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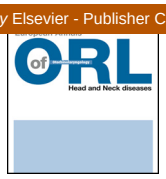

Original article

Importance of malnutrition and associated diseases in the management of Zenker's diverticulum

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ABSTRACT

Objectives: To study the impact of malnutrition on a population treated for Zenker's diverticulum and to look for the causes of persistence or recurrence of dysphagia after endoscopic surgery.
Material and methods: This retrospective study included 30 patients with Zenker's diverticulum treated by endoscopy. All swallowing disorders and manifestations of malnutrition and postoperative improvement in and/or recurrence of symptoms were noted.
Results: Nutritional status was evaluated for 26 patients. Before surgery, 54% suffered from malnutrition, which was severe in 31%; 28.6% of the cases with malnutrition showed postoperative complications, versus 8.3% of cases without baseline malnutrition. Ninety percent of patients ($n = 27$) declared complete resolution of symptoms. Nine patients presented recurrence of dysphagia, including 6 with recurrence of Zenker's diverticulum and 3 with, respectively, inclusion body myopathy, esophageal hypertonia and central disease.
Conclusion: Malnutrition should be quantified and treated before and after surgery for Zenker's diverticulum to prevent complications and decrease mortality. Associated pathologies should be systematically screened for, especially in case of recurrence of swallowing disorder without recurrence of Zenker's diverticulum.

1. Introduction

Zenker's diverticulum develops in the pharyngo-esophageal mucosa in Killian's dehiscence, a fragile area [1], contoured by the oblique fibers of the inferior pharyngeal constrictor muscle above and the horizontal fibers of the cricopharyngeus muscle below. Pathophysiology is little known. Impaired relaxation of the cricopharyngeus muscle, which is a major component of the superior esophageal sphincter, associated with muscle weakness adjacent to Killian's dehiscence may induce abnormally elevated pharyngeal pressure during the passage of food [2], leading to formation of a diverticulum.

Onset of Zenker's diverticulum is classically in the 6th to 8th decade of life, mainly affecting male subjects. Prevalence is reported as ranging from 0.01% to 0.1%, but is probably underestimated due to the long asymptomatic phase [3].

The most frequent functional signs are dysphagia, regurgitation of undigested food, chronic cough, halitosis, cervical borborygmi, inhalation pneumopathy and weight loss [3,4]. These symptoms, associated with the "rising tide" sign on swallowing fiberoptic endoscopy, orient diagnosis [5]. Pharyngo-esophageal transit with a contrast-filled pouch confirms the presence of diverticulum [3]. Malnutrition is one result of dysphagia [6], and recognized as aggravating morbidity in elderly patients [7]. To the best of our knowledge, there have been no studies analyzing malnutrition and its impact on the treatment of Zenker's diverticulum.

Treatment in Zenker's diverticulum is well-codified. Extramucosal myotomy of the cricopharyngeus muscle by cervicotomy, with or without associated diverticulopexy or diverticulectomy, used to be the reference attitude [1] until, over the last 20 years, endoscopic techniques (transmucosal myotomy) were developed. These techniques comprise diverticulum marsupialization in the upper third of the esophagus by endoscopic sectioning of the pharyngo-esophageal septum, using various procedures: CO_2 laser [8], UltraCision® scalpel [9], or autosuture staple gun [10]. With over 90% symptom resolution, on both external and endoscopic approaches, the literature agrees on the efficacy of these techniques [8–11]. However, no studies have determined the causes of persistent or recurrent dysphagia in the absence of recurrence of diverticulum.

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The present study sought to determine the incidence and impact of malnutrition in Zenker's diverticulum and factors for persistent or recurrent dysphagia following endoscopic treatment.

2. Patients and methods

A retrospective study was performed on the files of patients receiving endoscopic treatment for Zenker's diverticulum, confirmed on pharyngo-esophageal transit, between June 1995 and June 2012 in the ENT department of Angers University Hospital (France). Files were retrieved using the codes HDPE 001 and HDPE 002 of the medical IT system (PMSI: *programme de médicalisation des systèmes d'information*). Only patients managed endoscopically were included.

Functional signs were assessed preoperatively, at 6 weeks postoperatively and at post-treatment follow-up. On the diagnostic criteria for malnutrition defined by the French Heath Authority (HAS: *Haute Autorité de santé*) and shown in Table 1, body mass index and percentage weight loss were systematically calculated where data were available. Preoperative albuminemia was recorded. Patient history, time to refeeding and complications were noted. The Charlson comorbidity index, predicting overall survival and widely used in clinical studies in geriatrics, was systematically calculated.

Surgery systematically began with esophagoscopy to empty the diverticulum, measure its depth, and rule out neoplasia. A bivalve Weerda diverticuloscope (Storz®) was then positioned, with the anterior valve in the esophagus and the posterior valve in the diverticulum, exposing the entire height of the septum. Depending on the technique used, an autosuture staple gun (GIA, Endo-GIA Universal® 12 mm, Tyco Healthcare, USA) or an UltraCision® scalpel (Harmonic ACE, Ethicon Endo-Surgery®, Mexico) were introduced, using a 0°C endoscope; if CO_2 laser (Sharplan Laser®, Israel) was used, an AcuSpot microscope was positioned in the axis of the pharyngo-esophageal wall. The diverticulum septum was sectioned, marsupializing the diverticulum within the esophagus. Techniques were in some cases associated.

In the absence of any signs of complication (fever, interscapular pain, subcutaneous emphysema), feeding was resumed the day after surgery, beginning with liquid diet. Smooth foods were then prescribed for 1 week to 10 days. Discharge home was authorized when there was no more major swallowing disorder (false passage, persistent blockage) or complications. Postoperative pharyngo-esophageal transit was performed only in case of suspected complications, residual symptoms 6 weeks postoperatively or recurrence of dysphagia. Recurrence of Zenker's diverticulum was confirmed by an association of dysphagia or regurgitation after initially effective treatment and an aspect of diverticulum at the upper limit of the esophagus on pharyngo-esophageal transit.

Statistical analysis used SPSS software. Comorbidity was assessed on age-adjusted Charlson index. Pearson Chi^2 and Mann-Whitney tests were used to assess results according to the assessment criteria.

Table 1
Diagnostic criteria for malnutrition according to the French Health Authority (HAS: *Haute Autorité de santé*) [17].

Criteria	Malnutrition	Severe malnutrition
Weight loss	≥ 5% in 1 month or ≥ 10% in 6 months	≥ 10% in 1 month or ≥ 15% in 6 months
BMI	< 21 kg/m²	< 18 kg/m²
Albuminemia[a]	< 35 g/L	< 30 g/L
Global MNA® score	< 17	–

BMI: body mass index; MNA®: Mini Nutritional Assessment®.
[a] To be interpreted according to inflammatory status on C-reactive protein assay.

Table 2
Distribution of malnutrition criteria in the 14 malnourished patients.

	BMI ≥ 21 kg/m²	BMI < 21 kg/m²
Weight loss ≥ 10% in 6 months	4	1
Albuminemia < 35 g/L	2	1
Weight loss ≥ 5% in 1 month and albuminemia < 35 g/L	0	1
BMI < 21 alone	0	5
Total malnourished patients (including severe)	6 (4)	8 (4)

BMI: body mass index.

3. Results

Thirty patients, 17 male and 13 female, with a mean age of 77.4 years (range, 56 to 92 years), were included and followed up for a mean 6.5 years (range, 1 to 14 years). The Charlson index was calculated in all cases and found positive in 8: two scoring 4, two 5, three 6 and one 8.

Nutritional status could be assessed for only 26 of the 30 patients. Malnutrition was found in 14 cases (54% of those assessed), and was severe in 8 (31% of those assessed). The 8 patients with Charlson index between 4 and 8 all showed malnutrition, including 5 with severe malnutrition. Table 2 presents distribution according to malnutrition criteria. Mini Nutritional Assessment® (MNA®), however, could not be made. Severe malnutrition was diagnosed in 4 patients for BMI < 18 kg/m² (associated with albuminemia < 30 g/in 1 case and > 15% weight loss over 6 months in another), and for ≥ 15% weight loss in 4 patients. Table 3 shows complications, time to resume feeding and hospital stay according to nutritional status. In case of malnutrition, the complications rate was 28.6% (versus 8.3% without malnutrition; $P = 0.213$). Complications comprised: 1 death secondary to aspiration pneumonia; 1 esophageal perforation (managed medically by enteral feeding and antibioprophylaxis for 6 days in hospital and continued at home after resumption of oral feeding once healing was confirmed on control pharyngo-esophageal transit at 10 days); 1 transient recurrent nerve palsy; and 1 case of loss of autonomy with delayed resumption of oral feeding. In case of severe malnutrition, time to resumption of feeding and hospital stay were longer, at respectively 2.6 versus 2.3 days and 4.2 versus 3.8 days.

At the 6-week postoperative check-up, 90% of patients reported complete relief of symptoms, and 3 partial relief with persistent symptoms at 3 and 6 months: 1 Barrett's esophagus, 1 persistent odynophagia, and 1, with severe malnutrition, unable to resume normal feeding.

At follow-up, 9 of the 30 patients (30%) showed progressive recurrence of swallowing disorder. Six had recurrent diverticulum, and the other 3 has associated pathology inducing dysphagia.

Three of the 6 patients with recurrence of diverticulum had been treated by isolated autosuture, 2 by associated autosuture and CO_2 laser and 1 by CO_2 laser alone. Recurrence in case of autosuture was 37.5%, versus 13.6% for the other techniques taken together ($P = 0.175$). Mean time to recurrence was 9 months (range, 5 months to 13 years); 3 occurred within the first year, including 2 managed by autosuture, and all the others after 5 years. Recurrence was systematically treated by endoscopy (autosuture, laser, both, or UltraCision®), with no further recurrence during follow-up (2 to 11 years).

Table 3
Postoperative course in the 26 patients in whom malnutrition was assessed.

	General population	Malnourished population	Non-malnourished population	*P*
Number	30 (100)	14 (54%)	12 (46%)	
Male/female	17/13	6/8	7/5	
Mean age	77.4 years	81 years	73 years	
Complications	16.60%	28.60%	8.30%	0.213
Time to refeeding	2.2 days	2.3 days	2.7 days	NS
Mean hospital stay	2.8 days (1 to 6 days)	3.8 days (1 to 6 days)	1.9 days (1 to 5 days)	0.023

NS: non-significant.

In the other 3 patients, pathologies able to account for progressive recurrence of dysphagia without recurrence of diverticulum (ruled out by pharyngo-esophageal transit) were:

- inclusion body myopathy, diagnosed 6 years after treatment for Zenker's diverticulum, due to onset of gait disorder;
- central disease in a cerebral palsy patient with impaired tongue motion 1 year after surgery;
- global esophageal dyskinesia without abnormal relaxation of the superior esophageal sphincter.

4. Discussion

To the best of our knowledge, the present study is the first to seek to determine the criteria of malnutrition and its impact on patients with Zenker's diverticulum. Some authors have reported weight loss affecting 16% [12] to 50% [13] of Zenker's diverticulum patients, but none assessed malnutrition. Fifty-four percent of the 26 patients we were able to assess showed malnutrition, which was severe in more than half the cases. It was probably due to reduced intake associated with dysphagia and interminable meals, and to elevated basal catabolism due to more or less silent aspiration pneumonia and comorbidity, affecting half of these patients.

In patients already weakened by age and sometimes by iterative aspiration pneumonia, malnutrition needs to be screened for and assessed, as it impairs the quality of postoperative course. This resulted in significantly longer hospital stay: 1.9 days without malnutrition versus 3.8 days with ($P = 0.023$); the respective complications rates were 8.3% and 28.6%, including 1 death. These findings agree with those of Van Nes et al. in elderly subjects: malnutrition lengthened hospital stay from 30 to 40 days, with institutionalization rates increasing significantly from 7.7% to 20.3%, and mortality from 3.7% to 11.3% [14]. Complications are induced by physiological changes associated with malnutrition, impairing healing and causing relative immunodepression, in turn leading to infection, and sarcopenia and cognitive impairment, with falls and loss of autonomy [6]. In the present study, more than 50% of malnourished patients had positive Charlson indices; these [15] are the sum of scores on 22 comorbidities and vary according to the mortality risk associated with each: e.g., 1 for history of myocardial infarction, 2 for hemiplegia following stroke, 3 for moderate to severe liver failure, and 6 for cancer or AIDS. The Charlson index is predictive of increased 1-year mortality [16]. However, although the comorbidities taken account of in the index may be confounding factors in assessing malnutrition-related mortality, which they increase [17] while also increasing the risk of postoperative complications, the index itself cannot be used to weight malnutrition-related morbidity or hospital stay [18].

The impact of malnutrition is such that screening is justified, and the Health Authority (Table 1) [17] recommends basing this on weight loss, BMI, albuminemia, and the Mini Nutritional Assessment (MNA®). The MNA® was not assessed in the present study, as the criteria implemented at the time were only weight loss, BMI and albuminemia. The MNA® would have been useful for complete assessment of malnutrition, including in patients with normal BMI. It is easy to administer in consultation, is non-invasive, not cost-heavy, and has excellent sensitivity and specificity [19]. Developed in 1991, it is an 18-item questionnaire covering anthropometric parameters, estimated nutritional intake, general health status and self-assessed nutritional status. Patients are considered normal for scores $\geq 24/30$, at risk of malnutrition for 17–23.5 and malnourished for < 17 [20]. It is a very effective tool, especially when there is no weight loss or BMI is $> 21\ kg/m^2$. An MNA® score < 24 correlates strongly with lengthened hospital stay, risk of institutionalization and increased mortality in elderly subjects [21]. Screening should therefore begin in the preoperative consultation, with refeeding and information given to patient and family on the increased risk of complications and mortality associated with malnutrition. Refeeding measures should be adjusted to the results of assessment of spontaneous dietary intake in terms of proteins and energy, to any associated diabetes or other pathology requiring dietary restrictions, and to swallowing disorder and aspiration caused by the Zenker's diverticulum. In case of malnutrition or caloric intake $< 50\%$ of normal values, enriched diet is recommended, associated to dietary education [17]. Initial measures comprise enriching normal meals with foods such as butter, cream, grated cheese, powdered milk and eggs or prescribing oral high-calorie and high-protein supplements, once or twice daily, and increasing daily intake. Malnutrition in itself is a strong indication for surgical treatment of Zenker's diverticulum; any severity criteria or major risk of aspiration pneumopathy, however, indicate enteral feeding by nasogastric intubation, or gastrostomy if it would need to be maintained longer than 2 weeks [17], associated to geriatric assessment and treatment ahead of surgery for Zenker's diverticulum. Monitoring caloric intake, weight gain and albuminemia allow treatment adaptation. Screening for and managing malnutrition as of the first consultation are essential to minimize impact during treatment of Zenker's diverticulum.

The study also highlighted the frequency (13%) of other etiologies that might account for the persistence or recurrence of dysphagia without recurrence of diverticulum.

Barrett's esophagus associated with diverticulum led to residual functional signs after treatment. It affects 6–12% of the general population. It is induced by chronic gastro-esophageal reflux and may be suspected in pharyngo-esophageal transit. In case of any doubt, esophageal fiberoptic endoscopy with biopsy of metaplastic regions should be proposed. Preoperative diagnosis allows refinement of the expected functional results as presented to the patient, with adapted gastroenterologic follow-up [22].

Zenker's diverticulum is known to be associated with esophageal (Barrett's esophagus, esophageal motor disorder), neuromuscular (inclusion body myopathy, polymyositis,

dermatomyositis) or neurologic pathology (Parkinson's disease) [3,4,23]; however, the present study is the first to have investigated the causes of late recurrence of dysphagia after treatment without recurrence of Zenker's diverticulum. These associated pathologies were diagnosed in 10% of patients.

Thus, in the assessment and follow-up of Zenker's diverticulum, as in any form of swallowing disorder, signs of associated pathology should be screened for:

- study of oropharyngeal sensitivity and motricity and of swallowing coordination on fiberoptic endoscopy;
- "shoelace test" (reflux on bending over to tie shoelaces), acid reflux, retrosternal food blockage sensation in esophageal pathology requiring esophageal-gastric-duodenal fiberoptic endoscopy assessment and radiocinematography;
- progressive proximal limb muscle weakness, recent skin rash, Plummer's sign, amyotrophy in neuromuscular pathology requiring neurology consultation for electromyography and muscle biopsy;
- bradykinesia, cogwheel sign, memory and attention disorder, localized sensorimotor impairment in neurologic pathology requiring specialist opinion.

Early screening improves patient information as to the causes of the swallowing disorder and allows suitable treatment to be offered to relieve functional signs and prevent complications. Pathogenesis implicating factors other than Zenker's diverticulum, in contrast to Zenker's diverticulum patients without associated pathology, may be suggested, requiring further study.

Twenty percent of patients (6 out of 30) showed recurrence. This is a high rate compared to the literature, where rates range from 4% [8,9] to 19% [10]. The long present follow-up goes some way to accounting for this, but the use of an autosuture stapler for small diverticula may also have increased the rate of recurrence; Autosuture was associated with a 37.5% rate of recurrence, mainly within 1 year, compared to 13.6% for CO_2 laser and/or UltraCision®. A large pharyngo-esophageal wall remnant remains after autosuture, especially in case of small diverticulum, and may lead to recurrence, as the neck of the diverticulum is only partly sectioned; secondary CO_2 laser or UltraCision®, moreover, fail to complete sectioning, being obstructed by the staples. Autosuture thus seems indicated only for diverticula of more than 3 cm depth [23–25]. All cases of recurrence underwent endoscopic revision, without secondary recurrence of dysphagia. In case of small recurrent diverticulum, given the risk of pharyngo-esophageal wall remnant, extramucosal myotomy by cervicotomy may be considered, to section fully the cricopharyngeus muscle.

5. Conclusion

Management of Zenker's diverticulum cannot be reduced to surgery alone. Malnutrition is frequently associated and should be taken into account, following French Health Authority guidelines, so that it can be corrected, postoperative complications be prevented and mortality reduced. In case of persistent or recurrent dysphagia without recurrence of diverticulum, associated esophageal, neuromuscular or neurologic pathology should be suspected and screened for.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References

[1] Hillel AT, Flint PW. Evolution of endoscopic surgical therapy for Zenker's diverticulum. Laryngoscope 2009;119(1):39–44.
[2] Zaninotto G, Costantini M, Boccù C, et al. Functional and morphological study of the cricopharyngeal muscle in patients with Zenker's diverticulum. Br J Surg 1996;83(9):1263–7.
[3] Ferreira LEVVC, Simmons DT, Baron TH. Zenker's diverticula: pathophysiology, clinical presentation, and flexible endoscopic management. Dis Esophagus 2008;21(1):1–8.
[4] Sen P, Kumar G, Bhattacharyya AK. Pharyngeal pouch: associations and complications. Eur Arch Otorhinolaryngol 2006;263(5):463–8.
[5] Périé S, Dernis HP, Monceaux G, et al. The "sign of the rising tide" during swallowing fiberoscopy: a specific manifestation of Zenker's diverticulum. Ann Otol Rhinol Laryngol 1999;108(3):296–9.
[6] Sura L, Madhavan A, Carnaby G, et al. Dysphagia in the elderly: management and nutritional considerations. Clin Interv Aging 2012;7:287–98.
[7] Ahmed T, Haboubi N. Assessment and management of nutrition in older people and its importance to health. Clin Interv Aging 2010;5:207–16.
[8] Hoffmann M, Scheunemann D, Rudert HH, et al. Zenker's diverticulotomy with the carbon dioxide laser: perioperative management and long-term results. Ann Otol Rhinol Laryngol 2003;112(3):202–5.
[9] Fama AF, Moore EJ, Kasperbauer JL. Harmonic scalpel in the treatment of Zenker's diverticulum. The Laryngoscope 2009;119(7):1265–9.
[10] Saetti R, Silvestrini M, Peracchia A, et al. Endoscopic stapler-assisted Zenker's diverticulotomy: which is the best operative facility? Head Neck 2006;28(12):1084–9.
[11] Von Doersten PG, Byl FM. Endoscopic Zenker's diverticulotomy (Dohlman procedure): forty cases reviewed. Otolaryngol Head Neck Surg 1997;116(2):209–12.
[12] de Casso C, Lalam M, Ghosh S, et al. Endoscopic stapling diverticulotomy: an audit of difficulties, outcome, and patient satisfaction. Otolaryngol Head Neck Surg 2006;134(2):288–93.
[13] Mirza S, Dutt SN, Minhas SS, et al. A retrospective review of pharyngeal pouch surgery in 56 patients. Ann R Coll Surg Engl 2002;84(4):247–51.
[14] Van Nes MC, Herrmann FR, Gold G, et al. Does the mini nutritional assessment predict hospitalization outcomes in older people? Age Ageing 2001;30(3):221–6.
[15] Charlson ME, Pompei P, Ales KL, et al. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chronic Dis 1987;40(5):373–83.
[16] Charlson M, Szatrowski TP, Peterson J, et al. Validation of a combined comorbidity index. J Clin Epidemiol 1994;47(11):1245–51.
[17] HAS. HAS recommandations professionnelles. Stratégie de prise en charge en cas de dénutrition protéino-énergétique chez la personne âgée. Argumentaire. HAS; 2007. http://www.has-sante.fr/portail/jcms/c_1101438/fr/tableau-des-recommandations-de-bonne-pratique
[18] De Decker L. L'indice de co-morbidité de Charlson. Ann Gerontol 2009;2(3):159–60.
[19] Vellas B, Guigoz Y, Garry PJ, et al. The Mini Nutritional Assessment (MNA) and its use in grading the nutritional state of elderly patients. Nutrition 1999;15(2):116–22.
[20] Guigoz Y. The Mini Nutritional Assessment (MNA) review of the literature – what does it tell us? J Nutr Health Aging 2006;10(6):466–85 [discussion 485–487].
[21] Yang Y, Brown CJ, Burgio KL, et al. Undernutrition at baseline and health services utilization and mortality over a 1-year period in older adults receiving Medicare home health services. J Am Med Dir Assoc 2011;12(4):287–94.
[22] Boyer L, Caugier R, Arput J, et al. Diagnostic et surveillance de l'endobrachyœsophage. Recommandations de la Société française d'endoscopie digestive (SFED); 2007.
[23] Cox FM, Verschuuren JJ, Verbist BM, et al. Detecting dysphagia in inclusion body myositis. J Neurol 2009;256(12):2009–13.
[24] Bonavina L, Bona D, Abraham M, et al. Long-term results of endosurgical and open surgical approach for Zenker diverticulum. World J Gastroenterol WJG 2007;13(18):2586–9.
[25] Gutschow CA, Hamoir M, Rombaux P, et al. Management of pharyngo-esophageal (Zenker's) diverticulum: which technique? Ann Thorac Surg 2002;74(5):1677–82 [discussion 1682–1683].