



Despite regression of healthy lifestyle habits, weight loss after bariatric surgery is not affected during the COVID-19 pandemic

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Abstract

Background The coronavirus pandemic has caused a worldwide health crisis. Bariatric patients require extensive pre- and post-operative follow-up, which may be less feasible during public health social distancing mandates. We assessed the impact of the pandemic on the behaviors and weight loss outcomes of our pre- and post-operative bariatric patients.

Methods A retrospective review of a prospectively maintained database identified patients who underwent either sleeve gastrectomy (SG) or Roux-en-Y gastric bypass (RYGB) at a single institution between March 2018 and May 2020. A cohort undergoing surgery within 12 months before the pandemic as well as a cohort undergoing a medically supervised diet prior to surgery was surveyed regarding pre- and post-COVID-19 lifestyle habits. Excess weight loss (EWL) outcomes from a group of pre-COVID surgical patients were compared to that of a group of post-COVID surgical patients. Primary outcome was whether the lockdown changed 1-year weight loss outcomes. Secondary outcome was whether patient lifestyle behaviors were changed during the pandemic.

Results There was no difference in 1-year EWL between pre- and post-COVID SG patients (51.7% versus 55.9%, $p = 0.35$), or between pre- and post-COVID RYGB patients (88.9% versus 80.4%, $p = 0.42$). Pre-stay-at-home order, 91.8% endorsed physical activity compared to 80.3% post-stay-at-home order ($p = 0.0025$). Mean physical activity decreased from 4.2 h/week to 2.7 h/week after the stay-at-home order ($p < 0.0001$). Additionally, 41.3% reported worsened dietary habits post-stay-at-home order.

Conclusion The COVID-19 pandemic has greatly impacted the behaviors of bariatric surgery patients. Despite deterioration of lifestyle habits, 1-year weight loss outcomes after bariatric surgery remained the same before and after the instatement of social distancing measures. In the short term, the biological effect of metabolic procedures may mask the effects of suboptimal diet and physical activity, but more studies are necessary to better assess the impact of COVID-19 on outcomes after bariatric surgery.

Keywords Coronavirus · COVID-19 · Bariatric surgery · Weight loss

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Obesity is a global pandemic with rates rapidly increasing in the US [1, 2]. This rise has contributed to increasing rates of chronic conditions, such as cardiovascular disease and metabolic syndrome [3, 4]. For those with body mass index (BMI) ≥ 40 or ≥ 35 with comorbidities, surgical weight loss should be considered [5]. Bariatric surgery is also the most effective method of weight reduction; mean weight loss is 20–30% at 3 years [6, 7]. This, in turn, can lead to improvement and remission of the associated medical issues [7–10]. Studies show that 30-day mortality is improved if weight loss is achieved prior to bariatric surgery; many patients undergo a medically supervised diet (MSD) to achieve this goal [11, 12].

The rise of a new pandemic, the novel coronavirus (SARS-CoV-2) 2019 (COVID-19), has caused a worldwide health and economic crisis. To limit contagion, much of the population has been more isolated, practicing social distancing measures. Following CMS guidelines, elective surgeries, including bariatric procedures, were put on hold, as were in-person visits in preparation for these elective surgeries [13]. Surgical obesity management, both pre- and post-operatively, has understandably been affected by this crisis. Patients are not able to receive required preoperative assessments, nor are they able to attend dietitian and medical weight loss appointments in-person. Post-operative care, including nutrition and metabolic management, has also transitioned to a virtual platform.

Beyond these practical clinical issues, social distancing has affected patient routines during COVID-19. Observations from the previous SARS epidemic as well as vacation/holiday-induced changes in usual daily habits show that isolation and routine change are associated with significant weight gain in adults [14–16]. Pre- and post-operative weight loss requires access to healthy foods, behavior modification, social and professional support, and physical activity, all of which may be difficult during a pandemic [17, 18]. In addition, the increased stress that comes with self-isolation can lead to emotional eating and binge-eating behavior [19, 20].

Taking these aspects of self-isolation during COVID-19 into account, we aim to assess how this pandemic has affected our pre- and post-operative bariatric patients by assessing behavioral changes as well as weight loss outcomes.

Materials and methods

A retrospective review of a prospectively maintained database identified patients who underwent sleeve gastrectomy (SG) or Roux-en-Y gastric bypass (RYGB) between March 2018 and May 2020. The study was performed under the approval of an Institutional Review Board. Patient data included age, sex, Charlson Comorbidity Index (CCI), BMI at initial bariatric visit, and BMI at most recent clinic visit. 1-year excess weight loss (EWL) outcomes from a group of pre-COVID surgical patients (undergoing bariatric surgery between March 2018 and February 2019) was compared to that of a group of post-COVID surgical patients (undergoing bariatric surgery between June 2019 and May 2020).

Primary outcome was whether the lockdown changed 1-year weight loss outcomes. Secondary outcome was whether the lockdown changed patient lifestyle behaviors. Patients were excluded if they were awaiting laparoscopic band removal, undergoing MSD prior to a non-bariatric procedure, or treated with bariatric revision. Percent excess

weight loss (EWL) was calculated using the following formula: $(\text{initial weight} - \text{current weight}) / \text{excess weight}$. Excess weight was defined as initial weight (at time of entry into the bariatric program) – ideal weight (corresponding to BMI 25).

A cohort of patients who underwent surgery during the pandemic between March 2019 and March 2020 were surveyed. Patients in the process of undergoing insurance-mandated medically supervised diets (MSD) within the same time frame as part of our bariatric center's preoperative protocol were also surveyed. MSD durations ranged from 2 to 8 weeks, with the majority falling between 2 and 5 weeks. The survey for this study was hosted in Google Forms. Patients were given anonymized numbers prior to form entry and were contacted by phone. Survey assessments included: pre- and post-COVID-19 physical activity regimen and barriers to physical activity, as well as characterization of pre- and post-COVID-19 diet and food source. Data were also collected regarding pre- and post-COVID-19 drug and alcohol use in drinks per week, presence of new or worsening medical issues, and pre- and post-COVID-19 weight loss goals.

Continuous variables were analyzed using Student's *t* test. Pearson χ^2 test and Fisher's exact test was used for categorical variables. All analyses were performed using R (Version 4.1.2, Vienna, Austria). All statistical tests were 2-sided with $p < 0.05$ considered to be statistically significant.

Results

We identified 138 patients undergoing either SG or RYGB. Mean patient age was 41.3 years, mean BMI at initial bariatric encounter was 46.9 kg/m². Gender distribution included 80% female patients. There were no major differences in demographics between pre- and post-COVID SG or RYGB patients (Table 1). There was no difference in one-year EWL between pre- and post-COVID SG patients (51.7% versus 55.9%, $p = 0.35$), and there was no difference in 1-year EWL between pre- and post-COVID RYGB patients (88.9% versus 80.4%, $p = 0.42$) (Table 2).

Survey data: physical activity

A total of 184 patients were successfully contacted for the survey. Of these patients, 55 (29.9%) received SG, 24 (13%) received RYGB, and 91 (49.5%) were undergoing pre-operative MSD. Demographic data for surveyed patients are shown in Table 3. Revision bariatric surgery was performed on 4.3% of patients, while 3.3% were awaiting revision procedures. When evaluating their post-COVID-19 physical activity habits, 60.9% reported decreased physical activity, 12.5% noted increased

Table 1 Demographic data: pre-COVID versus post-COVID

	All (<i>n</i> = 149)	Sleeve gastrectomy (<i>n</i> = 121)		<i>p</i> -value	Roux-en-Y gastric bypass (<i>n</i> = 28)		<i>p</i> -value
		Pre-COVID (<i>n</i> = 89)	Post-COVID (<i>n</i> = 32)		Pre-COVID (<i>n</i> = 16)	Post-COVID (<i>n</i> = 12)	
Age, years (SD)	41.3 ± 10.5	40.9 ± 10.6	38.7 ± 10.3	0.31	44.1 ± 10.6	46.8 ± 8.9	0.47
Initial BMI, kg/m ² (SD)	46.9 ± 9.5	48.1 ± 11.1	45.5 ± 5.5	0.08	44.8 ± 8.2	44.9 ± 5.7	0.97
Female, <i>n</i> (%)	119 (80%)	71 (79.8%)	25 (78.1%)	0.80	12 (75%)	11 (91.7%)	0.36
CCI, <i>n</i> (%)							
0	57 (38.2%)	40 (44.9%)	16 (50%)		4 (25%)	5 (41.7%)	
1	45 (30.2%)	26 (29.2%)	12 (37.5%)		8 (50%)	2 (16.7%)	
2	15 (10.1%)	9 (10.1%)	1 (3.1%)		2 (12.5%)	3 (25%)	
≥ 3	32 (21.5%)	14 (15.7%)	3 (9.4%)		2 (12.5%)	2 (16.7%)	

Table 2 Average 1-year excess weight loss

	Pre-COVID cohort	<i>n</i>	Post-COVID cohort	<i>n</i>	<i>p</i> -value
Post-sleeve gastrectomy, % (SD)	51.7 ± 18.9	89	55.9 ± 18.3	32	0.35
Post-RYGB, % (SD)	88.9 ± 27.2	16	80.4 ± 22.4	12	0.42

physical activity, and 26.6% endorsed stable rates of physical activity (Table 4). Pre-stay-at-home order, the percentage of patients endorsing physical activity was 91.8% compared to 80.3% post-stay-at-home order ($p = 0.0025$). Mean physical activity decreased from an average of 4.2 h/week to 2.7 h/week after the stay-at-home order ($p < 0.0001$) (Table 5). The primary method of physical activity during COVID-19 was walking (136 [73.9%] patients). Prior to COVID-19, 48 (26.1%) patients were exercising at the gym; during COVID-19, no patients were. The most

commonly cited barriers to physical activity were the stay-at-home order (65 patients), gym closure (54 patients), and inability due to a chronic medical issue (23 patients).

Survey data: diet, substance, and mental health

When patients reported their post-COVID-19 dietary habits, 41.3% were worsened, 16.3% were improved, and 42.4% were unchanged (Table 4). Of the 74 patients specifying how their diet had worsened, 26 (35.1%) reported increased intake of processed carbohydrates, 31 (41.9%) reported increased snacking, 15 (20.3%) reported a combination of the former two, and 2 (2.7%) had difficulty obtaining healthy food options due to isolation during COVID-19.

Thirty-eight patients endorsed alcohol use. Intake remained stable for 84.2% of these patients, with 8.2% endorsing increased intake and 7.6% noting decreased intake. Seven patients endorsed drug use, all of whom were using marijuana—each of these patients reported increased or stable patterns of use. During COVID-19, 37 (20.1%) patients reported worsening of chronic medical issues; 104 (56.6%) had increased anxiety and depression.

Table 3 Demographic data (survey patients only)

	All (<i>n</i> = 184)	Pre-bariatric/MSD (<i>n</i> = 92)	Post-bariatric (<i>n</i> = 92)	<i>p</i> -value
Age, years (SD)	43.7 ± 12.3	43.7	43.7	0.97
BMI at last encounter, kg/m ² (SD)	40.7 ± 9.91	45.3	36.2	< 0.0001
Female, <i>n</i>	158 (85.9%)	77 (84.6%)	81 (87.1%)	0.67
CCI, <i>n</i>				
0	77 (41.8%)	40 (44%)	37 (39.8%)	
1	43 (23.4%)	18 (19.8%)	25 (26.9%)	
2	32 (17.4%)	15 (16.5%)	15 (16.1%)	
≥ 3	32 (17.4%)	18 (19.8%)	13 (14%)	

Table 4 Lifestyle questions

	Better	Worse	Unchanged
All surveyed patients (<i>n</i> = 184)			
Exercise	23 (12.5%)	112 (60.9%)	49 (26.6%)
Dietary habits	30 (16.3%)	76 (41.3%)	78 (42.4%)
MSD (<i>n</i> = 92)			
Exercise	13 (14.1%)	53 (57.6%)	26 (28.3%)
Dietary habits	22 (23.9%)	40 (43.5%)	30 (32.6%)
SG and RYGB (<i>n</i> = 92)			
Exercise	10 (10.9%)	59 (64.1%)	23 (25%)
Dietary habits	8 (8.7%)	36 (39.1%)	48 (52.2%)

Discussion

Our study showed that despite adverse effects of the COVID-19 pandemic on self-reported lifestyle behaviors, the short-term weight loss outcomes after bariatric surgery were not different. These results were observed for both SG and RYGB. If one considers weight loss after surgical intervention to be mostly governed by voluntary modification of dietary and physical activity habits, this finding would seem surprising and paradoxical. If, however, the physiologic effects of metabolic surgery predominate, post-operative weight loss may, to a large degree, be independent of volitional behaviors, especially in the short-term when the entero-neurohormonal mechanisms are most potent. Indeed, it is now widely accepted that the effectiveness of surgical weight loss is mediated through pleiotropic hormonal mechanisms [21]. Likewise, post-surgical weight regain may also be influenced by genetic and physiologic factors. Investigators have shown that weight regain was not prevented by intense lifestyle interventions 4 years after gastric bypass [22]. By no means, however, should one leap to the conclusion that lifestyle optimization is unnecessary and unimportant.

Almost all aspects of life have fallen victim to the COVID-19 pandemic, and healthy lifestyle habits are no exception. In the present study, we aimed to evaluate self-reported dietary and physical activity behaviors in our bariatric patients, both before and after surgery, to underline the ubiquitous effects of social distancing and public health infection control measures for all patients moving through the surgical weight loss pathway. Over half of the patients noted a decrease in their weekly physical activity, and the percentage of patients ceasing all physical activity more than doubled during the pandemic, which can partially be explained by the most commonly identified barriers such as gym closure and orders to stay at home. It has been established that lack of physical activity is positively associated with increased weight regain after bariatric surgery, but this is more germane to longer term results [23]. Moreover, other studies using high volume physical activity interventions have failed to show any effect on weight after surgical interventions with gastric bypass and adjustable gastric banding, in both the short-term and long-term [24]. Interestingly, while observational studies suggest positive correlations between exercise and post-operative weight loss, intervention studies do not consistently support causality [25, 26].

COVID-19 also contributes to regression of healthy nutrition behaviors; over a third of our patients indicated that they had worsened eating habits, with snacking as one of the primary factors. Maladaptive eating and snacking have both been significantly associated with weight regain after bariatric surgery, but these observations and associations are more apparent with medium- and long-term outcomes [23, 27, 28]. The stress of changing routines and fear of falling ill, along with increased symptoms of depression and anxiety that we noted in our study, may be factors as well, as stress is associated with poor eating behaviors and increased snacking [29]. Depression in particular has been significantly associated with post-operative weight regain in bariatric patients [30].

One of the strengths of this study was the use of a comparator group that underwent bariatric surgery soon before the pandemic restrictions, with the same surgeons and

Table 5 Pre- versus post-COVID physical activity

	Pre-stay-at-home order	Post-stay-at-home order	<i>p</i> -value
All surveyed patients (<i>n</i> = 184)			
Exercised, <i>n</i> (%)	168 (91.8%)	147 (80.3%)	0.0025
Amount exercised, h/week (SD)	4.2 ± 3.7	2.7 ± 2.9	<0.0001
MSD (<i>n</i> = 92)			
Exercised, <i>n</i> (%)	83 (91.2%)	77 (83.7%)	0.18
Amount exercised, h/week (SD)	4 ± 3.8	2.8 ± 3	0.013
SG and RYGB (<i>n</i> = 92)			
Exercised, <i>n</i> (%)	85 (92.4%)	70 (76.9%)	0.004
Amount exercised, h/week (SD)	4.3 ± 3.7	2.6 ± 2.8	0.0005

multidisciplinary team, the main difference being a transition from face-to-face visits to the majority of postoperative care conducted via telemedicine. Another study revealed worse weight loss outcomes one year after surgery when post-pandemic patients were compared to pre-pandemic patients, but it was limited to only SG intervention in a European center where there may have been different COVID-19 public health regulations [31]. In our center, no changes were made to the follow-up schedule during the pandemic with the goal of seeing patients with the same frequency as the pre-COVID timeframe. While there was likely an adjustment period during the transition to remote visits, it is possible that the convenience of telemedicine made healthcare more accessible as patients and providers became accustomed to the new system. Although overall short-term weight loss outcomes were superior in our RYGB patients, there were no differences between the pre- and post-pandemic groups when separated by procedure type.

This study is limited by the fact that the data relied on patient perception and recall, which introduces a number of potential biases. It is unlikely that the survey biases differ significantly from in-clinic patient reporting, though remote patients may have tended to under-report negative outcomes. The pandemic also affected patients to different extents and different ways, which can lead to a heterogeneous data set. Finally, there was some difficulty in reaching patients for survey via the telephone.

Further investigation should examine bariatric patients' weight status at extended time points to assess whether weight loss differs in the medium- or long-term, although the pandemic will likely confer less impact on lifestyle behaviors as public health restrictions relax. In addition, change in weight-loss habits and comorbidities should be assessed prospectively and more systematically to reduce the risk of recall and social desirability bias. Knowledge and data regarding the impact of lifestyle support and interventions on weight loss and weight regain after bariatric surgery may better inform how best to allocate resources for patients at various post-operative time points during possible future COVID-19 surges.

Conclusion

During the COVID-19 pandemic, public health and social distancing mandates adversely affected patients' healthy behaviors as they progressed through the bariatric surgery path. Despite this deterioration of lifestyle habits, weight loss at 1 year after bariatric surgery was not different before and after social distancing measures took hold. In the short term, the biological effect of metabolic procedures may mask the effects of suboptimal diet and physical activity,

but more studies are necessary to better assess the impact of COVID-19 on outcomes after bariatric surgery.

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