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VARIA

Redo procedure following Zenker`s diverticulum treatment – a clinical study

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Abstract: *Introduction: The prognosis of patients with Zenker`s diverticulum is dependent mainly on the type of procedure performed, either surgical or rigid/flexible endoscopy.*

Purpose - evaluation of the redo procedure by reviewing correlations in patients with iterative procedures.

Material and Methods: We included in the study 36 patients with cervicomediastinal Zenker diverticula treated from 2010 to 2017 at two university hospitals: Clinic of General and Esophageal Surgery. Mary Clinical Hospital Bucharest and Department of Diagnostic and Interventional Digestive Endoscopy of the Regional Institute of Hepatology and Gastroenterology Prof. Dr. Octavian Fodor, Cluj-Napoca. For the patients included in the study we studied correlations of patients with symptoms persistence and to those with reintervention with epidemiological, clinical and the treatment criteria.

Results: Postprocedural symptoms we observed in 5 patients of the 29 treated endoscopically and 6 of the seven treated surgically. Statistical correlations were noted in patients with persistent symptoms after surgical treatment ($p < 0.01$) with patients with diverticulectomy (54.5%) ($p < 0.01$), grade III diverticula (36.4%) ($p < 0.01$) statistical association was noticed in patients who have required reoperation and those with persistent symptoms (63.6%) ($p < 0.01$) and with remaining dysphagia (100%) ($p < 0.01$) and those with grade 2 dysphagia persistence (71.4%) ($p < 0.01$), grade 3 diverticula (42.9%) ($p < 0.03$) and the high number of comorbidities. ($p < 0.04$)

Conclusion: Undoubtedly, endoscopic treatment is being used more and more even for those cases that require further treatment. Reoperation has been necessary for patients with persistent dysphagia with voluminous diverticula and a high number of comorbidities.

Keywords: *diverticulum Zenker, endoscopic diverticulostomy, diverticulectomy, iterative procedure*

INTRODUCTION

Zenker`s diverticulum is a cause of morbidity in elderly patients. According to van Overbeek's theory, the predominant role in diverticulum formation has an anatomical predisposition represented by Killian dehiscence weakness. [1] The externally surgical approach has long been the conventional treatment with satisfactory clinical success rates ranging from 80-100%. [2]

The prognosis for these patients depends on the surgical procedure performed. Some authors stated that diverticulectomy patients have a long-term symptom recurrence rate of 2% to 33%. [3] Studies have been published since 1981, which noted that surgical resection or suspension of the pouch performed without a concomitant

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myotomy fails to improve dysphagia and fail to prevent complications or recurrence of the diverticulum, a fundamental consideration of the endoscopic techniques developed later. [4]

Some authors found that patients with endoscopic stapler technique, have a long-term symptom recurrence rate ranging from 0 to 47%. Most authors consider that the reasons for symptomatology after the endosurgical approach is the incompatibility of the dimensions of the septum with the length of the stapler (3 cm). A small diverticulum limits access to the tip of the stapler and it may not be possible to perform a proper myotomy. [5]

Data from the literature indicate a recurrence rate for laser endoscopic diverticulostomy of about 5-25%. [6, 7]

Flexible endoscopic therapy is a relatively new approach compared to rigid endoscopic and surgical techniques. Data from the literature on flexible endoscopic therapy show that symptomatic improvement was observed at 85%, with a symptom recurrence rate of 18-20%. [8-11]

The higher recurrence rate after flexible endoscopic treatment could be caused by incomplete septal dissection. Some authors have shown that the success of the treatment correlates with the length of the septotomy. The risk of perforation by over dividing muscular fibers and difficult identification of the last fibers of the cricopharyngeal muscle could make the endoscopist to leave a residual part of the septum to avoid perforation into the mediastinum. [12]

MATERIAL AND METHODS

We included in the study group 36 patients with Zenker diverticula treated during 2010/2017 in two university hospitals: Clinic of General and Esophageal Surgery Sfanta Maria Bucuresti and Department of Diagnostic and Interventional Digestive Endoscopy of the Regional Institute of Hepatology and Gastroenterology Prof. Dr. Octavian Fodor, Cluj-Napoca.

Inclusion criteria: patients with Zenker diverticulum admitted and treated endoscopically or by open surgery in the hospital during 2010/2017, over 18 years of age, investigated with barium swallow and upper GI endoscopy, patients with a follow-up period of at least 12 months post-procedure.

Exclusion criteria: immunocompromised patients, patients with associated malignant disease, patients lost from post-procedure follow-up.

All patients in the group were investigated by clinical examination, imaging with a barium swallow, upper endoscopy and functional tests with esophageal manometry when this exploration was possible.

Dysphagia was a constant symptom at presentation to the hospital, as well as the main symptom followed in the evaluation of the treatment efficiency. For the assessment of this symptom we used Mellow-Pinkas classification of dysphagia applied to the type of food that cannot be swallowed - grade 0 - No dysphagia, grade 1 - Dysphagia for solids, grade 2 - Dysphagia for semisolid, grade 3 - Dysphagia for solids and liquids grade 4 - Total dysphagia (inability to swallow saliva).

The sizes of the diverticula were appreciated both in centimeters and in degrees according to the Overbeeck classification by corroborating data obtained from the endoscopic exploration and the appearance of the barium contrast imaging. 1 – the small sac that has less than 1 vertebral body in length; 2 –intermediate sac 1-3 vertebral bodies in length; 3 – large sac greater than 3 vertebral bodies in length.

For all the patients surgically treated by cervicotomy, the resection of the diverticulum was performed with myotomy and manual esophageal suture, either single or double layer, or mechanically using a linear stapler. For the patients treated endoscopically, myotomy was performed with creating a wide communication of the diverticulum with the esophagus without resection of the diverticular pouch. A soft, flexible overtube (Cook Medical, Indiana, USA) was used to expose the septum, which was placed over the endoscope, with the short blade placed in the diverticulum and the long blade in the esophagus. After the septum was exposed, it was divided on the midline, from the esophageal lumen to the diverticular pouch, on an average length of 1.5 cm using a Dual knife (Olympus Co., Japan) followed by the closure of the mucosa with clips (2 -5 clips). All patients were clinically and imaged monitored at 3-month intervals during the first post-procedural year.

Study design

For the patients included in the study we studied correlations of patients with symptoms persistence, and to those with reintervention with epidemiological, clinical and the treatment criteria.

Statistical analysis

In comparison with the quantitative data, by the normality of the data, Student's t-test (for two groups with normally distributed data) and Mann-Whitney and Kruskal-Wallis (for data without normal distribution) were used. For the categorical data (synthesized as frequencies and percentages), Fisher exact tests (binary data) and Pearson

Chi-square were used as well as Likelihood Ratio (if 20% of expected frequencies were less than 5). The probability of error of less than 5% ($p < 0.05$) was considered as a significance threshold. The paper also included graphic representations, such as stratified bar type for data synthesized as frequencies and percentages.

RESULTS

Patients included were 29 patients treated endoscopically by myotomy in the Department of Diagnostic and Interventional Digestive Endoscopy of the Regional Institute of Hepatology and Gastroenterology Prof. Dr. Octavian Fodor, Cluj-Napoca and 7 patients surgically treated by resection of the diverticulum associated with myotomy. In the Clinic of General and Esophageal Surgery of St. Mary's Hospital Bucharest. The intraprocedural complications were laminar hemorrhage in three patients during the endoscopic procedure, and one surgically treated patient developed a postoperative hematoma that required drainage. Post-procedural mortality was 0%, and morbidity was 13.88% - five patients (3 patients after endoscopic treatment and 2 patients after surgical treatment).

Persistent postinterventional symptomatology was reported by 11 patients and consisted of the persistence of dysphagia of a lower degree associated or not with the persistence of other symptoms: sialorrhea, regurgitation, nausea, and cough.

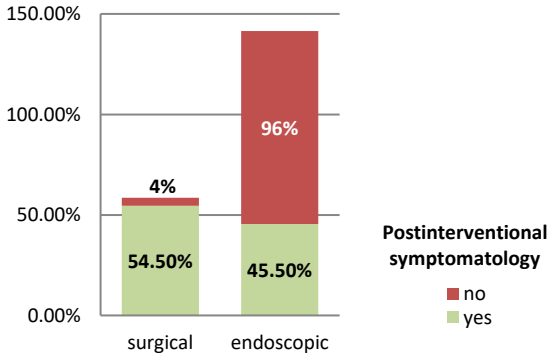
We did not observe associations regarding the correlation of the persistence of post-procedural symptomatology with the patients' sex, initial symptomatology or with diverticulitis. (Table 1)

Table 1: Correlations of post-intervention symptomatology - statistical processing of data

	Post opSymptoms = Yes (N=11)	**Post opSymptoms= No (N=25)**	**P_value (test)**
Sex=M	7/11 (63.6%)	14/25 (56.0%)	0.728773 (Fisher's Exact Test)
Grade			
1 2 3 4	0/11(0.0%) 5/11 (45.5%) 2/11 (18.2%) 4/11 (36.4%)	2/25 (8.0%) 15/25 (60.0%) 7/25 (28.0%) 1/25 (4.0%)	**0.063384** (Likelihood Ratio)
No Symptoms			
1 2 3 4 5	3/11 (27.3%) 1/11 (9.1%) 4/11 (36.4%) 1/11 (9.1%) 2/11 (18.2%)	8/25 (32.0%) 4/25 (16.0%) 11/25 (44.0%) 2/25 (8.0%) 0/25 (0.0%)	0.266965 (Likelihood Ratio)
Proceduresurgicalendoscopic			
	6/11 (54.5%) **5/11 (45.5%)**	**1/25 (4.0%)** **24/25 (96.0%)**	**0.001423** (Fisher's Exact Test)
Pouch resection			
Yes	**6/11 (54.5%)**	**1/25 (4.0%)**	**0.001423** (Fisher's Exact Test)
Div Dimensions			
1 2 3	2/11 (18.2%) 5/11 (45.5%) **4/11 (36.4%)**	12/25 (48.0%) 13/25 (52.3%) **0/25 (0.0%)**	**0.003085** (Likelihood Ratio)
Dysphagia post op			
Yes	**10/11 (90.9%)**	**1/25 (4.0%)**	**0.000000** (Fisher's Exact Test)
Dysphagia Grade			
0 1 2	**1/11 (9.1%)** **4/11 (36.4%)** 6/11 (54.5%)	24/25 (96.0%) 1/25 (4.0%) 0/25 (0.0%)	**0.000000** (Likelihood Ratio)
Hospitalisation			
	7.55±5.5563 **8.00 [2.00, 11.00]**	2.56±1.5832 **2.00 [2.00, 3.00]**	**0.005955** (Mann-Whitney Test)

Post-procedural symptomatology we observed only in five patients out of the 29 endoscopically treated and in six out of the seven surgically treated. The statistical association was observed for the type of intervention practiced – endoscopic or surgical treatment (p <0.01) and the persistence of postintervention symptomatology (endoscopic treatment = 45.5%) compared to those without postinterventional symptomatology (endoscopic treatment = 96.0%) – 96% of patients who did not report persistent symptoms had endoscopic treatment. (Table 1) (Figure 1)

Figure 1: Distribution of patients according to the presence of the post-intervention symptomatology to the surgical or endoscopic procedure type



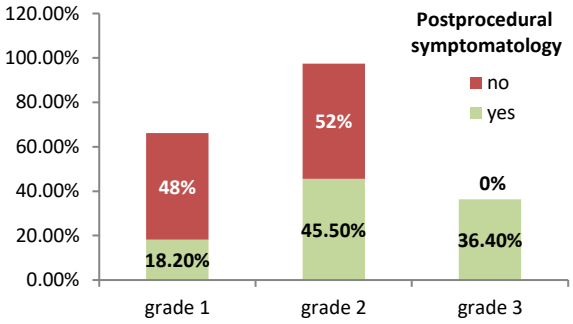
Resistant post-procedural symptoms may be influenced by the type of technique performed: resection of the diverticular pouch or just opening, and association of the myotomy or not. For the patients in the group, the resection of the diverticulum was performed only in the patients treated with open surgery.

The statistical association we observed comparing the percentage of resected Zenker's in patients with persistent postinterventional symptomatology (54.5%) compared to those without postinterventional symptomatology (4.0%) (p <0.01). (Table 1)

Of the 11 patients with postinterventional symptomatology, four patients had grade three diverticula. The correlation of the grade of the diverticulum with the persistence of the post-procedural symptomatology determined a statistical association to the dimension appreciated in degrees according to the Overbeeck classification.

The statistical association was found by correlating the persistence of postintervention symptomatology in patients with grade III diverticula (36.4%) compared with those without postinterventional symptomatology (0.0%) (p <0.01) (Table 1) (Figure 2)

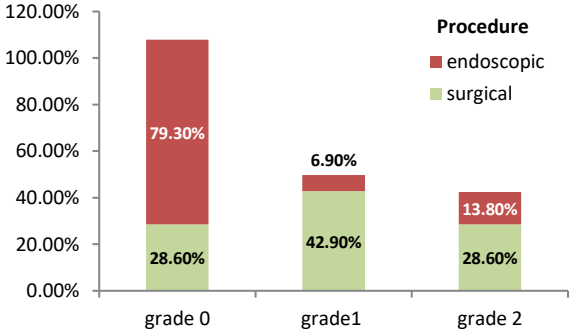
Figure 2: Distribution of patients with post-intervention symptomatology to the dimensional degree of the diverticulum.



In the post-procedural symptomatology dysphagia was the dominant symptom of 10/11 patients – 4 patients had dysphagia grade 1 and 6 patients dysphagia grade 2. The statistical association was observed between the percentage of patients with delayed dysphagia (p <0.01) and those with postinterventional symptomatology (90.9 %) compared to those without postinterventional symptomatology (4.0%). (Table 1) Persistent postinterventional symptomatology was mainly dysphagia.

Post-procedural persistent dysphagia was reported by 11 patients – 5 patients after surgical treatment and 6 after endoscopic treatment, 10 patients had a lower degree of dysphagia than at the initial presentation. Of the 5 patients surgically treated for 3 dysphagia persisted in the first postoperative month and did not require treatment, for the 2 patients with grade 2 dysphagia, one required re-intervention for a hematoma, and another one with esophageal fistula required adequate surgical treatment. We observed a statistical association between persistent dysphagia and surgical treatment (p <0.03), probably due to the small number of patients treated surgically. (Table 2) (Figure 3)

Figure 3: Distribution of patients according to the persistence of postintervention dysphagia to the surgical or endoscopic procedure type.



Tabel 2: Statistical correlation for redo procedure - statistical data analysis.

	Redo=Yes (N=7)	**Redo=No (N=29)**	**P_value (test)**
Sex=M	4/7 (57.1%)	17/29 (58.6%)	1.000000 (Fisher's Exact Test)
Grade			
1	0/7 (0.0%)	2/29 (6.9%)	
2	5/7 (71.4%)	15/29 (51.7%)	0.328714
3	2/7 (28.6%)	7/29 (24.1%)	(Likelihood Ratio)
4	0/7 (0.0%)	5/29 (17.2%)	
No Symptoms			
1	3/7 (42.9%)	8/29 (27.6%)	
2	1/7 (14.3%)	4/29 (13.8%)	
3	3/7 (42.9%)	12/29 (41.4%)	0.633852 (Likelihood Ratio)
4	0/7 (0.0%)	3/29 (10.3%)	
5	0/7 (0.0%)	2/29 (6.9%)	
Hospitalisation			
	6.29±6.7506 **3.00 [2.00, 14.00]**	3.55±2.9469 **2.00 [2.00, 3.50]**	0.360412 (Mann-Whitney Test)
Persistent dysphagia			
yes	**7/7 (100%)**	**4/29 (13.8%)**	**0.000040** (Fisher's Exact Test)
Persistent Dysphagia grade			
0	**0/7 (0.0%)**	**25/29 (86.2%)**	
1	2/7 (28.6%)	3/29 (10.3%)	**0.000009** (Likelihood Ratio)
2	**5/7 (71.4%)**	**1/29 (3.4%)**	
Sialorrhea			
Yes	2/7 (28.6%)	2/29 (6.9%)	0.162567 (Fisher's Exact Test)
Size			
	3.86±1.2149 4.00 [3.00, 5.00]	**2.93±1.2516** 3.00 [2.00, 3.50]	**0.086359** (Student T)
Size classif.			
1	1/7 (14.3%)	13/29 (44.8%)	
2	3/7 (42.9%)	15/29 (51.7%)	**0.023010** (Likelihood Ratio)
3	**3/7 (42.9%)**	**1/29 (3.4%)**	
Procedure			
surgical	2/7 (28.6%)	5/29 (17.2%)	0.601669
endoscopic	5/7 (71.4%)	24/29 (82.8%)	(Fisher's Exact Test)
Miotomy			
Yes	7/7 (100%)	28/29 (96.6%)	1.000000 (Fisher's Exact Test)
Pouch resection			
Yes	2/7 (28.6%)	5/29 (17.2%)	0.601669 (Fisher's Exact Test)
Intra op morbidity			
	1/7 (14.3%)	2/29 (6.9%)	0.488235 (Fisher's Exact Test)
Comorbidity			
yes/no	7/7 (100%)	21/29 (72.4%)	0.309298 (Fisher's Exact Test)
Comorbidities – No			
0	0/7 (0.0%)	8/29 (27.6%)	
1	3/7 (42.9%)	5/29 (17.2%)	
2	4/7 (57.1%)	7/29 (24.1%)	**0.033327** (Likelihood Ratio)
3	0/7 (0.0%)	8/29 (27.6%)	
4	0/7 (0.0%)	1/29 (3.4%)	

HTN	4/7 (57.1%)	15/29 (51.7%)	1.000000 (Fisher's Exact Test)
DM	0/7 (0.0%)	5/29 (17.2%)	0.558991 (Fisher's Exact Test)
Dyslipidemia	2/7 (28.6%)	12/29 (41.4%)	0.681030 (Fisher's Exact Test)
Other diverticula	1/7 (14.3%)	3/29 (10.3%)	1.000000 (Fisher's Exact Test)

Post-procedural sialorrhea was reported by four patients. It was not present as a unique symptom but it was always associated with persistent dysphagia. Post-procedural sialorrhea persisted in four patients.

Reintervention was necessary when the persistence of post-procedural symptoms was recorded for 7/11 patients. For the 5 patients treated endoscopically, who required reintervention for the persistence of the symptomatology, an average interval of 22.8 months was observed, while the reinterventions for the 2 patients treated by open surgery happened during the postoperative period. The statistical association was observed in patients who needed reintervention and those with postinterventional symptomatology (63.6%) ($p < 0.01$) (Table 1)

DISCUSSIONS

When comparing the technical and clinical results from the literature on the treatment of Zenker diverticulum, it should be critically emphasized that a direct comparison between studies and results may be inadequate, as the data are neither homogeneous nor standardized in regards of multiple variables. Noteworthy in this regard: symptom collection (dysphagia, dysphagia plus regurgitation, cumulative symptoms), symptom evaluation (objective scores for dysphagia, subjective grading of symptom relief and satisfaction), choice of one or another technique (sequentially, size of the diverticulum, clinical conditions, local policy), the definition of clinical success (total disappearance of symptoms, disappearance with improvement), success and extent of recurrences (after one or more sessions) and variable duration of follow-up (the shortest follow-up programs being reported after endoscopy) flexible, compared to the more recent series of patients treated transorally and with a historical cohort of patients treated surgically).

Patient follow-up included history taking, clinical examination, imaging investigations. Clinical criteria followed were persistence or recurrence of dysphagia and sialorrhea as with other similar studies. [13]

In patients in our group, we found the efficiency of endoscopic treatment of 96% and the whole group of 80%. Most cases published since 1995 demonstrate the efficacy and safety of flexible endoscopy, with clinical success rates between 56% to 100%. [14-15]

The success rate lower than 56% reported in a single series [10] is most likely because the clinical remission was evaluated according to the presence or absence of a group of symptoms and not only dysphagia.

The rate of recurrent symptoms was significantly higher in the surgical group than in the endoscopic group, results different from those reported in other studies where a 39% recurrence rate was found after endoscopic treatment and 0% recurrence in the patients who suffered surgery, probably due to the small number of patients treated surgically. [13]

In the studied group, the persistent postinterventional symptomatology was mainly represented by dysphagia, which is why we consider that in other studies, the efficacy of the treatment should be reported according to the improvement of this symptom. Data from the literature report clinical success increases to 84-100% when the unique series in which success is defined according to dysphagia is taken into account. [9, 11, 15]

As in our study and some other studies, treatment efficacy was reported after a single treatment session, [10, 16] while in other series the success rate was reported after several treatment sessions. [9, 17]

Unlike rigid staple endoscopy, the flexible septotomy technique for the Zenker diverticulum is neither univocal nor standardized. As already mentioned, different cutting techniques can be variably combined with different accessories. The optimal dividing technique is unknown because prospective randomized studies are lacking, and the choice is mainly based on the endoscopist's personal experience and preferences.

In evaluating the success rate of surgery, the most important factor is the subjective evaluation of the swallowing function performed by the patient. Both the primary and revision indications are guided by the patient's symptoms. [18]

Following rigid endoscopic or surgical treatment, persistent septum or residual pouch may still be present on barium

contrast examination. Persistent symptoms may be due to other swallowing abnormalities and/or inappropriate myotomy, without correlating the size of the residual pouch and the recurrence of the symptoms. There is a consensus in the literature that the evaluation of treatment efficacy and the need for further treatment must be determined by the patient's symptoms [19, 20] - which we agree with.

Some authors concluded that the presence of a residual diverticulum on an early postoperative esophagogram does not warrant early surgical revision, even when dysphagia persists. In many cases, there may be a slow process of gradual fibrosis of residual dysfunctional cricopharyngeal muscles or atrophy of the remaining diverticular sac over time. In addition, a normal postoperative esophagogram probably cannot predict a good and persistent outcome.

Some authors have reported that only 12.5% of patients with remaining diverticula on the postoperative contrast check develop a recurrence of Zenker's diverticulum. [18]

The approach of redo interventions has changed over time. If in older studies, there is a high percentage of recurrent surgical treatment, [21, 22] we are currently attending an endoscopic revision intervention, and in our study was noted that on a case of redo was necessary to use an endoscopic method after open resection of the Zenker diverticulum for the treatment of dysphagia in case of postoperative stenosis.

Other authors point out the need for classical intervention to resect the residual sac, which, even after a complete myotomy, can be a reason for the persistence of food retention mechanism. This may be the cause of symptoms in patients with prolonged retention of the contrast substance in the pharyngeal pouch and difficult passage into the esophagus, even after complete cricopharyngeal myotomy. [2, 3]

Other authors also suggest that an incomplete cricopharyngeal myotomy may result in higher recurrence rates associated with flexible endoscopy. Ideally, the diverticulum should be reduced to <1 cm. [24]

Incomplete cricopharyngeal myotomy may be visible on radiographs as a cricopharyngeal impression. Hypo-pharyngeal dysfunction during swallowing of the contrast substance may indirectly suggest incomplete myotomy or recurrent laryngeal nerve injury. On radiographs with contrast substance, pharyngeal dysfunction is suspected if we see contrast substance in the larynx or the tracheobronchial tree. Some authors consider that the persistence of the septum rather characterizes the endoscopic technique and does not predict the failure of the treatment, especially during the immediate postoperative period. [25]

Other authors have tried to evaluate the efficiency of the procedure through manometric studies. Ozgursoy and Salassa reported that a large diverticulum can cause obstruction of the esophageal passage and can lead to high pressure, even if the tone of the upper esophageal sphincter remains normal at manometry. Such a theory leads to the hypothesis that the weak wall of the hypopharynx may play an important role in the development of the diverticulum and leaving the weak adynamic segment of the esophagus creates a favorable environment for recurrence. In addition, the creation of a large cavity after diverticulostomy favors endoscopic techniques over open diverticulectomy on manometric evaluation, because, in a large cavity, small pressures are difficult to record, even if part of the septum remains and this causes dysphagia. [26, 27]

Some studies have shown that post-procedural soluble contrast studies do not correlate with symptoms following endoscopic therapy or relapses and that the second radiological examination, three months after surgery, presents the final functional results, with which we also agree. [8, 25] We also carried out new post-procedural or post-operative radiological studies to exclude a fistula on the seventh postoperative day and in the post-procedural monitoring of patients. Maybe a more accurate assessment of the contrast substance study could be done 3 months after the procedure.

For the patients in the group, we found that the duration of hospitalization in patients with postinterventional symptomatology and those without postinterventional symptomatology was significantly different. The average duration of hospitalization was 2 days for patients without post-procedural morbidity and 7 days for those with post-procedural morbidity comparable to the data in the literature. In our study, the duration of hospitalization of patients with open diverticulectomy was comparable with the data in the literature. [28-30]

The persistence of dysphagia in the 11 patients included in the group usually required reintervention; most of the patients with persistent symptomatology required a reintervention of the same type. Similar studies have also been reported in the literature, most patients who failed the procedure also underwent endoscopic reintervention. [31]

In the patients in the group with bulky diverticula of degree III or larger than 4 cm, the most frequent post-procedural reinterventions were required, 3 out of 4 patients, aspects encountered in other studies. Partial septotomy in the diverticula greater than 5 cm has been proposed by some surgeons, even if the myotomy fails to completely remove

the septum and may require more endoscopic interventions. [16, 32, 33]

According to recent literature, some authors recommend the endoscopic procedure for revision surgery as well. The great advantage compared to the open approach is that the endoscopic revision treatment is technically feasible and relatively easy, not more difficult than the primary endoscopic procedure, without an increase in risk. Furthermore, patient satisfaction was higher in those who underwent endoscopic revision surgery compared to those who underwent open surgery revision. [6, 18, 34]

Repeated procedures, in case of therapeutic failure or symptomatic relapse, can be easily and successfully performed by flexible or rigid endoscopy. An additional advantage is that repeated procedures for persistent or recurrent symptoms can be successfully achieved through a transoral (rigid or flexible) approach, while an open approach can be a major technical challenge. [5]

The data from the literature show recurrence rates of about 6% (range 0-22%), with the average recurrence rate of 5% compared to the classical approach, and according to data obtained in our study. [35]

The comorbidities of patients with diverticula included in the group also played a role in the emergence of the situations that required reintervention. [36]

Some authors consider that endoscopic findings tend to decrease over time and that incomplete septotomy is a significant factor for failure rate [37-40], an aspect we have also found.

CONCLUSIONS

Most of the time redo procedures were of the same type, the endoscopic iterative treatment being much easier than the surgical iterative treatment. Undoubtedly, endoscopic treatment has gained more and more confidence even in the field of revision interventions, considering that persistence or recurrence of dysphagia has as substrate an incomplete division of the septum requiring the same type of procedure. Redo procedures were necessary for patients with persistent dysphagia, bulky diverticula, and patients with a high number of comorbidities.

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