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Is unilateral laparoscopic TEP inguinal hernia repair a job half done? The case for bilateral repair

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Abstract
Introduction Bilateral laparoscopic totally extraperitoneal (TEP) repair of unilateral hernia is conspicuous in published literature by its absence. There are no studies or data on the feasibility, advantages or disadvantages of bilateral repair in all cases or in any subset of patients with unilateral primary inguinal hernia. The objective of this study is to investigate the feasibility of bilateral laparoscopic exploration for all unilateral cases followed by laparoscopic TEP in all cases and to compare complications, recurrence rates, postoperative pain, patient satisfaction, and return to work retrospectively with a similar number of age-matched retrospective controls.
Method One hundred fifty TEP operations were performed in 75 patients (group A) prospectively and were compared with 75 unilateral TEP operations (group B) in age-matched controls done previously by the same surgeon. All cases were performed under general anesthesia, and TEP repair was performed using three midline ports. All uncomplicated patients were discharged at 24 h, in keeping with departmental policy.
Results Of 75 patients (group A), 25 (33.3%) were clinically diagnosed with bilateral hernia and the rest (50, 66.66%) with unilateral hernia. The distribution of the 25 bilateral cases was 11 bilateral direct and 14 bilateral indirect inguinal hernias. The distribution of the 75 age-matched controls (group B) was all unilateral hernia, of which 47 were right-sided and 28 were left-sided. There were 23 direct hernias and 52 indirect hernias among the control group. The mean operative time for all 150 cases was 76.66 ± 15.92 min. The operative time in the control group (unilateral hernias) was 66.16 ± 12.44 min, whereas the operative time in the test group (bilateral repair) was 87.2 ± 11.32 min. The operative time in the bilateral group was significantly higher, by 21.04 min or 31.88% ($p = 0.000$). The operative time in the true unilateral group was 82.45 ± 9.38 min, whereas the operative time in the former group [occult contralateral hernias (OCHs) + bilateral hernias] was 91.35 ± 11.95 min, which is a statistically significant difference ($p = 0.0015$). Occult hernia was seen in a total of 15 cases, of which 13 were OCHs (26%) and 2 were occult ipsilateral hernias (OIH). The mean operative time in the OCH cases was 81.46 ± 7.9 min, whereas in those without OCH it was 82.45 ± 9.38 min, which is not a statistically significant difference ($p = 0.46$). Regarding complications, there were no cases of seroma, hematoma, wound infection, visceral injury or postoperative neuralgia in either group A or B. On statistical analysis, visual analog score (VAS)-measured pain score, at 12 h only, was significantly higher in the unilateral repair group as compared with the bilateral TEP group; VAS scores at all other times were not statistically significantly different between the two groups. The average time of return to light routine or activities of daily living was 1 day in group A, whereas in group B it was 1.91 days (range 1–3 days), which is a statistically significant difference ($p = 0.000$). There was one case of recurrence in this study, in a left-sided hernia in group A, over a follow-up period of 60–72 (mean 66) months; all patients reported for follow-up by office visit or correspondence until 2 years, and two patients were lost to follow-up after 2 years. In group B, there was no recurrence over a follow-up period

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of 72–84 months, with three patients lost to follow-up after 3 years.

Conclusion In the present study bilateral TEP was performed in three types of patients: those with clinically bilateral hernias, those with clinically unilateral hernia but with an OCH, and in truly unilateral hernias. All of these were compared with unilateral TEPs in clinically unilateral hernias, and we found no significant increase in morbidity, pain, recurrence or complications in bilateral repairs. Convalescence from surgery, as determined by return to activities of daily living and return to work parameters, was also comparable. Surgeons experienced in laparoscopic TEP, in high-volume centers, can provide bilateral repairs in patients with inguinal hernia, bearing in mind its advantages and comparable morbidity. We also feel that, in elective repair of inguinal hernia, the patient should be given the option of bilateral repair. Bilateral repair does not add to the risk of surgery in experienced hands and we strongly feel that unilateral TEP is actually a job half done.

Since the inception of modern surgical practice there has been a constant search for the ideal repair for groin hernia. From the original Bassini's procedure to the tension-free era of Lichtenstein's procedure, hernia repair has evolved through the ages until the advent of modern laparoscopy forced surgeons to bring groin hernias under the ambit of minimal-access surgery [1]. Today, laparoscopic total extraperitoneal (TEP) has emerged as the preferred and standard approach, supplanting laparoscopic transabdominal preperitoneal repair (TAPP) and intraperitoneal onlay-mesh (IPOM) techniques. TEP has been recommended as the surgery of choice for bilateral and recurrent hernias [2]. The discussion of the feasibility and appropriate role of TEP is an intense and continuing one. Proponents of TEP claim decreased morbidity, pain, and analgesic requirements, early return to work, bilateral access, and overall lower economic burden with comparable recurrence to open mesh repair [3–5]. The arguments given against it are the requirement of general anesthesia (GA), the difficult learning curve, and higher complication rates [6]. It has been shown that the learning curve can be overcome by proper training and technique [7]. More recently, it has been shown that TEP can be accomplished with lesser forms of anesthesia [8].

Among the advantages of TEP lies the potential advantage of detection of clinically undiagnosed contralateral hernias with minimal additional dissection [9]. The preperitoneal space is a potential space created using insufflation of gas and extraperitoneal dissection. During TEP, dissection is performed to the opposite side, and the placed mesh encroaches partly onto the opposite side. Entering the same space again after previous TEP, albeit on the opposite side, with mesh-induced fibrosis is fraught with difficulties, including higher chances of peritoneal, vascular, and visceral injury. Due to these technical difficulties it is difficult to offer the advantages of TEP on the opposite side for a patient previously operated by TEP. There is a wide array of meshes available for groin hernias, and based on the experience gained after the advent of the tension-free era, we now have reliable long-term data on the safety of these prosthetic mesh devices. As a corollary there is a strong case for performing opposite-side exploration which would only entail additional exploration of the cord and subsequent mesh placement after reducing the sac in all cases being operated for unilateral groin hernia by TEP.

Taking this argument further, the question that naturally arises is: How viable is bilateral repair in even those patients in whom laparoscopic exploration on the opposite side does not yield a hernia? In order to answer this question we must first investigate whether the incidence of inguinal hernia on the opposite side, in clinically unilateral hernias, is high enough. Secondly, is there any additional morbidity of such bilateral repairs over unilateral repairs? Thirdly, can bilateral repairs be accomplished without increasing operative access (incisions or ports) or operative time? Does repair in both sides in a clinically unilateral hernia compromise the repair of the symptomatic side (i.e., does it increase recurrence rates)? The purpose of our study is to answer some of these questions and consider whether bilateral repair of unilateral hernia is a viable alternative.

Bilateral TEP repair of unilateral hernia is conspicuous in published literature by its absence. There are no studies or data on the feasibility, advantages or disadvantages of bilateral repairs in all cases or in any subset of patients with unilateral primary inguinal hernia. The objective of our study is to investigate the feasibility of performing bilateral laparoscopic exploration of all unilateral cases followed by TEP in all cases and to compare the complications, recurrence rates, postoperative pain, patient satisfaction, and return to work retrospectively with a similar number of age-matched retrospective controls.

Methods

The present study was conducted in a large university referral hospital in New Delhi from March 2003 to March 2007. Hospital ethical committee clearance was obtained. Seventy-five consecutive patients were enrolled for the study for bilateral TEP in group A, and 75 age-matched controls in group B were derived retrospectively from previously operated unilateral TEPs performed by the same surgeon. The primary author, the operating surgeon in all cases, was well experienced, with cumulative experience of

over 500 TEPs. Patients with complicated hernia (in the form of irreducible hernias, strangulated hernia or obstructed hernia), history of previous lower abdominal surgery or history of radiotherapy were excluded from the study. All patients were completely investigated for fitness for GA. Thorough informed consent was obtained for surgery after explaining to patients the intention of the study, present literature, and statistics regarding the procedure. Patients not consenting to bilateral repair underwent unilateral repair and were excluded from the study. All patients were explained and familiarized with the visual analogue score (VAS) pain chart preoperatively.

Operative procedure

All cases were performed under general anesthesia. The patients were also instructed to micturate immediately before surgery. All patients were injected with 1 g cloxacillin and 80 mg gentamycin at induction and at 8 and 16 h postoperatively. TEP repair was performed in the same way as described by Lal et al. [5]. Three midline ports were used for the procedure. A standard 12×14 cm^2 polypropylene mesh was used in all cases, except in the first four cases where 10×12 cm^2 mesh was used and in six cases where 14×15 cm^2 size was used due to large body habitus.

Intraoperative monitoring

Details of operative procedure including operation time and complications such as bleeding, peritoneal breach, nerve injury, vas deferens injury, tearing of inferior epigastric vessels, major visceral or vascular injury were recorded.

Postoperative monitoring

Postoperative pain charting was done using the VAS pain scoring system, and record of oral and parental analgesics was kept. Complications such as pneumoscrotum, hematoma, seroma, neuralgia, and wound infection, and early recurrence were noted. A record of length of hospitalization and return to work was kept. All patients were advised to come for follow-up after 6 weeks, 3 months, and 6 months, or earlier if symptomatic; wound infection, pain, scar, neuralgia, seroma formation, and short-term recurrence were looked for.

All data were collated using Microsoft Excel® software and subject to appropriate statistical analysis in consultation with a consultant statistician of the Medical College. Descriptive data and their distribution were analyzed by nonparametric chi-square and Fisher exact chi-square tests, and quantitative data were analyzed using Student's *t*-test. Statistics were compiled using Statistica® software (StatSoft Inc.).

All patients were examined on the evening of surgery by the operating surgeon and examined for general condition and any early postoperative complications such as urinary retention, early recurrence, bleeding from port site/hematoma formation, and pneumoscrotum. All uncomplicated patients were discharged at 24 h, in keeping with departmental policy. Prophylactic antibiotics were given in two doses, at 8 pm and 8 am the following day. After discharge the patient was advised to take 50 mg diclofenac oral tablet on significant pain causing discomfort and to record this on the chart provided.

Patients were advised to perform day-to-day activities immediately after recovering from effects of anesthesia. VAS pain score chart was completed by each patient as explained at 12 h, 24 h, 48 h, 72 h, and 7 days after surgery. Patients were advised to attend out patients department (OPD) on 7th postoperative day for review and removal of stitches. A thorough examination was done during this visit. VAS pain score chart was taken from the patient and details of analgesia requirement was recorded. Patient's opinion about surgery and cosmesis was taken. All patients were advised to come for follow-up after 6 weeks, 3 months, and 6 months, or earlier if symptomatic.

Results

One hundred fifty laparoscopic TEP operations were performed in 75 patients (group A) prospectively and were compared with 75 unilateral TEP operations (group B) in age-matched controls done previously by the same surgeon. The mean age of the patients in the bilateral TEP group (group A) was 37.16 years (median 31 years, range 22–55 years), and the average age of the unilateral TEP group (group B) was 36.64 years (range 18–54 years).

Of the 75 patients in group A, 25 (33.3%) were clinically diagnosed with bilateral hernia and the rest (50, 66.66%) with unilateral hernia. Of the 50 unilateral hernias, 34 cases (68% of total cases) were right-sided and 16 cases (32%) were left-sided. In all cases bilateral repair was done. Among these 100 clinically diagnosed hernias in 75 patients, 33 (33%) were direct inguinal hernias and 67 (67%) were indirect inguinal hernias. The distribution of the 25 bilateral cases was 11 bilateral direct and 14 bilateral indirect inguinal hernias.

The distribution of the 75 age-matched controls (group B) was all unilateral hernia, of which 47 were right-sided and 28 were left-sided. There were 23 direct hernias and 52 indirect hernias among the control group.

Table 1 Mean operative times for all groups and subgroups

Group	Mean operative time (min)
All cases	76.65 ± 15.92
Unilateral repairs (group B)	66.16 ± 12.44
Bilateral repairs (group A)	87.2 ± 11.32
Bilateral repairs in unilateral hernias (group A minus bilateral hernias, 50)	82.16 ± 8.9
OCH (13 cases)	81.46 ± 7.9
Bilateral repairs in bilateral hernias (25 cases)	96.30 ± 13.17
Bilateral repairs in bilateral hernia + OCH (38 cases)	91.35 ± 11.95
Bilateral repairs in true unilateral hernia (–OCH) (37 cases)	82.45 ± 9.38
Peritoneal sleeve (9 cases)	87.81 ± 7.5
Unilateral (50) – OCH (13) – peritoneal sleeve (9) (26 cases)	80 ± 9.6

Operative time (Table 1)

The mean operative time for all 150 cases was 76.66 ± 15.92 min. The operative time in the control group (unilateral hernias) was 66.16 ± 12.44 min, whereas the operative time in the test group (bilateral repair) was 87.2 ± 11.32 min. The operative time in the bilateral group was significantly higher, by 21.04 min or 31.88% ($p = 0.000$, significant).

We also compared the operative times for unilateral hernia in group A (50) with bilateral hernia in the same group (25). Unilateral hernias were completed in 82.16 ± 8.9 min, whereas bilateral hernias took 96.30 ± 13.17 min to repair. Bilateral repairs took about 14 min longer to complete in cases with preoperative diagnosis of bilateral hernias as compared with bilateral TEPs in unilateral hernias. This difference was statistically significant ($p = 0.000$).

As a corollary we compared the operative times in cases of group A with preoperative diagnosis of bilateral hernia (25) plus those unilateral hernias with incidence of occult contralateral hernia on the opposite side (13) (making them bilateral hernias, total 38) versus true unilateral hernia (37). The operative time in the true unilateral group was 82.45 ± 9.38 min, whereas the operative time in the former group (OCH + bilateral hernias) was 91.35 ± 11.95 min, which is a statistically significant difference ($p = 0.0015$).

Table 2 Occult contralateral hernias distribution with respect to clinical diagnosis

Type of hernia	OCH present	Peritoneal sleeve present
Right	7/34[#]	5/25*
Left	6 /16[#]	4/10*

[#] $p = 0.30$, chi-square test (Fisher exact), not significant

* $p = 0.39$, chi-square test (Fisher exact), not significant

Occult contralateral hernia (OCH) (Table 2)

Occult hernia was defined as an intraoperative finding of peritoneal protrusion seen traversing beyond the deep ring into the inguinal canal (indirect) or a peritoneal protrusion seen going beyond a visible defect in the fascia transversalis, at a site different from the one diagnosed by clinical examination, preoperatively.

Occult hernia was seen in a total of 15 cases, of which 13 were occult contralateral hernias (OCH) and 2 were ipsilateral occult hernias. Of the 13 cases of OCH, 7 were on the left side (in primary right-sided inguinal hernias) and 6 were right sided (in primary left-sided inguinal hernias). Therefore, 7/34 (20.58%) cases of preoperative right-sided hernias and 6/16 (37.5%) cases of overt left-sided hernias were found to have occult contralateral hernia. This leads us to an interesting observation that, out of 100 cases of inguinal hernia, the incidence of OCH is around 17.5% more in overt left-sided inguinal hernias. Thus preoperative diagnosis of left-sided inguinal hernias had 17.5% higher risk of having an OCH in this study. This data was analyzed and not found to be statistically significant ($p = 0.24$).

The two occult ipsilateral hernias (OIH) were indirect occult sacs in cases of right-sided direct inguinal hernia which were discovered on exploration of the cord structures. Of the 13 cases of OCH, 12 (7 left OCH, 5 right OCH) were indirect and in only 1 case did we find a direct defect with a direct sac on the right side. We compared the operative times of unilateral hernia in which no OCH (37 cases) was found with those in which an OCH was seen (13 cases). The mean operative time in the OCH cases was 81.46 ± 7.9 min, whereas in those without OCH it was 82.45 ± 9.38 min, which is not a statistically significant difference ($p = 0.46$)

Peritoneal sleeve

Another novel parameter we assessed in this study was the concept of a peritoneal sleeve. This was defined as a

tubular peritoneal eventration, with or without contents, seen along the cord structures but not crossing the deep ring. There were 11 cases, of which 5 were seen on the left side in right-sided hernias, 4 were seen on the right side in left-sided hernias, and 2 were seen in direct hernias (one on each side) on the same side as the hernia on exploration of the cord structures. Among these 11 cases of peritoneal sleeve only the 9 cases of contralateral peritoneal sleeve were taken into consideration while computing statistical significance with respect to change in operative time or complications, since ipsilateral eventrations were handled with the primary hernia (Table 1). The mean operative time for the nine cases in which peritoneal eventration was found was 87.81 ± 7.5 min, compared with 80 ± 9.6 min in true unilateral hernias. On analysis there was a statistically significant difference between these ($p = 0.005$, $p < 0.05$). Bilateral hernias (25) and cases with OCH (13) were excluded from this analysis, as the incidence of OCH would have skewed this calculation. Thus in right-sided hernias, excluding cases with OCH and OIH, 5 out of the remaining 25 (20%) had a peritoneal sleeve, and in left-sided hernias this number was 4 out of 10 (40%). This clearly indicates the higher number of peritoneal sleeves on the contralateral side in right-sided hernias. This was, however, not statistically significant, with the chi-square test showing a p value of 0.12.

Complications (Table 3)

There were no cases of seroma, hematoma, wound infection, visceral injury or postoperative neuralgia in either group A or B. Although literature survey reveals varying incidences of seroma formation after TEP, the absence of seroma in the present series was due to meticulous hemostasis intraoperatively and dedicated use of tight compression over the inguinal dissection area using elastic adhesive bandage as strapping in all cases for the first 24 h after surgery. The primary author has been using this indigenous technique for all cases from the very beginning. The pressure presumably acts by obliterating the dissection space created during surgery between the extraperitoneal mesh and the fascia transversalis, and it seems that a 24-h period is adequate for creating early adhesion between the two layers.

Also conspicuous by its absence in our series is immediate postoperative and long-term neuralgia or any nerve entrapment syndrome.

Table 3 Complications

Complication	Unilateral repair (group B)	Bilateral repair (group A)
Urinary retention	0	0
Pneumoperitoneum	8	14[#]
Subcutaneous emphysema	4	12*
Wound infection	0	0
Neuralgia	0	0
Hematoma	0	0
Seroma	0	0
Recurrence	0	1
Peritoneal rent	10	14[†]

[#] $p = 0.20$, not significant (chi-square test)

*$p = 0.03$, significant (Fisher exact chi-square test)

[†] $p = 0.79$, not significant (chi-square test)

VAS scores

All patients were familiarized with VAS pain scoring preoperatively. VAS pain scoring was done at 6 and 12 h in the hospital and at 24 h, 48 h, 72 h, and 7 days by the patient on a VAS graph provided. This chart was then collected at the first postoperative visit and tabulated. This was the standardized approach for VAS scoring in our surgical unit and was similar to what was done for the retrospective age-matched controls. VAS scores were computed, and mean VAS scores in group A at 6, h 12 h, 24 h, 48 h, 72 h, and 7 days were 2.4, 1.2, 1.4, 0.63, 0.35, and 0.26, respectively. The VAS scores for group B (control group) were 2.26, 1.75, 1.15, 0.56, 0.43, and 0.26, respectively. On statistical analysis, the VAS-measured pain score, at 12 h only, was significantly higher in the unilateral repair group as compared with the bilateral TEP group; the VAS scores at all other times were not statistically significantly different between the two groups.

Return to daily activities and work

The average time of return to light routine or activities of daily living was 1 day in group A, whereas in group B it was 1.91 days (range 1–3 days). This is a statistically significant difference ($p = 0.000$). The mean time for return to work in group A was 7.03 days (range 3–16 days) and in group B it was 11.55 days (range 4–21 days). This parameter was again found to be statistically significant ($p = 0.00001$).

Recurrence

There was one case of recurrence in this study, on the left side in group A, over a mean follow-up period of 66 months (range 60–72 months); all patients reported for follow-up by office visit or correspondence until 2 years, and two patients were lost to follow-up after 2 years. In group B there was no recurrence over a follow-up period of 72–84 months, with three patients lost to follow-up after

3 years. The patient with recurrence in group A presented to us at 3 months after surgery and was re-explored and repaired by open surgery. The mesh was seen to have rolled up, leading to recurrence from the inferior side.

Peritoneal rent

There were 14 cases of peritoneal rent in the bilateral repair group, whereas in the unilateral group 10 cases of peritoneal rent were noted intraoperatively. Our next step was to assess whether the rate of peritoneal rent was higher in cases that were bilateral hernias to start with or had OCH detected intraoperatively. Among the 38 cases (bilateral hernias and OCHs), 10 cases (5 bilateral, 5 OCH) had peritoneal rent, whereas 4 cases of peritoneal rent were detected among the remaining unilateral hernias (37). On statistical analysis, peritoneal rent was more likely in cases of bilateral hernia or hernia with OCH ($p = 0.024$).

Subcutaneous emphysema

There were 12 cases of subcutaneous emphysema in the bilateral TEP group, whereas only 4 such cases were seen in the control group. This difference in incidence of subcutaneous emphysema was statistically significant ($p = 0.026$).

Discussion

Laparoscopic TEP has evolved over time from a novel procedure to the standard of care for bilateral and recurrent hernia. The purpose of this study was to further define the role of laparoscopic TEP in modern surgical practice. Laparoscopic TEP offers the inherent advantage and opportunity of exploring the contralateral side for presence of clinically undetected hernia.

Perusal of literature on this topic unearthed a myriad of interesting observations and facts. In children there is a reported range of 21–36% for incidence of contralateral patent processus on exploration, which is why many surgeons prefer bilateral exploration in pediatric inguinal hernia [10–13]. In another study conducted to demonstrate the incidence of incipient contralateral hernia, 11.2% of unilateral hernias were found to have OCH and were repaired [14]. A recent study in adults showed a 50% clinically undiagnosed contralateral hernia rate in inguinal hernias [15]. There are various studies where using TAPP, bilateral hernia repairs compare favorably with unilateral hernia repair [16].

A prospective study comparing unilateral and bilateral hernias using laparoscopic TEP and TAPP in 508 cases revealed no additional complication or recurrence rates for bilateral surgery and concluded that bilateral repair is indeed a viable alternative for bilateral hernia [17]; opposite-side exploration was not done in unilateral hernias in this study. Another similar study of 103 patients also emphasized similar morbidity and complication rates following bilateral hernia repairs with TEP as compared with unilateral laparoscopic TEP [18].

In another study aimed at characterizing the incidence of occult contralateral hernia (OCH), using a combination of diagnostic laparoscopy and TEP in 100 consecutive cases, higher incidence of OCH was found when laparoscopic TEP (45%) was used than when transperitoneal diagnostic laparoscopy (TADL) was used (13%). The study also found that patients presenting with left-sided hernias had bilateral hernias more often. There was no mention of the incidence of complications or additional morbidity, operative time or recurrences in these patients of OCH in comparison with those with unilateral hernia. Using a hypothetical approach they also postulated that 13% of cases would have been missed if contralateral exploration had not been done [9].

A study aimed at analyzing the risk factors for bilateral hernia found that laparoscopy helped in detection of 22% more bilateral hernias than would have been detected by clinical measures. The study also found that left-sided hernias were 10.5 times more likely to present with bilateral hernias than were right-sided hernias, whereas female sex, age less than 50 years, and right-sided hernia were less likely to have bilateral hernia [19]. A more recent study also showed 22% occurrence of bilateral defects in patients with unilateral inguinal hernia at TEP [20]. Another retrospective study has shown that, while the incidence of bilateral hernia in clinically unilateral hernias at TEP is 7.97%, only 1.12% of patients with unilateral hernia repair (who had undergone contralateral evaluation at surgery) subsequently developed a hernia on the other side over a 10- to 80-month follow-up period [21].

Putting this into perspective, there is a 9–36% incidence of contralateral hernia developing in the near or distant future. It is known that direct inguinal hernias are in fact primarily connective tissue deficiencies and that this leads to generalized weakness of the abdominal wall, causing hernias at inherent sites of weakness, namely the groin. In these patients the incidences of medial recurrent and contralateral hernias are higher and could justify contralateral exploration and possible mesh fixation for these. Contralateral exploration, in our opinion, is therefore justified and a natural extension of inguinal hernia repair if undertaken in unilateral cases. Given the fact that we approach all inguinal hernias with midline access as mentioned before and the fact that dissection does indeed reach at least the opposite inferior epigastrics (i.e., direct hernia territory), all that needs to be done for contralateral exploration is gentle evaluation of the cord structures.

All surgeons performing inguinal hernia repairs have experienced operating on the second symptomatic side in patients who have already had the opposite side operated several years previously or in childhood, although these data are largely unreported in the literature. Also, it is well known that not all patients would go back to the same surgeon on developing a recurrence or contralateral hernia. Thus a large amount of this data remains unrecorded. More recently, watchful waiting has been practiced for patients willing to do so after their symptomatic side has been treated.

Regarding safety, we draw on our previous experience and the absence of complications of cord manipulation such as nerve, vascular, visceral, and other cord injuries to be able to say that this additional step in contralateral exploration is safe. Approaching the issue of whether contralateral intervention in normal sides is safe, again we refer to our previous experience. The reason for this is that we have, over the last few years, adopted and evolved a technique which has yielded excellent long-term results in terms of complications and recurrence. The basic tenets include wide exposure, midline access, meticulous proximal dissection of peritoneum off the cord, lateralization of the cord, adequate size mesh, and two-point medial fixation. The complications of TEP repair will apply to the contralateral (normal) side as well. Seroma formation and hematomas seem to dominate in the early postoperative period, and these have been low in our experience. They do seem to be more prominent in incomplete hernias requiring extensive dissection off the cord. Since this is not the case we can assume that the additional repair would not significantly increase the incidence of acute fluid collection. This premise held true in this study. Other acute complications such as visceral injury again using the standardized approach are almost nonexistent. Among long-term complications, the most important besides recurrence is neuralgia. Since we do not fix the mesh with tacks laterally and only use two medial tacks, our experience with neuralgia has been different from prevalent world literature and is extremely low. Taking the aforementioned factors into consideration, we believe that addition of contralateral exploration of the cord and a mesh with two tacks on the opposite side, if done meticulously, would add minimal complications to the procedure and at the same time decrease the incidence of hernia, thus benefitting 20–30% of the population undergoing unilateral hernia repair.

Accessing a previously scarred preperitoneal space is fraught with increased complications, including but not limited to peritoneal rent, vascular injury, and prolonged operating time. Preperitoneal dissection in unilateral cases does extend to at least the epigastrics on the contralateral side, and we believe that this technique allows the necessary placement of the mesh medially to prevent recurrence. We strongly believe that not doing so is in fact leaving a "door open" for recurrences and that, along with the other precautions that we take, this is one of the key factors that has enabled us to achieve a low recurrence rate compared with world literature. After such exploration we have noted increased scarring and difficulty in accessing the preperitoneal space, once again leading us to inevitably question the merit of unilateral repair and favor bilateral exploration and mesh placement. The midline positioning of the ports works optimally for bilateral exploration and access, and we recommend this port placement for bilateral TEP in all cases.

Analysis of the results showed that average operative time in all cases (groups A + B) was 76.6 min, comparable to that reported in published literature [22]. Bilateral repairs took only 20 min (31.8%) longer. This can be explained by the fact that, even in unilateral cases, dissection of the preperitoneal space is routinely done up to half of the opposite side for better spatial orientation. The concept of bilateral repair in these cases means dissecting the opposite cord and fixation of a mesh on the other side. For the amount of potential benefit that opposite-side repair provides, is a 31.8% increase in operative time too high a price to pay, provided that the morbidity and recurrences of the procedure do not change? Another significant finding was that cases of bilateral hernias (clinical bilateral + OCH) took significantly longer to operate than truly unilateral cases. True unilateral hernias (i.e., group A minus bilateral minus OCH) took only 24% longer than group B, which means that bilateral TEP in cases of unilateral hernia without contralateral OCH (35 cases) took only 16 min longer to complete as compared with unilateral TEP.

Since one of the primary motivations of the study was to look for any evidence of OCH on the other side in clinically unilateral hernia, this parameter was looked for meticulously and recorded according to side and type. Occult hernia was defined as an intraoperative finding of peritoneal protrusion seen traversing beyond the deep ring into the inguinal canal (indirect) or a peritoneal protrusion seen going beyond a visible defect in the fascia transversalis, at a site different from the one diagnosed by clinical examination, preoperatively. There were 15 cases of occult hernia, of which 13 were contralateral (OCH) and 2 were indirect sacs in primary direct hernias (OIH). Among the 13 contralateral cases (OCH), 6/16 were on the right side in left-sided hernias and 7/34 were on the left in right-sided hernias. The incidence of OCH in our study falls well within the previously reported incidence of OCH [9, 15, 16, 18]. However no comparison was made in previous studies with respect to operative time and the incidence of complications in true unilateral cases versus those in which a contralateral OCH was discovered. In this study the

incidence of OCH was 26% (13/50), and left-sided hernias were 17.5% more likely to have an OCH than were right-sided hernias. This seems to be consistent with existing literature regarding the higher incidence of OCH on the opposite side in left-sided hernias [18]. The reason postulated for the higher incidence of OCH on the right in hernias of the left side could be attributed to embryological development of the processus vaginalis by which the left processus is the one that obliterates first.

Peritoneal sleeve was defined as a peritoneal eventration, with or without contents, seen along the cord structures like a true hernia but that had not yet crossed the deep ring. This phenomenon does not find mention in the reported literature. There were 11 such cases seen, of which 9 (associated with indirect hernia) were seen on the side contralateral to the side of hernia. The exact potential of these peritoneal sleeves to develop into a true inguinal hernia (clinically overt or covert) remains to be investigated. However the fact that there is a sleeve which is not in conformity with the regular peritoneal outline is enough reason to investigate and repair the same. The possibility that this was a dissection artifact is unlikely, since in this study the operating surgeon took meticulous care not to pull the peritoneum so as to cause a pseudo-eventration before defining the existence of a peritoneal sleeve. Any such eventration seen after dissection was not counted as a peritoneal sleeve. The significance of this phenomenon needs further investigation.

One of the objectives of this study was to look for and compare the complication and recurrence rates among bilateral repairs versus unilateral ones. There were 14 cases of peritoneal rent in group A versus 10 in group B, which was not a statistically significant difference. However on analysis of group A, cases of bilateral hernias or those with OCH were statistically more likely to have peritoneal rent than were unilateral hernias. The higher number of peritoneal rents in the bilateral + OCH group could be explained due to the more extensive dissection in these cases. The higher incidence of peritoneal rent in this study compared with previous studies can be explained by meticulous dissection of both sides in all cases, meticulous dissection of the peritoneum around the cord structures, deep ring dissection and extensive lateralization of the cord in all cases.

Subcutaneous emphysema was seen in more cases in group A than in group B, which on analysis was not statistically significant. This emphysema was present around the port sites, resolved after 6–12 h in all cases, and caused no increase in pain.

There were no cases of seroma, hematoma, neuralgia or visceral injury in either group. In summation, there was no statistical difference with respect to complications between the two groups.

All patients were made familiar with the visual analogue scoring preoperatively, and VAS scores were analyzed. The VAS scores of group A were higher than in group B at 6 h, 24 h, 48 h, and 7 days, and lower than in group B at 12 and 72 h. The VAS score at 12 h was less than in the bilateral repair group and this was statistically significant. The other VAS scores were statistically comparable. This is a very important criterion of our study and demonstrates that there was no significant difference in postoperative pain between unilateral and bilateral repair. Thus the presence of an additional mesh in the bilateral repair cases does not cause any increase in postoperative pain.

There was one case of recurrence in this study, in a left-sided hernia, over a follow-up period of > 5 years (60–72 months) with significantly low attrition. This patient was the second patient operated in group A and presented to us after 3 months. The patient was re-explored, and an indirect sac was seen emerging from below the inferior aspect of the mesh due to rolled-up inferior edge of the mesh. In retrospect we realized that in the first four cases we had placed a smaller mesh (10×12 cm^2) on the contralateral side, and in this case, a combination of a smaller mesh and possible rolling of the inferior edge of the mesh was the possible culprit. Standard mesh size of 12×14 cm^2 on each side was used in all cases thereafter, and we have had no recurrence in any subsequent case, inside or outside of this study. It is noteworthy that the average body mass index (BMI) and habitus of patients in our center and the rest of the Indian subcontinent is significantly smaller than the average patient in the USA or Western Europe. It has been our experience that, for the average Indian body habitus, 12×14 cm^2 is the appropriate size for TEP repair. A larger, 14×15 cm^2 mesh was used in six cases with large body habitus.

In our study return to work and return to activities of daily living (ADL) were significantly faster in the bilateral group. A comparably equal convalescence time was expected, since there was not much difference in the pain scores between the two groups. This further emphasizes that a bilateral mesh does not compromise activity in any way versus a unilateral mesh. The earlier return to work in group A (bilateral TEP group) was possibly aided by the encouragement and greater motivation to the patient from our side in the last approximately 100 cases provided there was no significant persistent postoperative pain. The control group (group B) of unilateral hernia repairs, carried out more than 1 year ago, were less motivated by us in this regard, hence the difference in return to work between the two groups.

To summarize, the operative times were significantly higher in the bilateral repair group. The complication rates and pain scores were comparable between unilateral and bilateral repair. Return to ADL and work were faster in the bilateral group.

Conclusions

In this study we wish to evaluate the merits and demerits of bilateral exploration and TEP repair in all cases of inguinal hernia. We found a reasonable (20–25%) chance of discovering an occult contralateral hernia on exploration of the clinically asymptomatic side in unilateral hernias, and this was higher on the right side in clinically left-sided hernias. Bilateral repair in all cases of unilateral inguinal hernia would also overcome the problem of perceived difficulty in entering a nonvirgin preperitoneal space for TEP after prior TEP on the opposite side. This study is possibly the first scientific study to provide data that bilateral TEP repair of unilateral and bilateral inguinal hernia are comparable in terms of morbidity, pain scores, recurrence rates, and return to work as compared with unilateral TEP repairs.

Performing a bilateral repair in all cases does take care of OCH in some, but is still a prophylactic repair in the majority (75% according to our study) of patients with unilateral inguinal hernias. Thus the moot question is whether it is justifiable to perform such a prophylactic repair in truly unilateral hernias. In the present study bilateral TEP was performed in three types of patients: those with clinically bilateral hernias, those with clinically unilateral but with an OCH, and those with truly unilateral hernias. All of these were compared with unilateral TEP in clinically unilateral hernias, and we found no significant increase in morbidity, pain, recurrence or complications with bilateral repair. Convalescence from surgery, as measured by return to activities of daily living and return to work parameters, was also comparable.

We therefore believe that surgeons, experienced in laparoscopic TEP, in high-volume centers, can provide bilateral repairs in patients with inguinal hernia, keeping in mind its advantages and comparable morbidity. We also feel that, in elective repairs of inguinal hernias, the patient should be given the option of a bilateral repair. Bilateral repair takes more time than unilateral TEP, as is understandable and in our opinion acceptable considering its potential benefits. Bilateral repair does not add to the risk of surgery in experienced hands and we strongly feel that a unilateral TEP is actually a job half done.

Disclosures

Drs. Pawanindra Lal, Prejesh Philips, Jagdish Chander, and Vinod K. Ramteke have no conflicts of interest or financial ties to disclose.

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