

# **Laser diverticulotomy for Zenker's diverticulum – does it improve quality of life?**

Haakon Pharo Skaug<sup>1</sup>, Amy Østertun Geirdal<sup>2</sup>, Kjell Brøndbo<sup>3</sup>

<sup>1</sup> Department of otorhinolaryngology, Oslo University Hospital, Rikshospitalet, Oslo, Norway.

Current address: Department of otorhinolaryngology, Vestre Viken HF, Drammen Sykehus, Drammen, Norway.

<sup>2</sup>Oslo and Akershus University College of applied sciences, Faculty of Social Science, Oslo, Norway.

<sup>3</sup> Department of otorhinolaryngology, Oslo University Hospital, Rikshospitalet, Oslo, Norway.

Corresponding author: Haakon Pharo Skaug, Department of otorhinolaryngology, Vestre Viken HF, Drammen Sykehus, 3004 Drammen, Norway. Tel: +47 32803872. Fax: +47 32803885. Email:

hakon.pharo.skaug@vestreviken.no

**Keyword:** Dysphagia, Zenker's diverticulum, laser diverticulotomy, quality of life.

**Abstract:**

*Purpose:* To determine quality of life (QoL) in individuals with dysphagia related to identified Zenker's diverticulum before (T1) and one year after undergoing endoscopic laser diverticulotomy surgery (T2). *Methods:* A total of 43 individuals (18 women and 25 men) were included at T1 and 37 of these responded at T2 (13 women and 24 men). Health-related QoL (HRQoL) was determined with the Short Form 36 (SF-36) and disease-specific QoL (DSQoL) was assessed with the MD Anderson Dysphagia Inventory (MDADI). In addition, two questions about specific symptoms related to Zenker's diverticulum were added and ordered as a fifth subscale of MDADI. Comparisons were made between patients and an age- and gender-adjusted normative sample from the Norwegian population. *Results:* Significant differences were found in all subscales on MDADI, but none between T1 and T2 on SF-36. Compared to the normative sample, the component score MCS of SF-36 was significantly lower in the dysphagia patients at both T1 and T2. The attrition sample had significantly lower PCS than the completers. *Conclusions:* The results substantiate that disease severity is associated with poorer disease-related QoL, and that the disease-specific QoL is significantly improved one year after laser diverticulotomy.

## **INTRODUCTION**

Zenker's diverticulum, first described by the German pathologist Friedrich von Zenker [1], consists of a herniation of mucosa and submucosa through a muscular defect in the so-called Killian's triangle. This is the weak area between the constrictor and cricopharyngeal muscles, the latter forming the upper oesophageal sphincter. The pathogenesis of the condition is unclear. The most common theory is that an increased pressure during swallowing leads to a herniation at the weak spot. Van Overbeek et al. [2], however, detected structural changes in the cricopharyngeal muscle, which may be a consequence of aging, as this is a disease most often seen in the elderly. The main symptoms are dysphagia, regurgitation of undigested food and weight loss. A common complaint is a dislike of eating in the company of others, which may lead to withdrawal from social activity and reduced quality of life. Since 1995, 15-20 patients have annually been treated with endoscopic laserdiverticulotomy at the Department of Otorhinolaryngology at Oslo University Hospital, and until today more than 300 have undergone this procedure without mortality.

We aimed to investigate patients' subjective assessment of endoscopic laser diverticulotomy, looking at their dysphagia and quality of life using questionnaires pre- and postoperatively at one year.

## **MATERIAL AND METHODS**

During the period of May 2006 – January 2009, 43 patients (18 women and 25 men) underwent endoscopic laser diverticulotomy for Zenker's diverticulum diagnosed by a barium-swallow X-ray. In our department, surgical treatment for Zenker's diverticulum is standardized. Under general anesthesia via the Benjamin diverticuloscope, the mucosal lined wall between the oesophagus and the diverticulum was cut with a Sharplan 1030 CO<sub>2</sub>-laser attached to a Leica microscope with a Unimax 2000 micromanipulator. Typical settings were regular pulse, continuous mode and a laser strength of 2 W. Preoperatively, all patients were administered doxycycline 400 mg iv, metronidazole 1500 mg iv and esomeprazole 40 mg iv. The patients were postoperatively fed via a nasogastric tube, and discharged after removing the tube on the third postoperative day without further appointments. None of the patients had any major complications.

All the referred patients were invited to participate in our study and were preoperatively asked to fill out two questionnaires: Norwegian version of Short Form 36 (SF-36) for general health-related quality of life [3,4,5],

and the MD Anderson Dysphagia Inventory (MDADI) for disease-specific quality of life [6]. After permission, the MDADI was translated to Norwegian by a professional translator and then translated back to English to maintain validity. Our aim was primarily to examine the score of both questionnaires before and after surgical treatment for Zenker's diverticulum. Consequently, one year after surgery, the patients were sent the same two questionnaires for responding. All patients were measured for bodyweight (kg) and height (m) for calculation of BMI (body mass index) before surgery. One year postoperatively, these measures were self-reported. The Regional Committee of Ethics in Medical Research (REK) approved this study.

## Quality of life questionnaires

### *Short Form 36 (SF-36)*

SF-36 is scored in subgroups by normal template [4] and is a self-administered health-related QoL questionnaire (HR-QoL) measuring eight subscales [7]: physical functioning (PF), role limitation due to physical health problems (RP), bodily pain (BP), general health (GH), vitality (energy/fatigue) (VT), social functioning (SF), role limitation due to emotional problems (RE) and mental health (defined as psychological distress and psychological well-being) (MH). On the basis of items from these dimensions, both the Physical Component scale (PCS) as well as the Mental Component scale (MCS) are constructed. VT, SF, RE and MH contribute to MCS, while PF, RP, BP and GH do so for PCS. The SF-36 has been extensively validated [8].

According to standard SF-36-scoring, all scores were transformed into 0 (worst) to 100 (best) scales. Based on T-transformation, both PCS and MCS have a mean of 50 and a standard deviation of 10 in the US general population. Clinically, poor QoL is defined by a score <40 for both PCS and MCS [9]. Studies have shown that the scores on the SF-36 for the Norwegian population are similar to that of the American [10].

### *MD Anderson Dysphagia Inventory (MDADI)*

The disease-specific QoL (DSQoL) questionnaire used was the MD Anderson Dysphagia Inventory (MDADI), primarily designed for patients with dysphagia after head-and-neck cancer treatment [6]. The scoring consists of 20 questions divided into the following 4 subscales: Global (1 question), Emotional (6 questions), Functional (5 questions) and Physical (8 questions). In this study, we added two questions specific to dysphagia due to Zenker's diverticulum (regurgitation and nightly mucus production), in the table shown as Physical\_b-scale. All

questions are scored on a 1-5 scale. The score is multiplied by 20, giving a maximum score of 100 for every question, where 100 equals excellent level of functioning [6].

### Normative sample

In the survey of “Level of Living” carried out by Statistics Norway (Statistisk sentralbyrå) in 2002 [11], SF-36 has been given to all participants. Because of this, we had the opportunity to compare the levels of HR-QoL measured by the SF-36 between individuals with dysphagia related to Zenker’s diverticulum and a representative age- and gender-adjusted sample from the general population [11]. From all the individuals of the survey who had returned the SF-36, 430 individuals, 180 women (42%) and 250 men (58%) were randomly drawn, matching the age and gender of our risk group. There were 10 controls per person in the Dysphagia-group (T1) related to gender and age.

### Data analysis

Quality of life measures were analyzed using an independent sample t-test and paired sample t-test when comparing the patients before (T1) and after treatment (T2) with endoscopic laser diverticulotomy. When comparing the attrition sample (those who only responded at T1) with the completers, non-parametric and Mann-Whitney U tests were used, due to the small attrition sample. Effect sizes (ES) were calculated on the dimensional differences between T1 and T2 according to Cohen’s coefficient d. The d values 0.20–0.49 were considered as small, 0.50–0.79 as medium, and  $\geq 0.80$  as large [Cohen 1992].

Internal consistency of the SF-36-dimensions and component scales and of all subscales of MDADI as well as self-added questions (physical b), was examined with the Cronbach coefficient  $\alpha$ , and was for all higher than 0.70.

## **RESULTS**

All of the referred 43 patients between May 2006 and January 2009 with a radiologically diagnosed Zenker’s diverticulum accepted surgery and were included in the study (T1). One year after surgery (T2), two patients were deceased due to unrelated disease and four patients did not return their questionnaires due to unknown reasons, leaving 37 patients returning their postoperative questionnaires completed.

### ***Demographics and dysphagia-related variables***

The completers sample consisted of 21 men and 13 women with a mean age of 72.57 (SD 11.75). The attrition sample consisted of one man and five women with a mean age of 84.0 (SD 4.94), which was significantly different from the completers group ( $p$  0.03). The age- and gender-adjusted normative sample had the same mean age as T1, and the gender groups were multiplied by 10. BMI increased from 22.47 (SD 4.16) at T1 to 24.20 (SD 3.56) at T2, but not at a significant level.

### ***Quality of life***

#### ***Health-related Quality of life (HRQoL) from SF-36***

No differences were found in SF-36 scores between T1 and T2 in HRQoL. On the other hand, significant differences were found between the patients and the normative sample in vitality, role emotional, mental health and the component score MCS at both T1 and T2, due to a lower score in the patients, who also scored at a significantly higher level in role physical. Social functioning showed significant differences at T1, but not at T2 (table 1).

No differences were found in HRQoL in men or women between T1 and T2. However, men were found to have a significantly higher score than women on physical functioning, role physical and the physical component score PCS at T1, while physical functioning remained at a significant level at T2 (data not reported in table). Also, physical functioning, role physical and social functioning were found to be significantly poorer in those above mean age (72.58 years) at both T1 and T2 (data not reported in table). When the groups under and above the mean age, respectively, were compared at T1 and T2, no significant differences were found in SF-36.

#### ***Disease-specific Quality of Life (DSQoL) from MDADI***

The results indicate better disease-related QoL in the patients as a result of the surgical treatment. All the subscales were scored significantly higher at T2 compared to T1 (table 2). When comparing the men and women, respectively, according to changes in DSQoL from T1 to T2, all subscales were significantly higher in men, while in women the MDADI score physical and global assessment as well as physical-b were significantly higher at T2. Before treatment, men had a significantly higher score on global assessment, but this difference did

not remain significant at T2 (table 3). Increasing age was associated with poorer emotional score at both T1 and physical-b score at T2, and also with the physical subscales at T2 (table 4).

Tables 2,3 and 4 approximately here

Note:

MDADI: dimension scores are measured from 0 – 100 with 100 being the best disease-related QoL

## **DISCUSSION**

Our endoscopic treatment of the Zenker's diverticulum is a simple and safe procedure and consists of laser resection of the wall between the oesophagus and the diverticular sac. At other institutions, stapling of the wall is standard treatment, and Leong et al, claiming it to be the national standard in the UK, have evaluated this technique [12]. Their recommendation is laser sectioning or open myotomy of the cricopharyngeal muscle only when the diverticulum is smaller than 3 cm. For deeper sacs they recommend open surgery or endoscopic stapling. In their review, they find a recurrence rate of 12.8% and a perforation rate of 4.8%. Forty-five (7.7%) procedures were abandoned intraoperatively, the most common reason being difficulty in assessing the small pouch. In our institution, all patients, regardless of size of the diverticulum, are treated with laser myotomy. In our opinion, we achieve better visual control of the base of the diverticulum and can resect the wall down to the bottom. Since 1992, more than three hundred patients have undergone this operation at our institution without mortality and very little postoperative morbidity. Our current material of 37 responders showed a low incidence of recurrence (2.2%), no perforations and no abandoned procedures. Our general impression is that the patients were satisfied with the treatment. The quality of life questionnaire SF-36 did not show any change when comparing the pre- and postoperative scores. This may be explained by the fact that Zenker's diverticulum is most often seen in the elderly, a group that suffers from many other medical conditions that influences the score in general health-related quality of life. Some of these conditions are more severe regarding daily activities and consequently overshadow the dysphagia in the SF-36-questionnaire, where several of our patients reported this as a footnote to their SF-36-questionnaire.

The MDADI was invented for use in patients with dysphagia after treatment for head-and-neck cancer. The questions are, however, quite general and cover most aspects of dysphagia, whatever the cause. Consequently, it

can also be applied in dysphagia related to the upper oesophageal sphincter. As a supplement, we added two more questions: regurgitation and increased salivation through the night (called physical\_b), both specific symptoms for Zenker's diverticulum [2]. As shown in tables 2, 3 and 4, we report a highly significant increase in the scores of all subscales of the MDADI. Interestingly, the most significant values appeared for these two self-composed questions, with an increase in mean score from 35.5 (SD 18.22) to 72.2 (SD 24.39) and a large effect size (ES) of 1.75.

Our findings prove that a disease-specific questionnaire is needed to differentiate dysphagia-related quality of life. Leong et al [14] using the Glasgow Benefit Inventory (GBI) could also report that endoscopic stapling had a positive health-effect and proposed to include it in the postoperative follow-up. They, however, also recommend prospective studies using validated dysphagia-specific questionnaires. In this sense, we find that the MDADI can be very useful.

There was neither significant change in BMI for the overall group, nor for any age-groups in our material. This indicates that the known weight loss in patients with Zenker's diverticulum [2] decreased or even ceased.

There are no existing autopsy studies regarding the incidence of Zenker's diverticulum. However, many elderly suffering from dysphagia [13] probably have an undiagnosed Zenker's diverticulum. Physicians should consider this diagnosis in this age group and should not hesitate to order a barium-swallow X-ray, as laser diverticulotomy is a low-risk procedure that can improve their quality of life.

## **CONCLUSION**

We conclude that the patients in our study showed a highly significant ( $p < 0.001$ ) increase in quality of life regarding dysphagia one year after surgery. Assessment with Cohen's-d also indicated a large effect size, which confirms clinical significance. The group also showed stabilization in body weight, without further weight loss. There has been no surgery-related mortality among our patients during the 17 years we have performed endoscopic laser diverticulotomy. The treatment is safe, has a low incidence of complications, shows no mortality and results in better quality of life for the patients. We will therefore continue and recommend our standardized treatment of Zenker's diverticulum by endoscopic laser diverticulotomy. A validated dysphagia-specific questionnaire, such as the MD Anderson Dysphagia Inventory can be very useful in a prospective postoperative evaluation.



**Conflicts of interest:** None

## References

- 1: Zenker FA, Von Ziemssen W. *Krankheiten des Oesophagus*. Leipzig 1867
- 2: Overbeek JJ. Pathogenesis and methods of treatment of Zenker's diverticulum. *Ann Otol Laryngol* 2003;112: 583-93
- 3: Ware, J. E., Snowk, K., Kosinski, M., & Gandek, B. (Eds.). (1993). *SF-36 Health Survey Manual and Interpretation Guide*. Boston, Ma: The Health Institute, New England Medical Centre.
- 4: Ware JE Jr, Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care*. 1992 Jun;30(6):473-83.
- 5: Loge JH, Kaasa S, Hjerstad MJ, Kvien TK. Translation and performance of the Norwegian SF-36 Health Survey in patients with rheumatoid arthritis. I. Data quality, scaling assumptions, reliability, and construct validity. *J Clin Epidemiol*. 1998 Nov;51(11):1069-76.
- 6: Chen AY, Frankowski R, Bishop-Leone J, Hebert T, Leyk S, Lewin J, Goepfert H. The development and validation of a dysphagia-specific quality-of-life questionnaire for patients with head and neck cancer: the M. D. Anderson dysphagia inventory. *Arch Otolaryngol Head Neck Surg*. 2001 Jul;127(7):870-6.
- 7: Ware, J. E., Jr. (2000). SF-36 health survey update. *Spine (Phila Pa 1976)*, 25(24), 3130-3139.
- 8: Ware, J., Jr., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Med Care*, 34(3), 220-233.
- 9: Gandek, B., Ware, J. E., Aaronson, N. K., Apolone, G., Bjorner, J. B., Brazier, J. E., . . . Sullivan, M. (1998). Cross-validation of item selection and scoring for the SF-12 Health Survey in nine countries: results from the IQOLA Project. *International Quality of Life Assessment. J Clin Epidemiol*, 51(11), 1171-1178.
- 10: Wagner, A. K., Gandek, B., Aaronson, N. K., Acquadro, C., Alonso, J., Apolone, G., . . . Ware, J. E., Jr. (1998). Cross-cultural comparisons of the content of SF-36 translations across 10 countries: results from the IQOLA Project. *International Quality of Life Assessment. J Clin Epidemiol*, 51(11), 925-932.
- 11: "The "normative sample" in this study is from the "Survey of level of Living 2002 – Cross-sectional Theme: Health". Statistic Norway (SSB) is responsible for collecting the data, and the survey is paid by SSB, the Norwegian Institute of Public Health and Department of Public Health and General Practice. Data are arranged and given the right to use in an anonymous form by the Norwegian Social Science Data Services (NSD). Neither SSB, the Norwegian Institute of Public Health, Department of Public Health and General Practice nor NSD is responsible for the analyses or interpretations of the data presented in this study.
- 12: Leong SC, Wilkie MD, Webb CJ.: Endoscopic stapling of Zenker's diverticulum: establishing national baselines for auditing clinical outcomes in the United Kingdom. *Eur Arch Otorhinolaryngol*. 2012 Aug;269(8):1877-84.
- 13: Jane F. Desforages, M.D., Editor. Robert D. Shamburek, M.D., and John T. Farrar, M.D. *Disorders of the Digestive System in the Elderly*. *N Engl J Med* 1990; 322:438-443

14: Leong SC, Wilkie MD, Webb CJ.: Impact of endoscopic stapling of Zenker's diverticulum on patient health status as assessed by the Glasgow Benefit Inventory. *Ann Otol Rhinol Laryngol.* 2012 Sep;121(9):576-8.

**Table 2. Comparison of DSQoL in dysphagia patients before and after treatment and with non-responders**

Disease specific QoL (DSQoL) MDADI	Dysphagia patients Completer sample N = 37				Dysphagia patients Attrition sample N = 6	
	T1	T2	<i>p</i>	ES	T1	<i>p</i>
Emotional	61.04 (13.14)	71.02 (15.39)	< 0.001	0.82	50.00 (5.109)	0.05
Functional	70.93 (20.56)	83.55 (17.26)	< 0.001	0.68	52.00 (17.43)	0.05
Physical	58.42 (17.57)	77.91 (20.36)	< 0.001	1.10	47.08 (17.13)	ns
Physical_b	35.45 (18.22)	72.22 (24.39)	< 0.001	1.75	46.66 (29.43)	ns
Global assessment	58.78 (24.46)	84.44 (20.90)	< 0.001	1.00	23.33 (8.16)	< 0.001

Note: ns = no significant differences

**Table 3. Comparison of DSQoL between genders in dysphagia patients before and after treatment**

Disease specific QoL (DSQoL) MDADI	Men N = 24			Women N = 13		
	T1	T2	<i>p</i>	T1	T2	<i>p</i>
Emotional	61.75 (12.37)	70.63 (14.82)	0.016	59.70 (15.31)	72.73 (15.76)	ns
Functional	70.44 (20.31)	88.22 (14.99)	< 0.001	72.00 (22.27)	82.67 (16.61)	ns
Physical	59.34 (16.68)	76.45 (22.47)	0.002	56.82 (19.75)	75.00 (20.46)	0.02
Physical_b	33.81(16.58)	74.76 (23.37)	< 0.001	38.33 (21.25)	72.50 (27.34)	0.002
Global assessment	63.81 (24.18)#	89.52 (14.99)	< 0.001	50.00 (23.35)	75.00 (28.44)	0.02

Note: MDADI: dimension scores are measured from 0 – 100 with 100 being the best disease-related QoL

#  $p < 0.01$  between men and women

ns = no significant differences

**Table 4. Comparison of disease-specific QoL between age groups in dysphagia patients before and after treatment**

	< 72.57 years			> 72.58 years		
	N = 18			N = 19		
<b>Disease specific QoL (DSQoL) MDADI</b>	<b>T1</b>	<b>T2</b>	<b>p</b>	<b>T1</b>	<b>T2</b>	<b>p</b>
Emotional	65.56 (12.70)##	74.64 (15.07)	ns	57.05 (12.74)	69.02 (14.85)	0.004
Functional	74.46 (22.18)	88.61 (13.)	0.03	68.53 (18.75)	83.20 (17.18)	0.002
Physical	63.26 (20.24)	84.80 (21.66)	0.001	54.71 (14.79)	69.12 (19.12)	0.02
Physical_b	34.66 (18.46)	86.00 (20.28)#	< 0.001	36.11 (18.52)	63.89 (23.55)	< 0.001
Global assessment	64.87 (26.40)	89.33 (18.46)	0.004	54.44 (22.54)	80.00 (25.66)	0.002

Note: ns = no significant differences

# p < 0.015 between < 72.57 years and > 72.58 years

## p < 0.05 between < 72.57 years and > 72.58 years