Ischémie péri-opératoire

Détection, prévention et traitement

Dans le cadre des cours de sciences de base

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27 Octobre 2004

Épidémiologie

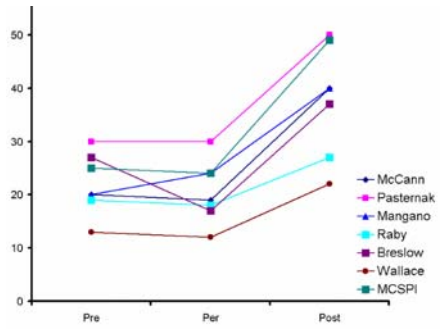
- 60 millions de patients subissent une chirurgie non cardiaque annuellement
- 30% porteur à risque de MCAS
- 3 millions ont des complications cardiaques
- Coût associé de 40 milliard $/an

McSPI-Erope Research Group, Anesthesiology 86:346,1997

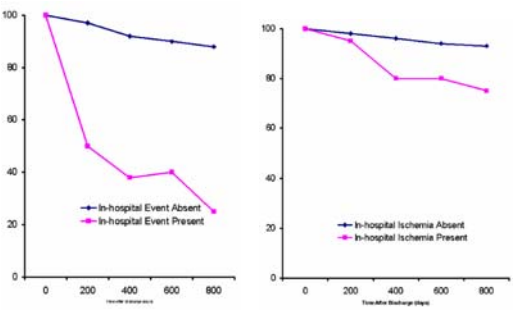
Importance de l'ischémie périopératoire

- 30-60% d'ischémie myocardique en postopératoire de chirurgie non-cardiaque (1-3)
- 9 fois plus de risque d'infarctus ou angine instable (1)

1) NEJM 1990;323:1781-8
2) JACC 1991;17:843-850
3) Lancet 1993;341:715-19



Impact sur le pronostique à long terme



Mangano DT et al. JAMA 268; 233-239 1992

Stratégie pour diminuer le pronostique clinique

- Évaluation préopératoire (1)
- Détection de l'ischémie
- Prévention
- Traitement

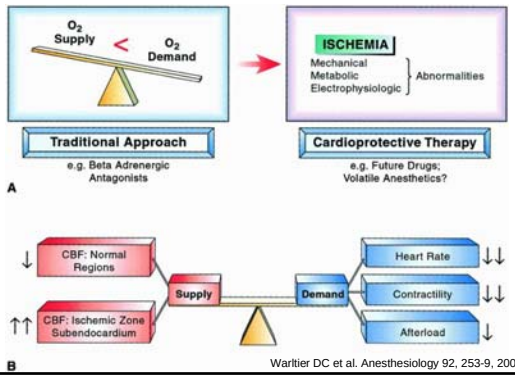
1 (ACC/AHA Guidelines, Circulation 93; 1278, 1996

Population à risque

- MCAS connu
- Chirurgie vasculaire
- Facteurs de risques:
  - Âge > 65 ans
  - HTA
  - Tabagisme
  - Hypercholestérolémie
  - Diabète

Mangano DT JAMA 268: 233-39, 1992

Physiologie de l'ischémie périopératoire



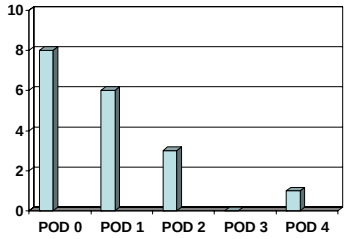
Warltier DC et al. Anesthesiology 92, 253-9, 2000

Caractéristiques de l'infarctus post-opératoire

- 323 patients à risques
- Chirurgie non cardiaque
- 5.6% d'infarctus post-opératoire
- Mortalité dans 17%
- Le plus souvent infarctus non Q
- Précédé d'ischémie prolongée

Badner et al, Anesthesiology 88; 572-8, 1998

Caractéristiques de l'infarctus post-opératoire



Badner et al. Anesthesiology 88, 572-8, 1998

Monitorage de l'ischémie: Électrocardiographie

- Récommandation de l'AHA
  - Pas de filtrage entre 0.05 et 100 hz
  - Monitoring: filtre < 0.5 hz
  - Diagnostique: filtre < 0.05 hz

Électrocardiographie: Critères d'ischémie

- Sous décalage du ST de 1 mm en pente descendante ou horizontale, 0.06 sec après le point J
- Élévation du segment ST de 1 mm dans une dérivation non-Q
- Sous décalage pente ascendante de 2 mm 0,08 sec après le point J

Dérivations électrocardiographiques

TABLE 9-1. Sensitivity for Different ECG Lead Combinations

No. of Leads	Sensitivity (%)
1	
II	33
V_4	61
V_5	75
2	
II/V_5	80
II/V_4	82
V_4/V_5	90
3	
$V_3/V_4/V_5$	94
$II/V_4/V_5$	96
4	
$II/V_2–V_5$	100

(Data from London et al.[52])

London et al. Anesthesiology 69; 232-41, 1989

Analyse du segment ST *vs* ECG

- **HP 78534c**:
  - Sensibilité de 80%
  - Spécificité de 67%
- **Marquette 7000 ST**:
  - Sensibilité de 100%
  - Spécificité de 67%
- Valeur prédictive négative élevée:
  - 93% HP
  - 100% Marquette

Ellis et al. Anest Analg 75; 764-72, 1992

Analyse du segment ST *vs* Holter

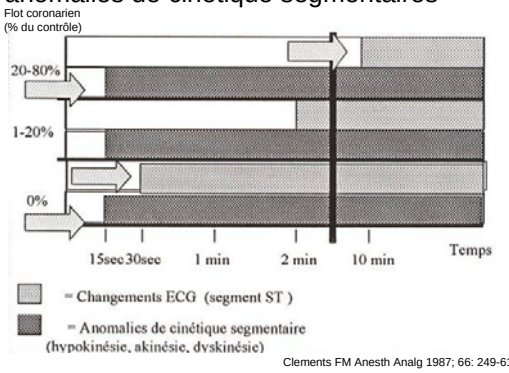
- 94 patients; chirurgie coronarienne
  - Marquette: sensibilité 75% spécificité 89%
  - Hp: sensibilité 78% spécificité 71%
  - Datex: sensibilité 60% spécificité 69%

Leung JM et al. Anesth Analg 87: 4-10, 1998

Pression capillaire pulmonaire

- **Leung et al. Anesthesiology 71: 1989**
  < 9% épisodes (ETO) associé à un changement du wedge > 20%
- **Van daele et al. Circulation 81: 1990**
  sensibilité de 33% (vs ETO)

Séquence des changements à l'ÉCG et des anomalies de cinétique segmentaires



Clements FM Anesth Analg 1987; 66: 249-61

Limitations de l'ÉTO

- Valeur prédictive faible en chirurgie non-cardiaque
- Observateur dépendant
- Axe fixe vs flottant
- Surestimation de la zone ischémique: effet d'étirement
- Évaluation en temps réel: surestimation des segments normaux(1)

(1) Bolduc, Couture et al, Anesth Analg; 90 S190, 2000

Prévention de l'ischémie: moyens non-pharmacologique

- Anémie et morbidité cardiaque post-opératiore

Table 3. Incidence of cardiac morbidity by postoperative hematocrit

Hematocrit	N	Ischemia[a]	Event[b]
<28%	13	10 (77%)	6 (46%)
≥28%	14	2 (14%)	0 (0%)

Nelson et al. Crit Care Med 21: 860-66 1993

Prévention de l'hypothermie

	Patient Age		Type of Anesthesia		
	> 65 y	<65 y	Epidural	General	Totals
Hypothermic (<35ºC)	10/24 (42)	2/9 (22)	4/10 (40)	8/23 (/%	12/33 (38)*
Normothermic (> 35ºC)	5/26 (18)	4/39 (10)	5/36 (14)	4/31 (13)	9/67 (13)
Totals	15/32 (29)**	6/48 (13)	9/46 (20)	12/54 (22)	21/100 (21)

Franck SM et al. Anesthesiology 78; 468-76 1993

CLINICAL REPORTS

Ronald D. Miller, M.D., Editor

Prevention of Intraoperative Myocardial Ischemia during Noncardiac Surgery with Intravenous Nitroglycerin

Pierre Coriat, M.D.,* Madeleine Daloz, M.D.,* Dominique Bousseau, M.D.,† Jacques Fusciardi, M.D.,* Ernest Echter, M.D.,‡ Pierre Viars, M.D.,‡

When the heart is subjected to stressful situations. (e.g., endotracheal intubation), an imbalance between myocardial oxygen supply and demand may cause myocardial ischemia in patients suffering from coronary artery disease.[1] Although fentanyl-N_2O-pancuronium anesthesia has the apparent advantage of preventing cardiovascular stimulation during endotracheal intubation and surgery,[2] the incidence of intraoperative myocardial ischemia with this approach has not been determined.

The beneficial effects of iv administered nitroglycerin

terpretation of the ST segment difficult. Informed consent was obtained from each patient at the preoperative visit, and the protocol was approved by the Ethics Committee of our institution. The patients randomly were assigned to NTG 0.5 $\mu g \cdot kg^{-1} \cdot min^{-1}$ (Group 1 n = 22) or 1.0 $\mu g \cdot kg^{-1} \cdot min^{-1}$ (Group 2 n = 25).

Both groups were identical in age (68 ± 8 vs. 66 ± 7), infarction dating for more than 6 months (18 vs. 15), and grade of angina (marked limitation of activity: 14 vs. 12). The type of operation was similar in both groups (carotid

Prophylactic nitroglycerin infusion during noncardiac surgery does not reduce perioperative ischemia.

Dodds TM, Stone JG, Coromilas J, Weinberger M, Levy DG.

Department of Anesthesiology, Dartmouth Hitchcock Medical Center, Lebanon, NH 03756.

We evaluated the impact of prophylactic nitroglycerin on the incidence of perioperative myocardial ischemia in patients with known or suspected coronary artery disease who undergo noncardiac surgery. Our goals were to better define the role of nitroglycerin in the management of high-risk patients and to explore the mechanisms of perioperative myocardial ischemia. Patients were assigned randomly to either a control group (n = 23) or to receive 0.9 micrograms kg-1 min-1 of intravenous nitroglycerin (n = 22). The diagnosis of myocardial ischemia was based on a review of Holter electrocardiogram (ECG) recordings. There was no difference in the incidence of ischemia between groups. Seven control patients (30%) and seven nitroglycerin patients (32%) exhibited ECG evidence of ischemia. The preponderance of myocardial ischemia occurred during emergence from anesthesia (of the 14 patients exhibiting ischemia, 12 did so at emergence). There was an acute increase in heart rate at the onset of ischemia in all patients exhibiting ischemia with 14 of 18 episodes associated with an increase of 20% or greater. The heart rate associated with the onset of ischemia was greater in the nitroglycerin-treated patients than in the control group. We also found that the occurrence of myocardial ischemia on a preoperative Holter recording was strongly predictive of the subsequent occurrence of perioperative ischemia. In conclusion, the addition of nitroglycerin to standard anesthetic management of these high-risk patients does not measurably reduce perioperative ischemia.

Publication Types:
- Clinical Trial
- Randomized Controlled Trial

PMID: 8466005 [PubMed - indexed for MEDLINE]

Nitroglycérine

- **Classe I**: Patient à haut risque qui prenaient de la NTG, avec ischémie, sans hypotension
- **Classe II**: Prophylaxie chez patients à risques
- **Classe III**: Hypovolémie, hypotension

Eagle KA et al. Circulation 93: 1278-1317, 1996

Beta-bloqueurs


The New England Journal of Medicine

EFFECT OF ATENOLOL ON MORTALITY AND CARDIOVASCULAR MORBIDITY AFTER NONCARDIAC SURGERY

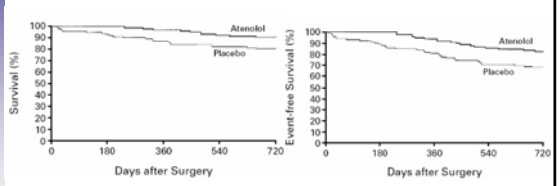
Abstract

Background Perioperative myocardial ischemia is the single most important potentially reversible risk factor for mortality and cardiovascular complications after noncardiac surgery. Although more than 1 million patients have such complications annually, there is no effective preventive therapy.

Methods We performed a randomized, double-blind, placebo-controlled trial to compare the effect of atenolol with that of a placebo on overall survival and cardiovascular morbidity in patients with or at risk for coronary artery disease who were undergoing noncardiac surgery. Atenolol was given intravenously before and immediately after surgery and orally there-

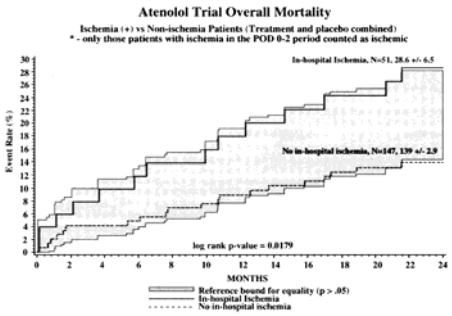
MORTALITY and morbidity due to cardiovascular disease are prevalent and costly for the 30 million patients who undergo noncardiac surgery annually in the United States, affecting more than 1 million of them.[1,2] In the subgroup of 3 million patients who require noncardiac surgery who have or are at risk for coronary artery disease, the most significant risk factors for mortality and cardiovascular morbidity are myocardial ischemia and nonfatal myocardial infarction during the first week after surgery; these factors increase the risk of serious cardiovascular outcomes by a factor of 2 to 20 over the two years

Beta-bloqueurs



Mangano DT, N Engl J Med 23; 1713-1720, 1996

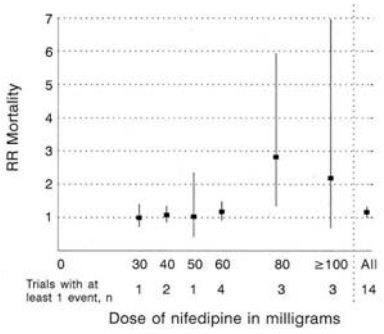
Beta-bloqueurs



Wallace A et al, Anesthesiology 88, 7-17, 1998

Nifedipine

Dose-related increase in mortality in patients with coronary artery disease



Furberg CD et al, Circulation 92; 1326-31, 1995

Dose chronic treatment with calcium entry blocking drugs reduce perioperative myocardial ischemia?

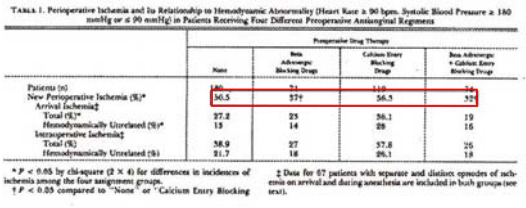


TABLE 1. Perioperative Ischemia and Its Relationship to Hemodynamic Abnormality (Heart Rate ≥ 90 bpm, Systolic Blood Pressure ≥ 180 mmHg or ≤ 90 mmHg) in Patients Receiving Four Different Preoperative Antianginal Regimens

	Preoperative Drug Therapy			
	None	Beta Adrenergic Blocking Drugs	Calcium Entry Blocking Drugs	Beta Adrenergic + Calcium Entry Blocking Drugs
Patients (n)	186	74	116	74
New Perioperative Ischemia (%)*	50.5	57†	56.5	32†
Arrival Ischemia‡				
Total (%)*	27.2	25	36.1	19
Hemodynamically Unrelated (%)*	13	14	28	16
Intraoperative Ischemia‡				
Total (%)	38.9	27	37.8	25
Hemodynamically Unrelated (%)	21.7	18	26.1	18

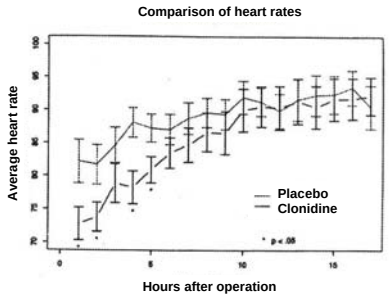
* $P < 0.05$ by chi-square (2 × 4) for differences in incidences of ischemia among the four assignment groups.
† $P < 0.05$ compared to "None" or "Calcium Entry Blocking"
‡ Data for 67 patients with separate and distinct episodes of ischemia on arrival and during anesthesia are included in both groups (see text).

Recommandations sur l'utilisation des bloqueurs calciques après un IM

- **Classe I:** Aucune
- **Classe IIa:** Contre indication aux beta-bloqueurs si ischémie ou FA rapide
- **Classe IIb:** IM sans élévation du ST (cardizem) peut-être donné chroniquement
- **Classe III:**
  - Nifedipine
  - Diltiazem, verapamil si disfonction VG

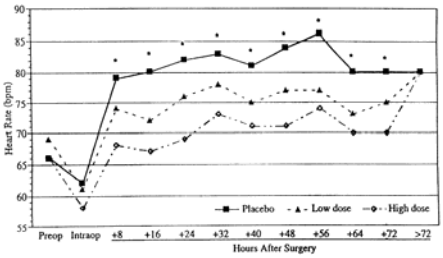
ACC/AHA Guidelines, J Am Coll Cardiol 28; 1328-1419, 1996

Alpha-2 agoniste: Clonidines



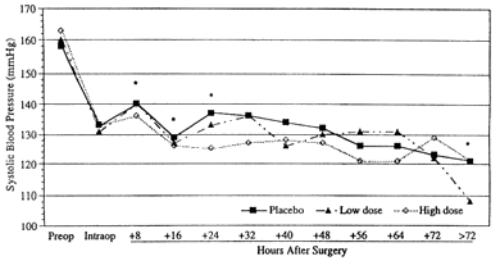
Ellis JE et al, Anesth Analg 79: 1133-40, 1994

Alpha-2 agoniste: mivazerol



McSPI-Europe Research Group Anesthesiology. 86(2):346-363 1997

Alpha-2 agoniste: mivazerol



McSPI-Europe Research Group Anesthesiology. 86(2):346-363 1997

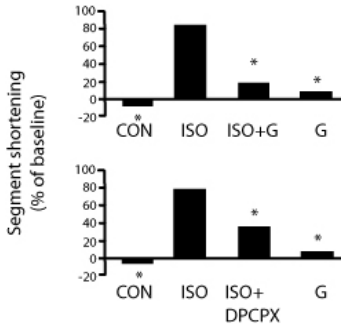
AINS

Table 3. Characteristics of Ischemia

	Ketorolac	Placebo	*P* value
Patients with ischemia (%)	17	14	NS
Time (h postop)†	9.3 ± 8	12.1 ± 7.3	NS
Heart rate (at start of ischemia)	97.7 ± 15.1	113 ± 15.8	.001
Heart rate (max during attack)	97.7 ± 15.7	114.1 ± 17.6	.006
Duration (length of ischemia in min)	24.4 ± 35.6	75.9 ± 95.4	.05
ST depression (mm)	2.8 ± 1.5	2.5 ± 1.2	NS

Beattie WS et al, Anesth Analg 84: 715-22, 1997

Agents anesthésiques et préconditionnement ischémique



Kersten JR et al, Anesthesiology 88: 495-513, 1998

JAMA. 1989 Jun 23-30;261(24):3577-81. Related Articles, Links

Epidural morphine decreases postoperative hypertension by attenuating sympathetic nervous system hyperactivity.

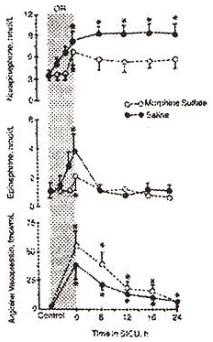
Breslow MJ, Jordan DA, Christopherson R, Rosenfeld B, Miller CF, Hanley DF, Beattie C, Traystman RJ, Rogers MC.

Department of Anesthesiology/Critical Care Medicine, Johns Hopkins Medical Institutions, Baltimore, Md 21205.

Twenty-four adults who were undergoing operations on the abdominal aorta were enrolled in a randomized, double-blind, placebo-controlled study in which epidural morphine sulfate (6 mg) was employed to attenuate the sympathoadrenal response to surgery to evaluate the possible contribution of sympathetic nervous system hyperactivity to postoperative hypertension. Patients who received epidural morphine required less parenteral morphine in the 24 hours following surgery, had lower analogue pain scores, and had markedly lower plasma norepinephrine levels when compared with patients in the control group who received an identical volume of saline in the epidural space. Epidural morphine had no effect on plasma epinephrine or arginine vasopressin levels. Fewer patients in the morphine group (4 of 12 vs 9 of 12 patients in the saline group) required treatment for hypertension (mean arterial blood pressure, greater than or equal to 110 mm Hg) in the 24 hours following surgery. In addition, patients in the morphine group had lower blood pressures in the 24 hours following surgery. These data suggest that sympathetic nervous system activity and not adrenal epinephrine or pituitary secretion of arginine vasopressin is responsible for the development of hypertension following aortic surgery. Furthermore, epidural narcotics appear to provide a means of attenuating this response.

Publication Types:
- Clinical Trial
- Randomized Controlled Trial

PMID: 2724504 [PubMed - indexed for MEDLINE]



Epidural analgesia and intravenous patient-controlled analgesia result in similar rates of postoperative myocardial ischemia after aortic surgery

	TEA (n = 55)	PCA (n = 59)	P value
Duration of myocardial ischemia per patient (min)	22.2 ± 119.8	20.5 ± 99	0.94
Number of ischemic episodes per patient	0.69 ± 2.1	1.2 ± 4.9	0.91
Surface area under the ST curve (mm/min)	30.8 ± 29.3	72 ± 136.5	0.74
Cardiac mortality	1	1	0.96
Myocardial infarction	2	5	0.28
Prolonged myocardial ischemia	5	1	0.08
Congestive heart failure	3	0	0.07
Ventricular tachycardia	2	3	0.71

TEA = thoracic epidural analgesia, PCA = intravenous patient-controlled analgesia.
Duration of myocardial ischemia, number of ischemic episodes per patient, and surface area under the ST curve are expressed as mean ± SD. The adverse cardiac outcomes are expressed as absolute numbers.
A P value < 0.05 was considered statistically significant.

Anesthésie analgésie epidurale

- Résultat controversés
- En général, bénéfices si anesthésie combinée **suivi** d'analgésie péridurale thoracique **post-opératoire**

Traitement: L'infarctus post-opératoire

- Dilatation coronarienne
- Pontage aorto-coronarien
- Thrombolyse contre-indiquée
- Ballon intraaortique
- AAS, beta-bloqueurs, IEC

Anatomie coronarienne et coupe mid-papillaire

Coronaire droite

Descendante antérieure

Circonflexe

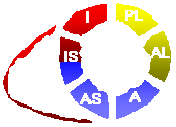
Coupes transgastriques

Apicale

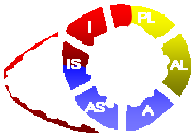
Coronaire droite

Circonflexe

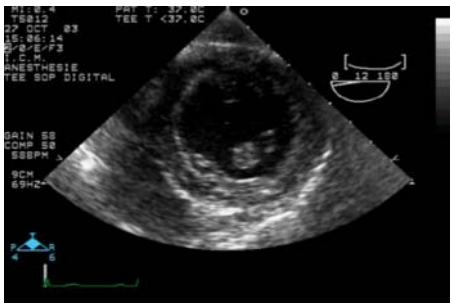
IVA

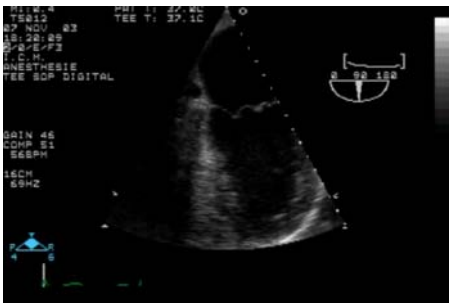


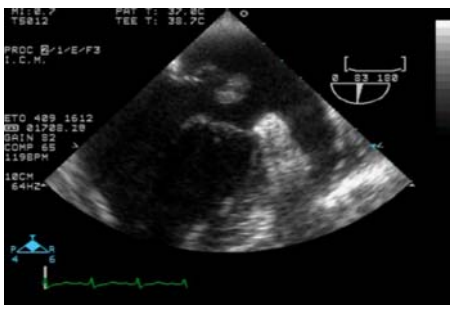
Mid-papillaire

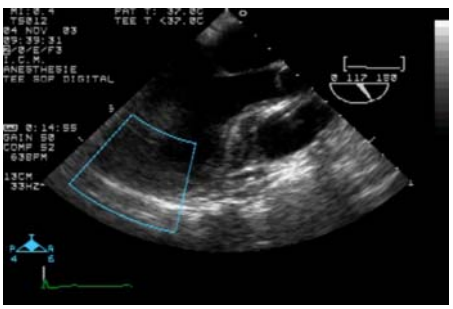


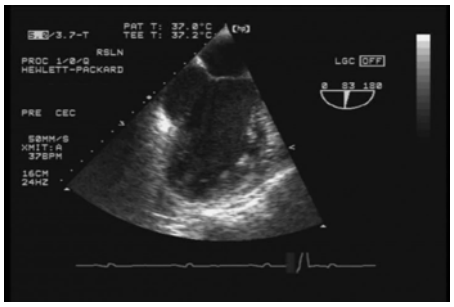
Basale

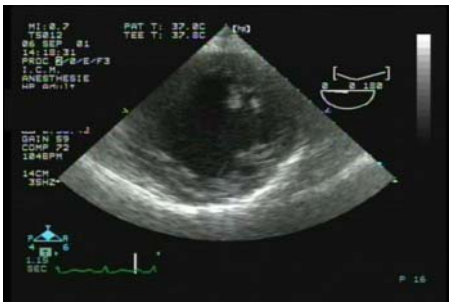


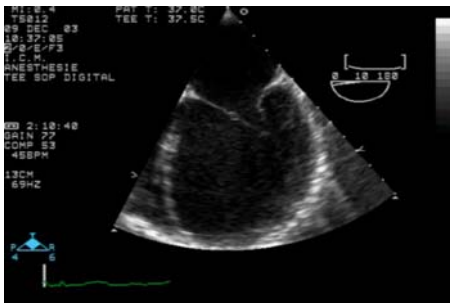


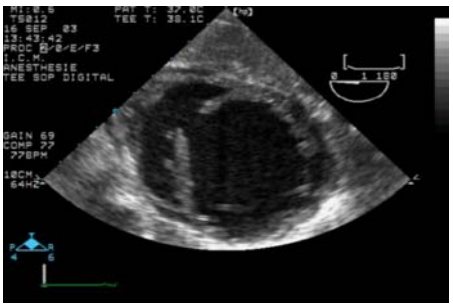


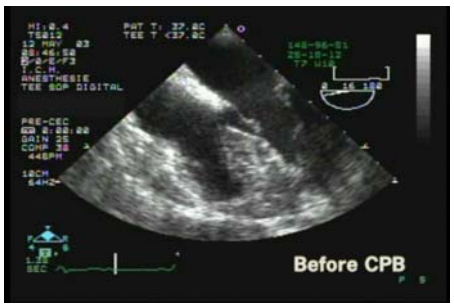




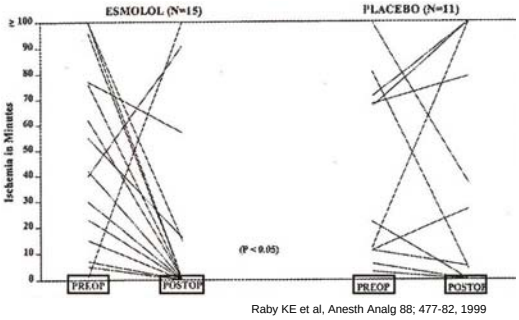






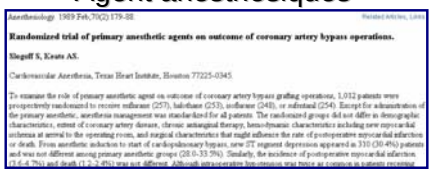


Beta-bloqueurs



Raby KE et al, Anesth Analg 88; 477-82, 1999

Agent anesthésiques



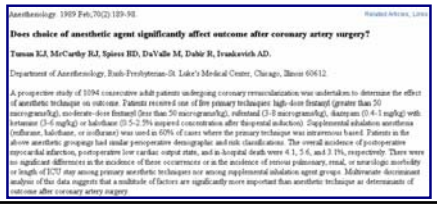
Anesthesiology 1989 Feb;70(2):179-88 Related Articles, Links

Randomized trial of primary anesthetic agents on outcome of coronary artery bypass operations.

Slogoff S, Keats AS.

Cardiovascular Anesthesia, Texas Heart Institute, Houston 77225-0345.

To examine the role of primary anesthetic agent on outcome of coronary artery bypass grafting operations, 1,032 patients were prospectively randomized to receive isoflurane (257), halothane (253), isoflurane (248), or sufentanil (254). Except for administration of the primary anesthetic, anesthesia management was standardized for all patients. The randomized groups did not differ in demographic characteristics, extent of coronary artery disease, chronic antianginal therapy, hemodynamic characteristics including new myocardial ischemia at arrival to the operating room, and surgical characteristics that might influence the rate of postoperative myocardial infarction or death. From anesthetic induction to start of cardiopulmonary bypass, new ST segment depression appeared in 310 (30.4%) patients and was not different among primary anesthetic groups (28.0-33.5%). Similarly, the incidence of postoperative myocardial infarction (3.5-4.7%) and death (1.2-2.4%) was not different. Although intraoperative hypotension was twice as common in patients receiving



Anesthesiology 1989 Feb;70(2):189-98. Related Articles, Links

Does choice of anesthetic agent significantly affect outcome after coronary artery surgery?

Tuman KJ, McCarthy RJ, Spiess BD, DeValle M, Dahir R, Ivankovich AD.

Department of Anesthesiology, Rush-Presbyterian-St. Luke's Medical Center, Chicago, Illinois 60612.

A prospective study of 1094 consecutive adult patients undergoing coronary revascularization was undertaken to determine the effect of anesthetic technique on outcome. Patients received one of five primary techniques: high-dose fentanyl (greater than 50 micrograms/kg), moderate-dose fentanyl (less than 50 micrograms/kg), sufentanil (3-8 micrograms/kg), diazepam (0.4-1 mg/kg) with ketamine (3-6 mg/kg) or halothane (0.5-2.5% inspired concentration after thiopental induction). Supplemental inhalation anesthesia (isoflurane, halothane, or isoflurane) was used in 60% of cases where the primary technique was intravenous based. Patients in the above anesthetic groupings had similar perioperative demographic and risk classifications. The overall incidence of postoperative myocardial infarction, postoperative low cardiac output state, and in-hospital death were 4.1, 5.6, and 3.1%, respectively. There were no significant differences in the incidence of these occurrences or in the incidence of serious pulmonary, renal, or neurologic morbidity or length of ICU stay among primary anesthetic techniques nor among supplemental inhalation agent groups. Multivariate discriminant analysis of the data suggests that a multitude of factors are significantly more important than anesthetic technique as determinants of outcome after coronary artery surgery.