Transinguinal Preperitoneal Mesh Plasty – An Alternative or a Dispensable Technique? A Prospective Analyze vs Lichtenstein Repair for Complex Unilateral Groin Hernias

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Abbreviations:

TIPP - transinguinal preperitoneal plasty;
LR - Lichtenstein repair;
DR - deep ring;
TF - transversalis fascia;

Rezumat

Plastia preperitoneală transinghinală (TIPP) - tehnică alternativă sau facultativă? Analiză prospectivă versus tehnica Lichtenstein pentru herniile inghinale complexe unilaterale

Introducere: hernia inghinală complexă este o entitate bine descrisă cu un risc ridicat de recidivă și complicații postoperatorii. Nu există o abordare standardizată și nu există rapoarte care să confirme eficacitatea unei proceduri chirurgicale. Scopul nostru a fost de a compara operația Lichtenstein (LR), considerată "standard de aur" pentru abordarea anterioară deschisă cu plastia preperitoneală transinghinală (TIPP) în tratamentul herniei inghinale complexe.

Material și Metode: studiul a fost prospectiv și include toți pacienții cu hernie complexă internați în Departamentul de Chirurgie al Spitalului Militar Cluj-Napoca între ianuarie 2010 și decembrie 2014. Toți pacienții au fost randomizați în două loturi: LR și TIPP. Caracteristicile de bază, constatările intraoperatorii, durerea și complicațiile postoperatorii au fost înregistrate. Urmărirea a fost de cel puțin 1 an. Principalele obiective urmărite după 1 an post-operator au fost recidiva, durerea cronică și intensitatea sa înregistrată pe scara VAS.

Rezultate: 205 de pacienți (101 în grupul LR și 104 în TIPP) au fost incluși în studiu. Nu au existat diferențe între caracteristicile inițiale și rezultatele operatorii. Durerea postoperatorie a fost mai mică pentru grupul TIPP ($p < 0,05$). Urmărirea a fost de 98% la 1

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lună, 74% după 6 luni și 64% după 1 an. Rata de recurență a fost mai mare pentru LR ($p = 0,027$). Durerea a fost crescută în grupul LR.

Concluzie: TIPP este egal cu LR în ceea ce privește durerea cronică și recurența pentru herniile inguinale complexe.

Cuvinte cheie: hernie inghinală complexă, LR, TIPP, recidivă, durere cronică

Abstract

Background: complex groin hernia is a well describe entity with a high risk of recurrence and post-operative complications. There is no standardized approach and no reports to confirm the efficacy of a surgical procedure. Our goal was to compare Lichtenstein repair (LR) as “golden standard” for open anterior approach with the transinguinal preperitoneal plasty (TIPP) in the treatment of complex groin hernia repair.

Material and methods: the study was a prospective one and includes all patients with complex hernias admitted in the Department of Surgery of the Military Hospital Cluj-Napoca between January 2010 and December 2014. All the patients were randomized in two groups: LR and TIPP. Baseline characteristics, intraoperative findings, pain and complications were recorded. Follow-up was at least 1 year. The main outcome after 1 year were recurrence, chronic pain and its intensity recorded on VAS scale.

Results: 205 patients (101 in LR group and 104 in TIPP) were included in the study. There were no differences in baseline characteristics and operative findings. Postoperative pain was lower for TIPP group ($p < 0.05$). Follow-up was 98% at 1 month, 74% after 6 months and 64% after 1 year. Recurrence rate was higher for LR ($p = 0.027$). Pain was increased in LR group.

Conclusion: TIPP is equal in terms of chronic pain and recurrence for complex groin inguinal hernias.

Key words: complex groin hernia, LR, TIPP, recurrence, chronic pain

Background

With almost 20 millions groin repair each year, inguinal hernia is the most frequent procedure worldwide in general surgery (1). Although many different surgical techniques have been described, although European Hernia Society (EHS) guidelines promotes some procedures as “golden standard”, there is still no consensus as to the best choice (2). Mesh repair has reduced the incidence of recurrence to 2 – 5 % (3).

Despite the development of laparoscopic and robotic surgery for inguinal hernia repair, open approach is still the first option for a large number of surgeons. Many techniques involving mesh repair use an anterior approach placing the prosthesis into the inguinal canal (Lichtenstein), or into the preperitoneal space

as described by Rives, Stoppa, Wantz and others (4-7).

Even if the recurrence rate was dropped with the advent of mesh, the issue is still a matter of concern for a special category of groin hernias. This group of hernias was termed by Stoppa as “complex hernias” and includes some entities considered difficult to repair and with high risk of recurrence (8). This difficult hernias are large inguinal hernias, recurrent inguinal hernias, associated inguinal hernias, femoral hernias and strangulated hernias. For this complex cases there is no standardized approach and there are no reports in the literature about early and late results.

The goal of this study was to evaluate our early and late results with two different

techniques – Lichtenstein repair (LR) and transinguinal preperitoneal plasty (TIPP) – for complex inguinal hernias. From our knowledge – except the report of Koning and Vries who present 7 cases – this is the first study comparing LR and TIPP for a series of complex groin hernias in terms of early and late groin pain, complications and recurrence more than 1 year after surgery (9).

Material and Methods

Patients

The study was unicentric and included all adult patients with groin hernias admitted in the Department of Surgery of the Military Hospital from Cluj-Napoca. The study began in January 2010 and was completed in December 2014 and finished in June 2016. Patients were informed about the trial when an informed consent was obtained. The protocol has been approved by the hospital local ethics committee. All the patients with complex hernias according to Stoppa's criteria were randomized to either TIPP or LR. Allocation was performed by a computer generated list sequence. Each number was enveloped and the type of procedure has been communicated before the incision by the OR nurse. Bilateral hernias, and emergency procedures, patients with ASA IV and radical prostatectomy were excluded.

Surgical Procedure

All the patients were admitted the night before surgery and a dose of 0,3 ml of Low Molecular Weight Heparine (Fraxiparine™ - Aspen Pharma) was administered. No antibiotic prophylaxis has been done before surgery. Both procedures were performed under spinal anaesthesia for all patients by a single surgeon (the senior author).

A variable length incision (6 to 10 cm, according to hernia volume) has been done as the angle bisector between lateral rectus margin and the line between anterior iliac superior spine and pubis. The inguinal canal was opened by transection of the external

oblique aponeurosis. All the inguinal nerves were identified and preserved. If the repair was embarrassed by the nerves they were cut on the entire inguinal length and ligated. The cord enveloped in the cremasteric fascia was bluntly dissected from the posterior wall with a mounted sponge and lifted on a rubber band. In indirect hernias the sac was opened and the content reduced in the peritoneal cavity. Sac dissection was done in the proximity of the deep ring (DR) and deep in the preperitoneal space. After that it was transected and the proximal stump was ligated with an absorbable suture. The remnant distal sac was abandoned after careful hemostasis. In sliding hernias the sac was fully dissected and inverted. The direct hernia sac was inverted in a “purse – string” suture for patients with LR and dissected after incision of the transversalis fascia (TF) for TIPP group. Femoral sac was reduced with or without transection of the ilio-pubic tract (IPT). Preperitoneal space was routinely explored for all patients through the DR and if an unknown femoral hernia was detected in LR the case was converted to TIPP.

The groin defect was classified according with the sac location as indirect (I), direct (D), femoral (F) and its dimensions in the largest diameter was measured. The recurrence was noted with r and the rank was recorded. Left or right location of hernia was also registered.

Groin defect was corrected according to Lichtenstein as described by Amid et al and by Rives for TIPP (4,5). For both repairs a flat sheet of macroporous monofilament polypropylene standard weight 45 g/m² was used. Mesh size was 13 x 7 cm for LR and 15 x 10 cm for TIPP. For LR the mesh was fixed with a 3-0 slowly absorbable suture (polydioxanone). For TIPP the mesh was inserted without a slit behind the epigastric vessels and for accommodation the cord was parietalised as in Stoppa repair modification (10). The mesh was also fixed with slowly absorbable sutures to the internal oblique muscle (11).

Data

Baseline characteristics (including clinical signs

at presentation), intraoperative findings, duration of surgery (from skin to skin) were recorded in a data base. Postoperative complications (haematoma, seroma, infection and testicular swelling were also noted). Postoperative pain on VAS scale from 0 (no pain) to 10 (maximum pain) was assessed at rest and mobilization at 24 and 72 hours. Pain evaluation was done by the score pain: 0 – 1 no pain; 2-4 mild pain; 5-7 moderate pain and 8 – 10 severe pain. According to protocol patients were examined 1 month, 6 months and at least 1 year postoperatively for pain and recurrence. The asses has been done by the secondary authors (GO and GD) in an ambulatory fashion. Both of them were unawhere with the surgical procedure.

Statistical Analysis

For categorical variables, the analysed data is represented as the number (percentage), the Chi-square test and Fisher exact test were used for comparisons. Continuous variables with

normal distributions, is represented as Mean $\pm$ SD and the comparisons are made with Student t-test. For continuous date with non-normal distribution, a non-parametric test is used (Mann-Whitney). Statistical analysis was performed using SPSS v. 17 for Windows (Chicago, Illinois). Threshold for significance was $p < 0.05$ (95% CI).

Results

Between January 2010 and December 2014, 914 patients with inguinal hernias were admitted in the Cluj-Napoca Military Hospital Department of Surgery. From this, 205 patients (178 males) meet the criteria of complex hernia and were included in the study. They were distributed equally between the two groups: 101 in LR and 104 in TIPP. Baseline characteristics (presented in *Table 1*) confirm an adequate stratification and randomization.

Perioperative findings are shown in *Table 2* for the two groups. There were no statistically

Table 1. Baseline characteristics

	Data for total number of patients (n=205)	LR Group (n=101)	TIPP Group (n=104)	p
Gender				
M	178	91	87	
F	27	10	17	
Complex hernias				
Recurrent	105	51	54	N**
Large	92	48	44	
Femoral	8	2	6	
Age (mean $\pm$ sd)	56 $\pm$ 8.73	54 $\pm$ 6.21	57 $\pm$ 7.09	N*
Occupation (active)	111	59	52	N**
BMI (kg/m ²) (mean $\pm$ sd)	28.2 $\pm$ 1.13	27.9 $\pm$ 0.7	28.4 $\pm$ 1.09	N*
ASA score				
I	32	15	17	N**
II	153	79	76	N**
III	20	7	11	N**
Right/left location of hernias	107/98	52/47	55/51	N**
Duration of complains (years)				
< 1 year	3	2	1	N**
1-3 years	39	20	19	N**
4-7 years	102	49	53	N**
8-10 years	45	24	21	N**
Over 10 years	16	6	10	N**

*unsignificant statistical difference (Student t-test); **unsignificant statistical difference (Fisher's exact test)

Table 2. Operative findings

	Data for total number of patients (n=205)	LR Group (n=101)	TIPP Group (n=104)	p
Hernia location				
Indirect	102	53	49	N*
Sliding	19	9	10	N*
Direct	65	35	30	N*
Femoral	9	0	9	0.001*
Combined	10	4	6	N*
Diameter of the defect (cm) (mean±sd)	3.8±0.21	3.7±0.32	4.1±0.74	N**
Duration of surgery (minutes) (median min max)	49 (39-68)	37 (32 – 44)	53 (47-62)	0.041***

* Fisher's exact test; N= insignificant statistical difference, $p>0.05$, ** Student t test; N= insignificant statistical difference, $p>0.05$, *** Mann-Whitney test

significant differences between LR and TIPP except for the femoral hernias and operative time. Operative time was significantly higher for TIPP ($p=0.041$ Mann-Whitney test) and was highly correlated with the onset of symptoms and with the rank of recurrence (Pearson correlation $r = 0.873$ respective $r = 0.921$; $p < 0.05$ for both) (data not shown).

Pain on VAS was found low for more than 50% of the patients in the first 24 hours; the percent increased at 72% at 72 hours. The

TIPP group was statistically significant with lower scores of pain than the LR group ($p < 0.05$ chi square test) (Fig. 1).

In our study 25 (12.9%) patients developed immediate postoperative complications. Even if the initial repartition of the patients in groups was equal, LR group developed more complications than TIPP group ($p=0.021$) (Table 3). Hematomas required evacuation in all instances while seromas were ultrasound supervised without any further compli-

Figure 1. Immediate postoperative pain at 24 and 72 hours (data expressed as percent %)

Table 3. Postoperative complications

Complication	Data for total number of patients (n=205)	LR Group (n=101)	TIPP Group (n=104)	p
Total number of patients with complications	25 (12.19%)	15 (14.85%)	10 (9.61%)	p = 0.021
Hemathoma	5	3	2	N
Seroma	4	3	1	N
Infection	3	2	1	N
Urinary retention	7	4	3	N
Testicular pain/sweeling	6	3	3	N
Death	0	0	0	
Duration of hospital stay (days) mean; range	5 ± 0.78	4 ± 0.63	4 ± 0.81	N
Total	25 (12.19%)	15 (14.85%)	10 (9.61%)	p = 0.021

N – insignificant statistical difference with Fisher's exact test; N* - insignificant statistical difference with Student t-test

cation up to complete resolution. All infectious were superficial (all with *Staphylococcus aureus*) and do not required mesh extrusion.

Follow-up was 98% after one month, 74% after 6 months and only 64% after 1 year. The results of the follow-up are summarized in Table 4.

The recurrence rate was surprisingly low reported to the whole number of the patients but also to the number of examined patients (1% in LR group) at 6 months. At 1 year the recurrence rate was 4% for the examined patients with an unequal distribution (6% for LR respective 3% for TIPP; p > 0.05 Fisher's exact test). The rate of local complications was equally distributed for both groups of patients (p>0.05). Chronic pain was the main complain after

Lichtenstein repair with a statistically significant difference (p = 0.049 Fisher's exact test) at six months postoperatively. Even if at 1 year the number of patients with moderate and severe pain was higher in the LR group the difference was not significant (p>0.05 Fisher's exact test (Table 5)).

Discussion

The incidence of inguinal hernias in adult population is up to 15% doing hernia repair the most common surgical procedure performed worldwide. After mesh repair the recurrence rate has been successfully dropped to 2- 5% (12). Chronic infection and chronic pain became the main postoperative complains with an incidence

Table 4. Pain and recurrence at 6 months and 1 year

	Data for total number of patients (n=205)	LR Group (n=101)	TIPP Group (n=104)	p
Recurrence				
6 months	1	1	0	
1 year	5	3	2	N*
Pain				
6 months	7	5	2	N*
1 year	12	9	3	
Complications	13	9	4	N*
Testicular atrophy	8	5	3	
Chronic synuses	2	2	0	
Hydrocele	3	2	1	

* insignificant statistical difference (Fisher's exact test)

Table 5. Intensity of pain on VAS at 6 months and 1 year

VAS score	Data for total number of patients (n=205)	LR Group (n=101)	TIPP Group (n=104)	p
6 months	(n=7)	(n=5)	(n=2)	
No pain and mild pain	0	0	0	p = 0.049
Moderate pain	4	2	2	
Severe pain	3	3	0	
1 year	(n=12)	(n=9)	(n=3)	N*
No pain and mild pain	0	0	0	
Moderate pain		0	3	
Severe pain		9	0	

*unsignificant statistical difference, $p > 0.05$

higher than the recurrence rate (13).

Despite of developments in laparoscopic and robotic hernia repair open approach is still the most popular choice for surgeons. According to EHS Guidelines LR is the “golden standard” for open mesh repair in terms of recurrence but there are not specific reports if the procedure is suitable for complex hernias with the same results (2).

Complex inguinal hernia was defined by Stoppa since 1989 and includes a large variety of groin hernias considered difficult to repair and with high risk of recurrence (8). Stoppa also considered that preperitoneal approach is a better option for repairing such hernias reporting it as a safe, short – term learning curve procedure. The true incidence of this special category of inguinal hernias is unknown. In our series the incidence was 22,42% with an almost equal yearly distribution but probably in the general population the incidence is higher. More than 50% of the patients were social and economic active, the impact of repair being of major importance on their daily life.

We focused on chronic pain and recurrence rate as the most relevant clinical outcomes in order to confirm the efficacy of one or other of the techniques. Globally patients from the both groups reported similar low rates of immediate postoperative pain at 24 and 72 hours but the amount of low scores of pain on VAS was higher for TIPP group. LR patients reported significantly higher pain scores in terms of severity than TIPP patients. Also the rate of immediate postoperative complication rates was higher for LR than TIPP. The distri-

bution of complications was quite similar for both groups and was correlated with the rank of recurrence and duration of symptoms.

At one year postoperatively only 64% of the patients could be examined, the rest of them just did not present. Based on this short – term follow-up and on the reduced number of examined patients our results might be biased since the incidence of recurrence and chronic /severe pain was low.

The recurrence rate was similar for both groups and also but the incidence of chronic pain was significantly higher for LR patients. Our data are consistent with other studies that have shown that almost 30% of patients experienced various degrees of pain 1 year after Lichtenstein inguinal hernia repair (14). Various causes can lead to chronic pain (meshoma, nerv entrapment in sutures or fibrosis, or – as Bendavid recently reported – by increased nerve density caused by regeneration of small branches in contact with the mesh (15). Even with the identification and preservation of the inguinal nerves, with the use of a light macroporous sheet of polypropylene mesh the incidence of chronic pain in LR group was high in our study (13%) for the examined patients. The causes for this pain were not identified. The direct contact of the mesh with the nerves could be involved. Also the incidence of severe pain was higher in the LR.

The TIPP technique seems to associate less chronic pain, even if the difference is not significantly statistic comparable to TEP (totally extraperitoneal) laparoscopic repair (16). A recent systematic review demonstrate

that TIPP repair was associated with a reduced risk of developing chronic pain but in this study there is no reference to complex groin hernias (1). Compared to LR the TIPP offers some advantages: 1) intraabdominal pressure secures the mesh eliminating the need for sutures; 2) a larger sheet of mesh could be placed, medial overlapping being superior; 3) the femoral area is also explored avoiding missed hernias and also secured. In opposition with TIPP as described by Pellisier preperitoneal dissection is not blind and all structures can be visualized limiting damage and pain. This was demonstrated in our study by the longer duration of surgery even if the difference was not statistically significant.

In a relatively recent study of König et al, health status measured on SF – 36 showed significant better outcomes after TIPP for “physical function” and “physical pain” when compared with LR at 1 year follow-up (17). These differences are in line with reported significant differences in less patients with postoperative chronic pain after TIPP compared with Lichtenstein at 1 year but the study was not performed on patients with complex groin hernias (18).

Our results can not be compared with other studies because we did not find in the literature other papers comparing the both techniques for complex groin hernias. A meta – analyse of Sajid et al found similar results in terms of recurrence and postoperative groin pain but not for difficult hernias (1).

Conclusion

This study revealed no significantly better results in terms of recurrence between LR and TIPP for complex hernias but the follow-up was too short for a firm conclusion. The incidence of pain was lower for TIPP after 1 year and also the incidence of severe pain but without any statistical difference. On this basis TIPP can be a real alternative to LR for complex hernia repair. More studies are necessary to evaluate the quality of life after this procedures for complex groin hernias.

Author Contribution

All authors conceived the study concept and study design. VO and DM performed compilation and synthesis of the data. OV and DM carried out statistical analysis. OG and DG supervised the research project and independently examined postoperative patients. All authors participated in interpretation of the results, writing the report, and approved the final version.

Conflict of Interest

All authors declare no conflict of interest.

Ethical Approval

The study was approved by the Institutional Ethical Committee of Military Hospital Cluj-Napoca (No.37/2009).

Informed Consent

Informed consent was obtained from all individual participants included in the study.

References

1. Sajid MS1, Craciunas L, Singh KK, Sains P, Baig MK. Open transinguinal preperitoneal mesh repair of inguinal hernia: a targeted systematic review and meta-analysis of published randomized controlled trials. *Gastroenterol Rep (Oxf)*. 2013;1(2):127-37.
2. Simons MP, Auffermann T, Bay-Nielsen M, Bouillot JL, Campanelli G, Conze J, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia*. 2009;13(4):343-403.
3. Heikkinen T, Bringman S, Ohtonen P, Kunelius P, Haukipuro K, Hulkko A. Five year outcome of laparoscopic and Lichtenstein hernioplasties. *Surg Endosc*. 2004; 18(3):518-22. Epub 2004 Jan 23.
4. Amid PK. Lichtenstein tension-free hernioplasty: its inception, evolution and principles. *Hernia*. 2004;8(1):1-7. Epub 2003 Sep 20.
5. Rives J, Lardennois B, Flament JB, Convers G. The Dacron mesh sheet, treatment of choice of inguinal hernias in adults. Apropos of 183 cases. *Chirurgie*. 1973;99(8):564-75. French
6. Stoppa R, Henry X, Verhaege P. Repair of inguinal hernias without tension and without suture using a large dacron mesh prosthesis and by pre-peritoneal approach. A method of reference for selective indication. *Ann Chir*. 1996;50(9):808-13. French
7. Wantz GE. The technique of giant prosthetic reinforcement of the visceral sac performed through an anterior groin incision. *Surg Gynecol Obstet*. 1993;176(5):497-500.
8. Stoppa R. The treatment of complicated groin and incisional hernias. *World J Surg*. 1989;13(5):545-54.
9. König GG, Vriens PW. Anterior preperitoneal repair of extremely

- large inguinal hernias: An alternative technique. *Int J Surg Case Rep.* 2012;3(2):45-8. Epub 2011 Nov 3.
10. Stoppa R, Warlaumont C, Chantreaux JP. Cure chirurgicale prothetique des hernies de l'aine. Parietalisation du cordon spermatique. *Press Med.* 1984;13(38):2317-18.
 11. Wantz GE, Stoppa R. Giant Prosthetic Reinforcement of the Visceral Sac for Repair of a Re-Recurrent Inguinal Hernia. *Postgrad Gen Surg.* 1992;4:109-113.
 12. EU Hernia Trialists Collaboration. Repair of groin hernia with synthetic mesh: meta-analysis of randomized controlled trials. *Ann Surg.* 2002;235(3):322-32.
 13. Bitzer EM, Lorenz C, Nickel, Dörning H, Trojan A. Patient-reported outcomes in hernia repair. *Hernia.* 2008;12(4):407-14.
 14. Bay-Nielsen M, Perkins FM, Kehlet H, For the Danish Hernia Database. Pain and functional impairment 1 year after inguinal herniorrhaphy: a nationwide questionnaire study. *Ann Surg.* 2001; 233(1):1-7.
 15. Bendavid R, Lou W, Grischkan D, Koch A, Petersen K, Morrison J, et al. A mechanism of mesh-related post-herniorrhaphy neuralgia. *Hernia.* 2016;20(3):357-65. Epub 2015 Nov 23.
 16. Čadanová D, van Dijk JP, Mollen RMHG. The transinguinal preperitoneal technique (TIPP) in inguinal hernia repair does not cause less chronic pain in relation to the ProGrip Technique: a prospective double – blind randomized clinical trial comparing the TIPP technique, using the Polysoft mesh, with the ProGrip self-fixing semi-resorbable mesh. *Hernia.* 2017;21(1):17-27. Epub 2016 Aug 18.
 17. Koning GG, de Vries J, Borm GF, Koeslag L, Vriens PW, van Laarhoven CJ. Health status one year after TransInguinal PrePeritoneal inguinal hernia repair and Lichtenstein's method: an analysis alongside a randomized clinical study. *Hernia.* 2013;17(3): 299-306. Epub 2012 Aug 8.
 18. Koning GG, Koole D, de Jongh MA, de Schipper JP, Verhofstad MH, Oostvogel HJ, et al. The transinguinal preperitoneal hernia correction vs Lichtenstein's technique; is TIPP top? *Hernia.* 2011;15(1): 19-22.