

# Évaluation de la Fragilité Osseuse chez l'Obèse, Eventuellement Opéré

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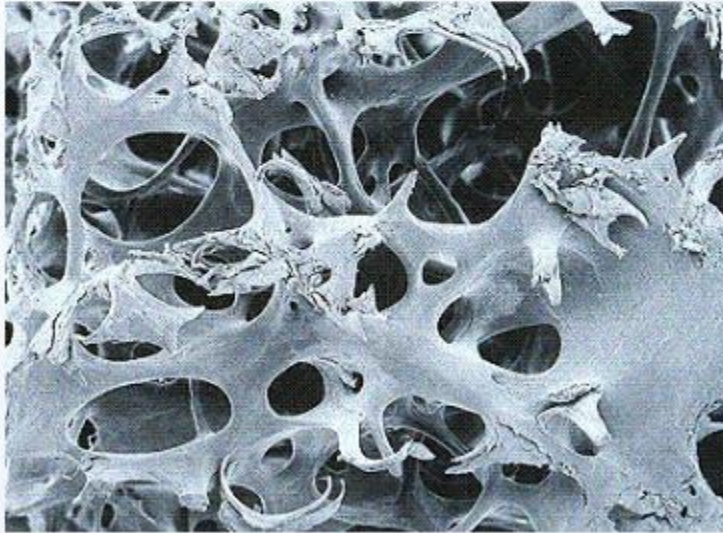


# Ostéoporose

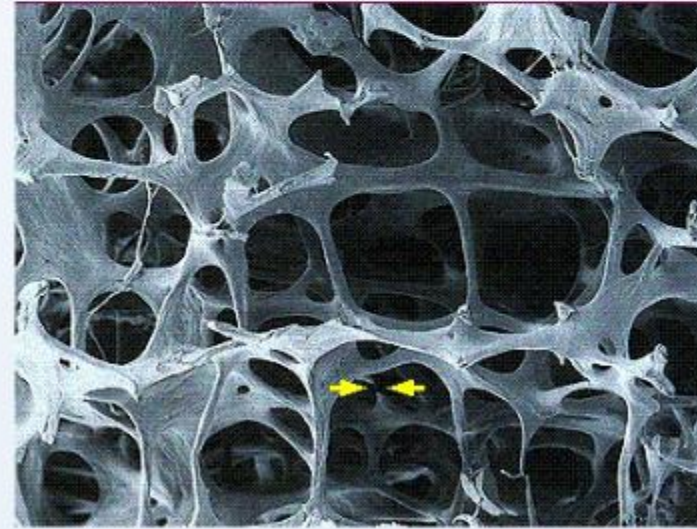


**Définition** (*Conférence de Consensus NIH 2000*) :

Etat du squelette caractérisé par une diminution de la solidité osseuse exposant à un risque accru de fracture



Os normal



Os ostéoporotique

# La Fracture Ostéoporotique : un Événement Complexe et Multi-factoriel

## Facteurs extra-osseux

### Chute :

- Direction
- Énergie cinétique

## Osseux

### Quantitatif : masse (DMO)

### Qualitatif :

- Structure (macro et micro)
- Matériau

CONTRAINTE

>>

RESISTANCE



# Evaluation du Risque de Fracture

## Facteurs Cliniques de Risque:

- Age
- Antécédent personnel de fracture
- Antécédent familial de fracture de l'ESF
- IMC < 19 kg/m<sup>2</sup>
- Ménopause précoce
- Causes secondaires d'ostéoporose
- Corticothérapie systémique
- Tabac/Alcool

Country:  Name / ID:  [About the risk factors](#)

**Questionnaire:**

1. Age (between 40-80 years) or Date of birth: Age:  Y  M  D

2. Sex:  Male  Female

3. Weight (kg):

4. Height (cm):

5. Previous fracture:  No  Yes

6. Parent (father) hip:  No  Yes

7. Current smoking:  No  Yes

8. Osteoarthritis:  No  Yes

9. Rheumatoid arthritis:  No  Yes

10. Secondary osteoporosis:  No  Yes

11. Alcohol 7 or more units per day:  No  Yes

12. Fennel neck BMD (g/cm<sup>3</sup>):

**Result: 22.0**  
The 10 year probability of fracture (%)

Without BMD	
Major osteoporosis	5.5
Hip fracture	1.5

[View NICE guidance](#)

Menopause



Unit



# Evaluation du Risque de Fracture

## Facteurs Cliniques de Risque:

- Age
- Antécédent personnel de fracture
- Antécédent familial de fracture de l'ESF
- IMC < 19 kg/m<sup>2</sup>
- Ménopause précoce
- Causes secondaires d'ostéoporose
- Corticothérapie systémique
- Tabac/Alcool

## Mesure de la DMO (DXA)



Country: GB Name / ID:  [About the risk factors](#)

**Questionnaire:**

1. Age (between 10-90 years) or Date of birth:  
Age:  Date of birth:

2. Sex:  Male  Female

3. Weight (kg):

4. Height (cm):

5. Personal fracture:  No  Yes

6. Parent fractured hip:  No  Yes

7. Current smoking:  No  Yes

8. Rheumatoid arthritis:  No  Yes

9. Secondary osteoporosis:  No  Yes

10. Alcohol 7 or more units per day:  No  Yes

11. Personal neck BMD (g/cm<sup>3</sup>):

Select Disk:

Clear Calculate

**200 - 220**  
The low your probability of fracture (%)

**without BMD**

<input type="checkbox"/> Major osteoporosis	5.5
<input type="checkbox"/> Hip fracture	4.5

[View NOO substance](#)

Menopause



Unit

# Evaluation du Risque de Fracture

## Facteurs Cliniques de Risque:

- Age
- Antécédent personnel de fracture
- Antécédent familial de fracture de l'ESF
- IMC < 19 kg/m<sup>2</sup>
- Ménopause précoce
- Causes secondaires d'ostéoporose
- Corticothérapie systémique
- Tabac/Alcool

## Mesure de la DMO (DXA)



Country / FR Name / ID:  [About the risk factors](#)

**Questionnaire**

1. Age (between 10-99 years) or Date of birth:  /  /

2. Sex:  Male  Female

3. Weight (kg):

4. Height (cm):

5. Previous fracture:  No  Yes

6. Parent fractured hip:  No  Yes

7. Current smoking:  No  Yes

8. Rheumatoid arthritis:  No  Yes

9. Secondary osteoporosis:  No  Yes

10. Alcohol (or more units per day):  No  Yes

11. Personal neck DMO (g/cm<sup>2</sup>):

**2019 - 2020**  
The 10-year probability of fracture (%)

Without BMD	With BMD
Major osteoporosis	5.5
Hip fracture	5.5

[View ACOG Guidance](#)

## Marqueurs du Remodelage osseux

- CTX, NTX
- OC, bALP, P1NP

Menopause



Unit

# Les Outils de Prédiction

## (GRIO 2018)

- **Age**
- **Antécédent personnel de fracture**
- **Mesure de la Densité Minérale Osseuse**
- ***Evaluation du risque de chute (> 70 ans)***

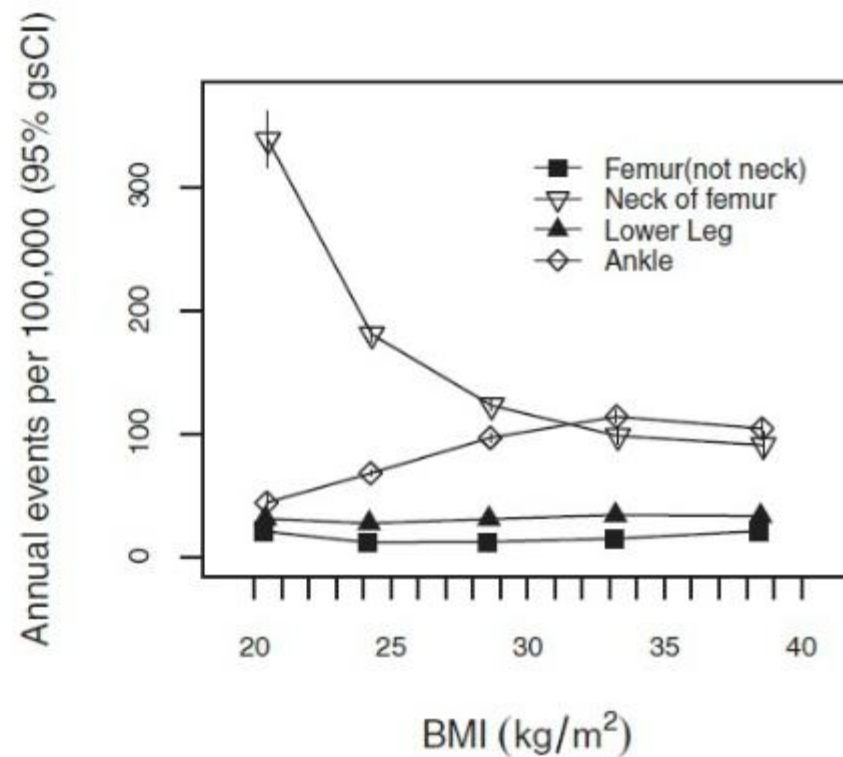
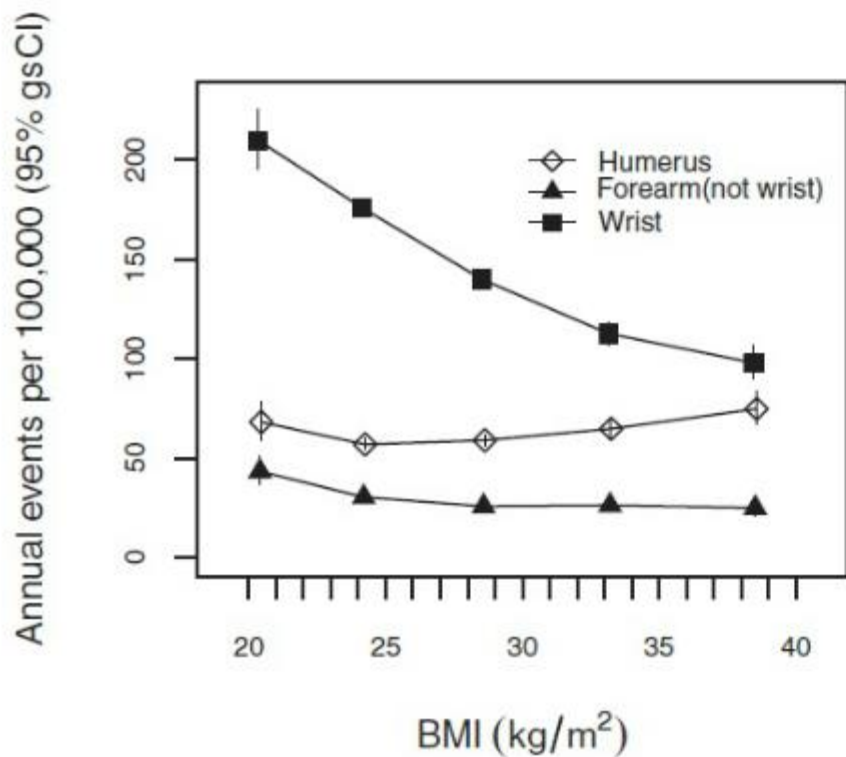


# Incidence Fracturaire en fonction de l'IMC

	Normal 18.5–24.9 kg/m <sup>2</sup>	Overweight 25–29.9 kg/m <sup>2</sup>	Obese 1 30–34.9 kg/m <sup>2</sup>	Obese 2 ≥ 35 kg/m <sup>2</sup>
<b>Women</b>				
Major osteoporotic fractures				
Fractures/person-years, n	1665/129 241	1232/111 073	501/49 526	176/23 364
Crude incidence rate <sup>a</sup>	13.0	11.0	10.1	7.5
Base model <sup>b</sup>	1.0 (referent)	0.85 (0.79–0.91)	0.80 (0.72–0.88)	0.67 (0.57–0.79)
Base model + femoral neck BMD	1.0 (referent)	1.00 (0.93–1.08)	1.05 (0.95–1.16)	0.95 (0.81–1.12)
Hip fractures				
Fractures/person-years, n	528/129 241	307/111 073	96/49 526	29/23 364
Crude incidence rate <sup>a</sup>	4.1	2.7	1.9	1.2
Base model <sup>b</sup>	1.0 (referent)	0.70 (0.61–0.80)	0.53 (0.42–0.66)	0.41 (0.28–0.60)
Base model + femoral neck BMD	1.0 (referent)	0.89 (0.77–1.02)	0.79 (0.63–0.99)	0.67 (0.46–0.98)
<b>Men</b>				
Major osteoporotic fractures				
Fractures/person-years, n	106/6815	117/10 006	39/3769	8/1033
Crude incidence rate <sup>a</sup>	15.4	11.6	10.4	7.8
Base model <sup>b</sup>	1.0 (referent)	0.82 (0.63–1.07)	0.75 (0.52–1.09)	0.64 (0.31–1.32)
Base model + femoral neck BMD	1.0 (referent)	1.02 (0.78–1.33)	1.05 (0.71–1.53)	0.92 (0.45–1.92)
Hip fracture				
Fractures/person-years, n	40/6815	21/10 006	9/3769	1/1033
Crude incidence rate <sup>a</sup>	5.8	2.1	2.4	1.0
Base model <sup>b</sup>	1.0 (referent)	0.43 (0.25–0.73)	0.55 (0.27–1.15)	0.24 (0.03–1.78)
Base model + femoral neck BMD	1.0 (referent)	0.61 (0.36–1.05)	1.01 (0.48–2.14)	0.45 (0.06–3.33)



## Incidence Fracturaire en fonction de l'IMC et du Site Osseux



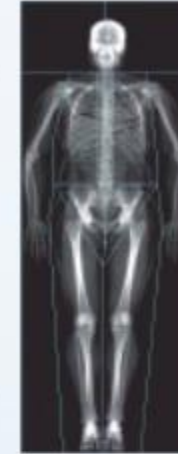
# Mesure de la Densité Minérale Osseuse



- **Nécessaire avant toute décision thérapeutique**
- **Quantifier la perte osseuse sous-jacente**
- **Estimer le caractère dit de fragilité de la fracture lorsque le T-score est peu abaissé et en fonction du site de fracture**
- **Valeur pronostique de la valeur de T-score après fracture**

*Briot K et al. Actualisation 2016 des recommandations des recommandations françaises de traitement de l'ostéoporose post-ménopausique. J Bone Spine 2018 (in press)*

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Menopause



Unit

## Poids Maximum des Appareils de DXA

Appareil	Poids maxi
QDR-4500 (W & A) EXPLORER W Delphi W et A	135 kg
Discovery avant 03/2005	160 kg
Discovery après 03/2005	180 kg
Discovery après 04/2007	204 kg

Appareil	Poids maxi
DPX NT	136 kg
Prodigy 1 <sup>ère</sup> génération	136 kg
Prodigy Advance, Primo	159 kg
iDXA (*)	182 kg

*(\*)Tube delivers X-ray flux to measure and image patients up to 182 kg*

**HOLOGIC™**





## La Mesure de la Densité Osseuse est un Défi chez les Obèses



Fig. 1. Manual retraction of an overlying fat panniculus. Patients were instructed to use two hands to retract their fat panniculus medially and upward away from the proximal femur scan area. (A) Pre-retraction. (B) Post-retraction.

## La Mesure de la Densité Osseuse est un Défi chez les Obèses

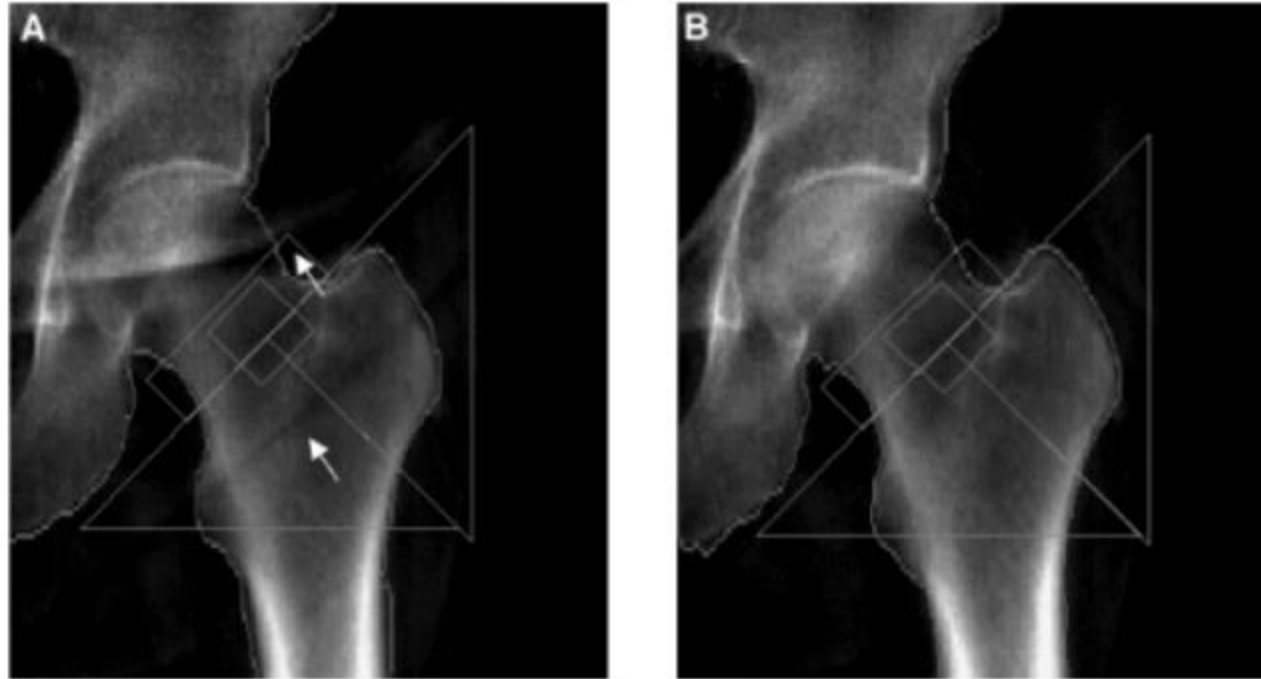


Fig. 2. Documentation of fat panniculus retraction from scan field. Visual examination of the scan images provide documentation that the panniculus has been successfully removed from the scan image. (A) Pre-retraction. (B) Post-retraction. Arrows indicate the panniculus edge in (A); the fat line is not present in (B).

# Densité FN droite plus basse de 14%

Patient :	C [REDACTED]	ID-examen :	[REDACTED]
Date de naissance :	[REDACTED] 57,0 ans	Médecin Prescripteur :	[REDACTED]
Taille / Poids :	175,0 cm 106,0 kg	Mesuré :	01/03/2010 11:44:49 (10,50)
Sexe / Ethnie :	Femme Blanc	Analysé :	01/03/2010 12:09:39 (10,50)

DualFemur Densité osseuse

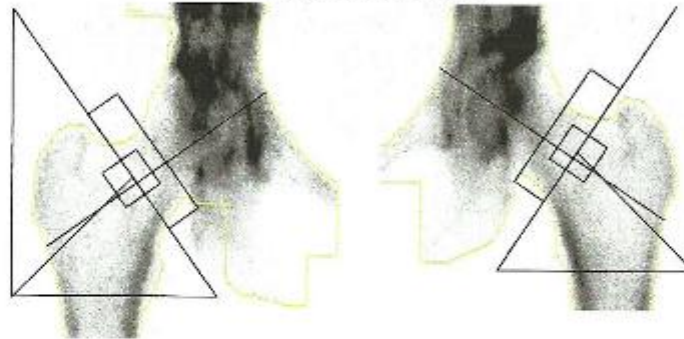
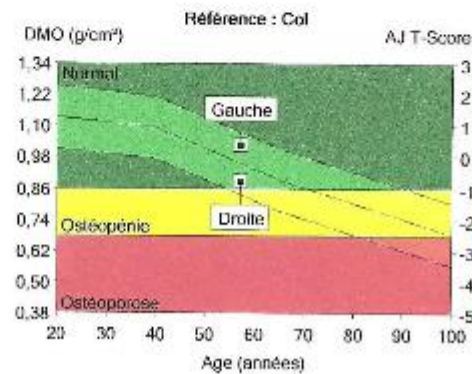


Image non diagnostique



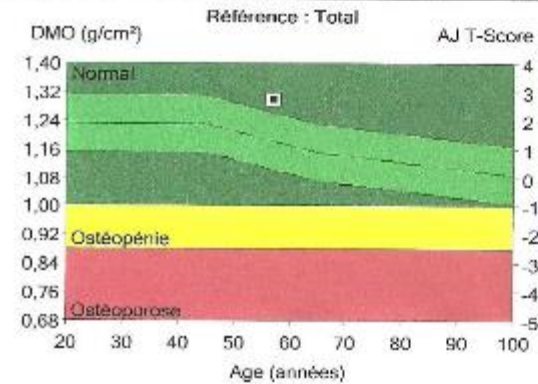
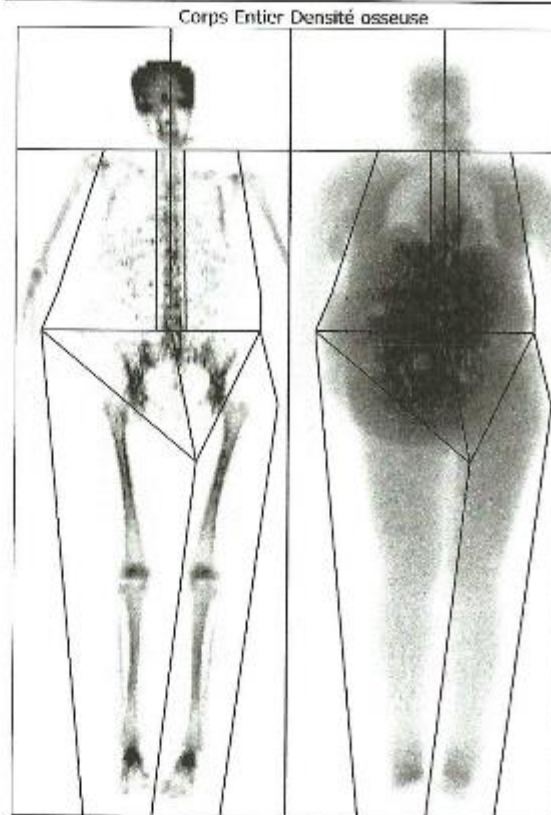
Comparaison de longueurs d'axes de hanches (mm)

Région	DMO <sup>1</sup> (g/cm <sup>3</sup> )	Adulte-Jeune <sup>2,7</sup> (%) T-Score	Age-Egal <sup>3</sup> (%) Z-Score
Col			
Gauche	1,021	104 0,3	107 0,5
Droite	0,886	90 -0,8	93 -0,6
Moyenne	0,954	97 -0,2	100 0,0
Différence	0,135	14 1,1	14 1,1
Total			
Gauche	1,101	110 0,8	112 0,9
Droite	0,989	99 -0,1	100 0,0
Moyenne	1,045	105 0,4	106 0,5
Différence	0,111	11 0,9	11 0,9

# Densité FN Droite plus Basse de 14% Mais ... Tablier Abdominal Latéralisé à Droite

**Patient :** Cl [REDACTED]  
**Date de naissance :** 07/02/1953 57,0 ans  
**Taille / Poids :** 175,0 cm 106,0 kg  
**Sexe / Ethnie :** Femme Blanc

**ID-examen :** [REDACTED]  
**Médecin Prescripteur :** [REDACTED] 01/03/2010 11:54:00 (10,50)  
**Mesuré :** 01/03/2010 12:11:03 (10,50)  
**Analysé :** 01/03/2010 12:11:03 (10,50)



Région	DMO <sup>1</sup> (g/cm <sup>3</sup> )	Adulte-Jeune <sup>2</sup> (%) T-Score	Age-Egal <sup>3</sup> (%) Z-Score
Tête	2,192	-	-
Bras	0,950	-	-
Jambes	1,364	-	-
Tronc	1,092	-	-
Côtes	0,707	-	-
Bassin	1,469	-	-
Rachis	1,165	-	-
Total	1,293	120 2,7	110 1,4



## La Mesure de la Densité Osseuse est un Défi chez les Obèses

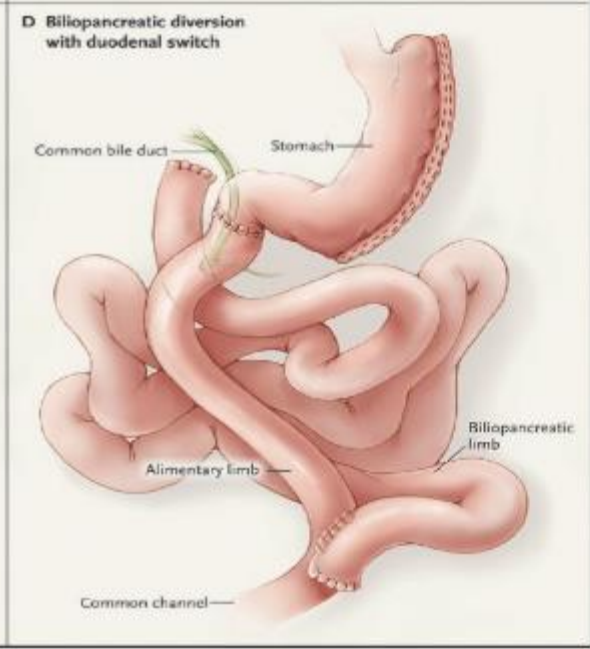
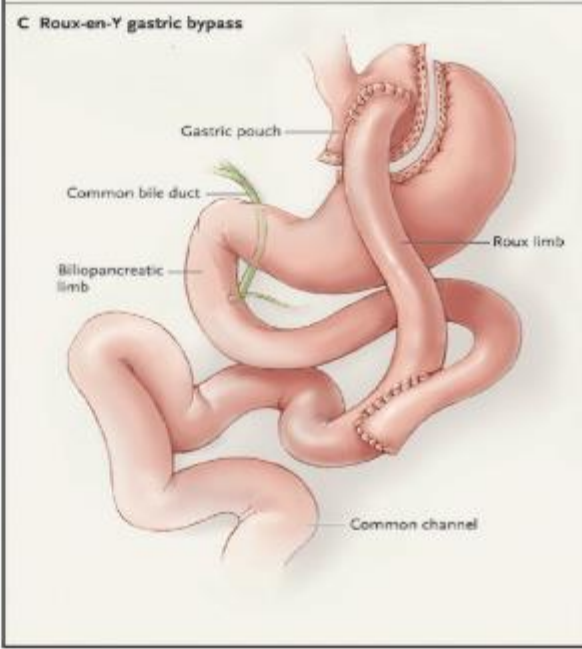
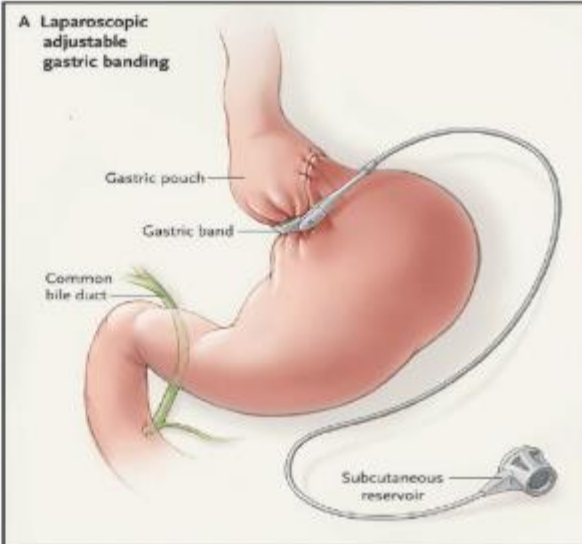
- **Nécessité d'une table d'examen adaptée (poids, mesure CE)**
- **DMO lombaire impactée par l'épaisseur abdominale  
*(habituellement sous-estimation de la DMO réelle)***
- **DMO fémorale habituellement normale ou élevée  
*(→ impact mécanique du surpoids)***
- **Impact des variations pondérales (chirurgie bariatrique)**

# Incidence Fracturaire Fonction des Variations Pondérales

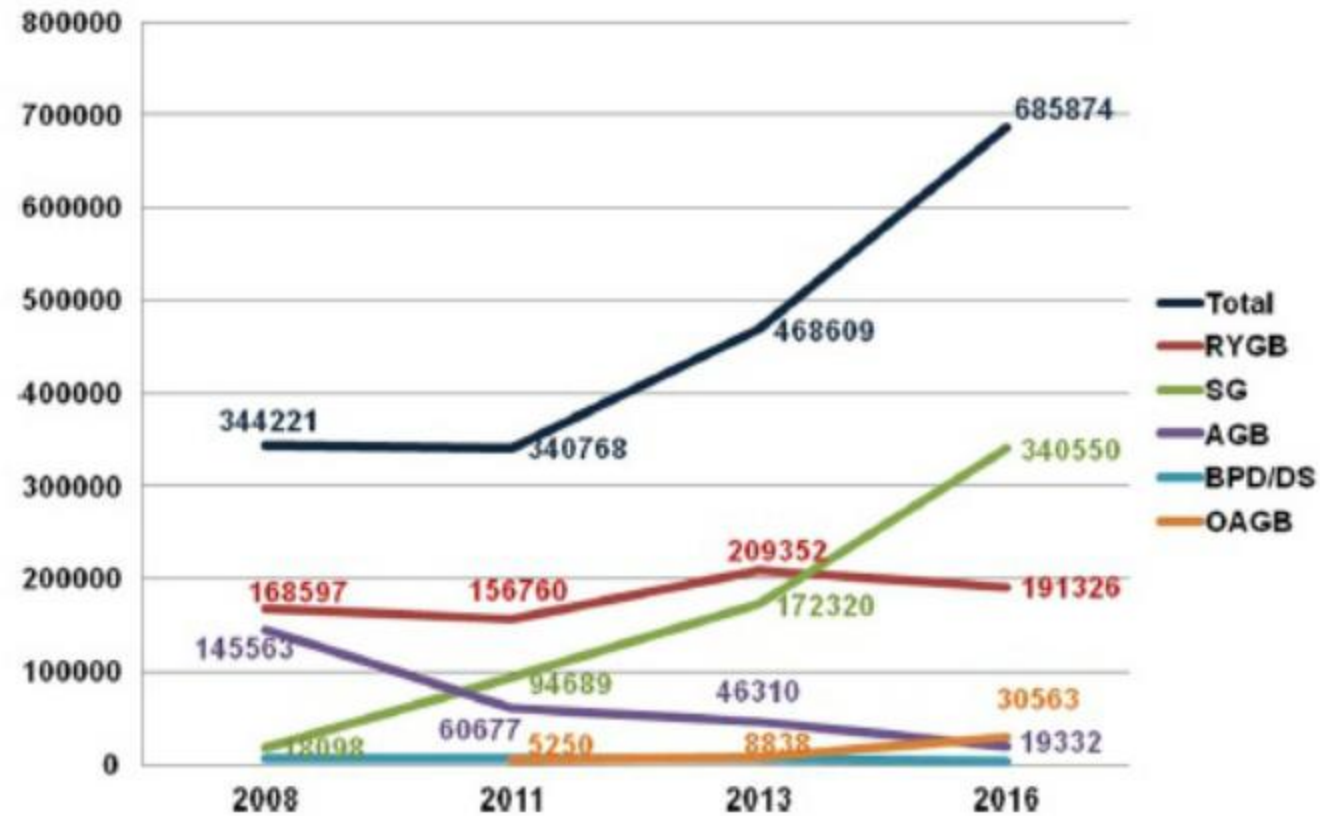
Variable	Stable weight (n=79 279)	Weight loss (n=18 266)	Weight gain (n=23 021)	Total
Age (years) at screening:				
<50–59†	24 221 (31)	5119 (28)	9670 (42)	39 010 (32)
60–69	37 063 (47)	8279 (45)	9898 (43)	55 240 (46)
≥70	17 995 (23)	4868 (27)	3453 (15)	26 316 (22)

Weight change category	Upper limb	Lower limb	Central body	Hip
Stable weight (reference)	1.00	1.00	1.00	1.00
Weight loss 5%–≤10%	1.07 (1.00 to 1.15)	0.96 (0.89 to 1.03)	1.27 (1.18 to 1.37)	1.53 (1.36 to 1.72)
Weight loss >10%	1.13 (1.03 to 1.25)	1.03 (0.93 to 1.14)	1.35 (1.22 to 1.50)	1.87 (1.61 to 2.17)
Weight gain 5%–≤10%	1.11 (1.05 to 1.19)	1.18 (1.11 to 1.25)	0.96 (0.89 to 1.04)	0.93 (0.81 to 1.06)
Weight gain ≥10%	1.08 (0.98 to 1.18)	1.18 (1.08 to 1.29)	0.98 (0.87 to 1.09)	1.08 (0.90 to 1.31)

\*Adjusted for baseline age, race, height, baseline weight, smoking, alcohol intake, total energy expended per week, dietary and supplemental vitamin D intake, dietary and supplemental calcium intake, physical function score, general health status, oophorectomy, hysterectomy, Charlson index score, use of menopausal hormone therapy, daily oral corticosteroid use, use of oral or injectable diabetes medication, study group (Women's Health Initiative Observational Study, Women's Health Initiative Clinical Trials), previous diagnosis of cancer, and previous fracture.

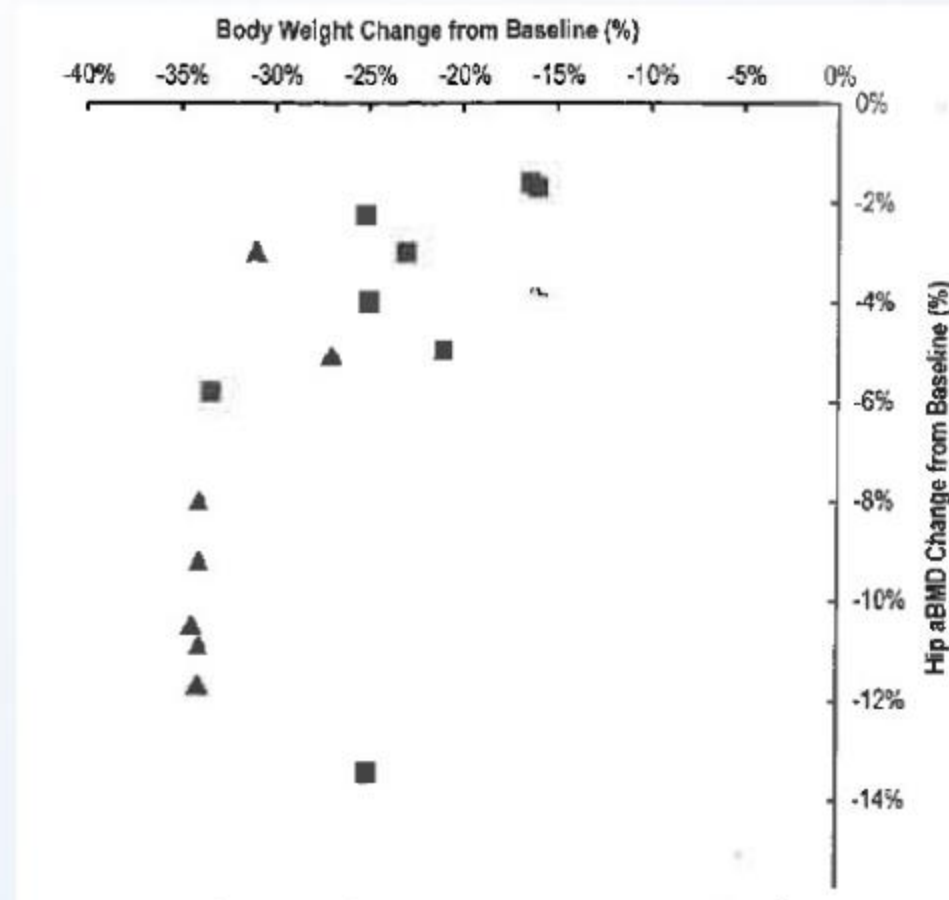


# Nombre de Procédures de Chirurgie Bariatrique entre 2008 et 2016 par Année et Type de Procédure



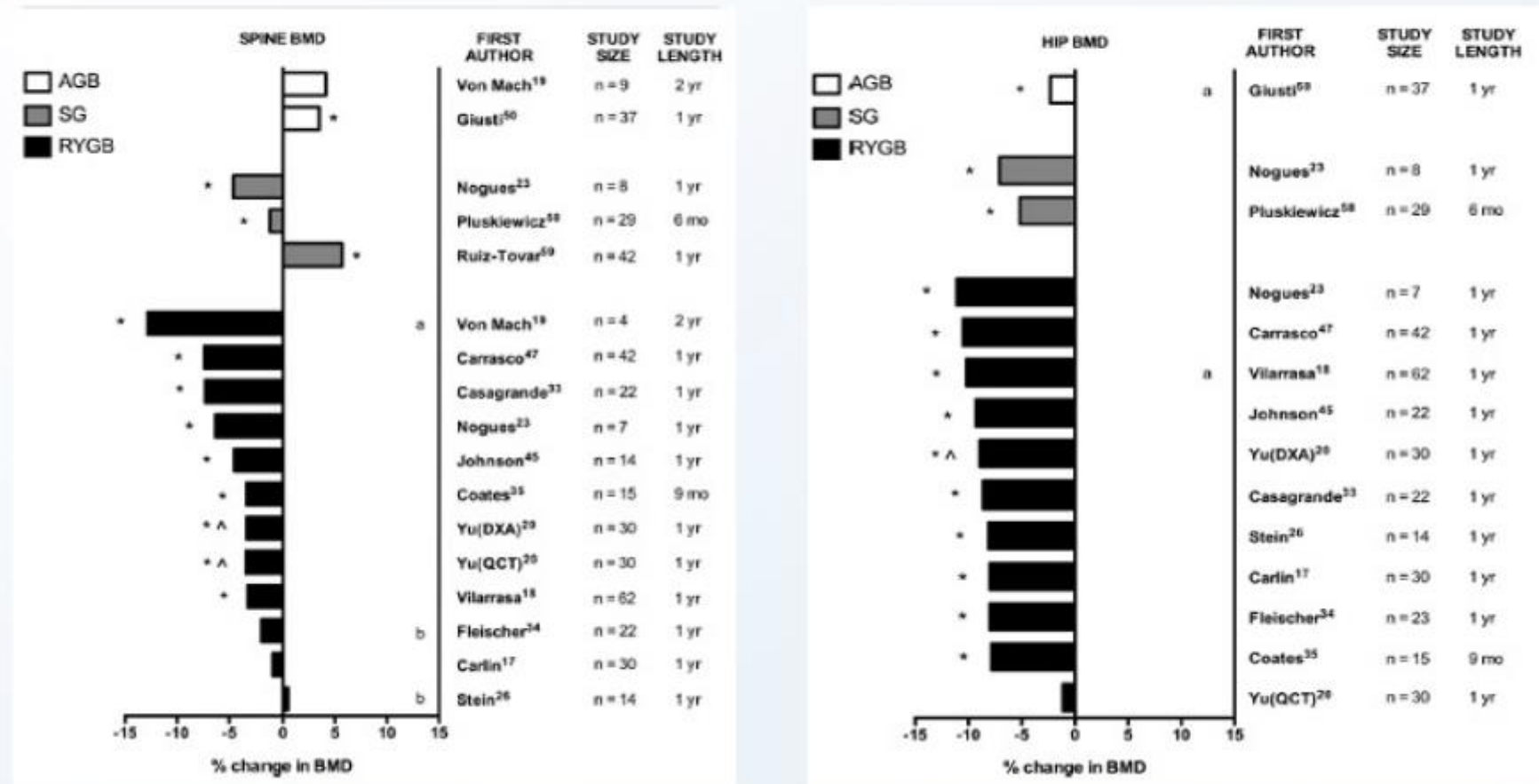


# Variations de la Perte osseuse à la Hanche en Fonction de la Perte de Poids



(triangles) : malabsorptive and restrictive/malabsorptive procedures  
(squares) : restrictive procedures

# Variations de la DMO après Chirurgie Bariatrique

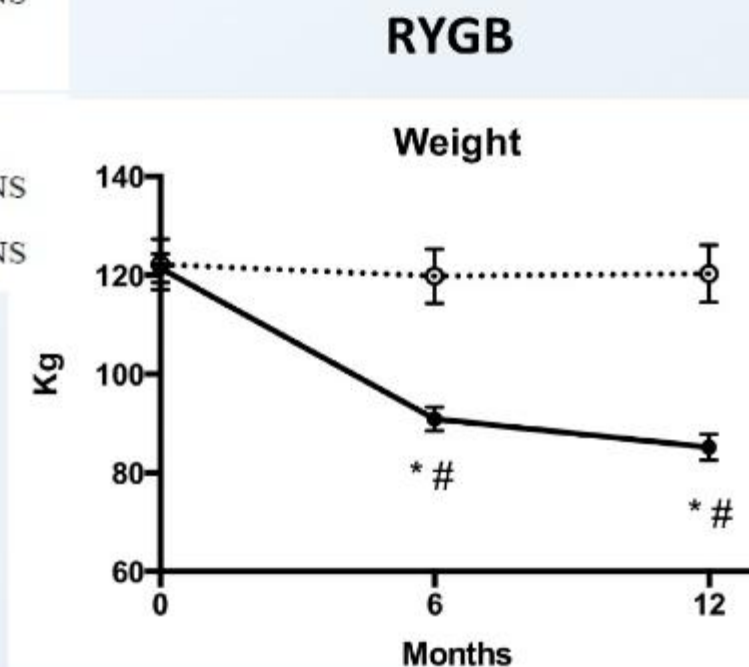


D'après Yu EW, J Bone Miner Res 2014

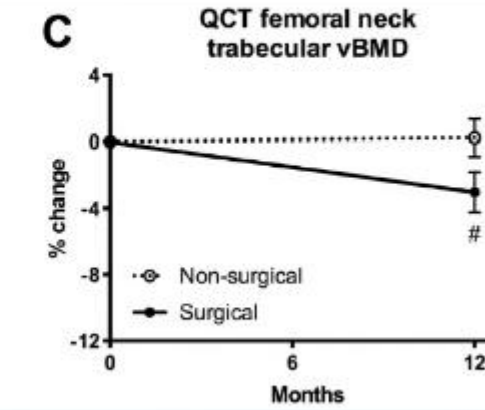
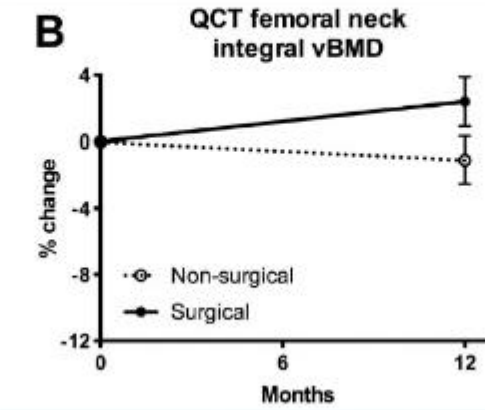
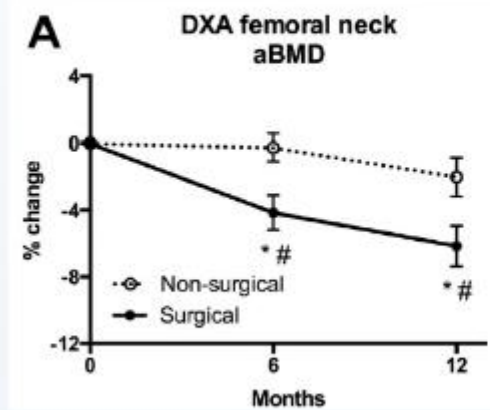
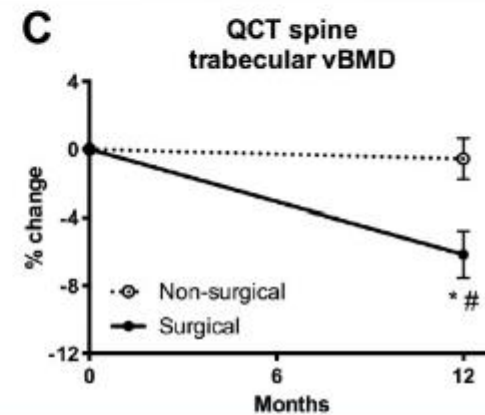
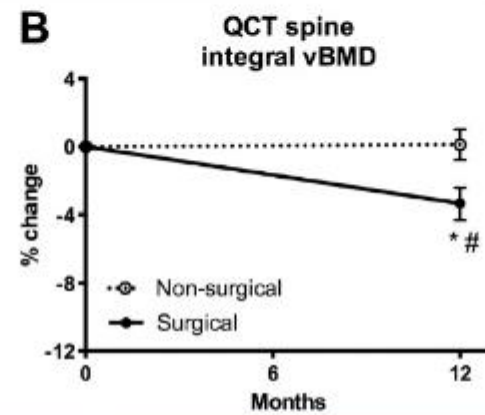
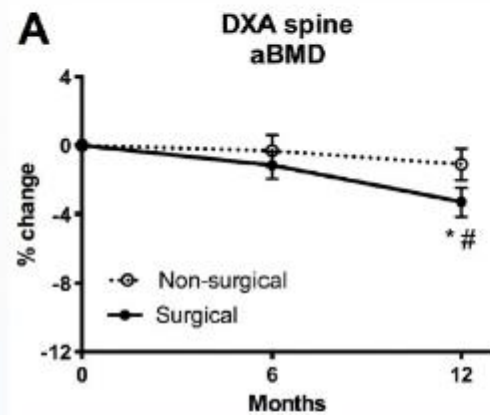
## Variations de la DMO après Chirurgie Bariatrique (DXA vs QCT)

	Surgical n=30	Non-surgical n=19	P-value
Age, y	47 ± 14	46 ± 16	NS
Gender / Menopause status			NS
Male, n (%)	4 (13%)	2 (11%)	
Bionutrition measures			
Weight, kg	121 ± 16	122 ± 22	NS
BMI, kg/m <sup>2</sup>	45 ± 6	45 ± 6	NS

Yu EW et al, JBMR 2014



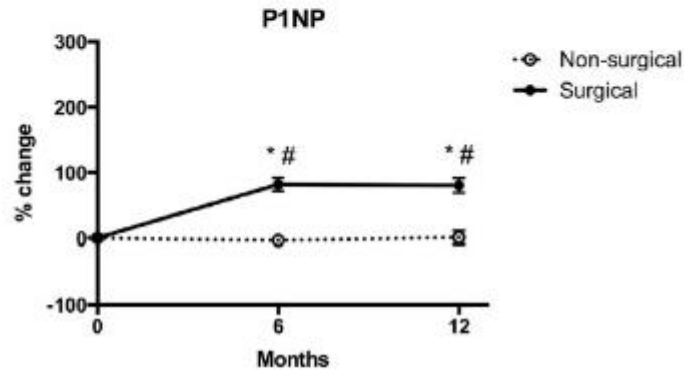
# Variations de la DMO après Chirurgie Bariatrique (DXA vs QCT)



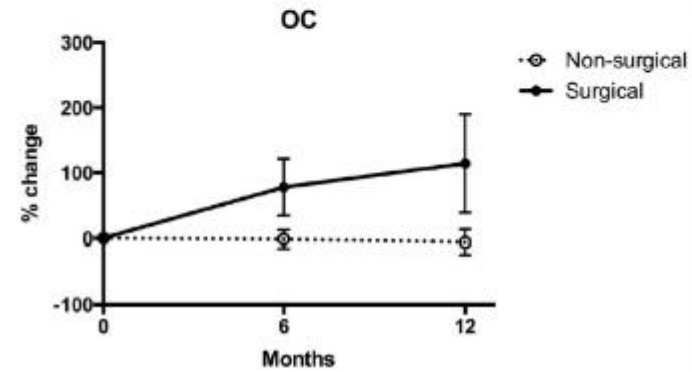


# Variations de la DMO après Chirurgie Bariatrique (DXA vs QCT)

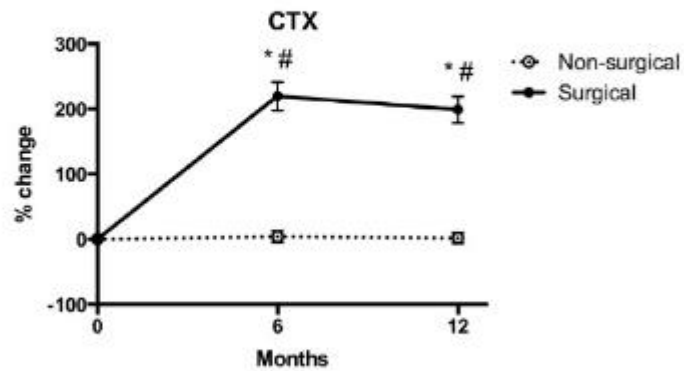
A



B



C



# Fracture Risk After Bariatric Surgery: A 12-Year Nationwide Cohort Study

Medicine® 2015

*Chia-Wen Lu, MD, MSc, Yu-Kang Chang, PhD, Hao-Hsiang Chang, MD, MSc, Chia-Sheng Kuo, MD, Chi-Ting Huang, MS, Chih-Cheng Hsu, MD, PhD, and Kuo-Chin Huang, MD, PhD*

	No. (%)		P Value
	Matched Controls N = 5027	Bariatric Surgery N = 2064	
Follow-up (years), mean (SD)	4.93 (2.13)	4.79 (2.27)	0.02
Age (years), mean (SD)	31.9 (9.9)	31.8 (9.2)	0.59
Age group, n (%)			0.32
0–19	317 (6.3)	130 (6.3)	
20–34	3154 (62.7)	1265 (61.3)	
35–49	1375 (27.4)	573 (27.8)	
50–64	177 (3.5)	94 (4.5)	
≥65	4 (0.1)	2 (0.1)	
Sex, n (%)			0.58
Male	1789 (35.6)	749 (36.3)	
Female	3238 (64.4)	1315 (63.7)	

	N	Event	Person-Years	Incidence <sup>a</sup>	Crude HR	aHR <sup>b</sup>
Controls	5027	374	24,887.77	1.50	1.0	1.0
Patients receiving bariatric surgery	2064	183	9965.96	1.84	1.22 (1.02–1.45)*	1.21 (1.01–1.44)*
Malabsorptive procedures	289	29	1307.3	2.22	1.48 (1.01–2.16)*	1.47 (1.01–2.15)*
Restrictive procedures	1775	154	8658.66	1.78	1.18 (0.98–1.42)	1.17 (0.97–1.41)

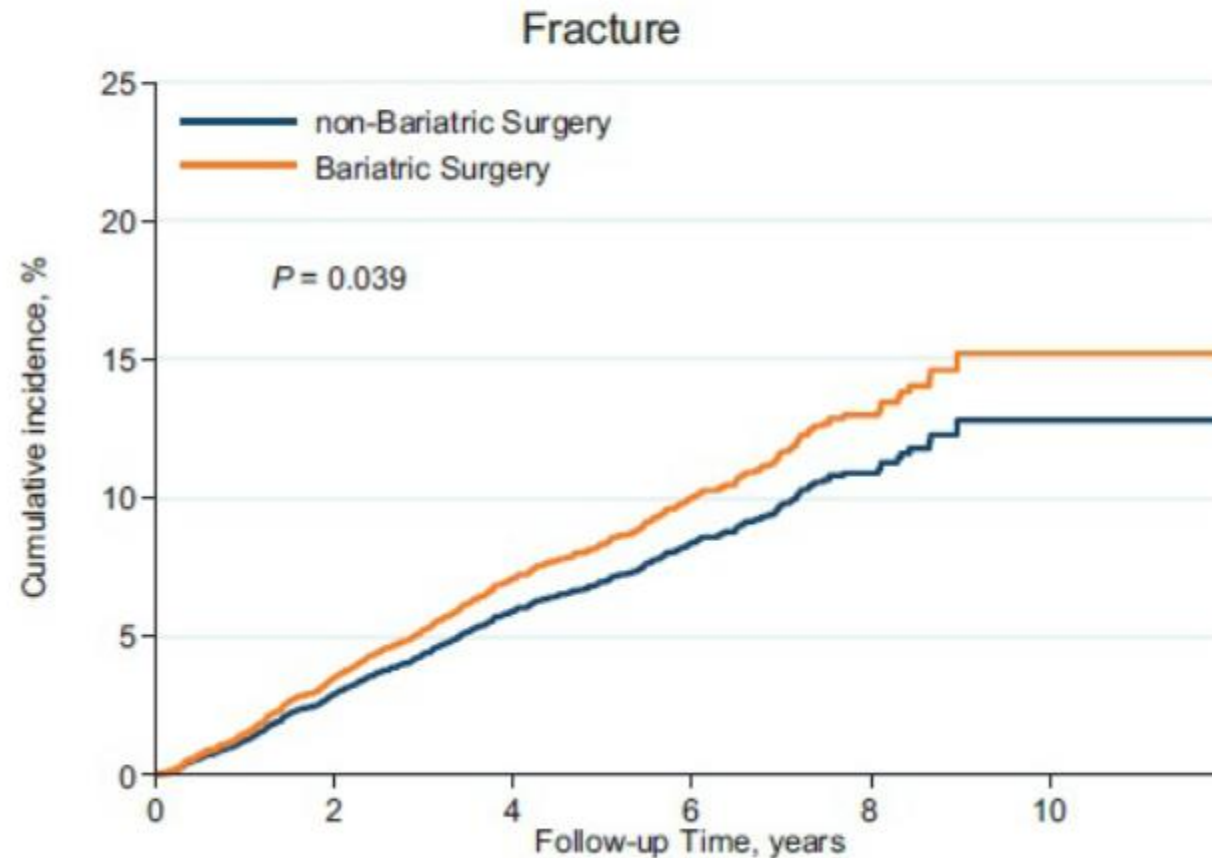
aHR was adjusted for age, sex, Charlson Comorbidity Index, history of diabetes, hypertension, hyperlipidemia and year obesity was diagnosed. Malabsorptive procedures included ICD-9-CM 44.31 (high gastric bypass), 44.38 (laparoscopic gastroenterostomy), 44.39 (other gastroenterostomy without gastrectomy).

Restrictive procedures included ICD-9-CM 43.82 (laparoscopic sleeve gastrectomy), 43.89 (open and other partial gastrectomy), 44.68 (laparoscopic gastropasty), 44.69 (other repair of stomach), 44.95 (laparoscopic gastric restrictive procedure), and 44.99 (other operations on stomach).

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	Bariatric Surgical Group			Controls			HR	aHR <sup>b</sup>
	Event	Person-Years	Incidence	Event	Person-Years	Incidence <sup>a</sup>		
Skull/face	6	10,467.96	0.06	25	25,896.15	0.10	0.59 (0.24–1.45)	0.59 (0.24–1.44)
Hands/fingers	33	10,392.12	0.32	66	25,779.92	0.26	1.24 (0.82–1.88)	1.24 (0.82–1.89)
Distal forearm	20	10,439.03	0.19	53	25,859.02	0.21	0.95 (0.57–1.59)	0.94 (0.56–1.58)
Proximal humerus	11	10,455.65	0.11	24	25,917.30	0.09	1.13 (0.55–2.30)	1.10 (0.54–2.24)
Clavicle/scapula/ sternum	26	10,414.55	0.25	29	25,914.88	0.11	2.22 (1.31–3.78)*	2.16 (1.27–3.68)*
Ribs	12	10,471.63	0.11	33	25,910.32	0.13	0.90 (0.46–1.74)	0.88 (0.46–1.71)
Thoracic/lumbar vertebrae	11	10,451.72	0.11	29	25,895.92	0.11	0.95 (0.47–1.90)	0.95 (0.47–1.89)
Cervical vertebrae	2	10,481.11	0.02	5	25,973.68	0.02	0.99 (0.19–5.08)	0.94 (0.18–4.87)
Pelvis	1	10,487.81	0.01	3	25,982.71	0.01	0.71 (0.07–6.92)	0.94 (0.09–9.60)
Proximal	9	10,461.10	0.09	12	25,941.24	0.05	1.80 (0.76–4.27)	1.82 (0.76–4.32)
Other leg	33	10,391.36	0.32	71	25,771.74	0.28	1.15 (0.76–1.73)	1.14 (0.76–1.73)
Feet/toes	37	10,386.72	0.36	60	25,820.85	0.23	1.54 (1.02–2.32)*	1.53 (1.02–2.30)*
All sites	183	9965.96	1.84	374	24,887.77	1.50	1.22 (1.02–1.45)*	1.21 (1.01–1.44)*

aHR was adjusted for age, sex, Charlson Comorbidity Index, history of diabetes, hypertension, hyperlipidemia and year obesity was diagnosed.

<sup>a</sup>Incidence was represented with per 100 person-year.

<sup>b</sup>aHR, adjusted hazard ratio.

\*  $P < 0.05$ .



# Change in fracture risk and fracture pattern after bariatric surgery: nested case-control study

the **bmj** | *BMJ* 2016

Catherine Rousseau,<sup>1,2</sup> Sonia Jean,<sup>2,3</sup> Philippe Gamache,<sup>3</sup> Stéphane Lebel,<sup>4</sup> Fabrice Mac-Way,<sup>1,2</sup>  
Laurent Biertho,<sup>4</sup> Laëtitia Michou,<sup>1,2</sup> Claudia Gagnon<sup>1,2,5</sup>

Characteristics	Bariatric (n=12 676)	Obese (n=38 028)	Non-obese (n=126 760)	P value*
Women	9169 (72.3)	27 507 (72.3)	91 680 (72.3)	1.00
Mean (SD) age, years	42.6 (11)	42.7 (11)	42.6 (11)	0.22

Groups	Period before surgery (or index date)			Period after surgery (or index date)		
	No (%) with fractures	Unadjusted RR (95% CI)	Adjusted RR* (95% CI)	No (%) with fractures	Unadjusted RR (95% CI)	Adjusted RR* (95% CI)
Bariatric group (n=12 676)	1326 (10.5)	1.65 (1.55 to 1.76)	1.30 (1.21 to 1.39)	514 (4.1)	1.85 (1.68 to 2.04)	1.44 (1.29 to 1.59)
Obese group (n=38 028)	3065 (8.1)	1.22 (1.17 to 1.27)	1.18 (1.13 to 1.23)	1013 (2.7)	1.13 (1.04 to 1.21)	1.04 (0.96 to 1.12)
Non-obese group (n=126 760)	8329 (6.6)	Reference	Reference	3008 (2.4)	Reference	Reference
P value†	-	<0.001	<0.001	-	<0.001	<0.001

RR=relative risk.

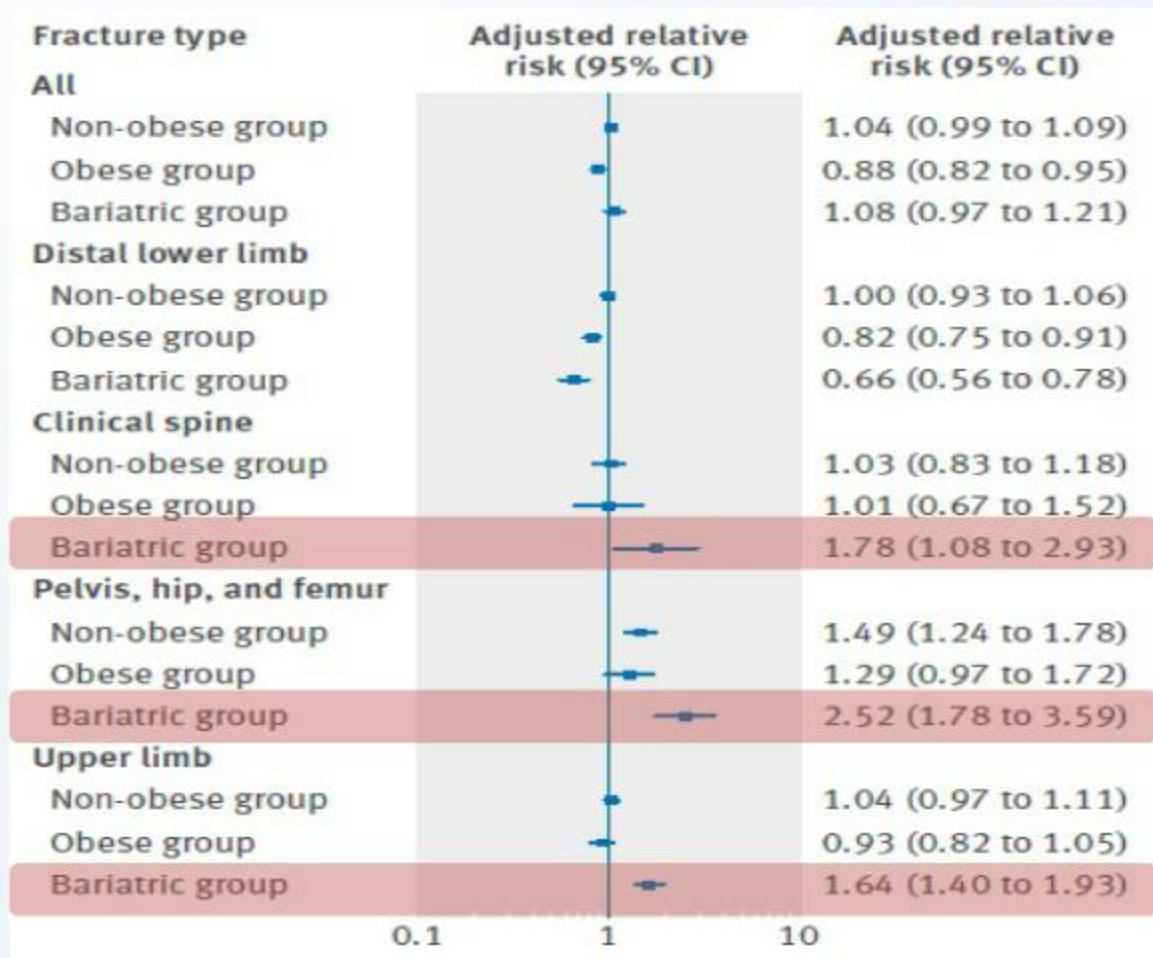
\*Adjusted for duration of follow-up, material and social deprivation, area of residence, history of fractures (analysis for period after index date only), and number of comorbidities in previous five years, using multivariate conditional Poisson regression model.

†Type III P value for group variable.

# Change in fracture risk and fracture pattern after bariatric surgery: nested case-control study

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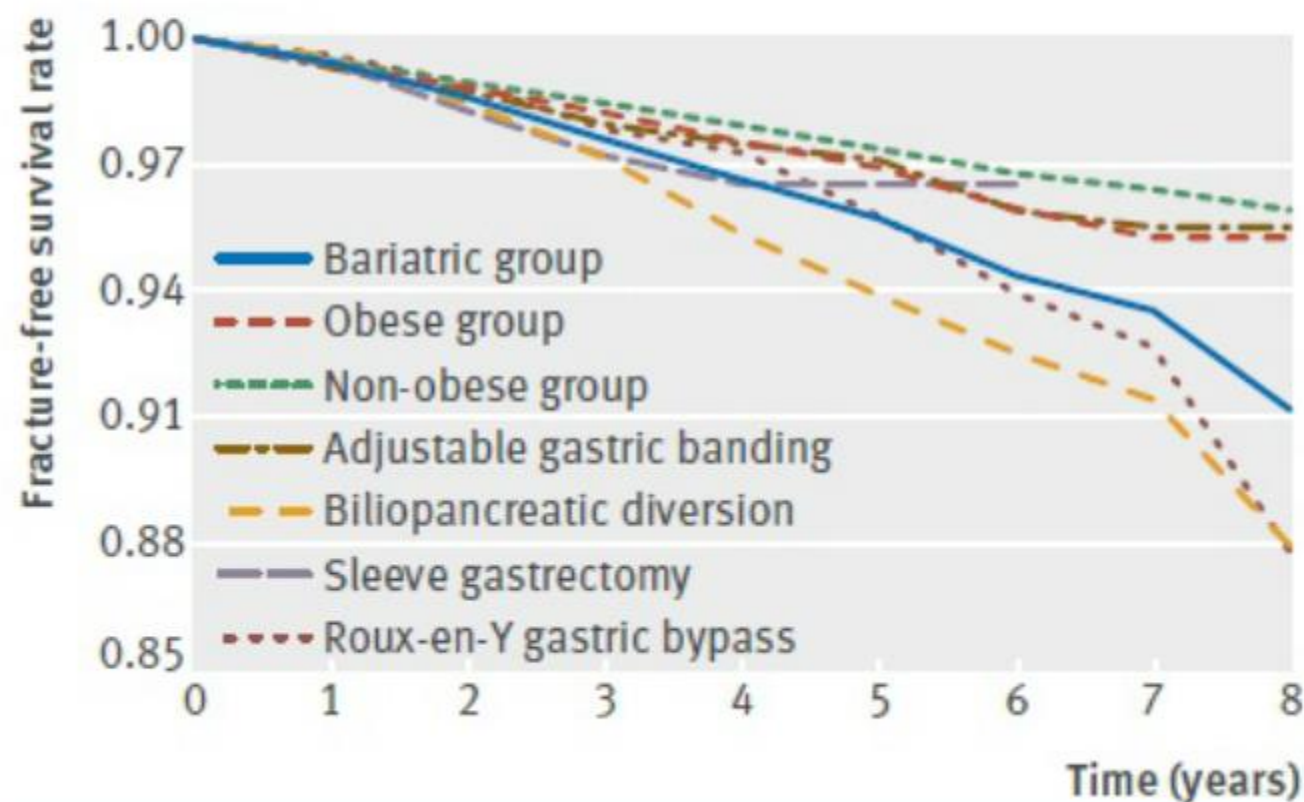
Catherine Rousseau,<sup>1,2</sup> Sonia Jean,<sup>2,3</sup> Philippe Gamache,<sup>3</sup> Stéfane Lebel,<sup>4</sup> Fabrice Mac-Way,<sup>1,2</sup>  
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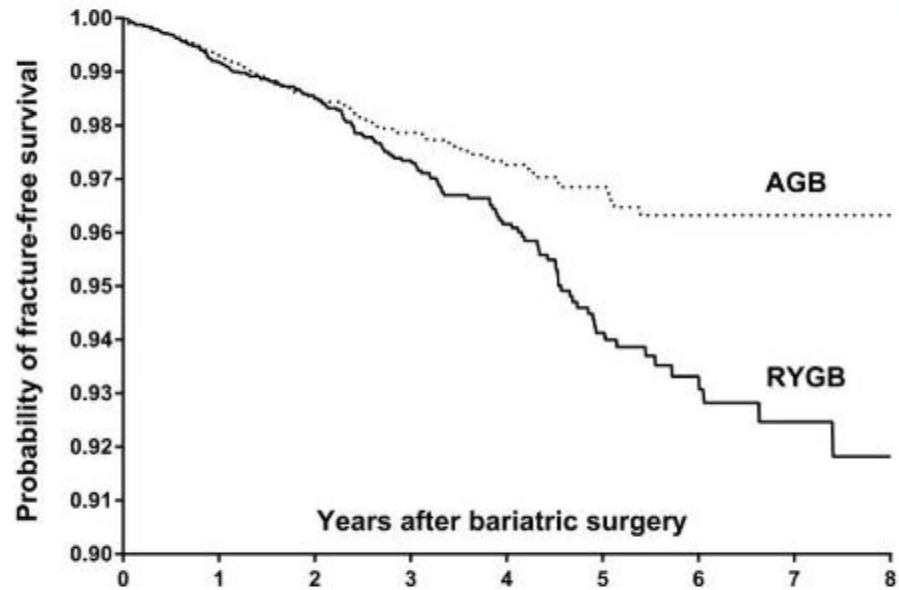
## Change in fracture risk and fracture pattern after bariatric surgery: nested case-control study

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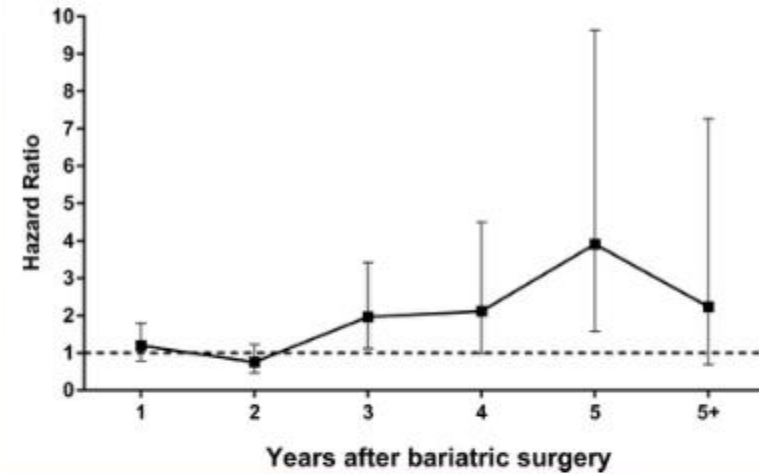
Catherine Rousseau,<sup>1,2</sup> Sonia Jean,<sup>2,3</sup> Philippe Gamache,<sup>3</sup> Stéfane Lebel,<sup>4</sup> Fabrice Mac-Way,<sup>1,2</sup>  
Laurent Biertho,<sup>4</sup> Laëticia Michou,<sup>1,2</sup> Claudia Gagnon<sup>1,2,5</sup>



## Fracture risk after bariatric surgery: Roux-en-Y gastric bypass versus adjustable gastric banding



Number at risk	RYGB	7516	6217	4229	2764	1735	1032	578	306	143
	AGB	7516	6217	4359	2937	1834	1122	621	307	73
Events	RYGB	--	50	27	35	20	22	5	3	1
	AGB	--	42	37	19	10	6	4	0	0



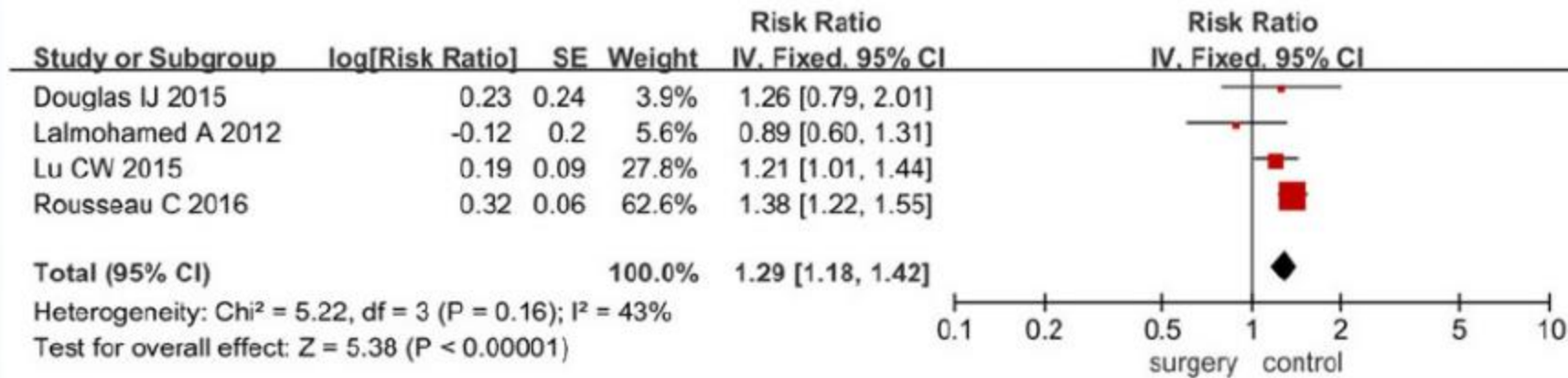
D'après Yu EW, *J Bone Miner Res* 2017

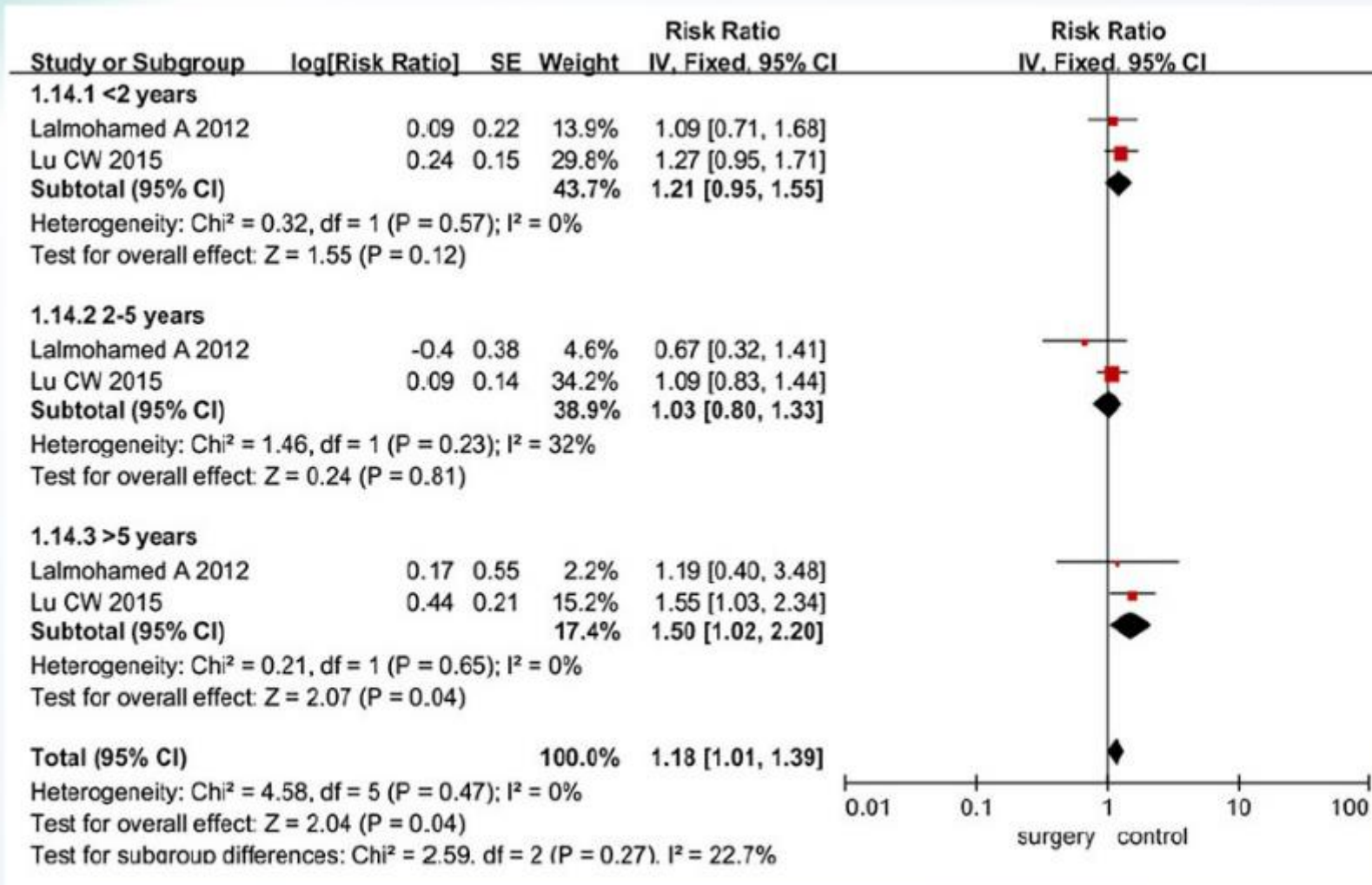


## Obesity Surgery/Outcomes 2018

# A meta-analysis of the effects of bariatric surgery on fracture risk

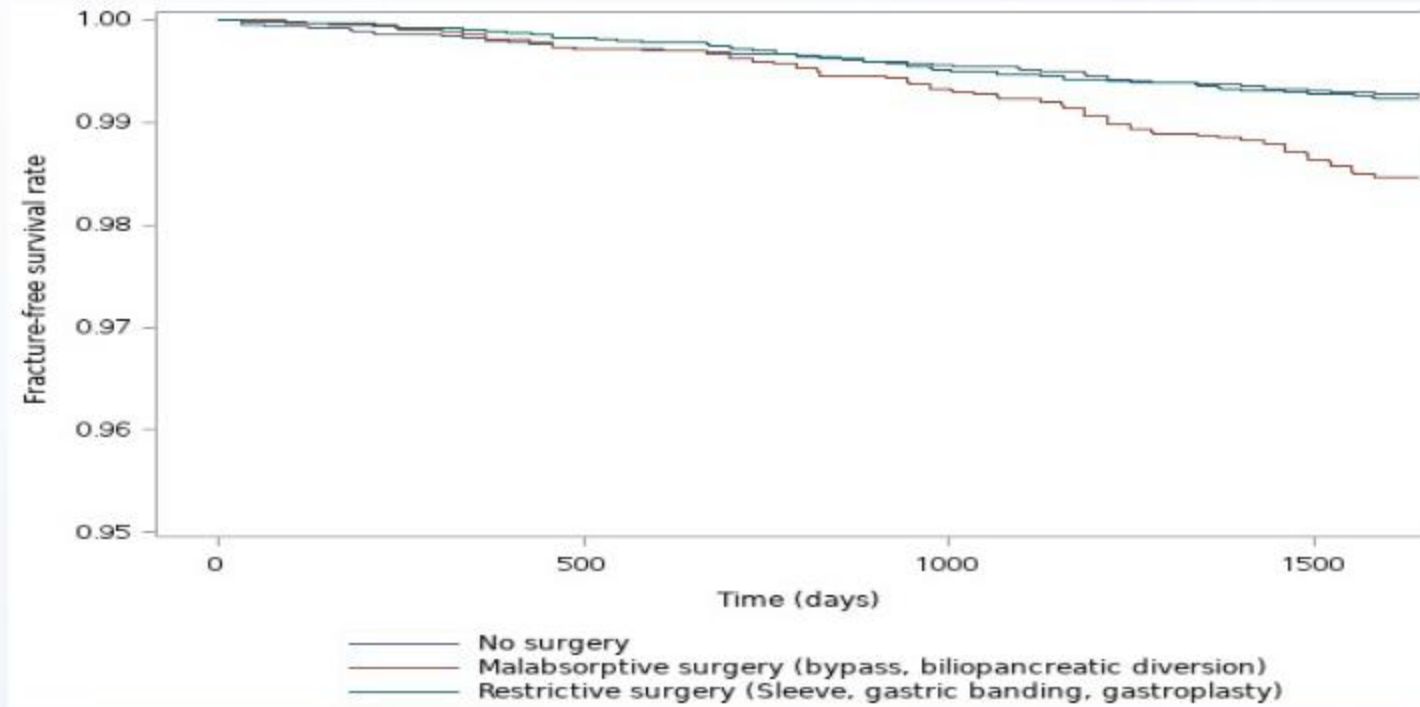
Q. Zhang<sup>1</sup>, Y. Chen<sup>2</sup>, J. Li<sup>1</sup>, D. Chen<sup>1</sup>, Z. Cheng<sup>2</sup>, S. Xu<sup>1</sup>, Y. Huang<sup>1</sup> and Q. Wang<sup>1</sup>





**Risk of fracture after bariatric surgery in France: population based, retrospective cohort study** Julien Paccou\*<sup>1</sup>, Niels Martignène<sup>1</sup>, Eric Lespessailles<sup>2</sup>, Bernard Cortet<sup>1</sup>, Grégoire Ficheur<sup>1</sup>. <sup>1</sup>Lille University Hospital, France, <sup>2</sup>Université d'Orléans, France

*Congrès annuel ASBMR 2018, Montréal*



The risk of MOF was significantly increased for the malabsorptive bariatric surgery : (OR=2.29, 95% CI [1.57-3.36]) whereas no association was found regarding restrictive surgery (OR=1.10, 95% CI [0.71-1.71])

# Fracture Risk After Gastric Bypass Surgery: A Retrospective Cohort Study

Kristian F. Axelsson,<sup>1,2</sup> Malin Werling,<sup>3</sup> Björn Eliasson,<sup>4</sup> Eva Szabo,<sup>5</sup> Ingmar Näslund,<sup>5</sup> Hans Wedel,<sup>6</sup>  
Dan Lundh,<sup>7</sup> and Mattias Lorentzon<sup>2,8</sup>

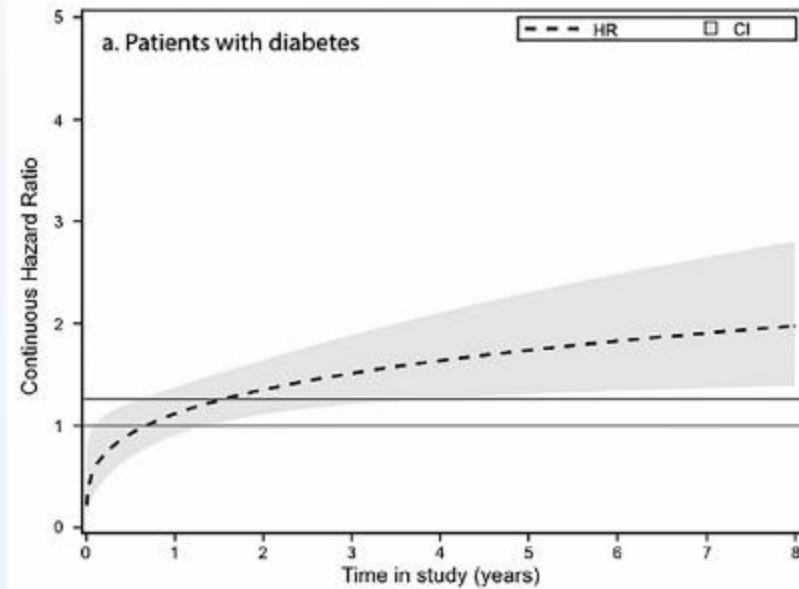
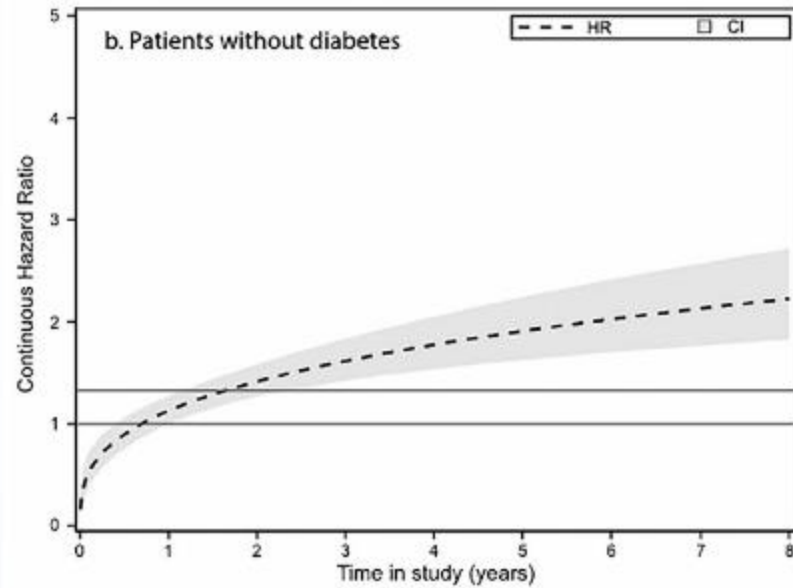
Description	Patients with diabetes			Patients without diabetes		
	Matched controls	Gastric bypass	<i>p</i>	Matched controls	Gastric bypass	<i>p</i>
Patients, <i>n</i>	7758	7758		31 213	31 213	
Time at risk (years), median (IQR)	3.09 (1.70–4.60)	3.21 (1.84–4.58)	0.005	3.11 (1.72–4.59)	3.18 (1.77–4.64)	<0.001
<b>Any fracture</b>						
Events, <i>n</i> (%)	195 (2.5)	251 (3.2)	0.007	579 (1.9)	768 (2.5)	<0.001
Per 1000 person years (95% CI)	8.0 (7.0–9.2)	10.1 (8.9–11.4)	0.02	5.9 (5.4–6.4)	7.7 (7.1–8.2)	<0.001
Crude Cox, HR (95% CI)	1 [Ref.]	1.26 (1.04–1.52) <sup>a</sup>	0.02	1 [Ref.]	1.31 (1.17–1.46) <sup>a</sup>	<0.001
Multivariable1	1 [Ref.]	1.28 (1.06–1.54) <sup>a</sup>	0.01	1 [Ref.]	1.33 (1.19–1.48) <sup>a</sup>	<0.001
Multivariable2	1 [Ref.]	1.26 (1.05–1.53) <sup>a</sup>	0.01	1 [Ref.]	1.32 (1.18–1.47) <sup>a</sup>	<0.001
<b>Major osteoporotic fracture<sup>b</sup></b>						
Events, <i>n</i> (%)	54 (0.7)	81 (1.0)	0.02	139 (0.4)	252 (0.8)	<0.001
Per 1000 person years (95% CI)	2.2 (1.7–2.9)	3.2 (2.6–4.0)	0.03	1.4 (1.2–1.6)	2.5 (2.2–2.8)	<0.001
Crude Cox, HR (95% CI)	1 [Ref.]	1.46 (1.04–2.07) <sup>a</sup>	0.03	1 [Ref.]	1.78 (1.45–2.19) <sup>a</sup>	<0.001
Multivariable1	1 [Ref.]	1.55 (1.09–2.18) <sup>a</sup>	0.01	1 [Ref.]	1.79 (1.45–2.20) <sup>a</sup>	<0.001
Multivariable2	1 [Ref.]	1.51 (1.07–2.15) <sup>a</sup>	0.02	1 [Ref.]	1.79 (1.46–2.21) <sup>a</sup>	<0.001
<b>Hip fracture</b>						
Events, <i>n</i> (%)	4 (0.1)	22 (0.3)	0.001	11 (0.0)	27 (0.1)	0.01
Per 1000 person years (95% CI)	0.2 (0.1–0.4)	0.9 (0.6–1.3)	0.002	0.1 (0.1–0.2)	0.3 (0.2–0.4)	0.01
Crude Cox, HR (95% CI)	1 [Ref.]	5.32 (1.83–15.44)	0.002	1 [Ref.]	2.41 (1.19–4.85)	0.01
Multivariable1	1 [Ref.]	5.75 (1.97–16.77)	0.001	1 [Ref.]	2.50 (1.24–5.06)	0.01
Multivariable2	1 [Ref.]	5.03 (1.70–14.88)	0.004	1 [Ref.]	2.62 (1.28–5.36)	0.008
<b>Upper limb fracture</b>						
Events, <i>n</i> (%)	60 (0.8)	73 (0.9)	0.30	148 (0.5)	254 (0.8)	<0.001
Per 1000 person years (95% CI)	24.4 (18.9–31.4)	29.0 (23.0–36.4)	0.32	14.9 (12.7–17.5)	25.1 (22.2–28.4)	<0.001
Crude Cox, HR (95% CI)	1 [Ref.]	1.19 (0.85–1.67)	0.32	1 [Ref.]	1.70 (1.38–2.08) <sup>a</sup>	<0.001
Multivariable1	1 [Ref.]	1.24 (0.88–1.74)	0.22	1 [Ref.]	1.69 (1.38–2.07) <sup>a</sup>	<0.001
Multivariable2	1 [Ref.]	1.24 (0.88–1.75)	0.22	1 [Ref.]	1.69 (1.38–2.07) <sup>a</sup>	<0.001
<b>Lower leg fracture</b>						
Events, <i>n</i> (%)	58 (0.7)	57 (0.7)	0.93	181 (0.6)	147 (0.5)	0.07
Per 1000 person years (95% CI)	2.4 (1.8–3.0)	2.3 (1.7–2.9)	0.82	1.8 (1.6–2.1)	1.4 (1.2–1.7)	0.04
Crude Cox, HR (95% CI)	1 [Ref.]	0.95 (0.66–1.38)	0.80	1 [Ref.]	0.79 (0.64–0.99) <sup>a</sup>	0.04
Multivariable1	1 [Ref.]	0.96 (0.66–1.38)	0.82	1 [Ref.]	0.80 (0.64–0.99) <sup>a</sup>	0.04
Multivariable2	1 [Ref.]	0.95 (0.65–1.37)	0.77	1 [Ref.]	0.79 (0.63–0.98) <sup>a</sup>	0.03



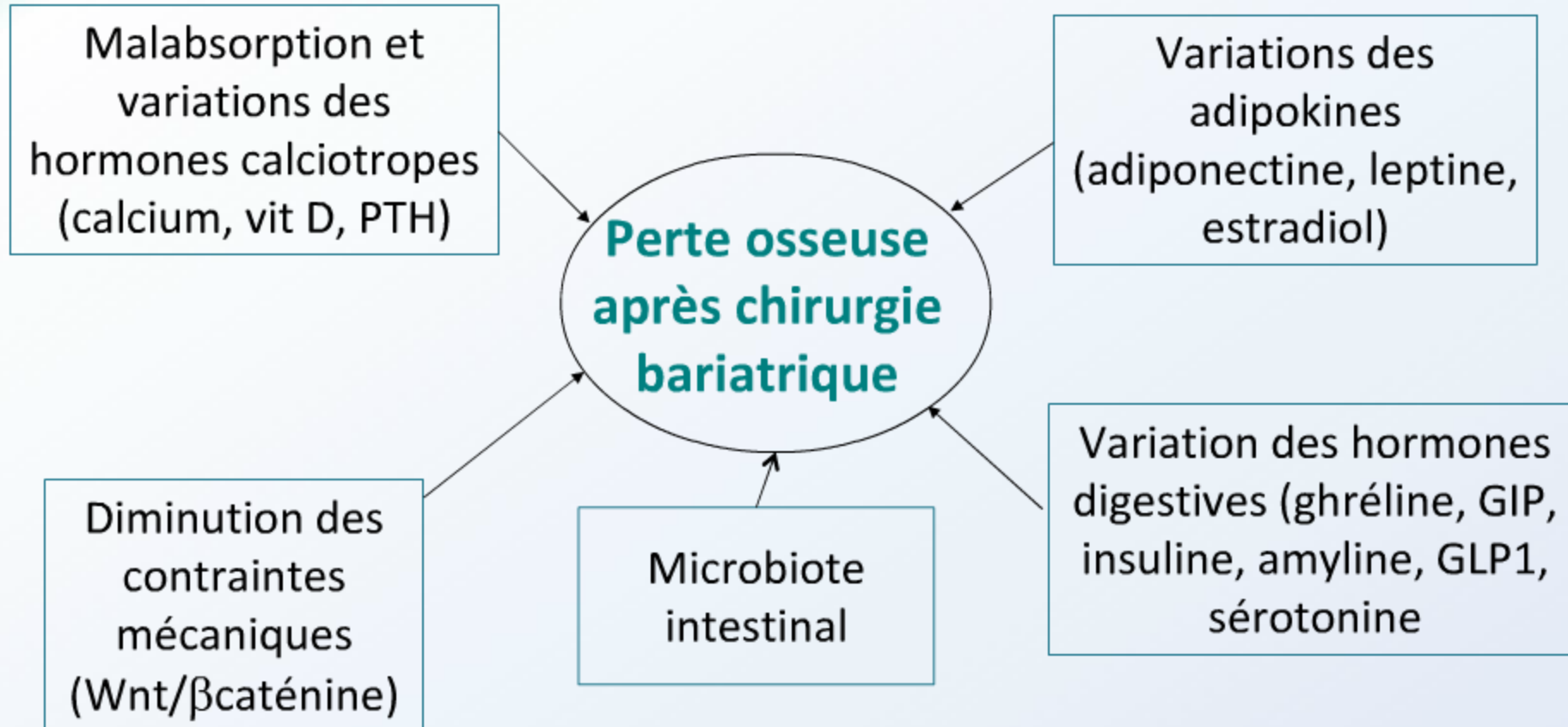
# Fracture Risk After Gastric Bypass Surgery: A Retrospective Cohort Study

JBMR®

Kristian F. Axelsson,<sup>1,2</sup> Malin Werling,<sup>3</sup> Björn Eliasson,<sup>4</sup> Eva Szabo,<sup>5</sup> Ingmar Näslund,<sup>5</sup> Hans Wedel,<sup>6</sup> Dan Lundh,<sup>7</sup> and Mattias Lorentzon<sup>2,8</sup>



# Perte Osseuse après Chirurgie Bariatrique : Quelles Raisons?



## Pour la pratique

	Avant chirurgie	Après chirurgie
<b>TOUS LES PATIENTS</b>	Mesure 25-hydroxyvitamine D	<ul style="list-style-type: none"><li>➤ <b>1200-1500 mg de citrate calcium/jour</b> par alimentation et supplémentation</li> <li>➤ <b>3000 UI de vitamine D par jour :</b><ul style="list-style-type: none"><li>➤ dose pour 25OH vitamine D &gt; 30 ng/ml</li><li>➤ Calciurie des 24h à 6 mois, puis tous les ans</li></ul></li> <li>➤ <b>Mesurer la DMO par DXA 2 ans après chirurgie</b></li></ul>

*2013/AACE/TOS/ASMBS guidelines for management of bone health in patients after bariatric surgery*

# Recommandations de Surveillance Post-Opératoire

(d'après ASMBSO, AACE, OS 2013)

	AGB (anneau)	VSG (sleeve)	RYGB (bypass)	BPD-DS (dérivation)
<b>DXA à 2 ans</b>	<b>Oui</b>	<b>Oui</b>	<b>Oui</b>	<b>Oui</b>
<b>Calciurie des 24 h à 6 mois puis annuellement</b>	<b>Oui</b>	<b>Oui</b>	<b>Oui</b>	<b>Oui</b>
Vit B12 annuellement puis substitution tous les 3 à 6 mois	Oui	Oui	Oui	Oui
Acide folique, fer, <b>vit D, PTH intacte</b>	Non	Non	<b>Oui</b>	<b>Oui</b>
Vit A initiale et tous les 6 à 12 mois	Non	Non	Optimal	Oui
Thiamine	Oui	Oui	Oui	Oui
Cuivre, Zinc, sélénium	NON	NON	Oui	Oui



## Conclusions

### **Chez les patients ayant une chirurgie bariatrique :**

- **Il existe une perte osseuse rapide dans les 2 premières années, variable selon les procédures**
- **Le risque de fracture est probablement augmenté bien que ce risque puisse ne pas être associé à la chirurgie par elle-même**
- **Une évaluation de la santé osseuse et du risque de fracture est à considérer en particulier chez les sujets ayant déjà des FDR de fracture pré-existants**
- **Le risque de fracture pourrait être spécifique de site osseux**