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Research Article

An Evaluation of the Effectiveness and Safety of Mini Laparoscopic Sleeve Gastroplasty in the Treatment of Severe Obesity

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Abstract

The study aimed to evaluate the feasibility of using mini laparoscopic tools in sleeve gastrectomy and compare its safety and efficacy with other techniques in patients with severe obesity. 141 patients underwent sleeve gastrectomy using mini laparoscopic tools from 2017 to 2022. The results showed a significant reduction in weight after one month postoperatively, with a mean weight reduction of 10.7 ± 1.5 kg and a significant reduction in BMI of 4 ± 0.55 and 12.4 ± 5.5 after one month and one year, respectively. The patients exhibited a total weight loss (TWL%) of 10.3% and 24% after one month and one year, respectively. The study concluded that mini laparoscopic sleeve gastrectomy is an effective, safe, and feasible technique, associated with a lower incidence of port site hernias, decreased postoperative pain, and better cosmesis. Compared to traditional laparoscopic sleeve gastrectomy, mini laparoscopic tools have the same effectiveness and safety, with a lower incidence of complications and better results regarding pain, cosmesis, and wound site infection.

Keywords: *sleeve gastrectomy, LSG, mini laparoscopy, obesity, bariatric metabolic surgery.*

Introduction

Bariatric metabolic surgery is a crucial method for controlling obesity, with over 190177 cases documented globally. The surgical treatment for morbid obesity has evolved from vertical gastric banding to gastric bypass and sleeve gastrectomy, which is less complicated and associated with fewer postoperative complications. The proportion of patients undergoing sleeve gastrectomy has exceeded that of patients undergoing gastric bypass, making it the most popular surgical procedure.

Laparoscopic bariatric metabolic procedures, such as laparoscopic sleeve gastrectomy (LSG), laparoscopic adjustable gastric banding (LAGB), and laparoscopic Roux-en-Y gastric bypass (LRYGB), are commonly used for managing severe obesity worldwide. Technological advancements have led to smaller and better-quality laparoscopic equipment and imaging, allowing surgeons to perform precise dissection with little bleeding through most dissection planes, even those that are highly vascular. Adequate hemostasis is crucial for clear visibility during laparoscopic surgeries, but the advantages of the laparoscopic method are defeated by the need to switch to an open operation.

Mini-laparoscopy, invented over 20 years ago, has evolved with newer generation instruments with enhanced effector tips, a selection of shaft diameters and lengths, improved shaft strength and rotation, better shaft insulation and electrosurgery capability, low-friction trocar options, more ergonomic handles, and increased instrument durability. This study aimed to evaluate the feasibility and safety of using mini laparoscopy for sleeve gastrectomy in patients with severe obesity.

Methods

This study enrolled 141 patients who underwent mini laparoscopic sleeve gastrectomy since December 2017, focusing on patients with severe obesity who were scheduled for elective sleeve gastrectomy. The patients were selected based on their BMI (≥35 kg/m2), obesity-related comorbidities, age over 18 years, and without a history of previous bariatric metabolic surgery. Exclusion criteria included those with BMI below 35 kg/m2, those under 18 or over 70 years old, those with a history of previous bariatric surgery, and those not fit for surgery.

Preoperative assessment

The study involved patients with a history of medical conditions, including demographic data and previous surgeries. Before surgery, ECG and routine laboratory tests were performed, and all patients signed an informed consent form. Baseline characteristics, operative time, postoperative complications, pain scor (visual analogue scale), and percentage excess weight were collected and analyzed.

Patients were placed in a split-leg position, with the left leg being more straight than the right leg to allow for more space during the suturing phase. They were strapped to the table at jowe level, exposing the lower abdomen. The surgical technique involved a direct abdominal puncture with a Veress needle through the umbilical incision, maintained at an inflation pressure of 16 mmHg and a carbon dioxide flow rate of 40 l/min.

The procedure used five ports, including three ports of three mm opening, a five mm port, and a 12 mm port for the stapler, along with a five mm lens. The left working port was modified from 12 mm to three mm, and the liver retractor port was modified from five or 10 mm to three mm. The assistant port on the left side was also modified.

The procedure began with a 12 mm umbilical port and a sealing device in the right working five mm port. Mini laparoscopic three graspers were used, and devascularization was started 4 cm from the pyloric ring to the angle of His. The stapler was introduced into the umbilical port, and the stomach and gauze were extracted from the umbilical port to ensure good hemostasis. Only two ports were closed with sutures, while the remaining three ports were closed with steri-strips.

Outcomes

The study aims to assess the effectiveness, feasibility, and safety of using mini laparoscopic tools in sleeve gastrectomy by assessing postoperative pain, complications, and weight loss at 1, 3, and 6 months after surgery and one year after surgery. The secondary outcome is to compare the results of mini laparoscopic sleeve gastrectomy with other techniques. All patients underwent postoperative appointments, with routine nutritional assessments and supplements recommended as needed. The same endocrinologist monitored each patient's condition and recommended oral analgesics for postoperative pain. The study adhered to ethical standards, including the 1964 Helsinki declaration and its later amendments. The researcher explained the study's goals, test, and investigation, and the participants' privacy and right to decline participation. Informed consent was obtained from all participants.

Statistical analysis

The study utilized IBM SPSS software for Windows version 26, with the Shapiro-Wilk test for data normality distribution. Quantitative data was analyzed using mean, standard deviation, or interquartile range, with descriptive statistics presented in numbers and percentages. The paired sample t-test was used to estimate variable differences at different time intervals.

Results

This study involved 141 patients who underwent mini-laparoscopic sleeve gastrectomy, with 133 being females (88.6%). The median weight and length at baseline were 104 kg and 164 cm, respectively. The median preoperative BMI was 39 kg/m2. The surgery took 44 minutes. Postoperative weight was significantly reduced at one month and one year, with a mean reduction of 10.7 ± 1.5 kg and 33.5 ± 15.4 kg, respectively. The mean

BMI reduction was also significant. After one month, 141 patients lost 28% of their excess body weight at baseline. After one year, 82 cases lost 79.8% of their excess body weight at baseline. Total weight loss (TWL%) was 10.3% and 24% after one month and a year, respectively. Postoperative pain was reported in only 3 cases (2%), and portsite hernia was not reported. The mean pain score was 3.5 on a VAS score from 0 to 10, and NSAID analgesics were used. No opioid use was needed.

Table 1: General and baseline characteristics of the included participants.

Parameter		**Value, N= 141**
Gender	**Male**	8 (5.7%)
	Female	133 (94.3%)
Weight of Cases, kg		104 (21)
Length of Cases, cm		164 (10)
BMI, kg/m^2		39 (7)
Time of Surgery, minutes		44 (15)

Data are presented as median (IQR), or n (%).

Table 2: Shows the weight of participants after different time intervals postoperatively.

Parameter	**Value**
Weight after 1 Month, kg, N= 141	92 (18)
Weight after 3 Months, kg, N= 61	92 (24)
Weight after 6 Months, kg, N= 61	82 (20)
Weight after 1 Year, kg, N= 82	73 (17)
Weight at the time of the study, kg, N=73	72 (17)
BMI after 1 Month, kg/m^2, N= 141	35.4 (± 5)
BMI after 3 Month, kg/m^2, N= 61	34.2 (± 5)
BMI after 6 Month, kg/m^2, N= 61	31.5 (± 5)
BMI after 1 year, kg/m^2, N= 82	28 (± 5.3)
BMI at the time of the study, kg/m^2, N=73	31 (6.3)

Data are presented as median (IQR), or mean (±SD).

Table 3: Comparison between the weight of participants at the baseline and at one month postoperatively.

Comparison	Mean Change	P- Value
Total weight loss after 1 month postoperatively, N= 141	10.7 ± 1.5	<**0.0001**
Total weight loss after 1 year postoperatively, N= 82	33.5 ± 15.4	<**0.0001**
BMI reduction after 1 month, N= 141	4 (± 0.55)	<**0.0001**
BMI reduction after 1 year, N= 82	12.4 (± 5.5)	<**0.0001**

Table 4: Excess weight loss and total wight loss at the baseline, one month and one year postoperatively.

Percentage of excess body weight loss after 1 month, n= 141	28.4 %
Percentage of excess body weight loss after 1 year, n= 82	79.8 %
Percentage of total body weight loss (TWL%) after 1 month, n= 141	10.3%
Percentage of total body weight loss (TWL%) after 1 year, n= 82	24%

Table 5: postoperative pain, hernia, surgical site infection

Parameter	Value, N= 141
Surgical site infection	3 (2%)
Hernia	0
Postoperative pain, VAS score (0-10)	3.5

Data are presented as n (%) or mean

Discussion

Mini-laparoscopy, also known as needlescopic tools, is a recent development in minimally invasive surgery that introduces a laparoscopic-like but different surgical approach. Studies have shown the advantages of needlescopic surgery, such as decreasing tissue injury, reducing scarring, improving cosmesis, reducing postoperative discomfort and the need for analgesics, reducing hospital stay, and reducing operative time. Additionally, needlescopic surgery lowers intraoperative costs.

Several studies have demonstrated that employing needlescopic instruments in laparoscopic procedures causes little to no change in surgical and procedural practice due to their structural similarity to usual tools. However, the tools' strength due to their reduced size and limited variety may lead to a decrease in the number of procedures that can be performed and the number of patients who are eligible, particularly patients with obesity.

In this study, data from 141 patients was pooled to evaluate the efficacy of mini-laparoscopic sleeve gastrectomy regarding weight reduction at different time intervals postoperatively (1, 3, and 6 months, in addition to 1 and 3 years). The results showed that mini laparoscopic sleeve gastrectomy was associated with a reduction in body weight after surgery at 1, 3, and 6 months and at 1 and 3 years postoperatively. Additionally, mini laparoscopy was associated with significant EBWL after one year, with patients exhibiting a TWL of 10.3% and 24% after one month and one year respectively.

Surgical site infection occurred in only 3 cases (2%), and postoperative pain scores showed mild pain after surgery. According to these results, the utilization of mini laparoscopic tools for sleeve gastrectomy was safe, effective, and feasible.

A meta-analysis by Shenoy et al. in 2020 found that 91 patients in the LRYGB cohort and 25 patients in the LSG cohort suffered from major complications in the perioperative period. In contrast, 43 patients in the LRYGB cohort and 16 patients in the LSG cohort suffered from late major complications.

Fayad et al. conducted a retrospective, case-control study that estimated total body weight loss (TBWL) at 3, 6, 9, and 12 months after the operation. They found that the highest TBWL at 6 months was in the LSG cohort than in the ESG cohort. Gray et al. conducted a retrospective review that found that the LSG cohort was associated with fewer major complications than the LRYGB cohort.

In conclusion, mini laparoscopic tools for sleeve gastrectomy were associated with lower rates of early and late complications and a higher rate of TBWL than other bariatric metabolic surgery methods. However, the study has limitations, including the number of patients lost during the follow-up period, not reporting the age of the involved individuals, and being a single-arm study.

Conclusion

Mini laparoscopic sleeve gastrectomy is a safe and effective technique for sleeve gastrectomy, with a lower incidence of port site hernias, reduced postoperative pain, and improved cosmesis. Compared to other procedures, it has a higher EBWL and lower complications. Further trials are needed to confirm these results with stronger evidence.

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