

# LICHTENSTEIN TECHNIQUE VERSUS OTHER OPEN TECHNIQUES FOR INGUINAL HERNIA REPAIR: A RETROSPECTIVE COMPARATIVE STUDY

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## Abstract

Groin hernia repair is one of the most common procedure in general surgery. Although numerous surgical techniques have been developed, Lichtenstein technique is the best evaluated technique. Despite this, the overall recurrence rate for inguinal hernia is estimated at 15%. The aim of this retrospective comparative study is to compare the clinical outcomes of Lichtenstein techniques with other mesh repair techniques and tissue-based techniques for the treatment of primary inguinal hernia among adult Romanian patients. Our data confirms that the Lichtenstein repair technique remains one of the best techniques in terms of recurrence rate and postoperative complications. However, in our study, Shouldice repair seems to be superior to mesh-based and other tissue-based techniques, due to low recurrence, small number of postoperative complications and shorter hospitalization. We found no statistically significant differences between Traucco, Lichtenstein and Shouldice technique, but we suggest using these methods over Bassini, Postemski or Juvara repair techniques.

**Keywords:** inguinal hernia, Lichtenstein technique, Shouldice technique, tissue-based repair techniques.

## Introduction

Groin hernia repair is one of the most common procedure in general surgery (Anadol et al., 2011). Every year, 800.000 cases are registered in United States and approximately 0.8% of Western population undergo inguinal hernia repair in a 5-year period (Rutkow 2003; Antoniou et al., 2014). Worldwide, more than 20 million operations are performed yearly and the chance of a man to undergo inguinal hernia repair is 27% (HerniaSurge Group, 2018; Youssef et al., 2015). In order to solve this problem, numerous surgical techniques were developed. According with latest International guidelines for groin hernia management, Lichtenstein technique is the best evaluated technique and compared with non-mesh techniques, has a lower recurrence rate (HerniaSurge Group, 2018). Even though the Lichtenstein Institute and Shouldice Hospital

reported a recurrence rate less than 1%, in non-specialist centers, the reported recurrence for mesh repair vary between 0.3-2.2% and may reach 17% for tissue repair (Nordin et al., 2002; Anadol et al., 2011). Despite the large use of Lichtenstein technique in primary inguinal hernia repair, the overall recurrence rate for inguinal hernia is estimated at 15% (HerniaSurge Group, 2018). Also, long-term chronic pain occurs in 12% patients underwent surgical procedure for inguinal hernia (HerniaSurge Group, 2018). Moreover, numerous reports indicate that primary tissue repair methods like Shouldice or Dresda are the procedures of choice for primary inguinal hernia (Arvidsson et al., 2005; Porrero et al., 2005; Youssef et al., 2015). The aim of this retrospective comparative study is to compare the clinical outcomes of Lichtenstein techniques with other mesh repair techniques and tissue-based techniques for the treatment of primary inguinal hernia among adult Romanian patients.

## Patients and methods

This study was performed in the general surgery unit of C.F. Hospital, Iasi. All patients over 18 years old with diagnosis of primary inguinal hernia were retrospectively analyzed between January 2007 and December 2016. The exclusion criteria from the study were: patients under 18 years old, previous operation in inguinal region, femoral hernia, umbilical hernia, diabetes mellitus, coagulopathy. The variables registered for each patient included age, sex, associated comorbidities, surgical techniques chosen, postoperative complications, length of hospital stay and percentage of recurrence at 3 years. The surgical techniques used in all cases were: Lichtenstein, Shouldice, Trabucco, McVay, Bassini, Juvara, Postemski and were performed by five surgeons. A single-dose antibiotic prophylaxis was used in the operating room at the start of the procedure, except for patients with mesh-based techniques which receive an additional single-dose of antibiotic. Postoperatively, all patients received a low-dose of heparin (4000 IE s.c.). All data were analyzed in SPSS 20 IBM program.

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**Results**

Over a period of 10 years, in our unit were operated 2010 hernias. After we applied the exclusion criteria, only 1703 cases were included in the study. Shouldice repair was performed in 695 cases, Lichtenstein technique was used in

579 cases and Trabucco in 251 cases. The rest of 178 cases were operated using Bassini, Postemski, Juvara or McVay techniques (Figure 1). The age and gender are shown in Table 1 and Table 2.

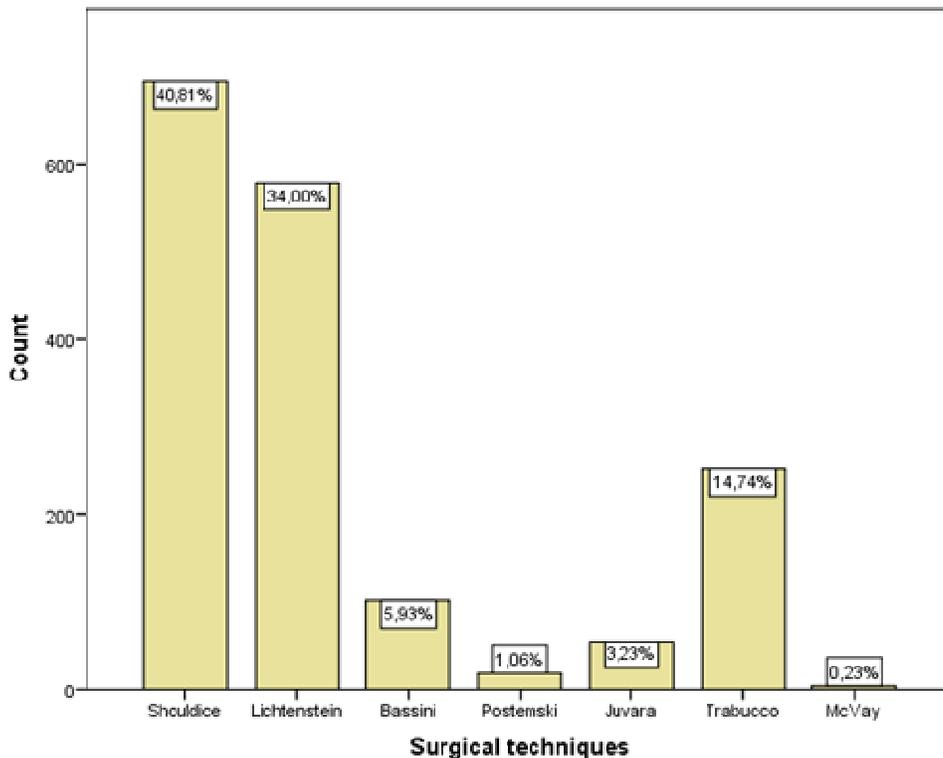


Figure 1. Distribution of surgical techniques.

**Age**

	N	Minimum	Maximum	Mean	Std. Deviation
Age	1703	18	90	58,46	15,348
Valid N (listwise)	1703				

Table 1. Distribution of patients by age.

**Gender**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Male	1590	93,4	93,4	93,4
Valid Female	113	6,6	6,6	100,0
Total	1703	100,0	100,0	

Table 2. Distribution of patients by gender.

The gender was dominated by male with 93,4% and the mean age of the patients was  $58,46 \pm 15,5$  years. The mean age in patients with Lichtenstein ( $60,86 \pm 14,86$ ) and Trabucco ( $58,16 \pm 17,31$ ) techniques was higher because some of the older patients preferred the mesh-based techniques (Figure 2). The distribution according to the residence area, rural/urban, show very small differences: 52,2% rural and 47,8 urban. Most of the patients did not

have preoperative comorbidities (59%) and only 13 cases (0,8%) underwent emergency surgery. Therefore, postoperative complications were registered only in 4,4% of cases. In our study, the overall recurrence at 3 years was 2,3%. Although we had very few cases underwent emergency surgery and the postoperative rate was small (4,4%), most of the patients (63,7%) stayed in the hospital for 5 to 10 days.

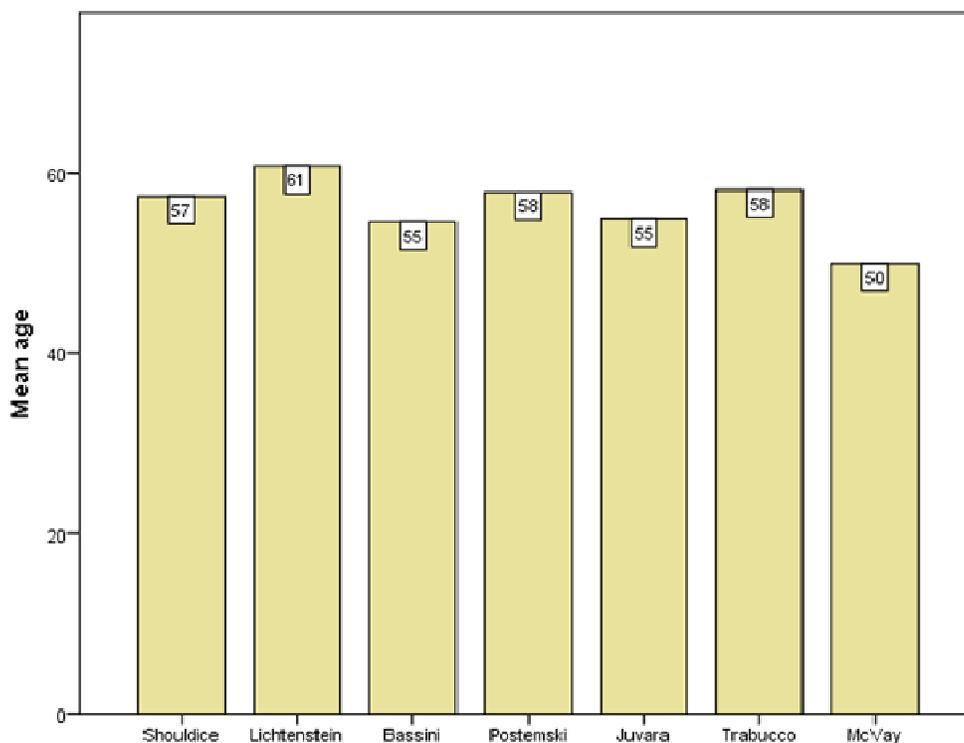


Figure 2. Age distribution by surgical technique.

When we compared the length of hospitalization between surgical techniques, we found that under 5 days hospitalization had 157 patients underwent Shouldice technique, 55 patients with Lichtenstein procedure and only 2 patients with Trabucco technique (Table 3). Moreover, 10-15 days hospitalization was registered in 166 patients underwent Lichtenstein techniques and only 60 patients with Shouldice repair method. Similar data were obtained for the rest tissue-based techniques (Table 3). Also, when we analyzed the distribution of recurrence at three years by surgical techniques, we have noticed that Lichtenstein and Shouldice techniques have equal number of recurrence but different percentage (2,2% and 1,9%). This difference in percentage is due to case number difference between this techniques. The smallest recurrence rate was registered in patients underwent Trabucco repair method, 1,2% (Table 4). With over 11%, Postemski technique had the highest

recurrence rate among all analyzed techniques. Patients with other tissue-based repair methods like Bassini or Juvara, had a significant increased number of cases with hernia recurrence (Table 4). Even though we did not observe recurrence in McVay repair method, the small number of cases make this result irrelevant. Postoperative complications in Lichtenstein technique were dominated by hematoma with six cases. In this inguinal hernia repair method we found one case of mesh rejection and one case of seroma. Similar results were obtained in Trabucco technique (Table 5). In Shouldice technique we found almost four times more cases with hematoma (25 cases) compared with Lichtenstein. Patients underwent Bassini or Postemski techniques, had a significant increased number of postoperative complications (9,9% and 16,7%) compared with the rest of techniques.

		Lenght of hospital stay				
Surgical techniques		Frequency	Percent	Valid Percent	Cumulative Percent	
Shouldice	Valid	<5 days	157	22,6	22,6	22,6
		5-10 days	472	67,9	67,9	90,5
		10-15 days	60	8,6	8,6	99,1
		15-20 days	5	,7	,7	99,9
		>20 days	1	,1	,1	100,0
		Total	695	100,0	100,0	
Lichtenstein	Valid	<5 days	55	9,5	9,5	9,5
		5-10 days	329	56,8	56,8	66,3
		10-15 days	166	28,7	28,7	95,0
		15-20 days	26	4,5	4,5	99,5
		>20 days	3	,5	,5	100,0
		Total	579	100,0	100,0	
Bassini	Valid	<5 days	7	6,9	6,9	6,9
		5-10 days	69	68,3	68,3	75,2
		10-15 days	24	23,8	23,8	99,0
		15-20 days	1	1,0	1,0	100,0
Total	101	100,0	100,0			
Postemski	Valid	<5 days	1	5,6	5,6	5,6
		5-10 days	12	66,7	66,7	72,2
		10-15 days	4	22,2	22,2	94,4
		15-20 days	1	5,6	5,6	100,0
Total	18	100,0	100,0			
Juvara	Valid	<5 days	4	7,3	7,3	7,3
		5-10 days	30	54,5	54,5	61,8
		10-15 days	17	30,9	30,9	92,7
		15-20 days	3	5,5	5,5	98,2
		>20 days	1	1,8	1,8	100,0
Total	55	100,0	100,0			
Trabucco	Valid	<5 days	2	,8	,8	,8
		5-10 days	169	67,3	67,3	68,1
		10-15 days	72	28,7	28,7	96,8
		15-20 days	7	2,8	2,8	99,6
>20 days	1	,4	,4	100,0		
Total	251	100,0	100,0			
McVay	Valid	5-10 days	4	100,0	100,0	100,0

Table 3. Lenght of hospitalization by surgical techniques.

			Recurrence			
Surgical techniques			Frequency	Percent	Valid Percent	Cumulative Percent
Shouldice	Valid	Recurrence	13	1,9	1,9	1,9
		No recurrence	682	98,1	98,1	100,0
		Total	695	100,0	100,0	
Lichtenstein	Valid	Recurrence	13	2,2	2,2	2,2
		No recurrence	566	97,8	97,8	100,0
		Total	579	100,0	100,0	
Bassini	Valid	Recurrence	8	7,9	7,9	7,9
		No recurrence	93	92,1	92,1	100,0
		Total	101	100,0	100,0	
Postemski	Valid	Recurrence	2	11,1	11,1	11,1
		No recurrence	16	88,9	88,9	100,0
		Total	18	100,0	100,0	
Juvara	Valid	Recurrence	3	5,5	5,5	5,5
		No recurrence	52	94,5	94,5	100,0
		Total	55	100,0	100,0	
Trabucco	Valid	Recurrence	3	1,2	1,2	1,2
		No recurrence	248	98,8	98,8	100,0
		Total	251	100,0	100,0	
McVay	Valid	No recurrence	4	100,0	100,0	100,0

Table 4. Distribution of 3 years recurrence by surgical techniques.

Postoperative complications					
Surgical techniques		Frequency	Percent	Valid Percent	
Shouldice	Valid	No complication	665	95,7	95,7
		Superficial infection	5	,7	,7
		Hematoma	25	3,6	3,6
		<b>Total</b>	<b>695</b>	<b>100,0</b>	<b>100,0</b>
Lichtenstein	Valid	No complication	568	98,1	98,1
		Superficial infection	3	,5	,5
		Hematoma	6	1,0	1,0
		Reject of the mesh	1	,2	,2
		Seroma	1	,2	,2
<b>Total</b>	<b>579</b>	<b>100,0</b>	<b>100,0</b>		
Bassini	Valid	No complication	92	91,1	91,1
		Superficial infection	2	2,0	2,0
		Hematoma	7	6,9	6,9
<b>Total</b>	<b>101</b>	<b>100,0</b>	<b>100,0</b>		
Postemski	Valid	No complication	15	83,3	83,3
		Superficial infection	1	5,6	5,6
		Hematoma	2	11,1	11,1
<b>Total</b>	<b>18</b>	<b>100,0</b>	<b>100,0</b>		
Juvara	Valid	No complication	45	81,8	81,8
		Superficial infection	4	7,3	7,3
		Hematoma	6	10,9	10,9
<b>Total</b>	<b>55</b>	<b>100,0</b>	<b>100,0</b>		
Trabucco	Valid	No complication	241	96,0	96,0
		Superficial infection	3	1,2	1,2
		Hematoma	7	2,8	2,8
<b>Total</b>	<b>251</b>	<b>100,0</b>	<b>100,0</b>		
McVay	Valid	No complication	3	75,0	75,0
		Hematoma	1	25,0	25,0
<b>Total</b>	<b>4</b>	<b>100,0</b>	<b>100,0</b>		

Table 5. Postoperative complications.

## Discussions

Though inguinal hernia is one of the most common surgical procedure in general surgery and numerous surgical techniques were developed, the number of recurrences and postoperative complications are still high. According to International guidelines for groin hernia management, the recurrence rate in inguinal hernia repair is 15% and in 12% of patients underwent surgery for inguinal hernia, pain lasting more than 3 months, occurs (HerniaSurge Group, 2018). A consensus regarding the best technique has not been achieved. Since 1970 when Lichtenstein described the tension-free inguinal hernia repair, numerous comparative studies with other tissue-based techniques were published (Panda et al., 2012). Recent publications reveal that tissue-based techniques are effective as the standard Lichtenstein procedure (Kockerling et al., 2018; Youseff et al., 2015). Therefore, we developed a retrospective comparative study, in order to evaluate the clinical outcomes of Lichtenstein technique and compare with other mesh-based or tissue-based techniques.

In our study only 6,6% patients were female and the mean age of the patients was  $58,46 \pm 15,5$  years. Shouldice patients were younger than those with Lichtenstein or Trabucco techniques (57 years vs 61 and 58 years;  $p < 0.02$ ). Similar results were obtained by Kockerling et al. with a mean age of 40 years for Shouldice group (Kockerling et al., 2018). A possible explanation for these data may be the patients preference. In our cohort, many elderly patients preferred Lichtenstein technique. In our study only 0,8% underwent emergency surgery. Though, the postoperative complication rate was over 4%. When we compare postoperative complications between Lichtenstein and the rest of surgical techniques, we found that Shouldice had a significant increased postoperative complication rate and very similar with Trabucco (1,9% vs 4,3% and 4%;  $p = 0.460$ ). Bassini and Postemski had an even greater postoperative complications percentage (8,9% and 17,7%;  $p = 0.437$ , respectively  $p = 0.113$ ). Similar to our data, Porrero et al. on 775 patients who underwent Shouldice herniorrhaphy, found ecchymosis in 6% of cases and infections in 0,2% (Porrero et al., 2004). Also, Hetzer et al. found very similar data: 4,6% patients with hematoma and 1,3% infections in Lichtenstein technique (Hetzer et al., 1999). We also compare the length of hospital stay between Lichtenstein and rest of the techniques. We found that patients underwent Shouldice repair had the shortest period of hospitalization. Taken together, mesh-based techniques (Lichtenstein and Trabucco) had only 10,1% of under 5 days hospital stay patients. By comparison, over 22% of patients underwent Shouldice repair had under 5 days of hospitalization ( $p < 0.05$ ). Other publications report a significant lower period of hospitalization in both mesh-based and tissue-based techniques. (Aldoescu et al 2015) Porrero et al. report that only 1% of patients were hospitalized for 3 days and 76% of patients stay in hospital only one day (Porrero et al., 2004). Same data were reported by Hetzer et al., with a mean post-operative stay between 3,3-3,5 days (Hetzer et al., 1999). Also, Berndsen et al.

reported that 98% of patients stayed in hospital one day or less (Berndsen et al., 2002). Even though we had similar postoperative complications rate with other published studies, 63,7% of the patients from our study, stayed in the hospital for 5 to 10 days. We believe that these big differences between our data and other published studies regarding hospitalization, may be due to „historical habits” of Romania surgeons. This issue must be further investigated and measures must be taken in order to reduce hospitalization of patients. When we analyzed the 3 years recurrence of the patients, we found that the smallest recurrence rate was registered in patients underwent Trabucco repair method, 1,2%. Lichtenstein and Shouldice techniques had similar recurrence (2,2% vs 1,9%). Consistent with our data, Ripetti et al. obtained a recurrence rate in patients underwent Trabucco technique of 1,85% (Ripetti et al., 2014). We registered 7,9% recurrence in patients underwent Bassini technique. Semnificative lower recurrence rate, only 2%, was published by Singh et al. on 50 patients underwent Bassini technique (Singh et al., 1999). On 381 patients electively operated with Bassini technique, Maggiore et al. found a recurrence rate of 5,51% (Maggiore et al., 2001). Consistent to our data, Hay et al. in a large multicenter controlled trial found a 8,6% recurrence rate for patients underwent Bassini repair (Hay et al., 1995). Different to our data, a Cochrane review comparing 2566 Shouldice repairs with 1121 mesh-based techniques, showed a higher recurrence rate for the Shouldice technique compared with other mesh techniques (OR 3.80, 95% CI 1.99–7.26) (Amato et al., 2012). Also, a study from Danish Hernia Database show a recurrence at 96 months in patients underwent Lichtenstein repair, of 3% (Bisgaard et al., 2008). Same results were obtained by Balen et al. (3,4% recurrence) and Anadol et al. (3,7%) (Balen et al., 2000; Anadol et al., 2011). Despite these results, when we applied One-Way ANOVA Comparative Test, no statistical difference between groups was attained. (Table 6).

## Conclusions

Despite big amount of publications and data, it is very difficult to determine the best inguinal hernia technique. Depending on individually particularities of each case, surgeons should be prepared to perform any of the analyzed techniques. Lichtenstein repair technique remains one of the best techniques in terms of recurrence rate and postoperative complications. Overall, Shouldice repair seems to be superior to mesh-based and other tissue-based techniques, with low recurrence, small number of postoperative complications and shorter hospitalization. We found no statistically significant differences between Trabucco, Lichtenstein and Shouldice technique, but we suggest using these methods over Bassini, Postemski or Juvara repair techniques.

## Conflict of interests

None of the authors of this manuscript could represent the subject of a potential competing financial or other kind of interests.

(I) Surgical technique	(J) Surgical technique	Mean Difference (I-J)	Std. Error	Sig.
<b>Shouldice</b>	Lichtenstein	,004	,008	,999
	Bassini	,061*	,016	,003
	Postemski	,092	,035	,125
	Juvara	,036	,021	,601
	Trabucco	-,019	,011	,610
	McVay	-,019	,075	1,000
<b>Lichtenstein</b>	Shouldice	-,004	,008	,999
	Bassini	,057*	,016	,007
	Postemski	,089	,036	,162
	Juvara	,032	,021	,726
	Trabucco	-,022	,011	,415
	McVay	-,022	,075	1,000
<b>Trabucco</b>	Shouldice	,019	,011	,610
	Lichtenstein	,022	,011	,415
	Bassini	,079*	,018	,000
	Postemski	,111	,036	,036
	Juvara	,055*	,022	,173
	McVay	,000	,075	1,000

Table 6. Rate of recurrence – statistical analysis between surgical procedures.

#### Acknowledgments

All authors approved the final manuscript and agree to be accountable for all aspects of the work. All authors contributed equally to this paper. This original study was performed in accordance with Declaration of Helsinki and was approved by the local hospital ethics committee.

Informed consent was obtained from the parents of reported pediatric patients. None of the authors have any conflicts of interest or any competing interests. All the data presented can be available on request. Funding: this research received no specific grant from any funding agency in the public or commercial sectors.

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