

# Antral Resection versus Antral Preservation during Laparoscopic Sleeve Gastrectomy: Does Outcome Differ?

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**Background:** The surgical technique of sleeve gastrectomy has not been fully standardized and, therefore, there are issues to be solved. Resection of the antrum is one of these debatable issues.

**Aim:** The study aims at assessing the difference in long and short term weight loss between both antral resection laparoscopic sleeve gastrectomy & antral preservation laparoscopic sleeve gastrectomy.

**Patients and methods:** Is a prospective randomized control study including 100 patients with BMI exceeding 35, fifty of them will undergo antral preservation in laparoscopic sleeve gastrectomy (group A), and the other fifty patients will undergo antral resection in laparoscopic sleeve gastrectomy (group B).

**Results:** Weight loss and BMI reduction after 6 months in the antral resection group were more than the antral preservation group with mean weight 92.25 kg in antral resection group compared to 99.46 kg in antral preservation group and mean BMI 34.48 in antral resection group compared to 39.29 in antral preservation group. Also weight loss and BMI reduction after 12 months in the antral resection group were more than the antral preservation group with mean weight 71.60 kg in antral resection group compared to 77.20 kg in antral preservation group and mean BMI 26.41 in antral resection group compared to 30.71 in antral preservation group.

**Conclusion:** Antral resection in LSG safely potentiates the restrictive effect achieved and may result in greater and better maintained weight loss.

**Key words:** Laparoscopic sleeve gastrectomy, Obesity, Antral preservation, Antral resection.

## Introduction

Laparoscopic sleeve gastrectomy (LSG) is an effective operation for severe obesity, with comparable short-term outcomes to Roux-en-Y gastric bypass (RYGB) for weight loss and diabetes resolution.<sup>1</sup>

Laparoscopic sleeve gastrectomy (LSG) was first described as the initial step of a two-staged bariatric procedure for high-risk patients.<sup>2,3</sup>

In subsequent years, LSG has been described as a stand-alone bariatric procedure, and it is currently one of the bariatric procedures most rapidly growing in popularity. This is because of promising results in terms of excess weight loss and the resolution of comorbidities.<sup>4,5</sup>

However, LSG is not as straightforward as one might think, and the technique has not yet been standardized. There is an overall tendency toward more restriction of the final sleeve by using a smaller bougie and leaving a shorter antrum.<sup>6</sup>

One aspect of controversy is the extent to which the antrum is excised. When fashioning the sleeve the staple line may be commenced close to the pylorus or at some distance away, resulting in more or less antral

excision. Practice between surgeons is highly variable.<sup>1</sup> The objective of this systematic review is to compare weight loss outcomes between antral-sparing (AP) and antral-resecting (AR) LSG for obesity.

## Patient and methods

This a prospective randomize control study held in El Demerdash hospital, Ain Shams university and Badr university hospital, Helwan University between November 2015 till December 2017 including one hundred patients with BMI exceeding 35, fifty of them underwent antral resection in laparoscopic sleeve gastrectomy, and the other fifty patients underwent antral preservation in laparoscopic sleeve gastrectomy. An informed consent was taken from all patients who accepted to participate in our study. All the patients in this study were randomly divided into two groups taking care that both groups were age matched. A unique computer generated randomization schedule was used. This consisted of alternating blocks, and was faithfully reproduced into sealed, ordered envelopes and kept in the operating theatre. The patients were divided into two groups. Group A: Antral preservation group included 50 patients where stapling started 6 cm from the pylorus while Group B: Antral resection group included the other 50 patients where stapling started 2 cm from the pylorus.

**All patients included in the study were subjected to:**

**Pre-operative:**

**History taking:**

- Age & sex.
- Weight & BMI.
- Dietary habits.
- History of previous operations (type, time, place, complications).

**Examination:**

**A. General:** Full general examination must be done, focusing on:

- Cardio-vascular fitness.
- Respiratory fitness.

**B. Local:** Full abdominal examination focused on:

- Scars of previous operations.
- Abdominal wall hernias.

**Investigations:**

**Laboratory:**

- General pre-operative investigations for all the patients included: full blood picture; prothrombin time, partial thromboplastin time; liver function tests: albumin; liver enzymes (AST, ALT); kidney function tests: (serum urea, serum creatinine) and electrolytes (sodium and potassium).
- Thyroid profile included: Free T3 & free T4 & TSH.
- Fasting blood sugar and HBA1c.
- Cardio-vascular investigations: All patients had ECG, CXR; while some had ECHO if they had cardiac troubles, and respiratory function tests and arterial blood gases if they had respiratory troubles as sleep apnea.
- Radiological: All patients had pre-operative pelvi-abdominal ultrasound to show any intra-abdominal and pelvic organs pathology as well as assessment of liver size.

**Intra-operative:**

Our technique was the laparoscopic five puncture

technique focusing on

- Operative time.
- Anatomy and Operative findings.
- Conversion to open surgery.

**Postoperative:**

Follow up to detect the difference between the 2 groups focusing on:

- Early Postoperative complications( leakage, bleeding).
- Postoperative hospital stay.
- Long term complications (stenosis, GERD, ulceration).
- Long term weight loss (6 and 12 months postoperative).

**Inclusion criteria:**

- Body mass index exceeding 35.
- Age: More than 18 years and less than 60years
- Gender: Both sexes.
- Fit for surgery.
- Motivated patients to be a part of the study.

**Exclusion criteria:**

- Contraindication to laparoscopy.
- Patients with hypothyroid state & on replacement therapy.
- Patient refusal or mentally retarded.
- Psychiatric illness.

**Data collection:**

Data was collected from patient records and medical files. Statistical presentation and analysis of the present study was conducted, using the mean, standard Deviation, student t-test, and chi-square test by SPSS V.20.

**Results**

100 patients were included in our randomized study (86 female patients and 14 male patients), and were divided to 2 groups; antral preservation group (group A) and antral resection group (group B) as shown in **Table 1.**

**Table 1: Showing no significant demographic differences between both groups as regard age and sex**

	No. = 50	Antral	Antral	Test value	P-value	Sig.
		Preservation	Resection			
		No. = 50				
Age	Mean ± SD	34.44 ± 7.45	33.50 ± 9.88	0.537	0.592	NS
	Range	22 – 46	20 – 54			
Sex	Female	40 (80.0%)	46 (92.0%)	2.990	0.084	NS
	Male	10 (20.0%)	4 (8.0%)			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant; NA: Not applicable.

\*: Chi-square test; •: Independent t-test.

As regard the preoperative measurements, there were no significant variations between both groups as regard preoperative weight, height and BMI with mean preoperative weight 122 kg in antral preservation group and 127 kg in antral resection group, mean preoperative BMI 48.3% in antral preservation group and 47.06% in antral resection group.

Patients with comorbidities as DM and HTN were not included in our study for the aim of justifying both groups results without underlying diseases.

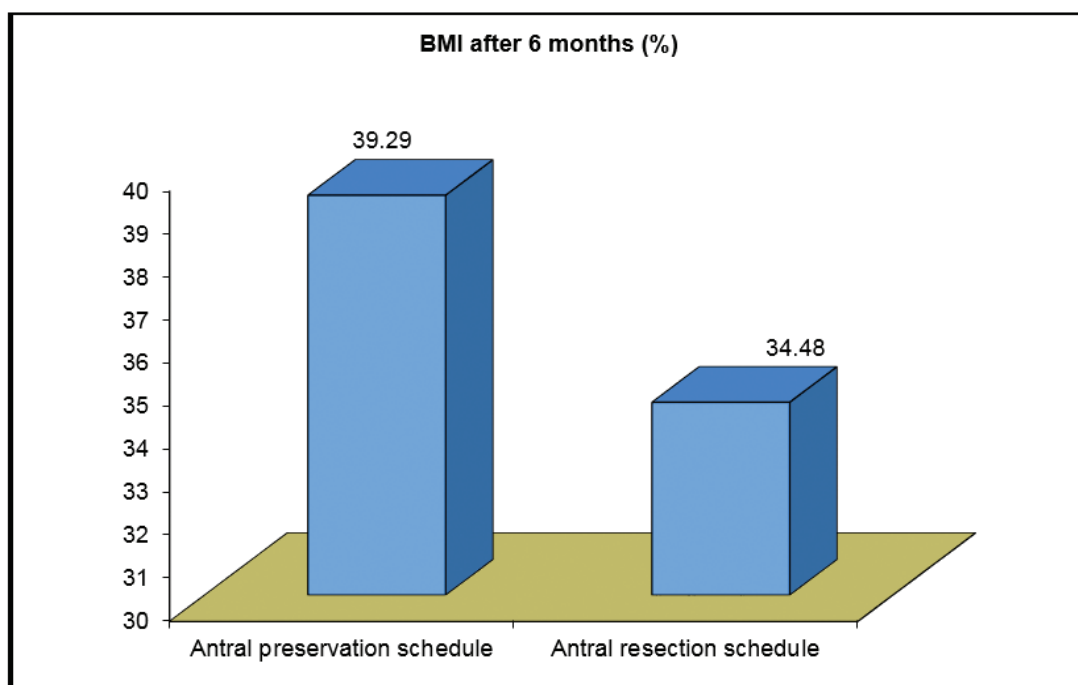
As regard the early post-operative complications, there were no bleeding or leakage reported in our 2 groups. In this study we compared the weight loss in both groups after 6 months. Our study showed significant increase in weight loss and BMI reduction after 6 months in the antral resection group more than the antral preservation group with mean weight 92.25 kg in antral resection group compared to 99.46 kg in antral preservation group. As regard BMI; our study showed high statistically significant value as the mean BMI in the antral resection group was 34.48 compared to 39.29 in the antral preservation group.

**Table 2: Shows the variations in weight loss and BMI reduction after 6 months between both groups**

No. = 50		Antral Preservation	Antral Resection	Test value•	P-value	Sig.
		No. = 50				
Weight after 6 months (kg)	Mean ± SD	99.46 ± 16.59	92.25 ± 17.10	2.1399	0.042	S
	Range	76 – 140	65 – 117			
BMI after 6 months (%)	Mean ± SD	39.29 ± 6.91	34.48 ± 5.48	3.858	0.000	HS
	Range	28.2 – 53.2	24 – 43.5			

P-value > 0.05: Non-significant; P-value < 0.05: Significant; P-value < 0.01: Highly significant; NA: Not applicable.

•: Independent t-test

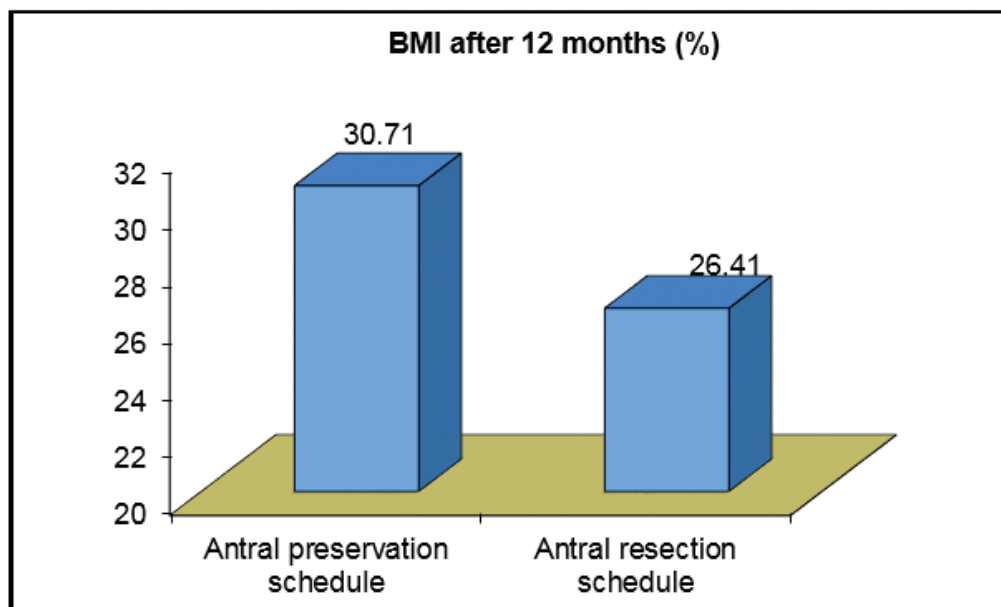


**Graph 1: Variations in weight loss and BMI reduction after 6 months between both groups.**

Our study showed also significant increase in weight loss and BMI reduction after 12 months in the antral resection group more than the antral preservation group with mean weight 71.60 kg in antral resection group compared to 77.20 kg in antral preservation group. As regard BMI, our study showed high statistically significant value as the mean BMI in antral resection group was 26.41 compared to 30.71 in antral preservation group.

**Table 3: Shows the variations in weight loss and BMI reduction after 12 months between both groups**

	No. = 50	Antral Preservation	Antral Resection	Test value●	P-value	Sig.
		No. = 50				
Weight after 12 months (kg)	Mean ± SD	77.20 ± 14.01	71.60 ± 14.00	1.9993	0.047	S
	Range	57 – 100	52 – 95			
BMI after 12 months (%)	Mean ± SD	30.71 ± 7.71	26.41 ± 3.93	3.507	0.001	HS
	Range	22.2 – 57	19.5 – 35.3			



**Graph 2: Variations in weight loss and BMI reduction after 12 months between both groups.**

In our study operative time was shorter in the antral preservation group than in the antral resection group.

group compared to 6 patients who developed vomiting but not GERD in the antral preservation group.

Although our study showed non-significant variations between both groups as regard incidence of GERD and developing vomiting, 3 patients developed GERD and 10 patients developed vomiting in the antral resection

Hospital stay was 1 day for all patients in both groups and no conversion to open sleeve gastrectomy was done in any patient in both groups.

**Table 4: Shows the variations in operation time, late postoperative complication (GERD, ulceration and vomiting), hospital stay and conversion to open surgery between both groups**

	No. = 50	Antral Preservation	Antral Resection	Test value	P-value	Sig.
		No. = 50				
Operation time (min)	Mean ± SD	24.62 ± 3.48	28.00 ± 4.73	4.072	0.000	HS
	Range	20 – 32	20 – 37			
GERD	Negative	50 (100.0%)	47 (94.0%)	1.375	0.241	NS
	Positive	0 (0.0%)	3 (6.0%)			
Vomiting	Negative	44 (88.0%)	40 (80.0%)	1.190	0.275	NS
	Positive	6 (12.0%)	10 (20.0%)			
Hospital stay (days)	Mean ± SD	1.00 ± 0.00	1.00 ± 0.00	NA	NA	NA
	Range	1 – 1	1 – 1			
Conversion to open	Negative	50 (100.0%)	50 (100.0%)	NA	NA	NA
	Range	0 (0.0%)	0 (0.0%)			

## Discussion

Sleeve gastrectomy is primarily considered a restrictive type of bariatric surgery, where surgical technique plays a major role in the resulting and maintained weight loss. The ideal restriction creates a narrow gastric tube without a large antral pouch, leaving a gastric capacity of no more than 80 ml.<sup>7</sup>

Although LSG is generally associated with good weight loss, some patients experience poor primary weight loss and a significant proportion of patients demonstrate weight regain (which tends to occur following a plateau of maximal weight-loss at about 12-18 months post-surgery.<sup>23,24</sup> Both of these adverse events are clearly clinically important, and there is much interest in operative approaches to prevent them.<sup>8,9</sup>

The degree of antral resection is a controversial issue in LSG. Some surgeons prefer antral resection and beginning stapling 2 cm from pylorus.<sup>4,10,11</sup>

Whereas others start 6 cm from the pylorus, there by preserving the gastric antrum.<sup>10,12-17</sup>

Supporters for antral resection claim that stapling within 2 cm of the pylorus adds more restriction and may contribute to better weight loss.<sup>4</sup>

The mechanism of action of the sleeve gastrectomy is believed to involve a combination of gastric restriction, hormonal effects, and changes in gastric motility and eating habits.<sup>18</sup>

Despite this clearly multifactorial mechanism, the size of the restriction performed is the most significant factor for weight reduction and maintenance. Moreover, the antrum tends to enlarge with time and the increased volume may contribute to weight regain.<sup>19</sup>

Mognol et al.<sup>11</sup> and Baltasar et al.<sup>4</sup> Began the division approximately 2 cm from the pylorus; they argue that since LSG is a purely restrictive procedure, the restriction should be more aggressive than when it is a part of another procedure such as a duodenal switch.

On the other hand, those with antral preservation see that doing so preserves contractile function, promoting gastric emptying and thus reducing intraluminal pressure and potentially decreasing leakage.<sup>6,10,12</sup>

One of the main differences between AR and AP that could theoretically influence weight loss and weight regain is sleeve volume: In AR procedures the fashioned sleeve would be expected to have a smaller volume – a finding which has been confirmed on volumetric CT scanning.<sup>20</sup> Few studies have examined the impact of sleeve volume on weight loss, but evidence suggests that while initial sleeve volume is not correlated with early weight loss,<sup>21,22</sup> beyond two years the formation of a narrower sleeve intraoperatively may be associated with significantly improved weight loss.<sup>23</sup>

Studies that have looked at the effect of pyloric antral resection on weight loss have shown conflicting results. Jacobs et al. showed no statistically significant difference in the %EWL following creation of a 4- versus 7-cm antral pouch.<sup>24</sup> In contrast, analysis of data from the Spanish national registry revealed that resection closer to the pylorus resulted in better weight loss during the first and second postoperative years.<sup>25</sup> Our study showed that a more radical antral resection resulted in significantly better weight loss in the first postoperative year.

It should be noted however that the volume of sleeves, and also the relative differences in volume between AR and AP sleeves, does change with time from surgery.<sup>20</sup> Longer-term follow up in trials of patients undergoing AP and AR sleeve gastrectomy is indicated to determine whether the weight loss advantage with AR continues to increase with time and what correlation, if any, this has with sleeve volume.

The other concern regarding radical antral resection is its effect on reflux symptoms. LSG's effect on gastroesophageal reflux (GERD) is controversial. LSG may lessen reflux by reducing intra-abdominal pressure (by way of decreasing intra-abdominal fat) and reducing acid production by decreasing gastric tissue.<sup>26-27</sup> Postoperative reflux may be attributed to technical issues; for example, partial resection of the sling fibers of the LES, which can produce a hypotensive LES, has been suggested to result in GERD.<sup>26</sup> A lack of gastric compliance, severely restricted gastric capacity with an intact pylorus, and impaired gastric emptying have also been suggested to predispose patients to reflux during the first postoperative period.<sup>28-30</sup> Whether antral resection is associated with the development of GERD is still controversial. Nocca et al.<sup>31</sup> performed resection at 10 cm from the pylorus and suggested that preservation of the antrum reduces the symptoms of reflux. However, Daes et al.<sup>32</sup> reported a very low incidence of postoperative GERD despite 3-cm antral resection. Our study showed no significant increase in the incidence of GERD symptoms in the antral resection group. This can be explained by the faster emptying mechanism previously suggested by some authors. However, further studies comparing gastric emptying are needed.

## Conclusion

LSG is a safe and effective bariatric procedure. The performance of radical antral resection safely potentiates the restrictive effect achieved by LSG and may result in greater and better maintained weight loss without increasing the complication rate. Long-term follow-up data and larger studies are needed to confirm these results, particularly in super-obese patients.

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