Bariatric and Metabolic Surgery in India: Where Do We Stand?

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Introduction

For time immemorial, obesity was known to humankind, though it was considered a sign of affluence. Gradually, its ill effects were recognized, and only in 1997, obesity was declared an epidemic by the World Health Organization (WHO) [1]. In 2003, the American Medical Association in their consensus statement defined obesity as a disease that is associated with other metabolic illnesses like diabetes, cardiovascular disease, sleep apnea, arthritis, non-alcoholic fatty liver disease, infertility, and cancers besides the poor quality of life for the individual [2]. It not only hampers the physical ability of an individual but also leads to a socio-economical setback. It has been associated with several psychological disorders and distress. Worldwide, more than 1.9 billion adults are overweight, and around 650 million are obese. Obesity has been one of the leading causes of death with over 2.8 million deaths globally [3]. It has become a prominent public health problem that is not only limited to developed nations but has also become endemic in developing nations.

Obesity and Related Disease in the Indian Population

India though a developing nation is one of the fastest-growing economies in the world. With over 135 million individuals suffering from obesity, India ranks third in the world behind the USA and China in the number of obese [3, 4]. Presently, obesity is not only a disease of the affluent class but plagues all sections of society. It is a well-known fact that the Asian population suffers more from visceral obesity and is more prone to develop diabetes and other obesity-related complications even at a younger age. The WHO in 2003 noted that the relationship between body mass index (BMI) and body composition and its effect on health may be different between the Asian and European populations. This led to the change in the WHO classification of overweight and obesity and also the indications of bariatric procedure for the Asian population. The cut-off for the definition of overweight and obesity was reduced to 23 kg/m² and 25 kg/m², respectively (Table 1 and 2) [5].

In 2015, 415 million individuals were suffering from type 2 diabetes mellitus (T2DM) worldwide with a prevalence of 8.8% [6, 7]. Approximately 60% of the world's diabetics are from Asia, and this disease is younger to middle-aged adults in this part of the world as compared to the western population [8, 9]. India is only second to China in the world with 69.2 million people suffering from diabetes mellitus [10]. According to the International Diabetes Federation, the prevalence of diabetes in the Indian adult population is approximately 9% with some states recording an incidence of as high as 21.9% [11]. Bariatric surgery leads to significant remission rates as well as improvement in diabetes. Dr. Buchwald and Dr. Varco were the first ones to formally define metabolic surgery in their book of the same title [12]. In 2005, the Asian Pacific Metabolic and Bariatric Surgery Society (APMBSS) became the first society to recommend the use of bariatric surgery as metabolic surgery for the treatment of T2DM even at lower BMI [13].

Bariatric surgery is an effective tool for the treatment of metabolic syndrome and diabetes mellitus [14–16]. Around

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Table 1 BMI classification (values in kg/m²)

Classification	WHO	Asia Pacific
Underweight	< 18.5	< 18.5
Normal	18.5–24.9	18.5–22.9
Overweight	25–29.9	23–24.9
Obese Class I	30–34.9	25–29.9
Obese Class II	35–39.9	30–34.9
Obese Class III	> 40	> 35

50 different bariatric procedures have been described in the literature for the management of obesity [17, 18]. In the report published by IFSO in 2019, a total of 833,687 bariatric procedures were performed worldwide [19].

Evolution of Indications of Bariatric Surgery in India

In 1991, the National Institutes of Health (NIH) published the first consensus statement describing the indication for bariatric surgery [20]. Since then, more than 31 different consensus statements have been published by various organizations globally on different topics in bariatric and metabolic surgery [21]. Asians, in general, have a higher proportion of visceral adiposity and body fat apart from increased risk of diabetes mellitus, hypertension, dyslipidemia, etc. at a comparatively low BMI [22]. In a study, it was seen that at a given BMI, Asians had a 3–5% higher body fat percentage

than Europeans [23]. The International Federation for the Surgeons of Obesity Asia Pacific Chapter (IFSO-APC) published a consensus statement in 2011 describing the indication for bariatric surgery for the Asian population [24]. The Obesity and Metabolic Surgery Society of India (OSSSI) in 2013 came out with the guidelines for indications for the Indian population. These guidelines were reviewed again in 2016. Apart from this, metabolic surgery is indicated in Asian patients with a BMI of more than 27.5 kg/m² and poor glycemic control despite appropriate medical management [25]. This should be done under clinical protocols and the guidance of a multidisciplinary team.

History of Bariatric and Metabolic Surgery in India

In India, the first bariatric procedure was performed in 1999 in Pune. It was an open vertical banded gastroplasty (VBG) done by Dr. Shrihari Dhorepatil. His hard work and passion for bariatric surgery drove him to attend various international workshops and a training program in Australia to learn the procedure. During the initial phase, open surgeries were performed for the safety of the patients. The outcomes of these initial procedures were presented in a conference the same year, and he conducted the first live bariatric workshop of India in Pune in Sept 1999 where three VBGs were performed by international faculties. In 2001, the first successful LGB was performed by Dr. Dhorepatil in Pune [26].

Table 2 Indication for bariatric and metabolic surgery

I. Bariatric surgery
1. For the western population
A. BMI > 40 without the presence of any obesity-related comorbidities
B. BMI > 35 with the presence of type 2 diabetes/any obesity-related comorbidities
2. For the Indian population
A. BMI > 37.5 without the presence of any obesity-related comorbidities
B. BMI > 32.5 with the presence of type 2 diabetes/any obesity-related comorbidities
II. Indications for metabolic surgery
1. For the Western population
A. BMI more than 30 kg/m ² and inadequate and poor glycemic control (HbA1c > 7.5%) despite appropriate medical management both oral as well as insulin
2. For the Indian population
B. BMI more than 27.5 kg/m ² and poor glycemic control (HbA1c > 7.5%) despite appropriate medical management
■ Common factors to be considered for all the patients
1. Patients motivated to lose weight and commitment to long-term follow-up
2. The patient should have attempted conservative methods of weight loss and failed
3. No psychiatric or drug dependency problems
4. Age of 18–65 years
5. Bariatric surgery may be considered in patients more than 65 years in the presence of severe obesity-related comorbidities/disability
6. Bariatric surgery may be considered in patients under 18 years in special situations

The first laparoscopic Roux-en-Y gastric bypass (LRYGB) was performed by Dr. Muffazzal Lakdawala in Mumbai. Dr. Michel Gagner demonstrated laparoscopic sleeve gastrectomy (LSG) for the first time in India in 2005, and this procedure quickly grabbed the attention of many Indian laparoscopic surgeons because of its apparent technical simplicity over more complex LRYGB procedure. In the same year, Dr. Balashanmugan performed the first LSG in India. In 2007, the first mini-gastric bypass (MGB-OAGB) was performed by Dr. K S Kular [26]. Ileal interposition was started by Dr. Surendra Ugale in 2008, and the single anastomosis duodenal-ileal switch (SADI-S) was first performed by Dr. Mohit Bhandari in 2013 in India.

In the year 2018, under the leadership of Dr. Mohit Bhandari and Dr. M. A. L. Fobi, the Bariatric Metabolic Surgery Standardization World Consensus Meeting (BMSS-WOCOM) was organized in New Delhi, India. It was a landmark consensus meeting to define standard versions of 25 bariatric metabolic procedures [21].

The Indian bariatric surgical community has been active in adopting new trends from around the globe by organizing several training programs and workshops. Apart from this, Indian surgeons have contributed to the progress of the science of bariatric and metabolic surgery by publishing excellent studies in peer-reviewed journals. As per the OSSI between 2007 and 2018, a total of 154 scientific studies have been published in India.

Bariatric Surgery in the Public Sector

Though initial few surgeries (2003–2005) were done by Dr. Ramen Goel at JJ Group of Hospitals in Mumbai, bariatric surgery took off in the public sector in the year 2008. All India Institute of Medical Sciences (AIIMS), New Delhi, has been the pioneer in public sector bariatric surgery programs in India. At present, bariatric surgery is being offered in several leading government institutions including PGIMER, Chandigarh (2012); Maulana Azad Medical College, New Delhi (2013); and Lady Hardinge Medical College, New Delhi (2018). Thus, many patients, who could not afford bariatric surgery in private hospitals, can now undergo surgery in these public sector hospitals. Another landmark policy change was when the government approved this surgery for CGHS beneficiaries with the efforts of Prof. M C Misra, Prof. Pawaninder Lal, and Prof. Sandeep Aggarwal who were part of the expert group.

Bariatric and Metabolic Procedures

The bariatric procedures can be classified as restrictive, malabsorptive, and combined procedures depending upon the mechanism of weight loss of each procedure (Table 3). At

present, IFSO recognizes 5 standard procedures, namely, laparoscopic adjustable gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG), laparoscopic Roux-En-Y gastric bypass (LRYGB), biliopancreatic diversion with duodenal switch (BPD-DS), and laparoscopic mini-gastric bypass (MGB-OAGB). All other procedures are defined as novel or experimental procedures.

IFSO and OSSI

The International Federation for the Surgery of Obesity is the main international organization of bariatric and metabolic surgeons and allied professionals. This was formed in 1995 in Stockholm under the leadership of Dr. Nicola Scopinaro. The first IFSO world congress was held in Prague in 1996 [27]. Since then, IFSO has been organizing the congress annually at different locations and is the biggest scientific event exclusively about surgical management of obesity.

Under the guidance of some senior surgeons who have been attending these meetings and were interested in bariatric surgery, the Obesity Surgery Society of India (OSSI) was formed in September 2002 with Dr. Shrihari Dhorepatil as the founding president. In January 2003, OSSI was registered with IFSO, and this was confirmed during the IFSO Congress in Salamanca, Spain, in September 2003 [26].

Since its formation, OSSI has become the apex body in India and has been organizing an annual congress. The first Congress of OSSI (OSSICON) was organized in Mumbai in 2003 and saw the participation of several international faculties. With each passing year, OSSICON has improved with increasing participation. In the year 2012, OSSI successfully organized the International Congress of IFSO at New Delhi under the leadership of Dr. P K Chowbey, who in 2013 became the IFSO president. This can be considered a landmark event in the history of bariatric and metabolic surgery in India as it increased the awareness about these surgeries not only among the general public but also in the surgeon community. In the year 2017, OSSI organized the IFSO-APC Congress in Goa, and Dr. Muffazzal Lakadawala took charge as the president of the IFSO-APC region.

OSSI has been organizing several training courses and live workshops not only on bariatric surgery but also on nutritional aspects across India. Apart from this, OSSI started a national registry requesting its members to

Table 3 Types of the bariatric and metabolic procedure

1. Restrictive	a. Laparoscopic adjustable banding b. Laparoscopic sleeve gastrectomy
2. Combined	a. Roux-en-Y gastric bypass
3. Malabsorptive	a. Mini-gastric bypass b. Biliopancreatic diversion–duodenal switch

contribute data of the surgeries in the registry. This will help in future researches and to analyze the outcomes and complications of different surgeries. In 2018, OSSI has started its accreditation program for awarding the center of excellence to different bariatric institutes. This helps not only to audit the results and outcomes of the institute but also to improve future results.

Training in Bariatric and Metabolic Surgery in India

At present, many short- and long-term fellowship programs are being run by different institutes and organizations. In 2019, the OSSI started a 1-year fellowship in metabolic and bariatric surgery (FMBS) in different institutes across the nation which are certified as a center of excellence by OSSI across the country. It is a structured program with a dedicated syllabus and an exit exam and assessment.

Similar to this, dedicated fellowship programs in bariatric and metabolic surgery are conducted by other institutes like AIIMS Delhi which established a 2-year academic fellowship in 2017–2018, Mohak Bariatrics Indore which runs a 1-year fellowship, and Wockhardt Hospital, Mumbai, which offers a 1-year Maharashtra University of Health Sciences accredited fellowship, etc.

National board of examinations, New Delhi, runs a Fellowship of National Board program in minimal access surgery. This program is the Medical Council of India recognized and is of a 2-year duration. Most of the teams running this program perform bariatric and metabolic surgery regularly and give a wide exposure to the candidates of the comprehensive management of an obese patient.

The Indian Association of Gastrointestinal Endo Surgeons (IAGES) conducts a yearly dedicated fellowship course (FALS) in bariatric surgery; several short observer-ship programs are conducted under different senior bariatric surgeons. At present, many international fellows also join the different bariatric training programs in India.

Current Trends in the Bariatric Procedure

Since the first bariatric procedure was performed in India in 1999, there has been a steady increase in the number of procedures performed each year [26]. As per the IFSO registry report published in 2019, the number of the bariatric procedure performed in India were 20,857 [19]. As per the 2018 and 2017 IFSO report, the number of procedures performed stood at 15,308 and 12,480, respectively [28, 29]. Though these numbers are good and have been increasing progressively as more centers are now running a bariatric surgery program and more surgeons are getting trained in different

procedures but still, these numbers are far less as compared to the prevalence of obesity and diabetes in the Indian population. This may be due to the different socio-economic and cultural architecture of Indian society. Though aggressive public awareness campaign and programs are being conducted by different institutions, there is still a social stigma associated with getting surgery done for obesity and lack of awareness.

If we take a look at the trends in the type of procedure currently being performed in India, the most commonly performed procedure has been laparoscopic sleeve gastrectomy between 2014 to 2018 (Fig. 1) [30]. This may be attributed to the relative technical simplicity of LSG over a gastric bypass as it requires no bowel anastomosis. Laparoscopic adjustable gastric banding has fallen out of favor due to high complication rates including inadequate weight loss, weight regains, and the need for frequent follow-ups. LRYGB is considered the gold standard procedure as it not only leads to an excellent excess weight loss and comorbidity resolution but is also an ideal procedure to be performed in the setting of gastroesophageal reflux disease (GERD) and hiatus hernia [31]. LRYGB has a long learning curve with 75–100 cases, and the risk of internal hernia may be one of the reasons for a lesser number of RYGB performed as compared to LSG and OAGB-MGB [32]. In the year 2014, the percentage distribution of different procedures performed was 68% for LSG, 16% for LRYGB, and 14% for MGB-OAGB. In 2018, 48% of the procedures performed were LSG, while MGB-OAGB and LRYGB were at 34% and 15%, respectively [30]. This increasing popularity of MGB-OAGB may be due to comparative ease in performing it as compared to LRYGB and better weight loss and comorbidity resolution as compared to sleeve gastrectomy on a long-term follow-up [31, 38]. The long-term results of MGB-OAGB are still to be analyzed, and especially its effect on GERD and bile reflux and nutritional sequelae is a cause of concern. Longer limb lengths can lead to significant malnutrition, especially in the vegetarian population [33, 34]. The comparative decrease in the share of LSG among three procedures over the years may be due to apprehension regarding weight regain and GERD after LSG on long-term follow-up [30, 35].

BPD-DS never became popular in India as there is a potential risk of nutritional deficiencies in the mostly vegetarian population. Several other procedures are also being performed though not very frequently like SADI-S, duodenojejunal bypass (DJB), and ileal interposition [30, 36].

Robotic bariatric surgery first started in 2011 has established itself as a useful tool in the management of patients who are superobese due to torque and reduced intraabdominal workspace in laparoscopic surgery. The use of robotics help to overcome some of these ergonomic challenges. This also finds utility in revisional surgeries while performing a hand-sewn anastomosis [37].

Fig. 1 Number of different procedures performed in the last 5 years

Apart from these endoscopic procedures, intragastric balloon placement and endoscopic sleeve gastropasty are being performed by a few surgeons and are slowly gaining popularity among a select group of patients.

In 2019, bariatric and metabolic surgery has been included in health insurance by the Insurance and Regulatory Development Authority of India (IRDAI) for the treatment of obesity. This was a significant development as it will lead to increased awareness and acceptance of both obesity as a disease and bariatric surgery as its treatment in Indian society. As the insurance procedure for this surgery becomes more streamlined, the number of bariatric surgeries performed is likely to increase.

Nutritional Aspects Post-BMS in Indian Scenario

Nutritional deficiencies form one of the most important Achilles heels of bariatric procedures. Most macro-nutrient deficiencies like protein and fat and micro-nutrient deficiencies like vitamins and minerals are seen after bariatric surgery [38]. These are more prominent after malabsorptive procedures. In a recent survey of complications after bariatric surgery by Goel et al., it was seen that nutritional deficiencies were the most common complication occurring in the patients apart from the post-op bleeding. Out of 363 patients analyzed for complications, postoperative nutritional deficiencies were reported in 87 patients. Of these, 29 had anemia, 35 had hypoproteinemia, and 41 had multi-vitamin deficiencies. A few patients had both multi-vitamin and macro-nutrient deficiencies. Out of 363 patients, seventy-five (86.2%) patients were managed with nutritional supplementation only. Twelve (13.8%) patients (6 OAGBs, 4 single anastomosis duodenal-ileal bypass with

sleeve [SADI-S], one sleeve with duodenojejunal bypass, and one RYGB) required revision of limb length or reversal for severe nutritional deficiency. Overall, six mortalities were reported after nutritional complications [39].

Most of these patients have deficiencies of these macro- and micronutrients preoperatively also. In the post-op period, it is important to keep a close tab on the nutritional values especially in patients who have undergone the malabsorptive procedure. Protein deficiency is quite common in Indians. Its management becomes a challenge as the majority of the Indian population prefers vegetarian food. For even those patients who consume nonvegetarian food, the quality and the quantity of protein intake is low and does not fill the adequate requirement. Micro-nutrient deficiencies are more common after bariatric surgery, and these include iron; vitamins B1, B12, A, D, and K; calcium, folate, copper, zinc, linoleic acid, and linolenic acid [40]. Anemia may be present in 17–50% of bariatric patients [40].

It is important to get these values checked at regular follow-up and to prescribe adequate supplementation as well as dietary advice.

Publications from India on BMS

There have been several excellent publications from India on different procedures for BMS. In 2010, Chowbey et al. published their initial experience with LSG and concluded that LSG was a safe and effective procedure %EWL of 59.13% at 1 year. They also noted that type 2 diabetes was resolved in 81.2%, hypertension in 93.75%, and dyslipidemia in 85% at 1 year [41]. In 2013, Lakdawala et al. published their experience of RYGB for uncontrolled DM in patients with a BMI of 30–35 kg/m². They found RYGB to be a safe, efficacious, and cost-effective treatment for DM. They also noted that

early-onset T2DM, better weight loss, and greater C-peptide levels were predictors of better control of T2DM after surgery [42]. An RCT between LGS and OAGB-MGB by Tanti et al. has been published with results of 1-year, 3-year, and 5-year follow-up. At 1-year follow-up, there was no significant difference between LSG and OAGB in the outcome of % excess weight loss, remission of HTN, and quality of life. OAGB has a better outcome in T2 DM remission but was not statistically significant [43]. Similar findings were observed at 36 months except that OAGB-MGB patients with comorbidities had a better quality of life and BAROS score compared to LSG patients [44]. At 5-year follow-up, weight loss, comorbidity resolution, and improvement in QoL were significantly better with OAGB as compared to LSG [45]. In a retrospective comparative study by Bhandari et al. comparing the outcomes after OAGB-MGB vs RYGB at 5-year follow-up, they noted that OAGB is associated with more weight loss and better resolution of comorbid conditions. However, it was also associated with a higher rate of nutritional deficiencies [46]. Bhandari et al. also published their initial experience with endoscopic sleeve gastroplasty recently. They observed that ESG is a safe and effective procedure with a mean %TWL of 19.94% at 1 year [47].

Future

It is now known that different epigenetics, genetic, and events during the initial phase of life affect the predisposition to weight gain and accumulation of fat mass. Besides these, several other environmental and lifestyle factors also play a major role in the development of obesity. Several humoral, neuronal, and metabolic pathways receive signals from different organ systems of the body and are important in maintaining energy hemostasis. Apart from bariatric surgery which modulates and alters some of these pathways, various pharmacotherapeutic agents have also been developed to treat obesity with varied success [48]. Each individual has a different biological and clinical phenotype which leads to heterogeneity in the type of obesity and its response to the surgery. With a better understanding of these pathways, targeted/tailored therapy may be developed in the future with surgery or pharmacotherapy or a combination depending on each individual's phenotype.

Also as the number of bariatric surgery is increasing, the percentage of patients who fail these procedures is also on a rise requiring revisional bariatric surgeries. It is important to individualize the treatment approach for such patients. It involves a careful selection of the patient as well as counseling and preparation. Revisional bariatric surgeries are

usually complex and require advanced laparoscopic skills and training. With the advancement in endoscopy technology, it is expected to play an important role in such procedures.

Apart from this, it is important to increase the awareness as well as the reach of bariatric surgery programs in the general population. This can be achieved with the start of rigorous awareness campaigns throughout the country which need to highlight the concept of obesity as a medical disease rather than a lifestyle problem. Another area to look upon is the continuous social campaign on social and digital media. These campaigns can focus on busting the myths surrounding bariatric and metabolic surgery. Also, the public needs to be sensitized about the coverage of BMS by IRDAI and CGHS for the treatment of obesity and metabolic syndrome. This may increase the acceptance of these procedures in the community.

Conclusion

Bariatric and metabolic surgeries have proved effective in the treatment of obesity, associated morbidity and metabolic syndrome. Despite the good results, the bariatric surgery numbers are still low in our country. This may be due to the stigma related to obesity and the labeling of obesity as a lifestyle aberration by society as well as fear of complications and high cost associated with bariatric and metabolic surgery. The surgeon and healthcare community along with the government need to work together to spread awareness about obesity as a chronic disease and to formulate policy for its prevention as well as treatment.

Declarations

Conflict of Interest The authors declare no competing interests.

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