Chapter

Spigelian Hernia

Bruno Barbosa, Maria João Diogo, César Prudente and Carlos Casimiro

Abstract

Spigelian hernia (SH) is uncommon and accounts for only 0.12–2% of all abdominal hernias. Spigelian hernia is a protrusion through a defect in the aponeurosis of the transversus abdominis muscle (Spigelian fascia) that is limited by the semilunar line and the lateral edge of the rectus abdominis muscle. It is more common in women 50–60 years and it is twice as common on the right side. Patients may present with non-specific abdominal pain. Clinical diagnosis may be difficult, especially in obese patients, and radiologic exams are essential to obtain the correct diagnoses. This type of hernia has a mandatory indication to surgical repair due to the risk of incarceration that can occur in about 25% and strangulation that can occur in about 40%. Traditionally, open surgical repair is most commonly used. However, laparoscopic approach is becoming increasingly popular since it allows faster recovery, shorter hospital stay, and less pain, with no commitment to recurrence. Currently, there are no studies that demonstrate the superiority of a laparoscopic technique (intraperitoneal onlay mesh (IPOM), transabdominal pre-peritoneal (TAPP) or extraperitoneal approach (TEP)). The intraperitoneal route is a simple, faster, and easily reproducible approach.

Keywords: Spigelian hernia, open surgery, intraperitoneal repair laparoscopic surgery, total extraperitoneal repair

1. Introduction

A hernia occurs when there is an abnormal protrusion of an organ or tissue through a natural orifice or weakness point. Abdominal wall hernias are quite frequent, with approximately 700,000 hernia repair surgeries currently performed in the United States every year [1]. There are several types of abdominal wall hernias depending on their location (**Figure 1**), with inguinal hernias being the most common, accounting for 75% of all abdominal wall hernias [1].

Spigelian hernias (SH) are defined as a protrusion of preperitoneal fat, peritoneum or an organ through a defect that can be acquired or congenital, located laterally to the rectus abdominis in the anterior abdominal wall [2, 3]. This type of hernia is rare and has been estimated to account for <2% of all abdominal wall hernias [3–10]. Pain is the most common symptom reported by patients [4, 7], but there are no pathognomonic signs and symptoms, making clinical diagnosis difficult. Complementary diagnostic tests such as ultrasonography (US) and computed tomography (CT) can play an essential role in its diagnosis. Due to the high risk of

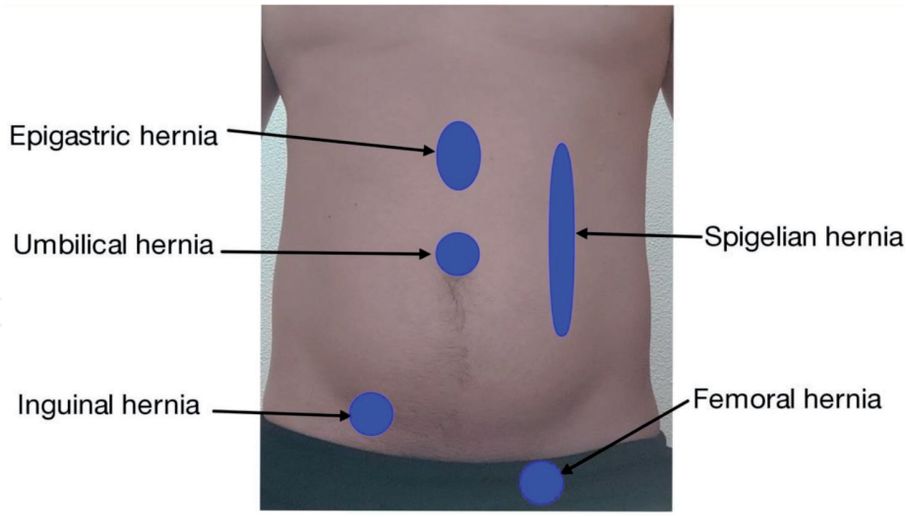

Figure 1.
Different types of abdominal wall hernias.

incarceration (25%) [4, 6, 7], this type of hernia is indicated for surgery [4, 5, 7, 9, 11, 12]. The surgery can be performed openly or laparoscopically, with or without mesh placement [2–18]. Currently, the laparoscopic approach is increasingly used as it is associated with low morbidity rates [2–6, 8, 9, 13, 14]. The laparoscopic approaches described include trans-abdominal approaches such as the intraperitoneal onlay mesh (IPOM), transabdominal pre-peritoneal (TAPP) and totally extra-peritoneal (TEP) techniques [2–5, 9, 11, 14].

2. Anatomy

Spigelian hernia owes its name to the Belgian anatomist Adrian van den Spiegel who first described the semilunar line in 1645 [6–8, 10, 12, 15].

Spiegel described a lateral, convex line extending from the cartilage of the ninth rib to the pubis, lateral to the rectus abdominis and where the transversus abdominis muscle transition to its aponeurosis is found [7, 11]. This line became known as the semilunar line or Spiegel's line (**Figure 2**) [7].

The transversus abdominis muscle aponeurosis that lies between the lateral border of the rectus abdominis muscle medially and the semilunar line laterally is called the Spigelian's fascia or aponeurosis [2, 4–7].

It was not until 1764, more than a century after the description of the semilunar line, that a Spigelian hernia was described for the first time, reported by the Belgian anatomist Josef Klinkosch [3, 6, 8].

This way, SH is defined as a protrusion of preperitoneal fat, peritoneum or an organ through a defect located in the Spigelian fascia [6, 7].

Throughout history, SH has also been called "spontaneous lateral ventral hernia," "semilunar line hernia" and "hernia through the conjoint tendon" [3, 6].

Although SH can occur anywhere on the Spigelian fascia, around 90% occur below the umbilicus, more specifically below the arcuate line [2, 5–8]. This zone is known as the "Spigelian hernia belt" and is defined medially by the lateral border of the rectus abdominis muscle, superiorly by the arcuate line and inferiorly by the inferior epigastric vessels [2–8]. Spigelien's belt is an area about 6 cm wide above a transverse line that passes through the anterior superior iliac spines [5–7].

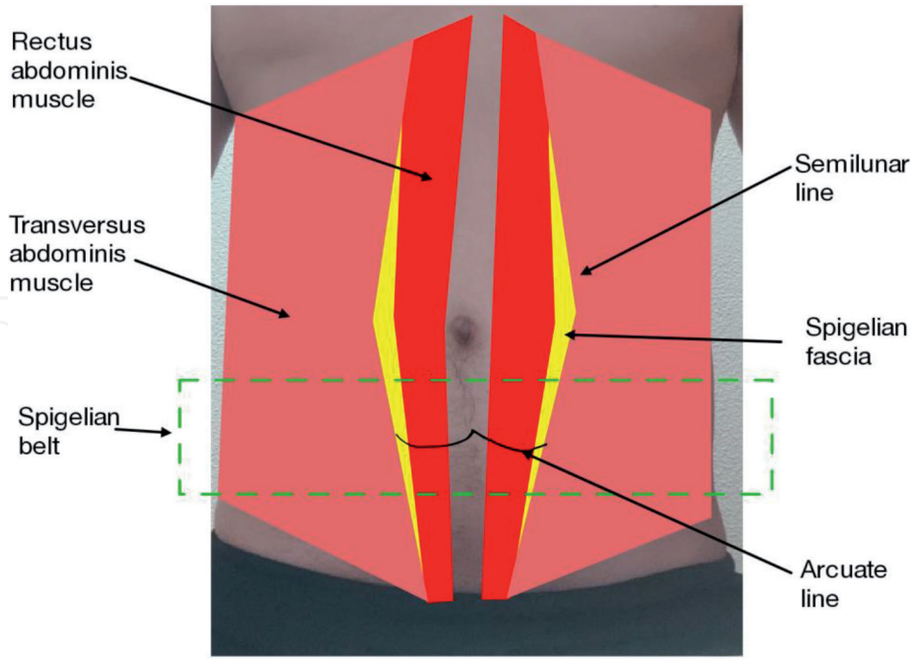

Figure 2.
Anatomy of Spigelian fascia.

The higher incidence of hernias in this location is associated with the fact that in this location the posterior sheath of the rectus abdominis is absent and the fibers of the transversus abdominis and internal oblique muscle are in cross-parallel, making it a weakness point [5–8, 15]. This does not happen above the umbilicus where there is the posterior sheath of the rectus abdominis and the fibers of the transversus abdominis and internal oblique muscles cross perpendicularly [6, 7]. A SH above this area is extremely rare [7].

SH can also occur below and medially to the epigastric vessels and extend to the pubic tubercle, being called "low Spigelian hernia" [7].

The SH sac usually contains extraperitoneal fat, peritoneum, small intestine or omentum, but it may contain other organs such as the stomach, gallbladder, ovaries, testes and bladder [6, 16].

The hernia defect is usually narrow (0.5–2 cm), with rigid margins and covered by the aponeurosis of the external oblique muscle, thus presenting a high risk of incarceration and strangulation [2, 3, 5, 9]. Some studies report that these hernias have a 25% risk of incarceration and 40% of strangulation, making surgical repair a recommendation [4, 6, 7]. Due to the rectus abdominis position, the hernia sac generally expands laterally and caudally along the intraparietal plane between the internal and external oblique muscle [7, 9].

3. Incidence

SH is a rare type of ventral hernia, accounting for about 0.12 to 2% of all hernias [1–3, 6–10, 16]. SH is most commonly diagnosed between age 40 and 70 and is slightly more common in women (male/female ratio 1:1.6) and on the right side of the abdomen (right/left ratio 2:1) [2, 7, 9, 12].

Patients with comorbidities that lead to increased intra-abdominal pressure or weakness of the abdominal wall have the greatest risk of herniation.

4. Pathophysiology and risk factors

SH results from congenital or acquired defects, with a peak incidence in the fifth decade of life [6, 7].

Congenital defects are related to a weak area at the junction of the aponeurosis of the abdominal muscles as they develop separately in the mesenchyme of somatopleure [6, 7]. However, SH rarely occurs in children [7].

Concerning acquired defects, these can be associated with situations that increase intra-abdominal pressure, trauma or degeneration of the abdominal wall aponeurosis [6–8, 15].

The increased intra-abdominal pressure may be caused by situations like chronic obstructive pulmonary disease, chronic cough, obesity, cirrhosis, chronic constipation and pregnancy [6–8, 10, 15]. History of previous abdominal surgery (open or laparoscopic) and abdominal trauma can also predispose to the appearance of SH as it can weaken the semilunar line [6–8, 17].

Some authors have also suggested that the neurovascular opening in Spigelian's aponeurosis may be a susceptible point of herniation; however, this factor is currently considered of little importance [17].

Collagen disorders such as Ehlers-Danlos Syndrome or the aging process can also increase the risk of developing these hernias [6–8].

Therefore, the development of SH is likely to be multifactorial.

5. Clinical presentation

The diagnosis of SH is difficult as there are no characteristic signs or symptoms of this pathology [2, 6, 7, 17].

Unlike other types of hernias, the most common symptom associated with a Spigelian hernia is pain and not a palpable protrusion/mass [2, 4, 5, 7, 17]. SH is often only diagnosed when it becomes symptomatic with incarceration, strangulation or occlusion, and before these events, patients are asymptomatic [7].

Pain varies in type, severity and location depending on the contents of the hernia sac [7, 18]. Typically, the pain is aggravated with standing or any other factor that causes an increase in intra-abdominal pressure, and it improves with rest and with the supine position [3, 7, 18].

In addition to pain, patients may present a palpable mass that may be located far from the hernia orifice [2, 3, 5, 7, 9, 14, 17]. This mass can appear when the patient is standing and disappear spontaneously when lying down [10, 17]. Large SH is easily palpable; however, the diagnosis of hernias with a small hernia sac and orifice is quite challenging [3, 4, 17].

During the physical examination, a tender spot over the hernia defect may be palpated when the abdominal muscles are tense [7, 17]. The sensitivity of the physical examination can be increased by asking the patient to relax and contract the abdomen (Valsalva maneuvers) [7, 18].

The diagnosis is made when a mass and hernia defect is palpated over the Spigelian aponeurosis [3]. However, this clinical presentation is not common since the orifice and hernia sac are rarely detected as it is covered by subcutaneous fat, especially in obese patients, and by the aponeurosis of the external oblique muscle [2–4, 6, 7, 17, 18].

These facts make the clinical diagnosis based only on the physical examination quite difficult, and some studies report that only in 50% of cases, a SH can be detected

with only the physical examination [6, 18]. It is therefore essential to complement with diagnostic exams when the patient is in pain but without any palpable mass.

The diagnosis of SH is challenging and requires a high level of suspicion [2–7, 17, 18].

6. Complementary diagnostic exams

As previously mentioned, the diagnosis of SH can be challenging and imaging exams are often necessary to help diagnose or assess the correct diagnosis. These exams are intended to show the presence of a hernia orifice and obtain information about the contents of the hernia sac [3, 4, 8, 14, 17]. Imaging exams also allow us to exclude differential diagnoses, which based only on the clinical presentation can be challenging.

6.1 Abdominal X-ray

In order to be able to make the diagnosis of SH through radiography, the hernia sac must have a subcutaneous location and contain an intestine with air, gas or oral contrast [17]. The use of oral contrast also allows diagnosing occlusion conditions [17]. However, this exam does not allow the diagnosis of SH if the hernia sac contains omentum or if the hernia sac has no content [17]. In these cases, radiography is usually an inconclusive exam [17].

6.2 Ultrasonography (US)

Ultrasonography is recommended as the first-line imaging test to investigate the existence of SH [14, 18], presenting diagnostic utilities on palpable and non-palpable SH [17, 18]. Diagnosis is made when the presence of a hernial orifice in Spigelian aponeurosis is demonstrated [17]. The hernia orifice is visualized as a defect in the echographic line of the aponeurosis (**Figure 3**) [17]. There may also be interruptions in the lines that represent the preperitoneal and peritoneum fat [17]. US has a diagnostic sensitivity of 90% for SH and a positive predictive value of 100% [2]. Thus, US is a highly sensitive and low-cost test, ideal for an initial approach to the diagnosis of SH, but it has the disadvantage of being operator-dependent [15, 18].

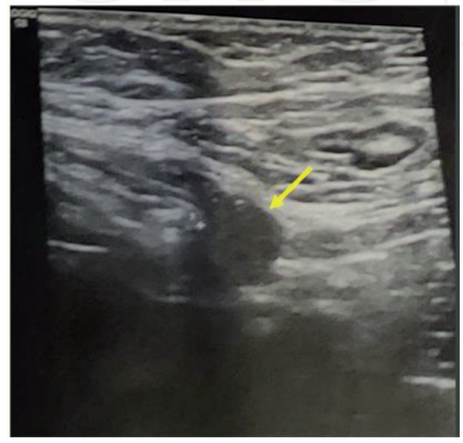

Figure 3.
Ultrasonography of Spigelian hernia (shown by the yellow arrow).

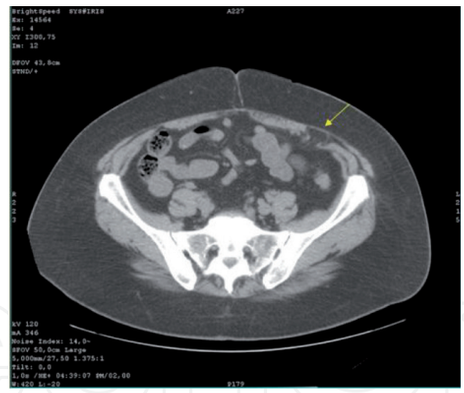

Figure 4.
CT scan of SH orifice (SH shown by the yellow arrow).

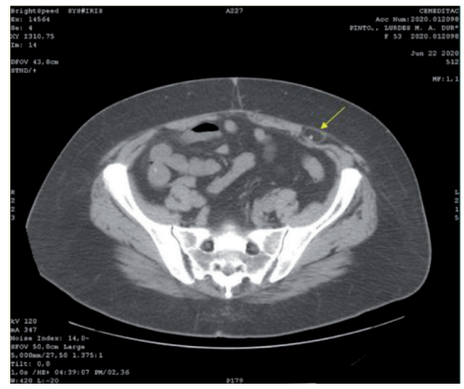

Figure 5.
CT scan of incarcerated SH (SH shown by the yellow arrow).

6.3 Computed tomography (CT)

Some studies suggest that the CT scan has a diagnostic sensitivity of SH of close to 100% [2, 14] and a positive predictive value of 100% [2], making the CT the most reliable exam to perform the diagnosis and delimit the anatomy in uncertain cases (**Figures 4** and **5**) [2, 4, 8, 18].

6.4 Magnetic resonance imaging (MRI)

With the increasing availability, MRI can bring benefits in the preoperative evaluation of doubtful cases [18]. However, more studies are needed to understand its use.

6.5 Laparoscopy

Although US and CT scans are useful tests to make a diagnosis, sometimes SH is not diagnosed by these exams. Thus, when the mass caused by SH is not palpable and is not visible by any imaging exam, exploratory laparoscopy may be indicated [4].

7. Differential diagnosis

SH can have a presentation with several non-specific symptoms, making this pathology easily confused with other intra-abdominal pathologies or lesions of the

anterior abdominal wall [7, 17, 18]. The presence of other types of hernias, namely ventral or incisional, the presence of soft tissue or abdominal wall tumors, abscesses or adenopathies should be excluded [7, 17].

Other causes of abdominal pain such as appendicitis, appendicular abscesses and diverticulitis should be excluded [18].

Besides, a hernia can dissect the sheath of the rectus abdominis, making SH to be confused with a spontaneous rupture of the rectum or a hematoma [7].

8. Treatment

As previously mentioned, SH must be treated surgically due to their risk of incarceration and strangulation [2, 4, 7, 9, 11, 17], and up to 1/3 of SH are urgently operated due to these complications [10].

Traditionally, SH was corrected by open surgery; however, with the advances in laparoscopic surgery, it started to play an increasingly important role [2–7]. This approach still allows for a diagnostic acuity of almost 100% [12].

Several studies have shown that laparoscopic surgery has less morbidity, with less pain, fewer operative wound complications and a shorter hospital stay (1–1.4 days vs. 5.2 open days) [2–17].

8.1 Open approach

This procedure is usually performed through a transverse or paramedian incision over the protrusion site [7, 10, 18]. A dissection of the subcutaneous tissue is carried out up to the aponeurosis of the external oblique muscle and its opening with a cut in the direction of the muscle fibers [5, 7, 10, 18, 19]. After reduction of the hernia sac, the hernia orifice can be closed with a non-absorbable suture or with the placement of a synthetic mesh (in a sublay or inlay position) anchored with separate stitches [4, 5, 7, 18, 19].

Some authors advocate that the open route should be chosen if the hernia orifice is larger than 5 cm and if the abdominal wall is visibly damaged [15].

8.2 Laparoscopic approach

In 1992, Carter and Mizes performed the first laparoscopic repair of an SH, having performed a primary suture repair with extracorporeal knotting [5, 11, 12, 14, 18, 19].

The laparoscopic approach allows for an easy location of the defect, requiring less tissue dissection [2, 4, 5, 8, 9, 13]. The use of synthetic mesh is recommended, as it guarantees better results when compared with suture of the hernia defect [4, 11].

Currently, there are three types of laparoscopic approaches with mesh placement described, two through an intra-abdominal approach (IPOM and TAPP) and one through an extraperitoneal approach (TEP). The IPOM approach is the most popular, being performed in about 46.2% of cases, followed by TAPP (35.5%) and TEP (18.3%) [2, 5, 11, 14].

The International Endohernia Society Guidelines Update 2019 recommends that in the laparoscopic treatment of ventral and incisional hernias, an "at least four time the radius of the defect" mesh should be used [4]. Other authors suggest that the mesh should exceed the limits of the hernia defect by 4–5 cm [17, 18].

Laparoscopic approach with the mesh placement is safe, has few complications and allows a faster recovery [2, 5, 11, 12, 14, 15, 17, 18]. However, if we are facing an intra-abdominal infection or signs of strangulation of the contents of the hernia sac, the synthetic mesh should not be used [7].

Given the rarity of this pathology, no study has been able to demonstrate superior outcomes between these three laparoscopic approaches [2, 4–9].

Most studies do not report the existence of SH recurrence after laparoscopic correction regardless of the chosen surgical approach [5, 8, 19].

8.2.1 Intraperitoneal onlay mesh

The IPOM approach is the most commonly used and reported in the literature as it is a technically less demanding approach and fast technique and requires a shorter learning curve compared with others [2, 5, 11, 14]. The IPOM does not require a peritoneal flap and surgeons are more familiar with the intra-abdominal anatomy [5, 14, 17–19].

Brief description of the surgical technique [14, 17, 18]: The patient is positioned supine with both arms along the body. Pneumoperitoneum is performed. Three trocars are introduced: 1 trocar of 10 mm in the mid-clavicular line contralateral to the hernia at the level of the umbilicus or at the umbilicus; 1 trocar of 10 or 5 mm on the midclavicular line in a position superior to the first trocar and the last trocar of 5 mm inferior to the first trocar on the midclavicular line. The content is bluntly reduced and the mesh is placed.

In this technique, a composite or expanded polytetrafluoroethylene (PTFE) mesh is placed to cover the defect, covering at least 5 cm from the circumferential margin of the orifice, and it is anchored with tacks or transabdominal suture [7, 14, 17, 18].

Some studies have shown that intestinal adhesions or erosion of loops can occur due to tacks and the mesh; however, this event has not yet been reported in any clinical case [5, 12, 14]. Another disadvantage of this technique is that it violates the integrity of the abdominal cavity [4, 14].

The IPOM approach has been shown to be safe, with less operative time (mean duration 39 minutes), shorter hospital stay and few complications [5, 14, 17, 18].

8.2.2 Transabdominal preperitoneal approach

The initial approach of TAPP technique is similar to the IPOM [2, 7]; however, unlike the IPOM, the mesh is located anterior to the peritoneum [2, 7, 14, 18]. In this technique, it is necessary to create a peritoneal flap to cover the mesh used making this technique more technically challenging [2, 14, 18]. This flap is then closed with tacks or continuous sutures [18].

As with the IPOM, TAPP also makes it possible to precisely locate the hernia defect and observe the viability of the intestine incarcerated [7, 14, 19].

The TAPP procedure takes an average of 45 minutes [14].

8.2.3 Total extraperitoneal

In 2002 Morena-Egeas described for the first time the correction of SH *via* the TEP technique [13].

Brief description of the surgical technique [2, 5, 7, 10, 11, 18]: Patient in supine position with both arms adducted. Infraumbilical ipsilateral incision and

introduction of a 30° optic into a 10-mm port. Creation of a preperitoneal space with carbon dioxide insufflation at a pressure of 10 mmHg or with the inflation of a balloon, followed by telescopic dissection at the midline. Introduction of 2.5-mm working ports in midline, 8 and 3 cm from the pubic symphysis, under a direct view. Dissection and development of a preperitoneal plane. Identification of the hernia sac and mesh placement.

Studies have revealed that patients undergoing correction for TEP require fewer doses of narcotics and less time to resume daily activities when compared with TAPP [11].

TEP has advantages over TAPP since it avoids complications due to the dissection necessary to perform the peritoneal flap and reduces the operative time by avoiding its closure [5, 11, 13]. In addition to these factors, TEP allows the use of a Prolene mesh and does not require the use of tacks to close the peritoneal flap, which reduces the cost of surgery [5, 13]. This technique also makes it possible to reduce possible complications such as iatrogenic lesions of intestine or intestinal obstruction, as there is no violation of the abdominal cavity [5, 11].

However, the disadvantage of TEPP is the inability to do an exploration of the contents of the intestinal sac, making this approach indicated only for elective patients [5, 11].

This approach has an average duration of 59 minutes [14].

TEP is the least used surgical approach as it is the most technically challenging and has a longer learning curve, in addition to requiring a longer hospital stay when compared with IPOM [2, 5].

8.3 Robotic surgery

With the advancement of the availability of robotic surgery, it is expectable that this route of surgical correction will become more and more frequent [7, 20, 21]. SH repair using robotic techniques was described similar to the IPOM laparoscopic approach [7]. Due to the limited number of procedures performed this way, studies have not yet been carried out to determine the effectiveness and safety of robot vs. laparoscopic repairs [20, 21].

A major disadvantage of robotic surgery is the longer surgical time as well as the higher cost [20, 21].

9. Conclusion

Spigelian hernia (SH) is a rare type of abdominal wall hernia and results from protrusion through a defect in the Spigelian aponeurosis. Diagnosis may be difficult, and sometimes, this hernia goes unnoticed on physical examination. It is essential that the physician has a high level of clinical suspicion and often this diagnosis is only possible with the aid of imaging tests (US and CT). This type of hernia has surgical indication due to its risk of incarceration and strangulation. Since it is a rare and underdiagnosed type of hernia, currently there is no surgical technique defined as the ideal one for its correction. The surgical approach chosen must be adjusted to the patient, characteristics of the hernia, the available technical means and the surgeon's experience. Currently, the laparoscopic approach is gradually becoming the preferred surgical approach; however, the open approach remains the most widely used. IPOM approach is the most commonly used, as it is a simple, faster and easily reproducible approach.

Acknowledgements

The authors would like to thank all members of the General Surgery department at Centro Hospitalar Tondela-Viseu for their support and demand for improvement. We highlight the collaboration of Dr. Raquel Pereira, Dr. José Carlos Pereira and Dr. Tiago Pavão.

Conflict of interest

The authors declare no conflict of interest.

Author details

Bruno Barbosa*, Maria João Diogo, César Prudente and Carlos Casimiro
Centro Hospitalar Tondela-Viseu, Viseu, Portugal

*Address all correspondence to: brunobarbosamd@gmail.com

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