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Original Research Article

Patient related outcomes and ergonomic evaluation of triangular 3-port or 'two-hand' TEP hernioplasty: a preliminary analysis in a university hospital

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ABSTRACT

Background: Standard TEP technique requires three skin incisions for placement of three trocars in the midline. This can be done by 3 port triangular technique or two-hand technique. This study reports a preliminary analysis of peri-operative outcomes and ergonomics characteristics of this procedure in our setup.
Methods: N=10 patients underwent triangular 3 port technique or two-hand TEP hernioplasty after informed written consent in Department of Surgery, King George's Medical University UP between January to June 2016 after institutional ethical approval. Patient related outcomes in terms of quality of life (QOL) and ergonomic evaluation of the technique have been reported in this study.
Results: The mean duration of surgery was 79.4±4.5 minutes with duration of hospital stay 2.4±0.5 days. The time to return to routine work was 1.0±0.2 days and office work was 4.0±1.8 days. Hernioplasty related QOL calculated using Carolina comfort scale showed improved with increased follow up period. Ergonomically the procedure can be safely performed without added stress on the surgeon.
Conclusions: 'Two-hand approach' or triangular 3-port TEP hernioplasty is ergonomically feasible and enables a surgeon to perform surgery safely using basic principles of laparoscopy.

Keywords: Hernioplasty, TEP, Two hand technique, Triangular 3-port

INTRODUCTION

Endoscopic inguinal hernia repair originated in the early 1990s as minimal invasive surgery gained a foothold in general surgery.[1-3] Endoscopic approaches have potential benefits that include - a better visualization of anatomy, usefulness for fixing all inguinal hernia defects, reduction in post operative pain, shortening of recovery period, reduced postoperative morbidities and decreased surgical site infections. Endoscopic repair has some disadvantages as well, including the following: increased cost, increased duration of operation, steeper learning curve, and high recurrence and complication rates particularly early in a surgeon's experience. The term endoscopic inguinal hernioplasty can refer to any of the following two techniques- Totally extraperitoneal (TEP) repair or Transabdominal preperitoneal (TAPP) repair.[4,5]

First TEP repair was performed by Dr. Barry Mckernan. TEP repair maintains peritoneal integrity, theoretically eliminating the risks while allowing direct visualization of the groin anatomy, which is critical for a successful repair. The TEP hernioplasty follows the basic principles of the open preperitoneal giant mesh repair, as first described by Stoppa in 1975 for the repair of bilateral hernias. Although many facets of endoscopic inguinal

hernia repair continue to be debated- such as the possible superiority of TEP/TAPP to another, comparisons between minimal invasive and open surgery, the learning curve and training issues, and the socioeconomic implications-both TAPP and TEP have been shown to be acceptable and safe for repair of inguinal hernias.[6,7] Therefore, among endoscopic hernioplasties, totally extraperitoneal (TEP) and transabdominal pre-peritoneal (TAPP) approach are widely accepted alternatives to open surgery, both providing less postoperative pain, hospital length of stay and early return to work. Published literature consider that the Lichtenstein technique represents the gold standard in the repair of parietal inguinal defects, being known that the technique reduced the number of postoperative recurrences.[8-10] However, recent articles opt for the use of endoscopic techniques in the repair of inguinal hernias.[11] Classical TEP technique requires three skin incisions for placement of three trocars in the midline.[12] This can be done by 3 port triangular technique or two-hand technique.[13] Even TEP by single incision have been reported.[14]

However, there is still paucity of literature evaluating ergonomic characteristics in endoscopic inguinal hernia repair using triangular 3-port technique of TEP or the two-hand TEP hernioplasty. Therefore, authors performed a preliminary analysis of peri-operative outcomes and ergonomics characteristics of this procedure in our setup.

METHODS

A number of N=10 consecutive patients of inguinal hernia presenting to the outpatient department of Surgery at the King George's Medical University from January 2016 to June 2016 were enrolled after informed written consent and institutional ethical approval. Inclusion criteria included uncomplicated, symptomatic unilateral/bilateral inguinal hernia with ASA Grade I and II tagged for endoscopic hernioplasty. All other patients with ASA Grade ≥III, h/o recurrence, h/o multiple abdominal surgery, coagulopathy, comorbidities – CAD, asthma, previous illness, patients requiring other concomitant procedures, patients who do not give consent, h/o chronic analgesic use, alcohol addiction, cognitive impairment were excluded.

Operative steps: two hand approach TEP

An infra-umbilical port and two lateral ports are created in mid-clavicular line 3-5 cm below the infra-umbilical incision. Approximately a 1.5 cm of transverse infra-umbilical incision was given on the side of hernia to be operated (preferably).

Skin, subcutaneous tissue and anterior rectus sheath was incised in the direction of incision. A 10 mm port was introduced over posterior rectus sheath after retraction of rectus muscle fibers. Either 10 mm Hasson's cannula was used or port was fixed with anterior rectus sheath with packing of sterile gauze around it to prevent pneumo leak. CO2 insufflation tube was connected to port and pre-peritoneal space was created using telescope (preferably 0 Degree) directly with pressure being created by CO_2. White house or Light house (white glistening Cooper's ligament or Retropubic symphysis) was visualized first. A space was created between two layers of transversalis fascia in midline and laterally so that inferior epigastric vessels remained in anterior abdominal wall and a little space was created lateral to these vessels. A 5 mm port was introduced in mid-clavicular line about 3-5 cm below infra-umbilical incision and pre-peritoneal space created by telescope was entered. Further dissection was carried out in midline and little in pre-peritoneal space of other side. Cooper's ligament and Inferior epigastric vessels of opposite side were visualized. Another 5 mm port on opposite side was introduced in mid-clavicular line about 3-5 cm below infraumbilical incision (Figure 1). Visualization of spaces and anatomical landmarks viz anteriorly in midline Cooper's Ligament, postero-laterally Psoas and antero-laterally Anterior Superior Iliac Spine by these two 5 mm ports was ascertained. Hernial sac was identified and dissected and reduced. Space of Retzius and space of Bogros visualized and Triangle of Doom and Triangle of Pain were ascertained after parietalization of sac. Approximately 15 x 12 cm mesh was introduced through 10 mm port. Mesh was fixed medially to Cooper's ligament and lateral to deep ring in anterior abdominal wall by intra-corporeal suturing or using tack fixation device. Mesh unfolded on roof and pneumo was deflated. All Ports were closed.

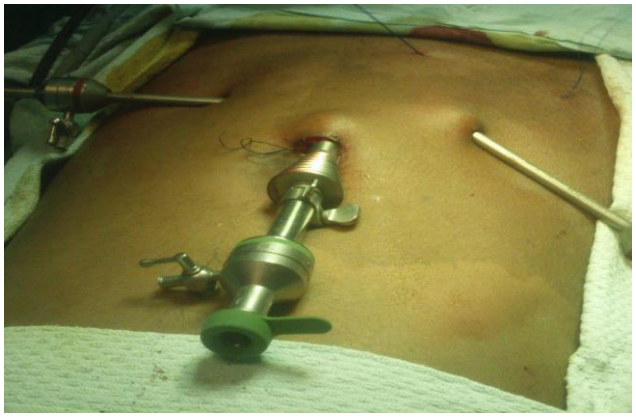

Figure 1: Triangular 3-port or two hand technique; (a) 10 mm port infra umbilical (b) two 5 mm port on either side in mid clavicular line.

Peri-operative outcome measures

During intra-operative period the various outcomes included duration of operation and Intra operative complications (nerve, vascular and visceral injury if any). In post-operative period the measures included post-operative pain, duration of hospital stays, time to return to usual work and office work and sensation of mesh. Post-op pain was measured by Visual Analog Scale

(VAS) and sensation of mesh using Carolina Comfort scale. Ergonomic evaluation was done by Subjective Mental Effort Questionnaire (SMEQ) and Local Experienced Discomfort (LED) scale. The SMEQ is a cognitive workload questionnaire with a scale of 0 to 150 points. It is designed so that individuals can rate the amount of effort invested during a task. The LED allowed surgeon to express their physical discomfort during performance of all the tasks. On a scale of 0 to 10 points, the surgeon was asked to identify their physical discomfort at several locations of the upper body.

Statistical analysis

Continuous data were summarized in Mean±SD and discrete (categorical) in number and %. All analyses were performed on Microsoft Excel software.

RESULTS

The mean age of patients was 45.2±10.1 years with mean body surface area (BSA) was 23.5±2.5. The mesh was fixed by either intra-corporeal suturing or tack fixation in equal number of patients (n=5 each). The mean duration of surgery was 79.4±4.5 minutes. The only reported intra-operative complication was peritoneal breach (n=2, 20%) with no other vascular or visceral complication.

Table 1: Comparison of different parameters in Carolina Comfort Scale (CCS) for TEP hernioplasty with follow up duration (n=10).

Time period	Pain	Movement limitation	Sensation of mesh
Immediate Post-op	24.3±1.2	15.9±3.0	17.5±1.9
After 1 month	5.8±1.5	4.2±2.0	12.7±1.9
After 3 month	3.5±1.2	0.8±1.4	10.4±1.2
After 6 month	0.4±0.9	0.4±0.9	9.4±1.9

Table 2: Mental (SMEQ score) and Physical Discomfort (Arm, wrist and hand using LED questionnaire score) scales of operating surgeon.

Physical And mental discomfort scales	Score
SMEQ score	50.6±12.7
LED scoring wrist and hand	
Right	16.4±0.9
Left	19.2±0.9
Arm	
Right	4.1±0.5
Left	5.8±0.7

The duration of hospital stay was 2.4±0.5 days. The post-operative pain scores on VAS scale were 5.2±0.8. The time to return to routine work was 1.0±0.2 days and office work was 4.0±1.8 days.

Various scores used to measure quality of life and ergonomic qualities have been described in Table 1 and Table 2. The quality of life was measured using disease specific Carolina comfort scale (Table 1). The pain sensation score (24.3±1.2 vs 0.4±0.9) decreased in the post operative follow up period. Similarly, the movement limitation and sensation of mesh scores also decreased with time leading to improvement in quality of life of the patient. The physical discomfort scale showed more discomfort on left side of the body both in wrist and hand (16.4±0.9 vs 19.2±0.9 and arm (4.1±0.5 vs. 5.8±0.7).

DISCUSSION

Classical TEP technique requires three skin incisions for placement of three trocars in the midline. The concept of 'two-hand technique' or triangulation of ports in TEP was first introduced by Rajapandian S et al.[13] They have stated that maintaining the triangular orientation of ports is considered vital to the ergonomics of laparoscopy.

Using this technique the mean duration of procedure in this study was 79.4±4.5 minutes. According to Cochrane data the duration of operation for inexperienced operators (up to 20 procedures) to be 70 minutes for TAPP (using triangulation principle) and 95 minutes for TEP (using midline ports) but for experienced operators (between 30 and 100 procedures) the estimated duration of operation are 40 minutes for TAPP and 55 minutes for TEP.[6] Therefore, the triangulation principle when applied in TEP procedure decreases the operating time with experience and as the surgeon gains confidence over the procedure technique.

In present study out of 10 patients that underwent TEP by triangular three port technique, peritoneal breach occurred in two patients. This might be due to inexperience in the initial stage of learning curve for triangular three port technique of TEP.

The mean hospital stay for TEP was 2.4±0.5 days for triangular three port technique. Kockerling F et al described perioperative outcome with a primary unilateral hernia with mean length of hospital stay for TEP group patients with midline ports was 1.88±2.19 days.[15]

Reiner MA et al performed a retrospective chart review and examined outcomes of 1240 laparoscopic hernia operations in 783 patients, focusing on intra-operative and early postoperative complications, pain, and time until return to work and normal physical activities and found that patients took an average of 3.0 days (median, 3.0; range, 1–41) to return to routine work and significant physical activity (office work) took an average of 3.8 days (median, 3.0; range, 0–28).[16] Compared to present findings, the time to return to normal routine activities and pain scores was less in triangular TEP technique with

no difference in return to office work. The plausible reason may be the 5 mm port over pubic symphysis which may have a role for pain in lower abdomen in post operative period.

The different quality of life (QOL) outcomes measured in Carolina comfort scale (CCS) viz. pain, movement limitation and sensation of mesh decreased with time in the 6-month follow up period. The CCS is an ideal tool for assessing patients' QOL post hernia repair, but its use has been hardly investigated in developing countries like ours. Heniford et al proposed a new QOL survey CCS that specifically pertained to patients undergoing hernia repair with mesh and found that when compared with SF-36, it assessed patients' outcome and satisfaction more satisfactorily.[17]

Christoffersen et al have also demonstrated that health-related QOL assessed with CCS changes significantly over a period of time, over a period of 3 months.[18]

To score the level of stress we used two questionnaires, Subjective Mental Effort Questionnaire (SMEQ) and the Local Experienced Discomfort (LED) scale. SMEQ Questionnaire was used for comparing the level of mental effort of surgeon while performing the surgery by the two techniques. LED Questionnaire was used for comparing level of physical discomfort of surgeon while performing both procedures.

Discomfort level of various body parts on left were compared to those on right side. Discomfort was more on left side which could be due to right handedness of the operating surgeon. Schatte V et al have used both these questionnaires for comparing ergonomics, user comfort, and performance in standard versus robot-assisted laparoscopic surgery.[19]

CONCLUSION

Present preliminary results show that 'two-hand approach' or triangular 3-port TEP hernioplasty is ergonomically feasible and enables a surgeon to perform surgery safely using basic principles of laparoscopy.

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