

Cours Européens
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Inserm
Institut national
de la santé et de la recherche médicale

Protection myocardique péri-opératoire

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Ischémie myocardique péri-opératoire

Chirurgie NON CARDIAQUE

Myocardial Injury after Noncardiac Surgery

A Large, International, Prospective Cohort Study Establishing Diagnostic Criteria, Characteristics, Predictors, and 30-day Outcomes

The Vascular events in noncardiac Surgery patients cohort evaluation (VISION) Writing Group, on behalf of The Vascular events in noncardiac Surgery patients cohort evaluation (VISION) Investigators

Etude de Cohorte, Prospective, Internationale / 15.065 patients

What We Already Know about This Topic

- Myocardial injury after noncardiac surgery was defined as prognostically relevant myocardial injury due to ischemia that occurs during or within 30 days after noncardiac surgery.

What This Article Tells Us That Is New

- Myocardial injury after noncardiac surgery is common among adults undergoing noncardiac surgery and associated with substantial mortality.

Predictor	Prevalence of Predictors (%)	Patients Dying within 30 Days after Surgery		Model Derivation		Model Validation		Population-attributable Risk (95% CI)
		n	% (95% CI)	Adjusted HR (95% CI)	P Value	Adjusted HR† (95% CI)	P Value	
Perioperative adverse complications	1,200 (7.8)	115	9.6 (8.0-11.4)	3.62 (2.96-5.08)	<0.001	3.90 (2.90-5.27)	<0.001	34.0% (26.6-41.5)
MINS = Myocardial Injury after Noncardiac Surgery								

Anesthesiology 2014;120:564-78

Protection myocardique péri-opératoire

Annuaire Français d'Anesthésie et de Réanimation 35 (2011) 45-49

Société Française d'Anesthésie et de Réanimation

Société Française de Cardiologie

RECOMMANDATIONS FORMALISÉES D'EXPERTS

Prise en charge du coronarien opéré en chirurgie non cardiaque

Perioperative assessment of cardiac risk patient in non-cardiac surgery

Société Française d'Anesthésie et de Réanimation (Sfar)
Société Française de Cardiologie (SFC)

2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management

The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA)

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Protection myocardique péri-opératoire

Evaluation et stratification **PRE**-opératoire

+

Gestion **PER**-opératoire

+

Gestion **POST**-opératoire

Société Française d'Anesthésie et de Réanimation

Société Française de Cardiologie

RECOMMANDATIONS FORMALISÉES D'EXPERTS

Prise en charge du coronarien opéré en chirurgie non cardiaque

Evaluation et stratification **PRE**-opératoire

Risque lié à la chirurgie:
Faible – intermédiaire – élevé

Score de Lee

Capacité fonctionnelle:

V Piriou, G Derumeaux AFAR 2011;30:e5-e29

Protection myocardique péri-opératoire

Gestion **PER**-opératoire

Intraoperative Tachycardia and Hypertension Are Independently Associated with Adverse Outcome in Noncardiac Surgery of Long Duration

David L. Reich, MD, Elliott Bennett-Guerrero, MD, Carol A. Bodian, DrPH, Sabera Hossain, MS, Wanda Winfree, RN, and Marina Krol, PhD

- Tachycardie**
- Hypertension Artérielle**

Variable	Odds ratio	P value
Operation duration >220 min (per minute)	1.003	0.02
POSSUM physiological score (per point of score)	1.096	0.0001
High heart rate	2.704	0.01
High systolic arterial blood pressure	2.095	0.009

Reich et al. Anesth Analg 2002;95:273-7

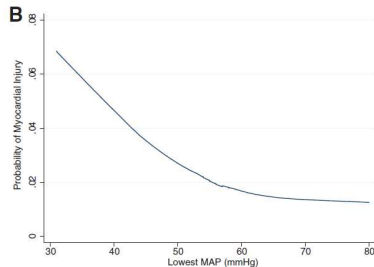
Protection myocardique péri-opératoire

Gestion **PER**-opératoire

Relationship between Intraoperative Mean Arterial Pressure and Clinical Outcomes after Noncardiac Surgery

- Hypotension Artérielle

Toward an Empirical Definition of Hypotension



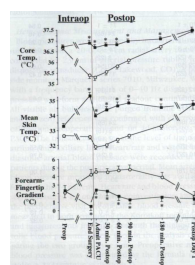
Walsh et al. Anesthesiology 2013;119:507-15

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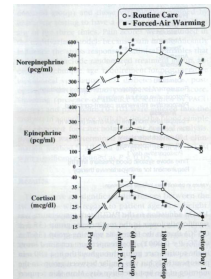
Gestion **PER**-opératoire

The Catecholamine, Cortisol, and Hemodynamic Responses to Mild Perioperative Hypothermia
A Randomized Clinical Trial

Steven M. Frank, M.D., Michael S. Higgins, M.D., L. Michael J. Brodeur, M.D., J. Lee A. Fisher, M.D., J. Douglas S. Gorman, M.D., James J. Stansbury, M.D., J. Michael S. Brodeur, M.D., J. Douglas S. Gorman, M.D., J. Michael S. Brodeur, M.D., J. Douglas S. Gorman, M.D.



- Hypothermie



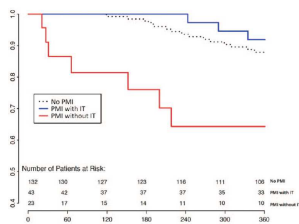
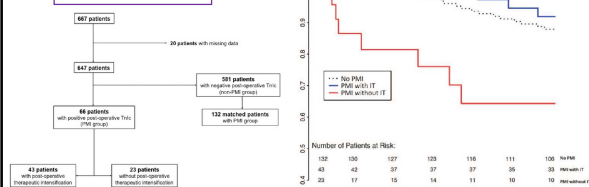
Frank et al. Anesthesiology 1995;82:83-93

Protection myocardique péri-opératoire

Gestion **POST**-opératoire

The Long-Term Impact of Early Cardiovascular Therapy Intensification for Postoperative Troponin Elevation After Major Vascular Surgery

Etude observationnelle



Therapeutic Intensification = ACE inhibitor + aspirin + β -blockers + statins

Foucrier et al. Anesth Analg 2014;119:1053-63

Protection myocardique péri-opératoire

Evaluation et stratification **PRE**-opératoire

Gestion **PER**-opératoire

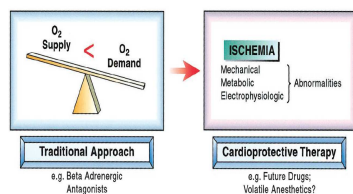
Gestion **POST**-opératoire

Protection myocardique péri-opératoire

Evaluation et stratification **PRE**-opératoire

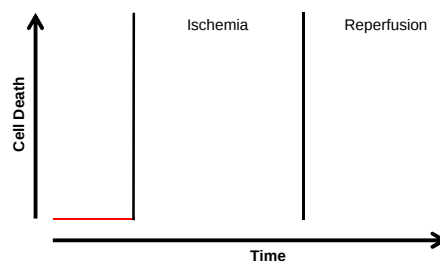
Gestion **PER**-opératoire

Gestion **POST**-opératoire

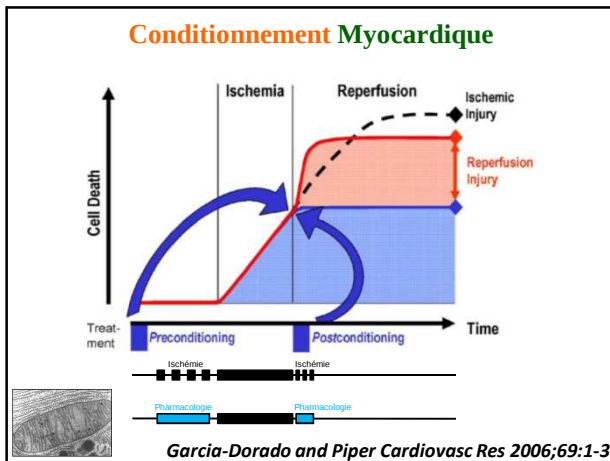


Wartler et al. Anesthesiology 2000;92:253-9

Lésions myocardiques



Lésions = Ischémie + Reperfusion



PRE-conditionnement

1986... PubMed le 14/06/2017 ...!!!

Contrôle ———— Ischémie ———— Reperfusion
Préconditionnement ————

The screenshot shows a PubMed search for 'preconditioning'. The search results are displayed in a table with columns for Title, Author, Journal, and Date. The first result is 'Effect of a single adenosine treatment on Fox expression in the brain after ischemic stroke' by Chacko Z, et al. The search results are sorted by Best Match.

Le PRE-conditionnement

The diagram shows a normal heart on the left and a heart with preconditioning on the right, indicated by a red arrow. The heart with preconditioning shows a larger infarcted area.

- Le mécanisme de cardioprotection **le + puissant!**
- Actif dans **toutes les espèces** animales, et chez l'**homme!**
- Sur ***organes** : cœur, SNC, poumon, rein, TD, muscles squelettiques...
- Actif **à distance** : ischémie IVA → protection artère marginale

ischémie $\begin{cases} \text{rein} \\ \text{mb} \end{cases}$ } Cardio-Protection } **RIPC** (remote ischemic preconditioning)

Remote Ischemic Pre-Conditioning - RIPC

The diagram illustrates the RIPC mechanism. It shows a Source organ (Brain, Heart, Lung, Liver, Kidney, Spleen) receiving a Stimulus (Ischemia/Reperfusion, Surgical trauma, Peripheral nerve stimulation, Chemical exposure). This leads to Transfer (Neuronal, Humoral) to the Target organ (Heart). The Cardiac signal transduction involves Adenosine, Endothelin-1, NO, and Mitochondrial pathways.

3 ou 4 cycles - 5 min Ischémie / 5 min Reperfusion du Mb Sup. ou Mb Inf.
- Inflation supra-systémique / Déflation du brassard

Heusch et al. J Am Coll Cardiol 2015;65:177-95.

“...are some anesthetics better than others at protecting the heart?”

Hobai Anesthesiology 2017

Volatile Anesthetics Protect the Ischemic Rabbit Myocardium from Infarction

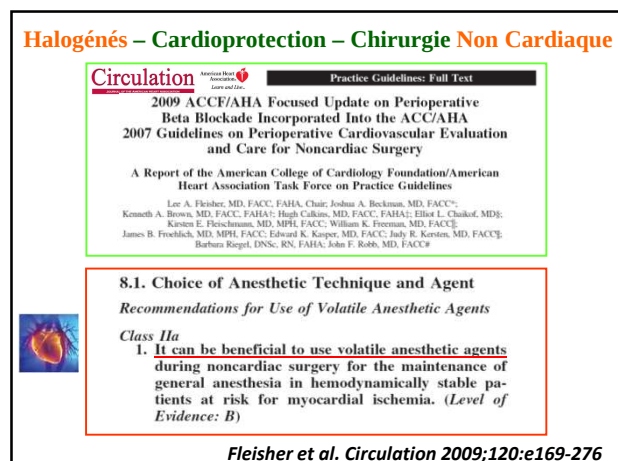
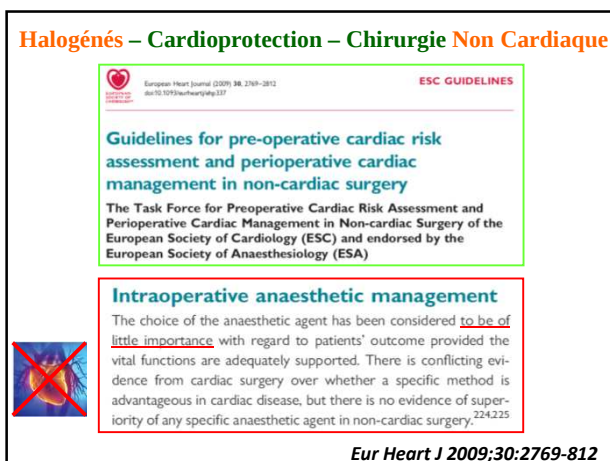
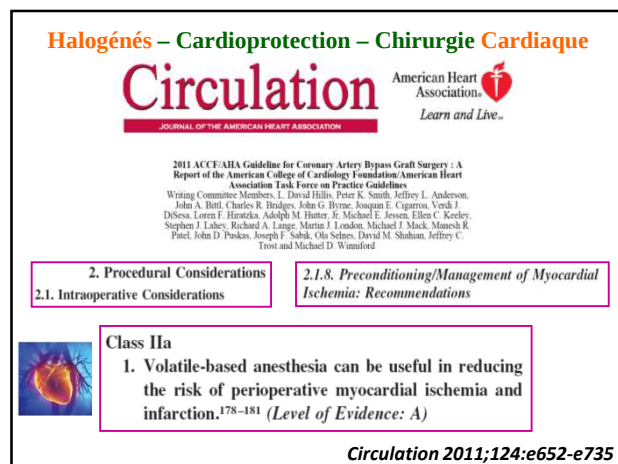
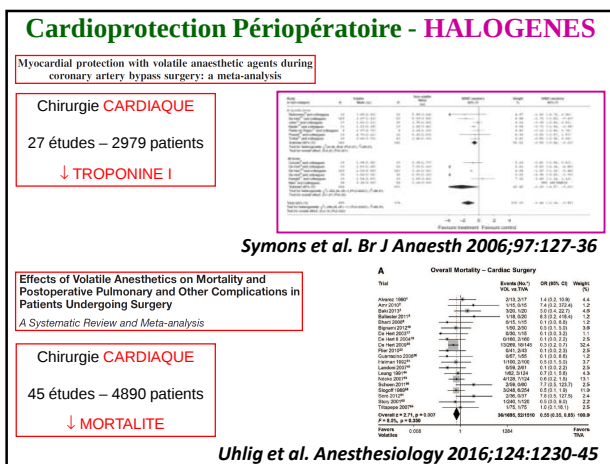
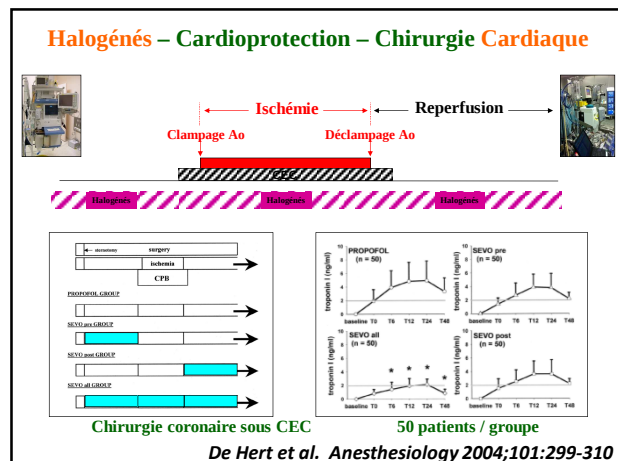
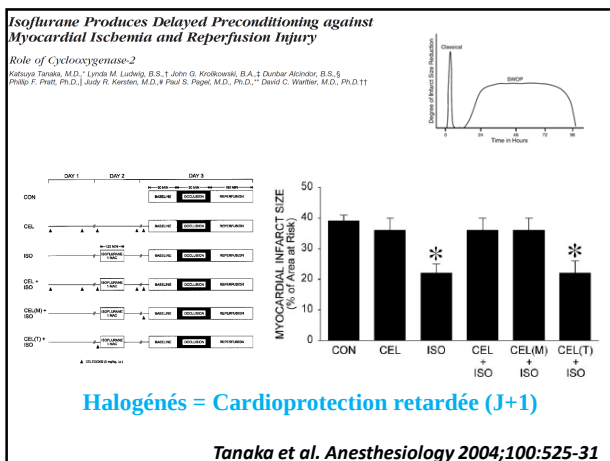
Doris K. Cope, M.D., * W. Keyser Impastato, B.S., † Michael V. Cohen, M.D., † James M. Downey, Ph.D. §

The graph shows the % Infarction of Risk Zone for various anesthetics. The y-axis ranges from 0 to 60. The x-axis lists the anesthetics: PENT, KX, PROP, ENFL, HALO, ISOFL. The data points show that PENT and KX have the highest infarction rates, while PROP, ENFL, HALO, and ISOFL have significantly lower rates.

1, p=0.01 vs. PENT
2, p=0.01 vs. PROP
3, p=0.01 vs. KX

Les Halogénés sont les seuls agents hypnotiques qui diminuent la taille de l'infarctus du myocarde!

Cope et al. Anesthesiology 1997;86:699-709



Halogénés – Cardioprotection – Chirurgie Non Cardiaque

Randomized Comparison of Sevoflurane Versus Propofol to Reduce Perioperative Myocardial Ischemia in Patients Undergoing Noncardiac Surgery

Giovanna A.L. Lurati Buse, MD; Philippe Schumacher, MD; Esther Seeburger, CCRCN; Wolfgang Stiller, MD; Regina M. Schuman, MD; Jens Kroll, MD; Jeger Kasper, MD; Michael Filipowicz, MD; Daniel Bolliger, MD; Martin D. Seeburger, MD

Etude randomisée, multicentrique, 385 patients à risque CV, en chirurgie non cardiaque

Etude « **PRAGMATIQUE** » = pas d'information sur les gestions per et post-op. analgésie, perfusions, seuils transfusionnels, gestion HD, réintroduction ttt...

	Sevoflurane (n=184)	Propofol (n=201)	RR or HR (95% CI)
Primary end point			
Myocardial ischemia (ECG and troponin)	75 (40.8)	81 (40.3)	RR=1.01 (0.78–1.30)
Secondary end points			
Cardiac mortality	5 (2.7)	5 (2.5)	RR=1.09 (0.32–3.77)
All-cause mortality	25 (13.6)	23 (11.4)	RR=1.19 (0.67–2.08)

Editorial

A Recipe for Perioperative Cardioprotection What Matters Most? The Ingredients or the Chef?

Judy R. Kersten, MD

Lurati Buse et al. Circulation 2012;126:2696-704

Halogénés – Cardioprotection – Chirurgie Non Cardiaque

CLINICAL PRACTICE GUIDELINE

2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Developed in Collaboration With the American College of Surgeons, American Society of Anesthesiologists, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Anesthesiologists, and Society of Vascular Medicine

Endorsed by the Society of Hospital Medicine

CLASS IIa

1. Use of either a volatile anesthetic agent or total intravenous anesthesia is reasonable for patients undergoing noncardiac surgery, and the choice is determined by factors other than the prevention of myocardial ischemia and MI (340,341). (Level of Evidence: A)

Fleisher et al. JACC 2014;64:e77-137

Cardioprotection péri-opératoire



Stratégie Globale = Stratégie Multimodale

Hyperglycémie - Cardio-Protection - Chirurgie cardiaque

8727 patients opérés d'une chirurgie cardiaque, 1996 – 2004

Highest blood glucose control (BGC) H0 → H60 post-op.

- **Good** < 200 mg/dL
- **Moderate** 200 – 250 mg/dL
- **Poor** > 250 mg/dL

15% des patients = hyperglycémie (HPG) > 200 mg/dL

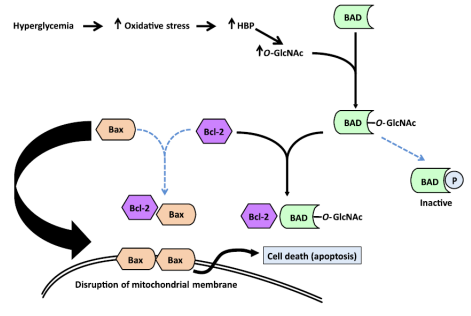
> 50% des HPG modérées ou sévères = patients **non** diabétiques

IDM post-opératoire

- Moderate / Good OR = 1,62 (1,15 – 2,29)
- Poor / Good OR = 2,73 (1,74 – 4,26)

Ascione et al. Circulation 2008;118:113-23

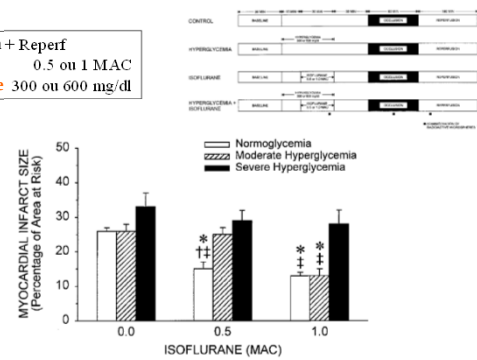
Hyperglycémie – Lésions Cardio-Vasculaires



Mapanga et al. Am J Physiol 2016;310:H153-73

Hyperglycémie – PRE-conditionnement / Isoflurane

Isch + Reperf
± **Isoflurane** 0.5 ou 1 MAC
± **HPglycémie** 300 ou 600 mg/dl



Kehl et al. Anesthesiology 2002;96:183-8

Oxygénation - ICU

Effect of Conservative vs Conventional Oxygen Therapy on Mortality Among Patients in an Intensive Care Unit
The Oxygen-ICU Randomized Clinical Trial

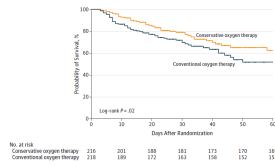
Massimo Girardis, MD, Stefano Buzani, MD, Elisa Damiani, MD, Abele Donati, MD, Laura Rinaldi, MD, Andrea Marudi, MD, Andrea Morelli, MD, Massimo Antonelli, MD, Morvyn Singer, MD, FRCA

Etude :
prospective, monocentrique, randomisée
480 patients admis en ICU

PaO₂: >150 versus 70-100 mmHg

SpO₂: >97 % versus 94-98 %

Figure 2. Probability of Survival From Study Inclusion (Day 0) Through Day 60 for Patients in the Conservative and Conventional Oxygen Strategy Groups



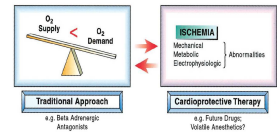
Girardis et al. JAMA 2016;316:1583-9

Cardioprotection péri-opératoire

Evaluation et stratification **PRE**-opératoire

+
Gestion **PER**-opératoire

+
Gestion **POST**-opératoire



Stratégie **Globale** = Stratégie **Multimodale**