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ADVANCEMENT OF NON-TENSION HERNIA ALLOPLASTY TECHNIQUE FOR VENTRAL HERNIA TREATMENT IN OBESE PATIENTS

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Summary.

Ventral hernias remain one of the most prevalent and socially significant challenges in contemporary abdominal surgery. Patients with obesity present unique difficulties due to specific pathological anatomy, diminished tissue regenerative capacity, and an elevated risk of postoperative complications.

Objective. *To enhance the safety and efficacy of ventral hernia treatment in obese patients by optimizing the technical aspects of open non-tension hernia alloplasty.*

Materials and Methods. *This prospective study included 121 patients with ventral hernias and concurrent obesity treated surgically at the Samarkand Branch of the Republican Center for Emergency Medical Care from 2016 to 2025. Patients were allocated into two groups: a control group (54 patients) underwent hernioplasty using the Devlin method with Zhebrovsky's modification, while the primary group (67 patients) received a novel non-tension hernia alloplasty technique involving U-shaped suture fixation of the hernia defect edge and on-lay endoprosthesis placement. Preoperative preparation included cardiology and pulmonology consultations and pulmonary function tests Preoperative preparation included cardiology and pulmonology consultations and pulmonary function tests, including the Stange test, vital capacity, maximum voluntary ventilation, and other assessments. The novel technique involved meticulous tissue dissection and endoprosthesis fixation without aponeurotic tension to minimize organ injury and complications risk. All procedures were conducted in accordance with the World Medical Association's Declaration of Helsinki (2000 amendments).*

Results. *Postoperative complications occurred in 6 (8.9%) patients in the primary group versus 8 (14.8%) in the control group, demonstrating a statistically significant reduction with the novel technique (p=0.045). Complications included wound-related issues and bronchopulmonary complications, with rare cardiovascular events and one case of abdominal compartment syndrome in the control group. Gastrointestinal function was preserved in 119 (98.4%) patients. Long-term follow-up (1-5 years) in 98 (76.8%) patients showed no recurrences in the primary group, unlike the control group. Mean hospital stay was 7 days in both groups, with reduced pain and faster return to work in the primary group.*

Conclusions. *The novel non-tension hernia alloplasty technique, utilizing U-shaped sutures and on-lay endoprosthesis, proved highly effective in obese patients, significantly reducing postoperative complications and eliminating long-term hernia recurrence. This method minimizes surgical trauma, accelerates recovery, and improves clinical outcomes, offering a promising approach for managing ventral hernias in this high-risk population.*

Keywords: *Ventral Hernia; Obesity; Alloplasty; Non-Tension Hernia Alloplasty; On-Lay Endoprosthesis; Postoperative Complications; Recurrence.*

Introduction

Ventral hernias remain a prevalent and socioeconomically significant challenge in modern abdominal surgery [1-3]. Obese patients present unique challenges due to distinct pathological anatomy, impaired tissue regeneration, and an elevated risk of postoperative complications [4, 5]. Obesity markedly increases the likelihood of primary ventral hernia development and recurrence after surgical repair, driven by excessive mechanical stress on the anterior abdominal wall, metabolic dysfunction, associated comorbidities, and a higher incidence of postoperative complications [6-8].

Evidence suggests that hernia recurrence rates following repair are significantly higher in obese patients compared to those with normal body mass index, necessitating advancements in surgical techniques, optimization of repair methods, and improved mesh fixation strategies [9-11]. Although open hernia repair with synthetic mesh is widely utilized, further refinement of these techniques is essential to minimize surgical trauma, reduce infection risk, and prevent wound dehiscence, particularly in obese patients where operative wounds endure amplified mechanical stress [12-14].

Contemporary surgical practice emphasizes non-tension repair techniques that preserve tissue integrity while enhancing mesh fixation reliability. This is critical for obese patients, who are at heightened risk of postoperative wound infection, seroma formation, and hernia recurrence [15, 16]. Increasingly, a multidisciplinary approach incorporating bariatric surgery is recognized as valuable, as weight reduction decreases intra-abdominal pressure, creating optimal conditions for successful hernia repair and improved quality of life [17-19].

The need to refine open non-tension hernia alloplasty techniques for obese patients is driven by the imperative to enhance surgical safety and efficacy, reduce recurrence and complication rates, and develop tailored approaches that address the unique characteristics of this population. This endeavor carries both clinical and socioeconomic significance, improving patient outcomes and reducing healthcare costs associated with complex ventral hernia management.

The objective of this study is to enhance surgical outcomes for ventral hernia repair in obese patients by optimizing the technical aspects of hernia alloplasty.

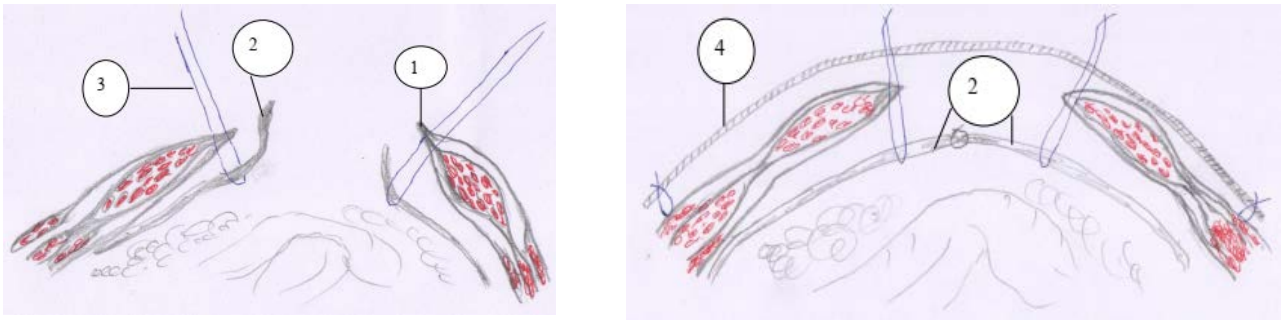
Materials and Methods. This prospective study evaluated 121 patients with ventral hernias and concurrent obesity who underwent surgical intervention at the surgical department of the Samarkand Branch of the Republican

Center for Emergency Medical Care from 2016 to 2025. Patients were treated in both emergency and elective settings and were allocated into two groups based on the surgical technique employed. The control group consisted of 54 patients who underwent open ventral hernia repair using the Devlin method with Zhebrovsky's modification. The primary group included 67 patients who underwent a novel non-tension hernia alloplasty technique developed by our team. All procedures were conducted in accordance with the World Medical Association's Declaration of Helsinki (2000 amendments).

Preoperative preparation included consultations with a cardiologist and pulmonologist, along with standardized pulmonary function tests, including the Stange test, respiratory rate, tidal volume, minute ventilation, vital lung capacity, and maximum voluntary ventilation.

The Devlin method with Zhebrovsky's modification has notable limitations. During mesh fixation, needle insertion occurs above the mesh, capturing the aponeurosis at the hernia defect edge without direct visualization, posing a significant risk of inadvertent perforation of underlying hollow organs beneath the aponeurosis and peritoneum.

To mitigate this risk, we developed a novel non-tension hernia alloplasty technique designed to prevent iatrogenic injury to intra-abdominal structures. The procedure involves the following steps: after exposing the peritoneum adjacent to the hernia defect and dissecting the aponeurosis 5 cm from its edge, the hernia sac edge is secured with U-shaped sutures prior to defect closure, with the number of sutures determined by the defect size (Figure 1a). The abdominal cavity is then closed using the peritoneum or hernia sac wall without suturing the aponeurosis. A polypropylene mesh is fixed to the pre-placed U-shaped sutures at the hernia defect edge using the on-lay technique and further secured to the aponeurosis with interrupted sutures placed 5 cm from the defect edge (Figure 1b).



a. **b.**

Figure 1. Non-tension hernia alloplasty technique for postoperative ventral hernias.

a. *1-edge of the hernia defect (aponeurosis); 2-parietal peritoneum or hernia sac wall; 3-pre-placed U-shaped suture;*
b. *2-parietal peritoneum or hernia sac wall; 4-polypropylene mesh, applied using the on-lay technique.*

Results

Optimization of the surgical technique for ventral hernia repair significantly improved immediate postoperative outcomes in this cohort. Gastrointestinal function was preserved in 119 (98.4%) patients postoperatively. Transient intestinal paresis occurred in 2 (1.6%) patients (one per group), and 1 (0.8%) patient in the control group experienced urinary retention, which resolved with medical management.

Bronchopulmonary complications were observed in 3 (2.5%) patients. Abdominal compartment syndrome developed in 1 (1.8%) patient in the control group, necessitating prolonged mechanical ventilation and respiratory training, which was successfully managed conservatively. Cardiovascular complications occurred in 2 (1.6%) patients. Both bronchopulmonary and cardiovascular complications were associated with abdominal compression from repair of large ventral hernias. Wound-related complications included postoperative hematomas in 2 (3.7%) control group patients and 1 (1.5%) primary group patient; seromas in 2 (3.7%) control group patients and 1 (1.5%) primary group patient; lymphorrhea in 3 (2.5%) patients (2 control, 1 primary); wound infection in 1 (1.8%) control group patient; and skin flap necrosis in 2 (3.7%) control group patients and 1 (1.5%) primary group patient.

In the control group, patients with complications often experienced multiple concurrent issues (2-3), combining bronchopulmonary and/or cardiovascular complications with wound-related complications. Overall, complications occurred in 8 (14.8%) of 54 control group patients, with 6 (11.1%) experiencing wound-related complications and 4 (7.4%) systemic extra-abdominal complications (Figure 2).

In contrast, the primary group had complications in 6 (8.9%) of 67 patients, with 3 (4.5%) wound-related and 3 (4.5%) systemic complications. The reduction in complication rates in the primary group was statistically significant (χ^2=4.043; df=1; p=0.045).

Long-term outcomes were evaluated in 98 (76.8%) of the 121 obese patients surgically treated for ventral hernias, with follow-up ranging from 1 to 5 years. Assessments included detailed questionnaires and outpatient or inpatient examinations.

The novel non-tension technique, incorporating pre-placed U-shaped sutures at the hernia defect edge, eliminated hernia recurrence in the primary group, while recurrences were observed in the control group.

Overall, the novel technique for preventing and treating ventral hernias in obese patients, incorporating pre-placed U-shaped sutures at the hernia defect edge, enabled the elimination of relapse cases.

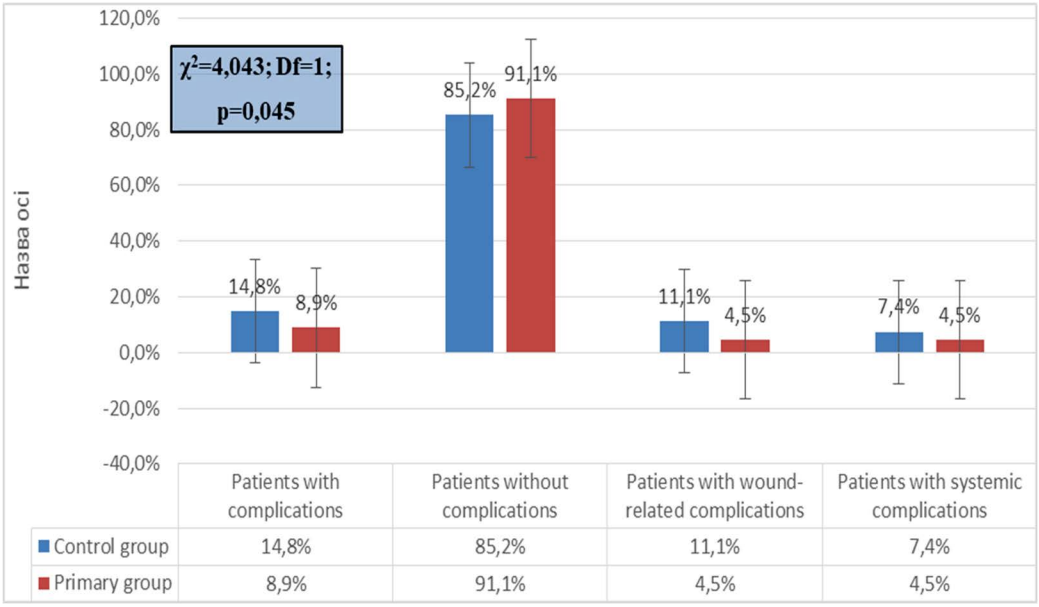


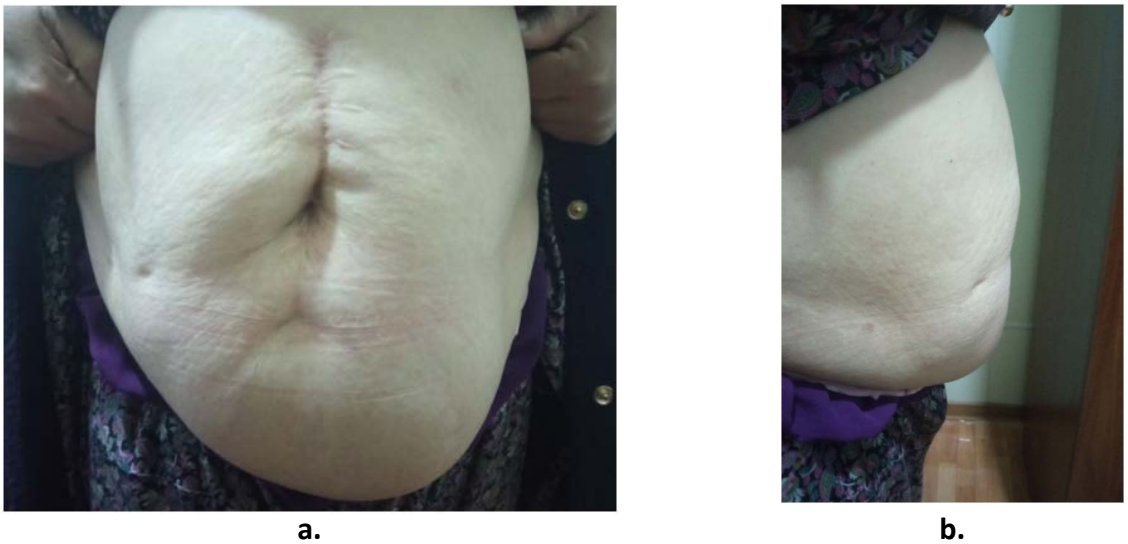
Figure 2. Distribution of complication frequency after ventral hernia repair

Clinical Case

A 50-year-old female patient, R. (medical record number 3298/276), was admitted to the surgical department of the Samarkand Branch of the Republican Scientific Center for Emergency Medical Care on March 3, 2024, presenting with a hernia protrusion along the linea alba above the umbilicus, intermittent abdominal distension, and pain during physical exertion.

Her medical history indicated that the hernia protrusion first appeared 8 years earlier. In 2020, she underwent ventral hernia repair at a local facility, but the hernia recurred within 1 year and progressively enlarged over time.

On palpation in the standing position, a 12×10 cm hernia protrusion was identified along the midline of the anterior abdominal wall above the umbilicus (Figure 3). The hernia was soft, elastic, and painless. On palpation in the supine position, it partially reduced into the abdominal cavity. The precise dimensions of the hernia defect could not be determined preoperatively. The patient's condition on admission was satisfactory, with grade III obesity noted. Vital signs included a regular pulse of 80 beats per minute with adequate filling and a blood pressure of 160/100 mmHg. The abdomen was enlarged due to a substantial subcutaneous fat layer.



a. **b.**

Figure 3. Preoperative patient appearance in anterior (a) and lateral (b) views

Clinical Diagnosis: Irreducible recurrent ventral hernia (W2, M1, R1), grade III obesity.

On March 9, 2024, after 6 days of preoperative preparation, the patient underwent herniolaparotomy followed by hernia alloplasty with implantation of an on-lay endoprosthesis without suturing the defect (non-tension hernia alloplasty). Following preparation of the surgical field, the hernia sac was isolated and opened. An altered portion of the greater omentum was resected. The hernia defect measured 10×8 cm. The peritoneum adjacent to the defect was exposed, and the aponeurosis was dissected 5 cm from its edge. The hernia defect edge was secured with 8 U-shaped sutures. The abdominal cavity was closed using the hernia sac wall without aponeurotic suturing. A polypropylene

mesh was fixed to the pre-placed U-shaped sutures using the on-lay technique and further secured to the aponeurosis with interrupted sutures placed 5 cm from the defect edge.

Figure 4. Redon drainage

The supra-mesh area was drained using a Redon drain (Figure 4), and the skin was closed with interrupted sutures (Figure 5).

Figure 5. Skin sutures.

Postoperatively, up to 10 mL of serous fluid was drained daily via the Redon drain. Drainage ceased by postoperative day 5, and follow-up ultrasound confirmed no fluid accumulation in the subcutaneous fat layer, permitting drain removal. The patient was discharged on postoperative day 7.

Discussion

A key advantage of the proposed non-tension ventral hernia repair technique is the reduction of tissue trauma through meticulous dissection and precise placement of U-shaped sutures along the hernia defect edges. This approach minimizes the risk of injury to adjacent structures, such as intestinal loops, thereby reducing intraoperative and postoperative complications [20]. Robust mesh fixation, achieved by anchoring the polypropylene mesh to the defect edges with U-shaped sutures and additional interrupted sutures to the aponeurosis, ensures stable mesh positioning and significantly lowers the risk of recurrence [21]. Additionally, by eliminating aponeurotic tension, the technique reduces the potential for microbial contamination, decreasing the incidence of postoperative wound infections. The non-tension approach promotes physiological restoration of the anterior abdominal wall, avoiding excessive pressure on surrounding tissues. This reduces the likelihood of postoperative defect formation and mitigates early postoperative pain. The secure placement of the mesh at an adequate distance from the defect edges further enhances long-term stability, minimizing recurrence risk. Collectively, these features contribute to accelerated wound healing, reduced postoperative rehabilitation time, and shorter hospital stays, facilitating a faster return to work and daily activities.

Conclusions

This study demonstrates the superior efficacy of a novel non-tension ventral hernia alloplasty technique in obese patients with ventral hernias. The use of U-shaped sutures for hernia defect edge fixation, combined with on-lay mesh placement, significantly reduced postoperative complications. Complications occurred in 6 (8.9%) of 67 patients in the primary group compared to 8 (14.8%) of 54 patients in the control group (χ^2=4.043; df=1; p=0.045), confirming the technique's enhanced safety profile and reduced adverse outcomes.

The technique also eliminated ventral hernia recurrence in the primary group during long-term follow-up (1-5 years), underscoring the reliability of mesh fixation and effective restoration of anterior abdominal wall integrity. In contrast, recurrences were observed in the control group, indicating limitations in the conventional Devlin method with Zhebrovsky's modification. This

advantage is particularly significant for obese patients, who are predisposed to hernia recurrence due to tissue characteristics and comorbidities.

Overall, the proposed non-tension ventral hernia alloplasty technique reduces surgical trauma and infectious complications while accelerating recovery. Decreased hospital stay duration and reduced postoperative pain enable a faster return to active life. Adoption of this technique in clinical practice offers substantial potential to improve outcomes for obese patients with ventral hernias, enhancing quality of life and reducing healthcare costs associated with treatment and rehabilitation.

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НЕОНАТОЛОГІЯ, ХІРУРГІЯ ТА ПЕРИНАТАЛЬНА МЕДИЦИНА
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ПРОГРЕС У ТЕХНІЦІ АЛОПЛАСТИКИ БЕЗ НАПРУЖЕННЯ ДЛЯ ЛІКУВАННЯ ВЕНТРАЛЬНИХ ГРИЖ У ПАЦІЄНТІВ З ОЖИРІННЯМ

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Резюме.

Вентральні грижі залишаються однією з найпоширеніших і соціально значущих проблем у сучасній абдомінальній хірургії. Пацієнти з ожирінням представляють особливі труднощі через специфічну патологічну анатомію, знижену регенеративну здатність тканин і підвищений ризик післяопераційних ускладнень.

Мета. Підвищити безпеку та ефективність лікування вентральних гриж у пацієнтів з ожирінням шляхом оптимізації технічних аспектів відкритої безнатяжної алопластики гриж.

Матеріали та методи. У цьому проспективному дослідженні взяли участь 121 пацієнт з вентральними грижами та супутнім ожирінням, які були прооперовані у Самаркандському відділенні Республіканського центру невідкладної медичної допомоги у період з 2016 по 2025 рік. Пацієнтів розподілили на дві групи: контрольна група (54 пацієнти) перенесла герніопластику за методом Девліна з модифікацією Жебровського, а основна група (67 пацієнтів) отримала нову техніку безнапружної герніопластики з фіксацією краю дефекту грижі U-подібним швом і накладенням ендопротеза. Передопераційна підготовка включала консультації кардіолога та пульмонолога, а також тести функції легень. Передопераційна підготовка включала консультації кардіолога та пульмонолога, а також тести функції легень, включаючи тест Стенджа, життєву ємність легенів, максимальну добровільну вентиляцію та інші оцінки. Нова техніка передбачала ретельне розсічення тканин та фіксацію ендопротеза без апоневротичного натягу, щоб мінімізувати ризик пошкодження органів та ускладнень. Всі процедури проводилися відповідно до Гельсінської декларації Всесвітньої медичної асоціації (поправки 2000 року).

Результати. Післяопераційні ускладнення виникли у 6 (8,9%) пацієнтів у первинній групі проти 8 (14,8%) у контрольній групі, що свідчить про статистично значуще зменшення при застосуванні нової техніки (p=0,045). Ускладнення включали проблеми, пов'язані з раною, та бронхолегеневі ускладнення, з рідкісними серцево-судинними подіями та одним випадком синдрому абдомінального компартменту в контрольній групі. Шлунково-кишкова функція була збережена у 119 (98,4%) пацієнтів. Довгострокове спостереження (1-5 років) за 98 (76,8%) пацієнтами показало відсутність рецидивів у первинній групі, на відміну від контрольної групи. Середня тривалість перебування в лікарні становила 7 днів в обох групах, при цьому в первинній групі спостерігалося зменшення болю та швидше повернення до роботи.

Висновки. Нова техніка алопластики грижі без натягу, що використовує U-подібні шви та накладний ендопротез, виявилася високоефективною у пацієнтів з ожирінням, значно зменшивши післяопераційні ускладнення та усунувши довгострокові рецидиви грижі. Цей метод мінімізує хірургічну травму, прискорює одужання та покращує клінічні результати, пропонуючи перспективний підхід до лікування черевних гриж у цій групі високого ризику.

Ключові слова: черевна грижа; ожиріння; алопластика; алопластика грижі без натягу; ендопротез; післяопераційні ускладнення; рецидив.

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