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Surgical Management and Recent Advances in Inguinal Hernia

Runjie Guo, Shile Wu*

Qinghai University, Xining, Qinghai, 810016, China
**Correspondence Author*

Abstract: ***Inguinal hernia is the most common type of external abdominal hernia encountered in clinical practice, with a significantly higher incidence in males than in females. Surgical repair remains the only effective treatment option. This article provides a comprehensive review of the etiology, risk factors, surgical indications, and classification of inguinal hernias. It offers a detailed comparison between traditional open repair techniques (such as the Bassini, Shouldice, McVay, and Lichtenstein methods) and minimally invasive approaches, including TAPP (transabdominal preperitoneal), TEP (totally extraperitoneal), and robot-assisted surgeries, highlighting their technical features, suitable patient populations, and clinical outcomes. In addition, recent advances are discussed in several key areas: the development of mesh materials (including biodegradable, composite, and functionally modified meshes), innovations in anesthesia and analgesia (such as nerve blocks, long-acting sustained-release agents, and multimodal pain management), the expansion of ambulatory surgery models, and personalized treatment strategies. Future research is expected to focus on artificial intelligence–assisted decision-making and surgical navigation, balancing standardization with individualization of care, and building intelligent management platforms. These efforts aim to advance inguinal hernia treatment toward greater precision, minimally invasiveness, and intelligent integration.***

Keywords: Inguinal hernia, Tension-free repair, Laparoscopic surgery, Personalized treatment, Artificial intelligence**.**

1. Introduction

Inguinal hernia is one of the most common types of external abdominal hernias, with a high incidence among adults. It ranks among the most frequently performed surgical procedures in men. The prevalence in males is significantly higher than in females, with a male-to-female ratio of approximately 9:1. Men aged 40 to 59 represent the highest-risk group, and it is estimated that about 27% of men will develop an inguinal hernia at some point in their lifetime. Statistics indicate that roughly one in four men will experience an inguinal hernia during their lives. Globally, over 20 million inguinal hernia repair procedures are performed each year [1], underscoring the substantial disease burden and surgical demand associated with this condition. Currently, surgical repair is the only effective treatment for inguinal hernia. Therefore, a thorough understanding of its etiology and main treatment strategies, along with attention to key issues in postoperative recovery, is of great clinical significance.

2. Etiology and Risk Factors of Inguinal Hernia

The development of inguinal hernia is influenced by a variety of factors, including genetic predisposition, anatomical structures, and lifestyle-related elements. Genetic susceptibility plays a significant role in hernia formation; studies have shown a familial clustering of inguinal hernias, following a complex polygenic inheritance pattern [2]. Genome-wide association studies have identified multiple susceptibility loci associated with inguinal hernia, most of which are involved in the regulation of connective tissue homeostasis [3]. Patients with hernias often exhibit abnormalities in the collagen composition of the abdominal wall connective tissue, which may reduce abdominal wall strength and increase hernia risk [4]. Anatomical weak points are also essential for hernia formation. For example, lateral (indirect) inguinal hernias are often due to the failure of closure of the processus vaginalis, allowing abdominal contents to protrude through this congenital passage. Medial (direct) hernias are typically associated with weakness in the fascia of the lower abdominal wall, specifically in the Hesselbach triangle [5]. Environmental and lifestyle factors further contribute to hernia occurrence. Epidemiological studies have shown that hernia incidence is significantly higher among males, the elderly, and individuals with a low body mass index (BMI). Men are several times more likely to develop hernias than women. Older adults are more prone due to degenerative changes in the abdominal wall tissues. Individuals with a lean and tall body habitus are more susceptible to hernia formation compared to obese individuals; although obesity may, to some extent, reduce the protrusion of hernia contents, the chronically elevated intra-abdominal pressure associated with obesity increases the risk of hernia recurrence and related complications [6]. Moreover, any factor that repeatedly increases intra-abdominal pressure—such as chronic coughing, straining due to constipation, or frequent heavy lifting—can contribute to hernia development. Smoking is also recognized as a risk factor, as it promotes collagen degradation and inhibits collagen synthesis, thereby weakening the abdominal wall and increasing the likelihood of hernia formation [7].

3. Surgical Indications and Classification of Inguinal Hernia

Inguinal hernia is the most common type of abdominal wall hernia encountered in clinical practice. Its primary pathological feature is the protrusion of intra-abdominal contents through the inguinal canal to the body surface, forming a reducible or irreducible mass. Due to the potential risk of incarceration or strangulation of the herniated contents, surgical repair remains the only definitive treatment for inguinal hernia [8]. Clearly defined surgical indications and standardized clinical classifications are essential for guiding

therapeutic decision-making and selecting the appropriate surgical approach.

3.1 Surgical Indications

Surgical indications for inguinal hernia are determined by a comprehensive evaluation of clinical symptoms, hernia type, and the patient's overall health status. The current consensus is that once an inguinal hernia is diagnosed, surgical treatment is recommended in the vast majority of cases [9]. The main surgical indications include:

Symptomatic patients: Those presenting with recurrent inguinal bulges accompanied by pulling pain, a sensation of heaviness, or activity limitation—especially when daily life or work capacity is affected—are advised to undergo early surgical intervention. Signs of incarceration or strangulation: A hernia that suddenly enlarges, becomes firm, irreducible, and is associated with severe pain, nausea, or vomiting should be treated as a surgical emergency to prevent complications such as bowel necrosis or peritonitis. Young or physically active patients: In patients who are younger or engage in significant physical activity, early surgery is recommended to prevent complications and restore functional capacity. Recurrent, bilateral, or large hernias: Even in the absence of obvious symptoms, patients with these hernias are advised to undergo elective repair due to the higher risk of complications and increased technical difficulty during surgery [10]. Asymptomatic patients with high-risk factors: Prophylactic surgery may be considered for individuals with chronic constipation, chronic cough, benign prostatic hyperplasia, smoking history, or other conditions that increase intra-abdominal pressure, as these factors elevate the risk of hernia progression or incarceration. However, for elderly or frail patients, those with severe comorbidities, limited life expectancy, or very small, stable, asymptomatic hernias, a personalized approach involving observation and regular follow-up may be appropriate instead of immediate surgical intervention.

3.2 Clinical Classification of Inguinal Hernia

Accurate classification of inguinal hernias is crucial not only for preoperative evaluation and surgical planning but also for assessing the risk of recurrence and predicting postoperative outcomes. Currently, the most commonly used classification systems include the following:

3.2.1 Classification by Anatomical Location

1) Direct Hernia: The hernia sac protrudes through a weakened area of the abdominal wall, specifically the Hesselbach triangle. It is more commonly seen in middle-aged and elderly men and is associated with degenerative changes in abdominal wall tissues.

2) Indirect Hernia: The hernia sac enters the inguinal canal through the internal inguinal ring and may extend into the scrotum. This is the most common type, particularly prevalent among children and adolescents.

3) Mixed Hernia: Features of both direct and indirect hernias are present simultaneously. This type requires intraoperative identification and simultaneous repair [11].

3.2.2 Classification by Recurrence Status

1) Primary Hernia: A hernia occurring for the first time, with no prior history of hernia repair.

2) Recurrent Hernia: A hernia that recurs after previous surgical repair, often due to inappropriate surgical technique or technical issues during the initial procedure [12].

3.2.3 Classification by Reducibility

1) Reducible Hernia: The hernia contents can be manually or spontaneously reduced into the abdominal cavity, typically presenting with mild symptoms.

2) Incarcerated Hernia: The hernia contents cannot be reduced but are not yet strangulated. This condition requires urgent evaluation and management.

3) Strangulated Hernia: The blood supply to the herniated contents is compromised, potentially leading to tissue necrosis. This is a surgical emergency requiring immediate intervention.

3.2.4 Nyhus Classification (Used for Intraoperative Precision)

The Nyhus classification is an internationally accepted intraoperative system that categorizes hernias based on the position of herniated contents, degree of internal ring dilation, and characteristics of the abdominal wall defect. It consists of Types I through IV and helps guide the assessment of recurrence risk and selection of appropriate surgical technique [13].

In summary, the indication for inguinal hernia surgery should be individualized based on the severity of the condition, the patient's overall health status, and potential risks. Meanwhile, standardized classification systems provide essential reference points for precise treatment planning and are critical for improving surgical outcomes and reducing recurrence rates.

4. Traditional Surgical Treatments for Inguinal Hernia

Before the widespread adoption of laparoscopic techniques, traditional open surgery was the mainstay of treatment for inguinal hernia. Although minimally invasive procedures have rapidly advanced in recent years, conventional open repairs are still widely used in specific patient populations and in regions with limited medical resources. The primary traditional techniques include the Bassini, Shouldice, McVay, and Lichtenstein tension-free repair methods. Each approach differs in anatomical principles, technical execution, and clinical outcomes, and the choice of procedure should be tailored to the patient's individual condition.

4.1 Bassini Technique

First introduced by Italian surgeon Edoardo Bassini in 1887, the Bassini method was among the earliest systematic

techniques for inguinal hernia repair. It involves suturing the transversalis fascia, transversus abdominis, and internal oblique muscles to the inguinal ligament to reconstruct the posterior wall of the inguinal canal and close the hernia defect. This method is relatively straightforward and suitable for primary hernia cases. However, due to significant suture tension, the recurrence rate is relatively high, especially in patients with high tissue tension [14].

4.2 Shouldice Technique

The Shouldice technique, developed and refined at the Shouldice Hospital in Canada, is a multilayered, tension-free suture repair. It strengthens the posterior wall of the inguinal canal using a four-layer suture method, thereby minimizing tension and reducing the risk of recurrence. Studies have shown that the Shouldice method has a lower recurrence rate compared to the Bassini technique and allows for faster postoperative recovery. However, it requires a high level of surgical expertise and should be performed by surgeons with specialized training [15].

4.3 McVay Technique

Also known as the Cooper's ligament repair, the McVay method is primarily used for direct and femoral hernias. It involves suturing the transversalis fascia to Cooper's ligament to close the hernia defect. This technique is suitable for patients with anatomical anomalies in the inguinal region or with large hernia rings. However, it is technically complex and may be associated with complications such as femoral canal narrowing postoperatively [16].

4.4 Lichtenstein Tension-Free Mesh Repair

Introduced in the 1980s by Lichtenstein, this technique revolutionized hernia surgery by advocating for a tension-free repair concept. The procedure involves placing a synthetic mesh, such as polypropylene, over the posterior wall of the inguinal canal. The mesh adheres naturally to the tissue without the need for tight sutures, thereby eliminating the tension-related issues seen in traditional techniques. The Lichtenstein repair is characterized by its technical simplicity, short learning curve, mild postoperative pain, rapid recovery, and low recurrence rate. Numerous large-scale clinical trials and meta-analyses have reported recurrence rates below 2%, along with a low incidence of complications, making it the most widely adopted open repair method worldwide [17].

However, the use of synthetic mesh also presents certain challenges. Approximately 5–10% of patients may experience chronic postoperative pain due to mesh-induced nerve compression. Other complications include mesh infection, migration, fibrosis, and allergic or foreign body reactions in sensitive individuals. Therefore, in younger patients, recurrent hernias, or those with mesh allergies or foreign body sensitivities, the risks and benefits must be carefully weighed before selecting the surgical approach. The Lichtenstein method has become the "gold standard" for open inguinal hernia repair and has laid the theoretical and technical foundation for subsequent minimally invasive, tension-free repair techniques [18].

4.5 Comparison and Selection of Surgical Techniques

Each traditional surgical method has its own advantages and limitations. The choice of technique should be based on patient-specific factors, hernia type, and the surgeon's experience: The Bassini and Shouldice techniques are more suitable for primary hernias. The McVay method is preferred for direct or femoral hernias. The Lichtenstein repair is applicable to most inguinal hernia cases, particularly recurrent and bilateral hernias. Postoperative care for traditional surgery should focus on wound management, pain control, and activity guidance. Common complications include wound infection, hematoma, chronic pain, and recurrence. Rigorous postoperative follow-up is essential to identify and manage complications promptly and improve surgical outcomes [19]. It is important to note that while traditional surgery still has value in certain situations, the rise of minimally invasive techniques, particularly laparoscopic hernia repair, has become the mainstream approach due to its advantages of reduced trauma, faster recovery, and lower recurrence rates. Nevertheless, in resource-limited settings or for patients unsuitable for general anesthesia, traditional open repairs remain a critical treatment option.

5. Minimally Invasive Surgical Treatments

With the rapid development of minimally invasive surgery, laparoscopic inguinal hernia repair has emerged as a major alternative to open surgery. It offers significant advantages such as less trauma, reduced postoperative pain, faster recovery, and better cosmetic outcomes, making it particularly suitable for patients with bilateral hernias, recurrent hernias, or those who require a quick return to work. The two primary laparoscopic techniques in current practice are TAPP (Transabdominal Preperitoneal Repair) and TEP (Totally Extraperitoneal Repair), both of which are regarded as mainstream approaches in minimally invasive inguinal hernia treatment.

5.1 Laparoscopic Techniques: TAPP and TEP

TAPP (Transabdominal Preperitoneal repair) involves entering the abdominal cavity laparoscopically, creating a transverse or vertical incision in the peritoneum above the iliopubic tract, and lifting the peritoneum to expose the preperitoneal space. The surgeon dissects the posterior abdominal wall, reduces the hernia sac, and places a synthetic mesh (typically polypropylene) in the preperitoneal space. The peritoneum is then sutured or stapled closed to restore its integrity [20]. TAPP offers a clear operative field, making it suitable for beginners and complex cases, allowing simultaneous assessment of bilateral or recurrent hernias, and facilitates the management of unexpected intra-abdominal pathologies. However, it requires peritoneal dissection and closure, increasing the risk of postoperative adhesions. Entry into the abdominal cavity also introduces potential complications such as visceral injury, bowel adhesions, and cardiopulmonary complications related to pneumoperitoneum. TEP (Totally Extraperitoneal repair) is performed through a small incision above the pubic symphysis. A working space is created in the extraperitoneal plane using blunt dissection or balloon dissection. The peritoneum is not opened; instead, the

hernia sac is reduced, and mesh is placed to cover the internal and external rings as well as Hesselbach's triangle. The instruments are then withdrawn, and the peritoneum adheres naturally. Since TEP avoids entry into the peritoneal cavity and extensive peritoneal suturing, it aligns better with the "purely minimally invasive" philosophy. It typically results in less postoperative pain, faster bowel recovery, and lower risk of bowel-related complications. However, it presents a narrower working space, limited visibility, and requires greater surgical skill, especially during the early learning phase. Peritoneal tears may occur, necessitating conversion to TAPP or open surgery [21].

Perioperative comparisons show that TEP generally has a slightly shorter operative time than TAPP (by 5–15 minutes on average), especially in straightforward unilateral hernias, as TAPP requires peritoneal closure. Hospital stay is comparable between the two, with both procedures often performed as day surgeries or with 1–2 days hospitalization [21–22]. In terms of postoperative pain, early pain scores are lower with TEP than with TAPP, although the difference disappears after one month. The incidence of chronic pain (>3 months) is similar for both procedures—around 5% to 10%, primarily influenced by mesh fixation methods [23]. Complication rates, such as hematoma or seroma, are below 5% for both techniques. However, peritoneal rupture during TEP can lead to conversion in 10%–15% of cases, while TAPP has a lower conversion rate (<2%) [21]. Because TAPP involves entry into the abdominal cavity, there is a slightly higher risk (<1%) of bowel or bladder injury, whereas such injuries are rare in TEP. Mid- to long-term follow-ups (2–5 years) show similar recurrence rates for both procedures—TAPP: 1%–3%, TEP: 1%–4%, with no statistically significant difference [24]. That said, laparoscopic hernia repair also has limitations. These include: High procedural costs and dependence on specialized equipment; Requirement for general anesthesia; Greater technical complexity, especially in cases with large hernia sacs, adhesions, or prior abdominal surgery. In clinical practice, the choice between TAPP and TEP should be based on the surgeon's experience and individual patient factors. For experienced surgeons with more than 100 cases annually, both techniques are considered safe and effective. For beginners, TAPP is recommended first due to easier anatomical orientation, with transition to TEP as skills mature to reduce peritoneal disruption. Patient-specific recommendations include: TAPP: Bilateral hernias, female patients, recurrent hernias, or those requiring intra-abdominal assessment; TEP: Unilateral hernias without prior abdominal surgery or patients sensitive to early postoperative pain [25]. Optimal perioperative management should include: Preoperative preparation: improving cardiopulmonary function, smoking cessation, and BMI control; Intraoperative care: ensuring tension-free, flat mesh placement to prevent folding; Postoperative strategies: encouraging early ambulation and establishing standardized follow-up mechanisms to ensure safety and effectiveness.

5.2 Robotic-Assisted Hernia Repair

In recent years, robotic surgical systems such as da Vinci have been introduced for inguinal hernia repair. Offering high-definition 3D visualization and precise mechanical arm control, robotic surgery significantly enhances anatomical clarity and surgical accuracy, particularly in mesh placement and peritoneal closure. From a surgeon's perspective, robotic platforms reduce fatigue from prolonged standing and awkward postures. Multi-center studies have confirmed superior ergonomic benefits compared to conventional laparoscopy, even though electromyographic differences are minimal [26].

Currently, the robot-assisted TAPP (r-TAPP) technique is well-established and suitable for bilateral, recurrent, or diagnostically complex cases. In contrast, robot-assisted TEP (r-TEP) is less commonly used due to the limited working space, although its avoidance of peritoneal suturing may help reduce adhesion-related complications. Preliminary evidence suggests that robotic surgery offers comparable complication rates, recurrence, and hospitalization durations to traditional laparoscopy. Some studies indicate lower conversion rates and a reduced risk of chronic pain, although larger randomized controlled trials are needed to confirm these findings [27]. Looking ahead, innovations such as AI-guided navigation and real-time image fusion are expected to further enhance the intelligence and personalization of robotic hernia repair.

Robotic systems are particularly advantageous in technically complex TEP procedures, reducing the risk of nerve injury and bleeding while improving surgical precision. However, the high cost, equipment maintenance, and surgeon training requirements currently limit widespread adoption in lower-tier hospitals. At present, robotic hernia repair remains in a developmental and high-tier center setting, and has yet to become the routine first-line approach.

6. Advances in New Materials and Technologies

6.1 Innovation in Mesh Materials

In recent years, significant progress has been made in mesh materials used for inguinal hernia repair. Biodegradable biological meshes, such as porcine small intestinal submucosa (SIS) and bovine pericardial collagen scaffolds, offer new options for high-risk patients by gradually integrating into host tissue, thereby reducing chronic inflammation and infection risks. Synthetic absorbable materials like polycaprolactone (PCL) and polydioxanone (PDO) can be fully absorbed within 6–18 months, eliminating permanent foreign-body retention—particularly suitable for immunosuppressed or diabetic patients [28]. Hybrid meshes combine the benefits of permanent synthetic materials with degradable components, ensuring initial mechanical strength while enabling partial resorption, forming a "semi-permanent" repair solution. Notably, functionalized meshes with antimicrobial coatings (e.g., vancomycin or silver ions) and growth factors (e.g., PDGF, VEGF) significantly improve repair quality by preventing infection and promoting tissue regeneration.

6.2 Optimization of Anesthesia and Analgesia Techniques

Advances in anesthesia and pain management have greatly improved postoperative recovery. Ultrasound-guided nerve blocks combined with long-acting local anesthetics such as

ropivacaine significantly reduce postoperative opioid requirements. Liposomal bupivacaine, a novel sustained-release formulation, provides up to 72 hours of analgesia, further minimizing opioid dependency. The widespread adoption of multimodal analgesia—integrating NSAIDs, COX-2 inhibitors, nerve blocks, and non-pharmacological interventions like cryotherapy and music therapy—has enabled "low-dose, multi-target" pain control strategies, which are highly beneficial for enhanced recovery after surgery (ERAS) protocols [29].

6.3 Maturation of Day Surgery Models

The implementation of day surgery, guided by ERAS protocols, has revolutionized inguinal hernia treatment. By selecting appropriate patients (ASA I–II, BMI < 35) and optimizing preoperative fasting, intraoperative fluid restriction, and early postoperative mobilization and feeding, patients can safely be discharged within 4–6 hours post-surgery. These measures have reduced surgical costs by 30%–50% and increased bed turnover rates. A standardized discharge evaluation system—ensuring pain score NRS ≤ 3, autonomous ambulation, and urination—combined with remote follow-up via apps or telephone, has led to a success rate of 85%–95% in Western countries. Since its inclusion in China's medical insurance in 2018, the readmission rate has remained below 3% [30].

6.4 Implementation of Personalized Treatment Strategies

Personalized strategies are now integral to clinical practice. Patients are stratified into high-demand (e.g., athletes), standard, and high-risk groups (e.g., elderly or recurrent hernias), with corresponding treatment plans: absorbable mesh with rapid recovery for high-demand patients; TAPP/TEP with permanent or hybrid mesh for standard cases; and biological mesh with robotic or open repair for high-risk individuals. Decision-support tools such as AI-based imaging analysis and molecular biomarker profiling aid in selecting optimal therapies. Multidisciplinary team (MDT) consultations and VR-based patient education promote informed participation, improving adherence and satisfaction. These integrated innovations are steering hernia treatment toward a more minimally invasive, precise, and efficient future.

7. Future Prospects and Research Directions

7.1 AI-Assisted Surgical Decision-Making and Navigation

Artificial intelligence (AI) is set to transform inguinal hernia treatment. Preoperative decision systems based on deep learning can integrate clinical and imaging data to predict postoperative complications and recommend personalized surgical approaches and mesh options. Intraoperative navigation systems utilizing 3D anatomy and augmented reality (AR) can automatically annotate key anatomical landmarks via semantic segmentation, greatly enhancing surgical precision. Robotic systems with visual learning capabilities may soon offer intelligent nerve avoidance and automatic assessment of mesh coverage. AI-based remote platforms also provide novel opportunities for surgical training and quality control.

7.2 Harmonizing Standardization and Personalization

The dialectical unity of standardization and personalization will be the core direction of future development. While international guidelines emphasize comparability and quality assurance, individualized patient needs must also be addressed. A national hernia database that captures full-cycle data—from preoperative evaluation to postoperative follow-up—will serve as a foundation for training robust AI models. Smart-matching systems can then generate personalized plans based on standardized templates and individual patient profiles. Continuous feedback will create a closed-loop system to refine clinical strategies, achieving a "standardized core with personalized guidance" model that is both structured and adaptive.

7.3 Key Research Priorities

Future research should focus on several critical areas: Validation of AI-based surgical recommendation models through multicenter clinical trials; Breakthroughs in real-timeAR navigation for successful clinical translation; Development of predictive systems for mesh performance, linking material properties, host immune response, and functional recovery outcomes. The ultimate goal is to establish an intelligent management platform encompassing the entire treatment process—from preoperative planning to postoperative rehabilitation—thus enabling fully data-driven, precision-controlled hernia care.

8. Conclusion

Inguinal hernia management has evolved from traditional open techniques to diversified, minimally invasive strategies. The Lichtenstein tension-free repair remains the "gold standard" for open surgery due to its low recurrence rate, while laparoscopic approaches such as TAPP and TEP are favored for their minimally invasive advantages. Robotic-assisted surgery further improves precision, though cost and training requirements remain limiting factors. Novel mesh materials—especially biodegradable and functionalized types—offer safer alternatives for high-risk patients. Innovations in anesthesia and pain management improve recovery experiences, and mature day surgery models enhance efficiency and patient satisfaction. Looking forward, the integration of AI and big data will usher in a new era of intelligent decision-making and full-process precision management in hernia surgery. Continued innovation in this field promises safer, more effective, and personalized treatment for patients worldwide.

References

[1] Öberg S, Andresen K, Rosenberg J. Etiology of inguinal hernias: a comprehensive review [J]. Frontiers in surgery, 2017, 4: 52.

[2] Huerta, Sergio, Amanda M Garza. A Systematic Review of Open, Laparoscopic, and Robotic Inguinal Hernia Repair: Management of Inguinal Hernias in the 21st Century. Journal of clinical medicine vol. 14,3 990. 4 Feb. 2025.

[3] Burcharth J, Pedersen M, Bisgaard T, et al. Nationwide Prevalence of Groin Hernia Repair [J].Plos One, 2013, 8(1):e54367.
[4] van Veen RN, van Wessem KJ, Halm JA, et al. Patent processus vaginalis in the adult as a risk factor for the occurrence of indirect inguinal hernia [J]. Surgical Endoscopy, 2007, 21(2):202-205.
[5] Kapur P, Caty MG, Glick PL. Pediatric hernias and hydroceles. Pediatr Clin North Am (1998) 45:773–89.
[6] Anders R, Ulf A, Annika R. Body mass index and groin hernia: a 34-year follow-up study in Swedish men. [J]. Annals of Surgery, 2008, 247(6):1064-1068.
[7] Abebe M S, Tareke A A, Alem A, et al. Worldwide magnitude of inguinal hernia: Systematic review and meta-analysis of population-based studies [J]. SAGE open medicine, 2022.
[8] Dominguez J E E, Ramos M G, Seetharamaiah R, et al. Feasibility of robotic inguinal hernia repair, a single-institution experience [J]. Surgical Endoscopy, 2015, 30(9):1-7.
[9] Oberg Stina, Kristoffer A, Jacob R. Etiology of Inguinal Hernias: A Comprehensive Review [J]. Frontiers in Surgery, 2017, 4:52.
[10] Shakil A, Aparicio K, Barta E, Munez K. Inguinal Hernias: Diagnosis and Management. Am Fam Physician. 2020;102(8):487-492.
[11] Shakil A, Aparicio K, Barta E, Munez K. Inguinal Hernias: Diagnosis and Management. Am Fam Physician. 2020;102(8):487-492.
[12] Perez AJ, Campbell S. Inguinal Hernia Repair in Older Persons. J Am Med Dir Assoc. 2022; 23(4):563-567. doi:10.1016/j.jamda.2022.02.008.
[13] Bulyk I, Shkarban V, Vasyliuk S, Osadets V, Bitska I, Dmytruk O. The history of inguinal hernia surgery. Historia chirurgie inguinální kýly. Rozhl Chir. 2023; 102(4):149-153.
[14] Tuveri M, Demontis R, Nicolò E, Pisu S. Bassini and the vanished art of pure tissue inguinal hernioplasty. Am J Surg. 2012;203(4):555-556.
[15] Agarwal D, Sinyard RD 3rd, Ott L, Reinhorn M. Primary Tissue Repair for Inguinal Hernias: The Shouldice Repair Technique and Patient Selection. Surg Clin North Am. 2023;103(5):859-873.
[16] Towfigh S. Inguinal Hernia: Four Open Approaches. Surg Clin North Am. 2018;98(3):623-636.
[17] Messias BA, Almeida PL, Ichinose TMS, et al. The Lichtenstein technique is being used adequately in inguinal hernia repair: national analysis and review of the surgical technique. Rev Col Bras Cir. 2023; 50:e20233655. Published 2023 Dec 8.
[18] Du R, Xiao JW. Inguinal-hernia repair using Lichtenstein combined with Bassini and Halsted techniques. Asian J Surg. 2024;47(4):2076-2077.
[19] Berndsen MR, Gudbjartsson T, Berndsen FH. Laeknabladid. 2019;105(9):385-391.
[20] Watanobe I, Miyano S, Machida M, Sugo H. Mesh shrinkage after transabdominal preperitoneal inguinal hernia repair. Sci Rep. 2023;13(1):3894. Published 2023 Mar 8.
[21] Andresen K, Rosenberg J. Transabdominal pre-peritoneal (TAPP) versus totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. Cochrane Database Syst Rev. 2024;7(7):CD004703. Published 2024 Jul 4.
[22] Aiolfi A, Cavalli M, Del Ferraro S, et al. Total extraperitoneal (TEP) versus laparoscopic transabdominal preperitoneal (TAPP) hernioplasty: systematic review and trial sequential analysis of randomized controlled trials. Hernia. 2021; 25(5): 1147-1157.
[23] Huang LC, Wu CC, Kang YN. Do TEP and TAPP have similar effect on postoperative pain?. Hernia. 2021; 25(5): 1401-1402.
[24] Köckerling F, Bittner R, Kuthe A, et al. TEP or TAPP for recurrent inguinal hernia repair-register-based comparison of the outcome. Surg Endosc. 2017; 31(10): 3872-3882.
[25] Neumayer L A, Gawande A A, Wang J, et al. Proficiency of surgeons in inguinal hernia repair: effect of experience and age [J]. Annals of surgery, 2005, 242(3): 344-352.
[26] Melhem M, Burki J, Algurabi O, et al. The safety and feasibility of simultaneous robotic repair of an inguinal hernia during robotic-assisted laparoscopic prostatectomy: a systematic review and meta-analysis. Scand J Urol. 2022;56(3):197-205.
[27] Kudsi OY, Gokcal F. Lateral approach totally extraperitoneal (TEP) robotic retromuscular ventral hernia repair. Hernia. 2021;25(1):211-222.
[28] Nathan J D, Pappas T N. Inguinal HerniaAn Old Condition With New Solutions [J]. Annals of surgery, 2003, 238(6): S148-S157.
[29] Wauschkuhn C A, Schwarz J, Boekeler U, et al. Laparoscopic inguinal hernia repair: gold standard in bilateral hernia repair? Results of more than 2800 patients in comparison to literature [J]. Surgical endoscopy, 2010, 24: 3026-3030.
[30] Öberg S, Rosenberg J. Contemporary inguinal hernia management [J]. British Journal of Surgery, 2022, 109(3): 244-246.
[31] Pilkington JJ, Zahid MS, Fullwood C, Boersma D, Van Geffen E, Sheen AJ. Contemporaneous evaluation of inguinal hernia causation: a European perspective. Hernia. 2020;24(3):591-599.