Review Article

Revision of bariatric surgery in Asia

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Abstract: Morbid obesity has become a health burden in Asia. Bariatric surgery offers the most effective long-term outcomes for morbid obesity and its related comorbidities. However, obesity is a chronic and life-long disease that requires sustained treatment even after bariatric surgery. The inherent defect of primary procedure, incompliance of the patients and improper choice of the primary procedure may resulted in the failure of the weight loss, weight regains, poor remission of the comorbidities, patients' intolerance and postoperative complications. Thus, the revision of primary bariatric surgery is required to deal with these situations. Revisional bariatric surgery (RBS) is a complex procedure and technically challenging, but offers favorable outcomes for the patients. The choice of RBS should base on the patient's individual situation and be performed by experienced bariatric surgeons.

Keywords: Revision surgery; bariatric surgery; metabolic surgery; complication; weight regain; weight loss; Asia

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The bariatric surgery represents the most effective treatment for morbid obesity and its comorbidities, compared with the behavioral interventions and long-term drug treatments (1-3). It is estimated that about half a million bariatric procedures were performed worldwide in 2013, while Asia accounts for around 10% of all these procedures and the numbers is still growing (4). Bariatric surgery is a procedure to convert one pathological status of obesity into another pathological status of diet intake restriction or mal-absorption. Therefore, the procedure itself may result in insufficient or excessive therapeutic outcomes and complications that require additional operation to rectify these problems. Moreover, weight recidivism in terms of either weight loss failure or weight regain remains the Achilles' heel of the bariatric surgery. Rates of weight loss failure are procedure-related, ranged from 5–34% (5). However, weight regain is mainly time-dependent. Weight regain in patients after RYGB increased from 3.4% to 41% during 4 to 10 years follow-up (6). Weight regain for patients undergoing LSG ranged from 5.7% to 75.6% during 2–6 years follow-up (7). With the increasing volume of bariatric procedures performed, the demand for RBS is steadily growing.

The RBS aims to offer therapeutic solutions for the failure or the side effect of the primary bariatric procedure. According to the classification from American Society for Metabolic and Bariatric Surgery (ASMBS), RBS was classified as follows: conversion, corrective or reversal surgery (8). A conversion surgery aims to change from a primary procedure to a different type of procedure. A corrective surgery is to treat the postoperative complications or inadequate therapeutic effect of a previous procedure in terms of either weight loss or comorbidities remission. Reversal surgery aims to restore the original anatomy due to the malnutrition or psychological disorders. Due to the diversity of the primary procedure and the complex of postoperative anatomy, the RBS is technique challenging and should be performed by experienced bariatric surgeons

with the full consideration of patients' physical status and demand. This review summarized the incidence, indications, contradictions and procedures of RBS within Asia.

Incidence of RBS in Asia

The incidence of revision surgery depends on the type of the primary procedure. It is estimated that the overall incidence of revisional surgery ranged from 5–50% (9). Due to the lack of the national registration system in most of the Asian countries, the exact incidence of RBS in Asia remains unknown. Based on the national survey, Japanese population who received the bariatric surgery had 3% of overall revision incidence, while in Korean population, the incidence was 2.6% (10,11). For gastric plication, it is mainly performed in Iran and China with a total of 899 cases reported. Among these patients, 10 of them received RBS due to the postoperative complications, with the overall incidence of 1.1% (12). For laparoscopic minigastric bypass, most of the cases were performed by Lee *et al.* in Taiwan, with 1.7% (23/1,322) of RBS rate (13). For laparoscopic adjustable gastric banding (LAGB), the incidences of RBS in Japan, Singapore, Korea, Hong Kong and Taiwan were 1.2%, 9.6%, 0.5%, 1.76% and 5.3%, respectively (8,10,14-16). For laparoscopic sleeve gastrectomy (LSG), the incidence of RBS was 2.0% in Japan and 1.5% in Korea (8,10). For Roux-en-Y gastric bypass (RYGB), the incidence of RBS was 1.0% in Japan and 4.2% in Korea (8,10). It is worth noting that the incidence of RBS in Asia was retrieved from the national survey or large case series, but not based on the registration system. Thus, it should be interpreted carefully.

Indications and contradictions for RBS in Asia

The main reasons for the RBS can be classified as failure of the primary procedure or postoperative complications related to the primary procedure. However, there is no agreed definition of failure of the primary bariatric procedure in terms of weight loss. It is frequently used that less than 50% of excess weight loss (EWL) at 18 months as the failure of the primary bariatric procedure (17). Vij *et al.* in Taiwan, referred that the indication for RBS was the EWL less than 50% at 2 years, or weight regain more than 15% from the baseline postoperatively (18). For patients who underwent laparoscopic mini-gastric bypass and required revisional surgery, Lee *et al.* defined the failure as weight regain more than 20% or postoperative weight loss less than 15% (13). The bariatric surgery aims to achieve not only adequate weight loss but also remission of the comorbidities. The failure of weight loss or weight regain is not necessarily associated with worsening or reversal of insulin sensitivity after RYGB (19). Thus, the indication for RBS should not just base on the weight regain or failure, and the remission of the comorbidities should be also included. Though it was confirmed that RYGB offered better remission of type 2 diabetes mellitus (T2DM) than LSG in Asian population, it is common that the obese patients with T2DM received LSG due to its less technical difficulty (20). For the patients with failed remission of T2DM after LSG, RBS should also be considered. It is accepted that complications, in terms of nonfatal chronic intolerable symptoms with the failure of conservative treatment and impairment of patient's quality of life, require RBS. The indication of RBS should be individualized to each patient with full consideration of the current weight, remission of the comorbidities, patient's expectations and postoperative complications.

Similar to the indications which did not obtain unified agreement, there is no consensus on the contradiction of RBS in the world. It was proposed that the following issues should be listed as the contradiction of the RBS: postoperative follow-up less than 6 months; lack of surgical experience of RBS and unclear gastric anatomy after primary procedure. The weight loss after bariatric surgery is time-demanding and maximal weight loss may occur around in 2 years postoperatively. A "wait and see" strategy should be used until solid evidence of failure of weight loss or weight regain emerged. The RBS is a technical challenging procedure, and it should be performed by the experienced bariatric surgeons to achieve the better therapeutic outcomes and less postoperative complications. Furthermore, preoperative evaluation is necessary, including of the patient's physical status, nutrition status, previous procedure, postoperative complications, resolution of the comorbidities and current anatomic features. Meanwhile, mental factors should also be considered before RBS. It was reported that most of the obese patients or patients with weight regain after bariatric surgery suffered from psychological disorders (21,22). Due to the complexity of RBS, a preoperative consultation with multidisciplinary team (MDT) is required to evaluate the possible advantages and disadvantages of the RBS. MDT would be of great help to identify the suitable candidate who will benefit from the RBS.

The choice of RBS varies from surgeon to surgeon, but

it mainly depends on the primary procedure. From 1980s, bariatric surgery, such as vertical banded gastroplasty, LAGB, RYGB, LSG and so on, was introduced in Asia. Later on, the popularity of bariatric procedures changed based on the long term therapeutic outcomes and postoperative complications. Some procedures were abandoned and some gained its wide application. Thus, the choice of RBS also changes as the primary bariatric procedures changes in Asia.

Revision of LAGB in Asia

LAGB was the most popular bariatric procedure in Asia and accounted more than 80% of all cases (4). With accumulating experience with LAGB in terms of inadequate weight loss and increasing complication of the prosthesis, the application of LAGB dropped sharply since 2008. To date, LAGB is almost abandoned and replaced by LSG or RYGB in Asia. In Asian region, the causes of RBS after LAGB were reported in a total of 137 cases (15,18,23,24). As for the causes of RBS, failure of weight loss accounts for 63.5% of them (87/137) and postoperative complications accounts for 36.5% (50/137). The major complications that resulted in RBS were band/tubing failure (33 cases), band slippage (27 cases), band erosion (18 cases), and infections (10 cases). For the revisional procedures, the percentage of LSG, RYGB, band replacement and biliopancreatic diversion with duodenal switch (BPD-DS) were 36.6%, 48.5%, 10.4% and 4.5%, respectively. Most of the patients received synchronous RBS after the removal of the band. The revisional band replacement is associated with higher postoperative complications than LSG and RYGB, including band slippage and band erosion (15). The reported EWL% for BPD-DS, RYGB, LSG, and band replacement were 69.9%, 41.2–58.5%, 16.2–67%, and 21.0%, respectively. The choice of synchronous or asynchronous RBS after LAGB should base on the causes of RBS. Synchronous RBS may be appropriate to treat insufficient weight loss, while asynchronous RBS may be better to treat the postoperative complications. The strategy for the revision of LAGB includes the removal of the gastric band, replacement of the new band or conversion to another bariatric procedure. The band removal will restore the normal gastric anatomy and result in rapid weight regain or recurrence of the comorbidities. Thus, simple band removal should not be considered unless there are multiple complications related to the band or new bariatric procedure is rejected by the patient. The revisional band replacement should also not be considered as the risks of weight regain, insufficient weight loss and band related complications remain high. The choice of conversion procedure should base on the patient's character and surgeon's skills. Regarding to the postoperative complications of RYGB, it may be reasonable that RYGB should be considered for the patients with comorbidities while LSG is more suitable for simple obese patients.

Revision of gastric plication in Asia

Laparoscopic gastric plication is an appropriate procedure for the young patients with low body mass index or unwilling to accept LSG or RYGB. The surgical volume of gastric plication in Asia remains small. In 2012, Talebpour *et al.* in Iran, reported a cohort of 800 patients undergoing gastric plication, with 55% of EWL% after 5 years follow-up and 31% of the cases with weight regain after 12 years (25). For the 18 patients with the weight regain requiring RBS, 11 of them received the replication, 2 cases converted to the RYGB and 5 cases received mal-absorptive procedure. The replication resulted in 44% of EWL% after 6 months and 51% after one year. However, recent studies beyond Asia indicated that gastric plication resulted in high incidence of weight loss failure (21.4–42%), several symptoms (38%) and gastric prolapse (32.1%), which require RBS (26,27). Meanwhile, for the patients undergoing RBS after gastric plication, RYGB exhibited higher EWL than LSG (75.7 % *vs.* 61.4%). It is worth noting that the postoperative reflux is high (>15%), thus, LSG should not be considered for the patients with severe reflux after gastric plication (27). As the gastric plication has not gained its wide application in Asia, the experience regarding to RBS after gastric plication remains limited.

Revision of LSG in Asia

LSG was used as the first-stage procedure for super obese patients to reduce the perioperative risk and evolved as an independent bariatric procedure due its effective excessive weight loss, safety and simplicity (28). The ASMBS recommended that LSG could be a stand-alone bariatric procedure to treat obesity (29). To date, LSG ranks the most popular bariatric procedure in Asia. After gained its fast growth since 2008, LSG now accounts for around 50% of all procedures (4). As the application of LSG in Asia is relatively late, the investigation focusing on the RBS after LSG remains scare. A total of 31 cases were reported to have

RBS after LSG with detailed data (18,24,30). Among these patients, the causes of RBS were insufficient weight loss (25.8%), weight regain (19.4%), gastro-esophageal reflux disease (GERD) (35.5%), stricture (12.9%) and persistent T2DM (6.5%). The choice of the RBS includes RYGB, BPS-DS, plication, seromyotomy and redo-sleeve, and the percentage for each procedure is 77.4%, 6.5%, 3.2%, 6.5% and 6.5%. The choice of RBS after LSG remains controversial. As LSG is a mainly restrictive procedure for weight loss, it might be reasonable to add a mal-absorptive RBS procedure to treat the weight loss failure. Development of the *de novo* gastroesophageal reflux disease (GERD) is common in long term follow-up for the patients undergoing LSG, with the incidence of 11–33% (30). The ideal treatment of GERD is RYGB. It is reported that the RBS resulted in 54% of EWL% at 6 months postoperatively (30). Though RYGB ranks the first choice for RBS after LSG in Asian surgeons, it remains unclear which procedure offers the best outcome in terms of weight loss, resolution of complication and comorbidities, and patients' quality of life due to the small sample size and short follow-up time. Though RBS after LSG is technique demanding, all of these patients recovered well with no major complications.

Revision of RYGB in Asia

RYGB is regarded as the golden standard of the bariatric surgery and accounts for around 25% of all bariatric procedures in Asia (4). The report of RBS after RYGB in Asia is rare. We only retrieved two reports regarding to the RBS after RYGB with a total of 36 cases in Taiwan (18). Among these patients, the causes of RBS were insufficient weight loss (22.2%), refractory marginal ulcer (36.1%), anastomotic stricture (13.9%), dumping syndrome (11.1%) anemia (5.6%) and mal-absorption (11.1%). For patients with the failure of weight loss, the author chose to do the revision of the gastric pouch or gastrojejunostomy (GJ) stoma. The marginal ulcer was also treated by redoing the GJ anastomosis with a single-layer hand-sewn technique plus bilateral truncal vagotomy to reduce the acid secretion. The anastomotic stricture was treated by redoing the anastomosis. For the patients with the dumping syndrome, the author chose to resize the dilated anastomosis to 1.5 cm. For the patients with mal-absorption, common channel lengthening was done to increase the absorption. While for the patients with intractable anemia, the primary procedure of RYGB was converted to LSG. The postoperative major complications were one case of anastomotic leak and one case of jejunal obstruction with the leak. This data also indicated that the revision of the gastric pouch or GJ stoma may not the best choice for the patients with the failure of weight loss after RYGB, due to the limited EWL (29.1%) at one year (31). To date, RYGB is confirmed to offer favorable outcomes in terms of weight loss and comorbidities remission (32). However, the incidence of malnutrition and postoperative complications after RYGB is relatively higher compared with other bariatric procedures. The RBS after RYGB only yielded 31.8% of EWL at one-year follow-up, but offered 90% complete resolution of preoperative complications (18). The RBS should be positive for postoperative complications but discreet for weight loss failure or regain.

Revision of laparoscopic minigastric bypass in Asia

Laparoscopic minigastric bypass is modified from the Mason's loop gastric bypass. Lee *et al.* reported a cohort of 23 cases of RBS after laparoscopic minigastric bypass in Taiwan (13). The common causes of RBS were intolerance (26.1%), weight regain (34.8%) and malnutrition (39.1%). The revisional procedures were RYGB (47.8%), LSG (43.5%) and reversal (8.7%). RYGB resulted in greater EWL than LSG for the patients after laparoscopic minigastric bypass, but LSG offered better improvement of the malnutrition.

Conclusions

It is important to evaluate the patients' psychological status, previous history of bariatric surgery and current anatomy before RBS. The choice of RBS should be different to treat the patients with the insufficient weight loss or with postoperative complications. Moreover, patients' compliance and complications in terms of malnutrition and vitamin insufficiency after RBS should also be considered.

The bariatric surgery in Asia is not widely accepted as it is in Western countries, with less surgical volume (10% of global cases in 2013). Meanwhile, bariatric surgery started late in most Asian countries. As a result, the investigations of RBS are sporadic in Asia, with small amount of cases. The main causes of RBS in Asia are insufficient weight loss, weight regain and postoperative complication related to the primary procedure. The choice of RBS procedure varies from surgeon to surgeon with no widely accepted criteria.

The therapeutic outcomes of RBS are heterogeneous, though most of the authors claimed that the incidence of major postoperative complications was low. Thus, the RBS in Asia requires further investigation.

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Footnote

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