The Use of Fluorescence Imaging in Bariatric Surgery

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• Medtronic (consultant, speaker)

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Complications?

I never get complications...
How do complications occur?

100 things that can go wrong

Surgeon #1 technique

Surgeon #2 technique

Surgeon #3 technique
It’s true...

Our technique works MOST of the time...

But NOT ALL THE TIME...
But how does fluorescence imaging “FIT” in to all this?
Companies with fluorescence imaging capability

- Novadaq (PINPOINT, SPY Elite, Luna)
- Intuitive (Firefly)
- Stryker (ENV)
- Karl Storz
- Olympus (coming soon)
FIT is (1) the next evolution of the way we’ll be able to see in surgery (2) to check “our work” in a way we haven’t been able to before.
Multiple functionality of FIT

• PERFUSION
  - tissue

• MAPPING
  - biliary tract
  - lymphatic vessels
  - vascular
  - tumor localization?

• ENHANCING LED LIGHT SOURCE
So how do you “see more” by using FIT?
In-vivo model of eye-ballling “ischemia” vs using fluorescence-based imaging (VIDEO)
TIME POINT = 2 seconds
TIME POINT = 10-12 seconds
TIME POINT = 20-22 seconds

Non-viable ischemic zone not visible to naked eye
Got me thinking...
Why would ischemic complications be of concern in bariatric surgery?
Bariatric surgery in the U.S.

- 200,000 surgical procedures per year (*only 1% of the patient population that qualifies for surgery are getting surgery)

- Obesity is an epidemic that is steadily increasing

- Complication and death are substantially lower than other GI surgery, but they have to be. Because…
  - elective surgery
  - zero tolerance for complication or death
Ischemia can cause multitude of problems in GI surgery...

- Ischemia
- Leak
- Ulcer
- Stricture
Ischemia can cause multitude of problems in GI surgery...

- Stricture
- Ulcer
- Leak (GI perforation)
Roux-en-Y gastric bypass and Sleeve gastrectomy

- Similar complication profiles

<table>
<thead>
<tr>
<th></th>
<th>Bypass</th>
<th>Sleeve</th>
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</thead>
<tbody>
<tr>
<td>Leak</td>
<td>1-3%</td>
<td>1-3%</td>
</tr>
<tr>
<td>Stricture</td>
<td>1-15%</td>
<td>1-2%</td>
</tr>
<tr>
<td>Marginal ulcer</td>
<td>3-5%</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td><strong>5–23%</strong></td>
<td><strong>2–5%</strong></td>
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7 – 28% complication rate associated with ischemia at the time of surgery
Technical factors associated with anastomotic leak after Roux–en–Y gastric bypass

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Background: Anastomotic leak is one of the most serious complications after Roux-en-Y gastric bypass (RYGB). Our objective was to examine the relationship between technical factors and incidence of clinically relevant anastomotic leak after RYGB in longitudinal assessment of bariatric surgery (LABS). The setting of the study was 11 bariatric centers in the United States, university, and private practice.

Methods: Patient characteristics, technical factors of surgery, and postoperative outcomes were assessed by trained researchers using standardized protocols. Correlation of surgical factors of patients undergoing RYGB (n = 4444) with the incidence of postoperative anastomotic leak was assessed by univariate $\chi^2$ analysis.

Results: Forty-four participants (1.0%, 95% CI .7%–1.3%) experienced a clinically relevant anastomotic leak. Of these, 39 (89%) underwent abdominal reoperation and 3 (7%) died. Technical factors associated with anastomotic leak were open surgery ($P < .0001$), revision surgery ($P < .0001$), and use of an abdominal drain ($P = .02$). Provocative leak testing, method of gastrojejunostomy, and use of fibrin sealant were not associated with anastomotic leak.

Conclusions: Anastomotic leak after RYGB was rare (1.0%). Most cases required reintervention; however, the majority (93%) recovered from this event. Open surgery, revision surgery, and routine drain placement were associated with increased leak rate. Some of these findings may be due to differences in preoperative patient risk. (Surg Obes Relat Dis 2015;11:313–320.) © 2015 American Society for Metabolic and Bariatric Surgery. Published by Elsevier Inc. All rights reserved.
Majority of leaks occur after negative leak test

So, these other leaks are likely due to
- Insufficient blood supply
- Late staple line failure
Why would ischemic complications be of concern in bariatric surgery?
Intentionally devascularize the stomach/bowel in pursuit of the “perfect” bypass / sleeve procedure.
Intentionally de-vascularizing the gastric pouch
To create the smallest pouch possible
Tighter the better right?
To get better restriction
Other examples…

- Tension at the GJ anastomosis (due to small pouch)
- Bariatric patients wants second and third procedures (“doc my stomach has stretched out!”)
So where do I use FIT during my bariatric procedures?
FIT can be used for the entire case!!!
(Don’t have to necessarily use ICG every time.)
Where do I use FIT?

• For GASTRIC BYPASS

1) Assistance in dividing the mesentery
2) Checking both ends of the small bowel after division of mesentery
3) Checking status of the gallbladder
4) Checking for vascular anomalies (accessory gastric artery) *
5) Check perfusion of gastric pouch *
6) Check perfusion of parallel staple line area *
7) Check perfusion of GJ anastomosis

* Especially during revisional surgery and/or high-risk patients (smokers, DM, PAD, advanced age)
Where do I use FIT?

- For SLEEVE GASTRECTOMY

1) To check initial blood supply pattern of GE junction *
2) To assist in safe passage and manipulation of lighted bougie ***
3) To allow precise stapling of the stomach against the lighted bougie without making it too tight or too loose ***
4) Checking status of the gallbladder
5) To check final product of the sleeve *
   - GE junction
   - transverse blood vessels

* Especially during revisional surgery and/or high-risk patients (smokers, DM, PAD, advanced age)
*** Thick and/or scarred stomach
Checking where blood supply is (operating with the fluorescent mode ON) (VIDEO)

PINPOINT mode

CSF mode
• Dividing small bowel for RYGB
  - to minimize tension at GJ anastomosis
  - to minimize kinking at JJ anastomosis

• GJ anastomosis on tension
  - size of pouch
  - mesentery characteristic and pliability
  - antecolic / retrocolic
Better precision and accuracy of each staple fire during sleeve gastrectomy
Avoiding potential complication (narrowing GE junction) by being able visualize the esophagus
But in addition to my “standard” protocol where I use it,

I find it most useful when a question arises during a case and I am able to get an immediate answer.
Challenging dogma
Avoid creating narrow gaps between parallel staple lines
Challenging dogma
Avoid creating narrow gaps between parallel staple lines
In this case, the parallel zone was NOT OK…
Initial perfusion check of the proximal stomach
ACCESSORY Gastric artery (to the left gastric?)
Initial perfusion check of the proximal stomach
Right side DOMINANT
Initial perfusion check of the proximal stomach

EQUAL
Initial perfusion check of the proximal stomach
Left-side SIGNIFICANT
This has led to new concept of doing sleeves...

“Perfusion-sparing” sleeve gastrectomy technique
Revisions and unforeseen situations
Revision of SLEEVE to GASTRIC BYPASS (VIDEO)
Examination of the “revision” gastric pouch (VIDEO)
Accidental division of left gastric artery during SLEEVE (VIDEO)
Summary of its use during bariatric surgery

• Leaks may be less common than other GI procedures, but it’s still a problem… esp for ELECTIVE, RISKY procedures

• It can be used at one or multiple parts during a routine or difficult case → depends on surgeon’s experience and clinical question / concern at hand

• Studies should be done, but somewhat difficult due to constant evolution of one’s surgical technique with constant addition of new knowledge