



Recurrent Hiatal Hernia: Evolving Definitions and Clinical Implications

James M Tatum* and John C Lipham

Department of Surgery, Keck School of Medicine of the University of Southern California, USA

Abstract

Recurrence of hiatal hernia after surgical repair remains of the most challenging problems in general thoracic surgery. Multiple adjuncts to crural closure have been suggested and implemented in the past three decades. Measuring and comparing rates of recurrence between methods of repair is made challenging by inconsistent definitions and follow-up periods between studies.

Keywords: Hiatal hernia; Hiatal hernia repair; Videosophagography

Key Points

- Adjusted freedom from recurrence is often lacking in reported studies.
- Standard size criteria for recurrence grading are needed.
- Consensus on appropriate modality for diagnosis of small recurrence needs to be achieved.

Introduction

The laparoscopic repair of a hiatal hernia was first described in a 1992 in case report [1]. Recurrence of hiatal hernia following laparoscopic repair were reported soon thereafter [2]. Recurrence of hiatal herniation after surgical repair remains one of the challenges of thoracic surgery, and plagued the specialty even when repairs were performed through open surgery. A large recurrence is easily diagnosed by any of several diagnostic modalities, but there remain inconsistencies on how we define the lower limits of recurrence and by which modality the diagnosis is most appropriately made. Varying follow-up times reported in studies compound the difficulty in understanding or comparing recurrence rates among methods of repair. The progression (expansion) of recurrent hiatal hernia over time in the setting of a failed repair is virtually unexamined in the literature. It is not clear if the natural history of the recurrent hiatal hernia parallels that of an untreated hiatal hernia or follows a more benign course. Consistent criteria for diagnosis is essential for the study of the disease and in planning appropriate surveillance and treatment of patients not only during study design, but in clinical practice. The aim of this article is to review how select publications describe recurrence rates of hiatal hernia--examining how as a surgical community we are measuring and defining the lower limits of recurrence.

Methods

Non-systematic review of the surgical literature. PubMed, SCOPUS and Embase were searched for all articles mentioning "hiatal hernia", "paraesophageal hernia" or "recurrent hiatal hernia". Articles were selected based on relevance by authors JMT and JCL to represent a cross-section of major publications since the introduction of laparoscopic hiatal hernia repair to surgical practice. Additional criteria for inclusion were that the article describes: type of hernia (I-IV); modality of pre-operative diagnosis; method of intra-operative measurement; criteria for diagnosis of post-operative recurrence; modality by which recurrence is diagnosed; time of imaging follow-up; proportion of patients in which post-operative radiographic follow-up was obtained; recurrence rates.

Results

Forty-four studies were deemed representative of current clinical practice; the eleven manuscripts most completely reporting the predetermined criteria, from 1999 through 2017 were included in this analysis.

OPEN ACCESS

*Correspondence:

James M Tatum, Department of Surgery, Keck School of Medicine of the University of Southern California, 1450 San Pablo Street, Healthcare Consultation Center 4 Suite 6200, Los Angeles, CA 90033, USA, Tel: 541-908-4221; Fax: 323-865-9630; E-mail: james.tatum@med.usc.edu

Received Date: 25 Oct 2017

Accepted Date: 15 Jan 2018

Published Date: 24 Jan 2018

Citation:

Tatum JM, Lipham JC. Recurrent Hiatal Hernia: Evolving Definitions and Clinical Implications. Clin Surg. 2018; 3: 1884.

Copyright © 2018 James M Tatum.

This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Table 1: Findings.

First author	Journal	Year	Hernia type	Pre-operative diagnosis	Intra-operative measurement	Post-op criteria	Post-op diagnostic modality	Post-op timing	% Diagnostic follow-up	Recurrence rate
Swanstrom [19]	Am J Surg	1999	II/III	Barium esophagram 100% EGD 100% Manometry 94%	--	--	Barium esophagram	--	--	8% PEH
Wu [3]	Surg Endosc	1999	II/III	Upper GI (100%) and EGD (74%)	--	Any evidence of herniation of the stomach above the diaphragm	Barium esophagram	3-5 months	100%	3% PEH 9% Small HH
Hashemi [4]	JACS	2000	III	Not specified	--	Any evidence of herniation of the stomach above the diaphragm	Video (barium) esophagram	Overall: 35 (Range 4-166) months Open Group: Median 35(Range 4-166) months Laparoscopic Group: Median 17 (Range 5-45) months	Overall: 75% Open: 74% Lap: 77%	Overall: 42% Open: 15% Lap: 42%
Diaz [7]	J Gastrointest Surg	2003	II/III	EGD 100% Barium esophagram 89% Large PEH: More than 1/3 of stomach in thoracic cavity	Distance from hiatus to GEJ (I) or fundus (III) --	Any gastric tissue in the thorax. Small <4cm, large ≥4cm Not specified	Barium esophagram Barium esophogram (72%); CXR (9.6%)	"6 to 12 months" Barium esophogram: Mean of 15 months post-op	69%	32%
Andujar [8]	Surg Endosc	2004	PEH						90% at 6 months 65% at 24 months 4% at 24 months	25%
Oelschlager [20]	Ann Surg	2006	PEH	Barium Esophagram	1. R-L Hiatus (cm) 2. A-P Hiatus (cm) 3. Length of herniated esophagus		Barium esophagram	6 months	90%	Mesh Repair: 9% 1° Repair: 24%
Zehetner [9]	JACS	2011	III/IV	>50% of stomach in the chest	--	Any size HH seen on VEG or	Barium esophagram or EGD	Serial follow up with barium esophagram at 1,3 and 5 years (Mean follow up in laparoscopic group of 12 months)	28%	18%
Dallemagne [10]	Ann Surg	2011	II-IV	Barium Esophagram (100%), EGD (93%), manometry (66%) with ≥ 50% of stomach in chest	--	Small <3 cm Mod 3-5 cm Large: >5 cm	Barium esophagram	Median 99 months, (Range: 17-186 months)	54%	66%
Oelschlager [5]	J Gastrointest Surg	2012	PEH	Barium Esophagram	1. R-L Hiatus (cm) 2. A-P Hiatus (cm) 3. Length of herniated esophagus	Small: >2-3.9cm Large: ≥ 4cm	Barium esophagram	Median 58 (Range 40-78) months	56%	14% at 6 months 57% at last follow up (mean size 4±1 cm)
Alicuben [10]	JACS	2014	I/III	≥ 50% of stomach in the chest + Fundus above GEJ	--	Any size HH seen on VEG or EGD	VEG 79% EGD 52% VEG+EGD in 48%	Median 15 months	84%	4%

Lidor [6]	JAMA Surg	2015	III	Barium esophagram	--	> Than a 2-cm vertical extension of gastric mucosa measured from the level of the diaphragm	Barium esophagram	"1-year [barium esophagram] examination"	63%	27%
Reynolds [11]	Am Surg	2016	II-IV	EGD or barium esophagram	Vertical extension hernia sac apex above the hiatus	1. Any gastric tissue above hiatus 2. >2 cm above the hiatus	Barium esophagram or EGD	Mean 24.5 (Range 12-88) months	79%	Overall: 11% K-M recurrence of 2%,8% and 18% at 12, 24 and 36 months.
Buckley [15]	Surg Endosc	2017	Any HH	>3 cm by EGD, barium esophagram or CT scan	A-P and R-L, hiatal surface area	>2 cm of gastric tissue above the hiatus	Barium esophagram	Median 11 months	64%	0%

EGD: Esophagogastroduodenoscopy; CXR: Chest X-Ray; GEJ: GastroEsophageal Junction; HRM: High Resolution Manometry; PEH ParaEsophageal Hernia

Table 2: USC Monitoring Protocol.

Time	Indicated Study
Any time with symptoms of recurrence or diagnosis of recurrence of any size on non-BE modality	Barium esophagram
One year post-operatively	Barium esophagram
Three years post-operatively	Barium esophagram
Five years post-operatively	Barium esophagram

Table 3: USC Recurrent Hiatal Hernia Definitions by Modality.

Modality	Not a recurrence (<2 cm)	Small 2- <5 cm)	Moderate (5-7 cm)	Large (>7 cm)
EGD	Not diagnostic	Screening	Screening	Screening
CT Scan	Not diagnostic	Screening	Screening	Screening
HRM	Not diagnostic	Screening	Screening	Screening
BE*	Diagnostic	Diagnostic	Diagnostic	Diagnostic

Definition

Findings are summarized in (Table 1). Recurrent hiatal hernia carried definitions including "any evidence of herniation of the stomach above the diaphragm", "any gastric tissue in the thorax", as well as more specific size criteria. Early studies are more likely to subjectively define recurrent hiatal [3,4] later studies largely define recurrent hiatal hernia as >2 cm of gastric tissue above the diaphragmatic hiatus [5,6]. Several studies distinguish between small and not-small hiatal hernia recurrences at a threshold of 4 cm [5,7].

Modality of Assessment

The modality by which recurrence is diagnosed is generally by a contrast Barium Esophagram (BE) (variably referred to as UGI, barium esophagram, or videoesophagram). One early study used CXR as an adjunct diagnostic in patients who failed to receive a BE [8]. The use of EGD to diagnose recurrent hiatal hernia occurs in several of the papers, generally from the USC group, and only as a supplemental means of diagnosis when patients had not receive the intended barium esophagram [9-11]. Recurrence rates as observed in the studies we examined are shown in (Figure 1).

Follow-up Time

Length of follow-up time to diagnosis varies widely in this sample of studies and is not always clearly defined or completely reported. Follow-up times during which recurrence is diagnosed range from 4 months to beyond 8 years [4,6]. Median and means are variable

reported, based on sample size and distribution of follow up, from 3 months to 99 months [3,6,12]. Recurrence rates vary over the course of the studies (as to adjuncts to repair and changes in technique), however they range from 66% to 0% [4,13].

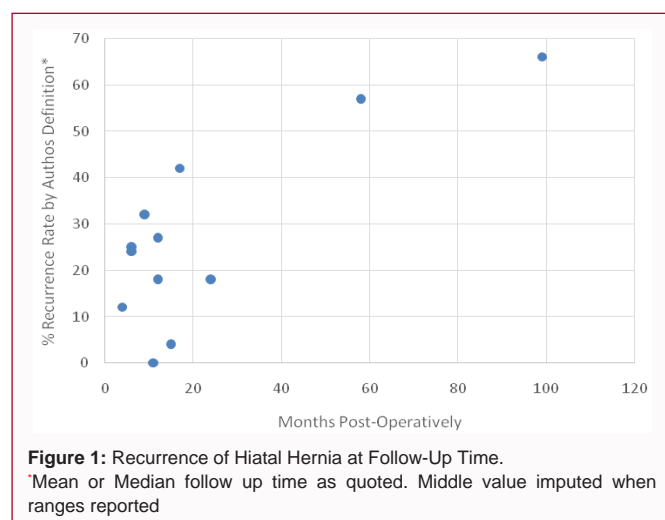
Progression over Time

Two of the studies that we reviewed in detail discuss progression over time. One study identified 13 patients with recurrent hiatal hernia at 6 months, at subsequent long-term follow up none of these 13 patients had a progression hiatal hernia size [5]. Neither 6 month nor long-term follow-up hernia sizes are reported for these 13 patients [5]. A second study reported that 9 patients that had ≥ 1 additional videoesophagrams performed a year or more after a recurrent hernia was initially detected, and of these, 7 had no change in the size of the hernia at a median follow-up of 12 months after recurrence (maximum 36 months). In 2 patients of the 9 patients, the hernia size increased at subsequent follow-up, in one patient going from 2 cm to 4 cm in 12 months, in the second from 2 cm to 3 cm after 24 months [9].

Discussion

Definition of recurrence

Recurrent hiatal hernia has proven difficult to study. This is in part due to a lack of consensus definitions, the relative infrequency of the operation and the relatively arduousness of follow-up studies for patients. It has been suggested that recurrence be defined as >2 cm of gastric tissue above the hiatus. This suggestion was not made based



on 2 cm being a threshold predicting progressive expansion of the recurrent hiatal hernia, but rather on the point at which authors felt the size of hernia correlated with a worsening of symptoms in their series, which achieved 88% follow up on BE at 1-year of 101 patients, 88 of whom were followed for one year post-operatively, of whom only 58% received a repeat barium esophagram at one year with a 28% recurrence rate, this in a series where bio-prosthetic buttressing was used [14].

While an argument can be made that recurrence should be based on at what size a recurrent hernia becomes troublesome, or at what size a clinician can expect further progression, until that data is reported, this seems a difficult argument to make. We advocate going forward that not only innovative methods of repair including: relaxing incisions; use of mesh or topical agents; repair with prosthetic devices—but also traditional methods of repair with primary cruroplasty and fundoplication be accompanied by protocolized follow-up with the diagnosis of recurrence based on consistent guidelines with the appropriate and consistent modality. Our suggested post-operative monitoring protocol is detailed in (Table 2).

Diagnosing a recurrence

Multiple modalities exist to assess the hiatus. Each has potential downfalls. Small hiatal hernia can be transient, and their presence is depended on the relative position of the diaphragm during the respiratory cycle and competing intrathoracic and intrabdominal pressures [15]. Barium esophagram is regarded as the most reliable due the dynamic nature of a video esophagram, this benefit is at least in part attenuated if only static plates are obtained during an UGI series. Video allows for the GEJ to be observed during each phase of the respiratory cycle and we believe allows the most clinically meaningful diagnosis. We have found both HRM and EGD to be unreliable in the diagnosis of small hiatal hernia due to the dynamic nature of sliding or transient hernia and the confounding of positive pressure gastric distension during endoscopy [16,17]. There seems to be little debate that BE is the appropriate means of diagnosis and measurement of recurrent hiatal herniation both initially and while screening or diagnosing recurrence. Screening for a moderate or large hiatal hernia can reasonably be accomplished by a variety of imaging modality and they allow a much higher sensitivity and specify as the hernia increases in size. A summary of our suggested appropriate uses of imaging modalities is summarized in (Table 3).

Timing and natural history

McMurray et al. performed a meta-analysis in 2007 and included only studies which quoted recurrence rate of BE in their analysis [18]. They however did not clearly specify either what was considered a recurrence, or did they consider variable follow up time for the studies included in their analysis. They argued that studies needed to be done with better adherence to a scheduled 1-year follow up barium esophagram. We agree that the need for this study persists, and until it has been completed there is little literature available allowing the delineation of the natural history of recurrent hiatal hernia at or beyond one year besides than mentioned above from the University of Washington and University of Southern California groups.

Unadjusted (those not considering time from surgery) recurrence rates should not be reported. Future studies reporting recurrence rates should carefully detail statistics describing the follow-up data (mean, SD or Median, IQR and Range) as well as an accounting and comparison of patients lost to follow-up and those included, as well as a percent completeness of both clinical and radiographic follow-up. Recurrence rates should be reported according to a standard definition (Table 3) and these recurrence rates (or freedom from recurrence) should only be reported in patients who have had the appropriate radiographic study particularly among those diagnosed with a small recurrence. Ideally each patient would have multiple studies and progressive time points allowing for a more detailed Kaplan-Meier survival analysis, in the fashion reported by Reynolds et al. [11] At the least, further studies that do not achieve follow up within a narrow margin of variability (i.e. 12 months \pm 2 months) should report adjusted results accounting for patients lost to follow-up with a survival analysis. Stating a single value as a recurrence rate as measured in patients with inconsistent lengths of follow-up from a sample with low follow-up rates is deceiving. Understanding the natural history of a small recurrent hernia requires that patients receive serial examinations with attention to progression. This is a critical area in immediate need of further study.

References

1. Congreve DP. Brief Clinical Report; Laparoscopic Paraesophageal Hernia Repair. *J Laparoendo Surg.* 1991;2:45-48.
2. Trus TL, Bax T, Richardson WS, Branum GD, Mauren SJ, Swanstom LL, et al. Complications of laparoscopic paraesophageal hernia repair. *J Gastrointest Surg.* 1991;1(3):221-7.
3. Wu JS, Dunnegan DL, Soper NJ. Clinical and radiologic assessment of laparoscopic paraesophageal hernia repair. *Surg Endosc.* 1999;13(5):497-502.
4. Hashemi M, Peters JH, DeMeester TR, Huprich JE, Quek M, Hagen JA, et al. Laparoscopic repair of large type III hiatal hernia: objective follow up reveals high recurrence rate. *J Am Coll Surg.* 2000;190(5):553-60.
5. Oelschlager BK, Petersen RP, Brunt LM, Soper NJ, Sheppard BC, Mitsumori L, et al. Laparoscopic paraesophageal hernia repair: defining long-term clinical and anatomic outcomes. *J Gastrointest Surg.* 2012;16(3):453-9.
6. Lidor AO, Steele KE, Stem M, Fleming RM, Schweitzer MA, Marohn MR. Long-term quality of life and risk factors for recurrence after laparoscopic repair of paraesophageal hernia. *JAMA Surg.* 2015;150(5):424-431.
7. Diaz S, Brunt LM, Klingensmith ME, Frisella PM, Soper NJ. Laparoscopic paraesophageal hernia repair, a challenging operation: medium-term outcome of 116 patients. *J Gastrointest Surg.* 2003;7(1):59-66.
8. Andujar JJ, Papisavas PK, Birdas T, Robke J, Raftopoulos Y, Gagné DJ, et al. Laparoscopic repair of large paraesophageal hernia is associated with a low

- incidence of recurrence and reoperation. *Surg Endosc.* 2004;18(3):444-7.
9. Zehetner J, Demeester SR, Ayazi S, Kilday P, Augustin F, Hagen JA, et al. Laparoscopic versus open repair of paraesophageal hernia: the second decade. *J Am Coll Surg.* 2011;212(5):813-20.
 10. Alicuben ET, Worrell SG, DeMeester SR. Impact of crural relaxing incisions, Collis gastroplasty, and non-cross-linked human dermal mesh crural reinforcement on early hiatal hernia recurrence rates. *J Am Coll Surg.* 2014;219(5):988-92.
 11. Reynolds JL, Zehetner J, Bildzukewicz N, Katkhouda N, Lipham JC. A Durable Laparoscopic Technique for the Repair of Large Paraesophageal Hernias. *Am Surg.* 2016;82(10):911-5.
 12. Dallemagne B, Kohnen L, Perretta S, Weerts J, Markiewicz S, Jhaes C. Laparoscopic repair of paraesophageal hernia. Long-term follow-up reveals good clinical outcome despite high radiological recurrence rate. *Ann Surg.* 2011;253(2):291-6.
 13. Buckley FP, Bell RCW, Freeman K, Doggett S, Heidrick R. Favorable results from a prospective evaluation of 200 patients with large hiatal hernias undergoing LINX magnetic sphincter augmentation. *SurgEndosc.* 2017;1-7.
 14. Lidor AO, Kawaji Q, Stem M, Fleming RM, Schweitzer MA, Steele KE, et al. Defining recurrence after paraesophageal hernia repair: correlating symptoms and radiographic findings. *Surgery.* 2013;154(2):171-8.
 15. Ayazi S, DeMeester SR, Hsieh CC, Zehetner J, Sharma G, Grant KS, et al. Thoraco-abdominal pressure gradients during the phases of respiration contribute to gastroesophageal reflux disease. *Dig Dis Sci.* 2011;56(6):1718-22.
 16. Tatum JM, Samakar K, Bowdish ME, Mack WJ, Bildzukewicz N, Lipham JL. Videosophagography vs. Endoscopy for Prediction of Intraoperative Hiatal Hernia Size. *Am Surg.* 2017.
 17. Tatum JM, Alicuben E, Bildzukewicz N, Sandhu K, Samakar K, Houghton C, et al. Intertest Reliability of Hiatal Hernia Diagnosed by High Resolution Manometry, Video Esophagography or Endoscopy and Association with Gastroesophageal Reflux Disease. Unpublished abstract. 2017.
 18. Rathore MA, Bhatti MI, Andrabi SI, McMurray AH. Laparoscopic repair of paraesophageal hernia requires cautious enthusiasm. *Int J Surg.* 2008;6(5):404-8.
 19. Swannstrom LL, Jobe BA, Kinzie LR, Horvath KD. Esophageal motility and outcomes following laparoscopic paraesophageal hernia repair and fundoplication. *Am J Surg.* 1999;177(5):359-63.
 20. Oelschlager BK, Pellegrini CA, Hunter J, Soper N, Brunt M, Sheppard B, et al. Biologic prosthesis reduces recurrence after laparoscopic paraesophageal hernia repair: a multicenter, prospective, randomized trial. *Ann Surg.* 2006;244(4):481-90.