Self-expanding metal stents in postoperative esophageal leaks
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ABSTRACT
Background: Postoperative esophageal leaks have a high morbidity and mortality. Self-expanding metal stents (SEMS) have been used as an alternative to re-operation.
Aim: Evaluating predictors of success of SEMS in postoperative esophageal leaks.
Methods: Retrospective study of patients with postoperative esophageal leaks referred for SEMS placement in a reference center during a period of 3 years. Technical success was defined as closure of the leak in barium swallow at 15 days. Clinical success was considered as endoscopic and/or radiographic confirmation of closure after stent removal.
Results: Thirteen patients placed SEMS. Median follow-up was 58 days. Leaks had a median size of 20 mm. Time between surgery and SEMS placement was 20 days. One patient died 2 days after SEMS placement and one had worsening of the fistula after SEMS expansion. Time till stent migration was 9 days. Technical success was achieved in 9 of 11 patients, with clinical success without recurrence in 5 patients. All leaks with less than 20 mm were solved endoscopically. Technical and clinical success was higher when time between surgery and SEMS placement was lower, even though without statistical significance (respectively, p = 0.228 and 0.374). In the 8 patients who died during follow-up, median survival was 59 days.
Conclusions: Technical success of SEMS was higher than 80%; however, due to high morbidity and mortality, only 45% of patients had their stent removed. Lower time from diagnosis to SEMS placement and leak size less than 20 mm may be associated with better results.
Key words: Postoperative esophageal leaks. Self-expanding metal stents. Survival.

INTRODUCTION
Postoperative esophageal leaks can develop after esophagectomy, gastrectomy or mediastinal surgeries with esophageal laceration. Intrathoracic leak rates after esophageal resection occur in 7.9% of the surgeries (1) and after gastrectomy in 4% to 27% (2,3). Endoscopy is useful in diagnosis because the defect, integrity of surrounding tissue, and infection in the adjacent tissue can be assessed. Early diagnosis significantly reduces the rate of complications and mortality (4-7). Clinical manifestations vary depending on the location of the leak and time elapsing from the perforation or rupture. Fever, systemic inflammatory response syndrome, and abnormal C-reactive protein, white blood cell count, and albumin are indicators of postoperative esophageal leak (8,9).

Despite aggressive therapy, mortality rate of postoperative esophageal leaks remain as high as 20% (1,10), with treatment delays being associated with increased mortality rates (11). Traditionally, management of leaks with more than 5 mm has been prompt surgery, consisting on surgical drainage and repair, nothing by mouth, parenteral nutrition, and antibiotics; however, up to 30% of repairs demonstrate a persistent leak and may require additional esophageal procedures (12).

Fibrin glue or endoscopic clip placement can be considered for small defects, although patients with dehiscence of 30% to 70% of the esophageal circumference likely warrant stent placement. Self-expanding metal stents (SEMS) placement has become a well-established treatment, by excluding the defect to allow healing and oral feeding. However, SEMS placement can be complicated by inadequate defect closure, stent migration, and difficult removal. Leak of the proximal cervical esophagus, stent traversing the gastro-esophageal junction, esophageal leak with more than 6 cm and anastomotic leak associated with a more distal conduit leak have been associated with failure of leak resolution (13).

The aim of our study was to evaluate the safety, efficacy, and technical and clinical success of SEMS placement in the management of postoperative esophageal leaks.
MATERIAL AND METHODS

Retrospective study based on medical records from patients with postoperative esophageal leaks referred for SEMS placement in a reference center between January 2011 and December 2014. Only patients submitted to esophageal, gastric or mediastinal surgeries were included. The diagnosis was made based on clinical symptoms (fever, respiratory distress, hemodynamic shock, and increased output of external drainage) combined with the findings of the computed tomography scan and/or a barium swallow that confirmed the leak. Leak size was measured endoscopically.

Technical success was defined as closure of the leak in barium swallow at 15 days. Clinical success was considered as endoscopic and/or radiographic confirmation of closure after stent removal. Timing for stent removal was individualized by patient according to co-morbidities, nutritional status, size, and location of the esophageal fistula. All the stents were fully covered (Hanarostent M.I. Tech Co., Inc, Seoul, South Korea), with 20 mm diameter, with proximal and distal flares with 26 mm, and were mounted on 18 Fr (6 mm) delivery systems. A .035-inch or .038-inch guidewire was inserted distal to the leak, and stent deployment was performed under direct endoscopic visualization. Clips were not used to anchor the stent to the esophageal mucosa. The length of the stent was chosen to extend each edge of the stent at least 2 cm beyond the proximal and distal extent of the esophageal leak. Nasogastric tubes were not routinely placed after esophageal stent insertion. Barium studies were routinely performed prior to patients’ discharge.

Collected data included baseline patient and leak characteristics, type of surgery performed, location of the leak, SEMS extension, time between surgery and SEMS placement, adverse events, technical and clinical success and survival.

Statistics

Descriptive statistics were used to characterize our population. Categorical variables were described through absolute and relative frequencies and continuous variables were described as mean and standard deviation, median, percentiles, minimum and maximum. Hypotheses were tested about the distribution of continuous variables with non-normal distribution, by using the nonparametric Mann-Whitney and Kruskal-Wallis test, depending on the nature of the hypothesis. Pearson Chi-square and Fisher’s exact test were used to test hypotheses about independence of categorical variables, as appropriate. Kaplan-Meyer analysis was used to calculate survival. All the reported p values were two-sided, and p values of < 0.05 were considered as statistically significant. All data were arranged, processed and analyzed with SPSS® v.20.0 (Statistical Package for Social Sciences).

RESULTS

Population

A total of 13 patients (11 males) were analyzed, with a median age of 63 year-old (20-83). Median follow-up was 58 days (IQR: 19-134). Four of the patients were on intensive care units, 3 were on intermediate care units and 6 were on the general ward. Baseline characteristics of patients are present in table I.

Leaks had a median size of 20 mm (8-40), being secondary to Ivor-Lewis esophagectomy in 6 patients, total gastrectomy in 2, thoracic surgery in 2, Nissen fundoplication in 1, after cervical esphagostomy reconstruction in 1 and excision of esophageal diverticulum in 1. Ten of the leaks were located at the level of the anastomosis, with 2 being in the proximal esophagus and 1 in the distal esophagus.

SEMS placement and adverse events

Eight patients placed SEMS longer than 11 cm, with the remaining 5 placing SEMS shorter or with 11 cm. Time between surgery and SEMS placement was 20 days (8-64). One patient died 2 days after SEMS placement (death not related to stent placement or fistula existence) and one had worsening of the fistula after SEMS expansion. Four patients had migration of the stent, with placement of a second stent in 3 of them and repositioning of the first stent in the other one. Time till stent migration was 9 days (2-23). Migration was not influenced by SEMS extension (25% vs. 33%, p = 0.777).

Technical success was achieved in 9 of 11 patients, with clinical success without recurrence in 5 patients (stent removal in median 46 days after placement). All leaks with less than 20 mm were solved endoscopically. Technical and clinical success was higher when time between surgery and SEMS placement was lower, even though without statistical significance (respectively, 10 days [8-27] vs. 48 days [10-64], p = 0.228 and 12 days [8-21] vs. 20 days [10-64], p = 0.374) (Fig. 1). Clinical success was not influenced by SEMS extension (50% vs. 33%, p = 0.599).

In the 8 patients who died during follow-up, median survival was 59 days (CI95%: 45-73). Mortality at the 1st month was 31% (n = 4) and at 3 months was 46% (n = 6).

DISCUSSION

Postoperative esophageal leaks remain the most important complication after upper gastroesophageal surgery. The constant leakage of gastric juices and saliva into the pleural and mediastinal cavities make this a life-threatening condition responsible for 40% of postoperative mortality (14). The incidence of leak with an intrathoracic anastomosis reported in the literature varies between 3% and 25%, even though published guidelines recommend that the incidence of anastomotic leak should not exceed 5% (15). The choice between surgical or alternative (conservative or endoscopic) management remains controversial. The main goals of surgery in this context are closure of the defect by primary repair (eventually reinforced by tissue interposition) and cleaning of the mediastinal or pleural space through
## Table I. Baseline characteristic of patients with postoperative esophageal leaks

<table>
<thead>
<tr>
<th>Age/gender</th>
<th>Previous surgery</th>
<th>Surgery indication</th>
<th>Ward</th>
<th>Time from surgery to SEMS</th>
<th>Leak size</th>
<th>Leak location</th>
<th>SEMS extension</th>
<th>Adverse events other than migration</th>
<th>Migration</th>
<th>Time until migration</th>
<th>Technical success</th>
<th>Clinical success</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-72/Male</td>
<td>Total gastrectomy</td>
<td>Gastric neoplasia</td>
<td>ICU</td>
<td>27 days</td>
<td>25 mm</td>
<td>El anastomosis</td>
<td>15 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>2-63/M</td>
<td>Ivor-Lewis esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>IMCU</td>
<td>8 days</td>
<td>25 mm</td>
<td>EG anastomosis</td>
<td>15 cm</td>
<td>NA</td>
<td>Yes</td>
<td>2 days</td>
<td>Yes</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>3-63/M</td>
<td>Thoracic surgery</td>
<td>Substernal goiter surgery</td>
<td>ICU</td>
<td>10 days</td>
<td>40 mm</td>
<td>Proximal esophagus</td>
<td>11 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>4-55/M</td>
<td>Ivor-Lewis esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>IMCU</td>
<td>29 days</td>
<td>25 mm</td>
<td>EG anastomosis</td>
<td>11 cm</td>
<td>NA</td>
<td>Yes</td>
<td>7 days</td>
<td>No</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>5-65/M</td>
<td>Total gastrectomy</td>
<td>Gastric neoplasia</td>
<td>ICU</td>
<td>10 days</td>
<td>30 mm</td>
<td>El anastomosis</td>
<td>14 cm</td>
<td>NA</td>
<td>Yes</td>
<td>23 days</td>
<td>No</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>6-46/M</td>
<td>Ivor-Lewis esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>GW</td>
<td>27 days</td>
<td>10 mm</td>
<td>EG anastomosis</td>
<td>15 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>No</td>
<td>Death</td>
</tr>
<tr>
<td>7-74/M</td>
<td>Excision of esophageal diverticulum</td>
<td>Esophageal diverticulum</td>
<td>GW</td>
<td>9 days</td>
<td>40 mm</td>
<td>EG anastomosis</td>
<td>14 cm</td>
<td>NA</td>
<td>Yes</td>
<td>5 days</td>
<td>Yes</td>
<td>Yes</td>
<td>Alive</td>
</tr>
<tr>
<td>8-83/F</td>
<td>Thoracic surgery</td>
<td>Aortic valve substitution</td>
<td>ICU</td>
<td>64 days</td>
<td>20 mm</td>
<td>Proximal esophagus</td>
<td>11 cm</td>
<td>Death 2 days after</td>
<td>No</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Death</td>
</tr>
<tr>
<td>9-74/F</td>
<td>Nissen fundoplication</td>
<td>GERD and hiatus hernia</td>
<td>IMCU</td>
<td>20 days</td>
<td>20 mm</td>
<td>Distal esophagus</td>
<td>14 cm</td>
<td>Fistula worsening after SEMS expansion</td>
<td>No</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>Death</td>
</tr>
<tr>
<td>10-20/M</td>
<td>Cervical esophagostomy reconstruction</td>
<td>Eosinophilic esophagitis perforation</td>
<td>GW</td>
<td>21 days</td>
<td>8 mm</td>
<td>El anastomosis</td>
<td>8 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Alive</td>
</tr>
<tr>
<td>11-57/M</td>
<td>Ivor-Lewis esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>GW</td>
<td>21 days</td>
<td>15 mm</td>
<td>EG anastomosis</td>
<td>14 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Alive</td>
</tr>
<tr>
<td>12-45/M</td>
<td>Mckewon esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>GW</td>
<td>14 days</td>
<td>10 mm</td>
<td>EG anastomosis</td>
<td>14 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Alive</td>
</tr>
<tr>
<td>13-60/M</td>
<td>Ivor-Lewis esophagectomy</td>
<td>Esophageal neoplasia</td>
<td>GW</td>
<td>8 days</td>
<td>8 mm</td>
<td>EG anastomosis</td>
<td>11 cm</td>
<td>NA</td>
<td>No</td>
<td>NA</td>
<td>Yes</td>
<td>Yes</td>
<td>Alive</td>
</tr>
</tbody>
</table>

ICU: Intensive care unit; IMCU: Intermediate care unit; GW: General ward; El: Esophago-intestinal; EG: Esophagogastric; NA: Not applicable.
surgical debridement and drainage. In more complex or extensive leakage a delayed reconstruction after diversion with a cervical esophagostomy may be required. However, surgical reintervention is associated with high morbidity and mortality (16-18) and prolonged intensive care unit and hospital stays, particularly in patients with a delayed diagnosis and mediastinal and pleural contamination.

Endoscopy can define whether intrathoracic leakage is secondary to gastric conduit necrosis, conduit staple line dehiscence, or esophagogastric anastomosis dehiscence. Insertion of an esophageal stent across the leakage region is the most popular and effective method to seal leaks and avoid surgery, with the use of temporary fully covered SEMS being well documented in various report series (19-21). Migration rate may be explained by the fact that stents used are not designed specifically for the indication of esophageal leakage or fistula. In our study, even though the majority of patients were on intensive or intermediate care units, technical success of SEMS in esophageal leaks was higher than 80%. However, postoperative esophageal leaks were associated with a high morbidity and mortality, partially explained by patients’ co-morbidities, as well as surgery adverse events, with mortality rates at 1st month being 31% and at 3 months 46%. Literature suggests that stents should be left in place for 6 to 8 weeks in post-operative esophageal leaks. Considering these, clinical success was low, with only 45% of the patients having their stent removed, once the remaining 4 patients died before removal. However, all the patients who achieved clinical success were alive at the end of follow-up. SEMS seem to be a safe and effective option in the endoscopic sealing of leaks, allowing feeding, nutritional and clinical improvement. Better results seem to be achievable when time from initial diagnosis to SEMS placement is lower and leak size is less than 20 mm. These patients probably benefit the most from SEMS, allowing resolution of leaks and surgery avoidance.

Limitations of our study include its retrospective nature, with results reporting data only from a tertiary and single center, with possible selection bias that may preclude generalizability to community practice, as well as the small number of patients and heterogeneous population of patients. However, it reflects only patients with postoperative esophageal leaks and addresses clinical and endoscopic factors associated with endoscopic resolution of leaks.

REFERENCES

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