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A comparison of post-operative parameters between the Shouldice methods modified according to Berliner darn and the Lichtenstein method in the repair of inguinal hernias

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ABSTRACT

Introduction: Surgical treatment of inguinal hernia is one of the most common procedures in surgery. Various techniques can be used to repair inguinal hernias, but the two most commonly used are the Shouldice surgical technique, modified by the Berliner Darn and Lichtenstein techniques, as a non-extension technique. However, despite the long tradition of surgical hernia treatment, there is still no consensus on the best or most appropriate surgical technique for elective inguinal hernia repair. Therefore, it remains a challenge for surgeons to choose the appropriate hernia repair method on a case-by-case basis that results in low complications and faster recovery. The aim of this study is to compare the efficiency of the Shouldice surgical technique modified by the Berliner Darn and Lichtenstein techniques in the treatment of hernias with respect to certain post-operative parameters.

Methods: A prospective and cohort study was conducted at the Clinical Hospital in Tetovo. The study included 100 patients diagnosed with inguinal hernia and treated in hospital. The monitored patients were divided into two groups according to the technique used: 50 patients treated with Shouldice technique modified by Berliner Darn and 50 patients treated with Lichtenstein technique. In addition, we based the selection of the groups mainly on the reproductive age of the patients. Only male patients were treated in both groups, as there were very few female cases during the study period.

Results: Patients operated on with the Lichtenstein technique were more mobile postoperatively, post-operative pain was less severe and return to daily and occupational activities and length of hospital stay were significantly shorter than with the Shouldice technique.

Conclusion: The Lichtenstein tension-free surgical technique is more efficient and adequate than the modified Shouldice technique according to Berliner Darn in terms of post-operative pain intensity, length of hospital stay, return to daily activities, and return to work.

Keywords: Lichtenstein; Shouldice; method; pain; duration; complications

INTRODUCTION

Surgical treatment of inguinal hernias includes a wide range of techniques, which together represent one of the most commonly used procedures in surgery in general (1). Despite the fact that surgical treatment has led to amazing results in the majority of patients, there are still some cases in which complications occur, such as prolonged post-operative recovery and delayed return to work. Inguinal hernias are most commonly of the inguinal type, but may also be femoral. However, the lifetime incidence of the inguinal or femoral type is reported to be 27–43% in men and 3–6% in women (2). In most cases, inguinal hernias are symptomatic and their surgical treatment is inevitable. Few patients are asymptomatic, but even a wait-and-see approach does not improve symptoms in this group so that surgical intervention is definitely required in about 70% of cases within 5 years (3). Many factors need to be considered when choosing the best or most appropriate technique for inguinal hernia repair, so it is really a challenge to determine the right technique. The best surgical technique should have several characteristics: Low risk of complications (pain and recurrence), fast recovery, good results, and cost-effectiveness. The decision also depends on many factors, such as the characteristics of the hernia, the type of anesthesia, the surgeon's preferences, training, skills, and logistics. The patient's wishes must also be considered.

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The procedures are not as simple as they should be, but they are very specific. Current surgical procedures that are widely used are: Modified Shouldice repair, Lichtenstein repair, laparoscopic transabdominal preperitoneal, and total extraperitoneal, also known as "laparoscopic surgery." Most guidelines published to date recommend mesh-based techniques for primary unilateral inguinal hernia repair due to the lower recurrence rate. However, a few surgeons believe that the use of mesh should be avoided whenever possible (4). There are differing opinions and ongoing debates about the published results and guidelines of specialized centers such as the Lichtenstein Hernia Clinic and Shouldice Hospital (5). The advantages of the Lichtenstein technique over Shouldice repair are simplicity, reduced time, and post-operative pain. However, in less developed countries with limited economic resources, the Shouldice technique appears to be more cost-effective.

In cases of incarcerated hernias, many surgeons choose not to repair with Lichtenstein mesh due to the increased risk of infection. The Shouldice technique may be a better suggestion in such cases (6).

However, this study focuses specifically on the post-operative parameters of two methods: The modified Shouldice technique and the Lichtenstein technique. Thus, the aim of this study is to compare the post-operative outcomes, including post-operative pain intensity at 6, 12, 24, and 72 h after surgery, length of hospital stay, time to full recovery of patients, and resumption of daily and occupational activities.

By analyzing the above parameters, the results of this study make a modest contribution to the existing empirical literature on the effects of the Lichtenstein method compared with the Shouldice method in terms of better hernia outcomes, rapid post-operative recovery, and minimal risk of potential post-operative complications. Our results are consistent with other studies on this topic, but what should be emphasized in the results of our studies is the use of the modification of the Lichtenstein method in all direct and indirect hernias with disruption of the posterior wall in the inguinal canal, in which, first, the posterior wall is straightened with an extended suture (Promylene 00), starting from the pubic tuberosity to the annulus profundus, which can be clearly seen in Figure 1, a single-layer extended polypropylene suture is placed under the mesh, and then the Lichtenstein mesh is placed in this area. This modification leads to significantly better post-operative results in terms of recurrence, as there were almost no recurrences in the cases in question.

In contrast to the free surgical method according to Lichtenstein (Figure 1.), in which the modification, i.e., straightening of the back wall of the inguinal canal with an extended suture (polypropylene 00), was performed, we did not perform any modification in the Shouldice technique modified according to Berliner Darn tension surgical method(Figure 2).

METHODS

The study is designed as a prospective and cohort study based on cases treated at the Clinical Hospital in Tetovo. There, from January 2019 to December 2020, we treated and monitored patients diagnosed with this disease and, of course, those who were willing to undergo surgery.

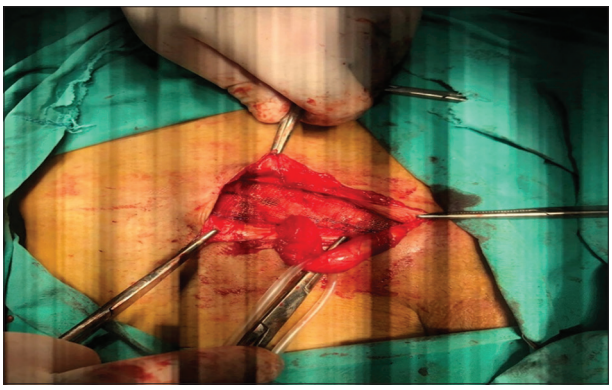


FIGURE 1. Straightening of the posterior wall of the ing. canal with an extended suture, the repair of the hernia defect with a mesh indirect hernias with ruptured posterior wall-Modified Lichtenstein op. Technique.

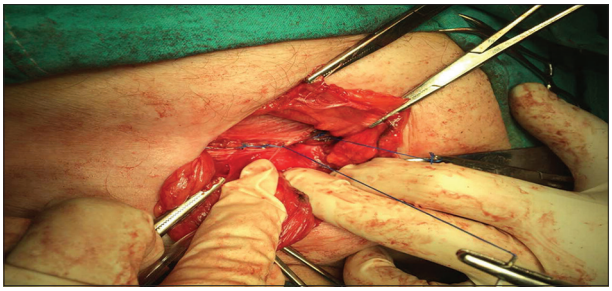


FIGURE 2. Shouldice - B. darn modification, Reconstruction of the inguinal canal according to the Shouldice method modified by Berliner Darn, the first row of the first layer begins with an extended suture in the caudo-cranial direction starting from the tuberculum pubicum, all the way to the inner ring of the inguinal hernia, capturing the inner or lower leaf of transversalis fascia with the iliopubic tract. The second row of the first layer begins using the same suture but in the opposite direction i.e. craniocaudally from the inner ring of the inguinal hernia all the way to the tuberculum pubicum, grasping the transversalis fascia, upper edge of the transversalis muscle and the fascia of the internal oblique muscle with Pouparti›s inguinal ligament.

The total number of patients or subjects enrolled in this study was 100, divided into two groups: 50 subjects diagnosed and treated with the Shouldice method, modified according to Berliner Darn, and 50 cases or subjects diagnosed and operated with the Lichtenstein method.

The inclusion criteria were: Correct diagnosis of inguinal hernia, age between 20 and 80 years, and use of surgical operation technique.

The exclusion criteria were: Patients with collagenopathy, patients on dialysis for end-stage renal failure, patients with liver cirrhosis, patients allergic to certain medications, patients taking immunosuppressants, and patients suffering from various coagulopathies.

In each case, the diagnosis was made by history, inspections, and clinical examination. In certain and specific cases, we were able to dispense with other diagnostic methods, such as echosonography, computed tomography (CT), and magnetic resonance imaging (MRI). When the differential diagnosis includes Adductor tendinitis, Osteitis pubis, Hip osteoarthritis, Bursitis iliopectinea, and Endometriosis, then MRI would be the most appropriate diagnostic method (7,8). CT is also very valuable in the diagnosis of hernias when ultrasound is negative and MRI is not possible.

Local field blockade is used in the majority of hernia repairs. The second most common form of anesthesia was general

anesthesia and regional epidural anesthesia (9). Regional anesthesia has been shown to be advantageous over general anesthesia and is more effective in terms of overall hospital and health-care costs (10) and ensures early patient mobilization and discharge from the hospital (11). Sometimes the reason for switching to general anesthesia was perioperative pain (12), but early post-operative pain appears to be less in the regional anesthesia group (13). The choice of anesthesia was based on patient preference and therefore was not randomized.

The treatment is basically as follows: (a) Pre-operative – on admission, all patients were thoroughly familiarized with the nature of this disease as well as the method of surgery in the pre-operative period; (b) peroperative – we tried to perform the surgical procedure correctly, with minimal lesions of the surrounding tissues, etc. (c) post-operative or outcome measures – post-operative pain, recovery of physiological functions such as level of consciousness, bladder emptying, mobility, recovery (including return to daily activities), and shorter duration of hospital stay are the main goal of every surgeon and, of course, mine.

Statistical analysis: To statistically analyze the differences in post-operative parameters between the two groups of the selected sample of patients, the group of patients operated on by the Shouldice and Lichtenstein methods, we used the t-test for independent samples. Descriptive statistics were presented as means ± SDs, frequencies t-test, and proportions (%). $p < 0.05$ is considered statistically significant. Statistical Package for the Social Sciences (SPSS) (IBM SPSS version 22) was used.

The study is approved by Ethical Committee of Clinical Hospital Tetovo.

RESULTS

From the prospective and cohort study of the group of patients who underwent inguinal hernia repair at Tetova Hospital between January 2019 and December 2020, we followed 100 patients who met the inclusion criteria (50 operated with the Lichtenstein technique and 50 with Shouldice. The mean age of patients operated on with Shouldice was 49.6 years (21–78), while the mean age of patients operated on with Lichtenstein was 52.2 years (29–75).

There was no significant difference in terms of duration of surgery ($p = 0.916$). The average duration of surgery in patients operated with Shouldice was 63.26 minutes, while in patients operated with Lichtenstein, it was 62.8 minutes (Graph 1). According to the intraoperative findings, a higher prevalence of indirect hernias was noted in group A (Shuldice B.D) and a higher prevalence of direct hernias in group B (Lichtenstein) (Table 1).

Hernia findings after intraoperative examination are shown in Table 2, with a slightly higher prevalence of indirect hernias in the group of patients operated on with the Shouldice technique and a higher prevalence of direct hernias in the group of patients operated on with the Lichtenstein technique. The type of hernia had no significant effect on the surgical methods ($p = 0.780$).

Nerve injury and urinary retention were the most common intraoperative complications (Table 3), with no significant difference between these two methods.

TABLE 1. Type of inguinal hernias observed during surgical exploration

Hernia type	A Shouldice	B Lichtenstein	Total
Direct	11	15	26
Indirect	28	22	50
Combined	11	13	24
Total	50	50	100

TABLE 2. Review of intraoperative complications and lesions

Intraoperative complications	A Shouldice	B Lichtenstein	Total
Vascular lesions	3	2	5
Nerve lesions	5	6	11
Defense duct lesions	0	0	0
Testicular lesions	0	0	0
Urinary compl. (Urine retention)	4	5	9

To statistically represent the differences in post-operative parameters between the two groups of the selected patient sample, the group of patients operated on with the Shouldice and Lichtenstein methods, we used the method of *t*-test for independent samples. The differences for each parameter are presented in Table 4.

In a sample of 100 patients, an independent t-test was performed to compare the differences in post-operative parameters between patients operated on with the Shouldice method and those operated on with the Lichtenstein method.

The results (Table 4) showed that pain scores were significantly lower 12 h postoperatively in the Lichtenstein group than in the Shouldice group (4.12 vs. 4.86; *t*-test, $p = 0.013$). The results also showed significant differences 24 h postoperatively (2.40 vs. 3.98; *t*-test, $p < 0.001$) and 72 h postoperatively (2.0 vs. 2.72, *t*-test, $p = 0.008$).

There were also significant differences in getting out of bed (14.71 vs. 20.64, *t*-test, $p < 0.001$); resuming daily activities (7.80 vs. 11.2 *t*-test, $p < 0.001$); resuming work activities (28.98 vs. 51.16, *t*-test, $p < 0.001$); hospital days (2.96 vs. 4.08, *t*-test $p < 0.001$), while the statistical results for other post-operative parameters (pain level 6 h postoperatively; body temperature after surgery; inflammation of the surgical wound; gastrointestinal manifestations) did not reveal significant differences between patients operated on according to the Lichtenstein and Shouldice methods.

DISCUSSION

At present, there are no standardized methods for the treatment of inguinal hernias. The European Hernia Society published a guideline in 2009 covering all aspects of the treatment of inguinal hernias in adult patients (14), which was updated in 2014 (15). The standard model described for open inguinal hernia repair has been the tension-free technique, which involves the placement of a mesh known as the Lichtenstein technique (16). There are other techniques that were described later. For example, the technique described by Rutkow and Robbins (17) known as plug-and-patch (18), followed by Trabucco (19) and the Prolene Hernia System (PHS) (20).

The Shouldice technique was considered the best mesh-free technique for inguinal hernia repair by the European

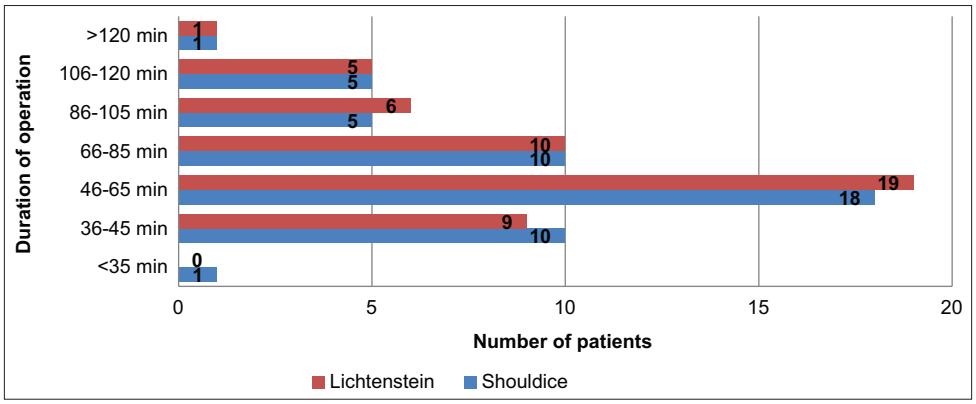
TABLE 3. Descriptive statistics of post-operative parameters

Post-operative complication	Technique	n	Mean	Standard deviation	Standard error mean
Pain level after 6 h of surgery	Shouldice	50	5.52	1.515	0.214
	Lichtenstein	50	5.34	1.944	0.274
Pain level after 12 h of surgery	Shouldice	50	4.86	0.538	0.217
	Lichtenstein	50	4.12	1.364	0.193
Pain level after 24 h of surgery	Shouldice	50	3.98	1.269	0.179
	Lichtenstein	50	2.40	1.355	0.191
Pain level after 72 h of surgery	Shouldice	50	2.72	1.294	0.183
	Lichtenstein	50	2.00	1.355	0.191
Post-operative body temperature	Shouldice	50	36.88	0.534	0.075
	Lichtenstein	50	36.80	0.539	0.076
Getting out of bed (hours)	Shouldice	50	20.64	6.874	0.972
	Lichtenstein	50	14.72	5.326	0.753
Return to daily activities (days)	Shouldice	50	11.12	3.612	0.510
	Lichtenstein	50	7.80	3.469	0.490
Return to work activities (days)	Shouldice	50	51.16	11.021	1.558
	Lichtenstein	50	28.98	7.862	1.111
Inflammation of the operative wound	Shouldice	50	2.58	0.810	0.114
	Lichtenstein	50	2.48	0.862	0.122
Hospital days	Shouldice	50	4.08	0.751	0.106
	Lichtenstein	50	2.96	0.637	0.090
Gastrointestinal manifestations in the early post-operative period	Shouldice	50	1.68	1.942	0.274
	Lichtenstein	50	1.60	1.772	0.250

TABLE 4. The significance levels of differences in means of post-operative parameters between the Lichtenstein and Shouldice techniques

Post-operative complication Mean and standard deviation	Shouldice	Lichtenstein	*P*-value
Pain level after 6 h of surgery	5.52±1.515	5.34±1.944	0.607
Pain level after 12 h of surgery	4.86±0.538	4.12±1.364	0.013*
Pain level after 24 h of surgery	3.98±1.269	2.40±1.355	0.000**
Pain level after 72 h of surgery	2.72±1.294	2.00±1.355	0.008**
Post-operative body temperature	36.88±0.534	36.80±0.539	0.425
Getting out of bed (hours)	20.64±6.874	14.72±5.326	0.000**
Return to daily activities (days)	11.12±3.612	7.80±3.469	0.000**
Return to work activities (days)	51.16±11.021	28.98±7.862	0.000**
Inflammation of the operative wound	2.58±0.810	2.48±0.862	0.552
Hospital days	4.08±0.751	2.96±0.637	0.000**
Gastrointestinal manifestations in the early post-operative period	1.68±1.942	1.60±1.772	0.830

**Statistical significance et 1% ($p < 0.01$), **statistical significance et 5% ($p < 0.05$)



GRAPH 1. Duration of surgery for patients undergoing the Lichtenstein and Shouldice methods.

Hernia Guidelines (14). Another study with long-term follow-up after Schouldice showed that the type of hernia, whether indirect or direct, was not an independent risk factor (15). Questions remain about the outcomes of the Shouldice technique, even when performed in specialized centers or by surgeons specializing in hernia repair. There is also less evidence that the mesh-free technique (Shouldice) has a recurrence rate of < 2%, even when performed in a specialized center such as Shouldice Hospital (21). To illustrate this, we will discuss some results of different studies

comparing these two methods. In the work of Aytac et al., the return to work was shorter in the Lichtenstein group (17 ± 4 days) than in the Shouldice group (25 ± 5 days) ($p < 0.05$) (22). This parameter is consistent with the results of our work, in which the return to work activity (days) was shorter in the Lichtenstein group (28.98 ± 8) than in the Shouldice group (51.16 ± 10), $p = 0.000$ ($p < 0.05$). The number of recurrences in their study differed significantly between the groups with five in the Shouldice group (4.1%) and one in the Lichtenstein group (0.8%) ($p < 0.05$).

Regarding the operative time between the two methods, Shah and Kumar reported in their work that Shouldice surgery took more time (84.16 min) compared to Lichtenstein (58.80 min) (23). Post-operative pain was reported to be 4.2% and 5.6% in the Shouldice and Lichtenstein groups, respectively, in the work of Nordin et al., (24). These results for post-operative correspondence are also consistent with our findings, as pain intensity was measured 6 h, 12 h, 24 h, and 72 h after surgery in our study. Post-operative pain, usually lasting longer than 1 month, is one of the most common complaints after inguinal hernia repair and has been reported to occur up to 60%. The reason for this could be the iatrogenic nerve lesions, which may be considered inevitable (25,26). In another logistic model with analysis of many other variables, such as sensitivity analysis, elements favoring the Shouldice technique are found. However, this should be interpreted with caution, as it could be an effect of larger samples and predefined variables (27). Based on the results presented in our study, this technique remains more satisfactory in terms of post-operative outcomes.

CONCLUSION

Lichtenstein non-tension operative technique was more efficient and adequate compared to Shouldice tension modified by Berliner Darn, due to the lower intensity of post-operative pain. It was also found that patients operated on with the Lichtenstein surgical technique were more mobile post-operatively than those treated according to Shouldice, modified according to Berliner Darn. The length of hospital stay was also shorter, and the speed of treatment and the return of patients to their physical and occupational activities are significantly faster with the Lichtenstein operation method.

DECLARATION OF INTERESTS

The author declare no conflict of interest.

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