



Pulmonary aspiration in adjustable gastric banding carriers undergoing a second surgical procedure.

Considerations on personal experience and review of the literature.

Ann Ital Chir, Digital Edition 2017; 6
pii: S0003469X17027622
Epub Ahead of Print - November 7
free reading: www.annitalchir.com

Contardo Vergani*/**, Marco Venturi**, Sara Badiali**, Barbara Chella**, Enrico Mozzi*/**

*Department of pathophysiology and transplantation, Surgery Unit, Università degli Studi di Milano, Milano, Italy

**Department of Surgery, Ospedale Maggiore Policlinico, Fondazione IRCCS "Ca' Granda" Milano

Pulmonary aspiration in adjustable gastric banding carriers undergoing a second surgical procedure. Considerations on personal experience and review of the literature.

BACKGROUND: *The observation of a relatively high number of pulmonary aspirations (PA) among gastric band (GB) carriers undergoing a second surgery, prompted us to modify our strategy for GB patients candidate to further operation under general anesthesia.*

MATERIAL OF STUDY AND RESULTS: *In January 2013, following the occurrence of PA at the induction of general anesthesia in 1 GB carrier undergoing a further operation, we reviewed our Data Base between January 2005 and 2013, to explore the rate of pulmonary aspiration in patients GB carriers undergoing a second surgery. Considering the rate (3/172 - 1.7%) too high in comparison with non-GB carriers, we decided to deflate the banding before any further surgery planned under general anesthesia. We then retrospectively reviewed the occurrence of PA after having changed the protocol. Since February 2013, through December 2016, 81 GB carriers underwent a second surgery and not a single episode of PA occurred (0/81).*

DISCUSSION: *The occurrence of PA in patients with GB seems greater than in non-GB patients. Larger series should be examined to assess the incidence of PA among this specific population. Awareness of the increased risk is important to general anesthesiologists and surgeons, considering the increasing number of GB carriers who may be in need of surgery. Our result after adopting the deflation policy, even though not statistically significant, seems highly suggestive.*

CONCLUSION: *We believe that, considering the potentially severe consequences of PA, the gastric band should be deflated before any planned procedure requiring general anesthesia. Further data are needed.*

KEY WORDS: Adjustable gastric banding, Aspiration Pneumonia, Bariatric surgery, Morbid obesity, Pulmonary Aspiration

Introduction

Obesity (BMI > 30) involves more than one third of U.S. adults (34,9%)¹. Bariatric surgery for morbid obe-

sity has been rapidly spreading, especially following the development of laparoscopic approach. Laparoscopic adjustable gastric banding (LAGB), previously the most frequently performed bariatric procedure, still represents a considerable portion of obesity surgery^{2,3}.

Even if its frequency has been progressively declining over the last years, according to the paper by Buchwald and Oien, based on an e-mail questionnaire obtained from 6705 surgeons in 50 nations, 60,677 new LAGBs were performed in 2011, corresponding to 20,044 AGB in Europe and 27,630 in USA/Canada².

It can be calculated that over than 145.000 new gastric bandings have been performed in the USA from 2011

Pervenuto in Redazione Luglio 2017. Accettato per la pubblicazione Settembre

Correspondence to: Contardo Vergani, MD, FACS, Aggregate Professor of Surgery, Department of pathophysiology and transplantation, Surgery Unit, Università degli Studi di Milano, Milano, Director Day/Week Surgery Unit, Department of Surgery, Ospedale Maggiore Policlinico, Fondazione "IRCCS Ca' Granda", Milano, Italy (e-mail: contardo.vergani@unimi.it)

ABBREVIATIONS

PA, Pulmonary Aspiration;
 AP, Aspiration Pneumonia;
 LAGB, Laparoscopic adjustable gastric banding;
 AGB, Adjustable gastric banding;
 GB, Gastric Band/Banding;
 BMI, Body Mass Index.

to 2015, based on the ASMBS best estimation from available data (BOLD, ASC/MBSAQIP, National Inpatient Sample data and outpatient estimations)³. These procedures are usually performed on young people who may be exposed to other surgical procedures during the course of their life, either related or unrelated to bariatric surgery or weight loss.

Aspiration pneumonia is a rare but potentially severe complication of surgical operations. The reported incidence ranges from 1 in 1116 to 1 in 8761 surgical cases. 4-10 (Table I).

The present article reports an evaluation of the incidence of pulmonary aspiration in our series of LAGB bearers submitted to another operation under general anaesthesia. We believe that awareness of the risk dimension of pulmonary aspiration among LAGB bearers is important not only to specialists involved in bariatric surgery but, even more, to anesthesiologists and general surgeons who may be called upon to perform surgical procedures unrelated to obesity or weight loss in patients no longer obese, but still bearing a gastric band.

Material and Methods

In January 2013, after having observed an episode of pulmonary aspiration during general anaesthesia in a patient with a LAGB undergoing a body contouring procedure, we reviewed our data base of patients who, having previously undergone laparoscopic gastric banding,

were submitted to a second surgery from January 2004 to January 2013, in order to explore the rate of pulmonary aspiration that occurred at the induction of general anaesthesia. Pulmonary aspiration was defined according to strict diagnostic criteria such as bronchoscopic confirmation of aspiration or immediate occurrence of pulmonary opacity following the suspect of inhalation at the induction of anaesthesia.

As we considered the rate of pulmonary aspiration among these patients too high in comparison to the data among the general population, in February 2013 we decided to alter our strategy and since then we prudentially started to deflate the adjustable gastric band in every patient scheduled for a general anaesthesia.

We have now reviewed our database of cases collected through December 2016, to evaluate the results after having changed the protocol. The two groups were compared using chi-square test and p value has been considered significant at $p < 0.05$.

Results

At our University hospital from January 2004 through December 2016, out of a total of 849 laparoscopic adjustable gastric bandings, 706 were performed before January 2013 and 143 from February 2013 through December 2016.

At our center, patients submitted to LAGB are enrolled for a regular prolonged follow-up with periodical adjustment of the band (quarterly during the first year after the procedure, every six months for the second year, and then yearly for at least 20 years). The adherence rate to the follow-up within the first three years is 98%, and decreases to 80% at 5 years, and to 30% at 15 years. Some of these LAGB bearers eventually underwent another operation for different reasons. Furthermore, in 2005 we had started to offer a body contouring surgery program to our bariatric surgery patient. From January 2005 through December 2016 a total of 253 patients bearing a LAGB had been submitted to surgery related or unrelated to their weight loss, under general anaesthesia (Table II).

TABLE I - Incidence of aspiration pneumonia (AP) during induction of general anaesthesia. Literature review.

Authors (year)	Period of study	# of procedures under general anaesthesia	# of assessed AP	Incidence of AP
Olsson et Al. (1986) ⁴	1967-1970	185 358		1/2131
Cohen et Al. (1986) ⁵	1978-1983	60 524		1/1592
Warner et Al. (1993) ⁶	1985-1991	215 488	67	1/3216
Mellin-Olsen et Al. (1996) ⁷	1989-1993	85 594		1/3424
Nelakanta et Al. (2005) ⁸	1991-94 + 1996-2000	199 429	23	1/8671
Sakai et Al. (2006) ⁹	2001-2004	99 441	14	1/7103
Landreau et Al. (2009) ¹⁰	2002-2007	117 033	40	1/3251

TABLE II - *Surgical procedures under general anaesthesia in LAGB bearers. Personal Experience from January 2005 through December 2016.*

Type of procedure	From Jan 2005 to Jan 2013	From Jan 2013 to Dec 2016	Total
Body Contouring Surgery	116	37	153
Cholecystectomy	11	12	23
Incisional Hernia Repair	9	17	26
Band removal	36	15	51
Total	172	81	253

Among the group of 172 LAGB carriers submitted to surgery before January 2013, we had observed the aspiration of gastric content in three cases (3/172 - 1.7%), all occurred at induction of general anesthesia for an elective surgical procedure. All three had previously undergone a significant weight loss. Details of the three cases of PA observed are summarized in Table III.

Since we considered this rate too high in comparison with the PA rate reported in the normal non-LAGB carrier population, we had decided to deflate the band before every planned surgical procedure requiring general anesthesia, so as to minimize the risk of regurgitation and inhalation.

Since then, we have submitted 81 additional patients with gastric band to surgery (Table II) and we have no longer observed any case of pulmonary aspiration (0/81).

Comparison between the two groups has resulted in a Chi-square statistics of 1.43 with a p value of 0.23, even if in these conditions the central limit theorem may not apply.

Discussion & Comments

Following the accelerating pandemic of global obesity, bariatric surgery dramatically increased worldwide. According to a survey conducted in 36 nations by Buchwald and Oien ², in 2008, 344, 221 bariatric surgery operations were performed, of which 42.3% were Laparoscopic Adjustable Gastric Banding (LAGB). A similar survey in 2013 reported 340,768 bariatric operations, of which 60,677 (17.8%) were LAGB ³.

The persistence of large soft tissue excess after massive weight loss induced by bariatric surgery, often represents a significant problem, and Body Contouring (BC) Surgery (panniculectomy, abdominoplasty, breast lift or reduction brachioplasty, thigh lift etc.) is increasingly offered to these patients. A study by the American Society of Plastic Surgeons reported that in 2016, 55,245 body contouring procedures were performed in massive weight-loss patients (+10% in comparison with 2015) ¹¹. Furthermore, patients submitted to bariatric surgery usually are young persons exposed to possible surgical operations for causes unrelated to obesity or weight loss. In addition, almost half of bariatric procedures are carried out on women of reproductive age, and it is well known that the rate of caesarean section delivery after bariatric

surgery is higher than in the normal population ¹². Unfortunately, we have no precise data on the global rate of patients with previous LAGB who later undergo another surgical operation under general anesthesia.

Inhalation of gastric content and aspiration pneumonia during induction of anesthesia in surgical operations is a well-known (Mendelson, 1946) ¹³, but infrequent condition, associated with significant morbidity and mortality. However, its incidence greatly varies among different large clinical series, depending on several factors and diagnostic criteria.

Warner et al. ⁶ from the Mayo Clinic, retrospectively reviewed 215,488 surgical procedures on adult patients and reported an incidence of pulmonary aspiration, diagnosed with restrictive criteria, of 1 in 3,216 surgical procedures. They also found that a greater ASA score and emergency surgery were associated with a greater risk ⁶. Other large surveys reported different rates, ranging from 1 in 1,592 to 1 in 8,761 surgical operations (Table I). 4-10 Sakai et al. ⁹ in a 4-yr retrospective study of 99,441 anesthesia on adult patients, suggested that the incidence of aspiration pneumonia following Warner's criteria is greater among patients submitted to thoracic esophageal surgery (1/1,166) than among those submitted to plastic (1/3,781), gastrointestinal (1/4,580) or general surgery (1/9,268).

The most recent survey conducted by Landreau et al. ¹⁰ examined a prospective data base of 117,033 anesthetic procedures; the survey also evaluated risk factors such as the emergency/elective condition of the procedure, age, sex, weight, BMI, obesity, ASA score, full stomach (no pre-op fasting, bowel occlusion, advanced pregnancy), gastro-esophageal reflux, peptic ulcer, opioid or antidepressant assumption and diabetes. The Authors reported a total inhalation rate of 31 in 100,000 (1/3,225 patients) and a rate of symptomatic aspiration of 1 in 5,573 patients. Fourteen patients required prolonged artificial ventilation (>6 hours), 11 patients had ARDS and 5 died. Landreau et al. ¹⁰ also found that more than half of all cases occurred in ASA 3 or 4 patients and that emergency multiplied the risk by 4.5. However, none of the available studies was able to assess the incidence of inhalation in the presence of obesity, gastro-esophageal reflux, diabetes, opioids or antidepressant drugs, even if the importance of gastro-esophageal reflux has been suggested by most.

TABLE III - Details of the observed three cases of pulmonary aspiration in LAGB carriers undergoing a second operation before January 2013.

	Patient #1	Patient #2	Patient #3
Age	40	53	39
LAGB	20 mos before	5 yrs before	8 yrs before
Weight loss	30kg	37Kg	40 Kg
Recent BMI	24.8	26.8	25
ASA	2	2	1
Gastric reflux	mild	Hiatal hernia No reflux	No reflux
LAGB Monitoring	Recent and regular	Recent and regular	Recent and regular
Last meal	> 12 hrs before	> 12 hrs before	> 12 hrs before
Intended operation	incisional hernia repair and thigh dermolipectomy	Abdominal dermolipectomy	Body contouring of abdomen, arm and thigh
Aspiration occurred	At induction of anesthesia	After difficult intubation	At induction of anesthesia
Diagnosis of Aspiration	At bronchoscopy	At bronchoscopy	At bronchoscopy
Operation	postponed	LAGB deflated and operation done	LAGB deflated and operation postponed
Following events	<ul style="list-style-type: none"> • ICU observation • WBC increased but no Aspiration Pneumonia • Two months later LAGB deflated and operation carried out uneventfully • Two years later bilateral mammopexy carried out unevenly after banding deflation 	<ul style="list-style-type: none"> • ICU observation • WBC increased mild fever • Fugacious Chest opacity • Bronchoscopy toilet • Full recovery 	<ul style="list-style-type: none"> • ICU observation • Small lung consolidation • Full recovery after 12 hrs • After the episode the patient recalled that she had experienced cough and one episode of gastric regurgitation through the nose two years before surgery
Notes			She had had a dermolipectomy without problems two years before.

The occurrence of three cases of pulmonary aspiration in a relatively short period of time and in a small group of 172 patients bearing gastric banding and candidate to another surgical procedure at our institution, seemed to us an exceedingly high rate (1/57 – 1.7%) in comparison to those of the normal population, and prompted us to review the literature and our protocols for preparing LAGB bearers to a second surgery.

It is important to stress that each of these three patients had undergone a regular follow-up and the band had been found correctly positioned and inflated (Table III). Late pulmonary complications and Aspiration Pneumonia (AP) after LAGB have rarely been reported. Three large series¹⁴⁻¹⁶ examining long-term complication rates after LAGB in over 1000 patients each, did not report any late respiratory problem. However, an observational study¹⁷ of intermediate results in 749 patients with gastric banding recorded 6 cases (0.9%) of late aspiration pneumonia associated with reflux from undiagnosed hiatal hernia or gastric prolapse.

Alamoudi¹⁸ described one case of AP that occurred two years after LAGB. Another case of recurrent AP was recorded by Hofer et al.¹⁹ and a case of pulmonary

abscess and chest empyema were reported respectively by Zimlichman²⁰ and Krassas²¹, while other Authors^{22,23} have described several cases of severe chronic cough.

A recent retrospective review²⁴ of adverse respiratory events after 2100 LAGBs in a tertiary university medical centre recorded 30 patients with major respiratory problems requiring hospitalization at least 6 months after bariatric surgery. Among them, 19 had AP (1 lethal). In our series we observed only 1 case of “spontaneous” AP. In our opinion this suggests the importance of a regular, prolonged, follow-up and regular band adjustments after LAGB.

All the previously cited examples of AP after LAGB occurred spontaneously and, to our knowledge, only the paper by Kocian and Spahn²⁵ described 2 cases of pulmonary aspiration occurring at induction of anesthesia for another surgery in patients bearing a gastric band. Based on their experience concerning anesthesia induction in patients treated with gastric banding, the Authors recommended allowing only liquid meals the day before the procedure and proposed a rapid-sequence induction anesthesia.

After the case we observed in January 2013, and con-

sidering that the majority of the reported cases of “spontaneous” aspiration pneumonia in gastric banding bearers had benefited from deflation of the gastric banding, we decided to deflate the band before any surgical procedure requiring general anesthesia. The deflation procedure is easy, quick and reversible, while, on the other hand, the potential evolution of aspiration pneumonia cannot be overemphasized.

Even if the period following adoption of this policy is relatively short, we have observed no further cases of pulmonary aspiration since.

Conclusions

We therefore recommend that every patient with gastric banding should have his band deflated before any surgical procedure requiring general anesthesia. In case an elective procedure is planned in a center without experience in bariatric surgery, the patient should be referred to a bariatric surgeon for band deflation prior to the elective procedure. All precautions known to minimize the risk of inhalation at anesthesia should be undertaken.

We believe that this message is important especially for anesthesiologists and non-bariatric surgeons who are called to treat an increasing number of patients bearing a gastric banding.

Riassunto

INTRODUZIONI: La chirurgia bariatrica coinvolge un gran numero di persone annualmente. Il bendaggio gastrico regolabile laparoscopico tuttora rappresenta una considerevole porzione della chirurgia per obesità, anche se la sua frequenza è andata gradualmente diminuendo. Dalle stime della ASMBS, tra il 2011 e il 2015 negli USA sono stati eseguiti più di 145.000 nuovi bendaggi gastrici. Questa procedura è generalmente eseguita su persone giovani che durante il corso della loro vita potrebbero essere esposte a successivi interventi chirurgici, correlati o meno alla chirurgia bariatrica o alla perdita di peso.

La polmonite da aspirazione è una rara, ma potenzialmente grave complicanza delle operazioni chirurgiche. In letteratura la sua incidenza varia tra 1 / 1116 e 1 / 8761 casi chirurgici (Tabella I). Il presente lavoro riporta una valutazione dell'incidenza della inalazione polmonare nella nostra serie di portatori di bendaggio gastrico sottoposti ad una nuova operazione in anestesia generale.

MATERIALI E METODI: Nel gennaio 2013 dopo aver osservato un episodio di inalazione polmonare durante l'induzione di anestesia generale in un paziente portatore di bendaggio gastrico candidato ad una procedura di rimodellamento corporeo, revisionammo la nostra casistica per rilevare l'incidenza dell'aspirazione polmonare

all'induzione dell'anestesia in pazienti portatori di bendaggio gastrico, sottoposti ad un nuovo intervento in anestesia generale. Ritenendo il risultato troppo elevato se comparato alla popolazione generale, decidemmo di sgonfiare il bendaggio gastrico prima di ogni procedura da effettuarsi in anestesia generale. Abbiamo ora rivisto la casistica raccolta fino a dicembre 2016, ed abbiamo paragonato i risultati prima e dopo il cambiamento del protocollo. I due gruppi sono stati comparati mediante il test del chi quadro considerando la p significativa se minore di 0.05.

RISULTATI: Nel nostro centro da gennaio 2004 a dicembre 2013 sono stati eseguiti 706 bendaggi gastrici laparoscopici ed altri 143 da febbraio 2013 a dicembre 2016. Tutti questi pazienti sono regolarmente seguiti annualmente, per periodiche regolazioni del bendaggio. Tra questi pazienti, 253 sono stati sottoposti per svariati motivi ad un successivo intervento chirurgico in anestesia generale (Tabella II).

Tra i 172 portatori di bendaggio gastrico sottoposti a nuovo intervento prima di gennaio 2013 abbiamo osservato 3 casi di inalazione polmonare alla induzione dell'anestesia (1/57 - 1.7%).(Tabella III) Dal febbraio 2013 al dicembre 2016, dopo aver deciso di sgonfiare il bendaggio in tutti i portatori di bendaggio candidati per una nuova operazione in anestesia generale, 81 pazienti sono stati sottoposti a nuovo intervento. Nessun nuovo caso di aspirazione polmonare è stato osservato (0/81).

DISCUSSIONE: Un enorme numero di pazienti viene sottoposto annualmente a impianto laparoscopico di bendaggio gastrico regolabile per obesità. Si tratta in genere di pazienti giovani, che potrebbero nel corso della loro vita andare incontro ad ulteriori interventi chirurgici correlati alla perdita di peso (chirurgia di rimodellamento corporeo, correzioni di laparoceli, rimozione del bendaggio etc.), o per le cause di intervento che ricorrono nella popolazione comune. A nostra conoscenza non esistono dati sull'incidenza di aspirazione polmonare all'induzione dell'anestesia in questo gruppo di popolazione. La sindrome da aspirazione polmonare è una ben conosciuta e potenzialmente fatale complicanza che ricorre con incidenze variabili tra 1/3216 e 1/8761 operazioni chirurgiche (Tabella III).

Il tasso da noi osservato prima del gennaio 2013 tra i portatori di bendaggio gastrico è stato più elevato che nella popolazione normale. Dopo aver deciso di sgonfiare il bendaggio nei candidati ad una nuova operazione in anestesia generale, pur considerando che la casistica è ancora limitata, non abbiamo più osservato alcun caso. Il test del Chi quadro fra i due gruppi di pazienti prima e dopo l'introduzione del protocollo di sgonfiaggio del bendaggio, è risultato 1.43 con un valore P= 0.23 tuttavia in queste condizioni il test statistico perde di significato. La potenziale gravità della complicanza giustifica ampie misure preventive e, del resto, la deflazione del bendaggio è manovra rapida, poco invasiva e reversibile.

CONCLUSIONI: Pur considerando la necessità di più ampie

casistiche, riteniamo di raccomandare la deflazione del bendaggio prima di ogni procedura in anestesia generale. Crediamo che la consapevolezza del rischio di un'aspirazione polmonare in portatori di bendaggio gastrico, sia importante non solo per gli specialisti di chirurgia bariatrica, ma soprattutto per gli anestesisti e i chirurghi generali che si trovino a dover eseguire procedure chirurgiche in anestesia generale in questi pazienti.

References

- Ogden CL, Carroll MD, Kit BK, Flegal KM: *Prevalence of Childhood and Adult Obesity in the United States, 2011-2012*. JAMA, 2014; 311(8): 806-14. doi:10.1001/jama.2014.732.
- Buchwald H, Oien DM: *Metabolic/bariatric surgery worldwide 2011*. Obes Surg, 2013; 23(4):427-36. doi: 10.1007/s11695-012-0864-0.
- ASMBS Fact sheets: *Estimate of Bariatric Surgery Numbers, 2011-2015. Published July, 2016*. Available at: <https://asmbs.org/resources/estimate-of-bariatric-surgery-numbers>. Accessed July, 11th 2017.
- Olsson GL, Hallen B, Hambræus-Jonzon K: *Aspiration during anaesthesia: A computer-aided study of 185,358 anaesthetics*. Acta Anaesthesiol Scand, 1986; 30:84-92.
- Cohen MM, Duncan PG, Pope WD, Wolkenstein C: *A survey of 112 000 anaesthetics in a teaching hospital (1975-83)*. Can Anaesth Soc J, 1986; 33:22-31.
- Warner MA, Warner ME, Weber JG: *Clinical significance of pulmonary aspiration during the perioperative period*. Anesthesiology, 1993; 78:56-62.
- Mellin-Olsen J, Fasting S, Gisvold SE: *Routine preoperative gastric emptying is seldom indicated. A study of 85,594 anaesthetics with special focus on aspiration pneumonia*. Acta Anaesthesiol Scand, 1996; 40(10):1184-88.
- Nelakanta G, Chikyarappa A: *A review of patients with pulmonary aspiration of gastric contents during anesthesia reported to the Departmental Quality Assurance Committee*. J Clin Anesth, 2006; 18(2):102-07.
- Sakai T, Planinsic RM, Quinlan JJ, Handley LJ, Kim TY, Hilmi IA: *The incidence and outcome of perioperative pulmonary aspiration in a university hospital: A 4-year retrospective analysis*. Anesth Analg, 2006; 103(4): 941-47.
- Landreau B, Odin I, Nathan N: *Inhalation gastrique: épidémiologie et facteurs de risque. Pulmonary aspiration: Epidemiology and risk factors*. Ann Fr Anesth Reanim, 2009; 28(3):206-10.
- American Society of Plastic Surgeons: *ASPS National Clearinghouse of Plastic Surgery Procedural Statistics. 2016 complete plastic surgery statistics report*. Available at: <https://www.plasticsurgery.org/news/plastic-surgery-statistics>. <https://d2wirczt3b6wjw.cloudfront.net/News/Statistics/2016/plastic-surgery-statistics-full-report-2016.pdf>. Accessed July 11th, 2017.
- Weintraub AY, Levy A, Levi I, Mazor M, Wiznitzer A, Sheiner E: *Effect of bariatric surgery on pregnancy outcome*. Int J Gynaecol Obstet, 2008; 103(3):246-51.
- Mendelson C: *The aspiration of stomach contents into the lungs during obstetric anesthesia*. Am J Obstet Gynecol, 1946; 52:191-205.
- Chevallier JM, Zinzindohoué F, Douard R, Blanche JP, Berta JL, Altman JJ, Cugnenc PH: *Complications after laparoscopic adjustable gastric banding for morbid obesity: experience with 1,000 patients over 7 years*. Obes Surg, 2004; 14(3):407-14.
- Owers C, Ackroyd R: *A study examining the complications associated with gastric banding*. Obes Surg, 2013; 23:56-59.
- Favretti F, Segato G, Ashton D, Busetto L, De Luca M, Mazza M, et al.: *Laparoscopic adjustable gastric banding in 1,791 consecutive obese patients: 12-year results*. Obes Surg, 2007; 17:168-75.
- Parikh MS, Fielding GA, Ren CJ: *U.S. experience with 749 laparoscopic adjustable gastric bands: Intermediate outcomes*. Surg Endosc, 2005; 19:1631-635.
- Alamoudi OS: *Long-term pulmonary complications after laparoscopic adjustable gastric banding*. Obes Surg, 2006; 16(12):1685-688.
- Hofer M, Stollberger C, Finsterer J, Kriwanek S: *Recurrent aspiration pneumonia after laparoscopic adjustable gastric banding*. Obes Surg, 2007; 17(4):565-67.
- Zimlichman E, Pitashny M, Konen E, Szyper-Kravitz M: *Lung abscess: an unusual complication of gastric banding*. Isr Med Assoc J, 2005; 7(11):742-43.
- Krassas A, Mallios D, Bouliou S, Kakaris S: *Thoracic empyema after laparoscopic adjustable gastric banding. A rare complication*. Obes Surg, 2010; 20(10):1459-61.
- Nemni J: *Severe chronic cough after lap-band gastric surgery*. Can Respir J, 2007; 14(3):171-72.
- Gentil B, Etienne-Mastroianni B, Cordier JF: *Chronic cough after laparoscopic adjustable gastric banding*. Rev Mal Respir, 2003; 20: 4515-54.
- Avriel A, Warner E, Avinoach E, Avnon LS, Shteinberg M, Shteinberg D, Heimer D, Yona S, Maimon N: *Major respiratory adverse events after laparoscopic gastric banding surgery for morbid obesity*. Respir Med, 2012; 106:1192-198.
- Kocian R, Spahn DR: *Bronchial aspiration in patients after weight loss due to gastric banding*. Anesth Analg, 2005; 100:1856-857.