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Abstract

Recurrence of hiatal hernia after surgical repair remains one 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; Videoesophagography

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 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 criterial 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.
## Table 1: Findings.

<table>
<thead>
<tr>
<th>First author</th>
<th>Journal</th>
<th>Year</th>
<th>Hernia type</th>
<th>Pre-operative diagnosis</th>
<th>Intra-operative measurement</th>
<th>Post-op criteria</th>
<th>Post-op diagnostic modality</th>
<th>Post-op timing</th>
<th>% Diagnostic follow-up</th>
<th>Recurrence rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swanstrom [19]</td>
<td>Am J Surg</td>
<td>1999</td>
<td>II/III</td>
<td>Barium esophagram 100%</td>
<td>EGD 100% Manometry 95%</td>
<td>Barium esophagram</td>
<td>Barium esophagram</td>
<td>--</td>
<td>--</td>
<td>8% PEH</td>
</tr>
<tr>
<td>Wu [3]</td>
<td>Surg Endosc</td>
<td>1999</td>
<td>II/III</td>
<td>Upper Gl (100%) and EGD (74%)</td>
<td>--</td>
<td>Any evidence of herniation of the stomach above the hiatus</td>
<td>Barium esophagram</td>
<td>3-5 months</td>
<td>100%</td>
<td>3% PEH 9% Small HH</td>
</tr>
<tr>
<td>Hashemi [4]</td>
<td>JACS</td>
<td>2000</td>
<td>III</td>
<td>Not specified</td>
<td>--</td>
<td>Any evidence of herniation of the stomach above the hiatus</td>
<td>Video (barium) esophagram</td>
<td>Overall: 35 (Range 4-166) months Open Group: Median 35 (Range 4-166) months Laparoscopic Group: Median 17 (Range 5-45) months</td>
<td>Overall: 75% Open: 74% Lap: 77%</td>
<td>Overall: 42%</td>
</tr>
<tr>
<td>Diaz [7]</td>
<td>J Gastrointest Surg</td>
<td>2003</td>
<td>II/III</td>
<td>EGD 100% Barium esophagram 95%</td>
<td>Large PEH: More than 1/3 of stomach in thoracic cavity</td>
<td>Distance from hiatus to GEJ (I) or fundus (II) --</td>
<td>Any gastric tissue in the thorax: Small &lt;4cm, large ≥4cm Not specified</td>
<td>Barium esophagram</td>
<td>Barium esophagram (72%); CXR (9.6%)</td>
<td>&quot;6 to 12 months&quot; Barium esophagram: Mean of 15 months post-op</td>
</tr>
<tr>
<td>Andujar [8]</td>
<td>Surg Endosc</td>
<td>2004</td>
<td>PEH</td>
<td>--</td>
<td>Any evidence of herniation of the stomach above the hiatus</td>
<td>Video (barium) esophagram</td>
<td>Median 99 months, (Range: 17-196 months)</td>
<td>90% at 6 months 65% at 24 months 4% at 24 months</td>
<td>25%</td>
<td></td>
</tr>
<tr>
<td>Zehetner [9]</td>
<td>JACS</td>
<td>2011</td>
<td>III/IV</td>
<td>&gt;50% of stomach in the chest</td>
<td>--</td>
<td>Any size HH seen on VEG or EGD</td>
<td>Barium esophagram or EGD</td>
<td>Serial follow up with barium esophagram at 1.3 and 5 years (Mean follow up in laparoscopic group of 12 months)</td>
<td>28% 18%</td>
<td></td>
</tr>
<tr>
<td>Dallemagne [10]</td>
<td>Ann Surg</td>
<td>2011</td>
<td>II-IV</td>
<td>Barium Esophagram (100%), EGD (93%), manometry (66%) with ≥ 50% of stomach in chest</td>
<td>--</td>
<td>Small &lt;3 cm Mod 3-5 cm Large: ≥5 cm</td>
<td>Barium esophagram</td>
<td>Median 99 months, (Range: 17-196 months)</td>
<td>54% 66%</td>
<td></td>
</tr>
<tr>
<td>Oelschlager [5]</td>
<td>J Gastrointest Surg</td>
<td>2012</td>
<td>PEH</td>
<td>Barium Esophagram</td>
<td>1. R-L Hiatus (cm) 2. A-P Hiatus (cm) 3. Length of herniated esophagus</td>
<td>Small: &gt;2-3.9cm Large: ≥ 4cm</td>
<td>Barium esophagram</td>
<td>Median 58 (Range 40-78) months</td>
<td>56%</td>
<td>14% at 6 months 57% at last follow up (mean size 4±1 cm)</td>
</tr>
<tr>
<td>Alicuben [10]</td>
<td>JACS</td>
<td>2014</td>
<td>I/III</td>
<td>≥ 50% of stomach in the chest + Fundus above GEJ</td>
<td>--</td>
<td>Any size HH seen on VEG or EGD</td>
<td>VEG 79%, EGD 52%, VEG+EGD in 48%</td>
<td>Median 15 months</td>
<td>84% 4%</td>
<td></td>
</tr>
</tbody>
</table>
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 hernia, while later studies largely define recurrent hiatal hernia as >2 cm of gastric tissue above the diaphragmatic hiatus. Several studies distinguish between small and not-small hiatal hernia recurrences at a threshold of 4 cm.

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. 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. 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. Median and means are variable reported, based on sample size and distribution of follow up, from 3 months to 99 months. 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%.

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 in size of the hernia. 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. 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.

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

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Table 2: USC Monitoring Protocol.

<table>
<thead>
<tr>
<th>Time</th>
<th>Indicated Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any time with symptoms of recurrence or diagnosis of recurrence of any size on non-BE modality</td>
<td>Barium esophagram</td>
</tr>
<tr>
<td>One year post-operatively</td>
<td>Barium esophagram</td>
</tr>
<tr>
<td>Three years post-operatively</td>
<td>Barium esophagram</td>
</tr>
<tr>
<td>Five years post-operatively</td>
<td>Barium esophagram</td>
</tr>
</tbody>
</table>

Table 3: USC Recurrent Hiatal Hernia Definitions by Modality.

<table>
<thead>
<tr>
<th>Modality</th>
<th>Not a recurrence (&lt;2 cm)</th>
<th>Small 2-&lt;5 cm</th>
<th>Moderate (5-7 cm)</th>
<th>Large (&gt;7 cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGD</td>
<td>Not diagnostic</td>
<td>Screening</td>
<td>Screening</td>
<td>Screening</td>
</tr>
<tr>
<td>CT Scan</td>
<td>Not diagnostic</td>
<td>Screening</td>
<td>Screening</td>
<td>Screening</td>
</tr>
<tr>
<td>HRM</td>
<td>Not diagnostic</td>
<td>Screening</td>
<td>Screening</td>
<td>Screening</td>
</tr>
<tr>
<td>BE</td>
<td>Diagnostic</td>
<td>Diagnostic</td>
<td>Diagnostic</td>
<td>Diagnostic</td>
</tr>
</tbody>
</table>
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 clinical 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 downsfalls. 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 reasonable 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 +/- 2months) 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


