

Les Diurétiques en Réanimation: PRO

Dr Raphaël CINOTTI Congrès SFAR Jeudi 23 Septembre



Conflits d'intérêts

Néant •



Indications

- Insuffisance cardiaque aiguë et chronique
- Œdème pulmonaire cardiogénique
- Hypertension artérielle
- Insuffisance rénale aiguë et chronique
- Divers: hyperkaliémie, hypercalcémie

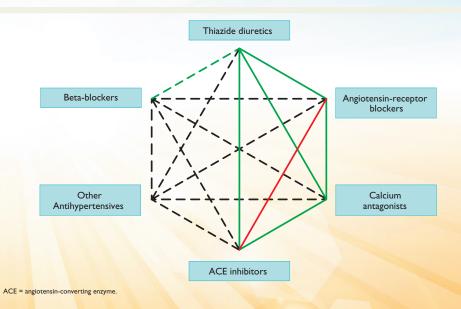
Cardiologie - HTA

Treatment strategies and choice of drugs

SFAR 23 du 23 au 25 PALAIS Beptembre 2021 DE PARIS

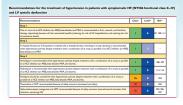
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Recommendations	Class ^a	Level ^b	Ref. ^c
Diuretics (thiazides, chlorthalidone and indapamide), beta-blockers, calcium antagonists, ACE inhibitors, and angiotensin receptor blockers are all suitable and recommended for the initiation and maintenance of antihypertensive treatment, either as monotherapy or in some combinations with each other.	I	A	284, 332



ESH/ESC Eur Heart Journal 2013

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The effects of diuretics on mortality and morbidity have not been studied in patients with HF, unlike ACE inhibitors, betablockers, and MRAs (and other treatments). However, diuretics relieve dyspnoea and oedema and are recommended for this reason in patients with signs and symptoms of congestion, irrespective of EF. Table 16Doses of diuretics commonly used to treatheart failure (with and without a preserved ejectionfraction, chronic and acute)

Diuretics	Initial dose	Initial dose (mg)		dose (mg)
Loop diuretics ^a	1		1	
Furosemide	20-40		40-240	
Bumetanide	0.5-1.0		I5	
Torasemide	5–10		10-20	
Thiazides [⊾]				
Bendroflumethiazide	2.5	2.5		
Hydrochlorothiazide	25		12.5–100	
Metolazone	2.5		2.5–10	
Indapamide ^c	2.5	2.5		
Potassium-sparing di	uretics ^d			
	+ACEi/ ARB	-ACEi/ ARB	+ACEi/ ARB	-ACEi/ ARB
Spironolactone/ eplerenone	12.5–25	50	50	100-200
Amiloride	2.5	5	5–10	10-20
Triamterene	25	50	100	200

ESC Eur Heart Journal 2012 WWW.SFAR-LECONGRES.COM

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Table 16 Doses of diuretics commonly used to treat heart failure (with and without a preserved ejection fraction, chronic and acute)

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Diuretics	Initial dos	e (mg)	Usual dail	y dose (mg)	
Loop diuretics*					
Furosemide	20-40		40-240		
Bumetanide	0.5-1.0		I-5		
Torasemide	5-10		10-20		
Thiazides ⁶					
Bendroflumethiazide	2.5		2.5-10		
Hydrochlorothiazide	25	25		12.5-100	
Metolazone	2.5	2.5		2.5-10	
Indapamide	2.5	2.5			
Potassium-sparing d	iuretics ^d				
	+ACEi/ ARB	-ACEi/ ARB	+ACEi/ ARB	-ACEi/ ARB	
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The effects of diuretics on mortality and morbidity have not been studied in patients with HF, unlike ACE inhibitors, betablockers, and MRAs (and other treatments). However, diuretics relieve dyspnoea and oedema and are recommended for this reason in patients with signs and symptoms of congestion, irrespective of EF. Recommendations for the treatment of hypertension in patients with symptomatic HF (NYHA functional class II-IV) and LV systolic dysfunction

Recommendations	Class ^a	Level ^b	Ref ^c
Step I			
One or more of an ACE inhibitor (or ARB), beta-blocker, and MRA is recommended as first-, second-, and third-line therapy, respectively, because of their associated benefits (reducing the risk of HF hospitalization and reducing the risk of premature death).	I	А	87, 108–111
Step 2			
A thiazide diuretic (or if the patient is treated with a thiazide diuretic, switching to a loop diuretic) is recommended when hypertension persists despite treatment with a combination of as many as possible of an ACE inhibitor (or ARB), beta-blocker, and MRA.	I	С	-
Step 3			
Amlodipine is recommended when hypertension persists despite treatment with a combination of as many as possible of an ACE inhibitor (or ARB), beta-blocker, MRA, and diuretic.	T	А	188, 189
Hydralazine is recommended when hypertension persists despite treatment with a combination of as many as possible of an ACE inhibitor (or ARB), beta-blocker, MRA, and diuretic.	I	А	114-116
Felodipine should be considered when hypertension persists despite treatment with a combination of as many as possible of an ACE inhibitor (or ARB), beta-blocker, MRA, and diuretic.	lla	В	204
Moxonidine is NOT recommended because of safety concerns (increased mortality).	Ш	В	203
Alpha-adrenoceptor antagonists are NOT recommended because of safety concerns (neurohumoral activation, fluid retention, worsening HF).	ш	А	202, 206, 207

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 Table 16
 Doses of diuretics commonly used to treat heart failure (with and without a preserved ejection fraction, chronic and acute)

Diuretics	Initial dose	e (mg)	Usual daily	dose (mg)
Loop diuretics*				
Furosemide	20-40		40-240	
Bumetanide	0.5-1.0		I-5	
Torasemide	5-10		10-20	
Thiazides ⁶				
Bendroflumethiazide	2.5		2.5-10	
Hydrochlorothiazide	25		12.5-100	
Metolazone	2.5		2.5-10	
Indapamide ^c	2.5		2.5-5	
Potassium-sparing di	uretics ^d			
	+ACEi/ ARB	-ACEi/ ARB	+ACEi/ ARB	-ACEi/ ARB
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Néphrologie – IRC et IRA

Medication Choices

SFAR

8.1.4-1. Simultaneous use of an ACE inhibitor, ARB, and/or renin inhibitor is potentially harmful and is not recommended to treat adults with hypertension. (COR III: Harm, LOE A)

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8.1.6-1. For initiation of antihypertensive drug therapy, firstline agents include thiazide diuretics, CCBs, and ACE inhibitors or ARBs. (COR I, LOE A^{SR})

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).

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En réanimation

Comment utilisez-vous les diurétiques?

- Sevrage VM
- Surcharge hydro-sodée
- Insuffisance rénale oligurique
- Hyperkaliémie



Table 2. Furosemide Dose

1 74.27±7.48 (133) 2 72.46±6.65 (146)

3 65.28±6.49 (140)

4 80.74±10.23 (129) 5 73.06±8.41 (119)

6 58.20±6.68 (106)

7 51.03±4.31 (87)

Furos Liberal

mg/24 hr (no

Conservativ Strategy

25.5

14.6±0.5

0.9±0.1

13.4+0.4

===

Day

Table 3. Main Outcome Variab

Death at 60 days (%)

ICU-free days? Days 1 to 7

Days 1 to 28

Ventilator-free days from day 1 to o



Ventilation mécanique

MAP ≥60 mm Hg without vasopressors

	Measur	ed intravascu	lar pressure (m	ım Hg)	MAP		MAP ≥60 mm Hg w (except dopamin	ithout vasopressors e ≤5 µg/kg/min)	
ose, Fluid Intake, Fluid C	CV	Ρ	PAC)p _G	<60 mm Hg or a need for any vasopressor	Average urinary ou	tput <0.5 ml/kg/hr	Average urinary ou	tput ≥0.5 ml/kg/hr
rosemide Conservative (no. of patients) 148.944.8.52 (312) 157.35±8.91 (304) 165.90±10.01 (269) 1) 154.25±10.61 (228) 164.7±12.06 (197) 158.87±13.45 (165) 127.86±11.61 (137)	Conservative strategy	Liberal strategy	Conservative strategy	Liberal strategy	(except dopamine ≤5 μg/kg/min); consider cor- rectable causes of shock first	Ineffective Circulation Cardiac index <2.5 liters/min/m ² or cold, mottled skin with capillary- refilling time >2 sec	Effective Circulation Cardiac index ≥2.5 liters/min/m ² or absence of criteria for ineffec- tive circulation	Ineffective Circulation Cardiac index <2.5 liters/min/m ² or cold, mottled skin with capillary- refilling time >2 sec	Effective Circulation Cardiac index ≥2.5 liters/min/m ² or absence of criteria for ineffec- tive circulation
tive Liberal ry Strategy P Value		Rar	ige 1		1 Vasopressor ^F Fluid bolus ^F	3 KVO IV Dobutamine ^A Furosemide ^{B,1,2,4}	7 KVO IV Furosemide ^{B,1,2,4}	11 KVO IV Dobutamine ^A Furosemide ^{B,1,3,4}	15 KVO IV Furosemide ^{B,1,3,4}
28.4 0.30 5 12.1:0.5 <0.001	>13	>18	>18	>24		r drosennde / / /		Turosennue / //	
1 0.6=0.1 <0001 4 11.2=0.4 <0001		Rar	ige 2			4 KVO IV Dobutamine ^A	8 KVO IV Furosemide ^{B,1,2,4}	12 KVO IV Dobutamine ^A	Furosemide ^{B,1,3,4}
An annual of steps Manual States Markan States M	9–13	15-18	13–18	19–24					
A b b b		Rar	ige 3		2 Fluid bolus ^F Vasopressor ^F	5 Fluid bolus ^C	9 Fluid bolus ^C	13 Fluid bolus ^C	17 Liberal KVO IV
A LOUIS	4–8	10–14	8-12	14–18					18 Conservative Furosemide ^{B,1,3,4}
		Rar	ige 4			<mark>6</mark> Fluid bolus ^C	10 Fluid bolus ^C	14 Fluid bolus ^C	19 Liberal fluid bolus
	<4	<10	<8	<14					20 Conservative KVO IV

ARDS network NEJM 2006

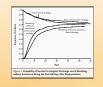




Ventilation mécanique

Menne	al interests	iar pressure (r	ue Hgj	MAP 100 mm Hz		MAP all non Hg u (recept departie	ident sampresses e ul. pg(kg(mir)	
c	e	PAG	2 per	or a rand for	horage uninary su	iput (0.5 mijlig)br	Jumpy seinary m	iput sû 1 mi/kg
Conservative sitrategy	Liberal strategy	Communities vinuings	Liberal sinulegy	prompt departies of pg/sig/wing metable courses of check first	ar sold, mattled skin with sapillary relifing time 12 uni	Effective Circulation Contactinities a2.1 liters/miniper or absence of estimate for ineffec- tive circulation	Intélective Circulation Cardiac index 12.5 liten; (min)/or 13.5 liten; (min)/or 14.5 million; (min)/or 14.5 millio	Effective Considerition Cantilace inder e2.11 liters, innin, or alterature o estimate for inself time strengture
	Fac.	ge 1		Veroproter' Fluid Indust	EVO // Dobutamine*	and the second se	Exilority Exiloritamine ⁴ Exceptionide ⁴¹¹¹	Puncusmida
-13	-18	-18	+24					_
	Range 2				EVO // Debutamina*	EVO /V Faranemide****	Deladamine*	Summer lief
9.11	11.18	13.18	18.24	1				_
	la:	φr1		Versperson*	Paul Indus*	• Phot Indus*	13 Plaid Indus*	KIO N
6.8	10.14	8-12	14-18					E Conservation Functionality*
	la:	gr á			Faid belos"	22 Plaid Indas"	14 Plant Indus"	State and State
-4	-10	-8	+14	1				Conservation KVO //

Table 3. Main Outcome Variable	:\$. ⁰		
Dutcome	Conservative Strategy	Liberal Strategy	P Value
Death at 60 days (%)	25.5	28.4	0.30
from day 1 to day 28†	14.6±0.5	12.1±0.5	< 0.001
CU-free days†			
ays 1 to 7	0.9±0.1	0.6±0.1	< 0.001
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Day	Furo	semide
	Liberal	Conservative
	mg/24 hr (1	no. of patients)
1	74.27±7.48 (133)	148.94±8.52 (312)
2	72.46±6.65 (146)	157.35±8.91 (304)
3	65.28±6.49 (140)	166.90±10.01 (269)
4	80.74±10.23 (129)	154.25±10.61 (228)
5	73.06±8.41 (119)	164.71±12.06 (197)
6	58.20±6.68 (106)	15 <mark>8.87±13.45</mark> (165)
7	51.03±4.31 (87)	127.86±11.61 (137)

ARDS network NEJM 2006

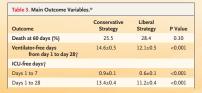


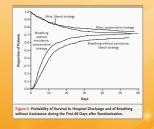
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Ventilation mécanique

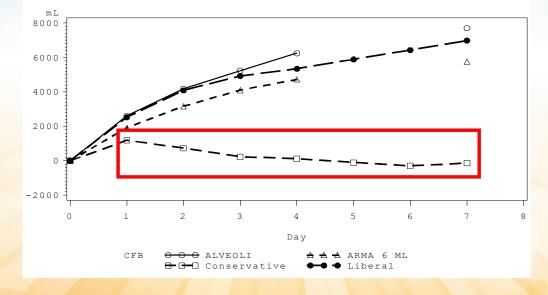


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Supplemental Figure 1. Cumulative Fluid Balance

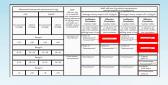


ARDS network NEJM 2006





Ventilation mécanique



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Table 3. Main Outcome Variables.*					
Outcome	Conservative Strategy	Liberal Strategy	P Value		
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Ventilator-free days from day 1 to day 28†	14.6±0.5	12.1±0.5	<0.001		
ICU-free days†					
Days 1 to 7	0.9±0.1	0.6±0.1	<0.001		
Days 1 to 28	13.4±0.4	11.2±0.4	< 0.001		



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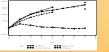
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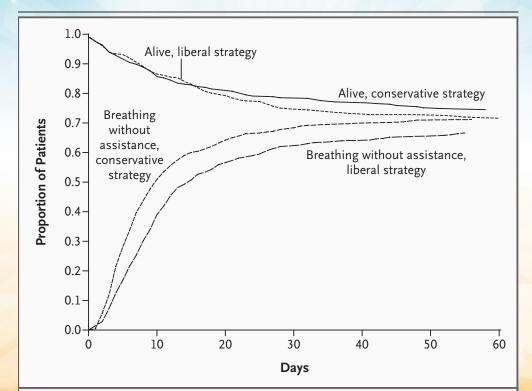


Figure 3. Probability of Survival to Hospital Discharge and of Breathing without Assistance during the First 60 Days after Randomization.

ARDS network NEJM 2006

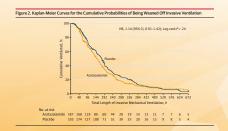




Ventilation mécanique

Table 1. Characteristics of the Patients at Baseline

	Group, Median (Interquartile				
Variable	Acetazolamide (n = 187)	Placebo (n = 193)	Between-Group Difference (95% CI)	P Value	
Primary Outcome					
Duration of invasive ventilation, h	136.5 (68.7 to 234.7)	163 (86.2 to 242.9)	-16.0 (-36.5 to 4.0)	.17	
Secondary Outcomes ^b					
Daily					
Serum bicarbonate change, mEq/L	-0.3 (-1.0 to 0.4)	0.3 (-0.2 to 1.3)	-0.8 (-1.2 to -0.5)	<.001	
Paco ₂ change, mm Hg	-0.5 (-2.0 to 0.8)	-0.2 (-1.4 to 1)	-0.3 (-0.8 to 0.2)	.25	
pH change	0 (-0.01 to 0.02)	0.01 (0 to 0.02)	-0.01 (-0.01 to -0.0)	.008	
Pao ₂ :Fio ₂ -ratio change, mm Hg	7.8 (-1.5 to 20.5)	3.5 (-5.2 to 13.9)	4.6 (0.6 to 8.6)	.009	
Respiratory rate change, cycle/min	0.1 (-0.8 to 1.0)	0.3 (-0.3 to 1.4)	-0.3 (-0.7 to 0.0)	.10	
Tidal volume change, mL	4.1 (-7.1 to 28.0)	3.8 (-8.6 to 19.4)	1.3 (-4.2 to 7.5)	.72	
Volume-minute change, L/min	0.2 (-0.2 to 0.8)	0.2 (-0.1 to -0.6)	0.0 (-0.2 to 0.2)	.72	
Weaning duration, h	18.7 (3.0 to 46.5)	22.0 (3.0 to 44.3)	-0.9 (-4.3 to 1.3)	.36	
Spontaneous breathing trials, d	1 (1 to 2)	1 (1 to 2)	0 (0 to 0)	.42	
Tracheotomy, median (range), d	0 (0 to 21)	0 (0 to 9)	0 (0 to 0)	.67	
Endotracheal intubation, No. (%)	187 (100)	192 (99.5)	0.05 (-0.05 to 1.5)	.99	
Use of noninvasive ventilation after extubation, No. (%)	62 (33.1)	72 (37.3)	-4.2 (-13.8 to 5.5)	.39	
Successful weaning, No. (%)*	118 (74.7)	127 (78.4)	-3.7 (-13.1 to 5.6)	.43	



	Study Group, Mean (SD)		
Characteristic	Acetazolamide (n = 187)	Placebo (n = 193)	
Age, y	69 (10)	69 (11)	
Men, No. (%)	131 (70)	141 (73.1)	
SAPS II score ^a	49.4 (13.9)	50 (15.1)	
SOFA score ^b	7.2 (3.1)	7.1 (3.2)	
BMI	27.2 (8.0)	26.7 (9.1)	

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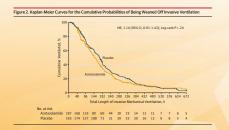


Ventilation mécanique

Table 2. Clinical Outcomes and Serious Adverse Events^a

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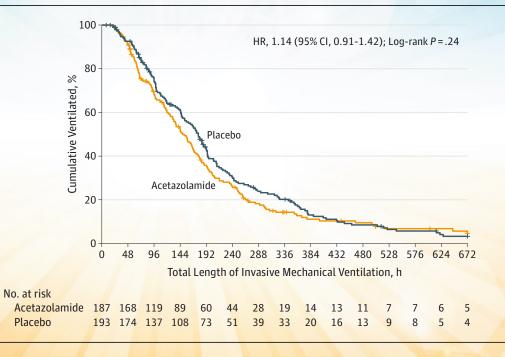
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Ventilation mécanique

Figure 2. Kaplan-Meier Curves for the Cumulative Probabilities of Being Weaned Off Invasive Ventilation

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SAPS II score ^a	49.4 (13.9)	50 (15.1)				
SOFA score ^b	7.2 (3.1)	7.1 (3.2)				
BMI	27.2 (8.0)	26.7 (9.1)				

	Group, Median (Interquartile	e Range)			
Variable	Acetazolamide (n = 187)	Placebo (n = 193)	Between-Group Difference (95% CI)	P Value	
Primary Outcome					
Duration of invasive ventilation, h	136.5 (68.7 to 234.7)	163 (86.2 to 242.9)	-16.0 (-36.5 to 4.0)	.17	
Secondary Outcomes ^b					
Daily					
Serum bicarbonate change, mEq/L	-0.3 (-1.0 to 0.4)	0.3 (-0.2 to 1.3)	-0.8 (-1.2 to -0.5)	<.001	
Paco ₂ change, mm Hg	-0.5 (-2.0 to 0.8)	-0.2 (-1.4 to 1)	-0.3 (-0.8 to 0.2)	.25	
pH change	0 (-0.01 to 0.02)	0.01 (0 to 0.02)	-0.01 (-0.01 to -0.0)	.008	
Pao2:Fio2-ratio change, mm Hg	7.8 (-1.5 to 20.5)	3.5 (-5.2 to 13.9)	4.6 (0.6 to 8.6)	.009	
Respiratory rate change, cycle/min	0.1 (-0.8 to 1.0)	0.3 (-0.3 to 1.4)	-0.3 (-0.7 to 0.0)	.10	
Tidal volume change, mL	4.1 (-7.1 to 28.0)	3.8 (-8.6 to 19.4)	1.3 (-4.2 to 7.5)	.72	
Volume-minute change, L/min	0.2 (-0.2 to 0.8)	0.2 (-0.1 to -0.6)	0.0 (-0.2 to 0.2)	.72	
Weaning duration, h	18.7 (3.0 to 46.5)	22.0 (3.0 to 44.3)	-0.9 (-4.3 to 1.3)	.36	
Spontaneous breathing trials, d	1 (1 to 2)	1 (1 to 2)	0 (0 to 0)	.42	
Tracheotomy, median (range), d	0 (0 to 21)	0 (0 to 9)	0 (0 to 0)	.67	
Endotracheal intubation, No. (%)	187 (100)	192 (99.5)	0.05 (-0.05 to 1.5)	.99	
Use of noninvasive ventilation after extubation, No. (%)	62 (33.1)	72 (37.3)	-4.2 (-13.8 to 5.5)	.39	
Successful wearing, No. (%) ^c	118 (74.7)	127 (78.4)	-3.7 (-13.1 to 5.6)	.43	



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Sevrage VM

TABLE 1. BASELINE CHARACTERISTICS

NBLE 2. FLUID MANAGEMENT DURING WEANING	105 (69.1%)	BNP-guided Group (n = 152) 100 (65.8%)	P Value 0.541 0.031		Usual Care Group	BNP-guided Group
tients treated at least once with furosemide during weaning, n (%) tients treated at least once with actazolamide during weaning, n (%) tients treated at least once with any diuretic during weaning, n (%) mulative furosemide dose during weaning, mg Wedann (QK)	108 (71.1%) 33 (21.7%) 110 (72.4%) 70 (0-160)	124 (81.6%) 65 (42.8%) 127 (83.6%) 118 (23-229)	0.031 <0.0001 0.019 0.003		(<i>n</i> = 152)	(n = 152)
tean (SD) rage daily turosemide dose during weaning, mg fedian (IQR) tean (SD)	180 (544) 14 (0 to 40) 30 (50)	180 (231) 40 (9 to 78) 47 (41)	<0.0001			
				Age, yr	65 (52–74)	66 (55–76)
TABLE 3. MAIN OUTCOMES				Sex, male	102 (67.1%)	93 (61.2%)
TABLE 3. MUNN OUTCOMES Usual Care Group. Time to find exclusion, h 47.7 (22.9-1) Maker O(3) 47.7 (22.9-1) Time to scenable exclusion, h 92.8 (116.2)	24.0 29.0 29.0 22.0	0.019		McCabe class		
Media (QB) 56 (213-1) Mana (QB) 122 (Q47.1) Time to accordul availing from invasive and noninvasive vestiliation, h 122 (Q47.1) Madia (QB) 124 (Q12-3) Madia (QB) 134 (Q12-4) Madia (QB) 134 (Q12-4) Media (QB) 97 (Q3-12)	86.2 (127.9) 60.5) 49.3 (21.9-140.6) 107.1 (141.0)	0.034		0	96 (63.2%)	93 (61.2%)
Maan (50) £2 (5.2)	93 (4.9)			1	48 (31.6%)	42 (27. <mark>6%)</mark>
				2	8 (5.3%)	17 (11.2%)
1.0-				SAPS II at ICU admission	44 (34–56)	43 (34–54)
E 13-		-		SOFA score at ICU admission	7 (4–9)	7 (4–9)
	Group			Duration of invasive mechanical ventilation before inclusion, d		
-A. Contraction	Usual weaning BNP-guided weaning p=0.022 (Breslow test)			Median (IQR)	4.4 (2.7–7.8)	5.0 (3.0-9.1)
0.0-				Mean (SD)	6.5 (5.7)	7.5 (7.6)
I I	0 40 50 ndomization 5 12 9 6 11 10	6 8		Diuretic treatment on the day before randomization	64 (42.1%)	64 (42.1%)
Unand come 922 92 22 13 12 9 6 Intelligation 12 22 23 96 11 90 8					A de lier	ntso-Dessap AJRCCM 202



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TARI F	1	RASELINE	CHARACTERISTICS

Time to finit exto Median (IQR) Mean (SD) Time to successf Median (IQR) Mean (SD) Time to successf Median (IQR)

	Usual Care Group (n = 152)	BNP-guided Group (n = 152)
Age, yr	65 (52-74)	66 (55-76)
Sex. male	102 (67.1%)	93 (61.2%)
McCabe class		
0	96 (63.2%)	93 (61.2%)
1	48 (31.6%)	42 (27.6%)
2	8 (5.3%)	17 (11.2%)
SAPS II at ICU admission	44 (34-56)	43 (34-54)
SOFA score at ICU admission	7 (4-9)	7 (4-9)
Duration of invasive mechanical ventilation before inclusion, d		
Median (IOR)	4.4 (2.7-7.8)	5.0 (3.0-9.1)
Mean (SD)	6.5 (5.7)	7.5 (7.6)
Diuretic treatment on the day before randomization	64 (42,1%)	64 (42,1%)

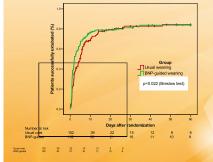
47.7 (22.9-124.8) 92.8 (110.2) 58.6 (21.3-139.8) 112.2 (147.1)

74.4 (11.7-166 134.3 (187.6)

39.8 (20.0-72.4 70.6 (106.8) 42.4 (20.8-107.

TABLE 2. FLUID MANAGEMENT DURING WEANING

Usual Care Group ($n = 152$)	BNP-guided Group ($n = 152$)	P Value
105 (69.1%)	100 (65.8%)	0.541
108 (71.1%)	124 (81.6%)	0.031
33 (21.7%)	65 (42.8%)	< 0.0001
110 (72.4%)	127 (83.6%)	0.019
		0.003
70 (0–160)	118 (23–229)	
180 (544)	180 (231)	
		< 0.0001
14 (0 to 40)	40 (9 to 78)	
30 (50)	47 (41)	
	105 (69.1%) 108 (71.1%) 33 (21.7%) 110 (72.4%) 70 (0–160) 180 (544) 14 (0 to 40)	105 (69.1%) 100 (65.8%) 108 (71.1%) 124 (81.6%) 33 (21.7%) 65 (42.8%) 110 (72.4%) 127 (83.6%) 70 (0–160) 118 (23–229) 180 (544) 180 (231) 14 (0 to 40) 40 (9 to 78)



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Sevrage VM

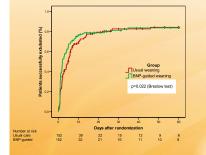
TABLE 1. BASELINE CHARACTERISTICS

	Usual Care Group (n = 152)	BNP-guided Group (n = 152)
Age, yr	65 (52-74)	66 (55-76)
Sex. male	102 (67.1%)	93 (61.2%)
McCabe class		
0	96 (63.2%)	93 (61.2%)
1	48 (31.6%)	42 (27.6%)
2	8 (5.3%)	17 (11.2%)
SAPS II at ICU admission	44 (34-56)	43 (34-54)
SOFA score at ICU admission	7 (4-9)	7 (4-9)
Duration of invasive mechanical ventilation before inclusion, d		
Median (IOR)	4.4 (2.7-7.8)	5.0 (3.0-9.1)
Mean (SD)	6.5 (5.7)	7.5 (7.6)
Diuretic treatment on the day before randomization	64 (42,1%)	64 (42.1%)

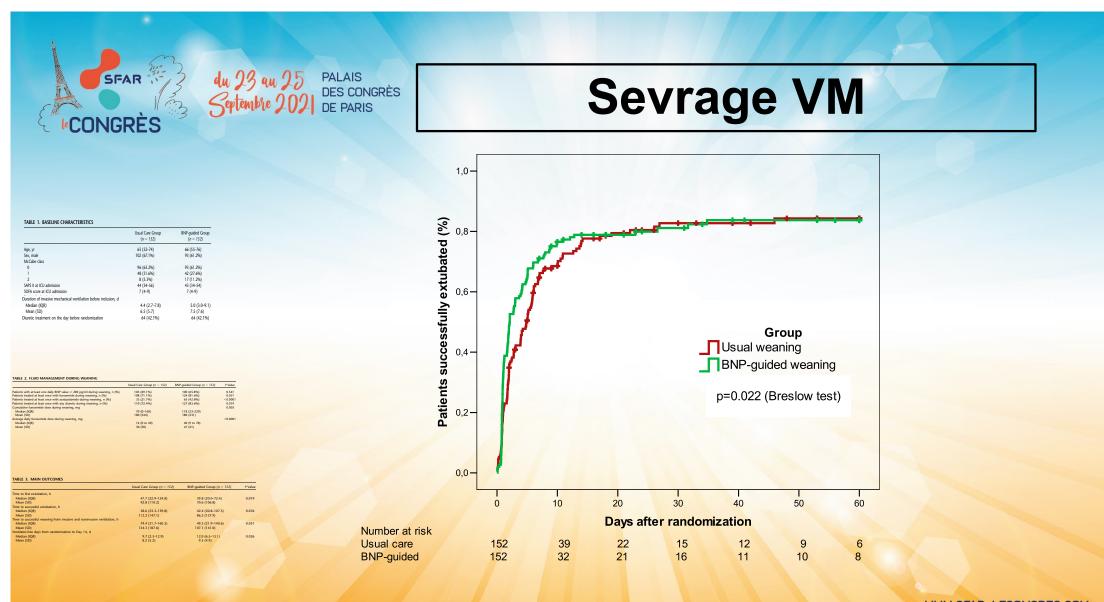
	Usual Care Group (n = 152)	BNP-guided Group (n = 152)	P Value
Patients with at least one daily 8NP value > 200 pg/ml during weaning, n (%)	105 (69.1%)	100 (65.8%)	0.541
Patients treated at least once with furosemide during weaning, n (%)	108 (71.1%)	124 (81.6%)	0.031
Patients treated at least once with acetazolamide during weaning, n (%)	33 (21.7%)	65 (42.8%)	<0.000
Patients treated at least once with any diaretic during weaning, n (%)	110 (72.4%)	127 (83.6%)	0.019
Cumulative furoserride dose during wearing, mg			0.003
Median (IQR)	70 (0-160)	118 (23-229)	
Mean (SD)	180 (544)	180 (231)	
Average daily furgemide dose during weaning, mg			-:0.000
Median (IOR)	14 (0 to 40)	40 (9 to 78)	
Mean (SD)	30 (50)	47 (41)	

TABLE 3. MAIN OUTCOMES

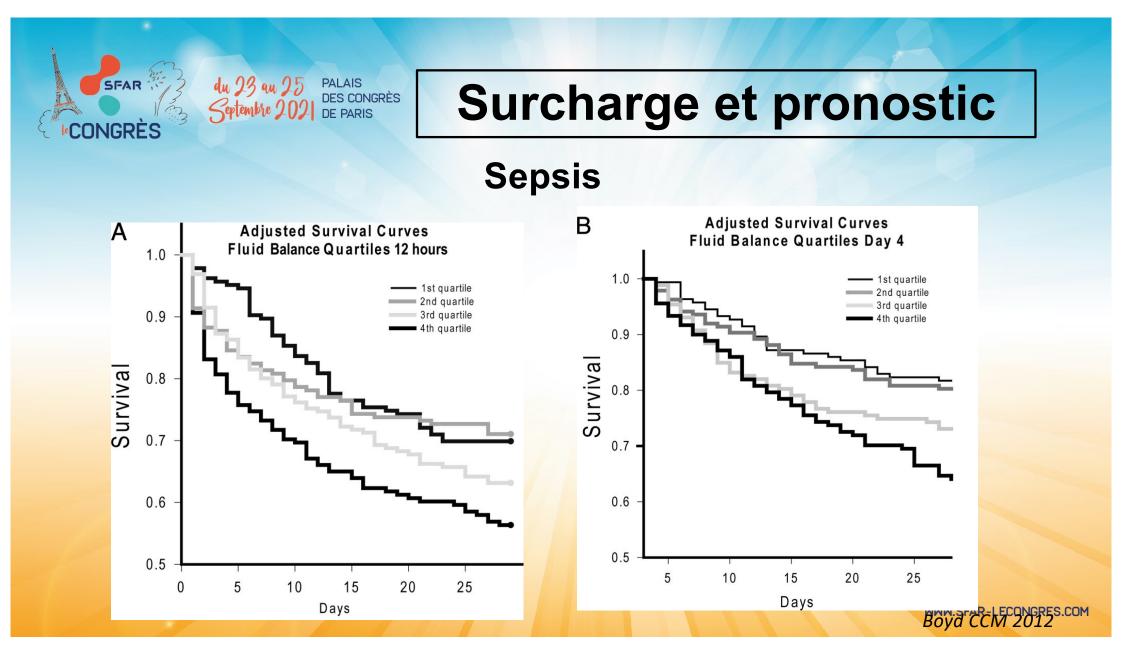
	Usual Care Group ($n = 152$)	BNP-quided Group ($n = 152$)	P Value
Time to first extubation, h			
Median (IQR)	47.7 (22.9–124.8)	39.8 (20.0–72.4)	0.019
Mean (SD)	92.8 (110.2)	70.6 (106.8)	
Time to successful extubation, h			
Median (IQR)	58.6 (23.3–139.8)	42.4 (20.8–107.5)	0.034
Mean (SD)	112.2 (147.1)	86.2 (127.9)	
Time to successful weaning from invasive and noninvasive ventilation, h			
Median (IQR)	74.4 (31.7–160.5)	49.3 (21.9–140.6)	0.051
Mean (SD)	134.3 (187.6)	107.1 (141.0)	
Ventilator-free days from randomization to Day 14, d			
Median (IQR)	9.7 (2.3–12.9)	12.0 (6.5–13.1)	0.026
Mean (SD)	8.2 (5.2)	9.3 (4.9)	



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Mekontso-Dessap AJRCCM 2012





Surcharge et pronostic

Brûlé

TABLE 3. Baseline Patient and Injury Characteristics					
Variable	Average (range) or %				
Total patients	72				
Age (yr)	40.6 (18-86)				
Weight (kg)	80.6 (49–124)				
Total body surface area (TBSA) burn	44.5 (20-90)				
Total full-thickness burn	30.7 (1–90)				
Inhalation injury	42%				
Time to admission postinjury (hr)	3.4 (0–12)				
Admitted on ventilator	57%				
Apache II score	20.1 (6–36)				
Initial base deficit	4.5 (-9 to 15)				
Burn mechanism (%)					
Flame	76				
Flash	11				
Other	13				
Gender (male) (%)	71				

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DE PARIS

TABLE 7. Effect of Proportion of Fluid Above Volume Predicted OR (95% CI)* Outcome ARDS 0%-25% above predicted 0.52 (0.17-7.3) >25% above predicted 1.69(0.48-5.9)Pneumonia 0%-25% above predicted 0.71 (0.23-2.1) >25% above predicted 5.67 (1.1-29.9) Multiple organ failure 0%-25% above predicted 0.94(0.24 - 3.7)>25% above predicted 1.6 (0.38-6.6) Bloodstream infections 0%–25% above predicted 1.12(0.17-7.33)>25% above predicted 2.91(0.51-16.5)Death 0%–25% above predicted 0.42(0.08-2.5)>25% above predicted 5.33 (1.4-20.4)

*Reference: less than or equal to predicted volume.

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Pédiatrie

 Table 3
 Primary disease

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Primary disease	Total 113 patients		- Table 6 Results of logistic regression analysis assessing odds of death based on degree of fluid overload at CRRT initiation			
	Number	% of total patients	Variable ^a	Odds ratio	95% CI	<i>p</i> -Value
Heart disease	41	36.3				-
Primary renal disease	6	5.3	Univariate analysis			
Bone marrow transplant	12	10.6	Method 1 fluid overload	1.056	1.025, 1.087	0.0002
Oncologic disease	10	8.9	Method 2 fluid overload	1.044	1.019, 1.069	0.0005
Metabolic	8	7.1	Method 3 fluid overload	1.045	1.022, 1.07	0.0002
Poisoning	2	1.8	Multivariate analysis ^b	1.045	1.022, 1.07	0.0002
Liver disease	15	13.3	-	1.0.4	1 00 1 07	0.0500
Sepsis without underlying disease	8	7.1	Method 1 fluid overload	1.04	1.00, 1.07	0.0529
Congenital diaphragmatic hernia	5	4.4	Method 2 fluid overload	1.03	0.99, 1.07	0.0829
Other	6	5.3	Method 3 fluid overload	1.03	0.99, 1.06	0.1

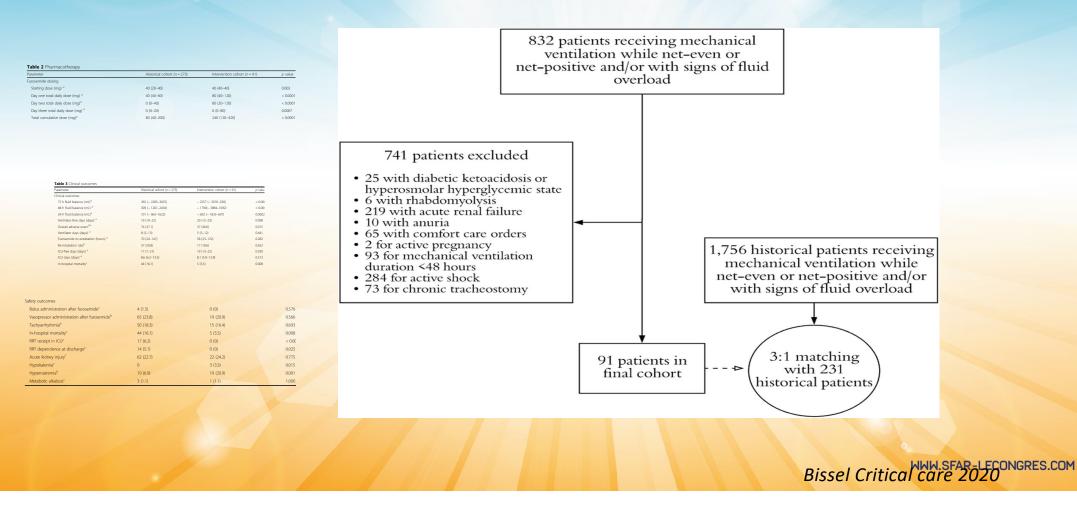
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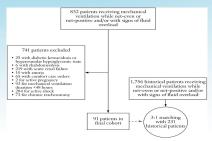
Diurétiques et pronostic?







Diurétiques et pronostic?



Parameter	Historical cohort (n = 273)	Intervention cohort (n = 91)	p valu
Clinical outcomes			
72 h fluid balance (mL) ^d	265 (- 2283-3025)	- 2257 (- 5676-920)	< 0.00
48-h fluid balance (mL) d	309 (- 1267-2434)	- 1799(- 3884-1092)	< 0.00
24-h fluid balance (mL) ⁴	101 (- 963-1622)	- 692 (- 1833-697)	0.0002
Ventilator-free days (days) "	19 (10-22)	20 (15-23)	0.028
Overall adverse event ^{by}	74 (27.1)	37 (40.6)	0.015
Ventilator days (days) "	8 (5-13)	5 (5-12)	0.441
Furosemide to extubation (hours) ^a	70 (24-147)	58 (23-122)	0.282
Re-intubation rate ⁶	57 (20.8)	17 (18.6)	0.652
ICU-free days (days) *	17 (7-21)	19 (13-22)	0.030
ICU days (days) "	8.6 (6.2-13.5)	8.1 (5.9-12.8)	0.513
In-hospital mortality ²	44 (16.1)	5 (5.5)	0.008

Safety outcomes			
Bolus administration after furosemide ^c	4 (1.5)	O (0)	0.576
Vasopressor administration after furosemide ^b	65 (23.8)	19 (20.9)	0.566
Tachyarrhythmia ^b	50 (18.3)	15 (16.4)	0.693
In-hospital mortality ^c	44 (16.1)	5 (5.5)	0.008
RRT receipt in ICU ^c	17 (6.2)	0 (0)	< 0.00
RRT dependence at discharge ^c	14 (5.1)	O (0)	0.025
Acute kidney injury	62 (22.7)	22 (24.2)	0.775
Hypokalemia ^c	0	3 (3.3)	0.015
Hypernatremia ^b	19 (6.9)	19 (20.9)	0.001
Metabolic alkalosis ^c	3 (1.1)	1 (1.1)	1.000

Table	2	Pharmacotherapy
IUNIC	~	

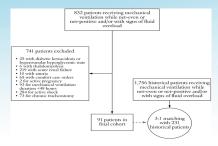
Parameter	Historical cohort ($n = 273$)	Intervention cohort ($n = 91$)	p value
Furosemide dosing			
Starting dose (mg) ^a	40 (20–40)	40 (40–40)	0.003
Day one total daily dose (mg) ^a	40 (40–60)	80 (40–120)	< 0.0001
Day two total daily dose (mg) ^a	0 (0-40)	80 (20–120)	< 0.0001
Day three total daily dose (mg) ^a	0 (0–20)	0 (0–80)	0.0007
Total cumulative dose (mg) ^a	80 (40–200)	240 (120–420)	< 0.0001

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Diurétiques et pronostic?



Parameter		Historical cohort (n = 273)	Intervention cohort (n = 91)	p value
Furosernide do	sing			
Starting dose	: (mg) ^a	40 (20-40)	40 (40-40)	0.003
Day one tota	l daily dose (mg) "	40 (40-60)	80 (40-120)	< 0.0001
Day two tota	l daily dose (mg) ^o	0 (0-40)	80 (20-120)	< 0.0001
Day three to	tal daily dose (mg) "	0 (0-20)	0 (0-80)	0.0007
Total cumula	tive dose (mg) ^e	80 (40-200)	240 (120-420)	< 0.0001

Safety outcomes			
Bolus administration after furosemide ^c	4 (1.5)	0 (0)	0.576
Vasopressor administration after furosemide ^b	65 (23.8)	19 (20.9)	0.566
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Metabolic alkalosis ^c	3 (1.1)	1 (1.1)	1.000

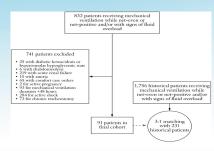
Parameter	Historical cohort ($n = 273$)	Intervention cohort ($n = 91$)	<i>p</i> valu
Clinical outcomes			
72 h fluid balance (mL) ^d	265 (- 2283-3025)	- 2257 (- 5676-920)	< 0.00
48-h fluid balance (mL) ^d	309 (- 1267-2434)	- 1799(- 3884-1092)	< 0.00
24-h fluid balance (mL) ^a	101 (- 963-1622)	- 692 (- 1833-697)	0.0002
Ventilator-free days (days) ^a	19 (10–22)	20 (15–23)	0.098
Overall adverse event ^{b,e}	74 (27.1)	37 (40.6)	0.015
Ventilator days (days) ^a	8 (5–13)	5 (5–12)	0.441
Furosemide to extubation (hours) ^a	70 (24–147)	58 (23–122)	0.282
Re-intubation rate ^b	57 (20.8)	17 (18.6)	0.652
ICU-free days (days) ^a	17 (7–21)	19 (13–22)	0.030
ICU days (days) ^a	8.6 (6.2–13.5)	8.1 (5.9–12.8)	0.513
In-h <mark>ospital</mark> mortality ^c	44 (16.1)	5 (5.5)	0.008

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Diurétiques et pronostic?



Parameter	Historical cohort (n = 273)	Intervention cohort (n = 91)	p value
Furosemide dosing			
Starting dose (mg) 4	40 (20-40)	40 (40-40)	0.003
Day one total daily dose (mg) "	40 (40-60)	80 (40-120)	< 0.000
Day two total daily dose (mg) ⁴	0 (0-40)	80 (20-120)	< 0.000
Day three total daily dose (mg) a	0 (0-20)	0 (0-80)	0.0007
Total cumulative dose (mg) ^o	80 (40-200)	240 (120-420)	< 0.000

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	In-hospital mortality ^c	44 (16.1)	5 (5.5)	0.008
	RRT receipt in ICU ^c	17 (6.2)	0 (0)	< 0.00
	RRT dependence at discharge ^c	14 (5.1)	0 (0)	0.025
	Acute kidney injury ^f	62 (22.7)	22 (24.2)	0.775
	Hypokalemia ^c	0	3 (3.3)	0.015
p valu	Hypernatremia ^b	19 (6.9)	19 (20.9)	0.001
< 0.001	Metabolic alkalosis ^c	3 (1.1)	1 (1.1)	1.000

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IRIHS-REA

Design

- Etude multicentrique
- Randomisée-contrôlée
- Simple aveugle
- Critère ppal: diminuer l'inflation hydro-sodée
- Critères secondaires: tolérance (rein, cœur, métabolique) / efficacité

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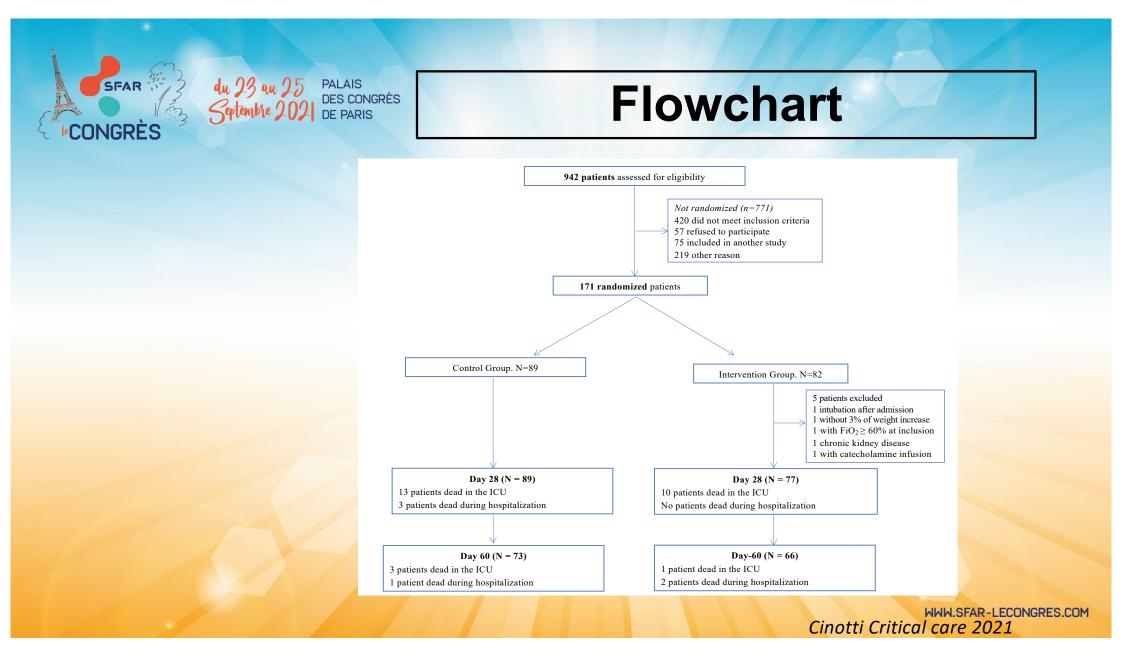


IRIHS-REA

Protocole

- Ventilation mécanique invasive ≥ 24 heures
- Sevrage NAD
- Inflation poids: Augmentation ≥ 3% par rapport au « poids sec »
- Intervention: Furosemide ou autre diuretique QSP poids sec jusqu'au sevrage de la VM
- Contrôle

Cinotti Critical care 2021





Démographie

	Groupe Contrôle	Groupe Diurétiques
	N=89	N=77
Age	66 [60 - 74]	66 [58 - 72]
Genre F/H	28(31.5%) / 61(68.6%)	16(20.8%) / 61(79.2%)
SAPS II	53 [45 - 59]	52 [41 - 58]
SOFA	7 [5 - 10]	8 [6 - 10]
IMC	25.5 [22.6 - 29.2]	28.4 [25.5 - 34.5]
НТА	13 (14.6%)	5 (6.5%)
ВРСО	10 (11.2%)	5 (6.5%)
IRC	3 (3.4%)	1 (1.3%)
Diurétiques au long cours	11 (12.4%)	8 (10.4%)
Diabète	9 (10.1%)	11 (14.3%)
Admission		
Sepsis/choc septique	28 (31.4%)	21 (27.2%)
Détresse respi	42 (47.2%)	33 (42.9%)
Trauma	7 (7.9%)	6 (7.8%)
EER/AKI avant inclusion	27 (30.3%)	21 (27.3%)

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Inflation hydro-sodée

	Contrôle	Intervention	Difference	Р
	N=89	N=77	95% IC	
Analyse permière				
Cas complets (N=144)	6.4 [5-11.2]	1.4 [1-4.5]		< 0.001
Imputation multiple			-4.9 [-7.4;-2.5]	< 0.001
(N=160)				
Analyse de sensibilité				
Biais maximal (N=160)	4.5 [-1.5;10.5]	1.5 [-2;7.7]	-0.5 [-3.2;2.3]	0.7
Per protocol (N=130)	5 [0.5;11.3]	1 [-2.5;4.5]	-4.8 [-7.2;-2.2]	<0.001

Critères secondaires

Efficacité

SFAR Children 25 Septembre 202

CONGRÈS

PALAIS DES CONGRÈS DE PARIS

	Contrôle N=89	Intervention N=77	Р	
Ventilation mécanique				
Durée (j)	14 [8-22]	12 [8-21]	0.7	
Après rando (j)	7 [3-17]	6 [2-14]	0.2	
VFD à J-28	19 [3-24]	22 [9-25]	0.3	
Échec d'extubation	11 (15.3%)	6 (9%)	0.3	
Durée séjour (j)	18 [10-32]	18 [11-29]	0.4	
Mortalité en réa	16 (18%)	11 (14%)	0.5	
Durée hôpital (j)	36 [22-55]	32 [18-53]	0.6	
Mortalité à J-60	20 (22.5%)	13 (16.9%)		R-LECONGRES.COM
			inotti Critical care .	2021



Tolérance rénale-métabolique

SFAR

CONGRÈS

du 23 au 25 Septembre 202 PALAIS DES CONGRÈS DE PARIS

	Contrôle N=89	Intervention N=82	Р
RIFLE (N)			0.2
None	22 (25.3%)	30 (40%)	
Risk	33 (37.9%)	25 (33.3%)	
Natrémie ≤ 135mmol/L (N)	42 (47.2%)	33 (42.9%)	0.7
Natrémi ≥ 145mmol/L (N)	40 (44.9%)	40 (52%)	0.5
Hypokaliémie (N)	51 (57.3%)	53 (68.8%)	0.1
Durée hypokaliémie (j)	1 [0-2]	1 [0-4]	0.2





Critères secondaires

Tolérance cardiaque

	Contrôle N=89	Intervention N=82	Ρ
Cardiac rhythm troubles (N)			
Atrial fibrillation	14 (15.3%)	9 (11.7%)	0.5
Torsade de pointes	0	1 (1.3%)	0.5
Ventricular tachycardia	2 (2.3%)	2 (2.6%)	0.9
Ventricular fibrillation	2 (2.3%)	1 (2.6%)	0.9

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Intérêts des diurétiques

- Lutte efficace contre l'inflation hydro-sodée à la phase sub-aiguë en réanimation
- Intérêt dans le sevrage de la VM
- Données rassurantes sur la tolérance

PALAIS DES CONGRÈS

Manque de preuve formelles sur l'efficacité des diurétiques

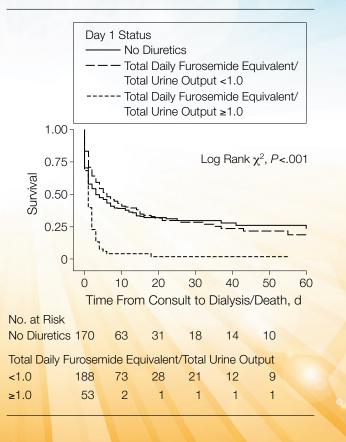


du 23 au 25 Septembre 2021 DE PARIS

Toxicité rénale!

Figure 2. Time to Death or Dialysis From Day of Consultation in Intensive Care Unit

Diuretics, Mortality, and Nonrecovery of Renal Function in Acute Renal Failure



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Toxicité rénale??

:OM

Table 1 Baseline characteristics between groups before matching

Variables	Non-diuretic group $n = 6269$	Furosemide group n = 7885	<i>P</i> value	SMD
AKI stage, <i>n</i> (%)			< 0.001	0.132
Stage 1	1953(31.2)	2293(29.1)		
Stage 2	2715(43.3)	3908(49.6)		
Stage 3	1601(25.5)	1684(21.4)		
Age	67.8 (54.7,78.9)	6 <mark>9.9</mark> (59.2,79.4)	< 0.001	0.167
Gender, male, n (%)	3503 (55.9)	4419 (56.0)	0.844	0.003

	Non-diuntic group	Furosemide group	P value HR Lov	er 95% CI Upper 95% CI										
matched cohort	.0 = 6209	n = 7885												
ary outcome														
-hospital mortality, n (%)*	1363(21.7)	1001(12.7)	< 0.001 0.63 0.5	0.69										
andary outcomes														
montality, n (N)*	1981(114)	1673(21.2)	< 0.001 0.66 0.6	0.70										
function, n (%) th	2939(45.9)	4209(53.4)	<0.001 1.29 1.2	1.38										
tay, (median (IQR))*	190(28, 6.8)	4.13(2.9, 7.4)	0.003 1.44 1.2	1.62										
al stay, (median (QR)*	957(60, 162)	10:08(6.8, 16.3)	0.013 1.37 1.3	1.68										
	n=4427	n = 4427												
ome														
rtality, n (%2*	974(22.0)	635(14.3)	< 0.001 0.67 0.6	0.74										
acomes														
097	1442(22.6)	1054(23.8)	< 0.001 0.69 0.6	0.75										
- 04 ⁺	2620(592)	2991(67.6)	<0.001 1.44 1.3	1.57								1 11 11 1	OFAD IF	TOOLODE
ht.	41(28, 7.0)	4.1(2.9, 7.2)	0.221 1.28 0.8	1.62								MMM	SFAR-IF	L'UNI-RE
		105(65, 164)									71		STATISTICS FL	



0.167

All stage, r Stage 1 Stage 2 Stage 3 Age

Toxicité rénale??

	Non-diuretic group	Furosemide group	P value	HR	Lower 95% Cl	Upper 95% Cl	
Pre-matched cohort	n = 6269	n = 7885	100				
Primary outcome		1.2.1.1.1.1.1					
In-hospital mortality, n (%) ^a	1363(21.7)	1001(12.7)	< 0.001	0.63	0.58	0.69	
Secondary outcomes							
90-day mortality, n (%) ^a	1981(31.6)	1673(21.2)	< 0.001	0.66	0.61	0.70	
Recovery of renal function, n (%) ^b	2939(46.9)	4209(53.4)	< 0.001	1.29	1.21	1.38	
Length of ICU stay, [median (IQR)] ^c	3.91(2.8, 6.8)	4.13(2.9, 7.4)	0.003	1.44	1.28	1.62	
Length of hospital stay, [median (IQR)] ^c	9.57(6.0, 16.2)	10.08(6.8, 16.3)	0.013	1.37	1.12	1.68	
Post-matched cohort	n = 4427	n = 4427					
Primary outcome							
In-hospital mortality, <i>n</i> (%) ^a	974(22.0)	635(14.3)	< 0.001	0.67	0.60	0.74	
Secondary outcomes							
90-day mortality, <i>n</i> (%) ^a	1442(32.6)	10 <mark>5</mark> 4(23.8)	< 0.001	0.69	0.64	0.75	
Recovery of renal function, <i>n</i> (%) ^b	2620(59.2)	2991(67.6)	< 0.001	1.44	1.31	1.57	
Length of ICU stay, [median (IQR)] ^c	4.1(2.9, <mark>7</mark> .1)	4.1(<mark>2</mark> .9, 7.2)	0.221	1.28	0.89	1.62	
Length of hospital stay, [median (IQR)] ^c	10.0(<mark>6.</mark> 4, 16.9)	10.5(<mark>6.5, 16.4)</mark>	0.032	1.71	1.04	2.85	

Zhao Crit care 2020



Conclusion

- Intérêt de la diminution de l'inflation hydro-sodée en réanimation
- Efficacité potentielle dans le sevrage VM
- Données rassurantes sur la tolérance