

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.theijs.com

Internal hernia: Complex diagnostic and therapeutic problem

Hizir Akyildiz^{a,*}, Tarik Artis^a, Erdogan Sozuer^a, Alper Akcan^a, Can Kucuk^a, Emine Sensoy^a, Ibrahim Karahan^b^a Department of General Surgery, Erciyes University School of Medicine, 38039 Kayseri, Turkey^b Department of Radiology, Erciyes University School of Medicine, 38039 Kayseri, Turkey

ARTICLE INFO

Article history:

Received 4 March 2009

Received in revised form

31 March 2009

Accepted 7 April 2009

Available online 5 May 2009

Keywords:

Acquired internal hernia

Congenital internal hernia

Intra-abdominal sepsis

ABSTRACT

Introduction: Internal hernias are neglected, life threatening and generally mismanaged surgical pathologies. They may be either acquired or congenital. The mortality and morbidity rates differ between the types and unfortunately reports investigating them are very rare, with limited number of patients, and mostly case reports. In this one of the largest series of the literature, we aimed to evaluate the resemblances and the differences between these two types.

Methods: From January 2001 to April 2008, 25 patients who underwent surgery for an internal hernia were evaluated. Patients were divided into two groups; group I consisted of patients with acquired internal hernia, and group II with congenital internal hernia. The patients' records, imaging modalities, and operative findings were recorded and analyzed statistically.

Results: Group I consisted of 16 patients whilst group II consisted of nine patients. There were no significant differences between the groups with regard to gender, patients' complaints, clinical and laboratory findings, imaging modalities, types of surgical procedures, and laparotomy time. Group I was significantly older, had significantly longer length of hospital stay (13.6 ± 2.3 days versus 7.2 ± 1.4 days) and had significantly higher postoperative mortality rate (43.8% in group I and 22.2% in group II, $p < 0.01$).

Conclusion: Acquired IH is becoming the most prevalent type of IH. They usually have rapid progression to bowel ischemia, so they have bad outcome. High index of suspicion is mandatory since the main factors that may influence the prognosis of affected patients are early diagnosis and therapy.

© 2009 Surgical Associates Ltd. Published by Elsevier Ltd. All rights reserved.

1. Introduction

An internal hernia (IH) is defined as a protrusion of a viscus, most commonly the small bowel, through a normal or abnormal peritoneal or mesenteric aperture within the abdominal and pelvic cavity. Although IHs have an overall incidence of less than 1%, they cause 0.6–5.8% of all small bowel obstructions.^{1–4} IHs can either be acquired, such as a postsurgical or inflammatory IH, or congenital, such as a paraduodenal or pericecal IH.

The several major types of IH include paraduodenal (53%), pericecal (13%), foramen of Winslow (8%), transmesenteric and transmesocolic (8%), intersigmoid (6%), and retroanastomotic (5%). The proportion of acquired IHs is increasing with new surgical procedures being performed using a Roux loop.^{5,6}

* Corresponding author. Tel.: +90 5334613605; fax: +90 3524374912.

E-mail addresses: hyakyildiz@gmail.com (H. Akyildiz), tarik_artis@yahoo.com (T. Artis), esozuer@erciyes.edu.tr (E. Sozuer), acakcan@erciyes.edu.tr (A. Akcan), cankucuk@erciyes.edu.tr (C. Kucuk), emines@erciyes.edu.tr (E. Sensoy), karahan@erciyes.edu.tr (I. Karahan).

Without a heightened awareness and understanding of these hernias, they can often be misdiagnosed. In the acute setting, symptoms occur when the bowel trapped in one of the defects leads to closed-loop obstruction with subsequent significant morbidity and mortality. The mortality rate is reportedly higher in acquired IHs,^{7,8} but the majority of these reports involved a limited number of cases. Although many reports discuss the anatomic causes of IHs, data are insufficient for a detailed comparison between the subgroups of IH. Therefore, we aimed to provide a concise study for better management and evaluated 25 patients who underwent surgery for an IH in our department.

2. Methods

From January 2001 to April 2008, 25 patients underwent surgery for an IH at Erciyes University Medical School, Department of General Surgery. We reviewed the patients' records, imaging modalities and operative findings of these cases. All patients underwent surgery; with regard to operative findings and patient history, patients were divided into two groups. Group I included

patients with an acquired IH and group II included those with a congenital IH. Congenital IH was diagnosed if the patient did not have a history of related abdominal surgery or a secondary cause such as a postsurgical, traumatic or postinflammatory defect. Acquired IH was diagnosed if the patient had undergone previous abdominal surgery or had an underlying cause such as trauma or infection. The morbidity and mortality statistics were restricted to the hospital stay and postoperative period (<1 month). The period of time between the onset of the symptoms and surgery was described as laparotomy time and expressed by number of days. Age, gender, comorbidities, massive necrosis, postoperative complications and laparotomy time were also investigated for their impact on mortality. Data were evaluated with the statistical SPSS package, version 13.0 (Chicago, IL). Data were expressed as mean \pm standard deviation (SD) or median (range). Differences between categorical variables were compared with the χ^2 test. The differences between the medians of the groups were compared with the Mann–Whitney *U* test. For factors that influenced mortality, univariate and multiple logistic regression analyses (model: backward Wald) were performed. A $p < 0.05$ was considered significant.

3. Results

Seven women and 18 men with a mean age 50.7 ± 14.2 years were evaluated. Groups I and II had 16 and nine patients, respectively (Table 1). The groups did not differ significantly with regard to gender, patients' complaints, clinical and laboratory findings, imaging modalities and laparotomy time. Patients in group I were significantly older than those in group II. The length of hospital stay was significantly longer in group I. Massive intestinal necrosis was more common in patients in group I, and postoperative mortality rates were also significantly higher in group I (Table 2).

All patients had at least one abdominal plain X-ray done, which showed a bowel obstruction in 100% of them. Eighteen patients underwent abdominal computed tomography (CT) scanning with intravenous contrast material. The other seven patients, who had acute abdominal findings, were transferred to the operating room after initial evaluation and resuscitation.

Massive small bowel resection (>100 cm) was performed in nine patients in group I and three patients in group II ($p < 0.05$). Additional large bowel resection was performed in three patients in group I and in one patient in group II. Four patients in group I (two patients with appendectomy-related, one patient with pericecal and one patient with sigmoid-related IH) and two patients (one with pericecal and one with paraduodenal IH) in group II did not require resection. The release of a herniated segment and getting rid of the hernial cause were surgically sufficient. The reconstruction and restoration of bowel continuity depended on the condition of the patient, the extent of small bowel resected and the viability of the remaining bowel. Approximately two thirds of the patients had one or more comorbidities, the most common of which was hypertension. The comorbidity rates were slightly higher in group I but they did not influence the mortality.

Table 1
Types of internal hernia (IH).

Types of acquired IH		Types of congenital IH	
Group I		Group II	
Transmesenteric	5 (3)	Left paraduodenal	4
Retroanastomotic	4 (2)	Right paraduodenal	1
Sigmoid-related	3 (1)	Pericecal	2
Pericecal	2 (1)	Transmesenteric	1 (1)
Appendectomy-related	2	Intersigmoid	1 (1)
Total	16	Total	9

The number of patients who died is given in parentheses.

Table 2

Comparison of the groups with regard to age, gender, length of hospital stay, laparotomy time and mortality.

	Group I (n = 16)	Group II (n = 9)	<i>p</i>
Age	41.2 \pm 14.3	54.1 \pm 14.8	$p < 0.05$
Gender	n = 16	n = 9	$p > 0.05$
Male	10	7	
Female	6	2	
Length of hospital stay, days (mean \pm SD)	13.6 \pm 2.3	7.2 \pm 1.4	$p < 0.05$
Massive necrosis, no. of patients	9	3	$p < 0.01$
Laparotomy time, days (mean \pm SD)	4.3 \pm 1.7	3.2 \pm 1.2	$p > 0.05$
Mortality, no. of patients	7	2	$p < 0.01$

In both groups, the most frequent postoperative complication was wound infection. Seven of 16 patients in group I had wound infection requiring further therapy compared with three patients in group II ($p > 0.05$). Atelectasis/pleural effusion was the second most common cause of postoperative morbidity. The lengths of hospital stay were 13.6 ± 2.3 days and 7.2 ± 1.4 days in groups I and II, respectively, a significant difference.

Mortality rates were 43.8% in group I and 22.2% in group II (seven patients versus two patients, respectively; $p < 0.01$). The most common cause of death in both groups was postoperative acute respiratory distress syndrome (ARDS)-related multiorgan failure due to sepsis with intra-abdominal infection. ARDS developed in six patients with one or more complications and five of them died. Five patients died because of ARDS-related multiorgan failure, three patients died from hemodynamic instability secondary to multiorgan failure with intra-abdominal sepsis in a short period of time after the operation, and one patient died secondary to myocardial infarction. Postoperative complications, especially ARDS, had a significant impact on mortality ($p < 0.01$). Except for the patient who died from myocardial infarction, all patients who died had a long period of time (4.8 ± 1.2 days) between the onset of symptoms and surgery. None of the surviving patients had short bowel syndrome. Univariate and multiple logistic regression analyses revealed that age, delayed laparotomy time, massive intestinal necrosis, and postoperative ARDS were statistically significant for mortality (Table 3).

4. Discussion

Since the first description of IH in 1786, many other types have been reported.^{9–11} Although the first description was made more than 200 years ago, the literature does not contain many reports about IH. To date, most of these reports are case reports or studies with a limited number of patients, probably because of the low incidence of 0.2–0.9%.^{12,13} Despite the limited number of cases, this report represents one of the largest series. IHs are often diagnosed very late; in most cases diagnosis is made at the time of laparotomy, usually following the clinical picture and plain radiographic findings of bowel obstruction. Unfortunately, they have a rapid progression to bowel ischemia, which is a life-threatening emergency.

IHs have no age or sex predilection.⁶ Similar to previous reports, congenital IH affected a younger population. Although group II consisted of a younger population, the majority of patients were still older than 40 years. There is no specific symptom for IH, and acute small bowel obstruction is the most common presentation. All of the patients in group II had mild digestive symptoms such as intermittent crampy abdominal pain or postprandial pain, typically chronic in nature, or subacute obstruction attacks dating back to childhood. In the medical histories, six patients reported that they were admitted to the emergency department due to crampy abdominal pain at least once but they were treated

Table 3
Univariate and multiple logistic regression analyses (backward Wald) of factors influencing mortality in groups.

Factors influencing mortality	Univariate logistic regression analysis		Multiple logistic regression analysis (backward Wald)	
	Odds ratio	95.0% CI lower–upper	Odds ratio	95.0% CI lower–upper
<i>Postoperative ARDS</i>				
Negative	1		1	
Positive	18.47	5.76–58.35	17.14	3.42–58.06
<i>Age</i>				
<50 years	1		1	
>50 years	3.26	1.28–9.35	3.35	1.15–9.61
<i>Delayed laparotomy time</i>				
<3 days	1		1	
>3 days	4.41	1.20–13.06	13.47	2.79–86.04
<i>Massive necrosis</i>				
Negative	1		1	
Positive	16.82	5.13–58.75	19.26	3.57–113.60

CI: confidence interval.

symptomatically by spasmolytics and discharged after the relief of the symptoms. The diagnosis is essentially based on a high index of suspicion. When the possibility of IH is considered, prompt evaluation and exploration are particularly important. If CT scanning, which can diagnose early or partial obstruction, closed-loop obstruction, and multiple segments of obstruction much better than a plain abdominal X-ray, is performed in these patients, emergent laparotomy can probably be prevented and postoperative mortality and morbidity rates could be decreased.

Abdominal CT can show the hernia sac and its anatomic relationship to the surrounding organs and vasculature (Fig. 1). Intramural abnormalities such as mural thickening and pneumatosis intestinalis are also well demonstrated by CT scanning. Additionally, CT is much faster to perform than other diagnostic imaging modalities, more widely available, and less invasive. It was reported to have high sensitivity and specificity (94% and 96%, respectively) in predicting small bowel obstruction.¹⁴ Therefore, it has become the dominant imaging modality for the investigation of acute abdominal conditions. However, there are not well-established CT criteria for diagnosing IH.¹⁵ Hence, negative results on radiologic examination should not influence the decision to operate if clinical suspicion exists.

In this study, acquired IH was the most prevalent type of IH (16 versus nine patients). There are three explanations for this difference. First, no child is among these cases. Second, the increase in new operational procedures using a Roux loop, such as liver transplantation, gastric bypass and laparoscopic surgery, carries a risk of developing IH. Finally, adults and the elderly suffer more commonly

from IH than do children.^{16,17} We also concluded that reconstruction and restoration procedures after radical cystectomy due to bladder cancers, if proper closure of the mesenteric defects are not done completely, carry a risk for the development of IH (two cases).

In our cases, paraduodenal hernias were the most common type of congenital IH and had a sex predilection for men. These findings were consistent with related reports. Although in older literature they were the most frequent types of all IHs, recent studies report the increase of the acquired types.^{18,19} The surgical treatment results for congenital types were also much better than the results for acquired types, and none of the patients with paraduodenal hernia died during the study. Transmesenteric hernias are increasing in incidence and have surpassed the frequency of paraduodenal hernias; they are more likely to develop volvulus and strangulation or ischemia.^{6,20} Among the three main types of transmesenteric hernias, type one was reported more frequently in the literature, but the second type that occurs when the bowel prolapses through a defect in the small bowel mesentery was the most common type in this study. Although these defects are surgically closed, incomplete closure or breakdown of the surgical sutures may occur, leading to a potential site for IH. The mortality of the transmesenteric hernias, which is reported to be as high as 50% for the treated group, was consistent with our results (66.7%).

Approximately 50% of the patients developed morbidity after surgical procedures. Delayed laparotomy time (>3 days after the onset of the symptoms) and the presence of a comorbidity were related to morbidity ($p < 0.05$). The reported mortality rate of IH

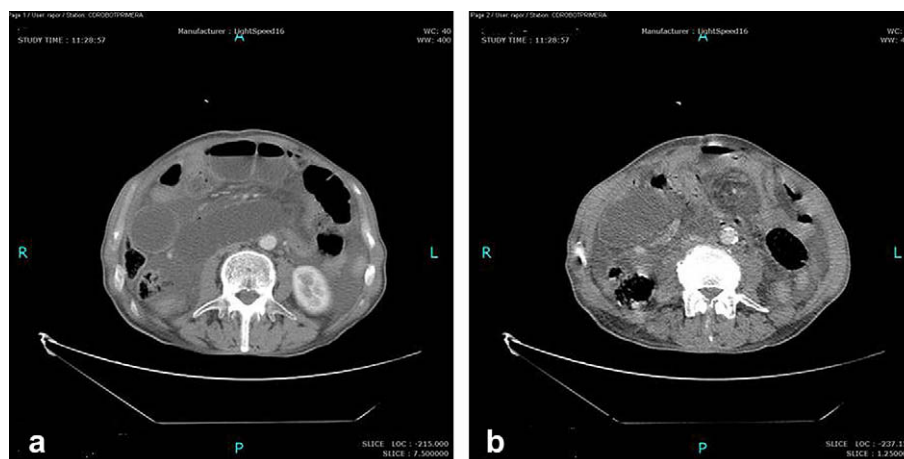


Fig. 1. Axial contrast enhanced sequential CT images show cluster of dilated small bowel loops (a) with distorted mesenteric vessels (b) ("whirl sign").

ranges from 20% to 75%.^{8,21} The overall mortality rate in this study was 36%. Patients with an acquired IH had much worse outcomes, a result similar to previous reports. Patients with a transmesenteric hernia and those with prior abdominal surgery were more susceptible for mortality, also similar to other reports. The majority of deaths were caused by multiorgan failure with intra-abdominal sepsis. Age, delayed laparotomy time, massive intestinal necrosis and postoperative ARDS were the main factors affecting mortality and were especially more frequent in group I. These important factors that may influence the prognosis may be prevented by early diagnosis and proper management, before the development of irreversible damage in the intestinal wall. Urgent surgical intervention to prevent strangulation, which is responsible for high mortality, is imperative. However, the differential diagnosis is time consuming and frequently delays the precise diagnosis, which makes the mortality of IH high despite medical advances. A “look and see”, rather than “wait and see”, policy should be followed and early laparotomy performed to avoid serious complications.

In conclusion, acquired IHs are becoming the most prevalent type of IH and, unfortunately, have bad outcomes. They usually rapidly progress to bowel ischemia once strangulated and have no definitive predictors. At surgery, complete closure of the potential defects that may predispose to IH is essential for prevention. Because of the difficulty with diagnosis and the potentially disastrous complication of gangrenous and even perforated bowel, symptomatic patients with signs of small bowel obstructions on an abdominal plain film should undergo a rapid evaluation for proper immediate therapy. A high index of suspicion is mandatory to prevent delay, especially in patients with previous abdominal surgery and with the necessity of preoperative intensive care.

Conflict of interest

None to declare.

References

- Ghahremani GG. Internal abdominal hernias. *Surg Clin North Am* 1984;**64**: 393–406.
- Liakakos T, Liatas AC, Kakoulides D, Dendrinos S. Multiple congenital internal hernias as a cause of acute abdominal symptoms in late adult life. *Eur J Surg* 1992;**158**:561–2.
- Fujiwara T, Ohno Y, Sasaki A, Suzaki N, Matsuo Y. Internal hernia with triple hiatus of congenital origin: report of a case. *Surg Today* 2000;**30**:954–8.
- Newson BD, Kukora JS. Congenital and acquired internal hernias: unusual causes of small bowel obstruction. *Am J Surg* 1986;**152**:279–85.
- Meyers MA. *Dynamic radiology of the abdomen: normal and pathologic anatomy*. 4th ed. New York, NY: Springer-Verlag; 1994.
- Martin LC, Merkle EM, Thompson WM. Review of internal hernias: radiographic and clinical findings. *Am J Roentgenol* 2006;**186**:703–17.
- Renvall S, Niinikoski J. Internal hernia after gastric operations. *Eur J Surg* 1999;**157**:575–7.
- Fan HP, Yang AD, Chang JG, Juan CW, Wu HP. Clinical spectrum of internal hernia: a surgical emergency. *Surg Today* 2008;**38**:899–904.
- Blanchar A, Federle MP. Internal hernia: an increasingly common cause of small bowel obstruction. *Semin Ultrasound CT MR* 2002;**23**:174–83.
- Saida Y, Nagao J, Takase M, Noto Y, Kusachi S, Kajiwara Y, et al. Herniation through both Winslow's foramen and a lesser omental defect: report of a case. *Surg Today* 2000;**30**:544–7.
- Cingi A, Demirkalem P, Manukyan MN, Tuney D, Yegen C. Left-sided paraduodenal hernia: report of a case. *Surg Today* 2006;**36**:651–4.
- Dritas E, Ruiz O, Kennedy M, Blackford J, Hasl D. Paraduodenal hernia: a report of two cases. *Am Surg* 2001;**67**:733–6.
- Tsutsui S, Kitamura M, Shirabe K, Tomoda M, Ohmori M, Yoshida M. Lesser sac herniation through the greater omentum and gastro-pancreatic ligament: report of a case. *Surg Today* 1995;**25**:59–61.
- Megibow AJ, Balthazar EJ, Cho KC, Medwid SW, Birnbaum BA, Noz ME. Bowel obstruction: evaluation with CT. *Radiology* 1991;**180**:313–8.
- Blanchar A, Federle MP, Brancatelli G, Peterson MS, Oliver JH, Li W. Radiologist performance in the diagnosis of internal hernia by using specific CT findings with emphasis on transmesenteric hernia. *Radiology* 2001;**221**:422–8.
- Mathieu D, Luciani A. *Am J Roentgenol* 2004;**183**:397–404.
- Lu HC, Wang J, Tsang YM, Tseng HS, Li YW. *Clin Radiol* 2002;**57**:855–8.
- Higa KD, Ho T, Boone KB. Internal hernias after laparoscopic Roux-en-Y gastric bypass: incidence, treatment and prevention. *Obes Surg* 2003;**13**:350–4.
- Filip JE, Mattar SG, Bowers SP, Smith CD. Internal hernia formation after laparoscopic Roux-en-Y gastric bypass for morbid obesity. *Am Surg* 2002;**68**:640–3.
- Blanchar A, Federle MP, Dodson SF. Internal hernia: clinical and imaging findings in 17 patients with emphasis on CT criteria. *Radiology* 2001;**218**:68–74.
- Zimmerman LM, Laufman H. Intraabdominal hernias due to developmental rational anomalies. *Ann Surg* 1953;**138**:82–91.