Zenker Diverticulum Treatment: Endoscopic or Surgical?

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Rezumat

Tratamentul diverticulului Zenker: endoscopic sau chirurgical?

Introducere: Diverticulul Zenker constituie o patologie rară, selecția pacienților pentru tratamente invazive este discutabilă, precum și metoda terapeutică aplicată. Scopul studiului este de a evalua principalele metode de tratament-chirurgical clasic și endoscopic, în această patologie și de a corela aspectele fiziopatologice cu consecințele clinice.

Material și metodă: Am inclus în lotul de studiu 36 pacienți cu diverticuli cervicali Zenker tratați în perioada 2010/2017 în două clinici universitare: 7 pacienți prin abord chirurgical clasic la Clinica de Chirurgie Generală și Esofagiană a Spitalului Clinic Sfânta Maria București și 29 de pacienți cu abord endoscopic la Departamentul de Endoscopie Digestivă de Diagnostic și Intervențională din cadrul Institutului Regional de Hepatologie și Gastroenterologie Prof. Dr. Octavian Fodor, Cluj-Napoca. Vârsta pacienților a fost cuprinsă între 42 și 84 ani și în decada a 7a - 15 pacienți.

Rezultate: Miotomia cricofaringiană s-a efectuat la toți pacienții. Diverticulectomia s-a practicat la 7 pacienți, cei tratați chirurgical. Durata de spitalizare medie a fost de 4 zile. Complicații intra-procedurale au prezentat 3 pacienți tratați endoscopic și au constat în apariția hemoragiei laminare. La 2 pacienți s-a practicat hemostază endoscopică cu clipuri și pensă caldă iar la un pacient s-a efectuat hemostază endoscopică cu clipuri. Complicațiile post-procedurale au fost: dureri locale, leucocitoză, melenă, febră,

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hematom cervical. Aceste manifestări postprocedurale au fost întâlnite la 6 pacienți. Morbiditatea postprocedurală a fost 16,66%.

Concluzii: La pacienții incluși în lot, eficiența tratamentului endoscopic a fost de 80%. simptomatologia postintervențională persistentă a fost reprezentată în principal de disfagie; sialoreea postprocedurală s-a asociat cu persistența disfagiei. Pacienții cu simptomatologie postprocedurală persistentă au necesitat reintervenție.

Cuvinte cheie: diverticul Zenker, tratament endoscopic, diverticullectomie, miotomie cricofaringiană

Abstract

Introduction: The Zenker Diverticulum is a rare pathology, the selection of patients for invasive treatments is questionable, as well as the applied therapeutic method. The aim of the study is to evaluate the main methods of classical and endoscopic surgical treatment in this pathology and to correlate pathophysiological aspects with clinical consequences.

Material and method: We included 36 patients with Zenker hypopharyngeal diverticulum treated in 2010/2017 in two university clinics: 7 patients by classical surgical approach at the General and Esophageal Surgery Clinic of St. Mary's Hospital Bucharest and 29 patients with endoscopic approach at Department of Diagnostic and Interventional Digestive Endoscopy of the Regional Institute of Hepatology and Gastroenterology Prof Dr Octavian Fodor, Cluj-Napoca. The age of the patients ranged from 42 to 84 years and in the 7th to 15th decade.

Results: Cricopharyngeal myotomy was performed in all patients. Diverticullectomy was performed in 7 patients treated surgically. The average hospitalization duration was 4 days. Intra-procedural complications showed 3 patients treated endoscopically and consisted of laminar haemorrhage. Two patients were treated with endoscopic hemostasis and hot pens and one patient had endoscopic hemostasis with clips. The post-procedural complications were: local pain, leukocytosis, melena, fever, cervical hematoma. These post-treatment events were seen in 6 patients. The post-treatment morbidity was 16.66%.

Conclusions: In patients included in the batch, the endoscopic treatment efficiency was 80%. Persistent postinterventional symptomatology was mainly represented by dysphagia, post-procedural syndrome was associated with dysphagia persistence. Patients with persistent post-surgical symptoms were required to reintervention.

Key words: Zenker diverticulum, endoscopic treatment, diverticullectomy, cricopharyngeal myotomy

Introduction

The Zenker Diverticulum (DZ), also known as the hypopharyngeal diverticulum, is a mucosal and submucosal sac-shaped sac that originates in the pharyngo-esophageal junction. DZ is located on the dorsal side of the pharyngo-esophageal wall by Killian's dehiscence and is bounded by the inferior pharyngeal constrictor muscle and the cross-hair fibers of the cricopharyngeal muscle (contributing to the upper

esophageal sphincter) (1) Typical symptoms are dysphagia, regurgitation, chronic cough, aspiration, and weight loss. The exact etiology remains unclear, the most accepted theory being the disturbance of the pharyngeal-esophageal motility. (2) Currently, the therapeutic attitude varies between conservative and surgical, classical or endoscopic treatment. Treatment should be reserved for symptomatic patients with or without associated complications (3,4), while small, asymptomatic diverticula do not

require treatment, as the risk of severe adverse events (cancer, aspiration pneumonia) is reduced (5). The surgical indication, as expressed in the literature, is still vaguely specified, varies between the formal indication for surgery, determined by the simple presence of the diverticular sac at the pharyngoesophageal level, up to a case-adjusted attitude depending on the presence of the symptomatology specific age, associated illness and of course the installation of direct complications, an attitude we opt for.

Material and Method

We included 36 patients with cervical diverticulum Zenker treated in 2010/2017 in two university clinics: the General and Esophageal Surgery Clinic of St. Mary's Hospital Bucharest and the Department of Diagnostic and Interventional Digestive Endoscopy of the Regional Hepatology Institute and Gastroenterology Prof Dr Octavian Fodor, Cluj-Napoca. Batch inclusion criteria: Patients with Zenker diverticals enrolled and treated endoscopically or surgically in the hospital during 2010/2017, over 18 years of age, patients investigated imaging with barium transit and endoscopy, patients with a follow-up period of 12 months postprocedural. Exclusion criteria: immunosuppressed patients, patients with associated malignancy, patients lost from post-tracing follow-up. The distribution of patients by gender was relatively equal - F / M- 15 / 21. Most of the patients included in the study are in the 7th decade of life. Patients included in the batch presented co-morbidities. Nearly a quarter of patients had no comorbidities, and only one patient had a combination of 4 comorbidities: atrial fibrillation, HTAE, coronary ischemic disease and sigmoid diverticulosis. Upon admission, the patients included in the study exhibited both esophageal symptoms: dysphagia, pyrosis, sialorrhea, and extra-esophagitis: dysphonia, odinophagia, cough. Most patients accused 3 symptoms - 41.7%. Dysphagia has been a constant symptom in hospital presentation. The evaluation of this symptom was made after the Mellow-Pinkas proposed dysphagia depending on the type of

food that can not be swallowed - Grade 0 - No Dysphagia, Grade 1 - Dysphagia for Solids, Grade 2 - Dysphagia for Semisolid, Grade 3 - Dysphagia for solid and liquid grade 4 - Total dysphagia (inability to swallow saliva). In the study group, 55.6% of patients had grade 2 dysphagia. Symptomatology in the ENT sphere was present in 10 of the 36 patients in the study and consisted of dysphonia, cough, odinophagia and was associated with oesophageal manifestations 70% of patients. All of the patients included in the group performed imaging experiments: X-ray examination with barium and EDS. EDS highlights the presence of the diverticulum, the diverticulum ventricular opening dimensions, the diverticulum content of the diverticulum and the diverticular mucosal appearance sometimes with diverticulitis aspect (*Figs. 1, 2*).

Barium X-ray examination gives information about the true size of the diverticulum, its content, possibly an associated pathology (*Figs. 3, 4*)

Exploration of oesophageal motility was done by means of oesophageal manometry. In patients in the batch, I did not experience manometric changes of the inferior esophageal sphincter in terms of its positioning, volume vector or relaxation but only changes in motility in the sense of reduced amplitude and aperistaltic contraction waves (*Fig. 5*).

The diverticular dimensions were appreciated both in centimeters and degrees depending on the Overbeeck classification by corroborating the data obtained from the endoscopic exploration and baritome transit aspect. Most of the patients had grade 1 and 2 diverticula, only 4 patients had grade 3 diverticulum. Secondary diarticulosus of the food stool of the retentive diverticula was present in only 9 patients. Patients who did not have diverticulitis had mainly small diverticulitis - 14 grade 1 diverticulitis patients and 13 grade 2 diverticulitis patients.

Results

All 36 patients in the study group underwent an endoscopic or surgical therapy procedure.

Figure 1. Endoscopic aspect of the diverticular pouch- food and barium residues

Figure 2. Endoscopic appearance of the esophagus opening with Zenker diverticula (arrowhead)

Figure 3. Barium X-ray examination – front view - voluminous plugs retracted retosternal

Figure 4. Zenker diverticulum- lateral view - cervical esophagus compressed by a voluminous Zenker diverticulum

Figure 5. Conventional esophageal manometry - an ineffective esophageal motility aspect in a Zenker diverticulum patient

29 patients were 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 were surgically treated by the resection of diverticulature associated with myotomy in the Clinic of

General and Esophageal Surgery of St. Mary's Hospital Bucharest. Endoscopic surgery was performed with the creation of a broad communication of the diverticulus with the esophagus without the resection of the

Figure 6. Intraoperative aspect - Zenker diverticulum dissected and externalized through the left cervicotomy incision

Figure 7. Intraoperative aspect - application of the linear stapler at the base of the Zenker diverticulum

Figure 8. Intraoperative aspect - final appearance after Zenker diverticulum resection and additional manual suturing after application of the stapler

diverticular pouch, and the resection of the diverticulum with myotomy and the esophageal manually sutured suture or double layer or mechanical using the stapler was performed surgically by cervicotomy (Figs. 6, 7, 8).

Intra-procedural complications presented 3 patients treated endoscopically and consisted of laminar haemorrhage. In 2 patients, endoscopic hemostasis was performed with clips and hot pens and a patient had endoscopic hemostasis with clips. The post-procedural complications were: local pain, leukocytosis, melena, fever, cervical hematoma. These post-treatment events were seen in 6 patients. The post-treatment morbidity was 16.66%.

Statistical Analysis

By correlating the post-procedural complications with the sex of the patients, the presence of the comorbidities, the presentation symptoms, the size of the diverticles expressed in centimeters or in degrees, the type of intervention, the practice

of the myotomy or the diverticular resection and the procedural intra-procedural complications, we did not find statistically significant values. A significant difference is observed between hospitalizations in post-treatment complications and those without post-procedural complications ($p_value = 0.007081$, Mann-Whitney Test) (Table 1).

Table 1. Correlation of post-procedural complications with the duration of hospitalization - statistical data processing

Postprocedural complications = Yes (N=6)	Postprocedural complications = N (N=30)	P_value (test)
8.67 ± 6.4083	3.17 ± 2.6403	0.007081
7.00 (3.50, 15.00)	2.00 (2.00, 3.00)	(Mann-Whitney Test)

On average, patients with no postprocedural morbidity necessitated a 2-days hospitalization period, whereas patients with postprocedural morbidity necessitated a 7-days hospitalization period.

Persistent postprocedural symptomatology was present for 11 patients and consisted in persistency of a lower degree dysphagia which might be associated to other symptoms (sialorrhea, regurgitations, nausea, cough).

No statistically significant differences were noticed with regard to postprocedural symptomatology in correlation to sex and initial symptomatology. Yet, significant difference in terms of hospitalization duration was noticed

between patients with and without post-interventional symptomatology. ($p_value = 0.005955$, Mann-Whitney Test) (*Table 2*).

Postprocedural symptomatology was observed at 5 out of 29 endoscopically treated patients, and at 6 out of 7 who underwent surgery (*Table 3*).

Postprocedural persistent symptoms may be influenced by used technique (i.e., diverticular pouch resection or lack of resection, presence or absence of myotomy). For patients in the test lot, diverticulum resection was carried out only for surgically treated patients (*Table 4*).

Out of 11 patients with postinterventional symptomatology, 4 had degree-3 diverticulum.

Table 2. Correlation of postinterventional symptomatology with hospitalization duration – statistical data processing

	Postinterventional symptomatology = Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Hospitalization duration	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)

Table 3. Correlation of postinterventional symptomatology with procedure – statistical data processing

	Postinterventional symptomatology = Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Intervention surgery	6/11 (54.5%)	1/25 (4.0%)	0.001423
endoscopic	5/11 (45.5%)	24/25 (96.0%)	(Fisher's Exact Test)
Myotomy=Yes	11/11 (100%)	24/25 (96.0%)	1.000000
			(Fisher's Exact Test)

significant differences were noticed between the type of intervention (surgery or endoscopic) ($p_value=0.001423$, Fisher's Exact Test) and the persistency of postinterventional symptomatology (endoscopic treatment =45.5%) and those without post-interventional symptomatology (endoscopic treatment =96.0%) – 96% of patients with no postinterventional symptomatology underwent endoscopic treatment

Table 4. Correlation of postinterventional symptomatology with diverticulum resection – statistical data processing

	Postinterventional symptomatology = Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Resection =Da	6/11 (54.5%)	1/25 (4.0%)	0.001423
			(Fisher's Exact Test)

significant difference was observed in regard to percentage of resected diverticula between patients with postinterventional persistent symptomatology (54.5%) and patients with no postinterventional persistent symptomatology (4.0%) ($p_value=0.001423$, Fisher's Exact Test) – presence of symptoms was predominantly noticed at patients having underwent resection

Table 5. Correlation of posyinterventional symptomatology with dimension of diverticulum (cm) and of degrees of diverticulitis – statistical data processing

	Postinterventional symptomatology = Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Dimension	4.00±1.7320 4.00 (3.00, 5.00)	2.72±0.7916 3.00 (2.00, 3.00)	0.014844 (Mann-Whitney Test)
Dimension classification			0.003085 (Likelihood Ratio)
1	2/11 (18.2%)	12/25 (48.0%)	
2	5/11 (45.5%)	13/25 (52.3%)	
3	4/11 (36.4%)	0/25 (0.0%)	
Diverticulitis=Yes	4/11 (36.4%)	5/25 (20.0%)	0.408774 (Fisher's Exact Test)

Correlation of diverticulum dimension (as a function of degree) with postprocedural symptomatology persistence has determined statistically significant difference ($p_{\text{value}} = 0.014844$, Mann-Whitney Test) both in what concerns dimension (expressed in cm) and values expressed in degrees (as per Overbeek classification) (Table 5).

Diverticula up to 3 cm seldom led to postprocedural symptoms, whereas diverticula larger than 4 cm were more susceptible for persistency of postprocedural symptoms.

The significant difference was noticed by correlating the percentage of patients with diverticulum of degree 3 and the persistency of postinterventional symptomatology ($p_{\text{value}} = 0.003085$, Likelihood Ratio), namely: between patients with postinterventional symptomatology (36.4%) and those without postinterventional symptomatology (0.0%) voluminous diverticula chiefly made the difference between patients with or without persisting postprocedural symptomatology.

In the context of postprocedural symptomatology, dysphagia was the key symptom (10 out of 11 patients): 4 patients had score 1 dysphagia, whereas 6 patients had score 2 dysphagia (Table 6).

Persistent postprocedural dysphagia was present in 11 patients – 5 of which underwent surgery, and 6 endoscopic treatment (Table 7).

Endoscopic treatment was beneficial for 80% of patients who underwent this type of procedure (Table 8).

10 out of 11 patients with postinterventional symptomatology have presented persistence of dysphagia with a lower score than initially.

Distribution of patients with persistent dysphagia with type of intervention. Postprocedural sialhorrea was noticed in 4 patients, not as unique symptom, but always in association with dysphagia (Table 9).

Reintervention was deemed necessary for 7 out of 11 patients with persistent postprocedural symptoms (Table 10).

Table 6. Correlation of postinterventional symptomatology with persistent dysphagia – statistical data processing

	Postinterventional symptomatology = Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Dysphagia=Yes	10/11 (90.9%)	1/25 (4.0%)	0.000000 (Fisher's Exact Test)

significant difference was noticed in regard of presence of dysphagia ($p_{\text{value}}=0.000000$, Fisher's Exact Test) between patients with postinterventional symptomatology (90.9%) and those without (4.0%). Actually, persistent postinterventional symptomatology was mainly characterized by dysphagia

Table 7. Correlation of type of intervention with postprocedural persistence dysphagia – statistical data processing

	intervention=S (N=7)	intervention=E (N=29)	P_value (test)
Score of dysphagia			0.027866 (Likelihood Ratio)
0	2/7 (28.6%)	23/29 (79.3%)	
1	3/7 (42.9%)	2/29 (6.9%)	
2	2/7 (28.6%)	4/29 (13.8%)	

Persistent Dysphagia significantly differs with the type of intervention (p_value=0.027866 Likelihood Ratio) .

Table 8.

	Postinterventional symptomatology =Yes (N=11)	Postinterventional symptomatology =No (N=25)
Score of dysphagia		
0	1/11 (9.1%)	24/25 (96.0%)
1	4/11 (36.4%)	1/25 (4.0%)
2	6/11 (54.5%)	0/25 (0.0%)

Table 9.

	Postinterventional symptomatology =Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
sialorrhea=Yes	4/11 (36.4%)	0/25 (0.0%)	0.005602 (Fisher's Exact Test)

sialorrhea persisted postprocedurally in 4 patients, which led to significant difference as regards this symptom between patients with postprocedural symptomatology (36.4%) and those without (0.0%). (p_value=0.005602, Fisher's Exact Test)

Discussions

Zenker Diverticulum or pharyngeal pouch is an anatomic defect characterized by herniation of the posterior pharyngeal wall and can lead to dysphagia and regurgitation.

Symptomatic Zenker diverticulum therapy has evolved from a open surgical approach to minimally invasive transoral endoscopic

techniques. Transoral endoscopic therapy using rigid instruments is performed primarily by otorhinolaryngologists, while transoral therapy using flexible endoscopes is performed by endoscopic surgeons and gastroenterologists.

The common purpose of all the modalities is the dismantling of the septum between the esophageal lumen and the septal diverticulum containing the cricopharyngeal muscle (7).

Table 10. Correlation of postinterventional symptomatology with reintervention – statistical data processing

	Postinterventional symptomatology =Yes (N=11)	Postinterventional symptomatology = No (N=25)	P_value (test)
Reintervention=Yes	7/11 (63.6%)	0/25 (0.0%)	0.000040 (Fisher's Exact Test)

significant differences have been noticed in regard to percentage of patients who necessitated reintervention between patients with postinterventional symptomatology (63.6%) and those without (0.0%). (p_value=0.000040, Fisher's Exact Test). significant portion of patients with persistent symptomatology necessitated reintervention.

Compliance of the upper esophageal sphincter is affected in Zenker diverticulum patients and is normalized by surgery. This physiopathological principle argues that cricopharyngeal myotomy is a mandatory component of Zenker diverticulum surgery. This principle is met both by the surgical, traditional approach and by the modern endoscopic approach (8).

The selection of patients for the application of a particular type of therapy has not been standardized, as commonly found in literature data, possibly due to the reduced incidence of this disorder. Usually, elderly patients tended to be treated with an endoscopic approach, with lower rates of complications and a shorter stay in the hospital. Since patients with Zenker diverticulum usually have many comorbidities, their clinical condition is essential to select the best treatment. Also, doctors' preferences, training, and practice standards are important issues in the final decision. Last but not least, the wishes of the patient should be considered (9).

Randomized studies are missing and the treatment method is usually chosen based on personal experience or preference. Although the overall tendency is to flexible endoscopic procedures, open surgery remains an alternative if endoscopic procedures fail. A major advantage of flexible endoscopic treatment, in addition to the 15% low complication rate and 0% mortality, is that it can be performed under conscious sedation compared to open surgery or rigid endoscopy.

The follow-up of patients was performed by anamnesis, clinical examination, imaging investigations. The clinical criteria followed were: persistence or recurrence of dysphagia and regurgitation as in other similar studies.

In patients in the study we had an average hospital stay of 4 days, the average hospitalization after endoscopic treatment was 2.3 days and 11.4 days after surgical treatment. Similar data were reported by other authors who observed an hospital stay between 2, 24 and 5 days (12,13)

Although surgical intervention requires a

longer time both as operator time and as days of hospitalization versus the endoscopic approach suggested by other studies, (11).

There was no mortality related to the procedure, issues encountered in other studies, but we noticed complications in 6 patients / 16.6% compared to 17.6% reported by other studies. In the patients group we recorded intraoperative complications in 3 endoscopically operated patients - 8.3% comparable to 6.8% reported by other studies. Only 2.6% of patients reported postoperative complications. Endoscopic first-line treatment had a success rate of 80% comparable to those in literature where comparable success rates are reported and may reach a 95.5% success rate after reintervention for the incomplete septum section. (14) Other authors report initial relief of recurrent symptoms in 90.2% of patients after a single procedure. (15) The rate of recurrent symptoms was significantly higher in the surgical group than in the endoscopic group - 17.24% results different from those reported in other studies where a recurrence rate of 39% was found after endoscopic treatment and 0% recurrence in the group patients who underwent surgery. (11)

The higher rate after flexible endoscopic treatment could be caused by incomplete septal dissection. Some authors have shown that treatment success correlates with the length of septotomy. The risk of perforation by imprecise sectioning and the difficulty of identifying the last cricopharyngeal fibers could cause the endoscopist to retain a residual part of the septum to avoid penetration into the mediastinal space(10).

The persistence of symptomatology occurred in 11 patients, 5 patients after endoscopic treatment against some literature data showing recurrence of 12.8%. Most patients whose recurrence fails the procedure have undergone all endoscopic reintervention similar to other data published in the literature. (15)

Patients in the study who experienced post-procedural complications required significantly more statistically significant hospitalization. similar data reported by other authors (16).

Conclusions

1. The length of hospitalization was higher in patients with post-procedural complications, post-interventional symptomatology and those treated surgically.
2. In patients included in the batch, the endoscopic treatment efficiency was 80%.
3. Persistent postinterventional symptomatology was mainly represented by dysphagia, post-procedural sialorrhea was associated with persistent dysphagia.
4. Diverticles of grade III or sizes larger than 4 cm were more susceptible to post-procedural persistence of symptomatology.
5. Patients with persistent post-surgical symptoms were required to reintervention.

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Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

Informed consent was obtained from all patients for being included in the study.

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