KESANS: International Journal of Health and Science
2808-7178 / 2808-7380
http://kesans.rifainstitute.com/index.php/kesans/index

Evaluation of Inguinal Hernia Management in Adult Patients: A Contemporary Review

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Article Information
Submitted: **23 June 2025**
Accepted: **30 June 2025**
Publish: **05 July 2025**

Keyword: Direct Inguinal Hernia; Indirect Inguinal Hernia; Inguinal Triangle; Hesselbach's Triangle; Hernia Sac; Spermatic Cord;

Abstract
Inguinal hernias are classified into two primary types based on their anatomical pathways: direct and indirect inguinal hernias. A direct hernia occurs when the hernia sac protrudes directly through the inguinal (Hesselbach's) triangle, which is bordered medially by the rectus abdominis muscle, inferiorly by the inguinal ligament, and laterally by the inferior epigastric vessels. This type of hernia may compromise the posterior wall of the inguinal canal. In contrast, an indirect hernia follows the path of the spermatic cord, entering through the deep inguinal ring and extending outside the boundaries of the inguinal triangle. Understanding the anatomical distinctions between these two types is essential for accurate diagnosis, surgical planning, and effective management.

How to Cite: **I Made Erik Sastra Gunawan/Evaluation of Inguinal Hernia Management in Adult Patients: A Contemporary Review, Vol. 4, No. 10, 2025**
DOI: https://doi.org/10.54543/kesans.v4i10.391
e-ISSN/p-ISSN: **2808-7178 / 2808-7380**
Published by: **CV Rifainstitut/KESANS: International Journal of Health and Science**

Introduction

Hernia represents one of the most common reasons for patient referral by primary care physicians for surgical evaluation. There are various types of hernias, the majority of which occur in the abdominal or inguinal regions. The term inguinal hernia encompasses three main subtypes, classified based on their anatomical relationship to the inguinal (Hesselbach's) triangle. A direct inguinal hernia involves the protrusion of tissue through the posterior wall of the inguinal canal, medial to the inferior epigastric vessels. In contrast, an indirect inguinal hernia protrudes through the internal inguinal ring, lateral to the inferior epigastric vessels. Femoral hernias occur below the inguinal ligament and are medial to the femoral vessels.(Berndsen, Gudbjartsson, & Berndsen, 2019); (Shakil, Aparicio, Barta, & Munez, 2020)

In the United States, approximately 1.6 million cases of inguinal hernia are diagnosed annually, with an estimated 700,000 cases undergoing surgical repair. The lifetime prevalence of inguinal hernia is about 27% in men and 3% in women. The incidence of inguinal hernia repair increases with age, from 0.25% among 18-year-olds to 4.2% in individuals aged 75 to 80 years. Approximately 96% of all groin hernias are inguinal (either direct or indirect), and around 20% of these are bilateral. Femoral hernias constitute roughly 4% of all inguinal hernia cases and are significantly more common in women (ranging from 16% to 37%).(Fadhilah et al., 2019)

Risk factors for inguinal hernia include a family history of hernia, male sex, advanced age, low body mass index, systemic connective tissue disorders, and a history of radical prostatectomy or radiation therapy. In women, additional risk factors include taller stature, chronic cough, umbilical hernia, and rural residence. (Fadhilah et al., 2019)

An increase in intra-abdominal pressure—resulting from obesity, chronic coughing, heavy lifting, or straining due to constipation—also contributes to hernia development. Inguinal hernias can be classified as congenital or acquired. Among adults, the majority of cases are acquired. Of all cases, approximately 30% of patients are asymptomatic, and up to 50% are unaware of the presence of a hernia.(Hammoud & Gerken, 2023)

Clinical Presentation

Patients with inguinal hernia may report a progressively enlarging bulge in the groin region. Most individuals experience vague discomfort or mild pain; however, up to one-third of patients may remain asymptomatic. Symptoms often worsen with activities that increase intra-abdominal pressure, such as standing, straining, lifting heavy objects, or coughing, which facilitate the protrusion of abdominal contents through the hernial defect (Hammoud & Gerken, 2023);(Hassler, Saxena, & Baltazar-Ford, 2017).

Some patients may only perceive symptoms later in the day or after prolonged physical exertion. In many cases, the bulge may disappear upon lying down. Nonetheless, the absence of a palpable or reducible mass does not rule out the presence of a hernia (Khan & Ahmed, 2021).

In certain patients, groin or pelvic pain may be attributed to an occult hernia, which is not readily visible or palpable. When present, inguinal pain is commonly described as a dull ache, a pulling sensation, or a localized burning discomfort. Such symptoms may result from stretching or tearing of tissues surrounding the hernial defect. As the hernia progresses, the protrusion generally increases in size. Severe pain may indicate an incarcerated hernia, which necessitates urgent surgical intervention.

Table 1 outlines differential diagnoses that should be considered in patients presenting with inguinal pain, with or without a scrotal mass. Importantly, asymptomatic hernias may also be discovered incidentally during physical examination (Khan & Ahmed, 2021); (Köckerling, Koch, & Lorenz, 2019).

Table 1
Differential Diagnoses of Inguinal Pain

Category	Conditions
Visceral	Abdominal hernia
	Adhesions – Appendicitis
	Diverticulosis
	Inguinal or femoral hernia
	Testicular torsion - Varicocele
Hip Joint Related	Acetabular labral tear and femoroacetabular impingement
	Avascular necrosis
	Iliotibial band syndrome
	Osteoarthritis
	Snapping hip syndrome and iliopsoas tendinitis
Infectious	Abscess
	Diverticulitis
	Herpes infection
	Osteomyelitis
	Septic arthritis
	Urinary tract infection
Inflammatory	Endometriosis
	Epididymitis and orchitis
	Inflammatory bowel disease
	Pelvic inflammatory disease
	Prostatitis
	Synovitis
Traumatic	Muscle contusion
	Stress fracture
	Tendon avulsion
	Nerve compression syndrome
Neurologic	Referred pain (e.g., sacroiliitis, hamstring pain, knee pain)

Physical Examination

In male patients, clinical examination should ideally begin with the patient in a standing position while the examiner is seated. The inguinal region must be inspected for any visible bulge. The examiner should observe whether the bulge enlarges during a Valsalva maneuver (straining) (Engbang et al., 2021).

An indirect inguinal hernia typically exhibits a piriform (pear-shaped) appearance—widening into the scrotum and narrowing above the medial half of the inguinal ligament. In contrast, a direct inguinal hernia is generally round, located medial to the inguinal ligament, and does not usually extend into the scrotum (Engbang et al., 2021); (Simons M P, 2018).

If no hernia is visibly apparent, further palpation is warranted. Using the index finger, the clinician should examine the base of the scrotum and gently guide any excess scrotal skin into the inguinal canal toward the pubic tubercle. The finger follows the path adjacent to the spermatic cord and ultimately rests just inside the external inguinal ring. The patient is then asked to strain or cough while the examiner palpates for a soft impulse indicative of herniation. In female patients, inguinal hernias may not produce a visible

mass but can occasionally be palpated, particularly during a Valsalva maneuver (Tran, 2018).

Imaging

In male patients, the diagnosis of an inguinal hernia typically does not require imaging studies. However, in female patients, imaging is often necessary, particularly when recurrence is suspected, postoperative complications are present, or alternative causes of inguinal pain—such as masses or hydroceles—are being considered (Tshijanu, Biniaris, Paraskevopoulou, Chatzigianni, & Xiarchos, n.d.).

Ultrasonography is the first-line imaging modality, with sensitivity ranging from 33% to 86% and specificity from 77% to 90% for the detection of occult hernias. It can be particularly useful when clinical examination does not yield conclusive findings (Tshijanu et al., n.d.).

If clinical suspicion for a hernia remains high despite negative ultrasound results, MRI with Valsalva maneuver may be considered. MRI offers superior diagnostic performance with a sensitivity of 91%, specificity of 92%, positive predictive value of 95%, and negative predictive value of 85% for detecting occult hernias. MRI surpasses both ultrasound and CT in identifying especially hidden inguinal hernias (Tshijanu et al., n.d.).

Herniography, involving the injection of contrast medium into the hernia sac, has a sensitivity of 91% and specificity of 83% for detecting occult hernias. This technique is more accurate than both ultrasonography and CT (which have a sensitivity of 80% and specificity of 65%) and may be beneficial in selected cases (Tshijanu et al., n.d.).

Management

In 2018, a consortium of international associations known as the HerniaSurge Group conducted a comprehensive literature review and formulated guidelines for the management of inguinal hernias. This group received direct financial support from mesh manufacturers Bard and Johnson & Johnson. The HerniaSurge Group classified hernia management into two principal categories: conservative and surgical approaches (Simons M P, 2018).

1. Conservative Management

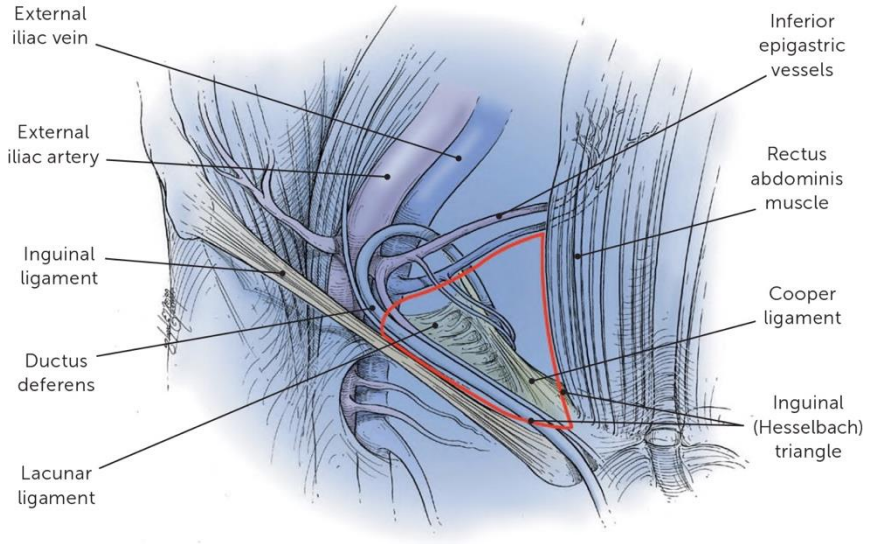
The watchful waiting approach—active clinical monitoring without immediate surgical intervention—is considered a reasonable and safe option for men with reducible hernias that do not interfere with daily activities or cause significant pain or discomfort. Surgery should be considered if the patient develops symptoms.

His approach is not recommended for non-pregnant women, due to a higher likelihood of femoral hernia, which carries an increased risk of strangulation. Similarly, watchful waiting is not advised in patients with symptomatic hernias because of the elevated risk of incarceration. One of the main risks of this approach is that intra-abdominal contents may become trapped within the hernia sac (incarceration), potentially compromising blood flow and leading to strangulation. A rare but potentially fatal complication is Richter's hernia, in which only a portion of the intestinal wall becomes strangulated (Simons M P, 2018).

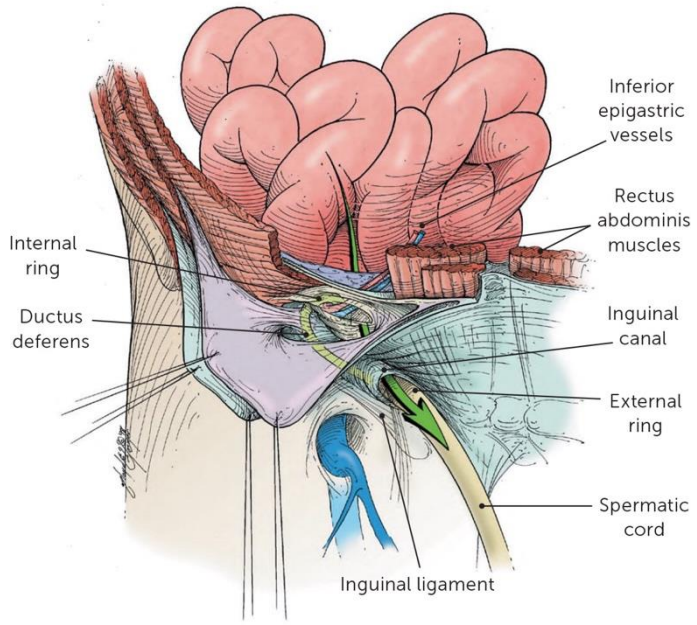
The HerniaSurge guidelines emphasize that physicians should provide comprehensive education to patients with asymptomatic or minimally symptomatic inguinal hernias regarding the natural history of the condition and the potential risk of

emergency surgical intervention. Primary care physicians may refer patients to a surgeon or collaborate during the conservative management period, including conducting routine follow-ups to monitor symptom progression and evaluate alternative contributing diagnoses. However, no consensus currently exists regarding the optimal interval for follow-up during the watchful waiting period (Simons M P, 2018).

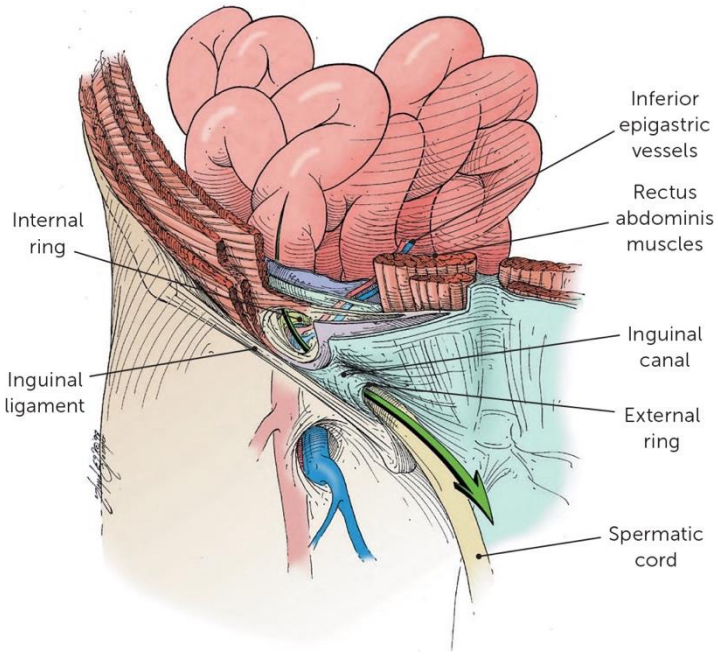
This conservative strategy is also commonly applied to pregnant patients, as inguinal swelling is often due to transient round ligament varicosities rather than true hernia. Color Doppler ultrasonography can help differentiate between a true inguinal hernia and round ligament varicosities. In a 2017 cohort study involving 20,714 pregnant women, only 25 were diagnosed with inguinal hernias, and none underwent elective or emergency surgery during pregnancy. In 10 of these patients, the inguinal bulge resolved spontaneously postpartum. For reducible inguinal hernias in pregnant women, deferring surgery until after delivery is considered both safe and cost-effective (Simons M P, 2018).



Picture 1. The inguinal triangle (Hesselbach's triangle) (marked by the red line) is an anatomical landmark bounded medially by the rectus abdominis muscle, inferiorly by the inguinal ligament, and laterally by the inferior epigastric vessels (Simons M P, 2018).



Picture 2. Direct hernia pathway, the hernia sac passes directly through the inguinal triangle and may compromise the floor of the inguinal canal (Simons M P, 2018).



Picture 3. Indirect hernia pathway, note that the hernia sac passes outside the boundaries of the inguinal triangle and follows the course of the spermatic cord (Simons M P, 2018).

2. Surgical Management

The choice of surgical technique for inguinal hernia repair depends on various factors, including access to anesthesia, surgeon preferences and training, patient preferences, mesh availability, cost, and logistical considerations. Understanding common surgical procedures is essential for primary care providers to ensure appropriate postoperative care and monitor for complications, including recurrence (Simons M P, 2018).

Surgical interventions can be broadly classified into the following categories (Simons M P, 2018):

- Open anterior repair
- Open posterior repair
- Tension-free mesh repair
- Laparoscopic repair

3. Open Repair Techniques

Open inguinal hernia repair is typically performed under local or spinal anesthesia, keeping the patient conscious while the surgical area is anesthetized. A 5–6 cm incision is made parallel to the inguinal ligament. There are two primary approaches: mesh-based (herniorrhaphy) and non-mesh techniques. The Lichtenstein technique is the most commonly used mesh-based method. It is tension-free and associated with low recurrence rates and minimal injury to vital structures. In contrast, the Bassini technique, a conventional non-mesh method, is still employed in developing countries due to limitations in cost and mesh availability. However, the Bassini method introduces tension at the suture line, increasing the risk of postoperative pain and long-term complications (Simons M P, 2018); (Tran, 2018).

4. Lichtenstein Technique

This technique involves covering the hernial defect with a synthetic mesh to reduce tension on the abdominal wall. The Lichtenstein procedure remains the gold standard for open inguinal hernia repair, particularly in large or recurrent hernias. Despite its effectiveness, chronic postoperative inguinal pain remains a concern, potentially due to inflammatory responses to the mesh material (Simons M P, 2018); (Tran, 2018).

5. Bassini Technique

Laparoscopy offers a minimally invasive alternative, using either the total extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) approach. Compared to open repair, laparoscopy provides faster recovery, reduced postoperative pain, and lower recurrence rates. It is strongly recommended for female and pediatric patients due to a lower risk of umbilical cord injury and improved detection of contralateral hernias (Köckerling et al., 2019).

However, laparoscopic repair demands advanced surgical skills and carries potential risks, including vascular, bladder, and bowel injury. Limited access to appropriate facilities in certain regions also poses a challenge to its widespread implementation (Tran, 2018).

Although non-mesh techniques are becoming obsolete in the United States, they remain acceptable in some international settings. Mesh-based repairs are strongly recommended due to significantly lower recurrence rates. If mesh is unavailable, the 2009

European guidelines endorse open anterior non-mesh repair as the preferred alternative (Engbang et al., 2021).

Laparoscopic techniques have demonstrated superiority over tension-free mesh repair in terms of reduced postoperative pain. The two most common laparoscopic approaches include (Engbang et al., 2021):

- **Total extraperitoneal (TEP) approach**
- **Transabdominal preperitoneal (TAPP) approach**

In both techniques, the mesh is placed within the preperitoneal space, although the anatomical entry points differ. Laparoscopic repair is generally favored over open techniques due to superior recovery outcomes (Engbang et al., 2021).

Guidelines specifically recommend laparoscopy in women to reduce the risk of chronic pain and avoid misdiagnosis of femoral hernias. Laparoscopic repair is also suitable for patients with prior open hernia repairs to circumvent extensive scar tissue.[9,10]

A Cochrane review comparing open and laparoscopic repairs found that laparoscopic procedures take longer and are associated with higher rates of vascular, colonic, and bladder complications. Nonetheless, laparoscopy offers faster overall recovery, earlier return to daily activities, reduced pain, and lower recurrence rates (Tshijanu et al., n.d.); (Ulfandi & Jeo, 2019).

6. Postoperative Care

Historically, surgeons have advised patients to refrain from physical activity for four to six weeks following inguinal hernia repair—a recommendation primarily based on expert opinion. However, there is no scientific evidence to support the notion that early physical activity increases the risk of hernia recurrence, regardless of the surgical approach used. Most patients undergoing laparoscopic hernia repair should be encouraged to resume physical activity within three to five days after the procedure. Prolonged use of analgesics and extended medical leave are also not supported by current evidence (Wu, Chang, Lin, Yeh, & Özçakar, 2022); (Yeap, Nataraja, & Pacilli, 2020).

Hernia is a common condition for which surgical intervention remains the only definitive treatment. This study confirms that inguinal hernia is the most frequently encountered type, predominantly affecting men, typically occurring on the right side, and presenting unilaterally. The use of mesh is highly recommended in most cases, except when infection is present (Montgomery, Dimick, & Telem, 2018); (Itani & Fitzgibbons, 2019).

The most frequently observed acute postoperative complications in this study were seroma, infection, hematoma, and pain—reported at higher rates than previously documented in the literature. Chronic complications such as persistent inguinal pain and recurrence were also observed, particularly among patients with a history of recurrent hernia. Advanced age was not significantly associated with increased complication risk; however, comorbidities—particularly hypertension and smoking—were found to substantially elevate the risk of acute complications. Conversely, diabetes did not demonstrate a significant correlation with either acute or chronic postoperative complications. Thus, while modern surgical techniques such as mesh implantation generally yield favorable clinical outcomes, special attention must be given to patients with certain comorbidities to reduce the risk of postoperative complications (Köckerling & Simons, 2018); (HerniaSurge Group, 2018).

Conclusion

Inguinal hernia is the most common type of hernia, predominantly affecting men and more frequently occurring on the right side of the body. The condition may present either asymptomatically or symptomatically, with a characteristic groin bulge that enlarges during straining or standing. Diagnosis is generally established through physical examination, though imaging modalities such as ultrasonography or MRI may be necessary, particularly in women or cases involving occult hernia.

Management of inguinal hernia falls into two categories: conservative and surgical. A conservative (watchful waiting) approach may be appropriate for asymptomatic men with reducible hernias, but it is not recommended for women or symptomatic patients due to the increased risk of complications such as incarceration or strangulation. Surgical intervention remains the definitive treatment.

Operative techniques include open and laparoscopic repairs. Tension-free mesh repair—most notably the Lichtenstein technique—remains the gold standard due to its low recurrence rate. Laparoscopic techniques, including total extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) approaches, offer the advantages of faster recovery and reduced postoperative pain, though they require advanced surgical expertise and specialized equipment.

Postoperative care no longer necessitates strict physical activity restrictions, and most patients can resume normal activities within a few days. Key complications to monitor include seroma, infection, hematoma, chronic pain, and recurrence—particularly in patients with comorbidities such as hypertension and smoking habits. Although modern surgical techniques provide generally favorable clinical outcomes, an individualized approach based on patient risk factors remains essential for optimizing long-term results.

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