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ORIGINAL ARTICLE

Pain after totally extraperitoneal (TEP) hernia repair might fade out within a year

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Abstract
Background The incidence of chronic pain after endoscopic hernia repair varies between 1 and 16 %. Studies regarding the course of pain in time after the operation are scarce.
Methods 473 male patients ≥18 years of age, scheduled for totally extraperitoneal (TEP) hernia repair (Prolene® mesh) between March 2010 and August 2012 were requested to record pain symptoms preoperative, and 1 day, 1 week, 6 weeks, 3 months and 1 year postoperatively and visit the outpatient department 3 months and 1 year postoperatively for a standardized interview and physical examination.
Results Preoperatively, 25 % ($n = 114$) of the patients had moderate-to-severe pain (NRS 4–10). Six weeks postoperatively, 3 % ($n = 12$) of the patients still experienced moderate-to-severe pain. Three months after TEP, only 3 patients (0.6 %) had moderate-to-severe pain, while 83 patients (18 %) experienced mild pain. One year after TEP, 39 patients experienced mild pain (8 %) and 3 patients moderate pain (0.7 %), no patients experienced severe pain after 1 year. Patients with moderate-to-severe pain preoperatively had a higher risk of pain persisting until 3 months and 1 year postoperatively ($p = 0.03$). In most patients who had pain 3 months postoperatively and were pain-free 1 year after TEP, pain 'faded out' at 4–6 months postoperatively. Two patients had a not-painful recurrent hernia, diagnosed 2 and 5 months after TEP repair.
Conclusion Moderate-to-severe pain after TEP hernia repair is self-limiting, with less than 1 % of the patients reporting moderate pain 1 year postoperatively.

Keywords Inguinal hernia · TEP repair · Postoperative pain · Course of pain

Introduction

Ever since the introduction of mesh repair in groin hernia surgery, postoperative pain has outnumbered recurrence as the most important complication after groin hernia repair [1]. Pain following inguinal hernia repair can be debilitating and often leads to costly multidisciplinary medical consultations [2].

The reported incidence of pain after all types of inguinal hernia repair varies between 2 and 53 %, with approximately a third of these patients encountering functional impairment in work or leisure activities [3, 4]. About one percent of all patients are referred to a specialized pain clinic [5]. Endoscopic inguinal hernia repair is a well-accepted alternative to open surgery and has advantages as a faster postoperative recovery and an alleged lower incidence of postoperative pain than after open repair [6].

The wide variety in incidence rates of pain described after inguinal hernia repair is due to differences in the definition, measurement and timing of assessment [2]. According to the International Association for the Study of Pain (IASP), chronic pain is defined as pain or discomfort lasting for more than 3 months after the injury [7]. Other authors define chronic pain after inguinal hernia repair as "persisting for at least 6 months or even a year

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postoperatively" [8]. To extend the definition of chronic postoperative groin pain to at least 6 months seems to be more realistic, since this allows alleged mesh-related inflammatory response reaction, as a causative factor of pain, to cease [9].

According to the European Association of Endoscopic Surgery (EAES), reliable instruments for the evaluation of post-herniorrhaphy pain are the Numeric Rating Scale (NRS) and the Inguinal Pain Questionnaire (IPQ) [10].

Despite an overwhelming amount of publications on post-herniorrhaphy pain, little is known about the course in time of postoperative pain. This information might be important to inform patients about and for the design of protocols for diagnostic and treatment strategies in future.

The aim of the present study is to prospectively describe the incidence and course of pain over time following TEP hernia repair.

Methods

The study was conducted in a dedicated hernia clinic in the Netherlands; in this clinic endoscopic totally extraperitoneal (TEP) hernia repair is the preferred operative technique in adult patients with groin hernias. All patients are operated upon by four surgeons with reasonable experience (>1000 procedures/surgeon), procedures are performed under general anaesthesia. The operative details of the TEP technique is well described elsewhere [11]. Fixation of the mesh is not performed, since this reduces operative time, saves costs and avoids possible entrapment neuralgia [12]. Skin closure is achieved using subcutaneous monocryl. Patients are routinely discharged on the day of surgery. Patients are advised to avoid strenuous physical activity during the first postoperative week.

All hernia repairs are registered in a database, where demographic data, hernia type, method of repair, and information regarding outcome are collected prospectively.

Male patients, at least 18 years old with a primary, unilateral inguinal hernia were eligible for inclusion in this study and scheduled for a TEP with a heavy weight mesh (Prolene®) between March 2010 and July 2012. Preoperatively, informed consent was obtained. The study was approved by the local medical ethical committee (VCMO, Nieuwegein, The Netherlands).

Patients were requested to record pain symptoms preoperatively, at day 1, day 7, after 6 weeks, 3 months and 1 year postoperatively. Inguinal pain was scored by the patients using a numeric rating scale (NRS 0 = no pain, 10 = worst pain imaginable). These pain scores were categorized as no (0), mild (1–3), moderate (4–7) or severe (8–10) pain; moderate and severe pain were combined and as such considered to represent substantial pain (NRS 4–10) [14]. The NRS pain scores were general and not specified between pain during rest and pain during activity. Pain and feelings of discomfort related to daily activities and sports were scored by the patients using the Inguinal Pain Questionnaire (IPQ) [13]. Pain related to sexual function was assessed by the PSF (pain related to sexual function) questionnaire, a Dutch translation of the questionnaire described by Aasvang et al. [15]. To analyse the localisation of the pain we used the PSF questionnaire. Patients could report the following localisations and one or more answers were permitted: scrotum, penis, medial thigh, pubic bone, groin (site of hernia) and surgical incision (umbilical, pubic, lateral). Pain in the testis was explicit questioned by the IPQ.

All patients visited the outpatient department at 3 months and 1 year after surgery for a standardized interview and physical examination by one of the hernia surgeons or a trained resident. Current pain intensity, character and location of pain and recurrences were evaluated. In patients with substantial groin pain 3 months after surgery, an ultrasound or MRI scan was done in addition.

Statistical analysis

Statistical analyses were performed using SPSS® version 17.0 (SPSS, Chicago, Illinois, USA). Continuous data were analysed using descriptive statistics. To compare the differences in the three groups Chi-square analysis was used for categorical variables. For continuous variables three intergroup comparisons were made using a Student's t test (normally distributed continuous) or Mann–Whitney analysis (not normally distributed continuous). Significance was set at a level of $p \leq 0.05$.

Results

A total of 452 (96 %) consecutive patients treated between March 2010 and July 2010 completed the 3-month follow-up and 429 (91 %) patients the 1-year follow-up (Fig. 1). Among the 23 patients lost to follow-up after 3 months, 19 patients had no pain at 3 months, 2 patients mild pain and 1 patient substantial pain.

Patients were divided into three groups based on the preoperative pain score: group 1 no pain (NRS 0), group 2 mild pain (NRS 1–3) and group 3 substantial pain (NRS 4–10). Baseline characteristics are summarized in Table 1. Groups were similar according to all baseline characteristics, only lateral hernias were seen more frequent in group 3 ($p = 0.03$).

Almost 71 % of all patients reported pain preoperatively, 207 of them (46 %) experienced mild pain

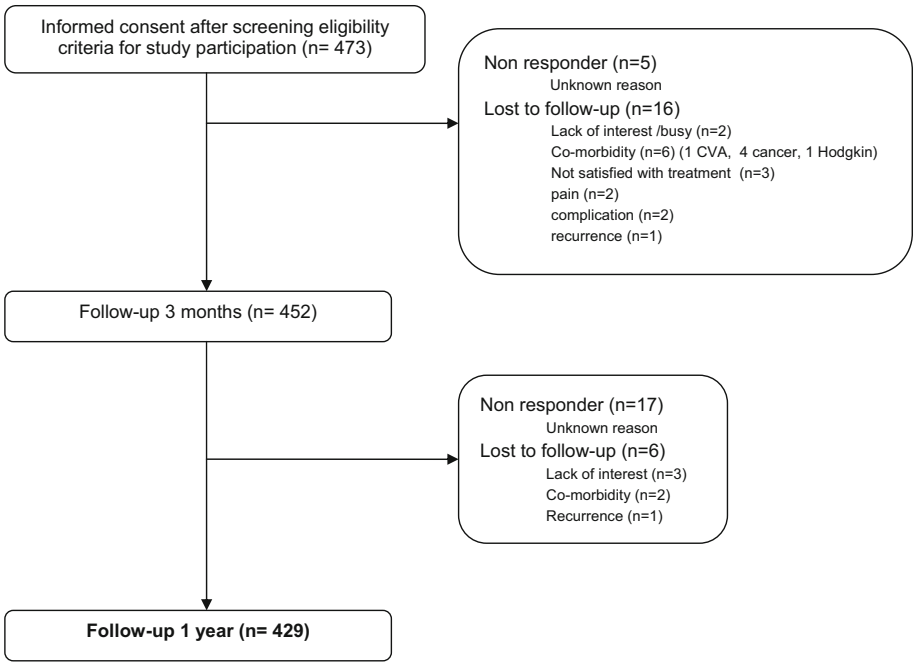

Fig. 1 Flowchart of included patients between March and September 2010

(group 2) and 114 patients (25 %) moderate-to-severe pain (group 3). The remaining 131 patients (29 %) who had no pain before hernia repair (group 1) were operated since they were young (<60 years of age) and had an uncomfortable sensation of a swelling in the groin or mechanical complaints resulting in impairment of daily activities, sports and sex or for cosmetic reason.

Preoperative, the groin pain affected daily life activities, ranging from less concentration on daily activities to necessary bed rest, in 104 patients (23 %). Sport activities were impaired in 37 % of patients and sexual activities in 36 % of all patients. Five patients were unable to work (1 %) and 30 patients (7 %) had to take 1–4 weeks off because of groin pain. The impact of pain on leisure activities and work was higher in patients with substantial pain ($p < 0.005$).

The course of pain in time after the operation for all patients is seen in Fig. 2a.

One week postoperatively, 62 patients (14 %) had moderate-to-severe pain and 262 patients (59 %) complained of mild pain. Six weeks postoperatively, 12 patients (3 %) had moderate-to-severe pain, mild pain was experienced by 103 patients (23 %). The median time to return to work was 7 (SD ± 7) days for all patients. Three months after TEP repair, 4 (0.9 %) patients still had substantial pain, while 83 patients (18 %) experienced mild pain. Most patients (94 %) experience pain starting at the day of operation and the pain decreased in the first weeks after TEP repair. Only in a few cases the pain started after the first week (11 patients) or between 6 weeks and 3 months postoperative (4 patients). This did not occur more often in one of the groups. One year after TEP the majority of patients ($n = 382$, 89 %) had no pain. Most patients with pain 3 months after TEP repair mentioned that pain 'faded out' approximately 4–6 months postoperatively. Of the 47 patients who still experienced 'any' pain after 1 year, only 3 patients (0.7 %) had moderate (NRS 4–6) pain, located in their scrotum (testis).

Pain courses of patients in group 1 with no pain preoperative differ from patients in group 3, starting with substantial pain: the amount of patients experiencing pain after the operation is higher at all time points ($p = 0.03$) and pain fades out less fast in group 3 (Fig. 2b, d). Eighteen patients (15 %) of group 1 experienced any pain after 6 weeks: 15 patients reported mild pain (12 %) and 3 patients substantial pain; however, in group 3 as many as 38 patients (35 %) experienced any pain after 6 weeks, 30 % with mild pain and 5 % with substantial pain. After 1 year only four (3 %) patients of group 1 experienced any pain, all mild pain without impact on daily life activities or work. Among the patients of group 3 still 18 patients (16 %) experienced pain after 1 year, 16 patients with mild pain and two with substantial pain impairing daily leisure activities in 13 patients.

The pain course of group 2 is comparable to the complete cohort (Fig. 2c).

The impact of pain on daily activities, sport, sex and work diminishes over time. After 6 weeks, daily life activities were impaired in 12 patients (3 %), after 1 year, only three patients experienced influence of pain during daily life (Table 2). Ten percent of all patients (43 patients) were not able to do their sports 6 weeks after surgery, only 7 patients after 1 year (1 %). Pain had influence on sexual activity in 18 patients (4 %) after 6 weeks and in 6 patients (1.3 %) after 1 year.

Table 1 Clinical characteristics of patients

	All patients $n = 452$ (100 %)	Group 1 $n = 131$ (29 %)	Group 2 $n = 207$ (46 %)	Group 3 $n = 114$ (25 %)	p**
Median age, years (range)	55 (18–94)	55 (18–83)	55 (19–94)	55 (18–82)	ns***
Mean BMI (SD)	25 (2.5)	25 (2.4)	25 (2.5)	25 (2.7)	ns***
Hernia type (%)					
Direct	24	30	26	16	
Indirect	75	69	74	83	
Femoral	1	1	0	1	**0.03**
Side (%)					
Left	41	46	38	42	
Right	59	54	62	58	0.4
Surgeon (%)					
1	29	28	31	26	
2	27	27	24	30	
3	14	14	12	16	
4	28	28	30	26	
5 resident	3	3	3	2	0.6
Intra-operative complications					
Bleeding	$n = 10$	$n = 2$	$n = 8$	$n = 0$	
Conversion	$n = 1$	$n = 0$	$n = 1$	$n = 0$	**0.08**
Mean operation time (SD)	20 (6.3)	20 (6.1)	20 (6.5)	20 (6.0)	ns***
Other pain complaints (%)					
Headache	4	3	4	5	
Back pain	8	3	9	12	
Other pain	11	9	11	12	0.6

Group 1: no pain preoperatively (NRS = 0), group 2: mild pain preoperatively (NRS = 1–3), group 3: substantial pain preoperatively (NRS = 4–10)

** $p < 0.05$ is significant

*** Medians were compared using three intergroup comparisons; none of these were statistically significant

Patients often localized pain in different regions. While preoperative pain was most frequently experienced inguinal (72 %), the scrotal region was most commonly used to localize postoperative pain (71–78 % depending on the time point; Table 3). Of all patients experiencing pain in the scrotal region, 82–86 % (depending on the time point) reported testicular pain in the IPQ. Dysejaculation occurred in 10 patients preoperative, disappearing in 8 patients after 6 weeks and in 1 patient after 3 months. In 7 patients dysejaculation occurred after the operation and was still present in 3 patients after 1 year. Two patients had a painless recurrent hernia, in one patient diagnosed 2 months, in the other patient 5 months after TEP repair.

Discussion

This prospective cohort study shows that the overall incidence of substantial pain 1 year after endoscopic TEP hernia repair is 0.7 %. This is low compared to other studies and it appears that in most cases postoperative pain is self-limiting, fading out during the first year postoperatively. Pain is higher and lasts longer in patients having moderate-to-severe pain preoperative.

The incidence of any pain 1 year after TEP repair was 10 %, which is low and consistent with the findings of 2 other studies [16, 17]. Clinically relevant pain (NRS 4–10) was only mentioned in 3 patients (0.7 %). Comparable results were demonstrated by Lau and Chowbey [17, 18] with rates of moderate-to-severe pain of 2.2 and 0.5 %, respectively. The low rate of clinically relevant pain could potentially be due to the positive effect of experience and high volume and to the fact that fixation of the mesh was not performed. The most recent systemic review reported an overall incidence of chronic pain after endoscopic repair of 6 % (range 1–16), but follow-up, methods of pain assessment and definition of chronic pain varied and no final conclusion about the exact incidence of chronic pain was made [19].

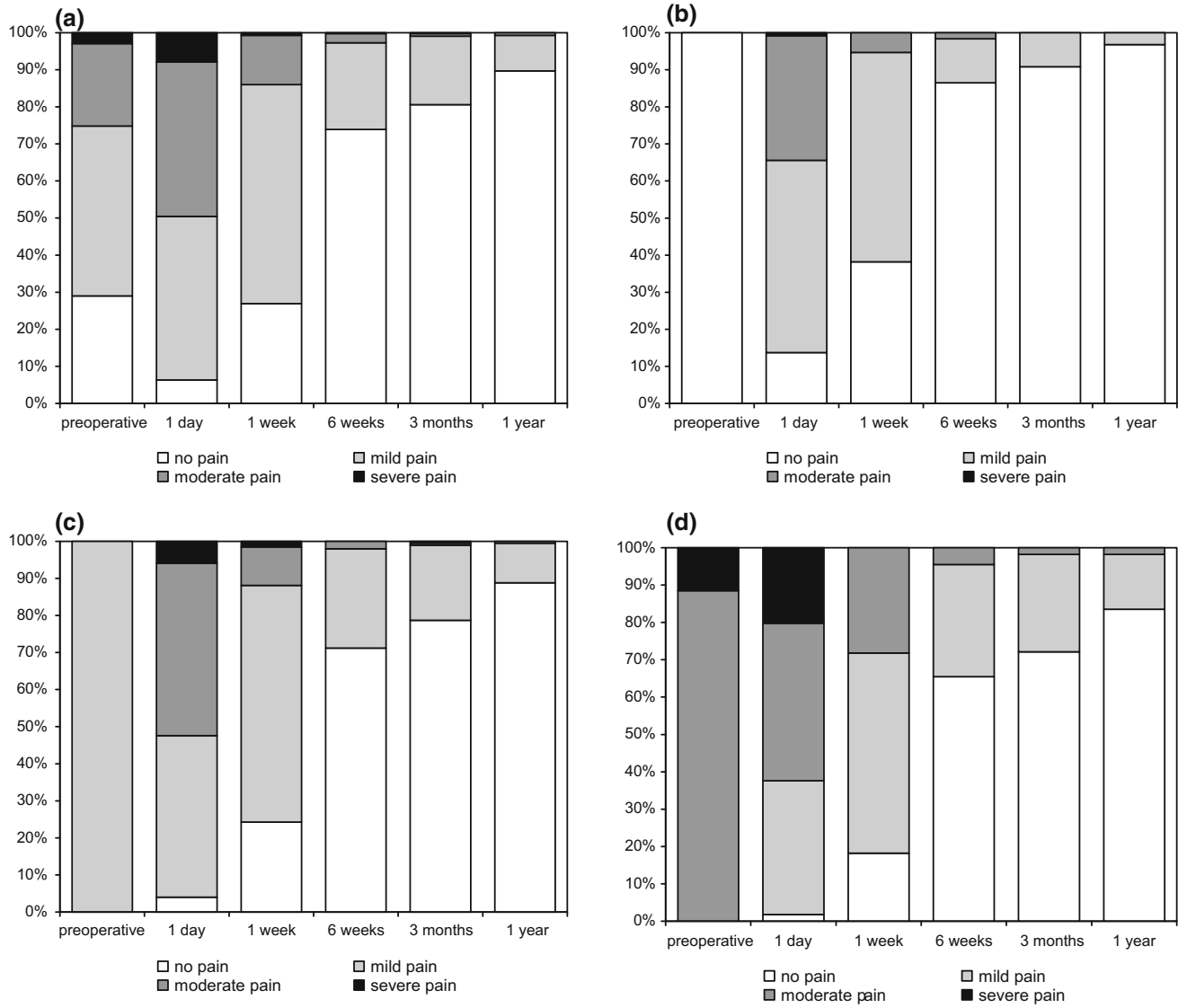

Fig. 2 **a** % Patients with pain before and after TEP: all patients ($n = 452$). **b** Patients without pain before TEP: group 1 ($n = 131$). % Patients with pain after TEP. **c** Patients with mild pain before TEP: group 2 ($n = 207$). % Patients with pain after TEP. **d** Patients with substantial pain before TEP: group 3 ($n = 114$). % Patients with pain after TEP

Data of this study also showed that pain fades out during the first postoperative year after TEP repair. In the first 6 weeks postoperatively, a substantial proportion of patients (i.e. 26 %) experienced some degree of pain, but this decreased to, respectively, 19 and 10 %, 3 months and 1 year postoperatively. One year after TEP, only 1 % of the patients had moderate pain interfering with daily activities in less than 1 %, with sports in 2 % and with sexual functioning in 1.3 %. Detailed and well-designed data assessing the time course of pain after endoscopic inguinal hernia repair are limited. Only one study described pain course during the first year after TEP in detail reporting any pain after 3 months and 1 year as 7.1 and 4.8 % and severe pain as 2.6 and 0.5 %, respectively [18]. Bittner et al. [20] found comparable declining pain incidences when patients were seen postoperative, at 1 week, 4 weeks, 6 months and 1 year after TAPP surgery. Previous studies describing pain after conventional mesh or non-mesh techniques suggest a similar 'burn out' effect' of pain [21–23]. This phenomenon can be explained regarding pathophysiology of post-hernia repair pain. As described by Amid et al. [24], post-hernia repair pain can be classified in neuropathic and non-neuropathic or nociceptive causes, and is not infrequently a combination of both. Inflammatory-mediated nociceptive pain, assumed as the causative factor after endoscopic repair, is basically a self-limiting condition because the inflammatory reaction diminishes over time. It is assumed to last up to 6 months postoperatively [25].

Table 2 Impact of pain on daily activities, driving car or perform sports by IPQ form

Worst pain past week	Preoperatively	6 weeks	3 months	1 year
No pain	116 (24.5)	316 (68.7)	370 (81.8)	389 (90.7)
Can easily be ignored	146 (30.9)	101 (22.0)	56 (12.4)	28 (6.5)
Cannot be ignored, no interference with daily activities	101 (21.4)	31 (6.7)	19 (4.2)	9 (2.1)
Interference with concentration on chores and daily activities	*55 (11.6)*	*7 (1.5)*	*5 (1.1)*	*2 (0.5)*
Interference with most activities	*33 (7.0)*	*4 (0.9)*	*0 (0.0)*	*1 (0.2)*
Need bed rest because of pain	*8 (1.7)*	*1 (0.2)*	*2 (0.4)*	*0 (0.0)*
Need prompt medical advice because of pain	*14 (3.0)*	*0 (0.0)*	*0 (0.0)*	*0 (0.0)*
Interference driving a car	*59 (12.5)*	*24 (5.2)*	*12 (2.7)*	*7 (1.6)*
Interference sports	*177 (37.4)*	*45 (9.8)*	*27 (6.0)*	*7 (1.6)*

Values are number of patients with percentages in parenthesis

Value in italics indicate if pain interferes with daily activities, driving car or perform sports

Table 3 Localisation of preoperative and postoperative pain (PSF questionnaire)

	Preoperatively	6 weeks	3 months	1 year
Patient with pain (*n*)	170	112	76	28
Localization of pain[a] (*n*, %)				
Inguinal	123 (72)	43 (38)	24 (32)	10 (36)
Scrotum[b]	59 (35)	87 (78)	55 (72)	20 (71)
Medial thigh	9 (5)	6 (5)	4 (5)	1 (4)
Pubic region	29 (17)	14 (13)	8 (11)	4 (14)
Surgical incision				
Umbilical	–	15 (14)	5 (7)	–
Pubic	–	2 (1)	1 (1)	–
Lateral	–	9 (8)	–	–

[a] Patients often located pain in more than 1 region

[b] Depending on the time point 82–86 % reported this pain to be testicular in the Inguinal Pain Questionnaire

The difference of the time course of pain 1 year after TEP in patients without pain preoperatively compared to patients with substantial pain in this study was significant and not described in former studies. These data are important to inform patients about their prognosis and reset patient's expectations regarding recovery.

In this study, postoperative pain was often localized at the scrotal or genital region, while inguinal pain was seen more frequently preoperatively.

Genital or scrotal skin pain might be caused by injury to the genital branch of the genitofemoral nerve [26]. However, most patients in our study with pain in the scrotal region, complained of testicular pain. Amid et al. [27] hypothesized that this orchalgia might be related to injury to nerve fibres originating from the hypogastric plexus, rather than being related to direct injury of the (genital branch) of the genitofemoral nerve. The testis is innervated by the spermatic plexus, a complex set of nerves originating from the hypogastric plexus [28]. However, branches of the ileoinguinal and genitofemoral nerves also supply sensation of the tunica vaginalis. Dissection of the preperitoneal space, expanding the space of Bogros and Retzius and isolating the spermatic cord might cause injury of these small nerve branches. The mechanism responsible for post-TEP orchialgia is complex, but merely temporary as testicular pain ceases over time in 96 % of patients in our study. In a study analysing ipsilateral orchialgia after laparoscopic donor nephrectomy, testicular pain spontaneously resoluted after 6.3 months [29].

Only two patients developed a recurrent hernia; one occurred within 2 months after TEP, suggestive of technical failure, the other occurred 5 months postoperatively. Both patients did not experience postoperative pain. This suggests that, although a recurrence is often the only diagnosis that surgeons consider when a patient presents with pain following inguinal hernia repair, the origin of (chronic) postoperative pain should be often found elsewhere [4].

In conclusion, the incidence of substantial pain 1 year after endoscopic TEP hernia repair is low, although a relatively high percentage of patients experience any pain symptoms in the first 6 weeks to 3 months after TEP repair. Patients with preoperative substantial pain have a higher risk to have complaints after 3 months and 1 year, but still in most patients pain fades away after 4–6 months.

Following this self-limiting time course of pain and the low risk of hernia recurrence in patients with pain, (surgical) re-intervention or diagnostic re-examination should not be considered too early in the follow-up of these patients.

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