History of Bariatric Surgery

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Introduction

The journey of the surgical treatment of morbid obesity largely stemmed from observations of secondary effects of other operations for unrelated pathology. The problem of incapacitating obesity found its primary treatment from the effects observed in individuals that underwent resection of a portion of their small intestine or stomach and the resulting weight loss, even if the individual was of normal weight at the outset.

Recognition of an obesity health crisis and its many comorbidities is only a few decades old. For many centuries, as a consequence of chronic scarcity of food, obesity was associated with affluence, power, health, and prosperity. It was only after the technologic advances of the eighteenth century that food became more affordable and readily available. As the world exited the Second World War, farming in many areas became increasingly mechanized and industrialized. Manpower was more available resulting in decreased costs and food commodities became more affordable. The birth of the fast-food industry emerged and thrived, as did the urbanization of not only the United States, but also the world. This environment established conditions in which the prevalence of obesity skyrocketed. Late in the nineteenth century, obesity was recognized only as an aesthetic issue, and it was not until the twentieth century that it was later accepted as a significant health problem [1].

Early attempts to curtail obesity were trivial. Surgical limitation of oral intake with jaw wiring was one of the earliest attempts to alleviate obesity [2]. Historical reports claim that the earliest bariatric surgery was performed in Spain in the tenth century. Accounts report that Sancho I, King of León, was so obese that he could not walk, ride a horse, or pick up a sword. He eventually lost his throne and was escorted by his grandmother to Cordoba to see the famous Jewish doctor Hasdai Ibn Shaprut where he sutured the king's lips, limiting him to a liquid diet. King Sancho lost half his body weight, returned to León on his horse, and triumphantly retook his throne [3, 4].

Other jaw wiring techniques proved to be unsuccessful, as patients would continue to consume high calorie liquids only to lead to weight regain. In addition, patients had difficulty maintaining oral hygiene and suffered from dental complications. Emesis and aspiration with resulting respiratory tract infections were also significant concerns [5]. Jaw wiring was abandoned, but an important concept in bariatric management was recognized: caloric restriction coupled with the need to provide permanent results.

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Weight loss operations and interventions were sparsely reported in the literature during the early twentieth century and largely remained in obscurity until the 1980s. It was not until the obesity epidemic was finally recognized that the medical community started considering surgical approaches, bringing surgery to the forefront as a durable and respected treatment [6, 7].

Obesity Epidemic

At present, obesity is recognized as a major public health crisis and many improvements in public health have come to a halt due to its effects. For the first time in decades, the life span of the next generation is predicted to be shorter than their parents [8]. Morbidly obese patients (body mass index, BMI > 40 kg/m^2) are clearly disadvantaged in our society. Not only are they afflicted by health conditions associated with morbid obesity, e.g., diabetes, sleep apnea, and cardiovascular diseases, but also struggle with many of life's simple activities, such as sitting in a chair or walking normal distances. A great deal of social marginalization is placed on the obese creating complex social and psychological burdens.

Obesity is an increasing public health challenge in both economically developed and developing regions of the world. 33.0% of the world's adult population is overweight or obese [9]. In 2008, more than 1.4 billion adults and more than 40 million children under the age of 5 were overweight. If current trends continue, by 2030 over half of the world's adult population (nearly 3.3 billion people) will be either overweight or obese [10]. While the prevalence of obesity is higher in economically developed countries compared with economically developing countries [10], the absolute number of obese children is greater in the developing world [9]. This represents a significant current and future burden on the developing world and the prevalence of obesity only continues to rise in developing countries, particularly in urban settings where unhealthy "fast food" has become common. Additionally, urbanization and mechanization, coupled with an increased sedentary lifestyle, results in sharp increases in obesity and metabolic syndrome.

Obesity in the United States

Some of the most compelling data on obesity prevalence rates over time in the United States come from figures released by the National Health and Nutrition Examination Surveys (NHANES) program of the National Center for Health Statistics of the Centers for Disease Control and Prevention. These surveys contain data from a national cross-section beginning in 1960 [11–15] in which representative samples of the US population were selected. Adult data suggested a steady prevalence of obesity from the 1960s through the 1980s, with a noticeable increase in beginning in the late 1980s from 23.0% in 1988 to 36.0% in 2010 [14, 15]. Interestingly, the rate of those classified as overweight has been relatively stable, but there has a significant increase in the rate of obesity. Projections based on NHANES data predict that more than half of US adults are likely to be obese and 86.3% are likely to be overweight or obese by 2030 [16]. Similar dramatic projections have been made for children, creating a critical outlook for this progressive epidemic. The global dilemma of obesity requires multiple actions, but for the already affected, bariatric surgery has become a valid option.

Early Pioneers

Soon after World War II, many young physicians returned from the call of duty to complete their training. Several institutions channeled a large part of this workforce into research, including investigating the mysteries of the gastrointestinal tract. It was in this setting that A.J. Kremen and John Linner at the University of Minnesota examined transposing segments of the small intestine to understand the physiology of the jejunum as compared to the ileum. They performed the first metabolic surgery by creating a jejunoileal bypass of various lengths in dogs [17]. They

discovered that the animals were not only able to survive with a significant portion of the intestine bypassed, but also that lipid absorption was greatly impacted leading to weight loss. Their canine studies were of such high quality that they were presented at the American Surgical Association Spring Meeting in 1954 [17]. During their presentation, a member of the audience commented that a woman had undergone a similar operation to bypass the majority of her small intestine. She had lost a significant amount of weight and interestingly her cardiac disease had improved [18]. Around the same time, the Swedish surgeon Viktor Henriksson had been performing an intestinal bypass procedure in a small group of patients resulting in notable weight loss; however, each had experienced "difficult situations of nutritional balance" [18]. In the groups operated upon by Linner and Henriksson, it was noticed that patients had experienced long-term control of obesity and associated conditions. Several surgeons would later adapt these intestinal bypass procedures in the 1960s and initiated the birth of the surgical treatment of obesity.

Boom in Surgical Techniques

In 1963, Payne, DeWind, and Commons formed a multidisciplinary group that conducted a large study on morbidly obese patients. Payne even coined the term "morbid obesity" to help persuade insurance providers to pay for the operation. They performed an end-to-side jejunocolic shunt in ten patients [19]. This purely malabsorptive procedure involved dividing the jejunum 35–50 cm distal to the ligament of Treitz and creating an end-to-side anastomosis to the proximal transverse colon. The distal end was simply closed leaving a long blind loop. The procedure was later modified by moving the anastomosis to the proximal ascending colon to help decrease the degree of diarrhea. Weight loss occurred in each of the patients after surgery, with the majority of weight loss observed in the first postoperative year. Decreased absorption of fats and resultant decreased serum cholesterol and lipoprotein levels were also noted in each patient [20].

Their protocol called for the reestablishment of continuity of the gastrointestinal tract when optimal weight had been achieved. In the six patients in whom continuity of the gastrointestinal tract was restored, all regained their previous obese state. Three patients had their jejunocolic shunt revised to an end-to-side jejunoileal shunt and one patient died from complications related to a pulmonary embolism [19].

The patients were plagued with many postoperative complications including poor absorption of essential vitamins and minerals, which required arduous continuous replacement [19, 20]. All experienced fatty stools, significant diarrhea, and anal excoriations [20]. Other complications included dehydration, electrolyte imbalance, postural hypotension, tetany, anemia, cholelithiasis, nephrolithiasis, fatty infiltration of the liver, hepatic cirrhosis, and hepatic failure [21]. The authors concluded that if a reasonable amount of jejunum, around 14 in., and a smaller portion of about 4 in. of terminal ileum were left in continuity with ingested food, weight loss could be better maintained. Other surgeons found similar results with intestinal bypass operations. In 1964, Henry Buchwald demonstrated that a similar ileal bypass with a jejunocolic anastomosis would lower the lipid levels in those with familial hypercholesterolemia and that the effect was sustainable for many years [22, 23]. These benefits were overshadowed by the severe complications, and the jejunocolic bypass was ultimately abandoned, and many patients were later converted to alternative operations [21].

In 1969, Payne and DeWind [24] reported the effects of another intestinal bypass operation—a jejunoileostomy bypass. This procedure again involved dividing the small intestine 35 cm distal to the ligament of Treitz, but was altered with an anastomosis at the terminal ileum, 10 cm proximal to the ileocecal valve rather than to the colon. These operations provided acceptable weight loss results in a large number of patients in addition to other favorable physiologic effects, while limiting some of the side effects seen in jejunocolic bypasses [24].

By the late 1960s and early 1970s, additional reports of successful weight loss from jejunoileal or jejunocolic shunt were being published. These studies were quick to identify complications directly associated with the intestinal bypass procedure and allowed researchers fertile ground to investigate the mechanisms of action that produced the aberrations. In Payne's original protocol, all of the patients had liver biopsies and the vast majority demonstrated steatosis of the liver with pathology that looked identical to alcohol-induced cirrhosis. Interestingly, if the excluded limb of intestine was resected, liver failure did not occur. Certain investigators demonstrated bacterial overgrowth of gram-negatives and anaerobic bacteria in the excluded limb of intestine along with morphological changes in the intestinal wall [25]. These investigators coined the term "enterohepatic syndrome" to describe this phenomenon.

Although the benefits of these intestinal bypass operations were profound, they continued to be limited by severe complications. The second National Institutes of Health (NIH) Consensus Development Conference was held in 1978 [26] with a primary focus on the treatment of morbid obesity, including investigations into surgical interventions. Although the recommendations were favorable for certain operative procedures, it was felt that the risk–benefit ratio for intestinal shunting was too high to recommend its routine use. This conclusion was combined with a sentiment that surgeons investigating weight loss operations were outsiders merely involved in the treatment of a condition not recognized as a disease, but simply the result of poor self-control. This prejudice intensified discrimination against the patients, their disease, and the surgeons dedicated to treating them. Continued pursuits in surgical obesity treatments were often viewed as a waste of resources that could be better used in the treatment of "real" surgical problems like cancer and ulcer disease [18].

In the following years, many surgeons became sensitive to the complications of malabsorptive procedures and started to look for alternatives. In 1967, Edward Mason, a surgeon from the University of Iowa with strong connections to Linner at the University of Minnesota, published a paper in which he observed that patients with subtotal gastrectomy for cancer and peptic ulcer disease lost a considerable amount of weight after resection. From this observation he proposed the first true "bariatric surgery," the gastric bypass [27]. Working with Chikashi "Chick" Ito, Mason was routinely performing a side-to-side anastomosis between the upper third of the divided stomach and a loop of jejunum to treat duodenal ulcer disease. A number of their patients were obese and it was noticed that although the procedure did not effectively control the ulcers, it was associated with significant weight loss [27]. His findings came at the peak of popularity for the jejunoileal bypass [27]and represented a fresh approach. The procedure was later optimized with a smaller gastric pouch and stoma size [28] and due to severe bile reflux, the reconstruction was adapted by Alden with a "Roux-en-Y" gastrojejunostomy [29]. Compared to the earlier jejunoileal bypass operation, gastric bypass resulted in less diarrhea, kidney stones and gallstones, and improvements in liver fat content [30].

The procedure was not without its own challenges. It required operating high in the abdomen and therefore was technically demanding and often the enlarged left lobe of the liver proved problematic. Staplers were not available and two hand-sewn anastomoses were technically challenging and time consuming. Postoperative complications often included dumping syndrome, anastomotic failure, marginal ulcers, bile reflux, and various nutritional deficiencies.

Several modifications to this technique were implemented to improve weight loss, such as the Fobi-Capella banded gastric bypass, which consisted of the application of a ring to the gastric pouch in order to limit its enlargement and possible weight regain [31, 32]. Mason himself continued to modify his procedure and explore alternatives and by the mid-1970s he performed a gastric partitioning procedure in which he stapled the stomach transversely toward the greater curvature, leaving a small orifice of communication between the two gastric channels [33]. This procedure was later modified by several surgeons to

various configurations. Over then following year, vertical gastric partitioning along the lesser curvature in conjunction with controlling the outlet using a variety of devices grew in popularity [34]. Mason further modified this approach by placing an end-to-end anastomosis stapler through the stomach at the distal end of the lesser curvature and placing a piece of mesh through the hole and back up through an aperture at the stomach [35]. This variation of vertical banded gastroplasty rapidly gained popularity and was arguably the most commonly performed bariatric operation in the United States in the 1980s.

Ironically, the same NIH Consensus Conference that led to the fall of the jejunoileal bypass also provided a new life for gastric restrictive procedures [18]. Various pioneers began to tirelessly work on adapting the operative techniques surrounding the gastric bypass procedures. Investigators published many comparison studies between the intestinal bypass procedure and gastric bypass [30, 36], demonstrating that complications were clearly less in the gastric procedures and weight loss was equivalent. During the 1980s, Mason continued to champion gastric restriction with variations of the banded gastroplasty.

In an ingenious modification of gastroplasty, in the 1980s Kuzmak invented a silastic ring with a small balloon embedded on the inner aspect of the ring that could be accessed from a subcutaneously placed reservoir [37]. This allowed calibration and adjustment of the outflow obstruction, and thus adjustable gastric banding was born. At this time gastric restrictive procedures, including gastric bypass, which was classified as a primarily restrictive procedure, and banding were commonly associated with less postoperative complications compared to previous shunts while providing satisfactory weight loss. These restrictive procedures benefited enormously from advances in technology, especially with improved stapling devices.

Investigations into obesity and bariatric surgery were not unique to North America as the field was becoming more recognized in Europe, Latin America, and to a lesser degree in Asia. In 1979, Italian surgeon Nicola Scopinaro devised an operation he termed the biliopancreatic diversion [38]. This operation consisted of a generous distal gastrectomy combined with dividing the small intestine near the midpoint. The distal end of the divided ileum is anastomosed to the proximal stomach remnant and the proximal biliopancreatic limb channeling the digestive excretions was anastomosed to the side of the ileum 50–120 cm proximal from the ileocecal valve [39]. This produced a shortened common channel for ingested food contact with digestive juices resulting in further decreased absorption. Scopinaro reported excellent weight loss results and his patients underwent a battery of metabolic studies that demonstrated resolution of many comorbidities associated with morbid obesity [40, 41]. As with previous operations, biliopancreatic diversion was not without many of the side effects observed in other malabsorptive procedures, especially related to iron and fat-soluble vitamin absorption. Many patients experienced frequent voluminous and malodorous stools and flatus in addition to postgastrectomy syndrome symptoms such as dumping. Regardless of these effects, Scopinaro reported excellent long-term results and the procedure remains popular outside the United States today, commonly resulting in 70% long-term weight loss in more than 90% of patients.

The high incidence of postgastrectomy syndrome after biliopancreatic diversion lead to several modifications and alterations of the operation. In 1986, Hess and Hess devised an alteration by changing to a pylorus-sparing gastrectomy to the original biliopancreatic bypass procedure and modified the anastomosis to a duodenojejunal configuration [42]. A similar operation was later described by Marceau in 1993 combining a pylorus-sparing gastrectomy along the greater curvature of the stomach, leaving a tube-like gastric remnant in order to preserve pyloric function and its innervation [43]. Similar to Scopinaro's reconstruction, the jejunum was divided approximately 250 cm distal to the ligament of Treitz; however, the Roux limb was anastomosed to the postpyloric duodenum. The long biliopancreatic limb was attached to the distal bowel 50 cm proximal to the ileocecal valve [39]. This operation,

aptly named a "duodenal switch," was and still is an effective surgery for weight loss, often reserved for super-obese patients [44]. It also allows patients to lose weight without significantly altering their eating habits, resulting in durable long-term weight loss [45]. Although the incidence of postgastrectomy syndrome decreased with the duodenal switch modification, other complications and postoperative effects are similar to those seen in patients with a biliopancreatic diversion [39].

Interest and investment in developing safer and more effective procedures continued and in 1987 Johnston performed an operation described as the Magenstrasse and Mill procedure in search for a safe and simple alternative to gastric bypass and vertical banded gastroplasty [46]. Similar to Marceau, the "Magenstrasse" referred to a thin tube created from the lesser curvature of the stomach while the "Mill" referred to the antrum; however, the operation performed using a circular stapler to create a defect in the antrum and then creating a narrow tube along the lesser curvature initially over a bougie. The technique was later modified by resecting the greater curvature of the stomach in same fashion as Hess in the duodenal switch and also Marceau in his series [42, 43]. This created a shift in thought as the sleeve gastrectomy was initially used as part of a two-step procedure in high-risk (BMI > 60) patients. Follow-up of these patients demonstrated substantial weight loss and resolution of comorbidities with the sleeve gastrectomy alone [47] eventually leading to popularity of sleeve gastrectomy as a stand-alone procedure, further aided with the progression of laparoscopy [48].

Minimally Invasive Revolution

On a second front, many pivotal technological advancements in general surgery found fertile ground in bariatric surgery. From the time Bozzini developed the Lichtleiter in the late eighteenth century, light conductors offered improved illumination allowing improved exploration and illumination of internal cavities. Initially these devices were limited to urologic and gynecologic procedures, the Lichtleiter and other viewing devices had limited application for the next 100 years until Edison's invention of the incandescent light, igniting a new chapter of minimally invasive surgery.

In 1901, Kelling used light and rudimentary optical technology to examine the abdominal cavity of dogs [49]. This was quickly followed by a report by Jacobeus, a surgeon from Stockholm, who coined the phrases *laparoscopie* and *thoracoscopie*, and who was the first to publish a series of abdominal and thoracic examination in humans using minimally invasive techniques [50]. Berheim at Johns Hopkins was the first in 1911 to perform laparoscopy in the United States [49]. These events were followed by numerous advancements in fiberoptics and insufflation over the next 70 years until this surgical approach would become a standard treatment and chisel the role of minimally invasive techniques into the surgical world. Surgeons committed to the treatment of obesity had also begun to explore the application of laparoscopic approaches to procedures.

The first laparoscopic gastric bypass operation in the United States was performed by Wittgrove and Clark in October 1993 after developing their technique in the laboratory. With a six-trocar technique, they created a retrocolic Roux limb using a circular stapler anastomosis for the gastrojejunostomy [51]. The anvil of the circular stapler was passed transorally, using a proprietary technique. The procedure was principally the same as its open counterpart with three common key components: creation of a small gastric pouch, a restrictive gastrojejunal anastomosis, and the creation of a long Roux limb for malabsorption. Their initial results were excellent, and the authors reported on 500 patients who maintained 73% excess body weight loss at 54 months [52]. The leak rate was low (2.2%) and comparable to open procedures at that time. The overall complication rate was less than 10%, which indicated that the laparoscopic approach was indeed feasible and safe.

Swedish surgeon Lönroth pioneered a manual suturing technique to connect an antecolic jejunal loop to the proximal stomach pouch [53] and in

2003, the Gothenburg group reported comparable long-term weight loss in laparoscopic gastric bypass patients compared to open [54]. In a large series of 400 patients, Higa et al. reported favorable complication rates with no leakages at the gastrojejunal anastomosis in addition to impressive long-term weight loss [55, 56].

The technical constraints of laparoscopy proved these operations very difficult, but as experience and more advanced devices became available, the learning curve proved manageable. The popularity of laparoscopic gastric bypass increased rapidly and by the late 1990s almost every major center had devoted a division for minimally invasive bariatric procedures. This era of minimally invasive surgery truly revolutionized the surgical treatment of obesity. Laparoscopy allowed surgeons to perform complex gastrointestinal operations with an improved level of safety. Operative mortality for many open bariatric operations had been around 1%, only to fall to less than 0.2% with a laparoscopic approach and complication rates fell by two-thirds [57]. Other benefits including decreased hospital length of stay, improved pulmonary function, less blood loss, decreased wound infections, and fewer incisional hernias were reported [58, 59].

Gastric bypass was not the only operation to benefit from laparoscopy. Although various reports date back to 1992 by Forsell and Cadière [60, 61], the first successful laparoscopic banding procedure is commonly credited to Broadbent in 1993 with the placement of a nonadjustable gastric band in a 16-year-old female [62]. Catona also published a series of patients who underwent nonadjustable gastric banding using a laparoscopic approach at around the same time [63]. During the same time, Belachew designed an adjustable gastric band that could be placed using laparoscopic techniques in a porcine model using a device similar to the band patented by Kuzmak a decade earlier [64]. Banding operations presented a favorable option for many patients and surgeons as an alternative to more dramatic bypass operations. In the 1990s and 2000s, a large number of bands were placed worldwide prior to FDA approval in the United States. In clinical practice, laparoscopic adjustable gastric banding boomed during the decade, yet eventually fell out of favor due to technical problems with slippage and pouch dilatation as well as reflux problems and disappointing long-term results [65].

Other operations found life in minimally invasive approaches. The first laparoscopic duodenal switch was performed by Ren and Gagner in 1999, as a modification of the original Scopinaro procedure [66]. A laparoscopic biliopancreatic diversion-duodenal switch is a technically demanding operation even for laparoscopic experts, but has been associated with larger weight loss when compared to other bariatric procedures and often remains reserved for patients with a BMI of 60 or greater. The operative mortality for open biliopancreatic diversion with duodenal switch was approximately 1% and the rate is slightly higher (2.5%) with a laparoscopic approach. This mortality rate may decrease as the surgeon gains expertise with the technical aspects of this procedure and overcomes the associated learning curve [44]. Due to technical difficulty as well as concerns for nutritional deficiency, the procedure has not been widely adopted in the United States. In 2003, the possibility of a two-stage procedure in super-super obese patients was suggested to overcome technical difficulties [67]. The idea was to first perform a sleeve gastrectomy, leading to sufficient weight loss to later facilitate to second stage division of the duodenum. Many patients elected not to proceed to the planned second stage, satisfied by their initial weight loss after the gastrectomy alone. From this a new stand-alone procedure was born, the laparoscopic sleeve gastrectomy. The number of laparoscopic sleeve gastrectomies continues to increase dramatically in the United States; however, long-term studies on effectiveness and difficult to treat complications, such as leak, require further evaluation.

In the end of the 1990s and into the 2000s, several high-profile celebrities underwent laparoscopic bariatric surgery. In 1999, singer Carnie Wilson famously under laparoscopic gastric bypass broadcasted live on the Internet, exposing the public to the operation [68]. This acceptance

and publicity was in great contrast to what the pioneers had endured in prior years and consequently the number of bariatric procedures dramatically increased. In consecutive reviews, Buchwald et al. presented fascinating worldwide data on all bariatric surgery performed in nations belonging to the International Federation for the Surgery of Obesity, IFSO. The proportion of laparoscopic bariatric surgery increased from 63% in 2003 to over 90% in 2008 [69, 70]. During the same time frame, the annual number of bariatric procedures worldwide increased from 146,000 to 340,000 with nearly 200,000 operations annually in the United States alone [70].

Laparoscopy adds many advantages to bariatric surgery including but not limited to reduced wound-related complications and improved patient recovery [71] with adverse event rates comparable to common procedures such as laparoscopic cholecystectomy and appendectomy [72]. In a systematic review of fast-track laparoscopic bariatric surgery, next-day discharge was possible in 81–100% of patients after laparoscopic gastric bypass [73], an impossible idea only a decade earlier in the area of open bariatric surgery when postoperative complications and prolonged hospital stays were the norm.

Metabolic Discoveries

Throughout the late twentieth century as the field of bariatric surgery reached new heights and knowledge about the disease had advanced substantially, the understanding of hormonal mechanisms and physiology grew. The majority of procedures focused on some variation of a gastric restrictive operation and the benefits of weight loss were clearly apparent and well documented on a macroscopic level. Microscopically, the effects remained largely unknown. In a report MacDonald and Pories published in 1995, the beneficial effects on type II diabetes in patients who had undergone a Roux-en-Y gastric bypass were examined [74]. The positive effects of weight loss on diabetes was already well known, but the metabolic effects of surgery had only occurred as an anecdotal observation until several authors reported decreases in insulin resistance and improved glucose metabolism after intestinal shunting procedures, often well before any weight loss had occurred [75]. Unfortunately these reports did not gain much notoriety partly because intestinal shunting procedures were falling out of favor. Decades later, Schauer reported similar results in a large cohort of gastric bypass patients who had either impaired testing glucose levels or type 2 diabetes [76]. Subsequent studies confirmed the positive effects of Roux-en-Y gastric bypass on treating type 2 diabetes, establishing the role of surgery in the treatment of diabetes and metabolic syndrome [77, 78].

A summit was convened in 2010 in Rome by a multidisciplinary group with an interest in type 2 diabetes where a consensus was reached and published outlining the creation of a research agenda in order to focus attention and efforts into understanding the mechanisms by which diabetes can be controlled with surgical intervention [79]. It was observed that something intrinsic was occurring physiologically that surpasses simply diverting and bypassing the flow of food in the intestines. Greater emphasis was placed on the distinction of "metabolic" surgery [80]. A third NIH consensus conference on obesity was held in 1991 that concluded that surgical intervention of morbid obesity significantly treated or resolved many of the comorbidities associated with obesity [81]. As further evidence of this shift in understanding, the American Society of Bariatric Surgery elected at the 2008 annual business meeting to change the name of the society by adding "Metabolic" to the organization's title. This change stressed the efforts on understanding how these procedures worked on a metabolic level and in many ways validated the work of earlier surgeons who had recommended that patients be followed long term to track metabolic parameters of success.

Conclusion

As demonstrated, bariatric surgery has come a long way from a king unfit to mount a horse to complex operations with significant metabolic

impact. Several operations born out of observation have paved the way to a more thorough knowledge and understanding of digestive physiology. The growth of laparoscopic surgery with reduced morbidity and mortality has ushered bariatric surgery to the forefront of innovation and treatment to combat the growing obesity epidemic. Today's surgeons are indebted to the pioneers that have sought for an ideal procedure in order to relieve morbidly obese patients from comorbid conditions, and to increase life expectancy and quality of life. In only a matter of a couple decades, laparoscopic techniques have revolutionized bariatric surgery and further technological advancements by the way of robotics await. The number of bariatric procedures performed worldwide continues to rise and will continue to increase as the indications and benefits for metabolic operations are further understood.

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