

# Superior and Inferior Gastric Pouch Dilatation Post-Sleeve Surgery: Does Revision Work? A Systematic Review and Case Reports

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## Abstract

Longitudinal sleeve gastrectomy (LSG) has become an acceptable option in the management of morbidly obese patients. Complications in the form of pouch dilatation may occur in post-sleeve surgery. However, revision sleeve gastrectomy procedures are effective in correcting such complications. The aim of this study was to systematically review all published cases that reported revision surgeries following the initial sleeve gastrectomy complicated by pouch dilatation. In addition, we are presenting two cases reported from our military/teaching hospital. A systematic literature search was conducted from English-language studies published from 2000 to 2014 from the following databases: PubMed, CINAHL, MEDLINE, EMBASE, Clinical evidence, Dara, Scopus, Web of Sciences, TRIP, Health Technology Database, Cochrane library, and Psych INFO. A total of 5340 articles were identified in the initial search and 5339 articles were excluded based on the exclusion criteria. Only one case study met the inclusion criteria for this systematic review, involving two patients. Also, we are reporting two cases with revision surgery performed for pouch dilatation post-sleeve surgery from our teaching hospital. There was only one study that reported revision surgery as a management of gastric pouch dilatation post-sleeve surgery. Authors believe

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**that the incidence of revision surgery for the management of pouch dilatation post-sleeve surgery is higher but underreported. This assumption may be valuable, especially because some surgeons consider pouch dilatation post-sleeve surgery a complication that arises due to surgical technique rather than the procedure itself; therefore, it is unreported.**

## Keywords

**LSG, Gastric Pouch Dilatation, BMI, Revision Surgery**

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## 1. Introduction

Bariatric surgical procedures have a long history that range back to 1954, when researchers found that the experimental resection of the intestines led to a decrease in fat absorption and subsequent weight loss in dogs. The first bariatric procedure conducted for the purpose of weight loss in human beings was in 1963, when a jejunocolic bypass was performed [1].

Overtime, the procedure continued to evolve until the longitudinal sleeve gastrectomy (also known as gastric sleeve) was first introduced in 1999. The gastric sleeve allows for an average of 33% of body weight reduction within the first year of post-surgery [2]. The procedure is less invasive than traditional gastric bypass surgeries because the goal is to reduce the size of the stomach rather than to rearrange the intestines. This surgery also owes its success to the fact that the smaller post-surgical stomach produces less ghrelin, the hormone that typically leads to a sense of hunger [3]. The procedure results in the removal of 85% of the original stomach, and poses a relatively lower risk for developing micronutrient deficiencies as the intestine remains intact compared to other bariatric surgery alternatives. The gastric sleeve also has a minimal risk of malabsorption with medications and will require less follow-up visits in comparison to other bariatric surgeries [3].

A variety of complications, both rare and common, may arise with gastric sleeve surgery. The most dangerous risk associated with the procedure is a gastric leak, which may occur in 1% - 5% of patients [4]. Post-operative bleeding and hemorrhage may occur in 1% - 6% of patients. A common complication that may arise with gastric sleeve surgery is the deficiency of micronutrients, especially of vitamins D and B12 [5]. A rare but chronic complication that may occur is stricture, which can lead to dysphagia, difficulty tolerating food, and nausea/vomiting [6].

Gastric dilatation is another rare complication during which the gastric sleeve expands, leading to a regain in weight, and/or a slow rate of weight loss [7]. A second surgery to repair this phenomenon was required by 4.5% of patients [8]. An increase in body weight of over 10 kg is considered to be a sign of failure for the procedure [9]. Gastric pouch dilatation may occur for a variety of reasons, including technical error during the operation. For instance, an incomplete release of the posterior gastric fundus or preservation of a part of the fundus in an effort to avoid injury of the esophagogastric junction may lead to the superior pouch dilatation pattern. On the other hand, an inferior pouch dilatation pattern may rise due to antral preservation, which may occur due to the misplacement of the bougie or misidentification of the pylorus [10] [11]. Patients may require a second surgery (revision surgery) to correct pouch dilation [12] [13].

The aim of this study was to systematically review all published cases that reported revision surgeries following the initial sleeve gastrectomy complicated by pouch dilatation. In addition, we are presenting two cases reported from our military/teaching hospital.

## 2. Materials & Methods

### 2.1. Search Strategy

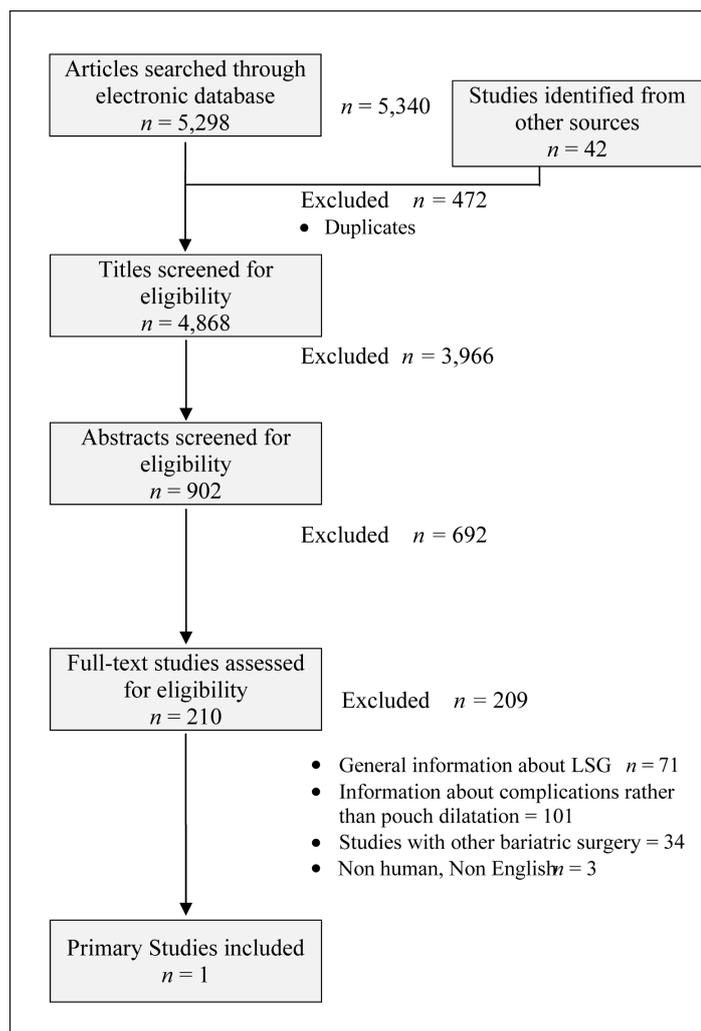
A systematic literature search was conducted from English-language studies published from 2000 to 2014 from the following databases: PubMed, CINAHL, MEDLINE, EMBASE, Clinical evidence, Dara, Scopus, Web of Sciences, TRIP, Health Technology Database, Cochrane library, and PsychINFO. The potential articles from the reference lists of selected articles were searched manually as well. The following terms were used in the search: revision surgery, post gastric sleeve surgery, revision surgery post (LSG), complication post sleeve surgery, gas-

tric pouch dilatation post laparoscopic sleeve gastrectomy, gastric pouch dilatation post sleeve surgery, re-sleeve surgery, superior pouch dilatation post-sleeve surgery, and inferior pouch dilatation post-sleeve surgery.

## 2.2. Data Collection and Quality Assessment

Studies of any design involving LSG for obese patients reporting revision surgery post sleeve surgeries from January 2000 to February 2014 were considered. “Two independent authors (FA) & (BA) then assessed the studies for eligibility then for relevance, inclusion and methodological quality. The studies were classified as relevant (meeting all the inclusion criteria), possibly relevant (meeting some but not all the inclusion criteria), and rejected (not relevant to our review and not meeting the inclusion criteria). Each article in this study was evaluated by two authors independently based on the title and abstract and classified as relevant or possibly relevant. Any disagreements about relevance were solved by a third coder (AA). Based on discussions amongst the three coders, we achieved 100% agreement of studies to be included”. Although we established a methodological process to assess the quality of the papers that we will include, this procedure was ultimately not followed due to the limitations of the papers identified and included.

The initial search yielded 5340 articles as described in **Figure 1**. Of these, 472 were duplicates, 3966 articles were excluded based on the title, a further 692 articles were excluded based on the abstract, and another 209 studies were eliminated after reading the full paper. Finally, we agreed only one article would be included in the present systematic review along with summarizing the two cases that were reported from our teaching hospital.



**Figure 1.** Flow chart showing systematic review search.

## 2.3. Outcome Measures

Studies included in this systematic review were revision surgeries following the initial sleeve gastrectomy complicated by pouch dilatation post-sleeve surgery.

## 2.4. Selection Criteria

Studies were included if they were: 1) revision surgeries following the initial sleeve gastrectomy complicated by pouch dilatation post-sleeve surgery, 2) studies of any design that involved LSG and reported any type of pouch dilatation post-surgery, and 3) published in English-language, peer-reviewed journals. We excluded studies that reported revision surgery for pouch dilatation following other types of bariatric surgeries.

## 2.5. Assessment of Risk of Bias in Included Studies

“All included studies were planned to be assessed independently by two authors for methodological quality using the Cochrane and risk of bias tools; however, this was not achieved as there was only one paper that reported such information [14]”. Two independent authors assessed the studies to be included based on the eligibility and relevance criteria only.

## 3. Results

### 3.1. Search Results

As summarized in **Figure 1**, a total of 5340 articles were identified in the initial search and 5339 articles were excluded based on the exclusion criteria. One study only met the inclusion criteria for this systematic review, involving two patients, results of the revision surgery for pouch dilatation post-sleeve surgery:

Only one study reported two cases of revision surgery following the development of pouch dilatation post-LSG. The first case was reported in a 48-year-old female patient who started with a BMI 58 kg/m<sup>2</sup> (considered morbidly obese) and lowered her BMI to 34 kg/m<sup>2</sup> (obese) at 18 months post-surgery. The patient eventually experienced an upper pouch dilatation of more than 4 cm and subsequent weight gain up to a BMI 46 kg/m<sup>2</sup>, placing her back in the morbidly obese category [15].

The second case reported by Baltasar *et al.* was in a 32-year-old male patient who had a BMI 65 kg/m<sup>2</sup> (morbidly obese) at pre-surgery. At nine months post-surgery the patient had lowered his BMI to 41 kg/m<sup>2</sup>, only to regain weight, and reaching a BMI 42 kg/m<sup>2</sup> due to an antral dilatation [15]. Both cases were managed by revision surgery in the form of a duodenal switch procedure, which was successful in significantly lowering their respective BMIs (**Table 1** and **Table 2**).

### 3.2. Cases Reported in Our Teaching Hospital

#### 3.2.1. Case Report 1

A 41-year-old female with k/c/o bronchial asthma and impaired DM with a BMI 54.36 kg/m<sup>2</sup> (weight 134 kg, height 157 cm) underwent a laparoscopic sleeve gastrectomy and umbilical hernia repair in May 2011. Thirteen months later, the patient was admitted with a six week history of hiccups and vomiting with a BMI 36.67 kg/m<sup>2</sup>

**Table 1.** Studies reported pouch dilatation post sleeve surgery.

Study name	Study design	Patient number	Age	BMI on surgery	Lowest BMI/time	BMI on presentation	Gender	Surgery	Type and size of the pouch
Baltasar <i>et al.</i> , 2006 [15] (Spain)	Case reports	1	48	58 kg/m <sup>2</sup>	34 kg/m <sup>2</sup> At 18 months	46 kg/m <sup>2</sup>	Female	LSG	Upper pouch dilatation (more than 4 cm)
Baltasar <i>et al.</i> , 2006 [15] (Spain)	Case reports	1	32	65 kg/m <sup>2</sup>	41 kg/m <sup>2</sup> At 9 months	42 kg/m <sup>2</sup>	Male	LSG	Antral dilatation
Al Khalifa <i>et al.</i> , 2014 (Bahrain)	Case reports	1	41	54.4 kg/m <sup>2</sup>	36.6 kg/m <sup>2</sup> At 13 months	36.6 kg/m <sup>2</sup>	Female	LSG	Fundal pouch (4 cm)
Al Khalifa <i>et al.</i> , 2014 (Bahrain)	Case reports	1	25	41.5 kg/m <sup>2</sup>	37.6 kg/m <sup>2</sup>	37.6 kg/m <sup>2</sup>	Female	LSG	Fundal pouch (3 cm)

(weight 90.4 kg, height 157 cm). An esophageal-gastric-duodenal endoscopy (OGD) was performed and a fundal gastric pouch was detected.

A barium meal study found that there was a focal pouch seen arising from the gastric fundus with a relatively wide neck. This pouch fills with contrast during swallowing and empties in the supine position. This pouch resulted in reflux of the contained barium which is of significant degree. No evidence of filling defect was found. The patient underwent revision LSG surgery and the pouch was excised laparoscopically in June 2012. The patient was doing well post-revision procedure and was discharged home safely (Figure 2 and Figure 3).

### 3.2.2. Case Report 2

A 25-year-old female, not k/c/o any medical illness, presented with a BMI 41.5 kg/m<sup>2</sup> (height: 159 cm, weight: 105 kg). The patient underwent laparoscopic sleeve gastrectomy on 20/6/2012 and was discharged on the third day post-op. She was doing well with no complications upon discharge.

The patient presented to the A & E on 11/7/2012 (approximately three weeks post-op) complaining of vomiting  $\times 10/7$  days. She was unable to tolerate a soft food diet and was experiencing generalized fatigue. She was admitted and an OGD was performed for her on 12/7/2012. The findings were: an edematous area in the prepyloric area and incisura of the gastric sleeve tube (stomach), as well as a small pouch in the fundus. The patient was doing well post-OGD and was tolerating small amounts of oral feeds. She was discharged on 15/7/2012.

However, our patient presented again to the A & E on 22/7/2012 (seven days later) with a history of recurrent attacks of vomiting  $\times 4/7$  days. She was admitted and a second OGD was performed for her on 23/7/2012. The findings were: a small fundal pouch, antral stenosis, and erosions.

The patient then underwent a barium swallow. The report found that: "The esophagus is of normal caliber.

**Table 2.** Continuation of the studies that reported pouch dilatation post sleeve surgery.

Study name	Time of presentation from surgery	Clinical presentation	Method of investigation	Management	BMI post management	Diagram reported
Baltasar <i>et al.</i> , 2006 [15] (Spain)	After 18 months	Weight gain	Upper gastrointestinal series	Duodenal switch (DS)	33 kg/m <sup>2</sup>	Yes
Baltasar <i>et al.</i> , 2006 [15] (Spain)	After 9 months	Weight gain	Upper gastrointestinal series	Duodenal switch (DS)	27.6 kg/m <sup>2</sup>	Yes
Al Khalifa <i>et al.</i> , 2014 (Bahrain)	After 13 months	Significant degree of reflux with excessive vomiting	Upper gastrointestinal series	Pouch excision	31.1 kg/m <sup>2</sup>	Yes
Al Khalifa <i>et al.</i> , 2014 (Bahrain)	After 45 days	Significant degree of reflux with excessive vomiting	Upper gastrointestinal series	Pouch excision	33 kg/m <sup>2</sup>	Yes



**Figure 2.** Pouch dilatation post LSG (view number one).



**Figure 3.** Pouch dilatation post LSG (view number two).

The stomach is small. There is marked hold-up in the stomach. After some delay, contrast appears to pass into the small intestine with no evidence of leak at the site of surgery”.

A second barium swallow was conducted on 23/7/2012. The report was that there was a: “Marked delay in passing the contrast from the stomach to the small intestine considering the smaller size of the stomach. No evidence of leakage”.

The patient underwent excision of the fundal pouch on 25/7/2012. The findings were: omentum adhesion of previous operation to suture line. The fundal pouch was confirmed with an intra-operative OGD. The patient was doing well post-revision procedure and was discharged on 29/7/2012. In both of our reported cases of pouch dilatation developing at post-sleeve surgery, a revision sleeve surgery was successful in correcting the pouch (**Figure 4** and **Figure 5**).

#### 4. Discussion

Sleeve gastrectomy surgeries carry with them both common and rare complications. Common complications include deficiency of micronutrients and symptoms of regurgitation. Rare complications include gastric leak, post-operative bleeding, and hemorrhaging [6]. A rare but important complication post-sleeve gastrectomy is the development of gastric dilatation which may lead to slow weight loss and possible weight regain [7] [16] [17].

There are a variety of different types of pouches that may develop as a complication due to laparoscopic sleeve gastrectomy surgeries. Patients with a superior pouch pattern, which develops near the gastro-esophageal junction, was found to be asymptomatic in a study conducted by Triantafyllidis *et al.* in 2011 [10]. This causes a difficulty in detecting the pouch in a timely manner. The superior pouch often resembles leaks [7]. The tubular pouch pattern was found to be the most common type of pouch, which resembles a tube-shaped matter. The inferior pouch pattern develops in the antral region. An inferior-superior pouch may also develop, manifesting as two separate pouches [10].

There have only been two reported case studies during which revision surgeries following the initial sleeve gastrectomy complicated by pouch dilatation post-sleeve surgery were published, both reported by Baltaser *et al.* in 2006 [15]. The first case was reported in a 48-year-old female patient who started with a BMI 58 kg/m<sup>2</sup> (considered morbidly obese) and lowered her BMI at 18 months post-surgery to 34 (obese). The patient eventually experienced an upper pouch dilatation and subsequent weight gain up to a BMI 46 kg/m<sup>2</sup>. The second case reported by Baltaser *et al.* was in a 32-year-old male patient who had a BMI 65 kg/m<sup>2</sup> (morbidly obese) at pre-surgery. At nine months post-surgery, the patient had lowered his BMI to 41 kg/m<sup>2</sup>, only to regain weight to reach a BMI 42 kg/m<sup>2</sup> due to an antral dilation [15]. Both cases were managed via a duodenal switch procedure,



**Figure 4.** Pouch dilatation post LSG (view number one).



**Figure 5.** Pouch dilatation post LSG (view number two).

which was successful in significantly lower their respective BMIs. Such cases illustrate that revision sleeve surgeries have proven to be successful in managing pouch dilatations that developed due to (LSG).

In our practice, we experienced two cases of gastric pouch dilatations post-sleeve surgery, both of which were successfully managed through revision gastric sleeve surgeries. Both were female patients who presented with a significant degree of reflux accompanied with excessive vomiting, and both were managed with a pouch excision procedure. One of our patients had a BMI  $54.4 \text{ kg/m}^2$  prior to her sleeve surgery and reached her lowest BMI  $36.6 \text{ kg/m}^2$  at 13 months post-surgery, at which time she had developed pouch dilatation. After her pouch excision procedure, this patient had reached a BMI  $31.1 \text{ kg/m}^2$ . Our second patient initially had a BMI  $41.5 \text{ kg/m}^2$  at the time of surgery but developed pouch dilatation just 45 days post-op. At this point, she had reached

her lowest BMI and presented with a BMI 37.6 kg/m<sup>2</sup>. This patient was also treated with a pouch excision, and following this management procedure, her BMI reached 33 kg/m<sup>2</sup>. Although some may argue that we rushed in excising the pouch (45 days post-surgery), we did so due to the severity of the patient's symptoms rather than due to her weight gain.

Revision surgeries are not only used for patients who have developed pouch dilatations; they may also be utilized effectively in patients who have developed gastric tube dilatations. This phenomenon was reported in a prospective study conducted by Langer *et al.* which noted weight regain in three out of 23 patients who underwent laparoscopic sleeve gastrectomy [18]. These 23 patients were followed for 5 - 29 months post-surgery to monitor weight changes. All patients included in the study were morbidly obese, with a mean BMI 48.5 kg/m<sup>2</sup>. At one year post-surgery, patients had an average of 56% excess weight loss. One patient underwent a revision surgery (second procedure), having a laparoscopic Roux-en-Y gastric bypass, due to having a relatively small amount of weight loss (18% one year post-op) and complete weight regain at two years post-op due to gastric tube dilatation. A second patient also had some weight regain, likely attributed to her healthy pregnancy and childbirth. One year following the initial procedure, 78% of the study participants were screened for gastric dilatation and one patient was identified who had developed a gastric tube dilatation. This patient, however, still had an excess weight loss of 59%, which remained stable at 30 months post-surgery [18].

Revision sleeve surgeries have also proven to be successful in managing pouch dilatations that have developed as a result of other bariatric procedures. A case report has been documented by Han *et al.* for a 34-year-old female patient undergoing laparoscopic Roux-en-Y gastric bypass surgery. The patient had a BMI 38 kg/m<sup>2</sup> at pre-surgery and the procedure created a 30 cm<sup>3</sup> gastric pouch. The patient began experiencing symptoms of nausea, vomiting, diarrhea, and deteriorating metabolic acidosis at five days post-surgery. An exploration procedure was conducted and a gastric remnant dilatation was discovered and excised [19].

Revision surgeries may correct pouch dilatations that have occurred from the initial bariatric procedure such as band surgeries. Jacobs *et al.* collected data from 32 patients who underwent various types of banding procedures, including laparoscopic adjustable gastric banding (LAGB), non-adjustable gastric banding (NAGB), and vertical banded gastroplasty (VBG). These patients were selected for the study due to having post-banding complications that then required laparoscopic sleeve gastrectomy as a revision surgery. Complications included inadequate weight loss, weight regain, pouch dilatation, band slippage, and esophageal dilatation, amongst others [20].

The mean BMI of the study population was 45.2 kg/m<sup>2</sup> at pre-banding surgery while it was 42.7 kg/m<sup>2</sup> at pre-revision surgery. After following the revision surgery, however, the mean BMI dropped to 33.3 kg/m<sup>2</sup>, with an average excess weight loss of 60%. In this study, one LAGB patient was found to have a relatively slow weight loss of only 11.3 kg. This patient was then managed with a sleeve revision surgery, which in turn allowed for the discovery of a large fundic pouch that had remained following the LAGB [20]. The sleeve surgery here was essential to correcting the pouch development. The results of this study indicate that revision surgeries are effective in addressing pouch dilatations that occur with other types of bariatric procedures such as band procedures.

A revision surgery to correct pouch dilatation post-band surgery was also reported by Bernante *et al.* who followed eight patients with failed results post-LAGB. Five of these patients were found to have poor compliance to band procedures and thus experienced insufficient weight loss, while three patients from the sample developed esophageal dilatation. The patients included in this study had a mean BMI 50.5 kg/m<sup>2</sup>, with an average excess weight loss of 57% at one year post-sleeve gastrectomy in five patients. Two patients were found to have no weight loss at post-revision surgery, while one patient had weight gain and was scheduled for another surgery. Significantly, one patient was found to have developed a large fundus remnant dilatation, which was discovered during the post-operative GI series. This patient had thick scar tissue from the initial LAGB procedure that presented a challenge to surgeons attempting to resection it. The resection margin was eventually moved laterally [21]. These results indicate the possibility of using revision surgery to excise pouches that developed following different bariatric surgeries such as band procedures.

Amongst these procedures is a biliopancreatic diversion with duodenal switch (BPD/DS), which has also been reported as an initial pouch-forming surgery that was followed by a sleeve gastrectomy revision procedure. A case study was presented by Gagner *et al.* to examine the efficacy of sleeve gastrectomy for a patient who had initially undergone a BPD/DS. The patient was a 47-year-old female with an initial BMI 64 kg/m<sup>2</sup>. The BPD/DS was successful in reducing her BMI to 29 kg/m<sup>2</sup>; however, the patient then started regaining her weight. Further

examination revealed the presence of a dilated gastric pouch, which led to her revision procedure. Following the sleeve gastrectomy, the patient lost significant weight, reducing her BMI to 22 kg/m<sup>2</sup>, which brought her from initial morbid obesity to a normal weight range [22]. The results of this study indicate that revision surgeries are effective in managing pouch dilatations that occur with other types of bariatric procedures such as (BPD/DS).

## 5. Limitation

There was only one study that reported two cases of revision surgeries to correct pouch dilatations following gastric sleeve surgery. Although reporting the findings of only one paper is a limitation of our study, we performed all the necessary steps of asystematic review in order to achieve these findings. Reviewing 5340 published papers was challenging, especially because we were only able to find one relevant paper. We did however find other papers reporting revision surgeries following pouch dilatations that occurred in the post different phase of different types of bariatric surgeries. We elaborated on these findings in our discussion.

## 6. Conclusion

The available data regarding the use of revision surgeries to correct pouch dilatations as a result of sleeve gastrectomies are scarce; however, we argue that this may in large part be due to the underreporting of such cases. Because pouch dilatation, which will eventually require revision surgery often occurs as a result of human error, whether it is surgeon technical error or patient non-compliance, some researchers tend to prefer publishing positive findings rather than those that may be perceived as negative. However, we believe that examining such issues is a crucial and necessary step toward reducing or eliminating the incidences of pouch dilatation post-sleeve gastrectomy in our institution. Our results indicated that revision surgeries were effective for correcting pouch dilatations; however, limited data are available. As such, we argue that future studies are needed to examine this issue in more depth.

## Conflict of Interest

The authors of this systematic review declare no conflicts of interest of any kind.

## Grant

There is no grant that was given to any author in this paper.

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