Case Report

Outcome of Robotic Approach for Bariatric Surgery: Our Initial Experience in Siriraj Hospital

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Objective: Bariatric surgery using the laparoscopic approach is the gold standard treatment for morbid obesity. Robotic systems have been utilized in many surgical fields, including bariatric surgery. However, the role of robotic bariatric surgery is still controversial. Therefore, in this study we aimed to establish the 1-year surgical outcomes of robotic bariatric surgery in Thailand.

Case Report: In total, 10 patients who underwent robotic-assisted bariatric surgery from March 2017 to January 2018 were included in the present study. The patients' demographic data, operative times, postoperative complications, weight loss outcome, and comorbidity resolution were analyzed. We performed 4 cases of robotic sleeve gastrectomy (RSG) and 6 cases of Roux-en-Y gastric bypass (RRYGB). The average patient's age, preoperative body weight, and BMI were 37.3±9.4 years old, 115.5±15.3 kg, and 43.2±3.4 kg/m^2, respectively. The mean total operative times of RSG and RRYGB were 141.3±28.4 and 231.7±30.4 minutes. The mean length of hospital stay was 4.2±1.4 days. There was no morbidity and mortality in our study. At 1-year follow-up, the mean %EWL was 52.20% for RSG and 59.13% for RRYGB.

Conclusion: The robotic approach for bariatric surgery is safe, feasible, and provides good surgical outcomes compared to the laparoscopic approach in Thailand.

Keywords: Morbid obesity, Bariatric surgery, Robotic, Roux-en-Y gastric bypass, Sleeve gastrectomy, Robot assisted

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Morbid obesity is known to be associated with many medical problems and has become a serious health issue over the past few decades. Bariatric surgery has been proven to be an effective treatment that can achieve long-term weight loss and comorbidity resolution in patients with morbid obesity[(1)].

The first laparoscopic bariatric surgery was introduced in 1994[(2)]. Since then, laparoscopic bariatric surgery has been widely performed and has become the standard treatment for morbid obesity due to the faster recovery and lower incidence of postoperative complications compared to open surgery[(3)].

Since the introduction of the Da Vinci surgical system, many procedures have evolved to adapt a robotic approach as an alternative to the standard laparoscopic procedure, including bariatric surgery. A robotic surgical system can provide better ergonomics, enhanced surgical dexterity, and superior visualization with three-dimensional images. These advantages may help overcome the limitations of conventional laparoscopic procedures.

Recent meta-analysis (Li et al 2016) showed no significant differences in the outcomes between robotic and laparoscopic bariatric surgeries regarding overall complications, major postoperative complications, mortality, and the length of hospital stay. However, some studies have mentioned a lower incidence of anastomosis-related complications, including leakage and stricture, in the robotic approach compared with laparoscopic bariatric surgery[(4,5)]. In Siriraj hospital of Mahidol university, the majority of robotic surgery cases was performed by urology department, which has become the leading center of robotic prostatectomy in Thailand since 2007[(6)]. The success of urologic program has increased the interest among general surgeons. Since then, the application of robotic surgery has started to become more utilized in hepatobiliary, pancreatic, adrenal, foregut and bariatric surgery.

Therefore, the objective of the present study was to establish the 1-year outcomes regarding the efficacy of weight loss, comorbidity resolution, safety, and incidence of complications in the first case series of robotic bariatric surgery carried out in a tertiary center of Thailand.

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Case Report

From March 2017 to January 2018, all 10 patients who underwent robotic bariatric surgery, including robotic sleeve gastrectomy and robotic Roux-en-Y gastric bypass, using the Da Vinci Si surgical system in Siriraj Hospital, Bangkok, Thailand, were enrolled in this study.

For inclusion, all the patients must have been evaluated by a multidisciplinary team comprising a surgeon, nutritionist, endocrinologist, and psychiatrist. The criteria for bariatric surgery in Siriraj Hospital and according to the Asia-Pacific Bariatric Surgery society consensus 2005 are: (1) obese patients with a BMI >37 kg/m^2; (2) obese patients with a BMI >32 kg/m^2 in the presence of diabetes or two significant obesity-related co-morbidities; (3) obese patients who have been unable to lose or maintain weight loss through dietary or other forms of medical management; and (4) patients whose age range is from 18 to 65 years old[7]. Revision surgery was excluded from the study.

The patients' demographic data and clinical characteristics, including age, gender, preoperative body weight, preoperative BMI, presence of obesity-related comorbidities, operative time, overall complications, and length of hospital stay were reviewed.

The outcome of the surgery was studied in terms of two aspects: (1) postoperative weight loss and (2) comorbidity resolution. Postoperative weight loss was reported as BMI change, percent total weight loss (%TWL), and percent excess weight loss (%EWL), as shown in Figure 1. The outcome of comorbidity resolution was reported according to the American Society of Metabolic and Bariatric Surgery (ASMBS) 2015. For type 2 DM, complete remission was stated if HbA1c <6% and FBG <100 mg/dL, and partial remission was considered when HbA1c = 6.0 to 6.5% and FBG = 100 to 125 mg/dL for at least 1 year with the absence of anti-diabetic medication. Disease improvement was considered when HbA1c and FBS were significantly reduced but did not meet the criteria for remission or were decreased with an anti-diabetic medications requirement. Hypertension remission was documented if BP <120/80 mmHg without medication. Dyslipidemia remission was considered when LDL <100 mg/dL, total cholesterol <200 mg/dL, and triglycerides <150 mg/dL[8].

Surgical technique

Robotic sleeve gastrectomy

The patient was positioned supine with both arms tucked at the sides. A 36-French orogastric tube was suitably placed. A Veress needle was used to enter the abdomen at Palmer's point and the abdomen was insufflated to 15 mmHg. A 12 mm camera port was placed 20 cm inferior to the xiphoid and 4 cm to the left of midline using an Optiview trocar and a 10 mm zero-degree laparoscope. Under direct visualization using a 30-degree laparoscope, the Veress needle at Palmer's point was replaced with an 8 mm port, and an additional 8 mm port was placed contralateral in the RUQ. Finally, a 15 mm laparoscopic assistant's port was placed 20 cm inferior to the xiphoid and 2 cm to the right of midline as shown in Figure 2. A 6 cm cut portion of a silicone flat channel drain secured to a 2-0 Prolene stitch was passed into the abdomen by a straight needle and used to tract the liver edge to the abdominal wall. The patient was placed in the reverse Trendelenburg position. Two working arms of the Da Vinci® Si robot were docked to the 8 mm port sites, and an additional arm was docked to the 12 mm camera port.

The robotic harmonic shears were used to divide the omentum from the greater curvature of the stomach 6 cm proximal to the pylorus to the angle of His. The short gastric artery was also ligated with harmonic shears during dissection. Using the orogastric tube as a guide, the robotic hook cautery was used to mark the planned line for resection of the stomach (Figure 3). The Covidien Autostapler was then introduced

$$\text{BMI change } (\Delta\text{BMI}) = (\text{Initial BMI}) - (\text{Postop BMI})$$

$$\%\text{Total weight loss} = \frac{(\text{Initial weight}) - (\text{Postop weight})}{(\text{Initial weight})} \times 100$$

$$\%\text{Excess weight loss} = \frac{(\text{Initial weight}) - (\text{Postop weight})}{(\text{Initial weight}) - (\text{Ideal weight})} \times 100$$

Figure 1. Reports of postoperative weight loss.

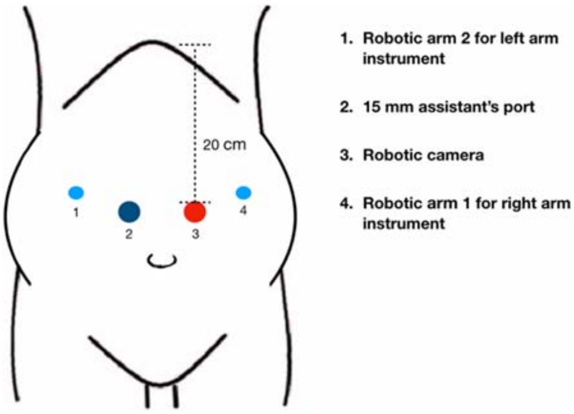

Figure 2. Port position for robotic sleeve gastrectomy.

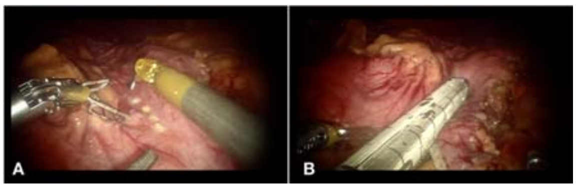

Figure 3. Robotic sleeve gastrectomy; A) Marking resection line guided by 36 French orogastric tube, B): Resection of greater curvature of stomach.

via the laparoscopic assistant's port. Using multiple fires of 60 mm iDrive black and purple cartridges, the greater curvature of the stomach was stapled off (Figure 3). The posterior wall of the gastric tube was secured to the posterior fat pad with interrupted 2-0 Tycron stitches.

Hemostasis was checked, then the resected stomach was removed using an endobag. All the ports were removed and the robot was undocked. The 12 and 15 mm port sites were closed using 1-0 Vicryl on a suture passer and the skin was closed in the standard fashion.

Robotic Roux-en-Y gastric bypass

The patient was positioned supine with both arms tucked at the sides. A 36-French orogastric tube was suitably placed. A Veress needle was used to enter the abdomen at Palmer's point and the abdomen was insufflated to 15 mmHg. A 12 mm camera port was placed 22 cm inferior to the xiphoid and 2 cm to the left of midline using an Optiview trocar and a 10 mm zero-degree laparoscope. The camera was exchanged to a 30-degree laparoscope, the Veress needle was removed, then two additional 8 mm working ports were placed to the left of the camera port: the first with 4 cm of lateral clearance and approximately 2 cm superior to the camera port, the second in the LUQ at the anterior axillary line. An additional 8 mm working port was placed in the RUQ and then a 12 mm laparoscopic assistant's port was placed 20 cm inferior to the xiphoid and 4 cm to the right of midline Figure 4. Then, 6 cm of a silicone flat channel drain secured to a 2-0 Prolene stitch was passed into the abdomen and used to track the liver edge to the abdominal wall.

Using a laparoscopic harmonic scalpel, the greater omentum was split in a left paramedian plane to 1 cm away from the transverse colon. While the assistant retracted the mesocolon caudally, the Ligament of Treitz was identified. Two interrupted 3-0 Vicryl stitches were placed to mark the jejunum at 100 cm and 200 cm. Then the loop of jejunum marked at 100 cm distal to the Ligament of Treitz was suture-fixed to the stomach using two interrupted 3-0 Vicryl stitches. The patient was then placed in the reverse Trendelenburg position and three working arms and a camera arm of the robot were docked to the 8 mm ports and the 12 mm port, respectively.

Using the robotic hook cautery, the lesser omentum was entered at the level of the second vein (about 6 cm from the EG junction) for creating the gastric pouch. Then the Covidien autostapler with a 45 mm purple cartridge was introduced via the assistant's port and fired horizontally across the stomach from the defect in the lesser omentum. Sequential vertical fires of the EndoGIA with 60 mm purple cartridges were used to carry the staple line upward to a point just lateral to the angle of His, ensuring complete gastrogastric division.

Using the hook electrocautery, enterotomies were made in the posterior wall of the gastric pouch and the jejunum that had been previously tacked to the greater curvature of the stomach. The tacking stitches were removed and a 45 mm purple cartridge stapler was used to create a 2 cm linear gastrojejunostomy (Figure 5). A 60 mm tan cartridge was used to divide the biliopancreatic limb just proximal to the gastrojejunostomy.

The hook cautery was used to create enterotomies in the distal biliopancreatic limb and at the site of the jejunal marking stitch that had been previously placed at 200 cm beyond the Ligament of Treitz. Using a 45 mm tan cartridge, a stapled jejunojejunostomy was made between the biliopancreatic limb and jejunum to create a 100 cm roux limb. The enterotomy site was closed using running 3-0 Vicryl and the mesenteric defect was closed to its base with running 2-0 Tycron. Reinforcing and anti-kink stitches were placed between the biliopancreatic and Roux limbs using 3-0 Vicryl. The gastrojejunal enterotomy site was closed using running 3-0 V-loc (Figure 5) and the corners were reinforced with interrupted 2-0 Tycron. A leak test was then performed by instilling 50 mL of dilute methylene blue (2 mL per 100 mL of NSS) into the orogastric tube.

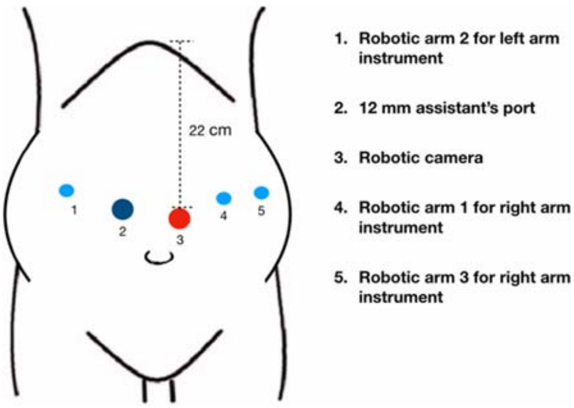

Figure 4. Port position for robotic roux-en-Y gastric bypass.

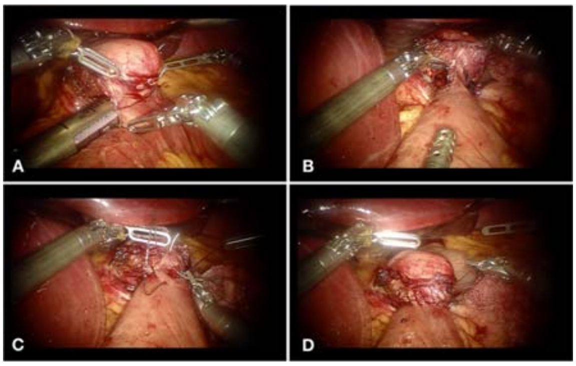

Figure 5. Robotic roux-en-Y gastric bypass; A, B) Creating linear gastrojejunostomy. C) Closing gastrojejunostomy enterotomy. D) Complete gastrojejunostomy anastomosis.

The Petersen's defect was closed by suturing the mesentery of the Roux limb to the transverse mesocolon using running 2-0 Tycron. A 10-French JP drain was placed near the gastrojejunostomy through the LUQ port site. All the ports were removed and the robot was undocked. The 12 and 15 mm port sites were closed using 1-0 Vicryl on a suture passer and the skin was closed in the standard fashion.

Postoperative care

The protocol for postoperative care was the same as for laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass. A diet program was initiated with clear liquid on postoperative day 1 and advanced to a full liquid diet (high-protein supplement) on postoperative day 3. After discharge, all the patients returned for a bariatric clinic visit at 2 weeks after surgery and were advised on a 3 small meal diet and micronutrient supplementation. The patients were scheduled for follow-up visits at 3 months, 6 months, 9 months, 12 months, and then annually after 1 year of surgery.

Results

Of all 10 patients who underwent robotic bariatric surgery, 4 patients underwent robotic sleeve gastrectomy (RSG) and 6 patients underwent robotic Roux-en-Y gastric bypass (RRYGB). The patients' demographic data are summarized in Table 1. The average patient's age, preoperative body weight, and BMI were 37.3±9.4 years old, 115.5±15.3 kg, and 43.2±3.4 kg/m^2, respectively. Pre-existing comorbid diseases were 30% type 2 DM, in which 1 of 3 patients required insulin as regular medication before surgery, 50% hypertension (HTN), 30% dyslipidemia, 20% gastro-esophageal reflux disease (GERD), and 10% obstructive sleep apnea (OSA).

All the patients underwent robotic bariatric surgery successfully without any conversion to open or laparoscopic surgery. The mean total operative times for RSG and RRYGB were 141.3±28.4 minutes (range: 120 to 180 minutes) and 231.7±30.4 minutes (range: 195 to 270 minutes) with a mean docking time of 20.2±9.6 minutes. No immediate complications, anastomotic leakage, or mortality were detected in the 90-day postoperative period, as shown in Table 2. The average length of hospital stay was 4.2±1.4 days (range: 3 to 7 days).

The mean follow-up time was 18.4±6.0 months (range: 12 to 15 months) and all the patients reached at least 12 months follow-up time.

Postoperative weight loss

The outcome of postoperative weight loss was demonstrated as BMI change, % total weight loss (%TWL), and % excess weight loss (%EWL), as shown in Table 3. At 1-year follow-up, the mean BMI change of all the patients was 12.45 kg/m^2, %TWL was 28.32%, and %EWL was 56.85%. While the mean BMI change from RSG and RRYGB were 10.49 and 14.01 kg/m^2. The mean %TWL from RSG and RRYGB were 25.33% and 30.71%, and the mean %EWL from RSG and RRYGB were 52.20% and 59.13%, respectively (Figure 6).

Comorbidity resolution

All three patients with pre-existing type 2 diabetes underwent robotic Roux-en-Y gastric bypass. The average level of HbA1c decreased from a baseline of 8.1% to 5.6% while fasting blood glucose decreased from 114 mg/dL to 94 mg/dL at 1 year after surgery, as shown in Table 4. Complete remission was achieved in 66.7% of cases (2/3 of patients). Another patient had disease improvement with glycemic control (HbA1c <7%) by discontinuing insulin therapy.

Also, we found the rate of hypertension and dyslipidemia remission to be 40% (4/5) and 100% (3/3), respectively.

Discussion

Morbid obesity has become a serious health problem worldwide and its incidence has been rising over the past few years. Bariatric surgery has been proved to be an effective treatment for morbid obesity in terms of sustainable weight loss and comorbidity resolution compared with non-surgical methods. Nowadays, the laparoscopic approach is considered as the standard approach for bariatric surgery. However, there may be some limitations in laparoscopic surgery, such as a limited angle while doing laparoscopic

Table 1. Patients' demographic data

Sex (F: M)	10:0
Age, year	37.3±9.4 (23 to 57)
Preoperative weight, kg	115.5±15.3 (92 to 140)
Preoperative BMI, kg/m^2	43.2±3.4 (37.8 to 48.1)
Pre-existing comorbidity	
Diabetes mellitus	3 (30%)
Oral hypoglycemic drug (2/3)	
Insulin (1/3)	
Hypertension	5 (50%)
Dyslipidemia	3 (30%)
GERD	2 (20%)
OSA	1 (10%)

GERD = Gastroesophageal reflux disease, OSA = Obstructive sleep apnea

Table 2. Operative data and perioperative outcomes

Operation (n = 10)	
Robotic sleeve gastrectomy	4
Robotic Roux-en-Y gastric bypass	6
Mean total operative time (min)	
Robotic sleeve gastrectomy	141.3±28.4 (120 to 180)
Robotic Roux-en-Y gastric bypass	231.7±30.4 (195 to 270)
Mean docking time (min)	20.2±9.6 (10 to 45)
Estimated blood loss (ml)	29.0±11.0 (20 to 50)
Conversion rate (%)	0
90-day postoperative complication	
Pulmonary complication	0
Bowel ileus	0
Intra-abdominal bleeding	0
Anastomosis leakage	0
Wound infection	0
Length of hospital stay (days)	4.2±1.4 (3 to 7)
Mean follow-up time (months)	18.4±6.0 (12 to 25)

Table 3. Postoperative weight loss after surgery

	3 months	6 months	12 months
Mean BMI change (kg/m^2)			
All	8.73	10.68	12.45
RSG	7.41	9.45	10.49
RRYGB	9.79	11.51	14.01
Mean %TWL (%)			
All	19.99	25.88	28.32
RSG	18.04	22.93	25.33
RRYGB	21.56	27.85	30.71
Mean %EWL (%)			
All	39.84	48.92	56.05
RSG	37.51	47.48	52.20
RRYGB	41.70	49.87	59.13

%TWL = %Total weight loss, %EWL = %Excess weight loss

suturing. Therefore, robotic surgery has been proposed as an alternative method for bariatric surgery. The advantages of robotic surgery over the laparoscopic approach include 3-dimensional visualization and the use of wristed instruments that can help facilitate hand sewing in difficult areas.

In this study, robotic bariatric procedures demonstrated good results for postoperative weight loss. The mean BMI of all the patients who underwent robotic bariatric surgery dropped from 43.2 kg/m^2 to 30.7 kg/m^2 (ΔBMI 12.5 kg/m^2). The mean %EWL from the robotic bariatric surgery, robotic sleeve gastrectomy (RSG), and robotic Roux-en-Y gastric bypass (RRYGB) was 56.05%, 52.20%, and 59.13%, respectively. These results were comparable with the outcomes reported in other robotic bariatric surgery studies. Several studies reported a %EWL from RSG of between 48.89% and 65.5% at 1 year after surgery[9] and a %EWL from RRYGB of between 60.3% and 84.0% at 1 year after surgery[10-12]. Compared to laparoscopic bariatric surgery, in our center, the 1-year overall %EWL from laparoscopic bariatric surgery was reported as 53.51% (LSG 52.65% and LRYGB 58.71%). These also showed similar results from robotic bariatric surgery compared with laparoscopic bariatric surgery in our center.

For the outcome of comorbidity resolution, our study also showed excellent results for type 2 DM remission. In the present study, all three patients with pre-existing type 2 DM underwent a robotic Roux-en-Y gastric bypass. The average HbA1c level in these patients dropped from 8.1% to 5.6% with a complete remission rate of 66.7% at 1 year after surgery. There was not much data about diabetic resolution after robotic bariatric surgery. In our center, complete remission of type 2 DM after laparoscopic RYGB was 61.7%. Some other studies have reported a complete remission of type 2 DM after laparoscopic RYGB of between 50.6% and 67.9%[13,14]. These results show that the outcome of diabetic remission from robotic RYGB was comparable to that from laparoscopic RYGB. However, since our study was conducted with a small number of patients, further study in a larger scale with longer term outcomes should be considered.

In terms of safety, there were no postoperative complications, including anastomotic leakage, bleeding, or mortality, detected in the 90-day postoperative period.

However, robotic bariatric surgery might be burdened with a longer operative time compared with conventional laparoscopic surgery. The longer operative time can be explained by the learning curve in the first few cases of robotic surgery. Hubens et al reported that the total operative time of robotic RYGB was decreased from 231 to 136 minutes ($p<0.05$) after the first 35 cases[15]. Therefore, after passing the learning curve, we believe that the total operative time will be shortened. Another advantage of robotic surgery is the shorter learning curve compared to laparoscopic surgery. Some studies showed that the learning curve for robotic RYGB required about 10 cases compared with 75 to 100 cases for laparoscopic RYGB[16,17].

In this study we demonstrated the technique of hybrid laparoscopic-robotic approach for roux-en-Y gastric bypass. In our center, we started with hybrid approach so that we could gain experience and be familiar with the system setup and docking. After that we planned to move forward to a total robotic approach. Moreover, the hybrid approach can be benefit in multi-quadrant operation which required multiple docking, like in roux-en-Y gastric bypass that performed jejunojejunostomy bypass in infracolic part and gastrojejunostomy in supracolic part.

As for the higher cost of robotic surgery, robotic bariatric surgery in our center costs approximately USD 300 more than laparoscopic bariatric surgery. Hopefully, we can reduce the cost of surgery by experiencing more cases in order to minimize the operative time as well as advancing the gastrojejunostomy anastomosis to a totally hand-sewn technique to reduce the cost of autostapler in the future.

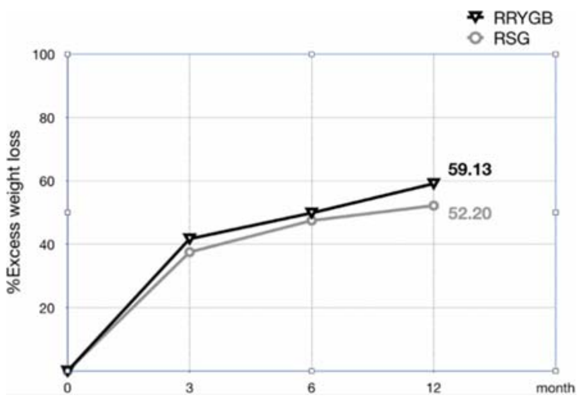

Figure 6. Postoperative excess weight loss percentage (%EWL).

Conclusion

This study suggests that the robotic approach applied for bariatric surgery in our center is safe, feasible, and provides good surgical outcomes comparable to the laparoscopic approach in terms of weight loss and comorbidity resolution in a short-term follow-up. The use of the robotic approach is useful in difficult cases or if precise work is required. However, further studies for assessing the long-term results and cost-effectiveness of this approach are needed in order to identify its true benefits.

Disclosure statement

No competing financial interests exist.

What is already known on this topic?

The surgical outcomes of robotic bariatric surgery are comparable to laparoscopic surgery in our center.

What this study adds?

This is the first case series of robotic bariatric surgery conducted in Thailand. The procedures were proved to be safe and feasible as the treatment for morbid obesity.

Potential conflicts of interest

The authors declare no conflicts of interest.

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Table 4. Change in HbA1c and fasting blood glucose in diabetes patients after surgery

	Preoperative	3 months	6 months	12 months
FBG (mg/dL)				
Patient 1	132	118	106	105
Patient 2	109	89	87	85
Patient 3	101	95	91	91
Mean	114	101	95	94
HbA1c (%)				
Patient 1	11.8	7.9	7.5	6.9
Patient 2	6.4	5.2	5.3	5.0
Patient 3	5.7	5.2	5.2	5.1
Mean	8.1	6.1	5.9	5.6

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ผลการรักษาภาวะโรคอ้วนทุพพลภาพด้วยการผ่าตัดลดน้ำหนักชนิดส่องกล้องโดยใช้หุ่นยนต์ในโรงพยาบาลศิริราช

วรบุตร ทวีรุจจนะ, ธัญเดช นิมมานวุฒิพงษ์, วิทูร ชินสว่างวัฒนกุล, อัษฎา เมธเศรษฐ, ธวัชชัย อัครวิพุธ, จิรวัฒน์ สว่างศรี, อัฐพร ตระการสง่า, ชัยณรงค์ พลานุสิตเทพา, ธรรมวัฒน์ ปรคนธรรพ์, อนุศักดิ์ เยี่ยงพฤกษาวัลย์, ณิชา ศรีสุวรนันท์

จุดประสงค์: การรักษาโรคอ้วนทุพพลภาพด้วยการผ่าตัดลดน้ำหนักแบบส่องกล้องถือเป็นวิธีการรักษามาตรฐาน ที่ให้ผลการลดน้ำหนักได้อย่างมีประสิทธิภาพ ปัจจุบันเริ่มมีการนำวิธีการผ่าตัดส่องกล้องด้วยหุ่นยนต์มาใช้ในการผ่าตัดมากขึ้น อย่างไรก็ตามยังไม่มีการรายงานผลการผ่าตัดลดน้ำหนักด้วยหุ่นยนต์ที่ชัดเจน การวิจัยนี้จึงมีจุดประสงค์เพื่อศึกษาผลการรักษาโรคอ้วนด้วยการผ่าตัดลดน้ำหนักแบบส่องกล้องหุ่นยนต์ ทั้งในผลด้านการลดน้ำหนักรวมถึงภาวะแทรกซ้อนที่อาจเกิดขึ้นจากการผ่าตัดชนิดนี้

รายงานผู้ป่วย: ได้มีการเก็บรวบรวมข้อมูลผู้ป่วยโรคอ้วน ที่เข้ารับการรักษาด้วยวิธีการผ่าตัดส่องกล้องหุ่นยนต์ในโรงพยาบาลศิริราช ตั้งแต่เดือนมิถุนายน พ.ศ. 2560 ถึงเดือนมกราคม พ.ศ. 2461 ในผู้ป่วย 10 รายที่เข้ารับการผ่าตัดส่องกล้องหุ่นยนต์ โดย 4 รายเป็นวิธี sleeve gastrectomy (SG) และ 6 รายเป็นวิธี roux-en-y gastric bypass (RYGB) ก่อนผ่าตัดผู้ป่วยมีดัชนีมวลกายเฉลี่ย 43.2 กิโลกรัม/ตารางเมตร เวลาผ่าตัดโดยเฉลี่ยของ SG เท่ากับ 141.3±28.4 นาที และของ RYGB เท่ากับ 231.7±30.4 นาที ระยะเวลานอนโรงพยาบาลเฉลี่ย 4.2±1.4 วัน และไม่พบภาวะแทรกซ้อนหลังการผ่าตัด ผลการรักษาหลังการผ่าตัด 1 ปี พบว่าสามารถลดน้ำหนักโดย %excess weight loss ของ SG อยู่ที่ 52.2% และ RYGB อยู่ที่ 59.13%

สรุป: การผ่าตัดลดน้ำหนักด้วยวิธีส่องกล้องแบบหุ่นยนต์ เป็นวิธีการรักษาที่ปลอดภัยและให้ผลการรักษาด้านการลดน้ำหนักดีเทียบเท่าการรักษาแบบส่องกล้องที่เป็นมาตรฐานในปัจจุบัน