambres du service.
Ce choix technologique repose sur la possibilité de réaliser tous les modes d'EER avec une seule machine, de sécuriser au maximum l'EER, de diminuer la charge de travail infirmier et de nettement diminuer les coûts de traitement.
Afin de sécuriser l'ensemble du dispositif –anticoagulation régionale au citrate et panne d'eau osmosée- un appareil d'hémodiafiltration de réanimation Fresenius MultiFiltrate est aussi disponible. Il sert de plus à réaliser les échanges plasmatiques.
Initier l'EER peut se faire dans différentes situations, impossibles à détailler ici, mais les principales indications sont, dans le contexte de l'IRA :

- en urgence une hyperkaliémie réfractaire au traitement médical,
- une acidose métabolique non contrôlée,
- une hyperhydratation compliquée d'œdème pulmonaire et/ou cérébral et

fichiers associés

- l'épuration extra-rénale en réanimation: théorie et pratique
- EER en réanimation: continue ou séquentielle ?
- hémodiafiltration online en réanimation
- hémofiltration à haut volume
- anticoagulation au citrate pour les techniques d'EER en réanimation
- anticoagulation au citrate sur multifiltrate
- modèle de prescription 5008
- modèle de prescription multifiltrate
- abords vasculaires
- choix de machine d'hémofiltration en réanimation (SRLF 2009)
- l'eau de dialyse en



Méd. Intensive Réa (2017) 26:277-284
DOI 10.1007/s13546-017-1286-8

ARTICLE ORIGINAL / *ORIGINAL ARTICLE*

Amélioration des pratiques paramédicales : élaboration d'un livret d'aide à l'épuration extrarénale en réanimation. Expérience d'un centre hospitalier général*

Improved Paramedical Practices: Development of a Handbook for Renal Replacement Therapy in the Intensive Care Unit. Experience in a General Hospital

C. Poupinet · C. Biedermann · M. Ventôse · C. Bornstain · F. Vincent

Reçu le 8 février 2017 ; accepté le 23 mai 2017
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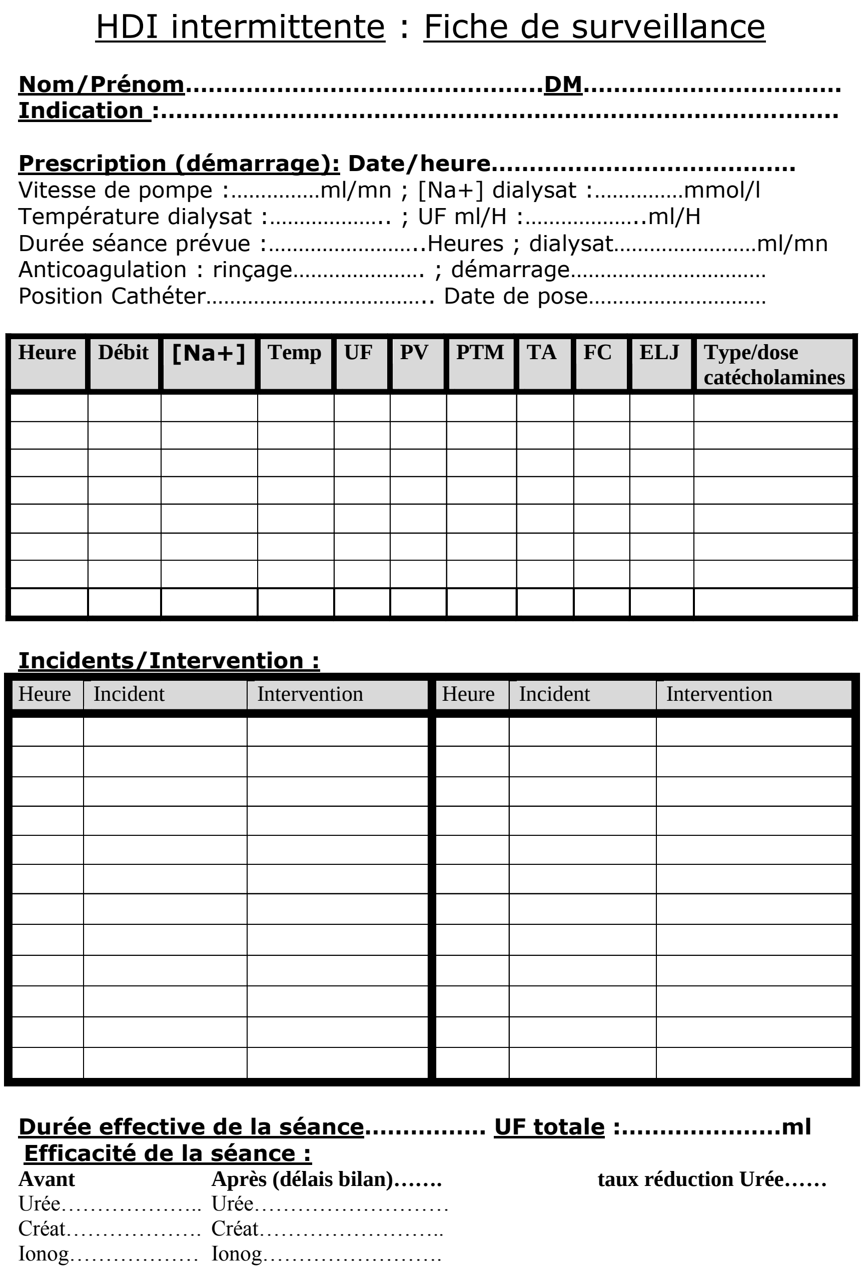


HDI intermittente : Fiche de surveillance

Nom/Prénom………………………………………**DM**……………………………
Indication :…………………………………………………………………………

Prescription (démarrage): Date/heure…………………………………
Vitesse de pompe :……………ml/mn ; [Na+] dialysat :……………mmol/l
Température dialysat :……………….. ; UF ml/H :………………..ml/H
Durée séance prévue :……………………..Heures ; dialysat……………………ml/mn
Anticoagulation : rinçage………………… ; démarrage……………………………
Position Cathéter……………………………….. Date de pose………………………

Heure	Débit	[Na+]	Temp	UF	PV	PTM	TA	FC	ELJ	Type/dose catécholamines

Incidents/Intervention :

Heure	Incident	Intervention	Heure	Incident	Intervention

Durée effective de la séance……………. **UF totale :**…………………**ml**
Efficacité de la séance :

Avant	Après (délais bilan)…….	taux réduction Urée……
Urée………………..	Urée………………………	
Créat………………	Créat……………………..	
Ionog………………	Ionog…………………….	

Procédures écrites fiches de surveillance standardisée

République Tunisienne
Ministère de la santé publique
VICE DE REANIMATION MEDICALE

Fiche de surveillance : Epuration extra-rénale continue

Nom :
Prénom :
DM :
Date :

KT posé le :
Rein changé le :
Anticoagulant :
poids :

Vitesse de pompe :
Dialysât :
Ultra-filtrat :
Pertes :

CVVH ☐
CVV HDF ☐
SCUF ☐

Heure	**Prescription**						**Malade**							
	Débit Sang	**PPS**	**Pertes**	**Pré/post dilution**	**Dialysât**	**Réinjection**	**PV**	**PA**	**PTM**	**Réinject°**	**Dialysât**	**Pertes cumulée**	**PA S/D/M**	**Dose catéchol**
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
1														
2														
3														
4														
5														
6														
7														
Bilan														

La récupération rénale

Meilleurs critères d’arrêt de dialyse seraient
- reprise diurèse ≥ 1l sans diurétique,
- stabilisation de la fonction rénale
- Clairance rénale urinaire créat /urée

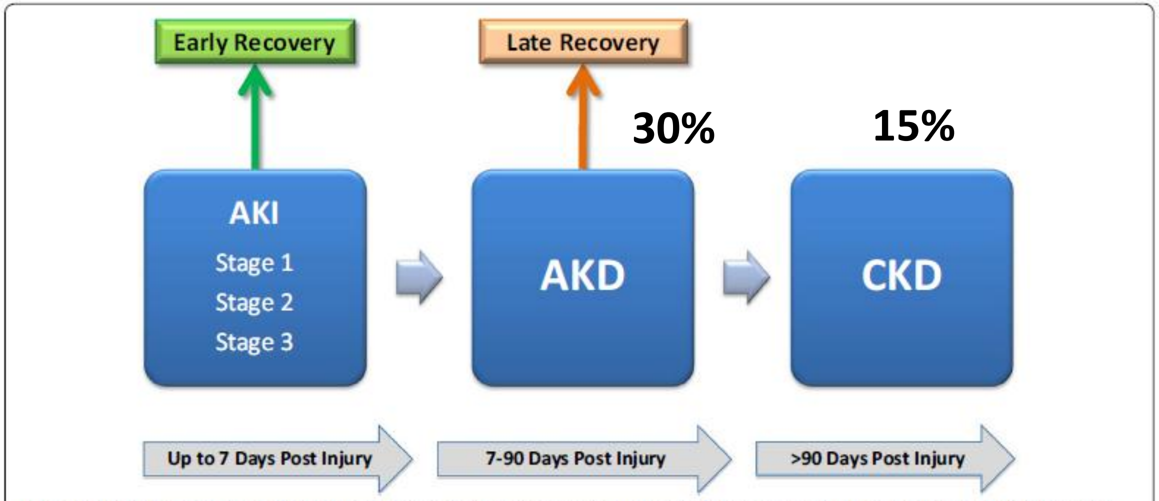
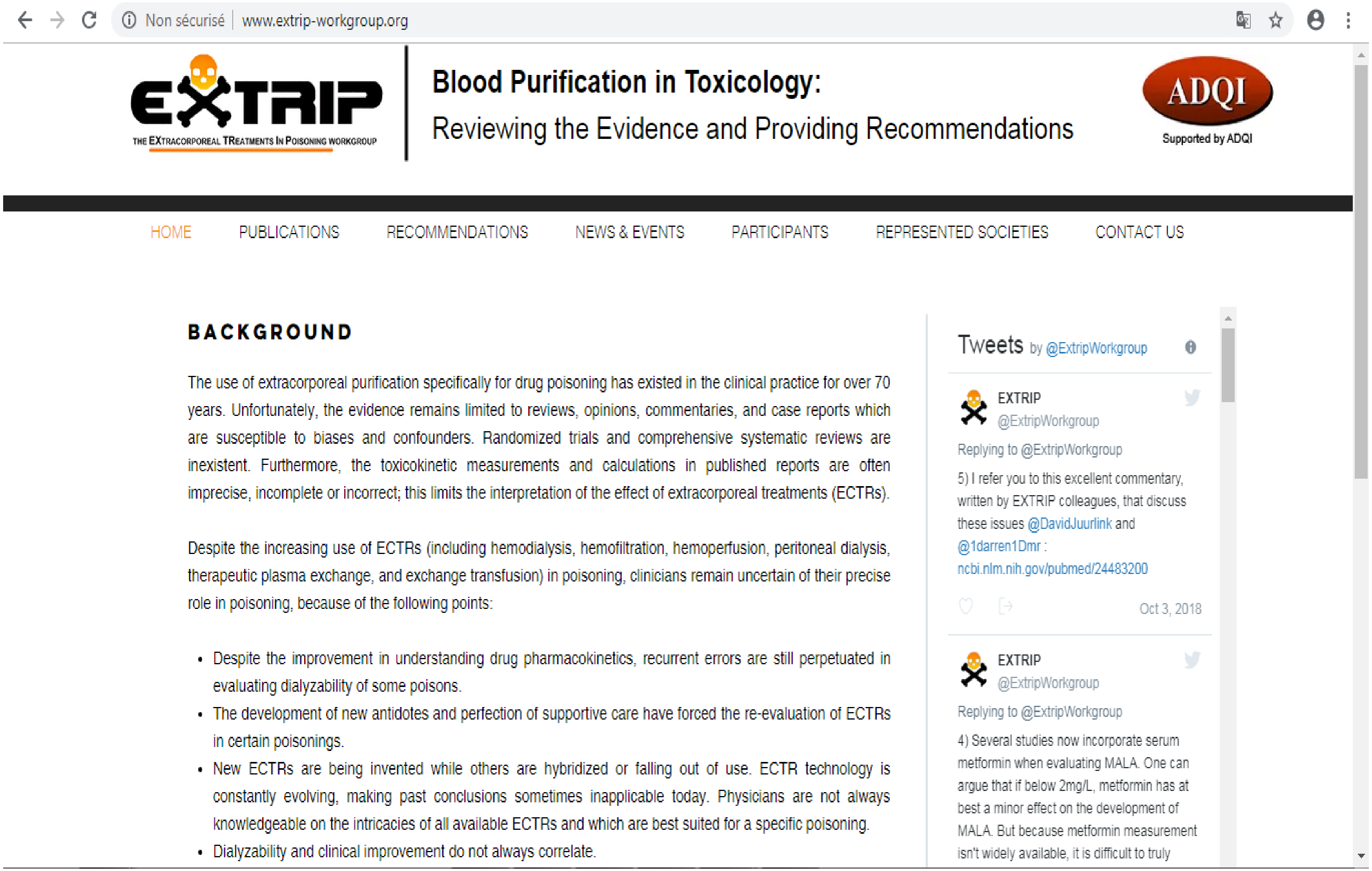

Early Recovery
Late Recovery
30%
15%
AKI
Stage 1
Stage 2
Stage 3
AKD
CKD
Up to 7 Days Post Injury
7-90 Days Post Injury
>90 Days Post Injury

Fig. 3 AKI, AKD, CKD and time course of recovery. Recovery may occur early during acute kidney injury (AKI) up to 7 days after the insult, or later during acute kidney disease (AKD), between 7 days and 3 months after the insult to the kidney

Pronostic à long terme si passage en IRC
- Augmentation de la morbi-mortalité
- Surcoût de santé
- Diminution de la qualité de vie

EER des toxiques

t (http://www.extrip-workgroup.org).



Blood Purification in Toxicology:

Reviewing the Evidence and Providing Recommendations

BACKGROUND

The use of extracorporeal purification specifically for drug poisoning has existed in the clinical practice for over 70 years. Unfortunately, the evidence remains limited to reviews, opinions, commentaries, and case reports which are susceptible to biases and confounders. Randomized trials and comprehensive systematic reviews are inexistent. Furthermore, the toxicokinetic measurements and calculations in published reports are often imprecise, incomplete or incorrect; this limits the interpretation of the effect of extracorporeal treatments (ECTRs).

Despite the increasing use of ECTRs (including hemodialysis, hemofiltration, hemoperfusion, peritoneal dialysis, therapeutic plasma exchange, and exchange transfusion) in poisoning, clinicians remain uncertain of their precise role in poisoning, because of the following points:

- Despite the improvement in understanding drug pharmacokinetics, recurrent errors are still perpetuated in evaluating dialyzability of some poisons.
- The development of new antidotes and perfection of supportive care have forced the re-evaluation of ECTRs in certain poisonings.
- New ECTRs are being invented while others are hybridized or falling out of use. ECTR technology is constantly evolving, making past conclusions sometimes inapplicable today. Physicians are not always knowledgeable on the intricacies of all available ECTRs and which are best suited for a specific poisoning.
- Dialyzability and clinical improvement do not always correlate.

Tweets by @ExtripWorkgroup

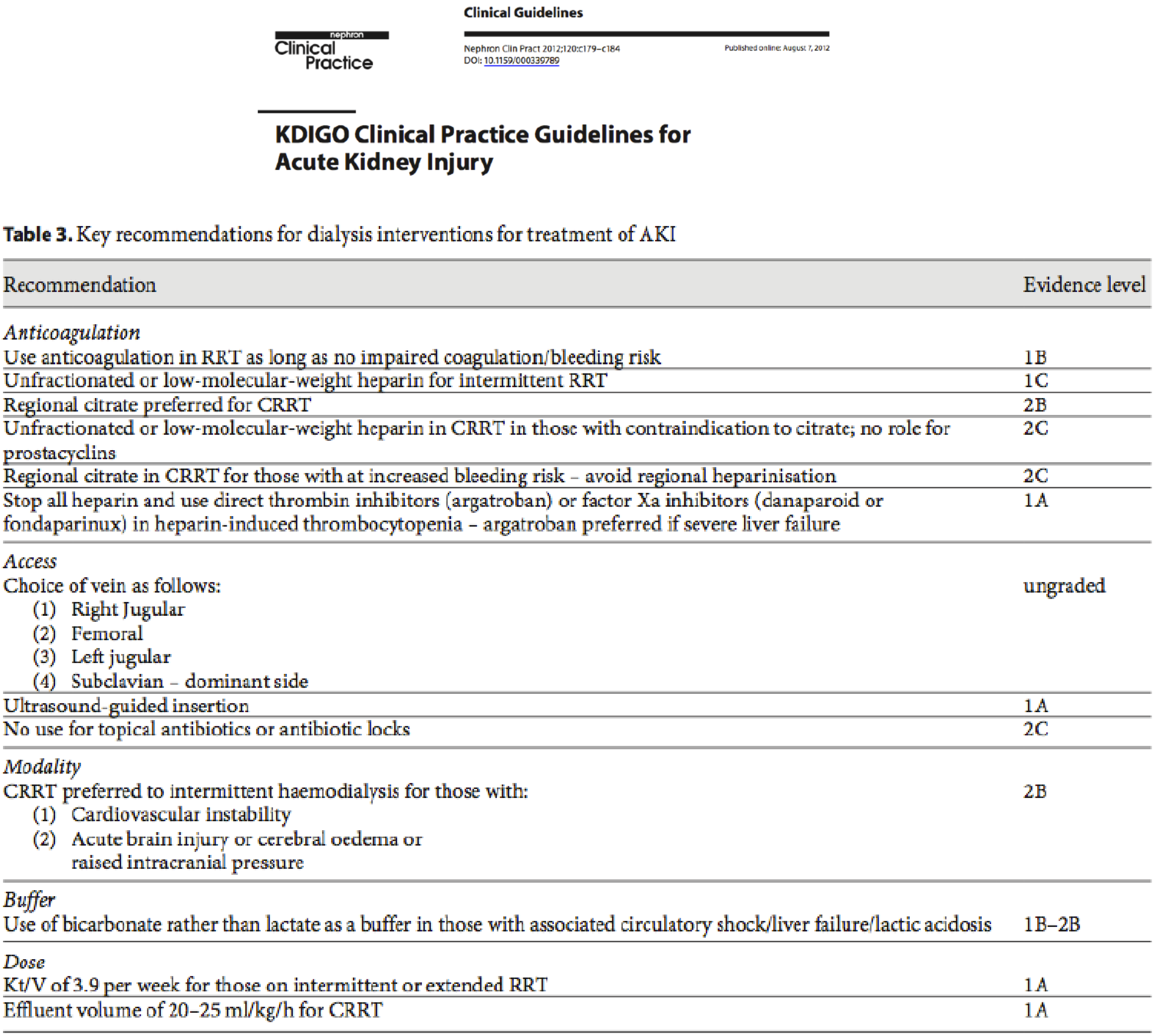
EXTRIP
@ExtripWorkgroup
Replying to @ExtripWorkgroup

5) I refer you to this excellent commentary, written by EXTRIP colleagues, that discuss these issues @DavidJuurlink and @1darren1Dmr : ncbi.nlm.nih.gov/pubmed/24483200

Oct 3, 2018

EXTRIP
@ExtripWorkgroup
Replying to @ExtripWorkgroup

4) Several studies now incorporate serum metformin when evaluating MALA. One can argue that if below 2mg/L, metformin has at best a minor effect on the development of MALA. But because metformin measurement isn't widely available, it is difficult to truly



nephron
Clinical Practice

Clinical Guidelines

Nephron Clin Pract 2012;120:c179–c184
DOI: 10.1159/000339789

Published online: August 7, 2012

KDIGO Clinical Practice Guidelines for Acute Kidney Injury

Table 3. Key recommendations for dialysis interventions for treatment of AKI

Recommendation	Evidence level
Anticoagulation	
Use anticoagulation in RRT as long as no impaired coagulation/bleeding risk	1B
Unfractionated or low-molecular-weight heparin for intermittent RRT	1C
Regional citrate preferred for CRRT	2B
Unfractionated or low-molecular-weight heparin in CRRT in those with contraindication to citrate; no role for prostacyclins	2C
Regional citrate in CRRT for those with at increased bleeding risk – avoid regional heparinisation	2C
Stop all heparin and use direct thrombin inhibitors (argatroban) or factor Xa inhibitors (danaparoid or fondaparinux) in heparin-induced thrombocytopenia – argatroban preferred if severe liver failure	1A
Access	
Choice of vein as follows: (1) Right Jugular (2) Femoral (3) Left jugular (4) Subclavian – dominant side	ungraded
Ultrasound-guided insertion	1A
No use for topical antibiotics or antibiotic locks	2C
Modality	
CRRT preferred to intermittent haemodialysis for those with: (1) Cardiovascular instability (2) Acute brain injury or cerebral oedema or raised intracranial pressure	2B
Buffer	
Use of bicarbonate rather than lactate as a buffer in those with associated circulatory shock/liver failure/lactic acidosis	1B–2B
Dose	
Kt/V of 3.9 per week for those on intermittent or extended RRT	1A
Effluent volume of 20–25 ml/kg/h for CRRT	1A

conclusion

- La meilleure épuration est celle qui est adaptée au malade et la mieux maitrisée par l’équipe
- Timing: pas trop tôt ni trop tard
- Objectif en EER: 20-25 ml/kg/h en EER continue et 3,9 Kt/v en HDI
- Anticoagulation: expertise de l’équipe
- Techniques hybrides : bon compromis

Mieux vaut prévenir que guérir

Aknowledgment