

# Supplementary Material

## Table of Contents

- Supplementary text ..... 2
  - Supplementary text 1: Detailed description of interventions..... 2
- Supplementary tables ..... 3
  - Table S1: in- and exclusion criteria..... 3
  - Table S2: time table of follow up ..... 3
  - Table S3: Success rates for the different subtypes of Achalasia ..... 4
  - Table S4: Association of Various Factors Leading to the Need for Redilation in the Pneumatic-Dilation Group. .... 4
  - Table S5: Correlation between oesophageal stasis after therapy and failure rates. .... 5
- Supplementary Figures..... 5
  - Supplementary Figure 1: Correlation between oesophageal stasis after therapy and Eckardt score 5

## Supplementary text

### Supplementary text 1: Detailed description of interventions

#### Pneumatic Dilation

A pneumatic dilation balloon (Rigiflex balloon, Boston Scientific, Boston, MA, USA) was positioned at the oesophagi-gastric junction and its position was checked either fluoroscopically or endoscopically. Then, dilation was performed at a pressure of 5 PSI for 1 minute, followed by 8 PSI for 1 minute. Standard treatment consisted of two dilations. As previously reported, the initial study protocol (first dilation with a 35-mm balloon) was amended due to a high perforation rate in the first 13 patients (30.7%).<sup>9</sup> Subsequently, the first pneumatic dilation was performed using a 30 mm balloon, followed by a 35 mm balloon within two weeks. If the Eckardt score four weeks after dilation was still > 3, a third dilation was performed using a 40-mm balloon. If the Eckardt score remained > 3 at four weeks after this final dilation, the patient was considered to have had treatment failure. Patients who responded to the initial series of PD but presented with recurrent symptoms during follow-up were allowed to be redilated using a 35 mm balloon, followed if necessary by a 40 mm balloon (i.e., if the Eckardt score remained > 3). A third and final series of dilations was allowed only if symptoms recurred more than two years after this second series. If symptoms recurred within two years after the second series of dilations, the patient was considered a treatment failure.

#### LHM with Dor's Antireflux Procedure

After division of the phreno-oesophageal ligament, the distal oesophagus was mobilized on the lateral and anterior side, and a myotomy was performed extending at least 6 cm above the gastroesophageal junction and at least 1 to 1.5 cm over the stomach.<sup>9</sup> Thereafter, an anterior 180-degree fundoplication according to the method of Dor was performed. If symptoms recurred after surgery, i.e. an Eckardt score > 3, the patient was considered a treatment failure.

## Supplementary tables

**Table S1: in- and exclusion criteria**

**Inclusion Criteria:**

- age between 18 and 75 years
- manometric diagnosis of achalasia  
defined as an absence of peristalsis and an impaired relaxation of the lower oesophageal sphincter (nadir pressure of  $\geq 10$  mm Hg during swallow-induced relaxation)
- Eckardt symptom score  $> 3$   
The Eckardt score is calculated by taking the sum of the symptom scores for dysphagia, regurgitation, and chest pain (0 = absence of symptoms, 1 = occasional symptoms, 2 = daily symptoms, 3 = symptoms at each meal) and weight loss (0 = no weight loss, 1  $< 5$  kg, 2 = 5 to 10 kg, 3 =  $> 10$  kg)

**Exclusion criteria were**

- severe cardiopulmonary disease
- serious disease leading to unacceptable surgical risk
- previous treatment for achalasia, pseudo-achalasia
- mega-oesophagus (diameter of  $> 7$  cm)
- previous oesophageal or gastric surgery (except for gastric perforation)
- oesophageal diverticula in the distal oesophagus.

**Table S2: time table of follow up**

	<b>Before</b>	<b>1 month</b>	<b>6 months</b>	<b>1 year</b>	<b>Every yr</b>	<b>Every 3 yr</b>
Demographics	×					
Symptom score	×	×	×	×	×	
QoL	×	×	×	×	×	
Manometry	×	×		×	×	
24h pH metry				×		×
Oesoph. emptying	×	×		×	×	
Endoscopy	×			×		×
Laboratory	×					
EUS or CT *	×					

Symptom score: Eckardt score; calculated by taking the sum of the symptom scores for dysphagia, regurgitation, and chest pain (0 = absence of symptoms, 1 = occasional symptoms, 2 = daily symptoms, 3 = symptoms at each meal) and weight loss (0 = no weight loss, 1  $< 5$  kg, 2 = 5 to 10 kg, 3 =  $> 10$  kg)

Qol: Quality of life questionnaire: the Medical Outcomes Study 36-Item Short-Form Health Survey [SF-36] ; mental and physical summary scores (which range from 0 to 100, with higher scores indicating better well-being)

Oesoph. Emptying: timed barium oesophagogram: Five min after ingestion of 200 ml diluted barium, the height of the contrast column is measured, to quantify oesophageal stasis.

**Table S3: Success rates for the different subtypes of Achalasia**

Outcome	1 year		2 year		5 year		p value
	LHM	PD	LHM	PD	LHM	PD	
treatment success - mean % (95%CI)							
Full analysis Set							
Type I	95 (69-99)	90 (67-97)	85 (60-95)	85 (61-95)	75 (50-89)	69 (44-85)	0.73
Type II	95 (85-98)	96 (85-99)	91 (81-96)	96 (85-99)	88 (76-94)	96 (85-99)	0.03
Type III	86 (33-98)	70 (33-89)	86 (33-98)	48 (16-74)	86 (33-98)	48 (16-74)	0.09
Per protocol Set							
Type I	95 (69-99)	94 (67-99)	85 (60-95)	94 (67-99)	75 (50-89)	82 (53-94)	0.59
Type II	95 (85-98)	100	92 (81-96)	100	88 (77-94)	100	0.003
Type III	86 (33-98)	71 (26-92)	86 (33-98)	57 (17-84)	86 (33-98)	57 (17-84)	0.19

Table S3: Success rates for the different types of achalasia at 1, 2 and 5 years of follow up, according to treatment

**Table S4: Association of Various Factors Leading to the Need for Redilation in the Pneumatic-Dilation Group.**

Factor	Hazard ratio (95% CI)	p-value
Age		
≥40 vs <40	0.3 (0.1-0.7)	0.005
Gender		
male vs female	0.7 (0.3-1.6)	0.4
Basal LOS pressure		
≤20mmHg vs > 20 mmHg	1.5 (0.6-3.8)	0.4
Chest pain		
daily vs no or non-daily chest pain	2.2 (0.8-5.7)	0.08
Height of barium contrast column after 5 min		
5 cm	reference	
5-10 cm	2.0 (0.6-7.0)	0.3
> 10 cm	0.7 (0.2-2.4)	0.5
Maximum width of the oesophagus		
≥4cm vs <4cm	0.4 (0.1-0.9)	0.02

Table S6: Association of various factors leading to the need for redilation in the pneumatic-dilation group. Hazard ratios were estimated with the use of a Cox Regression Model.

LOS denotes lower oesophageal sphincter.

Table S5: Correlation between oesophageal stasis after therapy and failure rates.

Oesophageal Emptying at 1 Month	Failure Rates (95% CI)		p(Interaction)	p(Oesophageal Emptying)
	LHM	PD		
< 5 cm	13.18% ( 7.08%, 23.81%)	16.97% ( 8.86%, 31.13%)	0.8355	0.8327
5 - 10 cm	20.20% ( 6.96%, 50.63%)	11.11% ( 2.90%, 37.58%)		
> 10 cm	0.00% ( 0.00%, 0.00%)	25.93% ( 7.00%, 71.08%)		

## Supplementary Figures

Supplementary Figure 1: Correlation between oesophageal stasis after therapy and Eckardt score

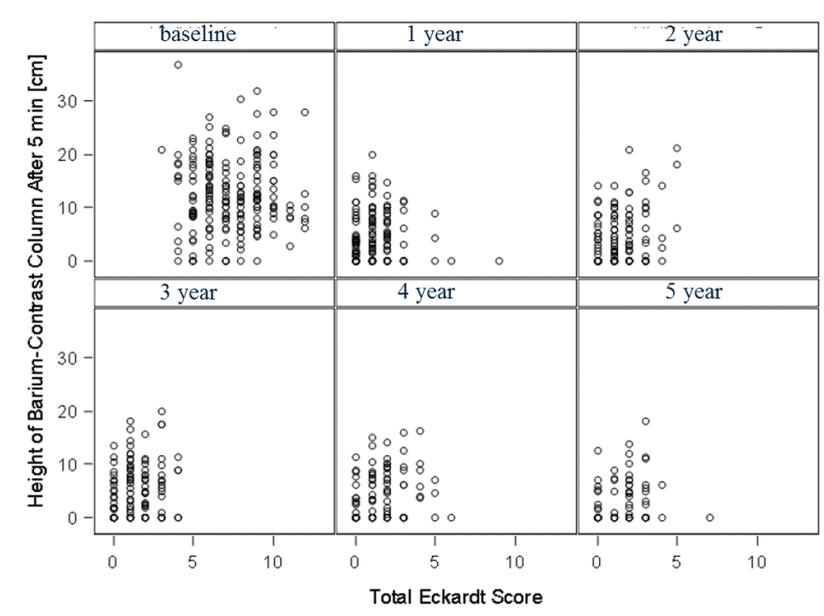


Figure 1: Correlation between oesophageal stasis after therapy and Eckardt score  
Pearsman correlation 0.037