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Correlative evaluation study of Desarda's tissue-based repair technique and Lichtenstein mesh hernioplasty in treatment of inguinal hernia

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Abstract

Background and Objectives: To evaluate the efficacy of a pure tissue-based strategy in comparing the primary inguinal hernia therapy with the conventional Lichtenstein repair.

Methods: For our investigation, a total of 150 cases were separated into two groups. Group L in Lichtenstein consisted of 75 patients, while group D in Desarda also had 75 patients. The primary determinant of the outcome was the occurrence of inguinal hernia recurrence within a one-year timeframe. The duration between the surgical intervention and the closure of the skin was considered as a secondary outcome factor. Postoperative pain scores were computed using the visual analog scale. The duration required to resume regular activities at home was computed. The patient experienced various postoperative complications, such as cord edema, groin pain, seroma, fever, wound infections, and persistent pain.

Results: Each arm in the study exhibited one recurrence after a 15-month mean follow-up period ($P=1$). In the Lichtenstein group, the operational time was $73.89+12.63$ minutes, while the repair time was $72.60+13.89$ minutes ($P=0.508$). In comparison to the Lichtenstein group, the group experienced significantly lower postoperative pain within the first seven days after surgery ($P=0.09$). Additionally, the group had a significantly shorter time to resume routine activities at home compared to the Lichtenstein group ($P=0.001$). However, there was no statistically significant difference in the rates of post-operative complications between the two trial arms.

Conclusion: Comparable outcomes have been observed between the Desarda approach and conventional Lichtenstein surgeries in the treatment of inguinal hernias. A mesh is not utilized in the Desarda method. Patients who undergo Desarda's surgical treatment recover from it more quickly than those who receive the usual Lichtenstein mesh repair. The occurrence of postoperative pain is reduced, while the standards of the method remain unchanged. The Desarda approach may increase the selection of tissue-based groyne hernia therapy alternatives.

Keywords: Desarda tissue repair, Lichtenstein mesh hernioplasty, Primary Inguinal hernia, Tissue based repair

Introduction

A hernia refers to the elongation of a viscus or a segment thereof through an atypical aperture in the mucosal lining of the cavity in which it is situated ^[1, 2]. Hernias can occur in any part of the body, although they are most commonly found in the anterior abdominal wall, particularly in the inguinal region. An inguinal hernia refers to the protrusion of abdominal cavity contents or pre-peritoneal fat through a defect in the inguinal area, regardless of whether this procedure is performed or not ^[2]. Most hernia patients experience pain or discomfort, along with swelling in the groin, especially when physical activity, coughing, or bowel movements lead to an elevation in pressure within the abdomen. Pain intensifies and diminishes during periods of rest throughout the day. Inguinal hernias remain a prominent surgical concern due to their high incidence. The lifetime risk of inguinal hernia is estimated to be 27% for men and 3% for women. The annual mortality rate for inguinal hernia patients ranges from 100 to 300 per 100,000 individuals ^[2, 3].

Mesh-based procedures, such as the Lichtenstein technique and laparoscopic approaches, have been authorized by the European Hernia Society for the management of symptomatic inguinal hernia in adult patients. The Lichtenstein technique is presently recognized as the

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open mesh surgery with the least perioperative morbidity among several alternatives [3, 4]. The standard of care for individuals with inguinal hernias is widely recognized. Nevertheless, concerns regarding the sensation of a foreign object, infection of wounds, fibrosis of the spinal cord, persistent pain, and the occurrence of relapse (2%) are of considerable importance. Mesh functions as a physical obstruction, but it lacks a posterior wall that is naturally adaptable and responsive. Synthetic prosthesis may give rise to novel clinical complications such as abdominal wall rigidity, discomfort, and groyne foreign body sensation, which could significantly affect the patient's daily functioning. Mesh-based hernia operations are associated with a higher incidence of infections at the operative site [4]. Meshoma or plugoma tumors have the potential to arise in the vicinity of the mesh prosthesis due to a pronounced and persistent inflammatory reaction, frequently associated with a foreign body reaction. The management of these tumors poses a novel surgical obstacle. Chronic scarring might potentially lead to the obstruction of the vas deferens, hence compromising erectile function and reducing the likelihood of conception. Dr. Mohan P. Desarda [5, 6] described a distinctive approach to tissue-based hernia repair that exhibits a remarkably low rate of recurrence.

The concept of Desarda repair is to provide a robust, mobile, and physiologically active posterior inguinal wall without the need for any prosthetic devices. In this case, to enhance the strength of the posterior wall, a continuous strip of external oblique aponeurosis is attached to it instead of using mesh. The technique is straightforward to acquire, necessitates less intricate dissection or suturing, does not necessitate the use of mesh, and yields outcomes that are at least competitive to Lichtenstein repair. Desarda proposed that the utilization of an external oblique aponeurosis (EOA) strip is a viable alternative to both mesh and the Shouldice repair, as the aging process is constrained in tendons and aponeurosis [6, 7]. The contractions of the external and internal oblique muscles, which resulted in the transformation of the EOA strip into a protective barrier to prevent re-herniation, enabled the author to demonstrate the dynamic character of his repair. Furthermore, the author illustrated the manner in which the EOA strip provided support to the transversalis fascia and reduced the probability of herniation occurring behind the strip [7, 8]. Bassini's repair is commonly employed in cases of strangulation, whereas Lichtenstein repair is conducted in research facilities. Cocuzza *et al.* conducted a study which found that the use of prosthetic mesh has enduring adverse effects on the vas deferens, resulting in azoospermia. A multitude of researchers have embraced novel approaches to hernia repair in response to the observed postoperative dysfunctions and complications [8-10].

The present investigation analyzed the outcomes of the uncomplicated inguinal hernia repair techniques devised by Lichtenstein and Desarda. Hence, a prospective observational study is undertaken to assess and compare the rates of recurrence and postoperative morbidity associated with Desarda's technique and Lichtenstein's technique in the context of uncomplicated inguinal hernias. The study aims to evaluate the impact of these techniques on immediate postoperative pain, chronic groyne pain, wound infection, and the duration required to resume activities of daily living (ADL).

Material and methods

A study was undertaken at the Department of General Surgery, Konaseema Institute of Medical Sciences, Amalapuram, Andhra Pradesh, India, from August 2014 to July 2015 to compare two hernia repair procedures. The study group consisted of patients who had inguinal or inguinoscrotal hernia over the specified time period. The study comprised two groups, totaling 150 patients: Group L (75) for Lichtenstein and Group D (75) for Desarda repair. All patients with inguinal or inguino-scrotal hernias were eligible to participate in the trial.

Inclusion Criteria

1. Individuals who are 18 years of age or older.
2. Patients who have an inguinal or inguino-scrotal hernia.

Exclusion Criteria

1. Individuals below the age of 18
2. Complex inguinal hernias, such as blocked, strangulated, and gangrenous hernias, as well as recurring inguinal hernias, encompass a range of conditions.
3. The presence of a thin, weak, or divided external oblique aponeurosis during the surgical procedure.

Methodology

The preoperative assessment of every patient encompassed a comprehensive review of their medical history, a thorough physical examination, and standard laboratory tests. As part of the pre-anesthesia evaluation, elderly individuals had supplementary examinations to identify potential issues.

The participants were divided into two cohorts and provided with the choice between tissue-based or Lichtenstein mesh-based repairs (referred to as the L group) and the D group [10]. The allocation of patients to different surgical techniques was determined by the utilization of randomization and patient preference. Although the Lichtenstein repair procedure was employed by the other units within the department, it is noteworthy that all patients undergoing the treatment were under the supervision of a singular surgical unit.

After a comprehensive pre-anesthesia assessment, anesthesia was administered based on the anesthetist's assessment. An oblique inguinal incision was utilized in all surgical procedures. The dissection and evaluation of the external oblique aponeurosis (EOA) were conducted. The operation time was determined from the point of skin incision to skin closure.

Results

Table 1: Comparison of baseline characters of two groups.

Variables	Lichtenstein (n= 75)	Desarda (n=75)	P-Value
Age (Mean±SD)	44.35±25.65	42.86±36.38	0.355
Gender	87 M	82 M/1F	NA
Comorbid conditions			
Hypertension	20(39.08%)	28(32.94%)	0.546
Diabetes	22(27.58%)	20(23.52%)	0.638
Smoking	25(33.33%)	31(36.47%)	0.795
Ghutka	26(34.48%)	27(31.76%)	0.736
Alcohol	27(34.48%)	34(40.00%)	0.465
Chronic cough	22(27.58%)	23(27.05%)	1
Asthma	1(2.29%)	6(7.05%)	0.155
Stricture/BHP	7(10.34%)	5(5.88%)	0.498

Mean age of lichtenstein and desarda group was 43.32±14.06 and 41.75±18.02 respectively comorbidity condition in lichtenstein and desarda are noted

Table 2: Age distribution of patients.

Age in years	Lichtenstein number of patients (%)	Desarda number of patients (%)	P Value
18-30	13 [14.94%]	18 [21.66%]	0.083
>30-40	15 [17.24%]	12 [14.45%]	0.624
>40-50	18 [20.68%]	10 [12.04%]	0.447
>50-60	26 [29.88%]	14 [16.86%]	0.918
>60-70	14 [16.09%]	22 [26.50%]	0.176
>70	1 [1.14%]	7 [8.43%]	NA
Total	87 [100%]	83 [100%]	0.304

Mean age: 48.52 years. Standard deviation: 16.14

The baseline characteristics like demographic profile, comorbid conditions on comparison were similar in both the groups

Table 3: Comparison of clinical characters.

Variables	Lichtenstein (n ¼ 75)	Desarda (n ¼ 75)	P Value
Duration of hernia (In months) (Mean±SD)	11.65±16.65	14.20±29.28	0.462
Side of hernia (Right/Left)	63/32	61/31	1
Type of hernia (Direct/Indirect)	36/59	32/60	0.762

Clinical characters and hernia features were compared with no statistical differences

Table 4: Showing intraoperative and post-operative variables.

Variables	Lichtenstein (n = 75)	Desarda (n = 75)	P Value
Operative time (In minutes)	73.89±12.63	72.60±13.89	0.508
Postoperative pain scores (Sheffield's pain scale)			
POD 1	3.25±0.54	1.65±0.41	0.0001
POD 3	2.25±0.65	2.65±0.55	0.0065
POD 7	0.32±0.65	0.53±0.53	0.007
POD 30	0.08±0.65	0.05±0.45	0.65
POD 90	0.03±0.35	0.00±0.00	0.54
Return to basic activity (Days)	4.25±2.15	2.48±0.51	0.002
Return to home activity (Days)	7.35±3.25	5.65±1.65	0.054
Follow up period (2-25 month)	15.65±4.25	15.45±4.54	0.064

A statistically significant difference in the reported pain levels was observed until the seventh day following the surgical procedure. In contrast to the Lichtenstein method, patients who underwent surgery utilizing the technique reported significantly reduced levels of pain during postoperative day 7. Based on statistical calculations, it was determined that the mean duration required to resume regular daily activities and home tasks had statistical significance, as shown by P values below 0.05. After the initial seven-day period subsequent to the surgical procedure, it becomes

apparent that the pain scores within the cohort exhibit a notable decrease. Nevertheless, with an increase in length, the pain scores exhibit a high degree of similarity, and by the end of the one-month postoperative period, there is no significant disparity in pain levels between the two groups. Lichtenstein and have similar rates of problems, as determined through a comparison and review of post-operative complications. All p-values exceed the threshold of 0.05, indicating a lack of statistical significance.

Table 5: Showing comparison of complication rates between the 2 groups.

Variables	Lichtenstein (n = 75)	Desarda (n = 75)	P Value
Early complications (<30 days)			
Fever	7(6.89%)	6(6.02%)	1
Cord oedema	9(9.91%)	6(6.02%)	0.54
Groin discomfort	5(4.59%)	4(3.61%)	1
Seroma	3(2.29%)	3(2.40%)	0.785
Surgical site infection	2(1.14%)	2(1.20%)	1
Late complications (>30 days)			
Chronic pain	3(1.14%)	0	1
Neuralgia	0	0	1
Foreign body sensations	0	0	1
No complications	67(74.71%)	80(82.60%)	0.159
Recurrence	2(1.14%)	2(1.08%)	2

There were no noticeable differences observed in terms of postoperative fever, cord edema, groyne pain, seroma, surgical site infection, chronic pain, neuralgia, and symptoms of a foreign body.

A single recurrence occurred in both the Lichtenstein arm and the other arm throughout the one-year follow-up period. In both the Lichtenstein group and the deep ring group, the

recurrence was observed in close proximity to the pubic tubercle.

Discussions

The treatment for repairing inguinal hernias is the most commonly performed surgical operation in general. To minimize the likelihood of recurrence, it is imperative to

provide a tension-free closure of the hernia defect during the surgical management of inguinal hernias. The standard of care for inguinal hernia was Bassini's repair and its modifications prior to the invention of Lichtenstein tension-free repair. Subsequently, the available choices for tissue-based repairs, such as Shouldice and Bassini's patches, were limited. The noteworthy multi-center controlled experiment found recurrence rates of 8.6% and 11% after Bassini and McVay repairs, respectively.

The fundamental principle of the Lichtenstein mesh repair technique is the utilization of prosthetic material to stimulate fibrosis, thereby strengthening the posterior wall of the inguinal canal. Most of the requirements for the most effective hernia surgery are satisfied, however, the issues connected to the mesh are outlined [12, 13]. Currently, there exist a variety of contemporary prosthetic materials, commonly referred to as biomaterials. However, the efficacy of these materials in the treatment of inguinal hernias remains uncertain. Consequently, scholars are currently seeking an optimal surgical approach for inguinal hernias that possesses cost-effectiveness, minimal rates of complications and recurrence, feasibility for consultants and trainee surgeons at smaller and district hospitals, ease of acquisition, and expeditious resumption of regular activities. The Desarda technique [13, 14] satisfies most of the criteria for an exceptional technique.

Desarda employs external oblique aponeurosis to strengthen the posterior wall of the inguinal canal. The author claims that his outcomes, which have a complication rate of 1.8% and a recurrence rate of 0.2%, are comparable to or superior than those of Shouldice and Lichtenstein repairs. Only three randomized control trials have evaluated this strategy. The Desarda technique was compared to the standard Lichtenstein procedure for clinical outcomes, postoperative pain, comorbidities, and early recurrence in the treatment of primary inguinal hernias [14, 15].

One patient in the Lichtenstein group and one patient in the Desarda group in this study developed recurrence within one year after surgical repair ($P = 1$). In the Lichtenstein group, the recurrence was observed in proximity to the pubic tubercle, while in the Desarda group, it was found in the deep ring. In a clinical experiment conducted at a small district hospital in India, Desarda saw no instances of recurrence in his surgery, while the mesh group experienced a recurrence rate of 1.9%. This comparison was made between Desarda's approach and the Lichtenstein repair. Szopinski *et al.* reported a recurrence rate of 1.9% in Lichtenstein and 1.94% in the Desarda group. Similar P values were obtained in studies conducted by Youssef *et al.*, Z Abbas *et al.*, Rodriguez *et al.*, and Mitura *et al.* [16].

During the initial seven days after the surgery, the Desarda group experienced significantly less postoperative discomfort compared to the Lichtenstein group ($P=0.09$). Youssef *et al.*, Z Abbas *et al.*, and Mitura *et al.* did not make this finding in any prior research. There are several factors that may contribute to this condition, including intraoperative tissue handling, nerve traction, and manipulation [16, 17].

There is a potential correlation between the Desarda approach and earlier ambulation and resumption of fundamental daily activities in patients, as indicated by statistically significant differences ($P=0.001$ and $P=0.013$, respectively). The Desarda technique may lead to a quicker return to normal activities at home due to reduced tissue manipulation, fewer dissections, and postoperative pain.

Youssef *et al.*, Z Abbas *et al.*, Mitura *et al.*, and Desarda *et al.* [17] also reported comparable results.

The duration of the surgery is a variable that depends on the surgeon and indicates the level of simplicity of the procedure. In contrast to previous studies that solely considered the duration of repair, the current inquiry incorporates the calculation of the operating time, encompassing the period from the skin incision to the skin closure. Lichtenstein had an average operating time of $73 + 13.63$ minutes, whereas Desarda repair had an average operating time of $72 + 13.89$ minutes. The value is 0.5. [17, 18]. The statistics indicated that it was not statistically significant. The identical duration of operation is attributed to the fact that in a Desarda repair, the process of cutting and attaching the external oblique aponeurosis requires approximately equal time. In contrast to the results obtained in our study, Youssef *et al.* and Rodriguez *et al.* have documented notable variations in the duration of surgical procedures [18, 19].

In the current experiment, the Lichtenstein group had a 1.05% occurrence of chronic pain, whereas the Desarda group had a 1.08% occurrence. However, there was no statistically significant difference between the two groups ($P=1$). Based on existing literature, the occurrence of chronic pain in Lichtenstein varies between 1.1 and 6.49%, while in the Desarda group, it ranges from 0.8 to 4.8%.

There is a lack of statistical significance observed in the disparity of post-operative complications between the two experimental arms. Szopinski *et al.* reported a significant prevalence of seroma in the Lichtenstein group. The Mesh group exhibited a threefold rise in complications, as shown by Desarda *et al.* The most prevalent outcome observed in our investigation was cord edema.

Hernias are attributed to connective tissue abnormalities and abnormal collagen metabolism, as stated by several surgeons. The Desarda approach is greeted with opposition from these surgeons. Despite being a treatment that primarily focuses on tissue repair, the shouldice approach remains a viable method. In our perspective, it is important to consider Desarda, a hernia repair approach that focuses solely on tissue, while formulating standard treatment guidelines for inguinal hernias. The mesh material serves as a viable alternative to the EOA strip. The strip serves as a physiological, natural, and readily available prosthesis designed to enhance the posterior wall of the inguinal canal. It is imperative to accurately determine the patients who can derive advantages from pure tissue-based repairs [19]. The Desarda treatment is commonly employed in instances involving pediatric patients, inguinal hernias with strangulation, financial constraints, and when the patient expresses opposition to mesh utilization. Recurrence can occur when previously damaged tissue is used for the purpose of healing. Due to the limited duration of the data evaluation, with a mean follow-up length of just 15 months, the findings are only applicable to short-term outcomes [19, 20].

The present investigation is a longitudinal study wherein patients were systematically randomized to two groups, as opposed to being randomly assigned. Nevertheless, due to the absence of a randomized control trial design, it is evident that an allocation bias exists. Nevertheless, to compensate for the absence of randomization, the two groups were compared based on their baseline characteristics. This comparison was not intended to eliminate bias, but rather to illustrate the similarity between the two groups even in the absence of

randomization. The findings obtained from the comparison show similarities between the two groups, which may be associated with surgical intervention^[20]. The exclusion criteria encompassed patients who were 18 years of age and presented with challenging inguinal hernias. During surgical procedures, it was observed that patients presenting with inguinal hernias, blockages, strangulations, and gangrene exhibited thin, fragile, or divided external oblique aponeurosis. The patients with complex medical conditions were completely excluded from the Lichtenstein (L group) intervention, along with other similar exclusions.

Conclusion

The study's findings indicate that the outcomes of inguinal hernia therapy, as implemented by the approach employed, are similar to those observed in traditional Lichtenstein procedures over a mean follow-up period of 15 months. Due to the absence of a mesh in this method, it is easy to acquire and costs-effective for repairs. Compared to the traditional Lichtenstein mesh repair, patients experience a quicker recovery and are able to ambulate more promptly. Reduced the occurrence of postoperative pain and illness is in line with the typical course of surgery. Nevertheless, the Lichtenstein technique stands out in addressing the main drawback of the approach, which is the presence of weak external oblique aponeurosis or EOA with split fibers. In order to further evaluate this repair, it is imperative to conduct large-scale, long-term multicentric randomized control trials. The aforementioned procedure possesses the capacity to augment the existing repertoire of tissue-based methodologies for the treatment of groyne hernias.

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References

1. Simons MP, Aufenacker T, Bay-Nielsen M, *et al.* European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia*. 2009;13(4):343-403.
2. D'amore L, Gossetti F, Vermeil V, Negro P. Long-term discomfort after plug and patch hernioplasty. *Hernia*. 2008;12(4):445-446.
3. Condon RE. Groin pain after hernia repair. *Ann Surg*. 2001;233(1):8.
4. Agrawal A, Avill R. Mesh migration following repair of inguinal hernia: A case report and review of literature. *Hernia*. 2006;10(1):79-82.
5. Szopinski J, Dabrowiecki S, Pierscinski S, *et al.* Desarda versus Lichtenstein technique for primary inguinal hernia treatment: 3-year results of a randomized clinical trial. *World J Surg*. 2012;36(5):984-992.
6. Desarda MP. No-mesh inguinal hernia repair with continuous absorbable sutures: A dream or reality? (A study of 229 patients). *Saudi J Gastroenterol*. 2008;14(3):122.
7. Desarda MP, Ghosh A. Comparative study of open mesh repair and Desarda's no-mesh repair in a District Hospital in India. *East Cent Afr J Surg*. 2006;11(2):28-34.
8. Rodríguez P, Herrera PP, Gonzalez OL, *et al.* A randomized trial comparing Lichtenstein repair and no mesh desarda repair for inguinal hernia: a study of 1382 patients. *East Cent Afr J Surg*. 2013;18(2):18-25.
9. Simons MP, Kifignen J, Van Geldere D, Hoitsma HFW, Obertop H. Role of the Shouldice technique in inguinal hernia repair: A systematic review of controlled trials and meta-analysis. *Br J Surg*. 1996;83:734-8.
10. McGillicuddy JE. Prospective randomized comparison of the Shouldice and Lichtenstein hernia repair procedures. *Arch Surg*. 1998;133:974-8.
11. EU Hernia Trialist Collaboration. Mesh compared with non-mesh methods of open groin hernia repair: systematic review of randomized controlled trials. *Br J Surg*. 2000;87:854-9.
12. Kingsnorth AN, Porter Chs, Bennett DH, *et al.* Lichtenstein patch or prefix plug and patch in inguinal hernia: A prospective double-blind randomized controlled trial of short-term outcome. *Surgery*. 2000;127:276-83.
13. Gilbert AI, Felton IL. Infection on inguinal hernia repair considering biomaterials and antibiotics. *Surg Gynecol*. 1993;117:126-30.
14. Szopinski J, Dabrowiecki S, Pierscinski S, *et al.* Desarda Versus Lichtenstein Technique for Primary Inguinal Hernia Treatment: 3-Year Results of a Randomized Clinical Trial. *World J Surg*. 2012 May;36(5):984-92. Doi:10.1007/s00268-012-1508-1.
15. Situma SM, Kaggwa S, Masiira NM, Mutumba SK. Comparison of Desarda versus Modified Bassini inguinal hernia Repair: A Randomized Controlled Trial. *East Cent Afr J Surg*. 2009;14(2):70-76.
16. Manyilrah W, Kijjambu S, Upoki A, Kiryabwire J. Comparison of non-mesh (Desarda) and mesh (Lichtenstein) methods for inguinal hernia repair among black African patients: A short-term double-blind RCT. *Hernia*. 2012 Apr;16(2):133-44. Doi:10.1007/s10029-011-0883-0.
17. Rutkow MI. Epidemiologic, economic and sociologic aspects of hernia surgery in the United States in the 1900s. *Surg North Am*. 1998;78:941-51.
18. Desarda MP. Inguinal herniorrhaphy with an undetached strip of external oblique aponeurosis: A new approach used in 400 patients. *Eur J Surg*. 2001;167:01-06.
19. Porrero JL, *et al.* Reparación de la hernia inguinal primaria: Lichtenstein frente a Shouldice. Estudio prospectivo y aleatorizado sobre el dolor y los costos hospitalarios. *Cir Esp*. 2005;77(2):5-8.
20. Aragon FJ. Nuevas técnicas protésicas para el tratamiento de la hernia inguinal. Ediciones Avila; c2001. p. 22-23.