

# Lichtenstein's Open Mesh Hernioplasty versus Desarda's no Mesh Hernia Repair in Inguinal Hernia: A Prospective Interventional Study

MANASA DAS<sup>1</sup>, SUSHANTA KUMAR DAS<sup>2</sup>, SUNIL KUMAR PATNAIK<sup>3</sup>, SHREYA JAIN<sup>4</sup>,  
V KARTHIKARAJAM<sup>5</sup>, CHIRUMAMILLA NAGA HARSHA VARDHAN<sup>6</sup>



## ABSTRACT

**Introduction:** Inguinal hernia repair with mesh is a common surgical procedure in the abdomen, involving the implantation of a mesh at the weak point of the abdominal wall. However, due to postoperative complications and a slower recovery rate, alternative methods, like Desarda's tissue repair method, have been introduced.

**Aim:** To compare the short-term outcomes of Desarda's no-mesh technique and Lichtenstein's mesh repair in inguinal hernia patients, focusing on postoperative pain, incidence of complications and recurrence.

**Materials and Methods:** A prospective interventional study was conducted in the Department of General Surgery at the Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India, from June 2022 to May 2024. The authors enrolled 108 patients with primary uncomplicated inguinal hernias aged over 18 years, of which 54 patients underwent Desarda's repair (Group 1) and

54 patients underwent Lichtenstein's mesh hernioplasty (Group 2). Clinico-demographic features, Visual Analogue Scale (VAS) scores for postoperative pain and postoperative complications were compared between both groups. Statistical significance was assessed using the Chi-square test or Student's t-test.

**Results:** Each group comprised 54 patients, with mean ages of 47.5±16.3 years for Group 1 and 44.2±14.9 years for Group 2. A significant difference ( $p=0.006$ ) in the incidence of seroma was observed between the two groups. When comparing both groups, Group 1 patients reported significantly less pain on Postoperative Day (POD) 1 ( $p=0.03$ ). The recovery rate was faster in the Desarda group (7.61±1.21 days) compared to the Lichtenstein group (8.28±1.29 days).

**Conclusion:** The Desarda technique was found to be a more effective method, offering a shorter duration of surgery and faster recovery. Thus, Desarda's procedure should be considered as an alternative to mesh-based treatments.

**Keywords:** Chronic inguinal pain, Haematoma, Hernia surgery outcomes, Mesh-free inguinal hernia repair, Seroma, Tissue-based hernia repair, Visual analogue scale score

## INTRODUCTION

Inguinal hernias are more prevalent in men (27%) than in women (3%) [1]. Inguinal hernia repair is a common surgical procedure involving an incision approximately 6-8 cm long, where a mesh is placed at the weak spot [2,3]. The primary objectives of any surgeon performing hernia surgery are to reduce complications, disability and to attain permanent functional restoration [4]. Although various hernia repair methods are available, the "best repair method" remains an area of exploration. Lichtenstein's hernioplasty is one of the most commonly used techniques to date. It was the first tensionless mesh-based procedure recommended for inguinal hernia repair and is considered the "Gold Standard" for managing symptomatic primary inguinal hernias [5,6]. Nevertheless, the use of mesh does not guarantee a successful outcome for all patients [7,8]. Major complications associated with mesh repair include foreign body sensation, chronic pain, stiffness of the abdominal wall, adhesion, mesh movement, mesh folding, damage to intra-peritoneal tissue, ejaculatory problems, potential for malignant transformation, surgical site infection, chronic scarring leading to occlusion of the vas deferens and autoimmunity due to the synthetic mesh [9,10].

Desarda's approach is a unique type of hernia repair that creates a dynamic, resilient, mobile and physiologically active posterior inguinal wall [11]. This tissue-based hernia repair involves using an unattached strip from the External Oblique Aponeurosis (EOA) to repair the posterior wall of the inguinal canal [8,12]. There is no use

of mesh or laparoscopy and the inguinal hernia is repaired using entirely absorbable sutures to avoid foreign body sensation, ensuring the procedure is tension-free. This technique has been associated with a reduction in postoperative complications and an earlier return to daily activities. It is a simple, cost-effective, physiological repair that is easy to learn and can be performed under local anaesthesia, leading to faster recovery rates. Therefore, this technique can be an ideal substitute for mesh repair [13-15].

Thus, the present study aimed to compare the short-term outcomes of Desarda's no-mesh technique and Lichtenstein's mesh hernia repair in terms of postoperative pain and seroma incidence, as well as complications like foreign body sensation, chronic inguinal pain, haematoma, orchitis and recurrence between the two techniques.

## MATERIALS AND METHODS

A prospective interventional study was conducted in the Department of General Surgery at the Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India, from June 2022 to May 2024. Ethical approval (Ref. No.: KIIT/KIMS/IEC/1010/2022) was obtained. A total of 108 patients were recruited.

**Sample size calculation:** The sample size was calculated using the following formula:  $\{Z^2 \times P \times (1-P)\} / d^2$ , where  $Z=1.96$  (Standard Deviation at 95% confidence interval);  $P$ =population; and  $d=0.05$  (Expected margin of error) [13,16].

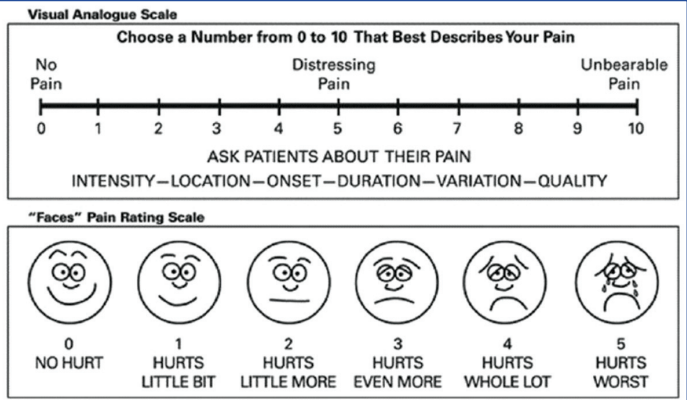
**Inclusion and Exclusion criteria:** Patients aged 18 years or older, those undergoing elective primary inguinal hernia repair (both direct

and indirect types) and those with unilateral or bilateral hernias were included. Patients with recurrent hernias, incarcerated hernias, strangulated hernias, infections at the groin site or any infective focus elsewhere in the body, patients with bleeding diathesis and those who were immunocompromised were excluded.

Study Procedure

Data were collected using random sampling methods. Selection bias was eliminated by enrolling all patients who met the inclusion or exclusion criteria. Patients were grouped into two groups, with 54 patients in each group. Group 1 consisted of patients who underwent Desarda's repair, while Group 2 included those who underwent Lichtenstein's mesh hernioplasty. Patients were alternately assigned to each group (for example, the first patient to Group 1, the second to Group 2 and so on).

Clinico-demographic features such as age, symptoms and their duration, medical history, complete physical examination, laboratory investigations, radiological investigations and hospital stay were recorded. Intraoperative findings were also noted. Patients were monitored preoperatively, intraoperatively and postoperatively. Postoperative pain was assessed using the Visual Analogue Scale (VAS) [2] on Postoperative Days (POD) 1, 3 and 7 and patients were followed up for six months [Table/Fig-1]. Seroma formation and complications such as foreign body sensation, chronic inguinal pain, haematoma, orchitis and recurrence were noted.



[Table/Fig-1]: Visual Analogue Scale (VAS) used for scoring postoperative pain in patients [2].

STATISTICAL ANALYSIS

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 24.0. Continuous data, such as age and VAS scores, were expressed as mean±Standard Deviation (SD) and were compared using Student's t-test. Categorical data, including gender, success rates and the incidence of complications, were reported as percentages and frequencies and comparisons were made using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The mean age of both groups was 47.5±16.3 years and 44.2±14.9 years, respectively. In terms of gender distribution, 90% patients were male in both groups [Table/Fig-2].

Parameters	Group 1 (n=54) (Desarda's)	Group 2 (n=54) (Lichtenstein's)	Chi-square (Significance level or p-value)
Demographic features			
Age group (years)			
Age (Mean±SD)	47.5±16.3	44.2±14.9	0.274 (t-statistics)*
Age group (18-30 years)	9 (16.67)	11 (20.37)	0.622
(31-50 years)	24 (44.44)	27 (50.00)	0.564

(51-70 years)	15 (27.78)	12 (22.22)	0.506
(>70 years)	6 (11.11)	4 (7.41)	0.509
Gender			
Male	52 (96.30)	51 (94.44)	0.647
Female	2 (3.70)	3 (5.56)	0.54
Clinical features			
Categorisation according to BMI (kg/m²)			
Normal (20-25)	21 (38.89)	25 (46.30)	0.72
Overweight (26-30)	29 (53.70)	26 (48.15)	0.566
Obese (>30)	4 (7.41)	3 (5.56)	0.697
Side of hernia			
Right	31 (57.41)	36 (66.67)	0.428
Left	23 (42.59)	18 (33.33)	0.323
Type of hernia			
Direct	30 (55.56)	28 (51.85)	0.700
Indirect	24 (44.44)	26 (48.15)	0.847
Size of hernia defect (cm)			
<1.5	19 (35.18)	26 (48.15)	0.173
1.5-3.0	25 (46.30)	19 (35.18)	0.242
>3.0	10 (18.52)	9 (16.67)	0.801
Duration of hernia occurrence (Months)	29.79±2.77	30.06±4.98	0.73 (t-statistics)*

[Table/Fig-2]: Clinico-demographic features of inguinal hernia among the two groups. A t-test was used. For the rest, the Chi-square test was used

According to the VAS pain scale, when comparing both groups at POD 1, the pain score was significantly lower in Group 1 compared to Group 2 (p-value: 0.03). At POD 30, the incidence of seroma was zero in Group 1, while it was detected in 12.96% of patients in Group 2, which was significantly higher [Table/Fig-3].

Parameters	Group 1 (n=54) (Desarda)	Group 2 (n=54) (Lichtenstein's)	t-statistics (Significance level or p-value)
Pain Severity (VAS Score) Mean±SD			
POD 1	2.51±0.42	2.68±0.39	0.03
POD 3	1.96±0.30	2.04±0.33	0.19
POD 7	1.49±0.41	1.61±0.42	0.14
Incidence of Seroma: n (%)			
POD 7	2 (3.70%)	4 (7.41%)	0.402 (Chi-square)
POD 30	0 (0.00%)	7 (12.96%)	0.006 (Chi-square)

[Table/Fig-3]: Incidence of postoperative pain and seroma between the two groups. POD: Postoperative day, VAS: Visual analogue scale

When comparing both groups, the duration of surgery was longer in Group 2 (62.43 minutes) compared to Group 1 (56.79 minutes) (p-value=0.02). In the Desarda group, the recovery rate in days was significantly faster (7.61 days) than in the Lichtenstein group (8.28 days) [Table/Fig-4].

Parameters	Group 1 (n=54) (Desarda)	Group 2 (n=54) (Lichtenstein's)	Chi-square (significance level p-value)
Incidence of haematoma: n (%)			
POD 7	2 (3.70%)	3 (5.56%)	0.647
Incidence of chronic pain: n (%)			
POD 30	1 (1.85%)	3 (5.56%)	0.309
Incidence of foreign body sensation: n (%)			
POD 30	0	3 (5.56%)	0.080
Incidence of orchitis: n (%)			
POD 30	1 (1.85%)	2 (3.70%)	0.560
Incidence of recurrence: n (%)			
6-Month follow-up	0	1 (1.85%)	0.317

Duration of surgery (Minutes)	56.79±10.50	62.43±8.33	0.02 (t-statistics)
Return to basic activity (Days)	7.61±1.21	8.28±1.29	0.03 (t-statistics)

**[Table/Fig-4]:** Incidence of other postoperative complications between the two groups.

POD: Postoperative day

## DISCUSSION

In terms of age distribution, patients from different age groups participated in the study, revealing that the maximum number of patients were aged between 31 and 50 years. Jain SK et al., compared the Desarda repair method with Lichtenstein's repair method, highlighting a predominance of patients in the middle age group (41-60 years) [15].

The Desarda group exhibited a considerably lower incidence of seroma in terms of intra- and postoperative sequelae (p-value: 0.01). In the mesh group, Paliwal DSS et al., found a high rate of seroma development [17]. The recurrence rates following "Desarda repair" (0%) were lower than those following "Lichtenstein's repair" (1.85%). The only recurrence occurred following surgery for a sliding hernia. There were no early recurrences (within the first few months) for either approach. Comparable recurrence rates have been documented in the literature [17,18]. Desarda compared his method with Lichtenstein's repair in a clinical trial conducted at a single district hospital in India, where he found that his technique did not result in any recurrences, while the mesh group experienced four recurrences [19]. Regarding the recurrence site, the traditional site of recurrence for the mesh group was located close to the pubic tubercle.

The incidence of postoperative complications was highest in Group 2, but statistically, it was not found to be significant between both groups. Desarda found that the mesh group experienced three times more complications compared to those using his procedure and this was statistically significant [19]. The Desarda group also had a lower grade of complications, like haematoma, foreign body sensation and orchitis. In comparison to Lichtenstein's method, Desarda discovered that nerve entrapment and chronic groin pain were caused by extensive fibrosis resulting from mesh implantation; these symptoms were significantly greater in the mesh group [19].

The impact of different surgical approaches on persistent groin pain following hernia surgery remains unclear. Although the exact origin of this discomfort is still unknown, several risk factors have been identified, including recurrence, the age of the patient, cremasteric muscle dissection, surgical experience and the presence of preoperative pain [20-22]. While the "International Association for the Study of Pain" defines chronic pain as lasting more than three months, we extended the duration of follow-up to six months to account for the time required for fibrosis caused by the mesh, a strategy that has also been suggested in recent publications [23,24].

On the 1<sup>st</sup> POD, patients in the Desarda group had a significantly lower VAS score (p-value: 0.03). The Desarda approach does not place stress on the tissues involved in the repair, as demonstrated by the considerable difference in initial postoperative pain scores between the two study groups [22]. In the current study, pain levels peaked 24 hours after surgery and significantly decreased on the third and seventh PODs. This contrasts with the findings of Ge H et al., and Situma SM et al., who noted that pain levels peaked on the third POD and attributed this to factors like peak of the inflammatory response at that time, tissue handling, the level of traction, prior ilioinguinal nerve stretching caused by the hernia, or intraoperative nerve manipulation [25,26].

In the present study, the duration of surgery was shorter in the Desarda group and this difference was found to be statistically significant (p-value=0.02). Ge H et al., also reported similar findings [25]. It should be noted that, in contrast to previous research that simply calculated the time required for repairs, the duration of

operation in the present study was determined from the point of skin incision to the point of skin closure. Factors such as the need for greater traction in certain cases-particularly at the lateral end of the repair-the time required to fashion and position the mesh around the cord and the potential for personal bias cannot be completely ruled out and they could all contribute to the shorter duration of operation in the Desarda group compared to the mesh group.

There was a significantly quicker return to basic activities in the Desarda group. The present results contradict those of two earlier investigations, which found no differences between the two groups in terms of basic activity, home activities, or the time taken to recover to normal gait [17,19]. These variations might result from the fact that the definition of the time to return to basic activity was not uniform across studies, influenced by factors like patient age and other co-morbidities.

The duration of surgery is shorter in the Desarda group; thus, Lichtenstein repair is associated with a lengthy learning curve and is regarded as the most complex tissue-based restoration [27-29]. The authors believe that pure tissue healing, such as that achieved with Desarda's approach, remains relevant in the current era of lightweight polypropylene meshes, composite meshes and various biologic prostheses under evaluation. Since mesh is not required, the Desarda approach is evidently more cost-effective and mesh prosthetics have their disadvantages. While mesh creates a mechanical barrier, it does not provide a posterior inguinal wall that is physiologically active, dynamic and movable.

The original technique's author hypothesised that because tendons and aponeurosis age more slowly than other tissues, using an External Oblique Aponeurosis (EOA) strip (which is tendo-aponeurotic in nature) is a superior option compared to using mesh or Shouldice repair [30,31]. This movable, non detachable aponeurotic strip naturally reinforces the posterior wall that covers the inguinal canal. In other words, employing a naturally displaced and movable aponeurotic strip to create a posterior inguinal wall that is significantly more physiological is preferable to using scar tissue formed around a synthetic prosthesis [27,28].

## Limitation(s)

Limitations were observed in subjects with weak EOA due to the smaller population in these groups. The determination of whether an EOA is suitable for repair is somewhat arbitrary and the present findings would be affected if subjects with weak EOA had not been included.

## CONCLUSION(S)

Desarda's technique was found to be more effective, with less complexity in postoperative pain compared to Lichtenstein's technique. The duration of surgery was also shorter in the Desarda group, allowing for an early return to basic activities. The process of Desarda repair is easy to perform and involves no complex tissue dissection or repair. To prevent mesh-related issues, Desarda's procedure should be considered as an alternative to mesh-based treatments. This method may prove beneficial when mesh placement poses a risk in an infected field. Further assessment is needed to determine whether Desarda repair is appropriate for individuals whose EOA is thin, weak, or divided after surgery.

## REFERENCES

- [1] Öberg S, Andresen K, Rosenberg J. Etiology of inguinal hernias: A comprehensive review. *Front Surg.* 2017;4:52. Doi: 10.3389/fsurg.2017.00052.
- [2] Gedam BS, Bansod PY, Kale VB, Shah Y, Akhtar M. A comparative study of Desarda's technique with Lichtenstein mesh repair in treatment of inguinal hernia: A prospective cohort study. *Int J Surg.* 2017;39:150-55.
- [3] Neogi P, Gupta V, Tripathi N. A comparative study of outcomes of Lichtenstein repair and Desarda tissue repair in patients of inguinal hernia. *Int Surg J.* 2017;4(8):2693-99.
- [4] Rodríguez Pr, Herrera PP, Gonzalez OL, Alonso JRC, Blanco HSR. 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.

- [5] Kamat TA, Shinde JV. Comparative study between no mesh inguinal hernia repair (Desarda Technique) and mesh hernioplasty and its outcome. *SJMPS*. 2020;06(01):42-49.
- [6] Mitura K, Romańczuk M. Comparison between two methods of inguinal hernia surgery--Lichtenstein and Desarda. *Pol Merkur Lekarski*. 2008;24(143):392-95.
- [7] Simons MP, Aufenacker T, Bay-Nielsen M, Bouillot JL, Campanelli G, Conze J, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia*. 2009;13(4):343-403.
- [8] Sowmya GR, Udapudi DG. Comparative study of Lichtenstein versus Desarda repair for inguinal hernia. *J Evol Med Dent Sci*. 2015;4:16261-65.
- [9] Zulu HG, Mewa Kinoo S, Singh B. Comparison of Lichtenstein inguinal hernia repair with the tension-free Desarda technique: A clinical audit and review of the literature. *Trop Doct*. 2016;46(3):125-29.
- [10] Falagas ME, Kasiakou SK. Mesh-related infections after hernia repair surgery. *Clin Microbiol Infect*. 2005;11:03-08.
- [11] Cocuzza M, Alvarenga C, Pagani R. The epidemiology and etiology of azoospermia. *Clinics*. 2013;68:15-26.
- [12] Desarda MP. New method of inguinal hernia repair: A new solution. *ANZ J Surg*. 2001;71:241-44.
- [13] Manyilira W, Kijambu S, Upoki A, Kiyabwire 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;16(2):133-44.
- [14] Szopinski J, Dabrowiecki S, Pierscinski S, Jackowski M, Jaworski M, Szuflet Z. Desarda versus Lichtenstein technique for primary inguinal hernia treatment: 3-year results of a randomized clinical trial. *World J Surg*. 2012;36(5):984-92.
- [15] Jain SK, Bhatia S, Hameed T, Khan R, Dua A. A randomised controlled trial of Lichtenstein repair with Desarda repair in the management of inguinal hernias. *Ann Med Surg (Lond)*. 2021;67:102486. Doi: 10.1016/j.amsu.2021.102486.
- [16] Philipp M, Leuchter M, Lorenz R, Grambow E, Schafmayer C, Wiessner R. Quality of life after desarda technique for inguinal hernia repair-a comparative retrospective multicenter study of 120 patients. *J Clin Med*. 2023;12(3):1001. Doi: 10.3390/jcm12031001.
- [17] Paliwal DSS, Katkar DA, Nangare DN. A study to assess Desarda vs Lichtenstein technique for the treatment of primary inguinal hernia. *J Pharm Negat Results [Internet]*. 2022;438-40. Available from: <http://dx.doi.org/10.47750/pnr.2022.13.s05.68>.
- [18] Youssef T, El-Alfy K, Farid M. Randomized clinical trial of Desarda versus Lichtenstein repair for treatment of primary inguinal hernia. *Int J Surg*. 2015;20:28-34.
- [19] 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.
- [20] Alfieri S, Amid PK, Campanelli G, Izard G, Kehlet H, Wijsmuller AR, et al. International guidelines for prevention and management of postoperative chronic pain following inguinal hernia surgery. *Hernia*. 2011;15:239-49.
- [21] Amid PK. A 1-stage surgical treatment for postherniorrhaphy neuropathic pain: Triple neurectomy and proximal end implantation without mobilization of the cord. *Arch Surg*. 2002;137(1):100-04.
- [22] Bay-Nielsen M, Perkins FM, Kehlet H. Pain and functional impairment 1 year after inguinal herniorrhaphy: A nationwide questionnaire study. *Ann Surg*. 2001;233(1):01-07.
- [23] Merskey HE. Classification of chronic pain: Descriptions of chronic pain syndromes and definitions of pain terms. Prepared by the International Association for the Study of Pain, Subcommittee on Taxonomy. *Pain Suppl*. 1986;3:S1-226. PMID: 3461421.
- [24] Callesen T, Bech K, Kehlet H. Prospective study of chronic pain after groin hernia repair. *Br J Surg*. 1999;86(12):1528-31.
- [25] Ge H, Liang C, Xu Y, Ren S, Wu J. Desarda versus Lichtenstein technique for the treatment of primary inguinal hernia: A systematic review. *Int J Surg*. 2018;50:22-27. Doi: 10.1016/j.ijsu.2017.11.055. Epub 2017 Dec 23. PMID: 29277678.
- [26] 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.
- [27] Klinge U, Zheng H, Si ZY, Schumpelick V, Bhardwaj R, Klosterhalfen B. Synthesis of type I and III collagen, expression of fibronectin and matrix metalloproteinases-1 and-13 in hernial sac of patients with inguinal hernia. *Int J Surg Investig*. 1999;1(3):219-27.
- [28] Zheng H, Si Z, Kasperk R, Bhardwaj RS, Schumpelick V, Klinge U, et al. Recurrent inguinal hernia: Disease of the collagen matrix? *World J Surg*. 2002;26(4):401-08.
- [29] Junge K, Rosch R, Klinge U, Schwab R, Peiper C, Binnebösel M, et al. Risk factors related to recurrence in inguinal hernia repair: A retrospective analysis. *Hernia*. 2006;10:309-15.
- [30] Desarda MP. Surgical physiology of inguinal hernia repair-a study of 200 cases. *BMC Surg*. 2003;3:01-07.
- [31] Desarda MP. Physiological repair of inguinal hernia: A new technique (study of 860 patients). *Hernia*. 2006;10(2):143-46.

#### PARTICULARS OF CONTRIBUTORS:

1. Final Year Postgraduate Trainee, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.
2. Professor, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.
3. Professor, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.
4. Final Year Postgraduate Trainee, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.
5. Final Year Postgraduate Trainee, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.
6. Second Year Postgraduate Trainee, Department of General Surgery, Kalinga Institute of Medical Sciences, Bhubaneswar, Odisha, India.

#### NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sushanta Kumar Das,  
Professor, Department of General Surgery, Kalinga Institute of Medical Sciences,  
Bhubaneswar-751024, Odisha, India.  
E-mail: kims.surgerydrc@gmail.com

#### AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

#### PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Nov 14, 2024
- Manual Googling: Mar 08, 2025
- iThenticate Software: Mar 11, 2025 (14%)

#### ETYMOLOGY: Author Origin

EMENDATIONS: 6

Date of Submission: Nov 12, 2024

Date of Peer Review: Jan 16, 2025

Date of Acceptance: Mar 13, 2025

Date of Publishing: Jun 01, 2025