

Ten Surgical Commandments of Totally Extraperitoneal Inguinal Hernia Repair: A Stepwise Technical Roadmap for Safe and Reproducible Surgery

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ABSTRACT

Background: Totally extraperitoneal (TEP) inguinal hernia repair is an established laparo-endoscopic technique that applies the principles of posterior preperitoneal mesh reinforcement without entering the peritoneal cavity. Despite well-recognised advantages in selected patients, the technique is limited by a narrow working space, unfamiliar posterior groin anatomy, and a learning curve that may predispose to technical errors.

Objective: To present a structured, anatomy-based set of ten operative commandments for TEP repair that can be used as a practical roadmap for training, intraoperative standardisation, and quality assurance.

Technique: The operative sequence is organised around safe retrorectus access, stable pneumo-extraperitoneum, medial Retzius dissection, lateral Bogros dissection, identification of all potential hernia sites, careful parietalisation of cord structures, achievement of the critical view of the myopectineal orifice, adequate mesh deployment, selective fixation, and desufflation under direct vision.

Conclusion: A reproducible TEP operation depends less on isolated manoeuvres and more on consistent exposure of the entire myopectineal orifice. The proposed commandments translate key anatomic concepts into a stepwise checklist that may reduce missed hernias, inadequate mesh overlap, neurovascular injury, and mesh displacement.

Keywords: Inguinal hernia, Totally extraperitoneal repair, TEP, Laparo-endoscopic hernia repair, Myopectineal orifice, Critical view, Mesh repair.

Key messages

- The technical goal of TEP repair is complete exposure and reinforcement of the myopectineal orifice rather than mere reduction of the visible hernia sac.
- The pubic symphysis and Cooper's ligament should be treated as the primary orientation landmarks during early dissection.
- Mesh placement should be deferred until direct, indirect, femoral and obturator spaces have been inspected and adequate haemostasis has been achieved.
- The final desufflation step is an active safety step, not a passive ending of the operation.

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INTRODUCTION

Totally extraperitoneal (TEP) inguinal hernia repair was introduced in the early 1990s as a posterior preperitoneal approach performed entirely outside the peritoneal cavity.^{1,2} It shares the anatomic logic of wide preperitoneal reinforcement of Fruchaud's myopectineal orifice while avoiding a peritoneal flap and intraperitoneal dissection. In appropriately selected patients and in experienced hands, laparo-endoscopic repair is associated with less early postoperative pain, faster functional recovery, fewer wound-related complications, and a lower

risk of chronic groin pain when compared with anterior open mesh repair.³⁻⁶

Nevertheless, TEP has not been adopted as widely as its potential benefits would suggest. The reasons are practical and anatomical: the working space is limited, dissection is performed from a posterior view that many surgeons do not encounter during open anterior repair, and minor errors in plane, extent of dissection, or mesh deployment can lead to recurrence or chronic pain. International guidelines and consensus statements emphasise that outcomes of laparo-

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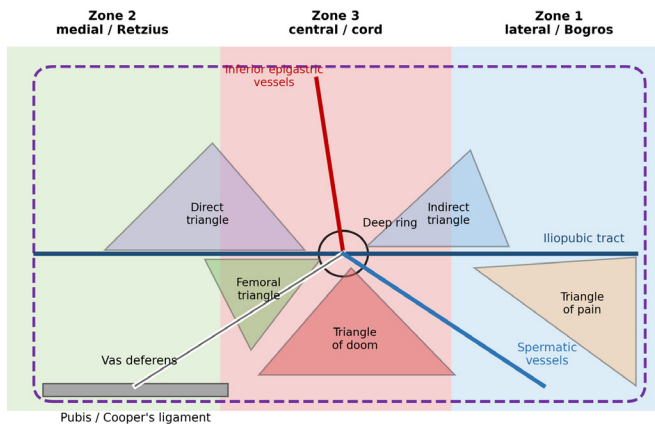


Figure 1: Schematic critical anatomy of the myopectineal orifice. The illustration shows the inverted-Y landmarks, dissection zones and clinically relevant triangles. The dashed outline denotes the intended area of mesh coverage. Original schematic prepared for this manuscript

endoscopic groin hernia repair are closely linked to appropriate case selection, surgeon training, knowledge of posterior anatomy, and adherence to standardised operative principles.⁵⁻⁸

The concepts of the critical view of the myopectineal orifice (CVMPO), the inverted Y, and the five triangles have provided a useful language for teaching and auditing posterior groin dissection.⁹⁻¹¹ The present manuscript revises the operative description of TEP repair into ten surgical commandments. The intent is to produce a concise but complete technical roadmap for safe, reproducible and teachable TEP repair. The inverted-Y configuration, anatomical dissection zones and clinically relevant triangles of the myopectineal orifice are illustrated in Figure 1.

Technical objective

The operation should be considered complete only when the surgeon has dissected the myopectineal orifice sufficiently to identify and cover the direct, indirect, femoral and obturator spaces. Reduction of the presenting hernia is therefore only one component of the operation. The more important endpoint is placement of a large flat mesh that covers every potential groin hernia site with adequate overlap, without folds, rolling, or interposed peritoneum.

This objective is particularly important because recurrence after laparo-endoscopic repair is often related to inadequate dissection, insufficient medial or inferior mesh overlap, missed femoral hernia, missed cord lipoma, or mesh displacement during desufflation.^{11,13}

Patient position and operating room setup

The patient is placed supine under general anaesthesia, usually in a mild Trendelenburg position to move the bowel away from the pelvis. The surgeon stands on the side opposite the hernia; for bilateral repair, the surgeon may adjust position according to institutional practice and ergonomics. The monitor is placed at the foot end of the table to maintain a coaxial view of the pelvis.

Bladder decompression is essential for a safe and spacious Retzius dissection. Routine Foley catheterisation is not mandatory for every uncomplicated unilateral case if the patient empties the bladder immediately before surgery; however, catheterisation is reasonable in long, bilateral, recurrent, large direct, or complex scrotal hernias, and in patients with lower urinary tract symptoms. The recommended operating room arrangement and midline port configuration are illustrated in Figure 2.

TEN SURGICAL COMMANDMENTS OF TEP REPAIR

Commandment 1. Enter the retrorectus canal safely

A small infra-umbilical curvilinear incision is made and the anterior rectus sheath is opened just off the midline. The rectus muscle is swept laterally to expose the posterior rectus sheath. The linea alba should be avoided because midline dissection increases the risk of entering the peritoneal cavity early. The first working space is the retrorectus canal; once this space is identified, dissection is directed caudally towards the pubic symphysis.

The initial space may be developed with a balloon dissector or by optical blunt dissection using the telescope. Balloon dissection is helpful during the learning phase and in complex cases; direct optical dissection is cost-effective when performed by experienced surgeons. Balloon inflation should be controlled and moderate because over-inflation may rupture the peritoneum and compromise the working space.

Commandment 2. Create a stable pneumo-extraperitoneum under vision

The Hasson trocar is placed into the created extraperitoneal space under direct vision and CO₂ insufflation is maintained at approximately 10 to 12 mmHg. A 30-degree laparoscope is used to extend the space towards the symphysis with gentle side-to-side movements. Two 5-mm working ports are placed in the lower midline under vision, one above the symphysis

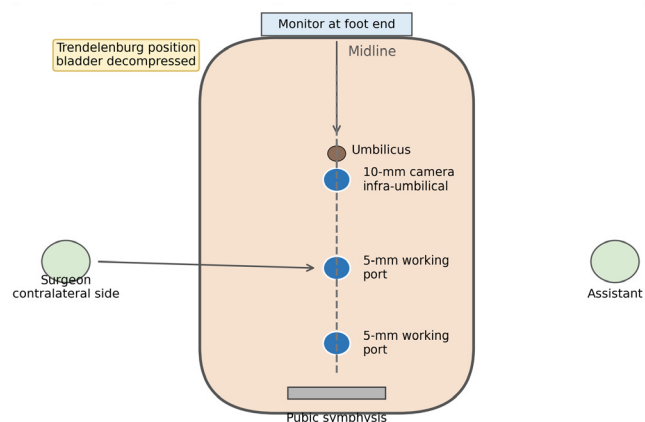


Figure 2: Operating room setup and midline port placement for TEP repair. The schematic illustrates patient position, monitor position and the commonly used infra-umbilical camera port with two lower midline working ports. Original schematic prepared for this manuscript

and the other between the camera port and the suprapubic port. Midline port placement allows ambidextrous access to both Retzius and Bogros spaces and facilitates bilateral repair if required.

Commandment 3. Identify the lighthouse: pubic symphysis and Cooper's ligament

The first critical landmark is the pubic symphysis, followed by Cooper's ligament. These structures form the lighthouse of TEP repair because they orient the surgeon in the medial compartment and help prevent dissection in the wrong or excessively deep plane. The bladder lies posterior to the pubis; hence, dissection in this area should remain close to the pubic bone and Cooper's ligament until the correct areolar plane is developed.

The space should be cleared sufficiently across the midline. In large medial defects, the contralateral Cooper's ligament should be visualised so that the final mesh can cross the midline by 1 to 2 cm and achieve adequate medial overlap.

Commandment 4. Develop the medial compartment - Retzius space

The medial dissection proceeds along Cooper's ligament from medial to lateral. Direct, femoral and obturator spaces are inspected deliberately. Any femoral or obturator hernia is reduced bluntly, with careful attention to the femoral vein and to a possible corona mortis vessel. Adequate medial and inferior clearance is required so that the medial and inferior margins of the mesh can lie in the space of Retzius without being displaced by postoperative bladder filling.

At least 2 cm of clearance between Cooper's ligament/pubic bone and the bladder is desirable. In direct hernias, the hernia contents are reduced and the attenuated transversalis fascia is separated from the sac. Application of the transversalis fascia may reduce dead space and seroma in selected large direct hernias, but it should be performed cautiously and without deep bites that may endanger nerves or vessels.

Commandment 5. Develop the lateral compartment - Bogros space

The lateral dissection develops the space of Bogros towards the anterior superior iliac spine and the lateral abdominal wall. The correct plane keeps preperitoneal fat on the abdominal wall rather than attached to the peritoneum. Dissection that exposes muscle unnecessarily should be avoided because it may bring the surgeon into proximity with the inferior epigastric vessels medially and the nerves laterally.

When the lateral plane is difficult to identify, careful division of selected lateral fibres near the arcuate line may help the surgeon enter the appropriate preperitoneal areolar plane. The endpoint of the lateral dissection is sufficient space for a flat, uncreased mesh that extends laterally to the iliopectineal region and ASIS.

Commandment 6. Define the hernia and inspect every potential defect

The visible hernia is not the only target. The surgeon must define the direct space, indirect space, femoral canal and

obturator space. In the direct space, reduction is performed with gentle traction-countertraction, maintaining awareness that a sliding bladder component may occasionally be present. Femoral and obturator defects must be excluded during the medial dissection; failure to visualise the femoral vein and canal is a common reason for a missed femoral hernia.

The inferior epigastric vessels are identified and kept anterior. The relation of these vessels to the hernia defect helps classify the hernia and direct the subsequent cord dissection. A systematic inspection prevents a procedure from being completed after treatment of only the most obvious sac.

Commandment 7. Parietalise the cord and reduce the cord lipoma

The indirect space is approached after the medial and lateral spaces have created adequate mobility. The spermatic cord in men, or the round ligament in women, is identified lateral to the inferior epigastric vessels at the internal ring. The sac is held anterolaterally while the vas deferens and gonadal vessels are swept posteromedially and laterally as appropriate. Dissection should be deliberate, bloodless and close to the sac to avoid injury to cord structures or the external iliac vessels.

Parietalisation is adequate when the peritoneum and sac have been mobilised sufficiently inferiorly so that the mesh will not be lifted by the peritoneum during desufflation. In large, chronic or inguinoscrotal sacs, it is often safer to transect the sac after clear identification of cord structures and leave the distal sac in situ rather than risk cord trauma, testicular ischemia, or scrotal haematoma. A cord lipoma should be actively searched for in the upper lateral quadrant of the internal ring and reduced; leaving a lipoma in the canal can mimic or contribute to recurrence.¹³

Commandment 8. Achieve the critical view of the myopectineal orifice

Before mesh insertion, the surgeon must confirm the critical view of the myopectineal orifice. The required elements include visualisation of Cooper's ligament from the pubic symphysis towards the femoral vein, identification of the inferior epigastric vessels, adequate direct space reduction, inspection of femoral and obturator spaces, reduction of the indirect sac and lipoma, lateral exposure towards the ASIS/iliopectineal region, and haemostasis. Any significant peritoneal tear should be repaired to prevent bowel contact with mesh and to preserve the extraperitoneal working space.

The inverted Y concept and five-triangle framework help trainees recognise the landmarks that define the safe and unsafe regions of dissection. The inferior epigastric vessels, vas deferens and gonadal vessels form the inverted Y; the iliopubic tract and adjacent landmarks then organise the direct, indirect, femoral, doom and pain triangles.

Commandment 9. Deploy an adequate mesh; fix selectively

A large, flat mesh is introduced into the extraperitoneal space, commonly at least 10 x 15 cm for an adult unilateral repair, and larger when the defect, body habitus, or bilateral dissection

requires it. The mesh should cover the direct, indirect and femoral triangles with at least 3 to 4 cm overlap. Medially, it should reach the pubic symphysis and cross the midline in large direct hernias; inferiorly, it should lie 1 to 2 cm below the pubis; laterally, it should reach the iliopsoas/ASIS region; superiorly, it should cover the area above the deep inguinal ring.

The mesh must lie flat without wrinkles, splitting, folding, or interposed peritoneum. Routine fixation is generally avoided in TEP to reduce the risk of chronic pain. Fixation may be considered for large medial defects, recurrent hernias, very large femoral defects, or when mesh stability is uncertain. If traumatic fixation is used, it should be placed above the iliopubic tract, away from the triangles of pain and doom, and preferably on Cooper's ligament or safe superior sites.^{5,7,8,16}

Commandment 10. Desufflate under direct vision

Desufflation is a critical final manoeuvre. The surgeon should watch the mesh as the extraperitoneal space collapses. A grasper may be used to hold or guide the lower edge of the mesh so that the peritoneum does not fold it upward. If the mesh moves significantly during desufflation, the dissection is probably inadequate, or the mesh is malpositioned, and correction should be performed before port removal.

After satisfactory desufflation, trocars are withdrawn. The anterior rectus sheath at the camera port is closed with absorbable suture, and skin incisions are closed as per institutional practice. Documentation should record the hernia type, side, mesh size, fixation, peritoneal tear repair, and whether a cord lipoma or occult femoral/obturator hernia was identified.

Summary Operative Checklist

Before completion of TEP repair, the surgeon should confirm that the pubic symphysis and Cooper's ligament have been clearly exposed, the direct, indirect, femoral and obturator spaces have been inspected, the hernia sac and cord lipoma have been completely reduced, and the cord structures have been adequately parietalised. Haemostasis should be secured before introducing the mesh. The mesh should cover the entire myopectineal orifice with adequate medial, inferior and lateral overlap and should remain flat without folding, rolling or interposed peritoneum. Fixation should be selective and restricted to safe anatomical zones. Finally, desufflation should be performed under direct vision while maintaining the mesh in its intended position. The ten commandments are summarised in Figure 3, and their operative endpoints and the errors they are intended to prevent are listed in Table 1.

DISCUSSION

TEP repair is an operation of planes and endpoints. The surgeon who simply chases the hernia sac may complete an apparently satisfactory reduction but still leave an undissected femoral canal, an unreduced cord lipoma, or a mesh with insufficient inferior and medial overlap. The commandments proposed here aim to shift attention from sac reduction to systematic exposure of the entire myopectineal orifice.

1	Enter the retrorectus canal safely Off-midline anterior sheath incision; controlled balloon or optical dissection.
2	Create a stable working space CO2 10-12 mmHg; place two midline working ports under direct vision.
3	Identify the lighthouse Pubic symphysis and Cooper's ligament orient every subsequent step.
4	Develop Retzius medially Clear Cooper's ligament; rule out direct, femoral and obturator defects.
5	Develop Bogros laterally Stay close to the anterior abdominal wall; preserve nerves and iliopsoas plane.
6	Define the hernia type Reduce direct, femoral and obturator defects; respect corona mortis and femoral vein.
7	Parietalise cord structures Reduce indirect sac and cord lipoma; protect vas deferens and gonadal vessels.
8	Achieve critical view of MPO Inspect Cooper's ligament, ASIS, epigastric vessels, direct space, femoral vein and all potential defects.
9	Deploy adequate mesh Use flat 10 x 15 cm or larger mesh with 3-4 cm overlap; fix only when indicated.
10	Desufflate under direct vision Check the lower mesh edge; avoid folding or rolling before closing fascia and skin.

Teaching point: proceed to mesh placement only after all potential hernia sites are exposed and haemostasis is complete.

Figure 3: Ten surgical commandments of TEP repair presented as an operative and teaching checklist. Original schematic prepared for this manuscript

The first safety principle is orientation. The pubic symphysis and Cooper's ligament provide the most reliable early landmarks. Once the medial compartment is safely opened, the surgeon can confidently develop the lateral pocket and then approach the indirect sac. This sequence reduces the tendency to begin the operation in the most variable region - the cord and internal ring - before the anatomy has been clarified.

The second safety principle is respect for the dissection plane. Excessively anterior dissection can injure the inferior epigastric vessels or create troublesome bleeding. Excessively lateral or deep dissection may expose or injure nerves in the triangle of pain. A peritoneal-plane dissection that preserves preperitoneal fat against the abdominal wall protects the parietal structures and creates a broad mesh bed.

The third safety principle is mesh behaviour. Adequate mesh size and overlap are necessary but not sufficient. The mesh must lie flat at the moment of desufflation, because the collapsing peritoneum can lift or roll the lower edge of the prosthesis. For this reason, desufflation under direct vision should be treated as an active step comparable to the final check in other critical-view operations.

For training programmes, the ten commandments can be used as a video-review checklist. Trainees may be asked to

Table 1: Practical checklist linking each commandment to its operative endpoint and the technical error it helps prevent.

<i>Commandment</i>	<i>Technical endpoint</i>	<i>Principal error prevented</i>
1. Retrorectus entry	Posterior rectus sheath identified; peritoneum not breached	Early peritoneal entry; loss of working space
2. Pneumo-extraperitoneum	Stable 10–12 mmHg space; ports under vision	Blind trocar injury; inadequate triangulation
3. Pubic lighthouse	Pubic symphysis and Cooper's ligament seen	Wrong plane; bladder injury
4. Retzius dissection	Direct, femoral and obturator spaces inspected	Missed medial/femoral hernia; insufficient medial overlap
5. Bogros dissection	Lateral pocket to ASIS/iliopsoas	Nerve exposure; lateral mesh folding
6. Hernia definition	All potential defects identified	Treating only the obvious sac
7. Cord parietalisation	Sac and cord lipoma reduced; cord protected	Cord injury; pseudo-recurrence from lipoma
8. Critical view of MPO	Full MPO exposed and haemostasis complete	Mesh placement before adequate dissection
9. Mesh deployment	Flat 10 x 15 cm or larger mesh with 3–4 cm overlap	Recurrence from inadequate overlap or fixation injury
10. Direct-vision desufflation	Mesh remains flat during the collapse of space	Mesh rolling, folding, or displacement

demonstrate the pubic symphysis, Cooper's ligament, femoral canal, direct space, indirect space, cord lipoma search, lateral pocket, mesh overlap, and direct-vision desufflation before the case is considered technically complete. This approach may help standardise feedback and reduce variability during the learning curve.

LIMITATIONS

This article is a technical review and operative standardisation proposal rather than a comparative outcomes study. The recommendations summarise accepted principles from guidelines and expert anatomical descriptions, but they should be adapted to patient factors, hernia complexity, available equipment and surgeon experience. Complex recurrent, incarcerated, large scrotal, post-pelvic surgery or post-radiotherapy hernias should be undertaken only after appropriate training and with a low threshold to convert or change strategy when safety is compromised.

CONCLUSION

A safe TEP repair is achieved by disciplined exposure of the myopectineal orifice, not by reduction of the hernia sac alone. The ten surgical commandments provide a structured roadmap from access to desufflation, emphasising anatomic orientation, correct plane of dissection, complete inspection of all hernia sites, adequate mesh coverage, selective fixation and final visual confirmation. Used as a teaching and intraoperative checklist, this framework may improve the reproducibility and safety of TEP inguinal hernia repair.

ETHICS APPROVAL

Not applicable for this technical review. If institutional clinical photographs or operative videos are added later, appropriate consent and institutional permissions should be obtained.

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REFERENCES

1. Ferzli GS, Massad A, Albert P. Extraperitoneal endoscopic inguinal hernia repair. *J Laparoendosc Surg.* 1992;2(6):281-286. doi:10.1089/lps.1992.2.281.
2. McKernan JB, Laws HL. Laparoscopic repair of inguinal hernias using a totally extraperitoneal prosthetic approach. *Surg Endosc.* 1993;7:26-28. doi:10.1007/BF00591232.
3. McCormack K, Wake B, Perez J, Fraser C, Cook J, McIntosh E, et al. Laparoscopic surgery for inguinal hernia repair: systematic review of effectiveness and economic evaluation. *Health Technol Assess.* 2005;9(14):1-203.
4. Cavazzola LT, Rosen MJ. Laparoscopic versus open inguinal hernia repair. *Surg Clin North Am.* 2013;93:1269-1279.
5. HerniaSurge Group. International guidelines for groin hernia management. *Hernia.* 2018;22(1):1-165. doi:10.1007/s10029-017-1668-x.
6. Stabilini C, van Veenendaal N, Aasvang E, Agresta F, Aufenacker T, Berrevoet F, et al. Update of the international HerniaSurge guidelines for groin hernia management. *BJS Open.* 2023;7(5):zrad080. doi:10.1093/bjsopen/zrad080.
7. Bittner R, Arregui ME, Bisgaard T, Dudai M, Ferzli GS, Fitzgibbons RJ, et al. Guidelines for laparoscopic (TAPP) and endoscopic (TEP) treatment of inguinal hernia [International Endohernia Society]. *Surg Endosc.* 2011;25(9):2773-2843.
8. Bittner R, Montgomery MA, Arregui E, Bansal V, Bingener J, Bisgaard T, et al. Update of guidelines on laparoscopic (TAPP) and endoscopic (TEP) treatment of inguinal hernia [International Endohernia Society]. *Surg Endosc.* 2015;29(2):289-321.
9. Daes J, Felix E. Critical view of the myopectineal orifice. *Ann Surg.* 2017;266(1):e1-e2. doi:10.1097/SLA.0000000000002104.
10. Furtado M, Claus CMP, Cavazzola LT, Malcher F, Bakonyi-Neto A, Saad-Hossne R. Systemization of laparoscopic inguinal hernia repair (TAPP) based on a new anatomical concept: inverted Y and five triangles. *Arq Bras Cir Dig.* 2019;32(1):e1426. doi:10.1590/0102-672020180001e1426.
11. Claus C, Furtado M, Malcher F, Cavazzola LT, Felix E. Ten golden rules for a safe MIS inguinal hernia repair using a new anatomical concept as a guide. *Surg Endosc.* 2020;34(3):1458-1464. doi:10.1007/s00464-020-07449-z.
12. Miserez M, Alexandre JH, Campanelli G, Corcione F, Cuccurullo D, Pascual MH, et al. The European Hernia Society groin hernia classification: simple and easy to remember. *Hernia.* 2007;11(2):113-116.
13. Kukleta JF. Causes of recurrence in laparoscopic inguinal hernia repair. *J Minim Access Surg.* 2006;2(3):187-191.
14. Simons MP, Aufenacker T, Bay-Nielsen M, Bouillot JL,

- Campanelli G, Conze J, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia*. 2009;13(4):343-403.
15. Poobalan AS, Bruce J, Cairns W, Smith S, King PM, Krukowski ZH, et al. A review of chronic pain after inguinal herniorrhaphy. *Clin J Pain*. 2003;19:48-54.
16. Zhang G, Zhang X, Zhan H, Hu S. Vacuum suction fixation versus staple fixation in TAPP laparoscopic hernia repair: introduction of a new technique for mesh fixation. *Surg Endosc*. 2016;30(1):114-120.
17. Tamme C, Scheidbach H, Hampe C, Schneider C, Kockerling F. Totally extraperitoneal endoscopic inguinal hernia repair (TEP): results of 5203 hernia repairs. *Surg Endosc*. 2003;17:190-195.
18. Hope WW, Cobb WS, Adrales GL. Minimally invasive inguinal hernia repair. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; updated 2023.