Safety of Bariatric Surgery in ≥ 65-Year-Old Patients During the COVID-19 Pandemic

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Received: 21 January 2022 / Revised: 10 April 2022 / Accepted: 13 April 2022
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Abstract

Background Age ≥ 65 years is regarded as a relative contraindication for bariatric surgery. Advanced age is also a recognised risk factor for adverse outcomes with Coronavirus Disease-2019 (COVID-19) which continues to wreak havoc on global populations. This study aimed to assess the safety of bariatric surgery (BS) in this particular age group during the COVID-19 pandemic in comparison with the younger cohort.

Methods We conducted a prospective international study of patients who underwent BS between 1/05/2020 and 31/10/2020. Patients were divided into two groups — patients ≥ 65-years-old (Group I) and patients < 65-years-old (Group II). The two groups were compared for 30-day morbidity and mortality.

Results There were 149 patients in Group 1 and 6923 patients in Group II. The mean age, preoperative weight, and BMI were 67.6 ± 2.5 years, 119.5 ± 24.5 kg, and 43 ± 7 in Group I and 39.8 ± 11.3 years, 117.7±20.4 kg, and 43.7 ± 7 in Group II, respectively. Approximately, 95% of patients in Group 1 had at least one co-morbidity compared to 68% of patients in Group 2 (p = < 0.001).

The 30-day morbidity was significantly higher in Group I (11.4%) compared to Group II (6.6%) (p = 0.022). However, the 30-day mortality and COVID-19 infection rates were not significantly different between the two groups.

Conclusions Bariatric surgery during the COVID-19 pandemic is associated with a higher complication rate in those ≥ 65 years of age compared to those < 65 years old. However, the mortality and postoperative COVID-19 infection rates are not significantly different between the two groups.

Keywords Obesity · Older patients · SARS-CoV-2 · Resuming elective surgery · Metabolic surgery

Introduction

Bariatric surgery is currently the only evidence-based durable treatment option for patients with obesity and related comorbidities. An ageing population worldwide presents a challenge to all healthcare practitioners, including those involved in providing obesity management services [1, 2]. Previously, advanced age was considered a relative contraindication for bariatric surgery [3]. However, the evolution of laparoscopic techniques and advances in perioperative care protocols have changed perceptions [4, 5].

While some studies confirm good weight loss and acceptable postoperative morbidity and mortality in older individuals, others show significant perioperative morbidity and mortality with varying weight loss results [6–8]. Additionally, the heterogeneity of the studies with different age cutoff points and definitions of the older patients’ population prevents the generalisation of these results [9, 10].

Older age is associated with an unfavourable prognosis with COVID-19 should a patient undergoing bariatric
surgery develop perioperative COVID-19 infection. At the same time, obesity and its associated comorbidities also increase the risk of adverse outcomes with COVID-19 [11–13]. This poses a dilemma for healthcare professionals dealing with older patients seeking bariatric surgery.

The present study aimed to understand the safety of bariatric surgery in ≥ 65-years-old patients during the COVID-19 pandemic. This study was a subset analysis of the GENEVA dataset; a global study aimed to prospectively assess the safety of bariatric surgery during the COVID-19 pandemic [14–16].

### Methods

#### Study Design, Setting, and Population

The GENEVA study was a global, multicentre, observational study of Bariatric Surgery (elective primary, elective revisional, and emergency) performed between 1/05/2020 and 31/10/2020 in the adult (≥ 18 years) population. The detailed methods have been described elsewhere [14–16].

### Table 1

| Group | Age (Min.–max.) | Sex | Preoperative Weight (Kg) | Calculated Preoperative BMI | White vs non white | Ethnicity of patient |
|-------|----------------|-----|--------------------------|-----------------------------|-------------------|---------------------|
| I     | 65–76 yrs    | 102 (68.5%) | 102 (68.5%) | 23 (15.4%) | 5 (0.3%) | I, American Indian or Alaska Native |
| II    | 17–64 yrs    | 5085 (73.5%) | 5085 (73.5%) | 1780 (25.7%) | 10 (0.1%) | II, Asian |
| III   | 67.6 ± 2.5   | 1837 (26.5%) | 1837 (26.5%) | 117.7 ± 20.4 | 86 (1.2%) | III, Black or African American |
| IV    | 39.8 ± 11.3  | 1307 (26.5%) | 1307 (26.5%) | 117.7 ± 20.4 | 14 (0.2%) | IV, Hispanic or Latino |
| V     | 126 (84.6%)  | 5143 (74.3%) | 5143 (74.3%) | 43.7 ± 7 | 126 (84.6%) | V, Native Hawaiian or Other Pacific Islander |
| VI    | 47 (31.5%)   | 390 (5.6%) | 390 (5.6%) | 47 (31.5%) | 0 (0%) | VI, White |
We used 65 years as a cutoff point to define the older age group as per the World Health Organisation and The National Institute for Health and Care Excellence (NICE) definitions [17, 18]. We divided patients undergoing primary BS into two groups — those ≥ 65 years old (Group I) and those < 65 years old (Group II). The two groups were compared with each other with regard to basic demographics, 30-day morbidity and mortality, postoperative symptomatic COVID-19 infection rates, and procedure choice.

The main outcome measures of this study were 30-day all-cause and COVID-19 specific morbidity and mortality. Continuous data were presented as mean ± standard deviation (SD) or median (IQR) depending on data distribution. Frequencies were used to summarise categorical variables. Independent t-test or Mann Whitney U test examined differences between continuous variables depending on data distribution. A chi-square test or Fisher’s exact test was used to compare categorical variables. Significance levels were set at p < 0.05. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) statistical software, version 27.0 (SPSS Inc).

| Table 2: Comparison between the two groups according to comorbidity and smoking status |
|---------------------------------|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                | Group I (≥ 65)                  | Group II (< 65)  | χ²   | p    |
| Any comorbidity                | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 8 (5.4%)                       | 2193 (31.7%)     | 47.093* | <0.001* |
| Yes                             | 141 (94.6%)                    | 4730 (68.3%)     |      |     |
| Type 2 diabetes not on medication | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 144 (96.6%)                    | 6507 (94%)       | 1.834 | 0.176 |
| Yes                             | 5 (3.4%)                       | 416 (6%)         |      |     |
| Type 2 diabetes on oral medication | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 98 (65.8%)                     | 6116 (88.3%)     | 69.708* | < 0.001* |
| Yes                             | 51 (34.2%)                     | 807 (11.7%)      |      |     |
| Type 2 diabetes on insulin      | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 126 (84.6%)                    | 6694 (96.7%)     | 62.438* | < 0.001* |
| Yes                             | 23 (15.4%)                     | 229 (3.3%)       |      |     |
| Overall diabetes                | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 77 (51.7%)                     | 5524 (79.8%)     | 69.983* | < 0.001* |
| Yes                             | 72 (48.3%)                     | 1399 (20.2%)     |      |     |
| Hypertension                    | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 38 (25.5%)                     | 4851 (70.1%)     | 135.764* | < 0.001* |
| Yes                             | 111 (74.5%)                    | 2072 (29.9%)     |      |     |
| Sleep apnea not on CPAP         | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 126 (84.6%)                    | 6091 (88%)       | 1.604 | 0.205 |
| Yes                             | 23 (15.4%)                     | 832 (12%)        |      |     |
| Sleep apnea on CPAP             | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 111 (74.5%)                    | 6014 (86.9%)     | 19.254* | < 0.001* |
| Yes                             | 38 (25.5%)                     | 909 (13.1%)      |      |     |
| Hypercholesterolemia            | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 87 (58.4%)                     | 5461 (78.9%)     | 36.233* | < 0.001* |
| Yes                             | 62 (41.6%)                     | 1462 (21.1%)     |      |     |
| Other comorbidities             | (n = 149)                      | (n = 6923)       |      |     |
| No                              | 87 (58.4%)                     | 4926 (71.2%)     | 11.516  | 0.001    |
| Yes                             | 62 (41.6%)                     | 1997 (28.8%)     |      |     |
| Smoking status                  | (n = 149)                      | (n = 6922#)      |      |     |
| Current smoker                  | 11 (7.4%)                      | 1027 (14.8%)     | 28.300* | < 0.001* |
| Ex-smoker                       | 40 (26.8%)                     | 887 (12.8%)      |      |     |
| Non-smoker                      | 98 (65.8%)                     | 5006 (72.3%)     |      |     |

χ²: Chi-square test; FE: Fisher Exact; p: p-value for comparing the two studied groups; *Statistically significant at p ≤ 0.05; #Cases with missing data were excluded from the comparison between the two groups CPAP, continuous positive airway pressure.
Results

Data were collected from 179 centres in 42 countries by 470 surgeons (Appendix 1). Seven thousand ninety-two adult patients who underwent primary BS between 01/05/2020 and 31/10/2020 were included. Complete 30-day morbidity and mortality data were available for 7084 (99.88%) patients. The mean age of the entire cohort was 40.35 ± 11.9 years, and 5197 (73.4%) were females. The mean preoperative weight and body mass index (BMI) was 119.49 ± 24.4 Kg and 43.03 ± 6.9 Kg/m², respectively.

Table 1 compares the demographics of the two groups. The mean age for group I was 67.6 ± 2.5 years, and for group II was 39.8 ± 11.3 years. Group I included more patients of white ethnicity (84.6%) than Group II (74.3%) (p = 0.004). The rest of the demographic parameters, including pre-operative BMI and weight, were comparable between the two groups (Table 1).

Table 2 details the prevalence of comorbidities and smoking status in the two groups. Nearly 95% of patients in Group I had at least one co-morbidity compared to 68% of patients in Group II (p < 0.001). Specifically, a significantly greater proportion of patients in Group I suffered from diabetes mellitus (DM) (48.3% vs 20.2%), hypertension (74.5% vs 29.9%), obstructive sleep apnoea requiring continuous positive airway pressure (CPAP) therapy (25.5% vs 13.1%), and hypercholesterolemia (41.6% vs 21.1%) compared to Group II (all comparisons p < 0.001) (Table 2). In Group II, 14.8% of patients were current smokers, compared to 7.4% of Group I (p < 0.001).

The most common operation type in both groups was laparoscopic sleeve gastrectomy (LSG) (Group 1: 51.0%; Group 2: 56.4%). This was followed by Roux-en-Y gastric bypass (RYGB) (Group 1: 32.9%; Group 2: 29.4%) and one-anastomosis gastric bypass (OAGB) (Group 1: 8.7%; Group 2: 10.0%). Other forms of procedures were performed in 7.4% (Group 1) and 4.2% (Group 2) of individuals. There were no significant differences in procedure choice between the two groups (p = 0.164) (Table 3).

There were significantly more complications in Group I (11.4%) compared to Group II (6.6%) (p = 0.022; Table 4). There was one (0.7%) mortality in Group I and eight (0.1%) in Group II (p = 0.17 on Fisher’s exact test). Additionally, 38 (0.5%) patients in Group II had symptomatic COVID-19 infection within 30 days of the surgical operation compared to none in Group I (p = 1.000).

Table 5 presents 30-day morbidity and mortality analysed by procedure type in both groups. Differences in morbidity and mortality were only significant for LSG.

Discussion

This study has demonstrated that 30-day morbidity was significantly higher for patients ≥ 65 years of age receiving bariatric surgery compared to those < 65 years of age during the COVID-19 pandemic. However, there was no significant difference in 30-day mortality or 30-day symptomatic post-operative COVID-19 infection rates between the two groups.

The finding of increased 30-day morbidity in patients ≥ 65 years old maybe because 94.6% of patients in Group I had at least one co-morbidity compared to 68.3% in Group II. This is similar to the findings by Susmallian et al. who identified that 77% of patients ≥ 65 years of age had at least one comorbidity [7]. Similarly, Bhandari et al. demonstrated that 47.3%, 84.2%, and 17.9% of patients ≥ 65 years old

| Surgical procedure | Group I (≥ 65) (n=149) | Group II (˂ 65) (n=6923) | χ² | p |
|--------------------|------------------------|------------------------|----|---|
| LSG                | 76 (51%)               | 3907 (56.4%)           | 5.111 | 0.164 |
| RYGB               | 49 (32.9%)             | 2038 (29.4%)           |    |    |
| OAGB               | 13 (8.7%)              | 689 (10%)              |    |    |
| Others             | 11 (7.4%)              | 289 (4.2%)             |    |    |

χ²: Chi-square test; p: p-value for comparing between the two studied groups; *Statistically significant at p ≤ 0.05

LSG, laparoscopic sleeve gastrectomy; OAGB, one anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass

| Complications | Group I (≥ 65) (n=149) | Group II (˂ 65) (n=6923) | χ² | p |
|---------------|------------------------|------------------------|----|---|
| No            | 132 (88.6%)            | 6463 (93.4%)           | 5.265 * | 0.022* |
| Yes           | 17 (11.4%)             | 460 (6.6%)             |    |    |

Clavien-Dindo (CD) Score

| CD Score | Group I (≥ 65) (n=149) | Group II (˂ 65) (n=6923) | χ² | p |
|----------|------------------------|------------------------|----|---|
| 0        | 132 (88.6%)            | 6463 (93.4%)           |    |    |
| 1        | 3 (2%)                 | 162 (2.3%)             |    |    |
| 2        | 4 (2.7%)               | 132 (1.9%)             |    |    |
| 3A       | 4 (2.7%)               | 29 (0.4%)              |    |    |
| 3B       | 4 (2.7%)               | 91 (1.3%)              |    |    |
| 4A       | 1 (0.7%)               | 31 (0.4%)              |    |    |
| 4B       | 0 (0%)                 | 7 (0.1%)               |    |    |
| 5 (Mortality) | 1 (0.7%)               | 8 (0.1%)               |    |    |

COVID within 30 days

| Group | No (n=149) | Yes (n=6923) | χ² | p |
|-------|-----------|-------------|----|---|
| No    | 149 (100%)| 6885 (99.5%)| 0.822 | Fisher’s exact test |
| Yes   | 0 (0%)    | 38 (0.5%)   |    |    |

χ²: Chi-square test; FE: Fisher Exact; p: p-value for comparing the two studied groups; *Statistically significant at p ≤ 0.05

CD, Clavein-Dindo Score; COVID, Novel Coronavirus 2019
suffered from diabetes, hypertension, and coronary heart disease compared to 20.1%, 23.4%, and 3.8%, respectively, in the younger age group [19]. The 30-day morbidity in our series was significantly higher in the older patients at 11.4% compared to 6.6% in the younger age group. A previous analysis of the National Surgical Quality Improvement Program (NSQIP) database demonstrated similar findings with increased rates of serious morbidity in the older age group compared to younger patients [20]. Another study reported a higher overall complication rate of 8.42% in older patients compared to 5.59% in the younger group, with significant differences in CD grades 3B and 4A [7].

In the current study, there was one mortality in the older age group (n = 149) and eight in the younger group (n = 6923), representing 0.7% and 0.1%, respectively. Though the difference did not reach statistical significance, this may be due to the small sample size. Bariatric teams should, therefore, be careful in offering bariatric surgery to patients in this age group. In contrast, a recent meta-analysis found that the mortality rate after LSG was similar at 0.2% in patients > 60 years and those ≤ 60 years of age whereas the mortality after RYGB was 2.2% and 0% (0/182), respectively [21]. However, those authors used 60 years as the cutoff which is no longer used to define older patients by WHO and other such bodies.

LSG was unsurprisingly the most commonly performed operation type in both groups (Group 1: 51.0%; Group 2: 56.4%) (Table 3). Importantly, there were no significant differences in procedure choice between the two groups.

Although the 30-day morbidity was significantly higher for LSG with Group I (15.8% vs 5.7%), it is difficult to draw firm conclusions from this due to the relatively low patient numbers (n = 76). All other procedures had comparable morbidity rates in both groups but once again there is potential for Type II error due to small numbers. We cannot make any justifiable conclusions regarding morbidity and mortality of different procedures in two groups based on the data in our study. Authors would however suggest that procedure selection is made in the usual manner on an individualised basis for each patient taking into account their wishes and specific characteristics.

### Strengths and Weaknesses

This study has several weaknesses. Firstly, it only included data from participating centres and might therefore not represent the complete global picture. Additionally, we cannot guarantee that all contributors submitted all their consecutive patients during the study period, though collaborators were repeatedly reminded to do so. It is also possible that all adverse outcomes were not reported, but it is hoped that anonymous data collection and reporting would have discouraged any underreporting. Lastly, there were only 149 patients in the older age group, meaning that there is a potential for Type II error concerning the difference in mortality which indeed appears to be higher in the older population (0.7% vs 0.1%).

At the same time, this is the first international study examining the safety of bariatric surgery in those ≥ 65 years

### Table 5 Morbidity and Mortality rates in each group sub-divided by procedure type

| Procedure Type | Overall (n = 7072) | Group I (n = 149) | Group II (n = 6923) | p-value |
|---------------|--------------------|------------------|---------------------|---------|
| Total patients |                   |                  |                     |         |
| LSG 30-day Morbidity | 233/3983 (5.8%)    | 12/76 (15.8%)    | 221/3907 (5.7%)     | < 0.001 |
| LSG 30-day mortality | 4/3983 (0.10%)     | 1/76 (1.32%)     | 3/3907 (0.08%)      |         |
| RYGB 30-day Morbidity | 166/2087 (8.0%)   | 4/49 (8.2%)      | 162/2038 (7.9%)     | 0.956   |
| RYGB 30-day mortality | 0/0                | 0/0              | 0/0                 |         |
| OAGB 30-day Morbidity | 53/702 (7.5%)      | 0/13             | 53/689 (7.7%)       | 0.298   |
| OAGB 30-day mortality | 3/702 (0.43%)      | 0/0              | 3/689 (0.44%)       |         |
| Other 30-day Morbidity | 25/300 (8.3%)     | 1/11 (9.1%)      | 24/289 (8.3%)       | 0.926   |
| Other 30-day mortality | 2/300 (0.67%)     | 0/0              | 2/289 (0.69%)       |         |

*LSG, laparoscopic sleeve gastrectomy; OAGB, one anastomosis gastric bypass; RYGB, Roux-en-Y gastric bypass*

Chi-square test performed (age more than 65 compared against presence/absence of morbidity/mortality)
of age during the COVID-19 pandemic, which is known to have affected older people disproportionately. Moreover, this study included a broad range of patients representing a wide range of demographics, geographical distribution, stage of COVID-19 pandemic severity in the host population, and surgeon and centre experiences. Other strengths of this study include the large sample size, the global reach of the study, high data completion rate, and nearly complete follow-up.

Conclusion

Bariatric surgery during the COVID-19 pandemic was associated with higher 30-day morbidity in older patients (≥ 65 years old) compared to younger patients. The mortality and postoperative COVID-19 infection rates were comparable to the younger age group.

Author Contribution  RS: conceptualization, methodology, investigation, formal analysis. IO: formal analysis, writing — original draft preparation, discussion of the results, writing — review & editing. BM, YR, YG, AAT, CL, and TW: investigation, data curation. KM: conceptualization, methodology, writing — review & editing, supervision. All authors have seen the final manuscript and approved it. The study was designed and conducted by the study group and the authors on behalf of GENEVA collaborators.

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The study was funded by the bariatric unit’s research funds at University Hospitals Birmingham NHS Foundation Trust (Birmingham, UK).

Data Statement The data used to support the findings of this study can be released upon request.
Declarations

Ethics Approval  This project was registered as a multinational audit (number: 5197) at the University Hospitals Birmingham NHS Foundation Trust, UK. Each site project lead was responsible for obtaining local governance approvals and data sharing agreements before entering data into the registry.

Consent to Participate  No informed consent was needed for an audit of this nature.

Conflict of Interest  KM has been paid honoraria by various NHS trusts and Ethicon®, Medtronic®, Gore Inc®, and Olympus® for educational activities related to bariatric surgery. Other authors have no conflicts of interest.

Statement of Human and Animal Rights  Not Applicable

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