



# Foramen of Winslow Hernia: a Review of the Literature Highlighting the Role of Laparoscopy

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## Abstract

Foramen of Winslow hernia (FWH) is an extremely rare entity accounting for up to 8% of internal hernias and 0.08% of all hernias. Only 150 cases of FWH have been described in the literature to date with a peak incidence between the third and sixth decades of life. Three main mechanisms seem to be implicated in the FWH pathogenesis: (a) excessive viscera mobility, (b) abnormal enlargement of the foramen of Winslow, and (c) changes in the intra-abdominal pressure. The presence of an abnormally long bowel, enlargement of the right liver lobe or cholecystectomy, a “wandering cecum,” and defects of the gastrohepatic ligaments are some reported predisposing factors. Timely diagnosis through computed tomography facilitates the appropriate treatment before complications are evident. Although open repair has been mostly utilized, recently laparoscopic approach seems to gain ground due to the encouraging preliminary results. To date, the debate continues as to whether prophylactic measures to prevent recurrence of the FWH need to be undertaken: closure of the foramen, fixation of the highly mobilized viscera, or both.

**Keywords** Foramen of Winslow · Internal hernia · Intestinal incarceration

## Introduction

Internal hernia is a rare category of abdominal hernias accounting for only a small percentage (0.2–0.9%) of all instances of intestinal obstruction.<sup>1</sup> Due to the difficulty in early

diagnosis and timely treatment, internal hernias could present at the time of treatment as strangulating closed-loop obstruction and delay in surgical intervention is responsible for a high mortality rate (49%).<sup>2</sup> Foramen of Winslow hernia (FWH) is an extremely rare kind of internal hernias. Due to its rarity, it is often overlooked and can be related to a high mortality rate.

The foramen of Winslow, otherwise known as the epiploic or omental foramen, is a normal orifice that allows virtual communication between the greater and lesser peritoneal cavities.<sup>3</sup> Anatomically, it is defined by the right, free border of the hepatoduodenal ligament anteriorly, the inferior vena cava covered by the peritoneum posteriorly, the caudate lobe of the liver superiorly, and the first portion of duodenum and the hepatic artery inferiorly. Under normal circumstances, the foramen of Winslow remains closed as a result of the intra-abdominal pressure that does not allow viscera to herniate.<sup>1</sup>

Due to its rarity, there are no established algorithms for the management of patients with FWH. In the previous decades, the majority of FWH diagnoses were set during laparotomies for small bowel obstruction.<sup>3</sup> With the widespread availability of cross-sectional imaging, early diagnosis and prompt management can be achieved.<sup>4</sup> In this setting, surgical intervention can be offered before ischemia occurs. Experience, however, remains sparse, and technical difficulties may be encountered.

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The aims of this review are to present, analyze, and critically evaluate the epidemiology, the predisposing factors, the role of imaging, the treatment strategy, and the current debates on the management of patients with FMH, highlighting the emerging role of laparoscopy.

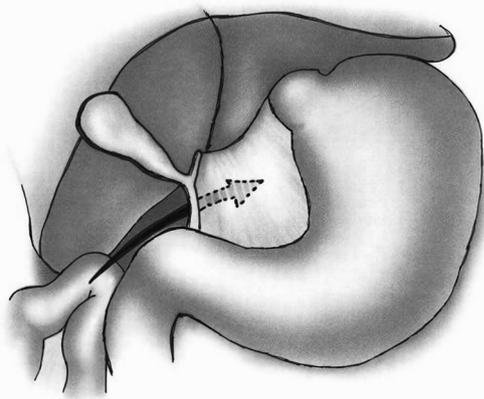
## Epidemiology and Classification

Hernias through the foramen of Winslow are extremely rare accounting for up to 8% of internal hernias and 0.08% of all hernias in general.<sup>5</sup> Nearly 150 cases of FWH have been described in the literature to date<sup>6, 7</sup> showing a slight predominance in males (male/female ratio = 2.5:1).<sup>5</sup> FWH displays a peak incidence between 20 and 60 years of age<sup>5</sup>; yet, sporadic neonatal cases of FWH associated with rotation abnormalities of the mid-gut have been reported.<sup>8</sup> In about 2/3 of FWH cases, small bowel (including ileum) is the herniating viscus followed by the cecum or ascending colon.<sup>9, 10</sup>

The classification of FWH is based upon the organ involved (Fig. 1): type I, small bowel (~65% of all cases)<sup>1, 5, 11</sup>; type II, terminal ileum, cecum, and ascending colon (~25%); type III, transverse colon (~7%)<sup>12</sup>; and, finally, type IV, gallbladder, or any other intra-abdominal structure such as the greater omentum.<sup>13, 14</sup> This condition is rare, is difficult to diagnose, and does not always have obvious risk factors to predict which organ will be affected. Given its nonspecific symptomatology, delayed diagnosis is often observed, resulting in high morbidity and mortality rates (36–49%).<sup>5</sup>

## Predisposing Factors

Herniation through the foramen of Winslow is rare due to the normal architecture of the internal organs that prevents them from entering into this orifice and the normal intra-abdominal pressure that keeps the peritoneal orifice closed. Although risk factors for internal herniation still remain unclear, quite a few



**Fig. 1** Illustration of the mechanism of herniation in foramen of Winslow

have been described in the literature so far (Table 1). Three main mechanisms seem to be implicated in the FWH pathogenesis: (a) excessive viscera mobility, (b) abnormal enlargement of the foramen of Winslow, and (c) changes in the intra-abdominal pressure.

Increased mobility of the bowel occurs with the presence of an abnormally long bowel mesentery or the persistence of the ascending mesocolon.<sup>1, 3, 12</sup> In addition, enlargement of the right liver lobe or cholecystectomy may direct the mobile intestinal loops into the foramen<sup>3</sup> and the failure of fusion between the right colon and the parietal peritoneum (“wandering cecum”)<sup>11</sup> enhances the possibility of herniation,<sup>11</sup> as do the defects in the gastrohepatic ligament. Moreover, greater omentum atrophy and a short transverse mesocolon confer to the reduced tension and increased mobility of those structures.<sup>6</sup>

Abnormal enlargement of the foramen is another strong determinant of the FWH occurrence. This is predefined genetically with an orifice of about 3 cm sufficient to permit viscera herniation.<sup>1, 13</sup> On the other hand, an acquired factor is the increase in the abdominal pressure as occurs during pregnancy or immediate postprandial periods.<sup>3, 7</sup> In that context, distal obstructive colonic lesions could increase intra-abdominal pressure and predispose formation of FWHs. Of note, overeating has also been described as a risk factor.<sup>7</sup> Although the aforementioned risk factors have been postulated to date, these have only been described on the basis of case reports or case series and not verified through larger cohort studies.

## Symptoms

Generally, symptoms are nonspecific and may be triggered by changes in the intra-abdominal pressure (pregnancy, postprandial period). This usually leads to misdiagnosis and significant delay in appropriate clinical management. In most cases, symptoms are related to bowel obstruction and occasionally to gastric outlet obstruction; acute pain in the upper abdomen often radiating to the left hypochondrium, the left shoulder, or the back, and less frequently nausea and vomiting are present.<sup>15</sup> A few may have a history of chronic or recurrent abdominal pain before the acute episode, presumably due to incomplete, self-reducing herniation. Jaundice due to the compression of extrahepatic biliary tract is not always evident.<sup>6</sup> The severity of the pain is related to the presence of bowel strangulation with subsequent necrosis. Palpation of the herniated mass is rarely possible, while peristalsis is often present or hypoactive; therefore, clinical examination rarely helps.<sup>9</sup>

## Diagnosis

Timely diagnosis is mandatory to prevent the possible complications of a herniated organ such as the

**Table 1** Risk factors for the development of FWH

Mechanism	Comments
Excessive viscera mobility	Abnormally long bowel mesentery or the persistence of the ascending mesocolon <sup>1, 3, 12</sup> Enlargement of the right liver lobe or cholecystectomy directs the mobile intestinal loops into the foramen <sup>3</sup> Failure of fusion between the right colon and the parietal peritoneum (“wandering cecum”) <sup>11</sup> enhances the possibility of herniation, <sup>11</sup> as do the defects in the gastrohepatic ligament Greater omentum atrophy and a short transverse mesocolon confer to the reduced tension and increased mobility of those structures <sup>6</sup>
Enlarged foramen of Winslow	Genetically predefined An orifice of about 3 cm is sufficient to permit viscera herniation
Changes in intra-abdominal pressure	This occurs during pregnancy or immediate postprandial periods <sup>3, 7</sup> Distal obstructive colonic lesions can also increase intra-abdominal pressure and provide a substrate for the formation of FWHs Overeating has also been described as a risk factor <sup>7</sup>

*FWH*, foramen of Winslow hernia

strangulation or necrosis associated with compromised patient outcomes.<sup>5</sup> In the past, diagnosis was mostly established during emergency laparotomy, since plain abdominal radiography cannot provide details about the exact anatomic location of the hernia. Abdominal plain film may be valuable only when small bowel obstruction is present. In a world literature review up to 1977, Ohkuma et al. found that only 11 out of 115 (9.6%) cases were correctly diagnosed preoperatively on the basis of either plain abdominal radiographs or contrast studies.<sup>16</sup> The key point on supine and erect abdominal radiographs is the presence of gas-containing intestinal loops in the left upper abdomen, medial to the lesser curvature of the stomach causing displacement of the stomach laterally and anteriorly. The transverse colon may be displaced inferiorly by the hernia and lie below this abnormal gas collection.<sup>17</sup> If the large bowel, particularly cecum and ascending colon, is involved in the hernia, no bowel gas or fecal material will be evident in the right iliac fossa. However, x-ray is neither sensitive nor specific in diagnosing a FWH.

Nowadays cross-sectional imaging is considered the diagnostic modality of choice. The recent advent of multi-detector computed tomography (MDCT) has completely altered the course of the FWHs, given the high accuracy, high-resolution images, multiplanar reconstructions, and vascular volume rendering this modality provides.<sup>11</sup> Classical findings are the following: (a) the presence of mesenteric adipose tissues and intestinal loops behind the hepatic pedicle, (b) abnormal localization of the cecum, (c) gas and/or fluid in the lesser sac with a “bird’s beak” pointing towards the epiploic foramen, (d) evidence of bowel obstruction in the lesser sac, associated with mesenteric vessels stretching anteriorly to the inferior vena cava and posteriorly to the portal vein, and (e) displacement of the stomach anteriorly and laterally<sup>5, 13</sup>

(Fig. 2). When the ileum is the herniated organ, it often creates a closed-loop obstruction behind the portal vein and this may cause portal vein compression and narrowing by the herniated ileum. Thus, portal vein narrowing could be other useful sign in diagnosing the hernia through the foramen of Winslow.<sup>4</sup>

Another possibility of the CT scan is the accurate detection of bowel ischemia or necrosis. This can be seen even in the case of intraperitoneal gas or bowel wall thickening, ascitic fluid, and absence of intestinal mural enhancement after contrast injection.<sup>1, 3, 11</sup> On the other hand, abdominal ultrasounds are not appropriate in the FWH setting since the interference of gas does not permit visualization of the lesser sac.<sup>11</sup> Finally, although barium enema study may efficiently show the herniated bowel in the foramen of Winslow, this is not considered first option imaging modality in the setting of acute abdomen.<sup>12</sup>



**Fig. 2** Coronal CT of the abdomen. White arrow identifies the herniated cecum and red arrow identifies the stomach

**Table 2** Laparoscopic management of FWH

First author	Year	Heriated viscera	Bowel resection	Bowel decompression	Prevention of recurrence	Follow-up	Comments
Ichikawa	2017	Ileum	No	No	None	6 days	12-mm umbilical port and three 5-mm working ports in the epigastrium, right hypochondria, and right lumbar regions
Brandão	2016	Transverse colon	No	No	Foramen closure	15 months	None
Duinhouwer	2016	Ascending colon	No	NR	Foramen closure	6 months	None
Daher	2016	Cecum, terminal ileum, appendix	No	Yes	Cecopexy, prophylactic appendicectomy	6 months	12-mm supraumbilical port and three 5-mm working ports in the left lumbar, right lumbar and epigastric regions
Garg	2016	Cecum, terminal ileum, appendix	No	No	Foramen closure, appendicectomy, cecopexy	1 day	11 mm infraumbilical port, one right lateral 5 mm port and one left lateral 5 mm port
Hansberger	2014	Cecum, terminal ileum	RHC due to ischemia	Yes	Foramen closure	21 months	12-mm optical port in the supraumbilical position using the umbilical stalk cut down technique, two 5-mm working ports placed in the left lateral abdominal and suprapubic regions, an additional subxiphoid 5-mm incision for liver retraction
Ryan	2014	Right colon	No	No	Appendicectomy	NR	None
Numata	2013	Gallbladder	No	No	Cholecystectomy	17 days	None
May	2013	Small bowel	No	Gallbladder punctured	Foramen closure	7 days	None
Lin	2013	Terminal ileum	No	No	None	NR	None
Yamashiro	2013	Ileum	Ileum resection due to ischemia	No	None	14 days	None
Clough	2011	Transverse colon	No	No	None	4 months	Two 5-mm working ports on the left side of the abdomen and atraumatic graspers.
Van Daele	2011	Cecum, right colon	No	No	None	6 days	None
Webb	2009	Colon	No	No	NR	NR	None
Izumi	2009	Gallbladder	No	No	Cholecystectomy	NR	None

*FWH*, foramen of Winslow hernia; *RHC*, right hemicolectomy; *NR*, not reported

## Surgical Treatment: Open Approach

Operative management is the treatment of choice for FWHs. Although spontaneous reduction of the hernia may occur, surgical management is considered mandatory in order to avoid the consequences of viscera strangulation, necrosis, and eventually bowel resection.<sup>3, 5</sup> Throughout the literature, urgent laparotomy has been consistently reported as a treatment method, although laparoscopic approach seems to gain ground recently.<sup>13, 14, 18</sup>

Most reports describe reduction of the herniated organ via gentle traction or by opening the lesser sac.<sup>3, 5, 7, 10</sup> The latter may be necessary in case the reduction is difficult due to massive colonic dilatation; in that setting, a wide Kocher's maneuver or opening of the gastrohepatic ligaments may be necessitated.<sup>19</sup> Needle decompression is another useful method to facilitate gentle reduction.<sup>20, 21</sup> When signs of necrosis are present, it is imperative to perform bowel resection with primary anastomosis.<sup>4, 21</sup> It is, therefore, advisable that urgent laparotomy be performed before irreversible ischemia occurs, since this reduces morbidity and mortality FWH rates.<sup>5</sup> Besides reduction of the hernia, closure of the foramen of Winslow or right colonic fixation or cecopexy may be performed in order to avoid further recurrences.

However, there are no definite criteria on these preventive strategies yet.

## Laparoscopic Treatment of FWH

Since the first successful reports of laparoscopic FWH repair in 2009,<sup>13, 22</sup> several studies have advocated that laparoscopic approach should be performed for preoperative diagnosis and if feasible for the bowel resection. In order to assess the role of laparoscopy in the treatment of FWH, we performed an extensive literature search and identified 15 case reports on the field.<sup>4, 13, 14, 18, 20–30</sup> Table 2 summarizes the characteristics of the procedure, type of visceral herniation, concomitant bowel resection, bowel decompression, and methods to prevent hernia recurrence. The most frequent viscera herniating through the foramen of Winslow was the ileum [40% (6/15)] followed by the cecum [26.7% (4/15)]. Right/ascending colon was implicated in 3 cases, while transverse colon in 2. Bowel resection was employed in 2 cases both due to the presence of ischemia (1 right hemicolectomy, 1 ileum resection).

Regarding the technical aspects of the procedure, four trocars were routinely placed, one 12-mm supraumbilical (or infraumbilical<sup>26</sup>) and another three 5-mm ports in the left and right lumbar regions as well as the epigastrium. Overall, bowel decompression was used in 2 cases (13.3%), while gallbladder puncture was necessary in one case to reduce a highly tense gallbladder hernia.<sup>14</sup> In order to prevent hernia recurrence, closure of the Winslow foramen was employed in

4 cases either with simple stitches<sup>25</sup> or with mobilized omentum.<sup>21, 26, 29</sup> Cecopexy was also utilized in 2 cases.<sup>20, 26</sup> Of note, Garg et al. performed both foramen obliteration with omentum and cecopexy.<sup>26</sup> On the contrary, no prophylactic measures were taken in 5 cases.<sup>4, 24, 27, 28, 30</sup> None of the patients—with or without foramen closure—experienced postoperative complications and all were healthy at the time of last follow-up (range, 1 day–21 months).

## Debates

The debate continues as to whether prophylactic measures to prevent recurrence of the FWH need to be undertaken: closure of the foramen, fixation of the highly mobilized viscera, or both. Although some surgeons oppose the closure of the foramen due to the potential significant negative consequences such as portal vein thrombosis or damage to the portal vein, hepatic artery, or bile ducts, others are in favor of the closure but with great caution. Controversy on the usefulness of this preventive measure may be justified by the fact that no evidence on recurrent herniation exists to date, probably due to adhesions obliterating the foramen and tethering the remainder of the small bowel.<sup>5</sup> However, if closure is decided, whether simple stitches<sup>25</sup> or mobilized omentum<sup>21, 26, 29</sup> has to be utilized is another issue. Instead, fixation of the hypermobile colon to the parietal peritoneum or cecopexy to the lateral abdominal wall may be an alternative<sup>20, 26</sup>; yet the effectiveness of these measures still needs to be established through larger cohort studies.

## Conclusions

FWH is an extremely rare entity that needs to be managed operatively. Timely diagnosis through computed tomography facilitates the appropriate treatment before complications are evident. Laparoscopic approach seems to be a safe and efficient alternative to laparotomy. However, whether or not the foramen should be closed still remains under question.

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Data acquisition: DM, DIT  
Analysis and data interpretation: DM, DIT  
Drafting of the manuscript: DM, DIT, BY, KAS  
Critical revision: DM, DIT, BY, KAS, ADG, PAF, ES, RS  
Supervision: DM, RS

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

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Learning Objectives for patients with Foramen of Winslow Hernia (FWH)

- To define its epidemiology and pathogenesis
- To describe the diagnostic approach including classification, symptoms and imaging algorithms
- To describe current practices in its surgical treatment
- To describe the role of laparoscopy in the treatment armamentarium of such patients

CME/MOC Questions:

1. Foramen of Winslow is an anatomic space which is defined by all the below EXCEPT:

- hepatoduodenal ligament anteriorly
- inferior vena cava
- caudate lobe of the liver
- Second portion of duodenum

2. Which is the most common organ involved in FWH?

- Cecum
- Greater omentum
- Small bowel
- Stomach

3. Which of the below is not a risk factor for FWH?

- A) excessive viscera mobility
  - B) abnormal enlargement of the foramen of Winslow
  - C) changes in the intra-abdominal pressure
  - D) Female gender
4. Which of the therapeutic options below should not be considered in the majority of patients with FWH?
- A) Laparoscopic repair
  - B) Open repair
  - C) Watchful waiting and conservative management
  - D) Bowel resection and cecopexy
5. Which of the following best represents the prevalence of FWH?
- A) 0.1-0.5%
  - B) 5-10%
  - C) 15-20%
  - D) more than 20%
6. Which of the following is NOT a CT finding indicative of FWH?
- A) Abnormal localization of cecum
  - B) Gas and/or fluid in the lesser sac
  - C) Mesenteric adipose tissue & intestinal loops behind hepatic pedicle
  - D) Presence of intestinal loop in the greater sac
7. What is the most sensitive imaging modality for the detection of FWH-related acute abdomen?
- A) CT-scan
  - B) Ultrasound
  - C) Barium enema
  - D) Abdominal X-ray
8. Which age period is associated with the peak incidence of FWH?
- A) <20 years
  - B) 20-60 years
  - C) 60-80 years
  - D) >80 years