



Asymptomatic intrathoracic stomach: elective repair versus watchful waiting

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Abstract: Optimal treatment of an asymptomatic intrathoracic stomach is the subject of ongoing debate. Historically, all paraesophageal hernias were repaired for fear of acute strangulation, but in recent years, intervention has been suggested for only for patients with symptoms in the setting of intrathoracic stomach. The authors will review current literature and evidence for watchful waiting compared to repair of an asymptomatic intrathoracic stomach.

Keywords: Intrathoracic stomach; paraesophageal hernia; watchful waiting; emergency repair

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Introduction

Patients presenting with an intrathoracic stomach (ITS) represent a small subset (5%) of all patients with hiatal hernias (HH). Traditionally, these hernias are defined as having at least half of the stomach above the level of the diaphragm (1), and are most commonly type III paraesophageal hernias (PEH), in which both the gastroesophageal junction and fundus of the stomach herniate through the diaphragmatic hiatus (1).

The classic triad of severe epigastric pain, unproductive retching, and inability to pass a nasogastric tube was first described by Borchardt in 1904, and this constitutes a surgical emergency (2). Historically, the rate of asymptomatic to symptomatic PEH progression was reported to be approximately 14% per year (3). Gastric volvulus was the feared complication and is characterized by either organoaxial or mesenteroaxial rotation of the stomach, causing acute strangulation and obstruction (1). Previously, all patients with ITS underwent surgical repair based on high reported rates (>30%) of developing acute symptoms and/or complications in patients who underwent

observation (4,5).

However, recent studies have demonstrated decreased incidence of symptom development, as well as increased safety of emergency surgery, with the incidence of acute complications and mortality (5%) being much lower than previously reported (6-8). These studies have caused the pendulum to swing towards watchful waiting (WW) for patients with asymptomatic intrathoracic stomach (AITS). Using a literature review to create a Markov Monte Carlo decision model, Stylopoulos *et al.* demonstrated that in 83% of the simulated patients WW was the superior strategy for the management of AITS compared to elective repair (3). Their pooled analysis of five studies yielded an annual probability of developing acutely emergent symptoms for patients undergoing WW was 1.16%, with a lifetime risk of 18% in patients over the age of 65 (3).

Current guidelines recommend WW in patients who are asymptomatic (1,3,9), and elective repair in patients who are symptomatic (1), to avoid higher morbidity and mortality associated with emergent repair (10-13). Conversely, as the understanding of the disease process increases and with the increased utilization of laparoscopic surgical techniques,

there are now advocates challenging the WW paradigm in select patients (12-14). This review focuses on the evidence for elective repair compared to watchful waiting based on retrospective studies, mathematical predictive models, and literature reviews. No randomized controlled trials currently exist comparing elective repair and WW.

Incidence and clinical presentation

The incidence of patients identified with ITS has dramatically increased since the 1950s with the advent of advanced imaging technology and increased life expectancy in industrialized countries (11-13). The ability to incidentally detect patients with an ITS is much higher due to wide availability and now ubiquitous use of computed tomography (CT). Despite increased rates of diagnosis, there still are very few population-based studies examining the natural progression of AITS to symptomatic ITS, or furthermore, identifying patients who would benefit from early elective surgery. There is no true estimate to how many people have AITS, as most patients present with symptoms and often undergo surgical intervention. This belies the difficulty of a risk-benefit analysis to identify those who would gain an advantage from prophylactic surgery, as there is no current tool that exists to predict who will become symptomatic, or who will go on to require emergency surgery.

ITS is primarily a disease of the elderly population with a median age of 65 to 75 years (15-17), with a higher prevalence in female patients. It is likely that some PEHs arise from smaller HHs that enlarge with time due to weakening of connective tissue and elastic fibers (18) or anatomic changes such as kyphosis and degenerative disc disease which cause migration of the stomach into the chest (1). Those that do present with symptoms do not typically present with GERD symptoms, unlike many HH patients. Instead, ITS patients will more commonly describe obstructive symptoms comprised of nausea, bloating, early satiety, post-prandial epigastric pain, shortness of breath, hematemesis, and relief of symptoms with vomiting (1).

Elective repair

A common theme of studies that advocate for prophylactic elective repair is the historical 6–7 fold increased risk of mortality with emergency repair (10), which can be as high as 17% (10,19) compared to an operative mortality of 2.5% for elective repair (10). This is often cited as the major

impetus for favoring elective surgery, even in asymptomatic patients.

Sihvo *et al.* published a population-based study from Finland spanning 1987 to 2001, in which the authors report the incidence and natural course of PEHs in a total population of 3.8 million (20). The authors identified 630 patients diagnosed with PEH, with an annual admission rate of 8.2/1,000,000 inhabitants. Of these patients, 563 (89%) underwent surgical repair (90.9% were open); with elective operative mortality of 0.5% (3), and total operative mortality of 2.7% (15). In hospital mortality for symptomatic patients managed non-operatively was 16.4% (11/67). Of the 32 total mortalities, 55% of patients had a known diagnosis of PEH prior to hospitalization, and 10% of patients died outside of a hospital. The authors concluded that approximately 12.5% of deaths may have been prevented by elective repair and advocated elective repair in those whose pre-operative mortality risk is less than 10% (20).

Gangopadhyay *et al.* reported outcomes of 171 consecutive laparoscopic PEH repairs from 1995 to 2005 in patients grouped by age (<65, 65–74, >75 years) (21). They found that patients in the older group had significantly higher American Society of Anaesthesiologists (ASA) scores ($P<0.05$) but similar rates of complications. Lengths of stay for patients >75 were higher than for those <65 (2.8 ± 2.4 vs. 1.9 ± 2.2 , $P<0.05$), and overall mortality was 0.6%. Upon follow up, recurrence occurred in 23.7% of patients and was lowest in the 65–74 age group, with only one of the 32 patients requiring surgical intervention (3.1%) for hernia recurrence. The authors concluded that a minimally invasive approach is safe and feasible for patients who are elderly or high risk undergoing elective repair (21).

Poulose *et al.* reviewed the 2005 Nationwide Inpatient Sample (NIS) to evaluate perioperative mortality of octogenarians undergoing PEH repair (10). They identified a 6-7-fold increase in mortality for emergency repair (16%) versus elective repair (2.5%) and higher length of stay (14.3 ± 0.9 vs. 7.0 ± 0.7 days, $P<0.05$). The authors concluded that an early elective repair may reduce overall mortality (10).

Polomsky *et al.* provided outcomes on 4,858 patients admitted with diagnosis of paraesophageal hernia in New York state from 2002–2006, with mean age of 65.2 years and 70% female (11). Fifty-three percent of the admissions were emergent, and of the emergent admissions, only 34% (859) required an operation. Mortality (5.1% vs. 1.1% , $P<0.0001$) and length of stay (13.1 vs. 4.9 days, $P<0.0001$) were higher for patients undergoing emergency operative intervention

versus elective repair. Odds of death increased by 9.7% per year of increased age (OR 1.1, CI: 1.07–1.12, $P<0.0001$). Costs were also higher in patients undergoing emergent compared to elective repairs ($P<0.0001$) (11).

In another retrospective review analyzing 127 consecutive PEH repairs from 2000 to 2006 at the University of Rochester, Polomsky *et al.* found that 23 (18.1%) required emergent surgery (12). Emergent repairs were associated with higher mortality (22% *vs.* 1%, $P=0.0007$), and were all associated with sepsis. There were also higher rates of major complications (30% *vs.* 3%, $P=0.0003$), minor complications (43% *vs.* 19%, $P=0.269$), admission to the ICU (22% *vs.* 2%, $P=0.0021$), and length of stay (21.5 *vs.* 5.7 days, $P<0.0001$). Those undergoing emergent repair were more likely to undergo open surgery than the elective group (74% *vs.* 21%, $P=0.0007$). Based on the increased morbidity and mortality, the authors suggest that all patients should undergo elective repair unless >90 years of age, prohibitive comorbidities, or completely asymptomatic (12).

Jassim *et al.* performed a retrospective analysis of the NIS from 2006–2008, capturing 8,482 patients undergoing PEH repair, with 74.2% having elective procedures (13). Patients undergoing emergent repair had higher morbidity (33.4% *vs.* 16.5%, $P<0.0001$), higher mortality (3.2% *vs.* 0.37%, $P<0.0001$), and lower rates of laparoscopic utilization (26.9% *vs.* 47.7%, $P<0.0001$). In multivariate analysis, younger age (1.061, CI: 1.039–1.084, $P<0.0001$), elective repair (0.310, CI: 0.176–0.544, $P<0.0001$), and laparoscopic approach (0.365, CI: 0.196–0.679, $P=0.0015$) were independently associated with decreased mortality. Given that younger patients undergoing elective, laparoscopic repair have improved outcomes, the authors advocate for elective repair with experienced surgeons. This study did not address preoperative symptoms (13).

Watchful waiting

Supporters of WW propose that the number of asymptomatic patients who ultimately become symptomatic, have complications, or require an emergency repair, is much less than earlier case series (4,5) have suggested (8,15,16). Surgery can lead to complications, including pulmonary complications, visceral injuries, vagal nerve injuries, and a high chance of recurrence, all of which can reduce quality of life in patients who initially had no symptoms.

In 2002, Stylopoulous *et al.* designed a Markov Monte Carlo decision analytic model to predict outcomes in AITS

patients who would either undergo WW or elective repair (3). In this model, the pooled probability of symptomatic progression, acute presentation, and mortality rate of emergency surgery were based off the 1997 NIS database and prior published studies. These hypothetical patients underwent the simulation which demonstrated that there is no gain in quality adjusted life years (QALY) for elective repair, and that surgery actually reduced QALYs by 0.13. The model inputs involved: the risk of developing life-threatening symptoms of 18% for a 65-year old patient, with risk of acute symptoms requiring emergency surgery being 1.16% per year, and overall lifetime mortality risk of 1%. WW was the optimal management strategy in 83% of patients, while only 17% would have benefited from elective repair. The study concludes that in AITS patients over the age of 65 undergoing laparoscopic repair, less than 1 in 5 would benefit from the surgery, and that the overall worsening of QALY dramatically increases as age increases. The authors add that only 1 in 10 AITS patients who are 85 years of age will benefit from an elective repair (3). Limitations of this study are that the simulation was limited to type II and III paraesophageal hernias, as well as patients over the age of 65.

A similar Markov model was published in 2018, which incorporated new data regarding morbidity and mortality of elective laparoscopic hernia repair (ELHR) and updated recurrence rates based on prospective studies (9). Jung *et al.* reported that WW resulted in greater QALY over ELHR in 82% of simulations, and that only 1 in 5 patients with asymptomatic PEH had better health outcomes with ELHR over WW (9). Compared to ELHR, WW was the superior strategy in 86% of patients over 80 years of age. This study assumed annual probability of hernia recurrence of 15.9%, where 55% of patients will have associated symptoms and decreased quality of life (9).

Beyond simulation models, updated population-based studies also demonstrate that mortality associated with emergency operation is much lower than previously feared. Augustin *et al.* queried the ACS-NSQIP database from 2009 to 2011 for patients undergoing elective versus emergent PEH repair (22). A total of 3498 patients were identified, with 95% having undergone elective operations. Of note, patients undergoing emergent operation were significantly older (71 *vs.* 62 years, $P<0.01$), more likely to have an ASA score of 3 or 4 (21.7% *vs.* 2.6%, $P<0.001$), more likely to have poor functional status (26.0% *vs.* 3.7%, $P<0.01$), and more likely to undergo open repair (63.4% *vs.* 17.9%, $P<0.001$). In an unadjusted analysis, patients requiring

emergent operation had 11 times greater odds of mortality compared with elective repair, but in multivariate analysis controlling for both patient and disease related factors, emergency surgery did not independently predict mortality. Rather, increased frailty and sepsis were driving factors towards mortality, while laparoscopic repair decreased odds of mortality. Without an emergent indication, many patients were not candidates for elective repair given their comorbidities (22).

Why does a controversy still exist?

Despite the numerous population studies, retrospective studies, and simulation models, perhaps the greatest unknown is the inability to accurately predict patients who will become symptomatic and require an emergent repair. Without that knowledge, clinicians are left guessing as to which patients will benefit from an elective repair. New technologies including volumetric paraesophageal hernia CT analysis may demonstrate benefit in identifying certain hernia characteristics predictive of emergent repair in the future (23). As the techniques for repair improve over time, morbidity and mortality rates for all PEH repairs have decreased (3,4,5,9), leading some to advocate for early elective repair of AITS.

There are many limitations of the current literature. Current national data registries have an inability to capture the true number of asymptomatic patients leading to overestimation of the prevalence of symptomatic patients. Additionally, many of the available studies are somewhat dated with regards to surgical technique, improved critical care, and a changing patient population. Simulation models designed to mimic the natural progression of asymptomatic PEH and subsequent repair is limited by the clinical assumptions and parameters set based on the current information that we have. There is mounting evidence that laparoscopic surgery decreases morbidity and mortality rates compared to open surgery for all patients (15,24-26), especially those undergoing emergency repairs (22,26). Laparoscopic approach to repair can be used to argue for both sides of the debate: early elective repair or WW. As this is felt to have improved outcomes for elective surgery and for emergent surgery if WW fails. In addition, patient characteristics may be more important for outcomes than the emergent status of surgery itself (22).

Concerns regarding PEH repair for ITS patients are due to low durability of repair and inability to improve quality of life with repair in the asymptomatic patient, with some

experiencing decreased quality of life due to the repair itself or recurrence. Recurrence rates vary substantially in the literature but can be over 50% with 5 years follow up (27). While it is impossible to improve quality of life in the asymptomatic patients, the argument for repair in symptomatic patients is more straightforward. Quality of life analysis after elective repair in symptomatic patients has been demonstrated to improve quality of life after repair from baseline at 2, 12, and 36 months (28), with another study demonstrating “good” to “excellent” GERD quality of life score results in 90% of patients (15).

Ultimately, randomized controlled trials and more current studies examining the natural progression of patients with AITS will be required to help understand the true incidence of symptomatic progression and risks of surgery compared with WW. Predictive models that are able to accurately identify patients at risk for symptom progression or acute presentation will also be crucial to the decision-making process.

Conclusions

In patients presenting with AITS, there is not conclusive data to support elective repair or watchful waiting definitively. Markov Monte Carlo models suggest that WW is superior to elective repair for most patients over the age of 65 with type II or III hernias. There is much less data regarding type IV hernias or PEH in younger patients. The risk of progression from AITS to a symptomatic ITS requiring emergent surgery appears to be low, which more recent literature also demonstrates reduced morbidity and mortality with laparoscopic repair in elective and emergent situations. Identification of predictive factors for symptom progression is needed. Asymptomatic patients with prohibitive risk, high frailty scores, and concomitant comorbidities have a high risk for perioperative morbidity and mortality and may not benefit from an elective repair.

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Footnote

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