Hernia (2022) 26:189–200
https://doi.org/10.1007/s10029-021-02404-w

ORIGINAL ARTICLE

Longitudinal cohort study on preoperative pain as a risk factor for chronic postoperative inguinal pain after groin hernia repair at 2-year follow-up

B. Romain[1,7] · T. Fabacher[2] · P. Ortega-Deballon[3] · L. Montana[4] · J.-P. Cossa[5] · J.-F. Gillion[6] · the Club-Hernie Members

Received: 17 December 2020 / Accepted: 29 March 2021 / Published online: 23 April 2021

Abstract

Purpose To assess the rate of late chronic postoperative inguinal pain (CPIP) after groin hernia repair in patients with different categories of preoperative VRS (Verbal Rating Scale) pain and to make a pragmatic evaluation of the rates of potentially surgery-related CPIP vs. postoperative continuation of preexisting preoperative pain.

Methods Groin pain of patients operated from 01/11/2011 to 01/04/2014 was assessed preoperatively, postoperatively and at 2-year follow-up using a VRS-4 in 5670 consecutive groin hernia repairs. A PROM (Patient Related Outcomes Measurement) questionnaire studied the impact of CPIP on the patients' daily life.

Results Relevant (moderate or severe VRS) pain was registered preoperatively in 1639 of 5670 (29%) cases vs. 197 of 4704 (4.2%) cases at the 2-year follow-up. Among the latter, 125 (3.7%) cases were found in 3353 cases with no-relevant preoperative pain and 72 (5.3%) in 1351 cases with relevant preoperative pain. Relevant CPIP consisted of 179 (3.8%) cases of moderate pain and 18 (0.4%) cases of severe pain. The rate of severe CPIP was independent of the preoperative VRS-pain category while the rate of moderate CPIP (3.1%, 3.4%, 4.1%, 6.8%) increased in line with the preoperative (none, mild, moderate, and severe) VRS-pain categories. The VRS probably overestimated pain since 71.6% of the relevant CPIP patients assessed their pain as less bothersome than the hernia.

Conclusion At the 2-year follow-up, relevant CPIP was registered in 4.2% cases, of which 63.5% were potentially surgery-related (no-relevant preoperative pain) and 36.5% possibly due to the postoperative persistence of preoperative pain. The rate of severe CPIP was constant around 0.4%.

Keywords Chronic postoperative inguinal pain · Registry · Inguinal hernia repair · Lichtenstein · Preoperative pain · Postoperative pain

✉ B. Romain
benoit.romain@chru-strasbourg.fr

1 Service de Chirurgie Générale Et Digestive, Hôpitaux Universitaires de Strasbourg, Hôpital de Hautepierre, Avenue Molière, 67098 Strasbourg Cedex, France

2 Groupe Méthodes en Recherche Clinique, CHRU, 67091 Strasbourg Cedex, France

3 Service de Chirurgie Digestive, Centre Hospitalier Universitaire Dijon-Bourgogne, 14 Rue Paul Gaffarel, 21000 Dijon, France

4 Service de Chirurgie Générale Et Digestive, Hôpital de La Croix Saint Simon, 125 Rue d'Avron, 75020 Paris, France

5 Clinique Bizet, Paris, France

6 Hôpital Privé D'Antony, Antony, France

7 Department of Digestive Surgery, Strasbourg University, 1 Avenue Moliere, 67000 Strasbourg, France

Introduction

Preoperative and early postoperative pain are two important risk factors for chronic postoperative inguinal pain (CPIP) after groin hernia repair [1–7]. Although it has been widely investigated [1, 2, 8], the pathogenesis of CPIP is still not completely understood [9–13] and is probably multifactorial, including many potential parameters such as surgical technique, surgeon's experience, postoperative complications, pre- and postoperative pains [2–5, 14–19]. In contrast, very few studies have been published on the rate and category of groin pain before and after groin hernia repair. Page et al. found that moderate (VAS 1–5) or severe (VAS > 5) pain on moving was present preoperatively in 133 (50.2%) of the 323 patients studied and postoperatively at 1-year in 46 (22.6%) of the 204 patients followed up [19]. Magnusson et al. [20] reported that 64% of 309 patients scheduled for surgery had groin pain (VAS 0.9–5.4), decreasing to 14%, 12% and 7% at 1, 2 and 3 years after surgery. Smeds et al. [21], in a longitudinal self-assessment study of 464 patients, observed that a significant proportion of the patients developed pain more than 3 months after the operation and a difference in pain evolution between moderate pain and severe postoperative pain at 3 months after surgery. Pain can increase in intensity from moderate to severe, both with and without the presence of clinical recurrence. The small number of patients with severe pain in their series impaired some subgroup analyses. Therefore, the evolution over time of groin pain in patients with each category of preoperative pain and the potential crossovers between pain categories need to be further analysed in larger series with a longer follow-up.

The main objective of this study was to evaluate, in a large series, the rate of CPIP in patients with different categories of VRS-4 (preoperative verbal rating scale) pain. The respective rates of possible surgery-related CPIP and postoperative continuation of preoperative groin pain (unchanged VRS-pain category at 2-year follow-up compared to baseline) were also analysed.

Methods

Study design

This retrospective study used the prospectively collected data of the Hernia-Club Registry [22]. The first step was a multivariate analysis to assess whether, in our series, preoperative pain was a risk factor for CPIP. The second step was a longitudinal cohort study of VRS-pain categories and a comparison between pain status at the 2-year follow-up vs. pain at baseline (preoperatively).

Endpoints

Our main endpoint was the rate of CPIP in patients suffering from different categories of preoperative VRS-4 pain.

The secondary endpoints were: (i) the respective rates of possible surgery-related CPIP (no or less pain at baseline than at 2-year follow-up) vs. postoperative continuation of preexisting preoperative pain (same VRS category for CPIP and preoperative pain); and (ii) the impact of CPIP on the patients' daily life evaluated using a PROM (Patient Related Outcomes Measurement) questionnaire.

Hernia-Club registry

The Hernia-Club registry is a collaborative, prospective, anonymised online database of all surgical procedures for primary and incisional hernias. Hernia-Club (club-hernie.com; club-hernie-mesh.com) is an association of French surgeons especially interested in parietal surgery, who have been gathering prospective anonymised data for all consecutive hernia patients in a dedicated registry since 2011. They comply with unselected consecutive patient inclusions and data entries (in close-ended boxes) and gave their formal consent for examination of the original medical chart in the case of a discrepancy between what was written in the database and what the patient said to the clinical research assistant (CRA) during follow-up, independent from the operating surgeon. More details on the methodology can be found in published international articles based on this database [23, 24]. All parameters collected in this database were fully compatible with the European Hernia Society (EHS) classification of inguinal hernias [25, 26].

Inclusions/exclusions

All consecutive groin hernia repairs registered in the Hernia-Club database between September 2011 and November 2016 were selected.

The inclusion criteria were: adult patients, treated for uni- or bilateral groin hernias using one of the four most frequent mesh repairs ('top four') in our registry: (i) open anterior inguinal mesh repair ('Lichtenstein'); (ii) transinguinal preperitoneal repair ('TIPP'); (iii) totally preperitoneal laparoscopic repair ('TEP') and (iv) transabdominal preperitoneal laparoscopic repair ('TAPP'). The choice of mesh was left to the operating surgeon's discretion. As, in bilateral hernias, the results may differ from one side to the other, the results were registered, studied and reported as hernia repairs or 'cases' rather than as patients. The exclusion criteria were:

sportsman hernia syndrome, surgery too recent to allow for 2-year follow-up and lack of patient's contact address.

Studied pain subgroups

Preoperative and postoperative pains were categorised [19, 27] as: none, mild pain/discomfort, moderate pain and severe pain based on a VRS-4, and were grouped as relevant pain (moderate or severe pain) or no-relevant pain (no pain or mild pain) for subgroup analysis. The pain registered was the worst pain experienced during the studied time interval. CPIP was defined as pain lasting longer than 3 months in the inguinal region [28, 29].

Data collection

Data extracted from the registry included patient characteristics: age, sex, body mass index (BMI), physical activity, previous history of hernias and comorbidities, preoperative pain, hernia characteristics, EHS groin hernia classification [25], surgical technique, postoperative pain (at D0, D1, D8, M1) and postoperative complications. A clinical examination was performed by the surgeon at discharge and at the 1-month clinical visit. An evaluation by phone was performed on D8. In the case of any symptoms, an optional additional visit was scheduled between 3- and 6-months post-surgery. Recurrences were recorded in the database.

Two-year follow-up

VRS-pain experienced at 2-year follow-up was assessed during the systematic close-ended telephone questionnaire used in our studies since 1999 [23, 24] and performed by a dedicated CRA, independent from the surgical team. The wording of the VRS (identical to that used preoperatively) was in the common language: no pain, mild pain, moderate pain, and severe pain. The impact of pain on daily life was self-assessed by the patient him/herself, using the PROM questionnaire.

Answers were recorded verbatim, without any medical adjustment according to our PROM policy. The CRA was aware of avoiding any response bias. In the case of any reported event, the patient was strongly recommended to schedule a clinical visit. Patients were considered lost to follow-up after five failed attempts to contact them by phone at different times on different days.

Ethical approval

In this observational study, patients received a non-opposition form informing them that their anonymised data were registered in an electronic database and that they would be offered a telephone questionnaire at different steps of their follow-up. The patients' telephone details were not stored in the database. Only the surgeon and the CRA were able to link the randomly allocated identification numbers and the patients' details. The anonymised data were stored in a specialised data centre where they were protected against network intrusion. The database complies with the requirements of the General Data Protection Regulation (GDPR), the French 'Méthodologies de Référence de la Commission Nationale Informatique et Liberté' (MR003) and the different specific French ethics committees.

Statistical analysis

For the descriptive analysis, mean, median and standard deviation (SD) were used for continuous variables and frequency and percentage for categorical variables. To analyse which variables were statistically related to postoperative pain at 2 years, categorical variables were analysed with the Chi^2 test and continuous variables with the Wilcoxon test. For the analysis of the PROM questionnaire, the Chi^2 or Fisher's tests were used depending on the application conditions. A logistic regression model was then used including variables known to be risk factors in the literature. An adjustment according to Bonferroni method was performed for PROM questionnaire analysis. The risk of the first species alpha was set at 5% for all analyses and R version 3.6 software was used.

Results

Study population

Among 16,439 consecutive groin hernia repairs registered from September 2011 to November 2016, 5670 cases in 4461 patients met the inclusion criteria (Fig. 1). As the results (especially pain) may differ on each side of a bilateral repair, the results were studied and reported for hernia repairs or 'cases' rather than for patients. In the cohort study, there were 90% males, mean (SD) age was 64.05 ± 1.9 years, mean (SD) BMI was 25.2 ± 0.25 kg/m^2 and ASA classification was: ASA1 (45%), ASA2 (39%), ASA3 (13.8%), and ASA4 (0.09%). The characteristics of the two populations with and without postoperative pain at the 2-year follow-up are summarised in Table 1.

Preoperative relevant (moderate or severe) VRS-pain was recorded in 1639 (29%) cases vs. no-relevant pain (mild pain/discomfort or no pain at all) in 4031 (71%) cases.

The correspondence between VRS-4 and NRS-11 (median; IQR) in our series was as follows: no pain (0; 0–0), mild (1; 0–2), moderate (3; 1–4), and severe (5; 3–7).

The 2-year follow-up rates were similar (82.4% vs. 83.2%) in both preoperative painful and pain-free groups.

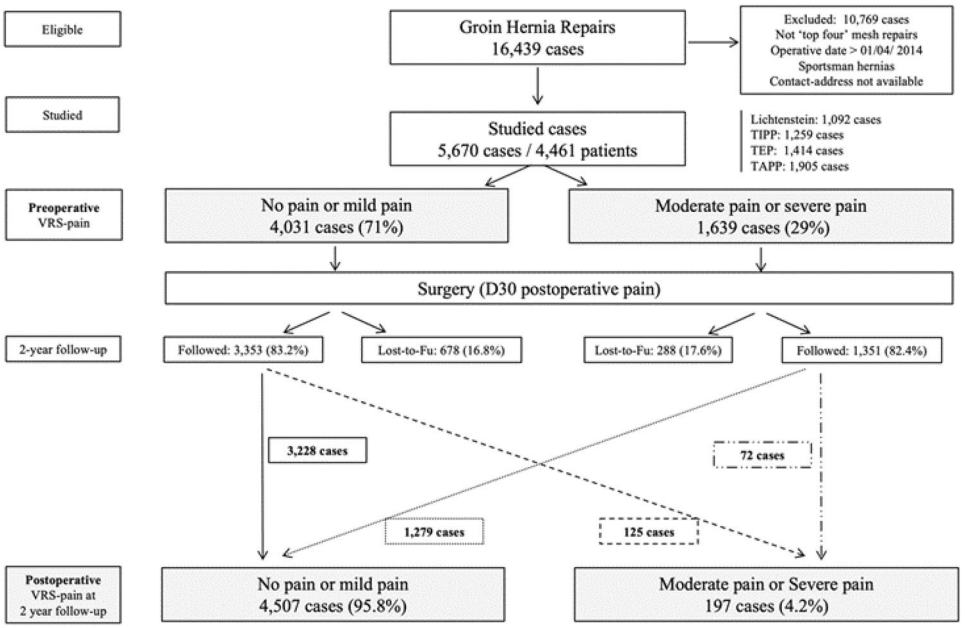

Fig. 1 PRISMA flow diagram of the study population

Postoperative relevant VRS-pain (CPIP) was recorded in 197 cases (4.2%): moderate in 179 (3.8%) and severe in 18 (0.4%) cases, while no-relevant pain was recorded in 4507 (95.8%) cases.

Uni- and multivariate analyses

In univariate analysis, preoperative VRS-pain was confirmed as a significant risk factor for relevant CPIP (Table 1). In multivariate analysis, severe preoperative pain (OR = 2.3 [95% CI 1.1–4.6]; $p = 0.02$), was an independent significant risk factor for CPIP (Supplementary Table 1). The surgical technique used (open mesh repair, TIPP, TAPP, and TEP) was not a risk factor for CPIP (OR = 1.3; 95% CI [0.6–2.7]; $p = 0.4$).

Some other potential risk factors, such as nerve management, mesh fixation and additional local ropivacaine infiltration were also registered (Supplementary Tables 2, 3, 4) but were not studied because they were not included in the endpoints of the present study.

Proportion of CPIP in each preoperative VRS-pain category

Among the 1639 cases with relevant preoperative pain, 1351 (82.4%) cases were followed up at 2 years (Fig. 1). Among the 4031 cases with no or mild preoperative pain, 3353 (83.2%) were followed up at 2 years. In 1279 (95%) of the 1351 cases with relevant preoperative pain, the pain disappeared after the groin hernia repair, while in 72 (5%) cases the pain did not disappear. In 95% of the cases with pain (1279/1351 cases followed) and 96% of the pain-free cases (3228/3353 cases followed), the pain present preoperatively disappeared or did not appear after the groin hernia repair. In 5% of cases with relevant preoperative pain (72/1351 cases followed), moderate or severe pain persisted after the groin hernia repair. In 4% of cases with no-relevant pain (125/3353 cases followed), moderate or severe pain occurred after the groin hernia repair.

When comparing pre- and postoperative pains at 2 years, VRS-pain decreased significantly in all pain categories: mild (51% vs. 2.9%; $p < 0.001$), moderate (19% vs. 4.1%; $p < 0.001$) and severe (10% vs. 0.4%; $p < 0.001$) (Table 2). Moderate CPIP (Table 2) increased linearly (3.1%, 3.4%, 4.1%, and 6.8%) with preoperative (no, mild, moderate, and severe, respectively) VRS categories ($r = 0.99$; $p < 0.001$), while severe CPIP, stable around 0.4%, was not significantly correlated with preoperative VRS categories ($p = 0.8$). Relevant CPIP was registered in 1639 (29%) preoperative cases vs. 197 (4.2%) postoperative cases: moderate in 179 (3.8%) and severe in 18 (0.4%) cases (Table 1). Seventy-two (37%) of the 197 CPIP cases had relevant preoperative pain, while 125 (63%) had no-relevant preoperative pain. Among 18 severe CPIP cases, 14 (77.8%) did not have pain or only had mild pain preoperatively. Among 179 moderate CPIP cases, 111 (62%) did not have pain or only had mild pain preoperatively.

Impact of CPIP on the patients' daily life at 2-year follow-up

The PROM questionnaire (Table 3) was completed in 4704 (83%) of the 5670 cases: 4507 cases in Group 1 (no-relevant CPIP) and 197 cases in Group 2 (relevant CPIP). In Group

Table 1 Characteristics of the study population (univariate analysis)

	Group 1 No or mild pain at 2-year follow-up ($N=4507$)	Group 2 Moderate or severe pain at 2-year follow-up ($N=197$)	p value
Sex			
Male	4087 (91)	177 (89.8)	0.524
Female	420 (8.9)	20 (10.2)	
Age (years)	66.6 ± 1.4	61.9 ± 1.1	0.432
BMI (kg/m^2)	25.2 ± 6.0	25.3 ± 3.8	0.058
Work			
Unemployed	1901 (42.2)	84 (42.9)	0.751
Sedentary work	877 (19.4)	38 (19.4)	
Moderately physical work	649 (14.3)	27 (13.8)	
Highly physical work	878 (19.4)	38 (19.4)	
Not known	202 (4)	10 (5)	
Sport			
None	2199 (48.7)	115 (58.3)	**0.011**
Occasional	691 (15.3)	18 (9.1)	
Moderate (1 time per week)	684 (15.1)	31 (15.7)	
Intense (several times per week)	840 (19)	27 (13.7)	
Not known	93 (2)	6 (3)	
Smoking			
None	2273 (50.4)	108 (54.8)	0.789
Stopped for > 12 months	1173 (26)	50 (25.3)	
Occasional	237 (4.7)	8 (4.1)	
Daily	726 (16.1)	30 (15.2)	
Not known	98 (1.3)	1 (0.5)	
Primary or recurrent hernia			
Primary	4190 (94.6)	179 (91.3)	0.135
First recurrence	211 (4.8)	14 (7.1)	
Second recurrence	28 (0.6)	3 (1.5)	
Third recurrence	2 (0)	0 (0)	
Not known	76 (1.7)	1 (0.5)	
Bilateral localisation			
No	2922 (65)	118 (60)	0.15
Yes	1585 (35)	79 (40)	
General anaesthesia			
No	241(5.3)	11 (5.6)	0.871
Yes	4266 (94.7)	186 (94.4)	
Additional local ropivacaine infiltration			
No	2407 (53.3)	98 (49.7)	0.3
Yes	2100 (46.6)	99 (50.2)	
Hernia EHS classification[a]			
Lateral			
Total	3051(68)	132 (67)	0.791
L1	610	29	
L2	595	71	
L3	846	32	

1, 4381 cases were pain free and 126 cases reported mild pain, detailed in questions Q4–Q7 and compared with the corresponding answers of Group 2.

Episodes of pain occurred more frequently (several times a week or several times a day) in Group 2 than in Group 1 (64.5% vs. 37.3%, respectively; $p < 0.001$),

Table 1 (continued)

	Group 1 No or mild pain at 2-year follow-up ($N=4507$)	Group 2 Moderate or severe pain at 2-year follow-up ($N=197$)	*p* value
Medial			
Total	1886 (41.4)	97 (49)	0.094
M1	361	25	
M2	864	38	
M3	524	25	
Mx	137	9	
Femoral			
Total	368 (8.1)	27 (14)	**< 0.001**
F1	128	9	
F2	88	5	
F3	8	5	
Fx	144	8	
Surgical technique			
Lichtenstein	818 (18.1)	43 (21.8)	0.117
TIPP	1050 (23.3)	35 (17.8)	
Laparoscopic TEP	1112 (24.7)	43 (21.8)	
Laparoscopic TAPP	1527 (34)	76 (38.6)	
Mesh fixation			
No fixation	3080 (68.3)	123 (62.4)	0.105
Fixation	1259 (27.9)	61 (31)	
Auto adhesive mesh	168 (3.7)	13 (6.6)	0.054
Postoperative complications			
Medical	79 (1.7)	5 (2.5)	0.4
SSO	195 (4.3)	12 (6)	0.2
Surgical non-SSO	38 (0.8)	2 (1)	0.8
Preoperative pain (VRS)			
None	911 (20.2)	33 (16.7)	**0.01**
Mild	2317 (51.4)	92 (46.7)	
Moderate	857 (19)	39 (19.8)	
Severe	422 (9.3)	33(16.8)	

Data shown are mean ± standard deviation, or *n* (%)

BMI: body mass index; EHS: European Hernia Society; TIPP: transinguinal preperitoneal repair; TEP: totally preperitoneal laparoscopic repair; TAPP: transabdominal preperitoneal laparoscopic repair; SSO: surgical site occurrence; SSI: surgical site infection, VRS: verbal rating scale; D0: day of the procedure

[a]Total > 100% due to combined hernias

Table 2 Distribution of VRS-pain over time

Preoperative VRS-pain	Total	No. of patients at follow-up	CPIP at 2-year follow-up			
			No CPIP	Mild CPIP	Moderate CPIP	Severe CPIP
No pain	1140 (20)	944 (82.8)	897 (95)	14 (1.5)	29 (3.1)	4 (0.4)
Mild pain	2891 (51)	2409 (83.3)	2248 (93.3)	69 (2.9)	82 (3.4)	10 (0.4)
Moderate pain	1083 (19)	896 (82.7)	830 (92.7)	27 (3.0)	37 (4.1)	2 (0.2)
Severe pain	556 (10)	455 (81.8)	406 (89.3)	16 (3.5)	31 (6.8)	2 (0.4)
Total	5670 (100)	4704 (83.0)	4381 (93.0)	126 (2.6)	179 (4.0)	18 (0.4)

All data shown are *n* (%)

CPIP: chronic postoperative inguinal pain

Table 3 Patient Related Outcomes Measurement (PROM) questionnaire assessed at the 2-year follow-up

	Group 1 No or mild CPIP ($N=4507$)	Group 2 Moderate or severe CPIP ($N=197$)	p value
Q1. Since your operation does your abdominal wall seem			
Solid	4475 (99.3)	183 (93)	**< 0.001**
Not solid	22 (0.5)	13[a] (7)	
Missing data	10	1	
Q2. Do you have a new hernia or bulge in the operated groin?			
No	4396 (97.5)	187 (95)	**< 0.001**
Yes	77 (1.7)	10[b] (5)	
Missing data	34	0	
Q3. Do you currently feel any pain or local discomfort?			
No (asymptomatic)	4381 (97.2)	0 (0)	**< 0.001**
Yes	126 (2.8)	197 (100)	
Missing data	0	0	
If 'No' go to Q8			
Q4. When exactly do you feel these symptoms?			
Not specified	25 (19.8)	12 (6)	
During lifting, coughing, or pushing	20 (15.9)	28 (14)	**0.003**
During other types of effort (please specify)	33 (26.2)	72 (36.5)	
After physical effort or at the end of the day	11 (8.7)	17 (9)	
At any other specified moment (please specify)	1 (0.8)	0 (0)	
At any time	36 (28.6)	68 (34.5)	
Missing data	0	0	
Q5. How often do you feel them?			
Not specified	18 (14.3)	8 (4.1)	**< 0.001**
Rarely	60 (47.7)	60 (30.5)	
Several time a week	41 (32.5)	97 (49.2)	
Several time a day	6 (4.8)	30 (15.2)	
24/24 h	1 (0.7)	2 (1)	
Missing data	0	0	
Q6. These symptoms:			
Have no impact	24 (19.1)	21 (10.7)	**< 0.001**
Do not interfere with your daily life	91 (72.2)	118 (60)	
Allow you to pursue the ongoing activity	11 (8.7)	52 (26.3)	
Cause a temporary interruption of your activity	0 (0)	4 (2)	
Prevent certain activities (impairment)	0 (0)	2 (1)	
Missing data	0	0	
Q7. These symptoms are:			
No impact	19 (15)	23 (11.7)	**0.002**
Less bothersome than the hernia	102 (81)	141 (71.6)	
More bothersome than the hernia	5 (4)	33 (16.8)	
Missing data	0	0	
Q8. Have you had any further operations on your abdominal wall?			
No	4490 (99.6)	192 (97)	**0.0001**
Yes (please specify)	17[c] (0.4)	5[d] (3)	
Missing data	0	0	

caused an interruption in the ongoing activity or prevented specific activities more frequently in Group 2 than in Group 1 (2% vs. 0%, respectively), and were assessed as more bothersome than the hernia itself more frequently in Group 2 than in Group 1 (16.8% vs. 4%, respectively; $p=0.002$).

Table 3 (continued)

	Group 1 No or mild CPIP ($N=4507$)	Group 2 Moderate or severe CPIP ($N=197$)	p value
Q9. How do you assess the result of your hernia operation			
Excellent	1464 (32.6)	8 (4)	**< 0.001**
Good	2943 (65.2)	107 (54.4)	
Medium	52 (1.2)	61 (31)	
Bad	8 (0.1)[e]	21 (10.6)[f]	
Missing data	40 (0.9)	0 (0)	

All data shown are n (%). CPIP: chronic postoperative inguinal pain

[a]Reoperations (3) (2 for recurrence, 1 for infection); others with unclear symptoms did not attend the proposed clinical visit; 1 medium result changed to good at 5 years

[b]Reoperation for recurrence, solid so far (1); no re-operated recurrence (1); others with unclear symptoms did not attend the proposed clinical visit

[c]Recurrences (7), infections (2), chronic pain (2), unrelated cause (1), not specified (5)

[d]Infections (2), chronic pain (1), not specified (1)

[e] Recurrences (4) (2 not re-operated, 1 solid after reoperation, 1 re-recurrence after reoperation), 3 for constant discomfort including hypoesthesia (3), not specified (1)

[f]Recurrence (1), infection (2), pain (15), not specified (3)

In Group 1, 81% of cases assessed their postoperative pain as less bothersome than the hernia itself and having no impact at all (15%) on their daily life. In Group 2, when reporting relevant pain, 71.6% assessed their pain as less bothersome than the hernia itself or having no impact at all (11.7%). No regular use of analgesia was registered by the CRA. This distortion in the patients' assessments between self-reported pain and relative impact on their daily life must be noted. Similarly, the patients' global assessments of their surgery did not appear to be completely linked to their pain status as surgery was assessed as excellent (4%) or good (54.4%) in the 'painful' Group 2 patients. The result of surgery was assessed as bad in 8 cases in Group 1: recurrence (4 cases), discomfort and/or numbness (3 cases) and not specified (1 case); the result was assessed as bad in 21 cases in Group 2: recurrence (1 case), infection (2 cases), pain (15 cases) and not specified (3 cases).

Reoperation (in the same or another hospital) was recorded in 17 cases in Group 1: recurrence (7 cases), infection (2 cases), chronic pain (2 cases), unrelated cause (1 case) and not specified (5 cases). Reoperation was also recorded in six cases in Group 2: infection (two cases), chronic pain (one case) and not specified (three cases). In Group 2, patients assessed their abdominal wall as not solid in 13 cases: reoperation (3 cases: 2 for recurrence and 1 for infection) and others with unclear symptoms did not attend the scheduled visit; in one of these, the result changed from medium to good at the 2-year control.

Finally, the global result of surgery was assessed as good or excellent in 98% of cases in Group 1 vs. 58% of cases in Group 2.

Discussion

In this large multicentre, registry-based, prospective study of groin hernia repairs, relevant (moderate or severe) preoperative VRS-pain was registered in 1639 of 5670 (29%) cases vs. 197 of 4704 (4.2%) cases followed up at 2 years, of which 125 (63.5%) could be potentially surgery-related (no preoperative relevant pain) and 72 (36.5%) due to the postoperative persistence of preoperative pain. Relevant CPIP was moderate in 179 (3.8%) cases and severe in 18 (0.4%). The rate of severe CPIP, stable around 0.4%, appeared to be independent from the preoperative VRS-pain category while the rate of moderate CPIP (3.1%, 3.4%, 4.1%, and 6.8%) increased along with the preoperative (none, mild, moderate, and severe) VRS-pain category. The VRS probably overestimated the pain since, in the PROM, 71.6% of the relevant CPIP patients assessed their pain as less bothersome than the hernia.

Preoperative groin pain rates (either relevant pain or overall pain) higher than 29% have already been published [19, 20, 30, 31], depending on the cutoff in pain levels used and the local implementation of guidelines, which suggest mainly operating on symptomatic patients [26]. Unlike many of the above-mentioned studies, almost 60% of our cases were laparoscopic and 35% were bilateral repairs (Table 1). The contralateral side of those repairs was frequently less symptomatic than the main one. Globally, pain decreases over time after surgery. In the series of Magnusson et al. [20], groin pain (VAS 0.9–5.4) registered preoperatively in 64% of patients decreased to 14%, 12% and 7% of patients at 1, 2 and 3 years after surgery. In the

present series, 94.7% (1279/1351 cases followed) of the relevant preoperative pain cases moved to the no-relevant postoperative pain subgroup (Fig. 1). This suggests that patients operated on in this series were mainly symptomatic. This also suggests that an important part of the preoperative pain was directly related to the hernia and dramatically decreased after the groin hernia repair [20]. This finding must be interpreted very cautiously because, frequently, the groin pain accompanying the hernia is not related to the hernia itself but is referred pain [13] from pubic, hip, sacroiliac, dorsal-lumbar disorders, urinary or pelvic diseases [32, 33], etc., and/or related to psychosocial or general conditions such as an individual pain susceptibility [34, 35]. Such pain persists or reappears after groin hernia repair and may result in clinical and sometimes medico-legal issues if not documented preoperatively. In the present study, relevant preoperative pain persisted in 72 (5.3%) of the 1351 cases followed (Fig. 1). The number of painful patients who had not undergone surgery was unknown because those cases were not registered in the database. Surgery on an inguinal hernia in adult male patients is not an emergency [26] and 'watchful waiting' is a good option [26, 31, 36–38], not only for asymptomatic patients.

In the present study, relevant CPIP occurred in 125 (3.7%) of the 3353 no-relevant (mild pain or no pain) preoperative pain cases followed. A potential surgery-related cause may be considered. The aim of this study was not to analyse surgical technical issues and their prevention (nerve preservation, mesh fixation, etc.), already widely discussed [39–41], nor to study CPIP prophylaxis using early infiltrations or regional blocks (Table 1). Our secondary endpoint was only an evaluation of the rate of continuation of preexisting pain vs. possible surgery-related CPIP.

These 125 cases accounted for 65% of the 197 relevant CPIP cases (179 (3.8%) moderate and 18 (0.4%) severe pain cases) (Fig. 1). The rate of severe CPIP, stable around 0.4%, appeared to be independent from the preoperative VRS-pain category (Table 2) while the rate of moderate CPIP (3.1%, 3.4%, 4.1%, and 6.8%) increased in line with the preoperative (none, mild, moderate, and severe) VRS-pain category ($r = 0.99$; $p < 0.001$). These results suggest that severe CPIP, independent from the preoperative pain status, could be mainly surgery-related, while moderate CPIP could be correlated with the preoperative pain status.

Groin hernia repair not only restored the anatomy but also significantly reduced groin pain or groin discomfort in all VRS categories. When comparing (Table 2) pre- and postoperative pains at 2 years, VRS-pain decreased significantly in all pain categories: mild (51% vs. 2.9%; $p < 0.001$), moderate (19% vs. 4.1%; $p < 0.001$) and severe (10% vs. 0.4%; $p < 0.001$). The ratio no-relevant vs. relevant pain changed from 71% vs. 29% preoperatively to 95.8% vs. 4.2% postoperatively at 2-year follow-up (Fig. 1). The present results confirm those of previous studies [19, 20].

Our final endpoint was an evaluation, using a PROM questionnaire, of the impact of CPIP on the patients' daily life (Table 3). In the 197 relevant (moderate or severe) CPIP cases (Group 2), only 16.8% assessed their pain as more troublesome than the hernia itself (Q7), while 71.6% assessed their pain as less bothersome than the hernia and 11.7% said it had no impact on their daily life (Q7; Q6). These results suggest that the VRS probably overestimates pain. Patients who describe a simple discomfort or "a feeling different than before", not necessarily pain, are classified as mild pain. This is an important issue, especially in our series in which 2891 cases preoperatively (64% of the 4530 VRS-pain cases) and 126 cases postoperatively (39% of the 323 VRS-pain cases) were classified as mild pain or discomfort. At the opposite end of the VRS-pain spectrum, severe pain was not defined precisely. For example, in our series, none of the patients reporting severe pain regularly used analgesics or consulted a pain centre. Postoperatively, the pain was assessed as more bothersome than the hernia itself in only 33/197 (17%) of the CPIP cases. This is why, in our PROM questionnaire, VRS-pain, recorded verbatim, was amended with questions Q5, Q6 and Q7 assessing its impact on daily life. Moreover, Magnusson et al. reported that the improvement in quality of life was mainly observed in patients with preoperative pain [20]. Unlike many of the above-mentioned studies, our study included not only open mesh repairs, but also TIPP, TAPP and TEP. In the uni- and multivariate analyses (Table 1, Supplementary Table 2), the type of surgical technique used was not identified as a risk factor for CPIP. Moreover, in a previous study from the same database [42], the 2-year PROM was similar amongst these four techniques.

The impact of pain on daily activities [43] and psychological considerations are of major relevance. There is a need for a uniform and validated assessment of CPIP. In a recent systematic review [1], 33 different instruments were individualised to quantify CPIP. Some of them are dedicated to hernia repair such as the Carolina Comfort Scale [44] or the Inguinal Pain Questionnaire and some others are too sophisticated to be used in daily practice [45], which suggests that simplified versions such as the short form Inguinal Pain Questionnaire SF-IPQ [46] should be proposed.

This study has several limitations. Although using prospectively collected data, the design of the present study is retrospective. Surgeries selected for assessment were performed 10–7 years ago, allowing for a late follow-up. Only 2-year follow-up data are presented in the present study. The 5-year follow-up data will be analysed in a further study. PROM used in this study, although non-formally validated, is the PROM we have been using in all our published studies since 1999 [47]. The weakness of any pain study is the

subjective dimension of pain evaluation by the patient. What is relevant is not the absolute value of the pain evaluated but its evolution over time for a given patient or for a category of pain patients. This is why we studied the evolution of pain over time looking at crossovers between pain categories and comparing preoperative with postoperative pain using the same tools. The 2-year delay between the assessment of discomfort due to CPIP and that due to the hernia could introduce a recall bias. Asking direct questions in a pain questionnaire, required for VRS assessment, could introduce a response bias. However, other tools, which are more complex and demanding, are difficult to use in large cohorts such as the present series. The patients did not undergo a medical visit at the 2-year follow-up, but the VRS-pain assessment does not require a visit to the surgeon's office. Dealing with bilateral repairs is an issue as the pain at one side could bias the evaluation of the contralateral pain. In our registry, many procedures are bilateral repairs and exclusion of these cases could have introduced a selection bias. The bias seems light, as the distribution of bilateral repairs was similar at around 35% in both the relevant and no-relevant CPIP subgroups (Table 1).

Conclusion

In this series of patients operated from 01/11/2011 to 01/04/2014, at the 2-year follow-up, relevant CPIP was registered in 4.2% cases, of which 63.5% could be potentially surgery related and 36.5% due to the postoperative persistence of preoperative pain. The rate of severe CPIP, stable around 0.4%, appeared to be independent from the preoperative VRS-pain category, while the rate of moderate CPIP (3.1%, 3.4%, 4.1%, and 6.8%) increased in line with the preoperative (none, mild, moderate, and severe) VRS-pain category. Thus, groin hernia repairs not only restored the anatomy but also significantly reduced groin pain or groin discomfort in all VRS categories. When comparing pre- and postoperative pains at 2 years, VRS-pain decreased significantly across all pain categories: mild (51% vs. 2.9%; $p < 0.001$), moderate (19% vs. 4.1%; $p < 0.001$) and severe (10% vs. 0.4%; $p < 0.001$). The ratio no-relevant vs. relevant pain changed from 71% vs. 29% preoperatively to 95.8% vs. 4.2% postoperatively at 2-year follow-up.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10029-021-02404-w.

Acknowledgements The authors thank Newmed Publishing for English editing services.

We would like to thank all members of the Hernia-Club for collecting patient data: Antor M (CHRU Rouen, Rouen, France), Beck M (Clinique Ambroise Paré, Thionville, France), Barrat C (Hôpital Universitaire Jean Verdier, Bondy, France), Berney C (Bankstown-Lidcombe Hospital, Sydney, Australia), Binot D (MCO Côte d'Opale, Boulogne sur Mer, France), Bousquet J (Hôpital Privé de la Chataigneraie, Montpellier, France), Blazquez D (Clinique Jeanne d'Arc, Paris, France), Bonan A (Hôpital Privé d'Antony, Antony, France), Cas O (Centre Médico Chirurgical–Fondation Wallerstein, Arès, France), Champault-Fezais A (Groupe Hospitalier Paris St Joseph, Paris, France), Chastan P (Bordeaux, France), Chollet J-M (Hôpital Privé d'Antony, Antony, France), Cossa J-P (CMC Bizet, Paris, France), Dabrowski A (Clinique de Saint Omer, Saint Omer, France), Delaunay T (Clinique St Hilaire, Rouen, France), Démaret S (Clinique Saint Vincent, Besançon, France), Drissi F (CHU Nantes, Nantes, France), Demian H (CHU Croix Rousse, Lyon, France), Dubuisson V (CHU Pellegrin, Bordeaux, France), Dugue T (Clinique de Saint Omer, Saint Omer, France), Fromont G (Clinique de Bois Bernard, Bois Bernard, France), Gillion J-F (Hôpital Privé d'Antony, Antony, France), Jacquin C (CH du Prado, Marseille, France), Jurczak F (Clinique Mutualiste, Saint Nazaire, France), Khalil H (CHRU Rouen, Rouen, France), Launay-Savary M (CHU Pellegrin, Bordeaux, France), Lepère M (Clinique Saint Charles, La Roche-sur-Yon, France), Lépront D (Polyclinique de Navarre, Pau, France), Longeville JH (Clinique du Val-de-Loire, Nevers, France), Le Toux N (Clinique Jeanne d'Arc, Paris, France), Loriau J (Groupe Hospitalier Paris St Joseph, Paris), Magne E (Clinique Tivoli, Bordeaux, France), Ngo P (Hôpital Américain, Neuilly, France), Oberlin O (Croix St Simon Diaconesses, Paris, France), Passot G (CHU de Lyon Sud, Lyon, France), Pavis d'Escurac X (Strasbourg, France), Putinier JB (CH Mutualiste, Grenoble, France), Renard Y (CHRU Reims, Reims, France), Romain B (CHU Strasbourg, Strasbourg, France), Soler M (Polyclinique Saint Jean, Cagnes-sur-Mer, France), Roos S (Clinique Claude Bernard, Albi, France), Thillois J-M (Hôpital Privé d'Antony, Antony, France), Tiry P (Clinique de Saint Omer, Saint Omer, France), Vu P (HPMV, Bry sur Marne, France), Verhaeghe R (MCO Côte d'Opale, Boulogne sur Mer, France), Warlaumont M (CHRU Lille, Lille, France) and Zaranis C (Clinique de La Rochelle, France).

Author contributions Conceptualisation: LM, JPC, JFG, and BR; methodology: JFG, BR, TF, and POD; formal analysis and investigation: JFG, BR, and TF; writing BR and JFG; supervision: BR, JFG, and POD; data collection: JFG and Hernia-Club Members.

Funding This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

Availability of data and materials Anonymised data are accessible on request.

Declarations

Conflict of interest The authors declare that they have no conflicts of interest to declare regarding this study.

Consent to participate In this registry-based study, patients were informed ('Non-opposition' form) that their completely anonymised data could be further used for scientific studies and that they could ask for a withdrawal of their own data whenever they wanted.

Consent for publication All the patients gave their informed consent for publication their data.

Ethics approval This prospective cohort study was performed within the French Hernia-Club registry. The Hernia-Club registry complies with the requirements of the 'Commission Nationale de l'Informatique et des Libertés' (CNIL) and of the General Data Protection Regulation (GDPR).

Human and animal rights Statement All procedures performed in this study were in accordance with the ethical standards of the French researchcommittee and with the 1964 Helsinki Declaration and its later amends.

Informed consent All the patients gave their informed consent for publication their data.

References

1. Molegraaf M, Lange J, Wijsmuller A (2017) Uniformity of chronic pain assessment after inguinal hernia repair: a critical review of the literature. Eur Surg Res 58:1–19. https://doi.org/10.1159/000448706
2. Alfieri S, Amid PK, Campanelli G et al (2011) International guidelines for prevention and management of post-operative chronic pain following inguinal hernia surgery. Hernia 15:239–249. https://doi.org/10.1007/s10029-011-0798-9
3. Reinpold W (2017) Risk factors of chronic pain after inguinal hernia repair: a systematic review. Innov Surg Sci 2:61–68. https://doi.org/10.1515/iss-2017-0017
4. Hoffmann H, Walther D, Bittner R et al (2018) Smaller inguinal hernias are independent risk factors for developing chronic postoperative inguinal pain (CPIP): a registry-based multivariable analysis of 57,999 patients. Ann Surg. https://doi.org/10.1097/SLA.0000000000003065
5. Köckerling F, Hoffmann H, Adolf D et al (2020) Female sex as independent risk factor for chronic pain following elective incisional hernia repair: registry-based, propensity score-matched comparison. Hernia 24:567–576. https://doi.org/10.1007/s10029-019-02089-2
6. Pierides GA, Paajanen HE, Vironen JH (2016) Factors predicting chronic pain after open mesh based inguinal hernia repair: a prospective cohort study. Int J Surg 29:165–170. https://doi.org/10.1016/j.ijsu.2016.03.061
7. Sevonius D, Montgomery A, Smedberg S, Sandblom G (2016) Chronic groin pain, discomfort and physical disability after recurrent groin hernia repair: impact of anterior and posterior mesh repair. Hernia 20:43–53. https://doi.org/10.1007/s10029-015-1439-5
8. Aasvang EK, Gmaehle E, Hansen JB et al (2010) Predictive risk factors for persistent postherniotomy pain. Anesthesiology 112:957–969. https://doi.org/10.1097/ALN.0b013e3181d31ff8
9. Kehlet H, Roumen RM, Reinpold W, Miserez M (2013) Invited commentary: persistent pain after inguinal hernia repair: what do we know and what do we need to know? Hernia 17:293–297. https://doi.org/10.1007/s10029-013-1109-4
10. Lange JFM, Kaufmann R, Wijsmuller AR et al (2015) An international consensus algorithm for management of chronic postoperative inguinal pain. Hernia 19:33–43. https://doi.org/10.1007/s10029-014-1292-y
11. Liem L, Mekhail N (2016) Management of postherniorrhaphy chronic neuropathic groin pain: a role for dorsal root ganglion stimulation. Pain Pract 16:915–923. https://doi.org/10.1111/papr.12424
12. Zwaans WAR, Perquin CW, Loos MJA et al (2017) Mesh removal and selective neurectomy for persistent groin pain following Lichtenstein repair. World J Surg 41:701–712. https://doi.org/10.1007/s00268-016-3780-y
13. Aasvang EK, Werner MU, Kehlet H (2015) Referred pain and cutaneous responses from deep tissue electrical pain stimulation in the groin. Br J Anaesth 115:294–301. https://doi.org/10.1093/bja/aev170
14. Olsson A, Sandblom G, Fränneby U et al (2017) Impact of postoperative complications on the risk for chronic groin pain after open inguinal hernia repair. Surgery 161:509–516. https://doi.org/10.1016/j.surg.2016.08.011
15. Niebuhr H, Wegner F, Hukauf M et al (2018) What are the influencing factors for chronic pain following TAPP inguinal hernia repair: an analysis of 20,004 patients from the Herniamed Registry. Surg Endosc 32:1971–1983. https://doi.org/10.1007/s00464-017-5893-2
16. Öberg S, Andresen K, Klausen TW, Rosenberg J (2018) Chronic pain after mesh versus nonmesh repair of inguinal hernias: a systematic review and a network meta-analysis of randomized controlled trials. Surgery 163:1151–1159. https://doi.org/10.1016/j.surg.2017.12.017
17. Lange JFM, Meyer VM, Voropai DA et al (2016) The role of surgical expertise with regard to chronic postoperative inguinal pain (CPIP) after Lichtenstein correction of inguinal hernia: a systematic review. Hernia 20:349–356. https://doi.org/10.1007/s10029-016-1483-9
18. Forester B, Attaar M, Chirayil S et al (2020) Predictors of chronic pain after laparoscopic inguinal hernia repair. Surgery. https://doi.org/10.1016/j.surg.2020.07.049
19. Page B, Paterson C, Young D, O'Dwyer PJ (2002) Pain from primary inguinal hernia and the effect of repair on pain. Br J Surg 89:1315–1318. https://doi.org/10.1046/j.1365-2168.2002.02186.x
20. Magnusson J, Gustafsson UO, Nygren J, Thorell A (2019) Sustainability of the relationship between preoperative symptoms and postoperative improvement in quality of life after inguinal hernia repair. Hernia 23:583–591. https://doi.org/10.1007/s10029-018-01875-8
21. Smeds S, Kald A, Löfström L (2010) Chronic pain after open inguinal hernia repair: a longitudinal self-assessment study. Hernia 14:249–252. https://doi.org/10.1007/s10029-009-0615-x
22. Kyle-Leinhase I, Köckerling F, Jørgensen LN et al (2018) Comparison of hernia registries: the CORE project. Hernia 22:561–575. https://doi.org/10.1007/s10029-017-1724-6
23. Gillion J-F, Chollet J-M (2013) Chronic pain and quality of life (QoL) after transinguinal preperitoneal (TIPP) inguinal hernia repair using a totally extraperitoneal, parietalized, Polysoft ® memory ring patch: a series of 622 hernia repairs in 525 patients. Hernia 17:683–692. https://doi.org/10.1007/s10029-013-1121-8
24. de Smet GHJ, Sneiders D, Yurtkap Y et al (2020) Functional outcomes in symptomatic versus asymptomatic patients undergoing incisional hernia repair: replacing one problem with another? A prospective cohort study in 1312 patients. Int J Surg 82:76–84. https://doi.org/10.1016/j.ijsu.2020.07.054
25. Miserez M, Alexandre JH, Campanelli G et al (2007) The European hernia society groin hernia classification: simple and easy to remember. Hernia 11:113–116. https://doi.org/10.1007/s10029-007-0198-3
26. HerniaSurge Group (2018) International guidelines for groin hernia management. Hernia 22:1–165. https://doi.org/10.1007/s10029-017-1668-x
27. Loos MJA, Houterman S, Scheltinga MRM, Roumen RMH (2008) Evaluating postherniorrhaphy groin pain: visual analogue or verbal rating scale? Hernia 12:147–151. https://doi.org/10.1007/s10029-007-0301-9
28. Classification of chronic pain (1986) Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the International Association for the Study of Pain, Subcommittee on Taxonomy. . Pain Suppl 3:S1-226
29. Aasvang E, Kehlet H (2005) Chronic postoperative pain: the case of inguinal herniorrhaphy. Br J Anaesth 95:69–76. https://doi.org/10.1093/bja/aei019
30. Hair A, Paterson C, Wright D et al (2001) What effect does the duration of an inguinal hernia have on patient symptoms? J Am

Coll Surg 193:125–129. https://doi.org/10.1016/s1072-7515(01)00983-8
31. de Goede B, Wijsmuller AR, van Ramshorst GH et al (2018) Watchful waiting versus surgery of mildly symptomatic or asymptomatic inguinal hernia in men aged 50 years and older: a randomized controlled trial. Ann Surg 267:42–49. https://doi.org/10.1097/SLA.0000000000002243
32. Drew MK, Osmotherly PG, Chiarelli PE (2014) Imaging and clinical tests for the diagnosis of long-standing groin pain in athletes. A systematic review. Phys Ther Sport 15:124–129. https://doi.org/10.1016/j.ptsp.2013.11.002
33. Kurosawa D, Murakami E, Aizawa T (2017) Groin pain associated with sacroiliac joint dysfunction and lumbar disorders. Clin Neurol Neurosurg 161:104–109. https://doi.org/10.1016/j.clineuro.2017.08.018
34. Powell R, Johnston M, Smith WC et al (2012) Psychological risk factors for chronic post-surgical pain after inguinal hernia repair surgery: a prospective cohort study. Eur J Pain 16:600–610. https://doi.org/10.1016/j.ejpain.2011.08.010
35. Werner MU, Mjöbo HN, Nielsen PR, Rudin A (2010) Prediction of postoperative pain: a systematic review of predictive experimental pain studies. Anesthesiology 112:1494–1502. https://doi.org/10.1097/ALN.0b013e3181dcd5a0
36. van Hout L, Bökkerink WJV, Ibelings MS et al (2018) Outcomes of surgery on patients with a clinically inapparent inguinal hernia as diagnosed by ultrasonography. Hernia 22:525–531. https://doi.org/10.1007/s10029-018-1744-x
37 Aly M, Farquharson BM, Clarke O, Atkin GK (2021) Should surgeons repair symptomatic, clinically occult, radiologically evident, inguinal hernias? A case-control study of patient-reported outcomes. Hernia. https://doi.org/10.1007/s10029-020-02346-9
38. Reistrup H, Fonnes S, Rosenberg J (2020) Watchful waiting vs repair for asymptomatic or minimally symptomatic inguinal hernia in men: a systematic review. Hernia. https://doi.org/10.1007/s10029-020-02295-3
39. Gutlic N, Rogmark P, Nordin P et al (2016) Impact of mesh fixation on chronic pain in total extraperitoneal inguinal hernia repair (TEP): a Nationwide Register-based Study. Ann Surg 263:1199–1206. https://doi.org/10.1097/SLA.0000000000001306
40. Bracale U, Rovani M, Picardo A et al (2014) Beneficial effects of fibrin glue (Quixil) versus Lichtenstein conventional technique in inguinal hernia repair: a randomized clinical trial. Hernia 18:185–192. https://doi.org/10.1007/s10029-012-1020-4
41. Sanders DL, Nienhuijs S, Ziprin P et al (2014) Randomized clinical trial comparing self-gripping mesh with suture fixation of lightweight polypropylene mesh in open inguinal hernia repair. Br J Surg 101:1373–1382. https://doi.org/10.1002/bjs.9598 (**discussion 1382**)
42. Romain B, Gillion J-F, Ortega-Deballon P et al (2018) Patient's satisfaction at 2 years after groin hernia repair: any difference according to the technique? Hernia 22:801–812. https://doi.org/10.1007/s10029-018-1796-y
43. Staal E, Nienhuijs SW, Keemers-Gels ME et al (2008) The impact of pain on daily activities following open mesh inguinal hernia repair. Hernia 12:153–157. https://doi.org/10.1007/s10029-007-0297-1
44. Heniford BT, Lincourt AE, Walters AL et al (2018) Carolinas comfort scale as a measure of hernia repair quality of life: a reappraisal utilizing 3788 international patients. Ann Surg 267:171–176. https://doi.org/10.1097/SLA.0000000000002027
45. Ruta DA, Abdalla MI, Garratt AM et al (1994) SF 36 health survey questionnaire: I. Reliability in two patient based studies. Qual Health Care 3:180–185. https://doi.org/10.1136/qshc.3.4.180
46. Olsson A, Sandblom G, Fränneby U et al (2019) The short-form Inguinal Pain Questionnaire (sf-IPQ): an instrument for rating groin pain after inguinal hernia surgery in daily clinical practice. World J Surg 43:806–811. https://doi.org/10.1007/s00268-018-4863-8
47. Gillion JF, Fagniez PL (1999) Chronic pain and cutaneous sensory changes after inguinal hernia repair: comparison between open and laparoscopic techniques. Hernia 3:75–80