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ORIGINAL ARTICLE

Patient's satisfaction at 2 years after groin hernia repair: any difference according to the technique?

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Abstract

Background Long-term patient's satisfaction after groin hernia repair is rarely studied in the literature. The aim of this study was to compare the four main techniques of inguinal hernia repair in terms of patient's satisfaction and quality of life at the 2-year follow-up in a prospective registry.

Methods From September 2011 to March 2014, consecutive patients underwent groin hernia repair and were prospectively included in the Club Hernie registry, which also consisted of expert surgeons in parietal repair. The data on patient demographics, clinical presentation, initial workup, operative technique, postoperative course, clinical follow-up, and quality of life at 2 years (2Y-FU) were recorded.

Results Overall, 5670 patients were included in the study: 1092 undergoing Lichtenstein's technique, 1259 for trans-inguinal preperitoneal technique (TIPP), 1414 for totally extraperitoneal approach (TEP) and 1905 for transabdominal preperitoneal approach (TAPP). The patients undergoing Lichtenstein's technique were significantly older, with more inguinoscrotal hernias and co-morbidities than those undergoing other techniques. A total of 83% patients had a complete 2Y-FU. The patient's satisfaction at 2Y-FU was similar between the different techniques. In the univariate and multivariate analyses, pain on postoperative day 1 was the only independent prognostic factor of the patient's satisfaction at 2Y-FU.

Conclusion In this large series, no statistical differences were found between the four studied techniques regarding the 2Y-Fu results and patients' satisfaction. Provided the technique has been done properly (expert surgeon) the results and the patients' satisfaction are fair and equivalent among the four studied techniques. In a multivariate analysis, the only factor predictive of bad late results was severe pain at D1.

Keywords Quality of life · Inguinal hernia repair · TIPP · Lichtenstein · TEP · TAPP · Registry

Introduction

Hernia repair (HR) is the most frequent operation performed by general surgeons worldwide [1, 2]. The choice of surgical technique for inguinal hernia repair is a matter of debate. According to the European Hernia Society guidelines [3] and to tailor the repair to each type of hernia and to each patient, each surgeon should master at least one anterior and one posterior technique (ideally, an endoscopic one) [4, 5].

Laparoscopic inguinal repair techniques are totally extraperitoneal approach (TEP) and transabdominal preperitoneal approach (TAPP). In both techniques, after reduction of the hernia sac, the mesh is inserted in the preperitoneal space to prevent the visceral sac from engaging into the hernia defect.

Among the open techniques, Lichtenstein's operation has become the standard technique worldwide [5–7]. The trans-inguinal preperitoneal technique (TIPP) consists in

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placing a preperitoneal mesh using a minimally invasive open approach. As in TEP, the mesh does not need to be fixed. The memory ring (permanent and, more recently, absorbable) helps to ensure the correct deployment of the mesh [8, 9].

Because the recurrence rate has been drastically decreased using mesh repairs, the evaluation of long-term quality of life (Q.o.L), patient's satisfaction and incidence of chronic pain are now of paramount importance in guiding the choice of the best operative approach [6, 10–13]. Several comparative studies and meta-analyses have been performed comparing different endpoints of laparoscopic and open techniques, but the long-term Q.o.L has rarely been assessed in a large number of patients [13, 14]. To date, long-term patient satisfaction using a PROM (Patient Reporting of Outcome Measures) concept and the factors influencing patient satisfaction have never been studied [15]. Registries, which provide us with large cohorts of patients, followed for a long time, are useful beside the randomized clinical trials (RCT) [3, 16] even more when their methodology is strictly controlled such as that of Club-Hernie Registry [16, 17].

The aims of our study were (1) to assess and compare the 2Y-Fu (2-year follow-up) Q.o.L of a large cohort of patients having undergone a groin hernia repair between the four techniques; and then (2) to compare their 2Y-Fu Q.o.L with their preoperative Q.o.L (baseline); and finally (3) to evaluate the factors significantly influencing the 2 Y-Fu patient's satisfaction.

Methods

Study design

This multicentre observational study consisted in a retrospective analysis of data prospectively registered from September 2011 to March 2014 in the French Club-Hernie Registry. Patients registered in the Club-Hernie Registry from Sept 11th, 2011 to November 21st, 2014, were considered for inclusion. The perioperative data were analysed in all the included patients. The 2Y-Fu Q.o.L was compared to the preoperative Q.o.L (baseline) (excluding the patients lost to Fu). The data extracted from the registry included:

- Patient demographics, BMI, ASA classification, comorbidities, physical activity, type of hernia, (recurrent, inguinoscrotal, strangulated),
- Technique used, mean operative time, length of stay (one-day surgery or not)
- Postoperative complications
- Postoperative pain at day: D0, D1, D8, D30.

Club hernie registry

In this collaborative registry each participant surgeon accepts and signs a charter of quality stating that ''all input must be registered, consecutive, unselected, exhaustive and in real time'. The participants allow a peer review control of the original medical chart in case of discrepancy with the retro-control done by the clinical research assistant (CRA). The Club-Hernie Members (nearly 40 members, academic or not, working in private or public hospitals) are co-opted, taking into account their specific interest in parietal surgery, their annual activity and their scientific behaviour. Every participant masters different techniques, but in daily routine they use their preferred technique. When the team was constructed, attention was paid to get a large panel of different techniques.

The data, registered online in real time are comprehensive for patients and items as well: ticks and completion gauges, updated with every input, help the surgeon to check the comprehensiveness of his entries.

The follow-up is gathered during a phone interview by a independent clinical research assistant (CRA), and blinded for the surgical procedure. In case of any reported problem, the patient is strongly recommended to schedule a clinical visit. A retro-control of the registered outcomes is done during the phone interview. In case of discrepancy the medical chart is reviewed. The late results and the Q.o.L are evaluated through a validated phone questionnaire, used in all our studies since 1999 [18, 19]. This questionnaire has been constructed as simple as possible to be mastered by the patient himself, in a PROM (Patient Reporting of Outcome Measures) concept [16]. The words used, easily understood by everyone, allow a patient's self-assessment. The terms of the pain grading: mild, moderate, severe, belong to the common language. Even though this grading entails a part of subjectivity and interpersonal variability we have chosen to record it without any medical adjustment. The same questionnaire is used in the preoperative period (baseline) and at each step of the follow-up. Q.o.L was evaluated at each step of the Fu using the same questionnaire and compared with that registered in the preoperative period (baseline). Patients are considered lost to follow-up after five failed attempts to contact them at different moments of different days. Patients who decline to participate in the telephone interview are considered lost to follow-up, but recorded apart.

The patients are informed that their de-identified data are registered and that they will be offered a phone questionnaire at different steps of their follow-up (1st, 2nd and 5th years). Only the operating surgeon and the CRA are able to link the randomly allocated identifying number and the patient. The data are stored in a specialized Swiss data

bank where they are protected against network intrusion. The registry complies with the requirements of the French 'Commission Nationale de l'Informatique et des Libertés' (CNIL; registration number 1993959v0), and the different specific French ethics committees. Data from the 2Y-Fu and QOL were extracted from the registry.

Pain evaluation

In front of the patient, pain was assessed using a 0–10 VAS (Visual Analog Scale) at D0, D1, D8, D30. During the phone questionnaire a four-levels VRS (Verbal Rating Scale) was used (No pain, Mild pain, Moderate pain, Severe pain) compared with the same preoperative four scale VRS [20]. According to our PROM policy, the patients' answers were registered without any medical correction.

Complications evaluation

The complications were categorized into two groups: medical and surgical complications. We detailed only urinary retention for medical complications. For surgical complications, we detailed only the most frequent and serious complications: postoperative collections (non-infected not peri-prosthetic collection, non-infected, but peri-prosthetic collection, infected but not peri-prosthetic collection, infected and peri-prosthetic collection) and reoperations for complication.

Patient's satisfaction

In case of any postoperative pain or discomfort, the patient was asked to assess if this discomfort was more or less bothersome than the hernia he had before surgery. At the end of the interview, the CRA asked to the patient, independently from the operating team, to give his personal assessment of his surgery, bad or medium versus good or excellent.

Endpoints

The endpoints of our study were (1) to assess and compare the 2Y-Fu (2-year follow-up) Q.o.L of a large cohort of patients having undergone a groin hernia repair between the four techniques; and then (2) to compare their 2Y-Fu Q.o.L with their preoperative Q.o.L (baseline); and finally (3) to evaluate the factors significantly influencing the 2 Y-Fu patient's satisfaction.

Statistics

A Chi-squared test was used to determine the association between categorical variables. Student's *t* test or ANOVA was used to evaluate the differences in the means of continuous variables between two or more than two groups. Univariate and multivariate logistic regression models were used to analyse the main outcome. Variables with a p value ≤ 0.2 in the univariate analyses were candidate variables in an ascending stepwise multivariate analysis. A $p < 0.05$ was considered to be statistically significant. Though not significant, some variables were kept in the final multivariate model due to their clinical relevance. The p values were not corrected for multiple comparisons. The multivariate models have been adjusted on technique. In fact, as each surgeon do use and master mainly a single technique, adjusting on the surgeon would be similar to adjusting on technique. All statistical calculations were performed using R 3.3.1.

Results

Prisma flow chart (Fig. 1)

Among 16 439 consecutive groin hernia repairs registered in the Club-Hernie Registry from Sept 11th, 2011 to November 21st, 2014, 10 769 cases were not included in the study, because (1) surgery had been done after April 1st, 2014 (8096 cases) to have a 2 year-FU; (2) surgeon declined to participate in the study (1656 cases) and did not provide the CRA with their patients' address; (3) the surgical technique did not belong to the four techniques studied (1017 cases).

Among the remaining 5670 groin hernias, 1092 were operated using the Lichtenstein technique, 1259 using TIPP, 1414 using TEP, and 1905 using TAPP (Fig. 1). The perioperative results were studied on these 5670 cases. Nine hundred and sixty-six were lost to follow-up because patients had died (21, 15, 12, 16, respectively), because patients declined to answer (0, 0, 1, 2, respectively), because patients were not reachable (210, 159, 246, 284, respectively). Four thousand seven hundred and four cases (83%) had a complete 2Y-FU (861, 1085, 1155, and 1603 respectively). The 2Y-Fu and preoperative Q.o.L were analysed on these 4704 cases.

Perioperative data (5670 cases)

The demographic data were different between the four techniques (Table 1). Age was statistically different among the four techniques, but the differences were small from a clinical point of view (fewer than 5-year differences between extreme mean values). The Lichtenstein group had more co-morbidities characterised with the ASA score (more patients with diabetes and with antithrombotic conditions, for instance). The types of hernias were different among the four studied techniques with more recurrent and inguinoscrotal hernias in the Lichtenstein group (Table 2). The

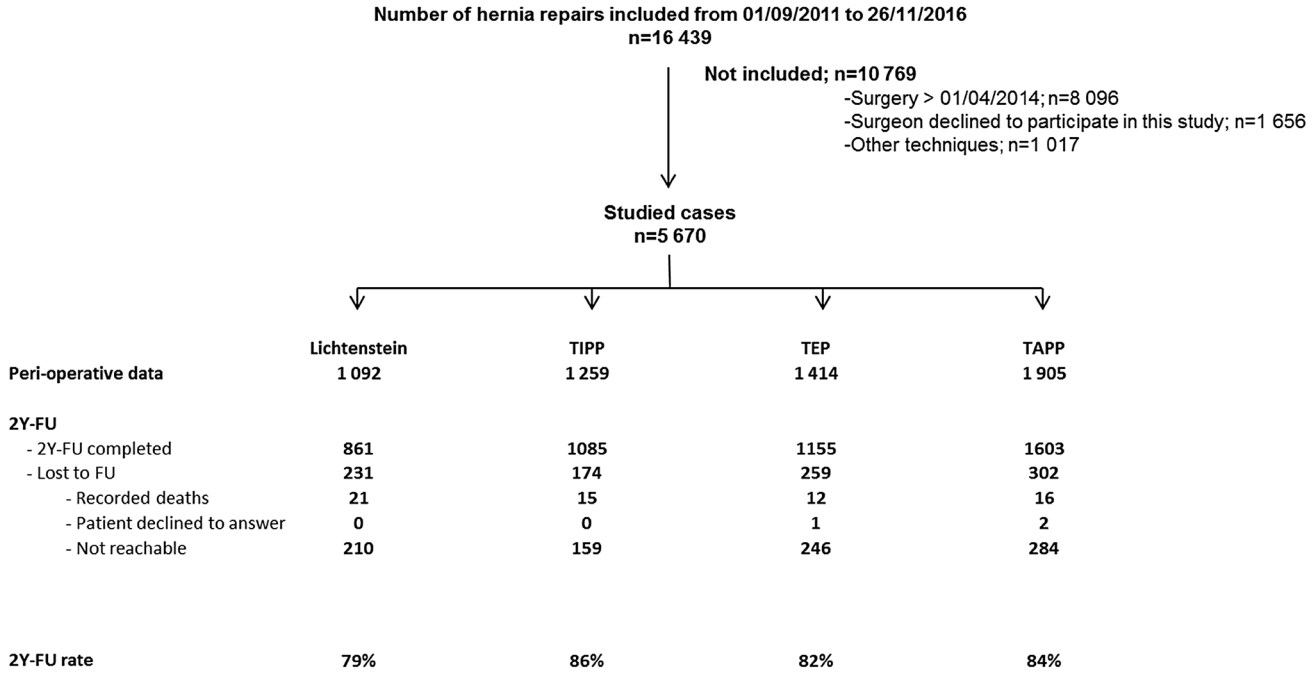

Fig. 1 Prisma flow chart

Table 1 Demographics (number of cases)

	Lichtenstein, $n=1092$	TIPP, $n=1259$	TEP, $n=1414$	TAPP, $n=1905$	p value
Mean age (years) ± SD	66.2 ± 0.4	64.8 ± 0.4	63.5 ± 0.4	61.7 ± 0.3	< 0.001
Gender					
Female	84 (7.7%)	108 (8.6%)	145 (10.3%)	207 (10.9%)	0.02
Male	1008 (92.3%)	1151 (91.4%)	1269 (89.7%)	1701 (89.3%)	
Mean BMI ± SD	25.2 ± 0.1	25.5 ± 0.1	24.9 ± 0.1	25.3 ± 0.1	0.001
Physical activity					
None	637 (58%)	577 (46%)	711 (50%)	951 (50%)	< 0.001
Rarely	175 (16%)	157 (12%)	240 (17%)	282 (15%)	
Moderate	130 (12%)	141 (11%)	254 (18%)	320 (17%)	
Intensive	118 (11%)	374 (30%)	203 (14%)	325 (17%)	
ASA					
1	384 (35%)	517 (41%)	907 (64%)	831 (44%)	< 0.001
2	404 (37%)	632 (50%)	423 (30%)	753 (40%)	
3	281 (26%)	107 (8%)	78 (6%)	320 (17%)	
4	5 (0.4%)	0 (0%)	0 (0%)	0 (0%)	
Diabetes	60 (5%)	42 (3%)	70 (5%)	64 (3%)	< 0.001
Antithrombotics	166 (15%)	215 (2%)	168 (12%)	206 (11%)	< 0.001

operative time and day-surgery rate were different between the four groups (Table 2).

Immediate postoperative course

Medical complications were higher in the Lichtenstein group compared to the other techniques ($p < 0.001$) (Table 3). Among the medical complications, urinary retention was the more frequent. For Lichtenstein technique, spinal anesthesia was used in 15.1% that could explain the high rate of urinary retention in this group, compared to TIPP technique (0.6%). Surgical complications were statistically different among the four techniques, but the differences were small from a clinical

Table 2 Type of hernias according to EHS classification and operative details

	Lichtenstein, $n=1092$	TIPP, $n=1259$	TEP, $n=1414$	TAPP, $n=1905$	p value
Type of hernia					
Primary	984 (90%)	1201 (95%)	1317 (93%)	1778 (93%)	0.003
First reccurence	80 (7%)	50 (4%)	63 (4%)	96 (5%)	
Second recurrence	8 (0.7%)	6 (0.5%)	12 (0.8%)	11 (0.5%)	
Third recurrence	0 (0%)	0 (0%)	2 (0.1%)	0 (0%)	
Inguinoscrotal hernia	211 (19%)	3 (0.2%)	74 (5%)	194 (10%)	< 0.001
Preoperative symptoms					
No pain	138 (13%)	287 (23%)	473 (2%)	1136 (23%)	< 0.001
Pain	876 (80%)	927 (73%)	1358 (96%)	1297 (68%)	
Non-reducible hernia	56 (5%)	25 (2%)	39 (3%)	125 (7%)	
Strangulated without occlusion	6 (0.5%)	4 (0.3%)	13 (1%)	30 (1.6%)	
Strangulated with occlusion	3 (0.2%)	3 (0.2%)	6 (0.4%)	14 (0.7%)	
Mean operative time (minute) ± SD	26.9 ± 0.3	38.9 ± 0.3	18.22 ± 0.3	21.44 ± 0.3	< 0.001
One-day surgery					
Yes	557 (54%)	1023 (82%)	1080 (80%)	1328 (75%)	< 0.001
No	477 (46%)	227 (18%)	272 (20%)	438 (25%)	

Table 3 Postoperative course: complications

	Lichtenstein, $n=1092$	TIPP, $n=1259$	TEP, $n=1414$	TAPP, $n=1905$	p value
Medical complications					
Yes	55 (5%)	25 (2%)	11 (0.7%)	14 (0.7%)	< 0.001
Urinary retention	32 (3%)	8 (0.6%)	5 (0.3%)	7 (0.4%)	< 0.001
Surgical complications					
Yes	52 (5%)	59 (5%)	95 (7%)	63 (3%)	< 0.001
Non infected not peri-prosthetic collection	36 (3%)	53 (4%)	77 (5%)	58 (3%)	< 0.001
Non-infected, but peri-prosthetic collection	7 (0.6%)	2 (0.2%)	8 (0.6%)	3 (0.2%)	0.03
Infected but not peri-prosthetic collection	4 (0.4%)	3 (0.2%)	8 (0.6%)	0 (0%)	0.008

point of view (Table 3). The rate of reoperation for complication was low but higher in the Lichtenstein group. There was one death in TIPP group due to heart attack on D20.

Pain evaluation (using a visual analogic scale) was overall lower or equal than 3/10 on D1, around 1/10 on D8 and less than 1/10 at 1 month. There were several significant differences among the techniques (data not shown). On D0 and D1, TIPP and Lichtenstein were more painful than TAPP and TEP. On D8, Lichtenstein remained the most painful approach compared to the other techniques. At one month after surgery (D30) TAPP was the most painful technique. Even though statistically significant, the clinical relevance of these extremely low differences is negligible.

Endpoints

2Y-Fu Q.o.L and Patients' satisfaction (Table 4: 4704 cases) Nine hundred and sixty-six patients were lost to follow-up and 4704 cases (83%) were followed. The global Q.o.L and patients satisfaction is reported in Table 4. They assessed their abdominal wall as firm in 99% (Q1), mentioned they felt a lump in the treated groin area in 1.9% (Q2). They mentioned some discomfort or pain in 7.4% (Q3), mild pain in 2.7%, moderate pain in 2.8%, severe pain in 0.4%. None required daily analgesic, or a referral to a pain-centre. Thus, there was no difference between the techniques for pain evaluation. The location and the moment of these symptoms are reported in Table 4 (Q4, Q5, Q6). These symptoms caused temporary interruption of patients' activi-

Table 4 Q.o.L at baseline (preoperative condition) and 2Y-Fu compared among the four studied techniques

N cases	LICHTENSTEIN (861)		TIPP (1085)		TEP (1155)		TAPP (1603)		*p* value
	Baseline	2y-Fu	Baseline	2y-Fu	Baseline	2y-Fu	Baseline	2y-Fu	
Q1: does your abdominal wall seem firm?									
Missing data	–	0	–	3	–	4	–	5	0.4
No	861 (100%)	5 (0.5%)	1085 (100%)	5 (0.4%)	1155 (100%)	9 (0.7%)	1603 (100%)	16 (1.0%)	
Yes	–	856	–	1077	–	1142	–	1582	
Q2: do you feel a swelling, a lump? (Treated groin)									
Missing data	0	1		17		7		10	0.006
No	0	836	0	1055		1121		1570	
Yes	861 (100%)	24 (2.8%)	1085	13 (1.2%)		27 (2.3%)		23 (1.4%)	
Q3: do you feel any pain or discomfort?									
Missing data	16	0	24	18	19	6	32	10	0.07
No symptom	90	785	242	1001	187	1074	395	1466	
Any symptom (detailed in Q4 to Q8)	755 (87.7%)	76 (8.8%)	819 (75.5%)	66 (6.0%)	949 (82.2%)	75 (6.5%)	1176 (73.4%)	127 (7.9%)	
Mild pain	492 (57.1%)	24 (2.8%)	425 (39.2%)	29 (2.7%)	518 (44.8%)	29 (2.5%)	899 (56.1%)	44 (2.7%)	
Moderate pain	143 (16.6%)	37 (4.3%)	286 (26.4%)	31 (2.9%)	294 (25.5%)	41 (3.5%)	172 (10.7%)	70 (4.4%)	
Severe pain	115 (13.3%)	6 (0.7%)	106 (9.8%)	4 (0.4%)	133 (11.5%)	2 (0.2%)	99 (6.2%)	6 (0.4%)	
Pain (total)	750 (87.1%)	67 (7.8%)	817 (75.3%)	64 (5.9%)	945 (81.8%)	72 (6.2%)	1170 (72.9%)	120 (7.5%)	
Isolated dysaesthesia	5	9	2	2	4	3	6	7	
Combined with pain	3	2	0	0	27	0	1	0	
Dysaesthesia (total)	8 (0.9%)	11 (1.3%)	2 (0.2%)	2 (0.2%)	31 (2.7%)	3 (0.2%)	7 (0.4%)	7 (0.4%)	
Q4: where are these symptoms located?									
Missing data or NA	11	3	4	3	11	0	15	6	0.01
Groin	736	65	804	55	922	54	1157	96	
Testis/scrotum only	2	2	4	1	0	3	1	7	
Combined with groin	4	2	22	1	8	0	1	0	
Testis/scrotum total	6	4 (0.5%)	26	2 (0.2%)	8	3 (0.3%)	2	0 (0%)	
Other locations	6	6	7	7	8	18	3	18	
Q5: when do you feel these symptoms?									
Missing data or NA	10	10	4	2	12	9	15	21	0.027
During coughing, lifting	313 (36.4%)	27 (3.1%)	400 (36.9%)	12 (1.1%)	173 (14.9%)	14 (1.2%)	679 (42.4%)	10 (0.6%)	
After exertion or at the end of the day	228 (26.5%)	5 (0.6%)	204 (18.8%)	8 (0.7%)	324 (28.0%)	1(0.1%)	229 (14.3%)	10 (0.6%)	
Combined	19 (2.2%)	0 (0%)	74 (6.8%)	0 (0%)	90 (7.8%)	0 (0%)	44 (2.7%)	0 (0%)	
Others	185	34	137	44	350	51	209	86	

Table 4 (continued)

N cases	LICHTENSTEIN (861)		TIPP (1085)		TEP (1155)		TAPP (1603)		*p* value
	Baseline	2y-Fu	Baseline	2y-Fu	Baseline	2y-Fu	Baseline	2y-Fu	
Q6: how often do you feel these symptoms?									
Missing data or NA	104	10	3	1	6	8	8	11	0.23
Rarely	409 (47.5%)	56 (6.5%)	365 (33.6%)	58 (5.3%)	502 (43.5%)	58 (5.0%)	830 (51.8%)	98 (6.1%)	
Several times a day	337 (39.1%)	8 (0.9%)	397 (36.6%)	6 (0.5%)	421 (36.5%)	9 (0.8%)	316 (19.7%)	14 (0.9%)	
All the time	11 (1.3%)	2 (0.2%)	54 (4.9%)	1 (0.1%)	20 (1.7%)	0 (0%)	22 (1.4%)	4 (0.2%)	
Q7: these symptoms?									
Missing data or NA	76	12	2	0	1	0	3	0	0.4
Do not hinder your activities	212 (24.6%)	49 (5.7%)	360 (33.2%)	53 (4.9%)	417 (36%)	58 (5.0%)	389 (24.3%)	102 (6.4%)	
Allow you to pursue at a slower pace	277 (32.2%)	14 (1.6%)	263 (24.2%)	10 (0.9%)	327 (28.3%)	16 (1.4%)	622 (38.8%)	24 (1.5%)	
Cause temporary interruption of your activities	153 (17.7%)	1 (0.1%)	93 (8.6%)	1 (0.1%)	138 (11.9%)	1 (0.1%)	107 (6.7%)	1 (0.1%)	
Prevent you from doing specific activities	37 (4.3%)	0 (0%)	103 (9.5%)	2 (0.2%)	66 (5.7%)	0 (0%)	55 (3.4%)	0 (0%)	
Q8: nuisance of pain/discomfort									
Missing data or NA		0		0		0		0	0.52
No nuisance	–	11		3		11		22	
Nuisance < hernia	–	57		57		53		91	
Nuisance > hernia	–	8 (0.9%)		6 (0.6%)		11 (0.9%)		14 (0.9%)	
Q9: reoperation									
Missing data	–	0		1		0		0	0.4
No	–	854		1079		1152		1595	
Yes	–	7 (0.8%)		5 (0.5%)		3 (0.3%)		8 (0.5%)	
Recurrence		3		2		2		1	
Other (specified)		2[a]		2[b]				4[c]	
Not specified reason		2		1		1		3	
Q10: personal assessment of procedure									
Missing data		1		19		10		11	0.2
Bad or medium	–	36 (4.2%)		25 (2.3%)		35 (3.0%)		48 (3.0%)	
Good or excellent	–	824 (95.8%)		1041 (97.7%)		1110 (97.0%)		1544 (97.0%)	

p values compare the four techniques together for each question of the questionnaire at 2-year FU

Q1, Q2, Q3, Q9, Q10: calculations based on all the studied cases

Q4 to Q8: calculations based on 'Any symptoms' (Q3)

Table 4 (continued)

Phone questionnaire: patients' assessment without any medical adjustment. e.g., Pain: no medical correction according to VAS nor medicine consumption (NB no one takes painkillers regularly nor has been referred to a pain centre)

Baseline = preoperative period

% were calculated including missing data; *p* value; comparisons were done on the 2Y-results of the four techniques with χ^2 test

NA not applicable, *a* contralateral hernias (2), *b* late infection (2), *c* late infection (2), and chronic pain (2)

ties in 0.1% and prevent them from doing specific activities in only 2 cases (Q7). Patients mentioned a reoperation in 23 cases, 8 for recurrence, 8 for other specified reason, and 7 for a not specified reason (Q9). Finally, they assessed the result of their surgery as bad or medium in 2.3–4.2% and good or excellent in 95.8–97.7% (Q10), but assessed their nuisance as more bothersome than the treated hernia in 0.8% of cases (Q8).

Comparison to the baseline Q.o.L (Table 4) At 2Y-Fu, the patients considered their abdominal wall as not firm (Q1) in 0.4–1.0% of cases compared to 100% in the preoperative period. Compared to their baseline the patients' Q.o.L dramatically improved: At least a global tenfold improvement for 'any symptom' (Q3) rising up to a 15–20 fold improvement for 'mild pain' (Q3). Patients who were suffering of any discomfort ranged from 6.0 to 8.8% at 2Y-Fu compared to 73.4–87.7% at baseline. If we calculate the ratio of painful patients (2 year-FU/baseline) for each technique, we had no significant difference between ratios 0.1 for Lichtenstein, 0.08 for TIPP, 0.08 for TEP and 0.1 for TAPP. Severe pain ranged from 0.2 to 0.7% at 2Y-Fu compared to 6.2–13.3% at baseline. These symptoms were felt several times a day in 0.5–0.9% at 2Y-Fu compared to 19.7–39.1% at baseline (Q6). These symptoms prevent the patient from doing specific activities in 0–0.2% at 2Y-Fu compared to 3.4–9.5% at baseline (Q7). The nuisance of these symptoms was self-assessed by the patients as more bothersome than the hernia they had in 0.6–0.9% (Q8).

Uni and multivariate evaluation of the factors that significantly influence the 2Y-Fu patient's satisfaction

In the univariate analysis, we studied the influence of different variables on the 2-year FU patient's satisfaction (Table 5). The technique did not influence the patient's satisfaction. Mesh fixation with staplers did not influence the results. The surgeon was a factor influencing the patient's satisfaction. However, the variable "surgeon" was confounded with the variable "technique" because each surgeon did almost only one technique. After adjustment, this variable was not associated with the patient's satisfaction.

In the multivariate analysis, ilioinguinal nerve tracking and preserving during the surgery were at the limit of significance ($p = 0.05$). Pain on D 1 was an independent risk factor significantly influencing the patient's satisfaction at 2 years (Table 5).

Reoperations for recurrence at 2-year FU

After the 2-year FU, re-do surgery was not significantly different between the techniques: 7 for Lichtenstein (0.7%); 6 for TIPP (0.6%) ($p = 0.6$); 3 for TEP (0.28%) and 8 for TAPP (0.4%) ($p = 0.2$).

Discussion

In this large multicentre study of patients registered in the Club Hernie registry, the 2Y-Fu Q.o.L and the patients' satisfaction were high: patients self-assessed their abdominal wall as firm in 99% (Q1), the result of their surgery as good or excellent in 97% (Q10), and their postoperative nuisance, if present, as more bothersome than the treated hernia in only 0.8% of cases (Q8). Among the four techniques, the patients' Q.o.L was improved compared to their preoperative condition. No significant difference was found between the four studied techniques regarding the 2Y results and the patients' satisfaction. In the multivariate analysis, the only independent risk factor significantly influencing the patient's satisfaction at 2 years was the pain at D1.

Beside the recurrence rate, drastically reduced with meshes, the incidence of chronic pain, the long-term quality of life, and the patient's satisfaction have become the main quality criterions of a groin hernia repair. In most studies, pain and discomfort have been evaluated only in the postoperative period and/or during the follow-up. Depending on the criterions used for qualifying pain, the 'chronic pain' is evaluated from 10 to 15% [21]. However, a lot of complaints registered during the follow-up, are usually not directly related with the hernia, or with the hernia repair. Moreover a response bias is frequent [16]. Some of these complaints finally appeared not so important for the patient: the post-operative recorded nuisances were self-assessed as more bothersome than the hernia in only 0.8% of cases (Q8). Therefore, much more than taking into account these figures as absolute values, these figures should be compared with the preoperative condition. This comparison with the baseline, one of the originalities of this study, is of major interest

Table 5 Evaluation of factors influencing patient's satisfaction at 2Y-FU (univariate and multivariate analysis)

	Univariate analysis			Mutivariate analysis		
	OR	IC 95%	*p* value	OR	IC 95%	*p* value
Technique						
Lichtenstein	1	–	0.2	1	–	**0.49**
TIPP	1.7	1.05–2.94		2.7	0.3–13	
TEP	1.3	0.88–2.16		2	0.46–7	
TAPP	1.3	0.87–2.11		1.9	0.7–5	
BMI	1	0.96–1.02	0.2	0.97	0.96–1.01	**0.26**
ASA						
ASA 1	1	–				
ASA 2	1	0.7–1.4	0.6			
ASA 3	1.18	0.7–2.12				
ASA 4	–	–				
Inguinoscrotal hernia	1.2	07–2.2	0.9			
Physical activity						
None	1	–	0.23			
Rarely	1.42	0.8–2.5				
Moderate	0.9	0.6–1.4				
Intensive	1.42	0.9–2.4				
Recurrent hernia						
Primary	1	–	0.9			
First recurrence	1.2	0.57–3.1				
Second recurrence	1.05	0.2–18.5				
Bilateral hernia repair	1.2	0.8–1.7	0.3			
Diabetes	1	0.5–2.6	0.9			
Antithrombotics	1.3	0.8–2.5	0.2			
Emergency	0.4	0.1–2.7	0.3			
Mesh fixation with staplers	0.9	0.5–1.8	0.8			
Iliohypogastric nerve tracking and preserving	0.8	0.6–1.2	0.3			
Ilioinguinal nerve tracking and preserving	1	0.8–1.5	0.036	1.78	1–3.2	**0.05**
Complications	0.6	0.1–10.8	0.6			
Pain at D 0	0.9	0.8–1	0.4			
Pain at D 1	0.9	0.8–1	0.1	0.54	0.34–0.86	**0.01**

to assess the improvement of the patient status related to his hernia repair.

Patient satisfaction, Patient Reporting of Outcome Measures (PROM) and Q.o.L have become major evaluation parameters for chronic illness and morbidity. A Q.o.L questionnaire is used increasingly to evaluate the outcome of surgical care [10, 13, 22]. McCormack et al. [12] reviewed the literature in 2005 and concluded that both TAPP and TEP provided better outcomes in terms of quality-adjusted life years than open repair. Recently, Myers et al. [10] found a significant improvement in all Q.o.L outcome measures following TEP repair except social functioning and mental health. In the study of Bansal et al. the TEP group showed significant improvement in all domains, whereas the TAPP group showed significant improvement in all domains except those of vitality and social functions [1]. According to this present study, we have shown that patient's satisfaction at the 2-year FU was similar between the techniques. One of the major key points of this present study was a very high-response rate at the 2-year follow-up. These results are especially interesting because groups were not homogeneous at the time of study inclusion. The patients in the Lichtenstein group were not as fit as the patients in the other groups. Although the patients were older with bulky hernias, the patient's satisfaction was reportedly as good despite the technique used.

According to Aasvang et al. and Bansal et al. studies [1, 23, 24], preoperative factors related with chronic groin pain were preoperative pain, physical work, and early postoperative pain at 24 h on univariate analysis. Only preoperative pain and immediate postoperative pain at 24 h were factors that demonstrated a significant correlation with the incidence of chronic groin pain on multivariate analysis. We have shown in this study that pain on D1 was a significant

predictive factor of satisfaction at 2-year FU. Immediate pain evaluation was heterogeneous between the techniques.

In the study of Grant et al. [25], the incidence of chronic pain was 12%. There are many discrepancies in the literature concerning chronic pain rates between the different hernia repair techniques [13, 26] and the type of pain evaluation [20]. Grant et al. [25] demonstrated that the incidence of pain at 1 year was greater in the open group compared with the laparoscopic group, but at the 5-year follow-up, the incidence of pain in both groups was equal. In other trials, the evaluation of pain results showed that preperitoneal repair causes less or comparable acute and chronic pain compared to the Lichtenstein procedure [27]. Additionally, Koning et al. [13] have shown a significantly better health status of TIPP than the Lichtenstein patients in the SF-36 dimensions 'physical pain' and 'physical function' at 1 year. In this study we did not use a SF-36 form nor other three-dimensional scales too complicated for a patient self-assessment and not specialized in hernia surgery. The late results and the Q.o.L were evaluated with a validated phone questionnaire, used in all our studies since 1999 [28]. This questionnaire has been constructed as simple as possible to be mastered by the patient himself, in a PROM (Patient Reporting of Outcome Measures) concept [16]. The words used, easily understood by everyone, allow a patient's self-assessment. The terms of the pain grading: mild, moderate, severe, belong to the common language. Even though this grading entails a part of subjectivity and interpersonal variability we have chosen to record it without any medical adjustment. The same questionnaire is used in the preoperative period (baseline) and at each step of the follow-up. During the phone questionnaire a four-levels VRS (Verbal Rating Scale) was used (No pain, Mild pain, Moderate pain, Severe pain) compared with the same preoperative four scale VRS. According to our PROM policy, the patients' answers were registered without any medical correction. In this present study, the incidence of chronic pain at 2 years was low whatever technique was used. Pain described in the questionnaire could not be systematically reliable to the surgery performed. For example, the patients in the Lichtenstein group were older with other co-morbidities that also might contribute to the pain. Despite a lower severity of pain in the laparoscopic group in the Bignell et al. study [29], this did not translate into a better Q.o.L after 10 years of FU. Overall age-adjusted scores revealed that persons under 65 years of age felt they had poorer physical health, thus reducing their Q.o.L, compared to the normal values. These results suggested that the presence of chronic pain detrimentally affects the young more significantly than the older patients.

In our series, no significant difference was found between the four studied techniques regarding the 2Y results and patients' satisfaction. A recent registry-based study with propensity score-matched comparison have found more postoperative complications, complication-related reoperations and pain at 1 year after Lichtenstein's technique than after TEP or TAPP [30]. We have found similar results for postoperative complications (mainly medical complications), complication-related reoperations, but not for chronic pain. In our series, like in the above-mentioned study (before matching), patients undergoing Lichtenstein operation had larger hernias, a higher ASA score and more comorbidities. After matching, the disadvantages for the Lichtenstein persisted, at the limit of significance when compared to TAPP, clearer when compared to TEP [30]. The recurrence rate on 1-year follow-up [29] was similar among these three techniques. Regarding the pain on 1-year follow-up the statistical difference appeared significant on exertion, slight at rest and no difference appeared in subgroups on pain requiring treatment. Authors mentioned that the variable intra operative nerve injury was not used for formation of matched pairs. It was significantly higher for the Lichtenstein technique (0.45 vs 0.01%; $p < 0.001$) [29]. The variable operating surgeon was not used either for formation of matched pairs. According to the International Guidelines [2] the TEP and TAPP procedures have certainly been performed by surgeons with a specific expertise. Conversely in such a large registry, some Lichtenstein techniques might have been carried out by surgeons without a specific expertise on parietal surgery. In our Club-Hernie, all surgeons are experienced in parietal surgery, master different techniques but mainly perform their preferred one. Therefore, in our series, the Lichtenstein techniques were performed, either by specialists of this technique or, in difficult cases, by specialists of parietal surgery.

In this cohort including exclusively expert surgeons practising almost one technique for inguinal hernia repair, the "surgeon" variable was a confounding factor with the "technique" variable. After adjustment, these factors did not influence the 2-year FU patient's satisfaction. In open techniques, the three nerves preservation, especially ilioinguinal nerve tracking and preserving during the procedure protected against postoperative pain [31]. In our study, ilioinguinal nerve tracking and preserving during the surgery was an independent risk factor at the limit of significance for the 2-year FU patient's satisfaction. As ilioinguinal nerve tracking is only possible during the open technique, this factor cannot be generalised to the other laparoscopic techniques. The fact that every surgeon practised mainly only a single technique explain why we did not use a propensity score to adjust for the potential factor associated with the treatment indication. Thus, the propensity to receive a certain type of treatment depends almost only on a single factor, which is the surgeon.

This study has several limitations because this was a nonrandomised cohort. The patients did not undergo a systematic clinical examination after 2 years, but they had completed an interview by phone, which might have led to

an underestimation of the actual rates of hernia recurrence. However, the power of this study consists of a prospective registration including a high number of consecutive patients with a 2-year standardised follow-up that achieved more than 80% compliance and a very high completion rate (missing data were very rare). All techniques were performed by expert surgeons with extensive experience. Each surgeon chose for each of his/her patients the most appropriate technique among those he/she has most often used. Furthermore, this registry gathers the data from private and public practice, general and academic hospitals, thus depicting accurately the general population. This could have produced a selection bias because the patients chosen for one technique (namely, Lichtenstein) might have been different from those chosen for another. Moreover, the large number of patients in each group and the number of participating surgeons permitted a balance of all groups. Questionnaire evaluation was performed by an independent clinical research assistant who was blinded to the type of technique.

In conclusion, the patient's satisfaction after groin hernia repair has been very rarely studied in literature. In our large cohort we did not found any statistical differences between the four studied techniques regarding the 2Y-Fu results and patients' satisfaction. Provided the technique has been done properly (expert surgeon) the results and the patients' satisfaction are fair and equivalent among the four studied techniques. In a multivariate analysis, the only factor predictive of bad late results was severe pain at D1.

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Compliance with ethical standards

Conflict of interest BR, JFG, POD and NM declare no conflict of interest.

Ethical approval The registry complies with the requirements of the French 'Commission Nationale de l'Informatique et des Libertés' (CNIL; registration number 1993959v0), and the different specific French ethics committees.

Human and animal rights The study including human participants has been performed in accordance with the ethical standards of the Declaration of Helsinki and its later amendments.

Informed consent Informed consent was obtained from all patients prior to all surgical procedures.

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