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Laparoscopic Inguinal Hernia Repair; Comparison between the Major Techniques: TEP and TAPP

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Abstract:

Introduction: Laparoscopic inguinal hernia repair made an important revolutionary stage in hernia management and with the accumulative knowledge and experience it is becoming the gold standard way of inguinal hernia repair. The choice of approach to the laparoscopic repair of inguinal hernia is controversial. There is a scarcity of data comparing the laparoscopic transabdominal preperitoneal (TAPP) approach with the laparoscopic totally extraperitoneal (TEP) approach and questions remain about their relative merits and risks.

Objectives: To compare the clinical effectiveness and relative efficiency of laparoscopic TAPP and laparoscopic TEP for inguinal hernia repair.

Methods: We went into internet search engines like Google Scholar, trusted medical websites like HINARI, Medline, Pup-med, and some special sites dedicated to the art of laparoscopy like Highwire and SAGES and some specialized minimal access magazines. Using the key words of: inguinal, hernia, laparoscopic repair, TEP, TAPP, comparison, complications, effectiveness, learning curve, preference and outcome.

Results: The search identified one RCT which reported no statistical difference between TAPP and TEP when considering duration of operation, haematoma, length of stay, time to return to usual activity and recurrence. The eight non-randomised studies suggest that TAPP is associated with higher rates of port-site hernias and visceral injuries whilst there appear to be more conversions with TEP. Vascular injuries and deep/mesh infections were rare and there was no obvious difference between the groups. Very limited data were available on learning effects but these data suggest that operators become experienced at between 30 and 100 procedures.

Conclusions: Both TEP and TAPP are good methods for inguinal hernia. Both are considered ranking the same position, and there is no sufficient data to draw any significant conclusions regarding what is better TAPP or TEP. Surgeons better to have adequate abilities to perform either of them, for either TAPP or TEP can be preferred over the other in a particular patient.

Keywords: laparoscopic, inguinal hernia, TEP, TAPP.

Introduction:

The surgical history of inguinal hernias dates back to ancient Egypt. From Bassini's heralding of the modern era, two revolutions in the inguinal hernia surgery have occurred during the past two decades. The first was the introduction of tension-free open mesh repair (OMR) by Lichtenstein et al. [(1)] in 1989, which significantly reduced the recurrence rates. The second revolution was the application of laparoscopic surgery in the treatment of inguinal hernia during the early 1990s, which led to decrease in postoperative pain and faster recovery along with low recurrence rates [(2)]. Ger et al. [(3)] reported first laparoscopic inguinal hernia repair (LIHR). Schultz et al. [(4)] were the first to report the use of prosthetic material during laparoscopic inguinal hernia repair.

This history parallels closely the evolution in anatomical understanding and development of the techniques of general surgery.[(5,6)]

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Accounting for 75% of all abdominal wall hernias, and with a lifetime risk of 27% in men and 3% in women, inguinal hernia repair is one of the most commonly performed surgeries in the world.[7]In the United States, inguinal herniorrhaphy accounts for approximately 800,000 cases annually.[8]

Most randomized studies comparing laparoscopy to open repair have confirmed the following findings:[9,10]

- Pros ○ Reduced postoperative pain ○ Earlier return to work
- Cons ○ Increased cost ○ Lengthier operation ○ Steeper learning curve
  - ○ Higher recurrence and complication rates early in a surgeon's experience

Although open, mesh-based, tension-free repair remains the criterion standard, laparoscopic herniorrhaphy, in the hands of adequately trained surgeons, produces excellent results comparable to those of open repair.[11,12]In a comparison of open repair with laparoscopic (totally extraperitoneal patch) repair, Eklund et al found that 5 years postoperatively, 1.9% of patients who had undergone laparoscopic repair continued to report moderate or severe pain compared with 3.5% of those in the open repair group.[13] **Definitions:**

Laparoscopic inguinal herniorrhaphy can refer to any of the following 3 techniques:

- TAPP: Transabdominal preperitoneal endoscopic inguinal hernia operation in which the approach to the inguinofemoral region is transabdominal, and the final placing of the prosthesis is extraperitoneal [14].
- TEP: Total extraperitoneal endoscopic inguinal hernia operation in which both the approach to the inguinofemoral region as well as the placing of the prosthesis is completely extraperitoneal [14]. The preperitoneal space is accessed through posterior rectus sheath then arcuate line and the space is dilated and dissected using a special inflation balloon then peumo-periperitoneum.
- Intraperitoneal onlay mesh (IPOM) repair: A dual-layer mesh is placed over the myopectineal orifice transabdominally and fixed in place. The preperitoneal space is not entered and minimal dissection is carried out. This technique is becoming not popular and it is not included in this review.

The most commonly performed laparoscopic techniques are the TEP and TAPP repairs.[9,10,11]
Here in this review we are going to do some comparison between the TAPP and
TEP

Methods:

We went into internet search engines like Google Scholar, trusted medical websites like HINARI, Medline, Pup-med, and some special sites dedicated to the art of laparoscopy like Highwire and SAGES and some specialized minimal access magazines. Using the key words of: inguinal, hernia, laparoscopic repair, TEP, TAPP, comparison, complications, effectiveness, learning curve, preference and outcome.

We ended up with many articles describing individual experience in single centers, and some reviews collecting some randomized clinical trials (RCTs) with few retrospective presentations of case series.

These all were came across and collected data then was gathered together looking for points of comparison between TEP and TAPP. Starting from cost, indication of both, technical points, operative complications, early, intermediate and late postoperative course; and some studies included the learning curve and surgeon preference.

Results and Discussion:

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There is only one RCT done by Schrenk et al. [15] who compared TAPP and TEP inguinal hernia repairs. The authors found less early postoperative pain after TAPP (p\0.02) and a shorter hospital stay than after TEP (p = 0.03), but the number of patients randomized to the two techniques is very small. The Cochrane database review 2005 [16] concluded that there are insufficient data to draw any significant conclusions regarding what is better TAPP or TEP.

Anesthesia consideration: LIHR requires general anesthesia and thus cannot be considered if the patient is unfit for this type of anesthesia.

Few reports expressed their concern that general anesthesia is too much a procedure for uncomplicated unilateral inguinal hernia in a young patient and advocated OMR under local anesthesia [17, 18]. LIHR should be offered to patients with bilateral and recurrent hernias. We feel that to pass on the advantages of LIHR to patients with bilateral and recurrent hernias, one should be doing LIHR even in uncomplicated unilateral inguinal hernia routinely to overcome the steep learning curve. Sumpf et al. [18] reported another issue related to CO_2 absorption during LIHR which can influence anesthetic management and perioperative morbidity. They observed that TEP group required more minute ventilation (range 9–22.6) than TAPP group (range 7.7–11.5) to maintain normocapnia and concluded that more CO_2 absorption during TEP [18] There are many reports published with variable experiences of TEP repairs performed under regional (1,724 repairs under spinal [19-22] and 82 under epidural [23,24]) anesthesia. All of the studies concluded that laparoscopic TEP repair under spinal/epidural anesthesia appears to be safe, technically feasible, and an acceptable alternative in patients who are at high risk or unfit for general anesthesia, but the same is not possible for TAPP.

TAPP versus TEP

Only one RCT [25] was available and reported outcomes on operation time, intraoperative and postoperative complications, length of hospital stay, time to return to work, time to return to usual activities and hernia recurrence. These results are given in **Table (1). Duration of operation [25]**

The operating time was slightly longer in TEP than TAPP; however, the difference was not statistically significant (Comparison 03:01: WMD –6.30, 95% CI –12.82 to 0.22, p = 0.06).

Haematoma [25]

There was only one haematoma recorded in the study and this was in the TAPP group (Comparison 03:04: RR 2.59, 95% CI 0.11 to 60.69, p = 0.6). **Length of stay (days) [25]**

Length of stay was shorter in the TAPP group (Comparison 03:11: weight mean difference (WMD) –0.70, 95% CI –1.33 to –0.07, p = 0.03).

Time to return to usual activity (days) [25]

An overall figure for time to return to usual activities was not given in the paper, but several separate activities were listed. Of all of those listed there were no statistically significant differences between TAPP and TEP. **Hernia recurrence [25]**

Hernia recurrence was only assessed up to 3 months. Within this time there was one recurrence in the TAPP group (Comparison 03:15: RR 2.59, 95% CI 0.11 to 60.69, p = 0.6).

SD: standard deviation; SEM: standard error of the mean.

A: Statistically significant result.

Complications/Adverse Events from Non-Randomised Studies and Observational Studies:

There were no reported complications or adverse events in the trial. For this reason, studies using other designs were identified in order to provide further comparative evidence of complications and adverse events. Attention was focused on vascular injuries, visceral injuries, deep/mesh infections, port-site hernia

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and conversions as these were deemed to be the more serious complications.Details of these studies can be found in **Table (2)**.

Table (1) Comparing effectiveness of TAPP with TEPP [25]

Outcome	TAPP (n = 28)	TEP (n = 24)
Operation time: mean (SD)	46.0 (9.2)	52.3 (13.9)
Intraoperative complications	None	None
Haematoma	1/28	0/24
Time to return to usual activities (days): mean (SEM):		
Walking	8.6 (1.4)	8.5 (1.3)
Driving a car	10.1 (1.4)	12.4 (1.7)
Sexual Intercourse	17.7 (2.7)	18.9 (2.6)
Sports	35.5 (4.9)	35.2 (4.6)
Time to return to work (weeks): mean (SEM)	4.9 (0.7)	4.6 (0.6)
Length of hospital stay (days): mean (SD)	3.7 (1.4)	4.4 (0.9)a
Recurrence at 3 months	1/28	0/24

Vascular injury

Seven studies reported vascular injuries,[26,27–32] including three large case series.[26,29,31] In the comparative studies, three reported no vascular injuries [27,30,32] and one reported a higher rate (3% versus 0%) in TEP; however this was only a small study of 120 patients.[28] In the three case series, one reported no vascular injuries in TAPP[26] whereas the rates from the other two case series showed similar rates for TAPP (0.5%, based on 5707 cases)[29] and TEP (0.47%, based on 5203 cases) [31]. Most commonly injured vessel is inferior epigastric artery.

Visceral injury

Seven studies reported visceral injuries [26–29,31,32] including the three large case series [26,29,31]. In the comparative studies, two reported no visceral injuries [28,32] and two reported a higher rate (0.9% versus 0% and 0.4% versus 0%) in TAPP than in TEP.[27,34] In the three case series, the two TAPP series[26,29] reported similar rates of 0.64% and 0.6% with a combined case number of 8207[26,29] whereas the one TEP series reported a lower rate of 0.23% based on 5203 cases [31]. The most common visceral injury is to the urinary bladder.Some studies comparing open versus laparoscopic repair of inguinal hernia indirectly discussed some aspects of comparison between TEP and TAPP; the vascular and visceral injuries, reporting almost similar findings shown in **Table(3).**

Deep infection

Deep infections, primarily mesh infections, are potentially more serious than superficial infections and can result in removal of the mesh. These were reported in seven studies.[26,27–29,31–33] In the comparative studies, three reported no deep infections[27,28,32] and one reported rates of 0.2% and 0% for TAPP and TEP, respectively.[33] Rates for TAPP were low in the two case series[26,29] 0% and 0.1%. The rate in TEP was again low, 0.02% [31] and did not indicate a difference between TAPP and TEP. **Port-site hernia**

Eight of the nine studies reported port-site hernia [26–29, 31–33]. The comparative studies showed rates of 0–3.7% [27, 28, 32, 33]. In all four studies where cases of portsite hernia were observed, TAPP was associated

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with a higher rate than TEP [27, 28, 33,34]. In three studies there were no cases of port-site hernia reported in the TEP groups compared with 3.7% [34], 0.8% [27] and 1.7% [28] in the TAPP groups. This trend was also confirmed in the case series where there were no reported cases of port-site hernia amongst 5203 TEP repairs [31], compared with 0.24% [26] and 0.35% [29] amongst 8207 TAPP repairs.

Conversions

The conversion rate was reported in six of the studies [26, 27, 28, 31, 32,34]. In three of the four comparative studies the rate was higher in the TEP group, with rates of 0% versus 4 %[34], 0% versus 1.8 %[27] and 5% versus 7 %[32]. The fourth comparative study was small with only 120 procedures and had no conversions [28]. However, in the large case series the conversion rates between TAPP and TEP were very similar at 0.24% [26] and 0.23% [31] respectively.

Learning effects

Limited data were available in the included trials describing the effects of learning of laparoscopic techniques on the relevant outcomes, although it is widely accepted that a learning effect exists for laparoscopic repair and Particularly for the more complex TEP repair. It was concluded that this was an important to identify any papers reporting learning curves for TAPP and TEP.The relevant outcomes from these studies addressing this issue were duration of operation, complications, length of stay, return to usual activities, hernia recurrence, persisting pain and persisting numbness.

Table (2): Results of potentially serious adverse events from non-randomized studies of TAPP and TEP

Study	Vascular injury		Visceral injury		Deep/mesh infection		Port-site hernia		Conversions	
	TAPP	TEP	TAPP	TEP	TAPP	TEP	TAPP	TEP	TAPP	TEP
Comp arative studies:										
Cohen 1998 (34)	NR	NR	0.9 (1/108)	0 (0/100)	NR	NR	3.7 (4/108)	0 (100)	0 (108)	4 (4/100)
Flex 1995 (27)	0 (0/733)	0 (0/382)	0.4 (3/733)	0 (0/382)	0 (0/733)	0 (0/382)	0.8 (6/733)	0 (0/382)	0 (0/733)	1.8 (7/382)
Khoury 1995 (28)	0 (0/60)	3 (2/60)	0 (0/60)	0 (0/60)	0 (0/60)	0 (0/60)	1.7 (1/60)	0 (0/60)	0 (0/60)	0 (0/60)
Lepere 2000 (30)	0 (0/1290)	0 (0 / 682)	NR	NR	NR	NR	NR	NR	NR	NR
Van Hee 1998 (32)	0 (0/33)	0 (0/58)	0 (0/33)	0 (0/58)	0 (0/33)	0 (0/58)	0 (0/33)	0 (0/58)	5 (2/33)	7 (4/58)

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Weiser 2000 (26)	NR	NR	NR	NR	0.2 (2/1216)	0 (0/1547)	0.3 (4/1216)	0.1 (1547)	NR	NR
C ase series:										
Baca 2000 (29)	0 (0/2500)	NA	0.64 (16/2500)	NA	0 (0/2500)	NA	0.24 (6/2500)	NA	0.24 (6/2500)	NA
Leibl 2000 (29)	0.5 (29/5707)	NA	0.6 (34/5707)	NA	0.1 (6/5707)	NA	0.35 (20/5707)	NA	NR	NA
Tamme 2003 (31)	NA	0.47 (24/5203)	NA	0.23 (12/5203)	NA	0.02 (1/5203)	NA	0 (0/5203)	NA	0.23 (12/5203)

NA: not applicable. NR: not reported.

Table (3): Potentially serious complications

Complication	TAPP	TEP
Intra-operative:		
Vascular:		
Trocar injury to left common iliac artery[47]	1/764 (0.13%)	0/744
Visceral:		
Bladder injury[48,49,47]	4/764 (0.52%)	0/644
Small bowel injury[47,50]	0/764	0/644
Postoperative:		
Visceral:		
Small bowel obstruction[47,50]	1/764 (0.13%)	1/644 (0.16%)

Seven studies were included [35,33,36–42] although two provided the same data [38,41] and so results from the study with most detail are shown in the tables [41].Two studies were prospective audits [36,40] two were retrospective analyses [35,37,42-46] one was a report of two RCTs [41] and one was a systematic review [39]. Two studies [37, 40] considered the TAPP repair, three studies considered the TEP repair [35, 36, 41–43] and one considered a combination of both [39]. The number of laparoscopic procedures performed prior to the study varied; however, for the majority of surgeons TAPP and/or TEP were relatively new techniques. The characteristics of patients, where given, did not vary significantly between the studies. Studies ranged in size from 120 repairs for one surgeon to 1605 repairs for 29 surgeons.Although data were collected for several outcomes, it was considered inappropriate to report on any outcome other than duration of operation. This data indicates that it takes between 30 and 100 procedures to become ‘expert’ in performing laparoscopic hernia repair; however, in the majority of the studies the figure was more likely to be closer

to 50 or more procedures. However, this could be misleading since surgeons performing TEP may already be experienced in TAPP. Crude interpretation of these data provides estimates for duration of operation for inexperienced operators (up to 20 procedures) to be 70 minutes for TAPP and 95 minutes for TEP. For experienced operators (between 30 and 100 procedures), the estimated duration of operation are 40 minutes for TAPP and 55 minutes for TEP

Conclusion:

Laparoscopic inguinal hernia repair, despite the problems of learning curve, made an important revolutionary stage in hernia management and with the accumulative knowledge and experience it is the gold standard way of inguinal hernia repair. Both TEP and TAPP are good methods for inguinal hernia repair. Both are considered ranking the same position, and there is no sufficient data to draw any significant conclusions regarding what is better TAPP or TEP. Surgeons better to have adequate abilities to perform either of them, for either TAPP or TEP can be preferred over the other in a particular patient.

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