

## Complications after laparoscopic gastric bypass for morbid obesity

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### Background

- Ca 3000 patients are surgically treated for morbid obesity in Norway each year.
- Laparoscopic gastric bypass (LGBP) is the most common method both in Norway and other countries.
- Gastric bypass is also called Roux-en-Y.
- LGBP results in weight loss and reduction in obesity-related co-morbidity, as type II diabetes, hypertension, sleep apnoea etc.

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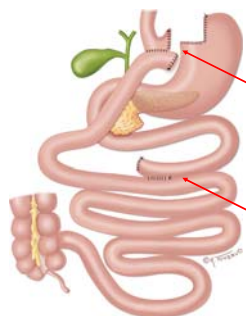
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### LGBP



The jejunum is transected ca 50 cm distal to the ligament of Treitz and connected to the gastric pouch:

Gastrojejunal (upper) anastomosis

The 100-150 cm long alimentary limb is connected to the bilipancreatic limb:

Jejunojejunal (lower) anastomosis

Mala T et al. Tidsskriftet 2013;133:640-4

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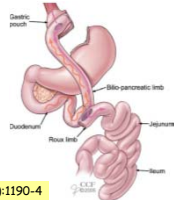
### Early complications after LGBP

These are as for other abdominal surgery and include:

- Hematoma
- Abscess and infection
- Anastomotic leaks
- Small bowel obstruction

A rare, atypical complication is the Roux-en-O misconstruction:

- The biliopancreatic limb is mistakenly anastomosed to the gastric pouch



Sherman V et al. *Obes Surg* 2009;19(8):1190-4

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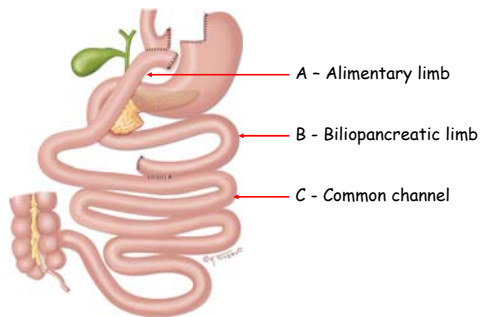
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### Taxonomy and Imaging Spectrum of Small Bowel Obstruction After Roux-en-Y Gastric Bypass Surgery

Sunnapwar A et al. *AJR* 2010;194:120-8



Mala T et al. *Tidsskriftet* 2013;133:640-4

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### SBO after LGBP

Alimentary limb		Biliopancreatic limb		Common channel	
Early	Late	Early	Late	Early	Late
Hematoma	Internal hernia	Hematoma	Internal hernia	Hematoma	Internal hernia
Lower anastomotic stenosis		Lower anastomotic stenosis	Lower anastomotic stenosis		Adhesions
Intussusception		Intussusception			

Modified from Sunnapwar A et al. *AJR* 2010;194:120-128

Late SBO and abdominal pain after LGBP → Suspect internal hernia !

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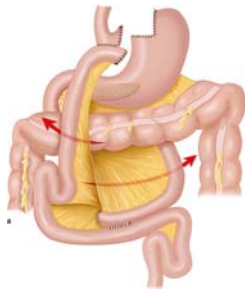
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### Internal hernia after LGBP



Antecolic A-limb  
Two types of internal hernia:  
- Petersen's space (upper arrow)  
- Behind the jejunojejunal anastomosis (lower arrow)

Retrocolic A-limb  
A third type of internal hernia:  
- Transmesocolic hernia

Mala T et al. Tidsskriftet 2013;133:640-4

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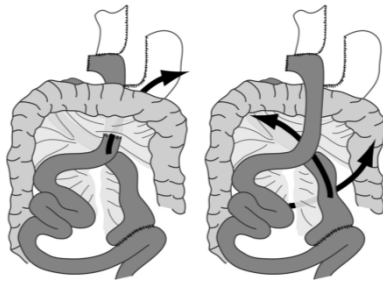
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### Internal hernia after LGBP



Retrocolic A-limb

Antecolic A-limb

Rosenkrantz AB et al. Clinical Radiology 2010;65(3):246-9

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### Internal hernia after LGBP

- Internal hernia is a well known complication after LGBP and may result in SBO, bowel ischemia and bowel necrosis.
- More common after laparoscopic than open procedure, probably because of less adhesions.
- Recent studies with longer post-operative follow-up time suggest a higher incidence of internal hernia than previously reported, accumulated life-long risk may be at least 10%.

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### Internal hernia after LGBP

- Internal hernia may be a life-threatening condition, prompt diagnosis and management is required.
- CT is the best modality
  - IV. contrast for visualisation of mesenteric vessels and bowel wall enhancement.
  - PO. contrast for visualisation of the alimentary limb and the jejunojejunal anastomosis.

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### Internal hernia after LGBP

What to look for?

Several studies have assessed different CT signs and their reliability for diagnosis of internal hernia after LGBP.

- Lockhart ME *et al.* AJR 2007;188:745-50
- Iannuccilli JD *et al.* Clinical Radiology 2009;64:373-80
- Goudsmedt F *et al.* Obes Surg 2014 (Epub)

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### Internal Hernia After Gastric Bypass: Sensitivity and Specificity of Seven CT Signs with Surgical Correlation and Controls

Lockhart ME *et al.*  
AJR 2007;188:745-50

18 patients with internal hernia, 18 controls, 3 radiologists

TABLE 2: Sensitivity and Specificity of Seven CT Signs of Internal Hernia

Sign	Sensitivity (%)			Specificity (%)		
	Reviewer 1	Reviewer 2	Reviewer 3 (Resident)	Reviewer 1	Reviewer 2	Reviewer 3 (Resident)
Enclined mesentery	61	78	83	94	89	67
Mushroom	33	72	33	89	89	100
Hurricane eye	17	11	6	100	100	100
Small-bowel obstruction	11	28	39	94	89	83
Clustered loops	17	6	6	72	78	83
Small-bowel behind superior mesenteric artery	0	22	44	100	89	94
Right-sided anastomosis	11	6	6	100	100	100
Overall impression	56	78	72	89	78	78

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### CT signs of internal hernia after LGBP

All the other signs have consistently lower sensitivity and low or variable inter-observer agreement.

The significance of some of the indirect signs are obviously difficult to evaluate, such as:

- clustered bowel loops
  - enlarged lymph nodes
  - ascites
- } could mean anything.

Are there other, more direct signs of internal hernia?

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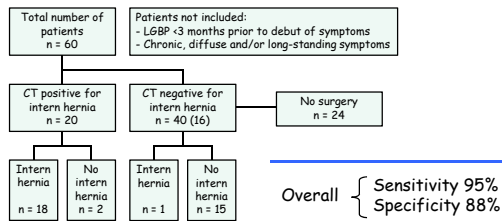
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### Internal herniation after LGBP for morbid obesity - CT features revisited

We included patients who had previously undergone LGBP, admitted to hospital with abdominal pain and referred to CT




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### Internal herniation after LGBP for morbid obesity - CT features revisited

Overall impression: Internal hernia yes/no:

		Surgery - IH		
		+	-	
Overall	+	18	2	20
	-	1	15	16
		19	17	36

Sensitivity 95%  
Specificity 88%

The best sign described in the literature ("swirl sign"):

		Surgery - IH		
		+	-	
Swirl	+	16	2	18
	-	3	15	18
		19	17	36

Sensitivity 84%  
Specificity 88%

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Three other signs

		+	-	
Anterior/right displacement of the Treitz' angle	+	16	0	16
	-	3	17	20
		19	17	36

Sensitivity 84%  
Specificity 100%

		+	-	
Small bowel in Petersen's space	+	18	0	18
	-	1	17	18
		19	17	36

Sensitivity 95%  
Specificity 100%

		+	-	
Compression of the superior mesenteric vein	+	15	1	16
	-	4	16	20
		19	17	36

Sensitivity 79%  
Specificity 94%

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Anterior/right displacement of the Treitz' angle




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Anterior/right displacement of the Treitz' angle




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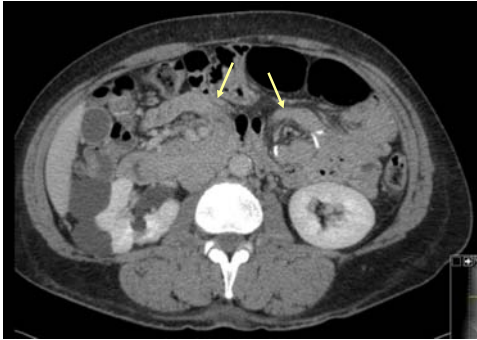
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Anterior/right displacement of the Treitz' angle and swirl in relation to the lower anastomosis



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Small bowel in Petersen's space



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Small bowel in Petersen's space



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Compression of the SMV



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Congestion of mesenteric veins secondary to compression of the SMV and hazy, edematous mesentery



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### CT after LGBP - a systematic approach

- Free air or free fluid?
- Use the ABC system and identify the upper and lower anastomoses and the A-, B- and C-limb (level of SBO?)
- Examine the area behind the A-limb and its vessels (Petersen's space) and the Treitz' angle of the B-limb
- Look closely at the mesentery and the mesenteric root (swirl?), follow the mesenteric vessels, in particular the SMV (compression?)
- Other signs of internal hernia or other findings?

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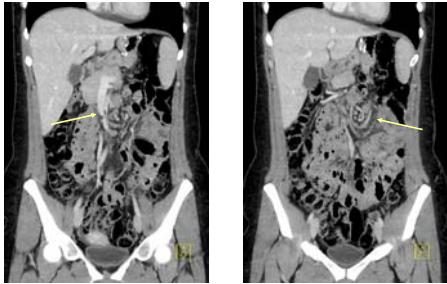
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Case: 22 year old woman, LGBP 1,5 year ago,  
weight loss 70 kg, acute abdominal pain



Compression of the SMV

Pathology in the mesenteric root

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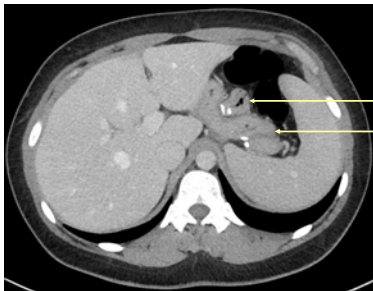
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No free air, no free fluid, no SBO



A-limb  
Excluded ventricle  
(start of the B-limb)

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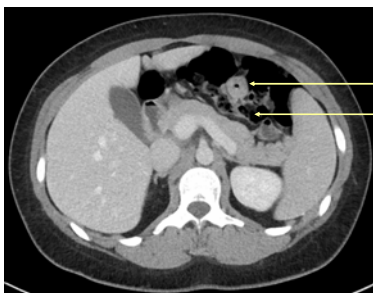
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A-limb  
Transverse colon

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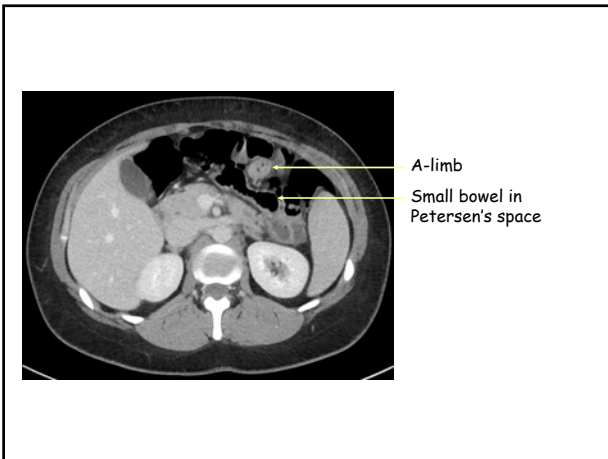
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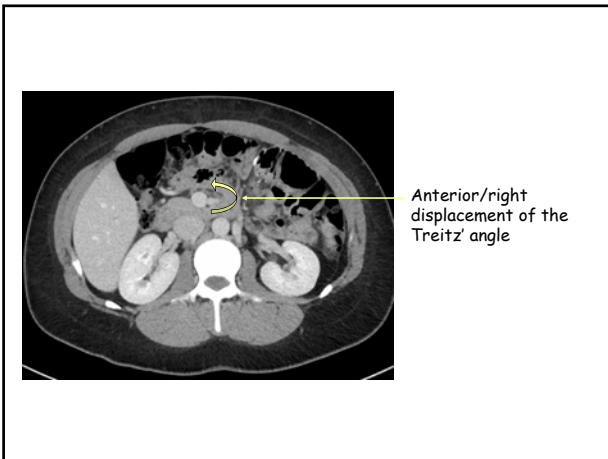
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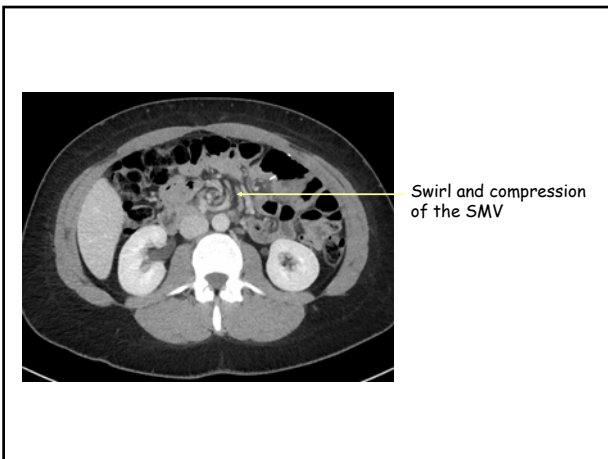
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### Summary

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- LGBP is the most common method for surgical treatment of morbid obesity - an increasing number of patients.
- Internal hernia after LGBP is more common than previously thought and may occur many years after surgery.
- Surgeons and radiologists need to be aware of the clinical and radiological signs of internal hernia.
- Look for:
  - SBO
  - mesenteric swirl
  - small bowel in Petersen's space
  - anterior/right displacement of the Treitz' angle
  - compression of the SMV

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