Chronic pain and quality of life (QoL) after transinguinal preperitoneal (TIPP) inguinal hernia repair using a totally extraperitoneal, parietalized, Polysoft® memory ring patch

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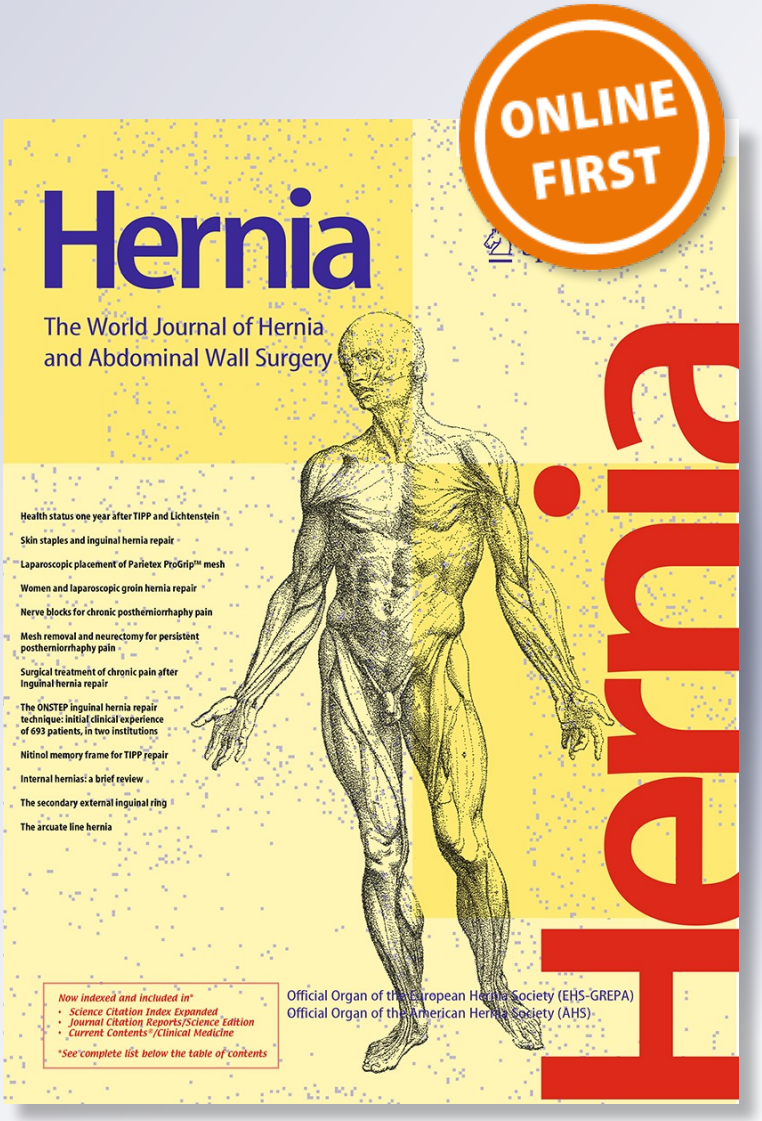

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ORIGINAL ARTICLE

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

J.-F. Gillion · J.-M. Chollet

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Abstract
Introduction Little is known about both incidence of chronic pain and quality of life (QoL) after the transinguinal preperitoneal (TIPP) technique using a totally extraperitoneal, parietalized, memory ring patch.
Materials and methods Among 622 (428 unilateral and 194 bilateral) hernia repairs (HR) in 525 patients, 92 % had a postoperative clinical control. Thereafter, two sets of postal self-assessed questionnaires were sent.
Results A total of 531 HR were studied with a mean follow-up of 17 ± 8 months. Only one recurrence was detected. In 151 (28.4 %) HR the patients alleged various symptoms, but in only 10 (1.9 %) HR they considered their discomfort more bothersome than the hernia they had before, and in just 2 (0.4 %) HR they judged their result as bad (one patch removal for sepsis and one for hematoma). Only mild pain (including no painful discomfort such as a foreign body sensation) or moderate pain was frequent. Pain was self-graded as severe in four cases. None of them reported any regular consumption of antalgics. None of them judged their result as bad. Dysesthesia (numbness 19, paresthesia 20) mentioned in 39 HR (7 %), associated with pain in 16 HR, was said to be more bothersome than the hernia treated in just 3 HR (0.6 %). The results of the entire series were self-assessed as good or excellent in 97 % of the HR.
Conclusion In our TIPP series, both the incidence of recurrences (0.2 %) and that of severe chronic pain (≤0.7 %) were very low, as well as patients' QoL was excellent. In our experience, the postoperative course was as painless as that of laparoscopic TEP we had been performing previously, but TIPP appeared more suited to day-case surgery.

Keywords Inguinal hernia · Mesh repair · TIPP · Pre-peritoneal · Memory ring patch · QoL · Chronic pain

Introduction

Postoperative chronic pain and patient's quality of life (QoL) currently constitute the main issues for hernia surgeons. According to EHS guidelines [1], the best results regarding these points are provided by the laparoscopic totally extraperitoneal (TEP) repair, without patch fixation. At that time, the transinguinal preperitoneal (TIPP) technique using a memory ring patch was not included in this EHS evaluation, because of the small number of available publications on this new technique.

The current TIPP technique is clearly a modern mini-invasive adaptation of the preperitoneal mesh placement through a groin approach pioneered by Rives et al. [2], Read et al. [3, 4] and Schumpelick et al. [5] and improved by Alexandre et al. [6], who described, via this inguinal route, the so-called parietalization of the spermatic cord, which avoids slitting the mesh. The invention by Pelissier et al. [7, 8] of an innovative brainchild, memory ring patch, was the latest crucial step for the further development by Berrevoet et al. [9, 10] of a promising mini-invasive inguinal approach.

The fairly good outcomes of the laparoscopic repair result from the combined advantages of a preperitoneal patch placement and a minimally invasive approach. Nevertheless, the laparoscopic repair, especially TEP, entails some drawbacks: (1) it is not convenient for every

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case (frail patient, big scrotal and irreducible hernia), (2) it is demanding for the surgeon due to frequent non-ergonomic positions, (3) it exposes to rare but serious complications [11], (4) it is associated with frequent unpredictable intraoperative events which may significantly prolong operative time [11–14], (5) it does not fit well with day-case surgery because of the nonpredictable duration of the procedure, (6) it needs specific materials increasing the hospital cost of the procedure (7) and finally it requires highly skilled surgeons [14].

The first studies on TIPP reported excellent short-term results [8–10, 15, 16], which have to be confirmed. Moreover, little is known on medium- and long-term outcomes, especially on QoL. The aim of the present study was to evaluate the impact of the TIPP technique on the postoperative course, the practice of day surgery and the medium-term QoL, and finally to compare these results with those of some other hernia repairs from the literature and from a historical cohort.

Patients and methods

Study design

From May 2008 to December 2010, all consecutive, unselected adult patients scheduled for groin HR were operated on using the Polysoft® patch (Davol Inc., C.R. Bard Inc., Crawley, UK) TIPP technique by two senior surgeons included in the present study and prospectively evaluated. The patients with a history of radical prostatectomy or cystectomy, as well as those operated on as emergency cases, were excluded.

Material

The polypropylene memory ring patch used in this study has been previously described [7, 8].

Operative technique

The operation was performed under general anesthesia with a laryngeal mask, without myorelaxant. No antibiotics were given. An inguinal incision (approximately 3.5 cm in length) was performed at the level of the internal orifice and the external oblique aponeurosis was cut open from deep to superficial inguinal ring. A careful attempt to identify and preserve the ilioinguinal nerve (II) running just behind it was carried out. No extensive dissection between the external oblique aponeurosis and the internal oblique muscle was done. The ilio-hypogastric nerve (IH) was left in its bed usually far from the TIPP dissection.

The cremaster muscle was not resected. The inguinal floor was not cleaned up. The external spermatic vessels were not mobilized. If the cord was lifted, to facilitate the parietalization of the cord constituents, attention was paid to avoid any direct or indirect traction on the genital branch of the genito-femoral nerve (GBGF) leaving in place the external spermatic vessels. This was achieved by passing throw the window between these vessels (lesser cord) [17], and both the internal spermatic vessel and the vas deferens (proper cord). In lateral hernias, the sac was dissected free and reduced in the preperitoneal space through the internal orifice. In medial hernias the transversalis fascia was incised and the sac was separated and reduced. No extensive pre-fascial dissection was required and the preperitoneal space was entered either through the hernia defect and/or through the internal orifice gently retracted, preserving both epigastric vessels and the GBGF entering the inguinal canal at its very external edge. Gently blunt (but not blind) preperitoneal dissection was carried out in the avascular plane located between transversalis fascia and preperitoneal fat. Medially, the Cooper ligament and the ipsilateral part of the Retzius cava were easily exposed. Laterally, the peritoneum was, under permanent visual control, separated from the vas deferens and the anterior aspect of the internal spermatic vessels, as far as they were completely parietalized (angulus of the deferens; psoas segment of the internal spermatic vessels). Attention was paid to preserve the retroparietal spermatic sheath coating these cord constituents [18, 19], or at least to avoid a dissection too close to the external iliac vessels to preserve both the GBGF and the lymphatic structures.

Anteriorly and laterally, the peritoneum was separated from the posterior aspect of both the transverse muscle and the transversalis fascia. The epigastric vessels were preserved and kept adherent to the abdominal wall. In lateral hernias the fascia transversalis was not open, keeping intact the inguinal floor. The preperitoneal space was entered via the deep inguinal ring gently retracted preserving the epigastric vessels and the BGGF.

The Polysoft® patch was then introduced via the hernia orifice—either laterally or medially—and inserted and deployed between the peritoneum and parietalized cord constituents (internal spermatic vessels and vas deferens), from the retropubic area to the anterosuperior iliac spine area, covering widely the medial and lateral compartments of the groin, as well as the femoral area. Its memory ring helped us in deploying the mesh and checking its correct positioning.

No fixation was performed, with the mesh being firmly applied by the abdominal pressure to the deep aspect of the previously preserved inguinal floor (epigastric vessels not transected and transversalis fascia not open in case of lateral hernias, sutured in case of medial ones). In some rare

cases of huge medial hernias or in some cases of femoral hernias, one stich fixed onto the Cooper's ligament (never elsewhere) secured the mesh. The external oblique aponeurosis was sutured superficially to the spermatic cord, followed by the subcutaneous tissue and skin.

Analgesic infiltration with 20 ml ropivacaine was performed. The prescription for the first 3 days was as follows: 200 mg/24 h ketoprofen, 2 g/24 h paracetamol and 37 mg tramadol before going to bed.

Evaluation

Pre, per and postoperative data were reported in the database in real time. The postoperative pain was assessed using a 0–10 visual analog scale (VAS). Further outcomes were assessed by questionnaires, where pain was self-graded on a four-point verbal rating scale (VRS) [20]: no pain, mild, moderate or severe pain (Figure 1); Discomfort was rated as mild pain.

The pain nurse carried out the pain evaluation on the day of surgery (D0) and on postoperative day 1 (D1) (by phone call in case of day surgery). Pain on day 8 (D8) was assessed either during a systematic clinical control for surgeon A, or by phone for surgeon B. Patients were given an appointment for clinical control on day 30 (D30).

Thereafter, two sets of self-administered QoL questionnaires were mailed: in October 2009 (Q1) and February 2011 (Q2). The survey used a previously validated ten-question QoL questionnaire [21] designed to be easily understood and filled in by patients themselves (Fig. 1). The answers were registered without any medical adjustment.

The patients who complained of any trouble were invited to have a clinical control at the surgeon's office. The correlation between the patient's answer and clinical assessment (e.g., VAS) and physical examination was then determined.

A patient was considered lost to follow-up only after postal and phone reminders, when it obviously appeared that he had completely changed both his address and phone number(s) and was not managing to elude contact with the surgical team. The QoL was assessed on five groups of patients (G1–G5), as specified in Table 1. Statistical differences were calculated using the χ^2 test.

Question 1. Since your operation does your abdominal wall seem:
- Firm ?
- Not firm ?

Question 2. Do you have a new hernia or 'bulge' ?
- No
- Yes (if so, specify the site) :
  - Operated side
  - Scar region
  - Other side
  - Both sides
  - Elsewhere (specify)

Question 3. Do you currently feel any pain or local discomfort? (several possible answers)
- No (if no, proceed directly to question 9)
- Discomfort
- 'Pins and needles'
- Loss of sensation
- Moderate pain
- Severe pain
- Other symptoms (please specify)

Question 4. Where are these symptoms located ? (several possible answers)
- Operated side
- Scar region
- Other side
- Both sides
- Thighs
- Scrotum
- Elsewhere (specify)

Question 5. When exactly do you feel these symptoms?
- During lifting, coughing, or pushing
- During other types of effort (please specify)
- After physical effort or and the end of the day
- At any other particular time (please specify)
- At any time

Question 6. How often do you feel them?
- Rarely
- Several times a week
- Several times a day
- Throughout the day
- 24h/24h

Question 7. The symptoms felt:
- Do not hinder your activities
- Allow you to pursue your activities but at a slower pace
- Cause temporary interruption in your activities
- Prevent certain activities (which one?)

Question 8. These symptoms
- Are more of a nuisance than those of the hernia you previously had
- Are less of a nuisance than those of the hernia you previously had

Question 9. Have you had further operation on your abdominal wall?
- No
- Yes (if so, please specify)

Question 10. Looking back, how do you assess the result of your hernia operation:
- Excellent
- Good
- Medium
- Bad

Fig. 1 Quality-of -Life questionnaire

Results

Six hundred and twenty-two hernias were treated in 525 patients whose characteristics were as follows: 482 males and 43 females, aged 59 ± 15 (range 18–96) years, 277 (53 %) with a professional occupation, BMI 25 ± 3 (range 17–43) and ASA stage I, II, III and IV, respectively, 193, 271, 61 and 0.

Table 1 Different groups of patients for QoL evaluation

		Questionnaire	Patients	Hernias
G1	Answer to 1st questionnaire	Q1	430	510
G2	Answer to 2nd questionnaire	Q2	163	191
G3	Answer to Q1 or Q2	Q1 or Q2	449	531
G4	Answer to both	Q1 + Q2	144	170
G5	Late physical examination		41	52

Table 2 Condition of the nerves in 622 hernia repairs

	Not seen (%)	Preserved (%)	Resected (%)
Ilio-inguinal	151 (24.3)	449 (72.2)	22 (3.5)
Ilio-hypogastric	528 (84.9)	85 (13.7)	9 (1.4)
Genital branch	487 (78.3)	126 (20.3)	9 (1.4)

The hernias repaired were unilateral (428 hernias) or bilateral (194 hernias).

As results may obviously be different from one side to the other, they were studied and reported in terms of hernia repairs (HR) rather than of patients.

The hernia type was lateral in 313 cases, medial in 188, combined in 89, femoral in 14, recurrent in 17 cases and not specified in 1 case. The size of the patch used was medium in 496 (80 %) and large in 126 cases. The condition of the nerves is given in Table 2. There were 27 (4.3 %) intraoperative events easily controlled: 20 peritoneal breaches which were sutured and 7 injuries to epigastric vessels controlled by hemostasis. The mean duration of operation was 35 ± 11 (15–120) min.

The overall percentage of day surgery was 60 % (319 patients), increasing from 48 % in 2008 to 72 % in 2010. No case of readmission occurred.

Postoperative course

None of the patients died; 28 postoperative complications occurred: 1 sepsis, 3 hematomas, 17 superficial seromas, 5 urinary retentions, 1 superficial thrombophlebitis and 1 pulmonary edema in a cardiac patient 15 days after his discharge. Three (0.5 %) reoperations were necessary: one for chronic seroma and two patch removals—one for sepsis and one for hematoma. The mean time out of work for patients in full-time employment was 18 ± 9 (range 1–70) days.

At 1-month control (D30), 573 (92 %) HR were examined and 49 (8 %) were not; 45 patients did not attend the consultation. Physical examination did not show any complication other than those mentioned above; in particular, there was no case of orchitis or testicular atrophy. The VAS value was 0 in 508 (89 %) cases.

The VAS values at four postoperative evaluations are given in Fig. 2; it is noticeable that the percentage of cases with VAS value ≤ 3 was 78 % at D0, 74 % at D1, 96 % at D8 and 99 % at D30 when the percentage of patients with VAS up to six was around 1 %.

Dysesthesia (either numbness or paresthesia or both) was present, distant from the scar, in 32 (5.5 %) of the examined groins: scrotum (13), upper thigh (6), iliac fossa (3) and unspecified (10). It was combined with mild pain in 16 cases and with moderate pain in 1 case. No correlation between identification or not, preservation or not of nerves

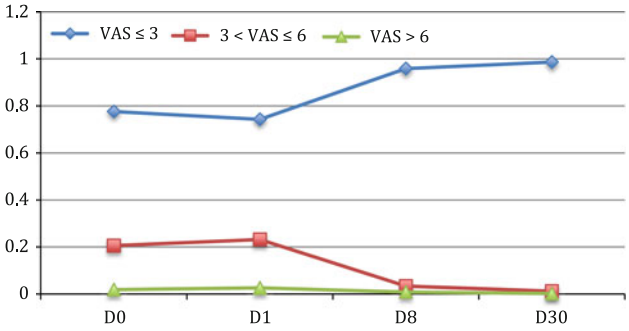

Fig. 2 Percentage of patients with three ranges of VAS values, at four different postoperative times

(Table 2) and dysesthesia or pain appeared in statistical tests.

Follow-up

The detailed follow-up is shown in Fig. 3; 39 of the 49 HR, not controlled at the first month, were further evaluated by questionnaires. Only ten (1.6 %) HR were lost to follow-up from the first month; their postoperative course had been uneventful.

161 HR patients did not spontaneously answer the questionnaire: for 80 of these repairs, patients filled it in after repeated phone call(s) and eventually assessed their results as excellent (74), good (6), medium (0) or bad (0). The remaining patients did not live any longer in the indicated address and additionally had changed their mobile phone number.

Evaluation by questionnaire was obtained in 531 (85 %) HR, with a mean follow-up of 17 ± 8 months. Only one (0.2 %) recurrence was detected and reoperated. This was a lateral recurrence, protruding lateral to the inferior border of the patch; it was simply cured by a plug. No case of testicular atrophy or debilitating pain occurred.

Quality of life

Group G3

The results of the patients who answered at least one questionnaire (G3) are given in Tables 3 to 7. In 151 (28.5 %) of 531 followed HR, the patients alleged some symptoms. In only ten (1.9 %) HR they considered their discomfort being more bothersome than the hernia they had before and in 2 (0.4 %) HR they judged their result as bad (cases of patch removal at reoperation for sepsis or hematoma). The result was assessed as good or excellent in 97 % of the HR. None of these 151 symptomatic HR patients reported any regular consumption of antalgics.

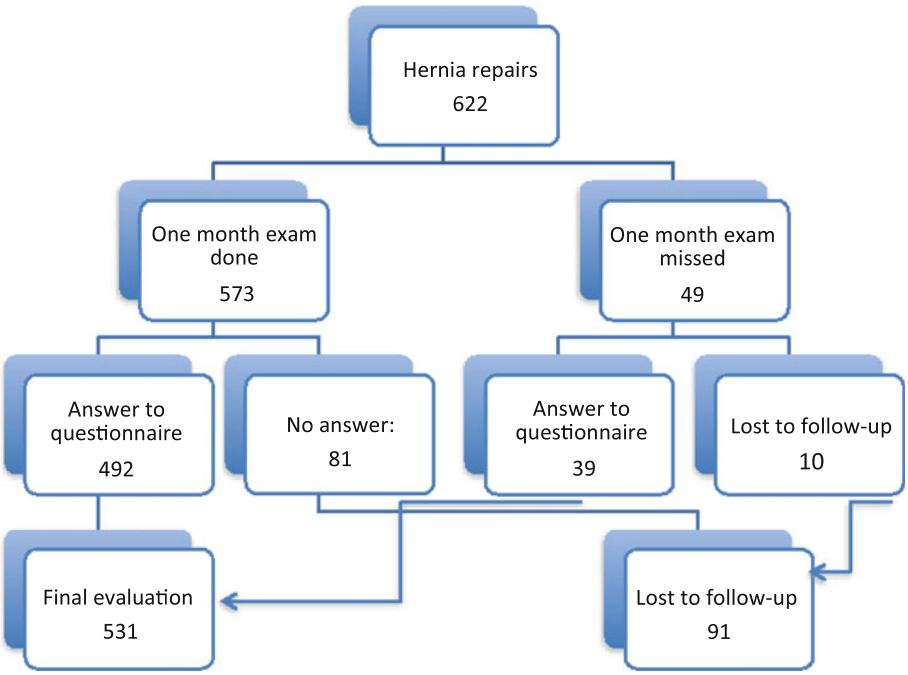

Fig. 3 Follow-up (622 hernia repairs in 525 patients)

Table 3 Alleged symptoms, discomfort and patients' evaluation of the result in 531 followed (G3 group) hernia repairs

Group (*N* %)	Symptoms		Discomfort[a]		Result of patients' evaluation			
	No	Yes	Less	More	Excellent	Good	Medium	Bad
G3 (531)	380	151	141	10	379	135	15	2
G3 (%)	71.6	28.4	26.6	1.9	71.4	25.4	2.8	0.4

[a] More or less discomfort after surgery than before

Pain location (Table 5) was inguinal in 88 % of the cases. Pain occurred with effort (14 %), at the end of the day (12 %), during some movements, especially when bending the thigh or rising from a car seat (16 %), and rarely (2 %) during or after sexual activities. In about two-thirds of the cases, the circumstances were not specified by the patients.

In most cases, the alleged symptoms did not preclude any activity. In eight cases the pain obliged the patient to temporarily interrupt his ongoing activity and in two cases the pain was said to hinder some specific activities but without details given. There were no cases of debilitating pain. All the patients resumed their professional and leisure activities and not one of them took analgesics or attended a pain treatment unit. Only mild or moderate pain was frequent (Table 7). Pain was graded as severe by the patient in four cases (Table 4). None of them reported any regular consumption of antalgics or judged the result as bad. Two chose being reoperated on by the same team using the same technique for a contralateral hernia that appeared during the follow-up period. Two of them judged the result as good and two as medium. In one of these cases the pain could be attributed to a femoral neuralgia of spinal origin, with a painless groin.

Group G5

The correlation between the patient claims and evidence from medical examination was carried out in the 56 HR which had a late physical examination. In 29 of them, the patients were symptom free and only attended the surgeon visit to feel reassured. In 27 HR cases, they alleged various

Table 4 Repartition of symptoms in 151 of the 531 followed (G3 group) hernia repairs

Symptoms	Hernia repairs	Discomfort[a]	
		Less	More
Dysesthesia + pain	16		
Dysesthesia alone	**23**		
Dysesthesia total	39	36	3
Numbness	19		
Paresthesia	20		
Pain + dysesthesia	16		
Pain alone	112		
Pain total	**128**	**118**	**10**
Mild	51	48	3
Moderate	73	69	4
Severe	4	1	3
Debilitating	0	0	0
Total	**151**	**141**	**10**

[a] More or less discomfort after surgery than before

Table 5 Site of pain In 128 of the 531 followed (G3 group) hernia repairs

	Mild	Moderate	Severe	Total *N* (%)
Inguinal	47	62	4	113 (88.3)
Scrotal	0	9	0	9 (7)
Ing + scrotal	1	3	0	4 (3.1)
Thigh	0	0	0	0
Elsewhere	1	3	0	4 (3.1)
Not known	2	1	0	3 (2.3)
Total	51	78	4	133 (103.9 %)[a]

[a] More than 128, because there was more than one site of pain in some cases

Table 6 Pain impact on daily activities in 128 of the 531 followed (G3 group) hernia repairs

	Mild	Moderate	Severe	Total *N* (%)
No impact	30	28	1	59 (46)
Allowed to continue	3	21	0	24 (18.8)
Oblige to stop[a]	2	5	1	8 (6.3)
Hinder some activities[a]	0	1	1	2 (1.6)
Not known	16	18	1	35 (27.3)
Total	51	73	4	128

[a] Temporarily

Table 7 Pain occurrence in 128 of the 531 followed (G3 group) hernia repairs

	Mild	Moderate	Severe	Total *N* (%)
Rarely	16	16	0	32 (25)
Several times a week	6	11	0	17 (13.3)
Sometimes in a day	5	13	3	21 (16.4)
Several times a day	4	7	0	11 (8.6)
Throughout the day	3	8	0	11 (8.6)
24 h/24 h	1	0	0	1 (0.8)
Not known	16	18	1	35 (27.3)
Total	51	73	4	128

symptoms. Only one patient considered the postoperative discomfort worse than the discomfort due to the hernia, but without any clinical evidence.

Most alleged troubles certainly had no relationship with the hernia repair: osteoarthritis, sciatica, erectile dysfunction (without dysejaculation) and irritable bowel. There was no correlation between the alleged symptoms and physical examination. Moreover, 2 patients out of the 15, who had judged the result of the operation to be medium at first evaluation (Table 3), chose to be operated on by the same surgeon and using the same method when a contralateral hernia occurred.

Group G4

The evolution over time of symptoms and QoL were evaluated (Table 8) in the group (G4) of patients who answered both questionnaires (170 HR) at the 1-year interval. The mean follow-up was 25 ± 6 months. There was no significant difference between the answers of both questionnaires. Switches from one category to the other compensated each other: 14 cases that were declared asymptomatic at Q1 were symptomatic at Q2 and, conversely, 21 cases with symptoms at Q1 were declared asymptomatic at Q2. Globally, no deterioration was apparent.

In a historical comparison between present results and those of the inguinal-approach subgroup of our 1999 study [21], the incidence of bothersome symptoms significantly decreased from 4.7 to 1.9 % ($p < 0.02$). Dysesthesia significantly decreased from 15.3 to 7.8 % ($p < 0.001$). Pain comparison was not accurate because discomfort or foreign body sensation, registered as mild pain in the present study, were not registred as mild pain in the 1999 series.

Discussion

Ninety-two percent (573 of 622) of our hernia repairs (HR) were examined at the first month visit, and for 85 % of the repairs patients answered almost one questionnaire with a mean follow-up of 17 ± 8 months.

This follow-up is long enough to evaluate chronic pain, defined as a pain lasting for 3 months [22], and to explore the patients' QoL.

These rates favorably compare with those obtained in similar surveys: 84.5 % at a 3- 6-week visit [23], 74 % at up to a 3-month follow-up [24], 80.8 % at 1 year [25], in these Swedish, Scottish and Danish series. The response rate at 10 months was 51 % in a large Italian survey [26]. Without a deep implication of the surgical team, the 6-month response rate was 54.1 % in a German survey conducted by sociologists and epidemiologists [27]. Our high response rate was reached after meticulous and time-consuming postal reminders and phone calls [28], which only ended when it was absolutely established that the patient had completely changed both his postal address and phone number(s) and was not eluding contact with the surgical team. Perhaps, some of them might be dead, although none of our questionnaires were sent back by relatives mentioning the patient had deceased.

Thus, the *non-response bias* was clearly minimized and it can be assumed that the results of the non-respondents would not be widely different from those of the respondents.

Table 8 Time evolution of symptoms between answers to Q1 and Q2 in 170 hernia repairs from the G4 group

	Symptoms (%)		Discomfort[a]		Result of patients' evaluation (%)			
	No	Yes	Less	More	Excellent	Good	Medium	Bad
Q1	125 (73.5 %)	45 (26.5 %)	42	3	124 (72.9 %)	41 (24.1 %)	5 (3 %)	0
Q2	132 (77.6 %)	38 (22.4 %)	31	7	129 (75.9 %)	38 (22.4 %)	3 (1.7 %)	0

[a] More or less discomfort after surgery than before

Reinforcing this meaning, the results of the 80 repairs obtained after repeated call(s) were not different from those of the entire series.

Our study is not only the largest published cohort of TIPP to date, but also the first one including an evaluation of the patients' QoL using a dedicated questionnaire.

We decided to choose the same questionnaire as previously used [21] for two main reasons. First, it allows historical comparisons among our entire series. Second, none of the scales frequently used, such as McGill Pain Questionnaire, Pain Disability Index (PDI) [29], Short Forms SF-36 [30] or SF-12 or Carolina Comfort Scale, have already reached a universal agreement in evaluating hernia repairs [31].

Our questionnaire is easier to answer than more complete questionnaires. Therefore, the patient does not need any assistance to fill it in. This precludes the risk of influencing the answers, but on the other hand (and whatever the scale used) the results of patient self-assessed scales have to be interpreted with caution. In these questionnaires, every impairment or change in daily life alleged by the patient is 'a priori' considered as related to the hernia repair. It is often untrue. The discomfort or change in daily life may proceed from many other causes, even if these troubles were not present in the preoperative period. Moreover, the patients may have overrated them because the simple mention of potential troubles in the questionnaire may have led them to give a positive answer (*response bias)*, even for mild ones that they probably were not conscious of without reading the questionnaire. Furthermore, some of them may overestimate their pain assessment because of a lack of personal pain reference. For instance, out of the four patients who mentioned severe pain, none of them usually took antalgics and did not assess the result as bad.

Indeed, the perception of operative results is widely different from the patient's or surgeon's point of view [23, 32]. This difference appeared clearly in our Group G5 where most alleged troubles had no relationship with the hernia repair itself. Moreover, 2 patients out of the 15 in group G3, who had judged the result of their operation no better than 'medium' at first evaluation (Table 3), further chose to be operated on by the same surgeon and using the same method when a contralateral hernia occurred.

From our personal viewpoint, the most relevant question is Question 8: 'these symptoms are more (or less) of a nuisance than those of the hernia you previously had'.

In a historical comparison between present results and those of the inguinal-approach subgroup of our 1999 study [21], the incidence of bothersome symptoms significantly decreased from 4.7 % to 1.9 % ($p < 0.02$). This significant improvement could come from both a better care of the inguinal nerves (dysesthesia significantly decreased; $p < 0.001$) and a preperitoneal positioning of the mesh, which were not systematic between 1992 and 1996. The incidence of late pain, depending on taking into account (present series) or not (previous series) the 'no painful foreign body sensation', could not be validly compared. Similarly, in the literature these 'no painful slight discomforts' are included [25, 30] or not [33, 34] in the 'mild pain cases' subgroup. The global incidence of late pain in our present series is consistent with other publications using the same criteria [25, 30, 35].

Severe pain can rise up to 3 % in some series [24]. Admittedly, four of our patients declared feeling 'severe' pain, but actually with no need of analgesic consumption and only slight impact on daily activities. The alleged pain hindered some activities only in the first case, caused a brief interruption of ongoing activity in the second one, did not interfere with current activities in the third and the impact was not detailed in the fourth one (Table 6). So, in the present series TIPP technique provided a very low rate (≤ 0.7 %) of severe chronic pain (which after objective revision could be medically adjusted as 0 %) and a very low impact on QoL, as just 1.9 % of patients said that their postoperative troubles were more bothersome than the one they were experiencing before their hernia repair. The result was self-assessed as good or excellent in 97 % of the cases.

In either TIPP or TEP, the patch is positioned in the same preperitoneal space with no need for any fixation. Like in TEP, in our TIPP technique the parietalization is not blind. Gentle retraction of the deep ring gives sufficient exposure of the preperitoneal structures allowing a complete dissection under permanent visual control as far as the vas deferens angulus and the psoas segment of the anterior aspect of the internal spermatic vessels. TIPP is actually a TEP performed via an external mini-invasive approach.

The only difference is the approach. Thus the benefits of both should be necessarily close, provided the inguinal nerves are preserved in the former [36]. Indeed, in the early postoperative course TIPP is noticeably as quite painless [7–10, 15] as the laparoscopic ones [11, 36–38], allowing an early return to work and daily activities. TEP can also be done as a 1-day surgery [39], in particular when not too many HR have been scheduled on the same day.

Compared to the TEP we performed earlier (more than 1,000 procedures), TIPP offers some advantages: (1) light anesthesia (laryngeal mask) without curare, associated with a TAP (transabdominal parietal) block providing shorter awakening without nausea, (2) intraoperative events (peritoneal tear, bleeding of epigastric vessels) that are easier to manage, (3) reduced risk of rare but serious complications [11], (4) shorter (35 min; standardized ± 11 min) and so more foreseeable operating room time, allowing to perfectly follow the regular pace of a complete day-case program, (5) no need of extensive dissection which could lead to some degree of 'dissectalgia' [38], (6) no need of expensive equipment [14], keeping this equipment free for other surgical procedures. Some of these benefits had been already underlined in the meta-analysis of Voyles et al. [40]. These advantages led us to switch from the TEP to the TIPP in 2008 as our routine method of choice. In our practice the percentage of day surgery for unselected patients, taking into account our national regulatory, increased from 48 % in 2008 to 72 % in 2010.

We usually perform the operation under slight general anesthesia (see above), which provides quick awakening and prevents vomiting. The operation can also be performed under local anesthesia if preferred [41], but when the surgeon is not used to it, local anesthesia may become a risk factor for recurrence [42]. We excluded patients with a previous medical history of cystectomy or radical prostatectomy, but others [8] did not exclude them. In their experience, the TIPP was possible in half the cases and when it was not possible, switching to a Lichtenstein repair by simply enlarging the incision was very easy. This is obviously not the case for all other preperitoneal techniques.

Compared to Lichtenstein or open onlay-patch repairs, the preperitoneal repair offers many advantages: (1) the patch is secured to the abdominal wall by the intra-abdominal pressure and does not require any fixation which entails an increased risk of nerve entrapment, (2) the medial overlapping is better than with an onlay patch, thus minimizing the risk of medial recurrences [43, 44], (3) the patch also covers the femoral area, (4) the risk of pain related to a hypothetic interstitial recurrence [45, 46] is excluded and (5) in the inguinal canal, the patch does not come in contact with the inguinal nerves, thus avoiding the risk of nerve irritation by sclerosis or traction due to mesh shrinkage [47]. In the preperitoneal space the genital branch of the genitofemoral nerve does not have an investing fascia [17], but, running in between the external iliac vessels, it is separated from the mesh by both the internal spermatic vessels and the retroparietal spermatic sheath described by Stoppa et al. [18, 19] and others [6]. This sheath, albeit thin, is easily preserved in many cases thanks to a direct visual control of the parietalization.

Few studies [10, 16, 48, 49] have compared TIPP with Lichtenstein repairs. Compared with a historical cohort of patients treated by the Lichtenstein technique [10], TIPP provided significant advantages including a shorter operative time, less postoperative pain and a significant trend for fewer recurrences. In a systematic Cochrane review [48], only three randomized studies were eligible. Two of them reported less chronic pain after preperitoneal repair. In the Tulip group, the difference, which did not appear in the first retrospective study [16], further appeared in the prospective one [49] that was carried out by the same team and published in a couple of complementary papers [49, 50]. Their double blind randomized study [50] clearly concluded that the SF-36 'physical function' and 'physical pain' dimensions after TIPP showed significant better patient outcomes at 1 year compared with the Lichtenstein patients.

In our series, only four (0.8 %) cases of self-assessed 'severe' pain were mentioned. None of them needed analgesic consumption and all the patients resumed their work and leisure activities. Dysesthesia (either numbness or paresthesia), noticed in 39 of 531 cases (7.3 %) and combined with pain in 16 of them (Table 4), was said to be more bothersome than the hernia itself in just 3 of the 531 cases (0.6 %).

The recurrence rate in our series was 0.2 %. It was reported at 1–2 % in previous TIPP studies [8, 10, 15, 16] and compares favorably with laparoscopic ones [51]. It may have been underrated in our series as not all the patients underwent physical examination, but this is generally the case in most studies published in the literature. Moreover, in our questionnaire the questions 1, 2 and 9 minimized the risk of a substantial underestimation.

The rare reported recurrences developed: (1) through mesh splitting, thus leading Pelissier and colleagues [52] to no longer slit the mesh, (2) lateral recurrence in case of the patch being placed too medially [10], (3) over or under an incompletely expanded mesh due to insufficient dissection, or (4) everywhere in case of a not large enough patch. In our experience, similar to Berrevoet et al. [9, 10], we had to use a large patch in roughly 20 % of our repairs.

All these mechanisms explain why recurrences occurred very early. Thanks to the memory ring that minimizes mesh shrinkage, it may be expected that the incidence of late recurrences will not be much higher.

In the last few months, a variant of TIPP, named 'ON STEP' [53] has been used. It is a mix of TIPP medially and Lichtenstein laterally, with a split in the cranial part of the Polysoft®. To our knowledge, the results of this new technique are not yet completely published. We hope that splitting the mesh, affixing the mesh to the rectus sheet (endangering the ilio-hypogastric nerve and its branches) and a pre-muscular placement of the cranial part of the mesh will not lead to an increased risk of recurrences and chronic pain.

Conclusion

In our TIPP series the incidence of both recurrences and chronic pain was very low and patients' QoL was excellent.

Compared to previously published TIPP series [8–10, 15, 16], our study confirms that the TIPP technique provides an excellent postoperative comfort, thus facilitating early return to normal activity as well as low levels of complications, recurrences and chronic pain. Compared to previously published results of inguinal onlay-repairs, in particular in a just being published RCT [49, 50] our study confirms that TIPP is likely to reduce the incidence of severe chronic pain as well as to improve patient QoL.

Compared to laparoscopic TEP technique we had been performing previously, our experience suggests that results of both are excellent but that TIPP is more suited to day-case surgery. This has led us to switch and choose TIPP as our technique of choice for routine practice while expecting the results of a randomized study.

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