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ORIGINAL ARTICLE

Long-term outcome of surgical treatment of chronic postoperative groin pain: a word of caution

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Abstract
Purpose Chronic postoperative groin pain is widely accepted to be a serious clinical condition after inguinal hernia repair and Pfannenstiel incision. Surgical treatment has been reported to be effective, but the long-term outcome following these interventions remains unclear. This retrospective study reports the outcome and investigates patient and intra-operative factors to identify possible predictors of success. A literature review of other outcome studies with more than 1 year follow-up is also presented.
Methods A registry of patients who underwent surgery for chronic postoperative groin pain was analyzed. Pain was assessed using DN4-score and VAS-scale. Primary endpoint was successful pain reduction, as defined by the ratio of VAS_{max} (post/pre) and the subjective outcome (better vs. same-worse).
Results Fifteen patients underwent surgery for chronic postoperative groin pain between December 2000 and April 2010. Overall, significant pain reduction was achieved in 1/3 of patients. There was no significant association between patient or intra-operative factors and favorable outcome. A complete concordance between subjective outcome and the ratio of VAS_{max} (post/pre) was noted.
Conclusion The success of surgery for chronic postoperative groin pain is difficult to predict. In this study, one in three patients benefits from an operative treatment. The ratio of VAS_{max} (post/pre) is suggested as a useful pain assessment tool. A further prospective study of sufficient sample size is necessary to identify possible factors associated with favorable outcome after surgery for chronic groin pain.

Keywords Inguinal hernia repair · Pfannenstiel incision · Chronic postoperative groin pain · Surgical treatment · Pain reduction

Introduction

The lifetime prevalence of inguinal hernia is estimated at 27 % for men and 3 % for women, thus making inguinal hernia repair one of the most frequently performed surgical procedures [1]. Hernia recurrence as a postoperative complication has been strongly reduced with the introduction of mesh implantation, shifting research interest toward chronic groin pain [2].

Frequency of chronic postoperative groin pain has been reported ranging from 11 to 54 % of the patients [3–5]. It is known to be moderate to severe in 1.9 to 3 %, having a severe impact on quality of life [4–6].

The cause of pain is widely accepted to be neuropathic (nerve injury) or nociceptive (tissue injury or inflammatory reaction). Both neuropathic and nociceptive pain are possible after inguinal hernia repair, whereas pain after Pfannenstiel incision is mainly neuropathic. Many risk factors for the development of chronic pain have been described including young patient age, female gender, high preoperative and postoperative pain scores, and recurrent hernia repair [3, 7, 8].

At present, a clear consensus concerning the management of chronic groin pain after surgery of the lower abdomen (inguinal hernia repair, Pfannenstiel incision) is lacking. Along with conservative strategies, surgery is to

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be considered in some patients. Selective or triple neurectomy and mesh removal have been successful in several studies [9–13]. Sufficient data are lacking and it remains unclear, which subset of patients will benefit from surgery. The objective of our retrospective study is to investigate the outcome of surgery for chronic postoperative groin pain in our tertiary referral center. A secondary goal is to investigate if we can detect patient or intraoperative factors that predict a better outcome after surgery for postoperative chronic groin pain. We also compare our results with a literature review of other outcome studies (>1 year follow-up).

Materials and methods

Study population

Patients who were referred to our service of Abdominal Surgery at the University Hospital of Gasthuisberg (Leuven, Belgium) for chronic postoperative groin pain (>3 months [7]) were reviewed. Those who underwent surgical treatment in our service between December 2000 and April 2010 were included. Patients with recurrent inguinal hernia and other suspected causes for chronic groin pain not related to the previous surgery were excluded. When the resection of a preperitoneal lipoma resulted in pain relief, the patient was excluded.

Data collection

Patient data including demographics as age and gender, type and details of previous surgery were recorded.

Details of previous surgery were reviewed and ascertained when not performed in our center. The type of surgical procedure (inguinal hernia repair, Pfannenstiel incision or abdominoplasty), laparoscopic or open, was investigated.

Despite high prevalence of chronic postoperative groin pain, a standardized system for the assessment of it is lacking. In our center, as a part of standard anamnesis, patients were asked to fill out a questionnaire pre- and postoperatively to determine the characteristics of their pain and to score it using the validated DN4-score (Table 1) and VAS-scale (Fig. 1). In some patients, however, the preoperative scores were not obtained at that time. To complete our data, these patients were asked to recall about the pain as it was before the surgical intervention for chronic pain. Pain was defined to be of neuropathic type when DN4-score was 4 or more [14, 15]. VAS-scale was registered for resting conditions, normal activities (e.g., walking, driving a car, etc.), more challenging physical activities (e.g., sports, sexual intercourse, lifting heavy objects, etc.), and for the worst pain experienced during the last 24 h. We defined VAS_{max} as the highest overall score.

Table 1 DN4 Questionnaire [14]

Question 1: Does the pain have one or more of the following characteristics?
1. Burning yes/no
2. Painful cold yes/no
3. Electric shocks yes/no
Question 2: Is the pain associated with one or more of the following symptoms in the same area?
4. Tingling yes/no
5. Pins and needles yes/no
6. Numbness yes/no
7. Itching yes/no
Question 3: Is the pain located in an area where the physical examination may reveal one or more of the following characteristics?
8. Hypoesthesia to touch yes/no
9. Hypoesthesia to prick yes/no
Question 4: In the painful area, can the pain be caused or increased by:
10. Brushing yes/no

The Douleur Neuropathique four Questionnaire includes a series of four questions consisting of both sensory descriptors and signs related to bedside sensory examination

Pain was defined to be of neuropathic type when DN4-score was four or more

In the present study, a Dutch translation of the questionnaire was used

The presence of important preoperative and early postoperative pain at the time of the primary surgery, duration of pain before surgical treatment and length of follow-up were assessed.

Surgery

All included patients were operated on in the University Hospital of Gasthuisberg (Leuven, Belgium) by the same surgeon (M.M.). Most surgical procedures were performed under general anesthesia. One patient was operated on using a combination of sedation, TAP block and local anesthesia. During a TAP block, local anesthetics are infiltrated in the transverse abdominal plane (TAP) between the internal oblique and transverse abdominal muscle, resulting in a sensory block of T6 to L1.

Procedures were classified as neurectomy, mesh removal procedure (partial or complete), combination of both, or another surgical procedure (exploration, infiltration). A neurectomy procedure was performed either as a selective neurectomy or as a standard triple neurectomy (ilioinguinal, iliohypogastric, and genitofemoral nerve) as defined in literature (as proximally and distally as possible, but never to the level of the psoas muscle) [16]. Most

Fig. 1 VAS

The Visual Analogue Scale consists of a horizontal line, 100 mm in length, anchored by word descriptors at each end. The patients mark on the line the point that they feel represents their perception of their current pain. The VAS score is determined by measuring in millimetres from the left hand end of the line to the point that the patient marks. These scales are of most value when looking at change within individuals, and are of less value for comparing across a group of individuals at one time point.

In the present study, the patients were asked to do this for four conditions:

1. How much pain have you perceived the last 24 hours during rest?
2. How much pain have you perceived the last 24 hours during normal activities of daily life (e.g. walking, going up staircases, driving your car, getting up from a chair, etc.)?
3. How much pain have you perceived the last 24 hours during sports, sexual intercourse, challenging physical activities or lifting heavy objects (which before you lifted with ease)?
4. How important did you perceive the worst pain during the last 24 hours?

resected specimens of a neurectomy were sent of for histological confirmation.

Many procedures were performed by a combined open and laparoscopic approach [17], however neurectomy or mesh removal was always performed during the open approach. Laparoscopy was performed and served for exploration (evaluation of the absence of a recurrent hernia, correct position of a preperitoneal mesh), and in one case for preperitoneal mesh placement (TEP) after (anterior) mesh removal. The decision of the exact type and extent of surgery depended on the preoperative data and intraoperative findings, and was decided ad hoc. In principle, a well flattened and nicely unfolded mesh was not resected, as there was no systematic exploration of all nerves. A neurectomy was not performed when there was no indication of neuropathic pain.

Study endpoints

Success was defined as pain reduction by the ratio of the VAS_{max} (post/pre) and overall subjective pain perception (better vs. same-worse).

Statistical analysis

The outcome after the second intervention was evaluated using (1) the ratio of the VAS measurement at last follow-up and the preoperative VAS measurement, (2) a subjective pain assessment (better vs. same-worse). Relations with the set of variables were evaluated using Spearman correlations, Fisher's exact tests, Mann–Whitney *U* tests and exact trend tests. Due to the low number of patients, relations were only explored in a univariable setting. *P* values less than 0.05 were considered significant. No corrections for multiple testing were considered. Therefore, a single (significant) *P* value should be interpreted carefully.

All analyses have been performed using SAS software, version 9.2 of the SAS System for Windows. Copyright © 2002 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

Results

Between December 2000 and April 2010, 18 patients underwent surgical treatment for chronic postoperative groin pain. Three patients were excluded, one because of recurrent hernia and two in whom the resection of a preperitoneal lipoma led to pain reduction. Fifteen patients were left for further analysis.

Raw data of major patient characteristics are available in Table 2, results of the statistical analysis with respect to potential patient or intraoperative factors that could predict the outcome of the surgical therapy are illustrated in Table 3. No investigated patient or intra-operative factor was found to have a significant association with favorable outcome.

When neuropathic pain was diagnosed and the nerves were identifiable during exploration, neurectomy was performed. Neurectomy alone was performed in three patients, two by an open and one by a combined open and laparoscopic approach. In one of these patients, a neuroma was found and resected.

Mesh removal was always performed by an open anterior approach, sometimes preceded by a laparoscopic exploration. Meshes were removed in two patients, one by an open and one by a combined approach. Three patients were treated with combined neurectomy and mesh removal, one by an open and two by a combination of open and laparoscopic approach. In one case, a partial mesh removal was performed due to a rim of mesh against the inguinal ligament, in the rest a total mesh removal was performed because of meshoma or poorly unfolded mesh.

In the remaining seven patients, four laparoscopic, two open and one combined explorations were performed without neurectomy or mesh removal. Four of them were infiltrated with local anesthetics, and in two infiltrations

Table 2 Major patient characteristics

Patient (sex, age)	Previous surgery	Neuropathic pain type?	VAS_{max}(pre)	Second intervention			Follow-up (months)	Ratio of VAS_{max} (post/pre)	Subjective
				Neurectomy	Mesh removal	Other			
♂, 40y	Laparoscopic	1	10			x^{O}	21.5	0.9	Same
♂, 61y	Laparoscopic	1	9			x^{O+L}	44	1	Same
♀, 45y	Laparoscopic	0	10			x^{L}	117.7	0.50	Better
♂, 56y	Laparoscopic	0	8.5			x^{L}	32.8	0.82	Same
♂, 58y	Laparoscopic	0	7.6			x^{L}	49.6	0.95	Same
♂, 54y	Laparoscopic	0	3.2			x^{L}	16.7	1	Same
♀, 48y	Pfannenstiel[a]	1	9.1			x^{O}	3.2	1.08	Worse
♀, 32y	Pfannenstiel[b]	1	8.5	x^{O}			1.8	0	Better
♀, 41y	Abdominoplasty	1	10	x^{O}			16.6	0.95	Same
♂, 28y	Laparoscopic	1	3.3	x^{O+L}			16.1	2.42	Worse
♀, 36y	Open	0	7.7		x^{O}		25.7	0.39	Better
♀, 45y	Laparoscopic	1	9.6		x^{O+L}		17.6	0.9	Same
♂, 50y	Open	1	7	x^{O+L}	x^{O+L}		20.4	0.06	Better
♂, 44y	Laparoscopic	1	9.2	x^{O}	x^{O}		14.4	0.02	Better
♂, 50y	Laparoscopic	1	7.3	x^{O+L}	x^{O+L}		10.9	0.9	Same

Previous surgery is the initial operation that was performed, causing chronic groin pain. Second intervention is the surgery treatment for pain we performed at our center. We note that many patients underwent other pain therapies and surgery before referral to us

The approach of the second intervention is shown as follows: ^{O} open, ^{L} laparoscopic, $^{O+L}$ combined open and laparoscopic. When a combined approach was used, neurectomy or mesh removal occurred always during the open part of the procedure

[a] In this patient, an appendectomy was performed by a Pfannenstiel incision

[b] In this patient, Pfannenstiel incision was used for a cesarian section

were combined with the resection of a preperitoneal lipoma (without pain relief). So in one patient, the procedure was limited to mere exploration, but this has lead to a subjective pain reduction. It is unknown if this is due to a placebo effect or a spontaneous resolution.

Time between onset of pain and second intervention ranged from 3.6 to 176.3 months, with a median of 30.6 months. The Spearman Correlation Coefficient between this interval and the ratio of VAS_{max} (post/pre) was 0.29982 ($P = 0.2776$). All patients had a follow-up of almost 1 year or longer, except two patients (1.8 and 3.2 months). Median duration of follow-up was 17.6 months (range 1.8–117.7 months). The Spearman Correlation Coefficient between ratio of VAS_{max} (post/pre) and length of follow-up was −0.00718 ($P = 0.9797$).

Subjective pain reduction was achieved in five patients, in eight patients the pain remained identical, and two patients experienced worse pain afterward. One of these two patients was a 28-year-old man with a very complex pain problem after initial laparoscopic total extraperitoneal hernia repair, who underwent multiple previous surgical and conservative treatments without benefit before referral to us. A neuroma of the genitofemoral nerve was found and removed, without pain relief. Afterward, he underwent more surgery (in other centers) and pain clinic treatments with very poor outcome.

The other patient was a 48-year-old woman who had undergone an appendectomy by Pfannenstiel incision. A iliohypogastric neuropathy was suspected, but during open exploration this nerve was not identifiable in a region of bulky scar tissue, which meant a neurectomy was technically impossible. At that time, we did not proceed with a retroperitoneal neurectomy at the level of the psoas muscle. Afterward, multiple treatments in pain clinics were also unsuccessful.

Finally, when we compare the two outcome variables used in the present study, ratio of VAS_{max} (post/pre) and subjective pain assessment (better vs. same-worse), there is a perfect statistical agreement as shown in Table 4. When we implement defined intervals (better = ratio of $VAS_{max} \leq 0.5$; same = ratio of $VAS_{max} > 0.5$ and ≤ 1.5; worse = ratio of $VAS_{max} > 1.5$), a concordance is seen between subjective outcome and objective ratio of VAS_{max} (post/pre) in all but one patient.

Discussion

Chronic postoperative groin pain is a challenging clinical condition generating interest in scientific literature toward a consensus regarding management and treatment. In our study, we present our experience of 15 patients with

Table 3 Potential patient or intraoperative factors that could predict the outcome of the surgical therapy

	N	Ratio of VAS_{max} (post/pre)					Subjective	
		Mean	Median	Min	Max	*P*-value[a]	Better (%)	*P*-value[b]
Overall	15	0.79	0.90	0.00	2.42		33.33	
Previous surgery								
Open	5	0.50	0.39	0.00	1.08	0.356	60.00	0.251
Laparoscopic	10	0.94	0.90	0.02	2.42		40.00	
Pain type								
Neuropathic	10	0.82	0.90	0.00	2.42	0.805	30.00	1.000
Non-neuropathic	5	0.73	0.82	0.39	1.00		40.00	
Second intervention								
Including neurectomy	6	0.73	0.48	0.00	2.42	0.314	50.00	0.329
Without neurectomy	9	0.84	0.90	0.39	1.08		22.22	
Patient age at the time of previous surgery								
<50 years old	9	0.80	0.90	0.00	2.42	0.594	44.44	0.580
≥50 years old	6	0.79	0.93	0.06	1.00		16.67	
Gender								
Male	9	0.90	0.90	0.02	2.42	0.515	22.22	0.329
Female	6	0.64	0.70	0.00	1.08		50.00	
Presence of important preoperative pain								
Yes	4	0.59	0.70	0.02	0.95	0.394	50.00	0.560
No	11	0.87	0.90	0.00	2.42		27.27	
Presence of important early postoperative pain								
Yes	4	0.92	0.93	0.82	1.00	0.512	0.00	0.231
No	11	0.75	0.90	0.00	2.42		45.45	

Min lowest value, *Max* highest value

[a] *P*-value is from a Mann–Whitney *U* test

[b] *P*-value is from a Fisher test

Table 4 Relation between outcome variables

Subjective	*N*	Ratio of VAS_{max} (post/pre)				*P*-value[a]
		Mean	Median	Min	Max	
Overall	15	0.79	0.90	0.00	2.42	
Better	5	0.19	0.06	0.00	0.50	0.002
Same-worse	10	1.09	0.95	0.82	2.42	

Min lowest value, *Max* highest value

[a] *P*-value is from a Mann–Whitney *U* test

different types of initial surgery (open or laparoscopic inguinal hernia repair, Pfannenstiel incision, abdominoplasty) and different pain types (neuropathic or nociceptive). Many of these patients underwent previous unsuccessful pain treatment or surgery before referral to our tertiary center. The decision of the exact type and extent of surgery was tailored to the preoperative data and intraoperative findings. Accordingly, surgery consisted of neurectomy, (partial) mesh removal, combination of both, or exploration. Pre- and postoperative pains were assessed and compared, with a median length of follow-up of 17.6 months.

We used the definition of chronic postoperative groin pain as a pain lasting for >3 months after the initial operation. We are well aware that, in the international guidelines of Alfieri et al. [7] in 2011, the working group suggests the definition should be modified from >3 to >6 months. In our study group, the duration of pain was less than 6 months in only 1 patient, and less than 1 year in only 2/15 patients.

Overall, significant pain reduction was achieved in only 1/3 of patients. When reviewing the literature concerning the surgical treatment of chronic postoperative groin pain, there are nine articles with a sufficient follow-up of more than 1 year. These are shown in Table 5.

In six of these studies, surgical treatment was tailored with an open exploration and a neurectomy and/or mesh removal and/or removal of staples, depending on the peroperative findings. Pain reduction was achieved in 69 to 100 % of patients. Apart from the studies performed by Delikoukos and Ducic et al. [10, 12, 19, 22–24] all of these

Table 5 Literature review for surgical treatment of chronic postoperative groin pain

References	Sample size	Neuropathic pain?[a]	Follow-up (months)[b]	Surgical treatment strategy[c]	Results[d]
Vuilleumier et al. [13]	43	Yes	12	Standard open exploration + double neurectomy (IIN + IHN) + resection of prosthetic material along involved nerve	Better = 100 % Same-worse = 0 %
Zacest et al. [25]	26	Yes	35	Standard open exploration + neurectomy IIN + mesh removal	Better = 66,7 % Same-worse = 33,4 %
Heise et al. [26]	20	No	16	Open exploration + standard mesh removal ± tailored neurectomy IIN/IHN/GFN	Better = 60 % Same-worse = 40 %
Bower et al. [23]	15	Yes	66	Open exploration ± tailored neurectomy IIN/IHN/GFN ± alcohol injection	Better = 86,6 % Same-worse = 13,4 %
Delikoukos et al. [10]	6	No	28	Open exploration ± tailored neurectomy IIN and mesh removal ± staple removal	Better = 100 % Same-worse = 0 %
Ducic et al. [24]	19	No	21.5	Open exploration ± tailored neurectomy IIN/IHN/GFN ± decompression LFCN	Better = 89 % Same-worse = 10 %
Giger et al. [19]	39	Yes	12	Tailored endoscopic retroperitoneal neurectomy GFN ± IIN	Better = 69 % Same-worse = 31 %
Loos et al. [22]	22	Yes	24	Open exploration ± tailored neurectomy IIN/IHN	Better = 87 % Same-worse = 13 %
Loos et al. [12]	49	Yes	18	Open exploration ± tailored neurectomy IIN/IHN/GFN ± mesh removal	Better = 76 % Same-worse = 24 %

[a] Does the study provide clear inclusion criteria for neuropathic pain?

[b] Mean follow-up is given in all studies but the two of Loos et al., in which median follow-up is given

[c] *IIN* ilioinguinal nerve, *IHN* iliohypogastric nerve, *GFN* genitofemoral nerve, *LFCN* lateral femoral cutaneous nerve

[d] Results of the studies mentioned above were converted as followed: *Better* CR + PR, *Same-worse* NR + WR, *CR* complete response, *PR* partial response, *NR* = no response, *WR* worse response

studies enrolled patients with clear inclusion criteria for postoperative neuropathic groin pain. In the subset of female patients with postoperative neuropathic groin pain after a low Pfannenstiel-incision, Loos et al. [22] treated these patients with an open exploration and tailored neurectomy of the ilioinguinal and/or iliohypogastric nerve, with a success rate of 87 %.

Only one study, performed by Vuilleumier et al. [13] applied a standard treatment protocol for patients with neuropathic postoperative pain. Patients were treated by an open exploration with double neurectomy (ilioinguinal and iliohypogastric nerve) and resection of prosthetic material along the involved nerve, with pain reduction in all patients.

Zacest et al. [25] performed an open exploration with a standard mesh removal and a neurectomy of the ilioinguinal nerve in patients with this specific neuropathy, with a success rate of 66.7 %.

Heise et al. [26] performed a combined standard and tailored approach consisting of an open exploration with a standard mesh removal and tailored neurectomy when indicated by peroperative findings, and were successful in 60 % of patients.

Finally, we would like to mention the study of Amid, in which a standard triple neurectomy was performed with a complete response in 80 % of patients [16, 20]. However, the short follow-up of only 6 months is an important limitation of this study.

Most surgical treatments are thus tailored to the pre- and peroperative findings, as was the treatment strategy in our center, but a standardized treatment as proposed by Veuillemier et al. and Amid et al. has been suggested with comparable (or even better) results.

In contrast, success rates in our present study are much lower than those mentioned above. We think there are multiple elements accountable. As we explain more extensively below, the previous surgery in most of our patients was laparoscopic hernia repair, resulting in chronic pain which is sometimes more difficult to treat due to the genitofemoral nerve at risk during laparoscopic hernia repair. Also, a tailored approach to chronic postoperative groin pain might be insufficient according to our results. Furthermore, central sensitization to pain was not routinely investigated preoperatively and could account for our results partially. It is a condition in which nociceptor inputs can trigger a prolonged increase in the excitability and

synaptic efficacy of neurons in the central nociceptive pathways. Thus it leads to pain, even when the original trigger is removed. Surgically induced neuropathic pain is susceptible to this phenomenon, which makes surgical pain treatment less successful. Further investigation is therefore necessary toward diagnostic criteria for central sensitization to pain [21].

According to Loos et al. [22], female patients with neuropathic pain after Pfannenstiel incision are good candidates for neurectomy, with excellent results in almost all of them. In our study, successful pain reduction by neurectomy was achieved in one out of two female patients with chronic groin pain after Pfannenstiel incision. A weakness however is the short duration of follow-up for these two patients.

A secondary goal of our study, was to try to identify from our experience different patient and intraoperative factors that predict a significant pain reduction after surgery. No such factor proved to be significant in predicting outcome in our small study population. A multi-center prospective study with sufficient sample size is therefore mandatory to identify the subset of patients with chronic postoperative groin pain who could benefit from surgery for pain relief.

Although it has been stated that laparoscopic hernia repair causes less chronic postoperative groin pain in comparison to open repair [28], it is an interesting observation that the previous surgery in our series consisted of a laparoscopic hernia repair in 10 patients and of an open hernia repair in only two patients. We believe this is the result of a patient selection, whereby surgeons are more reluctant to perform a second intervention for chronic postoperative groin pain after laparoscopic repair than after open repair. However, the treatment of this pain is not always straightforward. As mentioned before, the genitofemoral nerve is at risk of manipulation and injury during laparoscopic inguinal hernia repair, due to its anatomical location near the deep inguinal ring [18]. Therefore, for neurectomy of the genitofemoral nerve to be effective, it should be performed at a proximal level, and if possible at the level of the psoas muscle. In our current series of patients, this was not the case. Good results with the endoscopic retroperitoneal neurectomy, allowing triple neurectomy in this plane, have now been described [19]. However, during a (endoscopic) neurectomy at the level of the psoas muscle in the retroperitoneal plane, we have experienced difficulty to identify the anatomy of the nerves, which is variable, and to decide which nerves should be transected (and at which level) (especially after previous mesh insertion in the preperitoneal plane). Furthermore, the lateral femoral cutaneous nerve should not be damaged to avoid a meralgia paresthetica.

Pain intensity and outcome were assessed in two separate methods: the ratio of VAS_{max} (post/pre) and a subjective pain reduction. We noticed an agreement of over 90 % between our two outcome variables when using defined intervals (better = ratio of $VAS_{max} \leq 0.5$; same = ratio of $VAS_{max} > 0.5$ and ≤ 1.5; worse = ratio of $VAS_{max} > 1.5$). These results are absolutely logical because it is two ways for the patient to express the same pain. Nevertheless, it suggests the use of VAS_{max} is a valid tool which allows us to evaluate pain evolution over time in a quantified manner. In some patients, it was noted that the maximum pain occurred during resting conditions, in contrast to what was expected (i.e., at a maximum level during challenging physical activities). Therefore, it is important to enquire the VAS-score for all the conditions mentioned in Fig. 1.

Currently, all patients are entered into an algorithm that we developed together with colleagues from our pain clinic, including standardized clinical examination and clinical tools including the DN4 or LANSS (Leeds Assessment of Neuropathic Symptoms and Signs [27]) questionnaire to identify the subset of patients with neuropathic pain. Also, we perform systematic electromyography of the groin to objectivate nerve damage. After four diagnostic nerve blocks, all patients are reevaluated and discussed multidisciplinary. Central sensitization should be diagnosed and treated appropriately and surgery has only a restricted indication in the subset of patients with persistent pain after conservative treatment. We combine an open and laparoscopic approach for the exploration of the anterior and preperitoneal compartment, for proximal neurectomy and (partial) mesh removal, and for eventual new mesh placement.

In conclusion, surgery for chronic postoperative groin pain remains a difficult matter with only a moderate success in our study. Patients therefore should be adequately consented and informed about the surgical procedure.

Finally, the ratio of VAS_{max} (post/pre) was found to be a reliable tool for the assessment of chronic pain and its evolution over time.

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Conflict of interest E. V., Y. N. and M. M. declare no conflict of interest.

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