

# The influence of total bowel length on gastric bypass outcomes

Vincent Quan<sup>1</sup>, Fergus Paul MacDonald Cooper<sup>1</sup>, Mohamed Bekheit<sup>1-6</sup>

<sup>1</sup>Department of Surgery, Aberdeen Royal Infirmary, Aberdeen AB252ZN, UK.

<sup>2</sup>Department of Surgery, El kabary General Hospital, Alexandria 21551, Egypt.

<sup>3</sup>Institute of Biomedical Sciences, University of Aberdeen, Aberdeen AB252ZN, UK.

<sup>4</sup>Centre Hépatobiliaire, 12 av. Paul Vaillant Couturier, AP-HP, Hôpital Paul Brousse, 94800 Villejuif, France.

<sup>5</sup>Inserm Unité 1193, 12 av. Paul Vaillant Couturier, 94800 Villejuif, France.

<sup>6</sup>Ecole doctorale Innovation Thérapeutique, Université Pais-Sud, CHÂTENAY-MALABRY Cedex, 92296 Paris, France.

**Correspondence to:** Dr. Mohamed Bekheit, Department of Surgery, Aberdeen Royal Infirmary, Forsterhill Health Campus, Aberdeen AB252ZN, UK. E-mail: dr\_mohamedbekheit@hotmail.com

**How to cite this article:** Quan V, Cooper FPM, Bekheit M. The influence of total bowel length on gastric bypass outcomes. *Mini-invasive Surg* 2017;1:95-8.

**Article history:** Received: 30 Apr 2017 Accepted: 12 Jun 2017 Published: 30 Sep 2017



Dr. Bekheit received his surgical training in several internationally renowned institutions and by eminent surgeons in the field of minimally invasive, bariatric, and HBP surgery. Dr. Bekheit is a Board Member of the Minimal Invasive Bariatric Surgery Program delivered by the Alexandria Endoscopic Association (ALEXEA), where many other courses are delivered. He founded a few educational programs for the Faculty of Medicine, the University of Alexandria during his appointment as teaching assistant in the early stages of his training. Currently, he is practicing in surgery in the Aberdeen Royal Infirmary and conducting first class research with an honorary contract at the University of Aberdeen. He sits on the editorial board of several peer-reviewed journals.

Bariatric surgery is the only long-term solution to obesity-related comorbidities when other conservative measures have failed.<sup>[1,2]</sup> Diversional surgeries often offer the highest success rates when compared to restrictive procedures such as sleeve gastrectomies or gastric banding.<sup>[3]</sup> Of these, the Roux-en-Y gastric bypass (RYGBP) is the commonest diversional procedure because though it does not achieve quite the same amount of weight loss as the biliopancreatic diversion and duodenal switch, it does offer a better complication rate and mortality.<sup>[4,5]</sup>

Gastric bypass achieves weight loss not only by restriction of gastric capacity and therefore earlier

patient satiety but also by the diversion of digestion leading to malabsorption of nutrients and modulation of the metabolic system. It is a combination of these effects that contribute to its success rate in both weight loss and reversal of comorbidities.<sup>[6]</sup>

There are variations between the constructed limb lengths of RYGBPs described in the literature, and these are designed by the surgeon's preference.<sup>[7,8]</sup> Most surgeons create a restricted gastric pouch from which the alimentary limb (AL) (100-150 cm) follows to join the biliopancreatic limb (BPL) (usually 50-100 cm in length) to form the common limb. The remaining common limb (CL) length is of an indeterminate



This is an open access article licensed under the terms of Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, as long as the original author is credited and the new creations are licensed under the identical terms.

For reprints contact: [service@oaepublish.com](mailto:service@oaepublish.com)

Quick Response Code:



length based on the length of small bowel left, and the patient's anatomy,<sup>[7]</sup> and this configuration is known as the proximal or standard gastric bypass.<sup>[9,10]</sup> A distal gastric bypass differs by having a fixed CL length of 100-150 cm which leaves a variable AL and BPL length that may end up being very long or conversely very short.

The hypothesis is that a distal bypass can lead to better weight loss outcomes due to a longer diversion of the digestive tract and a shorter section of common bowel for absorption.<sup>[11]</sup> The small intestine has a huge variability in length among patients and can vary between 300 to 1,000 cm.<sup>[12]</sup> Because of this, the CL length can theoretically range from 50 to 850 cm in a proximal gastric bypass as intestinal lengths are not routinely measured before reconstruction of the digestive continuity.

Despite the RYGBP's success rate in reversing obesity and its comorbidities, the outcomes can be variable. An RYGBP may fail when its primary outcome is not achieved, whether this is resultant from either an insufficient weight loss from what is predicted<sup>[13-15]</sup> or the patient regains weight shortly after the procedure is performed.<sup>[16-18]</sup> Conversely, other patients may develop significant malnutrition when there is not enough absorption of key nutrients<sup>[19-21]</sup> which may even lead to a functional short bowel syndrome which despite its rarity is a far more severe complication and can occur more frequently the shorter the CL length is.<sup>[22-24]</sup>

Studies have assessed the effect of the limb lengths on weight loss, while others have addressed the malnutrition effect. Many studies concur that the CL length and AL length do not affect the amount of potential weight loss that a patient can achieve<sup>[25-28]</sup> though Tran *et al.*<sup>[29]</sup> has suggested the use of a distal bypass is an effective revision for a failed loss of weight on a standard bypass. There is certainly a range of results on whether proximal or distal bypasses have more pronounced effects on the metabolic and endocrine systems as reported by Risstad *et al.*<sup>[9]</sup> and Ramos *et al.*<sup>[30]</sup> Distal bypasses may also be related to increased rates of complication.<sup>[10,31]</sup> Longer BPL lengths have been found to result in both higher weight loss and malnutrition rates with the two are often correlating.<sup>[21,32,33]</sup>

The reasons for failure may have a technical component and could be related to constructed bowel length from diversion, but studies by Maleckas *et al.*,<sup>[16]</sup> Shantavasinkul *et al.*<sup>[34]</sup> and Perrone *et al.*<sup>[35]</sup> allude to a more complex etiology and suggest patient factors play a significant role in determining the outcome. What is

currently unknown is whether there is an impact of the total/bypassed bowel length on the incidence of complications and failure. A patient's preoperative total bowel length may indeed have an effect on the potential weight loss achievable with an RYGBP and also whether they are at risk of regaining weight with a very long bowel that minimizes the effect of the diversion or developing malnutrition with a very short one that has the very limited absorptive capacity. As such knowing a patient's total bowel length may be useful in the future as a predictor of outcomes and would be useful in patient selection when choosing diversion options and limb lengths to maximize benefit and minimize adverse outcomes.

Future studies aim to set a standard into intestinal lengths for optimal outcomes,<sup>[11]</sup> but very few studies seek to examine the patients' total bowel length and whether this has an influence on the success rates of proximal and distal bypasses.<sup>[28]</sup> Navez *et al.*<sup>[26]</sup> and Savassi-Rossa *et al.*<sup>[36]</sup> show that there may be no relation between CL length and weight loss though there is a small sample size and follow-up time to assess weight regain or the occurrence of malnutrition is short.

Further studies are required to assess if bowel length has a long-term influence on outcomes and whether routine measurement of bowel length can optimize this. Several studies have mentioned the technical challenges in measuring bowel length<sup>[37-39]</sup> and in the superobese patient, a high level of visceral fat will only complicate this further. A standardized method of bowel measurement should, therefore, be agreed upon to make accurate comparisons possible, and this could be a combination of preoperative radiographic bowel measurements and intraoperative laparoscopic measurements.

These studies have the potential to answer a fundamental question on the way we perform diversion surgeries in an attempt to optimize the outcome. There is no doubt that there are several other variables that might influence the outcome - such as genetic factors. However, we believe that the question raised - which cannot be ignored - is at the core of understanding the pathophysiology of the procedure, which is not fully understood until now.

### Authors' contributions

Manuscript concept: M. Bekheit  
Literature search and drafting: V. Quan, F.P.M. Cooper  
Critical revision and approval: V. Quan, F.P.M. Cooper, M. Bekheit

## Financial support and sponsorship

None.

## Conflicts of interest

There are no conflicts of interest.

## Patient consent

Not applicable.

## Ethics approval

Not applicable.

## REFERENCES

- Øvrebo B, Strømmen M, Kulseng B, Martins C. Bariatric surgery versus lifestyle interventions for severe obesity: 5-year changes in body weight, risk factors, and comorbidities. *Clin Obes* 2017;7:183-90.
- Gloy VL, Briel M, Bhatt DL, Kashyap SR, Schauer PR, Mingrone G, Bucher HC, Nordmann AJ. Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *BMJ* 2013;347:f5934.
- Padwal R, Klarenbach S, Wiebe N, Birch D, Karmali S, Manns B, Hazel M, Sharma AM, Tonelli M. Bariatric surgery: a systematic review and network meta-analysis of randomized trials. *Obes Rev* 2011;12:602-21.
- Hedberg J, Sundstrom J, Sundbom M. Duodenal switch versus Roux-en-Y gastric bypass for morbid obesity: systematic review and meta-analysis of weight results, diabetes resolution and early complications in single-centre comparisons. *Obes Rev* 2014;15:555-63.
- Colquitt JL, Pickett K, Loveman E, Frampton GK. Surgery for weight loss in adults. *Cochrane Database Syst Rev* 2014;8:CD003641.
- Chakravartty S, Tassinari D, Salerno A, Giorgakis E, Rubino F. What is the mechanism behind weight loss maintenance with gastric bypass? *Curr Obes Rep* 2015;4:262-8.
- Madan AK, Harper JL, Tichansky DS. Techniques of laparoscopic gastric bypass: on-line survey of American Society for Bariatric Surgery practicing surgeons. *Surg Obes Relat Dis* 2008;4:166-72; discussion 172-3.
- Mahawar KK, Kumar P, Parmar C, Graham Y, Carr WR, Jennings N, Schroeder N, Balupuri S, Small PK. Small bowel limb lengths and Roux-en-Y gastric bypass: a systematic review. *Obes Surg* 2016;26:660-71.
- Risstad H, Svanevik M, Kristinsson JA, Hjeltnes J, Aasheim ET, Hofsvold D, Søvik TT, Karlsen TI, Fagerland MW, Sandbu R, Mala T. Standard vs distal Roux-en-Y gastric bypass in patients with body mass index 50 to 60: a double-blind, randomized clinical trial. *JAMA Surg* 2016;151:1146-55.
- Svanevik M, Risstad H, Hofsvold D, Schou CF, Solheim B, Søvik TT, Kristinsson J, Hjeltnes J, Mala T, Sandbu R. Perioperative outcomes of proximal and distal gastric bypass in patients with BMI ranged 50-60 kg/m<sup>2</sup>—a double-blind, randomized controlled trial. *Obes Surg* 2015;25:1788-95.
- Gadiot RP, Grotenhuis BA, Biter LU, Dunkelgrun M, Zengerink HJ, Feskens PB, Mannaerts GH. Study protocol of the DUCATI-study: a randomized controlled trial investigating the optimal common channel length in laparoscopic gastric bypass for morbid obese patients. *BMC Obes* 2015;2:28.
- Ellis H, Mahadevan V. *Clinical Anatomy: Applied Anatomy for Students and Junior Doctors*, 13th Edition. Hoboken, New Jersey: Wiley-Blackwell; 2013.
- Luiz LB, Brito CL, Debon LM, Brandalise LN, Azevedo JT, Monbach KD, Heberle LS, Mottin CC. Variation of binge eating one year after Roux-en-Y gastric bypass and its relationship with excess weight loss. *PLoS One* 2016;11:e0167577.
- Costa AC, Furtado MC, de Godoy EP, Pontes ER, de Souza AS, Ivo ML. Profile of the obese patients submitted to Roux-en-Y gastric bypass without diabetes mellitus type 2 remission and/or insufficient weight loss. *Arq Bras Cir Dig* 2013;26:319-23.
- Puzziferri N, Roshek TB 3rd, Mayo HG, Gallagher R, Belle SH, Livingston EH. Long-term follow-up after bariatric surgery: a systematic review. *JAMA* 2014;312:934-42.
- Maleckas A, Gudaitytė R, Petereit R, Venclauskas L, Veličkienė D. Weight regain after gastric bypass: etiology and treatment options. *Gland Surg* 2016;5:617-24.
- Stanford FC, Alfaris N, Gomez G, Ricks ET, Shukla AP, Corey KE, Pratt JS, Pomp A, Rubino F, Aronne LJ. The utility of weight loss medications after bariatric surgery for weight regain or inadequate weight loss: a multi-center study. *Surg Obes Relat Dis* 2017;13:491-500.
- Monaco-Ferreira DV, Leandro-Merhi VA. Weight regain 10 years after Roux-en-Y gastric bypass. *Obes Surg* 2017;27:1137-44.
- Bal BS, Finelli FC, Shope TR, Koch TR. Nutritional deficiencies after bariatric surgery. *Nat Rev Endocrinol* 2012;8:544-56.
- Saltzman E, Karl JP. Nutrient deficiencies after gastric bypass surgery. *Annu Rev Nutr* 2013;33:183-203.
- Borbély Y, Plebani A, Kröll D, Ghisla S, Nett PC. Exocrine pancreatic insufficiency after Roux-en-Y gastric bypass. *Surg Obes Relat Dis* 2016;12:790-4.
- Williams N, O'Connell PR. *Bailey & Love's Short Practice of Surgery* 25th Edition. Boca Raton, Florida: CRC Press; 2008.
- McBride CL, Petersen A, Sudan D, Thompson J. Short bowel syndrome following bariatric surgical procedures. *Am J Surg* 2006;192:828-32.
- McBride CL, Oleynikov D, Sudan D, Thompson JS. Short bowel syndrome after laparoscopic procedures. *Am Surg* 2014;80:382-5.
- Dogan K, Homan J, Aarts EO, van Laarhoven CJ, Janssen IM, Berends FJ. A short or a long Roux limb in gastric bypass surgery: does it matter? *Surg Endosc* 2017;31:1882-90.
- Navez B, Thomopoulos T, Stefanescu I, Coubeau L. Common limb length does not influence weight loss after standard laparoscopic Roux-En-Y gastric bypass. *Obes Surg* 2016;26:1705-9.
- Valezi AC, Marson AC, Merguizo RA, Costa FL. Roux-en-Y gastric bypass: limb length and weight loss. *Arq Bras Cir Dig* 2014;27 Suppl 1:56-8.
- Hernández-Martínez J, Calvo-Ros MÁ. Gastric by-pass with fixed 230-cm-long common limb and variable alimentary and biliopancreatic limbs in morbid obesity. *Obes Surg* 2011;21:1879-86.
- Tran DD, Nwokeabia ID, Purnell S, Zafar SN, Ortega G, Hughes K, Fullum TM. Revision of Roux-En-Y gastric bypass for weight regain: a systematic review of techniques and outcomes. *Obes Surg* 2016;26:1627-34.
- Ramos RJ, Mottin CC, Alves LB, Benzano D, Padoin AV. Effect of size of intestinal diversions in obese patients with metabolic syndrome submitted to gastric bypass. *Arq Bras Cir Dig* 2016;29 Suppl 1:15-9.
- Inabnet WB, Quinn T, Gagner M, Urban M, Pomp A. Laparoscopic Roux-en-Y gastric bypass in patients with BMI <50: a prospective randomized trial comparing short and long limb lengths. *Obes Surg* 2005;15:51-7.
- Nergaard BJ, Leifsson BG, Hedenbro J, Gislason H. Gastric bypass with long alimentary limb or long pancreatico-biliary limb—long-term results on weight loss, resolution of co-morbidities and metabolic parameters. *Obes Surg* 2014;24:1595-602.
- Hamoui N, Anthone GJ, Kaufman HS, Crookes PF. Maintenance of

- weight loss in patients with body mass index  $>60$  kg/m<sup>2</sup>: importance of length of small bowel bypassed. *Surg Obes Relat Dis* 2008;4:404-6; discussion 406-7.
34. Shantavasinkul PC, Omotosho P, Corsino L, Portenier D, Torquati A. Predictors of weight regain in patients who underwent Roux-en-Y gastric bypass surgery. *Surg Obes Relat Dis* 2016;12:1640-45.
  35. Perrone F, Bianciardi E, Benavoli D, Tognoni V, Niolu C, Siracusano A, Gaspari AL, Gentileschi P. Gender influence on long-term weight loss and comorbidities after laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass: a prospective study with a 5-year follow-up. *Obes Surg* 2016;26:276-81.
  36. Savassi-Rocha AL, Diniz MT, Savassi-Rocha PR, Ferreira JT, Rodrigues de Almeida Sanches S, Diniz Mde F, Gomes de Barros H, Fonseca IK. Influence of jejunoileal and common limb length on weight loss following Roux-en-Y gastric bypass. *Obes Surg* 2008;18:1364-8.
  37. Gazer B, Rosin D, Bar-Zakai B, Willenz U, Doron O, Gutman M, Nevler A. Accuracy and inter-operator variability of small bowel length measurement at laparoscopy. *Surg Endosc* 2017; doi: 10.1007/s00464-017-5538-5.
  38. Muise ED, Tackett JJ, Callender KA, Gandotra N, Bamdad MC, Cowles RA. Accurate assessment of bowel length: the method of measurement matters. *J Surg Res* 2016;206:146-50.
  39. Bodenstedt S, Wagner M, Mayer B, Stemmer K, Kenngott H, Müller-Stich B, Dillmann R, Speidel S. Image-based laparoscopic bowel measurement. *Int J Comput Assist Radiol Surg* 2016;11:407-19.