

Brief Overview about Laparoscopic TAPP Operation (For Inguinal Hernia Repair) Complications

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Abstract

Background: The intraperitoneal onlay mesh (IPOM): Access the abdominal cavity through the peritoneum (intra-abdominal approach) and places a large piece of mesh against the peritoneum. The mesh is secured with staples placed into the same anatomic structures as in the TAPP repair but is placed in an intraperitoneal position instead of a preperitoneal position i.e. in direct contact with the intestinal loops. All vessels in the inguinal region can be ligated when injured except external iliac vessels. No sutures or staples must be put in the (triangle of doom) between ductus deferens medially and spermatic vessels laterally to avoid external iliac injury. Seroma formation occasionally follows laparoscopic hernia repair. Seromas are more common following TEP repair , most probably from inability of fluid to drain into the peritoneal cavity. These usually resolve within six weeks but can present for several months.

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Introduction:

Complications of laparoscopic inguinal hernia repair

The complications of laparoscopic inguinal hernia repair can be classified into:

A-Intra-operative complications which are subdivided into three groups:

1- Complications of anesthesia:

At present laparoscopic hernioplasty require general anesthesia which is extremely safe in healthy patients. But it can be harmful for cardiac and pulmonary diseased patients. It adds to the potential for complications. It also may lead to some other problems such as aspiration, deep venous thrombosis, pulmonary embolism, damage to the teeth (*Macintyre, 2003*).

2- Complications related to the use of laparoscopy:

These complications are the same for any laparoscopic procedures.

a- Cardiovascular effect of pneumoperitoneum:

These are hypercapnia and cardiopulmonary effects, rarely cause hypotension or arrhythmia. Hemodynamic problems, usually during insufflation and are associated with vasovagal reflex or decreased venous return, most often can be corrected with administration of fluids or atropine. When significant rhythm disturbances occur, the pneumoperitoneum must be released immediately, in addition to corrective measures specific for the dysrhythmia (Hsieh, 2003).

b- Carbon dioxide embolus:

The incidence of clinically significant CO₂ embolism is very low. Clinically important CO₂ embolism may be noted by unexplained hypotension and hypoxia during the operation. The mainstays of treatment are immediate evacuation of the pneumoperitoneum and placement of the patient in the left lateral decubitus, head down position. This allows the CO₂ bubble to "float" to the apex of the right ventricle where is less likely to cause right ventricular outflow tract obstruction. It is important to administer 100% oxygen and hyperventilate the patient during this period. Additionally, aspiration of gas through a central venous line may be performed (Vernon and Hunter, 2007).

b- Bowel injuries:

They are rare and usually occur during Veress needle insertion and creation of pneumoperitoneum. They also can result from open technique using Hasson cannula and this facilitates immediate identification and repair. The incidence of accidental enterotomy when pneumoperitoneum is created increased in patients who have had previous abdominal surgery. Previous abdominal surgery is a relative contraindication to laparoscopic hernia repair (Phillips et al., 1995).

Veress needle injury to the bowel requires no further management and can be managed with close observation. But trocar injuries usually require operative repair. The trocar should be left within the injured bowel so that the injury can be readily identified when the abdomen is opened. Most bowel injuries are treated by primary repair (Phillips et al., 1995).

c- Vascular injury

Injury to blood vessels may occur during laparoscopy either due to Veress needle insertion, during trocar insertion or even during dissection. Veress needle injury to blood vessels rarely cause any significant hemorrhage. Open technique of pneumoperitoneum insufflation eliminate the risk of injury to major intra-abdominal vessels. Trocar injuries for major blood vessels have been the cause of fatal bleeding (Richard et al., 2006).

Major hemorrhage occurs with injury to the distal aorta or common iliac vessels with high mortality. Minor bleeding causing abdominal wall hematoma may occasionally occur from trocar injuries to abdominal wall vessels, these bleeding points must be identified and ligated (Richard et al., 2006).

3- Complications that result during the procedure of laparoscopic hernioplasty:

a- Vascular injuries:

The most common vascular injuries during laparoscopic hernioplasty are injuries to inferior epigastric and spermatic vessels. In addition, the external iliac, circumflex iliac, obturator vessels also may be injured during laparoscopic hernioplasty. Anatomical variations and confusion during dissection can predispose to these injuries, especially if the patient has had previous abdominal surgery (*Schmedt et al., 2005*).

All vessels in the inguinal region can be ligated when injured except external iliac vessels. No sutures or staples must be put in the (triangle of doom) between ductus deferens medially and spermatic vessels laterally to avoid external iliac injury (*Schmedt et al., 2005*).

b-Nerve injury:

The nerves are often not visible during laparoscopic hernioplasty and neurologic injuries may not be recognized intraoperatively (*Phillips et al., 1995*).

c- Urinary bladder injury:

Is a very rare intraoperative complication. Transient microscopic (or rarely macroscopic) haematuria can occur as a result of quite minor bladder manipulation and is of no significance. If these complications happened, the bladder injury must be repaired with two layers of absorbable sutures and urethral catheter is put from four to six days (*Richard et al., 2006*).

d- Injury to the vas deferens or cord structures:

Severance of the vas deferens or cord structures is a rare occurrence during laparoscopic repair of groin hernia. It has been reported during dissection, ligation and division of the sac. If transected, the cut ends of the vas must be repaired with fine, interrupted sutures (*Richard et al., 2006*).

B-Post operative complications:

1-Neurologic complications or nerve injuries:

Nerve injuries are recognized complications of laparoscopic inguinal hernia repair. Injury to cutaneous nerves in and around the inguinal canal may be responsible for chronic pain or numbness in the groin in all types of hernia surgery. Various neuralgia may develop, usually from incorporation of a nerve during the fixation of mesh by staples or sutures. Staples should not be placed in the triangle of pain below the iliopubic tract lateral to the internal spermatic vessels (*Callesen, 2003*).

The nerves that are usually involved are the ilioinguinal nerve, iliohypogastric, both the genital and femoral branches of the genitofemoral nerve and the lateral cutaneous nerve of the thigh. The former two are especially prone to injury if a vigorous bimanual technique is used for stapling, while the later are most likely damaged by stapling below the iliopubic tract lateral to the internal spermatic vessels. A femoral nerve injury is extremely rare and is almost always the result of a gross technical misadventure (*Callesen, 2003*).

Reassurance and conservative treatment with anti-inflammatory medication and local nerve blocks is preferred initially, as commonly these will resolve spontaneously. The only exception might be the patient with severe intensity pain that can't be tolerated immediately (Poobalan et al., 2003).

This patient may be best treated by rest and analgesics, if persist, injection of hydrocortisone or long lasting local anaesthetic or immediately re-exploration before scar tissue developed. Otherwise we scrupulously avoid re-exploration before 1 year to allow the possibility of spontaneous resolution . When groin re-exploration is required; removal of offending clips should be considered and neuroma excision is performed. The results are often less than satisfying (Poobalan et al., 2003).

There is small numbers of patients complained of lateral thigh pain compatible with meralgia paraesthetica due to compression of the lateral femoral cutaneous nerve, but the majority settled spontaneously (Richard et al., 2006).

2-Testicular complications

a- Ischemic orchitis and testicular atrophy :

It can occur with any hernia surgery but very rare complication and it may happen due to damage of the blood supply to the testis. The incidence appears to be lower with laparoscopic hernia repair than open repair (Irving et al., 2007).

b- Testicular pain:

It occurs infrequently after laparoscopic hernioplasty . It is transient pain and resolve in one to three weeks. The cause of this pain is obscure but it may be due to trauma to genitofemoral nerve or to sympathetic innervation of the testes during dissection around the cord structures, or during separation of peritoneum from cord structures. The pain usually resolves spontaneously, but scrotal elevation with support and analgesia are indicated for prolonged cases (Beddy et al., 2006)

c-Hydrocele:

It occurs infrequently after laparoscopic hernioplasty . It may be due to unexcised large hernial sac or extensive skeletonization of the cord which disturb cord lymphatics. As a result, fluids can no longer be drained into the peritoneal cavity and hydrocele forms. The treatment is the same as for any other hydroccle (Richard et al., 2006).

3- Seroma formation:

Seroma formation occasionally follows laparoscopic hernia repair. Seromas are more common following TEP repair , most probably from inability of fluid to drain into the peritoneal cavity. These usually resolve within six weeks but can present for several months (Lau and Lee, 2003).

Most trials have suggested that the incidence of this complication is greater in laparoscopic surgery than in open surgery. Most seromas are self limiting and resolve without any

further intervention. This is probably dependent upon the type of mesh used, and may be less evident with softer, less irritant meshes (*Lau and Lee, 2003*).

Seromas are insignificant as long as they are diagnosed and not mistaken for recurrence. In contrast to hydroceles, seroma usually do not extend into the scrotum. Pressure dressing has been used to reduce seroma formation after laparoscopic ventral hernia repairs. External compression helps to obliterate dead space, prevent shearing of the surgical planes and promote adherence between the opposite tissues. However, pressure dressing is difficult to apply over the groin region (*Lau and Lee, 2003*).

4-Surgical emphysema

This is common particularly in the scrotum and abdominal wall. It may, however, extend through the subcutaneous planes into the chest, neck and facial tissues. Despite alarming appearances, it is harmless, and the carbon dioxide reabsorbs within 12-24 hours without any treatment (*Richard et al., 2006*).

5- Mesh complications:

After TEP repair, the incidence of mesh infection is about 0.1%. The lower risk of mesh infection after laparoscopic repair is because of the introduction of the mesh through trocars, avoiding skin contact, and mesh placement far from the trocar incision. Antibiotic-impregnated mesh has recently become available (*Vernon and Hunter, 2007*).

Mesh rejection, mesh migration, adhesion formation, and erosion of the prosthesis into intrabdominal organs, all are potential complications. Meticulous dissection, adequate mesh size, strict aseptic precautions and proper fixation decrease chances of mesh migration, recurrence and infection (*Choy et al., 2004*).

6- Bowel obstruction:

Mechanical bowel obstruction complicates laparoscopic herniorrhaphy mainly TAPP repair as a result of:

- a- Herniation through a defect in the peritoneal closure
- b- Adhesions from intraperitoneal technique.
- c- Trocar site herniation (*Boughey and Nottingham, 2003*).

Prevention:

- a- Ensure that extensive peritoneal flaps are created so that the peritoneum can be reconstituted at the end of procedure without any tension
- b- All trocar sites > 5 mm should be closed

(*Boughey and Nottingham, 2003*).

7- Ileus:

Ileus can be seen with either the conventional or the laparoscopic repair but is more common with the latter. Treatment is symptomatic, and spontaneous resolution is the rule. Nasogastric decompression is occasionally needed (*Richard et al., 2006*).

8- Recurrence:

Recurrence is a complication of all repair techniques, laparoscopic as well as open. The recurrence rate remains less than after open surgery. Long term recurrence rate following laparoscopic hernia repair is unknown. Technical factors are responsible for early recurrence. The most common causes:

- 1- Undersized mesh, the mesh is too small to cover all the hernia sites.
- 2- Mesh is applied without fixation by stapling or suturing.
- 3- Inexperience of the surgeon.
- 4- Early disruption of the mesh by excessive activity. (*Neumayer et al., 2004*).

COMPLICATIONS OF TAPP

Like any other laparoscopic procedures, complications have been recorded during the learning curve. These complications can be classified into

1. Intra-operative complications
2. Post-operative complications.

INTRAOPERATIVE COMPLICATIONS

Bladder Injuries

Bladder injury most commonly occurs during port placement, dissecting a large direct sac or in a sliding hernia. It is mandatory to empty the bladder prior to an inguinal hernia repair to avoid a trocar injury. It is advisable that beginners catheterize the bladder during the initial part of their learning curve. The diagnosis is evident when one sees urine in the extraperitoneal space. Repair is done with Vicryl in two layers and a urinary catheter inserted for 7 to 10 days (*Caruso et al., 2021*).

Bowel Injuries

Bowel injury is rare during hernia surgery. It can occur when reducing large hernias, inadvertent opening of peritoneum causing the bowel to come into the field of surgery and in reduction of sliding hernias. Injury is best avoided in such circumstances by opening the hernial sac as close as possible to the deep ring. The initial studies showed a higher incidence, especially with TAPP, but it decreased over time (*Caruso et al., 2021*).

Vascular Injury

This is one of the most common injuries occurring in hernia repair and often a reason for conversion. The various sites where it can occur is rectus muscle vessel injury during trocar insertion; inferior epigastric vessel injury; bleeding from venous plexus on the pubic symphysis; aberrant obturator vein injury; testicular vessel injury; and the most disastrous of all, iliac vessels, which requires an emergency conversion to control the bleeding and the immediate services of a vascular surgeon to repair the same. Most of the other bleeding can be controlled with cautery or

clips. Careful dissection and adherence to the principles of surgery will help in avoiding most of these injuries (Caruso et al.,2021).

Injury To Vas Deferens

Injury occurs while dissecting the hernia sac from the cord structures. The injury causes an eventual fibrotic narrowing of the vas. A complete transaction of the vas needs to be repaired in a young patient. An injury to the vas is best avoided and this may be done by identifying before dividing any structure near the deep ring or floor of the extraperitoneal space. Also, the separation of cord structures from the hernial sac must be gentle and direct; grasping of vas deferens with forceps must be avoided (Caruso et al.,2021).

POSTOPERATIVE COMPLICATIONS

Seroma/Hematoma Formation

It is a common complication after laparoscopic hernia surgery, the incidence being in the range of 5 to 25 percent. They are especially seen after large indirect hernia repair. Most resolve spontaneously over 4 to 6 weeks. A seroma can be avoided by minimizing dissection of the hernia sac from the cord structures, fixing the direct sac to pubic bone and fenestrating the transversalis fascia in a direct hernia. Some surgeons put in a drain if there is excessive bleeding or after extensive dissection . (Bittner R et al.,2011) .

Urinary Retention

This complication after hernia repair has a reported incidence of 1.3 to 5.8 percent. It is usually precipitated in elderly patients, especially if symptoms of prostatism are present. These patients are best catheterized prior to surgery and catheter removed the next day morning . (Bittner R et al.,2011) .

Vascular Injury

The incidence of vascular injury has been documented to be about 0.5 to 1 percent and inferior epigastric artery is the one most commonly traumatized.

Injury to iliac vessels: Chances of mortality

Inferior epigastric vessel: Hematoma

Iliopubic vein and artery which traverse the lacunar ligament: Hematoma

Injury to spermatic vessels: Postoperative scrotal hematoma. (Bittner R et al.,2011) .

Nerve Entrapment and Injury

The lateral cutaneous nerve of thigh and the femoral branch of genitofemoral nerve are the two nerves vulnerable to trauma due to indiscriminate placement of staples lateral to the spermatic cord on the iliopubic tract. (Bittner R et al.,2011) .

Other Complications

1. Migration of mesh
2. Rejection of mesh (Rare)
3. Bowel adhesion and injury

There is no doubt that the laparoscopic hernia repair is a proven technique and will become more popular over time . (Bittner R et al.,2011) .

Mesh Infection and Wound Infection

Wound infection rates are very low. Mesh infection is a very serious complication and care must be taken to maintain strict aseptic precautions during the entire procedure. Any endogenous infection must be treated with an adequate course of antibiotics prior to surgery . (Bittner R et al.,2011) .

Recurrence

It is the most important endpoint of any hernial repair . It requires a proper and thorough knowledge of anatomy and a thorough technique of repair to help keep the recurrence . (Bittner R et al.,2011) .

Cause of recurrence in TAPP

The factors involved in mesh dislocation or failure are insufficient size, wrong/defective material, incorrect placement, immediate or very early displacement by folding, lifting by a hematoma or urinary retention, missed cord lipomas and herniation through the keyhole (mesh slit) late displacement by insufficient scar tissue ingrowth, mesh protrusion, collagen disease or pronounced shrinkage. Despite the correct and stable mesh position, there is still a limited risk of a late sliding of the retroperitoneal fat under/ in front the mesh into the enlarged inner ring. Leibl in 2000 advised to avoid slitting of of the mesh and increase its size to reduce the recurrence rate. Generous dissection of preperitoneal space is required to eliminate potential herniation through the slit or strangulation of the cord structures completely and reduces the risk of genitofemoral neuropathy . (Bittner R et al.,2011) .

References:

- [1] Abedin P , Daniels J and Khan KS (2007): Laparoscopic and open repair for inguinal hernia. Eur J Surg, 71: 183-211.
- [2] Adrian K (2010) : Inguinal Hernias: A Current Review of an Old Problem Proceedings of Singapore Healthcare. Int J Sci Stud, 19(3):202-211
- [3] Ajita S. Prabhu, ; Alfredo Carbonell, ; William Hope, ; et al ,(2020), Robotic Inguinal vs Transabdominal Laparoscopic Inguinal Hernia RepairThe RIVAL Randomized Clinical Trial; JAMA Surg. 2020;155(5):380-387. doi:10.1001/jamasurg.2020.0034
- [4] Ajita S. Prabhu, ; Alfredo Carbonell, ; William Hope, ; et al ,(2020), Robotic Inguinal vs Transabdominal Laparoscopic Inguinal Hernia RepairThe RIVAL Randomized Clinical Trial; JAMA Surg. 2020;155(5):380-387. doi:10.1001/jamasurg.2020.0034
- [5] Alfieri S, Amid PK, Campanelli G, et al. International guidelines for prevention and management of post-operative chronic pain following inguinal hernia surgery. Hernia. 2011;15:239–249. doi: 10.1007/s10029-011-0798-9
- [6] Altintoprak, F., Akin, E., Gundogdu, K., et al. (2018). Laparoscopic inguinal hernia repair: technical details, pitfalls and current results. Hernia Surgery and Recent Developments, 73

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- [7] Amid PK and Lichnestein-Piee (2005): Open inguinal hernioplasty versus laparoscopic approach. International Surgical Journal, 72:125-131.
- [8] Andersen TE, Lahav Y, Ellegaard H, Manniche C. A randomized controlled trial of brief Somatic Experiencing for chronic low back pain and comorbid post-traumatic stress disorder symptoms. Eur J Psychotraumatol. 2017;8(1):133-1108
- [9] Arslan OE. (2016) Muscular Anatomy of the Anterior Abdomen;
- [10] Arslan OE. (2016) Muscular Anatomy of the Anterior Abdomen; in Aesthetic Plastic Surgery of the Abdomen:Springer, Cham., p. 17-36.
- [11] Aruna D , Jadhav A, Pawar S, et al. (2015) : Diagnosis of Inguinal Bladder Hernias: Current Role of Sonography. Int J Sci Stud ,3(1):216-218.
- [12] Beddy P , Ridgway PF and Geoghegan T (2006): Inguinal hernia repair protects testicular function: a prospective study of open and laparoscopic herniorrhaphy. J. Am. Coll. Surg. ; 203; 17-23
- [13] Bhoopat, T., & Chansaenroj, P. (2021). Comparison of intraocular pressure during laparoscopic totally extraperitoneal (TEP) versus transabdominal preperitoneal (TAPP) inguinal hernia repair. Surgical Endoscopy, 1-7.
- [14] Bittner R, Arregui ME, Bisgaard D, Dudai M, Ferzli GS, Fitzgibbons RJ, et al. Guidelines for laparoscopic (TAPP) and endoscopic (TEP) treatment of inguinal hernia. Surgical Endoscopy. 2011;25(9):2773-2843
- [15] Bittner R, Chen D, Reinhold W. (2018). Clinical Anatomy of the Groin: Posterior Laparoscopic Approach; in Laparoendoscopic Hernia Surgery: Springer, Berlin, Heidelberg,5-19.
- [16] Bittner R, Chen D, Reinhold W. (2018). Clinical Anatomy of the Groin: Posterior Laparoscopic Approach; in Laparoendoscopic Hernia Surgery: Springer, Berlin, Heidelberg,5-19.
- [17] Bittner R. Laparoscopic view of surgical anatomy of the groin. Int J Abdom Wall Hernia Surg. 2018;1:24–31
- [18] Blank M , Leanne L, and Karl A (2013) : Inguinal Hernias: Diagnosis and Management. American Family Physician, Vol 87(12):844-848
- [19] Boughey JC and Nottingham JM (2003): Richter`s hernia in the laparoscopic era. Surg.Lapros. Endosc. Percuten. Tech.; 13-55.
- [20] Bracale U, Melillo P, Pignata G, Di Salvo E, Rovani M, Merola G. Which is the best laparoscopic approach for inguinal hernia repair: TEP or TAPP? A systematic review of the literature with a network meta-analysis. Surg Endosc. 2012;26:3355–33663.
- [21] Bracale U, Merola G, Sciuto A, Cavallaro G and Andreuccetti J (2018): Achieving the Learning Curve in Laparoscopic Inguinal Hernia Repair by Tapp: A Quality Improvement Study. J Invest Surg. Jun 14;:1
- [22] Bracale U, Merola G, Sciuto A, Cavallaro G and Andreuccetti J (2018): Achieving the Learning Curve in Laparoscopic Inguinal Hernia Repair by Tapp: A Quality Improvement Study. J Invest Surg. Jun 14;:1-8.
- [23] Bracale U, Merola G, Sciuto A, Cavallaro G, Andreuccetti J, Pignata G. Achieving the Learning Curve in Laparoscopic Inguinal Hernia Repair by Tapp: A Quality Improvement Study. J Invest Surg. 2019 Dec;32(8):738-745. [PubMed]
- [24] Brooks D, Rosen M, Chen W. (2017). Overview of abdominal wall hernias in adults. UpToDate Waltham, MA: Wolters Kluwer.
- [25] Callesen T (2003): Inguinal hernia repair: anaesthesia, pain and convalescence. Dan. Med. Bull., 50; 203–18.

- [26] Campanelli G, Bruni PG, Morlacchi A et al. (2017). Chronic Pain after Inguinal Hernia Repair; in Inguinal Hernia Surgery: Springer, Milano, p. 157-168.
- [27] Carbajo MA, Olma JC and Blance JI (2000): Laparoscopic repair of ventral abdominal wall hernias. Preliminary result in 100 patients. Surg Endosc, 14: 141-145.
- [28] Carbajo MA, Olma JC and Blance JI (2000): Laparoscopic repair of ventral abdominal wall hernias. Preliminary result in 100 patients. Surg Endosc, 14: 141-145.
- [29] Caruso.G, Evola.G, Benfatto S and Gangemi.G(2022), Transabdominal Preperitoneal (TAPP) Inguinal Hernia Repair(Online), Submitted: December 8th, 2021 Reviewed: December 9th, 2021 Published: January 5th, 2022, Hernia Surgery(working title),chapter 91, DOI: 10.5772/intechopen.101962
- [30] Caruso.G, Evola.G, Benfatto S and Gangemi.G(2022), Transabdominal Preperitoneal (TAPP) Inguinal Hernia Repair(Online), Submitted: December 8th, 2021 Reviewed: December 9th, 2021 Published: January 5th, 2022, Hernia Surgery(working title),chapter 91, DOI: 10.5772/intechopen.101962
- [31] Chang, K., Gokcal, F., Bou-Ayash, N., et al. (2020). 42nd Annual European Hernia Society Congress 2020. Hernia, 24(1), S1-S112
- [32] Cho HM, Park DS, Kim DH, Nam HS. Diagnosis of Ilioinguinal Nerve Injury Based on Electromyography and Ultrasonography: A Case Report. Ann Rehabil Med. 2017 Aug;41(4):705-708
- [33] Choksi D, Parmar A, Raiyani G, et al. (2014) : Comparative prospective study of laparoscopic TEP repair versus laparoscopic TAPP repair for inguinal hernioplasty conducted at tertiary level hospital, Vadodara, Int J Res Med , 3(1): 17-19
- [34] Chowbey K, Pithawala M and Khullar R (2006): Complications in groin hernia surgery and the way out. J MAS,2(3):174-77.
- [35] Choy C , Shapiro K and Patel S (2004): Investigating a possible cause of mesh migration during totally extraperitoneal repair (TEP). Sur. Endosc.; 18:523-525.
- [36] Claus CM, Rocha GM, Campos AC. Prospective, randomized and controlled study of mesh displacement after laparoscopic inguinal repair fixation versus no fixation of mesh. Surg Endosc. 2016;30(3):1134–1140. doi: 10.1007/s00464-015-4314-7
- [37] Claus CM, Rocha GM, Campos AC. Prospective, randomized and controlled study of mesh displacement after laparoscopic inguinal repair fixation versus no fixation of mesh. Surg Endosc. 2016;30(3):1134–1140. doi: 10.1007/s00464-015-4314-7
- [38] Claus, C., Furtado, M., Malcher, F., et al. (2020). Ten golden rules for a safe MIS inguinal hernia repair using a new anatomical concept as a guide.
- [39] Claus, C., Furtado, M., Malcher, F., et al. (2020). Ten golden rules for a safe MIS inguinal hernia repair using a new anatomical concept as a guide.
- [40] Coffey JC, Dockery P, Moran BJ et al. (2017). Mesenteric and peritoneal anatomy. Mesenteric principles of gastrointestinal surgery: basic and applied science 1:11-40,
- [41] Coffey JC, Dockery P, Moran BJ et al. (2017). Mesenteric and peritoneal anatomy. Mesenteric principles of gastrointestinal surgery: basic and applied science 1:11-40,
- [42] Daes J, Felix E(2017). Critical View of the Myopectineal Orifice. Ann. Surg. Jul;266(1):e1-e
- [43] Daes J. The enhanced view-totally extraperitoneal technique for repair of inguinal hernia. Surg Endosc. 2012;26(4):1187–1189. [PubMed] [Google Scholar]
- [44] Davis CJ and Arregui ME (2003): Laparoscopic repair for groin hernias. Surg. Clin. North. Am, 83: 1141-1161.

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Brief Overview about Laparoscopic TAPP Operation (For Inguinal Hernia Repair) Complications

- [45] Eklund A , Montgomery A , Rasmussen C et al (2009): Low recurrence rate after laparoscopic (TEP) and open (Lichtenstein) inguinal hernia repair. *Ann Surg* 249:33–38.
- [46] Esposito C, St Peter SD, Escolino M, et al, (2014): Laparoscopic versus open inguinal hernia repair in pediatric patients: a systematic review. *J Laparoendosc Adv Surg Tech A*; 24(11): 811-8
- [47] Felix E (2000): laparoscopic extraperitoneal hernia repair in Mastry of laparoscopic and endoscopic surgery. Edited by Steve Eubanks, Lee L. Swannstrom and Nathanyal J. Saper. Published by Lippincot, Williams and Wilkins, P.443-457
- [48] Felix E (2000): laparoscopic extraperitoneal hernia repair in Mastry of laparoscopic and endoscopic surgery. Edited by Steve Eubanks, Lee L. Swannstrom and Nathanyal J. Saper. Published by Lippincot, Williams and Wilkins, P.443-457.
- [49] Fitzgibbons RJ , Filipi CJ and Quinn TH (2005): Inguinal hernia, In: Schwartz`s principles of surgery. edited by Brunicardi F, Anderson D and Dunn D., 8th ed., McGraw-Hill, Vol 4,Ch 36,p1353-1394
- [50] Fitzgibbons RJ , Filipi CJ and Quinn TH (2005): Inguinal hernia, In: Schwartz`s principles of surgery. edited by Brunicardi F, Anderson D and Dunn D., 8th ed., McGraw-Hill, Vol 4,Ch 36,p1353-1394
- [51] Fitzgibbons Jr, Forse RA. (2015). Groin hernias in adults. *New England Journal of Medicine* 372:756-63.
- [52] Frassanito L, Zanfini BA, Pitoni S, et al. Ultrasound-guided genitofemoral nerve block for inguinal hernia repair in the male adult: a randomized controlled pilot study. *Minerva Anesthesiol.* 2018;84:189–195. -
- [53] Fumagalli R et al. Self-gripping mesh versus staple fixation in laparoscopic inguinal hernia repair: A prospective comparison. *Surgical Endoscopy.* 2013;27(5):1798-1802
- [54] Fumagalli R et al. Self-gripping mesh versus staple fixation in laparoscopic inguinal hernia repair: A prospective comparison. *Surgical Endoscopy.* 2013;27(5):1798-1802
- [55] Furtado M, Claus CMP, Cavazzola LT, et al. (2019): Systemization of laparoscopic inguinal hernia repair (TAPP) based on a new anatomical concept: inverted y and five triangles. *Arq Bras Cir Dig*; 32:e1426.
- [56] Gainant A and Chir J (2003) : Secrets in groin hernia repair. *N Engl J Med*, 349:1819-27
- [57] Gallagher EJ, Liebman M and Bigur PE (2006): Postoperative pain in repair of recurrent inguinal hernia. *Ann J Emerg Med*, 43: 633-638.
- [58] Gilbert AI, Young J and Azuaje R. (2017). Overview of Modern Surgical Techniques in Inguinal Hernia Repair; in *Textbook of Hernia*: Springer, Cham. p. 41-42.
- [59] Granger A, Kollias T and Loukas M. (2018): Anatomy of the Groin; in *Malignancies of the Groin*: Springer, Cham,. p. 17-38.
- [60] Hammoud M and Gerkin J (2021), Inguinal Hernia, Last Update: August 22, 2021. INTERNET
- [61] Hammoud M and Gerkin J (2021), Inguinal Hernia, Last Update: August 22, 2021. INTERNET
- [62] Hamza Y, Gabr E, Hammadi H and Khalil R (2009): Four arm randomized trial comparing laparoscopic and open hernia repairs. *Egyptian Journal of Surgery*, Vol 28(3): 110-117.
- [63] Hsieh CH: Laparoscopic cholecystectomy for patients with chronic obstructive pulmonary disease. *Laparoendosc Adv Surg Tech [A]* 2003;13:5–9.
- [64] Hsieh CH: Laparoscopic cholecystectomy for patients with chronic obstructive pulmonary disease. *Laparoendosc Adv Surg Tech [A]* 2003;13:5–9.
- [65] in *Aesthetic Plastic Surgery of the Abdomen*: Springer, Cham,. p. 17-36.
- [66] Irving F, Colin J and Taylor D (2007): Laparoscopic repair of groin hernia. *Recent advances in surgery*,28:41-50

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- [67] Irving F, Colin J, and Taylor D. (2005): Minimal invasive abdominal wall hernia repair. Recent advances in surgery, Volume 27: 27-40.
- [68] Jenkins T and O'Dwyer P (2008): "Inguinal Hernias": BMJ , Feb 2; 336 (7638): 269–272
- [69] Jenkins T and O'Dwyer P (2008): "Inguinal Hernias": BMJ , Feb 2; 336 (7638): 269–272
- [70] Joubert F, Gillois P, Bouaziz H, Marret E, Iohom G, Albaladejo P. Bleeding complications following peripheral regional anaesthesia in patients treated with anticoagulants or antiplatelet agents: A systematic review. Anaesthesia Critical Care & Pain Medicine. 2019;38(5):507-516
- [71] Joubert F, Gillois P, Bouaziz H, Marret E, Iohom G, Albaladejo P. Bleeding complications following peripheral regional anaesthesia in patients treated with anticoagulants or antiplatelet agents: A systematic review. Anaesthesia Critical Care & Pain Medicine. 2019;38(5):507-516
- [72] Kalra A, Tuma F. Anatomy, Abdomen and Pelvis, Peritoneum. Treasure Island: StatPearls, 2019. [Google Scholar]