

# Comparison of Coskun and Lichtenstein hernia repair methods for groin hernia

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**Purpose:** Coskun hernia repair technique has been reported to be an effective new fascia transversalis repair with its short-term follow-up results. Our aim is to determine the results of Coskun hernia repair technique and to compare it with Lichtenstein technique.

**Methods:** At this comparative retrospective study a total of 493 patients, who had groin hernia repair procedure using Coskun or Lichtenstein technique, between January 1999 and March 2010 were enrolled into the study. Patients were reached by telephone and invited to get a physical examination.

**Results:** Out of 493 groin hernia repairs, 436 (88.5%) were carried out by residents and 57 (11.5%) by attending surgeons. Lichtenstein technique was the choice in 241 patients and 252 patients underwent Coskun hernia repair technique. Groin hernia recurrence was detected in 8 patients (3.1%) in Coskun hernia repair group and 7 patients (2.9%) in Lichtenstein group. Comparison of early complication rates in Coskun group (3.9%) and Lichtenstein group (4.5%) showed no significant difference. Late complication rates were significantly higher in Lichtenstein group (1.2% vs. 4.9%). The operation time was shorter in Coskun group (44 minutes) than in Lichtenstein group (60 minutes). Subgroup of patients, whose hernia repair operations were carried out by attending surgeons, had a recurrence rate of 0% and 3.8%, in Coskun group and Lichtenstein group, respectively.

**Conclusion:** This study showed that Coskun hernia repair technique has a similar efficacy with Lichtenstein repair, on follow-up.

[Ann Surg Treat Res 2015;89(3):138-144]

**Key Words:** Herniorrhaphy, Surgical mesh, Groin hernia, Operative surgical procedures

## INTRODUCTION

There is no supportive tissue in the groin region anterior to fascia transversalis and below the arcuate line. All hernias are protruded from this myopectineal orifice. Endogenous hernia repair techniques that are supporting the orifice only anteriorly, without including fascia transversalis like Bassini procedure have high recurrence rates [1]. Multilayered repair techniques that include fascia transversalis as the supportive tissue, like Shouldice repair, are reported to have low recurrence

rates. However, excessive surgical dissection requirement and the need of advanced skill in these procedures limit its widely preference. Exogenous techniques, which are based on closing the myopectineal orifice or defect with a mesh, were initially used for recurrent or bilateral hernias [2], however, the simplicity of the techniques, ease of application and low recurrence rates made them become widely used techniques for almost all types of groin hernias.

There is still a need for a technique that does not require prosthetic materials, and has low postoperative complications

Received February 27, 2015, Revised April 4, 2015,  
Accepted April 24, 2015

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and low recurrence rates. In experienced centers, results of the procedures using endogenous tissues are reported to be similar with Lichtenstein technique, opposing the high recurrence rates in inexperienced centers [3]. Therefore, a favorable endogenous repair technique need to be easy to learn and apply and also should have acceptable recurrence and complication rates in any center other than the experienced centers for widely preference.

Short-term results of a prospective study, comparing Coskun hernia repair technique [4] with Lichtenstein technique showed similar low recurrence and complication rates. Coskun repair technique is a recently represented method for groin hernia repairs. It includes plication of fascia transversalis and approximation of conjoint tendon with inguinal ligament by continuous suturing to distribute the tension. Coskun repair is a double layered technique and it can be easily learned and applied (Figs. 1, 2) [4].

The primary aim of this study is to compare the results of Coskun hernia repair technique and Lichtenstein procedure regarding effectiveness on follow-up.

## METHODS

Hospital database and institutional standardized patient forms for groin hernia patients were searched and all available data of the patients who underwent groin hernia repair in our clinic between January 1999 and March 2010 were recorded. Obtained data was analyzed carefully and relevant patients were reached by telephone and invited to get a physical examination. Physical examinations were performed by a single surgeon and any sign of recurrence was recorded. Patients were also questioned for existence of pain in the operation zone. Patients who underwent Lichtenstein or Coskun hernia repair and has been reached by us were included in the study. Patients

who declined to come to the hospital were subjected to a telephone questionnaire to check any signs of recurrence or late complications.

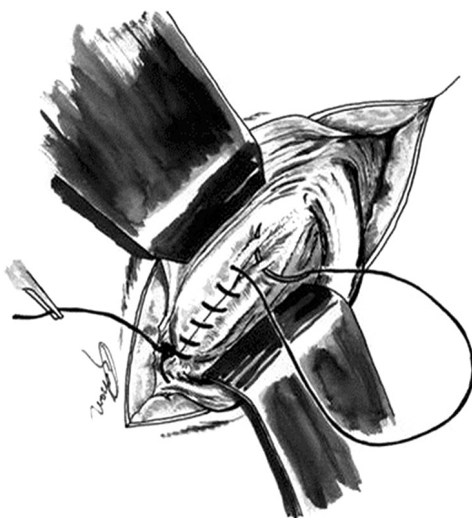
The groups were analyzed regarding surgical method of choice, age, gender, type of hernia, operative time, length of hospital stay, type of anesthesia, early complications (hematoma formation, scrotal edema, infection, urinary retention), late complications (chronic pain, testicular atrophy, paresthesia), recurrence rate, and seniority of the operating surgeon. Hernia types are grouped according to Nyhus classification. Types 1 and 4 patients excluded from the study. Nyhus type 2 refers to indirect hernias with an enlarged internal ring, while Nyhus type 3a refers to direct inguinal hernias, and Nyhus type 3b to indirect hernias caused by posterior wall weakness [5].

The etiologic factors that affect hernia formation or post-operative recurrences such as smoking, coughing, prostatism and constipation were recorded and also their relations with recurrence were analyzed.

Patient data were analyzed using NCSS (Number Cruncher Statistical System) 2007 & PASS 2008 Statistical Software (Kaysville, UT, USA). Descriptive statistics (mean, standard deviation) and quantitative comparisons were done using Student t-test. Chi-square and Fischer exact tests were used to compare observed data. P-values below 0.05 were accepted as statistically significant.

## RESULTS

Analysis of all collected data revealed that a total of 493 patients underwent Coskun or Lichtenstein hernia repair. As a result of the systematic order of the clinic, the choice of the treatment method was totally made according to the attending



**Fig. 1.** Plication of fascia transversalis.



**Fig. 2.** Aproximation of ligamentum inguinale with tendon conjoint.

**Table 1.** Patients and characteristics

Characteristic	Coskun (n = 252)	Lichtenstein (n = 241)	P-value
Age (yr)	48 ± 17	54 ± 16	0.001*
Sex			
Male : female	226 : 26	217 : 24	0.895
Nyhus type <sup>a)</sup>			0.960
2	22 (8.7)	22 (9.2)	
3a	80 (31.8)	74 (30.7)	
3b	150 (59.5)	145 (60.1)	
Length of hospital stay (day)	1.45 ± 1.1	1.49 ± 1.2	0.664
General anesthesia (%)	166 (65.8)	172 (71.2)	0.361
Follow-up period (mo), mean (range)	12–108 (38.3)	12–108 (38.6)	-

Values are presented as mean ± standard deviation or number (%) unless otherwise indicated.

<sup>a)</sup>Type 2 represents indirect hernias with an enlarged internal ring; type 3 represents direct inguinal hernias; type 3b is the indirect hernia with posterior wall weakness.

\*P < 0.05, statistically significance.

**Table 2.** Distribution of recurrence according to surgical seniority

Variable	Lichtenstein (n = 241)	Coskun (n = 252)	P-value
Surgical seniority			0.671
Resident & attending	215 (89.2)	221 (87.6)	
Attending	26 (10.8)	31 (12.4)	
Recurrence			0.791
Attending/resident	1/6	0/8	
Operation time (min)	60.3 ± 19	44.4 ± 15	0.001*

Values are presented as number (%) or mean ± standard deviation.

\*P < 0.05, statistically significance.

surgeon's personal preference. Four hundred and thirty-nine of the patients (89%) who were reached, accepted to get a physical examination. 54 patients (11%) who declined to come to the clinic (most common reason for not coming was the great distance between patients' residences and the hospital), were subjected to the telephone questionnaire. Lichtenstein technique was the method of choice in 241 patients and Coskun hernia repair technique was preferred in 252 patients. The mean age of the patients was 51.2 ± 17.3 years and 89.8% of the patients were males. The follow-up period was 38.4 ± 17.3 months. On the day of this research, follow-up period of the patient who has been operated most recently was 12 months and it was 108 months for the patient who has undergone surgery earliest. The mean age at Coskun group was 48.4 ± 17.8 years of age and was significantly younger than the Lichtenstein group (54 ± 16 years of age) (Table 1). When hernia types of the patients were analyzed; 44 (8.9%) had type 2, 154 (31.3%) had type 3a, 295 (59.8%) had type 3b.

Of the patients, 14% had cough, 9.6% had constipation, 18.3% had prostatism, and 39.2% were smokers. Approximately 70%

**Table 3.** Distribution of complications and recurrence

Variable	Coskun (n = 252)	Lichtenstein (n = 241)	P-value
Complications			
Early	10 (3.9)	11 (4.5)	0.824
Late	3 (1.2)	12 (4.9)	0.014*
Recurrence	8 (3.1)	7 (2.9)	0.862

Values are presented as number (%).

\*P < 0.05, statistically significance.

of the patients' anesthesia preference was general anesthesia. Mean postoperative length of hospital stay (LOS) was 1.45 days in Coskun procedure group and 1.49 days at Lichtenstein group. There were no difference among the groups regarding gender, hernia type, anesthesia type and LOS.

When the groups were compared regarding the operative time and the seniority of the operating surgeon, 89.2% of Lichtenstein group and 87.6% of Coskun group were performed by residents, primarily, mean operative time was 44.4 minutes in Coskun group and it was significantly shorter than the mean operative time in Lichtenstein group (60.3 minutes) (P = 0.001) (Table 2). Patients were subgrouped according to the performing surgeon's seniority. No significant difference regarding operative time was detected between resident and attending surgeon subgroups neither in Coskun nor Lichtenstein groups (P > 0.05).

Recurrence, which is relatively the most important complication of groin hernia operations, was detected in 8 patients in Coskun group (3.1%) and 7 patients Lichtenstein group (2.9%) (P > 0.05). Early complication rates were 3.9% in Coskun group and 4.5% in Lichtenstein group. Late complication rate was 1.2% in Coskun group and 4.9% in Lichtenstein group (Table 3). The lower rates in Coskun group was not significantly different, however, hematoma formation in the early term (2

**Table 4.** Early and late complications in Coskun and Lichtenstein groups

Group	Total (n = 241)	Resident with attending (n = 215)	Attending (n = 26)	P-value
Lichtenstein group				
Early complication				0.102
+	230 (95.4)	207 (96.3)	23 (88.5)	
-	11 (4.6)	8 (3.7)	3 (11.5)	
Late complication				>0.999
+	229 (95.0)	204 (94.9)	25 (96.2)	
-	12 (5.0)	11 (5.1)	1 (3.8)	
Coskun group	n = 252	n = 221	n = 31	
Early complication				0.617
+	242/252 (96.0)	211/221 (95.5)	31/31 (100)	
-	10/252 (4.0)	10/221 (4.5)	0/31 (0)	
Late complication				>0.999
+	249/252 (98.8)	218/221 (98.6)	31/31 (100)	
-	3/252 (1.2)	3/221 (1.4)	0/31 (0)	

Values are presented as number (%).  
Fisher exact test.

patients in Coskun group and 6 patients in Lichtenstein group) and paresthesia in the late term (2 patients in Coskun group and 8 patients in Lichtenstein group) was significantly lower in Coskun group ( $P < 0.05$ ). Chronic pain, which is the most commonly reported late complication, was encountered in 3 patients in Lichtenstein group and one patient in Coskun group. There were 2 wound site infections in Lichtenstein group and none in Coskun group. Scrotal edema occurred in 4 patients in Coskun group and in 2 patients in Lichtenstein group, however, the only testicular atrophy was seen in Lichtenstein group. No mesh infections were seen in Lichtenstein group.

Recurrent cases were analyzed regarding the seniority of the operating surgeon. All eight patients who had recurrence in Coskun group were performed by residents, on the other hand, 6 residents and 1 attending surgeon were the operating surgeons of the patients who had recurrences in Lichtenstein group (Table 2). Of all of the recurrent hernia patients, 66.6% were smokers and 33% had prostatic complaints.

Early complications (hematoma, scrotal edema, wound infection, or urinary retention) were seen in 21 out of 493 patients (4.25%). Eleven of these patients with early complications underwent Lichtenstein repair (4.5%) and 10 of them underwent Coskun repair (3.9%). Late complications (chronic pain, testicular atrophy, paresthesia) were seen in 15 patients (3.04%), whereas 12 patients were in Lichtenstein group (4.9%) and 3 were in Coskun group (1.2%). Early and late complication numbers and rates regarding the performing surgeon's seniority are listed in Table 4. No significant difference between resident and attending surgeon groups was detected, regarding complication rates ( $P > 0.05$ ).

## DISCUSSION

Inguinal hernia repair is one of the most frequently performed surgical operations and it is usually regarded as a minor procedure by many surgeons. In fact, these procedures are one of the best opportunities for junior surgical residents. Groin hernia repair is one of the most frequent operations in general surgery. Although groin hernias consist around 80% of all abdominal hernias and have a prevalence of 5%–10% among population [6]; there is no consensus on the most appropriate repair technique [7]. The main criterion for outcome of groin hernia surgeries is the recurrence rate. In management of groin hernias a reliable, easily applicable technique which is serving sufficient exploration with minimal dissection, and have minimal recurrence rate would be preferred. Although there are several hernia repair techniques described in the literature with 1% to 20% recurrence rates, there is no gold standard surgical procedure with zero recurrence rate. Furthermore, patient comfort in early postoperative period, operative cost, loss of manpower, LOS and loss of working days should be taken into consideration.

The entire groin hernias originate from the myopectineal orifice located on the lower abdominal wall. Nevertheless, recurrent hernias also originate at the same location. Because there is no posterior rectus sheet below the arcuate line, this orifice is supported just by fascia transversalis below the arcuate line [8]. Hernias arise through the myopectineal orifice due to disruption of fascia transversalis. Consequently, all hernia repair techniques aim to support and reinforce this region. Endogenous hernia repair techniques are procedures fundamentally proving continuous closure of the myopectineal orifice. Nyhus type 1 hernias are generally encountered in

children and high ligation procedure is sufficient in these cases. However, endogenous repair techniques using solely anterior wall as supportive tissue in hernias with fascia transversalis deformation has unacceptable high recurrence rates. Among these techniques, Bassini is an easy and widely applied unilayer procedure. It was the most commonly performed procedure in recent past; however, high recurrence rates lead clinicians to the search for new repair techniques.

Edoardo Bassini, who is considered as "master of hernia surgery", has spent most of his lifetime on hernia surgery [9]. He practiced inguinal and anterior abdominal wall anatomic dissections in autopsy series and he presented his work as a first step in modern hernia repair surgery in 1883. In his own definition of his repair technique, he suggested to remove fat tissue and cremaster muscle around the inguinal cord, and to excise the hernia sac in the preperitoneal zone after incising the transvers fascia. He also described his unique three layer technique for repairing the transverse fascia [10]. Likewise, endogenous tissue is used in Coskun hernia repair technique. However, while the transverse fascia is incised and then sutured over itself in Bassini technique; in Coskun technique the transverse fascia is not incised and is "plicated" over itself. After first plication of the fascia, conjoint tendon and inguinal ligament are approximated to each other with sutures, forming the second layer. It is also important that unlike Bassini technique, continuous sutures are used in Coskun technique to obtain balanced distribution of pressure. Finally, in Coskun technique, internal oblique muscle is not included in the suture lines and shutter mechanism is not affected.

The most important outcome in our study is the recurrence rate. Seven recurrences were identified in 241 patients (2.9%) in Lichtenstein group in 12 to 108 months follow-up, while recurrences happen in 8 in 252 patients (3.1%) in Coskun group. Previously our short-term results were reported, and in the mentioned study recurrence rates were 3.3% vs. 1.67% in Lichtenstein and Coskun, respectively. This difference was not statistically significant [4]. In this study, likewise, we find that Coskun and Lichtenstein repair had similar recurrence rates (3.1% vs. 2.9%) ( $P = 0.862$ ).

Shouldice technique was established after Bassini procedure and popularized with recurrence rates around 1%, which triggered its widely application. However, this procedure is a four layer technique that requires excessive surgical dissection and can only be performed by experienced surgeons. Nonetheless, both difficulties in surgical practice and discrepancies in recurrence rate reports from the other centers diminished its use in surgical practice. Shouldice procedure is applied in Shouldice Clinic with around 0%–1% recurrence rates. The main difference of this technique from Bassini procedure is the usage of fascia transversalis as supportive layer. The clear and dramatic recurrence lowering effect of this relatively weak

tissue layer, lead to consideration of fascia transversalis as one of the important supportive tissues, in creation efforts of new and easy techniques [11,12].

High recurrence rates with endogenous techniques were associated with tension on the suture line. This consequently popularized tension-free procedures, using prosthetic materials anterior or posterior to the fascia transversalis. Today, hernia repairs are grouped in two main topics: tense (endogenous tissue is used) [1], and tension free (exogenous prosthetic mesh is used) [2] using procedures. Until 1990's, repairs using endogenous tissue like Bassini/Halsted, Cooper/Mc Vay, and Shouldice were popular, however; recently prosthetic mesh based repairs like Lichtenstein (anterior mesh), Nyhus (preperitoneal mesh), mesh plug or laparoscopic approaches became more popular [4,13-16]. Tension-free procedures using prosthetic materials in groin hernia surgery lowers the recurrence rates, however, are not still recurrence free. Moreover, adverse effects like mesh reaction, rejection, and chronic pain could cause patient discomfort. Despite of the promising results in mesh repair claimed by many authors; nonmesh repair is still a commonly performed surgical procedure at the international level [17,18].

Coskun groin hernia repair is a multilayered, endogenous and tense technique. Plication of the fascia transversalis without any incision is the difference of Coskun repair, from other two layer procedures. Even some authors propose better results with incising fascia transversalis, our study's results reveal that incising fascia transversalis is unnecessary [4]. As this procedure limits further dissections, it also simplifies the operation and shortens operation time. There are two important reasons for choosing Lichtenstein repair to compare with Coskun repair: Firstly, Lichtenstein procedure is the most commonly preferred tension-free open technique; and secondly, to our opinion, this anterior mesh technique is also a multilayer procedure, because distorted fascia transversalis should be repaired before laying mesh, according to the technical definition of the Lichtenstein procedure.

Significantly lower early and late complication rates for Coskun repair reported our previously [4]. Our follow-up study also shows lower complication rates for Coskun procedure. Chronic pain is reported to be encountered after Lichtenstein repairs over 10% of patients [19], however, our series in this study had a rate of 0.4% chronic pain (only one patient) in Coskun group and 1.2% (3 patients) in Lichtenstein group. Our both studies reveal that chronic pain is not a common complication. None of the patients in this study had readmission because of chronic pain or complained about any persisting pain during the medical questionnaire. Therefore, it is impossible for us to evaluate chronic pain in each technique comparatively. Moreover, routine use of pain killers after surgery limits this study in terms of evaluating postoperative

pain.

The most serious early complication of Lichtenstein repair is the mesh reaction and rejection. In our study, there was no complication regarding prosthetic mesh. There are not many studies on how many years patients should be followed up for complications and foreign body reactions regarding mesh implantation. Although reports on complications regarding prosthetic mesh in groin hernia surgery is limited, risk of fistulization in procedures using mesh should be kept in mind [20].

Long-term recurrence rates of Lichtenstein technique is reported to be between 0.1% and 5% [14,21]. Lichtenstein repair's recurrence rate reported to be 0.7% [2]. Also, lower recurrence rates are reported from the Lichtenstein Clinic. Amid et al. [22] reported their 11 years follow-up experience on 4,000 patients in Lichtenstein Clinic with Lichtenstein repair in 1995. In that study, 87% of patients were reached and re-examined. Four patients (0.1%) had recurrence. Low recurrence rates of studies from experienced groin hernia repair centers underlines the importance of surgical practice and experience.

In our study 89.2% of the patients in Lichtenstein group and 87.6% of Coskun group were operated primarily by surgery residents. The high rate of resident performed operations reflects that groin hernia repair surgery is among the most important components of education in hospital practice. Six of 7 recurrent groin hernia patients in Lichtenstein group and all eight in Coskun group were operated by residents. When only the patients, whose repairs were performed by attending surgeons were taken into consideration, recurrence occurred in 0% of the Coskun group (31 of patients) and 3.8% of Lichtenstein group (26 of patients). In spite of the inadequate number of patients, these results support the importance of experience. In the retrospective study of Sondenaa et al. [23] at 2001, recurrence rates of 1,059 patients with groin hernia on 5.5 years follow-up were analyzed. Recurrence rate is reported to be 8% in primary hernia repairs. However, the rate was 29% in patients who underwent surgery for recurrent hernias. High recurrence rate was interpreted to be associated with the insufficient attention paid by the residents during operations on the course of their training.

When the operating times are compared, Coskun repair had 45 minutes mean operation time whereas Lichtenstein repair

had 60 minutes, and the difference was significant. When mean operative time in Coskun group is compared with the other centers' reports; Stoppa, Shouldice, Lichtenstein, and laparoscopic hernia repairs seem to take longer time [24,25]. In our opinion, this is associated with much easier learning curve. Easy and fast experience gain and lower recurrence rates are two major advantages of Coskun repair, both for hernia specialized centers and less experienced centers.

Similar recurrence rates of both tense and tension-free techniques and frequent repetition of the similarity in different studies is an important issue. It is clear that tension is not the only factor effecting groin hernia recurrences, moreover, tension-free operations using prosthetic materials are not the definite solution for recurrence. Experience of the surgeon and specialization of the clinic seem to be two of the most important factors for lowering the recurrence rates [26]. As a matter of fact, existence of recurrences underlines likelihood of factors interfering wound healing, like collagen tissue disorders. Prosthetic materials are suggested to have positive effects on wound healing, in patients with collagen metabolism disorders [27]. It is reported that, ongoing collagen metabolism disorders were diagnosed in patients who underwent recurrent groin hernia repair operations with prosthetic meshes [22]. We think that; while treating patients with primary groin hernia, an effective repair using endogenous tissues can eliminate any possible adverse consequences of mesh use.

The major limitation of this study is its retrospective design. Randomized prospectively designed studies would grant more valuable information about recurrence rates, complication rates and operative time.

In conclusion, we conclude that recently defined hernia repair technique of Coskun is a reliable and acceptable hernia repair technique with similar low recurrence rates and lower complication rates comparing widely used Lichtenstein technique. Furthermore, using endogenous tissues makes the procedure cheaper, easier to learn, and easier to apply. Thus, it is a reliable technique even for inexperienced centers.

## CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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