



WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy



A Case of Lower Limb Myiasis in Hong Kong: Case Report and Brief Review of Existing Literature

Single Stitch Mesh Fixation During Laparoscopic Trans-Abdominal Pre-Peritoneal GroinHernia Repair: A Retrospective Study of 3800 TAPP Repairs

Medical Student Involvement in and Attitudes towards Audit and Research: The MEDical Student Experience of Audit and ResearCH (MED-SEARCH) Survey

Body Mass Index and Pregnancy Outcomes in Expectant Women at Moi Teaching and Referral Hospital, Eldoret Kenya

Impressions of Musculoskeletal Medicine Education in Current Doctors

The High Ratio of Undiagnosed Cases of Low Back Pain: Implications for Its Management

Abstracts from the 8th International Academic and Research Conference 2018

**DOCTORS
ACADEMY**



BETTER EDUCATION. BETTER HEALTH.

ISSN 2052-1715



Single Stitch Mesh Fixation During Laparoscopic Trans-Abdominal Pre-Peritoneal Groin Hernia Repair: A Retrospective Study of 3800 TAPP Repairs

Hussain A*, Owers C*, Komolafe O*, El-Hasani S**

Institution

*Doncaster and Bassetlaw
NHS Foundation Trust,
Armthorpe Road, Doncaster,
DN2 5LT, UK

**Princess Royal University
Hospital, Farnborough
Common, BR6 8ND

*WJMER, Vol 17: Issue 1,
2018*

Abstract

Background: Two major techniques are currently used for groin hernia repair: the laparoscopic and the open repair. The aim of this study is to demonstrate the outcomes of single stitch mesh fixation in laparoscopic Trans-Abdominal Pre-Peritoneal (TAPP) repairs of groin hernia.

Material and Methods: Between 2000 and 2016, 3800 TAPP repairs were performed using a 10mm umbilical port and two 5mm ports on either side of the umbilicus, 5cm lateral to the rectus muscle. In this technique, a peritoneal flap is raised, the sac reduced, and 10x15cm polypropylene mesh fitted in the space to cover potential defects. This is then fixed by a single vicryl stitch at its upper edge with no additional tacking. The peritoneum is closed with a vicryl suture. A polydioxanone stitch is used to close the sheath at the umbilicus and monocryl sutures used for the skin. This study examines the complications, both early and late, from this large series of patients by retrospectively examining notes and GP referrals to our team or other colleagues within our department.

Results: A total of 3260 patients underwent 3800 TAPP operations during the 16-year period of this study: 3106 men and 694 women aged 17-92 years of age. Body mass index (BMI) ranged from 19-52. Of these TAPP repairs, 2258 were right sided, 1002 left and 540 were bilateral hernias. Types of hernia included: 3268 indirect, direct or pantaloon; 190 femoral; and 342 recurrent groin hernias. A significant number of cases were performed as day-case operation (2641). Complications identified included: 11 vas deferens injuries; 216 patients experienced post-operative urinary retention. Nine patients (0.23%) required conversion to open operation for a variety of reasons (see Table 1). Only five patients (0.13%) experienced a recurrence of their groin hernia.

Conclusions: Mesh fixation using single vicryl stitch results in negligible recurrence of the hernia in TAPP groin hernia repair.

Key Words

Trans Abdominal Pre-Peritoneal repair; Totally Extra Peritoneal repair

Corresponding Author:

Mr Oluyemi Komolafe; E-mail: oluyemi.komolafe@gmail.com

Introduction

The Trans-Abdominal Pre-Peritoneal (TAPP) groin hernia repair is a popular technique with the advantage of intraoperative peritoneal diagnosis (i.e. the type of hernia) and is a relatively less challenging approach¹. The Totally Extra Peritoneal repair (TEP)² is another technique with excellent results. The debate as to which of these techniques is superior is ongoing, with some studies demonstrating superiority of one technique over the other². However, the general consensus is that both techniques can produce equivalent, and satisfying, results¹, although some studies have demonstrated lower recurrence rates following open repair³. Laparoscopic repair is beneficial in numerous situations including bilateral or recurrent hernias⁴, those keen for a shorter recovery period⁵ and where patients specify a preference for laparoscopic surgery. Both methods are preferential to the open tech-

nique, although some studies show lower recurrence after open repair⁶.

Whilst mesh fixation is not recommended in TEP repair⁷, various different methods of mesh fixation have been suggested for TAPP repairs^{8,9}.

A potential cause of recurrence after TAPP repair could include the method of mesh fixation and alignment. Therefore, the aim of this study is to report the outcomes of using single stitch fixation for mesh in a large series of TAPP repairs.

Material and Methods

This study includes a retrospective review of prospectively collected data from 3800 patients. All patients were treated by one of two consultant surgeons (AH or SE), in one of two University Hospitals in the UK (Princess Royal in London or Don-

caster Royal Infirmary in South Yorkshire), following referral from their General Practitioner. Patients were assessed and consented for surgery by a consultant surgeon or their deputy. Consecutive patients over the age of 16 years, eligible for laparoscopic surgery were included, minimising selection bias. Patients unwilling to undergo TAPP repair; those unsuitable for general anaesthesia or laparoscopic surgery, patients with indirect hernia defects > 5cm, and those with recurrence following previous laparoscopic repair were excluded.

Demographic data was collected, including: hospital number, date of birth, gender, date of admission, date of operation and date of discharge. Data specific to the operation was also collected including: the type of groin hernia, the site of operation (right or left), BMI, the type and numbers of meshes used, post-operative complications (such as vas deferens injury, inferior epigastric artery injury, spermatic cord injury, bladder injury, bowel obstruction, conversion to open operation), post-operative morbidities and length of hospital stay. Post-operative morbidities of interest included: hernia recurrence, seroma, infection, organ injury, urine retention and chronic groin pain. The usual Numeric Rating Scale NRS from 0-10 (11-point scale) was used for assessment of chronic groin pain. Finally, data pertaining to readmission rates and the follow-up examination findings were recorded. All data was placed into an excel file sheet.

Post-operative assessment was carried out by the operating surgical team, therefore complete elimination of assessment bias was not possible. However, complications were recorded by the operating surgeon (AH or SE). In most cases, this assessment was performed at eight weeks, and in the absence of any complication requiring additional surgical input, the patient was discharged back to the care of their General Practitioner. Upon discharge, General Practitioners were instructed to refer the patient back to the surgical department in the event of any late complication or recurrence. For those with a complication (seroma, infection, recurrence, groin pain), further follow up was arranged until complete resolution of the morbidity, or a referral to another speciality occurred.

For the purposes of this study, early recurrence was defined as occurring during the first eight weeks post-operatively (by which time the patient was reviewed in the outpatient clinic). Late hernia recurrence was noted by a re-referral to the surgical department from primary or emergency care; where clinical or radiological recurrence was noted, these were managed by re-operation.

Simple statistical analyses were performed using an

Excel spreadsheet.

Operative technique

A standard operating technique was used for all hernias. Patients are placed head down with the laparoscopic stack at the foot end, with the surgeon stood on the contralateral side to the hernia. TAPP repairs are performed using three ports; a 10mm umbilical utility port allowing for mesh introduction and camera use. Two 5mm ports are inserted on either side of the 10mm umbilical port, 5cm lateral to the rectus muscle on either side.

Upon entering the abdominal cavity, inspection for other pathology is made and the hernia identified. A peritoneal incision is made approximately 2cm above the edge of the apparent defect, medially extended to the lateral umbilical ligament, exposing the medial edge of the rectus; superiorly and laterally the dissection is extended as much as required to obtain 3-5cm overlap of the lateral edge of the hernia defect. Inferiorly, the peritoneal flap is dissected to overlap the pubic bone in the pre-vesical space, providing adequate space for the mesh to lie flat on the psoas muscle. In the male patient, the lower peritoneal flap is dissected off the vas and cord; in female patients, usual practice is to clip and transect the round ligament, which is then reflected with the peritoneum.

Hernias are repaired with polypropylene mesh size 10 x 15cm (Cousin Biotech, France). Irrigation of the mesh with antibiotics is not routinely performed. Mesh is aligned to the medial border of the contralateral rectus muscle. The mesh should lie flat on the abdominal wall without creases as these are believed to contribute to chronic pain via rolling and mesh displacement. If the first mesh does not adequately overlap the hernia defect superiorly or laterally then another mesh is inserted to provide sufficient overlap. There is a low threshold for the use of more than one mesh. Meshes are fixed using a single 2/0 vicryl stitch at the middle of the top edge of the mesh and away from the inferior epigastric artery.

Following satisfactory mesh placement, the peritoneum is closed using vicryl stitches. The 10-millimetre port is closed with polydioxanone (PDS) stitch(es) and the skin incisions closed with monocryl. Twenty millilitres of local anaesthetic (0.5% Marcaine) is infiltrated at the wounds.

Results

A total of 3260 patients underwent 3800 TAPP operations; 3106 (81.73%) males and 694 (18.26%) females aged 17-92 years. A wide range of body mass index patients were included (BMI range 19-52). Of these operations, 2258 (59.42%) were right

sided repairs, 1002 (26.36%) left sided and 540 (14.21%) were bilateral hernias. Types of hernia included: 3268 (86%) indirect, direct and or pantaloon; 190 (5%) femoral and 342 (9%) recurrent groin hernias. Two thousand six hundred and forty-one (69.5%) patients were treated as day case surgeries; 1159 (30.5%) were planned elective admissions and 74 (1.94%) were readmitted from day surgery (failed day case surgeries).

Although all operations were started as TAPP repairs, nine patients (0.23%) required conversion to open repair for a variety of reasons (see Table 2). Of the documented complications, injury to the vas deferens was the most common organ injury, noted in 11 patients (0.28%). Post-operatively, 216 (5.68%) patients experienced urinary retention, which was the most common post-operative complication overall. Other complications included three mesh

Total number of patients (operations)		3261 (3800)
Male		3106 (81.73%)
Female		694 (18.26%)
BMI		19-52
Age		17-91
ASA		1-3
Site	Bilateral Left Right	540 (14.21%) 1002 (26.36%) 2258 (59.42%)
Type	Femoral Recurrent Indirect, Direct and or Pantaloon Incidental hernias	190 (5%) 342 (9%) 3268 (86%) 241 (6.34%)
ASA		1-3
Hospitalization	Inpatient Day cases Admitted from day surgery	1159 (30.5%) 2641 (69.5%) 74 (1.94%)

Table 1: Demographic features, diagnosis and hospitalisation

Operative complications	Number (%)	Post-operative complications	Number (%)
Vas deference injury	11 (0.28)	Urinary retention	216 (5.68)
Inferior epigastric injury	8 (0.21)	Seroma /haematoma	96 (2.52)
Spermatic cord injury	6 (0.15)	Lateral thigh paraesthesia	32 (0.84)
Bladder injury	1 (0.026)	Recurrence	5 (0.13)
Bowel obstruction	1 (0.026)	Mesh infection	3 (0.07)
Conversion to open	9 (0.23)	Needed blood transfusion	3 (0.07)
		Port site hernia	2 (0.05)
		Chronic post-operative groin pain	5 (0.13)
		Mortality	0 (0)

Table 2: Complications

infections (0.07%) in inguinal hernias, two of which responded to antibiotics and one of which was salvaged by radiological aspiration of the abscess and antibiotics. Five cases (0.13%) of chronic groin pain were reported, also following inguinal hernia repairs. These patients were fully investigated by Ultrasound scanning (USS) and Magnetic Resonance Imaging (MRI) scans before referral to the pain team. Overall, only five (0.13%) port site hernias were reported and repaired by open surgical technique (tables 1 and 2). Five patients (0.13%) experienced recurrence of their inguinal hernia, which was managed by open repair. No complications were recorded following femoral hernia repairs.

Discussion

TAPP repair of the groin hernia is a popular technique and has the advantages of being diagnostic (i.e. able to determine the type of hernia), unlike the TEP technique¹⁰. Both techniques provide comparable results with regards to mesh infection, recurrence, chronic pain and quality of life¹¹⁻¹³. These results were clearly demonstrated by the low incidence of complications in this, one of the larger case series published in the literature.

There are numerous variations in surgical technique which can be used during TAPP repair. For example, the authors would advocate that it is mandatory to dissect and reduce the hernia sac. This is in order to decrease the risk of recurrence³⁰. In TAPP repair for femoral hernias, it is almost always necessary to incise the medial edge of the femoral ring for safe and total delivery of the sac and contents from the femoral canal, without jeopardising the femoral vein¹⁴. For the indirect inguinal hernia sac, care is taken to reduce the sac without injuring the spermatic cord or the vas¹⁴.

For sacs that are stuck deep in the inguinal canal towards the scrotum, the dissection may cause unnecessary bleeding or injury to the cord, so there should be a low threshold to circumcise the sac as safely as possible distally, toward the scrotum. When the sac is circumcised, it is important that the hole in the peritoneal flap is closed using a Vicryl stitch. Should a long indirect inguinal sac be reduced, then it is necessary to ligate this sac with Vicryl in order to avoid leaving a potential space for further bowel herniation¹⁵.

An interesting point for debate during TAPP repair of groin hernias is whether or not to fix the mesh. Numerous methods of mesh fixation have been described in the literature^{8, 9, 16, 17}. Studies have shown that mesh fixation is unnecessary in most patients¹⁸ and may not affect the incidence of chronic groin pain⁹, the main concern of those surgeons who do not advocate mesh fixation¹⁹. The

authors in this study used a single stitch mesh fixation, as it was considered effective in reducing the incidence of mesh slippage and therefore may have led to a decreased rate of hernia recurrence²⁰. The use of tackers to fix the mesh is controversial as it is costly²¹. Given that this case series included 3800 repairs, suture fixation rather than specialist tacking devices is estimated to have saved the equivalent of approximately \$130 000 to 200 000. However, the advent of new meshes which do not require fixation removes the need for suturing or tacking and may therefore negate this concern²². However, the cost of this type of mesh may have significant financial implications, especially when used in a series as large as the one reported in this article (3800 repairs). In the author's experience, mesh fixation to the edges of the defect (with sutures, or more commonly, with tackers) is only required in large, wide hernias (more than 5cm defect) in order to prevent protrusion of the mesh through the defect into the scrotum; these patients were not included in this study. Avoiding use of a tacking device can decrease the cost of the operation; it is also potentially associated with less neuralgic pain²³, although some studies debate this issue²⁴. Following placement of the mesh (with or without fixation), meticulous closure of the peritoneal defect and any peritoneal defect using Vicryl stitches is crucial to avoid potential herniation of the bowel which may require further surgery¹⁵.

In terms of which mesh to use, in the experience of the operating surgeon (AH), absorbable synthetic materials are more susceptible to bacterial colonization than non-absorbable materials, thus polypropylene mesh is was used for all patients in this series. In spite of the fact that mesh infection is very low, supported by this study, the first two mesh infections were treated with antibiotics. However, one patient who presented with pain and raised inflammatory markers 15 days following surgery had formed an abscess cavity around the mesh; this was subsequently treated by ultrasonography guided aspiration in addition to antibiotics. All meshes were salvaged.

The causes of recurrence after TAPP repair are variable and it cannot be categorically stated that single stitch fixation of the mesh is solely responsible for our low recurrence rate. It also difficult to conclude that operative and post-operative bleeding is less with single stitch fixation compared to tackers, although the use of multiple fixation points using a tacking device is more likely to injure vessels in the dissection field and cause bleeding; this risk is significantly reduced with single point fixation. However, the cost of surgery is most certainly reduced²¹ and the authors hypothesise that it has most likely reduced the incidence of pain after surgery given that

previous studies have linked pain to the use of tackers²⁵.

There is a debate about the discovery intra-operatively of contralateral (and often incidental) hernias, and whether or not to repair them at the same operative sitting²⁶. The authors would advocate that this can, and may, be done safely in a selected group of patients (if they are fit enough for laparoscopic surgery, without significant comorbidities), as TAPP repair lends itself well to this technique. The size of the mesh and the nature of the technique imply that contralateral hernias are automatically repaired. In the authors' routine practice, contralateral or concurrent hernias are repaired during the same operation; all patients were informed during the consent procedure that an incidental hernia on the contralateral site will be repaired, especially if the patient declares minor symptoms on that side. However, long operative time, the risk of surgical emphysema, patient age and physiology is taken into consideration and where the risk is deemed too high, contralateral incidental herniae may be left alone, or a future repair planned if the patient is keen.

Post-operative pain can be difficult to manage, especially when chronic²⁷. Patients are usually pain free by the end of the first post-operative week. Occasionally, patients complain of groin discomfort, describing "twinges" when they widely abduct or flex the thigh.

In the authors' experience, most of these symptoms dissipate within three months following surgery. On rare occasions, the patient may complain of chronic groin pain after this time. Within this series, this occurred in five (0.13%) patients. Clinical and radiological assessment (ultrasound and MRI examinations) often do not show any abnormality, and local wound exploration may exacerbate the problem. In most cases, the authors would advocate referral to the chronic pain specialist. Patients may also complain of paraesthesia on the upper lateral aspect of the thigh along the distribution lateral cutaneous nerve. In this series, where patients complained of this loss of sensation, follow up was extended for up to 18 months; in all cases the paraesthesia sensation either improved or resolved.

Recurrence following any type of hernia repair is widely acknowledged, and many new operative techniques have been suggested over the years to try to prevent this complication from occurring. One study published in 2003 reported recurrence rate of 2.3%, however a later study showed the recurrence rate to be as little 0.68% after five years^{14, 28}.

Within our study, a very low recurrence rate (five patients; 0.13%) was demonstrated. Recurrence after TAPP repair is most likely to occur if the medial dissection is short of the midline, and if the lower edge of the mesh is not placed flat, as it can roll up with consequent herniation through the inguinal or femoral canal. If the mesh is not fixed to the edges of a large defect, there is the potential for herniation into the inguinal canal. Therefore, it is important to ensure that the mesh is large enough to provide adequate coverage of the hernia defect and surrounding tissues.

Laparoscopy and exploration of the groin area can be offered to active patients who present with chronic groin pain with no gastrointestinal or urological symptoms and where radiological investigation has excluded any musculoskeletal cause for their pain. When performed, the peritoneal flap should be dissected, as, in the authors experience, there are occasions where there may be a hernia, but the defect is filled with pre-peritoneal fat without a peritoneal sac. Therefore, diagnosis can only be made by peritoneal dissection. Dissection for groin pain is the same as dissection for a hernia. Out of the 117 patients who had laparoscopic exploration of the groin for chronic pain and repair of a previously undiagnosed hernia with mesh, 91 (78%) patients had complete relief of their pain post-operatively. However, these patients should be selected carefully, often after consultation with orthopaedic colleagues.

With regards to post-operative complications, seromas may occur due to the collection of reactionary serous fluid in the potential space left in the groin region following hernia reduction. All patients should be counselled regarding the possibility of seroma formation; in the event of seroma occurrence, they should be reassured at any consequent follow-up or hospital visit that this is not a hernia recurrence. This is particularly important for large or inguino-scrotal hernias which may have a larger incidence of seroma²⁹. The majority of seromas are asymptomatic³⁰; however, for those patients with tenderness or symptoms suggestive of early infection, seromas can be aspirated under strict aseptic technique. In the experience of these authors, where there is persistence on clinical examination for more than three months following the operation, the presentation is often an organised haematoma rather than a seroma, as seromas are usually absorbed before three months³⁰.

Retention of urine following hernia repair is common in both the laparoscopic and open approach. Two hundred and sixteen (5.68%) patients developed retention in this series. Distension of the blad-

der may displace the medial part of the mesh and also may disrupt the closure of the peritoneal flaps. Both of these effects may lead to a recurrence of the hernia, or entrapment of the bowel through the peritoneal defect. All patients should be encouraged to empty their bladder before they go to theatre, and it is policy within the authors' units that if the bladder is distended at laparoscopic exploration, a catheter be inserted while the patient is anaesthetised and removed two hours after surgery.

This is a very large case series, showing favourable results in terms of technique and complications. However, given that this was a retrospective study, there are some limitations. The most important one, as is the same for many published hernia series, is the follow up. Standard follow up following laparoscopic groin hernia repair is for eight weeks as per local guidelines. This allowed for detection of early complications. The late complications of recurrence, mesh infections and chronic groin pain however, are only identified and confirmed after referral from GPs, admissions from the emergency department or by direct contact between surgeon and patient. As not all patients were seen after eight weeks of follow up (patients not attending the clinic), some cases of recurrence or chronic groin pain may not have been reported and therefore the final figures reporting these complications may be considered low.

The other limitation of the study is in the assessment of chronic groin pain. Given that if, following their initial clinic appointment, patients were considered well, they were discharged, there is a potential for missing patients who developed 'chronic' groin pain. Patients who were referred back to the department via their GP or A+E were reviewed and treated for chronic pain. However, there is no way to know if patients were referred to other hospital departments, or managed in the primary care setting only, despite patients being told to contact the department if they experienced any chronic groin pain. Unfortunately, long-term data for this potential complication of groin hernia repair may therefore not be accurate.

Conclusions

TAPP repair of groin hernia using single stitch mesh fixation is safe, effective and associated with negligible rate of recurrence and chronic groin pain in a large cohort of patients. The authors therefore recommend the use of this technique in routine clinical practice.

References:

1. Gass M, Banz VM, Rosella L, Adamina M, Candinas D, GÄfÄ¼ller U. TAPP or TEP? Population-Based Analysis of Prospective Data on 4,552 Patients Undergoing Endoscopic Inguinal Hernia Repair. *World journal of surgery*. 2012;36(12):2782-6.
2. Gass M, Banz VM, Rosella L, Adamina M, Candinas D, Guller U. TAPP or TEP? Population-based analysis of prospective data on 4,552 patients undergoing endoscopic inguinal hernia repair. *World J Surg*. 2012;36(12):2782-6.
3. Scheuermann U, Niebisch S, Lyros O, Jansen-Winkeln B, Gockel I. Transabdominal Preperitoneal (TAPP) versus Lichtenstein operation for primary inguinal hernia repair - A systematic review and meta-analysis of randomized controlled trials. *BMC Surg*. 2017;17(1):55.
4. Pisanu A, Podda M, Saba A, Porceddu G, Ucheddu A. Meta-analysis and review of prospective randomized trials comparing laparoscopic and Lichtenstein techniques in recurrent inguinal hernia repair. *Hernia*. 2015;19(3):355-66.
5. Hamza Y, Gabr E, Hammadi H, Khalil R. Four-arm randomized trial comparing laparoscopic and open hernia repairs. *Int J Surg*. 2010;8(1):25-8.
6. Beets GL, Dirksen CD, Go PM, Geisler FE, Baeten CG, Kootstra G. Open or laparoscopic preperitoneal mesh repair for recurrent inguinal hernia? A randomized controlled trial. *Surg Endosc*. 1999;13(4):323-7.
7. HerniaSurge G. International guidelines for groin hernia management. *Hernia*. 2018;22(1):1-165.
8. Nagahisa Y, Kawashima R, Matsumoto R, Harada M, Hashida K, Okabe M, et al. Feasibility of a novel tacking method of securing mesh in transabdominal preperitoneal inguinal hernia repair: Secure tacking against recurrence. *Asian J Endosc Surg*. 2018.
9. Andresen K, Fenger AQ, Burcharth J, Pommergaard HC, Rosenberg J. Mesh fixation methods and chronic pain after transabdominal preperitoneal (TAPP) inguinal hernia surgery: a comparison between fibrin sealant and tacks. *Surg Endosc*. 2017;31(10):4077-84.
10. Hussain A, Nicholls J, El-Hasani S. Technical tips following more than 2000 transabdominal preperitoneal (TAPP) repair of the groin hernia. *Surg Laparosc Endosc Percutan Tech*. 2010;20(6):384-8.

11. Sharma D, Yadav K, Hazrah P, Borgharia S, Lal R, Thomas S. Prospective randomized trial comparing laparoscopic transabdominal preperitoneal (TAPP) and laparoscopic totally extra peritoneal (TEP) approach for bilateral inguinal hernias. *Int J Surg.* 2015;22:110-7.
12. Kockerling F, Bittner R, Kuthe A, Hukauf M, Mayer F, Fortelny R, et al. TEP or TAPP for recurrent inguinal hernia repair-register-based comparison of the outcome. *Surg Endosc.* 2017.
13. Gass M, Scheiwiller A, Sykora M, Metzger J. TAPP or TEP for Recurrent Inguinal Hernia? Population-Based Analysis of Prospective Data on 1309 Patients Undergoing Endoscopic Repair for Recurrent Inguinal Hernia. *World J Surg.* 2016;40(10):2348-52.
14. Bittner R, Leibl BJ, Jäger C, Kraft B, Ulrich M, Schwarz J. TAPP - Stuttgart technique and result of a large single center series. *J Minim Access Surg.* 2006;2(3):155-9.
15. Kohler G, Mayer F, Lechner M, Bittner R. Small bowel obstruction after TAPP repair caused by a self-anchoring barbed suture device for peritoneal closure: case report and review of the literature. *Hernia.* 2015;19(3):389-94.
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):114-20.
17. Lederhuber H, Stiede F, Axer S, Dahlstrand U. Mesh fixation in endoscopic inguinal hernia repair: evaluation of methodology based on a systematic review of randomised clinical trials. *Surg Endosc.* 2017.
18. Li W, Sun D, Sun Y, Cen Y, Li S, Xu Q, et al. The effect of transabdominal preperitoneal (TAPP) inguinal hernioplasty on chronic pain and quality of life of patients: mesh fixation versus non-fixation. *Surg Endosc.* 2017.
19. Ayyaz M, Farooka MW, Malik AA, Khan A, Mansoor R, Toor AA, et al. Mesh fixation vs. non-fixation in total extra peritoneal mesh hernioplasty. *J Pak Med Assoc.* 2015;65(3):270-2.
20. Mayer F, Niebuhr H, Lechner M, Dinnewitzer A, Köhler G, Hukauf M, et al. When is mesh fixation in TAPP-repair of primary inguinal hernia repair necessary? The register-based analysis of 11,230 cases. *Surg Endosc.* 2016;30(10):4363-71.
21. Kleidari B, Mahmoudieh M, Yaribakht M, Homaei Z. Mesh fixation in TAPP laparoscopic hernia repair: introduction of a new method in a prospective randomized trial. *Surg Endosc.* 2014;28(2):531-6.
22. Birk D, Pardo CG. Self-gripping Parietene and Parietex Progrid mesh laparoscopic hernia repair: have we found the ideal implant? *Surg Technol Int.* 2012;22:93-100.
23. Chandra P, Phalgune D, Shah S. Comparison of the Clinical Outcome and Complications in Laparoscopic Hernia Repair of Inguinal Hernia With Mesh Fixation Using Fibrin Glue vs Tacker. *Indian J Surg.* 2016;78(6):464-70.
24. Andresen K, Fenger AQ, Burcharth J, Pommergaard HC, Rosenberg J. Mesh fixation methods and chronic pain after transabdominal preperitoneal (TAPP) inguinal hernia surgery: a comparison between fibrin sealant and tacks. *Surg Endosc.* 2017.
25. Shah NS, Fullwood C, Siriwardena AK, Sheen AJ. Mesh fixation at laparoscopic inguinal hernia repair: a meta-analysis comparing tissue glue and tack fixation. *World J Surg.* 2014;38(10):2558-70.
26. van den Heuvel B, Beudeker N, van den Broek J, Bogte A, Dwars BJ. The incidence and natural course of occult inguinal hernias during TAPP repair: repair is beneficial. *Surg Endosc.* 2013;27(11):4142-6.
27. Werner MU. Management of persistent postsurgical inguinal pain. *Langenbecks Arch Surg.* 2014;399(5):559-69.
28. Czechowski A, Schafmayer A. [TAPP versus TEP: a retrospective analysis 5 years after laparoscopic transperitoneal and total endoscopic extraperitoneal repair in inguinal and femoral hernia]. *Chirurg.* 2003;74(12):1143-9.
29. Köckerling F, Bittner R, Adolf D, Fortelny R, Niebuhr H, Mayer F, et al. Seroma following transabdominal preperitoneal patch plasty (TAPP): incidence, risk factors, and preventive measures. *Surg Endosc.* 2018;32(5):2222-31.
30. Cihan A, Ozdemir H, Ucan BH, Acun Z, Comert M, Tascilar O, et al. Fade or fate. Seroma in laparoscopic inguinal hernia repair. *Surg Endosc.* 2006;20(2):325-8.

Video link on Youtube: <https://www.youtube.com/watch?v=zYzHNhi9tNA>

The World Journal of Medical Education & Research (WJMER) is the online publication of the Doctors Academy Group of Educational Establishments. It aims to promote academia and research amongst all members of the multi-disciplinary healthcare team including doctors, dentists, scientists, and students of these specialties from all parts of the world. The journal intends to encourage the healthy transfer of knowledge, opinions and expertise between those who have the benefit of cutting-edge technology and those who need to innovate within their resource constraints. It is our hope that this interaction will help develop medical knowledge & enhance the possibility of providing optimal clinical care in different settings all over the world.



WJMER

World Journal of Medical Education and Research

An Official Publication of the Education and Research Division of Doctors Academy

ISBN 978-93-80573-66-3



9 789380 573663 >