Short-term follow-up of trans-rectus sheath extraperitoneal procedure versus totally extraperitoneal for the repair of unilateral inguinal hernia repair

Mahmoud A. Mahmoud[a], Ahmad S. Badry[a], Ahmad A. Maklad[b]

[a]Department of General Surgery, Qena Faculty of Medicine, South Valley University, Qena, [b]Department of General Surgery, Faculty of Medicine, Suez University, Suez, Egypt

Correspondence to Mahmoud A. Mahmoud, MD, Department of General Surgery, Qena Faculty of Medicine, South Valley University, Qena 83511, Egypt. Tel: +201111250011/+20963345955; e-mail: mahmoud_abdelhameid@yahoo.com

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Introduction
Inguinal hernioplasty is one of the most frequently performed surgical procedures. Laparoscopic hernia repair popularized the preperitoneal mesh position due to promising results in alleviating chronic pain. However, considerable proportions of severe adverse events, learning curves, or added costs have to be taken into account. Therefore, open preperitoneal mesh techniques may have more advantages.
The trans-rectus sheath extraperitoneal procedure (TREPP) is a novel technique that was developed in 2006 combining the advantages of both the Lichtenstein technique and totally extraperitoneal (TEP). It differs from other preperitoneal techniques due to its medial approach avoiding the interference with the course of all three inguinal nerves through the lateral abdominal wall.
Patients and methods
This study recruited 100 patients, 50 were operated upon by the TREPP technique and another 50 patients were operated upon by TEP techniques. The items of comparison were conversion to another technique, postoperative pain, bleeding (intraoperative or postoperative hematoma) and surgical site infection. The late items of comparison were chronic postoperative inguinal pain and early recurrence.
Results
The mean operative time was significantly shorter for the TREPP group. Two patients among the TEP group were converted into TREPP techniques while all the patients among the TREPP group were completed successfully. There were no differences between the two groups as regards postoperative pain, hematoma, or surgical site infection. Also, chronic postoperative inguinal pain occurred in one patient out of 48 patients among the TEP group but occurred in two patients out of the 52 patients among the TREPP group. There was no single recurrence among the TREPP group (52 patients), while there were two hernia recurrences among the TEP group (two out of 48 patients, 4%).
Conclusion
There were significant advantages of TREPP over TEP: shorter operative time and significantly reduced postoperative pain with less recurrence rate. The main advantage is the ease of learning of the TREPP technique. So, we obtain better results using a simple inexpensive open technique in comparison with the laparoscopic TEP technique.
The main criticism, in my mind, was the small sample size of patients and the short follow-up period.

Keywords:
inguinal hernia, totally extraperitoneal, trans-rectus sheath extraperitoneal procedure

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Introduction

Inguinal hernioplasty is one of the most frequently performed surgical procedures, with a lifetime risk for inguinal hernia of 27% in men and 3% in women [1].

Many techniques have been used in the treatment of inguinal hernias since Bassini first described his method in 1887 [2]. Since that time, more than 70 methods have been introduced. Today, the principal techniques that have been scientifically validated and can be recommended for clinical application are the open anterior flat mesh repair according to Lichtenstein and the laparoscopic posterior flat mesh repair. Both techniques show specific advantages and disadvantages with respect to equipment, difficulty of performance, materials, complication and recurrence rates, recovery times, and rates of acute and chronic pain [3].

Laparoscopic tension-free hernia repair avoids a long incision and has proved to be superior to open repairs in the short term, as it results in less postoperative pain and shorter convalescence and sick leave periods [4,5].

Laparoscopic and endoscopic hernia repair popularized the preperitoneal mesh position due to promising results concerning less chronic pain. However, considerable proportions of severe adverse events, learning curves, or added costs have to be taken into account. Therefore, open preperitoneal mesh techniques may have more advantages [6].

In 2006, a new technique was developed combining the advantages of both the Lichtenstein technique and totally extraperitoneal (TEP): the trans-rectus sheath extraperitoneal procedure (TREPP). It differs from other preperitoneal techniques because of its medial approach avoiding the interference with the course of the three inguinal nerves through the lateral abdominal wall [7].

The TREPP mesh repair might be a promising method because of the complete preperitoneal view, the short learning curve, and the stay-away-from-the-nerves principle [6].

The TREPP technique was developed by Akkersdijk and is summarized in five key steps:

(1) Use a simple, easy-to-learn, and open technique, avoiding the scopic approaches with their considerable learning curves, severe adverse events, and lower cost effectiveness.
(2) Stay away from the nerves and the inguinal canal during dissection.
(3) Mesh positioning in the preperitoneal space (PPS), out of reach of the nerves.
(4) No need for mesh fixation (because of the PPS mesh position).
(5) No dissection or reconstruction of the inguinal canal is necessary [6].

The TREPP technique, which is an open posterior mesh repair, may be a feasible alternative to the standard laparoscopic posterior mesh repair, the TEP technique.

Patients and methods

The study included 100 patients with de novo inguinal hernia. After approval from the local ethical committee, an informed written consent was taken from all cases who accepted to participate in this research article.

Inclusion criteria

(1) Adults between 18 and 60 years of age.
(2) Male patients.
(3) Unilateral hernia.

Exclusion criteria

(1) Patients unfit for general anesthesia for TEP.
(2) Complicated hernia, for example, obstruction, strangulation, etc.
(3) Massive scrotal hernia.
(4) History of previous lower abdominal surgery.

All the patients involved in the study were subjected to full clinical assessment and required investigations including scrotal ultrasound. Preoperative management of comorbidities such as chest disease, diabetes mellitus, cardiac disease, and chronic constipation was properly carried out so that all patients were properly prepared for the surgery.

The patients were randomly categorized into two groups as follows:

TREPP group: included 50 patients. They were operated upon using the TREPP technique.

TEP group: included 50 patients who were operated by laparoscopy (TEP, totally extraperitoneal approach).

The technique of TREPP can be summarized as follows [8]:

(1) Incision: a transverse incision of about 4–5 cm cranial to the internal ring at the level of the anterior superior iliac spine. It is caudal to linea semicircularis where there is no posterior rectus sheath (Fig. 1).
(2) Sharp incision of the Scarpa fascia, external oblique aponeurosis, and (or) anterior rectus sheath.
(3) Medial retraction of the infero-lateral border of the rectus sheath to expose the PPS, which is covered by a thin layer of fascia transversalis (Fig. 2).
(4) After incision of the fascia transversalis, blunt dissection of the PPS is done using the forefinger till we can identify the following structures:
    (a) Anterior superior iliac spine lateral.
    (b) Iliopsoas muscle dorsolateral.
    (c) Iliac vessel dorsal.
    (d) Inguinal ligament caudal.
(5) Identification of the spermatic cord is done with dissection of the sac. Dissection should be performed until the point where the vas deferens

Figure 1

Right TREPP: incision. TREPP, trans-rectus sheath extraperitoneal procedure.

Figure 2

Preperitoneal space with inferior epigastric vessels.

turns medially while the testicular vessels turn craniolaterally (Fig. 3).

(6) Insertion of a lightweight polypropylene mesh to cover all the possible hernias. The mesh must overlap the copper's ligament and symphysis pubis by at least 1 cm (Fig. 4).

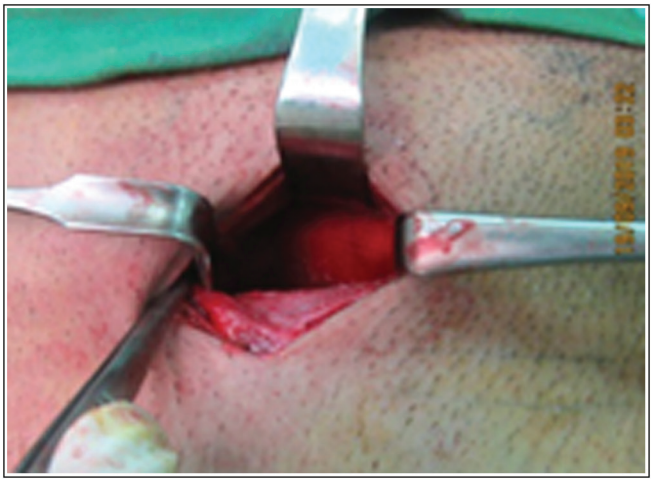
(7) Closure of the anterior rectus sheath and closure of the skin.

Technique of TEP as described by Ferzli and Iskandar [9]:

Figure 3

Indirect sac+VAS. VAS, visual analog scale.

Figure 4



Mesh in place.

Trocar placement

Through a 15 mm curvilinear infraumbilical incision, the anterior rectus sheath is incised on the same side of the hernia and the rectus muscle is retracted laterally (Fig. 5). A 12 mm trocar is inserted gently to avoid injury of the posterior rectus sheath and the peritoneum. CO_2 gas is insufflated to the pro-peritoneal space under 10–12 mmHg pressure. A 10 mm 30° camera is inserted down to the pubic bone and by gentle side to side movement. Two additional 5 mm trocars are inserted gently 'to avoid entry to the peritoneum' at the midline inferior to the camera port.

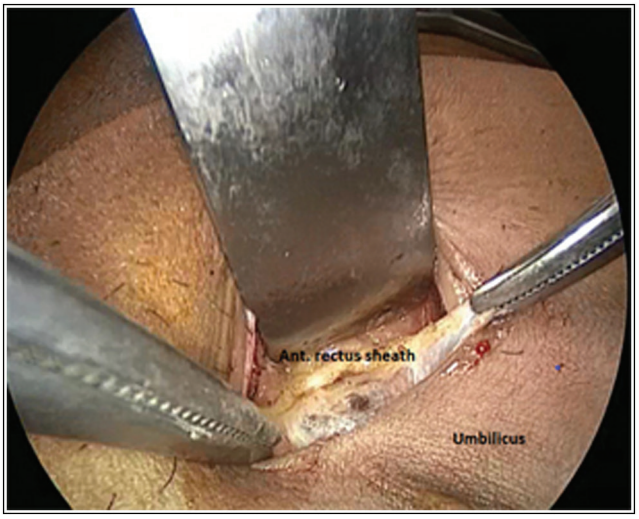
Steps of TEP

(1) Identification of the pubic symphysis in the midline and retro-pubic dissection.

(2) Blunt dissection of the Cooper's ligament from medial to lateral to open the Retzius space and to identify any femoral or obturator hernias.

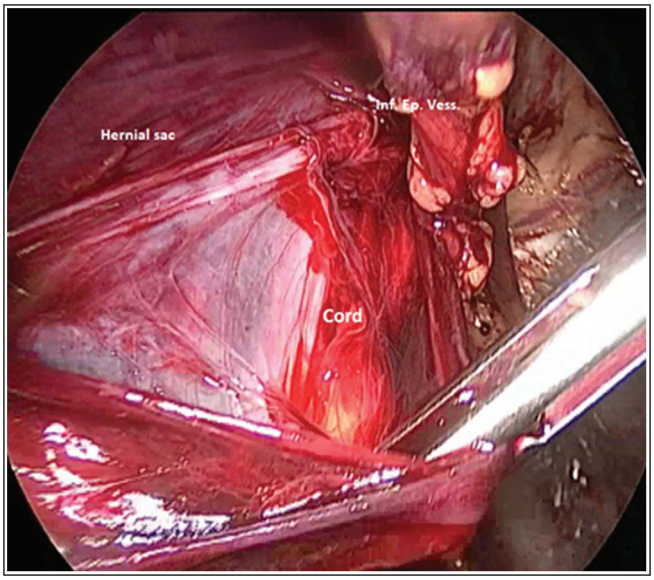
(3) Hesselbach's triangle identification.

Figure 5



TEP: incision for camera port. TEP, totally extraperitoneal.

Figure 6



During indirect sac dissection.

(4) Identification and elevation of the inferior epigastric vessels.
(5) Bogros space is developed using a horizontal blunt dissection laterally to the level of the anterior superior iliac spine.
(6) Indirect space is identifiable by finding the cord structures in men (or round ligament in women) passing through the internal ring and lateral to the epigastric vessels. Dissection of the indirect sac and any cord lipoma (Fig. 6).
(7) Mesh placement: a 15 × 15 cm sheet of polypropylene mesh that is trimmed to an appropriate shape and size, rolled and introduced into the Retzius space through the camera port. The mesh is then unrolled and should extend from the midline to the ASIS and cover all hernia spaces. No slit is placed in the mesh. Usually no need to tack the mesh in place unless in large defects.

Items of comparison

Early:

Conversion to another technique.

Postoperative pain: using the visual analog scale (VAS), bleeding: intraoperative or post-operative hematoma.

surgical site infection.

Late:

Chronic postoperative inguinal pain (CPIP) (pain of discomfort that last for >3 months) [10] and early recurrence (within 12 months).

Statistical analysis

Data were analyzed using IBM SPSS software package, version 20.0 (IBM Company, Chicago, Illinois, USA). Quantitative data were presented as mean and SD. Qualitative data were presented as number and percentage. Logistic regression analysis was used to calculate odds ratio and *P* value. A *P* value less than 0.05 was considered significant.

Results

(1) Overall mean age was 49 ± 14 years (range, 18–82 years). The mean age of patients in the TREPP group was 47 ± 16 years (range, 18–82 years) and that of the TEP group was 51 ± 13 years (range, 27–78 years).
(2) The mean operative time 'skin to skin' was 26 ± 6 min (range, 18–42 min) for the TREPP group and 65 ± 18 min (42–92 min) for the TEP group. So the endoscopic technique took a significantly longer time. The statistical analysis confirms this conclusion (*P*=0.01).
(3) Two patients among the TEP group were converted to TREPP due to technical difficulties (the operative time for these two patients were not included for both the groups). None of the patients among the TREPP group were converted to another technique.
(4) For TREPP, the mean postoperative pain did not exceed a VAS score of 4 in the first 14 days, while for the TEP group the VAS was 5 in the first 14 days. Postoperative pain was relieved easily with oral analgesia.

(5) Hematomas were observed in 4/48 (8.33%) patients among the TEP. It required nonsurgical intervention. No hematoma among the TREPP group.
(6) No surgical site infection occurred.
(7) One patient among each group complained of CPIP (one out of 48 '2%' for the TEP group, one out of 52 '1.9%' for the TREPP group).
(8) No single recurrence among the TREPP group (52 patients), while there were two hernia recurrences among the TEP group (two out of 48 patients, 4%). They were detected clinically and confirmed by scrotal ultrasound within the first year postoperative.

Discussion

Mesh application is considered an important step in inguinal hernia surgery to prevent recurrence. However, the current 'standard' varieties of mesh repair have their specific disadvantages: TEP has a long learning curve and requires general anesthesia, while Lichtenstein repair has the disadvantages of exposure of the three inguinal nerves to iatrogenic damage (dissection, coagulation, and mesh fixation) or direct contact with the mesh, causing CPIP [7].

So, TREPP is considered an ideal technique, avoiding all three inguinal nerves by its medial approach, Also general anesthesia is unnecessary. TREPP is considered a variant of the preperitoneal approach. The important difference between TREPP and other preperitoneal approaches like TEP is that TREPP is a strictly medial approach, avoiding the three inguinal nerves. For TEP, specific laparoscopic skills are required [7].

The aim of this study was to estimate whether these assumed advantages of TREPP would also be reflected in practice and if this new procedure would have any potential additional clinical value by evaluating the results of TREPP versus TEP.

TEP operation is technically more demanding and requires more operative time than the TEPP technique and has a longer learning curve. It has been criticized because it requires general anesthesia, rather than the regional anesthesia employed in TREPP. Although general anesthesia is now safe and easy to apply even in day-case surgery t is more expensive than regional anesthesia.

The rate of CPIP in this study, with a mean follow-up of 12 month, is low (2% for TEP, 1.9% for TREPP). Poobalan *et al.* [11] reported incidences of CPIP ranging from 0 to 63%. A similar range was confirmed later by Aasvang and Kehlet [12]. The overall incidence of moderate-to-severe CPIP is generally considered to be about 12% [13,14]. So, the results of TREPP are promising. This finding supports the assumed advantage of TREPP, that is avoiding the inguinal nerves reduces postoperative pain [11,15]. This idea was not new: it was suggested that the high incidence of CPIP after Lichtenstein hernioplasty may be improved by a more careful nerve-sparing technique [16–18].

As the bilateral surgery was significantly associated with CPIP, it was assumed that direct nerve damage is not the only contributing factor to the development of CPIP. This suggestion is confirmed by the fact that CPIP was not associated with sensibility loss [19]. In this respect, it was hypothesized that inflammatory reaction around the mesh ('meshoma') causing the pain receptors might be prominent. So, CPIP due to a fibrotic reaction around the mesh cannot be prevented totally by TREPP or any other technique in which mesh is used. In this respect, meshoma might also occur in a minority of patients. The retroperitoneal position of the mesh prevents the mesh coming in direct contact with iliohypogastric and ilioinguinal nerves. In contrast to all other open techniques, TREPP is a medial approach, that is chronic pain as a result of iatrogenic nervous damage during the approach and dissection will be lower in TREPP [7].

Recurrence, for many years, was considered the most important criterion by which the quality of hernia repair was the measured end point of any hernia surgery. It requires a proper knowledge of anatomy and a thorough technique of repair to keep the recurrence in laparoscopic repair to a minimum [20].

It is concluded that the factors leading to recurrence included: lack of experience, inadequate dissection, inadequate mesh size to overlap all the defects, improper fixation, twisted or folded prosthesis, missed hernias, or mesh displacement secondary to hematoma formation. The cornerstones for successful preperitoneal hernia repair are adequate dissection, satisfactory delineation of anatomy with complete exposure, and coverage of the entire myopectineal orifice [20].

We reported in this study two hernia recurrences among the TEP group (two out of 48 patients, 4%). Gavriilidis *et al.* [21] reported an evidence of a higher recurrence in the TEP cohort (149/2678 patients; 6% of patients), while Lau *et al.* [22] reported a lower incidence of recurrence after TEP (around 1–2%).

Thus, from this study it can be concluded that there are significant advantages of TREPP over TEP: shorter

operative time, significantly reduced postoperative pain, and less recurrence rate. The main advantage is the easy learning of TREPP technique. So we obtain better results using a simple open technique (TREPP) in comparison with the expensive laparoscopic technique (TEP).

The main criticism, in my mind, is the small sample size of patients and the short follow-up period.

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Conflicts of interest
There are no conflicts of interest.

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