Bariatric fellowship positively influences early outcomes for laparoscopic Roux-en-Y gastric bypass surgery over seven years of independent practice

A Ilcyszyn, W Lynn, S Rasheed, J Davids, R Aguilo, S Agrawal

Department of Upper Gastrointestinal and Bariatric Surgery, Homerton University Hospital, London, UK

ABSTRACT

INTRODUCTION Laparoscopic Roux-en-Y gastric bypass (LRYGB) is technically demanding and has an associated learning curve. We published previously that bariatric fellowship reduces the learning curve of primary LRYGB and improves patient outcomes after one year of independent practice. However, the long-term effect of fellowship is unknown. We therefore aimed to compare the 30-day outcomes of LRYGB between the first year of a surgeon's independent practice with the subsequent six years.

MATERIALS AND METHODS A prospective database of patients undergoing primary LRYGB under a single surgeon from March 2010 until February 2017 was analysed. Two groups were studied: first year (< 1 year) and the subsequent six years ($\geq$ 1 year) of independent practice. Patient demographics, length of hospital stay, conversion to open surgery, perioperative complications and mortality were compared.

RESULTS Among 279 eligible patients, 74 (26.5%) were in the < 1 year group and 205 (73.5%) in $\geq$ 1 year group. The pre-operative risk scores, American Society of Anesthesiologists (ASA) grade, $P = 0.00$; obesity surgery mortality risk score (OS-MRS), $P = 0.04$ were significantly higher in $\geq$ 1 year group. There was no significant difference in perioperative outcomes (length of stay, $P = 0.38$; total complications, $P = 0.20$; readmissions, $P = 1.00$; reoperations, $P = 0.60$) between the two groups.

CONCLUSIONS Bariatric fellowship reduces the learning curve for LRYGB and helps to achieve excellent outcomes in the first and subsequent years of independent practice. The higher risk profile of $\geq$ 1 year group did not equate to an increase in complications, suggesting that experience and standardisation may help in handling complex cases. To our knowledge, this represents the only such study in the literature.

KEYWORDS

Gastric bypass – Fellowship – Complications

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CORRESPONDENCE TO

Sanjay Agrawal, E: sanju_agrawal@hotmail.com

Introduction

Laparoscopic Roux-en-Y gastric bypass (LRYGB) is the most popular bariatric procedure performed in Europe and the second most popular in the United States.^{1,2} However, this surgery is technically demanding and associated with a significant learning curve of up to 100 cases.^{3,4}

We have demonstrated that a bariatric fellowship reduces the individual surgeon's learning curve of primary LRYGB and also improves patient outcomes after one year of independent practice.⁵ However, the effect of bariatric fellowship over a surgeon's career is not known. Our study therefore aimed to compare the outcomes of the initial year of independent practice with subsequent six years to assess whether independent practice is associated with further learning curve following the completion of an accredited

bariatric fellowship. To our knowledge, this represents the only such study in the literature.

Materials and methods

A prospectively maintained database of all patients undergoing primary LRYGB under a single surgeon, from March 2010 to February 2017, was analysed. The study adhered to the Declaration of Helsinki and patient confidentiality was maintained. The surgeon had previously undergone an accredited bariatric fellowship.^{5,6} Patients were divided into two groups for the purposes of analysis; the initial year of independent practice (< 1 year group) and the subsequent six years of independent practice ($\geq$ 1 year group). Patient demographics, including ASA, OS-MRS score,⁷ length of hospital stay, conversion to open surgery,

Table 1 Standardised postoperative protocol.

Day of surgery	Day 1	Day 2	Discharge
In recovery: Sips of water with straw On ward: Clear fluids with straw Sit out of bed Mobilise to toilet Deep breathing exercises Regular saline nebulisers Analgesia: paracetamol IV + diclofenac PR (if not contra-indicated) ± morphine sulphate liquid PO PRN Antiemetics: ondansetron IV + metoclopramide IV + cyclizine PRN IV Antibiotics: 2 × post-op doses PPI: omeprazole IV Fluids IV 8-hourly	On ward: Free fluids with straw 100 ml/hour Chest physiotherapy Saline nebulisers Mobilise on ward Analgesia: paracetamol IV + diclofenac PR or codeine phosphate liquid if diclofenac contraindicated Stop morphine sulphate liquid Antiemetics: ondansetron IV + metoclopramide IV + cyclizine PRN IV PPI: omeprazole IV Fluids IV 12-hourly Peppermint water Routine blood tests Drain: colour and volume review Bariatric specialist nurse review	On ward: Free fluids with straw 200 ml/hour Chest physiotherapy Saline nebulisers Mobilise on ward Medications as per postoperative day 1 Remove drain if haemoserous only Routine blood tests Discharge: Discharge if 5P criteria met: Pain controlled Pulse < 90 Pipe (drain) haemoserous and removed CRP declining trend Passed wind (flatus)	Take-away medications: Enoxaparin 40 mg OD SC for 7–14 days TED stockings for 30 days PPI: lansoprazole orodispersible 30 mg OD for 6 months Chewable multivitamins and minerals lifelong Analgesia: liquid paracetamol for 5 days and codeine phosphate for 3 days Laxatives: lactulose 14 days and PRN thereafter Dietary advice: Free fluids with straw, slowly 200 ml/hour for 2 weeks Puree diet 2 weeks subsequently Semi-solid 2 weeks subsequently Solids 2 weeks subsequently
Throughout hospital stay: VTE prophylaxis with pneumatic calf compression devices while immobile, TED stockings, and LMWH (enoxaparin 40 mg SC commencing 6 hours post-surgery every 24 hours thereafter)			
CRP: C reactive protein; IV, intravenous; LMWH, low molecular weight heparin; OD, once daily; PO: per os; PPI, proton pump inhibitor; PR, per rectum; PRN: pro re nata; SC, subcutaneous; TED, thromboembolic deterrent; VTE, venous thromboembolism.			

perioperative complications and mortality were analysed. The OS-MRS combines five preoperative factor: (body mass index, gender, age, hypertension, venous thromboembolism risk), producing a risk stratification score for patients undergoing bariatric surgery. Scores of 0–1 are classified as group A; a score of 2–3 is intermediate, risk group B; 4–5 is classed as C, high risk. Perioperative complications were considered to be complications occurring within 30 days of surgery. All complications were graded using the Clavien–Dindo classification.⁸ Complications classified as Clavien–Dindo grades IIIb–V were considered to be severe.

Patient selection was according to national guidelines at the time of surgery.⁹ A standardised operative technique was used in all cases.^{5,10} All cases were performed by the senior author or by a senior trainee assisted by the senior author. LRYGB was performed using a four-abdominal trocar technique and a Nathanson liver retractor. The first step was to create the jejunojejunal anastomosis. The biliopancreatic limb was measured to the desired length from the ligament of Treitz and divided with a laparoscopic stapling device, and the mesentery was divided with the use of a surgical energy device. The Roux limb was then measured from the distal stapled end to the length of choice (100 cm if body mass index less than 40, 150 cm if 40 or greater) and the jejunojejunal anastomosis was created with a single linear stapler. The enterotomy was closed with a two-layer closure of a continuous absorbable monofilament suture. The mesenteric defect was closed in all cases in a purse-string fashion with a continuous

nonabsorbable suture. A small (20–30 cc) lesser curve based gastric pouch was created with a linear stapler and the gastrojejunal anastomosis formed with a linear stapler. The enterotomy was closed with a two-layer closure of a continuous absorbable monofilament suture. Methylene blue was used routinely to assess for any intraoperative evidence of anastomotic leak. A 20F Robinson drain was placed alongside the gastrojejunal anastomosis in all cases.

A standardised postoperative protocol and enhanced recovery principles were followed in all cases (Table 1). Patients were encouraged to drink from recovery and were mobilised on the day of surgery; a standardised medication plan was followed in all cases. Discharge was planned on the second postoperative day. All patients were followed-up by the bariatric specialist nurse at two weeks after surgery and subsequently reviewed by the senior author.

Filemaker™ was used for data management. The Statistical Package for the Social Sciences version 21.0 was used to analyse the results. The Chi-square test or the Fisher's exact test (when numbers were small) was used for categorical data. Parametric data were analysed using the unpaired t-test. Statistical significance was determined to be a *P*-value of less than 0.05.

Results

Over a seven-year period, 279 cases were eligible for this study. Thirty-day outcome data was available for all cases. Seventy-four (26.5%) patients had the surgery in the first

year of independent practice (< 1 year group) and 205 patients (73.5%) in the subsequent six years (≥ 1 year group). There was no significant difference between the two groups in terms of age, gender and body mass index. The preoperative risk profile in terms of the ASA and OS-MRS scores was significantly higher in the ≥ 1 year group when compared with the < 1 year group (Table 2).

Complications were classified according to the Clavien–Dindo score (Table 3). There was only one complication in the < 1 year group, a re-laparoscopy for abdominal pain revealing an early internal hernia (grade IIIb). Within the ≥ 1 year group, there were: three grade I complications (all readmissions with abdominal pain and negative investigations); four grade II complications (all with a diagnosis of pneumonia treated with antibiotics); four grade III complications (one patient who underwent an endoscopy and was diagnosed with a staple line ulcer, two patients who underwent a negative laparoscopy for pain and one patient in whom haemorrhage from the staple line of the remnant

stomach required return to theatre). There was one grade IVa complication in a patient who required re-laparoscopy for a remnant stomach staple line bleed and required high dependency unit monitoring postoperatively. There were no complications greater than grade IVa and no statistically significant difference between the two groups for any of the grades of the Clavien–Dindo classification (Table 3).

The 30-day or perioperative outcomes for both the groups are shown in Table 4. There was no significant difference in length of stay, total complications, readmissions or reoperations between the two groups despite the higher OS-MRS score of the ≥ 1 year group. There were no conversions to open surgery, anastomotic leaks or inpatient mortality in either of the groups within 30 days of surgery. There was one death in the < 1 year group due to a drug overdose in the community, which was unrelated to surgery.

The overall complication rate was 1.35% in the < 1 year group and 5.85% in the ≥ 1 year group ($P = 0.20$). One patient (1.35%) was readmitted within 30 days in the < 1 year group, compared with five patients (2.44%) in the ≥ 1 year group ($P = 1.00$). There was one (1.35%)

Table 2 Comparison of demographic characteristics between less than one year and over one year of independent practice.

Demographics	Group		P-value
	< 1 year (n = 74)	≥ 1 year (n = 205)	
Age (years), mean (SD)	45.1 (9.00)	44.4 (10.5)	0.59
Sex ratio (male : female)	13:61	49:156	0.26
BMI (kg/m ²), mean (SD)	47.7 (4.76)	48.0 (5.97)	0.65
ASA, median (IQR)	2 (2-3)	3 (2-3)	0.00
OS-MRS, median (IQR)	A, 0–1 (A–B)	B, 2–3 (A–B)	0.04

ASA, American Society of Anesthesiologists; BMI, body mass index; IQR, interquartile range; LRYGB, laparoscopic Roux-en-Y gastric bypass; OS-MRS: Obesity Surgery Mortality Risk score; SD, standard deviation.

Table 3 Complications as classified by the Clavien–Dindo score.

Grade of complication	Group		P-value
	< 1 year (n = 74)	≥ 1 year (n = 205)	
I	0	3 (1.46%)	0.57
II	0	4 (1.95%)	0.58
IIIa	0	1 (0.49%)	–
IIIb	1 (1.35%)	3 (1.46%)	1.00
IVa	0	1 (0.49%)	–
IVb	0	0	–
V	0	0	–

Table 4 Comparison between less than one year and over one year of independent practice in terms of length of stay and perioperative outcomes.

Perioperative outcomes	Group		P-value
	< 1 year (n = 74)	≥ 1 year (n = 205)	
Length of stay (days), mean (SD)	2.34 (0.832)	2.44 (0.898)	0.38
Complications:			
Total	1 (1.35%)	12 (5.85%)	0.20
Severe ^a	1 (1.35%)	5 (2.44%)	1.00
Chest infection	0	5 (2.44%)	0.33
Abdominal pain – normal investigations	0	2 (0.976%)	–
Staple line bleeding	0	2 (0.976%)	–
Mesocolic hernia	1 (1.35%)	0	–
Diagnostic laparoscopy for pain – normal	0	1 (0.488%)	–
Anastomotic ulcer	0	1 (0.488%)	–
Biliary colic	0	1 (0.488%)	–
Reoperations, n (%)	1 (1.35%)	4 (1.95%)	0.60
Conversion to open	0	0	–
Anastomotic leak	0	0	–
Mortality	0	0	–

^a Severe complications defined as Clavien–Dindo $\geq$ grade IIIa. LRYGB, laparoscopic Roux-en-Y gastric bypass; SD, standard deviation.

reoperation within 30 days in the < 1 year group compared with four reoperations (1.95%) in the ≥ 1 year group ($P = 0.60$).

Discussion

LRYGB is a technically challenging operation associated with low but significant risk of complications.¹¹ It requires multiple operation steps and high-level laparoscopic skills including technically complex dissection, intracorporeal suturing and stapling. We have previously shown the effect of bariatric fellowship on early postoperative outcomes following the step up to independent practice.⁵ This study highlights the effect of bariatric fellowship on outcomes beyond the first year of independent practice.

Various forms of advanced bariatric training is available varying from short workshops to extended bariatric specific fellowships.^{6,12} Shortened training programmes may not provide significant experience to overcome the learning curve.¹² Various studies have proven that bariatric fellowships have a positive effect on patient outcomes.^{4,5,15}

As experience increases, operative times decrease. Ballantyne *et al.*¹⁴ reported that the median operative time for LRYGB decreased for every 100 cases performed mirroring the results of Wittgrove *et al.*¹⁵ and Pournaras *et al.*¹⁶ Gonzalez *et al.*¹⁷ showed that the establishment of bariatric fellowship training programme was associated with decrease in operating time for both open and laparoscopic RYGB. Abu-Hilal *et al.*¹⁸ also showed that operating times decrease with increased experience. In our study, many steps of the operating procedure were carried out by different trainees under supervision. Therefore, we chose not to include operative times to avoid this confounding effect.

The significant learning curve associated with LRYGB has been variously reported to be between 75 and 100 cases.^{3,19,20} Doumouras *et al.* reviewed the results of 11,684 cases performed by 29 surgeons over nine years; they reported a perioperative risk plateau at 500 cases and the lowest risk rate among surgeons who had performed over 600 cases.²¹ The overall complication rate in this study was 10.1% and included data from surgeons with different levels of experience prior to commencement of the study. Our study is the first that has examined the effect bariatric fellowship has on post-learning curve outcomes in a single surgeon who has already overcome the learning curve.⁵

Our results showed that there is no statistically significant difference in perioperative outcomes (length of stay, $P = 0.38$; total complications, $P = 0.20$; readmissions, $P = 1.00$; reoperations, $P = 0.60$) between those patients operated in the first year of independent practice (< 1 year group) compared with those operated in subsequent years (≥ 1 year group). Anastomotic leaks, open conversions or 30-day mortalities were also not observed in either of the two groups. The Clavien–Dindo classification provides a reproducible framework for reporting the complications.⁸ There is no statistically significant difference between < 1 year and ≥ 1 year groups for any of the grades of the Clavien–Dindo classification (Table 3). All these results

suggest that bariatric fellowship helps in overcoming the learning curve and improving the outcomes even in the subsequent years of independent practice.

The importance that standardisation of perioperative care plays in reducing postoperative complications should also be considered. We have described our standardised operative technique and postoperative protocol, which was adhered to in all 279 cases. Dillemans *et al.*²² reported that a standardised approach to fully stapled bypass plays a vital role in determining the complication rates after surgery. Similarly, Hahl *et al.*²⁵ showed that standardisation of operative modalities helps in enhanced recovery even in a small general hospital.²⁵ We believe that standardisation of both operative techniques and postoperative management are imperative factors in aiming for the best possible outcomes, particularly in complex multistage procedures performed in high-risk patients.

In our study, the rate of severe complications (Clavien–Dindo $\geq$ IIIa) across both groups was 1.79%. Only one complication (grade IIIa) was reported in the < 1 year group whereas the ≥ 1 year group reported five complications (1 grade IIIa, 3 grade IIIb and 1 grade IVa). This is similar to other reports in the literature,²⁵ but much less than that of reported by Garcia-Garcia *et al.*²⁴

The OS-MRS score has been shown to predict postoperative complications.^{7,25} In our study, both the OS-MRS score and ASA grade were significantly higher in ≥ 1 year group than that of < 1 year group. There was, however, no increase in complications in the ≥ 1 year group, as might have been expected. This indicates the importance of increased experience acting to ameliorate the increased complexity of cases undertaken during the subsequent years of independent practice. It suggests that as experience increases, more complex cases may be taken on without any significant increase in complication rates.

There were some limitations to this study. Data were collected prospectively but analysed retrospectively. Data were not analysed on the effect that increased experience had on operative times, as our institution has supervised trainees undertaking the procedures. The wide geographical catchment area of our institution provides the potential for more minor complications to have been dealt with at a local institution without our knowledge potentially underestimating the complication rate.

Conclusions

There was no significant difference between 30-day outcomes in the first and subsequent years of independent practice. Bariatric fellowship reduces the learning curve for LRYGB and also helps in excellent outcomes both in the first and subsequent years of independent practice.

The higher risk profile of the ≥ 1 year group did not equate to an increase in postoperative complications, suggesting that experience may play a role in handling complex cases without significantly increasing the complications. Standardisation of operative techniques and postoperative protocols help in achieving best outcomes and in reducing complications.

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