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A CASE REPORT: ABDOMINAL WALL RECONSTRUCTION FOR A THIRD-TIME RECURRENT GIANT VENTRAL HERNIA WITH LOSS OF DOMAIN

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Introduction. Giant ventral hernias with loss of domain (LoD) pose significant challenges in abdominal surgery due to irreducibility, scar tissue, and the risk of abdominal compartment syndrome. According to the European Hernia Society (EHS) giant hernias are defined as defects > 10 cm. Traditional hernioplasty methods without tissue preparation are associated with high recurrence rates (30–80%)

Aim. To present a case of successful abdominal wall reconstruction in a patient with a three-times recurrent giant ventral hernia with LoD using a combined approach involving botulinum toxin injections, progressive pneumoperitoneum, bone anchor fixation, two polypropylene meshes, and to evaluate the effectiveness of this method.

Materials and methods. The case involved a 69-year-old female patient with a giant third time recurrent ventral hernia with a defect size 30×35 cm classified as W3 M3 R with LoD. Methods included anamnesis history collection, physical examination, preoperative and 6-month postoperative CT control, intraoperative photo documentation. Preoperative preparation involved weight loss, lateral abdominal muscle relaxation with Dysport (botulinum toxin A) and progressive pneumoperitoneum. Intraoperational implantation of two Covidien Parietene 30×45 cm macroporous meshes and Smith & Nephew 4×8 mm titanium bone anchors. Procedures adhered to the ethical principles of the World Medical Association (Helsinki Declaration), with informed consent obtained.

Conclusions. The combined approach achieved stable abdominal wall reconstruction without recurrence over 6 months. Botox, pneumoperitoneum, TAR, and two mesh implants with bone anchors proved effective for complex hernias, though further studies are needed for long-term validation.

Keywords: ventral hernia, loss of domain, botulinum toxin, pneumoperitoneum, mesh implant.

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КЛІНІЧНИЙ ВИПАДОК: РЕКОНСТРУКЦІЯ ЧЕРЕВНОЇ СТІНКИ ПРИ ВТРЕТЄ РЕЦИДИВУЮЧІЙ ГІГАНТСЬКІЙ ВЕНТРАЛЬНІЙ КИЛІ З ВТРАТОЮ ДОМЕНУ

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Вступ. Гігантські вентральні кили з втратою домену (LoD) є складною проблемою абдомінальної хірургії з високим рівнем ускладнень і рецидивів у традиційній герніопластиці (30–80 %).

Мета – показати успішну реконструкцію черевної стінки у 69-річної пацієнтки з грижею з втретє рецидивуючою гігантською вентральною килою W3 M3 R з LoD із застосуванням ботулотоксину, пневмоперитонеуму, кісткових анкерів та двох поліпропіленових сіток і сепарацією заднього компонента, оцінити ефективність підходу.

Висновки. Комбінований підхід забезпечив стабільну реконструкцію черевної стінки. Ця методика виявилися ефективною, хоча для довгострокової перевірки потрібні подальші дослідження.

Ключові слова: вентральна кила, втрата домену, ботулотоксин, пневмоперитонеум, сітчастий імплант.

Introduction

Giant ventral hernias with loss of domain (LoD) represent a significant challenge in abdominal surgery due to the extensive defect in the abdominal wall and the inability to reduce hernia contents without preparatory measures [1]. Repeated recurrences following surgical interventions complicate treatment due to scar tissue formation, adhesions, and the risk of abdominal compartment syndrome [2]. Traditional hernioplasty techniques using mesh without adequate tissue preparation

are associated with a high recurrence rate (30–80%) [3]. Developing combined approaches for stable reconstruction remains a pressing issue in modern surgery.

The aim of this study is to describe a clinical case of successful abdominal wall reconstruction in a patient with a third-time recurrent giant ventral hernia with LoD using a combination of botulinum toxin injections, progressive pneumoperitoneum, bone anchor fixation, and double-layered polypropylene mesh, and to evaluate the effectiveness of this approach.

Materials and Methods

The study material was a clinical case of a 69-year-old female patient with a giant thrice-recurrent postoperative ventral hernia classified as W3 M3 R according to the European Hernia Society [4]. with Loss of Domain (LoD). Data collection included medical history, physical examination, preoperative and 6-month postoperative computed tomography (CT) imaging, and intraoperative photo documentation. Preoperative preparation involved relaxation of the lateral abdominal wall muscles using Dysport (botulinum toxin A) and progressive pneumoperitoneum. Intraoperative procedures included the placement of Covidien Parietene macroporous mesh implants (30×45 cm) and Smith & Nephew titanium bone anchors (4×8 mm).

All procedures were performed in accordance with the ethical principles of the World Medical Association (Helsinki Declaration), with informed consent obtained from the patient prior to treatment.

Clinical case

A 69-year-old patient complained of periodic cramping pain of varying intensity in the abdominal cavity, which worsened with habitual physical exertion and after eating, frequent episodes of vomiting, back pain that limited physical activity and the presence of a giant painful irreducible protrusion of the anterior abdominal wall.

Objectively: height 165 cm, weight 98 kg, BMI 36 kg/m² (Fig. 1). Presented with a giant irreducible recurrent incisional ventral hernia, which occupied most of the anterior abdominal wall.

Fig 1. Preoperative Appearance of the Patient Before Weight Loss

Medical history: in 2004 – urgent surgery for rupture of an ovarian cyst, after which a ventral hernia developed. In 2007 – hernioplasty (recurrence after 1 year). In 2010 – second hernioplasty (recurrence after 6 months). In 2014 – third hernioplasty (recurrence on the first postoperative day). According to the patient, previous operations were performed using mesh implants. No medical documentation available.

A computed tomography scan was performed. According to the CT scan, the size of the hernial defect was 22×20 cm. The measurements of the defect were made from the most distant points of the defect in the longitudinal and transverse directions.

The patient was clinically diagnosed with a giant incisional recurrent ventral hernia of the white line W3 M3 R [4] according to the European Hernia Society classification with Loss of Domain.

The chosen tactic was herniolaparotomy with abdominal exploration, retromuscular hernioplasty with two polypropylene mesh implants using the posterior component separation transversus abdominis muscle release method and fixation of the implants with titanium anchor screws to the spina iliaca anterior superior, with combined preoperative preparation, which included the injection of botulinum toxin type A into the lateral muscles of the abdominal wall and progressive pneumoperitoneum with a gradual increase of intra-abdominal pressure and stretching of the abdominal wall muscles.

LoD was assessed using the Sabbagh and Tanaka indices [5, 6]. Measurements as shown on (Fig. 2):

• Wih (hernia sac width) = 23.7 cm, Hih (height) = 32.14 cm, Dih (depth) = 14.33 cm;

• Wac (abdominal cavity width) = 21.9 cm, Hac (height) = 38.29 cm, Dac (depth) = 8.64 cm.

$$Vh = \frac{Wih \times Hih \times Dih}{2} - hernia\ sac\ volume$$

$Vac = Wac \times \mathrm{Hac} \times \mathrm{Dac}$ – abdominal cavity volume

$$Lod = \frac{Vh}{Vh + Vac} \times 100\%$$

2. Tanaka Formula:

$$LoD = \frac{Vh}{Vac}$$

Interpretation: According to Sabbagh, LoD = 42.96% indicates a significant loss of domain (>20%), which requires preparatory measures [5]. According to Tanaka, LoD = 0.75 also confirms a high degree of abdominal volume loss [6].

Preoperative Preparation

Over one month, the patient lost 5 kg (weight 93 kg, BMI 34.2 kg/m²) through diet and exercise. One month later, the first stage commenced with botulinum toxin administration. Under sedation, 300 units of botulinum toxin A (Dysport) dissolved in 200 mL of 0.9% NaCl was injected into the external oblique, internal oblique, and transversus abdominis muscles along the anterior axillary line at three points on each side of the trunk (approximately 11 ml for each injection) under ultrasound guidance, following the protocol by Ibarra-

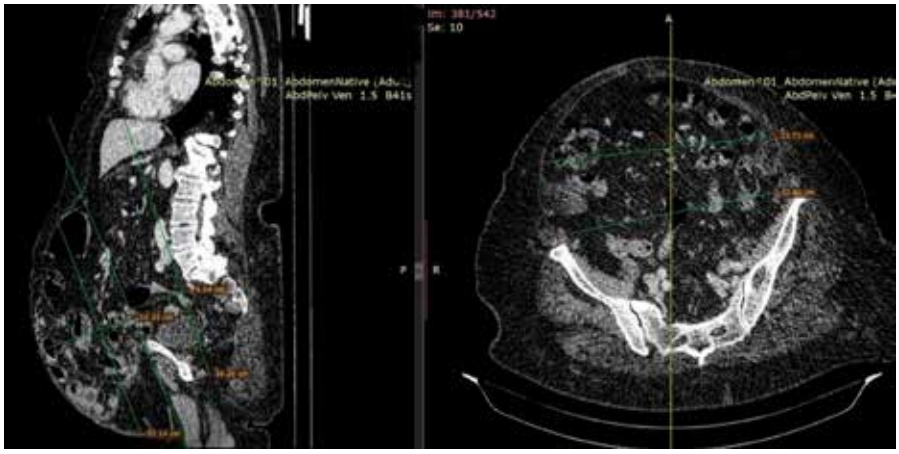

Fig. 2. CT with Measurements of the Hernia Defect Before Preparation Calculation of Loss of Domain (LoD) Before Preparation

Hurtado [7]. The patient was discharged a few hours post-procedure.

After 28 days, when the botulinum toxin effect peaked (maximum effect at 3–4 weeks, as confirmed by Timmer et al. [8; 9]), progressive pneumoperitoneum was initiated. Under general anesthesia, a subclavian catheter was inserted at Palmer's point (2 cm below the left costal margin on the midclavicular line) into the abdominal cavity (Fig. 3) and 600 mL of free atmospheric air was insufflated in a single session per the protocol by Subirana et al. [10]. Daily insufflation of atmospheric air using a sterile Janet syringe continued until mild discomfort was reported, with total volume of 6000 mL of air insufflated at day 10, when further pneumoperitoneum became untorelable.

On day 10, a repeat CT was performed: (photo 4)

Wih = 20.83 cm, **Hih** = 32.06 cm, **Dih** = 16.78 cm;

Wac = 25.51 cm, **Hac** = 34.78 cm, **Dac** = 8.63 cm.

LoD After Preparation: According to Sabbagh and Tanaka, LoD was calculated as 42.66% and 0.74 respectively.

Interpretation and Comparison: According to Sabbagh, the percentage of LoD decreased from 42.96% to 42.66% by 0.3% is insignificant. According to Tanaka, the LoD decreased from 0.75 to 0.74 by 0,1, which is also insignificant in numerical terms. However, a comparative analysis of CT before preparation and after the introduction of botulinum toxin and progressive pneumoperitoneum visualized a qualitative change in the contents of the hernial sac, which consisted mainly of air, and most of the small intestine relocated back to the abdominal cavity (Fig. 4).

Surgical Intervention

The patient underwent surgery on day 10 of pneumoperitoneum. In the operating room, an anesthesiologist placed an epidural catheter for intraoperative and postoperative analgesia. Under general anesthesia, the surgical field was prepped with Cutasept solution three times and covered with an Ioban 3M antibacterial film. A midline incision was made from just below the xiphoid process to the suprapubic region, exposing the skin and subcutaneous

Fig. 3. Inserted catheter for progressive pneumoperitoneum

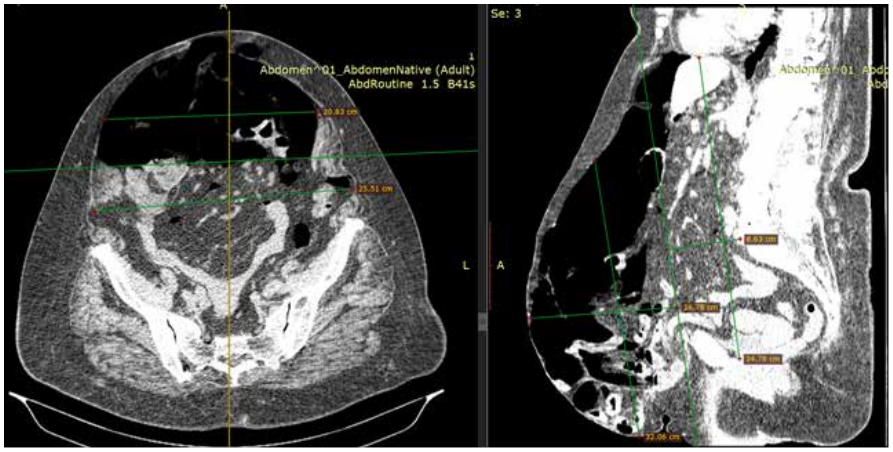

Fig. 4. CT After botulinum toxin injections and 10 days of progressive pneumoperitoneum

fat. A multicameral hernia sac was fully dissected from the subcutaneous tissue, with aponeurotic tissue of the hernia defect identified. After complete dissection final size of a hernia defect was measured as 30×35 cm (Fig. 5), which differs from the 22×20 cm measurements we got on the CT scan. Herniolaparotomy was performed, preserving the hernia sac and its attachments to the lateral edges of the hernia defect. The contents included viable but fibrotically altered small bowel loops with strangulation grooves from repeated incarcerations, areas of pathological dilatation and stenosis, and weak peristalsis. Several smaller hernia sacs were identified, with small bowel loops adhered to their bases. Fragments of mesh implants from prior surgeries, resembling onlay or inlay placement, were visualized within the disrupted aponeurotic tissue. An intense intra-abdominal adhesive process was noted. Adhesiolysis was performed. Approximately 50 cm of injured small bowel was resected, including a segment intimately fused with a previously placed mesh implant. An end-to-end entero-enteroanastomosis was constructed 50 cm proximal to the ileocecal junction using double-row interrupted Vycril 3-0 sutures.

Retromuscular dissection of both rectus abdominis muscles was performed per the Rives-Stoppa technique, preserving the hernia sac tissue attachments to the posterior sheath of the right rectus abdominis and the anterior sheath of the left rectus abdominis. Bilateral posterior component separation with transversus abdominis release (TAR) was conducted by transecting the transversus abdominis muscle fibers at the linea semilunaris, as described by Novitsky [11].

Dissection extended from the subxiphoid space and diaphragm in both subcostal regions distally, with pretransverse dissection laterally to visualize the *m. iliopsoas* bilaterally. The extraperitoneal portions of the round ligaments of the uterus were transected bilaterally to facilitate pelvic dissection. The Retzius space was dissected 4 cm below the pubic bone, exposing both Cooper's ligaments, Bogros spaces, and iliac vessels. Minor peritoneal defects were closed with Monocryl 4-0 sutures. The central defect of the posterior sheath was closed with a running PDS 2-0 suture.

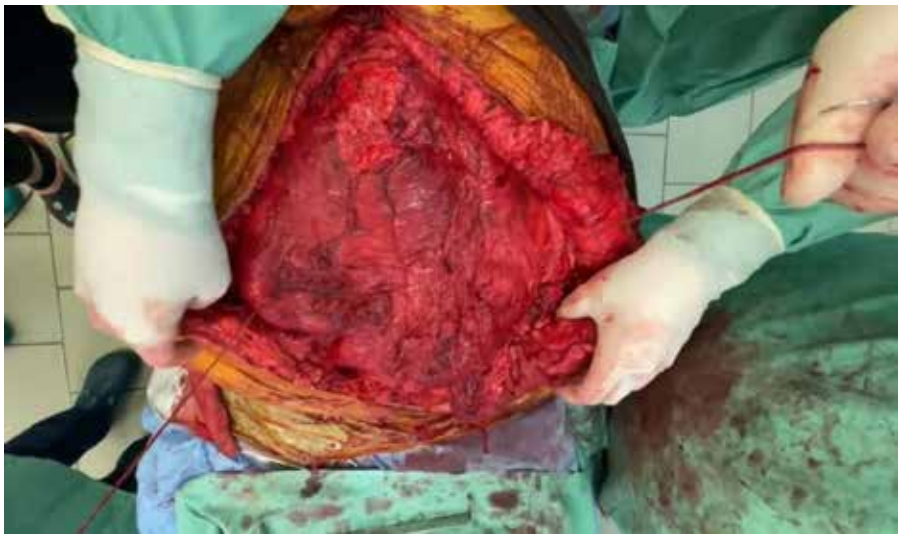

Fig. 5. Size of hernia defect after Posterior component separation Transversus abdominis muscle release. Titanium anchor screws installed in the spina iliaca anterior superior

Using blunt dissection, the anterior superior iliac spines were identified and visualized bilaterally, where one titanium bone anchor screw (Smith & Nephew, 4×8 mm) with attached reinforced sutures was placed on each side.

A Covidien Parietene mesh (30×45 cm) was positioned longitudinally, extending from 4 cm proximal to the xiphoid process to 3 cm below the pubic bones. The mesh was fixed with two PDS 2-0 sutures to Cooper's ligaments and several Vycril 0 sutures to the aponeurotic tissues near the xiphoid process. A second Covidien Parietene mesh (30×45 cm) was placed transversely, perpendicular to the first, creating a double-layered polypropylene coverage in the central defect area, where bridging was most likely and additional strength and structural support were required. Laterally, the mesh extended to both m. iliopsoas muscles. Both meshes were secured to the bone anchors in a single position (Fig. 6). The meshes were further sutured with interrupted Prolene 2-0 stitches at multiple points.

The 30×35 cm aponeurotic defect could not be fully reapproximated due to excessive tissue tension and the risk of elevated intra-abdominal pressure. The aponeurotic tissues along the periphery were gradually sutured to the meshes with interrupted Prolene 0 stitches at several points, followed by a running Maxon 1 suture along the entire bridging perimeter.

A central bridging area of 20×5 cm was created. The lower portion of the mesh was partially covered with hernia sac tissues, whose connection to the anterior sheath of the left rectus muscle was preserved (Fig. 7).

The retromuscular space and Retzius space were drained bilaterally with ative drains, and the space above the mesh was drained with an active drain. The subcutaneous fat was closed with Vycril 0 sutures, eliminating dead space. Skin sutures and an antiseptic dressing were applied.

Research results and their discussion

The postoperative course was consistent with the complexity of the procedure. Patient mobilization began on postoperative day 3. Active retromuscular drains and the Retzius space drain were removed on days 5 and 7,

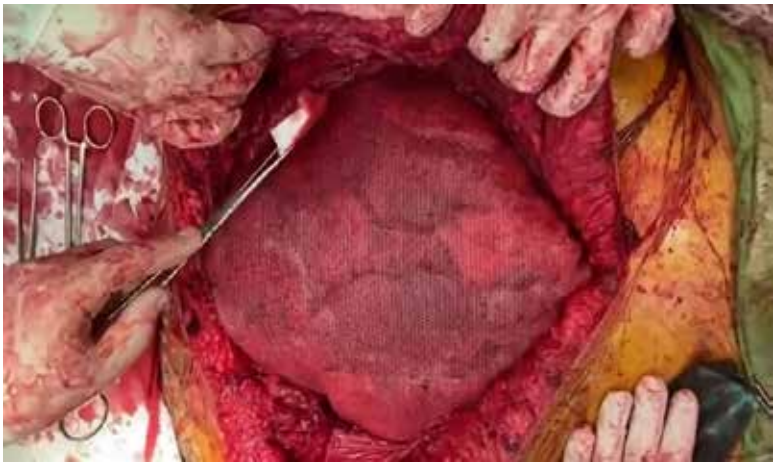

Fig. 6. Two 30x45 cm mesh implants in a cross position

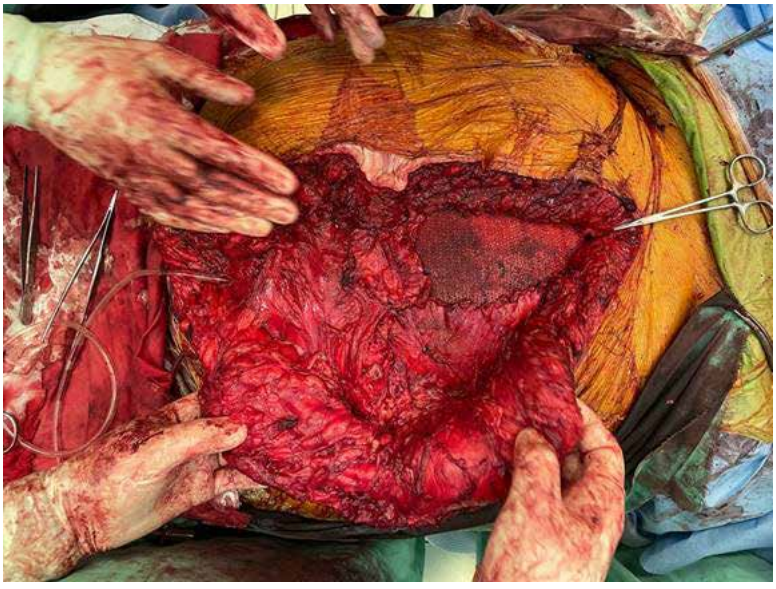

Fig. 7. Final level of reapproximation of the aponeurotic tissues of the anterior sheath of the repair

respectively. The subcutaneous drain was removed on day 8. The patient was discharged on day 9. On postoperative day 14, the patient presented with a seroma in the central portion of the surgical scar. The seroma (approximately 100 mL) was widely opened, inspected, and managed with a negative pressure wound therapy (NPWT) system for 10 days, with three dressing changes prior to wound closure.

All symptoms (pain, vomiting, discomfort) resolved completely post-surgery. A CT scan at 6 months confirmed full abdominal wall reconstruction, with muscles restored to their typical anatomical positions and no recurrence (Fig. 8).

The application of a combined approach involving botulinum toxin injections, progressive pneumoperitoneum, TAR technique, and two 30×45 cm macroporous polypropylene meshes in the described clinical case enabled stable abdominal wall reconstruction for a third-time recurrent giant ventral hernia with loss of domain (LoD). This outcome aligns with findings by Novitsky et al. [11], who highlight the efficacy of TAR for large abdominal wall defects. However, our experience suggests that preoperative tissue preparation with botulinum toxin and pneumoperitoneum was a pivotal factor in achieving success. Relaxation of the lateral abdominal muscles with Dysport significantly facilitated the reapproximation of the hernia defect tissues, reducing the risk of excessive tissue tension. Compared to the study by Ibarra-Hurtado et al. [7], where botulinum toxin was used as a standalone preparatory step, we found that adding progressive pneumoperitoneum enhanced the abdominal cavity's adaptation to the hernia sac contents. In our case, insufflating 6000 mL of air over 10 days not only stretched the tissues but also allowed partial visceral reduction prior to surgery, as evidenced by post-preparation CT imaging. This observation partly echoes Subirana et al. [10], where their emphasis was on gradual air insufflation.

The use of two polypropylene meshes fixed to bone anchors provided additional strength to the reconstruction, particularly in the central bridging zone (20×5 cm). We consider this technique to be a solution to the issue of the inability to achieve complete aponeurotic reapproximation and the consequent need for bridging. In contrast to traditional methods described by Bhardwaj et al. [3], which report recurrence rates of 30–80%, our approach showed no recurrence over 6 months, offering grounds for optimism. Nevertheless, the occurrence of a seroma on postoperative day 14 highlights the need to refine drainage techniques or postoperative care, potentially through broader use of negative pressure wound therapy systems.

This case highlights the importance of a comprehensive approach to giant hernias with LoD. In our opinion, future studies should focus on optimizing the amount of pneumoperitoneum and the duration of preparation, as well as comparing different types of mesh implants in similar scenarios. Our experience suggests that personalized tissue preparation may become the standard for such complex reconstructions.

Conclusions

This clinical case is an example of the effective use of a combined approach for abdominal wall reconstruction in a complex case of a third recurrent giant ventral hernia with loss of domain (LoD). The significant size of the defect (30×35 cm) and the history of unsuccessful previous surgical interventions using mesh implants are a difficult challenge for surgeons. The use of botulinum toxin injections allowed significant relaxation of the lateral muscles of the abdominal wall, which made it possible to reduce tissue tension before surgery. Progressive pneumoperitoneum gradually expanded the volume of the abdominal cavity, preparing it for the relocation of internal organs without excessive pressure. The use of the TAR (Transversus Abdominis Release) technique became a key stage of the operation, as it allowed to mobilize tissues and provide sufficient coverage of the defect. For additional strength, two polypropylene meshes were used, which were securely fixed with bone anchors, which ensured the stability of the structure. The postoperative period was complicated by the formation of a subcutaneous seroma, but thanks to the use of the NPWT system, this problem was eliminated without a negative impact on the outcome. Within 6 months after surgery, no hernia recurrence was observed, which indicates the effectiveness of the approach. This case highlights the importance of

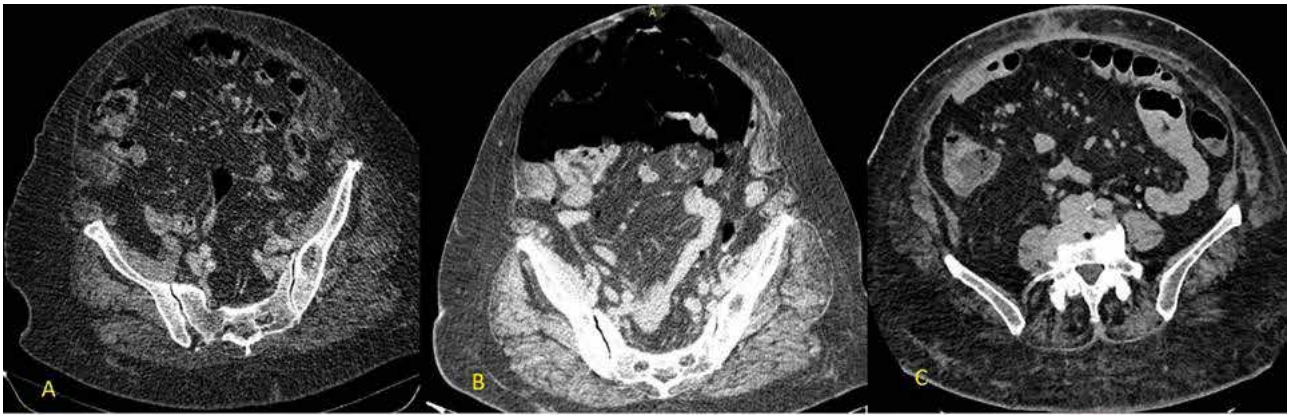

Fig. 8. Comparison of CT scans at three stages: A) before preparation B) after Botox with progressive pneumoperitoneum and C) 6 months after abdominal wall reconstruction

individual planning and combining modern methods to achieve success in the treatment of complex hernias. However, to generalize these findings, larger clinical studies with a larger number of patients and a longer follow-up period are needed to confirm the reliability and safety of this method in the long term.

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