**E-ISSN: 3123-8696**
**P-ISSN: 3124-484X**

**DIAN MEDICAL JOURNAL**
**FAKULTAS KEDOKTERAN**
**UNIVERSITAS DIAN NUSWANTORO**
*Volume 1 No.2,2026*

# DIFFERENCE OF NEUTROPHIL TO LYMPHOCYTE RATIO (NLR) VALUE AND PAIN SCALE IN HERNIORRHAPHY SURGERY WITH MESH AND NON-MESH REPAIR

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**ARTICLE INFO**

Article History
Received: 30/04/2026
Revised: 21/06/2026
Accepted: 23/06/2026

Keywords:
Herniorrhaphy, Mesh Method, Non-mesh Method, Neutrophil to Lymphocyte Ratio, Visual Analogue Scale.

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**ABSTRACT**

**Introduction:** Inguinal hernia accounts for 75% of all abdominal wall hernias. Herniorrhaphy becomes the definitive procedure for inguinal hernia. This procedure is aimed to close the defect and perform tension-free repair using Mesh. However, the use of mesh has been associated with increasing of several complications such as risk of infection and inflammation which lead to chronic post-operative pain.
**Objective:** Our study objective is to analyze the difference of herniorrhaphy Mesh and Non-mesh Repair method based on the neutrophil to lymphocyte ratio (NLR) value and visual pain scale.
**Method:** An experimental study with post-only design, single blind involving hernia patients who were indicated to undergo herniorrhaphy surgery. Research subjects were obtained by consecutive sampling. Patients have to fulfilled the inclusion criteria, did not have exclusion criteria, and were willing to participate in the study would become research subjects. Evaluation was performed on neutrophil to lymphocyte ratio (NLR) value and pain scale at 4 hours after surgery. Pain scale was measured using visual analogue scale (VAS) measurement tool with scale 0-10, where score 0 means no pain and score 10 means severe pain.
**Results:** NLR value in the mesh group was significantly higher compared to the non-mesh group (8.56 ± 1.87 vs 4.56 ± 1.5; p<0.001). Correlation evaluation found that there was a significant correlation between NLR value and VAS score with moderate positive correlation level (p=0.023; r=0.400).
**Conclusion:** Inguinal hernia patients who underwent herniorrhaphy with mesh method significantly had higher NLR value compared to non-mesh group. The increasing of NLR value has been associated with the increasing degree of pain based on VAS score.

## INTRODUCTION

Hernia is a protrusion of an organ or tissue through an abnormal hole. Inguinal hernia is a protrusion of intraabdominal or extraperitoneal organ through a gap in the myofascial plane of the oblique and transversalis abdominis muscle. Inguinal hernia accounts for 75% of all abdominal wall hernias. Two thirds of inguinal hernia cases are classified as indirect inguinal hernia.[1]

Herniorrhaphy becomes the definitive procedure for inguinal hernia. Herniorrhaphy is performed by opening the hernia sac, returning the hernia contents to its normal place, cutting the hernia sac, and closing the defect with strong sutures. Laparotomy or laparoscopy approach is used with the aim of closing the defect and performing tension-free repair using mesh. Although the effectiveness of surgical procedure is generally assessed based on the rate of hernia recurrence after surgery, however the occurrence of chronic post-operative pain also becomes one of the evaluation forms related to the effectiveness of surgical procedure.[1]

The gold standard management for inguinal hernia remains hernioplasty with mesh method. The technique is performed by placing polypropylene mesh between the base of the inguinal area and the aponeurosis of external oblique abdominis muscle (OAE). This mesh will eliminate the need for tension sutures. The increasing of intra-abdominal pressure during the procedure will cause contraction of OAE muscle, which gives a back pressure on the mesh, so it effectively utilizes intra-abdominal pressure for hernia repair.[2] However, the use of mesh method is associated with problems related to complications such as chronic post-operative pain and infection. The increasing number of chronic post-operative pain cases is caused by persistent inflammation in the wound after mesh placement. The main causes of pain include nerve involvement in scar tissue, nerve damage, scar tissue that forms around the mesh, and infection in the mesh.[3]

Currently, non-mesh herniorrhaphy method has been introduced which is performed through strengthening of the posterior wall of inguinal canal with transversal fascia and muscles. The spermatic cord is placed and the edges of OAE aponeurosis are sutured above it. However, the non-mesh method also has disadvantages, because muscle fibers that are sutured to the inguinal ligament will eventually become scar tissue and lose their functional activity that can create a new area for hernia recurrence.[3]

Although the effectiveness of herniorrhaphy procedure is generally assessed based on recurrence rate only, in fact the side effects in the form of chronic pain and inflammatory response in the body are also able to affect the overall quality of life of the patient. This study was conducted to analyze the difference of herniorrhaphy Mesh and Non-mesh Repair method based on NLR value and visual pain scale.

**METHOD**

This study employed an experimental post-test only, single-blind design involving patients with hernia who were indicated for herniorrhaphy. Subjects were recruited using a consecutive sampling method until the required minimum sample size was achieved. Patients who met the inclusion criteria, did not meet any exclusion criteria, and provided informed consent were enrolled in the study. The inclusion criteria were: diagnosis of lateral, medial, or femoral inguinal hernia; unilateral inguinal hernia; and absence of preoperative pain (VAS score of 0)

The exclusion criteria were: bilateral hernia; recurrent hernia; presence of acute or chronic inflammatory disease or autoimmune disorders; and immunodeficiency conditions, such as HIV infection.

Outcome measures included the neutrophil-to-lymphocyte ratio (NLR) and postoperative pain assessed at 4 hours post surgery. The measurement

of pain intensity was measured using the Visual Analog Scale (VAS), ranging from 0 to 10, where 0 indicates no pain and 10 indicates severe pain.

Statistical analysis was performed using parametric independent t-test if the requirement achieved or the Mann–Whitney U test. A p-value of <0.05 was considered statistically significant.

**RESULTS AND DISCUSSIONS**

Evaluation of 32 patients who underwent herniorrhaphy for inguinal hernia yielded the following results.

**Table 1**. Sample Characteristic

| Variable | Non-Mesh | | Mesh | | *p* |
|---|---|---|---|---|---|
| | n (%) | Mean ± SD; Median (min-max) | n (%) | Mean ± SD; Median (min-max) | |
| Sex | | - | | - | 1.000 *f* |
| • Man | 16 (100) | | 16 (100) | | |
| • Women | 0 (0) | | 0 (0) | | |
| Age | - | 57.25 ± 10.63; 59 (21-68) | - | 52 ± 12.61; 53 (26-68) | 0.199 ‡ |

Mann Whitney U; *f*Fisher exact; signifikan p<0.05

All subjects in both study groups were male. In the non-mesh group, the mean age was 57.25 ±10.63 years, with median of 59 years, minimum age is 21 years, and maximum age is 68 years. In the mesh group, the mean age was 52 ±12.61 years, a median of 53 years, a minimum age of 26 years, and a maximum age of 68 years. There was no significant difference observed in age distribution between the study groups (p = 0.199).

**Table 2**. The Differences of pain scale and NLR

| Variable | Non-Mesh | Mesh | *p* |
|---|---|---|---|
| VAS | 4.50 ± 0.63; 5 (3-5) | 4.63 ± 0.5; 5 (4-5) | 0.630‡ |
| NLR | 4.56 ± 1.5; 4.32 (2.49-7.38) | 8.56 ± 1.87; 8.6 (5.96-12.3) | **<0.001**† |

†Independent T test; ‡Mann Whitney U; signifikan p<0.05

The VAS score in the non-mesh group showed a mean of 4.50 with a standard deviation of 0.63, a median of 5, a minimum value of 3, and a maximum value of 5. In the mesh group, the mean VAS score was 4.63 with a standard deviation of 0.50, a median of 5, a minimum value of 4, and a maximum value of 5. There was no difference in VAS score distribution between the study groups (p = 0.630).

For the NLR value, the non-mesh group showed a mean of 4.56 with a standard deviation of 1.50, a median of 4.32, a minimum value of 2.49, and a maximum value of 7.38. In the mesh group, the mean NLR value was 8.56 with a standard deviation of 1.87, a median of 8.60, a minimum value of 5.96, and a maximum value of 12.3. There was a significant difference in NLR distribution between the study groups (p < 0.001), with significantly higher NLR values observed in the mesh group.

**Table 3.** Correlation between NLR values and pain scale

| Variabel | NLR | |
|---|---|---|
| | *p* | r |
| VAS | **0.023** | 0.400 |

Spearman test; significant p<0.05

Correlation evaluation was conducted to analyze the relationship between changes in VAS scores and changes in NLR values. The correlation test showed a significant correlation between VAS score and NLR value (p=0.023) with a moderate positive correlation level (r=0.400). This indicates that an increase in NLR value will be followed by an increase in VAS score.

**DISCUSSION**

Patients with inguinal hernia are predominantly male and aged >50 years. Agarwal

et al, who evaluated inguinal hernia cases involving 110 patients, found that most subjects were aged >50 years (39%) and 97.27% were male. Brett et al, who evaluated 6000 male and 9000 female subjects, found that in men, the estimated cumulative incidence of inguinal hernia over 10 and 20 years was 8% and 14%, respectively. The risk of inguinal hernia is inversely related to BMI: the 20-year risk was 17% among those with BMI <25 kg/m² and 12% among those with BMI 25–30 kg/m² or >30 kg/m².

The high prevalence in males is caused by involvement in heavier physical activity and lifting, as well as anatomical differences. The main risk factor is heavy lifting, followed by changes in bowel habits and respiratory diseases. Smoking habit and diabetes are also associated as risk factors for hernia.

The lifetime risk of developing inguinal hernia is around 27% for men and 3% for women. Risk factors for primary inguinal hernia include male, older age, patent processus vaginalis, connective tissue disorders, and low BMI. Increasing age and low BMI increase the risk of medial and lateral hernia repair. However, high BMI can also increase intra-abdominal pressure and is suspected to increase the risk of recurrence.

Smoking is known to increase the risk of hernia recurrence. This may occur because smoking increases collagen degradation and decreases collagen synthesis, as shown by reduced fibroblast cell numbers. High intra-abdominal pressure is also a risk factor. A database study of 1.5 million individuals showed an increased risk of primary lateral hernia repair with increasing cumulative exposure to lifting and standing/walking activities each day. By reducing standing/walking activity from ≥6 hours to <4 hours per day, about 30% of primary lateral hernia repairs could be prevented. Increased intra-abdominal pressure is involved in the formation of lateral hernia, possibly through a patent processus vaginalis.

Patent processus vaginalis and inguinal hernia are more common in men. Asymptomatic patent processus vaginalis is reported in 20% of patients aged 5 months, 9% at 12 years, and 6–19% in adults. NLR values were found to be significantly higher in the mesh herniorrhaphy group. There was no significant difference in VAS scores between groups. Our results showed there is a correlation between VAS score and NLR value, where increased NLR value is followed by increased VAS score.

Kayalar et al., who evaluated the correlation between NLR value and VAS score, found a positive correlation (47.7%) and statistically significant relationship between preoperative NLR value and VAS score ($p=0.018$; $p<0.05$). Smith et al., who compared mesh versus non-mesh hernia repair, found different results where mesh repair had a lower recurrence rate, without significant differences in chronic pain, seroma, hematoma, or wound infection compared to non-mesh technique. Patients aged <40 years had a higher risk of postoperative pain.

Mesh, especially small-pore mesh and three-dimensional mesh, has been found to shrink, migrate, or erode into surrounding structures, which can be a common cause of chronic pain after inguinal hernia repair. Ejaculatory dysfunction and pain related to sexual activity have also been reported as complications of mesh repair. Mesh repair, especially with preperitoneal placement, has a potential risk of rare visceral complications due to

its proximity to organs such as the colon, small intestine, and urinary bladder.

Although there is strong evidence that mesh repair is superior to non-mesh, there are some cases where non-mesh repair is preferred. Due to concerns regarding permanent mesh use and complications reported in other surgical fields, some patients seek surgeons who can perform either mesh or non-mesh repair. There are also clinical conditions where permanent mesh is contraindicated, such as in infected surgical areas.

The results of this study differ from other studies, possibly due to several factors not evaluated in this study, including duration of surgery, emergency operation, type of anesthesia, hernia subtype, and size of hernia defect. Longer operative time (>50 minutes), emergency surgery without adequate patient preparation, primary direct hernia subtype, and large defect size are associated with increased risk of postoperative complications, such as inflammation and chronic postoperative pain.

## CONCLUSION

Patients with inguinal hernia undergoing mesh herniorrhaphy have significantly higher NLR values compared to the non-mesh group. Increased NLR values are correlates by increased VAS scores. Therefore, routine monthly evaluation may be a necessary to monitor the degree of postoperative inflammation, as it correlates with the level of pain experienced by the patients.

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