Original Article

Short-Term Outcomes of Reduced versus Conventional Ports in Sleeve Gastrectomy: A Controlled Clinical Trial

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Abstract

Aim: The study aims to compare the short-term outcomes of reduced ports sleeve gastrectomy versus conventional five ports sleeve gastrectomy in postoperative weight loss, morbidity rate, pain, and resolution of obesity-related diseases. **Materials and Methods:** One hundred forty patients were equally allocated to reduced ports (n = 70) and conventional ports (5 ports) Laparoscopic Gastrectomy groups. The primary outcomes are postoperative pain by numeric rating score, cosmetic visual analog score, satisfaction visual analog score, operative time, and hospital stay. The secondary outcomes are postoperative complications and comorbidity resolution. **Results:** The numeric rating score for pain assessment was statistically significantly lower in the reduced ports group compared with the conventional ports group at 2, 6, 12, and 24 hours, postoperatively (P < .001). Cosmetic visual analog score was statistically significantly higher in the reduced ports group compared with conventional ports group at 2 and 3 months follow-up (P < .001 and P = .008, respectively). Patient satisfaction visual analog score was statistically significantly higher in the reduced ports group than the conventional ports group at 2 and 3 months follow-up (P < .001 and P = .032, respectively). **Conclusion:** Reduced ports laparoscopic sleeve gastrectomy is safe and feasible in patients with body mass index (BMI) up to 50 kg/m². It is cosmetically well appreciated with noticeable patient satisfaction. It should be practiced with regularity. Further trials should be considered in patients with high BMI (>50 kg/m²).

Keywords: *Bariatric surgery, gastrectomy, reduced ports*

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Introduction

Over the past 50 years, obesity has become a global epidemic. It is one of the most critical risk factors for several fatal diseases.[1]

In 2016, there were approximately 340 million overweight or obese kids and teenagers between the ages of 5 and 19. In 2016, 39% of adults over 18 were overweight, and 13% were obese.[2]

Bariatric surgery for morbid obesity resulted in significant weight loss and lower mortality. Laparoscopic sleeve gastrectomy is the most common surgical treatment performed globally.[3]

There is growing interest in surgical methods that reduce abdominal wall trauma as a result of recent developments in minimally invasive surgery. As a result, a novel idea known as reduced-port laparoscopy, which involves reducing either the number of ports used or the size of existing ports or both, was made possible.[4]

The umbilicus is inferiorly shifted in morbidly obese patients with central obesity, which decreases the viability of the trans-umbilical approach. Furthermore, these patients' thick abdominal walls, intraabdominal fat deposits, and an enlarged fatty liver make it difficult to do surgery with hard equipment through a

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single-incision. The fundus may not be removed entirely during Single-Incision Sleeve Gastrectomy (SISG) due to technical issues.[5] The surgical specimens from SISG were shorter than those from conventional laparoscopic sleeve gastrectomy (CLSG).[6] The distinction might be significant because, over time, the residual fundus can lead to both weight gain and gastroesophageal reflux disease (GERD).[7]

Single-incision laparoscopic surgery (SILS) was first introduced in the 1990s, and its application has been extended to various surgical procedures.[8-10] SILS has been associated with less postoperative pain, lower risk of wound infection, shorter hospital stay, and better cosmesis.[11]

Single-port sleeve gastrectomy (SPSG) and reduced ports sleeve gastrectomy (RPSG) that utilizes one additional port have been increasingly reported in the literature.[5,12] However, there is still an ongoing debate on whether the technical difficulties of the single-port approach might lead to an increased risk of postoperative morbidity and suboptimal sleeve construction.[13]

Due to technical difficulties that may result in less-than-ideal results, reduced-port laparoscopic surgery is still debatable, and there is a lack of information on the operative and clinical outcomes of RPSG in comparison to CLSG.[5]

RPSG has developed through advances in technology and devices. However, given that results have not yet been verified, a comparison with conventional ports should be studied carefully.

In the present study, we compare the short-term outcomes of RPSG versus conventional five ports sleeve gastrectomy in postoperative weight loss, morbidity rate, pain, and resolution of obesity-related diseases.

Aim of the work

The study aims to compare the short-term outcomes of RPSG versus conventional five ports sleeve gastrectomy in postoperative weight loss, morbidity rate, pain, and resolution of obesity-related diseases.

Materials and Methods

Study design

Controlled clinical trial (nonrandomized), equal allocation, parallel design. The research Ethics Committee at the Faculty of Medicine Ain Shams University, Egypt, and the General Surgery Department have approved the study. The study was prospectively registered in Cochrane Pan African Clinical Trial Registry (identification number is PACTR 202206919034739).

Method of sampling

Convenience sampling technique.

Sample size calculation

The minimal sample size is calculated based on a previous study aimed to compare the short-term outcomes of single-port sleeve gastrectomy (SPSG) and reduced-port sleeve gastrectomy (RPSG) versus CLSG in postoperative weight loss, morbidity rate, pain, and resolution of obesity-related diseases.[14] Park *et al*.(2021)[14] reported that complication rates showed no significant difference, and the results suggest that single-port and reduced-port approaches could be alternative choices for selected patients. The sample size was calculated to detect if there is a true difference in favor of the experimental treatment (SPSG) of 3% in the percentage of patients with no major early (or late) complications. Based on their results, adopting a power of 80% to detect a standardized effect size (noninferiority margin, d) of 10 3% in success rate (primary outcome) (no major early (or late) complications), and level of significance 95% (α =0.05), the minimum required sample size was found to be 65 patients per group (number of groups = 2) (Total sample size = 130 patients).[15-17] Sample size was calculated using online Power (sample size) calculators https://www.sealedenvelope.com/power/binary-noninferior/.

Allocation to intervention: Non-randomized, with an allocation ratio of 1:1

Sample size = 140 patients with laparoscopic sleeve gastrectomy. Consort flow diagram is illustrated in [Figure 1].

Cosmetic Visual Analogue Score was statistically significantly higher in the reduced ports group (72.00±10.92) when compared with the conventional ports group (53.43±10.62) at two months follow up (p<.001); and (79.92±10.92) vs. (74.00±10.95) at three months follow up (p=.008). The Cosmetic Visual Analogue Score increased significantly at three months follow-up when compared with two months follow-up in the whole study population (p<.001) (n=140) and also in each reduced port and conventional ports groups of the study (p<.001, p<.001; respectively) [Table 1] [Figure 2].

Patients Satisfaction Visual Analogue Score was statistically significantly higher in the reduced ports group (70.00±8.16) when compared with the conventional ports group (54.71±10.59) at two months follow up (p<.001); and (80.14±15.37) vs. (75.14±11.76) at three months follow up (p=.032). The Patient Satisfaction Visual Analogue Score statistically significantly increased at three months follow up when compared with two months follow-up in the whole study population (n=140) and also in each reduced port and

conventional ports groups of the study ($p<.001$, $p<.001$; respectively) [Table 2] [Figure 3].

Eligibility criteria

Inclusion criteria

The study included patients in whom surgical management of obesity is indicated: Patients aged between 18-60 years old from both gender; Patients with BMI from 40 to 50; Patients with BMI 35–40 with obesity-related comorbidities (e.g., hypertension, hyperlipidemia, type 2 diabetes mellitus, obstructive sleep apnea, obesity hypoventilation syndrome, non-alcoholic fatty liver disease, gastroesophageal reflux disease, and severe arthritis); Patients able to give informed consent; and Patients able to be committed to follow-up.

Exclusion criteria

Patients with previous upper gastrointestinal tract surgery or liver cirrhosis; on oral steroid therapy; who had previous bariatric surgery; not fit for general anesthesia (e.g., patients with severe heart disease or untreatable coagulopathies); with contraindications for insufflation as those with severe cardiovascular or

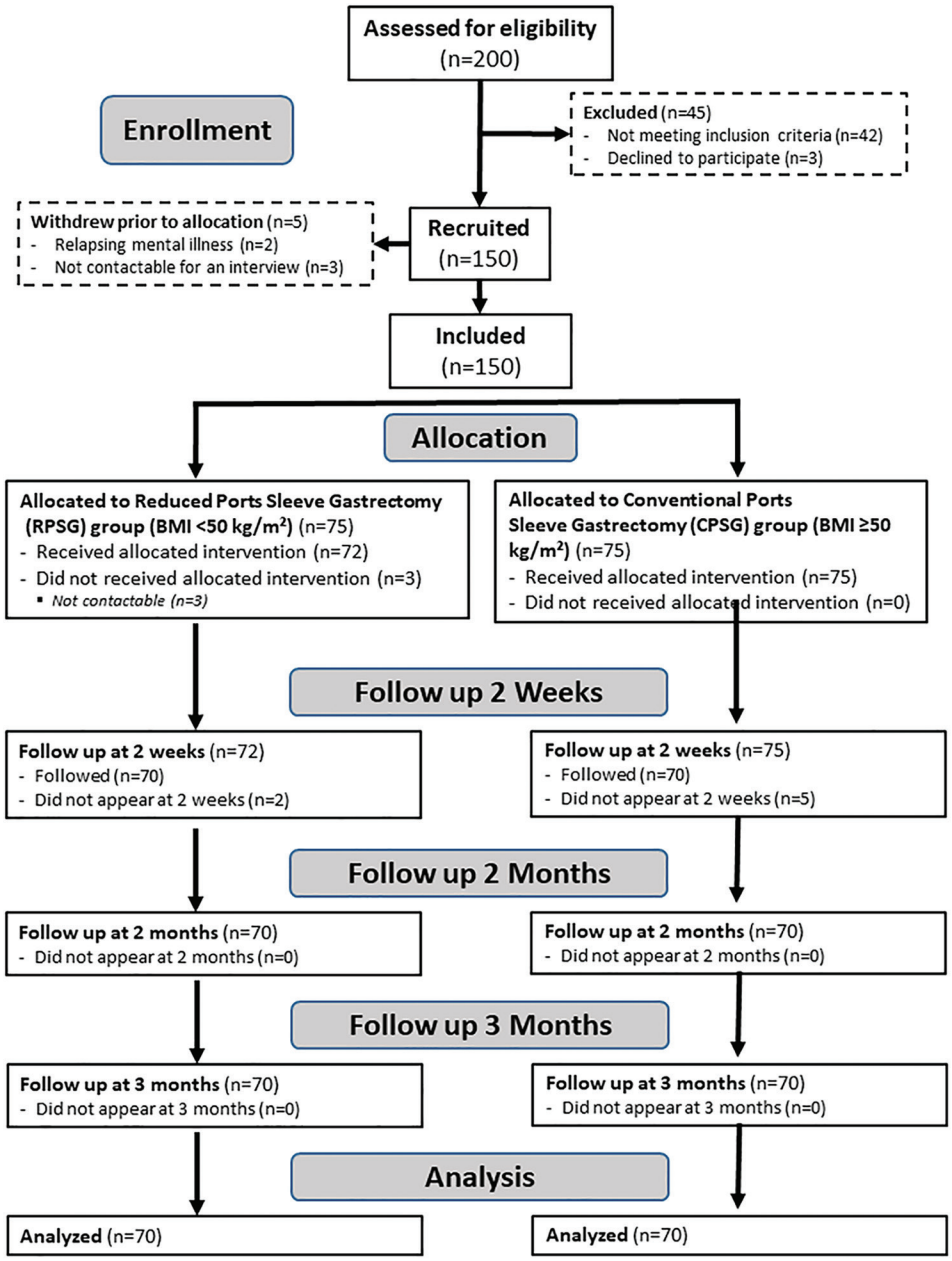

Figure 1: Consort flowchart

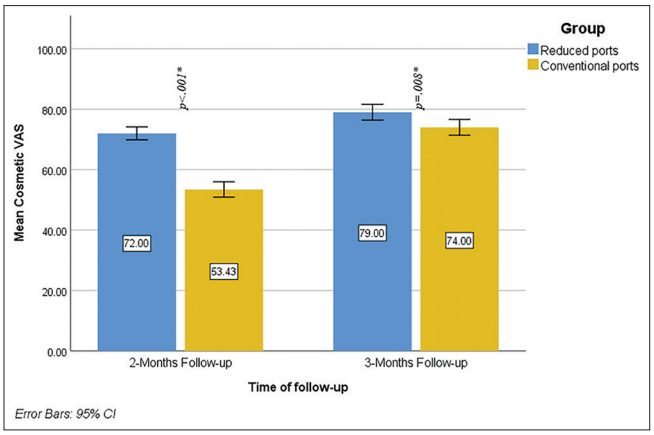

Figure 2: Bar chart of mean (±95% CI) of cosmetic VAS (maximum = 100) at 2 and 3 months postoperative follow-up in the two studied groups

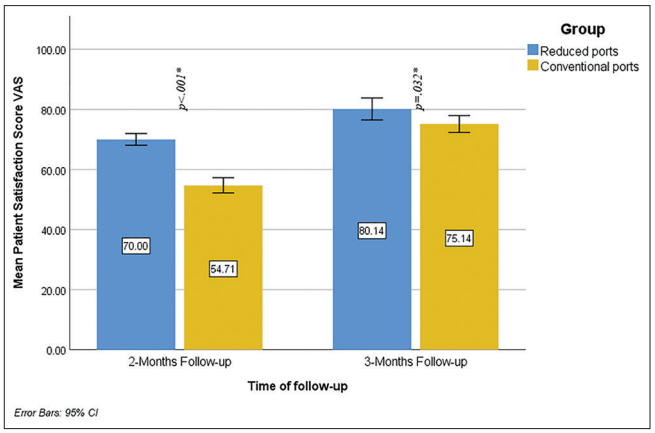

Figure 3: Bar chart of mean (±95% CI) of patient satisfaction score VAS (maximum = 100) at 2 and 3 months postoperative follow-up in the two studied groups

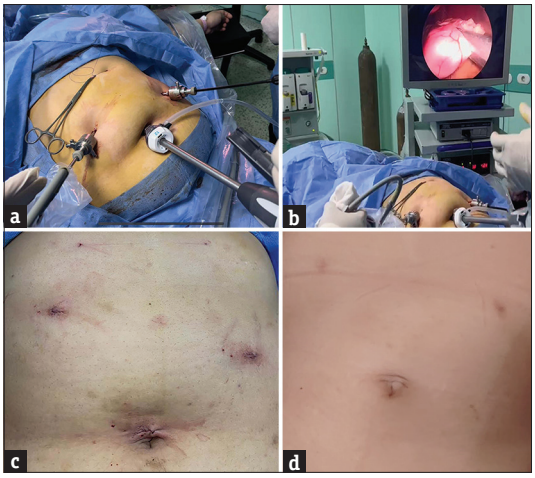

Figure 4: Reduced ports laparoscopic gastrectomy (a) position of the three ports, (b) Stapler introduced through the umbilical 12 mm port, (c) appearance of port sites incisions after closure, and (d) appearance of scars 3 months postoperatively

severe restrictive respiratory diseases; with a significant abdominal ventral hernia; with major psychiatric illness; or pregnant women.

Patients were nonrandomly allocated according to BMI equally: 70 patients either to the reduced ports arm (3 ports) (BMI <50) or to the conventional ports arm (5 ports) (BMI ≥50).

All patients were subjected to complete history taking with special emphasis on personal history: age, sex, marital status, dietary habits and if the patient likes sweets much or not, duration of obesity, history of previous trials of weight loss, whether surgical or nonsurgical, medical history for comorbidities: as diabetes mellitus, hypertension, cardiac problems, respiratory problems, and previous deep vein thrombosis, GERD, and past surgical history.

Complete clinical examination: weight and height and calculate BMI, type of obesity (android or peripheral), abdominal examination for (scar of previous surgery, hernial orifices, and organomegaly), cardiac and pulmonary evaluation, endocrinological assessment, psychiatric assessment (If indicated). Consort flow diagram is illustrated in [Figure 1].

Surgical technique

The operation was performed under general endotracheal anesthesia when the patient was in the French position. At the time of skin incision, a single dose of broad-spectrum antibiotic was given (ceftriaxone 2 gm)[Figure 4].

In the conventional group, five ports technique is adopted, and one 10-mm port is inserted just above the umbilicus for the endoscope. Two 12-mm ports are inserted at the right and left mid-clavicular lines for the operator's both hands. One 5 mm incision is made below the xiphoid process for introducing the liver retractor. One 5-mm port was inserted at the left side of the abdomen for the assistant.

In the reduced (3) ports group, A vertical 1–1.2-cm skin incision is made starting slightly off and above the apex of the umbilicus. A Veress needle is inserted to establish a pneumoperitoneum of 12–15 mmHg. A 12-mm Optiview trocar is then inserted. Next, two 5-mm ports are inserted laterally and superior to the 12-mm port to create a triangle with approximately 5-10 cm sides. The left lobe of the liver is retracted internally by 2.0 polypropylene stitch (30 cm) on a straight cutting needle (Keith) which is passed through the mid-upper abdomen 5–7 cm below the xiphoid process and fixed into the right crus of the diaphragm.

A 5-mm 45° angled camera was used in the procedure. Regular inline graspers and powered articulating staplers (Ethicon) with a linear load of 60-mm black, green, gold, or blue cartridges are used depending on

Table 1: Postoperative numeric rating score, cosmetic visual analog score, and patients satisfaction visual analog score in the studied groups

	Group		Test of significance (independent samples *t*-test), *P*
	Reduced ports sleeve gastrectomy (*n*=70)	Conventional ports sleeve gastrectomy (*n*=70)	
Numeric Rating Score for pain assessment (postoperative Day 1) (max=10)			
Two hours postoperative			
Min. – Max.	2.00-6.00	4.00-8.00	$t_{(df=138)}$=7.048
Mean±SD	4.44±1.14	5.77±1.09	*P*<0.001*
95% CI of the mean	4.17-4.71	5.51-6.03	
Six hours postoperative			
Min. – Max.	0.00-5.00	2.00-6.00	$t_{(df=138)}$=6.479
Mean±SD	1.94±1.09	3.10±1.02	*P*<0.001*
95% CI of the mean	1.68-2.20	2.86-3.34	
Twelve hours postoperative			
Min. – Max.	0.00-3.00	0.00-5.00	$t_{(W)(df=131.325)}$=5.726
Mean±SD	0.80±0.84	1.73±1.06	*P*<0.001*
95% CI of the mean	0.60-1.00	1.48-1.98	
Twenty four hours postoperative			
Min. – Max.	0.00-2.00	0.00-4.00	$t_{(W)(df=101.490)}$=6.577
Mean±SD	0.31±0.51	1.29±1.11	*P*<0.001*
95% CI of the mean	0.18-0.45	1.02-1.55	
Cosmetic Visual Analog Score (max=100)			
Two months follow-up			
Min. – Max.	60.00-90.00	40.00-70.00	$t_{(df=138)}$=11.193
Mean±SD	72.00±8.94	53.43±10.62	*P*<0.001*
95% CI of the mean	69.87-74.13	50.90-55.96	
Three months follow-up			
Min. – Max.	60.00-100.00	60.00-90.00	$t_{(df=138)}$=2.704
Mean±SD	79.92±10.92	74.00±10.95	*P*=0.008*
95% CI of the mean	76.40-81.60	71.39-76.61	
Paired sample *t*-test	$t_{(df=69)}$=4.465	$t_{(df=69)}$=12.455	
P	*P*<0.001*	*P*<0.001*	
Patient Satisfaction Visual Analog Score (max=100)			
Two months follow-up			
Min. – Max.	60.00-80.00	40.00-70.00	$t_{(W)(df=129.592)}$=9.562
Mean±SD	70.00±8.16	54.71±10.59	*P*<0.001*
95% CI of the mean	68.05-71.95	68.05-71.95	
Three months follow-up			
Min. – Max.	60.00-100.00	60.00-90.00	$t_{(W)(df=129.189)}$=2.161
Mean±SD	80.14±15.37	75.14±11.76	*P*=0.032*
95% CI of the mean	76.48-83.81	72.34-77.95	
Paired sample *t*-test	$t_{(df=69)}$=4.465, *P*<0.001*	$t_{(df=69)}$=12.455, *P*<0.001*	
P			

Min-Max=Minimum to Maximum, SD=Standard deviation, CI=Confidence interval, df=degree of freedom, W=Welch's *t*-test. *Statistically significant (*P*<0.05)

transected tissue thickness. Gastrosplenic attachments and short gastric vessels are taken with a LigaSure™ device (Medtronic USA). Before transecting the stomach, a 36-Fr gastroscope is passed along the lesser curvature of the stomach toward and into the pylorus. Then stapling is started through the 12 mm umbilical port with the replacement of the camera to the right working 5-mm port.

Table 2: Weight preoperatively and during the follow-up period

	Group		Test of significance, *P*
	Reduced ports sleeve gastrectomy (*n*=70)	Conventional ports sleeve gastrectomy (*n*=70)	
Preoperative weight (kg)			
Min. – Max.	86.00-153	87.00-150.00	$t_{(df=138)}$=1.908
Mean±SD	112.84±14.74	117.48±14.01	*P*=0.059 NS
95% CI of the mean	109.33-116.36	114.14-120.82	
Preoperative BMI (kg/m2)			
Min. – Max.	35.43-51.42	35.55-54.11	$t_{(df=138)}$=1.454
Mean±SD	41.68±3.66	42.62±4.01	*P*=0.148 NS
95% CI of the mean	40.81-42.55	41.67-43.58	
Preoperative Excess Weight (kg)			
Min. – Max.	27.59-74.68	27.00-72.76	
Mean±SD	45.16±10.86	48.44±10.72	$t_{(df=138)}$=1.798
95% CI of the mean	42.75-47.75	45.88-51.00	*P*=0.074 NS
At 2 Weeks Follow-up			
Weight (kg)			
Min. – Max.	82.00-139.00	81.00-142.00	$t_{(df=138)}$=1.777
Mean±SD	105.99±13.47	110.09±13.83	*P*=0.078 NS
95% CI of the mean	102.77-109.20	106.79-113.38	
Percentage of Total Weight Loss (%) (%TWL)			
Min. – Max.	3.09-10.16	0.70-11.30	$t_{(W)(df=122.480)}$=1.060
Mean±SD	6.03±1.38	6.34±2.01	*P*=0.291 NS
95% CI of the mean	5.70-6.36	5.86-6.82	
Percentage of Excess Weight Loss (%) (%EWL)			
Min. – Max.	8.79-25.37	1.69-33.24	$t_{(W)(df=119.055)}$=0.533
Mean±SD	15.39±3.60	15.80±5.49	*P*=0.595 NS
95% CI of the mean	14.53-16.24	14.50-17.11	
At 2 Months Follow-up			
Weight (kg)			
Min. – Max.	74.00-125.00	74.00-130.00	$t_{(df=138)}$=1.978
Mean±SD	96.57±11.69	100.73±13.14	*P*=0.050 NS
95% CI of the mean	93.78-99.36	97.60-103.86	
Percentage of Total Weight Loss (%) (%TWL)			
Min. – Max.	9.28-18.30	3.85-20.87	$t_{(df=138)}$=0.036
Mean±SD	14.30±2.15	14.31±2.96	*P*=0.971 NS
95% CI of the mean	13.78-14.81	13.61-15.02	
Percentage of Excess Weight Loss (%) (%EWL)			
Min. – Max.	25.85-57.98	9.36-55.98	$t_{(W)(df=120.593)}$=0.600
Mean±SD	36.47±5.85	35.71±8.73	*P*=0.550 NS
95% CI of the mean	35.07-37.86	33.63-30.33	
At 3 Months Follow-up			
Weight (kg)			
Min. – Max.	69.00-116.00	70.00-122.00	$t_{(df=138)}$=1.847
Mean±SD	90.39±10.97	94.00±12.15	*P*=0.067 NS
95% CI of the mean	87.77-93.00	91.10-96.90	
Percentage of total weight loss (%)			
Min. – Max.	6.67-25.00	10.00-27.83	$t_{(df=138)}$=0.511
Mean±SD	19.76±2.98	20.02±3.06	*P*=610 NS
95% CI of the mean	19.04-20.47	19.29-20.75	

Contd...

Table 2: Contd...

	Group		Test of significance, *P*
	Reduced ports sleeve gastrectomy (*n*=70)	Conventional ports sleeve gastrectomy (*n*=70)	
Percentage of excess weight loss (%)			
Min. – Max.	20.04-76.10	24.32-73.47	$t_{(W)(df=132.988)}$=0.302, *P*=0.763 NS
Mean±SD	50.41±8.42	49.94±10.25	
95% CI of the mean	48.41-52.42	47.49-52.38	

n=number of patients, Min-Max=Minimum to Maximum, SD=Standard deviation, CI=Confidence interval, *t*=Independent Student's (*t*) test for comparison of means, W=Welch's *t*-test, df=degree of freedom. *Statistically significant (*P*<0.05), NS=Statistically not significant (*P*>0.05)

Table 3: Demographic data, history of abdominal surgery, chronic diseases, and present history of obstructive sleep apnea, gastroesophageal reflux, operative time, and hospital stay in the two studied groups

	Group		Test of significance, *P*
	Reduced ports sleeve gastrectomy (*n*=70)	Conventional ports sleeve gastrectomy (*n*=70)	
Age (years)			
Min. – Max.	18.00-56.00	18.00-60.00	$T_{(df=138)}$=1.732
Mean±SD	29.26±9.33	32.07±9.89	*P*=0.086 NS
95% CI of the mean	27.03-31.48	29.71-34.43	
Sex			
Male	11 (15.71%)	16 (22.86%)	$\chi^2_{(df=1)}$=1.147
Female	59 (84.29%)	54 (77.14%)	*P*=0.284 NS
History of Any Abdominal Surgery	23 (32.86%)	32 (45.71%)	*Z*=1.557 *P*=0.118 NS
History of Bariatric Surgery	1 (1.43%)	2 (2.86%)	*Z*=0.583 *P*=0.561 NS
Hypertension	7 (10.00%)	14 (20.00%)	*Z*=1.656 *P*=0.096 NS
Diabetes mellitus	1 (1.43%)	5 (7.14%)	*Z*=1.669 *P*=0.094 NS
Cigarette smoking (current or ex)	3 (4.29%)	6 (8.57%)	*Z*=1.033 *P*=0.303 NS
Obstructive Sleep Apnea (OSA)	14 (20.00%)	20 (28.57%)	*Z*=1.182 *P*=0.238 NS
Gastroesophageal Reflux Disease (GERD)	22 (31.43%)	21 (30.00%)	*Z*=0.183 *P*=0.857 NS
Operative time (minutes)			
Min. – Max.	40.00-61.00	44.00-64.00	$t_{(W)(df=132.311)}$=1.508, *P*=0.134 NS
Mean±SD	51.81±4.19	53.01±5.17	
95% CI of the mean	50.81-52.81	51.78-54.25	
Hospital stay (days)			
Min. – Max.	1.00-2.00	1.00-2.00	$t_{(W)(df=89.924)}$=2.474, *P*=0.015*
Mean±SD	1.02±0.13	1.13±0.34	
95% CI of the mean	0.99-1.05	1.05-1.21	

n=number of patients, Min-Max=Minimum to Maximum, SD=Standard deviation, CI=Confidence interval, χ^2=Pearson Chi-Square, Df=degree of freedom, *Z*=Test of comparison of two independent proportions, T=Independent Student's (*t*) test for comparison of means, W=Welch's *t*-test. *Statistically significant (*P*<0.05), NS=Statistically not significant (*P*>0.05)

Special added steps

The stomach staple line is oversewn with absorbable suture Polydioxanone Suture (PDS). The specimen is then removed through the 12-mm port site. This site is closed with a 1-0 Vicryl in a figure-of-eight using a fascia closure needle. The abdominal fascia and subcutaneous tissue are infiltrated with local anesthetics.

A standardized analgesic regimen was prescribed in the postoperative period. All patients received paracetamol 1 gm every 6 h. If the numeric rating score (NRS) is more than 3, intravenous morphine 3 mg was administered.

All surgeries were performed by the author (single surgeon).

Routine postoperative CT volumetry of the stomach was performed on postoperative day 1 before discharge.

Outcomes

The primary outcomes are postoperative pain measured by NRS at 2, 6, 12, and 24 hours postoperatively;

Table 4: Postoperative status of comorbidities after 3 months follow-up in the two studied groups

	Group		Test of significance, *P*
	Reduced ports sleeve gastrectomy (*n*=70)	Conventional ports sleeve gastrectomy (*n*=70)	
Hypertension			
No Change	2/7 (28.57%)	6/14 (42.86%)	$\chi^2_{(df=2)}$=1.977
Partial remission	0/7 (0.00%)	2/14 (14.29%)	$P_{(MC)}$=0.517 NS
Complete remission	5/7 (71.43%)	6/14 (42.86%)	
Diabetes Mellitus			
Partial remission	1/1 (100.00%)	2/5 (40.00%)	$\chi^2_{(df=1)}$=0.000
Complete remission	0/1 (0.00%)	3/5 (60.00%)	$P_{(Y)}$=1.000 NS
Obstructive Sleep Apnea (OSA)			
No Change	1/14 (7.14%)	1/21 (4.76%)	$\chi^2_{(df=2)}$ =1.667
Partial remission	1/14 (7.14%)	5/21 (23.81%)	$P_{(MC)}$=0.580 NS
Complete remission	12/14 (85.71%)	15 (71.43%)	
Gastroesophageal Reflux Disease (GERD)			
No Change	3/22 (13.64%)	6/21 (28.57%)	$\chi^2_{(df=2)}$=2.508
Partial remission	8/22 (36.36%)	9/21 (42.86%)	$P_{(MC)}$=0.334 NS
Complete remission	11/22 (50.00%)	6/21 (28.57%)	

n=number of patients, χ^2=Pearson Chi-Square test, df=degree of freedom, MC=Monte Carlo correction, NS=Statistically not significant (*P*>0.05)

cosmetic visual analog score measured at 2 and 3 months of follow-up; patient satisfaction visual analog score measured at 2 and 3 months of follow-up, operative time, and hospital stay.

The secondary outcomes are postoperative complications and comorbidity resolution.

Patients were followed up all through the first 3 months postoperatively. Follow-up visits were planned after discharge: at 2 weeks, 2 months, and 3 months postoperatively.

Data collection team was not blinded throughout the study.

Statistical methodology

Data were collected and entered into the computer using Statistical Package for Social Science (SPSS) program for statistical analysis (ver 25).[18] Data were entered as numerical or categorical, as appropriate. Kolmogorov–Smirnov test of normality revealed no significance in the distribution of the variables, so parametric statistics was adopted.[19] Data were described using minimum, maximum, mean, standard deviation, and 95% CI of the mean.[20]

Comparisons were carried out between two studied independent, normally distributed variables using an independent sample t-test.[21] When Levene's test for equality of variances is significant, Welch's t-test is used.[22] Chi-square test was used to test the association between qualitative variables.[23] Monte Carlo correction[24] was carried out when indicated (n x m table and >25% of expected cells were less than 5). Z-test for comparing different independent proportions was used.[25] During sample size calculation, beta error accepted up to 20% with a power of study of 80%. An alpha level was set to 5% with a significance level of 95%. Statistical significance was tested at a *p*-value <.05.[26]

Results

RPSG was successfully performed in the 70 patients allocated. None of these patients were converted to a conventional five-port laparoscopic sleeve gastrectomy or open surgery.

The demographic data and perioperative findings of the patients included in the study are summarized in Table 2. There were no statistically significant differences in age (*P* = .086), sex (*P* = .284) (females seeking the bariatric procedure in our center represent a higher percentage than males), history of any abdominal surgery, history of bariatric surgery, or any associated comorbidities (hypertension, diabetes mellitus, cigarette smoking) (*P* > .05) between the two studied group. Also, there were no statistically significant differences in preoperative obstructive sleep apnea (OSA) and preoperative GERD (*P* > .05). The duration of hospital stay (days) was statistically significantly shorter in the reduced ports group (1.02 ± 0.13 days) when compared with conventional ports group (1.13 ± 0.34) (*P* = .015) [Table 3].

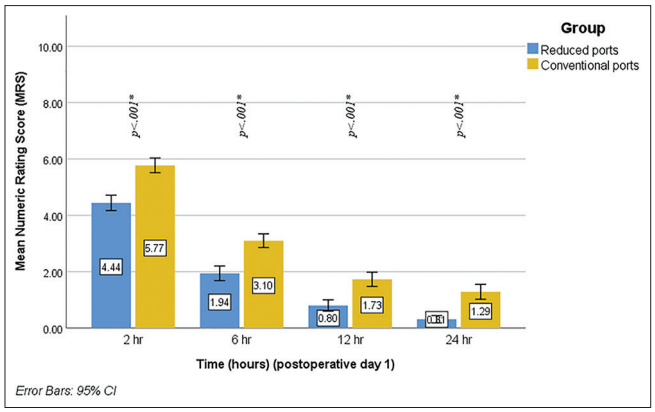

Figure 5: Bar chart of mean (±95% CI) of numeric rating score (maximum = 10) in postoperative day 1 in the two studied groups

The mean operative time in the RPSG group (51.81 ± 4.19 min) was not statistically significantly different when compared with the conventional ports group (53.01 ± 5.17 min) (P = 0.134).

The NRS for pain assessment was statistically significantly lower in the reduced ports group (4.44 ± 1.14) when compared with the conventional ports group (5.51 ± 1.09) at two hours postoperatively (P < .001); (1.94 ± 1.09) vs. (3.10 ± 1.02) at six hours postoperatively (P < .001); (0.80 ± 0.84) vs. 1.73 ± 1.02) at 12 hours postoperatively (P < .001) and (0.31 ± 0.51) vs.(1.02 ± 1.55) at 24 hours postoperative (P < .001) [Table 1].

There was no statistically significant difference preoperatively in weight (P = .059) [Figure 5], BMI (P = .148), WHO classification of BMI (P = .353), and preoperative excess weight (P = .074).

The groups were also similar in complication rates. The most feared complications of sleeve gastrectomy are staple line leakage and bleeding; there were no patients with postoperative bleeding that required surgical revision in both the studied groups, and none with gastric twist in the whole study series.

At 2 weeks of follow-up, there was no statistically significant difference between the two studied groups in weight (P = .078), Percentage of total weight loss (%TWL) (P = .291), and percentage of excess weight loss (%EWL) (P = .595). At 2 months of follow-up, there was no statistically significant difference between the two studied groups in weight (P = .050), percentage of total weight loss (P = .971), and percentage of excess weight loss (P = .550).

At 3 months of follow-up, there was no statistically significant difference between the two studied groups in weight (P = .067), percentage of total weight loss (P = .610), and percentage of excess weight loss (P = .763) [Table 2].

There was no statistically significant difference in the remission of hypertension (P = .517), diabetes mellitus (P = 1.000), OSA (P = 0580), and GERD (P = 0.334) between the two studied groups at the end of follow-up period [Table 4].

Cosmetic visual analog score was statistically significantly higher in the reduced ports group (72.00 ± 10.92) when compared with the conventional ports group (53.43 ± 10.62) at 2 months follow-up (P < .001); and (79.92 ± 10.92) vs.(74.00 ± 10.95) at 3 months follow-up (P = .008). The cosmetic visual analog score increased significantly at 3 months follow-up when compared with 2 months follow-up in the whole study population (P < .001) (n = 140) and also in each reduced-port and conventional ports groups of the study (P < .001 and P < .0,1; respectively) [Table 1].

Patients satisfaction visual analog score was statistically significantly higher in the reduced ports group (70.00 ± 8.16) when compared with the conventional ports group (54.71 ± 10.59) at 2 months follow-up (P < .001); and (80.14 ± 15.37) vs. (75.14 ± 11.76) at 3 months follow-up (P = .032). The patient satisfaction visual analog score statistically significantly increased at 3 months follow-up when compared with 2 months follow-up in the whole study population (n = 140) and also in each reduced-port and conventional ports groups of the study (P < .001 and P < .001, respectively) [Table 1].

In the present study, neither group had intra- or postoperative complications, no intraoperative complications as injury to adjacent viscera like the liver, esophagus, and spleen. No early postoperative complications (leaks, DVT, wound infection, or late complications: strictures, acid reflux, and incisional hernia) are reported. There were no mortalities in either group.

Discussion

Sleeve gastrectomy (SG), as a first-stage treatment in high-risk patients with morbid obesity and a stand-alone procedure, has experienced tremendous growth in popularity.[27] Since it doesn't include an intestinal bypass or gastrointestinal anastomosis, SG has attracted much attention from surgeons.[28]

RPSG gained increasing acceptance in bariatric procedures, with the advantage of minimal muscle trauma and thus reduced postoperative pain, shorter hospital stay, and improved cosmetic results.

At 2, 6, 12, and 24 hours postoperatively, the NRS for pain assessment showed statistically significantly lower values in the reduced ports group compared with the conventional ports group ($P < .001$). This finding supports the advantage of the reduced ports technique for pain reduction on the first postoperative day. This finding agrees with Lakdawala *et al*.(2015),[29] who reported that SILS has proven to be less painful and has greater cosmetic results.

Lakdawala *et al*.(2011),[30] in their randomized pilot study, reported that there was no significant difference in the pain scores for the first four hours postoperatively in SISG and laparoscopic sleeve gastrectomy (LSG), but they found A paired significance after 8 hours postoperatively.

Also, cosmetic visual analog score (Cosmetic VAS) at 2 and 3 months postoperatively was statistically significantly higher in the reduced ports group when compared with the conventional ports group ($P < .001$ and $P = .008$, respectively). Lakdawala *et al*. (2015)[29] reported that improved cosmesis remains one of the most significant advantages of single-incision surgery.

The patient satisfaction visual analog score at 2 and 3 months postoperatively was also statistically significantly higher in the reduced ports group when compared with the conventional ports group ($P < .001$ and $P = .032$, respectively). This is also an added advantage of the reduced ports technique for improving patient satisfaction.

The main advantages of RPSG include minimal muscle trauma and thus reduced postoperative pain, shorter hospital stay, and improved cosmetic results. In the present study, the weight reduction (whether weight, % TWL, or % EWL) was comparable between both techniques.

Conclusion

Reduced ports LSG is safe and feasible in patients with BMI up to 50 kg/m². It is cosmetically well appreciated with noticeable patient satisfaction. Our data elucidate that Reduced port laparoscopic gastrectomy (RPLG) has a definite advantage over Conventional laparoscopic gastrectomy (CLG) in terms of lesser postoperative pain and duration of hospital stay. To conclude, in selected patients, RPLG should be practiced with regularity. Further trials should be considered in patients with high BMI (>50 kg/m²)

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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