



## Long-term outcome of a modified balloon dilatation in the treatment of patients with achalasia

### Dugoročni ishod modifikovane balon dilatacije u lečenju bolesnika sa ahalazijom

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#### Abstract

**Background/Aim.** Balloon dilatation is a standard approach to the initial achalasia treatment. Modified dilatation is also applied to rise efficacy and to lower complications. **Methods.** A total of 57 patients were analysed within a median follow-up of 8.2 years. No premedication was used, dilatation was performed up to the pain threshold, while introduction and positioning of a dilatator was done in combination of endoscopic and radiological control. Dilatation effect was estimated by both Kim Symptom Scoring and objective parameters: body weight rise and radiological scintigraphic findings. **Results.** Excellent and good results were obtained in 50 (88%) of the patients, while in 7 (12%) of the patients surgery was performed. There was no difference in dilatation efficacy regarding sex of the patients, but the results were better in the patients above 40 years. Duration of symptoms, body weight loss, esophageal lumen width do not indicate the definitive dilatation outcome. Esophageal scintigraphy and body weight increase were in a direct correlation with the effect of dilatation measured with the Kim Symptom Scoring. After the one to two repeated dilatations the efficacy increased from 74% to 88% justifying the repetition of dilatation. In 2 (3.57%) of the patients, that is in 2.65% of the totally dilated patients, perforation was recorded. There was no lethal outcome of dilatation, and the other complications were not clinically significant. **Conclusion.** Modified balloon dilatation can be recommended for initial method in achalasia treatment due to high efficacy, easy performance in daily hospital while complications are in standard range.

#### Key words:

esophageal achalasia; radionuclide imaging; balloon dilatation; prognosis.

#### Apstrakt

**Uvod/Cilj.** Balon dilatacija je standardni pristup u početnom lečenju ahalazije. Primenjena je „modifikovana“ tehnika dilatacije u lečenju ahalazije u cilju povećanja efikasnosti i smanjenja komplikacija. **Metode.** Analizirano je 57 bolesnika sa medijanom praćenja od 8,2 godine. Nije korišćena premedikacija, dilatacija je vršena do praga bola, a uvođenje i pozicioniranje dilatatora vršeno je kombinacijom endoskopske i radiološke kontrole. Efekat dilatacije određen je kombinacijom Kimovog sistema za ocenjivanje simptoma i objektivnih parametara: porasta telesne mase i radioloških scintigrafskih nalaza. **Rezultati.** Odlični i dobri rezultati postignuti su kod 50 (88%) bolesnika, a kod 7 (12) nisu postignuti željeni rezultati i kod njih je primenjena klasična hirurška intervencija. Nije bilo razlika u efikasnosti dilatacije u odnosu na pol bolesnika, ali bolesnici stariji od 40 godina imali su bolje rezultate. Trajanje simptoma, gubitak telesne mase i širina lumena jednjaka pre dilatacije nisu ukazivali na definitivni ishod dilatacije. Scintigrafija jednjaka i porast telesne mase bili su u direktnoj korelaciji sa efektom dilatacije određenim Kimovim sistemom za ocenjivanje simptoma. Posle ponovljene jedne do dve dilatacije, efikasnost je porasla sa 74% na 88%, što ukazuje na opravdanost ponavljanja dilatacije. Kod 2 (3,57%) bolesnika, odnosno kod 2,65% svih dilatiranih, zabeležena je perforacija jednjaka. Smrtnih ishoda dilatacije nije bilo, a ostale komplikacije nisu bile od kliničkog značaja. **Zaključak.** Modifikovana balon dilatacija može se preporučiti kao početna metoda u lečenju ahalazije zbog visoke efikasnosti, jednostavog izvođenja u dnevnoj bolnici, uz komplikacije koje se kreću u standardnim okvirima.

#### Ključne reči:

jednjak, ahalazija; scintigrafija; dilatacija balonom; prognoza.

## Introduction

Achalasia is a serious neuromuscular disorder of the esophagus with no peristaltic activity of its body and especially the failure of the lower esophageal sphincter (LES) to relax with swallowing<sup>1</sup>. This functional disorder leads to food and liquid retention in the esophagus thus causing dysphagia, regurgitation, pain in the chest, loss in body weight and, sometimes, bronchopulmonary infections due to aspiration of esophageal contents. Etiology of achalasia has not completely been understood<sup>2</sup>. The occurrence of antibodies in the region towards the myenteric plexus is very likely to suggest a basically autoimmune disorder, but it remains unknown whether it is the primary or secondary defect<sup>3, 4</sup>. Maintaining of the LES tonic pressure is a complex and poorly explained phenomenon<sup>5</sup>, while a recent hypothesis says that the LES tonus results from the balance of excitatory (cholinergic and substances P) and inhibitory (vasoactive intestinal peptide and nitric monoxide) effects<sup>3, 6</sup>. Thus, achalasia could be taken as nitrinergic neuritis that leads to late LES relaxation with swallowing<sup>4</sup>.

It is not possible to restore motility of esophagus with achalasia, so the options in achalasia treatment are of palliative type either conservative or surgical<sup>5</sup>. It seems that the only way to improve esophageal emptying is to reduce the resistance to the level of LES<sup>7, 8</sup>. Several methods are available for the treatment of achalasia, namely medicamentous (nitrites, calcium antagonists, botulinum toxin), dilatation and surgical treatment including laparoscopic cardiomyotomy<sup>9-11</sup>.

Most often performed conservative method for the treatment of achalasia is dilatation. Whether to initially use surgery or dilatation in achalasia treatment is a not yet resolved dilemma<sup>12-16</sup>.

It is known that many factors affect the efficacy of balloon dilatation in achalasia treatment. The aim of this study was to examine the possibility to rise efficacy and reduce complications in a patients with achalasia by the use of a modified balloon dilatation.

## Methods

A total of 57 patients were treated by the use of balloon dilatation in a 16-year period. The average follow-up period was 8 years and 2 months. The diagnosis of achalasia was confirmed in all the patients on the basis of clinical examination, endoscopy, radiography, manometric and scintigraphic findings. Children, psychotic and uncooperative patients were excluded from the study. Dilatation was performed also in the patients with the law Karnofsky status, while those with serious cardiovascular diseases, such is unstable angina pectoris, were excluded from the study. The patients with tortuous, "sigmoid" esophagus, as well as those with hiatal hernia were also treated.

The basic standardized principles of the dilatation technique suggested by the National Medical Center, Bethesda, USA were applied including no premedication with diazepam, midazolam, pethidine, atropine, nor any other medica-

tions; endoscopic and radiographic positioning of a balloon (balloon widening with hydrosoluble contrast agent), and balloon widening up to above the pain threshold were signalled by a patient.

Dilatation was performed by the use of a Regiflex dilator (Boston, USA), made of a special plastic material filled with a gas or liquid, affecting radially a reduced part of the esophagus.

Dilatation efficacy degree was estimated with the symptom score suggested by Kim et al.<sup>9</sup>. The symptom score for dysphagia, regurgitation, chest pain and heartburn (pyrosis) was calculated by multiplying the frequency of symptoms and their intensity. On the basis of the total symptom score the patients were divided into three groups regarding the response to balloon dilatation: the group I with excellent an good results (implying the total symptom score reduction by 50% or more as compared with the initial value), the group II with the result improvement (the total symptom score reduced by 50% to 25%), and the group III with the bad result (the total symptom score not reduced by 25% or less).

## Results

Out of 57 analysed patients, there were 32 (57%) males and 25 (43%) females, the ratio being 1.2 : 1 (Figure 1).

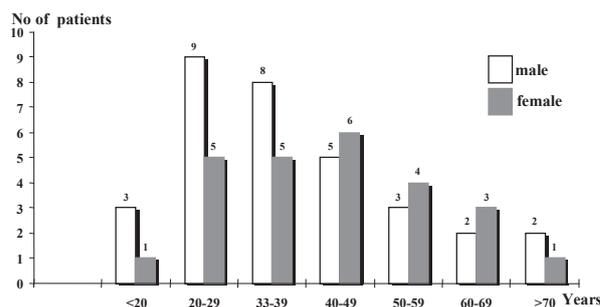


Fig. 1 – Age of the patients with achalasia.

The disease was most common in the males from the age group 20–30 years, and the females from the age group 40–49 years, the average age being 43 years. Up to 40, there were 31 patients, while above 40 there were 26 patients. The youngest patient was 16, and the oldest 83. There was no significant correlation found between the efficacy of balloon dilatation and sex distribution of the patients.

There was a correlation found between the efficacy of balloon dilatation and the age of the patients. The patients above 40 had better prognosis regarding dilatation success as compared to those below 40 years of age (Table 1).

The effect of dilatation evaluated by the use of symptom score suggested excellent (42) and good results (8) in 50 (89%) of the patients regarded as a complete recovery from the disease, while in 7 (11%) of the patients the results were bad including two patients with a perforation.

The majority of patients had symptoms for 1–5 years. In three patients symptoms were present for more than 12

**Table 1**  
**Long-standing results of dilatation in the patients with achalasia under 40 and above 40 years of age**

Age of patients (years)	Dilatation efficacy			
	excellent	good	poor	total
< 40	21 (36.84)	5 (8.77)	5 (8.77)	31 (54.38)
> 40	21 (36.84)	3 (5.26)	2 (3.50)	26 (45.61)
Total	42 (73.68)	8 (14.03)	7 (12.28)	57 (100)

Data are present as number (%) of patients.

years, although radiographically it was decompensated achalasia. In the younger patients there was a shorter period of symptoms prior to dilatation. Out of the 10 patients with symptoms more than 10 years, 9 were above 40.

There was no significant correlation found between the efficacy of balloon dilatation and the period of symptoms present prior to dilatation. The duration of symptoms was found not to have a prognostic significance for a final outcome of dilatation. A few excellent and good results were achieved in the patients with a longer disease presence, and a few bad results in the patients with a short period of symptoms presence (Table 2).

Loss in body weight is the most common sign of the disease. The highest number of the patients lost 10 kg of body weight (Table 3).

A total of 54 patients showed loss in body weight. Six months after the dilatation the majority of the patients (n = 30) gained 1–10 kg of body weight. The three patients gained even more than 20 kg of body weight, while in 11 of the patients there was no increase in body weight (Table 4).

There was a significant correlation between the efficacy of balloon dilatation and the increase of body weight in the patients after the dilatation. Body weight increase is regarded to be an objective parameter for monitoring the efficacy of dilatation and suggests a final outcome of the therapy.

The majority of patients had esophagus lumen width of 3.5 cm to 6 cm in esophagogram, while in 13 of the patients it was more than 6 cm, implying that they were in decompensation stage (Table 5).

**Table 2**  
**Association of symptoms duration and dilatation efficacy**

Duration of symptoms (years)	Dilatation efficacy			
	excellent	good	poor	total
< 1	6 (15.53)	2 (3.51)	1 (1.75)	9 (15.79)
1–5	19 (33.33)	3 (5.26)	2 (3.51)	24 (42.11)
5–10	8 (14.03)	2 (3.51)	2 (3.51)	12 (21.05)
> 10	9 (15.79)	1 (1.75)	2 (3.51)	12 (21.05)
Total	42 (73.68)	8 (14.03)	7 (12.28)	57 (100)

Data are present as number (%) patients.

**Table 3**  
**Association of body weight loss and dilatation efficacy**

Weight loss (kg)	Dilatation efficacy			
	excellent	good	poor	total
No loss	3 (5.26)	1 (1.75)	1 (1.75)	5 (8.77)
< 5	12 (21.05)	2 (3.51)	2 (3.51)	16 (28.07)
5–10	14 (24.56)	3 (5.26)	2 (3.51)	19 (33.33)
> 10	13 (22.81)	2 (3.51)	2 (3.51)	17 (29.82)
Total	42 (73.68)	8 (14.03)	7 (12.28)	57 (100)

Data are present as number (%) of patients.

**Table 4**  
**Association of body weight increase after dilatation and dilatation efficacy**

Results of dilatation	Dilatation efficacy			
	excellent	good	poor	total
Body weight increase (kg)				
no change	3 (5.26)	3 (5.26)	5 (8.78)	5 (8.78)
< 5	14 (24.56)	2 (3.51)	1 (1.75)	16 (28.07)
6–10	11 (24.56)	1 (1.75)	1 (1.75)	19 (33.33)
> 10	14 (19.30)	2 (3.51)	0 (0)	17 (29.82)
Total	42 (73.68)	8 (14.03)	7 (12.28)	57 (100)

Data are present as number (%) of patients.

There was no significant correlation found between the efficacy of balloon dilatation and the loss of body weight. The success of dilatation could not be predicted on the basis of body weight loss.

There was no significant correlation found between esophageal dilatation degree before the dilatation and the efficacy of balloon dilatation.

Table 5

## Association of esophageal dilatation and dilatation efficacy

Esophageal dilatation width (cm)	Dilatation efficacy			total
	excellent	good	poor	
< 3.5	13 (22.81)	3 (5.26)	2 (3.51)	18 (31.59)
3.5–6	20 (35.09)	4 (7.02)	2 (3.51)	26 (45.60)
> 6	9 (15.79)	1 (1.75)	3 (5.26)	13 (22.81)
Total	42 (73.68)	8 (14.03)	7 (12.28)	57 (100)

Data are present as number (%) of patients.

Esophagus scintigraphy is a non-invasive, simple and reliable method which in physiological manner provides a direct quantification of esophageal motor function, that is esophageal clearance (Table 6, Figures 2 and 3).

There was a significant correlation found between balloon dilatation efficacy and esophageal emptying measured by the use of scintigraphy.

Table 6

## Association of radionuclide discharge and dilatation efficacy

Radionuclide discharge (%)	Dilatation efficacy			total
	excellent	good	poor	
> 50	23 (56.09)	0 (0)	0 (0)	23 (56.09)
< 50	8 (19.51)	1 (2.44)	4 (9.76)	13 (31.71)
No change	0 (0)	4 (9.76)	1 (2.44)	5 (12.20)
Total	31 (75.60)	5 (12.20)	5 (12.20)	41 (100)

Data are present as number (%) of patients.

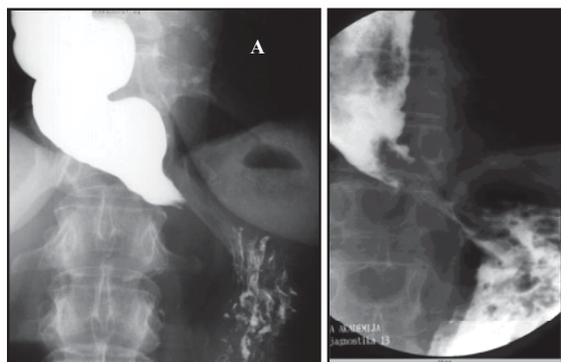


Fig. 2 – Typical radiological image of achalasia before (left) and after (right) successful dilatation.

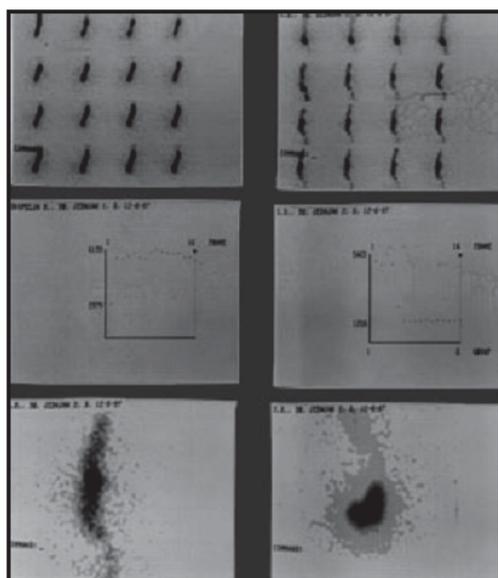


Fig. 3 – Radionuclide imaging in achalasia before (left) and after (right) dilatation.

In 40 (70%) of the patients one dilatation was performed, in 14 (25%) two, while in three (5%) of the patients three dilatations were done, thus a total of 74 dilatations were performed in 57 patients. Dilatation was repeated not earlier than three months after the previous one. The majority of patients were motivated for dilatation repetition, while the one was referred to esophagomyotomy due to failure in the first dilatation (Table 7).

Excellent and good results were obtained in two thirds of the patients after first dilatation, indicating best results of first dilatation. Second and third dilatations were justified by the fact that another 9 (15%) of the patients showed excellent results after repeated dilatation. Final excellent and good results were shown by 50 out of the total of 57 patients, and dilatation success rate was increased from 67% to 89%.

Esophageal perforation is the most common complication of balloon dilatation causing morbidity that could lead to death.

In 2 (3.57%) dilated patients there was a perforation, that is in 2.60% out of all dilatations. The diagnosis in both patients was made immediately after dilatation, then they were successfully operated on. There were no lethal outcomes. In 2 (3.57%) of the patients submucosal damage was registered. They were conservatively treated. In 23 (40%) of the patients there was blood on a balloon dilatator indicating mucosal damage and dilatation efficacy. It should not be considered as complication.

Early complications (prolonged pain, fever, gastrointestinal bleeding) were present in 7 of the patients, but only temporary. A total of 3 patients had prolonged chest pain for 8–20 h. Esophagogram was repeated with no perforations found. Anxiolytics, not analgetics, were used for treatment. In 3 patients there was temperature increase above 38°C, and in one melena with hematocrit reduction to 0.08%.

Late complications were registered in 8 of the patients. They were mostly manifested by stage 1 esophagitis, and in 2 of the patients by stage 2, and in 1 by stage 3 esophagitis.

Table 7

## Association of the number of dilatations and dilatation efficacy

Number dilatation	Dilatation efficacy			total
	excellent	good	poor	
One	33 (57.89)	7 (12.28)	17 (29.82)	57 (76.00)
Two	8 (14.03)	2 (3.50)	6 (10.52)	16 (28.07)
Three	1 (1.75)	1 (1.75)	1 (1.75)	3 (3.95)
Total	42 (73.67)	10 (8.77)	24 (41.09)	76 (100)

Data are present as number (%) patients.

There was no carcinoma found in any patients treated by dilatation, indicating good evaluation of the disease prior to dilatation.

### Discussion

Sir Thomas Willis was the first one to report on achalasia in 1672, and then to perform dilatation on the same patient by the help of a whale bone<sup>1</sup>. Three and a half centuries later there are no significant changes except for technical improvements of the method<sup>16-20</sup>. Today achalasia treatment methods are still palliative, while esophageal emptying completely depends upon gravitation<sup>21-23</sup>.

Medicaments such as nitroglycerin, isosorbide dinitrate, calcium antagonists are advised to patients with mild symptoms<sup>24,25</sup>. Botulinum toxin in achalasia treatment was reported first in Lancet in 1993<sup>26</sup>. Application of botulinum toxin in achalasia is safe, simple and efficient, and till now indicative in patients with a high risk for dilatation or cardiomyotomy<sup>27</sup>.

Today there are two options of basic approach to the treatment of achalasia: dilatation and surgery including numerous modifications of both methods. Research for alternative endoscopic modalities for achalasia treatment is under way all the time. Reducing pressure of diffuse esophageal spasm (DES) by ethanolamine, used in sclerotherapy of esophageal varices, has not found wider application, and the results have been followed up in short-term at the level of dilatation<sup>28</sup>.

In 1991 laparoscopic myotomy as possible option in achalasia treatment was introduced while the results were shown later<sup>29,30</sup>. Excellent results in 88% of patients indicate that laparoscopic myotomy is a method of choice in achalasia management<sup>31</sup>. In his study, Richter<sup>32</sup> tried to solve the dilemma whether to use laparoscopic myotomy or dilatation in achalasia management.

Initial achalasia treatment method is a personal choice of the physician, attitude of a medical institution and capability of teams for surgery or dilatation<sup>1</sup>. Here, we exclusively used dilatation as an initial method in achalasia treatment.

The second question to answer is what dilatation technique to use for achalasia treatment. Balloon dilatation is a traditional method for non-surgical achalasia treatment with the aim to mechanically cut muscle fiber of DES. Vantreppen and Hellemans<sup>5</sup> gave the greatest contribution to the promotion of this method. Many dilator types were used in the past: Brown-McHardy, Hurst, Tucker, Mosher, Rider-Moller etc. In 1981 the results obtained by dilators positioned under endoscopic monitoring were published<sup>1</sup>. Dilators with polyurethane balloon (Rigiflex) came into use 15 years ago. One of Rigiflex balloon most significant advantages is its possibility to be in-

flated only up to a clearly set radius. Richter<sup>32</sup> comes to a conclusion that the use of one or the other dilator depends more upon the endoscopist's experience than on the instrument type itself. Pneumatic dilatation is considered by the majority of authors to be the most efficient nonsurgical treatment of achalasia<sup>33-36</sup>. Dilatation technique has not yet been standardized in spite of its wide application in achalasia treatment<sup>37-39</sup>.

Values of insufflation pressure that cause muscle fibres splitting have not been determined so far. Insufflation pressure ranging from 200 mmHg to 300 mmHg (5 psi – pound square inch) is used in Europe and Japan, while 450–740 mmHg (9–15 psi) is used in the USA. The higher the pressure, the efficient the method, but also the most frequent perforation. It is advisable to determine the pressure under which the efficacy increases with acceptable range of complications. By analysing 270 perforations, Borotto et al.<sup>40</sup> conclude that the upper limit of 11 psi allows a balloon insufflation with no higher risk for perforation.

The dilemma about dilatation balloon width has not been resolved, as well. Vantreppen and Hellemans<sup>5</sup> suggest a balloon of 4 cm width, while others suggest to start dilatation with a 3 cm balloon and to perform repeated dilations by the use of wider diameters, but not wider than 4.5 cm<sup>20,41</sup>.

The mentioned dilemmas about defining insufflation pressure and balloon diameter we solved by insufflating balloon up to just above pain threshold since that is the pressure under which DES muscle fibers split. It is individual to each patient. In order not to change pain threshold, however, we do not perform premedication, which makes the said method less comfortable to patients.

Insufflation duration for one treatment takes 15–60 s in the USA, and 1–3 min in Europe and Japan. In a prospective study Kim et al.<sup>9</sup> came to a conclusion that insufflation taking more than 1 min do not affect the results of dilatation and that muscle fibers probably split within the first 5–10 s. Duration of maximal insufflation pressure do not affect significantly the results of dilatation, thus leaving to the therapist to make a choice<sup>21</sup>. Like the majority of authors, we decided for maximal insufflation pressure in one minute<sup>42</sup>.

Balloon insufflation for one treatment has to be repeated at least once by rising insufflation pressure in the second dilatation or by widening the diameter of a balloon<sup>5</sup>. There are the authors who consider that dilatation has not to be repeated within one treatment<sup>9,43</sup>. We repeat dilatations within a treatment up to above pain threshold since we suppose that a way to rise dilatation efficacy.

Richter<sup>23</sup> and Cohen et al.<sup>44</sup> consider fluoroscopy necessary, while the majority of authors consider it unnecessary in the control of dilatation and to be used only from time to time.

With the Witzel dilator which is introduced and positioned under endoscopic vision there is no need for fluoroscopy. Combining endoscopic/fluoroscopic vision makes it possible to take advantages of both methods and to minimize their disadvantages. We introduce a dilator under endoscopic vision which is very safe even in sigmoid esophagus, thus reducing exposition to radiography. Fluoroscopy allows good balloon positioning and its keeping in the correct position. The use of a contrast agent in balloon dilatation make it possible to measure balloon width and to register all that at radiography.

Esophagogram is required only in patients with symptoms indicating perforation. That is the way to avoid unnecessary radiation and to reduce costs of treatment<sup>16</sup>. The clinical images of both patients clearly indicated perforation and radiography just confirmed it. In spite of the fact that we did esophagogram in all of the patients immediately after the dilatation, the mentioned experience suggests radiography only in case of doubt in perforation.

The majority of authors come to a conclusion that achalasia equally affects both sexes which was confirmed by our study, so that the ratio males to females is 1.2 : 1. There are, however, opposite data, thus some authors claim that achalasia is two times as present in males than in females, while the others claim quite the opposite<sup>42</sup>.

Balloon dilatation efficacy measured by the symptom score regarding sex had no statistical significance in our study which is in accordance with data presented by other authors<sup>5, 38, 45-50</sup>.

According to our study, the disease is most frequent in the third decade of life, although in females it prevails at 40 to 50 years of age. The average age of our patients was 43 that also corresponds with data from the literature, while Kodakia and Wong<sup>16</sup> state 52, and Mikaeli et al.<sup>49</sup> 35.5 years. There is no significant difference in efficacy of dilatation regarding age. However, dilatation results are worse in patients under 40 with the significance of  $p < 0.05$ . There is no a generally accepted attitude, however, the majority of authors report worse results in younger patients<sup>1, 38</sup>.

Ever since introducing dilatation into the treatment of achalasia, numerous authors had tried to define risk factors that could anticipate the outcome of dilatation and in so doing select the patients that would have good response and the others treat surgically.

It is reported most frequently that there is no correlation of the duration of symptoms with good response<sup>20</sup>. In our study we did not find a significant correlation of the duration of symptoms before dilatation with the efficacy of dilatation.

The majority of authors confirmed no correlation of body weight reduction with the efficacy of dilatation, which is also confirmed in our study<sup>5, 51, 52</sup>. In our study, there were patients with a significant body weight loss and excellent results, as well as a low body weight loss and bad results. Higher loss in body weight within a short time period suggests the need to exclude malignancy and perform additional diagnostics not standard for achalasia diagnostics (computed tomography, echo endosonography). These procedures could predict cancer due to perineural myenteric esophageal plexus infiltration by pancreatic and suprarenalis cancers<sup>38</sup>.

Vantreppen and Hellemans<sup>5</sup> were the first to point out that monitoring of body weight rise could estimate dilatation efficacy<sup>5</sup>. Body weight loss together with dysphagia is the major symptom of achalasia, thus it seems logical that monitoring of body weight rise could suggest dilatation outcome. In our series, 92% of the patients had body weight loss prior to dilatation, while 80% of the patient had body weight loss after dilatation. Body weight rise directly correlates with dilatation efficacy. So, by monitoring body weight, both physicians and patients could estimate dilatation efficacy in a simple, objective, measurable and acceptable way.

There is a controversy of predicting dilatation outcome on the basis of esophageal lumen width. Ponce et al.<sup>50</sup> reports such correlation having a high significance, while other authors conclude that there is no significant correlation of esophageal lumen width prior to dilatation with dilatation efficacy<sup>9, 20, 41</sup>. In our study there was no significant correlation of esophageal lumen width prior to dilatation which is logical to expect since dilatation is palliative and irreversible.

There is no predictive model which could be used for identification of patients who might have bad dilatation results and refer them to surgical treatment. The majority of authors conclude that worse results could be expected in patients younger than 20 years, esophageal width less than 3 cm, esophageal basal pressure higher than 15 mmHg, and DES pressure higher than 30 mmHg<sup>9, 20, 50, 53</sup>.

Some authors state that esophageal scintigraphy could not replace manometry of the esophagus in the diagnostics of motor skill disorder due to high number of false positive findings<sup>53-55</sup>. Our study confirmed that scintigraphy of the esophagus can most objectively estimate dilatation effect in esophageal achalasia.

How many dilatations should be performed to be able to definitively estimate the treatment of achalasia by dilatation? If dilatation is unsuccessful, Vantreppen and Hellemans<sup>5</sup> consider that dilatation efficacy significantly rises by favorable dilatations, and recommend maximally four repeated dilatations. Richter<sup>23</sup> and the American Association of Gastrointestinal Endoscopy recommend two dilatations, and then refer a patient to surgery if dilatation was not efficient. Kodakia and Wong<sup>16</sup> state that increasing the number of dilatations does not significantly increase dilatation efficacy. Lake and Wong<sup>42</sup> come to a conclusion that dilatation efficacy rises up to two reinterventions, and that higher number of dilatations is not justified also due to treatment costs. Our study confirmed that dilatation efficacy rises with one or two redilatations. We did not have patients with more than three dilatations. In about two thirds of the patients excellent results were obtained after first dilatation, while after repeated dilatations the results were excellent or good in 89% of the patients. In other words, if repeated dilatations were not performed, the 12 more patients would have been operated on.

Perforation is the major complication of dilatation in achalasia affecting 2% to 6% of dilated patients. There were two perforations in our study, both in males, of which one occurred in first and one in repeated dilatation. They were localized above DES to the left in the form of longitudinal rupture of 2-3 cm. Borotto et al.<sup>40</sup> analysed eight perforations con-

cluding that they are more frequent in patients with less body weight loss and high amplitude of esophageal contraction. Other authors conclude that there are no clearly defined risk factors for perforation, making it impossible to identify patients with a high risk of perforation<sup>1, 5, 40, 44</sup>. Contrary to the fact that the literature tells that the majority of perforations are treated conservatively, both of our patients were operated on.

The application of botulinum toxin remains as alternative for patients with risky operation or dilatation or in those patients who do not accept dilatation for any reason<sup>56-65</sup>.

The most recent studies suggest that laparoscopy has good results and that its application increases leaving conventional surgery as alternative<sup>66-68</sup>.

Peroral endoscopic myotomy (PEM) was developed by Inoue et al.<sup>68</sup> to ensure less invasive approach to achalasia treatment.

### Conclusion

The use of modified balloon dilatation in achalasia treatment resulted in excellent and good results in 88% of the patients. The patients above 40 years as compared to younger ones showed better clinical response. Perforation was recorded in 3.67% of the patients without lethal outcome. A modified dilatation technique is efficacious and safe method in the initial achalasia treatment.

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