



Comparison of Absorbable Tuckers and N-Butyl Cyanoacrylate Glue in Mesh Fixation for Laparoscopic Extraperitoneal Inguinal Hernia Repair: A Single General Surgeon's Experience

Laparoskopik Ekstraperitoneal Kasık Fıtığı Onarımı için Meş Fiksasyonunda Emilebilir Zimba ile N-Butil Siyanoakrilat Yapıştırıcıların Karşılaştırılması: Tek Bir Genel Cerrahın Deneyimi

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ABSTRACT

Aim: Laparoscopic inguinal hernia surgery is performed in many centers today. Mesh fixation is an important step in this procedure. In this study, we aim to show our results in total extraperitoneal repair of inguinal hernias using absorbable tuckers and n-butyl cyanoacrylate glue for mesh fixation.

Materials and Methods: All surgeries were performed by a single surgeon. The surgeries were performed in Private Erdem Hospital İstanbul and Al Zahra Hospital Dubai between January 2015 and February 2022. Mesh fixation of the patients was applied in a randomized manner using absorbable tucker and glue. The patients were compared in terms of postoperative visual pain score (VAS), opioid need, length of hospital stay, duration of surgery, presence of recurrence and chronic pain.

Results: A total of 226 patients were operated. Absorbable tucker were used for mesh fixation in 138 patients, and glue was used in 88 patients. The age and gender distribution of the patients were similar in both groups. No patient had any major complications or mortality during or after surgery. There was no conversion to open surgery. Operation time was similar in both groups. In the glue group, VAS was found to be significantly lower at the 8th hour after surgery. There was also a significant reduction in opioid requirement in the same group. The same-day discharge rate in the glue group was statistically significantly higher than in the absorbable tucker group. All patients were followed up for at least six months. Recurrence was observed in two patients (one patient in each group). The number of patients with chronic pain was significantly higher in the absorbable stapler group than in the other group.

Conclusion: The use of glue for mesh fixation in laparoscopic extraperitoneal inguinal hernia repair is a safe method. Fixation with glue is clearly advantageous comparing to absorbable tuckers in terms of postoperative pain, early discharge, and chronic pain.

Keywords: N-butyl cyanoacrylate, laparoscopic hernia repair, mesh fixation, total extraperitoneal hernia repair

ÖZ

Amaç: Laparoskopik fıtık cerrahisi günümüzde birçok merkezde uygulanmaktadır. Meşin fiksasyonu ameliyatın önemli bir aşamasıdır. Biz bu çalışmada total ekstraperitoneal laproskopik fıtık tamirinde emilebilir zimba ile n-butil siyanoakrilat yapıştırıcısı kullanımının kısa ve uzun dönem etkilerini araştırdık.

Gereç ve Yöntem: Bütün ameliyatlar tek bir cerrah tarafından laparoskopik ekstraperitoneal yöntemle yapıldı. Ameliyatlar İstanbul ve Dubai'de 2015 Ocak ve 2022 Şubat ayları arasında yapıldı. Hastaların meş fiksasyonu randomize bir şekilde emilebilir zimba ve yapıştırıcı kullanılarak uygulandı. Hastalar, ameliyat sonrası vizuel ağrı skoru (VAS), opioid ihtiyacı, hastanede kalış süresi, ameliyat süresi, nüks ve kronik ağrı varlığı açısından karşılaştırıldı.

Bulgular: Toplam 226 hasta ameliyat edildi. Yüz otuz sekiz hastada meş fiksasyonu için emilebilir zimba, 88 hastada yapıştırıcı kullanıldı. Hastaların yaşı, cinsiyet dağılımı her iki grupta da benzerdi. Hiçbir hastada ameliyat sırasında veya ameliyat sonrasında herhangi bir majör komplikasyon veya mortalite görülmedi. Her iki grupta da açık cerrahiye geçiş olmadı. Ameliyat süresi her iki grupta da benzerdi. Yapıştırıcı grubunda ameliyattan

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hemen sonra 8. saatte VAS belirgin düşük olarak saptandı. Ayrıca opioid ihtiyacında anlamlı bir şekilde azalma mevcuttu. Yapıştırıcı grubunda aynı gün taburcu oranı emilebilir zımba grubuna göre istatistiksel olarak anlamlı bir şekilde daha fazla idi. Bütün hastaların en az altı aylık takibi yapıldı. Her iki grupta da birer hastada nöks görüldü. Kronik ağrı tespit edilen hasta sayısı emilebilir zımba grubunda diğer gruba göre belirgin olarak fazla idi.

Sonuç: Laparoskopik ekstraparitoneal kasık fıtığı tamirinde meş fiksasyonunda yapıştırıcı kullanımı güvenli bir yöntemdir. Ameliyat sonrası ağrı, erken taburcu, kronik ağrı açısından emilebilir zımba ile tespitinde belirgin olarak avantajlıdır.

Anahtar Kelimeler: N-butil siyanoakrilat, laparoskopik fıtık tamiri, meş fiksasyonu, total ekstraparitoneal fıtık tamiri

INTRODUCTION

Dating back to ancient Egypt, hernia surgery is one of the oldest known surgical techniques. Bassini's discovery of the hernia sac for the first time in 1884 and his repair of the defect with stitches were considered as the revolution of hernia surgery. With the better understanding of anatomy over time, rapid advances were made in hernia surgery, and laparoscopic hernia surgery showed rapid progress with the frequent use of laparoscopy in surgery in the early 1990s^{1,2}. It is now an accepted fact that laparoscopic hernia surgery has advantages such as less pain, shorter hospital stay, earlier return to work, and better cosmetic results compared to open surgery³. Total extraperitoneal and trans abdominal preperitoneal repairs are the most commonly used methods. The advantages and disadvantages of the two have been shown in many publications⁴⁻⁷. There are differences depending on the surgeon in both types of surgery, such as port locations, which type of mesh is used, and mesh fixation^{8,9}. Mesh fixation can be done with sutures, absorbable or non-absorbable staples, and glue. Although suture fixation has a cost advantage, it has technical difficulties¹⁰. With the emergence of absorbable staples, it has become widely used. Despite the ease of use of staples, they also had disadvantages such as chronic pain and nerve compression, so surgeons began to look for other methods¹¹. Alternatively, in extraperitoneal repairs, 3D mesh has not been used for fixation and has been shown to be safe^{12,13}. With the introduction of fibrin glues in laparoscopic hernia surgery, a new method for mesh fixation has begun to be adopted^{14,15}. Although it has the potential for allergic reactions due to its animal origin, no such case report has been found today; however, its weak binding and slow effect have been reported as its disadvantages¹⁶. Although there are many publications in the literature on the method of providing mesh fixation in laparoscopic hernia repair, there is still no definitively accepted method. Studies showing that alternative methods are associated with less pain compared to absorbable staples are still up to date¹⁷. In this study, we compare n-butyl-cyanoacrylate (NBSA) adhesive fixation with absorbable stapler mesh fixation. The main purpose of this study is to compare important criteria such as pain in the early period after surgery, length of hospital stay, chronic pain, need for painkillers, chronic pain and recurrence that affect

patient comfort and cost, in both methods, and to investigate the reliability of them.

MATERIALS AND METHODS

To compare mesh fixation methods in laparoscopic inguinal hernia repair, patients who underwent surgery at Private Erdem Hospital and Al Zahra Hospital Dubai between September 2018 and March 2023 were retrospectively examined.

The patients were divided into two groups as A and B. In Group A patients, the mesh was fixed with absorbable staples. In Group B patients, mesh fixation was done with NBSA adhesive. All patients were evaluated according to the visual pain scale (VAS) documented at the eighth hour after surgery. Patients' opioid requirements were recorded during hospitalization. Surgery times and hospital stays were documented, and finally, all patients were recalled at least in the sixth month after surgery and examined for chronic pain and recurrence. All patients were operated by a single surgeon who had already performed more than 1000 laparoscopic hernia repairs. All patients underwent total extraperitoneal laparoscopic hernia repair. Two hours after the surgery, all patients were mobilized and oral liquid nutrition was started. Soft diet was allowed after four hours if the patient tolerated it. The patients were given a dose of nonsteroidal analgesic (injection diclofenac 50 mg) in the recovery room. Then, analgesics (diclofenac 50 mg + paracetamol 500 mg tablet) were administered if needed. Patients were asked to rate their pain on VAS at the sixth hour after surgery. If the patient's pain severity was VAS 7 or above, an ampoule of opioid analgesia (2 mL 100 mg pethidine hydrochloride) was applied. Patients were discharged on the same or the next day. Patients were called for follow-up visits on the third day, first month, sixth month, 12th month, and 24th month. At each follow-up, the groin was evaluated for pain, swelling, and foreign body sensation. If there were suspicious findings for recurrence, the patient underwent groin ultrasound. Chronic groin pain was defined as discomfort in the groin area on the operated side lasting more than six months.

In order to conduct the research, ethical approval was obtained from the Al Zahra Hospital Dubai (date: 11.07.2023, no: 14/301) and informed consent was obtained from all patients.

The procedures followed in conducting the study were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 1975 Helsinki Declaration, as revised in 2000 and 2013.

Statistical Analysis

Statistical analysis was performed using the chi-square test. Differences between independent variables were evaluated using the chi-square test. P value <0.05 was considered statistically significant.

Surgery Technique

The patients were operated under general anesthesia in the supine position with both hands closed. All patients were administered 1 g of ceftriaxone in the perioperative period. A urinary catheter was applied to all patients after anesthesia, and the catheter was removed before the patient woke up. The laparoscopy tower was at the patient's foot level. By making a transverse incision in the subumbilical extra-peritoneal space, a 10 mm trocar of any brand is used in surgeries performed in Turkey and a 10 mm [®]Kii Balloon Blunt-Tip System access balloon trocar is used in surgeries performed in Dubai (applied medical resources cooperation, Dubai, UAE). The Surgeon in Charge stood on the opposite side of the hernia and the assistant/nurse stood on the same side (Figure 1). A zero degree telescope was used to examine the preperitoneal space and

for dissection. The working ports were placed under vision in the midline at a distance of 5 mm. The lower port was placed just above the symphysis pubis and the third port was placed between the other two ports. The dissection area was provided as wide as possible. In all cases, the preperitoneal space was opened from the symphysis pubis medially to the psoas muscle laterally and the hernia sac was exposed. In direct hernias, the entire sac is separated from the fascia transversalis. In all direct hernia cases, the presence of cord lipoma and synchronous indirect hernia was investigated. In indirect hernias, the peritoneal sac was carefully dissected from the cord structures. When the peritoneal cavity had to be opened in large or very adherent indirect sacs, the neck of the opened sac was closed with the help of endoloop and endoclip. In the follow up of these stages, when it was decided that sufficient extraperitoneal space was created and the hernia sacs were completely reduced, 3D Max™ Mesh (Bard Mesh, BD Company, Switzerland) was folded and inserted through the camera port and left in the operating field. All potential hernia areas were tried to be closed by regularly opening the rolled mesh laterally from the pubic symphysis to the psoas muscle. In Group A patients, the mesh was fixed to the ipsilateral Cooper ligament with two absorbable staples. In Group B, the mesh was fixed by spraying 0.5 mL of NBSA adhesive (Aesculap, B. Braun, Brazil) onto the Cooper ligament and various places on the mesh. The mesh was kept pressed on the mesh with the tip of the adhesive apparatus at the spray point for not less than five seconds and not more than ten seconds (Video 1).

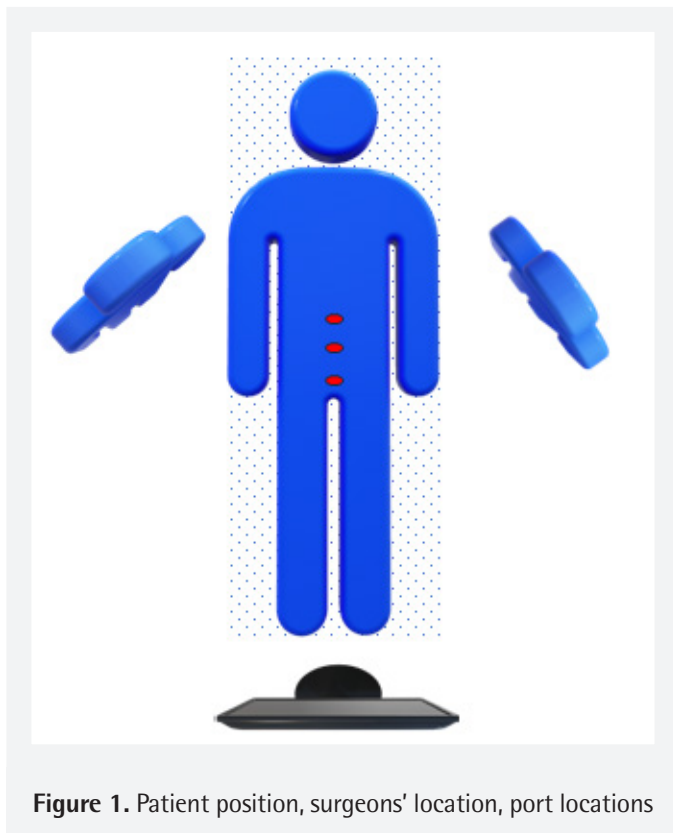


Figure 1. Patient position, surgeons' location, port locations

RESULTS

A total of 149 patients were included in the study between January 2015 and February 2023. One hundred thirty eight patients were included in Group A (fixation with absorbable staples) and 88 patients were included in Group B (fixation with adhesive). Their ages ranged from 25 to 76. 200 (88.4%) of the patients were male. All patients underwent surgery for unilateral inguinal hernia under general anesthesia. Mean surgery times were similar in both groups (Group A: 44.5 minutes, Group B: 43.1 minutes). All surgeries were completed laparoscopically and no complications were observed during the surgeries. A total of five patients returned to the hospital after discharge. Urinary catheterization was applied to four of them because urinary retention developed (Group A: 2, Group B: 2). One of them applied to the emergency department due to severe pain and was taken into observation for pain treatment. This patient was a Group A patient (Table 1). All patients were mobilized under nurse supervision approximately two hours later and allowed to take clear liquids orally. Patients were allowed to take soft diet after four hours. Forty-six patients could not switch to soft food after four hours because they could not tolerate it. More patients in Group A (32 patients) could not tolerate soft food, but no statistical difference

Table 1. Characteristics of the patients

Gender	
Male	200 (88.4%)
Female	26 (11.6%)
Age (year)	
Range	25-76
Mean	42.9
Mean surgery time (minute)	
Group A	44.5
Group B	44.1
Complications during surgery	
Group A	Not seen
Group B	Not seen
Returning back to the hospital	
Group A	3 (2 patients with urinary retention, 1 patient with pain)
Group B	2 (urinary retention)
Switching to open surgery	
Group A	Not seen
Group B	Not seen

Table 2. Parameters

	Group A (%)	Group B (%)	p value
Switching to soft nutrition at the 4 th hour	106 (76.8)	74 (84)	0,18
VAS score measured at the 6 th hour <4	51 (36.9)	58 (65,9)	0,009
Opioid requirement	61 (44.2)	2 (2.2)	<0.0001
Same day discharge	14 (10)	68 (70)	<0.0001
Recurrence	1 (0.7)	1 (1.1)	0.747257
Chronic pain	17 (12.3)	2 (2.2)	0.0079

VAS: Visual pain score

was detected between the two groups ($p=0.18$). The average VAS score measured at the sixth postoperative hour was 5.5 in Group A and 4.5 in Group B. Considering the number of patients with a VAS score of four and below in both groups, the number of patients in Group B was higher ($p=0.009$). Opioid requirement was found to be 61 in Group A and two in Group B. Opioid requirement was significantly reduced in Group B patients ($p<0.00001$). All patients were discharged on the same day or the next day. After the patients were checked at the evening visit, they were allowed to be discharged on the same day, depending on the patient's condition or at his/her own request. 77% of the patients in Group B were discharged on the same day. When Group A and B were compared, there was a significant superiority of patients in Group B who were discharged on the same day (Group A 14 patients, $p<0.00001$). Recurrence was detected in only two patients (1 patient in Group A and B). All patients were called for a check-up at least

six months later and questioned about pain or foreign body sensation in the groin. Findings considered as chronic pain were detected in a total of 19 patients. Seventeen of them were Group A patients and two were Group B patients. Patients with chronic pain in Group A were statistically significantly higher than those in Group B ($p=0.0079$). These findings are summarized in Table 2.

DISCUSSION

NBSA, a butyl polymer of cyanoacrylate, an acrylic resin, reacts in the presence of water, forming a bond within seconds and providing mesh fixation. Therefore, after application, the mesh must be fixed to the underlying tissue for at least 5-10 seconds. In laparoscopic hernia surgery, mesh fixation is a critical step of the procedure. Pain and doom area triangles are important anatomical regions in the total extraperitoneal hernia repair technique. The doom area triangle is a triangle bounded by the vas deferens, testicular vessels, and peritoneal fold. The importance of this triangle is that it covers major arteries and veins. The pain triangle includes the lateral femoral cutaneous nerve, the femoral branch of the genitofemoral nerve, and the femoral nerve. Avoiding these areas, especially when fixing the mesh with staples, is one of the most important steps of the surgery.

Otherwise, it may lead to complications such as chronic pain, major vascular injuries or nerve damage. Although the cause of chronic pain seen after surgery is not fully known in the literature, genitofemoral nerve, iliohypogastric nerve, and ilioinguinal nerve close to the surgery area, damage to the nerve and lateral cutaneous nerve of the thigh during dissection and accidental stapling are the most likely causes^{18,19}. In the literature, postoperative neuralgia is generally reported to be between 0.5-14%²⁰. In our study, chronic pain was seen in 8.4%. Most of the patients were in the staple group (Group A) and there was a statistically significant difference between them and the adhesive group (Group B). Chronic pain is an important factor in quality of life after laparoscopic hernia surgery. Many authors, who think that mesh fixation is associated with chronic pain, have tried to complete the surgery without fixing the mesh, especially by using wide meshes in extraperitoneal hernia repair, opening the dissection area widely, removing the air under vision after fully opening the mesh, and they have achieved a decrease in the incidence of chronic pain as well as showing that there was no difference in long-term complications such as recurrence²¹⁻²³.

Despite many studies conducted over many years, no conclusion has been reached as to what the mesh will be fixed with or even whether it will be fixed at all. In cases where the mesh is not fixed, some surgeons still have reservations about the possibility of the mesh shifting, folding, and consequently

increasing the likelihood of hernia recurrence in the long term²⁴. The negative effect of absorbable staples on chronic pain and the possibility of causing some serious complications have led surgeons to look for alternative methods, and the idea of non-mechanical fixation of the mesh using various adhesive materials has emerged. Many studies have begun to be carried out, such as cost calculations and its effect on chronic pain²⁵. Comparing cost-effectiveness is controversial, as is the issue of mesh fixation. Some studies also report that fibrin glues are expensive^{26,27}. Considering the fact that disposable absorbable staple guns are re-sterilized and used in underdeveloped and developing countries and reduce the cost, we think that adhesives are less costly in terms of material cost. However, it is another research topic that in common laparoscopic hernia surgeries, the cost is calculated not only on the materials used, but also on the basis of daily discharge, surgery time, anesthesia time, and feasibility of being performed at lower costs in medical centers²⁸. In our study, while there was a statistically positive difference in the tendency to be discharged on the same day in the adhesive group (Group B), there was no significant difference in surgery times. Inguinal hernia repair is one of the most frequently performed operations in general surgery. More than 20 million patients undergo inguinal hernia repair every year. There are many different approaches to treatment, with laparoscopy and, in recent years, even robotic surgery contributing to inguinal hernia repair. In 2018, the HerniaSurge community presented international recommendations for inguinal hernia in a study involving many experienced hernia surgeons. According to these recommendations, laparoscopic surgery for inguinal hernia is still performed at a rate of 55% even in developed countries, and there is no consensus on a standard surgical technique. According to the same recommendation, it is recommended not to use mesh in laparoscopic hernia repairs in almost all types of hernia, except for large defects. The HerniaSurge group has a consensus on mesh fixation in large defects and atraumatic fixation techniques (fibrin glue, cyanoacrylate) are recommended²⁹. In another study conducted by Novik et al.³⁰ in 2022, 25190 laparoscopic hernia surgeries were examined and recurrence was found to be high in the groups where mesh was not detected and adhesives were recommended for fixation. In the same study, it was shown that there was no difference in the effect of absorbable staples on relapse in both standard propylene meshes and light weight meshes compared to the adhesive group. As stated in extensive studies conducted in recent years, there is no fully accepted method in hernia surgery, and there is no standard for mesh fixation in laparoscopic hernias. In this study, we wanted to share in the Turkish literature the results of a surgeon with advanced laparoscopy experience, who used mesh absorbable staples and glue in laparoscopic total extraperitoneal hernia repair.

Study Limitations

This study has some strengths and limitations. The strength of our study is that all surgeries were performed by a single surgeon. One limitation is the retrospective design of the study. Prospective studies in which many variables will be examined in the future may provide more valuable results. Second, our sample size was relatively small.

CONCLUSION

In laparoscopic total extraperitoneal hernia repair, NBSA adhesive fixation is associated with lower pain scores in the acute phase compared to absorbable staple fixation. In addition, the ability to discharge patients in the same manner also reduces cost calculations. When chronic pain is examined, there is a significant statistical advantage in the adhesive group. There is no significant difference in both groups in terms of surgery times, complications, transition to oral nutrition and recurrence. Fixation of mesh with NBSA is a feasible and safe method in total extraperitoneal hernias.

Ethics

Ethics Committee Approval: In order to conduct the research, ethical approval was obtained from the Al Zahra Hospital Dubai (date: 11.07.2023, no: 14/301).

Informed Consent: Retrospective study.

Peer-review: Externally peer-reviewed.

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Video 1. Surgical view of fixation with absorbable staples and glue

<http://glns.co/x9ur4>