Colloque secteur URO-DIG

Jeudi 3 mai 2012

HUG Hôpitaux Universitaires de Genève

Département APSI

Service d'anesthésiologie

Agression Rénale Aigue

Acute Kidney Injury (AKI)

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DESAR 4ème

UNIVERSITÉ DE GENÈVE

FACULTÉ DE MÉDECINE

Introduction

Multitudes définitions (acute renal failure, renal insufficiency, kidney injury, and renal impairment…)

Leur survenue en périopératoire est corrélée à une augmentation de la mortalité, du séjour hospitalier et des coûts des soins

Chertow et al. J Am Soc Nephrol 2005
Kheterpal et al. Anesthesiology 2009

Définitions

Acute renal failure

‘’ Acute renal failure is a symdrome characterized by rapide decline in glomerular filtration rate and retention of nitrogenous waste products such as blood urea nitrogen and creatinine’’

Acute renal failure: The Kidney 5th edition. Brenner 1996

- Désordre complexe
- Manifestations cliniques variables
- Sous-diagnostiquée
- Conséquences sévères

Acute kidney injury

Définie par l’un des critères suivants:

- Remplace tous les autres termes
- Définition universelle
- Permet une stratification du risque
- Permet une détection précoce des lésions rénales
- Définit par L’AKIN (Acute Kidney Injury Network)

Une augmentation de la créatinine plasmatique ≥ 26 umol/l dans un délai de 48 heures

ou

Une augmentation de la créatinine plasmatique ≥ 1.5 fois la valeur de référence

ou

Débit urinaire < 0.5 ml/kg/h pour 6 heures

Mehta RL et al. Critical Care 2007

Classification

Clairance de Cockcroft

N'est pas valable dans le contexte périopératoire

Classification de RIFLE

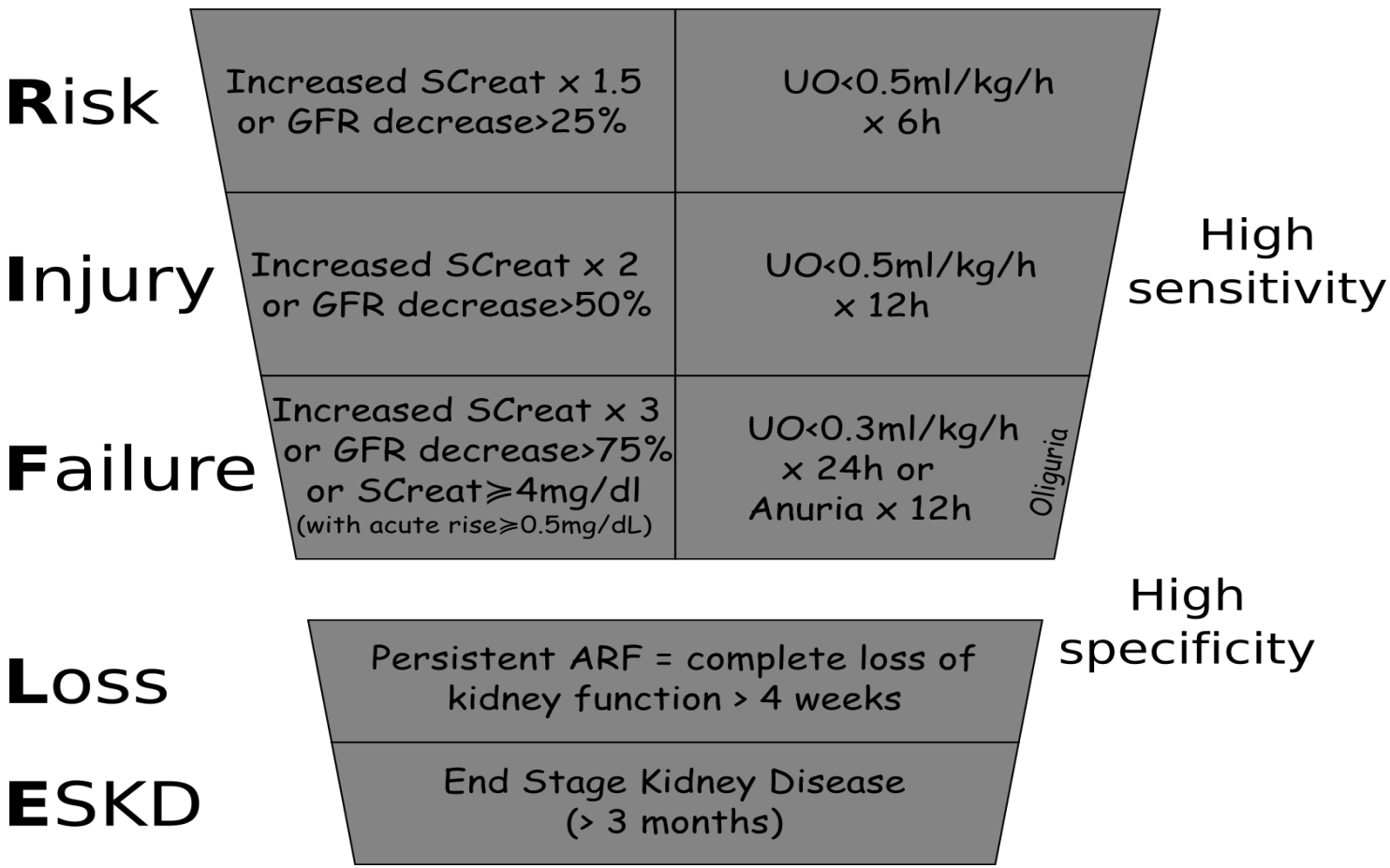
- Stratification des patients selon le degré d'IRA

- Association entre la sévérité de l'atteinte rénale et EER, durée de séjour hospitalier et mortalité

Classification AKIN

- Mêmes avantages que RIFLE
-Sensibilité plus élevée pour les formes modérées
- Classification plus consensuelle en 2012

La classification de RIFLE



Bellomo et al, ADQI II, Critical Care 2004

La classification AKIN

STADE	Créatinine plasmatique	Diurèse
STADE 1	Augmentation de la créatinine ≥ **1.5 à 2 fois** la valeur de base Ou Augmentation de la créatinine ≥ **0.3 mg/dl**	Diurèse < **0,5 ml/kg/heure sur 6 heures**
STADE 2	Augmentation de la créatinine ≥ **2 à 3 fois** la valeur de base	Diurèse < **0,5 ml/kg/heure sur 12** heures
STADE 3	Augmentation de la créatinine ≥ **3 fois** Ou Créatinine ≥ **4mg/dl (avec une augmentation de 0.5 mg/dl)** Ou Epuration rénale	Diurèse < **0,3 ml/kg/heure sur 24 heures** Ou Anurie depuis **12 heures**

Mehta RL et al. Critical Care 2007

A comparison of the RIFLE and Acute Kidney Injury Network classifications for cardiac surgery–associated acute kidney injury: A prospective cohort study

Michael Haase, MD,[a,b] Rinaldo Bellomo, MD,[a] George Matalanis, MD, FRACS,[c] Paolo Calzavacca, MD,[d] Duska Dragun, MD,[b] and Anja Haase-Fielitz, PharmD[a,b]

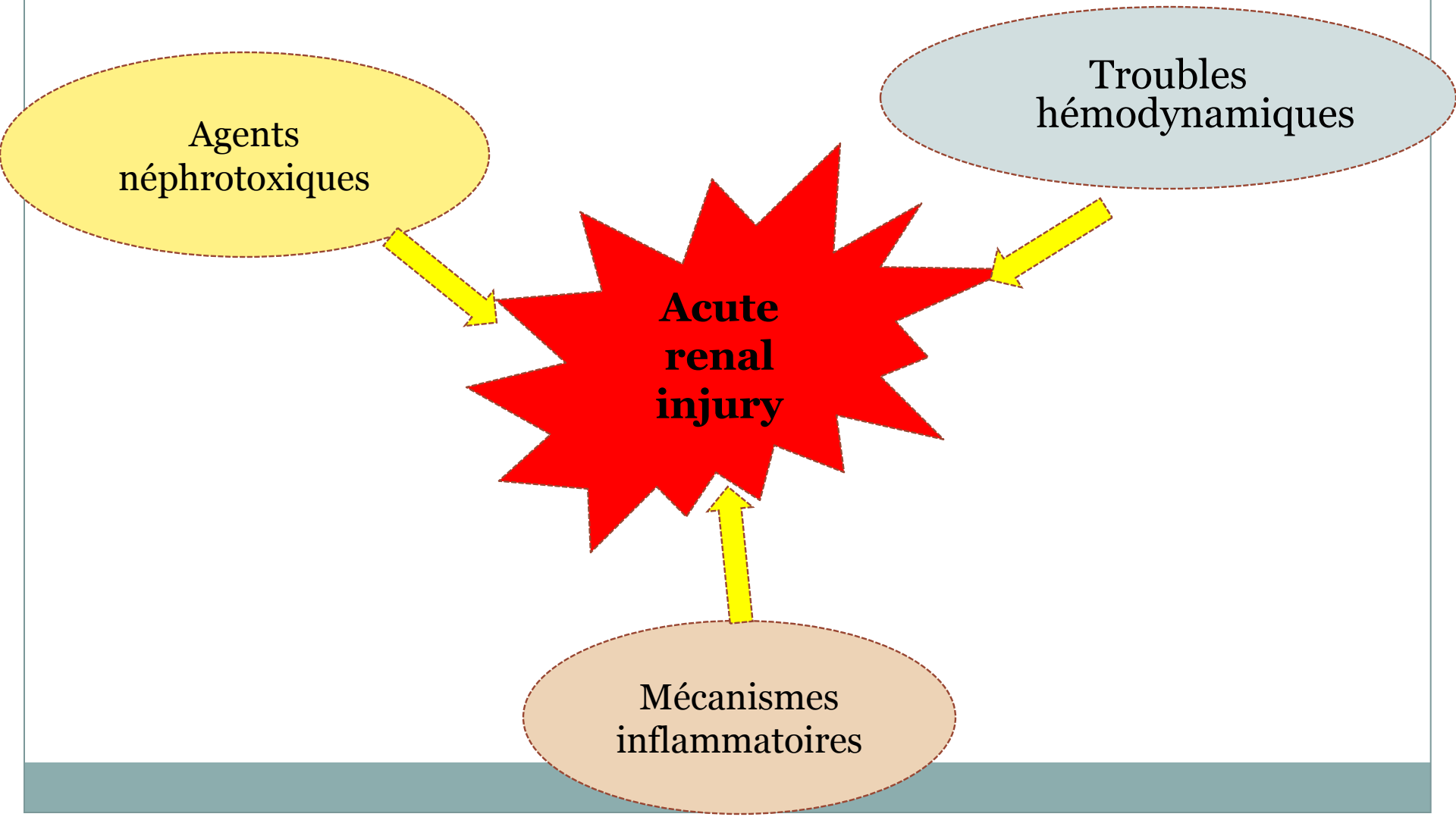
TABLE 3. Agreement of AKIN with RIFLE classifications according to identification of AKI across classes

		RIFLE				
		No AKI	Risk	Injury	Failure	Total
AKIN	No AKI	146	8	0	1	155
	Stage 1	6	76	13	0	95
	Stage 2	0	0	19	0	19
	Stage 3	0	1	2	9	12
	Total	152	85	34	10	282

AKIN, Acute Kidney Injury Network; *RIFLE*, R–renal risk, I–injury, F–failure, L–loss of kidney function, E–end-stage renal disease; *AKI*, acute kidney injury.

Pas de différence significative

Physiopathologie



Incidence des AKI

	Type de chirurgie	Nombre de patients	Incidence des AKI
Kheterpal et al. Anesthesiology 2007	Chirurgie non cardiaque	15102	1%
Abelha et al. Critical Care 2009	Chirurgie intrapéritonéale, thoracique et vasculaire	1166	7.5%
Ishikawa et al. Anesthesia Analgesia 2012	Chirurgie Thoracique	1300	5.9%

Facteurs de risques des AKI

Predictors of Postoperative Acute Renal Failure after Noncardiac Surgery in Patients with Previously Normal Renal Function

Sachin Kheterpal, M.D., M.B.A., Kevin K. Tremper, Ph.D., M.D.,† Michael J. Englesbe, M.D.,‡ Michael O'Reilly, M.D.,§ Amy M. Shanks, M.S.,‖ Douglas M. Fetterman, M.D.,* Andrew L. Rosenberg, M.D.,# Richard D. Swartz, M.D.***

Table 2. Independent Preoperative Predictors of Postoperative Acute Renal Failure

Preoperative Predictor	*P* Value	β Coefficient
Age, yr*	<0.001	0.055
Emergent surgery	<0.001	1.121
Liver disease	<0.001	1.047
Body mass index, kg/m²*	<0.001	0.047
High-risk surgery†	0.001	0.589
Peripheral vascular occlusive disease	0.015	0.914
Chronic obstructive pulmonary disease necessitating chronic bronchodilator therapy	0.045	0.589

Independent predictors of postoperative acute renal failure among patients with normal preoperative renal function were derived using full model fit logistic regression.

Anesthesiology 2007; 107:892-902

ASSOCIATION FOR ACADEMIC SURGERY

Identifying Risk Factors for Renal Failure and Myocardial Infarction Following Colorectal Surgery

Marlin Wayne Causey, M.D.,*,[1] Justin A. Maykel, M.D.,† Quinton Hatch, M.D.,* Seth Miller, M.D.,* and Scott R. Steele, M.D.*

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Journal of Surgical Research 170, 32–37 (2011)

TABLE 2

Multivariate Analysis of Perioperative Variables in Patients not Sustaining a Major Complication

	Acute renal failure		Myocardial injury	
Variable	Hazard ratio [95% confidence interval]	*P* value	Hazard ratio [95% confidence interval]	*P* value
Gender	1.1 [0.3–3.7]	0.801	2.5 [0.2–25.]	0.416
Pulmonary disease	2.8 [0.9–9.0]	0.07	2.1 [0.2–18.1]	0.466
Cardiovascular disease	2.3 [0.6–8.9]	0.203	N/A	N/A
Renal disease*	2.0 [0.3–11.9]	0.426	15.7 [3.6–66.8]	0.001
Functional limitations	1.1 [0.2–5.6]	0.821	9.5 [2.1–42.2]	0.002
Alcohol use	0.7 [0.2–2.3]	0.573	1.9 [0.2–14.]	0.503
Tobacco use	0.7 [0.2–2.3]	0.578	1.0 [0.1–9.5]	0.986
Transfusion	7.5 [1.9–28.6]	0.003	4.2 [0.4–43.]	0.224
SBP < 90 on preoperative examination	2.4 [0.7–9.5]	0.18	12.0 [5.523–26.072]	0.041
Elective *versus* emergent indication	0.8 [0.1–5.2]	0.884	0.1 [0.0–3.6]	0.269

*Determined by baseline creatinine.

Acute Kidney Injury After Lung Resection Surgery: Incidence and Perioperative Risk Factors

Seiji Ishikawa, MD, PhD,†‡ Donald E. G. Griesdale, MD, MPH, FRCPC,†§‖ and Jens Lohser, MD, MSc, FRCPC†

Table 4. Multivariable Logistic Regression Analysis of Factors that Are Related to Postoperative AKI After Lung Resection Surgery

Variable	OR_{unadj}	OR_{adj}	95% CI	*P* value
Age in years (per year)	1.0	1.0	0.98–1.0	0.75
Hypertension	3.3	2.0	1.1–3.8	0.03
Peripheral vascular disease	5.5	4.4	1.8–10.0	0.001
eGFR (per 10 mL · min^{-1} · 1.73 m^{-2})	0.74	0.80	0.69–0.93	0.003
Angiotensin II receptor blocker	3.5	2.2	1.1–4.4	0.04
HES (per 250 mL)	1.6	1.5	1.1–2.1	0.01
Crystalloids (per 250 mL)	1.1	1.0	0.90–1.1	0.87
Intraoperative RBC transfusion	5.6	2.1	0.54–7.8	0.29
Thoracoscopy	0.22	0.37	0.15–0.90	0.03
Duration of surgery (per minute)	1.0	1.0	1.0–1.0	0.54
Surgical procedure				
Wedge resection/ bullectomy	1.0	1.0	—	—
Segmentectomy/ lobectomy	3.2	1.5	0.59–3.8	0.39
Pneumonectomy	6.6	2.1	0.61–7.2	0.24

AKI = acute kidney injury; OR_{unadj} = odds ratio unadjusted; OR_{adj} = odds ratio adjusted; CI = confidence interval; eGFR = estimated glomerular filtration rate; HES = hydroxyethyl starch; RBC = red blood cell.

Table 2. Preoperative Patient Characteristics Stratified by RIFLE Criteria

Variables	RIFLE-0 (n = 1,254)	RIFLE-R (n = 56)	RIFLE-I & F (n = 35)	*p* Value
Age, years	63 (11)	66 (9)	67 (8)	<0.001
Male, n (%)	844 (67.3)	45 (80.4)	28 (80.0)	0.158
Body mass index, kg/m^{-2}	24.9 (4.7)	25.8 (4.7)	25.7 (4.6)	0.108
ASA class 3 or 4, n (%)	537 (42.8)	38 (67.9)	23 (65.7)	<0.001
Smoking status, pack-years	47 (21)	51 (19)	56 (20)	0.062
Alcohol status, n (%)	172 (13.7)	10 (17.9)	9 (26.5)	<0.001
Coronary artery disease, n (%)	132 (10.5)	7 (12.5)	5 (14.3)	<0.001
Hypertension, n (%)	428 (34.1)	26 (46.4)	14 (40.0)	0.098
Congestive heart failure, n (%)	29 (2.3)	2 (3.6)	2 (2.8)	0.793
Diabetes mellitus, n (%)	116 (9.3)	13 (23.2)	6 (17.1)	0.039
Dyslipidemia, n (%)	401 (16.0)	16 (28.6)	10 (29.4)	0.022
Renal dysfunction grade				0.714
eGFR ≥60 mL/min, n (%)	1073 (85.6)	41 (73.2)	30 (85.7)	
eGFR 59 to 30 mL/min, n (%)	179 (14.3)	15 (16.8)	4 (11.4)	
eGFR <30 mL/min, n (%)	3 (0.2)	0 (0.0)	0 (0.0)	
eGFR, $mL \cdot min^{-1}$	83 (23)	75 (21)	96 (34)	0.926
FEV_1 (% predicted)	83 (20)	71 (16)	72 (15)	<0.001
RCRI	0.7 (0.8)	1.0 (1.0)	1.2 (0.9)	<0.001
RCRI ≥2, n (%)	172 (13.7)	14 (25.9)	10 (28.6)	<0.001
VO_2max ($mL^{-1} \cdot kg^{-1}$)	22.2 (13.6)	17.8 (5.1)	14.7 (5.8)	<0.001
Hematocrit, %	36.1 (6.6)	33.2 (5.7)	34.8 (5.6)	0.044
Drug treatment				
ACEI or ARB, n (%)	166 (13.2)	13 (23.2)	9 (25.7)	0.027
Beta-blockers, n (%)	103 (8.2)	7 (10.7)	4 (11.4)	0.247
Calcium antagonist, n (%)	62 (4.9)	2 (3.6)	2 (5.7)	0.795
Neoadjuvant chemotherapy, n (%)	185 (14.7)	9 (16.1)	6 (17.1)	0.494

Data are presented as mean values with standard deviation or percentage in parentheses where appropriate.

ACEI = angiotensin-converting enzyme inhibitor; ARB = angiotensin receptor blocker; ASA = American Society of Anesthesiologists; eGFR = estimated glomerular filtration rate; FEV_1 = forced expiratory volume in 1 second; RCRI = revised cardiac risk index; RIFLE = risk (R), injury (I), failure (F), loss of function, and end-stage kidney disease; VO_2max = maximum volume oxygen consumption.

Table 3. Patient Perioperative Variables Stratified by RIFLE Classification

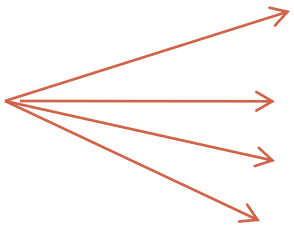
	RIFLE-0 (n = 1,254)	RIFLE-R (n = 56)	RIFLE-I & F (n = 35)	*p* Value
Intraoperative period				
Cancer stages Ia and Ib, n (%)	454 (36.2)	22 (33.3)	12 (34.2)	0.784
Surgical time, minutes	121 (51)	141 (529	154 (92)	0.009
Anesthesia time, minutes	175 (68)	193 (619	208 (101)	0.012
Pneumonectomy or bilobectomy, n (%)	25.0	28.6	45.7	<0.001
V_T during OLV, mL · kg^{-1}	6.9 (2.2)	6.7 (2.1)	7.0 (2.9)	0.239
Crystalloids, mL · kg^{-1} · h^{-1}	4.9 (3.0)	4.3 (2.2)	4.8 (2.5)	0.193
Colloids, mL · kg^{-1} · h^{-1}	3.2 (1.7)	4.3 (1.8)	4.7 (1.9)	0.043
PRBC transfusion, n (%)	35 (2.8)	2 (3.6)	2 (5.7)	0.097
Patients requiring any vasopressors, n (%)	912 (72.7)	45 (80.4)	29 (82.9)	<0.001
Phenylephrine, n (%)	789 (62.9)	38 (67.9)	26 (74.4)	0.009
Milligrams	467 (612)	822 (966)	1,144 (1,009)	0.010
Ephedrine, n (%)	743 (59.3)	33 (58.9)	21 (60.0)	0.395
Milligrams	15 (11)	16 (11)	18 (12)	0.098
Noradrenaline, n (%)	55 (4.4)	3 (5.4)	2 (5.7)	0.119
Milligrams	0.03 (0.02)	0.04 (0.03)	0.06 (0.04)	0.087
First postoperative day				
Crystalloids (mL · kg^{-1} · h^{-1})	1.1 (0.8)	1.0 (0.7)	1.1 (0.9)	0.938
PRBC transfusion, n (%)	29 (2.3)	2 (3.6)	1 (2.9)	0.597
Patients requiring any vasopressors, n (%)	370 (29.5)	30 (53.6)	21 (60.0)	<0.001
Phenylephrine, n (%)	278 (22.2)	15 (26.8)	11 (31.4)	0.031
Milligrams	187 (112)	332 (196)	544 (309)	0.002
Ephedrine, n (%)	143 (11.4)	7 (12.5)	5 (14.2)	0.275
Milligrams	13 (8)	14 (10)	15 (11)	0.118
Noradrenaline, n (%)	45 (3.6)	9 (16.1)	7 (20.0)	0.009
Milligrams	0.06 (0.04)	0.08 (0.05)	0.09 (0.05)	0.017

Data are presented as mean values with standard deviation or percentage in parentheses where appropriate.

OLV = one-lung ventilation; PRBC = packed red blood cells; RIFLE = risk (R), injury (I), failure (F), loss of function, and end-stage kidney disease; V_T = tidal volume.

Prévention des AKI

Prévention



- Hypotension
- Hypovolémie
- Hyperinflation
- Hyperhydratation

Sugrue et al. Arch Surg 1999

Optimisation hémodynamique selon ‘’Goal directed therapy’’

Brienza et al. Critical Care 2009

Initiation précoce de l’EER

Shiao et al. Critical Care 2009

Conclusion

Evolution des concepts de prise en charge de l'insuffisance rénale

Quelle place des nouveaux biomarqueurs (NGAL) ?

Le moment idéal de l'EER ?