

## Development of Bariatric Surgery: The Effectiveness of a Multi-disciplinary Weight Management Programme in Hong Kong

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### Abstract

**Introduction:** In Hong Kong, obesity and its associated co-morbidities are increasingly becoming a health and societal burden. Conservative weight management therapy is ineffective in maintaining substantial weight loss in severely obese patients and more invasive interventions are required to achieve sustainable weight loss. **Materials and Methods:** Invasive bariatric procedures were introduced to Hong Kong in 2002. Severely obese patients will be seen in a combined obesity clinic where multi-disciplinary assessment was carried out before interventional therapy. Patients will be allocated to various bariatric surgeries such as laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG) or laparoscopic gastric bypass (LGB) when operative criteria were met. For selected patients who were not suitable or refused surgical treatment, endoscopic placement of intragastric balloon (IGB) will be used as an alternative weight control option. Multi-disciplinary approach was also applied during perioperative period to accomplish different clinical needs for the individual patient. **Results:** Over 500 patients were seen in our unit seeking advice on severe obesity. Two hundred and twenty-five patients received interventional therapy which included LAGB (n = 57), LSG (n = 71), LGB (n = 7) and IGB programme (n = 120). Thirty patients (25%) received second bariatric surgery after IGB removal. Adverse events occurred in 20 patients (7.8%) and there was no operative mortality. At 2 years, the mean percentage of excessive weight loss (%EWL) for LAGB, LSG and LGB are 34%, 51% and 61%, respectively. In those patients who received IGB alone, the mean %EWL at removal and 6 months after removal were 44% and 34%, respectively. **Conclusions:** Through a multi-disciplinary weight management programme with different specialties and various bariatric procedures, favourable results can be achieved in patients with severe obesity.

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**Key words:** Bariatric surgery, Laparoscopy, Obesity, Outcome

### Introduction

Obesity is one of the most common chronic illnesses in the Western World with a frequency of 10% to 15%. It causes or exacerbates many diseases and is associated with major physical and psychological disability.<sup>1</sup> Data from US national population surveys have shown that the prevalence of being overweight (BMI 25 to 30) and obese (BMI >30) was 61% and 27%, respectively,<sup>2</sup> and data from Hong Kong have shown a lower prevalence of the problem of being overweight (29%) and obese (3.8%).<sup>3</sup> However, the problems of obesity in Hong Kong should not be underestimated especially when the prevalence of obesity in children and adolescents is increasing.<sup>4</sup> Moreover,

ethnicity can also affect BMI-related disease risk as Southeast Asian populations have a higher risk of developing diabetes and cardiovascular disease than do Caucasians who have the same BMI values.<sup>5</sup>

These figures are alarming, as many obese patients will inevitably suffer from metabolic syndrome and other co-morbidities that lead to premature mortality. The goal of weight-reduction therapy is to improve health by modifying obesity-related disease and the risk for future obesity-related medical complications. Substantial weight loss with weight maintenance has been shown to reduce markedly the prevalence of cardiovascular risk factors<sup>6</sup> and in most patients reverses diabetes, hypertension and pulmonary

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dysfunction.<sup>7</sup> While lifestyle modification, exercise, dietary training and medical therapy may be effective in weight control for slightly overweight people, those who are morbidly obese often fail with these simple measures. Bariatric surgery has been proven to be the most effective and long-lasting measure in the management of such a condition. It is becoming one of the most common operations in Western countries. However, the extent and development of obesity surgery in Hong Kong is far behind that of Caucasian countries.

## Patients and Methods

### *Multi-disciplinary Weight Management Programme in Hong Kong*

Before year 2000, bariatric surgery is almost non-existent in Hong Kong. With the foresight of the problem, 2 of our surgeons underwent overseas training in advance laparoscopic surgery and bariatric procedure in 2 of the nations in the world with the highest prevalence of being overweight, Australia and United States of America (US). The purpose of training is not only acquiring the skill of the procedures, but also understanding the structure and programme behind the success in Western countries. In 2002, the Surgery Department of the Chinese University of Hong Kong (CUHK) established the first Combined Obesity Clinic (COC) in Hong Kong. COC is a multi-disciplinary clinic, which recruits the input of involved surgeons, endocrinologists, dietitians and specialty nurses to provide assessment and counselling to those patients with severe obesity who need bariatric intervention. It provides preoperative counselling, endocrine and metabolic disease screening for secondary causes of obesity and obesity-associated co-morbidities, dietary assessment and counselling, and if required, psychiatric assessment of potential eating and depressive disorders for those morbidly obese patients before the bariatric procedure is being contemplated. A tailor-made weight management plan was formulated according to patients' severity of obesity, potential risk-benefit adjustment; together with a thorough discussion of realistic goals in relation to various treatment strategies (Fig. 1). Apart from the clinical service, a Combined Bariatric Surgery Research Centre (CBSRC) between CUHK and Union Hospital (UH-private hospital) was established in 2007. This centre allows us to extend our research potential so that interdisciplinary research involving both surgeons and endocrinologists regarding the treatment of obesity can be carried out and audit of difference procedures can be maintained among different hospitals.

### *Candidates for Bariatric Surgery*

*Indication for surgery:* From 2002 to 2005, we recruited patients for surgery (LAGB, LSG, LGB) according to

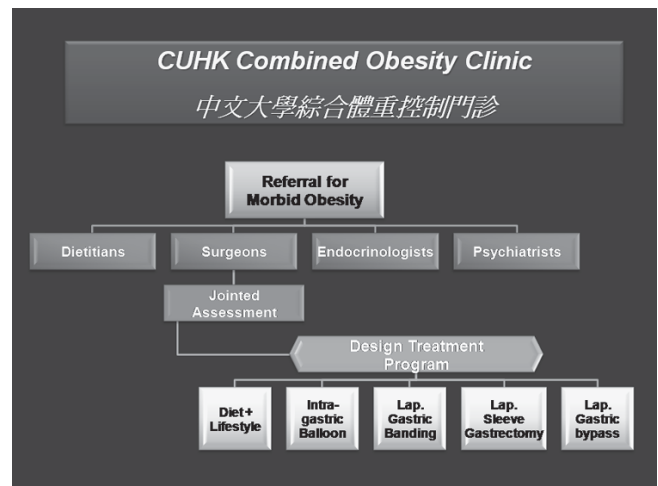


Fig. 1. Multi-disciplinary weight management programme before interventional bariatric procedures.

United State National Institute of Health (NIH) consensus: patients whose BMI exceeded 40 kg/m<sup>2</sup>, or patients who were less obese (BMI between 35 kg/m<sup>2</sup> to 40 kg/m<sup>2</sup>) but suffered from high risk co-morbidities.<sup>9</sup> However, subsequent studies in Hong Kong showed that the Chinese had a higher body fat percentage than Caucasians with comparable BMI.<sup>8-9</sup> These observations are in agreement with the previous findings of higher morbidity risks at a lower BMI in Hong Kong Chinese.<sup>10</sup> In 2005, the Asia Pacific Bariatric Surgery Group consensus meeting recommended bariatric surgery in Asian patients with BMI >37 or >32 kg/m<sup>2</sup> with diabetes or 2 other obesity-related co-morbidities.<sup>11</sup> Since 2005, we have modified our inclusion criteria and started recruiting patients with a lower BMI for surgery.

### *Bariatric Surgery*

Since 1954, surgery has been performed in an attempt to control morbid obesity. Since the first jejunio-ileal bypass performed by Kremer and Linner, various approaches and procedures have been developed in the attempt for weight reduction, and hence to improve patients' health and quality of life. In Hong Kong, the development of bariatric surgery is still at its infancy stage as compared to Western countries. Starting from 2002, we have introduced a variety of surgery, including laparoscopic adjustable gastric banding (LAGB),<sup>12</sup> laparoscopic gastric bypass (LGB), laparoscopic sleeve gastrectomy (LSG).<sup>13</sup>

### *Laparoscopic Adjustable Gastric Banding (LAGB)*

Among various types of surgeries, LAGB is considered one of the safest operations among other procedures. Laparoscopic adjustable gastric banding, which was introduced in the early 1990s, offers the advantages of minimally invasive surgery, adjustability and reversibility.

It is a purely gastric restrictive procedure that involves the use of an adjustable silicone band placed around the gastric cardia, which creates a small gastric pouch (15 mL) with a narrow outlet, similar in concept to that of the vertical banded gastroplasty (VBG). The 2 most common commercially available products are the LapBand (Bioenterics, Allergran, Inc) and the Swedish Adjustable Gastric Band (SAGB, OBECH, Ethicon Endosurgery, J&J, Inc). These bands can be adjusted postoperatively by inflating a reservoir, which is accessed percutaneously by a subcutaneous port placed deep in the abdominal wall. Injection or withdrawal of saline from the port allows adjustment of the band luminal diameter. In year 2002, we performed our first LAGB under the proctorship of Professor James Toouli from Australia. Since then, LAGB has become our primary bariatric procedure for most of our patients. Our initial experience showed that LAGB is certainly an effective procedure for morbid obesity, which results in a substantial weight loss and improvement of co-existing morbidities and quality life.<sup>6</sup>

#### *Laparoscopic Gastric Bypass (LGB)*

Although LAGB is effective for most of our patients with morbid obesity, it still has its limitations. The restrictive procedure cannot limit calories from fluids and patients with poor compliance of dietary advice are at risk of inadequate weight loss or pouch dilatation secondary to binge eating behaviour. Gastric bypass, on the other hand, is a hybrid procedure combining restriction and foregut bypass in the form of either Roux-en Y reconstruction (Roux-en Y gastric bypass, proximal gastric bypass) or Billroth II reconstruction at distal stomach (Mini-bypass, distal gastric bypass). The former is considered as the “Gold-Standard” bariatric procedure in the US while the latter is commonly performed in Asia, especially in Taiwan. Although gastric bypass is more effective in weight reduction and induces remission of type II diabetes,<sup>14</sup> it carries higher perioperative morbidities and mortality, and requires life-long nutrition supplement. In our centre, laparoscopic gastric bypass is used as the primary bariatric procedure for super-obese patients (BMI >50) or used for salvage patients with previous failed restrictive procedures.

#### *Laparoscopic Sleeve Gastrectomy (LSG)*

“Sleeve gastrectomy” or “vertical gastrectomy” is a new form of bariatric procedure in weight management. It involves the removal of >75% of the stomach and leaves a small gastric tube. This procedure results in the decrease in the stomach size inhibiting distention of the stomach and increasing the patient’s sensation of fullness and decreasing their appetite. Some posit-increased satiety results from the decreased ghrelin, secreted by the fundus, which is resected in sleeve gastrectomy. This procedure is initially used as

the first stage of a 2-staged procedure to achieve weight loss and reduce comorbidities in patients who were super-obese before performing the second stage Roux-en-Y gastric bypass or biliopancreatic diversion with duodenal switch.<sup>15-16</sup> As the effectiveness and safety of laparoscopic sleeve gastrectomy is encouraging, it is gradually used as the primary procedure in various centres in Asia and Europe.<sup>17-18</sup>

#### *Intra-gastric Balloon (IGB) Programme*

Although bariatric surgery is considered as the only method to induce sustainable and profound weight loss in obese patients, its acceptance in the Chinese is far below that of Western counterparts. Cultural differences affect the attitudes of patients towards obesity surgery. Most traditional Chinese do not consider obesity a chronic illness and the majority of patients are unwilling to undertake a more aggressive surgical approach for obesity treatment. IGB becomes a very valid alternative to these patients who are reluctant for a more invasive intervention. A new design of balloon (Bioenterics® Intra-gastric Balloon, BIB® system) was introduced in 1999<sup>19</sup> and has undergone extensive evaluation in Europe and South America.<sup>20,21</sup> In 2004, we established a new IGB programme for those patients who are not suitable or who do not consent for operative bariatric surgery. In this programme, IGB therapy is used as a temporary weight control measure in these 3 groups of patients:

1. Patients who are surgical candidates<sup>11</sup> and willing to receive bariatric surgery, but whose preoperative weight reduction is considered beneficial, especially in a super-obese (BMI >60) individual.
2. Patients who are candidates for bariatric surgery but unwilling to undergo a major surgical procedure.
3. Patients with low BMI (BMI 25 to 32) who are not candidates for surgery but suffer from obese-related comorbidities and had failed conservative weight reduction therapy in the past.

Patients who enrolled into the IGB programme will first be assessed in the COC and receive pre-endoscopic counselling by a dietitian and surgeons. Endoscopic placement of IGB is performed under conscious sedation and patients will be monitored overnight for side-effects such as severe nausea and vomiting and they will be treated with intravenous antiemetic treatment until they can tolerate diet. Patients will receive monthly follow-up by the dietitian in the first month and then be monitored monthly for the next 6 months for their eating behaviour and for side-effects of the treatment. IGB will be removed after 6 months or when the patient suffers from intolerance and complications from the IGB treatment. The initial result is promising with a high satisfaction rate at 6 months.<sup>22</sup> After

IGB treatment, patients will be reviewed and a second bariatric procedure will be offered if necessary.

*Multi-disciplinary Perioperative and Postoperative Care*

Every patient will receive upper gastrointestinal endoscopy to rule out significant upper gastrointestinal tract diseases such as peptic ulcer, cancer, severe gastroesophageal reflux disease and hiatus hernia. For patients with symptoms of obstructive sleep apnoea, preoperative polysomnography will be performed and reviewed by the respiratory physician. Before the operation, patients will be checked by endocrinologists and anesthesiologists for an perioperative risk assessment. Patients with severe sleep apnoea or significant operative risk will require overnight postoperative care in the high-dependence or intensive care unit. Operating theatre staffs were informed before the operation that they needed to ensure the availability of special instruments such as the gastric band, optical trocar, extra-long laparoscopic trocars and forceps.

Most patients will resume a fluid diet 1 or 2 days after the operation, and a selective postoperative radiological study such as the contrast swallow fluoroscopy will be performed by the radiologist to look for possible complications such as gastric leakage and band malposition. Dietary advice will be given by our dietitian before discharge and immediate medication adjustment will be prescribed by our endocrinologists before the patient’s discharge. All patients will be followed-up in the COC regularly. Before attending our clinic, patients will be treated by our dietitian for dietary assessment and advice. Patients who received LAGB will be followed-up monthly for 6 months for band

adjustment according to their food tolerance and weight change. Patients who received LSG and LGB will be seen monthly for the first 3 months and then once in 3 months according to dietary adjustments and symptoms. Vitamins, iron and calcium supplements will be prescribed to patients who received LGB and patients who had difficulties adapting to a normal diet at the initial phase of the postoperative period. Subsequent adjustment of their medication for diabetes and hypertension will be titrated by our endocrinologists, and our respiratory physician will also treat them regularly for sleep apnoea, and will titrate their settings and need of the CPAP machine during follow-up. For patients with significant fat loss, skin redundancy over the lower abdomen, thighs, hips, breast and armpit will sometimes cause problems such as bacterial or fungal infection, social embarrassment and psychological stress. Assessment and corrections by plastic surgeons may be necessary in selected cases.

**Results**

*Combined Obesity Clinic*

Since 2002, we have received a total of 564 referrals for bariatric surgery in the COC (Fig. 2). Three hundred and sixty-three patients were female (65%) and their mean age was 39.6 (SD 9.9). Their mean baseline body weight was 96.8 Kg (SD22.1) and their mean BMI was 36.3 kg/m<sup>2</sup> (SD 7.2). Within all these referred patients, 376 patients (66.7%) had a BMI >32 and 311 (55.1%) fulfilled the criteria for bariatric surgery. All patients were assessed by our multi-disciplinary team and 260 patients (46%) were either not suitable or refused further bariatric intervention. The remaining patients were recruited for either bariatric surgeries (n=92), IGB (n= 120) or an ongoing comparative study of obesity intervention (n = 92).

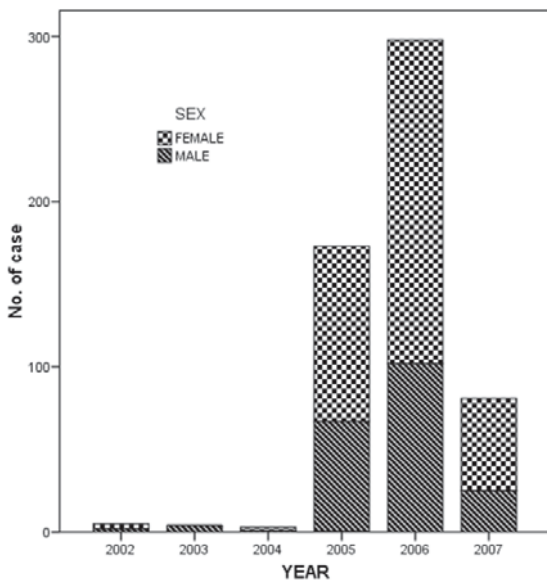


Fig. 2. Number of new case referrals to Combine Obesity Clinic from 2002 to 2007.

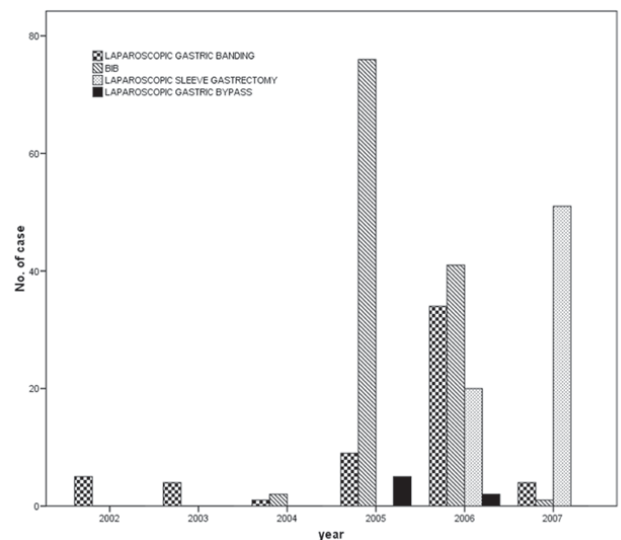


Fig. 3. Various bariatric procedures performed in the last 6 years.



### Combined Results on Bariatric Procedures

Combined with the surgical data from our hospital, Prince of Wales Hospital (PWH) and the private hospital (UH), a total of 255 patients had received bariatric procedure and were included for the analysis. Among these patients, bariatric surgeries (LAGB, LSG, LGB) and IGB were performed in 135 (52.9%) and 120 patients (47.1%), respectively (Fig. 3). For patients who received bariatric surgeries, the mean body weight was 108 kg (SD 22) and the mean BMI was 40.2 kg/m<sup>2</sup> (SD 7.2). As compared to patients who received IGB, patients who received surgeries have a higher mean BMI (40 vs. 38.5 kg/m<sup>2</sup>,  $P = 0.04$ ) and a higher incidence of obesity-related disease (78% vs. 62%,  $P = 0.01$ ).

One hundred and twenty patients underwent the IGB programme during the study period. The mean hospital stay is 1.4 days (SD 0.9) and the procedure is well tolerated with 76% of patients being discharged the next day. Five patients had severe nausea and vomiting which resulted in the removal of balloons (4.2%) and one of them developed hypokalaemia and required intravenous fluid and electrolyte therapy. Another patient developed biliary pancreatitis which finally settled with the removal of the balloon and subsequent ERCP. After 6 months of treatment, the mean body weight loss was 12.3 kg (SD 6.9) and a BMI loss of 4.6 kg/m<sup>2</sup> (SD 2.7). The mean %EWL after balloon removal is 44%. Thirty patients (25%) subsequently received bariatric surgery (20 LAGB, 7 LSG, 3 LGB) after IGB removal. For patients who did not receive further bariatric surgeries, 41 of them had returned for follow-up 6 months after the balloon removal and their mean weight loss and BMI loss were 9.6 kg (SD 10.4) and 3.6 kg/m<sup>2</sup> (SD 4.0), and the mean %EWL at 6 months after balloon removal is 34%, respectively.

One hundred and thirty-five patients received operative bariatric procedures (57 LAGB, 71 LSG, 7 LGB) in PWH and UH. The mean operation time for LAGB, LSG and LGB were 99 min (SD 43), 90 min (SD 39) and 200 min (SD 59) and the duration of hospital stay were 1.9 days (SD 1.1), 3.8 days (SD 2.3) and 15.0 days (SD 13.3), respectively. Significantly longer operation times ( $P < 0.001$ ) and hospital stay ( $P < 0.001$ ) were observed in the LGB group. There were no operative mortality and the overall complication rate was 10.3% ( $n = 14$ ). Complications included postoperative fever, port site infection, band leakage and port site malposition (5 patients; 8.8%) in the LAGB group; staple-line leakage, gastric tube stricture, wound infection and urinary retention (6 patients; 8.5%) in the LSG group; anastomotic leak, small bowel obstruction and stomal ulcer (3 patients; 42.9%) in the LGB group. Three patients in the LAGB group required a second operation for port adjustment, band replacement and band removal. The

mean follow-up duration for LAGB, LSG and LGB were 24 months (SD 16), 8 months (SD 5) and 24 months (SD 5), respectively. During the 2 years of follow-up, the mean weight loss was 15 kg (SD 13), 27 kg (SD 7) and 30 kg (SD 8) in the LAGB, LSG and LGB groups, respectively. The mean percentage of excessive weight loss at 2 years was 34%, 51%, 61%, and the mean percentage of BMI loss was 13%, 22% and 26% in the LAGB, LSG and LGB groups, respectively. Among 255 patients who received bariatric procedures, plastic surgical reconstruction of redundancy skin was performed in 12 patients (4.7%), which included abdominoplasty (panniculectomy), trunkoplasty, mammoplasty (breast lift) and brachioplasty.

### Discussion

Bariatric surgery is a new sub-specialty in Hong Kong and its development is in the infancy stage. In the last 6 years, the bariatric procedure in Hong Kong is evolving from a single surgical procedure (LAGB) to the full package of both endoscopic and laparoscopic surgeries. From 2002 to 2005, the number of new referral to the COC remained small and most Chinese patients and doctors still have difficulty in accepting such an invasive treatment for obesity. It was only in 2005, when we introduced the IGB programme and announced this innovative and relatively less invasive therapy in the public media, the number of referrals increased substantially. In parallel with the increase in new referrals, more and more people understand and agree to receive invasive therapy for their serious weight control problem. Moreover, a proportion of patients who underwent the IGB programme had certain degrees of weight regain. We found that it is easier to convince this group of patients to undergo bariatric surgery even though they had refused surgery before the IGB programme. However in 2007, we observed a major reduction of new cases in our clinic. We cannot explain the drop in referrals but we suspect that it may be related to an operative mortality that happened in that year after bariatric surgery in another regional hospital in Hong Kong.

Laparoscopic adjustable gastric banding is our first introduced procedure due to its safety and reversibility. However, over the last few years, we notice that the initial amount of weight loss is relatively less than the other bariatric procedures. Moreover, as compared to gastric bypass, LAGB cause more vomiting and obstructive symptoms with worsened gastrointestinal quality of life.<sup>24</sup> In 2005, we started to perform laparoscopic gastric bypass as one of the weight reduction procedures. Although the degree of weight loss was more significant, the severity of complications is also relatively more serious. LGB is a relatively complex procedure and requires a much longer learning curve to obtain an optimal and satisfactory result.

On the other hand, laparoscopic sleeve gastrectomy is a relatively simple procedure. Without intra-corporeal anastomosis, LSG required less laparoscopic skills and morbidity after surgery is significantly less. Moreover, the degree of weight loss is compatible with LGB, which makes LSG an attractive alternative bariatric procedure and the number of cases performed in our unit had exceeded LSG in the last 2 years. However, there is still a concern on the long-term outcome on patients who received LSG as there is a lack of published evidence for sustained weight loss beyond 3 years. As stated by the American Society of Bariatric and Metabolic Surgery (ASBMS) on LSG, patients need to be informed of the uncertainty on the long-term outcome data for this relatively new procedure.

However, the development of bariatric surgery in Hong Kong is still limited by a constraint of resources. Our CUHK weight-control clinic in the Prince of Wales Hospital is heavily subsidised by departmental funds and all patients are required to pay for their surgical instruments and devices. The endoscopic procedures (IGB) and other advanced laparoscopic bariatric surgeries require expensive instruments and intensive postoperative care, but unlike the US or Australian model, medical expense on these advanced surgical procedures were not additionally subsidised by the Hospital Authority. Patients and the surgical unit need to bear the extra cost, which means that substantial numbers of morbidly obese patients cannot acquire their ultimate needs. Recently, more and more studies had demonstrated the improvement of both morbidity and mortality after bariatric surgeries.<sup>24-26</sup> The alternation of foregut anatomy had recently been found to create a significant impact on glucose homeostasis, which makes this new subspecialty evolve from weight control (bariatric) to diabetes control (metabolic). Indeed, the term “Metabolic Surgery” is now beginning to adhere to bariatric surgery in most international bariatric surgical societies. This reflects the considerable room for further development in this surgical field and our surgical society should be prepared for the new era of surgery for obesity.

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#### REFERENCES

- National Institutes of Health. Health implication of obesity. National Institutes of Health Consensus development Conference Statement. *Ann Intern Med* 1985;103:1073-7.
- National Center for Health Statistics, Center for Disease Control and Prevention. Available at: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/obese/obse99.htm>. Accessed 21 October 2008.
- Ko GT, Tang JS. Prevalence of obesity, overweight and underweight in a Hong Kong community: the United Christian Nethersole Community Health Service (UCNCHS) primary health care program 1996-1997. *Asia Pac J Clin Nutr* 2006;15:236-41.
- Leung SS, Ng MY, Lau TF. Prevalence of obesity in Hong Kong children and adolescents aged 3-18 years. (Chinese) *Chung-Hua Yu Fang I Hsueh Tsa Chih* 1995;29:270-2.
- McKeigue PM, Shah B, Marmount MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asia. *Lancet* 1991;337:382-6.
- Martin LF, Hunter SM, Lauve RM, O'Leary JP. Severe obesity: experience to society, frustrating to treat, but important to confront. *South Med J* 1995;88:895-902.
- Long SD, O'Brien K, Macdonald KG Jr, Leggett-Frazier N, Swanson MS, Pories WJ, et al. Weight loss in severely obese subjects prevents the progression of impaired glucose tolerance in Type II diabetes. *Diabetes Care* 1994;17:372-5.
- Deurenberg P, Deurenberg-Yap M, Guricci S. Asians are different from Caucasians and from each other in their body mass index/body fat per cent relationship. *Obes Rev* 2002;3:141-6.
- Ko GT, Tang J, Chan JC, Sung R, Wu MM, Wai HP, et al. Lower BMI cut-off value to define obesity in Hong Kong Chinese: an analysis based on body fat assessment by bioelectrical impedance. *Br J Nutr* 2001;85:239-42.
- Ko GT, Chan JC, Cockram CS, Woo J. Prediction of hypertension, diabetes, dyslipidaemia or albuminuria using simple anthropometric indexes in Hong Kong Chinese. *Int J Obes Relat Metab Disord* 1999;23:1136-42.
- Lee WJ, Wang W. Bariatric surgery: Asia-Pacific perspective. *Obes Surg* 2005;15:751-7.
- Wong SK, So WY, Yau PY, Chan AK, Lee S, Chan PN, et al. Laparoscopic adjustable gastric banding for the treatment of morbidly obese patients: early outcome in a Chinese cohort. *Hong Kong Med J* 2005;11:20-9.
- Mui WL, Ng EK, Tsung BY, Lam CC, Yung MY. Laparoscopic sleeve gastrectomy in ethnic obese Chinese. *Obes Surg* (Epub 2008 May 28).
- Rubino F, Gagner M. Potential of surgery for curing type 2 diabetes mellitus. *Ann Surg* 2002;236:554-9.
- Gagner M, Inabnet WB, Pomp A. Laparoscopic sleeve gastrectomy with second stage biliopancreatic diversion and duodenal switch in the superobese. In: Inabnet WB, DeMaria EJ, Ikramuddin S, editors. *Laparoscopic Bariatric Surgery*. 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2005.
- Silecchia G, Boru C, Pecchia A, Rizzello M, Casella G, Leonetti F, et al. Effectiveness of laparoscopic sleeve gastrectomy (first stage of biliopancreatic diversion with duodenal switch) on co-morbidities in super-obese high-risk patients. *Obes Surg* 2006;16:1138-44.
- Moon Han S, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at 1 year in morbidly obese Korean patients. *Obes Surg* 2005;15:1469-75.
- Roa PE, Kaidar-Person O, Pinto D, Cho M, Szomstein S, Rosenthal RJ. Laparoscopic sleeve gastrectomy as treatment for morbid obesity: technique and short-term outcome. *Obes Surg* 2006;16:1323-6.
- Bioenterics Intragastric Balloon (BIB®) System. Revision to Indications for use. Manufacturer's guidelines information sheet. Carpinteria, California: Bioenterics Corporation, 1999.
- Sallet JA, Marchesini JB, Paiva DS, Komoto K, Pizani CE, Ribeiro ML, et al. Brazilian multicenter study of intragastric balloon. *Obes Surg* 2004;14:991-8.
- Methus-Vliegen EM, Tytgat GN. Intragastric balloon for treatment-resistant obesity: safety, tolerance, and efficacy of 1-year balloon treatment followed by a 1-year balloon free follow-up. *Gastrointest Endosc* 2005;61:19-27.
- Mui WL, So WY, Yau PY, Lam CH, Yung MY, Cheng AY, et al. Intragastric balloon in ethnic obese Chinese: initial experience. *Obes Surg* 2006;16:308-13.
- Lee WJ, Wang W, Yu PJ, Wei PL, Huang MT. Gastrointestinal quality of life following laparoscopic adjustable gastric banding in Asia. *Obes Surg* 2006;16:586-91.
- Maggard MA, Shugarman LR, Suttrop M, Maglione M, Sugerma HJ, Livingston EH, et al. Meta-analysis: surgical treatment of obesity. *Ann Intern Med* 2005;142:547-59.
- Sjostrom L, Lindroos AK, Peltonen M, Torgerson J, Bouchard C, Carlsson B, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. *N Engl J Med* 2004;351:2683-93.
- Adam TD, Gress RE, Smith SC, Halverson RC, Simper SC, Rosamond AD, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med* 2007;357:753-61.