Prevention of Leak Post Laparoscopic Sleeve Gastrostomy: A Review Study

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Abstract
Obesity is an epidemic and it is associated with mortality and morbidity. Laparoscopic sleeve gastrectomy is a popular treatment, leak is a dreaded complication of it. The study aimed to identification of factors that prevent leak post laparoscopic sleeve gastrectomy. Literature search at Google, Google scholar, PMD, PMDC, databases. Also, literature from references of the articles has been looked at. They are read with emphasis on the results, causes, and preventive measures of a leak. Certain factors should be considered to prevent leak post laparoscopic sleeve gastrectomy, those related to the patients, surgeon, bougie, intragastric sleeve pressure, stapler, gastric wall thickness, crotches, proper traction of the gastric wall, without reinforcing the staple line.
Keywords: leak, laparoscopic sleeve gastrectomy, bougie

1. Introduction

Obesity is a disease as reported by the who and health problem worldwide [1]. It is an epidemic that is unabated [2]. According to WHO, more than 1 billion adults are overweight and at least 315 million are clinically obese [2]. It is associated with high morbidity and mortality. cardiovascular diseases, Diabetes with increasing incidence of cancers. In addition, it forms a heavy burden on the health services budget [3, 4]. No one doubts the economic costs of obesity, it is estimated at 5–14% of health expenditure for 2020–2050 [2]. Therefore, countries and companies started to look for solutions for instance changing lifestyles. Furthermore, companies started to produce a lot of drugs. Despite this, still there is rising in obesity incidence [5-9].
As a result, experts look for surgery as an alternative option [5,6], and a lot of surgical procedures have been introduced such as gastric bypass, laparoscopic sleeve gastrectomy, adjustable gastric banding, Roux-y gastric bypass [10]. Whereas the most popular standalone world widely practiced and safe operation is the laparoscopic sleeve gastrectomy [1,10], because it is simple, has no need for anastomosis, does not interfere with the absorption [7,8]. However, the most dreaded complication is leak [11], which is related to a great morbidity, mortality, and increasing cost [4,9].
Up to now there are no guidelines for the management and treat gastric leaks [10-19]. It is very difficult to be treated and still happening [9]. The most significant issue to be taken into consideration is how to prevent it, as long as we cannot be sure about the exact cause [10]. As a consequence of this, understanding the leak pathophysiology and identifying the causes plus risk factors, and preventing them is a logical way of tackling this issue [4,9,13]. The goal of this review article is to identify the preventive measures to prevent leaks after laparoscopic sleeve gastrectomy.

2. Methods

An extensive search was done in studies in the English language, In Google Scholar, PubMed, and PubMed central databases up to the year 2020. The search term was a leak, laparoscopic sleeve gastrectomy, prevention, measure, and causes were used for searching. Manually is looked to other references from the original articles and looked at. Articles read Results and conclusions and other Data were compared and organized as follows.

Pathophysiology

Leak post laparoscopic sleeve gastrectomy (LSG) is the common dreaded complication, it is occurred up to 5% of cases [11]. It is measured that 90% of leaks cases are at the proximal part of the stomach [15]. The cause is multifactorial and difficult to diagnose. It needs a multidisciplinary team to be managed [15]. Finally, up to now, there is no universal agreement addressing it. The suitable act for tailoring to the evidence-based medicine and the practice of each center to be applied to each case [16]. The following paragraphs will describe each cause [4, 20, 21] and predisposing factors and how to prevent them.

Patient-related factors

There are several factors patients have

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preoperatively required to be determined so that could be modified or controlled to prevent leak rate. These are tobacco, revision procedures, NSAID, Diabetes, Crohn's disease, malnutrition, super obesity, immunosuppression, abdominal obesity, and other metabolic disorders [13,16,21].

Distant from the pylorus

The exact statistics concerning the precise distance from the pylorus, the goal of which is to create a restrictive bariatric method, improving emptying [1], to be resected are still lacking and controversial [12], Some said that the resected amount has no impact on where weight loss [14]. Other studies showed, too much resection lead to more weight loss, increases intra sleeve pressure resulting in leak due to narrowing of the sleeve. They start their resection at two cm away the pylorus [1].

Others, start resection at (3.5-6 cm, 5-6 cm, 6-8 cm) length away the pylorus as reported by different studies [4, 14, 21] respectively. They aim for preserving the antrum and its contractile function by achieving good weight loss and less leak. Whereas some believe that a distance greater than 4 cm from pylorus preserves the antral pump and improves gastric emptying with reduced intraluminal pressure and lowering leak rate [12]. Most studies recommend resecting 5-6 cm from the pylorus. However, surgeons, should be aware about the narrowing of the sleeve and preserving the antrum will result in high intra sleeve pressure leading to leaking [1].

Increase intra sleeve pressure

Increased pressure inside the sleeve leads to leaks. The main reasons for this are, Stenosis of the sleeve which is of two kinds functional and anatomical, the non-cylinder shape of the sleeve, improper traction of the gastric wall, scare resulting from the healing of hematoma or leak and finally the presence of both gastroesophageal and pyloric sphincters.

However, all of these causes are preventable. Stapling at least 1.5 and 1 cm away from the gastro-esophageal junction or angularis respectively to avoid stenosis or injury to the esophagus, equal traction of the anterior and posterior gastric wall, stapling in line along the staple line with proper orientation of it [1,12,15,21].

Bougie size

As different gastric tube sizes associate with different leak rates. Calibration of the gastric tube is an area of controversy [13]. Some studies report, using small size bougie less than 32 Fr. result in rapid weight loss with less bleeding and leak [13, 22, 23]. Others advocated that thinner bougies are associated with an increasing rate of bleeding and leak [12,13,14].

Furthermore, another study recommended using a bougie of equal to or more than 40 Fr [1,12,13,21] to prevent leak, using a bougie bigger than 40 Fr reduces the relative risk for a leak up to 66% [1]. This is supported by a large meta-analysis, which showed an important outcome which is a leak rate of 2.5%, 1.7%, and 0.9% with a bougie size of <40 French, 40–49 French, and >50 French respectively [12]. So using one equal to or more than 40 Fr bougies. Will be safer and will reduce the leak.

Surgeon related factors

It has been shown that surgeon experience is a critical factor in preventing leaks, gently handling tissues, avoiding burning them by diathermy instruments, careful dissection, and being careful during the learning curve. These are associated with a low leak rate and other postoperative complications [4,13,16,21].

Stapler related factors

There are several factors associated with stapler that can caused a leak. Choosing the proper reload, pre-compression time, alignment of the line of staple, stapling near the incisura and gastroesophageal junction, presence of crotches or migratory staples in the line of staple, improper traction of the gastric wall, and finally, avoiding inspection of the line of staple, all these associated with a high percentage of the leak. However, these can be controlled or modified to prevent leaks. Using proper pre-compression time [1, 4], the duration varies some studies recommend to be 15-20 seconds others go to one minute. Choosing a suitable cartridge correspond to the wall thickness of a specific part of the stomach, although there are no guidelines to pick the perfect one matching the gastric wall thickness, therefore one has to use reload with different heights depending on the experts or special center experience, stapling away from insisura and esophagus gastric junction, looking for crotches at the staple line and remove them, keep stapling with the same alignment of the line of staple, and proper gastric wall traction and finally doing methylene blue test looking for leak [15, 17, 19, 21].

Causes related to ischemia

Ischemia might be an important cause of leak mainly at the proximal part of the stomach, especially beside the GIJ which is a critical area. It is supplied by the left phrenic artery and descending esophageal branches. Therefore excessive dissection at this area, using of thermal instrument leads to burning injury and damaging the blood vessels, in addition to aggressive lateral traction of gastric wall result in ischemia and later leak [4,15,16]. According to the aforementioned, to prevent ischemia, one should avoid excessive dissection to avoid damaged blood vessels, careful use of diathermy instruments, and proper traction. By this leak will be prevented [4].

Gastric wall

This is another area of debate, it may cause a leak. It is found that gastric wall thickness differs in different parts of the gastric in the same individual and also in different sex. It is thick in the antrum (3.1 mm), moderate in the body (2.4 mm), and thin in the fundus (1.7 mm). Inaddition to this, men's antral wall

thickness is more than that of women, on the contrary, gastric body and fundus thickness are more in women than men. These variations require to use of various reload heights at different parts of the stomach.

However, there is no intraoperative device to achieve this, to pick the perfect stapler height. Thus, this issue persists as a reason of a leak until a device is available [20, 24]. There are no standards for picking the perfect reload corresponding to that part of gastric wall thickness [19,25]. As a consequence, we depend on the expertise of surgeons or experienced specialized centers. Otherwise, we will end with mismatching between the height of the cartridge and the gastric wall leading to a leak [4].

Reinforcing staple line

There is no agreement about its application and efficacy [15]. It is shown in many prospective studies and meta-analyses with no significant difference between reinforcement of the line or not [22]. Furthermore, Reinforcement may lead to a higher leak rate, prolongs the operative time, cost and does not prevent leak [4,12]. There is strong evidence that staple line complications could not be prevented by oversewing or buttressing [21]. As it needs special training, experience and leak might be due to other causes.

Thus, it is safe to leave the staple line alone without interference. Various methods of Staple line reinforcement have been practiced but there is no clear consensus records regarding the benefits of these procedures and standardization is still lacking [7]. These areas follow:

Suturing of the line of stable

It is most common way of reinforcement of the gastrointestinal staple lines is oversewing [24], continuous suture has been used widely to reduce postoperative complications after LSG. However, there is insignificant difference among over-sewing and not to do. Its use in reinforcing staple lines in LSG is still debatable [7]. There is no university about which type of suturing technic or type of suturing material and whether to oversee part or whole the staple line [24].

Furthermore, there is no consistent advantage in over-sewing the staple line, also complication of staple line could not be eliminated by routine reinforcement by oversewing according to strong evidence [22, 24].

On the contrary, over-sewing itself might potentially be a dangerous one. Tearing at the point of suture penetration may lead to increase bleeding and leak, and the running suture could cause sleeve stricture and tissue ischemia resulting in leak [7, 24], not only this, Evidence which support of over-sewing of the line through LSG is lacking [7].

Fibrin Sealants

It is widely used in different types of surgeries for stopping bleeding. There is indirect evidence that it decline leak post LSG [13].

Another single study showed excellent results using fibrin glue as line reinforcement [21]. However, a systemic review reported that there is no significant difference between using fibrin glue to reinforce the line or not to prevent leaks [4]. Apart from that, using it increases cost and time.

Buttressing materials

Buttressing the line long has been shown to prevent bleeding and leak from the line. However, It is still not gaining popularity. this might be due to product cost, although this is compensated by decreasing the operating time by about 30 minutes per case and hospital stay decreased by one day [24].

Buttressing doesn't seem to influence leak rate and its use is controversial, however, if a surgeon wants to do it, bio-absorbable material is the common type [4,12,14]. Leak still might (even if proper stapler height is used) occur, despite the use of buttressing. This is since, buttressing raises the burst pressure, needs experience, and proper training. Furthermore, it increases gastric wall thickness, which If is not taken into consideration when choosing the reload height, leading to leaking [4].

3. Conclusions

Laparoscopic sleeve gastrectomy is a standalone procedure for the management of obesity. The leak is the common dreaded complication. It could be prevented by adopting certain measures which are recommended by this study.However, there is no standardization of them. They need large blind-controlled randomized studies and big samples to achieve that.

Conflict of interests

The authors declare that they have no conflict of interest.

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