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A Comparative Study of Cyanoacrylate Glue Versus Non-Absorbable Sutures for Mesh Fixation in Lichtenstein Inguinal Hernia Repair: A Randomized Prospective Trial

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HIGHLIGHTS

1. Cyanoacrylate glue offers faster fixation times.
2. Non-absorbable sutures provide robust support.
3. Study compares outcomes in hernia repairs.
4. Adhesive method may reduce complication rates.
5. Results guide future surgical fixation choices.

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ABSTRACT

This randomized prospective control trial aimed to compare the effectiveness of cyanoacrylate glue versus non-absorbable sutures for mesh fixation in Lichtenstein inguinal hernia repair, specifically evaluating postoperative outcomes such as pain, tenderness, and swelling. Conducted from August 2022 to January 2024 at Gajra Raja Medical College, Gwalior, the study enrolled 80 male patients diagnosed with primary unilateral inguinal hernia. The patients were randomly divided into two groups: one receiving mesh fixation with cyanoacrylate glue (test group) and the other with conventional sutures (control group). Postoperative pain was measured using the Visual Analogue Scale (VAS), while complications like seroma, hematoma, wound infection, and recurrence were tracked to assess clinical outcomes. The study found that the test group demonstrated significantly better outcomes in terms of pain reduction, with 97.5% of the patients reporting minimal pain by Day 7, compared to only 37.5% in the suture group. Furthermore, the glue group showed significantly lower rates of tenderness and swelling, indicating that cyanoacrylate glue may offer superior postoperative comfort. Complication rates, including fever and hernia recurrence, were also lower in the glue group, underscoring the potential benefits of glue fixation in preventing common surgical complications. Based on these results, the study advocates for the broader adoption of cyanoacrylate glue in clinical practice, emphasizing its potential to improve patient outcomes by reducing pain and minimizing postoperative complications. Further research is warranted to confirm these findings and evaluate the cost-effectiveness and long-term benefits of glue fixation in routine hernia repair surgeries.

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INTRODUCTION

An inguinal hernia is characterized by the protrusion of a viscous organ or a part of it into the inguinal canal, either through the deep inguinal ring or Hesselbach's triangle [1]. The ideal hernia repair technique should be tension-free, tissue-based, and cause no damage to vital structures, ensuring there is no long-term postoperative pain, complications, or recurrence. Among the various techniques available, Lichtenstein hernioplasty, first described in 1989, remains a widely accepted method for open inguinal hernia repair. Its popularity is attributed to its safety, efficacy, and low recurrence rates, which have established it as the gold standard even in the era of laparoscopic surgery [2]. Despite the advantages of laparoscopic hernia repair, such as minimally invasive procedures, its long and complex learning curve makes the open Lichtenstein technique a preferred choice for many surgeons.

Postoperative complications following inguinal hernia repair can include early recurrence, groin pain, seroma formation, wound infection, hematoma, and urinary retention. Postoperative pain, a significant concern, can be categorized as either acute or chronic. Chronic pain is defined as pain persisting for more than three months after surgery, a duration that exceeds the normal tissue healing time. This type of pain, particularly in the groin region following hernia repair, affects a significant portion of patients, with incidence rates ranging from 16% to 60%. Chronic inguinal pain has become a primary focus when evaluating the outcomes of inguinal hernia surgery due to its substantial impact on patients' quality of life.

Certain patients are at a higher risk of developing chronic pain after hernia repair. These include females, younger individuals, those with pre-existing painful hernias, patients with chronic pain syndromes, those who exhibit an exaggerated response to heat stimuli, and individuals with certain psychological tendencies. Chronic groin pain after Lichtenstein's repair is particularly challenging, as it can significantly compromise patients' quality of life [3].

The pain experienced after inguinal hernia repair can be classified into two main types: neuropathic and non-neuropathic. Neuropathic pain typically arises from injury to the ilioinguinal, iliohypogastric, or genitofemoral nerves during surgery [4]. Nerve injuries may occur due to nerve entrapment within the fixating sutures or the scar tissue that develops around the mesh. Additionally, accidental transection of these nerves can lead to neuroma formation at the nerve ends, resulting in chronic pain. Non-neuropathic causes of chronic pain may include mechanical pressure from folded or wadded mesh, periosteal reactions, and scar tissue formation. Therefore, limiting the use of sutures and fixation devices may reduce the incidence of chronic groin pain. Reducing the reliance on these fixation methods can also decrease hospital stays and lead to a quicker return to normal activities [5].

To avoid complications associated with sutures or tackers, alternative mesh fixation techniques using tissue adhesives have been explored. These methods, including the use of fibrin glue or cyanoacrylate tissue adhesives, have shown promising postoperative outcomes, leading to increased satisfaction among both surgeons and patients [6]. Although these alternative methods have demonstrated similar or improved postoperative results compared to traditional suture or tack fixation, they have yet to gain universal acceptance.

The ideal adhesive material should be biocompatible, cost-effective, and easy to store and use. Long-lateral-chain cyanoacrylates are considered one of the best choices for mesh fixation in open mesh repair of inguinal hernias. The use of atraumatic mesh fixation techniques, such as those employing fibrin or butyl-2-cyanoacrylate glues, has gained popularity in recent years over traditional suture-based mesh fixation[7]. Studies have demonstrated the advantages of glue mesh fixation, including decreased operative time, reduced postoperative pain and complications, lower recurrence rates, and shorter hospital stays.

Fibrin glue, known commercially as Tissel® or Tissucol®, is a biologic hemostatic agent made of human fibrinogen and thrombin. When activated by calcium chloride, it forms a strong fibrin fiber matrix. Cyanoacrylate, a chemical adhesive known by various trade names such as Dermabond®, TrueSeal™, and Histoacryl®, is commonly used for closing small surgical wounds or traumatic lacerations [8]. Its unique bonding properties allow it to form strong chains in the presence of moisture.

Using tissue adhesive methods for mesh fixation can be beneficial, particularly in patients prone to pain or those who require an early return to work. Fixation with tissue adhesives may reduce nerve and tissue injury while enhancing stability, albeit with the potential for minor complications. The superior short and long term results observed with glue fixation compared to sutures are likely due to the reduced risk of nerve and vessel injury associated with sutures.

The purpose of the study in question is to clarify the efficacy of cyanoacrylate glue versus non-absorbable sutures for mesh fixation in Lichtenstein

hernia repair [9]. The primary endpoint is postoperative groin pain, with operative duration and other postoperative complications, such as wound infection, seroma, recurrence, and hematoma, as secondary endpoints[10].

AIMS AND OBJECTIVES

This study aims to compare the efficacy of cyanoacrylate glue versus sutures for mesh fixation in Lichtenstein inguinal hernia repair. The objectives include investigating short-term outcomes such as postoperative pain, hematoma, seroma, and hospital stay, as well as long-term outcomes like recurrence following hernioplasty. The comparison focuses on the effectiveness of cyanoacrylate glue versus sutures in achieving optimal results in these areas.

MATERIAL AND METHODS

A simple randomized prospective control study was conducted with two groups: a test group for mesh fixation using glue and a control group for mesh fixation using sutures. Randomization was performed using the blind envelope method. The study took place from August 2022 to January 2024 in the Surgery Department at Gajra Raja Medical College, Gwalior. To ensure uniformity, all surgeries were performed by consultants from respective units. Male adults diagnosed with primary unilateral inguinal hernia were included after giving informed consent. Patients were randomized to undergo open hernia repair with either suture fixation (control group) or cyanoacrylate glue fixation (test group). Approval from the Ethics Committee was obtained before commencing the study. The sample size was calculated to be 80 patients, with 40 in each group. The study was single-blinded, with pain monitored using the Visual Analogue Scoring (VAS) scale. Patients' postoperative outcomes, including pain, seroma, hematoma, fever, wound discharge, and recurrence, were recorded and analyzed using SPSS software and the Chi-Square test.

The compared age distribution between the test and control groups in our study. In the test group, 27.5% of participants were aged 50-60, followed by 20% in the 40-50 and 60-70 ranges. The control group showed a more even distribution across the 30-40, 40-50, and 60-70 ranges, with a higher percentage (17.5%) in the 70-80 range. This suggests an older demographic in the control group. Additionally, the table compared hernia types between the groups, revealing no statistically significant difference (P=0.1095). Finally, immediate postoperative pain scores showed the test group had significantly lower pain (P=0.0001), indicating superior pain management.

Table 1: Discharge from Suture Line at Day 1

Discharge Day1	Test (N)	Test (%)	Control (N)	Control (%)
Yes	6	15%	13	0.325
No	34	85 %	27	0.675
Fisher Exact Test P Value	0.1136	Not Significant		

The table compared Day 1 postoperative wound discharge between the test and control groups. The test group had a 15% discharge rate, while the control group had 32.5%. However, the difference was not statistically significant (P=0.1136), suggesting no significant impact of treatment type on wound discharge.

Table 2: Tenderness at Suture Line Day 1

Tenderness	Day 1 Test	Day 1 Test (%)	Day 1 Control	Day 1 Control (%)
Yes	5	12.5 %	25	62.5 %
No	35	87.5 %	15	37.5 %
Fisher exact test P value	0.0001			

This table compared Day 1 postoperative tenderness between the test and control groups. Only 12.5% of the test group reported tenderness, compared to 62.5% in the control group. The Fisher exact test yielded a P-value of 0.0001, indicating a hi--ghly signif- difference, suggesting the test treatment was much more effective in reducing postoperative tenderness. This highlights the superior efficacy of the test treatment in minimizing discomfort.

Table 3: Swelling (Due to Seroma and Hematoma Formation) Around Suture Line Day 1

Swelling Around Suture Line Day 1	Test	Test (%)	Control	Control (%)
Yes	1	2.5	14	35
No	39	97.5	26	65
Fisher Exact Test P Value	0.0003			

This table compared Day 1 postoperative swelling around the suture line between the test and control groups. Only 3% of the test group experienced swelling, compared to 35% in the control group. The Fisher exact test yielded a P-value of 0.0003, indica--ting a highly significant difference. This suggests that the test treatment was much more effective in preventing postoperative swelling, demonstrating its superior efficacy in minimizing this complication.

Table 4: Pain Scores at Day 3

Pain Day 3	Day 3 Test (N)	Day 3 Test (%)	Day 3 Control (N)	Day 3 Control (%)
<2	17	42.5	3	7.5
2 To 4	22	55	9	22.5
4 To 6	0	0	7	17.5
6 To 8	0	0	18	45
>8	1	2.5	3	7.5
Fisher Exact Test P Value (<2 Vs 2 To 4)	0.3227			
Fisher Exact Test P Value (2 To 4 Vs 4 To 6)	0.0001			
Fisher Exact Test P Value (4 To 6 Vs 6 To 8)	0.0001			

This table compared Day 3 post-treatment pain levels between the test group (acrylate glue) and the control group (traditional stitching). In the test group, 97.5% of patients reported pain levels under 4, with 42.5% experiencing minimal pain (<2) and 55% experiencing mild pain (2-4). In contrast, the control group had only 30% reporting pain under 4, with 62.5% experiencing moderate to severe pain (4-8). The Fisher exact test showed significant differences, with P-values of 0.0001, indicating that acrylate glue was significantly more effective in reducing postoperative pain.

Table 5: Tenderness at Suture Line Day 3

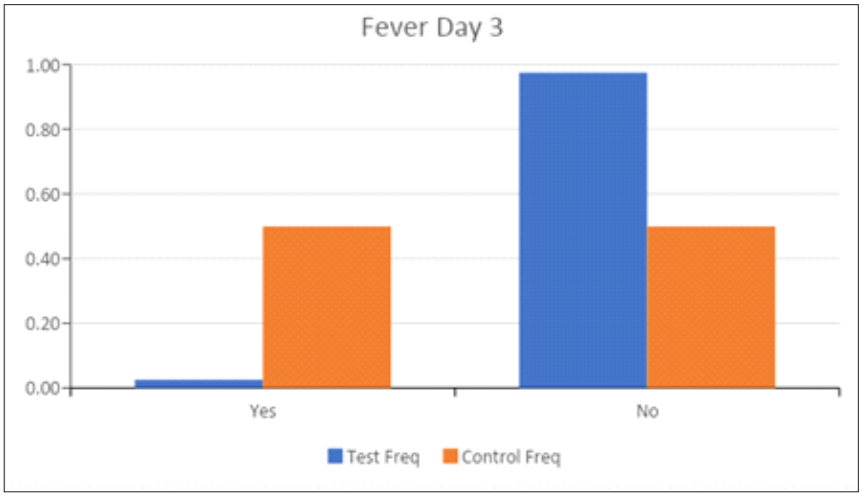
Tenderness	Day 3 Test	Day 3 Test (%)	Day 3 Control	Day 3 Control (%)
Yes	1	2.5 %	16	40 %
No	39	97.5 %	24	60 %
Fisher exact test P value	0.0001			

This table compared Day 3 post-treatment pain levels between the test group (acrylate glue) and the control group (traditional stitching). In the test group, 97.5% of patients reported pain levels below 4, with 42.5% experiencing minimal pain (<2) and 55% mild pain (2-4). The control group, however, had only 30% reporting pain under 4, while 62.5% experienced moderate to severe pain (4-8). The Fisher exact test yielded P-values of 0.0001, confirming that acrylate glue was significantly more effective in reducing postoperative pain.

Table 6: Swelling (Due to Seroma and Hematoma) Around Suture Line Day 3

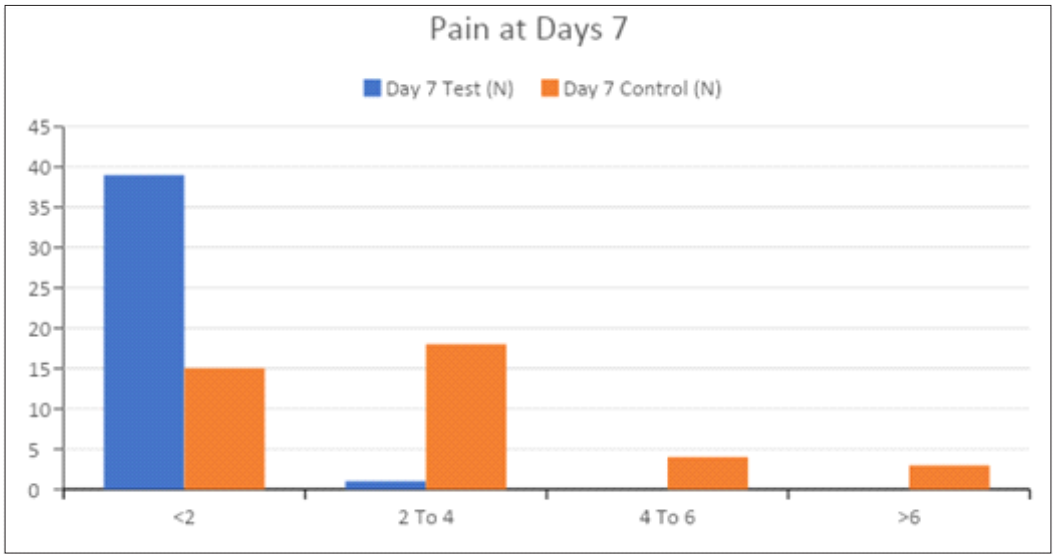
Swelling Around Suture Line Day 3	Test	Test (%)	Control	Control (%)
Yes	1	2.5	7	18
No	39	97.5	33	82
Fisher Exact Test P Value	0.0598	Not Significant		

This table compared the incidence of swelling around the suture line on Day 3 post-surgery between the test and control groups. Swelling occurred in 3% of the test group and 18% of the cont-rol group. Conversely, 97.5% of the test group and 93% of the control group did not experience swelling. The P-value of 0.0598 indicated that the difference was not statistically significant.



Graph 1: Fever at Day 3

This table compared the incidence of fever on Day 3 post-surgery between the test and control groups. Fever occurred in 3% of the test group and 50% of the control group, while 98% of the test group and 50% of the control group did not experience fever. The Fisher exact test yielded a P-value of 0.0001, indicating that the test treatment was significantly more effective in preventing postoperative fever.



Graph 2: Pain Scores at Day 7

This table compared Day 7 post-treatment pain levels between the test group (acrylate glue) and the control group (traditional stitching). In the test group, 97.5% reported minimal pain (<2), with only 2.5% experiencing mild pain (2-4), and none reported pain above 4. Conversely, the control group had a wider pain distribution: 37.5% reported minimal pain, 45% mild pain, 10% moderate pain, and 7.5% severe pain. The Fisher exact test yielded a P-value of 0.0001, highlighting the superior pain relief with acrylate glue.

Table 7: Comparison of Mean Recurrence of Hernia in 2 Groups

Recurrence	Test Group		Control Group	
	N	%	N	%
Within 1 month	0	0	0	0
Within 3 months	0	0	0	0
Within 6 months	0	0	1	2.5

This table showed the distribution of inguinal hernia recurrence in both groups over a 6-month follow-up. Only 1 patient (2.5%) in the control group had a recurrence, while none occurred in the test group. Statistical analysis indicated no significant difference in recurrence rates between the groups, with a p-value above 0.05.

DISCUSSION

Inguinal hernioplasty is a common surgery aimed at repairing groin hernias by reinforcing the weakened area with mesh. Traditionally, sutures have been used for mesh fixation, but this method can lead to increased postoperative pain, nerve injury, and longer operative times. As a result, the surgical community has been investigating alternatives like surgical glue. This biocompatible adhesive secures the mesh with potentially less tissue damage, reduced inflammation, and minimized postoperative pain. Additionally, glue may simplify the procedure, shorten operation times, and lower overall costs, offering a promising alternative to traditional suture fixation [11] [12].

Sutures in inguinal hernioplasty can cause discomfort and persistent pain due to tension and pressure on surrounding tissues. In contrast, glue fixation adheres the mesh without repeatedly puncturing the tissue, which may result in less immediate and long-term pain, potentially leading to a more comfortable and faster recovery. Suture fixation can also lead to complications such as nerve entrapment, irritation, inflammation, and scarring, which glue may reduce by evenly distributing forces and avoiding tissue penetration. Furthermore, glue application is generally quicker than suturing, which can shorten operative time, reduce anesthesia exposure, and improve surgical efficiency. Comparing our findings with Koehler RH et al. (1999), which showed an average patient age of 54 years, our study's age distribution ali-

-gns closely, particularly within the 50-60 year range. This broad age range highlights the relevance of hernia repair across different age groups. Our study's detailed age distribution enhances understanding of demographic variations and facilitates comparisons with other research, such as Koehler's, to evaluate the benefits of glue fixation in hernia repair surgeries [13][14].

Our study assessed pain scores on Days 3 and 7 post-surgery between two groups: the Test group (using glue for mesh fixation) and the Control group (using conventional sutures). On Day 3, 42.5% of the Test group reported pain scores under 2, compared to just 7.5% in the Control group. For pain scores of 2-4, 55% of the Test group experienced this level of pain, while 22.5% of the Control group did. No patients in the Test group had pain scores between 4 and 8, whereas 62.5% in the Control group did. Significant differences were noted in the 2-4 versus 4-6 (p= 0.0001) and 4-6 versus 6-8 (p =0.0001) ranges. By Day 7, 97.5% of the Test group reported pain scores under 2, versus 37.5% in the Control group, with significant differences in the <2versus 2-4 range (p=0.0001). These results suggest that glue fixation may offer improved pain management and patient comfort, highlighting the need to explore alternative fixation techniques for better surgical outcomes. Regarding hernia types, 30% of the Test group had Type 1 hernias and 70% had Type 2, compared to 50% Type 1 and 50% Type 2 in the Control group. The Fisher exact test showed no significant difference in hernia type distribution (p =0.1095). Comparing our results with Etemad SA et al. (2020), which examined fixation-free versus mechanical fixation methods, we found similar patterns, including no significant difference in 30-day recurrence rates (0.2% vs. 0%, p = 1) but longer hospital stays and higher pain scores with mechanical fixation. Both studies emphasize the need to evaluate fixation techniques to improve patient outcomes [15][16][17].

Our study evaluated postoperative pain and tenderness on Days 1 and 3 between patients undergoing hernia repair with glue fixation (Test group) and conventional suture fixation (Control group). On Day 1, the Test group reported significantly lower pain, with 92.5% having a pain score of 1 versus 2.5% in the Control group (p = 0.0001) [18]. Tenderness at the suture line was also notably lower in the Test group, with only 12.5% reporting tenderness compared to 62.5% in the Control group (p = 0.0001). By Day 3, tenderness was reduced further in the Test group, with only 2.5% experiencing tenderness versus 40% in the Control group (p =0.0001).

These findings underscore the advantage of glue fixation in enhancing immediate postoperative comfort. Comparatively, the MOVE trial by Odijk R et al. found no significant differences in pain scores over time but noted glue's superiority in reducing wound dehiscence [19]. Similarly, our study showed glue fixation's benefit in reducing early swelling, though the difference at Day 3 was not significant (p = 0.0598). The study by Pascual G et al. highlighted concerns about potential cytotoxicity of cyanoacrylate adhesives, suggesting a need for careful material selection. Overall, our results and comparisons emphasize the potential of glue fixation in improving patient outcomes and reducing early postoperative complications [20].

SUMMARY AND CONCLUSION

This study compared cyanoacrylate glue with conventional sutures for mesh fixation in inguinal hernia repair, assessing pain, tenderness, swelling, and complications. Conducted over 18 months at G.R. Medical College, it involved 80 male patients randomly assigned to glue or suture groups. Results showed significantly lower pain scores, tenderness, and swelling in the glue group, with 97.5% reporting minimal pain by Day 7 compared to 37.5% in the suture group. Fewer patients in the glue group had postoperative fever. The study indicates cyanoacrylate glue offers superior pain management and fewer complications than sutures, supporting its broader clinical use. Further research is needed to confirm these findings and evaluate cost-effectiveness.

REFERENCES

1. Amato G. Inguinal Hernia: Pathophysiology and Genesis of the Disease. Springer Nature; 2022 Jun 22.
2. Nathan JD, Pappas TN. Inguinal HerniaAn Old Condition With New Solutions. Annals of surgery. 2003 Dec 1;238(6):S148-57.
3. Nguyen DK, Amid PK, Chen DC. Groin pain after inguinal hernia repair. Advances in surgery. 2016 Sep 1;50(1):203-20.
4. Kuponiyi O, Alleemudder DI, Latunde-Dada A, Eedarapalli P. Nerve injuries associated with gynaecological surgery. Obstetrician & Gynaecologist. 2014 Jan 1;16(1).
5. Campanelli G, Cavalli M, Bruni PG, Morlacchi A. Prevention and Evaluation of Chronic Groin Pain. Textbook of Hernia. 2017:141-5.
6. Bao Z, Gao M, Sun Y, Nian R, Xian M. The recent progress of tissue adhesives in design strategies, adhesive mechanism and applications. Materials Science and Engineering: C. 2020 Jun 1;111:110796.
7. Ebnesajjad S. Adhesives for medical and dental applications. In Handbook of Polymer Applications

in Medicine and Medical Devices 2011 Jan 1 (pp. 103-129). William Andrew Publishing.

8. Vikram J. A Comparative Study Between Conventional Skin Suturing, Staples and Adhesive Skin Glue for Surgical Skin Closure (Master's thesis, Rajiv Gandhi University of Health Sciences (India)).
9. Ather MZ, Tukaram A, Mise AJ. A Comparative Study of Cyanoacrylate Surgical Glue VS Polypropylene Suture Material for Mesh Fixation in Open Inguinal Hernia Surgery.
10. Kennedy S, Mayo Z, Gao Y, Miller BJ. What are the results of surgical treatment of postoperative wound complications in soft tissue sarcoma? A retrospective, multi-center case series. The Iowa orthopaedic journal. 2018;38:131.
11. Rangwani SM, Kraft CT, Schneeberger SJ, Khansa I, Janis JE. Strategies for mesh fixation in abdominal wall reconstruction: concepts and techniques. Plastic and Reconstructive Surgery. 2021 Feb 1;147(2):484-91.
12. Monsen C. Effects of Negative Pressure Wound Therapy on Perivascular Groin Infections after Vascular Surgery. Wound Healing, Cost-Effectiveness and Patient-Reported Outcome.
13. McCulloch P, Altman DG, Campbell WB, Flum DR, Glasziou P, Marshall JC, Nicholl J. No surgical innovation without evaluation: the IDEAL recommendations. The Lancet. 2009 Sep 26;374 (9695):1105-12.
14. Koehler RH, Voeller G. Recurrences in laparoscopic incisional hernia repairs: a personal series and review of the literature. JSLS: Journal of the Society of Laparoendoscopic Surgeons. 1999 Oct;3(4):293
15. Paajanen H. A single-surgeon randomized trial comparing three composite meshes on chronic pain after Lichtenstein hernia repair in local anesthesia. Hernia. 2007 Aug;11:335-9.
16. Etemad SA, Huang LC, Phillips S, Stewart TG, Pierce RA, Schneeberger SJ, Poulose BK. Advantages of a fixation-free technique for open retromuscular ventral hernia repair. Plastic and Reconstructive Surgery. 2020 Oct 1;146(4):883-90.
17. Sreekanth KT. Comparative study of complications following laparoscopic TEP versus TAPP versus open hernioplasty in inguinal hernia repair (Doctoral dissertation, Stanley Medical College, Chennai).
18. Tan NR. A comparison between knotless and conventional sutures: A novel approach to third molar surgery (Doctoral dissertation, University of Otago).
19. Odijk R, Hennipman B, Rousian M, Madani K, Dijksterhuis M, de Leeuw JW, van Hof A. The MOVE-trial: Monocryl® vs. Vicryl Rapide™ for skin repair in mediolateral episiotomies: a randomized controlled trial. BMC Pregnancy Childbirth. 2017 Oct 16;17(1):355. doi: 10.1186/s12884-017-1545-8. PMID: 29037181; PMCID: PMC5644141.
20. Pascual G, Sotomayor S, Rodríguez M, Pérez-Köhler B, Kühnhardt A, Fernández-Gutiérrez M, San Román J, Bellón JM. Cytotoxicity of cyanoacrylate-based tissue adhesives and short-term preclinical in vivo biocompatibility in abdominal hernia repair. PloS one. 2016 Jun 20;11(6):e0157920.

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