



Laparoscopic inguinal hernia repair after prostatectomy: Evaluating safety, efficacy, and efficiency

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ABSTRACT

Background: For many surgeons, a prior prostatectomy is considered a contraindication to laparoscopic totally extraperitoneal hernia repair. This study aims to evaluate the safety, efficacy, and efficiency of totally extraperitoneal in these patients.

Methods: This is a review of a prospectively collected hernia database evaluating patients who underwent totally extraperitoneal repair between October 2009 and March 2018. Patients with prior prostatectomy were matched to controls without prior prostatectomy. Secondary analysis compared the case group to patients who underwent open hernia repair.

Results: In the study, 1,751 patients underwent laparoscopic totally extraperitoneal repair. Thirty patients with a prior prostatectomy were matched to 90 controls. Operative duration was greater in the prostatectomy group (56 vs 36 minutes, $P < .0001$) and more peritoneal tears occurred (40% vs 12%, $P = .002$). Duration of stay, return to activity, complications, and rates of recurrence and chronic pain were equivalent. When compared with prior prostatectomy patients who underwent open hernia repair, the laparoscopic totally extraperitoneal group had equivalent rates of complications and outcomes with a faster return to activities of daily living (3 vs 7 days $P = .007$).

Conclusion: Despite a more difficult dissection, laparoscopic totally extraperitoneal repair in patients with prior prostatectomy is safe, efficacious, and efficient. In addition, totally extraperitoneal offers similar outcomes to open repair with a quicker recovery in this patient population.

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Introduction

Although the exact mechanism is poorly understood, it is well established that operative prostatectomy increases the risk of development of inguinal hernias, primarily the indirect type. Some authors have suggested that stretching of or damage to the muscles of the abdominal wall during prostatic surgery may weaken the internal ring predisposing patients to future hernia development.¹ The reported incidence is 5.8% to 19.4% in this patient population.^{2–5} As a result of this predisposition, general surgeons commonly encounter patients with an inguinal hernia and history of prostatectomy. Decreased postoperative pain, a lesser incidence

of chronic pain, and earlier return to work have made laparoscopic hernia repair an attractive option.^{6–9} In laparoscopic totally extraperitoneal (TEP) repairs, the success of the operation relies on creating an extra-peritoneal plane of dissection. These planes are often scarred or even obliterated from prior abdominal and pelvic operations causing many surgeons to consider prior abdominal and pelvic surgery, especially a prior prostatectomy, to be a contraindication to TEP repair.

As surgeons have become more skilled performing TEP repairs and other complex laparoscopic operations, several studies have demonstrated that, in experienced hands, TEP is safe and feasible in patients with nonurological abdominal surgery^{10–13}; however, the safety and feasibility of TEP after a procedure that requires broad pelvic dissection, such as a radical prostatectomy, has only been addressed by a small number of reports written by skilled surgeons who have performed a small number of procedures.^{14–16} The current literature suggests that TEP repairs in this population are safe in experienced hands, but differing

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Table 1
Hernia information

	TEP repair without prior prostatectomy	TEP repair with prior prostatectomy	<i>P</i> value
Total patients, (<i>N</i>)	90	30	
Total hernias, (<i>N</i>)	104	35	
Bilateral hernia, <i>N</i> (%)	14 (16)	5 (17)	.89
Hernia type, <i>N</i> (%)			
Direct	39 (38)	6 (17)	.04
Indirect	65 (63)	29 (83)	.04
Surgeon, <i>N</i> (%)			1.00
A	72 (80)	24 (80)	
B	15 (17)	5 (17)	
C	3 (3)	1	
Hernia size, cm, mean ± SD	3 ± 1	3 ± 1	.30

operative times and rates of conversion and complications among these studies makes the ultimate conclusion unclear. In addition, some of this literature is >10 years old, a relatively distant time from the current era of advanced laparoscopic techniques and procedures by an increasing number of well-trained, experienced surgeons.

Our study aims to add to the small amount of literature addressing TEP repair in patients who have undergone a prostatectomy previously. Additional and more current data on this topic has the potential to better inform surgeons on the risks and benefits of offering this treatment option. We hypothesize that TEP repair in patients who have undergone prior prostatectomy is safe, efficacious, and efficient for surgeons with laparoscopic experience.

Methods

Data acquisition

A prospective quality hernia database is kept at Northshore University HealthSystem. This database includes all patients undergoing inguinal hernia repair in any of the 4 associated hospitals completed by multiple surgeons. The database is kept by dedicated research associates who maintain accuracy by reviewing office electronic medical records in real time and have regular opportunities to query attending surgeons on discrepancies. Any radiologic imaging of the operative field is reviewed as well. Metrics are recorded pre-, intra- and postoperatively. In addition, surveys are sent to patients preoperatively and at 3 weeks, 6 months, 1 year, 3 years, 5 years, 7 years, and 10 years after surgery. These surveys serve to maintain follow-up, track recurrence of the hernia, and investigate metrics of quality of life. This database is compliant with the Health Insurance Portability and Accountability Act of 1996 and is kept in an encrypted section of the organization's protected intranet.

Appropriate Institutional Review Board approval was obtained for a review of this database. This database was queried for all patients who underwent a TEP repair during the study period of October 2009 to March 2018. Patients were excluded for the following criteria: emergency surgery, hernia strangulation, incomplete record, and loss to follow-up. An additional database query was made for patients with a history of prostatectomy who underwent an open inguinal hernia repair during the same study period. Exclusion criteria, methods of data acquisition, and study variables were the same.

Data from preoperative (eg, demographics, medical history), intraoperative (hernia size, duration of procedure), and postoperative periods were reviewed. All studied patients were male

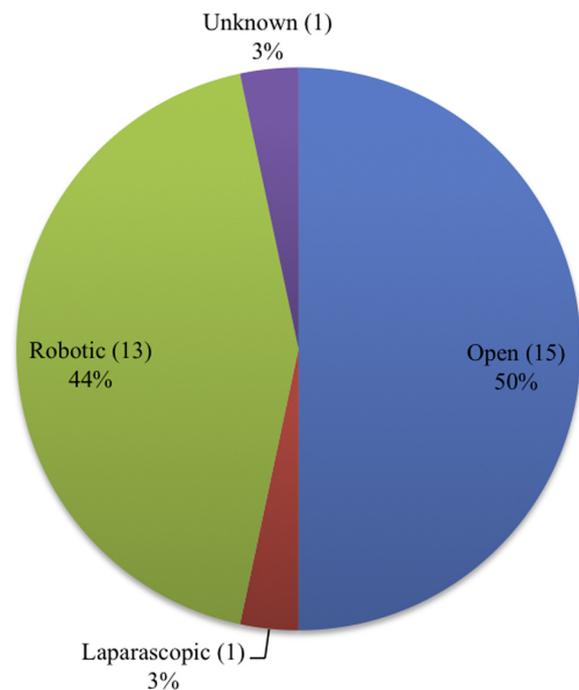


Fig 1. Type of prostatectomy before laparoscopic TEP repair (*N*). Open and robotic techniques made up the majority of prior prostatectomies.

because only males are capable of having a prior prostatectomy. Return to activities of daily living and duration of the home use of narcotics are patient-reported metrics documented regularly in follow-up visits. Thirty-day surgical site infection, mesh infection, seroma, and hematoma were determined by the attending surgeon at the follow-up visit and extracted from the medical record. Chronic pain was defined as requiring referral to a pain management specialist, reoperation for pain, or requiring a narcotic pain prescription >30 days after the initial operation. Recurrence was defined clinically and included documentation of a bulge in the previously operated side. Any clinician could make the diagnosis of recurrence. Patients with continued medical visits within our health system including nonsurgical visits after an operation were assumed not to have had a recurrence up to that time point under the condition that an abdominal exam was recorded in the clinic note. This amount of time was used to calculate follow-up. Patients who did not have follow-up within Northshore HealthSystem, usually a result of patient relocation were excluded because of inability to acquire the necessary data unless specified otherwise.

Table II
Patient information

	TEP repair without prior prostatectomy	TEP repair with prior prostatectomy	P value
Age, years, mean \pm SD	68.5 \pm 14.9	72.9 \pm 7.6	.48
BMI, kg/m ² , mean \pm SD	25.0 \pm 3.6	24.7 \pm 2.6	1.00
Obese, N (%)	6 (7)	1	.68
Smoking status, N (%)			.93
Never	61 (68)	20 (67)	
Former	24 (27)	9 (30)	
Current	5 (6)	1	
Steroid use, N (%)	0	1	.25
Diabetes, N (%)	4 (4)	2	.64
COPD, N (%)	0	0	—
Prior inguinal repair, N (%)	18 (20)	8 (27)	.45
Concurrent ventral repair, N (%)	15 (17)	6 (20)	.78
ASA class, mean \pm SD	2.1 \pm 0.6	2.2 \pm 0.5	.52

ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease.

Statistical methods

The case group, defined as patients with a history of prostatectomy who underwent TEP repair, was then matched to controls using a 3:1 propensity score matching method. Controls were defined as patients who underwent TEP repair without a history of prostatectomy. Controls were matched without replacement using a greedy, nearest neighbor algorithm on age, sex, bilaterality, smoking status, surgeon, and surgeon experience. Fisher exact and Wilcoxon rank-sum tests were used to compare characteristics and outcomes between cases and matched controls. In addition, we compared cases to unmatched patients with open hernia repairs using the same methods. All statistical analysis was performed using SAS 9.3 (SAS Institute, Cary, NC). Continuous data are expressed as mean \pm standard deviation.

Operative methods

The operative methods were the same for both TEP groups with the following exception. Patients undergoing a TEP after prostatectomy had a Foley catheter placed after induction of anesthesia as a safety measure; we have found that a Foley balloon is helpful in identification and protection of the bladder especially when dissecting scarred tissue planes. After general anesthesia was administered, a small midline incision was made in the infra-umbilical region, and the fascia was identified and incised as the rectus was retracted laterally. A port was placed into the preperitoneal space followed by a 30-degree laparoscope. Two additional ports were placed under direct visualization in a linear fashion between the umbilical port and the pubic bone. In patients with a midline incision from prior open prostatectomy or otherwise, port placement was not altered and it was not unusual for ports to be placed within the midline scar. A dissection balloon was not used typically; rather, the preperitoneal space was dissected bluntly. In both patient groups, the contralateral side was not dissected routinely unless indicated clinically. The epigastric vessels were identified and not dissected from the abdominal wall. The lateral space was developed superior to the iliopubic tract, and Cooper's ligament was identified. The hernia sac was dissected off the cord structures, and synthetic mesh was placed. Typically, the mesh was secured with tacks laterally above the iliopubic tract, medially on Cooper's ligament, and anteriorly, although some surgeons may not have placed lateral tacks in certain situations. Peritoneal tears were repaired using laparoscopic clips. The technique of open hernia repair was a tension-free plug and patch method with little

variation between surgeons. Postoperative order sets and discharge instructions were standardized and did not differ depending on the type of hernia repair performed: TEP or open.

Results

Prior prostatectomy group and matched controls had similar preoperative characteristics

The database contained 1,751 patients who underwent TEP repair during the study period. Thirty patients with a history of prostatectomy and 90 patients without a prior prostatectomy underwent a TEP repair allowing for comparison of 139 hernia repairs (Table 1). Proportion of bilateral hernias, size of hernia, and distribution of surgeons were similar in each group. The prior prostatectomy group had a greater incidence of indirect hernias when compared with controls. A history of robotic and open prostatectomy was observed with similar frequency, 45% and 52% respectively (Fig 1).

The groups were of a similar age and body habitus (Table II). Medical comorbidities were similar with regard to smoking status, steroid use, diabetes, and chronic obstructive pulmonary disease. Both groups had similar proportions of prior inguinal hernia repairs as well as concurrent ventral hernia repairs. Lastly, American Society Anesthesiologists class was similar between groups. These data suggest that the case and control groups were well-matched and thus offered a fair comparison.

Greater operative time and more peritoneal tears occurred in patients with prior prostatectomy

Operative time differed between the prior prostatectomy and control group (Fig 2). Unilateral hernia repair took greater mean time to accomplish in the prior prostatectomy group (56 \pm 24 minutes vs 36 \pm 10 minutes; $P < .01$). This difference did not persist when comparing bilateral repairs (69 \pm 25 minutes vs 52 \pm 11 minutes, $P = .16$). The prostatectomy group also experienced statistically more peritoneal tears; 40% of prior prostatectomy patients experienced peritoneal tears during dissection compared to just 12% of patients in the control group ($P = .002$; Fig 3). The differences in operative times and rate of peritoneal tears indicate that the prostatectomy group required more operative time and likely a more difficult dissection.

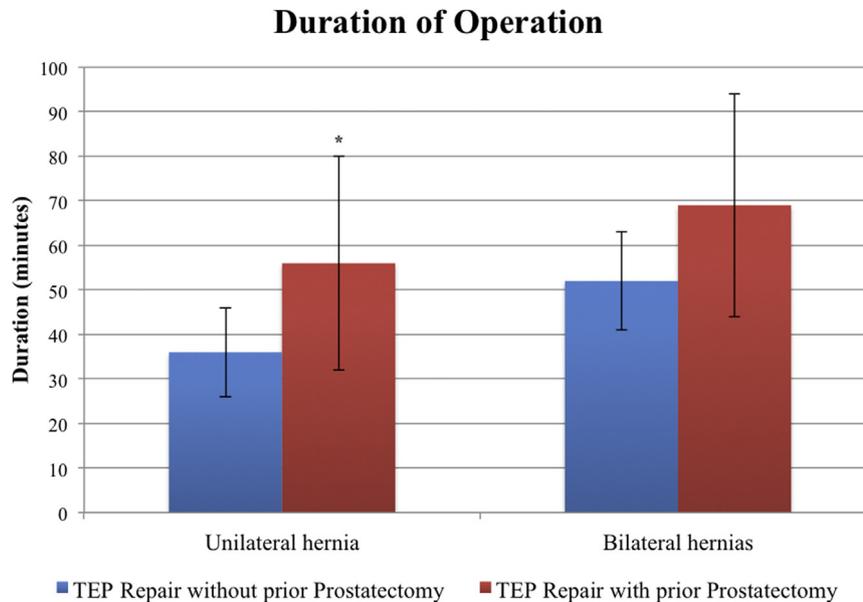


Fig 2. Operative duration. TEP unilateral repair in the prior prostatectomy group had a significantly greater operative time when compared with the control group. This difference was not in bilateral repairs. *Denotes statistical difference.

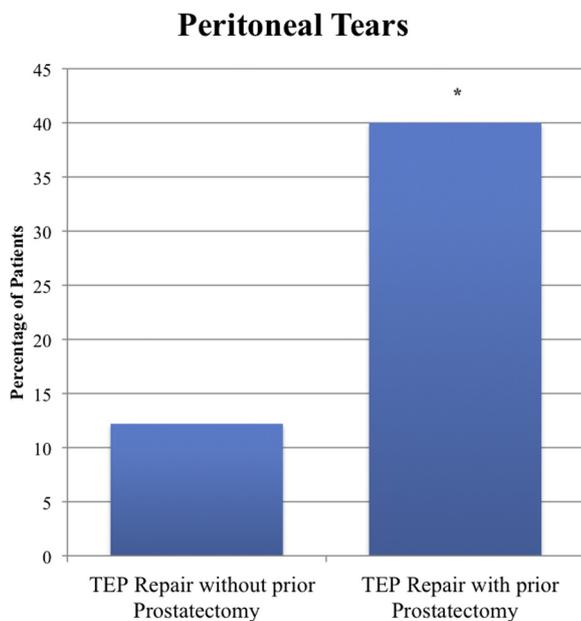


Fig 3. Percentage of patients with intraoperative peritoneal tears. A significantly greater percentage of patients experienced peritoneal tears in the prior prostatectomy group. *Denotes statistical significance.

Despite a more difficult dissection in the prostatectomy group, complications and outcome metrics were similar when compared with the control group

A single patient in the prior prostatectomy group required conversion to an open repair compared to no patients in the control group (Table III). There were no intraoperative complications in either group and the duration of stay was similar. The median return to activities of daily living (ADL) was 3 days in both groups and home narcotic use duration was similar. There were no surgical site or mesh infections in either group. Follow-up was similar between groups at 36 and 35 months,

respectively. A similar proportion of patients in each group experienced postoperative seromas; the prostatectomy group trended toward having a greater proportion of postoperative hematomas (2 out of 90 [2.2%] vs 3 out of 30 [10%]; $P = .1$). None of these seromas or hematomas required intervention. A single patient in the control group developed chronic pain and a single patient in the prior prostatectomy group experienced a recurrence at 15 months postoperatively. These data suggest that, based on all clinically relevant outcomes, both groups of patients had similar intraoperative and postoperative results.

TEP after prostatectomy group when compared with a nonmatched open hernia repair after prostatectomy group had similar preoperative characteristics

Eighty-eight patients with a history of prostatectomy underwent an open inguinal hernia repair during the study period (Table IV). Preoperative variables of this open hernia group were similar to the TEP group in terms of age, steroid use, diabetes, chronic obstructive pulmonary disease, prior inguinal hernia repair, and American Society Anesthesiologists class. Body mass index trended toward being greater in the open hernia repair group, and more patients in the open repair group had a concurrent ventral hernia repair. Both groups had a predominance of indirect hernias, and hernia size was similar in each group. These groups did differ in the type of prior prostatectomy performed and the distribution of surgeon performing hernia repair. Taken together, despite being unmatched, the preoperative characteristics of the open hernia repair group and TEP group were relatively similar and thus allowed for a reasonable comparison. Type of hernia repair, open or laparoscopic, was based on surgeon preference.

When compared with the open hernia repair group, the TEP group had similar intraoperative and postoperative outcomes in addition to a shorter return to ADL

Operative duration in both groups was similar for unilateral and bilateral repairs (Table V). There were no complications in either

Table III
Intraoperative and postoperative details

	TEP Repair without prior prostatectomy	TEP repair with prior prostatectomy	P value
Conversion to open, N (%)	0	1	.25
Intraoperative complication, N (%)	0	0	—
Duration of stay, hours, median (Q1–Q3)	4 (3–6)	3 (2–5)	.42
Return to ADL, days, median (Q1–Q3)	3 (2–7)	3 (2–5)	.99
Home narcotic use duration, days, Median (Q1–Q3)	0 (0–2)	0.5 (0–3)	.76
30-day surgical site infection, N (%)	0	0	—
Mesh infection, N (%)	0	0	—
Seroma, N (%)	12 (13)	6 (20)	.39
Hematoma, N (%)	2	3 (10)	.10
Chronic pain, N (%)	1	0	.75
Recurrence, N (%)	0	1	.25
Follow-up months, median (Q1–Q3)	35 (15–67)	36 (8–52)	.61

Table IV
Open hernia repair compared with laparoscopic TEP in patients with prior prostatectomy, preoperative details

	TEP Repair with prior prostatectomy	Open repair with prior prostatectomy	P value
Total patients, N	30	88	—
Total hernias, N	35	94	—
Age, years, mean \pm SD	72.9 \pm 7.6	72.3 \pm 8.2	.86
BMI, kg/m ² mean \pm SD	24.7 \pm 2.6	26.0 \pm 3.0	.06
Steroid use, N (%)	1	2	.84
Diabetes, N (%)	2	11 (13)	.51
COPD, N (%)	0	3 (3)	.57
Prior inguinal repair, N (%)	8 (27)	22 (25)	.67
Concurrent ventral repair, N (%)	6 (20)	2	.003
ASA class, mean \pm SD	2.2 \pm 0.5	2.3 \pm 0.5	.71
Bilateral hernia, N (%)	5 (17)	6 (7)	.14
Prostatectomy type, (%)			.034
Open	15 (50)	61 (69)	
Laparoscopic	1	3 (3)	
Robotic	13 (43)	16 (18)	
Unknown	1	8 (9)	
Hernia type, N (%)			
Direct	6 (17)	19 (20)	.81
Indirect	29 (83)	81 (86)	.78
Hernia Size, cm, Mean \pm SD	2.6 \pm 1.0	2.3 \pm 1.1	.14
Surgeon, N (%)			<.0001
A	72 (80)	24 (27)	
B	15 (17)	25 (28)	
C	3 (3.3)	23 (26)	
D	0 (0)	16 (18)	

ASA, American Society of Anesthesiologists; BMI, body mass index; COPD, chronic obstructive pulmonary disease.

group. Median duration of stay was ≥ 1 hour in the open repair group, but these patients also had a slower return to daily activities (3 days vs 7 days, $P = .007$). A single patient developed chronic pain in the open hernia group, and a single patient developed a hernia recurrence in the TEP group. The rate of surgical site infection, mesh infection, seroma, and hematoma were similar between groups. Duration of the home use of narcotic was similar, and follow-up was a median of 36 months in both groups. These data suggest that in patients who have previously undergone prostatectomy, a TEP repair has similar operative duration and postoperative outcomes as an open repair with the additional benefit of a faster return to activity.

Discussion

This study indicates that laparoscopic TEP inguinal hernia repair in patients who have undergone prostatectomy previously is safe, efficacious, and efficient when performed by experienced

laparoscopic surgeons. The safety of TEP in this patient group is evidenced by the absence of clinically important intraoperative or postoperative complications. Similar recurrence rates after three years of follow-up support the efficacy of a TEP repair in prior prostatectomy patients. The greater operative duration in unilateral repairs and increased peritoneal tears challenges the efficiency of TEP repairs in this patient population, but differences in duration were marginal, and peritoneal tears are generally considered to be clinically inconsequential.^{17–19}

When compared with the current standard of open hernia repair, similar operative duration and intraoperative complications suggest that either approach is acceptable in these patients. This point is augmented by similar clinical outcomes, including surgical site infections, rates of chronic pain, and recurrence. There was, however, a notable difference in return to daily activities favoring TEP repair.

In 2006, Dulucq et al¹⁴ conducted a prospective study comparing 124 patients without prior abdominal surgery to 10 patients with a prior prostatectomy who underwent TEP repair.

Table V
Open hernia repair compared to laparoscopic TEP in patients with prior prostatectomy, intraoperative and postoperative details

	TEP repair with prior prostatectomy	Open repair with prior prostatectomy	P value
Intraoperative			
Operative duration, min, mean \pm SD			
Unilateral	56 \pm 24	48 \pm 14	.37
Bilateral	69 \pm 25	62 \pm 9	.63
Intraoperative complication, N (%)	0	0	—
Postoperative			
Duration of stay, hours, median (Q1–Q3)	3 (2–5)	2 (2–3)	.0002
Return to ADL, days, median (Q1–Q3)	3 (2–5)	7 (4–7)	.007
Home narcotic use duration, days, Median (Q1–Q3)	0.5 (0–3)	2 (0–5)	.27
30-day surgical site infection, N (%)	0	1	.75
Mesh infection, N (%)	0	0	—
Seroma, N (%)	6 (20)	13 (15)	.57
Hematoma, N (%)	3 (10)	3 (3)	.17
Chronic pain, N (%)	0	1	.75
Recurrence, N (%)	1	0	.25
Follow-up months, median (Q1–Q3)	36 (8–52)	36 (18–61)	.69

They too found a greater operative duration in the prostatectomy group (36 \pm 8 minutes vs 15.8 \pm 6 minutes, $P = .001$). Their study, however, reported a greater intraoperative complication rate (2 out of 10 vs 1 out of 124) and a greater conversion rate to a transabdominal laparoscopic hernia repair (2 out of 10 vs 0) in the prostatectomy group. These differences, when compared to our data, may be explained in part by a different level of surgeon familiarity and experience with laparoscopic surgery applied to prostatectomy patients with inguinal hernia. Similar to our study though, the authors found equivalent duration of stay, days to ambulation, and rate of long-term complications between groups. More recently, Le Page et al¹⁵ performed a case-control study of a prospective database allowing for comparison of 52 prior prostatectomy patients to 102 controls. A greater operative duration in the prostatectomy group was again observed in unilateral repairs (62.5 minutes vs 46 minutes, $P < .0001$), and this difference was sustained for patients undergoing bilateral repair (102 minutes vs 65 minutes, $P = .0001$). Consistent with our data, the authors found no difference in clinically relevant variables, such as duration of stay, complications, recurrence, or patient satisfaction.

When evaluating our own data, we were surprised that we did not demonstrate a difference in operative duration during bilateral hernias between cases and controls, which was likely a result of the small sample size in this subgroup. It was additionally surprising that an open bilateral hernia repair, requiring 2 completely separate incisions and closures, took a similar amount of time as the bilateral TEP repair. This fact independently is a testament to the additional time required for TEP repairs in prior prostatectomy patients. Despite this, there are numerous clinical implications of our study.

First, for surgeons with laparoscopic training, skills, and experience who prefer a TEP repair, a prior prostatectomy should not be an absolute contraindication. Consistent with reports in the literature, this approach is safe and effective in this patient population. The differences in operative duration do not seem to affect patient risk and are unlikely to alter case flow or operational logistics. Alternatively, for surgeons who have less experience with TEP repairs, an open hernia repair may offer similar operative duration, complications, and outcomes with the exception of a slower return to ADL.

There are several limitations that require mention. Any study that measures recurrence without systematic postoperative

imaging or clinical assessments may be affected by missed asymptomatic or subclinical recurrences. This possibility was vetted vigorously in our patient selection process, requiring follow-up within our health system to qualify as adequate follow-up; if a patient were to go to a surgeon outside of our health system for diagnosis and treatment of recurrence while still maintaining other medical care at our institution, this recurrence might be missed. Estimated blood loss was intentionally removed from this analysis because each surgeon estimated the small amount of blood loss in different ways, which resulted in inconsequential values when analyzed as a whole. In addition, we were unable to include subgroup analysis divided by the type of prostatectomy. Both subgroup sample size and the rate of notable outcomes, such as recurrence or chronic pain, were too infrequent to create well-powered results which may have introduced bias into our study, although anecdotally, our surgeons do not think that the dissection is substantially more difficult after open compared to minimally invasive prostatectomy. The challenging aspect of the dissection in these patients tends to be near the bladder and lower pelvis; all types of prostatectomy require extensive dissection of this area. Lastly, the only prior surgical history included in this review was prior inguinal hernia repair and prostatectomy. Patients who underwent another extensive form of abdominal surgery not collected may get matched to another patient who is not actually similar. For example, if a case patient had a prior ileostomy or groin dissection in addition to a prostatectomy and was matched to a patient with no prior abdominal operation, this would be an unfair comparison. Luckily, the incidence of these operative complexities is rare in our patient cohort, and it is unlikely that a surgeon would attempt a TEP repair in the former group.

In summary, our data suggest that a prior prostatectomy has comparable safety, efficacy, and efficiency to those patients without this surgical history and thus may be offered by surgeons experienced in laparoscopic surgery who prefer this repair. A prior prostatectomy alone should not be an absolute contraindication to TEP repair, although it may influence a surgeon's decision-making depending on various patient and surgeon-related variables. TEP seems to be equivalent to open hernia repair in prior prostatectomy patients and has the added benefit of faster return to ADLs. These data support other literature aimed at expanding operative approaches for patients with prior prostatectomy who present with inguinal hernia and offers a reasonable alternative treatment option.

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Conflict of interest/Disclosure

None of the authors have conflicts of interest to report.

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Discussion

Dr Michael S. Nussbaum (Roanoke, VA): This excellent review of a prospectively collected hernia database aimed to evaluate the safety, efficacy, and efficiency of laparoscopic totally extraperitoneal (TEP) inguinal hernia repair in patients with prior prostatectomy compared with matched controls without prior prostatectomy as well as post prostatectomy patients who underwent open inguinal hernia repair. Although operative duration was longer in the prostatectomy group and there were more peritoneal tears, the length of stay, return to activity, complications, rate of recurrence and chronic pain were equivalent. When compared to open hernia repair in these patients, the TEP group had equivalent rates of complications and outcomes with a faster return to activities of daily living. They conclude that TEP repair in patients with prior prostatectomy offers similar outcomes to open repair with a shorter recovery which is an important observation. I applaud you and your colleagues for the work.

I have several questions:

- The authors propose that prostatectomy increases the risk of inguinal hernia development, and primarily the indirect type. Since indirect inguinal hernia is a congenital defect, are the authors implying that there is a correlation between indirect inguinal hernia and the development of prostate cancer? Further, if there is such a strong correlation, should we be advocating for operative evaluation for inguinal hernia and consideration for repair at the time of prostatectomy?

- Fifty percent of the patients studied had undergone open prostatectomy. Were separate comparisons made between the TEP after open versus TEP after minimally invasive prostatectomy? I would expect that the preperitoneal dissection would be much more difficult in a patient with a lower midline incision versus laparoscopic incisions.
- Please describe how the preperitoneal dissection was accomplished in patients with lower midline incisions. Was dissection carried out bilaterally in all or only when there was clinical suspicion for bilateral inguinal hernia?
- How were peritoneal tears handled? Why not use a TAPP approach, particularly in patients with prior open prostatectomy?
- Finally, did any of the prostatectomy patients undergo radiation therapy? If so, were there any differences in their operative outcomes?

Dr Zachary Callahan: Thank you for these interesting questions. In regards to the question regarding a correlation between indirect hernias and prostate cancer, we are not implying a correlation rather we are reporting a predisposition to indirect inguinal hernia development after prostatectomy. This correlation was first reported in the mid-1990s but has been supported in numerous studies since, many that evaluate robotic/laparoscopic prostatectomy in addition to the open procedure. The reviewer's point is well taken though. We agree that a patent processus vaginalis is a



congenital defect that heavily increases the risk of indirect inguinal hernia development. How a prostatectomy further increases this risk is not perfectly understood. However, prior studies have hypothesized that stretching or damage to the muscles of the posterior rectus sheath or abdominal wall musculature in general may loosen the internal ring predisposing to herniation in the future. Some studies do support evaluation of bilateral inguinal canals during prostatectomy and prophylactic closure on a case-by-case basis. Some authors call for prophylactic hernia repair during prostatectomy of subclinical hernias in all patients found to have a patent processus vaginalis.

With regards to the question about dividing patients into subgroups based on type of prostatectomy. This analysis was completed but because the subgroup sample sizes (14 MI vs 15 open) and the number of positive outcomes (1 recurrence, 0 chronic pain) were so small, it was difficult to draw meaningful conclusions from these data. This may have introduced bias into our study though anecdotally, our surgeons do not feel that the dissection is substantially more difficult after open compared to minimally invasive prostatectomy. The challenging aspect of the dissection in these patients tends to be distally, near the bladder and lower pelvis; all types of prostatectomy require extensive dissection of this area.

Referring to the question about operative technique. The operative methods were the same for both TEP groups with the following exception. TEP after prostatectomy patients received Foley catheter placement after anesthesia induction as a safety measure; we have found that a Foley balloon is helpful in identification and protection of the bladder especially when dissecting scarred tissue planes. In patients with a midline incision, from prior open prostatectomy or otherwise, port placement was not altered and it was not unusual for ports to be placed within the midline scar. A dissection balloon was not typically used and the preperitoneal space was bluntly dissected. In both patient groups, the contralateral side was not routinely dissected unless indicated clinically. Peritoneal tears were closed with clips during TEP repair.

We acknowledge that a TAPP approach is also a reasonable treatment option for prior prostatectomy patients and this is supported in the literature. Our institution prefers the TEP repair and felt that the outcomes of TEP after prostatectomy were less addressed in the literature and thus would benefit from further study.

Lastly, to answer the question about radiation. Unfortunately, radiation therapy was not collected or evaluated in this study. It is likely that, similar to a sub-analysis of prostatectomy type, a \pm radiation subgroup analysis would have lacked sufficient statistical power.

Dr Gerald Fried (Montreal, QC): I would like to congratulate you and your group on doing this study. I think oftentimes we make clinical decisions based on either dogma or what seems like good logic, without actually looking at the evidence. So, it is nice to have evidence.

My question relates to the instructions that you give your patients about resumption of normal activities after surgery. In an early randomized controlled trial of laparoscopic versus open inguinal hernia repairs, it was found that if the patients don't know which operation they have had, and if you give both groups the same instructions, they actually recover at a very similar rate. My question is whether there may have been some bias in the instructions that you gave your patients about when they could resume their full activities.

Dr Zachary Callahan: That's a great question. Our postoperative orders and discharge instructions are identical regardless of type of hernia repair.

Dr R. Matthew Walsh (Cleveland, OH): When did the peritoneal tears happen? Did they happen with the initial balloon dissection or during the dissection?

Dr Zachary Callahan: That's an excellent question, and it brings to light an important point which is that our institution typically does not use dissection balloons. An incision is made at the umbilicus and a pocket is dissected bluntly. We encountered peritoneal tears most commonly during the distal dissection close to the bladder and low pelvis which tend to be scarred after prostatectomy.

Dr R. Matthew Walsh (Cleveland, OH): So, if a patient comes in with a unilateral hernia after prostatectomy, what you would advise? Open, TEP or TAPP?

Dr Zachary Callahan: This is a difficult question but if this patient presents to our institution, I would recommend a TEP repair. At institutions where surgeons are less experienced with TEP, an open repair is completely reasonable but our study suggests that patients will have a much longer recovery.