Research Article

A Prospective Study on Manometric Evaluation of Achalasia Cardia Following Heller's Cardiomyotomy

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Abstract

Introduction: Achalasia cardia is the most commonly diagnosed primary esophageal motor disorder. High-Resolution Manometry (HRM) is highly sensitive modality of diagnosis. Laparoscopic Heller's Myotomy (LHM) is the main modality to treat Achalasia.

Aim: To compare pre and post treatment manometric variables among the achalasia cardia subtypes based on HRM at 3, 6 and 12 months of followup.

Results: A total 30 patients of achalasia cardia underwent LHM with a mean of 36.76 ± 8.42 years (range 21-56 years) with 7, 18 and 5 patients belonged to type I, type II and type III Achalasia respectively. During followup 4 patients (13.3%) developed recurrence of symptoms. One patient of type II developed recurrence at 3 months of followup and was managed with pneumatic dilatation who did well after the endoscopic procedure while 2 patients of type III developed recurrence at 3 months. The height and width of the barium column in timed barium esophagogram, among the three subtypes were comparable in all three types at both 1 min and 5 min. After 3, 6 and 12 months of treatment Eckardt symptom scores improved and was comparable in all the achalasia sub-types. On comparing the LESP, IRP and DCI as assessed by HRM the mean value of LESP was higher in type III achalasia as compared to type I and II but not statistically significant. IRP and DCI values were also comparable in all types of achalasia. After 3, 6 and 12 months, the LESP, IRP were comparable in all subtypes of achalasia.

Conclusion: Success rates in type I and II are higher than type III. The recurrence following LHM can be successfully managed with pneumatic dilation.

Keywords: Dysphagia; High resolution manometry; Laparoscopy; Esophagogram

Introduction

Achalasia cardia is the most commonly diagnosed primary esophageal motor disorder and the second most common functional esophageal disorder leading to progressive dysphagia, regurgitation and weight loss [1]. The pathophysiology abnormality results from neurodegenerative changes involving a reduction in myenteric plexus neurons in the Lower Esophageal Sphincter (LES) and in the esophageal body [2]. The main functional abnormality in achalasia is poor esophageal emptying which is treated by reducing LES pressure so that gravity promotes the passage of food down into stomach.

Esophageal manometry is necessary for the diagnosis of achalasia. The absence of normal peristalsis of esophageal body and incomplete relaxation of LES are its typical findings. High-Resolution Manometry (HRM) is more sensitive, provides more detailed information and easier to perform than Conventional Manometry (CM). On the basis of HRM pressure topography achalasia can be classified into three subtypes: type I achalasia with minimal esophageal

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pressurization; type II achalasia with esophageal compression and type III achalasia with spasm [3].

Endoscopic Pneumatic Dilation (PD) and Laparoscopic Heller's Myotomy (LHM) are two main modalities to treat achalasia in present time. Which is superior modality, however, is still debatable as both the modalities have been shown to be equally effective in randomized controlled trials [4,5]. A tailored approach has been suggested based on many factors like age, gender, patient preference and availability of the expertise. Most of the data pertaining to the treatment of achalasia has been reported from developed countries, while little is known about the most appropriate treatment modality for patients in developing country like India. We conducted this study to compare pre and post treatment manometric variables among different achalasia cardia subtypes based on HRM findings after Laparoscopic Heller's Cardiomyotomy (LHM).

Materials and Methods

Patients with age between 15 years to 70 years, manometric diagnosis of achalasia, Eckardt score >3 were included in the study. Exclusion criteria were severe cardio-pulmonary disease or other disease leading to unacceptable surgical risk, previous treatments, except treatment with nitro derivatives, CCBs, sildenafil, dilation with savary bougies or balloons of 2 cm diameter or smaller pseudo-achalasia, mega-esophagus (>7 cm), previous esophageal or gastric surgery, not willing for follow-up and esophageal diverticula in the distal oesophagus.

Patients with suspected achalasia cardia underwent upper gastrointestinal endoscopy to rule out other organic disease, followed by timed barium swallow study. HRM was done to confirm the diagnosis. Confirmed patients of achalasia were subjected for Laparoscopic Heller's cardiomyotomy (LH). After treatment patients were followed up for clinical outcome. A repeat HRM was done in all patients at 3-monthly interval up-to one year for assessment of therapeutic outcome.

High resolution manometry

The Chicago Classification (CC) categorized esophageal motility disorders in HRM depicted with color pressure topography plots [6]. The primary objective of the CC was to apply standardized HRM metrics to categorize esophageal motility disorders in patients with non-obstructive dysphasia and/or esophageal chest pain. In order to assure adequate recording of LES Pressure (LESP), especially during swallowing, the manometry was performed using a sleeve assembly. The basal LESP and the swallow-induced LES relaxation was monitored and measured at the end of expiration. After introduction and equilibration, basal pressure was monitored at least for 5 minutes. Swallow-induced relaxation of the sphincter was assessed by 5 ml wet swallows, at least 30 apart. The vigor of the distal esophageal contraction was the Distal Contractile Integral (DCI), measured for the segment spanning from the proximal to distal pressure trough. Achalasia was diagnosed if the mean Integrated Relaxation Pressure (IRP) was >15 mmHg or there was simultaneous contractions, aperistalsis and high LESP. On the basis of HRM subtyping was done.

Esophageal emptying

Timed barium esophagogram was done before treatment after the patients ingested low density barium sulphate over 30 seconds to 45 seconds in accordance with technique described by de Oliveria [7]. The patients were instructed to drink the amount of low density barium (45% w/v) which they could tolerate without regurgitation or aspiration (200 ml), in upright position after 4 hours fasting. A radiograph was taken at 1 min and 5 min. The distance from the tapered distal esopha-gastric junction to the top of the barium column and the maximal diameter were measured. The five min barium height was used as measure of esophageal emptying. The height is measured relative to the height of the vertebrae (level of the diaphragm).

Symptom score (Eckardt)

Patients symptoms were assessed prior to treatment and at 3, 6 and 12 months after treatment in all the types. According to Eckardt [8], weight loss, dysphagia, chest pain and regurgitation were scored on a scale from 0 to 3 (Table 1).

Table 1: Eckardt symptoms scoring.

Score	Weight loss (kg)	Dysphagia	Chest pain	Regurgitation
0	None	None	None	None
1	<5	Occasional	Occasional	Occasional
2	44839	Daily	Daily	Daily
3	>10	Each meal	Several times a day	Each meal

Laparoscopic Heller's myotomy

All patients included in the study underwent LHM which was performed by single experienced advanced Laparoscopic surgeon in The Department of General Surgery, IMS, BHU, Varanasi. The patients were kept nil per as the night before

the surgery and were operated under general anaesthesia with Endo-tracheal intubation.

Pneumoperitoneum was established by closed technique using Verres needle by 10 mm incision given 2 inches above the umbilicus in midline. Laparoscopic Heller's myotomy was performed using standard 5 trocar technique with the patient in the French position as used for laparoscopic anti-reflux procedures. After establishing pneumoperitoneum of 12 to 15 mm Hg 10 mm trocar was inserted from the incision given for the camera (30 degree optical system).Two working ports were inserted. One 5 mm port on right side of midline in the epigastric region and another 10 mm port in mid clavicular line just below the costal margin on the left side. Two lateral ports in anterior axillary line on both sides were inserted for elevating the liver and retraction of the stomach. The phrenoesophageal ligament was divided starting on the right by opening the lesser sac and the distal esophagus was mobilized on the lateral and anterior side. The anterior vagal nerve was identified and spared. After circumferential mobilization, a length of 5 cms to 6 cms of thoracic esophagus was mobilized and retracted downwards. The myotomy was performed by dividing longitudinal muscle fibres extending at least 6 cm above the gastroesophageal junction and at least 1 cms-1.5 cm inferiorly over the stomach. The extent downwards required dividing the well vascularized epiphrenic fat pad overlying the cardia. The length of the myotomy performed was measured. To prevent reflux from the stomach into the esophagus, a Dor fundoplication was performed by partially wrapping the stomach around the esophagus and suturing the gastric seros with the separated longitudinal esophageal muscle fibres. In case an injury occurred it was repaired with interrupted 3-0 polygalactin sutures. Nasogastric tube was removed on post-operative day 1 and patients were started with clear liquid diet and gradually shifted to normal diet in next 24 hours. Patients were discharged on second post-operative day. No postoperative medication was given routinely.

Follow-up

Symptom scores were assessed at 3, 6 and 12 months. Repeat manometry was done at 3 months for assessment of LESP, IRP and DCI. Retreatment was allowed when symptoms recurred, which was defined as an Eckardt score of >3. If the score again became >3 the patients underwent pneumatic dilatation and were followed. In case of failure of dilation patients were planned for open cardiomyotomy.

Statistical analysis

The data were analyzed using SPSS 16.0 software. Student's t test, Mann Whitney U test and one way analysis of variance was used to compare the significant difference in mean. For paired samples Paired Student's t test and Wilcoxon Signed Ranks test were used. For categorical variables *Chi square* test and Fisher's-exact test were used. P value <0.05 was considered as statistically significant.

Results

A total 30 patients of achalasia cardia were included with a mean of 36.76 ± 8.42 years (range 21 years to 56 years). Majority of cases (53.3%) were age group of 31 years to 40 years. Females were in majority (53.3%) with female:male ratio of 1:1.14. The mean duration of symptom was 35.60 ± 25.74 months (range 6 months to 120 months) and majority of cases (70%) had duration of symptom >12 months. Dysphagia was the most common symptom in all the cases of achalasia cardia followed by regurgitation and weight loss in 26 (86.7%) and chest pain in 25 (83.3%) cases. Pre-treatment manometry was done to classify patients into three sub types. Type I achalasia was present in 7 (23.3%) cases, type II in 18 (60.0%) and type III achalasia in 5 (16.7%) cases. Among the three subtypes, dysphagia was common to all followed by regurgitation in 85.71%, 83.33% and 100% patients while chest pain was present in 85.71%, 77.77% and 100% patients among type I, II and III achalasia types respectively. All the patients underwent LHM as the primary treatment. During follow up 4 patients (13.3%) developed recurrence of symptoms. One patient of type II developed recurrence at 3 months of follow up and was managed with pneumatic dilatation who did well after the endoscopic procedure while 2 patients of type III developed recurrence at 3 months. Bothe these patients initially did not consented for endoscopic procedure. Further in followup a total of 3 out of 5 type III patients including the 2 before had recurrence. All these patients did well after pneumatic dilatation.

On comparing height and width of the barium column in timed barium esophagogram, among the three subtypes of achalasia we found that the mean esophageal width at 1 min and 5 min were higher in type I achalasia as compared to type II and type III but the difference was not statistically .significant The height on barium swallow was also comparable in all three types at both 1 min and 5 min (Table 2).

Table 2: Comparison of Eckardt symptoms score in between sub types of Achalasia.

	Type 1 Mean ± SD (N=7)	Type 2 Mean ± SD (N=18)	Type 3 Mean ± SD (N=5)	p-value
		Timed barium esophagogram		
Height at 1 min (in mm)	138.42 ± 18.86	136.16 ± 6.12	134.20 ± 6.83	0.78
Width at 1 min (in mm)	37.85 ± 5.27	33.61 ± 3.68	34.60 ± 2.60	0.07

Height at 5 min (in mm)	108.71 ± 5.05	113.33 ± 5.69	115.80 ± 5.89	0.08
Width at 5 min (in mm)	30.85 ± 3.48	28.22 ± 3.91	29.80 ± 2.49	0.26
		Pretreatment score		
Dysphagia	2.86 ± 0.38	2.39 ± 0.61	2.40 ± 0.55	0.15
Regurgitation	2.00 ± 1.00	1.56 ± 0.86	1.60 ± 0.89	0.4
Chest pain	1.71 ± 0.95	1.50 ± 0.86	2.20 ± 0.45	0.21
Weight loss	1.14 ± 1.07	2.06 ± 0.73	2.20 ± 0.45	0.07
Eckardt score	7.86 ± 1.07	7.500 ± 0.79	8.400 ± 2.19	0.79
		Post treatment score at 3 month		
Dysphagia	0.86 ± 0.38	0.44 ± 0.51	1.00 ± 0.71	0.08
Regurgitation	0.29 ± 0.49	0.67 ± 0.59	0.40 ± 0.89	0.25
Chest pain	0.43 ± 0.53	0.50 ± 0.62	0.60 ± 0.89	0.98
Weight loss	0.00 ± 0.00	0.00 ± 0.00	0.20 ± 0.45	0.08
Eckardt score	1.57 ± 0.79	1.111 ± 0.68	2.200 ± 1.65	0.13
		Post treatment score at 6 month		
Dysphagia	0.71 ± 0.49	0.44 ± 0.51	1.20 ± 0.84	0.09
Regurgitation	0.14 ± 0.38	1.00 ± 0.84	0.60 ± 0.90	0.06
Chest pain	0.29 ± 0.49	0.33 ± 0.48	0.60 ± 0.89	0.82
Weight loss	0.00 ± 0.00	0.00 ± 0.00	0.40 ± 0.55	0.01
Eckardts core	1.00 ± 0.58	1.39 ± 0.98	2.24 ± 0.96	0.07
		Post treatment score at 12 month		
Dysphagia	0.71 ± 0.49	0.33 ± 0.49	0.60 ± 0.55	0.2
Regurgitation	0.14 ± 0.38	0.61 ± 0.61	0.40 ± 0.55	0.17
Chest pain	0.14 ± 0.38	0.22 ± 0.41	0.40 ± 0.55	0.59
Weight loss	0.00 ± 0.00	0.06 ± 0.27	0.00 ± 0.00	0.72
Eckardt score	1.00 ± 0.55	1.22 ± 0.55	1.40 ± 0.89	0.46

Eckardt symptom scores were also comparable for all types at baseline with mean values of 7.85 ± 1.06, 7.50 ± 0.78 and 8.40 ± 2.19 for type I, II and III achalasia respectively. After 3, 6 and 12 months of treatment Eckardt symptom scores improved and were comparable in all the achalasia sub-types.

On comparing the LESP, IRP and DCI as assessed by HRM the mean value of LESP was higher in Type III achalasia as compared to Type I and II but not statistically significant. IRP and DCI values were also comparable in all types of achalasia. After 3, 6 and 12 months, the LESP, IRP were comparable in all subtypes of achalasia (Table 3).

Table 3: Manometry variables in different type of Achalasia before and after treatment.

	Type I	**Type II**	**Type III**	**p-value**
	Mean ± SD	**Median**	**Median**	
		Pretreatment score		
LESP	46.73 ± 9.81	50.29 ± 12.06	50.960 ± 33.04	0.87
IRP	36.29 ± 6.58	35.17 ± 12.42	30.600 ± 11.87	0.67
DCI	336.70 ± 265.15	846.89 ± 777.28	218.400 ± 120.12	0.07

		Post treatment score at 3 month		
LESP	39.571 ± 9.36	43.278 ± 10.77	46.600 ± 30.53	0.73
IRP	19.000 ± 5.75	17.056 ± 6.66	15.200 ± 2.77	0.56
DCI	328.843 ± 264.08	838.111 ± 778.35	206.800 ± 123.04	0.07
		Post treatment score at 6 month		
LESP	14.400 ± 7.51	16.389 ± 5.79	13.720 ± 3.13	0.58
IRP	6.429 ± 4.28	6.667 ± 3.45	5.200 ± 3.03	0.72
DCI	310.571 ± 366.19	330.944 ± 394.75	109.800 ± 66.16	0.48
		Post treatment score at 12 month		
LESP	7.029 ± 4.33	10.056 ± 4.76	7.400 ± 2.70	0.23
IRP	2.857 ± 2.12	2.333 ± 1.14	2.200 ± 0.84	0.64
DCI	150.000 ± 177.84	154.389 ± 125.77	47.200 ± 29.46	0.27

On comparing change of Eckardt symptom score and manometric variables (LESP, IRP and DCI) at baseline to 3, 6 and 12 months of follow up. The mean Eckardt symptom score was significantly decrease from baseline to 3 months ($p<0.001$), 6 months ($p<0.001$) and 12 months ($p<0.001$) after treatment. The mean baseline LESP, IRP and DCI were also significantly decreased from baseline to 3, 6 and 12 months after treatment (Table 4).

Table 4: Comparison of change of Eckardt symptom score and manometric variables at baseline to 3, 6 and 12 months post treatment.

	Baseline	3 month	6 month	12 month	Baseline *vs.* 3 month	Baseline *vs.* 6 month	Baseline *vs.* 12 month
			Eckardt symptom score				
Dysphagia	2.50 ± 0.57	0.63 ± 0.56	0.63 ± 0.62	0.47 ± 0.51	<0.001	<0.001	<0.001
Regurgtation	1.67 ± 0.88	0.53 ± 0.63	0.73 ± 0.83	0.47 ± 0.57	<0.001	<0.001	<0.001
Chest Pain	1.67 ± 0.84	0.50 ± 0.63	0.37 ± 0.56	0.23 ± 0.430	<0.001	<0.001	<0.001
Weight loss	1.87 ± 0.86	0.03 ± 0.18	0.07 ± 0.25	0.03 ± 0.183	<0.001	<0.001	<0.001
Eckardt Score	7.73 ± 1.17	2.11 ± 0.97	2.29 ± 0.99	1.20 ± 0.61	<0.001	<0.001	<0.001
			Manometric variables				
LESP	49.57 ± 16.07	42.97 ± 14.82	15.48 ± 5.83	8.907 ± 4.50	<0.001	<0.001	<0.001
IRP	34.67 ± 11.07	17.20 ± 5.94	6.37 ± 3.51	2.43 ± 1.36	<0.001	<0.001	<0.001
DCI	623.09 ± 670.69	614.06 ± 671.60	289.33 ± 355.58	135.50 ± 132.48	<0.001	0.004	<0.001

In our study, success rate was analyzed at 3, 6 and 12 months after treatment. In type I achalasia patients showed 100% response to treatment. In type II achalasia response rate was 100%, 94.4% and 100% at 3, 6 and 12 months respectively. In type III Achalasia response rate was 60%, 40% and 100% at 3, 6 and 12 months respectively (Table 5).

Table 5: Success rate according to Eckardt score in all patients at 3 months, 6 month and 12 months in different types of Achlasia cardia.

	Eckardt score<3		Eckardt score>3	
	No.	**%**	**No.**	**%**
		Type 1		
At 3 month	7	100	0	0
At 6 month	7	100	0	0
At 12 month	7	100	0	0

		Type 2		
At 3 month	18	100	0	0
At 6 month	17	94.4	1	5.6
At 12 month	18	100	0	0
		Type 3		
At 3 month	3	60	2	40
At 6 month	2	40	3	60
At 12 month	5	100	0	0

Discussion

Achalasia is an esophageal motility disorder that leads to dysphagia, chest pain, regurgitation and weight loss. Its diagnosis is clinically suspected and is confirmed with esophageal manometry. High resolution manometry has served to predict treatment outcomes and plan appropriate treatment. Laparoscopic Heller cardiomyotomy is considered by many experts as the best treatment modality for most patients with newly diagnosed Achalasia [9].

In our study total 30 patients were included. Out of these patients 14 patients were males and 16 females. In our study female patients were more as compared to male. However prevalence of Achalasia is equal in both male and female. Some studies have shown slight female predominance [10,11].

In this study, the mean age of patients were 32.14 ± 10.26 years, 36.41 ± 11.44 years and 37.63 ± 13.21 years in type I, II and III achalasia respectively. Type I Achalasia patients were younger as compared to the other two types (p=0.446). This is similar to other studies [12,13]. Total duration of symptoms was 35.60 ± 25.74 months. While in a study by Lee found total median duration of symptoms was in months 32.60 ±14.66 months. In this study type III achalasia patients had longer duration of symptoms [14].

In the present study, pre-treatment manometry was done to classify patients into three sub-types. Seven (23.3%) patients had type I, 18 (60.0%) had type II and 5 (16.7%) patients had type III achalasia sub-types. This distribution among all three types is consistent with other studies by Wout and Lee. An Indian study by Ghoshal showed that 33 of 62 (53%) patients had type I achalasia and the others had type II disease. None of the patients had type III achalasia. But Pratap found that out of 51 patients, 24 patients had type I and type II had similar number of patients while 3 patients had in type III achalasia [15].

In this study dysphagia was the most common symptom in all three types of achalasia followed by regurgitation in 85.71%, 77.77% and 100% patients in type I, II and III respectively. Chest pain was seen in 85.71%, 83.33% and 100% patients in type I, II and III achalasia respectively. These results were similar to other studies.

Manometry variables in different type of achalasia

Before treatment, LES pressure, IRP and DCI were assessed by HRM. The mean value of LESP was higher in type III achalasia as compared to type I and II. IRP and DCI values were comparable in all types of achalasia. IRP and LESP value were decreased at 3, 6 and 12 months in all subtypes of achalasia as compared to pretreatment. However, there was no significant difference between all subtypes of achalasia. These results were consistent with result of Jung, LESP value decreased at 3 months in all subtypes of achalasia as compared to pretreatment values. However, there was no significant difference among subtypes of achalasia. Similar results were also reported by Goshal where patients who underwent pneumatic dilatation were assessed [16].

In our study, on comparing mean change in LESP, IRP and DCI before and after 3, 6 and 12 months of follow up, there was significantly decrease in LESP, IRP and DCI values at baseline to 3, 6 and 12 months after treatment.

Success rate after LHM at 3, 6 and 12 months

In our study success rate was analyzed at 3, 6 and 12 months. In type I Achalasia patients showed 100% response to treatment. In type II Achalasia response rate was 100%, 94.4% and 100% at 3, 6 and 12 months respectively. In type III Achalasia response rate was 60%, 40% and 100% at 3, 6 and 12 months respectively.

Lee published short term results at 3 months showed that response to treatment in type I Achalasia was 71.4% and 50% after LHM respectively while in type II Achalasia response rate was 85.7% and 75% after LHM respectively, there were no patients in type III. Pandolfino after a follow-up period of at least 1 month, concluded that the treatment success rate of type II patients (96%) was significantly higher compared to type I (56%) and type III (29%) patients after LHM.

Conclusion

Success rates in type I and II are higher than type III. This implies that patients with type III Achalasia either respond less to LHM and need a longer follow up than type 1 and 2 Achalasia after Heller's Myotomy can have a delayed full response and should be included in a more rigorous follow-

up protocol. It further implies that patients of type II and III Achalasia cardia in which symptoms reappeared at 3 and 6 months should be followed up to 12 months before labeling them as a recurrence. The recurrence following LHM can be successfully managed with pneumatic dilation. We concluded that surgical treatment for Achalasia is effective among all subtypes based on HRM, however a larger study with longer follow up is needed to draw a substantial conclusion.

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