STENOSIS AFTER SLEEVE GASTRECTOMY – CAUSE, DIAGNOSIS AND MANAGEMENT STRATEGY

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In recent decades one may observe a significant increase in the number of performed bariatric operations. This is associated with the ever-increasing group of patients requiring surgery, due to morbid obesity, as well as the proven effectiveness of surgical management in such cases. One of the methods gradually gaining popularity is laparoscopic sleeve gastrectomy. The operation is associated with the occurrence of specific complications, such as leakage within the stapler line, bleeding, lack of weight loss, significant GERD, as well as stenosis resulting in high occlusion. Stenosis after sleeve gastrectomy is rarely observed. The above-mentioned complication was observed in 0 to 4% of patients (1-5). Brethauer et al. noted that in a group of 2367 patients the occurrence of stenosis requiring endoscopic or surgical intervention amounted to 0.6% (6). In case of a study (Miami in 2009) presenting results obtained from a questionnaire covering 14 776 operations, the ratio of stenosis complications amounted to 0.9% (7). Fuks et al. showed sleeve gastrectomy results obtained from 135 patients subjected to surgery during the period between 2004 and 2007, reporting no such complication (8). The frequency of stenoses, considering the diameter of the gastric tube, type of staple line, and BMI of operated patients was presented in tab. 1.

Table 1. Stenosis after laparoscopic sleeve gastrectomy

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>n patients/ n stenoses</th>
<th>%</th>
<th>Diameter of the probe/ endoscope (Fr)</th>
<th>Type of reinforcement material</th>
<th>Mean BMI kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottam (3)</td>
<td>2006</td>
<td>126/5</td>
<td>3,9</td>
<td>46-50</td>
<td>sc/kf</td>
<td>65,3</td>
</tr>
<tr>
<td>Lalor (2)</td>
<td>2008</td>
<td>148/1</td>
<td>0,7</td>
<td>44 lub 52</td>
<td>sc</td>
<td>44</td>
</tr>
<tr>
<td>Rubin (10)</td>
<td>2008</td>
<td>120/0</td>
<td>0</td>
<td>48</td>
<td>sc</td>
<td>43</td>
</tr>
<tr>
<td>Kakoulidis (11)</td>
<td>2009</td>
<td>79/0</td>
<td>0</td>
<td>32</td>
<td>sc</td>
<td>34</td>
</tr>
<tr>
<td>Fuks (8)</td>
<td>2009</td>
<td>135/0</td>
<td>0</td>
<td>34</td>
<td>brw</td>
<td>48,8</td>
</tr>
<tr>
<td>Szewczyk (12)</td>
<td>2009</td>
<td>331/0</td>
<td>0</td>
<td>34</td>
<td>sc</td>
<td>46,14</td>
</tr>
<tr>
<td>Bellanger (1)</td>
<td>2010</td>
<td>529/0</td>
<td>0</td>
<td>34</td>
<td>kf</td>
<td>44,2</td>
</tr>
<tr>
<td>Zundel (19)</td>
<td>2010</td>
<td>1155/3</td>
<td>0,26</td>
<td>np</td>
<td>np</td>
<td>np</td>
</tr>
<tr>
<td>Alley (14)</td>
<td>2011</td>
<td>85/2</td>
<td>2,4</td>
<td>36</td>
<td>mu/ds</td>
<td>41,7</td>
</tr>
<tr>
<td>Triantafylidis (24)</td>
<td>2011</td>
<td>85/2</td>
<td>2,3</td>
<td>36</td>
<td>bw</td>
<td>43,8 m</td>
</tr>
<tr>
<td>Parikh (13)</td>
<td>2012</td>
<td>230/8</td>
<td>3,5</td>
<td>36</td>
<td>mu/sc</td>
<td>43</td>
</tr>
<tr>
<td>Brockmeyer (23)</td>
<td>2012</td>
<td>209/2</td>
<td>0,96</td>
<td>36</td>
<td>bw</td>
<td>43,6</td>
</tr>
</tbody>
</table>

Explanation: bw – lack of routine reinforcement of the staple line, sc – continuous suture, ds – additional sutures, mu – sealing material integrated with the stapler, kf – fibrin glue, np – not mentioned, m – men, w – women
Causes

The stenoses occur most often near the gastric angle or esophago-gastric junction (9). The size of the gastric tube is very important considering the calibration sleeve. The diameter of the gastric tubes ranges between 16 and 60 F, depending on the surgical center (7). According to Cottama et al., when larger diameter gastric tubes were used (46-50 Fr) the frequency of stenoses was estimated at 3.9% (3), while Lalor et al. (44-52 Fr) estimated the above-mentioned at 0.7% (2). Rubin et al. used 48 Fr diameter gastric tubes and observed no complications (10). The use of smaller diameter tubes (32-34 F) is not associated with increased risk of stenosis (1, 8, 11).

Many surgeons suture the staple line, in order to reduce the risk of bleeding or leakage (7, 12). The strengthening of the staple line by means of manual sutures might have an effect on the occurrence of stenosis or the size of the gastric tube. The use of a suture covering the whole thickness of the stomach wall, too close to the small curvature, or too large space between each suture might have negative influence on normal intestinal peristalsis. Parikha et al. observed stenosis, both in case of patients subjected to partial staple line suturing, as well as those without the continuous suture. In case of all patients absorbable material was used, being integrated with the stapler (13). Other authors also mentioned about the possible stenoses requiring endoscopic intervention after sleeve gastrectomy with the use of staplers integrated with the sealing material. In case of 85 patients subjected to the above-mentioned, stenosis was observed in 2.4% patients (14).

Italian investigators, in a prospective, randomized study comprising 100 patients observed that suturing of the staple line by means of a continuous suture had no influence on leakage or bleeding, but favored stenosis (15). However, in a study describing the technical aspects of sleeve gastrectomy, there were no cases of stenosis during the early perioperative period, considering 331 patients subjected to staple line, continuous suture strengthening (12). A mechanical vise may be used when applying continuous sutures. In a study which used the above-mentioned no such complications were observed during a one-year observation period (16).

Particular attention should be paid when supplying the edges of the gastric stump, so that closure not be associated with the improper use of the stapler. The use of consecutive staplers or manual sutures is associated with increased risk of stenosis. The presence of stenoses might also be associated with the improper placement of the staple line, in relation to the minor curvature, or too strong stretching of the gastric walls resulting in the development of a narrow sleeve after gastric tube removal. A less frequent cause of stenosis is the development of a functional valve within the sleeve, resulting in high occlusion, in spite of the passage of the endoscope through the occlusion, during gastroscopy (17). Such stenosis might be caused by torsion of the sleeve along its long axis (13). Stenosis requiring surgical intervention is also associated with the presence of narrow sleeve flexion, especially near the gastric angle (18). The occurrence of stenosis after sleeve gastrectomy favors the development of other perioperative complications, such as hematoma causing compression and stenosis of the gastric lumen, as well as consequences of their surgical treatment (13, 19).

Symptoms

Stenosis or complete occlusion of the sleeve is manifested by nausea, vomiting, dysphagia, and in case of lack of treatment- dehydration and worsening of the patients‘ general condition. Clinical symptoms of stenosis may occur immediately after the surgical procedure. During this period the above-mentioned may be observed when initiating oral nutrition. In most cases, intestinal passage disturbances during the early postoperative period are associated with tissue edema, and usually regress after several days of conservative treatment. Symptoms may also appear several months after the operation. In such a case there is gradual impairment of oral nutrition tolerance. According to Dapri et al., dysphagia in case of reoperated patients, due to stenosis, was observed an average of 9.2±2.6 months after isolated sleeve gastrectomy, and after 18.6±13.2 months in case of patients after sleeve gastrectomy with duodenal switch (9).

Sometimes oral dietary intolerance results from the presence of severe psychiatric distur-
bances, including depression, in spite of a normal endoscopy result, and free contrast passage observed during the X-ray examination (20).

Diagnosis

In most cases diagnosis is based on X-ray examinations showing significant stenosis or lack of intestinal contrast passage (9). In case of gastroscopy one may observe stenosis or closure of the sleeve lumen (13). In the presence of functional gastric obstruction the gastric lumen is preserved and the endoscopic passage is possible. However, intestinal passage is significantly impaired. In case of patients with future stenosis the X-ray examination performed on the day after surgery might be normal. On the other hand, one may also observe contrast passage disturbances without future stenosis (13). Therefore, not all authors recognize the prognostic value of routine radiological examinations, when determining the risk of symptomatic stenoses (11, 22).

In some centers routine radiological examinations have been abandoned (23). On the other hand, other investigators underline the legitimacy of such examinations performed during the initial days after surgery, in order to diagnose early complications after sleeve gastrectomy. However, the above-mentioned are performed on the third day after surgery (24). An important role is attributed to the experience of the radiologist in performing and describing the postoperative examinations. In doubtful cases the operating surgeon should also be involved. This facilitates the interpretation of the obtained result. The reason for the observed abnormalities may be associated with impaired gastrointestinal motor activity. Lack of contrast passage during consecutive X-rays performed every several tens of minutes raises suspicion of an organic cause of stenosis.

In case of radiological stenosis one may usually observe the presence of GERD symptoms and lower esophageal distention (24).

Prevention

In order to avoid stenosis one should follow several rules. One of these rules consists in the proper positioning of the stapler, especially in the vicinity of the gastric angle. Too strong stretching of the gastric walls might lead to a narrow lumen after gastric tube removal. Another way to avoid the narrowing is to cut off the stomach at the level of the small vessels branching off the minor curvature. This allows to maintain a sufficiently wide gastric stump lumen, and reduce staple line bleeding. Some authors proposed the excision of the stomach near the gastric angle at a distance of 1 ½ diameter of the gastric tube. In case of the proximal segment the stapler is placed directly in the vicinity of the gastric tube (1). In order to avoid torsion along the long axis or angular flexion of the gastric stump one should ensure that the amount of the anterior and posterior gastric wall is symmetrical. This is associated with the need for proper exposition of the posterior gastric wall during stapling.

Symmetry should be maintained during suturing of the staple line. When suturing the staple line special attention should be paid to the use of a serous-serous suture involving the only necessary amount of the gastric wall. One should avoid too much space between consecutive sutures, due to the possibility of sleeve flexure. This may lead to the development of a functional occlusion rendering impossible the intestinal passage, in spite of the preserved gastric lumen enabling endoscopic passage. In order to reduce the risk of stenosis the suture may be placed with the gastric tube left intact. This makes it difficult to suture the staple line, due to reduced sleeve mobility, and at the same time reduces the possibility of suture passage through the gastric lumen. The resignation of suturing the staple line in favor of sealing by means of fibrin glue may significantly reduce the number of clinically important stenoses (3).

Treatment

In case of impaired intestinal passage symptoms the first day after surgery, conservative treatment is usually sufficient (24). Conservative treatment consists in intravenous fluid supplementation, and the administration of anti-inflammatory and PPI drugs. In case of confirmed stenosis requiring endoscopic or surgical intervention, enteral or complete parenteral nutrition are required. If passage disturbances are observed during the early
postoperative period one may consider relaparoscopy, due to the presence of a hematoma or improper continuous suture in the gastric stump. Hematoma evacuation or severing of the suture leads to the regression of passage disturbances.

Endoscopic treatment

In the absence of effective conservative treatment one should try endoscopic therapy. Symptomatic short-segment stenosis is usually effectively managed by means of balloon endoscopy. Several sessions are required in order to obtain good oral nutrition tolerance (2, 13, 19). Considering literature data there are no clear recommendations as to when to perform balloon endoscopy after the primary surgical intervention. Endoscopic dilatation immediately after surgery may lead to stapler line dehiscence. In one study the average time from surgery to balloon endoscopy was 49 days (ranging between 27-151 days). The average number of balloon endoscopy sessions in one patient was 1.6 (ranging between 1-2), and balloon diameter: 15-18 mm. The duration between the first balloon session and oral nutrition tolerance was 50 days (ranging between 27-72 days), and regression of symptoms after the primary operation: 99 days (ranging between 55-181 days). None of the patients required delayed surgical intervention (13). Zundel et al. presented a scheme of endoscopic dilatation consisting in 5 sessions using balloons with an increasing diameter (up to 40mm) and pressure. The duration of the session ranged between 10 and 20 minutes. According to the authors, in case of lack of success, the above-mentioned scheme may be repeated after one month (19). Endoscopic dilatation in case of a long stenotic segment is usually ineffective and requires surgical intervention.

Stents

The use of coated stents allows to implement oral nutrition, but does not result in the resolution of the stenosis. In one study the use of stents was mentioned, considering two patients with stenosis following sleeve gastrectomy. The first patient presented with functional obstruction symptoms, distally to the esophago-gastric junction, due to the presence of a large hematoma in the vicinity of the staple line. We were able to pass through the stenosis by means of an endoscope, although high occlusion symptoms were present. The implanted stent was displaced proximally to the esophagus. In case of the second patient the implantation of the stent proved successful, however, the patient complained of discomfort requiring a significant amount of painkillers. Improvement was not observed after 27 days of stent presence (13). Therefore, stent implantation seems to be a temporary solution enabling the introduction of oral nutrition. Eubanks et al. (2009) presented treatment results with the use of stents, as well as complications after gastric bypassing and sleeve gastrectomy. Stents were used in the management of leakage, late fistulas, and stenoses, due to unsuccessful endoscopic dilatation. The study group comprised 19 patients with six being treated for stenosis. The average duration of stent presence in stenotic patients was 7 days, management proved effective in 83% of cases (good tolerance of oral nutrition after stent removal). In 58% of cases one observed stent migration, and three patients required surgical removal of the stent from the small bowel (25). Eubanks et al. used self-expanding stents covered with silicon, made of polyester (Polynex, Boston Scientific Inc: diameter: 16 to 21 mm and length: 9 to 15 cm), and nitenol (Alveolus Inc: similar diameter, and length 10 and 12 cm). The decision concerning the type of stent used was based on its current availability, and preferences of the surgeon for each patient (25). Stent implantation is not always possible, due to the anatomical conditions. The relatively high incidence of stent migration is probably associated with the fact that the above-mentioned are designed to be implanted in the esophagus, and not in other parts of the gastrointestinal tract.

Surgical treatment

In case of diagnosis of stenosis during the primary surgical intervention, one solution might consist in simultaneous plasty or conversion to gastrointestinal bypass surgery or loop exclusion of the stomach. The insertion of the gastric tube used for calibration, through the
sleeve after its withdrawal to the upper part of the gastric stump, after continuous suture implantation on the staple line seems helpful in diagnosis. In case of smooth passage of the gastric tube to the prepyloric area, there is small likelihood of stenosis immediately after surgery. After the occurrence of high occlusion symptoms during the early stage after sleeve gastrectomy, some authors recommend re-laparoscopy. During re-intervention one can evacuate the hematoma, responsible for the external compression, or section the continuous suture, which leads to pressure reduction or ischemia within the sleeve (26). The surgical effectiveness of early re-intervention has also been described, three weeks after primary surgery, in case of short gastric stump flexion, not being eligible for endoscopic dilatation. Reoperation consisted in the section of the continuous suture and fixation of the stomach to the diaphragm in such a way as to prevent recurrent flexion of the stump (18).

Sudan et al. described two cases of stenosis after sleeve gastrectomy performed during the exclusion of the pancreato-biliary junction with the duodenal switch. In case of one patient the edges of the gastric stump remained open, due to improper stapler functioning. The authors unsuccessfully tried to close the opening by means of another stapler, the defect being finally closed by means of absorbable sutures. The radiological examination performed five days after discharge showed stenosis. In both patients several endoscopic balloon dilatation (18-20 mm diameter) attempts proved ineffective. Plasty was performed in both cases using da Vinci’s robot, 18 and 62 days after the exclusion of the pancreato-biliary junction with the duodenal switch. The operation began with diagnostic laparoscopy and intraoperative gastroscopy, in order to identify the stenotic segment and confirm its length. In both cases the stenotic segment was 5 cm long. The opening was closed by means of Heinke-Mikulicz’s plasty. The patients were discharged from the hospital, 5 and 11 days after surgery with good oral nutrition tolerance (17).

Another option, especially in case of long stenosis or functional obstruction is the conversion to gastrointestinal junction exclusion on the Roux loop (3, 13). Parikha et al. showed that in two cases gastric bypassing proved clinically effective, 65 and 89 days after sleeve gastrectomy (13). By-pass surgery, due to symptomatic stenosis does not differ technically and functionally from operations performed during the second stage of bariatric surgery, in the absence of satisfactory weight reduction after the initial operation. Such management is also possible in case of short stenosis. In case of long stenosis sero-myotomy is possible to perform. The above-mentioned technique was thoroughly described by Dapri et al. In case of 4 patients after isolated sleeve gastrectomy the average stenotic segment was 4.7±0.9 cm, while in 5 patients from the second group- 5.2±1.3 cm. All patients were qualified for laparoscopic seromyotomy. One patient underwent Roux-en-Y by-pass surgery. In one case, there was leakage during the postoperative period, requiring stent implantation. All patients were subjected to control barium enema, which showed proper intestinal passage and good oral nutrition tolerance.

According to the authors, laparoscopic sero-myotomy in case of long stenosis is an effective and safe therapeutic method (9). It seems, however, that such a solution may only be applied in case of stenosis, and not in case of complete sleeve lumen closure. In extreme cases, the need to perform gastrectomy was reported (19).

CONCLUSIONS

Stenosis is a rare complication after sleeve gastrectomy. Errors associated with the operative technique observed during sleeve formation or staple line strengthening by means of the continuous suture favor stenosis. The relatively low incidence of the above-mentioned may be attributed to the increasing experience of the surgical centers in such operations. The radiological and endoscopic examinations play a key role in diagnostics. If occlusion symptoms persist, in spite of conservative treatment, balloon endoscopy should be initiated. Balloon dilatation should be continued during gradual improvement until good oral nutrition tolerance is obtained. In order to achieve temporary oral nutrition, stent implantation may be considered. In the absence of endoscopic treatment efficacy the patient should be qualified for surgery. The decision concerning the type of surgical intervention should be based on experience and length of the stenosis. Possible surgical proce-
dures include Heineke-Mikulicz’s plasty, Roux-en-Y by-pass surgery, seromyotomy, and in extreme cases, gastrectomy. Symptomatic stenosis is usually not associated with direct life-threatening conditions, although require long-term treatment.

Considering the above-mentioned, after the confirmation of the diagnosis by means of imaging and endoscopic methods the patient should be fully informed about the planned treatment and prognosis. This favors better therapeutic tolerance and improves the psychological comfort during the several weeks of hospitalization. The experience of the endoscopic and surgical teams plays an important role during treatment. Particular attention should be paid to the sleeve technique, since laparoscopic sleeve gastrectomy, despite the apparent facility, like other bariatric procedures requires significant surgical experience.

REFERENCES


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