Laparoscopic intraperitoneal onlay mesh for Spigelian hernia repair: a prospective study

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Background
Spigelian hernia is a rare variant of the ventral hernia protruding from a small defect in the Spigelian fascia. The surgical treatment is recommended once diagnosed.
Objective
In this study, we tried to spotlight on this mysterious disease as a cause of vague abdominal pain, evaluating the laparoscopic intraperitoneal onlay mesh (IPOM) technique as regards the efficacy and complications.
Patients and methods
A prospective study had been conducted at the Abha Private Hospital, Abha, Saudi Arabia, on 10 consecutive patients who suffered from Spigelian hernia, between 1 June 2015 and 31 December 2017. The patients were scheduled for laparoscopic IPOM using a composite mesh (Symbotex).
Results
During the period of the study, 10 patients had undergone 11 IPOM (one bilateral hernia); the mean age of the patients was 63.7 years (range: 37–82 years). The preoperative diagnosis was made in nine (81.8%) patients. The reformatted thin-cut axial computed tomographic scan with multiplanar reformatted modality was found to be more sensitive than the superficial ultrasound (81.8 vs. 72.7%). The laparoscopic IPOM is a fast procedure (average: 44.7 min), and was associated with relatively short postoperative hospital stay (average: 1.2 days). Only one patient developed chronic pain related to the mesh. No recurrence has been detected during a follow-up period of 6 months.
Conclusion
The Spigelian hernia is a rare type of ventral hernia. Reformatted computed tomographic scan is the best imaging modality. Although the open approach is the classic way of treatment, laparoscopic IPOM has been shown to be a safe, fast, and efficient alternative.

Keywords:
computed tomographic scan, intraperitoneal onlay mesh, laparoscopic intraperitoneal onlay mesh, radiological diagnosis, Spigelian hernia

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Introduction

The oldest written anatomical references [1] about the Spigelian hernia have illustrated the two great anatomists whose names stand out in the history of Spigelian hernia; the first is Adriaan Van Den Spieghel (1578–1625), who had discovered the semilunar line [2–4] and the second is Joseph Klinkosch who is the first to describe the Spigelian hernia in 1764 [1].

Semilunar line (Spigelian line) is the crescent line of the lateral border of the anterior rectus sheath. The Spigelian aponeurosis (Spigelian fascia) is the sword-shaped area between the lateral border of rectus abdominis and the medial border of transversus abdominis [5,6].

Spigelian hernia represents only 0.1–2% of all abdominal wall hernia [7,8]. The literature review showed that the total number of reported cases is ~1000 cases [9], of which there were only 25 pediatric cases [10]. It accounts for 2% of all emergency hernia repairs [11].

It may be congenital or acquired. Larson and Farley [11] reported a 3-day-old male infant representing the youngest case in the literature. Congenital Spigelian hernia is linked to undescended testis [10,12]. The acquired type is due to the Spigelian fascia defects due to rapid weight loss or increased intra-abdominal pressure [5,6,13,14].

The surgical repair is recommended for Spigelian hernia once diagnosed [11]. A number of

approaches and techniques have been described. Yet, there was no agreed consensus on the best one. Although, open repair is the most common approach used, laparoscopic techniques have been increasingly used. It includes intraperitoneal onlay mesh (IPOM) [2,15,16], transabdominal preperitoneal repair [17], and totally extraperitoneal repair [13,18]. In this study, we tried to spotlight on this mysterious disease as a cause of vague abdominal pain from radiological and surgical perspectives.

Patients and methods

Study design

Upon approval of the Institutional Review Board, a prospective trial had been conducted at Abha Private Hospital, Abha, Saudi Arabia, on 10 consecutive patients who have been diagnosed as Spigelian hernia. Those patients had undergone a laparoscopic IPOM from 1 June 2015 to 31 December 2017. Patients of either sex, aged from 15 to 85 years irrespective of their ethnicity with an established diagnosis of Spigelian hernia (either preoperative or intraoperative) were included. Exclusion criteria were bleeding disorders, psychiatric disorders, history of malignancy, and those with high operative risk. This study has been conducted in accordance with The Code of Ethics of the World Medical Association for experiments involving humans.

Preoperative evaluation

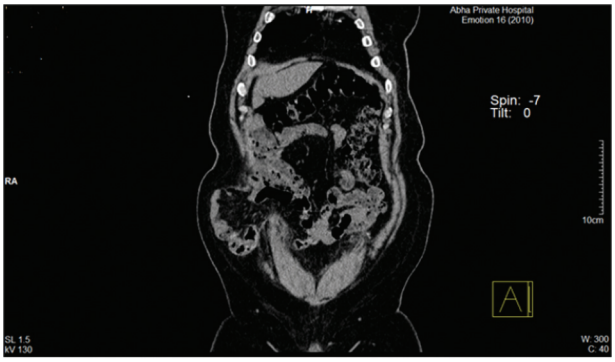
Patients were evaluated by routine blood investigation, ultrasound (US), and computed tomography (CT) scan (Figs 1–7). The US scanning of the abdominal wall was performed via the iU22 scanner (xMATRIX; Philips Medical Systems, Bothell, Washington, USA) using either the linear transducer (7–12 MHz) in thin patients or the convex transducer (3.5–6 MHz) in obese patients. Each hernia was evaluated in terms of size of the defect, hernia sac contents, and vascularity state. Valsalva's maneuver is a critical component of the examination.

The CT study had been performed using a 16-detector row scanner CT system [SOMATOM Emotion eco (16 slice configuration); Siemens Healthcare GmbH, Erlangen, Germany], in a supine position during a single breath-hold with or without oral and intravenous contrast. Thin (2.5 mm) reformatted axial images were routinely obtained, in addition to the multiplanar reformatted (MPR) images, which provide an additional significant data, and hence increase the sensitivity of the study.

Figure 1

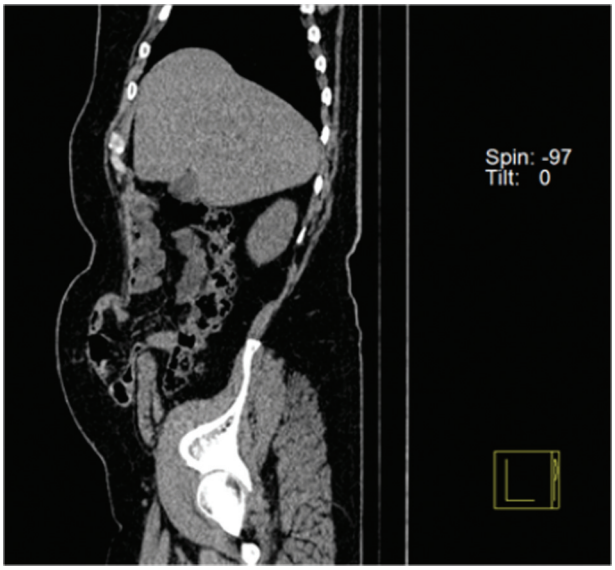
High-resolution ultrasound study using the superficial probe showing the defect.

Figure 2



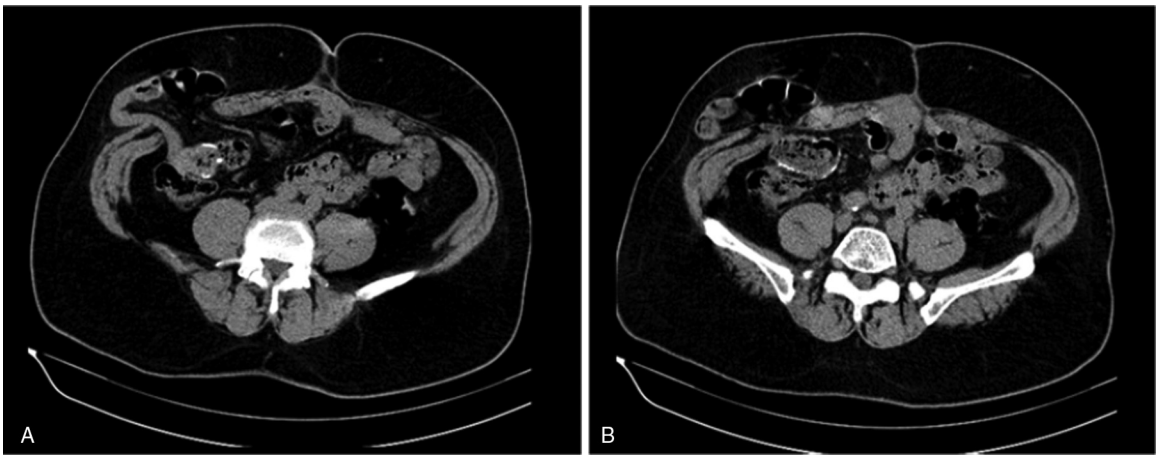
Computed tomographic scan without contrast (coronal cuts) showing right Spigelian hernia with small intestinal loop.

Figure 3



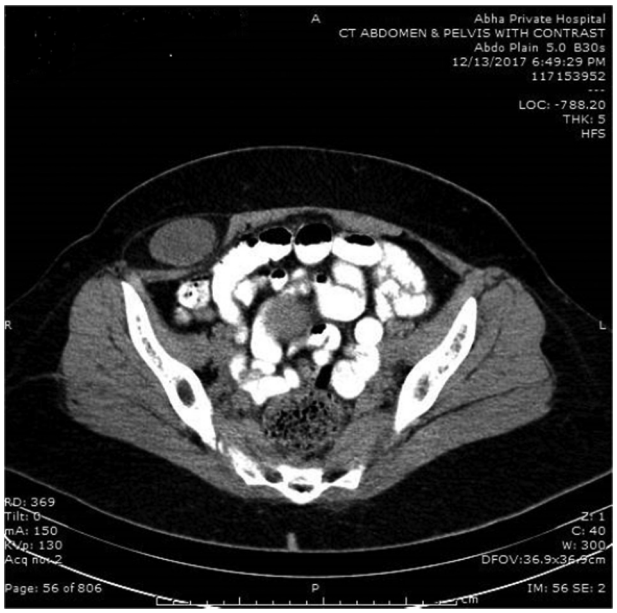
Computed tomographic scan without contrast (sagittal view) showing a Spigelian fascia defect with intestinal herniation.

Figure 4



(a, b) Axial reformatted computed tomographic scan showing a typical defect in the Spigelian fascia transmitting the small intestine.

Figure 5



Axial reformatted computed tomographic scan with intravenous contrast and bowel opacification showing the interstitial type Spigelian hernia.

All the enrolled patients signed a preoperative written informed consent and were scheduled for laparoscopic IPOM. The preoperative demographic (as age and sex) and clinical data (such as the presenting symptoms and signs, site, and previous abdominal surgery) were documented.

Surgical technique

All operations were conducted in supine position under general anesthesia; a prophylactic antibiotic was given. The IPOM technique was done through three ports: one 10 mm port was placed in the contralateral lumbar area for a 30° scope, and two 5 mm ports were situated in the contralateral hypochondrial and iliac fossa areas, taking into consideration the shape of the abdomen and the triangulation concepts. We started by diagnostic laparoscopy of the whole abdomen, identifying the defect in the Spigelian fascia (Figs 8–10); closure of the defect was achieved via a suture passer with PDS 0 suture. We applied a dual-layer composite mesh (Symbotex, Autosuture; Covidien, Mansfield, Massachusetts, USA) that was fixed with tackers (ProTack; Covidien) (Fig. 11). The mesh should be centralized overlapping the defect with 3–5 cm covered around the defect; no drains were used.

All patients were instructed to abide by regular follow-up after 3, 6, 9, and 12 months postoperatively. In each follow-up visit, an ample history was taken and clinical assessment was done. US and/or CT was performed if needed to rule out recurrence.

The other relevant surgical and radiological data such as the duration of surgery, intraoperative and postoperative complications, length of stay, number of cases diagnosed by US and CT scan, and recurrence were documented in a standard Excel sheet for Windows, and were verified checking for its statistical significance.

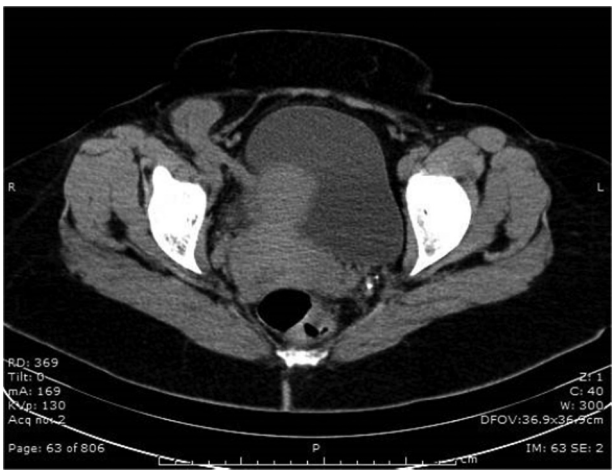
Statistical analyses

The standard descriptive statistics were used to analyze the demographic and clinical data, as well as surgical operations and outcomes. Quantitative variables with a normal distribution were expressed as mean±SD, whereas qualitative data with categorical variables were expressed as frequencies and proportions and were analyzed using Fisher's exact test. The statistical analyses were carried out using the statistical package for social sciences, version 22 software package (SPSS Inc., Chicago, Illinois, USA); the significance level was set to 0.05.

Figure 6

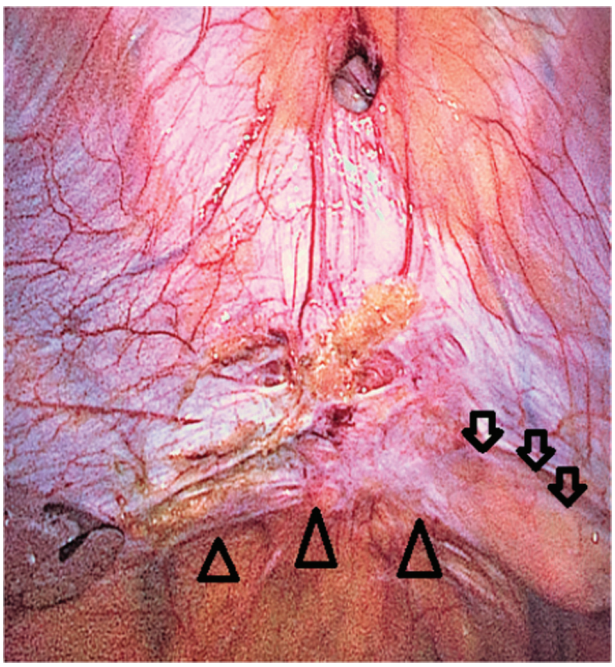
Multiplanar reformatted computed tomographic scan showing right Spigelian hernia (a) coronal view and (b) sagittal view.

Figure 7



Axial reformatted computed tomographic scan showing the right ovary within the Spigelian hernia.

Figure 8



Laparoscopic view of a patient suffering from a paraumbilical hernia with an accidentally discovered Spigelian hernia (containing extraperitoneal fat). Arrows: demarcates the hernia. Triangles: demarcates the arcuate line.

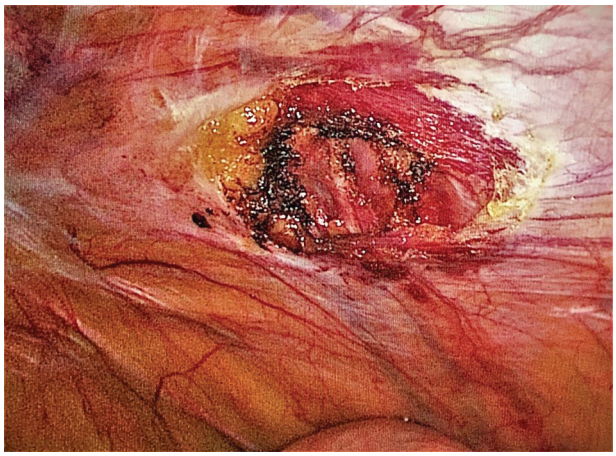
Results

During the defined period of study, 10 patients had undergone 11 Spigelian hernia repair; one case of bilateral hernia was included in this series, six women and four men, with a mean age of 63.7 years (range: 37–82 years). The hernia was situated on the right side in 36.3% of the patients and on the left in 63.6% of the patients. The presenting symptoms and signs are summarized in Table 1.

The preoperative diagnosis was made in nine patients, of whom seven (63.6%) patients were diagnosed clinically. The other two patients were diagnosed with the aid of imaging studies; US was positive in one patient only, whereas CT was conclusive in both patients. Hence, the overall sensitivity of the reformatted CT was 81.8% (9/11), whereas that of US was 72.7% (8/11).

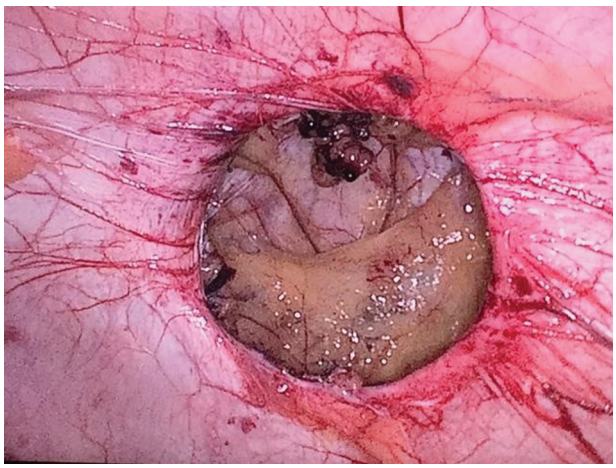
The remaining two patients were diagnosed intraoperatively, the first patient was incidentally diagnosed during laparoscopic paraumbilical hernia

Figure 9



Laparoscopic view showing the early stage of development of Spigelian hernia (slit in the Spigelian fascia at the arcuate line).

Figure 10



Magnified laparoscopic view of a scarred, edged defect after reduction of incarcerated omental content with the small residual fat inside.

Figure 11

Laparoscopic view showing the Symbotex mesh during fixation centered over the defect and fixed with nonabsorbable tackers.

Table 1 The presenting symptoms of patients

Presentation	*N*=11 [*n* (%)]
Elective	10 (90.9)
Localized pain in the lower abdominal quadrant only	2 (18.1)
Swelling only	4 (36.3)
Both of them	2 (18.1)
Asymptomatic (came for another operation)	1 (9.09)
Emergency	1 (9.09)
Acute abdomen (diffuse abdominal pain)	1 (9.09)

repair; laparoscopic IPOM was undergone for both hernia (Fig. 8). The second patient was an 80-year-old man who presented with acute abdomen; preoperative radiological investigations were not conclusive; the decision was to explore through diagnostic laparoscopy, which revealed incarcerated Spigelian hernia through a 2 cm defect with congested nongangrenous small intestine; gentle reduction of this loop was done, the defect was closed by a suture passer using a PDS 0 stitch, followed by laparoscopic mesh fixation with uneventful postoperative period. No intraoperative complications were encountered; one patient developed chronic postoperative intermittent pain mostly related to the mesh. The average postoperative hospital stay was 1.4 days (range: 0.9–2.4 days). The average duration of operation was 44.7 min (range: 28.9–67.3 min); there was no recurrence nor mortality recorded in this trial.

Discussion

Despite two and half centuries passed since the discovery of Spigelian hernia, it still lurks in the darkness. Unlike other types of hernia, the diagnosis of Spigelian hernia remains a challenging issue due to its interstitial location, absence of pathognomonic physical findings, in addition to its elusive imaging findings.

Interestingly, 90% of the Spigelian hernias occur near the arcuate line (Fig. 8), within the Spigelian hernia belt, which is a 6-cm horizontal band above the interspinal line [3,16]. Below this line, the Spigelian aponeurosis is a single layer resistant to herniation [10,11].

A high index of suspicion and increased awareness of the Spigelian hernia are the clues for earlier diagnosis. Postural pain, intermittent palpable mass, with point tenderness in the Spigelian hernia belt in a patient with a history of abdominal surgery may therefore raise suspicion of Spigelian hernia. This postural

nature of pain was exacerbated by abdominal flexion, and moving the ipsilateral leg and was partially alleviated by laying down [3,4,9,14].

The pain may be chronic intermittent in the lower quadrant and flank, increased by Valsalva's maneuver, and relieved by defecation [3,7,19–21]. Other presenting symptoms include vomiting, altered bowel habits, and dyspareunia [4,6,22,23]. Characteristically, patients sought medical advice several times without reaching a diagnosis [7].

In this study, 18.1% of the patients were aged less than 50 years, whereas 81.8% were more than 50 years; this predilection toward older age at the time of presentation is in line with the other series [11,19], it is more common in women (60%) and more on the left side (70%).

The preoperative diagnosis was made in 81.8% of patients, which is in range reported by other studies (64–92.5%) [5,8,11,16,19,20]. A palpable swelling was the main presenting symptom (occurred in 54.5% of our patients), whereas abdominal pain was the complaint in 45.4%, which was either localized to the ipsilateral lower abdominal quadrant in 36.3% or diffuse and associated with acute abdomen in 9% (Table 1).

In a retrospective study of 81 operations performed on 76 patients (two cases of bilateral hernia and three cases of recurrent hernia) at Mayo Clinic, Larson and Farley [11] demonstrated that 35% of their patients had a palpable swelling, 24% had abdominal pain, and only 6% were completely asymptomatic.

After 2 years, Vos and Scheltinga [14] published a retrospective series conducted in The Netherlands on 25 patients over 22 years, who had open Spigelian hernia repair. They found that intermittent palpable swelling was noted in 88% of their patients, whereas pain was evident in 80% of them.

The diagnosis of this mysterious disease is considered a challenging issue in other surgical specialties; Ussia *et al.* [4] reported a 35-year-old-female patient who was misdiagnosed for 4 years as deep endometriosis or the Alcock syndrome, but in the third laparoscopy, Spigelian hernia was diagnosed and repaired.

Even though radiological modalities as US and CT had been proved to be beneficial, its sensitivity is variable according to the size of defect and the experience of the radiologist. Not only they allow accurate identification of abdominal wall hernias, and differentiate them from other abdominal wall masses, but also they help in the detection of preoperative or postoperative complications.

The defect could be easily overlooked by the US especially if small and free of content. In addition, being operator-dependent and hindered by pain on examination, it is believed that US is more beneficial for the elective cases (Fig. 1). US could be more informative if performed in the standing position with a meticulous scanning of the transverse plane of the Spigelian fascia [3,4].

Although the multislice reformatted CT scan is considered the most sensitive imaging modality, experience of the radiologist could significantly influence the CT scan outcomes. The multislice reformatted CT can diagnose Spigelian hernia, define sac contents, and even determine its types (subcutaneous (Fig. 4) and interstitial types (Fig. 5).

In this study, the reformatted thin-cut axial CT scan with MPR modality was found to be more sensitive in the detection of Spigelian hernia than the superficial US scanning (81.8 vs. 72.7%). These figures are comparable to that reported by other studies [14,20].

The Spigelian hernia has a characteristically small defect, which is reflected as a high incidence of incarceration, hence requiring an emergent operation. In this study, incarceration rate is 9.09% which is a bit lower than that concluded by other previous studies (17–33%) [11,19].

Owing to the rarity of this hernia and the heterogeneity of available studies, there is no consensus about the best surgical approach. The open approach was the classic option for surgery, it is conducted through either transverse or midline incisions. Vos and Scheltinga [14] had repaired 25 patients by the open repair (20 with primary closure only and five with mesh use). Of those, two presented with acute abdomen and underwent emergency laparotomy with resection and anastomosis of the gangrenous bowel. Two other recent studies from the USA [24] and Australia [20] used midline exploratory laparotomy for incarcerated Spigelian hernia with small bowel gangrene. Shea *et al.* [10] reported the open repair of post-traumatic Spigelian hernia in the pediatric age group.

Carter and Mizes [25] documented the first successful laparoscopic Spigelian hernia repair in 1992. Since that success, several prospective case series have tickled from overseas trying to verify the different laparoscopic

techniques with the introduction of new types of mesh and fixation devices. Yet, there is no consensus regarding the best laparoscopic technique.

Palanivelu *et al.* [17] used the transabdominal preperitoneal repair for eight hernias with a polypropylene mesh secured by interrupted sutures. Baucom *et al.* [26] presented two incarcerated hernia cases that were successfully repaired using polytetrafluoroethylene mesh. Some studies [2,15,16] used laparoscopic IPOM with a composite mesh fixed by takers; others [13,18] have shown that totally extraperitoneal repair is a good option for concurrent Spigelian and inguinal hernias.

In this trial, laparoscopic IPOM was shown to be associated with a short postoperative hospital stay (1.2 days) and a low morbidity rate (9%). No recurrent hernia has been detected in this study after a 1-year follow-up period.

Moreno-Egea *et al.* [19] published a randomized trial that had been conducted in a Spanish University Hospital on 28 patients over 8 years; they found no significant difference between open and laparoscopic approaches in terms of recurrence after a 3.4-year follow-up. However, they noted that open approach resulted in considerable increase in the length of stay (5 vs. 1 day). The weak points in the study by Moreno-Egea *et al.* [19] was that the laparoscopic arm included two different techniques (extraperitoneal and intraperitoneal), and two different types of mesh (Parietex and polypropylene) which may affect the overall results.Surgical implications, effects on patient care, and recommendationsIn fact, laparoscopy can easily diagnose the Spigelian hernia, even if asymptomatic. Thus, we stress on the importance of abdominal wall examination as an essential step of the diagnostic laparoscopy in any laparoscopic procedures.

Our recent knowledge on the natural history of progression of the Spigelian hernia illustrates that it begins as a small split in the Spigelian fascia with protrusion of the extraperitoneal fat (Fig. 9). This should lead us to further recommend the sublay (underlay) positions for mesh placement because the preperitoneal position of the mesh can potentially prevent hernia protrusion, in contrary to the onlay (overlay) position that adds a strong layer over the external aponeurosis, but does not prevent the defect in the underneath Spigelian fascia.

Iatrogenic Spigelian hernia is a potentially preventable disease; it has a causal relation with trocar insertion [4], that is why there is a recent trend to use atraumatic round trocars, and to be placed outside the Spigelian fascia.

Given the rarity of the Spigelian hernia, the number of cases enrolled in this study can be considered as an adequate sample. However, more studies with a longer follow-up can further confirm the results and reach a consensus about the best surgical approach for Spigelian hernia repair.

Conclusion

Spigelian hernia is a rare type of ventral hernia. A high index of suspicion is required to avoid misdiagnosis. The thin-cut CT scan with MPR remains the imaging modality of choice. Surgical treatment is recommended once diagnosed; laparoscopic IPOM has been shown to be a safe, efficient, and fast approach with short postoperative hospital stay and low morbidity rate.

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Conflicts of interest

There are no conflicts of interest.

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