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Long Term Outcomes of Laparoscopic Adjustable Gastric Banding for Treatment of Morbid Obesity in Adolescents

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Childhood obesity becomes a concern to parents and health providers. Children with body mass index (BMI) >99th percentile tends to become obese adults with more health complications and higher mortality rate than those who become obese in adulthood. Non-operative management through a well supervised diet, psychological counseling, and physical activity program have been shown to result in poor long-term sustainability and low success rate in significant percentage of adolescents [1,2]. A minimally invasive procedure without alteration in the anatomy of the gastrointestinal tract is considered more appropriate and less risky. Laparoscopic adjustable gastric banding (LAGB), therefore, has rapidly become the preferred bariatric operation for adolescents. Despite promising short-term results, little is known about its long term outcomes. We designed a study to review long term outcomes of LAGB in morbidly obese adolescents to understand the procedure benefits and to delineate its role in the treatment of childhood obesity.

Using PubMed, MEDLINE, and CHINAHL databases, meta-analytic review of 13 articles from 2005 to 2012 was performed (Table 1). Keywords used were adolescent, children, and laparoscopic gastric banding. The primary endpoint was long-term weight loss outcomes of LAGB for treatment of morbid obesity in adolescents.

Five hundred ninety one morbidly obese adolescents were included with equal gender distribution. The average preoperative BMI was 46.5 kg/m^2. Preoperative obesity-related co morbidities included steatohepatitis (80.8 ± 14.3%), dyslipidemia (55.1 ± 29.4%), diabetes mellitus (DM) (51.0 ± 44.1%), hypertension (HTN) (38.9 ± 24.7%), polycystic ovary syndrome (PCOS) (34.4 ± 11.9%), obstructive sleep apnea (OSA) (30.7 ± 15.8%), depression (26.9 ± 4.2%), osteoarthritis (OA) (22.5 ± 19.5%), and gastroesophageal reflux disease (GERD) (12.2 ± 15.5%). The mean operative time was 62.7 minutes and the length of hospital stay was 32.9 hours. At 6, 12, 18, 24, 36, 48, and 60 months after the LAGB, the average excess weight loss were 29.1%, 44%, 57.8%, 51%, 60.8%, 63%, and 66.2%, respectively (Table 2). All of the comorbidities were improved or resolved postoperatively. Postoperative complications were reported in 76 patients (12.3%), which included band slippage ± pouch dilation 30 (39.47%), vitamin or mineral deficiency 11 (14.5%), subcutaneous port complications requiring revision 8 (10.5%), severe gastro esophageal reflux 5 (6.6%), dehydration 4 (5.3%), band leakage 3 (3.9%), and others.

Author	Sample	Mean BMI	Age	Duration of	Operative Time	Length of
	(n)	pre-op (kg/m^2)	(yrs)	Study	(mins)	Stay (hours)
Osorio et al. 2011	14	46.1	13 - 17	2001-2010	90	24 - 72
Silberhumer et al. 2011	50	45.2	9 - 19	1998-2004	55.9	96
Holterman et al. 2007	10	50	14 - 17	2005-2006	45	23
Holterman et al. 2010	20	50	14 - 17	2010	NR	NR
Conroy et al. 2010	108	45.9	14 - 18	2006-2010	NR	24
O'Brien et al. 2010	25	42	14 - 18	2005-2008	NR	NR
Fielding et al. 2005	41	42.4	12 - 19	1998-2003	NR	24
Yitzhak et al. 2006	60	43	9 - 18	2000-2006	30	24
Nadler et al. 2007	53	47.6	13 - 17	2001-2006	38	24
Nadler et al. 2009	45	48	14 - 17	2005-2007	NR	NR
Zitsman et al. 2011	100	48.2	14 - 19	2006	110	24
Al-Qathani et al. 2007	51	49.9	9 - 19	2003-2005	70	24
Silva et al. 2012	14	46.1	13.5 - 17.5	2001-2010	NR	NR
NR= Not Recorded	591	46.5		Average	62.7	32.9

Table 1: Several previously published studies on laparoscopic adjustable gastric banding in adolescents.

Morbidly obese adolescents with multiple obesity-related co morbidities are at risk for suboptimal performance and development during their adulthood. Childhood obesity is associated with steatosis, dyslipidemia, type 2 diabetes, hypertension, polycystic ovary, obstructive sleep apnea, depression, nonalcoholic fatty liver, orthopedic problems, gastroesophageal reflux disease, coronary artery disease, fatty liver disease, and premature mortality in adulthood. Obesity causes vessels rigidity especially carotid artery, which subsequently causes hypertension and cardiovascular disease. Consequence of obstructive sleep apnea presents as learning difficulties, hyperactivity, and cardiovascular abnormalities. Depression brings a concern where it is accompanied by potentially dangerous behaviors such as feelings of guilt, anxiety, panic, paranoia, alcohol use, tobacco use, illicit drug use, suicidal ideation, suicidal attempts, and deliberate self-harm [3].

Surgical weight loss method has been known to be the most effective and durable treatment for morbid obesity. O'Brien et al. reported in their study of randomized controlled trial comparing gastric banding procedure versus a lifestyle weight loss program [1]. The extent of weight

Months Follow Up	6	12	18	24	36	48	60
Sample	388	352	117	202	148	54	58
EWL (%)	29.1	44	57.8	51	60.8	63	66.2

Table 2: Follow up of laparoscopic adjustable gastric banding in adolescents.

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loss, resolution of metabolic syndrome and insulin resistance were substantially greater in the gastric banding group. The variability in the rate of weight loss between time periods was observed and it is thought to be related to uncontrolled diet, lack of exercise or psychological support [1,4-6], and loss of follow-up [7,8]. A combination of surgical procedure, exercise program and lifestyle modification produce the most optimal outcomes. Lack of social supports, failure to change eating habits, and failure to incorporate recommended exercise are the most common causes of suboptimal weight loss following LAGB. Overall complication after LAGB was 12.3% (Figure 1). Band slippage with or without pouch dilation was the most common complication after LAGB. Yitzhak et al. and Fielding et al. proposed the solution for this problem by utilizing pars-flaccida approach to the esophagogastric angle. This method reduced the incidence of band slippage from 28% to <3% [2] and from 12% to 1-2% [9], respectively. Of the total patients, only eleven (1.8%) experienced vitamin or mineral deficiency. Appropriate supplementation before symptoms development effectively prevents this complication. Gastroesophageal reflux and inability to tolerate oral diet resulting in dehydration can be managed by adjusting the gastric banding during follow-up visits. Lack of experience in managing early port-related complications is associated with increased need for reoperation. Other reported minor complications include tube crack, port site bleeding or hematoma, superficial soft tissue infection, cholelithiasis and nephrolithiasis.

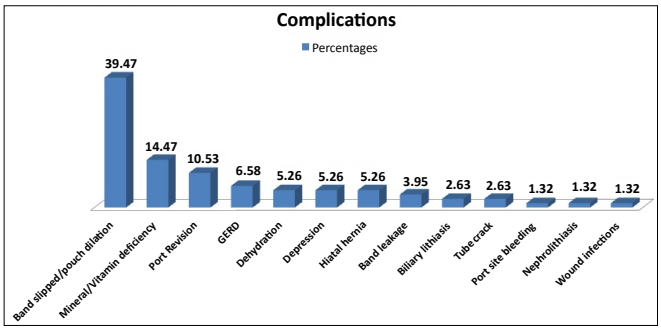

Figure 1: Postoperative complications of laparoscopic adjustable gastric banding in adolescents.

Morbidly obese adolescent who failed multiple attempts of non-operative weight loss programs, potentially benefit from laparoscopic adjustable gastric banding. This procedure is safe, effective, and durable in achieving weight loss outcome, with acceptable rates of postoperative complications. Postoperative exercise program, lifestyle modification, and psychological support continue to play a major role in the ultimate success of the operation.

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