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## Hiatal hernia – epidemiology, pathogenesis, diagnostic

## Przepukliny przeponowe – epidemiologia, patogenezą, diagnostyka

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hiatal hernia, fundoplication, gastroesophageal reflux

### Słowa kluczowe

przepuklina rozworu przełykowego, fundoplikacja, refluks żołądkowo-przełykowy

### Conflict of interest

#### Konflikt interesów

None  
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### Summary

Hiatal hernia is a common pathology in the field of surgery, the frequency of occurrence increases along with age. It is caused by an increase in intra-abdominal pressure and weakening of the diaphragm crura tissues. Sliding hiatal hernia and paraesophageal hernia are distinguished. Patients with diaphragmatic hernia reveal many non-specific symptoms which causes delay of proper treatment due to other diseases. The most frequently, patients present symptoms of gastroesophageal reflux and are treated conservatively with proton pump inhibitors.

Epidemiology of hiatal hernia occurrence has been analyzed along with their pathogenesis, symptomatology, the most frequently used diagnostic methods and therapeutic possibilities.

The type of applied procedure should depend on the size and type of hernia, preoperative symptoms and co-morbidities and current scientific reports. Surgical treatment brings satisfying therapeutic results and is connected with low risk of complications.

### Streszczenie

Przepuklina rozworu przełykowego jest częstą patologią, a częstość występowania rośnie wraz z wiekiem. Spowodowana jest wzrostem ciśnienia śródbrzusznego oraz osłabieniem tkanek odnóg przepony. Wyróżniamy przepuklinę wślizgową i przepuklinę okołoprzełykową. Pacjenci z przepukliną przeponową mają wiele niespecyficznych objawów, które sprawiają, że pacjenci leczeni są z powodu innych chorób, opóźniając właściwe leczenie. Najczęściej chorzy demonstrowują objawy refluksu żołądkowo-przełykowego i leczeni są zachowawczo inhibitorami pompy protonowej.

Przeanalizowano epidemiologię występowania przepuklin rozworu przełykowego, ich patogenezę, symptomatologię, najczęściej stosowane metody diagnostyczne oraz możliwości terapeutyczne.

Rodzaj podjętego leczenia musi być dostosowany do wielkości i rodzaju przepukliny, objawów przedoperacyjnych i chorób współistniejących oraz oparte na najnowszych doniesieniach naukowych. Leczenie chirurgiczne daje dobre efekty terapeutyczne i wiąże się z niskim ryzykiem.

### INTRODUCTION

Hiatal hernia is a frequent pathology and its frequency of occurrence increases along with age. Four types are distinguished: sliding hiatal hernia, paraesophageal hernia, mixed hiatal hernia and giant hiatal hernia. The first is the most frequent and is connected with reflux disease (1).

Patients with hiatal hernia present many different symptoms, such as thoracic pain, dyspnea, belching, heartburn, recurrent pneumonia, hoarseness, chronic cough, anemia caused by iron deficits. Non-specific symptoms are connected with the fact that patients are under control of different specialists and are treated due to different conditions such as asthma, COPD, cir-

culatory failure, angina, ulcerous disease (2). The most frequently, patients present symptoms of gastroesophageal reflux and are treated conservatively with proton pump inhibitors.

Literature reports that hiatal hernia coexisting with GERD brings better treatment results, lower number of remissions, higher improvement of quality of life after laparoscopic Nissen fundoplication than after conservative treatment with proton pump inhibitors. Surgical treatment is necessary in case of sliding hiatal hernia with reflux disease and paraesophageal hernia. However, perioperative risk should be considered for patients in advanced age and numerous co-morbidities when treatment with proton pump inhibitors brings

relief. In patients with non-symptomatic hiatal hernia, the operative risk should be compared with the risk of perioperative complications (3).

The first report on hiatal hernias has been published in 1853 by Bowditch (4). Hirsch in 1900, diagnosed hiatal hernia using X-ray (5). Akerlund in 1926 proposed the term hiatal hernia and classified its 3 types which are used until now (6).

## REVIEW

### Epidemiology

The frequency of occurrence of hiatal hernia increases along with age. Actual frequency of occurrence of hiatal hernia may only be estimated due to the fact that it brings only mild or no symptoms, and diagnostic criteria may differ. Clinical estimations report that approximately 50-60% of patients over 50 years old suffer from hiatal hernia (7, 8). The frequency of occurrence of symptomatic cases of hiatal hernia is strictly connected with the recognition of gastroesophageal reflux disease (GERD) due to the fact that both those conditions are strongly correlated (9, 10). Approximately 9% of hiatal hernias are symptomatic. Precise frequency of treated cases of GERD in large populations is difficult to verify but specific indexes for Western countries is within 10-20% (11-13).

Sliding hiatal hernia (type I) are significantly more frequent and consist of 90-95% of cases, esophageal type (type II) consists of only 5% where LES remains below the diaphragm and the stomach is relocated to the thorax.

Hiatal hernias occur the most frequently in highly developed countries of Northern America and Western Europe, and the most rarely in African and Eastern populations (14, 15). Some authors suggest that predispositions for hiatal hernia development include insufficient amount of fiber and high sitting position during defecation (16, 17).

### Pathogenesis

Hiatal hernia may be congenital or acquired. Among acquired hiatal hernias, traumatic and nontraumatic are distinguished. The most common types of hernia are acquired in non-traumatic manner. Nontraumatic acquired hernias are divided into four subtypes: sliding (type I) and paraoesophageal (type II). Mixed type with coexisting features of sliding and paraoesophageal hernia are also observed (type III). IV type of hiatal hernia is connected with short esophagus.

Sliding hiatal hernia is most common type of hiatal hernia. It occurs when the gastro-esophageal junction, along with the part of the stomach, migrates to the mediastinum through the esophagus (fig. 1). In the majority of patients with esophageal hernia, no symptoms are observed, in part of patients' symptoms of reflux are visible. This type of hernia interferes with the anti-reflux barrier mechanisms in several ways. The lower esophageal sphincter (LES) relocates from an area with positive pressure inside the abdominal cavity to the area of low pressure in the thorax, which interferes with the activity of the sphincter. What is more, the relaxation of diaphragm

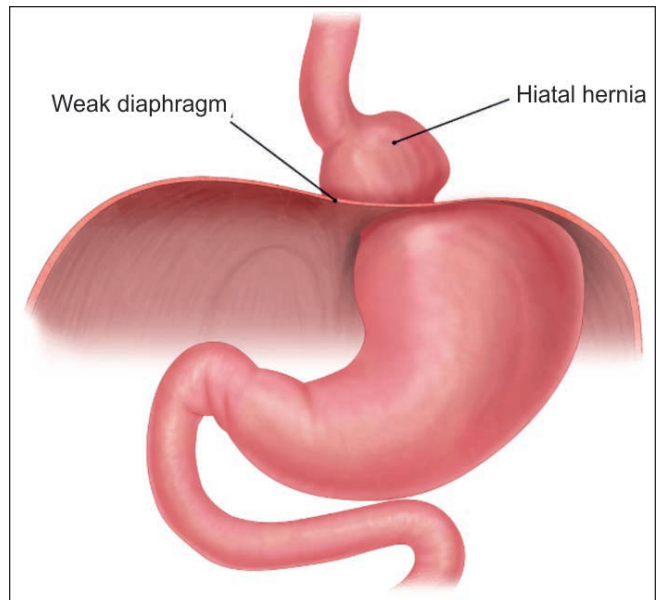


Fig. 1. Sliding hiatal hernia. Original Artwork by: <https://mexicobariatriccenter.com/hiatal-hernia-paraesophageal-peh/>

crura reduces the anti-reflux barrier of the esophagus. The Hiss angle is lost in the diaphragmatic hernia, which causes higher risk of regurgitation of gastric contents. These changes, not only predispose to reflux of gastric contents to the esophagus, but also prolong the time of acid contact with the esophageal epithelium causing chronic esophagitis, metaplasia of the epithelium.

In the paraoesophageal hernia, broadened diaphragmatic hiatus allow to relocate the stomach fundus to the thorax, the gastro-esophageal junction stays below the diaphragm (fig. 2). Within the time, the part of the stomach and other abdominal organs moved to the thorax are enlarged. In this type of hernia, the anatomical Hiss angle remains unchanged, so there is no gastro-esophageal reflux (18).

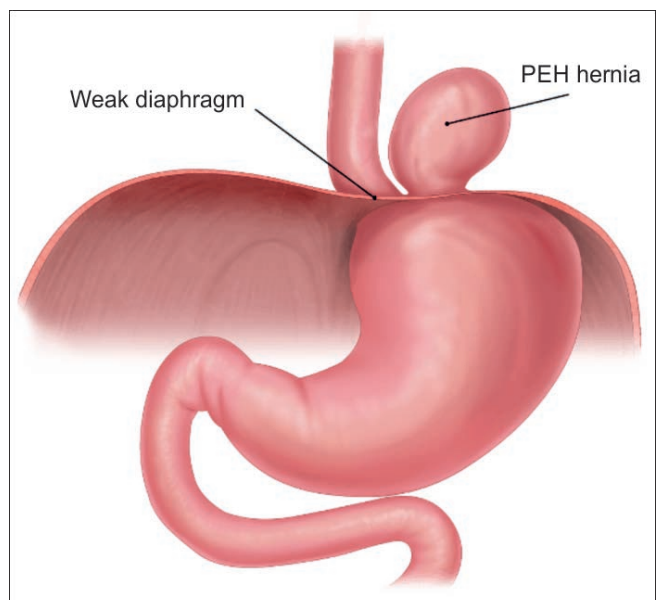


Fig. 2. Paraoesophageal hiatal hernia. Original Artwork by: <https://mexicobariatriccenter.com/hiatal-hernia-paraesophageal-peh/>

Many factors influence the development of hiatal hernia. Due to the increasing prevalence in older people, it is believed that muscle weakness and loss of flexibility with age predispose to the development of hiatal hernia. Along with decrease in elasticity, the cardia may not return to its natural position below the diaphragm in normal swallowing. Loss of muscular tension in the diaphragm crura also affect the development of diaphragmatic hernias. Another important factor predisposing to the development of hernias is the increase in intra-abdominal pressure. Obesity, as an increasingly common pathology, is associated with an increase in pressure in the abdominal cavity, and consequently, obese patients more often suffer from hernia. There is a theory that suggests a relationship between increased intra-abdominal pressure during pregnancy and hernia, which is a probable explanation for more frequent hiatal hernias in women. The presence of ascites in the course of, for example, cirrhosis, is also associated with the occurrence of esophageal hernia. Burkitt and James suggest that the western diet containing a small amounts of fiber leads to a state of chronic constipation and effort during defecation, which may explain the higher incidence of this condition in Western countries (19). Conditions, such as, chronic esophagitis may cause shortening of the esophagus, causing fibrosis of the longitudinal muscles and thus predisposing to the hiatal hernia.

Epigastric hernias tend to enlarge within the time, sometimes the entire stomach is in the thorax. The risk of incarcerated hernia is approximately 5%. This condition requires urgent surgical intervention. Due to the high mortality associated with this condition, planned surgery for paraoesophageal hernia is recommended (20-22).

Sihvo et al. recommended the surgery of paraoesophageal hernia, except for those with high surgical risk (20). The Swiss study by Larusson et al. states that age, the result of the American Society of Anesthesiologists (ASA) and the type of surgery are important prognostic factors in patients undergoing laparoscopic diaphragmatic hernia surgery (21). The researchers recommended caution in balancing surgical indications with coexisting diseases, age, symptoms and potentially life-threatening complications (21). Among the cardiac complications after laparoscopic procedures of large hiatal hernia, cardiac tamponade, esophageal fistula, arrhythmias are observed (23).

### Diagnostics

Esophageal hernia may be suspected in a patient during a careful investigation and physical examination. However, it should be emphasized that most patients have a low or asymptomatic seizure. Symptoms that patients report during gathering case history and the examination are mostly non-specific and may only suggest the presence of hiatal hernia (2). Diagnosis of hiatal hernia may be confirmed by radiological, endoscopic and manometric examination (24).

Typical complaints reported by a patient with symptomatic esophageal hernia may include heartburn, reflux, dull chest pain, dysphagia, swallowing pain (odynophagia), vomiting, bloody vomiting, early feeling of satiety, bloating, hoarseness and wheezing, shortness of breath, recurrent inflammations of the throat, larynx, lungs. None of the symptoms is pathognomy for hiatal hernia and may be associated with other diseases (2).

The contrast examination of the upper gastrointestinal tract is a basic test in patients with suspected diaphragmatic hernia (fig. 3). During the barium test, a spherical “phrenic ampulla” structure corresponding to the hernia is visible above the diaphragm (25, 26). The examination allows determination of the anatomy of the hernia and qualitative assessment of esophageal mobility. Due to anatomical conditions, the diagnosis of small hiatal hernia < 2 cm becomes impractical in barium contrast examination (27, 28).

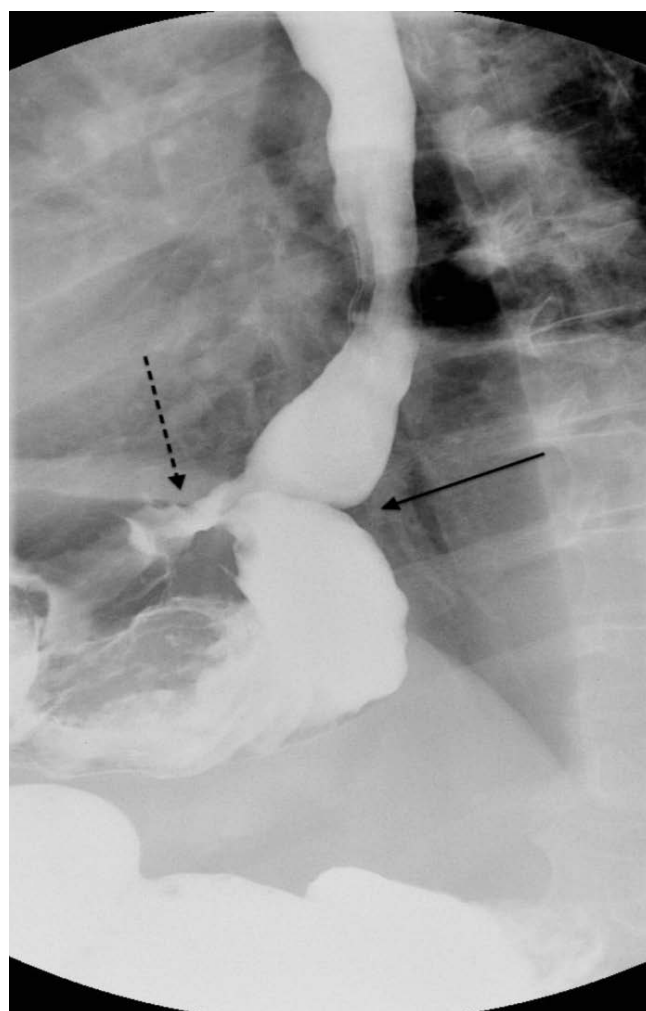


Fig. 3. Contrast upper gastrointestinal series

The use of endoscopy has become common over the past few decades and is now considered a standard method of diagnosing and treating upper gastrointestinal tract diseases (fig. 4). The most commonly accepted diagnostic criterion for endoscopic hiatal hernia is a proximal displacement of the gastro-esoph-

ageal junction > 2 cm above the diaphragmatic cavity (29, 30). The examination also evaluates the presence of esophagitis and esophageal dysplasia (31).

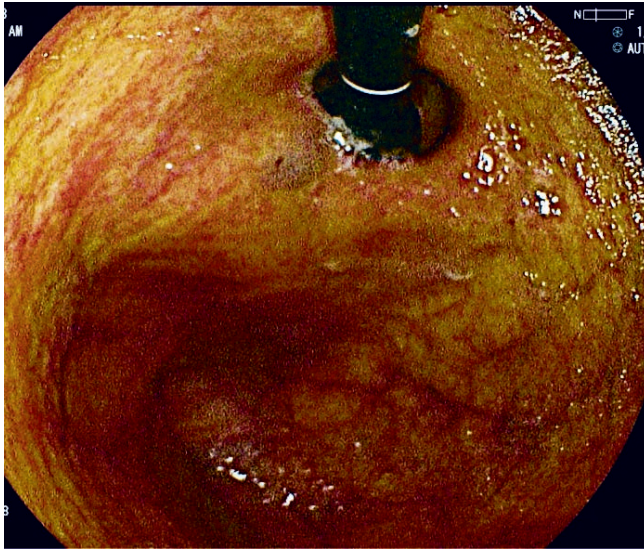


Fig. 4. Gastroscopy

CT or MRI scan may provide a three-dimensional reconstruction of the anatomy and the content of the hernia sac especially before planned surgery (fig. 5).

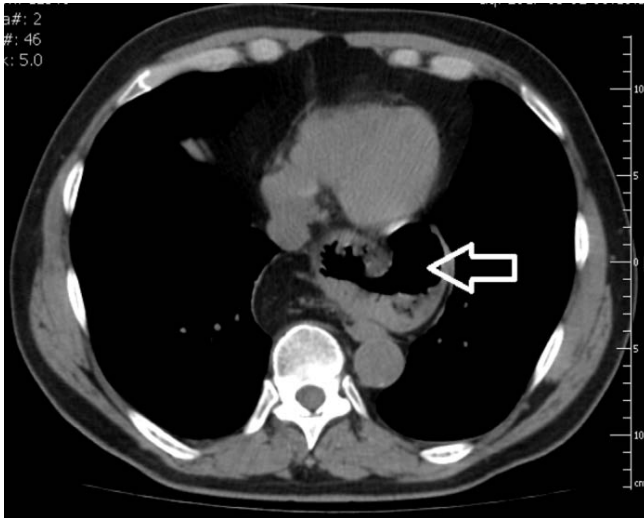


Fig. 5. CT

High resolution esophageal manometry (HRM) is another diagnostic tool for hiatal hernia (32). In the Weijenborg study evaluating HRM records, endoscopic reports and barium esophagus results, HRM had a sensitivity of 92% and a specificity of 95% for identifying hiatal hernia compared with 73% of the sensitivity of endoscopy and radiography (33).

### Therapeutic possibilities

Proper and early diagnostics followed by immediate treatment allow to avoid complications related to esophageal hernia. The most common complications of untreated hiatal hernia with or without GERD include Barrett's esophagus and esophageal cancers, Mallory-Weiss Syndrome, chronic gastritis, lower esopha-

gus stenosis, esophageal ruptures, recurrent aspiration respiratory tract infections of (34).

The first planned surgical procedure has been performed almost 100 years ago by Soresi in 1919. The 20<sup>th</sup> century is the dynamic development of surgical techniques, initially classical and now laparoscopic (35).

The surgery of diaphragmatic hernia aims at relocation of the stomach and other organs from the thorax to the abdominal cavity, removal of the hernia sac and bringing diaphragm crura closer. Not all patients with diagnosed hiatal hernia must be a subject to surgery. The occurring complications of GERD, such as stenoses, ulcerations and bleeding, despite aggressive pharmacological treatment are an indication for surgical treatment, especially in young patients. Moreover, complications of the respiratory system, recurrent aspiration pneumonia require surgery. Patients who have been diagnosed with a paraoesophageal hernia should be subject to a planned operation due to serious complications.

Hiatal hernia repair surgery may be performed using an open or laparoscopic method, which is now used more frequently (36). These procedures provide relief of symptoms in 80-90% of patients with low mortality and morbidity.

The most common type of surgery currently being performed is Nissen's fundoplication. The procedure involves enlacement of the fundus around the gastroesophageal junction by 360° and reducing the light of the esophagus by applying sutures to the diaphragm crura. The surgery may be supplemented with gastropexy, which is, placement of the stomach below the diaphragm using sutures (37) (fig. 6).

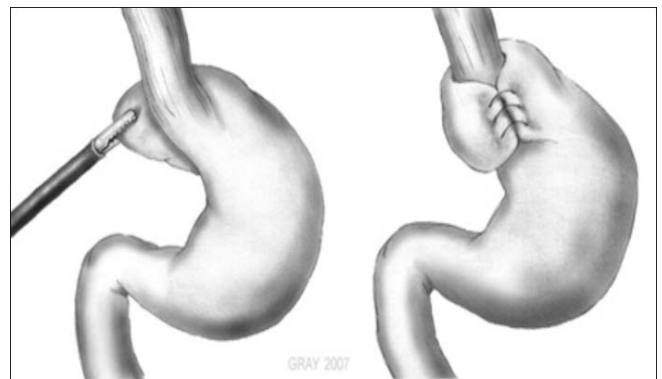


Fig. 6. Nissen fundoplication. Original Artwork by James P. Gray, M.D. 2007

The next frequently performed procedure is the Toupet operation, which is a variation of the Nissen operation and involves enlacement of the fundus around the esophagus by 180°. It aims to reduce the probability of post-operative dysphagia, which often occurs after Nissen's fundoplication.

In patients with large diaphragmatic defects, especially in the paraoesophageal type, in which it is not possible to close the diaphragm with sutures, synthetic meshes may be used (38-40).

### CONCLUSIONS

The development of hiatal hernia imaging techniques, understanding the pathophysiology of

the disease and the creation of effective drugs for the treatment of gastro-esophageal reflux led to the elaboration of an algorithm for qualifying and therapeutic procedures. Observation of the results of surgical treatment, complications and inconven-

niences in operated patients resulted in the development of various surgical methods. Surgical procedures in cases of hiatal hernia and gastro-esophageal reflux require basic knowledge about current scientific reports.

## BIBLIOGRAPHY

- Hyun JJ, Bak Y-T: Clinical significance of hiatal hernia. *Gut and Liver* 2011; 5(3): 267-277.
- Mackiewicz A, Wojtun S, Gil J: Noncardiac chest pain. *Pediatr Med Rodz* 2013; 9(1): 25-31.
- Korzonek M, Dziergas A, Kuczynska M: Gastroesophageal reflux disease – current problem. *Forum Med Rodz* 2014; 8(5): 201-210.
- Bowditch HI: A treatise on diaphragmatic hernia. Jewettthomas, Buffalo 1853.
- Schwarz GS: Historical aspects of the anatomy of the cardia with special reference to hiatus hernia. *Bull N Y Acad Med* 1967; 43: 112-125.
- Akerlund A, Onnell H, Key E: Hernia diaphragmatica hiatus oesophagei vomanastomischen und roentgenologischengesichtspunkt. *Acta Radiol* 1926; 6: 3-22.
- Goyal Raj K: Chapter 286. Diseases of the Esophagus. *Harrison's Principles of Internal Medicine*. McGraw Hill Medical, New York 2008.
- Mittal RK: Hiatal hernia: myth or reality? *Am J Med* 1997; 103: 33S-39S.
- Skinner DB: Pathophysiology of gastroesophageal reflux. *Ann Surg* 1985; 202: 546-556.
- Petersen H, Johannessen T, Sandvik AK et al.: Relationship between endoscopic hiatus hernia and gastroesophageal reflux symptoms. *Scand J Gastroenterol* 1991; 26: 921-926.
- Des B, Varannes S, Marek L et al.: Gastroesophageal reflux disease in primary care. Prevalence, epidemiology and quality of life of patients. *Gastroenterol Clin Biol* 2006; 30: 364-370.
- Dent J, El-Serag HB, Wallander MA et al.: Epidemiology of gastro-oesophageal reflux disease: a systematic review. *Gut* 2005; 54(5): 710-717.
- Spechler SJ: Epidemiology and natural history of gastro-oesophageal reflux disease. *Digestion* 1992; 51 (suppl. 1): 24-29.
- Chang CS, Poon SK, Lien HC et al.: The incidence of reflux esophagitis among the Chinese. *Am J Gastroenterol* 1997; 92: 668-671.
- Fujimoto K: Review article: prevalence and epidemiology of gastro-oesophageal reflux disease in Japan. *Aliment Pharmacol Ther* 2004; 20 (suppl. 8): 5-8.
- Burkitt DP: Hiatus hernia: is it preventable? *Am J Clin Nutr* 1981; 34(3): 428-431.
- Sontag S: Defining GERD. *Yale J Biol Med* 1999; 72(2-3): 69-80.
- Polomsky M, Peters JH, Schwartz SI: Hiatal hernia and disorders of the spine: a historical perspective. *Dis Esophagus* 2012; 25(5): 367-372.
- Burkitt DP, James PA: Low-residue diets and hiatus hernia. *Lancet* 1973; 2(7821): 128-130.
- Sihvo EI, Salo JA, Rasanen JV et al.: Fatal complications of adult paraesophageal hernia: a population-based study. *J Thorac Cardiovasc Surg* 2009; 137(2): 419-424.
- Larusson HJ, Zingg U, Hahnloser D et al.: Predictive factors for morbidity and mortality in patients undergoing laparoscopic paraesophageal hernia repair: age, ASA score and operation type influence morbidity. *World J Surg* 2009; 33(5): 980-985.
- Szelachowski P, Strutyńska-Karpinska M, Grabowski K et al.: Massive hiatal hernia-presentation of one case. *Adv Clin Exp Med* 2006; 15(2): 389-391.
- Fernandez MC, Diaz M, Lopez F et al.: Cardiac complications after laparoscopic large hiatal hernia repair. Is it related with staple fixation of the mesh? Report of three cases. *Ann Med Surg (Lond)* 2015; 4(4): 395-398.
- Banks M: The modern investigation and management of gastro-oesophageal reflux disease (GERD). *Clinical Medicine* 2009; 6(9): 600-604.
- Lin S, Brasseur JG, Poudereux P et al.: The phrenic ampulla: distal esophagus or potential hiatal hernia? *Am J Physiol* 1995; 268(2 Pt 1): G320-G327.
- Kahrilas PJ: Hiatus hernia causes reflux: fact or fiction? *Gullet* 1993; 3(1 suppl.): 21-30.
- Dodds WJ, Walter B: Cannon Lecture: current concepts of esophageal motor function-clinical implications for radiology. *AJR Am J Roentgenol* 1977; 128: 549-561.
- Ott DJ, Gelfand DW, Chen YM et al.: Predictive relationship of hiatal hernia to reflux esophagitis. *Gastrointest Radiol* 1985; 10: 317-320.
- Bytzer P: Information bias in endoscopic assessment. *Am J Gastroenterol* 2007; 102: 1585-1587.
- Johnson LF, Demeester TR, Haggitt RC: Endoscopic signs for gastro-oesophageal reflux objectively evaluated. *Gastrointest Endosc* 1976; 22: 151-155.
- Gyawali CP, Kahrilas PJ, Savarino E et al.: Modern diagnosis of GERD: the Lyon Consensus. *Gut* 2018; 67: 1351-1362.
- Ott DJ, Glauser SJ, Ledbetter MS et al.: Association of hiatal hernia and gastroesophageal reflux: correlation between presence and size of hiatal hernia and 24-hour pH monitoring of the esophagus. *Am J Roentgenol* 1995; 165: 557-559.
- Weijnenborg PW, van Hoeij FB, Smout AJ et al.: Accuracy of hiatal hernia detection with esophageal high-resolution manometry. *Neurogastroenterol Motil* 2015; 27(2): 293-299.
- Gray DM, Kushnir V, Kalra G et al.: Cameron Lesions in Patients with Hiatal Hernias: Prevalence, Presentation, and Treatment Outcome. *Dis Esophagus* 2015; 28(5): 448-452.
- Stylopoulos N, Rattner DW: The History of Hiatal Hernia Surgery: From Bowditch to Laparoscopy. *Annals of Surgery* 2005; 241(1): 185-193.
- Migaczewski M, Grzesiak-Kuik A, Pedziwiatr M et al.: Laparoscopic treatment of type III and IV hiatal hernia – authors' experience. *Videosurger Miniinv* 2014; 2: 157-163.
- DeMeester TR, Peters JH: Surgical treatment of gastroesophageal reflux disease. [In:] Castell DO (ed.): *The Esophagus*. Mass, Little, Brown and Company, Boston 1995: 577-617.
- Petersen LF, McChesney SL, Daly SC et al.: Permanent mesh results in long-term symptom improvement and patient satisfaction without increasing adverse outcomes in hiatal hernia repair. *Am J Surg* 2014; 207(3): 445-448.
- Hazebroek EJ, Leibman S, Smith GS: Erosion of a composite PTFE/ePTFE mesh after hiatal hernia repair. *Surg Laparosc Endosc Percutan Tech* 2009; 19(2): 175-177.
- Soricelli E, Basso N, Genco A et al.: Long-term results of hiatal hernia mesh repair and antireflux laparoscopic surgery. *Surg Endosc* 2009; 23(11): 2499-2504.

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