ATR
الجمعية التونسية لطب الانعاش
ASSOCIATION TUNISIENNE DE REANIMATION
3ème JOURNÉE COMMUNE de RÉANIMATION
STAAR

# Peut-on prédire les complications postopératoires des patients obèses?

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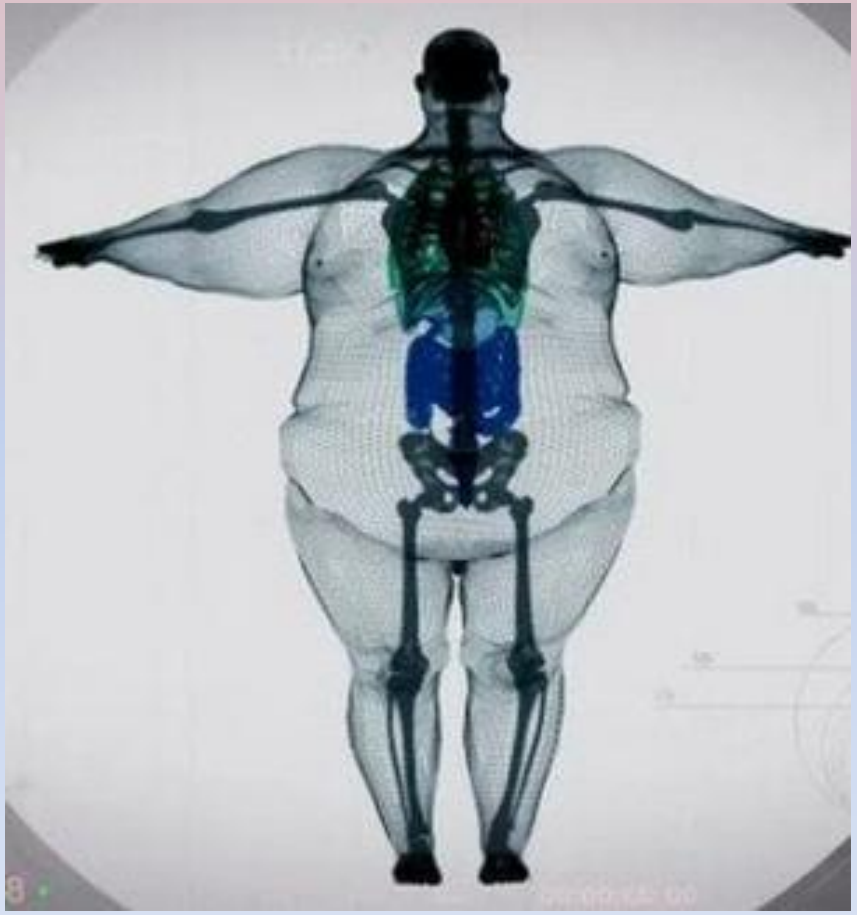
- Epidémies non infectieuses du XXIème siècle selon les instances sanitaires (OMS, CDC..)
- Obésité = maladie chronique et évolutive
- 1.6 milliard de personnes en surpoids
- 400 millions obèse
- Obèses > > dénutris

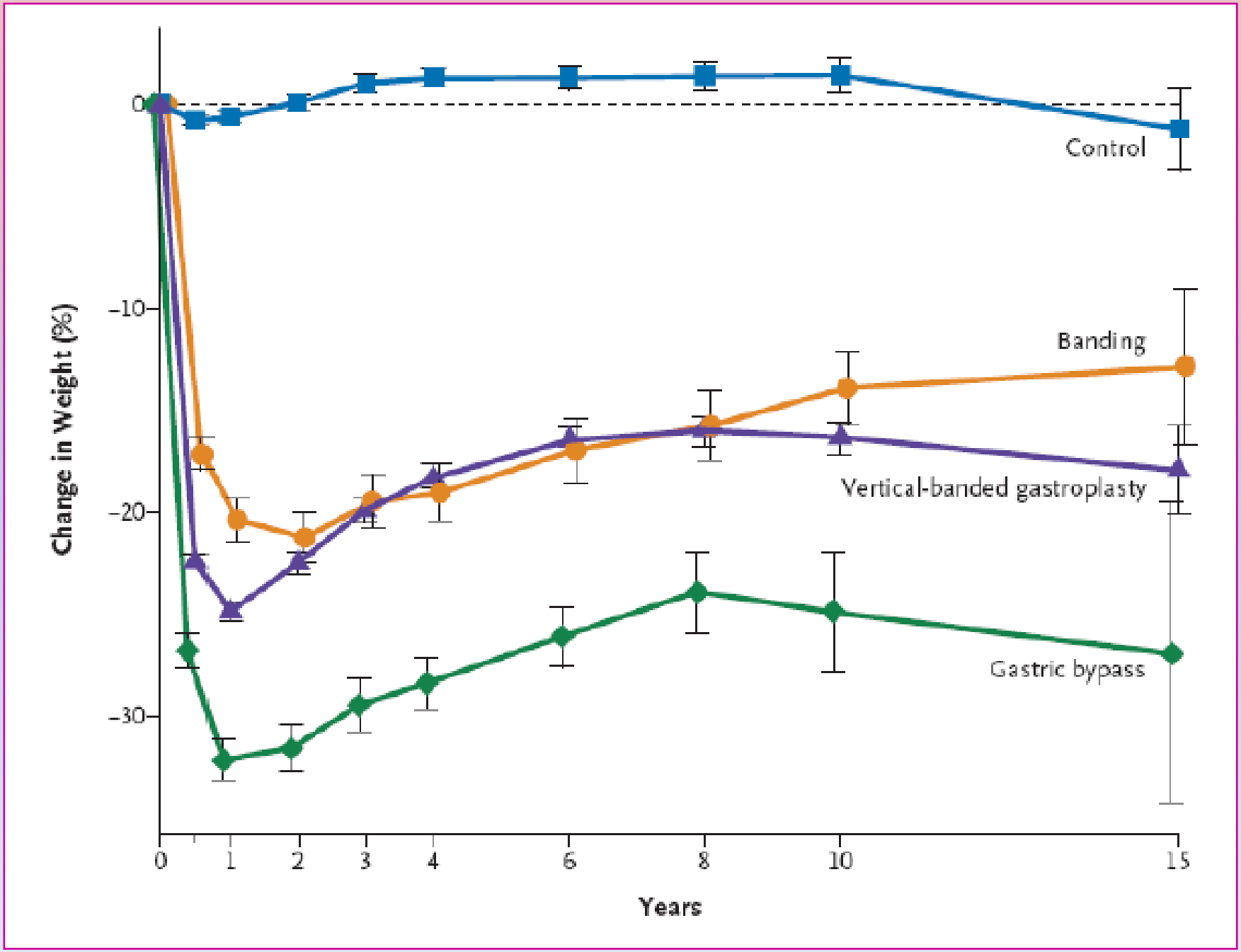


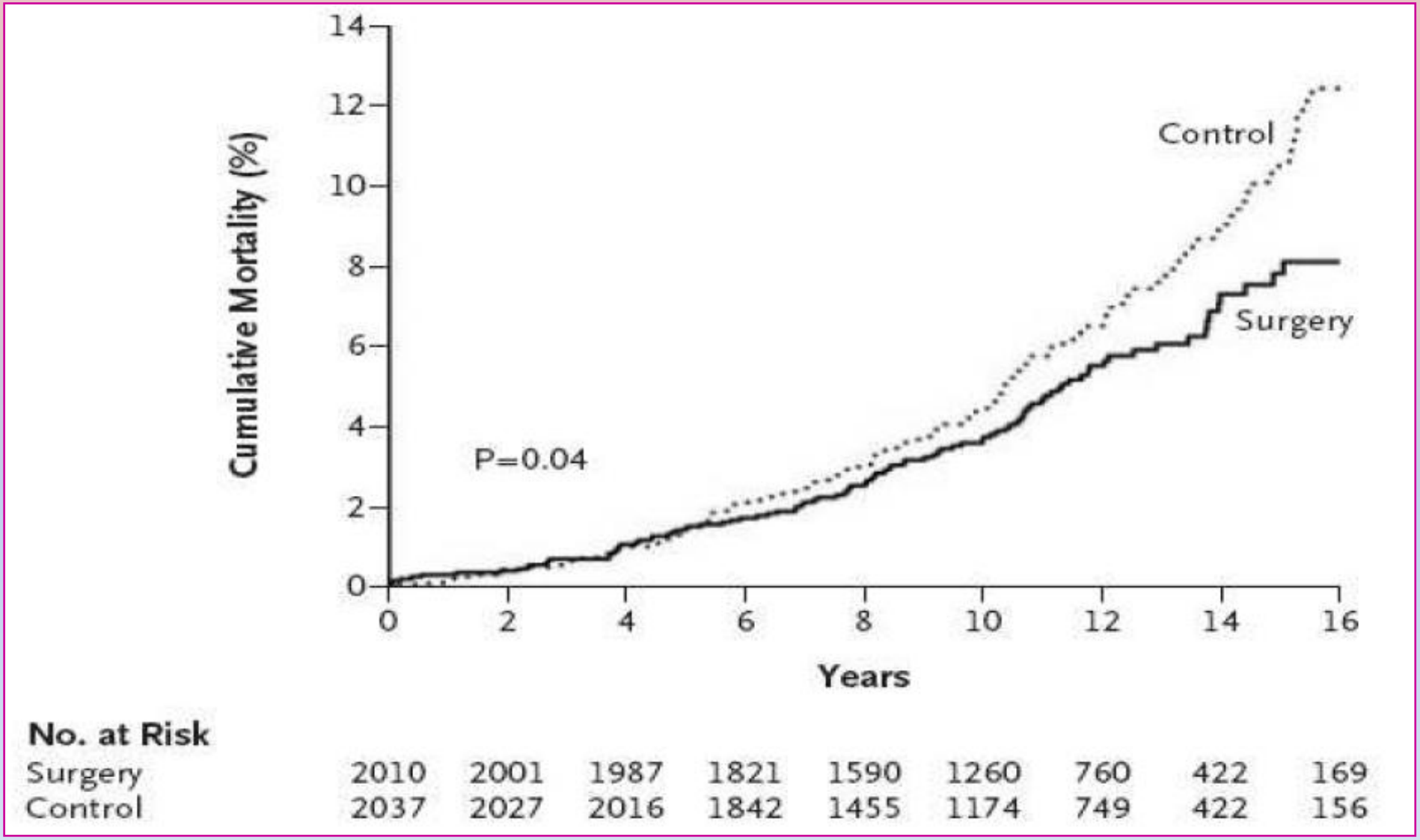
# Bariatric Surgery
## A Systematic Review and Meta-analysis

*JAMA. 2004;292:1724-1737*

La chirurgie bariatrique = efficacité prouvée

- Perte de poids prolongée dans le temps > 15 ans
- Réduction morbidité + mortalité liées à l'obésité
- Qualité de vie
- Variable selon technique chirurgicale


Change in Weight (%)
0
−10
−20
−30
Control
Banding
Vertical-banded gastroplasty
Gastric bypass
0
1
2
3
4
6
8
10
15
Years




# Impact de la chirurgie sur la mortalité

Prévalence élevée de certaines co-morbidités:

- Cardio-vasculaires
- Respiratoires
- Digestives
- Métaboliques

## 1. Au niveau cardio-vasculaire:

- HTA
- Cardiopathies ischémiques
- IDM
- Artériopathies oblitérantes
- AVC
- MTEV – EP
- Troubles du rythmes

## 2. Au niveau respiratoire:

- Sd restrictif
- Sd obstructif
- SAOS
- Collapsus pulmonaire + shunt
- ↗ W respiratoire
- ↘ réserves $O_2$
- Sd obésité hypoventilation centrale

## 3. Au niveau digestif:

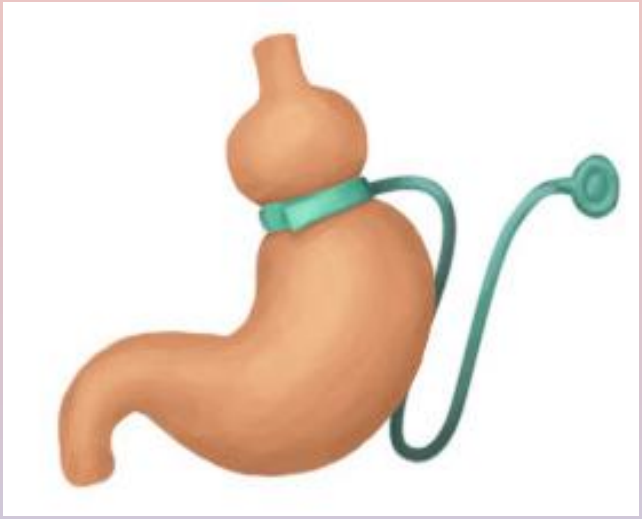
- RGO
- Stéato-hépatite
- LV
- ↗ pathologie cancéreuse

## 4. Au niveau métabolique:

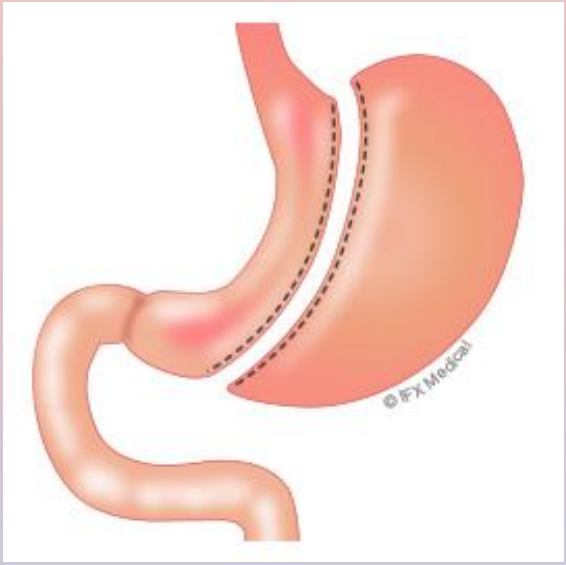
- Insulino-résistance
- Diabète
- Dyslipidémie
- Hyperuricémie
- Perturbation métabolisme médicamenteux

## Plusieurs techniques chirurgicales

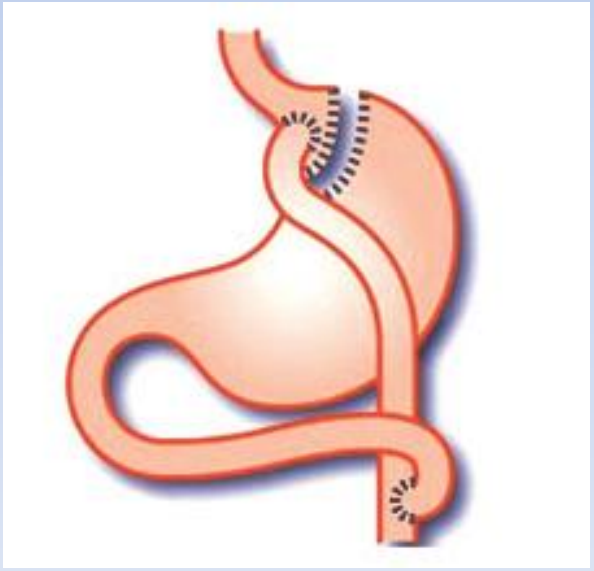
- Restrictive / malabsorptive / combinée
- Laparotomie / laparoscopie



Gastroplastie par anneau modulable



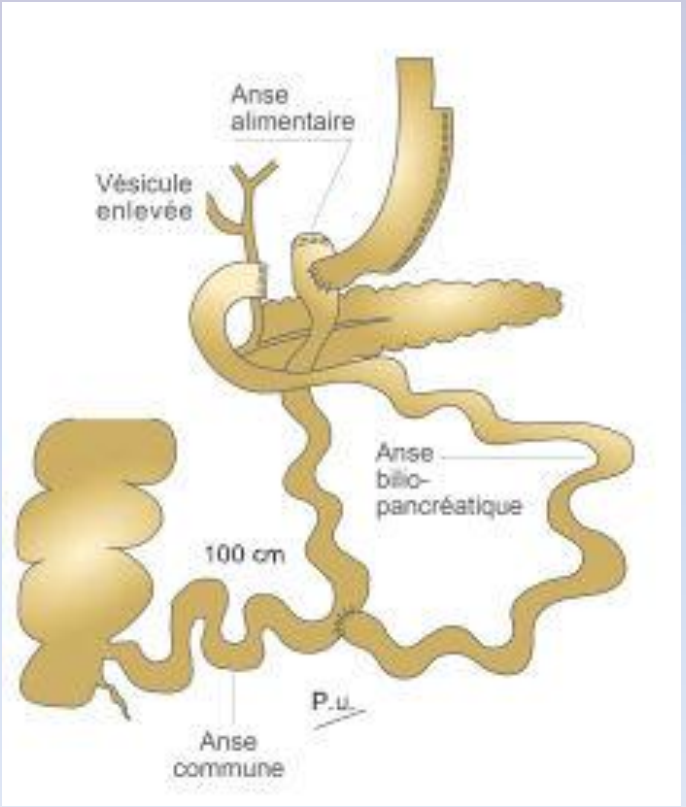

Sleeve gastrectomy



By-pass gastrique

Gastroplastie verticale calibrée (GVC)

Dérivation bilio-pancréatique avec switch duodénal



# Complications de la chirurgie bariatrique

# Complications

- Peuvent revêtir plusieurs formes et niveaux de gravité.
- Le terrain favorise leurs survenue (diabète, hypoperfusion tissulaire…)
- Le nombre d'anastomoses digestives

# Postoperative Complications in Obese and Nonobese Patients

Olumuyiwa A. Bamgbade, MD, FRCA, Timothy W. Rutter, MD, Olubukola O. Nafiu, MD, FRCA, Pema Dorje, MD

World J Surg (2007) 31: 556–560

| Complications | Nonobese (%) | Obese (%) | *P* value |
|---|---|---|---|
| Myocardial infarction | 0.1 | 0.5 | 0.001 |
| Wound infection | 3.5 | 6.0 | 0.001 |
| Peripheral nerve injury | 0.1 | 0.4 | 0.039 |
| Urinary tract infection | 2.6 | 3.9 | 0.004 |
| Acute renal failure | 0.7 | 0.9 | 0.376 |
| Hemorrhage | 0.4 | 0.2 | 0.176 |
| Cardiac arrest | 0.4 | 0.5 | 0.545 |
| Coma | 0.2 | 0.2 | 1.000 |
| Thromboembolism | 1.0 | 0.9 | 0.588 |
| Graft/wound breakdown | 1.1 | 1.2 | 0.714 |
| Postoperative 48-hour ventilation | 1.7 | 1.8 | 0.690 |
| Pneumonia | 1.5 | 1.5 | 0.831 |
| Stroke | 0.1 | 0.2 | 0.312 |
| Septicemia | 1.2 | 1.6 | 0.261 |
| Unplanned intubation | 1.1 | 1.2 | 0.714 |
| Death | 1.3 | 1.3 | 1.000 |

# Complications liées à la position per opératoire

➔ Rhabdomyolyse

Mais manque d'études

# Bariatric surgery: Rhabdomyolysis after open Roux-en-Y gastric bypass: A prospective study

Tamer Youssef*, Ibrahim Abd-Elaal, Gamal Zakaria, Mona Hasheesh

*Mansoura Faculty of Medicine, Mansoura University, Mansoura, Egypt*

International Journal of Surgery 8 (2010) 484–488

| | Mognol et al.[10] | Ettinger et al.[17] | Lagandre et al.[20] | Carvalho et al.[21] | de Oliveira et al.[22] | Present study |
|---|---|---|---|---|---|---|
| Number of patients | 66 | 114 | 49 | 98 | 22 | 23 |
| Surgical technique | • Lap RYGBP (16)<br>• Lap GB (50) | • Open RYGBP (56)<br>• Lap RYGBP (58) | • Lap GB (32)<br>• Open BPD/DS (13)<br>• Open RYGBP (4) | Open RYGBP | Open RYGBP | Open RYGBP |
| Age (years) | 39.0 | 38.25 | 39.9 | 37.4 | 39.9 | 33.5 |
| Sex (female %) | 75 | 75.4 | 73.4 | 64.3 | 63.6 | 69.6 |
| BMI (kg/m$^2$) | 58.8 | 43.1 | 51.0 | 43.2 | 52.4 | 54.9 |
| Hypertension (%) | 22.7 | – | – | – | 63.6 | 43.5 |
| Diabetes (%) | 19.6 | – | 36.5 | – | 13.6 | 13.1 |
| Surgical time (min) | 390 | 176.7 | 233.5 | 216 | 253 | 252 |
| RML (%) | 22.7 | 7 | 26.5 | 37.7 | 77.3 | 30.4 |
| Post-operative CPK (IU/l) | 7890 | 400 | 1386 (RML+) | 1075.2 | 7467.7 | 2328.5 |
| Diagnostic criteria of RML | CPK >1000 IU/l in both sexes | CPK >950 IU/l in both sexes | CPK >1000 IU/l in both sexes | M: CPK >1160 IU/l<br>F: CPK >1075 IU/l | M: CPK >850 IU/l<br>F: CPK >675 IU/l | CPK >1000 IU/l in both sexes |
| Identified risk factor for RML | • Massive obesity<br>• Long duration of the operation | BMI | Surgery time >4 h | Male gender | Long surgical time | BMI |
| Type of the study | Prospective | Retrospective | Prospective | Retrospective | Prospective | Prospective |

Lap, laparoscopic; GB, gastric banding; BPD/DS, biliopancreatic diversion with duodenal switch; RYGBP, Roux-en-Y gastric bypass.

# Rhabdomyolysis in Bariatric Surgery: a Systematic Review

Saurav Chakravartty · Diwakar R. Sarma · Ameet G. Patel

OBES SURG (2013)

- 22 études (n = 145)
- 14% d'insuffisance rénale
- Mortalité après IR = 25%
- Facteurs de risque:
  - Sexe masculin
  - BMI > 52
  - Durée d'intervention

# Mortalité

Obesity surgery mortality risk score: proposal for a clinically useful score to predict mortality risk in patients undergoing gastric bypass

Eric J. DeMaria, M.D.[a,b,*], Dana Portenier, M.D.[b], Luke Wolfe, M.S.[a]

Surgery for Obesity and Related Diseases 3 (2007)

## ➔ Obesity Surgery Risk Score (OS-MRS)

- Prospective, monocentrique, 1995 → 2004
- 2075 by-pass gastrique
- Mortalité à J 90
- Variables pré op = 15

# Obesity Surgery Mortality Risk Score (OS-MRS)

- 5 paramètres
  - BMI > 50
  - Sexe masculin
  - HTA
  - Risque de MTEV
  - Age > 45 ans

1 point par item

# Obesity Surgery Mortality Risk Score (OS-MRS)

| | Classe | Mortalité |
|---|---|---|
| 0-1 point | A | 0.31 % |
| 2-3 points | B | 1.9 % |
| 4-5 points | C | 7.5 % |

# Limites du OS-MRS

- ✓ Effectif réduit
- ✓ seulement pour By pass gastrique
- ✓ Ne prend pas en compte voie d'abord (Coelio / laparo)
- ✓ Seulement 15 variables pré op
- ✓ 0-1 par item (non pondéré selon OR)

# Mortality After Bariatric Surgery

## *Analysis of 13,871 Morbidly Obese Patients From a National Registry*

*Mario Morino, MD,* Mauro Toppino, MD,* Pietro Forestieri, MD,† Luigi Angrisani, MD,‡ Marco Ettore Allaix, MD,* and Nicola Scopinaro, MD, FACS Hon§*

*Annals of Surgery* • Volume 246, Number 6, December 2007

- Italie, sur 10 ans.
- Mortalité globale à M2 = 0.25%
- Variable selon chirurgie:

  Anneau gastrique: **0.1%**

  ↓

  Dérivation bilio-pancréatique: **0.8%**

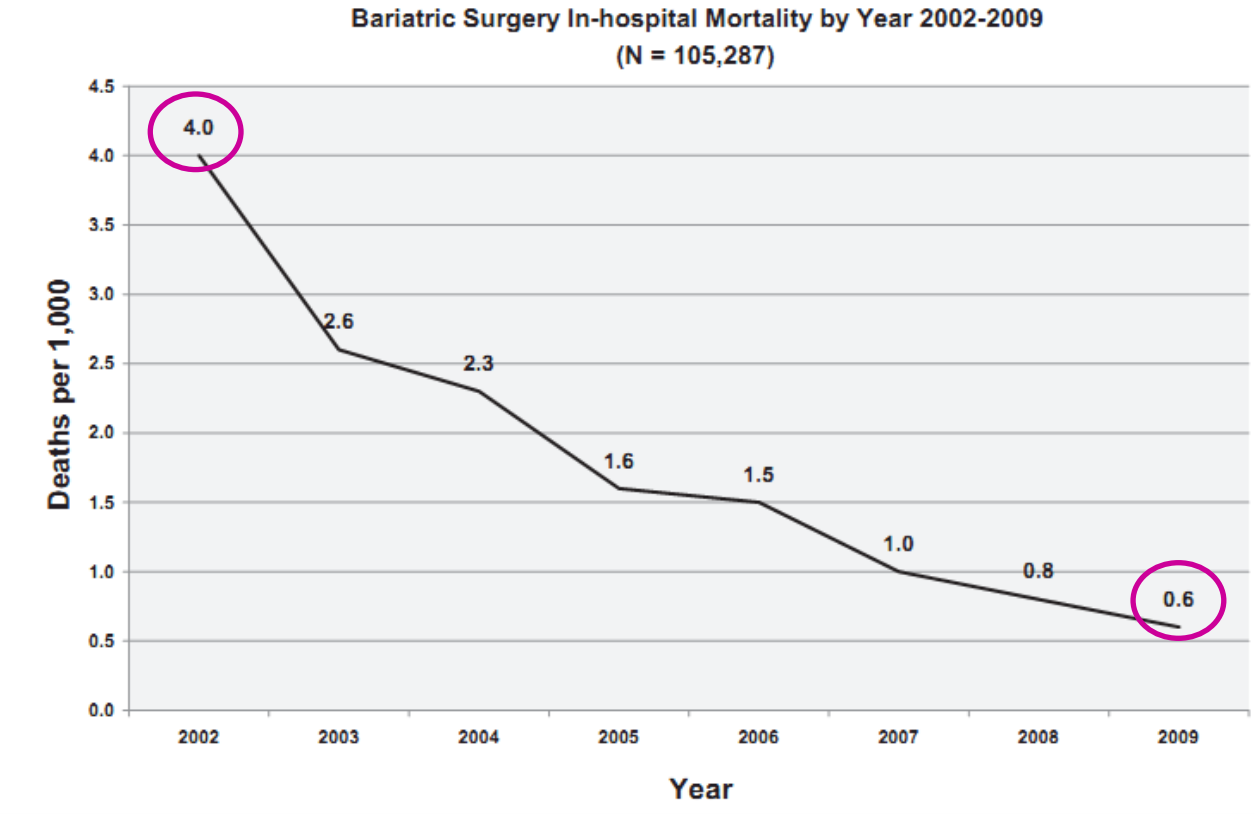
- Causes de DC:
  - EP: 38%
  - Fistule digestive: 17%
  - Défaillance cardiaque: 17%
  - Insuffisance respiratoire: 11%
- Facteurs de risque:
  - Laparotomie
  - Durée chirurgie
  - HTA, diabète 1

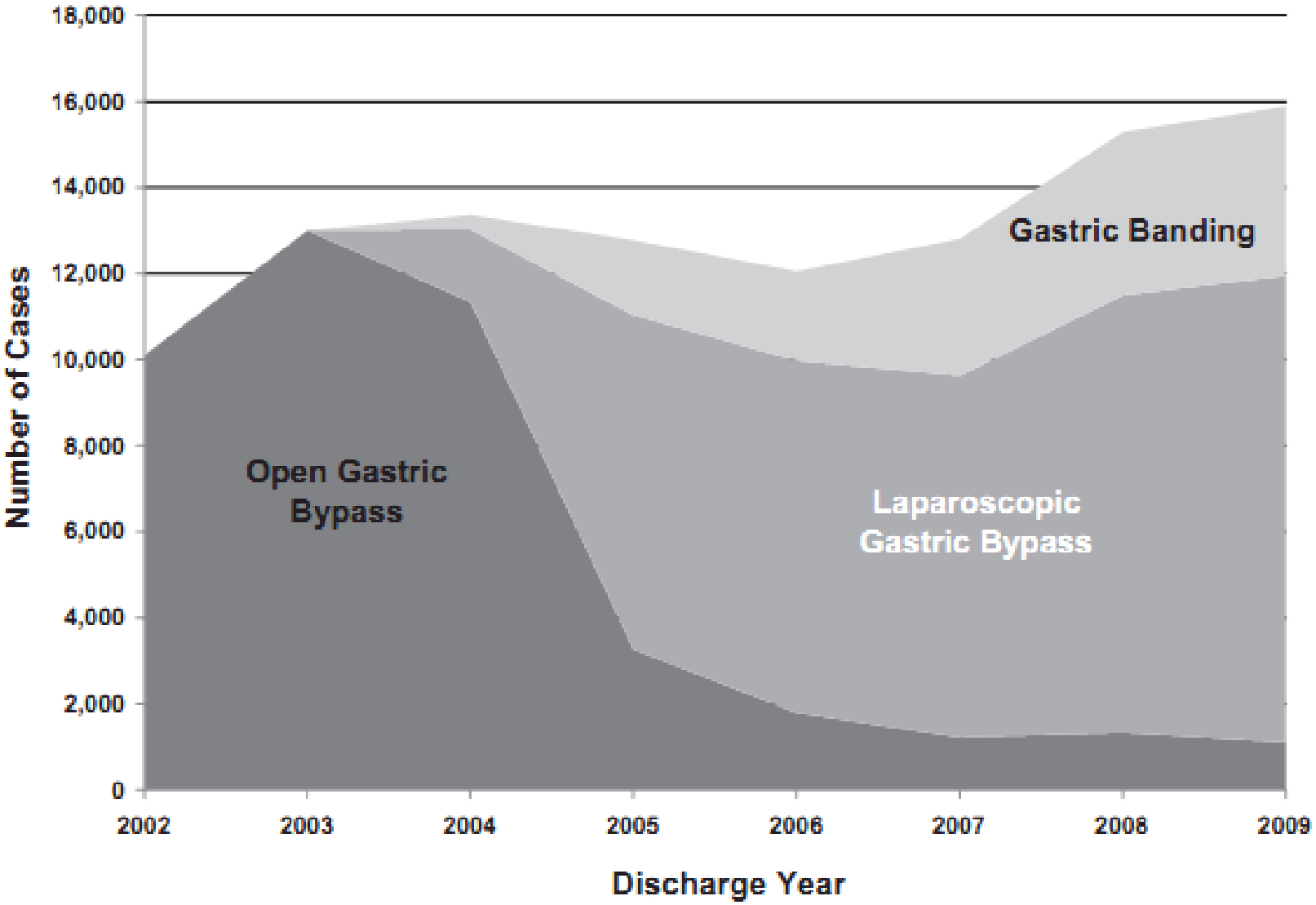
Original article

# Proposal for a bariatric mortality risk classification system for patients undergoing bariatric surgery

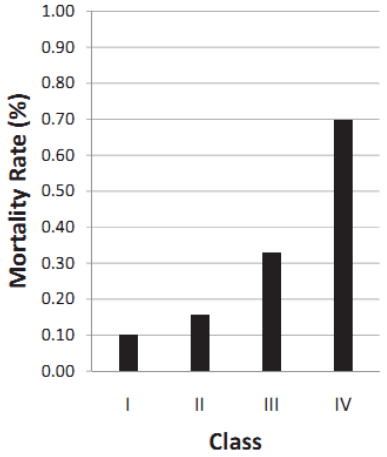
Surgery for Obesity and Related Diseases 9 (2013) 239–246

- 2002-2009 (105.287 patients)
- Réduction de la mortalité: de 4‰ à 0.6 ‰ en 2009




18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Number of Cases
Gastric Banding
Open Gastric Bypass
Laparoscopic Gastric Bypass
2002
2003
2004
2005
2006
2007
2008
2009
Discharge Year

| Bariatric mortality risk classification | |
|---|---|
| Variable | Points |
| Risk factor | |
| Age ≥60 yr | .5 |
| Diabetes | .5 |
| Open surgical technique | 1 |
| Gastric bypass operation | 1 |
| Medicare payer | 1 |
| Male gender | 1 |
| Total possible | 5 |
| Classification category | |
| Class I | 0–.5 |
| Class II | 1.0–1.5 |
| Class III | 2.0–3.0 |
| Class IV | ≥3.5 |




Class I: 0-0.5 points; Class II: 1.0-1.5 points; Class III: 2.0-3.0 points, and Class IV: ≥3.5 points.

# Quelques limites au BMR…

- La base de donnée manquait de:
  - BMI
  - Certaines comorbidités (SAOS..)
  - DC qui surviennent après sortie ne sont pas comptabilisés
  - Nombre très faible de Sleeve

# Development and Validation of a Bariatric Surgery Mortality Risk Calculator

Bala Ramanan, MBBS, Prateek K Gupta, MD, Himani Gupta, MD, Xiang Fang, PhD,
R Armour Forse, MD, PhD, FACS

*J Am Coll Surg* 2012;214:892–900.

Mortalité à J30: 0.14%

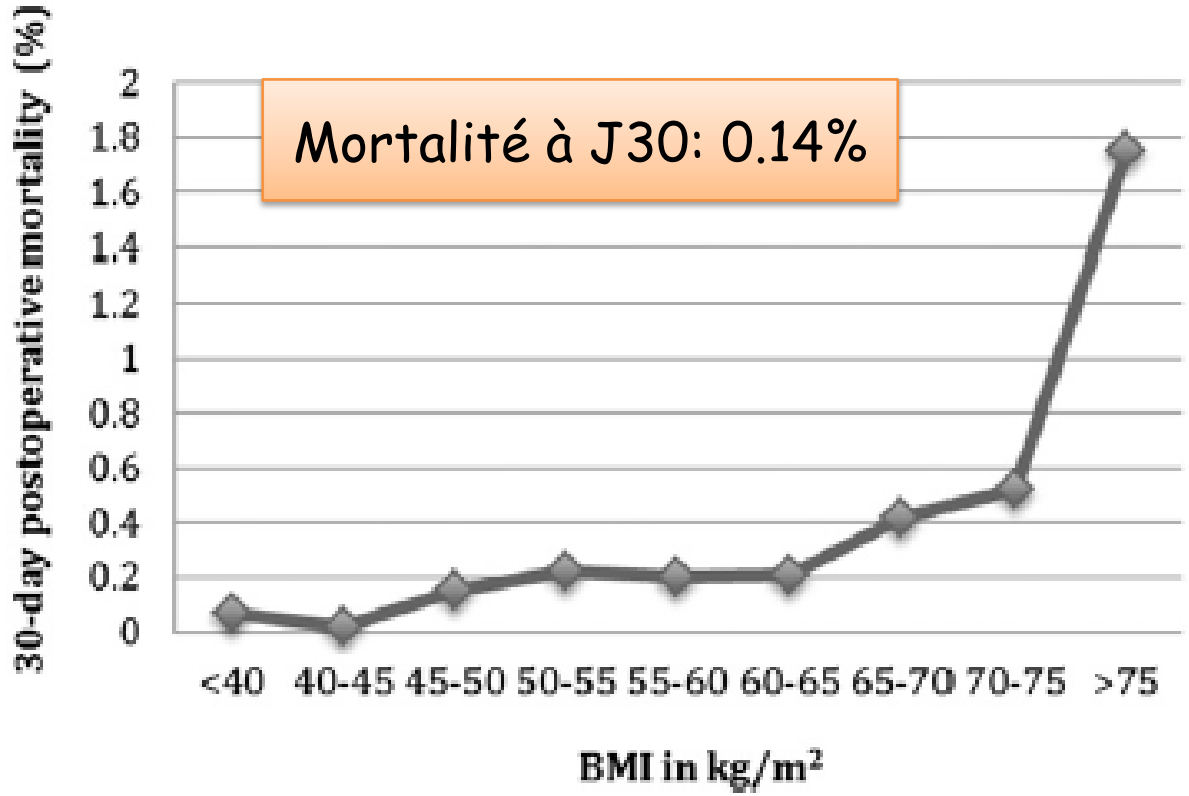



**Figure 1.** Relation of body mass index (BMI) in kg/m$^2$ and 30-d postoperative mortality.

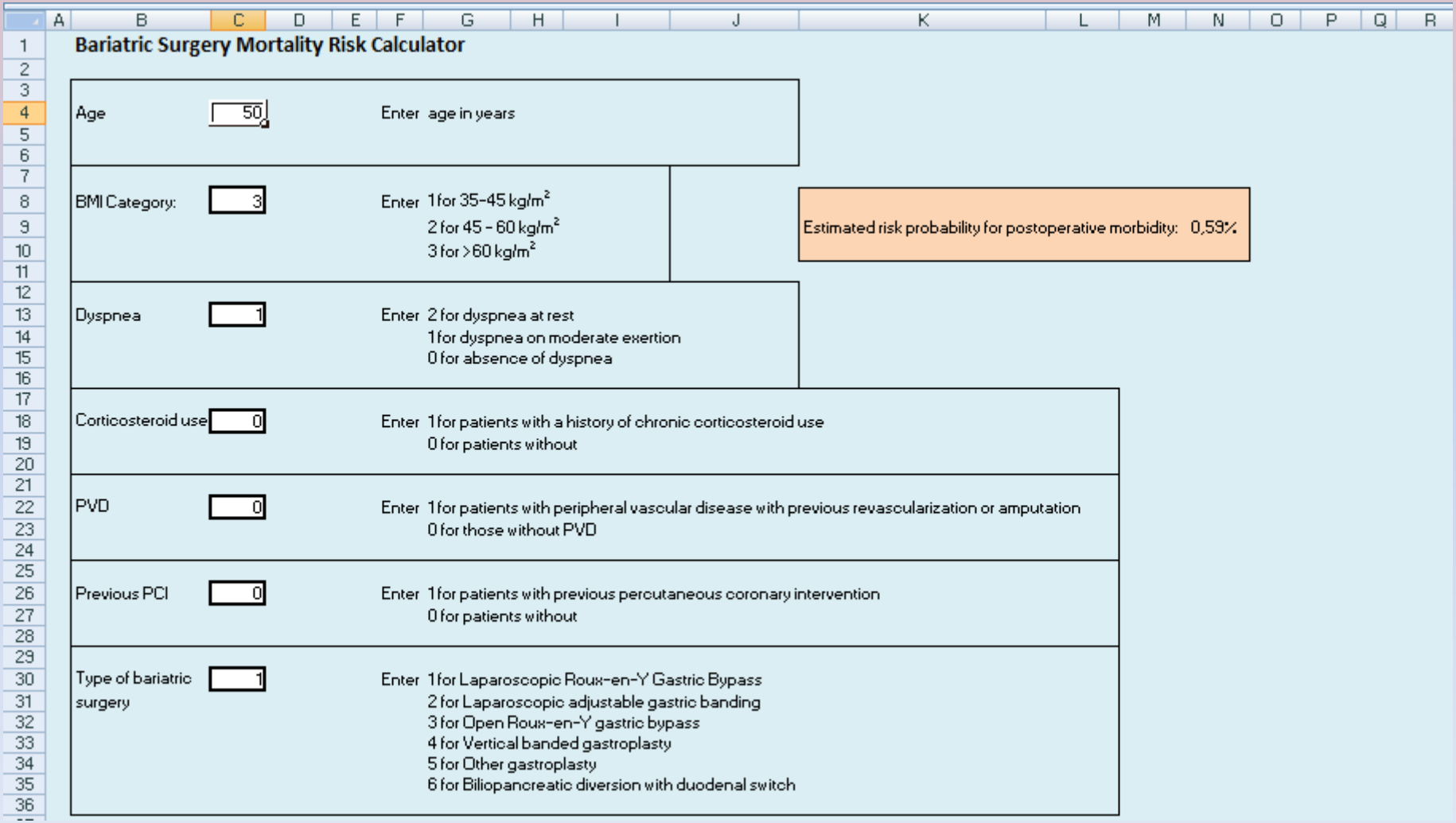
- n = 21891 (NSQIP) ➔ Mortalité à 30 j
- Plusieurs techniques chirurgicales +++
- Mais … pas de sleeve !!!
- Validation: cohorte de 10998 patients

# Facteurs de risque

- Age
- BMI
- Dyspnée
- Corticothérapie
- Pathologie vasculaire sévère
- ATCD de reperméabilisation coronaire
- Type de chirurgie

AUC > 0.8

# http://www.surgicalriskcalculator.com/bariatric-surgery-risk-calculator



**Bariatric Surgery Mortality Risk Calculator**

| | | |
|---|---|---|
| Age | 50 | Enter age in years |
| BMI Category: | 3 | Enter 1 for 35-45 kg/m$^2$<br>2 for 45 - 60 kg/m$^2$<br>3 for >60 kg/m$^2$ |
| Dyspnea | 1 | Enter 2 for dyspnea at rest<br>1 for dyspnea on moderate exertion<br>0 for absence of dyspnea |
| Corticosteroid use | 0 | Enter 1 for patients with a history of chronic corticosteroid use<br>0 for patients without |
| PVD | 0 | Enter 1 for patients with peripheral vascular disease with previous revascularization or amputation<br>0 for those without PVD |
| Previous PCI | 0 | Enter 1 for patients with previous percutaneous coronary intervention<br>0 for patients without |
| Type of bariatric surgery | 1 | Enter 1 for Laparoscopic Roux-en-Y Gastric Bypass<br>2 for Laparoscopic adjustable gastric banding<br>3 for Open Roux-en-Y gastric bypass<br>4 for Vertical banded gastroplasty<br>5 for Other gastroplasty<br>6 for Biliopancreatic diversion with duodenal switch |

Estimated risk probability for postoperative morbidity: 0,59%

# Les points forts

- Grand échantillon (21891)
- 50 variables pré opératoire
- Fort pouvoir discriminant (test c > 0.8)
- Base de donnée nationale
- Applicable à tout type de chirurgie (sauf sleeve)

# Limites de l'étude

- Manque de précision pour certains FDR dans la base de données (MTEV, HTAP…)
- Pas de sleeve gastrectomy
- Compétences des chirurgiens non prise en compte

**Perioperative risk factors for 30-day mortality after bariatric surgery: is functional status important?**

Muhammad Asad Khan · Roman Grinberg · Stelin Johnson · John N. Afthinos · Karen E. Gibbs

Surg Endosc (2013)

- n = 44408, 3 ans
- NSQIP
- Uniquement chirurgie primaire
- Mortalité J30: 0.14%
- L'accent est mis sur le statut fonctionnel du patient (dépendance)

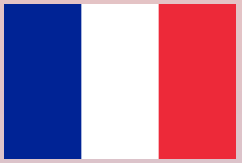
| Risk factors | OR | 95 % CI | *p* value |
|---|---|---|---|
| Open bariatric procedure | 2.34 | 1.33–4.13 | <0.01 |
| Male gender | 1.77 | 1.04–3.03 | 0.04 |
| Age ≥ 45 years | 2.45 | 1.24–4.8 | 0.01 |
| BMI ≥ 50 | 2.48 | 1.47–4.18 | 0.01 |
| DM on oral hypoglycemics | 1.87 | 0.97–3.5 | 0.06 |
| Dyspnea on rest | 4.64 | 1.04–20.7 | 0.04 |
| Previous PCI | 2.66 | 1.19–5.9 | 0.02 |
| Ascites | 2.94 | 0.154–56.3 | 0.47 |
| Functional status: partial dependence | 2.16 | 0.71–8.52 | 0.15 |
| Functional status: total dependence | 27.6 | 3.6–210 | <0.01 |
| >10 % Weight loss in 6 months | 13.5 | 2.20–83.0 | <0.01 |
| Bleeding disorder | 2.63 | 1.03–6.69 | 0.04 |
| Steroid use | 2.14 | 0.56–8.13 | 0.26 |

| No. of comorbid factors | % In cohort | % Mortality |
|---|---|---|
| 0 | 19.2 | 0 |
| 1 | 32.2 | 0.04 |
| 2 | 26.5 | 0.12 |
| 3 | 14.9 | 0.24 |
| 4 | 5.7 | 0.51 |
| 5 | 1.4 | 1.6 |

| Class | No. of comorbidities | No. of patients | No. of deaths | Group % mortality |
|---|---|---|---|---|
| A | 0 or 1 | 22,740 | 7 | 0.03 |
| B | 2 to 3 | 18,331 | 31 | 0.16 |
| C | 4 or greater | 3,230 | 24 | 7.4 |

# Reduction in early mortality outcomes after bariatric surgery in France between 2007 and 2012: A nationwide study of 133,000 obese patients

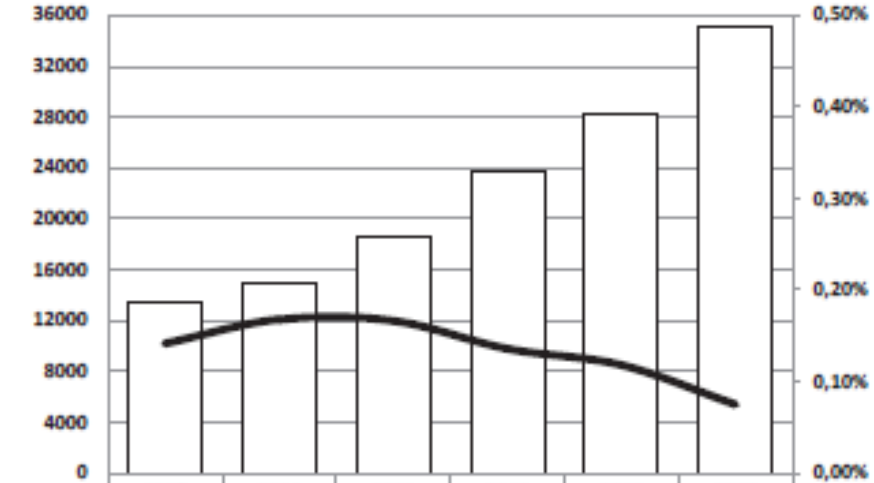
*Surgery 2016;159:467-74*



- Sleeve gastrectomy: 36.5%
- By-pass gastrique: 31.2%
- Anneau gastrique: 32.3%

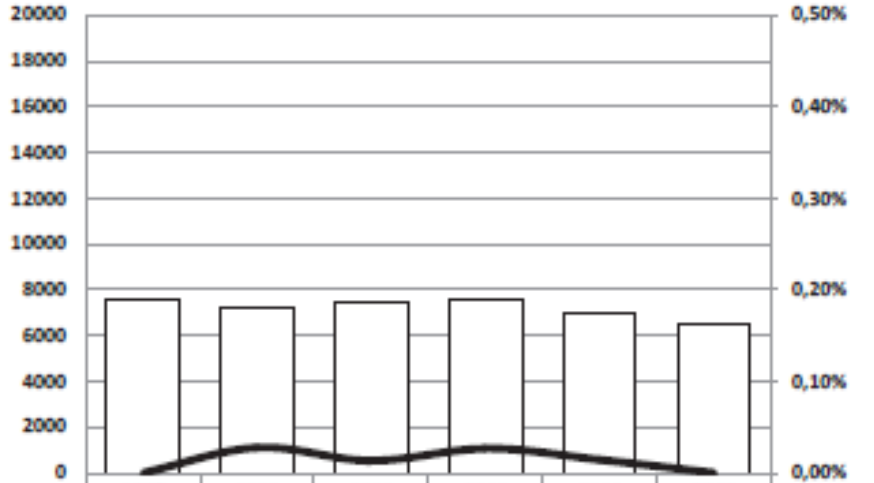
➔ Mortalité globale de 0.12%

## All Bariatric Procedures



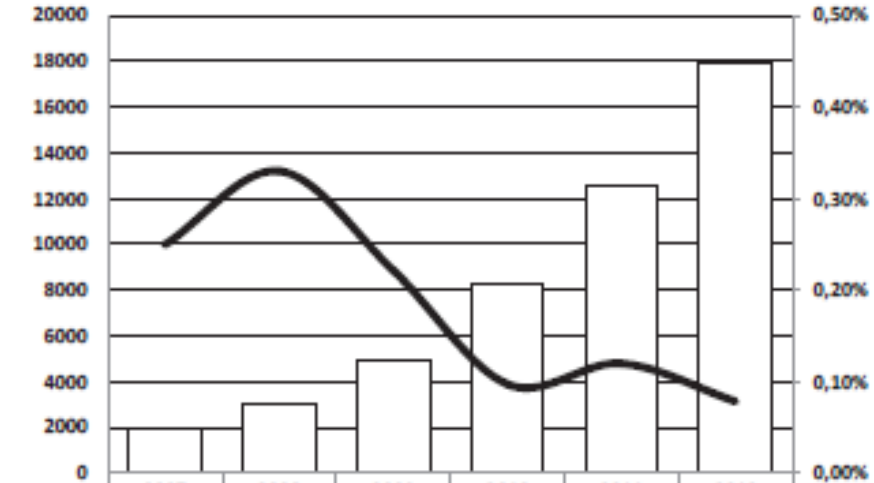

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| N° | 13447 | 14933 | 18658 | 23662 | 28113 | 34992 |
| POM | 0,14% | 0,17% | 0,17% | 0,14% | 0,12% | 0,07% |

## Adjustable Gastric Banding



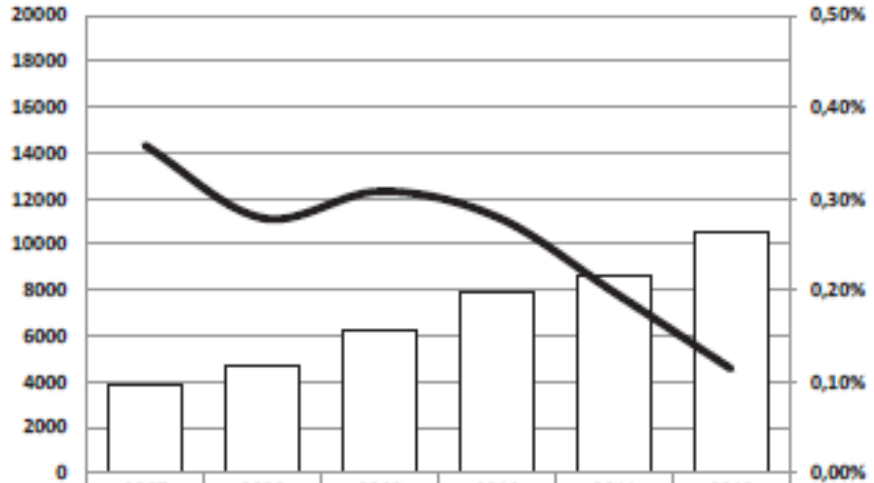

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| N° | 7529 | 7233 | 7506 | 7551 | 6957 | 6506 |
| POM | 0,00% | 0,03% | 0,01% | 0,03% | 0,01% | 0,00% |

## Sleeve Gastrectomy




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| N° | 2007 | 3032 | 4974 | 8250 | 12553 | 17960 |
| POM | 0,25% | 0,33% | 0,22% | 0,10% | 0,12% | 0,08% |

## Gastric Bypass




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|
| N° | 3911 | 4668 | 6178 | 7861 | 8603 | 10526 |
| POM | 0,36% | 0,28% | 0,31% | 0,28% | 0,20% | 0,11% |

# Facteurs indépendants de mortalité:

- Sexe masculin
- Age > 50
- Diabète type 2
- HTA
- BMI > 50
- Laparotomie
- Expérience des équipes (n par an)

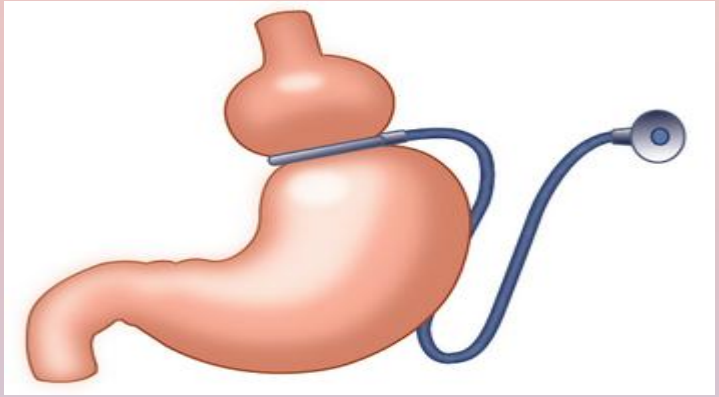
# Finalement…

- Bcp de scores de calcul du risque de mortalité
- Bases de données très hétérogènes
- Mortalité très faible !!!
- Difficile de tirer des conclusions

➔ La tendance actuelle: renoncer aux score de mortalité au profit des scores de morbidités post opératoire

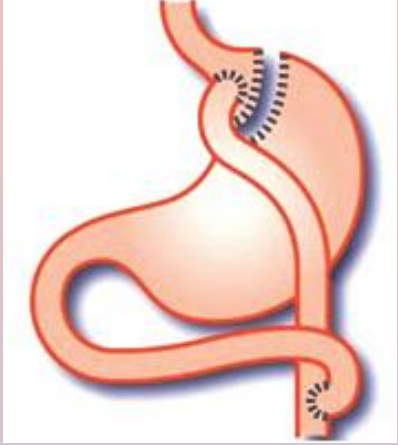
# Complications chirurgicales

# Anneau gastrique ajustable



- Occlusion gastrique aigue: 6-18%
- Infection: 0.3-9%
- Complications tardives:
  - Érosion anneau gastrique
  - Glissement, déplacement anneau
  - Dilatation œsophage / réservoir
  - Dysfonctionnement boitier
  - ŒSophagite / RGO

# Bypass gastrique



**Fistules: 1ème cause de mortalité**

**d'ordre chirurgical:**

- Incidence jusqu'à 6%
- Signes frustes
- Imagerie non fiable

# Symptomatologie variable

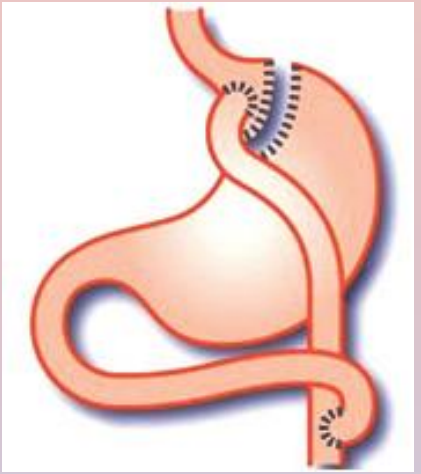
- Asymptomatique 8%
- Tachycardie 72%
- Fièvre 63%
- Douleurs abdominales 54%
- Liquide drainage purulent 24%

- Oligurie 21%
- Nausées et vomissements 17%
- Hypotension 17%
- Douleurs de l'épaule 14%

# Evolution

- Reprises chirurgicales (63%) ➔ mortalité = 10%
- Traitement non opératoire ➔ Mortalité = 0%

# Bypass gastrique (fistules)



- Reprise en urgence
  - Irrigation drainage péritonéal
  - ATB large spectre
  - Laparo > coelio

| Location | Incidence |
|---|---|
| Gastrojejunostomy | 67.8% |
| Gastric pouch | 10.2% |
| Gxcluded stomach | 3.4% |
| Jejunojejunal anastomosis | 5% |
| Gastrojejunostomy plus pouch | 3.4% |
| Pouch plus excluded stomach | 3.4% |
| Undetermined sites | 6.8% |

ABCD Arq Bras Cir Dig 2015;28(1):74-80

# Analysis of Factors Predictive of Gastrointestinal Tract Leak in Laparoscopic and Open Gastric Bypass

*Hossein Masoomi, MD; Hubert Kim, MD; Kevin M. Reavis, MD; Steven Mills, MD; Michael J. Stamos, MD; Ninh T. Nguyen, MD*

*Arch Surg. 2011;146(9):1048-1051*

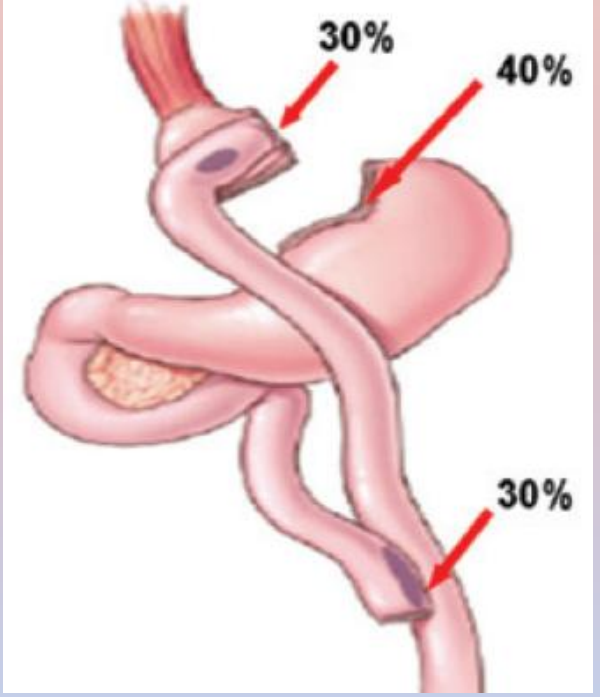
- 0.7% de fistules sur 226.452 patients (3 ans)
- Mortalité liée à la fistule: 6.8%
- En analyse multivariée:
  - GBP laparo
  - Insuffisance rénale chronique
  - Pathologies pulmonaires chroniques
  - Cardiopathie congestive
  - Sexe masculin
  - > 50 ans

# Use and Outcomes of Laparoscopic Versus Open Gastric Bypass at Academic Medical Centers

Nguyen 2007

Journal of the American College of Surgeons

- n = 22.422 patients (coelio vs laparo)
- Fistules: 1.4% vs 3.1%
- Mais aussi moins de:
  - Pneumonies
  - ISO
  - MTEV
  - Durée d'hospitalisation et de coût




**Les hémorragies: 0.6 à 4%**

**Infections pariétales**

**Distension de l'estomac exclu**

**Gastroparésie**

## Population a risque

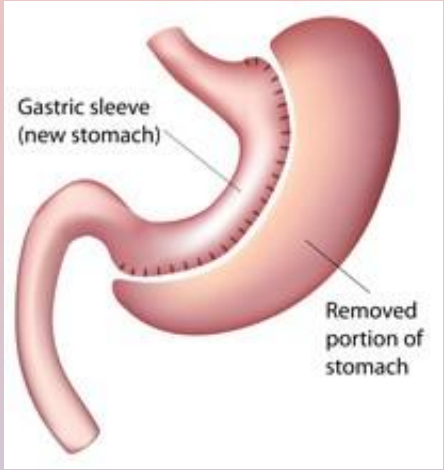
- Sujets âgés
- Diabète sévère
- Super obèse
- Reprise chirurgicale

# Spectrum and Risk Factors of Complications After Gastric Bypass

*Arch Surg. 2007*

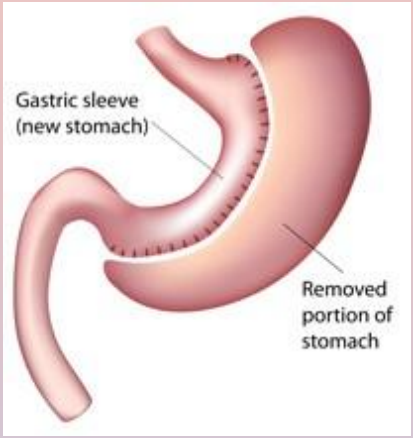
- Etude de cohorte prospective
- 404 GBP
- Taux de complication: 18.3%
- Facteurs de risque en multivariée:
  - Diabète type 2
  - Laparotomie
  - Expérience

# Sleeve gastrectomy




- Moins pourvoyeuse de complications
  - Mortalité: 0.4%
  - Morbidité: 8-12%

# Sleeve gastrectomy

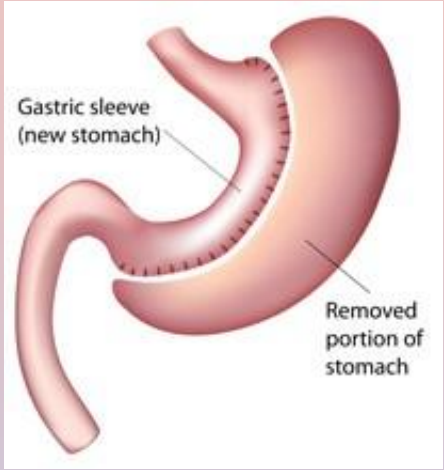



## Fistules

- lâchage ligne d'agrafe: 2.3%
- Précoce < 7j

**Table 1 Different leak sites as found by different series *n* (%)**

| | Number of patients | Proximal third | Mid-third | Distal third | Posterior wall | Not located |
|---|---|---|---|---|---|---|
| Mui *et al*[64], 2008 | 70 patients, 1 leak (1.42) | 1 (100) | | | | |
| Burgos *et al*[18], 2009 | 214 patients, 7 leaks (3.3) | 6 (85.6) | | 1 (14.3) | | |
| Csendes *et al*[16], 2010 | 334 patients, 16 leaks (4.66) | 14 (87.5) | | 2 (12.5) | | |
| Sakran *et al*[14], 2013 | 2834 patients, 44 leaks (1.5) | 33 (75) | 3 (6.8) | 3 (6.8) | 2 (4.5) | 3 (6.8) |




- Tableau:

  Radiologique ⟶ Péritonite grave

  – Tachycardie > 120 non expliquée

  – Tachypnée > 20

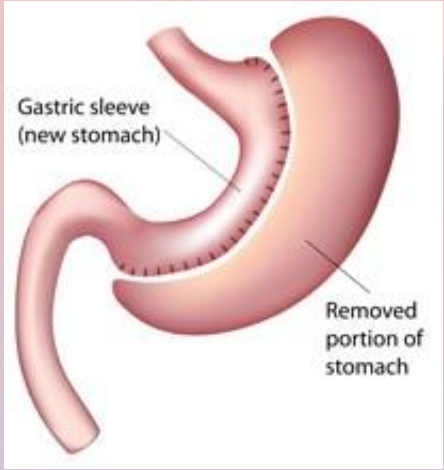
  – Dl hypochondre gauche

  – Fièvre, Sd inflammatoire

**Gastric Leak After Laparoscopic-Sleeve Gastrectomy for Obesity**

Ana Maria Burgos · Italo Braghetto · Attila Csendes · Fernando Maluenda · Owen Korn · Julio Yarmuch · Luis Gutierrez

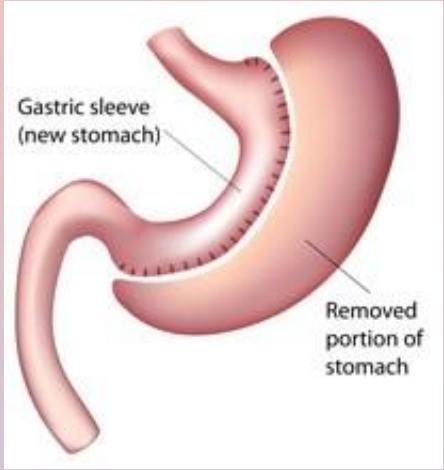
OBES SURG (2009) 19:1672–1677




- Tachycardie ➔ fistules précoces
- Fièvre ➔ fistules tardives
- TOGD normal dans $\frac{3}{4}$ des fistules

  ➔ Fausse sécurité du TOGD
- Le temps de fermeture est long: 43j

- Facteurs prédictifs:
  - BMI élevé
  - Diabète
  - Chirurgie antérieure
  - Petit calibrage du tube




**Laparoscopic Sleeve Gastrectomy Performed with Intent to Treat Morbid Obesity: A Prospective Single-Center Study of 261 Patients with a Median Follow-up of 1 Year**

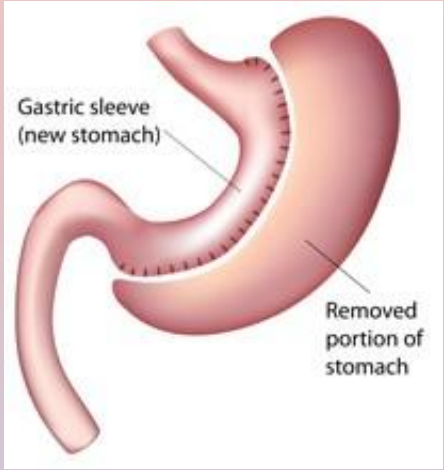
Evangelos Menenakos · Konstantinos M. Stamou · Konstantinos Albanopoulos · Joanna Papailiou · Demetrios Theodorou · Emmanuel Leandros

OBES SURG (2010) 20:276–282

**Gastric leaks post sleeve gastrectomy: Review of its prevention and management**

Antoine Abou Rached, Melkart Basile, Hicham El Masri

*World J Gastroenterol* 2014




- Prévention:
  - Renforcement des agrafes
  - Collagène bovin
  - Tissucol
  - Décompression gastrique (SNG 24h)
  - Taille de la bougie de calibration

META-ANALYSIS

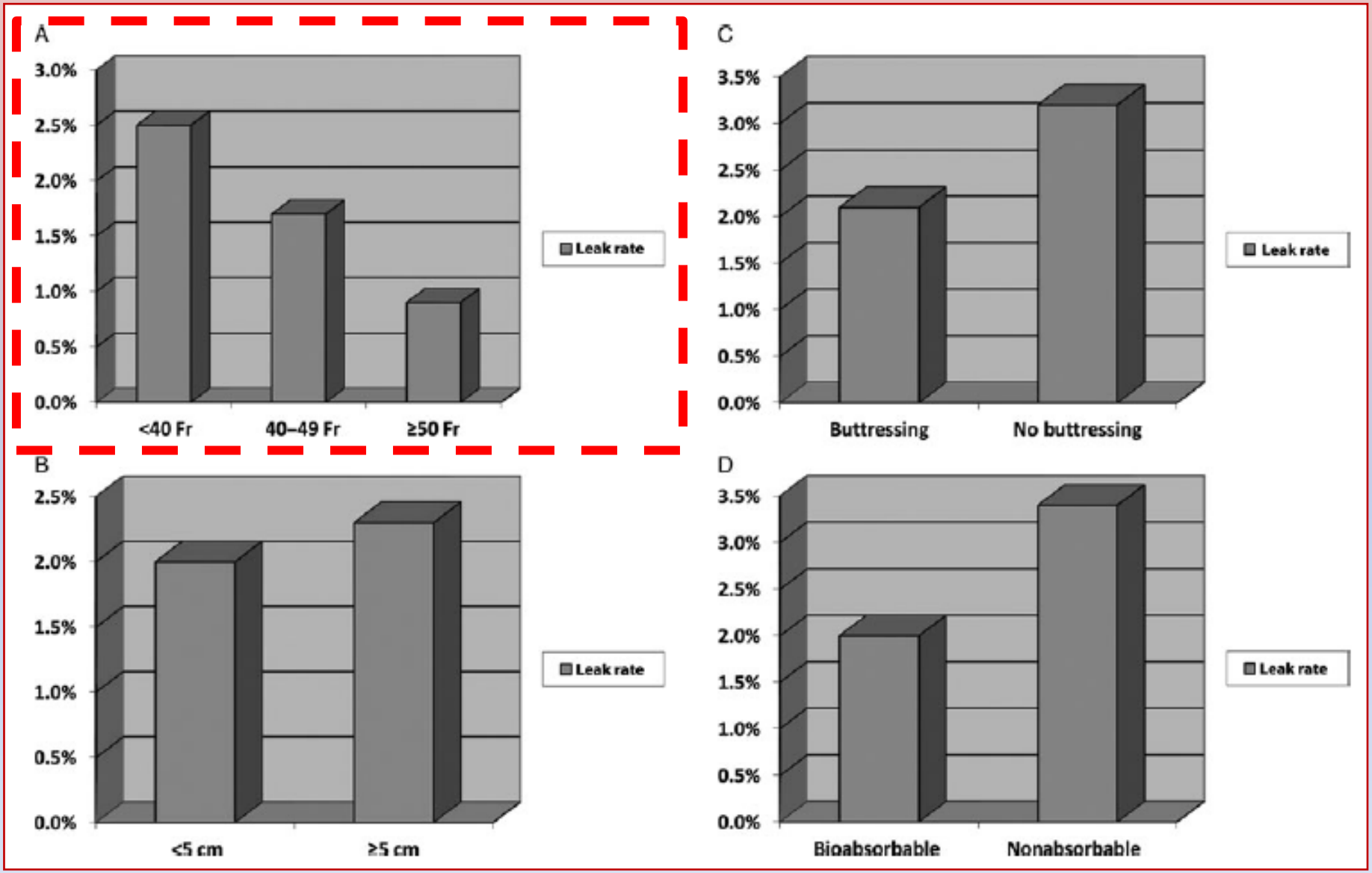
# Surgical Strategies That May Decrease Leak After Laparoscopic Sleeve Gastrectomy

## *A Systematic Review and Meta-Analysis of 9991 Cases*

*Manish Parikh, MD,* Reda Issa, BA,* Aileen McCrillis, MLIS,† John K Saunders, MD,* Aku Ude-Welcome, MD,* and Michel Gagner, MD‡*

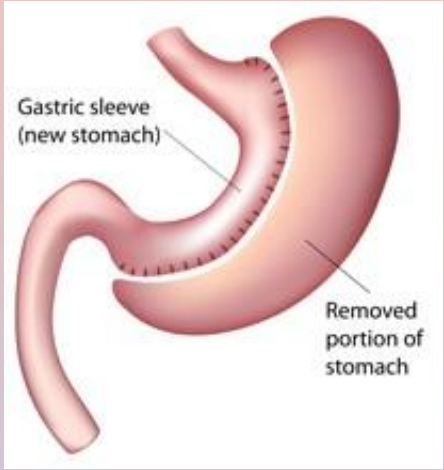
*Annals of Surgery* • Volume 257, Number 2, February 2013

- Taux de fistules: 2.2%
- 1/3 sup du tube gastrique
- Bougie ≥ 40 Fr: diminue /2 le risque de fistule




# Effet des techniques sur l'incidence des fistules

# Sleeve gastrectomy




## Hémorragie sur ligne d'agrafes

- 4.8% (HAS 2008)

Prévention par:

- Surjet d'enfouissement
- Colle biologique
- Renforcement bio-résorbabale

- Transfusion dans 0.5% des cas

# Prediction Model for Hemorrhagic Complications after Laparoscopic Sleeve Gastrectomy: Development of SLEEVE BLEED Calculator

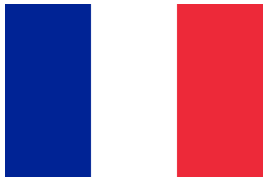
OBES SURG 2016

- 522 sleeve gastrectomy primaire

| Factor | Adjusted odds ratio | 95 % CI | Estimate |
|---|---|---|---|
| No history of hypertension | 0.38 | 0.14–1.05 | −0.486 |
| No history of obstructive sleep apnea | 0.22 | 0.05–0.90 | −0.749 |
| Low surgeon experience in bariatric surgery | 2.85 | 1.08–7.5 | 0.524 |
| No staple line reinforcement | 3.34 | 1.21–9.21 | 0.603 |

# Clinical Features and Outcome of Postoperative Peritonitis Following Bariatric Surgery

Philippe Montravers · Jean Guglielminotti · Nathalie Zappella · Mathieu Desmard · Claudette Muller · Pierre Fournier · Jean Pierre Marmuse · Guillaume Dufour · Pascal Augustin



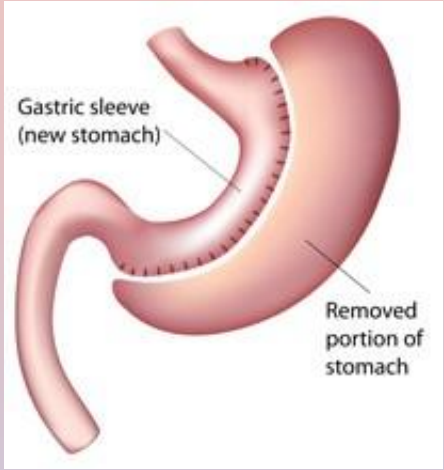
OBES SURG (2013) 23:1536–1544

- Particularités des PPO après chirurgie bariatrique:
  - Patients admis en USI
  - Même score SOFA à la ré intervention

- Le groupe obèse:
  - Plus de cocci Gram +
  - Moins de BGN, anaérobes, BMR
- ATB empirique adéquate: 82% des cas
- Même taux de mortalité: 24%

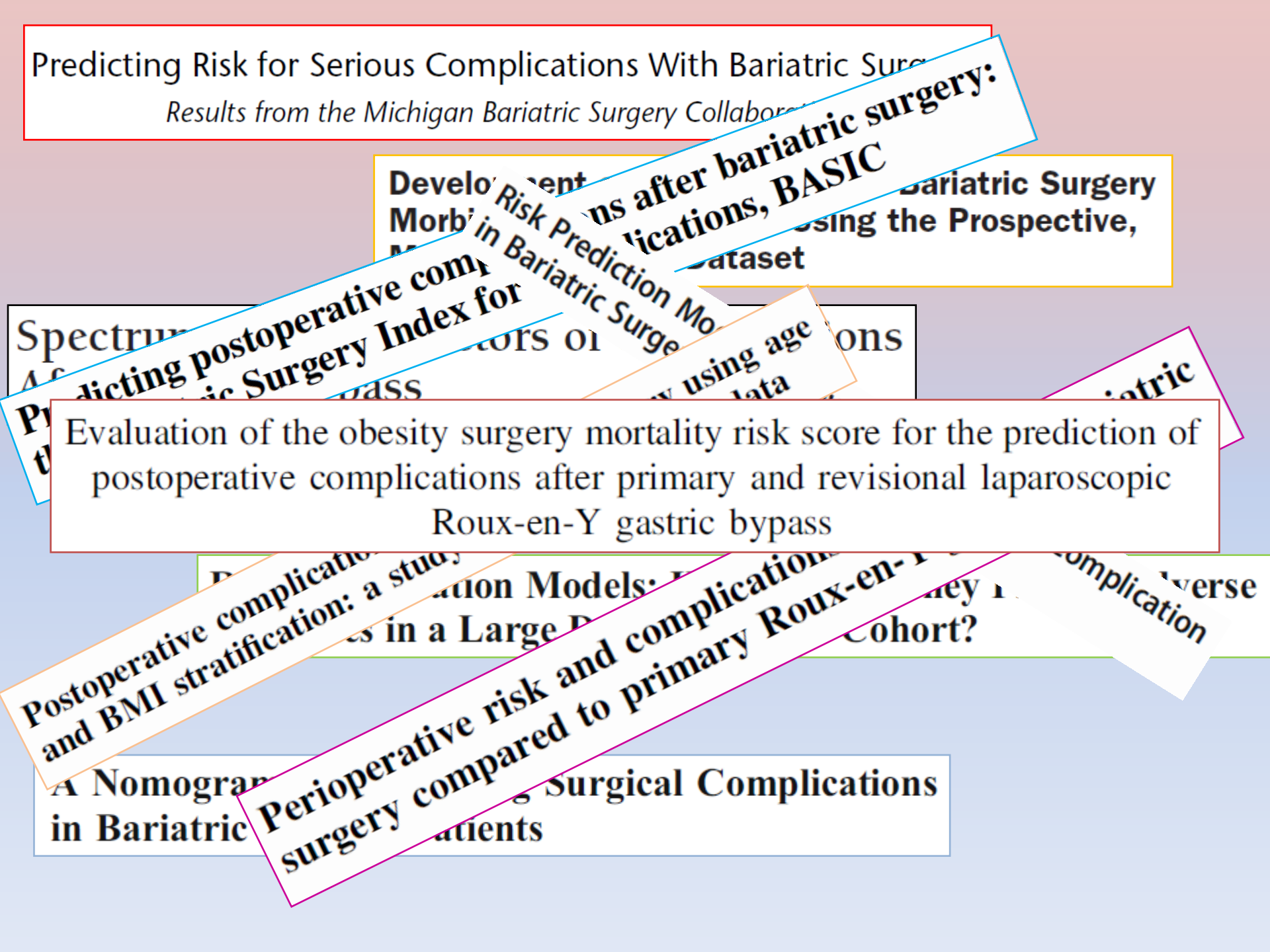
L'antibiothérapie probabiliste pour PPO après chirurgie bariatrique ne diffère pas de celle pour les patients non obèses

# Autres complications




- Sténose gastrique: 0.7 – 4 %
- RGO
- Dilatation du tube gastrique

# Quelques modèles de prédiction


Predicting Risk for Serious Complications With Bariatric Surg
Results from the Michigan Bariatric Surgery Collabor
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Evaluation of the obesity surgery mortality risk score for the prediction of postoperative complications after primary and revisional laparoscopic Roux-en-Y gastric bypass
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# Predicting Risk for Serious Complications With Bariatric Surgery

*Results from the Michigan Bariatric Surgery Collaborative*

*Ann Surg* 2011

- USA, 25469 patients, chirurgie primaire
- Toute chirurgie bariatrique:
  - Technique chirurgicale
  - Voie d'abord
- 3 grades de complications
- Complications majeures: 2.5%

**TABLE 3.** Significant Risk Factors for Serious Complications on Multivariable Analysis Among Patients Undergoing Bariatric Surgery in Michigan Between June 2006 and December 2010

| Risk Factor | Regression Coefficient | Odds Ratio | 95% CI | Bias-Corrected 95% CI* | *P** |
|---|---|---|---|---|---|
| Procedure type (Ref. Adjustable gastric band) | | | | | |
| Duodenal switch | 2.2702 | 9.68 | 6.08–15.41 | 6.05–15.49 | 0.0001 |
| Laparoscopic gastric bypass | 1.2759 | 3.58 | 2.80–4.58 | 2.79–4.64 | 0.0001 |
| Open gastric bypass | 1.2556 | 3.51 | 2.37–5.20 | 2.38–5.22 | 0.0001 |
| Sleeve gastrectomy | 0.8988 | 2.46 | 1.72–3.51 | 1.73–3.50 | 0.0001 |
| Patient factors | | | | | |
| Previous venous thromboembolism | 0.6410 | 1.90 | 1.42–2.54 | 1.41–2.54 | 0.0001 |
| Mobility limitations | 0.4784 | | | | 04 |
| Coronary artery disease | 0.4260 | | | | 2 |
| Age over 50 years | 0.3225 | | | | 01 |
| Pulmonary disease | 0.3150 | | | | 03 |
| Male gender | 0.2321 | | | | |
| Smoking history | 0.1797 | | | | |

| Risk Factor |
|---|
| Procedure type (Ref. Adjustable gastric band) |
| Duodenal switch |
| Laparoscopic gastric bypass |
| Open gastric bypass |
| Sleeve gastrectomy |
| Patient factors |
| Previous venous thromboembolism |
| Mobility limitations |
| Coronary artery disease |
| Age over 50 years |
| Pulmonary disease |
| Male gender |
| Smoking history |

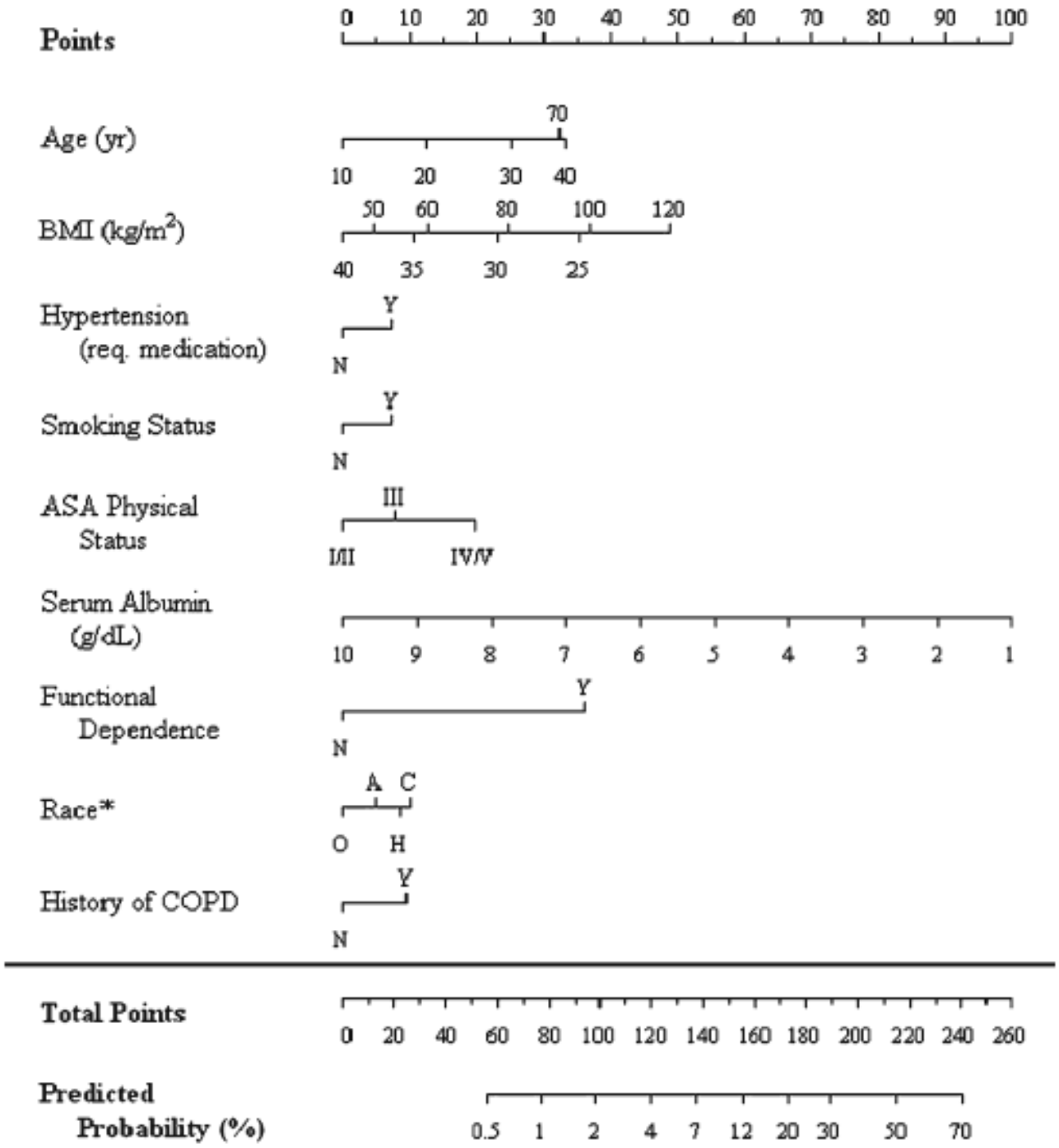
AUC: 0.68

# A Nomogram for Predicting Surgical Complications in Bariatric Surgery Patients

OBES SURG (2011)

- USA, 2005-2008
- n= 32426
- NSQIP (National Security Quality Improvement Program du collège américain de chirurgie)
- Morbidité / mortalité à J 30

Normogramme de Turner pour la prédiction de la morbi-mortalité


Points
0 10 20 30 40 50 60 70 80 90 100
Age (yr)
70
10 20 30 40
BMI (kg/m2)
50 60 80 100 120
40 35 30 25
Hypertension (req. medication)
Y
N
Smoking Status
Y
N
ASA Physical Status
III
I/II IV/V
Serum Albumin (g/dL)
10 9 8 7 6 5 4 3 2 1
Functional Dependence
Y
N
Race*
A C
O H
History of COPD
Y
N
Total Points
0 20 40 60 80 100 120 140 160 180 200 220 240 260
Predicted Probability (%)
0.5 1 2 4 7 12 20 30 50 70

AUC: 0.62

# Development and Validation of a Bariatric Surgery Morbidity Risk Calculator Using the Prospective, Multicenter NSQIP Dataset

J Am Coll Surg 2011

- NSQIP
  - 2007: élaboration du score
  - 2008: sa validation
- Toute chirurgie sauf sleeve
- n = 11023
- Complications majeures à J 30 (4.2%)

## Les 7 Facteurs prédictifs:

- IDM (6 mois) / angine de poitrine (1 mois)
- Etat de dépendance fonctionnelle
- AVC
- Anomalies de l'hémostase
- HTA
- BMI (35-45, 45-60)
- Type de chirurgie

AUC: 0.69

http://www.surgicalriskcalculator.com/bariatricsurgery-risk-calculator

## Bariatric Surgery Morbidity Risk Score

| | | |
|---|---|---|
| Procedure: | 2 | Enter 1 for Biliopancreatic Diversion with Duodenal Switch<br>2 for Laparoscopic Roux-en-Y Gastric Bypass<br>3 for Laparoscopic Gastric Banding<br>4 for Open Roux-en-Y Gastric Bypass<br>5 for Vertical Banded Gastroplasty<br>6 for Other Gastroplasty |
| BMI Category: | 2 | Enter 1 for 35-45 kg/m²<br>2 for 45 - 60 kg/m²<br>3 for >60 kg/m² |
| Functional status: | 0 | Enter 1 for partially or totally dependent<br>0 for independent |
| History of MI or Angina: | 0 | Enter 1 for patients with a history of Myocardial infarction within 6 months or angina within 1 month of surgery<br>0 for patients without |
| Hypertension: | 0 | Enter 1 for patients who have persistent BP > 140/90 or on anti-hypertensives<br>0 for those without hypertension |
| History of CVA: | 1 | Enter 1 for patients with a history of cerebrovascular accident<br>0 for patients without |
| History of bleeding disorder: | 1 | Enter 1 for patients with a history of having a bleeding disorder<br>0 for patients without |

Estimated risk probability for postoperative morbidity: 17,92%

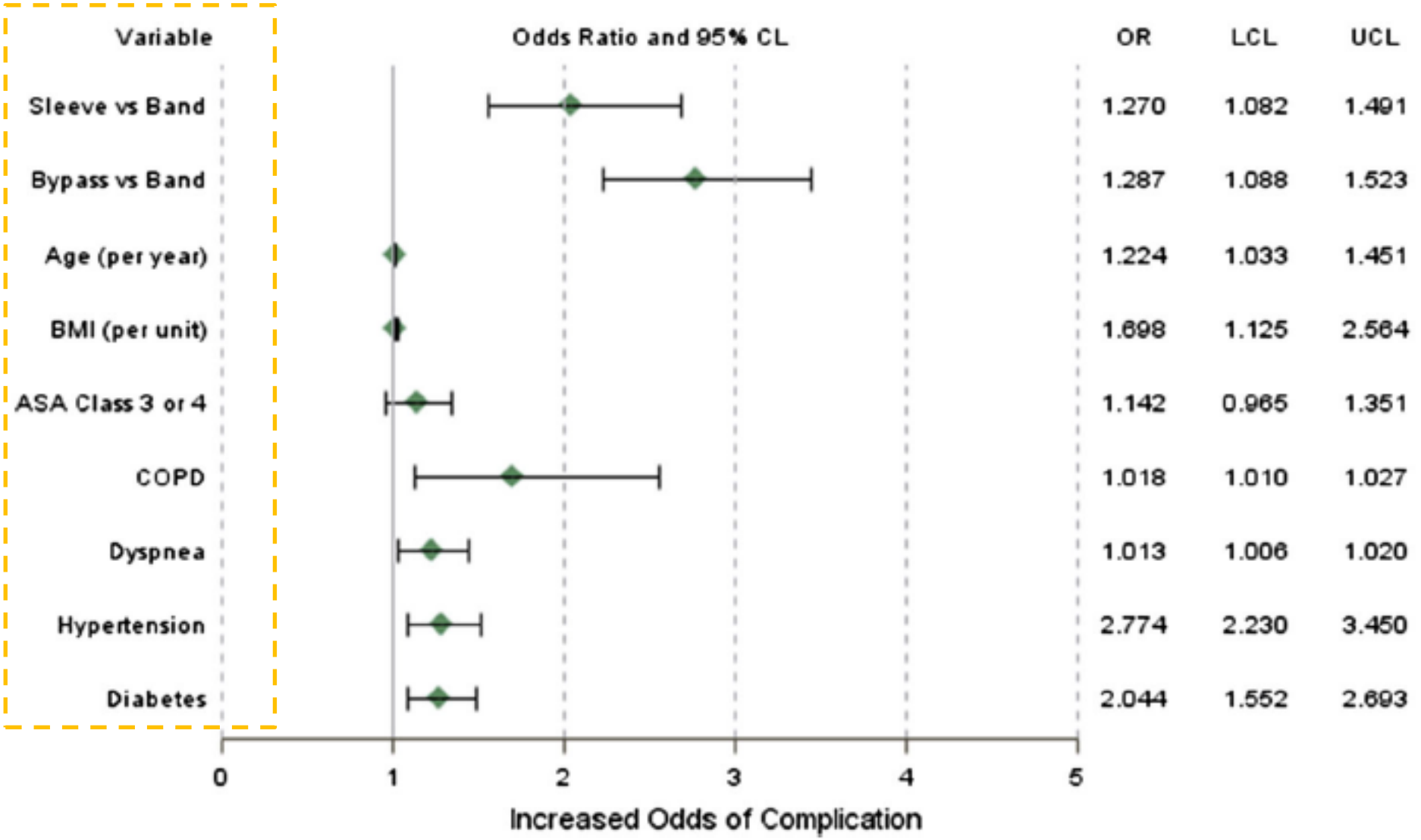
- Limites de ce score:
  - Ne précise pas certaines comorbidités (SAOS, ATCD de MTEV)
  - Ne mentionne pas toutes les complications (hémorragie, occlusion …)
  - Expérience du chirurgien
  - Pas de sleeve

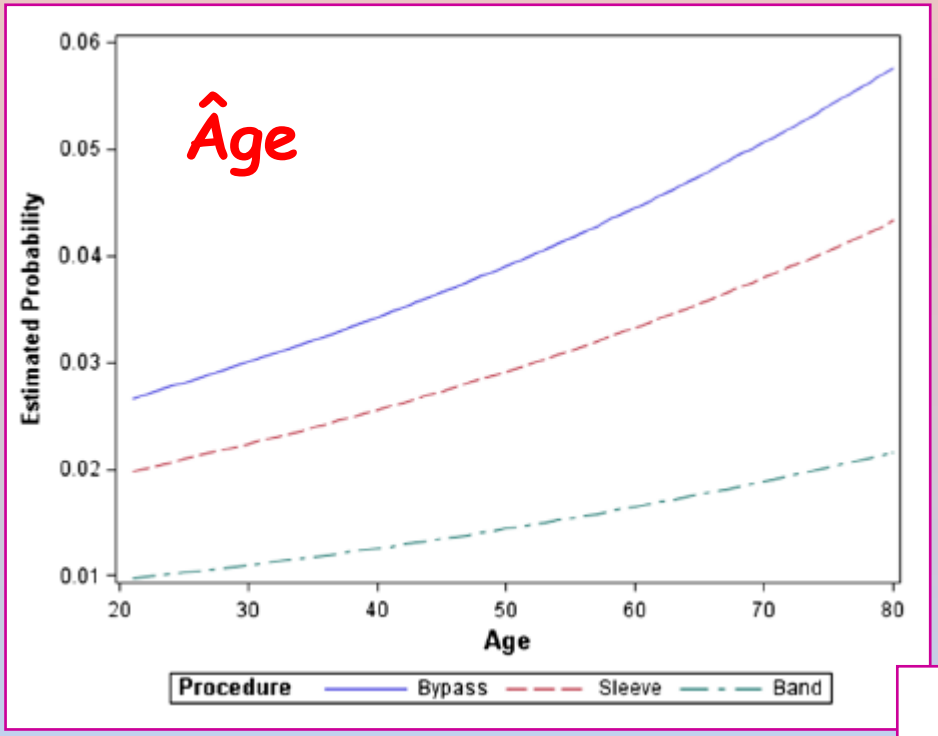
**Postoperative complications in bariatric surgery using age and BMI stratification: a study using ACS-NSQIP data**

Surg Endosc (2014)

- Etudier la tendance de la morbi-mortalité en fonction de l'âge et du BMI
- n= 20308, NSQIP (2010-2011)
- Anneau / Sleeve / By Pass

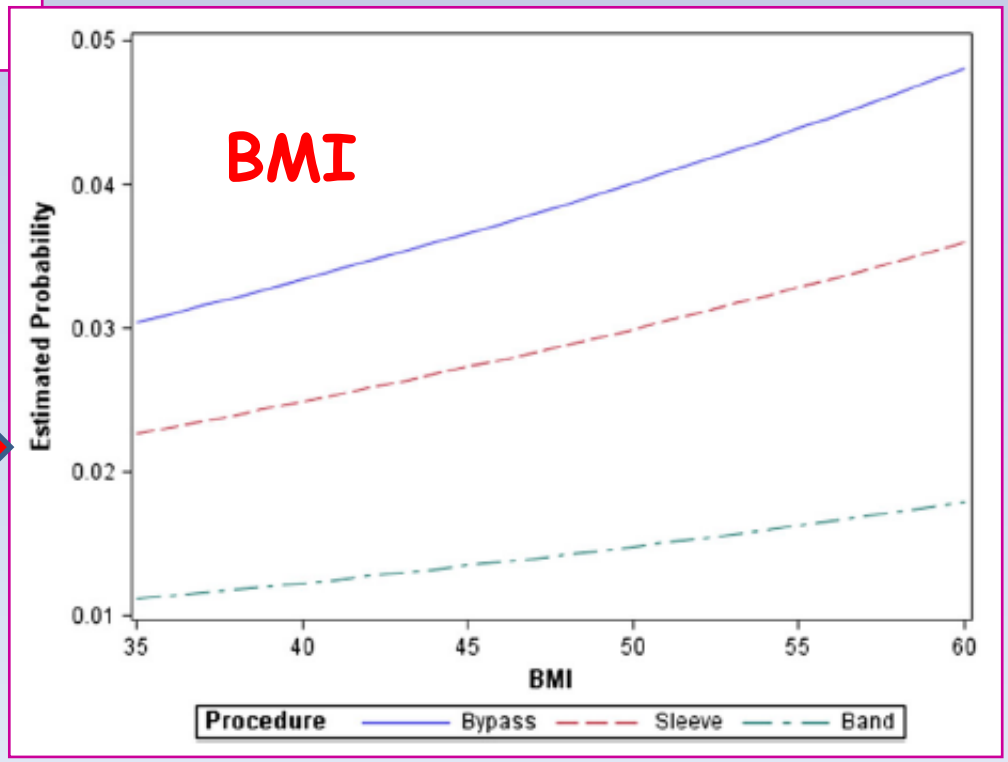
## Logistic Model Results






Le risque ↗ 1% pour chaque année

Le risque ↗ 2% pour chaque point en BMI



# Development of a sleeve gastrectomy risk calculator

Surgery for Obesity and Related Diseases ▮ (2015)

- n = 5871, NSQIP
- Sleeve gastrectomy uniquement
- 52 variables pré op
- 17 complications post op
- Validation du modèle (n = 3130)

# 7 facteurs prédictifs

Predictive factors of primary outcome based on multivariate analysis

| Risk factor | Univariate odds ratio | Adjusted odds ratio | 95% CI |
|---|---|---|---|
| Congestive heart failure | 9.53 | 6.23 | 1.25–31.07 |
| Steroid use for chronic conditions | 5.02 | 5.00 | 2.06–12.15 |
| Male sex | 1.71 | 1.68 | 1.03–2.72 |
| Diabetes | 1.87 | 1.62 | 1.07–2.48 |
| Preoperative serum total bilirubin level | 1.59 | 1.57 | 1.11–2.22 |
| Body mass index | 1.03 | 1.03 | 1.01–1.05 |
| Preoperative hematocrit level | .96 | .95 | .89–1.00 |
| Constant | | | |

AUC: 0.68

## Sleeve Gastrectomy Risk Calculator

www.r-calc.com

CALCULATOR:

| | |
|---|---|
| Gender* | Male |
| Body Mass Index (BMI) * | 52 |
| Diabetes* | Yes |
| History of Congestive Heart Failure (CHF)* | No |
| Steroid Use for Chronic Condition * | No |
| Preoperative Hematocrit Level (%)* | 38 |
| Preoperative Serum Total Bilirubin Level (mg/dL)* | 0 |

SUBMIT RESET

| Outome | Result |
|---|---|
| Estimated Probability of Serious Adverse Events* | 29.2% |

**Predicting postoperative complications after bariatric surgery: the Bariatric Surgery Index for Complications, BASIC**

Surg Endosc (2017)

- Etude BASIC, n = 1709 (2007-2014), monocentrique
- By Pass / Sleeve / chirurgie de révision ++
- Classification de Clavien – Dindo (CD)
- 24 variables en pré op
- Complications sévères (CD ≥ 3) : 8.2%

# Six facteurs de risque indépendants

**Table 4** Multivariable analysis, risk factors BASIC

| Variable | *p* value | Odd's ratio | 95% CI for the Exp. | |
|---|---|---|---|---|
| Anticoagulants | 0.142 | 1.454 | 0.883 | 2.394 |
| COPD | 0.007 | 2.271 | 1.254 | 4.113 |
| Dyslipidemia | 0.042 | 1.396 | 1.012 | 1.928 |
| Gender (male) | 0.037 | 1.438 | 1.023 | 2.023 |
| Psychiatric history | 0.137 | 1.298 | 0.921 | 1.831 |
| Revisional surgery | 0.021 | 1.498 | 1.064 | 2.110 |

**Table 6** Distribution among classes short-term complications

| Classification | Total number (%) | Complication (%) | *p* value |
|---|---|---|---|
| Class I (0–1 risk factor) | 1338 (78.3) | 136 (10.2) | **0.001** |
| Class II (2 risk factors) | 269 (15.7) | 40 (14.9) | |
| Class III (≥3 risk factors) | 102 (6.0) | 21 (20.6) | |

- Manque de validation sur une large cohorte
- Uniquement des paramètres pré opératoire

# Risk Prediction Model for Severe Postoperative Complication in Bariatric Surgery

Obesity Surgery 2018

- n = 37811 (2010-2014)
- Scandinavian Obesity Surgery Registery (SOReg)
- Clavien-Dindo classification (≥ IIIb), J30

  ➔Modèle pour le calcul du risque

- Validation sur cohorte de 6250 patients (2015)

- Type de chirurgie :
  - By pass gastrique: 90%
  - Laparoscopie: 96.6%
  - Chirurgie révisionnelle: 3.6%
- Complications sévères: 3.3%

- Facteurs prédictifs:
  - Chirurgie révisionnelle
  - BMI bas
  - Tour de taille
  - Age
  - RGO
  - Année de chirurgie

AUC: 0.53

Bonne spécificité mais sensibilité basse

Question: peut-on prédire les complications uniquement sur des paramètres pré opératoires?

# Risk Stratification Models: How Well do They Predict Adverse Outcomes in a Large Dutch Bariatric Cohort?

OBES SURG 2015

- Test de 8 modèles de prédiction
- n= 740 (2007-2012)
- By pass gastrique (Roux-en-Y)
- Classification Clavien-Dindo
- 3 Test statistiques

# OS-MRS

DeMaria et al. [11]

| *Predictors* | |
|---|---|
| Age ≥45 | 2.442 (1.1126–5.295) |
| Male gender | 0.672 (0.302–1.498) |
| BMI ≥50 | 1.248 (0.424–3.678) |
| Hypertension | 0.878 (0.416–1.853) |
| Risk of PE | 1.196 (0.152–9.404) |

AUC: 0.63

| | |
|---|---|
| Campos et al. [18] | |
| Clinical diagnosis of T2DM | 1.567 (1.051–2.337) |
| Early surgeon experience | 1.145 (0.740–1.771) |
| Open approach | ∞ |

AUC: 0.55

| LABS [9] | |
|---|---|
| VTE | 1.167 (0.151–9.047) |
| Sleep apnea | 1.691 (0.678–4.220) |
| Functional status[b] | – |
| BMI >70[b] | – |

AUC: 0.53

Gupta et al. [8]

| | |
|---|---|
| *Predictors* | |
| MI/Angina | 2.987 (0.969–9.206) |
| Dependent functional status[b] | – |
| Stroke | 0.672 (0.078–5.829) |
| Bleeding disorder | 0.252 (0.032–1.952) |
| Hypertension | 1.845 (1.162–2.930) |
| BMI 35–45 | 1.171 (0.707–1.939) |
| BMI >60 | 1.455 (0.161–13.177) |
| *Morbidity score* | 1.056 (0.995–1.120) |

AUC: 0.61

Finks et al. [7]

| | |
|---|---|
| *Predictors* | |
| History of VTE | 1.455 (0.181–11.960) |
| Mobility limitations[b] | |
| CAD | 0.000 (0.000–∞) |
| Age ≥50 | 2.566 (1.243–5.296) |
| Pulmonary disease | 0.654 (0.220–1.941) |
| Male gender | 0.595 (0.267–1.326) |
| Smoking | 1.526 (0.748–3.114) |
| Risk stratification model | |
| Severe | 1.364 (0.996–1.867) |
| Any | 1.119 (0.997–1.255) |

AUC: 0.65

Maciejewski et al. [6]

| | |
|---|---|
| Age ≥65 | 0.000 (0.000–∞) |
| OHS | 1.402 (0.542–3.750) |
| Functional status[b] | – |
| Pulmonary hypertension | 0.694 (0.233–2.064) |
| BMI ≥60 | 4.501 (0.462–43.888) |
| Back pain | 0.565 (0.208–1.534) |
| Age 40–64 | 2.234 (0.909–5.490) |
| Diabetes | 1.369 (0.631–2.971) |
| ASA class 4/5[b] | – |
| Male | 0.730 (0.313–1.704) |
| Ischemic heart disease | 0.000 (0.000–∞) |
| BMI 50–59.9 | 0.958 (0.281–3.261) |

Stenberg et al. [38]

| | |
|---|---|
| Age 40–50 | 2.304 (0.821–6.470) |
| Age 50–60 | 4.207 (1.467–12.061) |
| Intraoperative adverse events | 8.290 (3.284–20.925) |
| Conversion | 0.000 (0.000–∞) |
| Other procedure | 0.000 (0.000–∞) |
| Learning curve (>400 cases) | 0.443 (0.193–1.014) |

AUC: 0.77

Sanni et al. [37]

| | |
|---|---|
| Age | 1.023 (0.996–1.050) |
| BMI | 0.986 (0.941–1.032) |
| COPD | 1.238 (0.692–2.217) |
| Dyspnea[c] | NA |
| Hypertension | 1.554 (0.947–2.552) |
| Diabetes | 1.091 (0.645–1.844) |

AUC: 0.61

- Faible pouvoir prédictif de ces modèles
- Modèle de Stenberg: le plus puissant
  - Population Européenne
  - Paramètres variés
    - Pré opératoire
    - Per opératoire
    - Expérience chirurgien

# Complications d'ordre médical

# Complications thrombo-emboliques

- 1ère cause de mortalité
- État d'hypercoagulabilité
  - ↗ Fibrinogène, Fact VII, FVW,
  - ↗ Facteur Inhibiteur du Plasminogène
- Co-morbidités (diabète, Insuffisance veineuse..)
- Type de chirurgie

Obes Surg. 2015 Nov;25(11):2011-7. doi: 10.1007/s11695-015-1649-z.

**Identifying the Bariatric Patient at Risk for Pulmonary Embolism: Prospective Clinical Trial Using Duplex Sonography and Blood Screening.**

Holländer SW[1], Sifft A[2], Hess S[3], Klingen HJ[4], Djalali P[5], Birk D[6].

- Bilan de thrombophilie chez 101 patients
- Déficit protéine S: + fréquent chez les obèses
- Thrombophilie plus fréquente en cas de:
  - Diabète
  - SAOS

# Mortality After Bariatric Surgery

## *Analysis of 13,871 Morbidly Obese Patients From a National Registry*

*Mario Morino, MD,* Mauro Toppino, MD,* Pietro Forestieri, MD,† Luigi Angrisani, MD,‡ Marco Ettore Allaix, MD,* and Nicola Scopinaro, MD, FACS Hon§*

*Annals of Surgery* • Volume 246, Number 6, December 2007

- EP: 1ère cause de DC post op (38%)
- Par ordre de fréquence:
  - Diversion bilio-pancréatique
  - Roux-en-Y gastric bypass
- Dépistage peut être discuté

# Pulmonary Embolism Complicating Bariatric Surgery: Detailed Analysis of a Single Institution's 24-Year Experience

*J Am Coll Surg* 2006;203:831–837

- Incidence 0.85% - Mortalité 27%
- Délai moyen de survenue d'une EP: 13 j
- 1/3 des EP surviennent après la sortie
- Facteurs de risque identifiés:
  - Insuffisance respiratoire
  - Insuffisance veineuse
  - BMI > 55

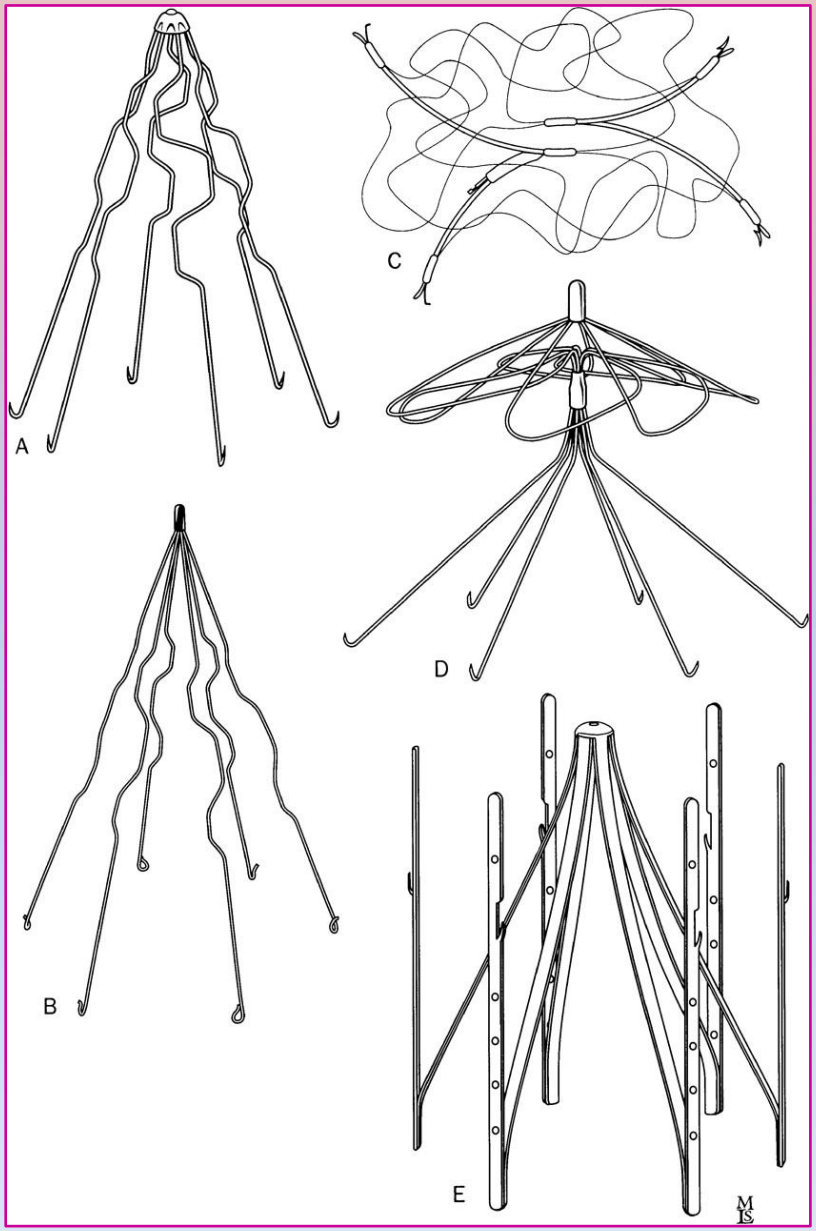
# Predicting Risk for Venous Thromboembolism With Bariatric Surgery

*Results From the Michigan Bariatric Surgery Collaborative*

*Ann Surg* 2012

- Michigan Bariatric Surgery Collaborative (MBSC)
- n= 27818 - MVTE: 0.33%

| Risk Factor | Regression Coefficient | Odds Ratio |
|---|---|---|
| Procedure type (Reference adjustable gastric band) | | |
| Duodenal switch | 2.25 | 9.45 |
| Open gastric bypass | 1.87 | 6.48 |
| Laparoscopic gastric bypass | 1.38 | 3.97 |
| Sleeve gastrectomy | 1.25 | 3.50 |
| Patient factors | | |
| Previous VTE | 1.42 | 4.15 |
| Male gender | 0.733 | 2.08 |
| Operative time > 3 h | 0.622 | 1.86 |
| BMI category† (per 10 units) | 0.311 | 1.37 |
| Age category‡ (per 10 yrs) | 0.223 | 1.25 |




# Place du filtre cave?

# Les complications respiratoires

# Mortality After Bariatric Surgery

## *Analysis of 13,871 Morbidly Obese Patients From a National Registry*

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*Annals of Surgery* • Volume 246, Number 6, December 2007

Défaillance respiratoire = 2ème cause de

mortalité d'origine respiratoire

# Association of metabolic syndrome and surgical factors with pulmonary adverse events, and longitudinal mortality in bariatric surgery†

R. Schumann[1*], S. A. Shikora[2], J. C. Sigl[3] and S. D. Kelley[2]

*British Journal of Anaesthesia* **114** (1): 83–90 (2015)

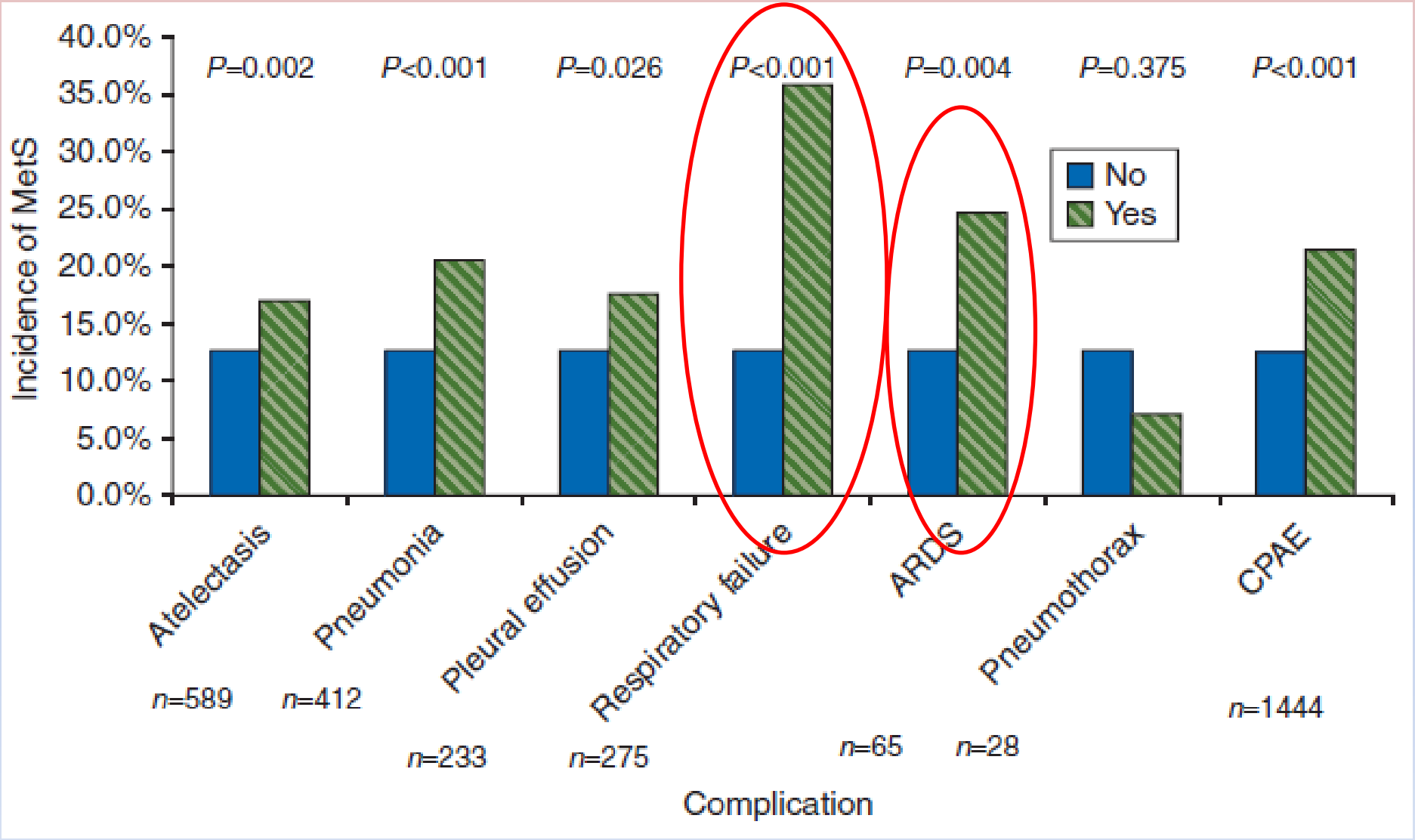
- Prévalence 0.91%
  - Atélectasies (0.4%)
  - Pneumonies (0.3%)
  - Pneumothorax
  - Épanchements pleuraux
  - SDRA

**Table 2** The prevalence of PPC and associated longitudinal mortality. ARDS, adult respiratory distress syndrome; *n*, number of records available for analysis. *$P<0.05$ *vs* no pulmonary adverse event

| Pulmonary adverse event | Incidence ($n=158\,405$) (%) | Mortality (%) | | |
|---|---|---|---|---|
| | | 30 days ($n=135\,107$) | 90 days ($n=113\,079$) | 365 days ($n=43\,562$) |
| None | 99.1 | 0.1 | 0.2 | 0.6 |
| Composite | 0.91 | 0.9* | 1.8* | 5.4* |
| Atelectasis | 0.4 | 0.2 | 0.4 | 0.9 |
| Pneumonia | 0.3 | 0.8* | 1.6* | 4.1* |
| Respiratory Failure | 0.2 | 3.3* | 6.5* | 24.7* |
| ARDS | 0.04 | 5.2* | 8.9* | 17.4* |
| Pneumothorax | 0.02 | 0 | 0 | 0 |
| Pleural effusion | 0.1 | 0 | 0 | 0 |

- La mortalité X 9 si événement respiratoire
- Détresse respiratoire
- SDRA post opératoire

Les plus pourvoyeuses de mortalité




Complications respiratoires et syndrome métabolique

# Postoperative Hypoxemia in Morbidly Obese Patients With and Without Obstructive Sleep Apnea Undergoing Laparoscopic Bariatric Surgery

Anesth Analg 2008;107:138–43

- Incidence SAOS entre 40 et 50% des cas
- Même taux d'hypoxémie entre:
  - Patients obèses SAOS +
  - Patients obèses SAOS -

# Complications cardiovasculaires

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

**Obesity and Cardiovascular Disease**

Caroline M. Apovian and Noyan Gokce

*Circulation*. 2012;125:1178-1182.

- Résistance à l'insuline
- HTA
- Dyslipidémie
- État pro inflammatoire

- Athérosclérose
- coronaropathie
- Insuffisance cardiaque
- Troubles du rythme

- Remodelage myocardique
- Hypertrophie ventriculaire
- Altération fonctions systoliques et diastoliques
- Dysfonctionnement endothélial
- Pathologie coronaire
- Hypertonie sympathique
- HTAP
- Arythmies

# Eligibility for bariatric surgery among adults in England: analysis of a national cross-sectional survey

Journal of the Royal Society of Medicine Open; 5(1) 1–6

| | % BMI < 35 (CI) | % BMI 35–40 (CI) | % BMI > 40(CI) |
|---|---|---|---|
| Hypertension | 19.3 (18.5–20.2) | 42.1 (38.4–45.8) | 51.6 (43.9–59.2) |
| Type 2 diabetes | 3.2 (2.8–3.6) | 8.8 (6.8–10.9) | 16.7 (10.8–22.5) |
| Stroke | 1.2 (1.0–1.5) | 2.4 (1.3–3.4) | 2.1 (0.0–4.2) |
| Coronary heart disease | 3.2 (2.8–3.5) | 5.9 (4.2–7.6) | 8.4 (4.3–12.6) |
| Osteoarthritis | 6.6 (6.1–7.2) | 16.2 (13.6–18.8) | 21.1 (15.2–26.9) |
| Comorbidities† | | | |
| 0 | 73.9 (73.0–74.8) | 50.8 (47.0–54.6) | 35.8 (28.3–43.3) |
| ≥1 | 26.1 (25.2–27.1) | 49.2 (45.4–53.0) | 64.2 (56.7–71.7) |
| Weighted base (*N*) | 8712 | 705 | 172 |
| Unweighted base (*N*) | 8525 | 721 | 179 |

## Prevalence and Predictors of Atrial Fibrillation among Patients Undergoing Bariatric Surgery

*Obes Surg.* 2014 April

- 1341 chirurgie bariatrique (2008-2012)
- En analyse transversale

➔ Prévalence FA à **1.9%**

**Multivariable Model of AF in Patients Undergoing Bariatric Surgery (N=1341)**

| | Odds Ratio (95% CI) | p-Value |
|---|---|---|
| Age (per 10 years) | 2.2(1.4-3.5) | <0.001 |
| Gender-Male | 2.4(1.1-5.4) | 0.03 |
| BMI (per 5 kg/m$^2$) | 1.15(0.98-1.41) | 0.09 |

➔Obésité = facteur de risque indépendant d'ACFA

- Dilatation OG
- Remodelage ventriculaire
- ↗ volume circulant
- Dysfonction diastolique

International Journal of Cardiology 173 (2014) 20–28

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

# Bariatric surgery and its impact on cardiovascular disease and mortality: A systematic review and meta-analysis

Chun Shing Kwok [a,*,1], Ashish Pradhan [b], Muhammad A. Khan [c], Simon G. Anderson [d], Bernard D. Keavney [e], Phyo Kyaw Myint [f], Mamas A. Mamas [g], Yoon K. Loke [h]

- 14 études (29,208 patients)
- Groupe contrôle (166,200 patients obèses non opérés)

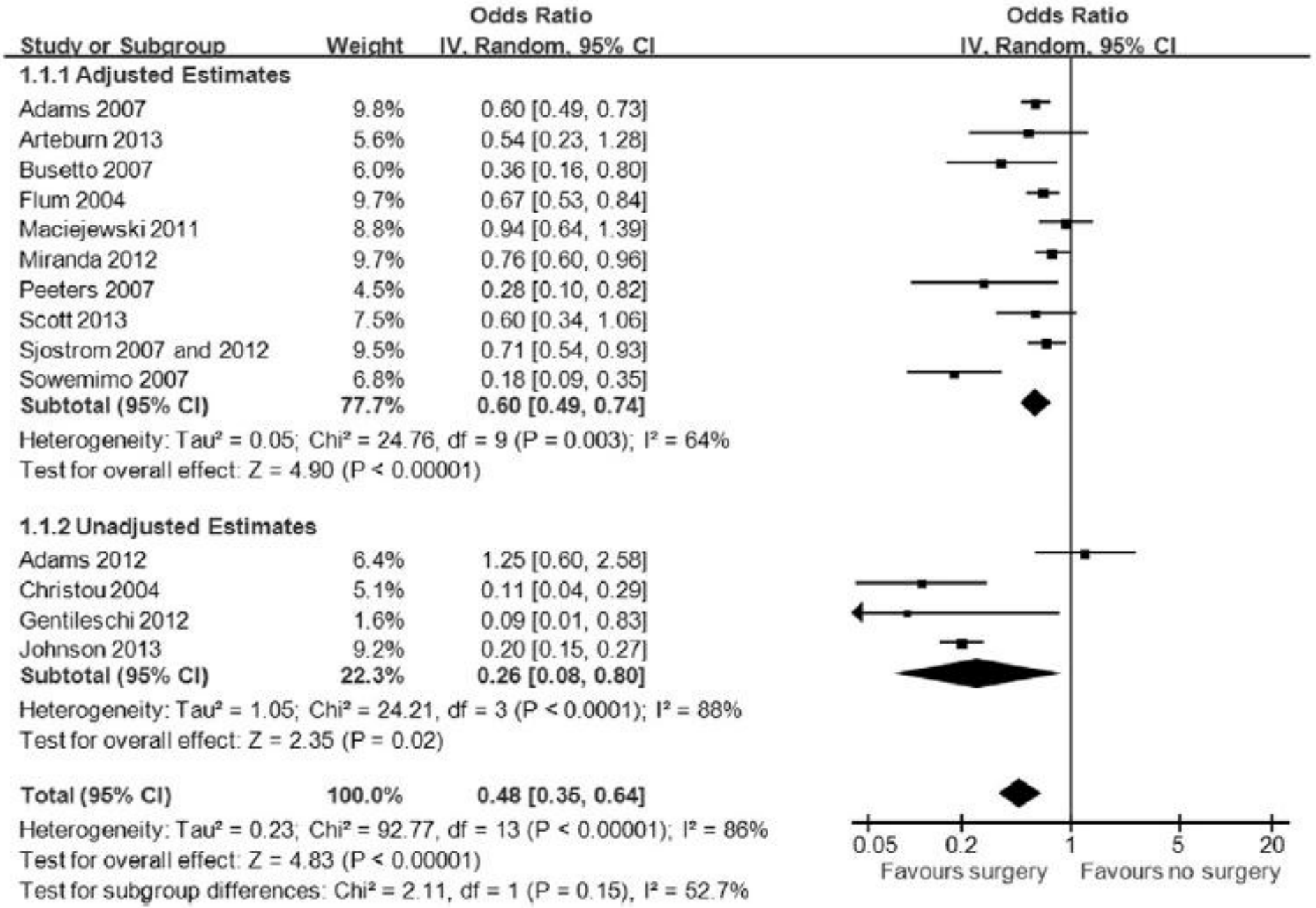



**Fig. 2.** Meta-analyses of mortality risk after bariatric surgery as compared to no surgery.

| Study or Subgroup | Weight | Odds Ratio IV, Random, 95% CI |
|---|---|---|
| Adams 2007 | 25.4% | 0.51 [0.36, 0.73] |
| Johnson 2013 | 16.9% | 0.32 [0.19, 0.54] |
| Scott 2013 | 23.0% | 0.59 [0.40, 0.88] |
| Sjostrom 2007 and 2012 | 34.7% | 0.67 [0.54, 0.83] |
| **Total (95% CI)** | **100.0%** | **0.54 [0.41, 0.70]** |

Heterogeneity: $Tau^2 = 0.04$; $Chi^2 = 7.23$, df = 3 (P = 0.06); $I^2 = 58\%$

Test for overall effect: Z = 4.47 (P < 0.00001)

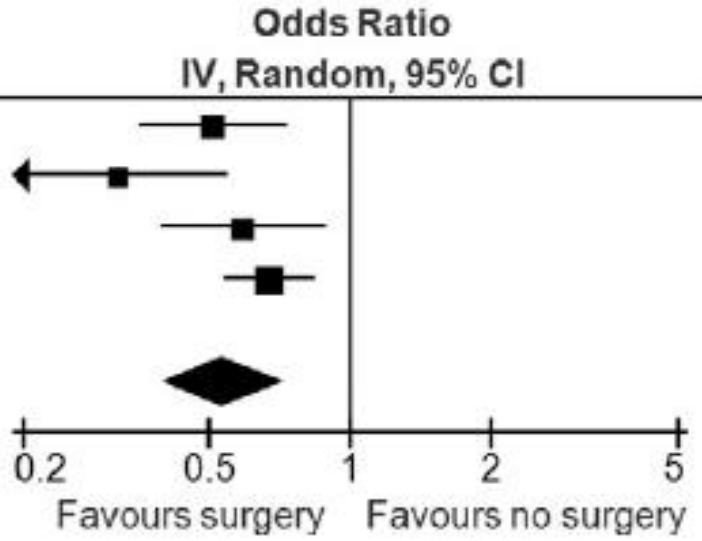



**Fig. 3.** Meta-analysis of risk of myocardial infarction after bariatric surgery compared to no surgery.

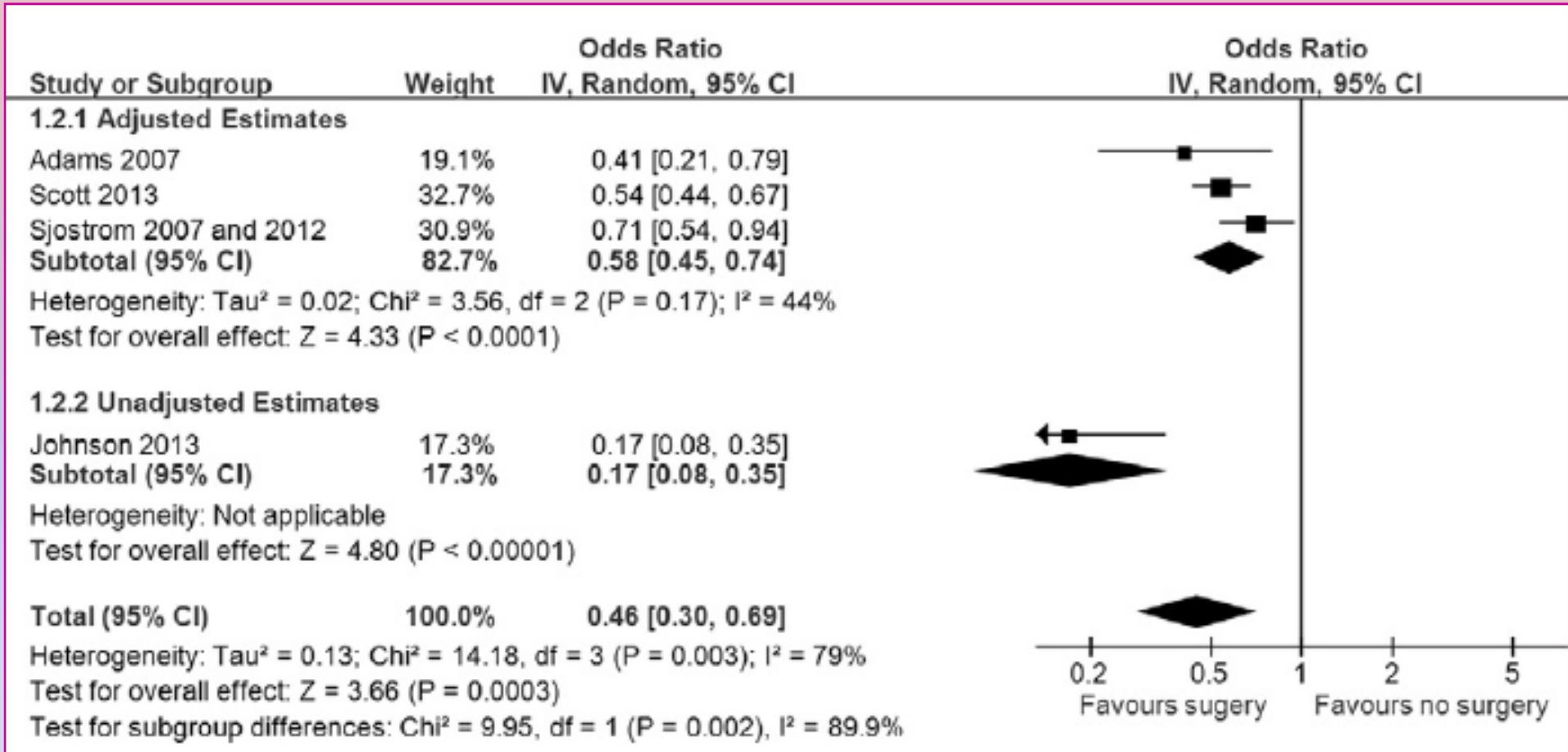



**Fig. 4.** Meta-analysis of stroke risk after bariatric surgery as compared to no surgery.


Merci de votre attention