Journal of Plastic, Reconstructive & Aesthetic Surgery (2016) **69**, 1490–1496

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Body contouring surgery decreases long-term weight regain following laparoscopic adjustable gastric banding: A matched retrospective cohort study☆

Itay Wiser [a,b,*], Eliezer Avinoah [c], Oren Ziv [d], Adam J. Parnass [a], Roni Averbuch Sagie [a], Lior Heller [a], Tali Friedman [a]

[a] *Department of Plastic Surgery, Assaf Harofeh Medical Center, Zerifin, Israel*
[b] *Department of Epidemiology and Preventive Medicine, Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel*
[c] *Department of Surgery A, Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel*
[d] *Soroka University Medical Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, Beer-Sheva, Israel*

Received 1 April 2016; accepted 22 August 2016

KEYWORDS
Bariatric surgery;
Body contouring;
Plastic surgery;
Gastric banding;
Massive weight loss;
Body mass index

Summary *Background:* Laparoscopic adjustable gastric banding (LAGB) surgery is the safest yet least effective method for massive weight loss. Thirty to 50 percent of patients undergoing LAGB will regain part of their lost weight.
Objective: To evaluate the effect of body contouring plastic surgery (BCPS) following LAGB on long-term body mass index (BMI) control.
Setting: Department of Surgery A, Soroka University Medical Center, Beer-Sheva, Israel.
Methods: A retrospective cohort study of patients aged 18–50 years, who underwent LAGB surgery between 1997 and 2007, was performed. Out of 2405 patients undergoing LAGB during those years, 861 were excluded and 1544 were recruited by phone. The final group included 72 patients matched for age and gender. Long-term weight regain was evaluated and compared between a group of patients who underwent subsequent body contouring plastic surgery (LBCPS) and a group of LAGB only (LAGBO). Groups were matched for age, gender, and pre-operative body mass index (BMI).
Results: LBCPS ($n = 18$) had lower endpoint BMI and BMI regain percentage compared with LAGBO ($n = 54$) (24.64 ± 3.76 vs. 31.0 ± 7.2 kg/m^2, $p < 0.001$; 13 ± 14% vs. 34± 31%.

☆ This work was presented as an oral lecture at the American Society of Plastic Surgeons (ASPS) meeting" in Chicago 10–14 October 2014 (Plast Reconstr Surg. 2014; 134(4 Suppl. 1):130–131).

* Corresponding author. Department of Plastic Surgery, Assaf Harofeh Medical Centre, Zerifin, 70300 Israel. Fax: +972 8 9779427.
E-mail address: wiser125@gmail.com (I. Wiser).

http://dx.doi.org/10.1016/j.bjps.2016.08.012

$p < 0.001$, respectively). BCPS had an independent strong protective effect for endpoint BMI regain over 25% and BMI $\geq$30 kg/m^2 (HR = 0.19, $p = 0.025$; HR = 0.13, $p = 0.046$, respectively).
Conclusion: When compared with patients who did not undergo BCPS following LAGB, patients who underwent BCPS following LAGB had improved long-term BMI control.

Introduction

Obesity is a major public health concern of the 21st century. It is associated with an increased risk for cardiovascular disease, diabetes, chronic musculoskeletal conditions, and malignancy.[1,2] When compared with non-surgical interventions, weight loss after bariatric surgery is more efficacious in reducing cardiovascular risk factors,[3,4] achieving higher remission rates for type two diabetes[5] and decreasing overall mortality rate.[6]

Laparoscopic assisted gastric banding (LAGB) is a minimally invasive bariatric procedure[7] that is considered safe[7,8] but is less effective for weight reduction, compared with other bariatric procedures.[8,9]

Overall patient satisfaction is influenced by immediate and long-term surgical complications and comorbidities, body image and health related quality of life.[10] For example, skin excess following bariatric surgery is considered by more than two-thirds of the patients to be a negative outcome that can cause psychological disturbances which reduce the beneficial effects of weight loss.[11,12] Kitzinger and colleagues reported that following bariatric surgery, up to 74% of patients seek body contouring procedures with only 21% undergoing at least one such procedure.[13]

We formed the hypothesis that body contouring plastic surgery (BCPS) in obese patients who underwent LAGB might have physiological and psychological benefits which would allow the patients to maintain their target weight over the long-term.

The main objective of the present study was to estimate the effect of BCPS on weight trends following LAGB.

Materials and methods

We performed a retrospective group matched cohort study. This study received Institutional Review Board approval, and was conducted in the Bariatric Surgery Unit, Soroka Medical Center, Israel.

Study design

Participants were selected from a single computerized database, and included patients who underwent LAGB between the years 1997–2007. LAGB was performed using standard pars flaccida technique avoiding gastrogastric sutures. Inclusion criteria were age between 18 and 50 years at the time of LAGB surgery, a minimum of 25% decrease of excess body weight following surgery, and written patient consent to participate in the study. Patients who underwent more than one bariatric procedure due to weight reduction failure, or those diagnosed with psychiatric illness were excluded from the study.

Following recruitment and data acquisition, study participants were later assigned to groups that underwent LAGB only (LAGBO) or LAGB and BCPS (LBCPS). In order to control potential for confounding factors, the two groups were matched for gender, age at LAGB and pre-operative body mass index (BMI).

Data measurement

Data including demographics, medical history and weight documentation was obtained from the bariatric surgery unit medical record database. Information on their annual follow up included weight and height measurements.

We conducted a telephone interview to complete data on current medical status, weight change, past and current smoking, physical activity and eating behavior. All participants graded their motivation to undergo BCPS on a scale from one to ten. LBCPS participants were asked to state the type and number of BCPS procedures they underwent. LAGBO participants were asked to state the reasons they declined BCPS.

Excess weight was calculated by subtracting the weight needed to reach a BMI of 25 kg/m^2 from the pre-operative weight. Excess body weight loss (EBWL) was also expressed as a percentage by dividing the difference between the minimum weight achieved and the pre-operative weight by the excess weight.

Study endpoint was defined by interview completion date. Outcome variables included: weight (kg), minimal to endpoint weight regain (kg), BMI (kg/m2), minimal to endpoint BMI regain (kg/m2), minimal to endpoint BMI regain (%) and endpoint EWBL%. For the multivariate analysis minimal to endpoint BMI Regain >25% and endpoint BMI $\geq$30 (kg/m2) were used as outcome variables.

Sample size calculation

Sample size was calculated using Winpepi software v2.75 (© J.H. Abramson, Israel). Based on preliminary clinical observations, we assumed a difference of clinical significance in BMI between LAGBO and LBCPS of 5 kg/m^2, with a standard deviation range of 3.5–7 kg/m^2. The ratio between LAGBO and LBCPS was noted to be three: one. Alpha was considered 0.05 and power was 80%. At this power, the sample size needed for the study was calculated at 18 participants in the LBCPS group and 54 in the LAGBO group.

Statistical methods

Statistical analysis was conducted using SPSS software v.21 (SPSS technologies, IBM, USA). Continuous variables are presented as mean ± standard deviation, and were compared using the paired student's t-test for normally distributed variables. Mann—Whitney test was used to compare continuous variables without normal distribution. Categorical variables are presented as counts and percentage. Differences in categorical variables were compared using either the χ^2 test, Fisher's exact test or the log-rank test. We performed a Cox proportional hazards model to assess the effect of BCPS on two main outcomes. One was an increase in BMI of more than 25% from the maximum BMI lost, and the second was an endpoint BMI equal to or above 30. Time to event was calculated as years passed from the minimum BMI achieved until the BMI at the endpoint of the study. The model was controlled for age at bariatric surgery, gender and minimal BMI reached. Variables were introduced to the model in enter mode. Statistical significance was set to 0.05, using a two-sided assumption.

Results

Participants

The LAGB database included 2405 procedures performed between 1997 and 2007. The study participant selection process is outlined in Figure 1.

Following exclusion, the LAGB group included 1544 potential participants with a mean age of 33.44 ± 7.75 years and a mean BMI of 42.16 ± 4.68 kg/m^2. In order to obtain study participants in each group matched for gender, age at LAGB and pre-operative BMI, we contacted 150 patients; of those, reliable contact was not established with 32 patients and two refused to participate. The final matched groups showed no significant difference in age at LAGB, gender and pre-operative BMI compared to the initial cohort (32.36 ± 7.15 years vs. 33.44 ± 7.75 years, $p = 0.25$; 9% vs. 5.6%, $p = 0.31$; 42.95 ± 5.59 kg/m^2 vs. 42.16 ± 4.68 kg/m^2, $p = 0.17$; respectively).

Descriptive/outcome data

The baseline characteristics of the study groups are presented in Table 1. Mean age at LAGB for LBCPS and LAGBO was 30.8 ± 9.1 years and 32.8 ± 6.4 years respectively ($p = 0.388$). The majority of the study groups (94%) were female.

No significant differences were observed between groups in terms of height, pre-operative weight or BMI (see Table 2). The pre-operative BMI in the LBCPS and LAGBO groups was 42.96 ± 5.42 kg/m^2 and 42.8 ± 5.6 kg/m^2 respectively ($p = 0.91$).

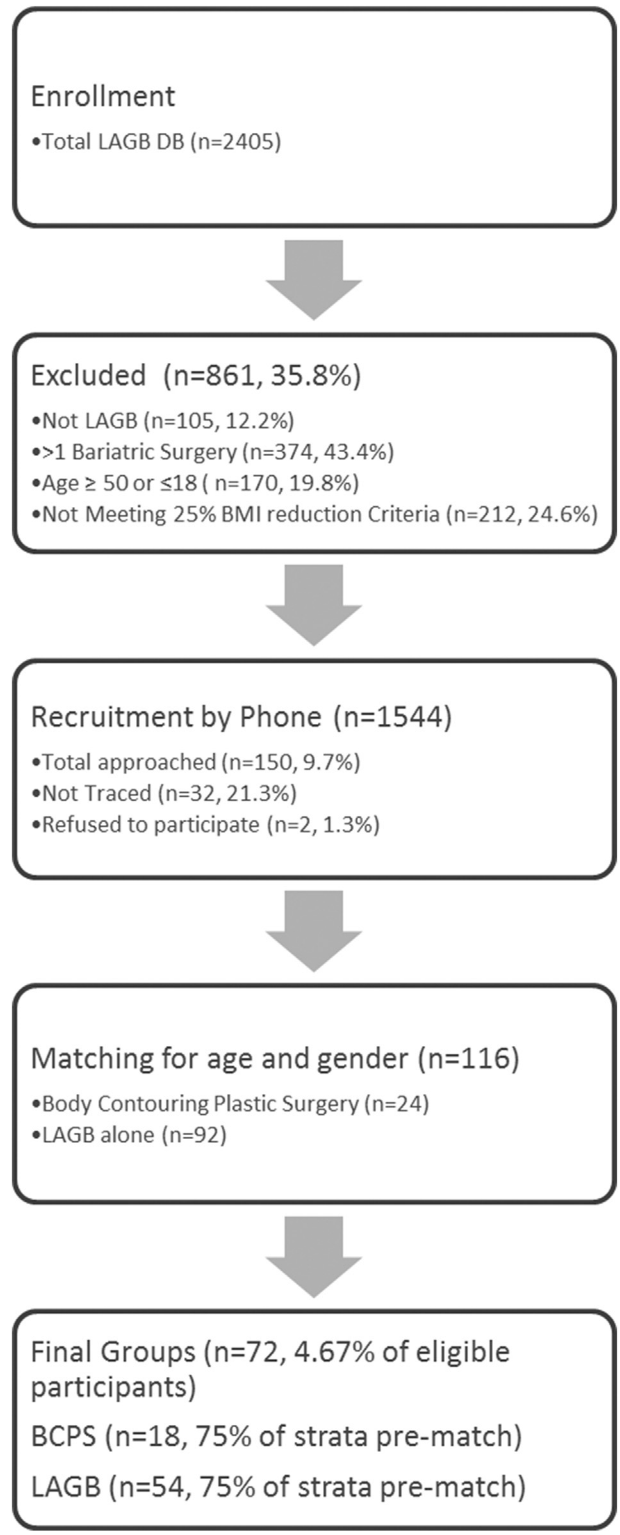

Figure 1 Study enrollment flowchart.

Weight and BMI maintenance following LAGB

Weight and BMI follow-up data are summarized in Table 2. Weight and BMI reduction (minimum weight achieved) were significantly higher in the LBCPS group (61.1 ± 10.5 kg vs. 69.2 ± 14.6 kg, $p = 0.03$; 22.5 ± 3.3 kg/m^2 vs.

Table 1 Baseline characteristics.

	BCPS (n = 18)	LAGBO (n = 54)	p value
Age in years at LAGB (±SD)	30.8 ± 9.1	32.8 ± 6.4	0.388
Female gender	17	51	1
Married	10	38	0.248
Academic education	10	22	0.273
≥1 children	13	49	0.108
No. children	2.2 ± 1.8	2.5 ± 1.8	0.581

BCPS, body contouring plastic surgery; LAGB, laparoscopic adjustable gastric banding; LAGBO, laparoscopic assisted gastric banding only.

25.7 ± 4.9 kg/m^2, p = 0.01; respectively), and mean time to minimum weight achieved was similar between both groups (2.3 ± 1.5 years vs. 2.7 ± 1.8 years, p = 0.39; respectively).

At study endpoint, the LBCPS group had significantly lower weight, absolute BMI, and lower weight regain values compared with the LAGBO group. The time taken to reach the endpoint weight was similar between the two groups (5.0 ± 3.0 years vs. 5.3 ± 2.6 years, p = 0.69).

Lifestyle characteristics

A comparison of tobacco use, eating habits, and exercise routine between LBCPS and LAGBO groups, before and after LAGB, is outlined in Table 3. Initial rates of smoking, poor eating habits, and regular exercise were similar between both groups. The LBCPS group had a higher rate of smoking cessation, improved eating habits, and routine exercise, but none achieved a difference that was statistically significant.

Subgroup analysis

Our subgroup analysis for the study endpoint is summarized in Table 4. When comparing the LBCPS and LAGBO groups for BMI regain >25% and endpoint BMI ≥30 kg/m^2, we found that marital status, level of education, and gender had a measurable effect. Single participants had lower levels of BMI regain >25% and endpoint BMI ≥30 kg/m^2 compared with married participants (0% vs. 20% and 0% vs. 10%, respectively). Participants with academic education showed higher rates of BMI regain >25% and endpoint BMI ≥30 kg/m^2 compared with those with only a high school education (20% vs. 0% and 10% vs. 0%, respectively). However, these differences failed to achieve statistical significance. Lower rates of BMI regain >25% and endpoint BMI

Table 2 Outcome comparison Between LBCPS and LAGBO groups ± 2SD.

Measurement	LBCPS (n = 18)		LAGBO (n = 54)		p
	Mean	Min − Max	Mean	Min − Max	
Pre-operative measurements					
Height in cm	164.8	154–181	164.0	150–187	0.71
Weight (kg)	116.8	92–155	115.2	88–175	0.74
Excess weight (kg)	48.7	31.2–86.9	47.8	12.6–105.3	0.82
BMI (kg/m^2)	42.96	37.7–56.9	42.8	29.1–62.7	0.91
Post-operative measurements − minimal weight					
Weight (kg)	61.1	46.0–83.0	69.2	43.0–116.0	0.03
BMI (kg/m^2)	22.5	16.9–28.7	25.7	18.1–39.8	0.01
Weight loss %	46.9	23.9–65.8	39.7	20.0–69.7	0.009
EWBL%	114.2	70.7–156.3	101.1	40.2–270.7	0.13
LAGB to minimal weight time (years)	2.3	1.0–7.0	2.7	1.0–10.0	0.39
Post-operative measurement − endpoint					
Weight (kg)	67.1	47.0–95.0	83.6	48.0–145.0	<0.001
Minimal to endpoint Weight regain (kg)	6.00	0.0–15.0	14.19	0.0–55.0	<0.001
BMI (kg/m^2)	24.64	17.5–32.9	31.0	20.0–47.6	<0.001
Minimal to endpoint BMI regain (kg/m^2)	2.19	0.0–5.9	5.3	0.0–22.3	<0.001
Minimal to endpoint BMI regain (%)	12.7	0.0–46.2	34.3	0.0%–136.7	<0.001
Endpoint EWBL%	53.0	16.7–76.9	35.1	−12.4%–63.5	<0.001
Minimal to endpoint weight time (years)	5.0	1.0–11.0	5.3	0.5–11.0	0.69
Time since LAGB (years)	7.3	5.0–13.0	8.0	5.0–13.0	0.32

BMI, body mass index; EWBL, excess body weight loss; LAGB, laparoscopic adjustable gastric banding; LAGBO, laparoscopic assisted gastric banding only; LBCPS, laparoscopic assisted gastric banding followed by body contouring plastic surgery.

Table 3 Lifestyle characteristics: comparison between LBCPS and LAGBO groups.

Characteristic	LBCPS (n = 18)	LAGBO (n = 54	p
Pre-LAGB			
Smoking	6	17	0.88
Keeping meal routine	3	11	0.73
Regular eating out	18	49	0.18
Binge eating	8	39	0.032
Regular exercise	4	18	0.37
Post-LAGB			
Stopped smoking	2	5	0.85
Improved meal routine	5	11	0.37
Improved eating out routine	2	1	0.24
Decreased binge eating	1	4	0.064
Established exercise routine	6	12	0.42

LAGB, laparoscopic adjustable gastric banding; LAGBO, laparoscopic assisted gastric banding only; LBCPS, laparoscopic assisted gastric banding followed by body contouring plastic surgery.

$\geq$30 kg/m^2 were observed in the male subgroup (0% vs. 12% and 0% vs. 5.9% respectively).

The most common reason to decline BCPS after LAGB surgery was cost (52%). Out of this group, 22% of the patients did not reach their target BMI and therefore chose not to have the surgery. A further 13% reported having no need for BCPS.

The LBCPS group had a mean age of 34.3 $\pm$ 9.7 at surgery, and had BCPS at an average of 3.5 years after LAGB. The average number of BCPS performed was two (range one-six). Ten out of 18 patients in the LBCPS group had more than one BCPS, and 22% (n = 4) of procedures were performed before reaching minimal BMI.

The most common BCPS site was the breast (83%), followed by the abdomen-waist area (56%). In participants who had multiple BCPS, the most common BCPS site was abdomen-waist (90%) followed by the breast (80%).

Long-term risk of BMI regain

In a Cox proportional hazards model, controlled for minimal BMI, BCPS was found to protect from a BMI regain over 25% from BMI lost (HR = 0.186 CI95% 0.042–0.812, p = 0.025, see Figure 2). Independent controlling variables found in the model were male gender (HR = 5.086, CI95% 1.411–18.336, p = 0.013) and minimum BMI achieved (HR = 1.17, CI95% 1.089–1.261, $p < 0.001$). No significant confounding effect was observed for education, marital status, regular exercise, or smoking ($p > 0.05$).

A similar Cox proportional hazards model for endpoint BMI $\geq$30 kg/m^2 produced similar results. BCPS protected from an endpoint BMI $\geq$30 kg/m^2 (HR = 0.126, CI95% 0.016–0.963, p = 0.046). Independent controlling variables found in the model were male gender (HR = 4.675, CI95% 1.253–17.445, p = 0.022) and minimum BMI achieved (HR = 1.203, CI95% 1.123–1.289, $p < 0.001$).

Discussion

Key results

Our study objective was to assess the effect of BCPS on long-term weight maintenance in patients who underwent LAGB bariatric surgery. In this study, the minimum weights achieved and the lowest BMIs were observed in participants who underwent BCPS compared with those who did not. These findings remained valid in a multivariate analysis controlled for possible confounders such as age, gender, minimum BMI achieved, and follow-up time. In our study, participants that underwent BCPS had an 81 percent less chance of gaining back more than 25% of BMI that was lost following LAGB, compared with participants who did not. They also had an 87 percent less chance of having a BMI $\geq$30 kg/m^2 at study endpoint.

We found that the most common reason to waive BCPS was cost and not related to body perception or fear of undergoing surgery. Although the mean motivation score in LAGBO was

Table 4 Subgroup analysis of BMI regain >25% and endpoint BMI $\geq$30 between LBCPS vs. LAGBO groups.

LBCPS vs. LAGBO	Minimal to endpoint BMI regain >25%		Endpoint BMI $\geq$30 (kg/m^2)	
Marital status				
Single	0% vs. 62.5%	p = 0.003	0% vs. 56.3%	p = 0.009
Married	20% vs. 50%	p = 0.09	10% vs. 50%	p = 0.03
Education				
Academic	20% vs. 45.5%	p = 0.17	10% vs. 45.5%	p = 0.106
High school	0% vs. 59.4%	p = 0.003	0% vs. 56.3%	p = 0.005
Gender				
Male	0% vs. 100%	p = 0.25	0% vs. 100%	p = 0.25
Female	11.8% vs. 51%	p = 0.005	5.9% vs. 49%	p = 0.001

LAGBO, laparoscopic assisted gastric banding only; LBCPS, laparoscopic assisted gastric banding followed by body contouring plastic surgery.

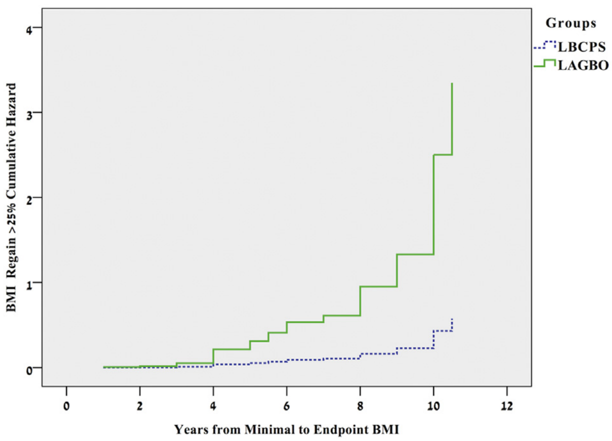

Figure 2 Hazard function for body mass index regain >25% in laparoscopic assisted gastric banding only and laparoscopic assisted gastric banding followed by body contouring plastic surgery groups.

significantly lower than in the LBCPS group, it was still above five on a scale of one to ten, suggesting that BCPS was perceived as a desirable contribution to the final outcome.

Interpretation

The long-term efficacy of LAGB bariatric surgery is associated with several factors. Weichman and colleague found in a study on 2909 patients who underwent LAGB that an increased number of office visits, younger age, female gender, and Caucasian race were significantly associated with a higher maximum excess weight loss percentage.[14] Our study concurs with theirs in regard to female gender, but not age. Unfortunately, data on ethnicity and number of post-operative visits were not available in the present study.

A retrospective cohort study conducted by Balague and colleagues demonstrated better weight control following roux-en-Y gastric bypass bariatric surgery, in patients that underwent BCPS.[15] In a seven-year follow-up after bariatric surgery, patients who had BCPS maintained an average of 67 percent excess body weight loss compared with 38 percent in patients who did not. Our study results show similar endpoint weight loss difference, only that the bariatric procedure performed was LAGB, which is known to have a lower complication rate and higher regain rate. Initial BMI, gender distribution, and follow-up time were similar to our study. However, Balague's study included more frequent and valid weight measurements, which adds to its validity.

In common with the published data,[4,5] our cohort presented a 75 percent partial or complete resolution rate in pre-LAGB comorbidities, including essential hypertension, dyslipidemia, diabetes mellitus, osteoarthritis, and infertility. Further, we found no differences in the resolution of associated comorbidities between the two groups in our study.

Numerous reports exist on the improvement in quality of life and body image when body contouring surgery is used after bariatric surgery.[16–19] Apart from the purely esthetic concerns, patients are motivated to undergo BCPS in the hope of achieving an improvement in medical and functional disabilities and impairments such as intertrigo, dermatitis, skin fold infections, impaired wound healing, and decreased performance of activities of daily living.[20] Mitchell and colleagues found that the majority of patients who underwent bariatric surgery desired body contouring surgery, although less than 50% of them actually underwent such surgery.[21] In our study, we found high motivation for BCPS, and furthermore, the major reasons for not undergoing BCPS were either financial (52%) or temporary reasons such as a failure to reach the target BMI (22%) or family planning (1.9%).

Limitations

Our study has several limitations. Firstly, part of our data was obtained from a patient telephone questionnaire; therefore, a recall bias is possible. Study participant recruitment was based on telephone numbers taken from a 15 year old registry which led to an inability to trace patients (no answer, switched numbers etc.), which might have resulted in selection bias. Although based on sample size calculation, our sample is limited in its capacity to provide enough power for a more elaborate statistical subgroup analysis. Finally, we did not obtain data on the amount of excess skin removed during BCPS, a fact that may partly explain weight differences. However, in our opinion, and that of recent publications[15] this effect is negligible.

Conclusions

In our study, BCPS following LAGB was associated with successful long-term control of BMI in the majority of patients in this study group. This finding remained statistically and clinically significant after being controlled for multiple factors. When examining the cohort's overall and specific motivation for BCPS, we speculate that the removal of financial barriers to surgery and early patient referral to post-bariatric consultation might result in further improvement in the long term efficacy of bariatric procedures in general. While this is the first study examining the effect of BCPS on LAGB patients, future studies are needed to compare the long-term effect and the complication rate of LAGB and BCPS compared to other bariatric techniques with or without BCPS. Additionally, it would be interesting to observe the effect of routine funding of BCPS after bariatric surgery on patients' long-term weight control and quality of life.

Conflict of interest

The authors declare that they have no conflict of interest.

References

1. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser* 2000; **894**(i–xii):1–253.

2. Hjartaker A, Langseth H, Weiderpass E. Obesity and diabetes epidemics: cancer repercussions. *Adv Exp Med Biol* 2008;**630**: 72—93.
3. Pontiroli AE, Morabito A. Long-term prevention of mortality in morbid obesity through bariatric surgery. a systematic review and meta-analysis of trials performed with gastric banding and gastric bypass. *Ann Surg* 2011;**253**:484—7.
4. Woodard GA, Peraza J, Bravo S, Toplosky L, Hernandez-Boussard T, Morton JM. One year improvements in cardiovascular risk factors: a comparative trial of laparoscopic Roux-en-Y gastric bypass vs. adjustable gastric banding. *Obes Surg* 2010; **20**:578—82.
5. Dixon JB, O'Brien PE, Playfair J, et al. Adjustable gastric banding and conventional therapy for type 2 diabetes: a randomized controlled trial. *JAMA* 2008;**299**:316—23.
6. Sjostrom L. Bariatric surgery and reduction in morbidity and mortality: experiences from the SOS study. *Int J Obes (Lond)* 2008;**32**(Suppl. 7):S93—7.
7. de Wit LT, Mathus-Vliegen L, Hey C, Rademaker B, Gouma DJ, Obertop H. Open versus laparoscopic adjustable silicone gastric banding — a prospective randomized trial for treatment of morbid obesity. *Ann Surg* 1999;**230**:800—5.
8. Nguyen NT, Slone JA, Nguyen XM, Hartman JS, Hoyt DB. A prospective randomized trial of laparoscopic gastric bypass versus laparoscopic adjustable gastric banding for the treatment of morbid obesity: outcomes, quality of life, and costs. *Ann Surg* 2009;**250**:631—41.
9. Boza C, Gamboa C, Awruch D, Perez G, Escalona A, Ibanez L. Laparoscopic Roux-en-Y gastric bypass versus laparoscopic adjustable gastric banding: five years of follow-up. *Surg Obes Relat Dis* 2010;**6**:470—5.
10. Chakravarty PD, McLaughlin E, Whittaker D, et al. Comparison of laparoscopic adjustable gastric banding (LAGB) with other bariatric procedures; a systematic review of the randomised controlled trials. *Surgeon* 2012;**10**:172—82.
11. Kinzl JF, Traweger C, Trefalt E, Biebl W. Psychosocial consequences of weight loss following gastric banding for morbid obesity. *Obes Surg* 2003;**13**:105—10.
12. Knol JA. Management of the problem patient after bariatric surgery. *Gastroenterol Clin North Am* 1994;**23**:345—69.
13. Kitzinger HB, Abayev S, Pittermann A, et al. After massive weight loss: patients' expectations of body contouring surgery. *Obes Surg* 2012;**22**:544—8.
14. Weichman K, Ren C, Kurian M, et al. The effectiveness of adjustable gastric banding: a retrospective 6-year U.S. follow-up study. *Surg Endosc* 2011;**25**:397—403.
15. Balague N, Combescure C, Huber O, Pittet-Cuenod B, Modarressi A. Plastic surgery improves long-term weight control after bariatric surgery. *Plast Reconstr Surg* 2013;**132**: 826—33.
16. Pecori L, Serra Cervetti GG, Marinari GM, Migliori F, Adami GF. Attitudes of morbidly obese patients to weight loss and body image following bariatric surgery and body contouring. *Obes Surg* 2007;**17**:68—73.
17. Migliori F, Rosati C, D'Alessandro G, Cervetti GG. Body contouring after biliopancreatic diversion. *Obes Surg* 2006;**16**: 1638—44.
18. Song AY, Rubin JP, Thomas V, Dudas JR, Marra KG, Fernstrom MH. Body image and quality of life in post massive weight loss body contouring patients. *Obes (Silver Spring* 2006; **14**:1626—36.
19. Bolton MA, Pruzinsky T, Cash TF, Persing JA. Measuring outcomes in plastic surgery: body image and quality of life in abdominoplasty patients. *Plast Reconstr Surg* 2003;**112**: 619—25. discussion 26—27.
20. Borud LJ, Warren AG. Body contouring in the postbariatric surgery patient. *J Am Coll Surg* 2006;**203**:82—93.
21. Mitchell JE, Crosby RD, Ertelt TW, et al. The desire for body contouring surgery after bariatric surgery. *Obes Surg* 2008;**18**: 1308—12.