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Outcomes of laparoscopic sleeve gastrectomy at a bariatric unit in South Africa

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HIGHLIGHTS

- First study of laparoscopic sleeve gastrectomy performed in South Africa.
- Laparoscopic sleeve gastrectomy produces an adequate percentage excess BMI loss at 6 months.
- A significant improvement in the quality of life was observed.
- Results of this research are comparable to other studies of LSGs.
- Low complication rate supports the use of the procedure.

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ABSTRACT

Background: Laparoscopic sleeve gastrectomy (LSG) has gained popularity over the years as a standalone procedure. In 2014, it was the most rapidly growing bariatric procedure. The aim of this study was to describe the outcomes of LSG at a single bariatric unit in Johannesburg, South Africa, using the Bariatric Analysis and Reporting Outcome System (BAROS) standardised scoring.
Methods: A retrospective record review and analysis was carried out using data collected from patients who had LSGs. The information obtained included patient demographics, comorbidities, preoperative weight and height, operative technique, time and complications, postoperative gastrografin swallow results, hospital stay, and weight at 6 months postoperatively. The percentage of excess body mass index (BMI) loss (%EBMIL) was calculated at 6 months, and included in the BAROS questionnaire completed by the patients at the 6-month follow-up visit. Statistical significance was set at $p < 0.05$.
Results: A total of 103 patients were included in the study; of these, 85.4% were female and 14.6% were male. The mean preoperative BMI was 42.1 kg/m^2; additionally, 77.7% of the patients in the study had comorbidities prior to the procedure. The mean operative time was 104.3 min, with a mean hospital stay of 2.5 days. No mortalities occurred, and a complication rate of 7.7% was encountered. At the 6-month follow-up, the mean %EBMIL was 65%. When followed up at 6 months, all 103 patients demonstrated no failures according to the BAROS assessment. It was found that 96.1% had good, very good or excellent outcomes. In total, 9.7% of the patients had an excellent outcome.
Conclusions: LSG was shown to produce an adequate %EBMIL loss at 6 months, resulting in a significant improvement in the quality of life (QoL), coupled with good BAROS outcomes. The results of this research are comparable to other studies of LSGs, and the low complication rate supports the use of the procedure and accounts for no observed mortality.

1. Background

Obesity is a growing health problem that affects more than one-third of the US population [1]. In the past 30 years, the age-standardised prevalence of obesity has almost doubled worldwide [2]. Obesity is defined as a body mass index (BMI) ≥30 kg/m^2, and is further subdivided into three classes by the BMI value [3].

1.1. The South African context

The end of Apartheid in 1994 promised a better life for all South

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Africans, but also brought with it an abrupt increase in diseases of lifestyle [4]. South Africa belongs to the subset of regions with the highest obesity prevalence [2]. In a 10-year report, the South African Medical Research Council stated that 61% of South Africans are overweight, obese or morbidly obese [5]. Southern Sub-Saharan Africa exhibits the greatest difference in the male and female prevalence of obesity, with prevalences of 18.7% and 36.7% in males and females, respectively [6]. Weight gain is observed to be highest in middle age, and once obese, there is a significant increase in morbidity and mortality [7]. This is accounted for by the comorbid conditions triggered by obesity, including type 2 diabetes, hypertension and heart disease, and certain types of cancer [8].

1.2. Bariatric surgery

Currently, bariatric surgery is the most effective method to treat morbid obesity and achieve a reduction in patient weight, control or the remission of comorbid conditions, and ultimately a reduction of long-term mortality [9]. Furthermore, bariatric surgery shows greater cost-effectiveness compared to other nonsurgical treatments [9]. To date, six procedures have predominated bariatric surgery. In chronological order, these are jejunoileal bypass (JIB), Roux-en-Y gastric bypass (RYGB), vertical banded gastroplasty (VBG), biliopancreatic diversion (BPD), adjustable gastric banding (AGB) and sleeve gastrectomy (SG) [10].

1.3. Laparoscopic sleeve gastrectomy (LSG)

Sleeve gastrectomy is a partial gastrectomy where the majority of the greater curvature of the stomach is removed. The antrum is divided approximately 4 cm from the pylorus and a tubular stomach (sleeve) is fashioned around a bougie (32–40 French in size) [11]. It was initially performed in patients characterised by high surgical risk and represented the first stage of a more complex procedure, namely duodenal switch or gastric bypass [12]. In subsequent years, SG has gained popularity as a standalone procedure [12]. Standalone SG was first advocated by Regan et al., in 2005, and was popularised by Michel Gagner [13]. In 2014, SG was the most rapidly growing bariatric procedure in terms of the number of bariatric surgeries performed [10]. SG is easier to perform than RYGB and does not require any anastomosis. Further, there is a reduced risk of internal herniation and trace element or mineral deficiencies [14]. The mechanism of weight loss in SG is largely restrictive in nature, as the stomach is reduced in size. However, an interesting point is that the physiological consequences of SG also account for weight loss after the procedure. Levels of ghrelin are reduced; thus, the patient feels less hungry [15]. In a paper published in *Nature* in 2014, Ryan et al. elucidated further molecular mechanisms for weight loss [16]. SG results in significant increases in circulating bile acids, which bind to the farsenoid-X receptor (FXR), thereby regulating metabolism [16].

1.4. Bariatric surgery outcomes

Assessments of the results of bariatric surgery have incorporated many different factors. Outcomes of a bariatric procedure should include weight loss, improvement in comorbid conditions, and an assessment of the patient's quality of life (QoL) [17]. The use of a standardised scoring system allows for a better comparison of the results across different studies. The Bariatric Analysis and Reporting Outcome System (BAROS) was developed by Oria and Moorehead [17], and offers two distinct advantages; it is comprehensive and its ease of use allows it to be utilised in daily practice [18]. The aim of this study was to describe the outcomes of LSG at a single bariatric unit in Johannesburg, South Africa, using the Bariatric Analysis and Reporting Outcome System (BAROS) standardised scoring.

2. Methods

An intensive literature search revealed no articles describing the outcomes of SG in the South African context. With the recent advent of SG and its increased use worldwide, it would be helpful to analyse outcomes of the procedure in a South African setting.

2.1. Study area

This study is a single-institution study based at the Bariatric Unit at Life Bedford Gardens Hospital in Johannesburg, South Africa. This unit is multidisciplinary in nature, and provides a holistic bariatric surgery service. The Life Bedford Gardens Hospital is a private healthcare hospital and requires payment for services. Available bariatric procedures include the placement of an intra-gastric balloon, laparoscopic AGB, LSG or RYGB.

2.2. Study design

The study design is a retrospective record review, including all patients undergoing LSG over the previous 4 years in the unit, from January 2011 to October 2014.

2.3. Inclusion criteria

To be included in the study sample, each patient had to meet the following three inclusion criteria: they had undergone an LSG, they had had no previous bariatric surgery, and they presented for a follow-up visit at 6 months postoperatively.

2.4. Statistical analysis

The Statistical Package for the Social Sciences (SPSS) 22.0 (SPSS Inc., Chicago, IL) software programme for Macintosh was used for the data analysis. Descriptive results included frequencies, mean ± standard deviation, median and range, while the statistical evaluations were performed using the non-parametric Mann–Whitney *U* test, and Pearson's correlation. The significance level was set at $p < 0.05$.

2.5. Perioperative management

The multidisciplinary team, including the bariatric surgeon, physician, psychologist, dietician and kinesiotherapist, reviewed prospective bariatric surgery patients. Preoperative investigations included blood tests, electrocardiograms, chest radiographs, abdominal ultrasound and upper gastrointestinal tract (GIT) endoscopy.

All cases utilised a laparoscopic approach. Low-molecular-weight heparin in combination with an intermittent pneumatic compression device and early mobilisation were used as perioperative thromboprophylaxis. A single dose of antibiotic was administered 30 min prior to the induction of anaesthesia. For the procedure, the patient was placed on the operating table supine, with legs abducted and the surgeon positioned between the patient's legs. The primary operating port was a 12 mm trocar placed to the right of the midline, halfway between the umbilicus and xiphoid process. Four 12 mm trocars were then placed under laparoscopic vision. A 35F bougie was used to calibrate the sleeve size for all LSG surgeries performed at the Life Bedford Gardens Hospital.

The patients were initiated on clear fluids by the first postoperative day, and once an upper gastrointestinal swallow demonstrated no leak. The patients were discharged when they were tolerating the liquid diet, ambulant without assistance, had no tachycardia at rest and oxygen saturation was more than 93% [19].

The patients in this study were initially evaluated by the surgeon 2 weeks postoperatively, monthly until 6 months, every 3 months until a year, then yearly thereafter.

2.6. Weight measurements

The BMI and percentage excess BMI loss (%EBMIL) are the most reliable methods to report, or compare, the results of weight loss after bariatric surgery [20]. This study utilises the %EBMIL as an indicator of weight loss at the follow-up appointments. Preoperatively, the kinesiotherapist performed bioelectrical impedance measurements to determine the body composition using the Bodystat 1500 analyser (Bodystat, Douglas, Isle of Man), and this was recorded as %Fat (percentage fat of total body composition) in the Bariatric Unit records.

3. Results

A total of 116 LSGs were performed at the Bariatric Unit during the study period, and a total of 103 patients were included in the study. Thirteen were excluded; one patient had an open sleeve gastrectomy and 12 were lost to follow up. Patient demographics are outlined in Table 1.

There were 23 (22.3%) patients with no comorbidities identified preoperatively, while 80 (77.7%) had comorbidities. The commonest comorbidity in the study group was depression in 26 (25.2%) patients, followed by hypertension in 25 (24.3%). The distribution of comorbidities is presented in Table 2. Twelve (11.7%) patients had three or more comorbidities, 34 (33.1%) had two comorbidities and 34 (33.1%) had only one comorbidity.

All patients included in the study underwent an LSG by the same surgeon. The mean operative time was 104.3 min (range: 65–168 min), with a mean hospital stay of 2.5 days (range: 1–9 days). A laparoscopic cholecystectomy was performed for four patients at the time of the LSG due to symptomatic gallstone disease, as confirmed upon preoperative abdominal ultrasound. A laparoscopic cholecystectomy at the time of bariatric surgery is not routine at this Bariatric Unit, unless symptomatic disease exists. All sleeves were calibrated with a 35F bougie and oversewn with an absorbable suture.

No mortality was encountered in any of the patients undergoing LSG in this study. Complications were divided into *medical* and *surgical*, and further stratified into *major* and *minor* as previously described by Oria and Moorehead [17]. The complication rate was 7.7%, with 87.5% (n = 7) of the complications being surgical, while 12.5% (n = 1) were medical. Fifty percent (n = 4) of the complications were major, while 50% (n = 4) were minor. Table 3 shows the distribution of these complications. The single medical complication was atelectasis, which resolved after intense physiotherapy. Three patients required reoperation (2.9% reoperation rate); two of these patients were stented for proximal GI leaks and one had a haematoma evacuated. The proximal GI leaks were not demonstrated by the initial postoperative upper gastrointestinal study, but presented at 10 and 14 days postoperatively. The superficial wound infections (n = 2) were treated with topical antibiotics and the resolution was satisfactory. Postoperative ileus was treated with bowel rest and also resolved without further intervention.

At the 6-month follow-up, the mean %EBMIL was 65% (range: 25–148%). The patient BMI averaged 32 kg/m^2 (range: 22.4–51.3 kg/m^2), while the LSG resulted in an impressive loss of excess BMI, even at the early 6-month follow-up. It is interesting to note the significant correlation between the %Fat as measured by the kinesiotherapist preoperatively and the 6-month %EBMIL and QoL score. The results of the Pearson's product–moment correlation for these factors are displayed in Table 4.

The BAROS questionnaire was completed by all patients at the 6-month follow-up appointment. A BAROS score was calculated for each patient, and this was used to stratify them into the various outcome groups, as described by Oria and Moorehead [17]. The mean BAROS score was 5.1 (range: 1.9–8.7). The distribution of the patients and outcome groups is indicated by Table 5.

The BAROS includes the M-A QoLQII in the calculation of the final score, and consequently, the final outcome group. The mean QoL score was 2.1 out of a total of 3 points, with a range of 0.3–2.9. The scoring of the M-A QoLQII is shown in Table 6.

A preliminary Shapiro–Wilk test demonstrated that the QoL

Table 1
Patient demographics.

	Mean	Range
Age (years)	41.8	18–72
BMI (kg/m^2)	42.1	30.3–69.3
Weight (kg)	119.3	70–217
Waist circumference (cm)	118.7	78–182
Fat (% total body composition)	46.8	29.1–79.1

Table 2
Comorbidities.

	Number of patients	Percentage
Depression	26	25.2
Hypertension	25	24.2
Type 2 diabetes mellitus	20	19.4
Hyperlipidaemia	12	11.7
Insulin resistance	11	10.7
Obstructive sleep apnoea	11	10.7
Hypothyroidism	10	9.7

Table 3
Complications.

Major	Minor
Surgical	
GI leak (1.9%; n = 2)	Ileus (1.9%; n = 2)
Haematoma (0.9%; n = 1)	Superficial wound infection (1.9%; n = 2)
Medical	
Atelectasis (0.9%; n = 1)	Nil

Table 4
Correlation between %Fat and %EBMIL, and QoL score at 6 months.

	Pearson's correlation coefficient [r(101)]	Significance [p]	Correlation
%Fat vs. %EBMIL	−0.520	$p < 0.0001$	Strong negative
%Fat vs. QoL score	0.209	$p = 0.034$	Small positive

Table 5
Patient outcomes.

	BAROS score	Number of patients	Percentage
Excellent	>7 to 9 points	10	9.7
Very good	>5 to 7 points	46	44.7
Good	>3 to 5 points	43	41.7
Fair	>1 to 3 points	4	3.9
Failure	1 or less points	0	0

Table 6
M-A QoLQII score.

Quality of life	M-A QoLQII score
Very good	2.1 to 3 points
Good	1.1 to 2 points
Fair	−1 to 1 points
Poor	−1.1 to −2 points
Very poor	−2.1 to −3 points

scores were not normally distributed. A non-parametric Mann–Whitney *U* test then displayed no significant differences between the patients' QoL scores and gender. Pearson's product–moment correlation was run and showed a moderate negative correlation between the %EBMIL and QoL scores at 6 months ($r(101) = -0.314$, $p = 0.001$), with the %EBMIL explaining 9.9% of the variation in QoL scores. This negative correlation showed that as the %EBMIL increased, the QoL scores were observed to decrease. This is also supported by the moderate positive correlation displayed by Pearson's product–moment correlation between the BMI and QoL scores at 6 months ($r(101) = 0.254$, $p = 0.01$), with the BMI explaining the 6.5% variation in the QoL scores.

4. Discussion

The LSG as a stand-alone surgical procedure for obesity has been described since 2005 [13], and represents a rapidly emerging technique in the armamentarium of bariatric surgery. It is technically easier to perform than other types of bariatric surgery but has comparable outcomes [14].

This study reports a 6-month follow-up of 103 patients who underwent SG as a stand-alone procedure. There were 12 patients who had LSG but were lost to follow-up, and they were excluded from the study. This number is small and is unlikely to affect the results. The majority of the study patients were female (85.4%), and a wide age range was represented, with no patients under the age of 18.

The aim of this study was to ascertain the outcomes of these patients using standardised measures such as BAROS, as well as to report the complications and %EBMIL at 6 months. The use of BAROS gives a better overview of the outcomes, rather than relying on weight loss (or excess weight loss) on its own [17]. Successful bariatric surgery should result in an improvement in the patient's QoL, and this important facet forms part of the BAROS, combined with weight loss, comorbidity improvement and complications, to give a score which better represents the outcome of bariatric surgery as a whole for the individual patient. BAROS allows for the comparison of the results of different procedures performed by various surgeons, and is independent of culture [21]. Lemanu et al. used a simple method to validate the BAROS for their population by asking the participants to rate the surgery success as a ‘yes’ or ‘no’, and comparing this to the BAROS score for each participant [22]. This simple form of validation could be considered in a future studies.

The maintenance of weight loss at a number of years after surgery, and especially beyond 5 years, is an important component dictating the success of a bariatric procedure and is termed ‘durable weight loss’ [23]. A limiting factor of this study is that the patients were followed up at 6 months only; a longer follow up at 5 years would indeed differentiate durable weight loss from weight loss which would possibly reverse after the 6-month follow-up visit. The mean %EBMIL at 6 months was 65% (range: 25–148%). This %EBMIL was the second highest compared to other series of LSG patients [24–29]. At present, there is no absolute cut-off level indicating a successful procedure based on the %EBMIL alone; however, few would disagree that 65% %EBMIL is an acceptable post-surgery weight loss.

This study utilised the %EBMIL to quantify weight loss, while the %EBMIL was described by Deitel et al. to be a more objective method in reporting weight loss for bariatric surgery patients [30]. A large number of studies utilise the %EWL to describe weight loss outcomes after bariatric surgery; however, this calculation relies on the ideal body weight (IBW), which is frequently derived through the Metropolitan Life Tables, which were last updated in 1983 [31].

In this study, a mean operative time of 104.3 min was demonstrated, which is comparable to the 100.4 min observed by Shi et al. in a review of 940 cases [31]. The mean hospital stay was 2.5 days, which is significantly lower than the 4.4 days in the same review by Shi et al. [31] A 35F bougie was used to calibrate the size of the sleeve intra-operatively, while the optimal bougie size was 32–36F [32]. A bougie size of less than 32F may lead to an unacceptable increase in complications, while one greater than 36F may lead to inadequate restriction and a long-term failure of weight loss [32]. The staple line was oversewn with an absorbable suture in all patients, although consensus on whether this reduces leaks has not been reached [32]. To reduce complications, oversewing should always take place with the bougie in situ [32]. Recently, Saleh et al. suggested that reinforcing the staple line with a bioabsorbable material could reduce complication rates [33].

An upper gastrointestinal series was carried out for all patients, and no leaks were demonstrated at postoperative day 1. The performance of an upper gastrointestinal swallow is controversial; however, it is useful in documenting postoperative anatomy, and serves as a baseline should future complications arise [34]. Gastric leaks occur in up to 5% of patients undergoing LSG [35], and are classified as early (within 3 days of surgery) or late (more than 8 days after surgery) [36]. Two leaks were reported in our study (1.9%), a significantly lower rate than that classically reported. Both of these leaks were delayed and were not demonstrated on the initial upper gastrointestinal series; they were treated successfully with stenting.

The overall complication rate of 7.7% observed in this study was not as low as the 0% observed by Lakdawala et al. [27], but was lower than the 12.1% complication rate in the review by Shi et al. [31] The percentage of 30-day mortality, as reported in the review by Diamantis et al., was 0.2% [23]. No mortality was observed in this study. Most of the complications encountered were surgical (87.5%) and resulted in three reoperations: two patients were stented for GI leaks, as described previously, and a third patient had post-operative bleeding.

Keren et al. emphasised the need for constant, available follow-up for post-surgery bariatric patients [37]. The aim of the holistic management of these patients and the constant engagement from day 1 is to reduce the number of patients lost to follow-up. In the present study, 12 patients were not followed up after LSG, as they did not respond to a number of attempts to contact them. BAROS excludes patients that are lost to follow-up or die intra-operatively. The 103 patients followed up at 6 months demonstrated no failures according to the BAROS assessment. Moreover, 96.1% had a good, very good or excellent outcome. In total, 9.7% of the patients had an excellent outcome.

The QoL is an important aspect of bariatric surgery outcomes, as patients may lose weight, but not experience a higher quality of life. The M-A QoLQII scores were isolated from the 103 patients followed up at 6 months, and the mean score was 2.1 out of 3 points; thus, on average, LSG results in a very good perceived QoL. The negative correlation between the QoL scores and %EBMIL, and conversely the positive correlation with 6-month BMI, show that these factors cannot account for the high QoL scores observed after

LSG. The reason for this is most likely comorbidity improvement, but further investigation is required.

Bariatric surgeons have always searched for ways to improve overall patient outcomes and experience. Enhanced Recovery after Surgery (ERAS) is a framework employed in other types of surgery, for example colorectal surgery, and has been shown to dramatically reduce procedure-related morbidity. No ERAS guidelines exist at present for bariatric surgery, and Lemanu et al. conceded in their study that research is necessary to develop evidence-based recommendations for an ERAS programme in bariatric surgery patients [38]. A fast-track program was described in January 2015, and claims that areas of concern in bariatric surgery patients are pain control and antiemetic prophylaxis intra-operatively, along with early mobilisation of the patient in the postoperative period [39]. This is an area of research that could be expanded on and included in future studies to improve bariatric surgery care, as well as to lower complication rates.

5. Conclusion

The series of 103 patients undergoing LSG at a Bariatric Unit in South Africa showed an adequate %EBMIL at 6 months and significant improvement in their QoL. BAROS outcomes are comparable to those reported in other studies of LSG. The low complication rate also supports the use of the procedure and accounts for no observed mortality. Areas of continued research, such as ERAS, were briefly explored and should be included in future studies.

Ethical approval

Yes ethical approval provided by Medical Advisory Committee.

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Author contribution

Both authors were involved from the outset with study design, and data collection. Data analysis was performed by Chrysis Sofianos and verified by Constantinos Sofianos. The writeup was jointly performed by both authors.

Conflict of interest

The authors have no conflicts of interest to declare.

Trial registry number

N/A.

Guarantor

Both authors listed are the guarantors for the research.

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