

Efficacy and Safety of Laparoscopic Inguinal Hernia Repair

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ABSTRACT

Background: Inguinal hernia results from a defect or weakness in the muscles in the inguinal region, through which the peritoneum protrudes, forming the sac. One of the most common operations that general surgeons perform to repair this defect is inguinal herniorrhaphy. Laparoscopic herniorrhaphy started being performed when laparoscopic cholecystectomy has shown definite benefits over the open technique. However, laparoscopic hernia repair is an advanced laparoscopic procedure and has a longer learning curve.⁴

Objectives: (1) To evaluate the efficacy and safety of three laparoscopic hernia repair techniques: Transabdominal preperitoneal (TAPP), totally extraperitoneal (TEP), and intraperitoneal onlay mesh (IPOM). (2) Specifically, this review aims to: (a) Determine which laparoscopic technique has lowest recurrence rate, (b) determine which laparoscopic technique has the least perioperative complications.

Materials and methods: The database used in this study was PubMed and MeSH. Search terms included: laparoscop*, inguinal, hernia, repair, TAPP, TEP and IPOM. Study designs included in this study were prospective clinical studies, and retrospective clinical studies.

Results: All three laparoscopic techniques had complication rates comparable to those of the open techniques. However, recurrence rates after laparoscopic repair was much lower. IPOM, although technically the easiest procedure to perform among the three laparoscopic techniques, is associated with the highest risk of adhesion formation and the lowest tensile strength. In comparison, the TEP and the TAPP techniques had the advantages of better tissue incorporation and tensile strength.

Conclusion: Laparoscopic inguinal herniorrhaphy is an effective method to correct an inguinal hernia but is not without complications nor risk for recurrences. The TAPP, IPOM, and TEP procedures appear to be equally effective. Training, experience, and proper operative technique will prevent some of these complications.

Keywords: Hernia, Inguinal, Laparoscop*, Repair, TAPP, TEP and IPOM.

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INTRODUCTION

Inguinal hernia results from a defect or weakness in the muscles in the inguinal region through which the peritoneum protrudes, forming the sac. One of the most common operations that general surgeons perform to repair this defect is inguinal herniorrhaphy. Laparoscopic herniorrhaphy started being performed when laparoscopic cholecystectomy has shown definite benefits over the open technique. However, laparoscopic hernia repair is an advanced laparoscopic procedure and has a longer learning curve.⁴

In 1982, Ger attempted minimal access groin hernia repair by using Michel clips to close the opening of an indirect inguinal hernia sac. In 1989, Bogojavlensky modified the technique by plugging a polypropylene mesh into the sac and applying an intracorporeal suture on the deep ring. In 1991, Toy and Smoot described a technique of intraperitoneal onlay mesh (IPOM) placement. This involved placement of an intra-abdominal piece of polypropylene or e-PTFE mesh and stapling it over the myopectineal orifice without dissection of the peritoneum.⁴

Stoppa's concept of preperitoneal reinforcement of the transversalis fascia over the myopectineal orifice with its multiple openings by a prosthetic mesh brought about the evolution of the present day techniques of laparoscopic hernia repair. In the early 1990's, Arregui and Doin described the transabdominal preperitoneal (TAPP) hernia repair. During TAPP, the abdominal cavity is first entered followed by the incision of the peritoneum over the posterior wall of the inguinal canal, allowing access into the avascular preperitoneal plane. Adequate dissection is carried out along this plane to allow placement of a large (15 × 10 cm) mesh over the hernia orifices. The peritoneum is carefully sutured or stapled back into place after fixation of the mesh. Transabdominal

*Laparoscop stands for 'Laparoscopy' or 'Laparoscopic' for PubMed result.

preperitoneal (TAPP) repair has the advantage of identifying missed additional direct or femoral hernia during the initial operation.⁴

Phillips and McKernan described the totally extraperitoneal (TEP) technique of endoscopic hernioplasty. The peritoneal cavity is not breached when performing this technique and the entire dissection is performed bluntly in the preperitoneal space using a balloon device or the tip of the laparoscope itself. This procedure requires an advanced knowledge of the posterior anatomy of the inguinal region. Upon completion of dissection, a 15 × 10 cm mesh is stapled in place over the myopectineal orifice.⁴

The mesh is placed in direct contact with the fascia of the transversalis muscle in the preperitoneal space in both the TAPP and TEP repairs, allowing tissue ingrowths which lead to the fixation of the mesh. This is opposed to the IPOM technique wherein the mesh is merely being brought in contact to the peritoneum and is prone to migrate.⁴

Depending on the type of repair and expertise of the surgeon, recurrence after primary open inguinal herniorrhaphy occurs in approximately 10% of patients. Open repair of the recurrence is challenging because of already weakened tissues and obscured and distorted anatomy leading to a failure rate of as high as 36%. Because of this, focus has been given on repairing these difficult recurrent hernias laparoscopically using a tension-free approach. Some of the earlier reports suggested a low recurrence rate of 0.5 to 5% when a laparoscopic approach was used.³

OBJECTIVES

- To evaluate the efficacy and safety of three laparoscopic hernia repair techniques: TAPP, TEP and IPOM
- Specifically, this review aims to:
 - Determine which laparoscopic technique has lowest recurrence rate
 - Determine which laparoscopic technique has the least perioperative complications.

MATERIALS AND METHODS

The database used in this study was PubMed and MeSH. Search terms included: laparoscop*, inguinal, hernia, repair, TAPP, TEP and IPOM.

Study designs included in this study were prospective clinical studies and retrospective clinical studies.

DEFINITION OF TERMS

Transabdominal Preperitoneal Laparoscopic Inguinal Herniorrhaphy

Laparoscopic hernia repair wherein the peritoneum then is incised transversely above the hernia defect, and a

complete dissection of the preperitoneal space is accomplished using instruments placed intra-abdominally via accessory ports. Direct sacs are reduced and indirect sacs are either dissected from the cord structures and reduced or divided circumferentially at the internal ring, leaving the distal sac in place. These were accomplished during the course of the preperitoneal dissection. An appropriately sized prosthetic mesh is placed in the preperitoneal space over the hernia defect, overlapping it widely and is either slit to accommodate the cord structures or placed over them. The mesh is then fixed in place using the following landmarks: the symphysis pubis medially, transversalis fascia above the internal ring superiorly, an arbitrary point approximately 1 cm medial to the anterior superior iliac spine laterally, the iliopubic tract inferolaterally, and Cooper's ligament inferomedially before peritoneal closure over the mesh using either staples or sutures, thereby preventing the mesh from coming in contact with intra-abdominal viscera.²

Intraperitoneal Onlay Mesh Laparoscopic Herniorrhaphy

Laparoscopic hernia repair wherein a prosthetic mesh was placed directly onto the peritoneum overlapping the hernia defect widely rather than the preperitoneal space, leaving the hernia sac in place. The same landmarks as described with the TAPP procedure were used for fixing the prosthetic mesh in place.²

Totally Extraperitoneal Laparoscopic Herniorrhaphy (Extra)/(TEP)

Laparoscopic hernia repair wherein the skin and fascia at the umbilicus are incised using an open laparoscopic technique, leaving the underlying peritoneum intact. The preperitoneal space is dissected beginning at the umbilicus and continuing inferiorly, creating a 'pneumoextraperitoneum' using CO₂ gas. Additional ports were placed into the extraperitoneal space once the space was sufficiently enlarged, allowing introduction of laparoscopic instrumentation. The abdominal cavity is not entered. Dissection is performed until the hernia defect is encountered and the procedure continued in an identical fashion to the TAPP operation.²

DISCUSSION

Catani et al¹ reported their experience on laparoscopic hernioplasty using the IPOM repair in 56 patients. Thirty patients had a monolateral hernia, nine of which were recurrent. Twenty-six had bilateral hernias, six of which were recurrent. A total of 90 hernias were treated. The first 32 cases were repaired with the 'GORETEX Dual Mesh Plus biomaterial with holes'. The 'Corduroy' type was used

to repair the following 24 cases. Meshes were fixed with titanium spiral tacks (Protack, Auto Suture, Tyco Healthcare). There were no noted intraoperative complications and no conversion was necessary. There were five minor postoperative complications (5.5%): Two seromas and three transient paresthesias. Analgesics were needed in four patients (7.1%) after the first 24 hours. Mean hospital stay was 36 hours with a minimum of 24 and a maximum of 48. Resumption of normal activity was within a mean of 8 days with return to work in 2 weeks. Three recurrences were recorded (3.3%) within an average of 18 months of follow-up.

Fitzgibbons et al² conducted a multicenter trial to determine if laparoscopic inguinal herniorrhaphy represented a viable alternative to the conventional repair and to assess whether a prospective randomized controlled trial comparing both procedures is warranted. Three types of laparoscopic inguinal herniorrhaphies TAPP, IPOM and TEP (EXTRA) were studied in a phase II design. A total of 21 investigators from 19 institutions participated. There were 686 patients with 869 hernias; 366 (42.1%) were direct, 414 (47.6%) were indirect, 22 (2.5%) were femoral, and 67 (7.7%) were combination hernias. Five hundred and sixty-two hernias underwent TAPP, 217 hernias underwent IPOM, and 87 hernias underwent EXTRA. The overall recurrence rate was 4.5%, with a minimum follow-up of 15 months. Complications were divided into the following three groups: (1) those related to laparoscopy, (2) those related to the patient and (3) those related to the herniorrhaphy. Laparoscopy related complications were noted in 5.4% of patients; there were 31 cases of bleeding or abdominal wall hematomas with two patients requiring transfusions; there was one case of bowel perforation, which was sutured laparoscopically; one bladder injury was managed with open surgery. Patient complications occurred in 6.7% with 5.8% involving the urinary tract. Secondary abdominal procedures had to be performed on two patients for adhesions, one for pain in the right lower quadrant and the other for adhesive small bowel obstruction. The sole mortality (0.1%) was due to a myocardial infarction on postoperative day 5. Complications related to the herniorrhaphy itself were noted in 17.1% of the cases, most of which were minor: transient groin pain (3.5%), seroma (3.5%), transient leg pain (3.3%), hematoma (1.5%), or transient cord or testicular problems (0.9%). As surgeons became more familiar with the anatomy of the nerve supply to the groin when viewed laparoscopically, the incidence of leg pain decreased dramatically. Ninety-three percent of patients were discharged within 24 hours postoperatively.

A study by Phillips et al⁵ reported on the complications of 3,229 laparoscopic hernia repairs performed by

the authors in 2,559 patients. The TAPP technique was performed 1,944 times (60%), the totally preperitoneal technique was performed 578 times (18%) and the IPOM repair was performed 345 times (11%). The plug-and-patch technique was used 286 times (9%) while simple closure of the hernia defect without mesh was performed 76 times (2%). There were a total 336 complications (10%): 17 major (0.5%) and 265 minor (8%). A total of 54 recurrences (1.6%) were noted, within a mean follow-up of 22 months. The TAPP technique had 19 recurrences (1%) and 141 (7%) complications including four bowel obstructions due to herniation of small bowel through the peritoneal closure and trocar sites. The totally preperitoneal technique had no noted recurrences and 60 complications (10%). Those who underwent IPOM had seven recurrences (2%) and 47 complications (14%). Patients who underwent the plug-and-patch technique had 26 recurrences (9%) and 24 complications (8%). Simple closure of the internal ring had two recurrences (3%) and 10 complications (13%).

Rasim et al⁶ conducted a study to evaluate the incidence of adhesion formation and the tensile properties of the various techniques of laparoscopic inguinal herniorrhaphy. The techniques evaluated included laparoscopic extraperitoneal mesh repair (EXTRA), TAPP mesh repair and IPOM repair. Young male pigs underwent mesh placement using the above techniques and had a follow-up for 6 weeks. No trocar site adhesions were observed. In the group that underwent EXTRA technique, no intraperitoneal adhesions were noted. One case of filmy omental adhesions was noted with the TAPP technique. Two cases of adhesions were noted with the IPOM technique, one was minimal while the other was a case of dense adhesions to the bladder. Mesh tensile strength was compared for the three techniques and measured using a tensiometer. Both the EXTRA and TAPP were comparable and significantly stronger ($p < 0.05$), with tensiometric values of 0.69 ± 0.03 and 0.60 ± 0.02 Kg respectively. The IPOM technique resulted in the weakest tensile strength of 0.53 ± 0.01 Kg (mean \pm SEM).

Sarli et al⁷ conducted a study to evaluate the safety and efficacy of two techniques of laparoscopic hernia repair: the TAPP technique and the IPOM technique. From May 1992 to October 1994, 115 patients with 148 hernias were included in the trial, 59 of which underwent TAPP and 56 underwent IPOM. The TAPP took significantly longer to perform the IPOM. No intraoperative complications, conversions to open repair, nor postoperative deaths were noted in either group. There were 10 postoperative complications in the TAPP group (16.9% of patients) and 14 postoperative

complications in the IPOM group (25% of patients). The difference was not statistically significant. Neuralgias were noted in three cases of TAPP and 11 cases of IPOM ($p < 0.05$), local hematoma in six cases of TAPP and three cases of IPOM (NS), and urinary retention in one case of TAPP and in no case of IPOM (NS). There were no recurrences among those who underwent TAPP and eight recurrences among those who underwent IPOM ($p < 0.01$).

Tetik et al⁸ conducted a study as a preliminary review of complications and recurrences associated with laparoscopic repair of groin hernias. Each investigator was given a questionnaire specific for complications. From December 1989 to April 1993, 1,514 hernias were repaired; 119 (7.8%) were bilateral and 192 (12.7%) recurrent. There was a total of 860 indirect, 560 direct, 43 pantaloon, 37 femoral, and six obturator hernias. Eight were not specified. A TAPP mesh technique was used to repair 553 hernias, 457 hernias were repaired with a TEP technique, 320 hernias were repaired with the IPOM technique, 102 hernias were repaired by ring closure, and 82 hernias were repaired using the plug and patch technique. A total of 18 intraoperative and 188 postoperative complications were seen. The total complication rate was 13.6 to 1.2% were intraoperative. Twelve of the intraoperative complications were related to the laparoscopic technique, three were related to the hernia repair, and one was related to anesthesia. The conversion rate to open surgery was 0.8%. Postoperatively, there were 95 local, 25 neurologic, 23 testicular, 23 urinary, 10 mesh, and 12 miscellaneous complications. A total of 34 recurrences (2.2%) after the 1,514 hernia repairs were noted. A 22% recurrence rate was noted after the plug and patch repair *vs* 3, 2.2, 0.7, and 0.4% with the ring closure, IPOM, TAPP and TEP, respectively.

CONCLUSION

Laparoscopic inguinal herniorrhaphy is an effective method to correct an inguinal hernia but is not without complications nor risk for recurrences. The TAPP, IPOM and TEP procedures appear to be equally effective. Training, experience and proper operative technique will prevent some of these complications.

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