ORIGINAL ARTICLE

CONTENTS

The use of botulinum toxin type a to prepare patients with large ventral hernias for laparoscopic hernioplasty: Our experience

Tetiana V. Tarasiuk [1], Oleksandr Yu. Ioffe [1], Oleksandr M. Chukanov [2], Mykola S. Kryvopustov [1], Oleksandr P. Stetsenko [1]

[1] BOGOMOLETS NATIONAL MEDICAL UNIVERSITY, KYIV, UKRAINE

[2] LIFESCAN-CLINIC, KYIV, UKRAINE

ABSTRACT

Aim: To study the effectiveness of BTA in a total dose of 100 IU as the preparation for patients with primary and incisional ventral hernias (VH).

Materials and Methods: The prospective study included 59 patients with large VH (defect ^{3}10 cm). All patients received 100 IU of BTA in abdominal wall muscles 4-5 weeks before surgery from June 2017 to December 2022. An average age of the patients was 59.13 ± 9.07 years, body mass index – 32.20 ± 4.95 kg/m^2.

Results: An average width of the hernia defect after BTA decreased by 4.5 ± 1.11 cm ($p<0.001$). An average length of the hernia defect after BTA also decreased, without clinical significance. A significant increase in the length of the abdominal wall and a decrease in its thickness were observed. The abdominal cavity volume after BTA increased by 4.04 ± 4.55% ($p=0.008$) and the hernial sac volume decreased by 21.43 ± 16.57% ($p=0.005$). All patients underwent surgery with hernia defect suturing and without component separation: laparoscopic IPOM hernioplasty – 50 (84.7%) patients, open IPOM hernia repair – 7 (11.9%) patients, open sublay hernioplasty – 2 (3.4%) patients. There was no recurrence of hernia during 12 months after surgery.

Conclusions: The administration of 100 IU BTA allows to increase the length of the abdominal wall muscles and to perform laparoscopic IPOM hernioplasty for patients with large VH.

KEY WORDS: botulinum toxin, ventral hernia, hernia repair, laparoscopic hernioplasty

Wiad Lek. 2024;77(6):1188-1197. doi: 10.36740/WLek202406112 DOI

INTRODUCTION

Operations for VH are one of the most common in surgery [1, 2]. Surgical methods of treatment of VH vary depending on the size of the hernia defect, its localization, and the concomitant pathology of the patient [3, 4]. The use of mesh to strengthen the anterior abdominal wall is the basical approach of VH surgical repair in elective surgery [5-12].

Laparoscopic methods of treatment can be used for VH diameter up to 15 cm [11]. But when the width of the hernial defect is up to 10 cm, laparoscopic methods are recommended. At the same time, the suturing of the hernia defect when using the laparoscopic method of hernioplasty is recommended by the guidelines [11] and remains at the discretion of the surgeon [8]. When VH repair is performed using the intraperitoneal onlay mesh technique (IPOM), suturing of the hernia defect demonstrates a reduction in the risk of seroma formation and hernia recurrence [11].

Currently, there is a tendency to decrease the number of laparoscopic IPOM hernioplasty in the treatment of incisional VH [13]. One of the explanations for this tendency can be the increased number of incisional VH with the size of the hernia defect greater than 10 cm during 2010-2019 yy. and limited recommendations for the use of laparoscopic methods of hernioplasty for large hernias. For hernias larger than 10 cm the hernia defect suturing is technically difficult without using the component separation technique and may require the use of additional preparation methods in the preoperative period [11].

In 2009, Ibarra-Hurtado et al. published the proposition to use botulinum toxin type A (BTA) in the preoperative period for relaxation of the muscles of the anterior abdominal wall in patients with VH [14]. Since the publication of this work, the use of BTA in the treatment of large VH has not become a common practice and requires further study of the effectiveness and standardization of the technique [12, 15]. In the updated guideline of International Endohernia Society (IEHS) about laparoscopic treatment of ventral and incisional hernias (2019) there is no recommendations for the use of BTA in prepara-

Table 1. Demographic and Pre-operative Data

Characteristic	N
Total number of patients:	59 (100%)
women	37 (62.7%)
men	22 (37.3%)
Average age, years	59.13 ± 9.07
Body mass index, kg/m^2	32.20 ± 4.95
ASA score: I	8 (13.5%)
II	48 (81.4%)
III	3 (5.1%)
IV	0
Type of hernia (according to EHS classification):	
primary ventral, width ≥10 cm average width of hernia defect, cm	21 (35.6%) 12.06 ± 1.91
midline, epigastric	4 (6.8%)
midline, umbilical	17 (28.8%)
lateral, spigelian	0
lateral, lumbar	0
incisional ventral average width of hernia defect, cm	38 (64.4%) 15.46 ± 1.09
M1 midline, subxiphoidal	0
M2 midline, epigastric	8 (13.6%)
M3 midline, umbilical	17 (28.8%)
M4 midline, infraumbilical	5 (8.5%)
M5 midline, suprapubic	0
L1 lateral, subcostal	1 (1.7%)
L2 lateral, flank	2 (3.4%)
L3 lateral, iliac	3 (5.0%)
L4 lateral, lumbar	2 (3.4%)

Note. ASA, American Association of Anesthesiologists; EHS, European Hernia Society; N – the volume of the research sample; the data are presented as M±SD or abs. (%).

tion for surgery. The limited number of observations, the heterogeneity of the methods of performing the procedure and the combination of BTA injections with other interventions (progressive pneumoperitoneum (PP)) determine the low level of evidence of the BTA effectiveness in the treatment of large and giant VH [12].

One of the main effects expected from the BTA injections is the increase in the length of the lateral abdominal muscles and the possibility of avoiding the component separation when suturing large primary and incisional hernia defects [15, 16].

AIM

The aim of the present research is to investigate the effectiveness of using BTA in a total dose of 100 IU as the preparation of patients with primary and incisional ventral hernias before the planned laparoscopic IPOM hernioplasty with the hernia defect suturing.

MATERIALS AND METHODS

GENERAL CHARACTERISTICS OF PATIENTS

The prospective study included 59 patients with VH who were treated from June 2017 to December 2022. All patients were diagnosed with a large size primary or incisional VH (hernial defect more than 10 cm). The type and size of hernia defects were determined according to the classification of European Hernia Society (2009) [17]. An average age of the patients was 59.13 ± 9.07 years. The body mass index of the patients ranged from 24 to 42 kg/m^2. Detailed characteristics of patients are presented in Table 1.

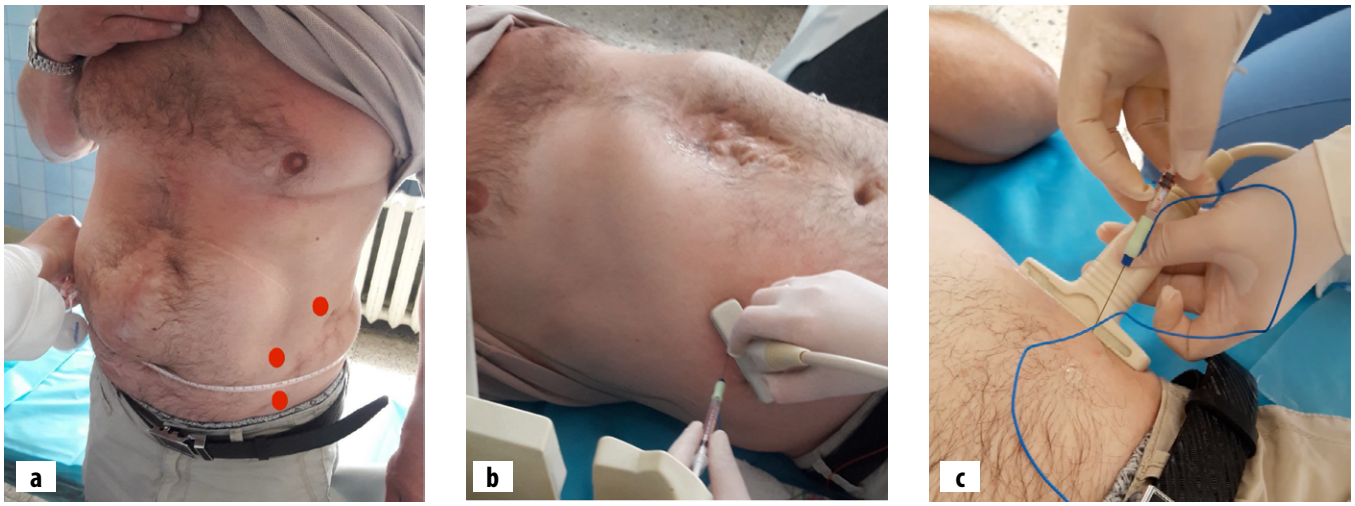

Fig. 1. Foto of BTA injections into the muscles of the anterior abdominal wall.
a – general view of points for injection on left side of the abdominal wall, b – view of the one point injection under the ultrasound control, c – view of the needle connected to the neurostimulator and syringe with BTA.

THE BTA INJECTION TECHNIQUE

The use of BTA in the treatment of VH currently belongs to the "off-label use" category. The conduct of this study was examined and approved by the Medical Ethics Committee of Bogomolets National Medical University. All patients in the study gave written informed consent for use of BTA in preoperative preparation for surgical treatment of VH.

All patients received BTA injections in the muscles of the anterior abdominal wall in the preoperative period. The introduction of BTA was navigated under ultrasound control in real time. The procedure was made under double control using an injection needle attached to a neurostimulator Stimuplex HNS-12 (B. Braun, Melsungen, Germany), to improve the accuracy of injecting BTA directly into the muscle tissue.

The first step was to perform an ultrasound examination of the anterior abdominal wall, to determine the location, number and size of the hernial defect. After that the 6 points for BTA injections into the transverse, external and internal oblique muscles of the abdomen on left and right side were determined, 1 point in each of the muscles. A puncture of the selected muscle under ultrasound control was performed. With the help of a neurostimulator and visual control, the location of the end of the injection needle in the thickness of the selected muscle was verified, after which the administration of BTA was started. The total dose of the injected BTA per patient was 100 IU (Botoxâ, Allergan, USA) diluted in 20 ml of 0.9% sodium chloride solution. As a basis, the following method of BTA administration into the muscles of the anterior abdominal wall was chosen, a total into 6 injection points:

- the right external oblique muscle of the abdomen - along the line between the anterior axillary and mid-clavicular lines 4 cm above the navel on the right, 15 IU (3 ml of solution),
- the right transversus abdominis muscle – along the right mid-clavicular line at the level of the navel, 15 IU (3 ml of solution),
- the right internal oblique muscle of the abdomen - along the right mid-clavicular line 3 cm below the navel, 20 IU (4 ml of solution),
- the left external oblique muscle of the abdomen - along the line between the anterior axillary and mid-clavicular lines 4 cm above the navel on the left, 15 IU (3 ml of solution),
- the left transversus abdominis muscle – along the left mid-clavicular line at the level of the navel, 15 IU (3 ml of solution),
- the left internal oblique muscle of the abdomen – along the left mid-clavicular line 3 cm below the navel, 20 IU (4 ml of solution) (Fig. 1).

THE CHARACTERISTIC OF COLLECTED DATA

The size, number and localization of hernia defects were determined by ultrasound examination. Also, the patients underwent computed tomography with 3D modeling of the abdominal cavity and determination of the volume of the abdominal cavity, the volume of the hernial sac, the size of the hernial defect, the length and thickness of the muscles of the anterior abdominal wall before and 4 weeks after the administration of BTA.

Intra-abdominal pressure was measured at least twice: for the first time – after the end of the injection of BTA, for the second time – intraoperatively. In both cases, the measurement was performed using an in-

Table 2. Changes in the size of the abdominal wall and hernial before and after BTA.

Indicator	Before BTA	After BTA	P
Width of the hernia defect, cm	13.31 ± 2.34	8.81 ± 2.46	<0.001
Length of the hernial defect, cm	12.43 ± 4.86	12.28 ± 4.87	0.048
Volume of the abdominal cavity, cm^3	9251.64 ± 2971.83	9616.13 ± 2907.49	0.008
Volume of the hernia sac, cm^3	426.05 ± 303.24	357.46 ± 258.84	0.005
Length of the abdominal wall, cm:			
- right side	25.21 ± 6.51	26.88 ± 7.17	0.027
- left side	22.78 ± 6.05	24.43 ± 6.59	0.006
Thickness of the abdominal wall, cm:			
- right side	1.69 ± 0.13	1.41 ± 0.15	<0.001
- left side	1.65 ± 0.38	1.55 ± 0.40	0.017

Note. Data are presented as M±SD or abs. (%).

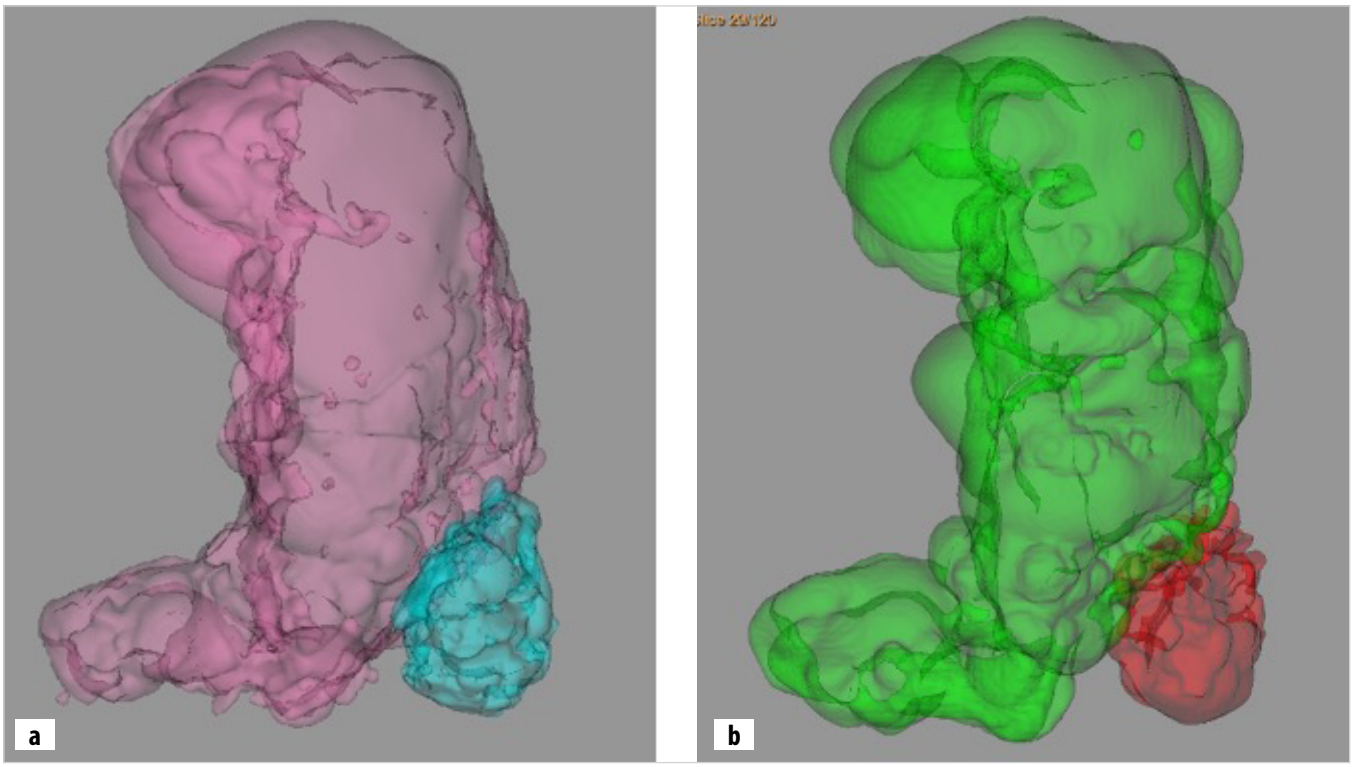

Fig. 2. Computed tomography scans before (a) and after (b) the introduction of BTA with 3D modeling of the volumes of the hernial sac and abdominal cavity.

direct method by inserting a Foley catheter into the urinary bladder.

All patients underwent surgery 4-5 weeks after BTA injection. Laparoscopic surgery (hernioplasty according to the IPOM method with suturing of the hernia defect) was planned for all patients.

Introduction of BTA under the ultrasound control was performed by one surgeon who specialized in ultrasound diagnostics. Evaluation of all CT results and size calculation was performed by a single radiologist.

The follow-up examinations were carried out after 2 weeks, 1 month, 1 year after operation. During control visits the ultrasound examination of the anterior abdominal wall was also carried out to detect complications and a possible recurrence of the hernia, which was not diagnosed during an objective examination.

STATISTICAL ANALYSIS

Data were analysed with the statistical package IBM SPSS Statistics Base (version 22). All results were considered statistically significant at a value of $p<0.05$. Quantitative data are presented as mean (M) ± standard deviation (SD), unless otherwise stated. The normality of the data distribution was checked using the chi-square test ($p>0.05$). For normally distributed data, comparisons were made using paired Student's t-test for related samples. For non-normally distributed data the comparison was performed using the Wilcoxon sign rank criterion for related samples.

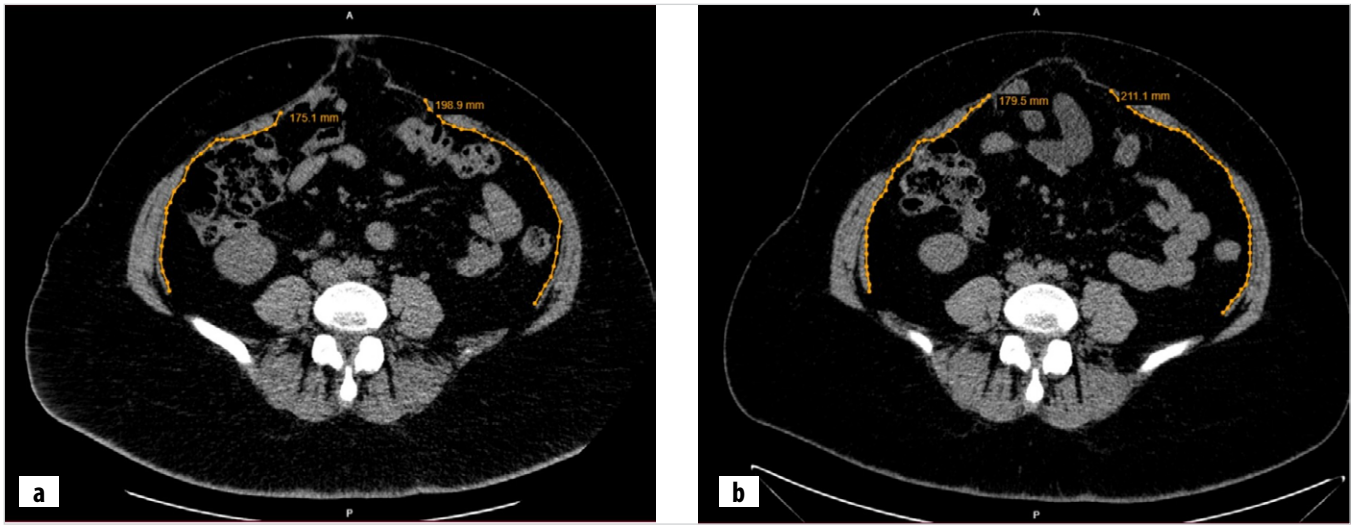

Fig. 3. Computed tomography scans before (a) and after (b) the introduction of BTA with determination of the length of the abdominal wall on the right and left side.

RESULTS

Before administration of BTA the average width of the hernia defect was 13.31 ± 2.34 cm (min – 10 cm, max – 18.9 cm). In 18 (30.5%) patients with incisional hernias the width of the hernia defect exceeded 150 mm. The average length of the hernial defect was 12.43 ± 4.86 cm (min – 7.20 cm, max – 20.1 cm). Eight (13.6%) patients had left-sided hernias, 6 (10.2%) patients had right-sided hernias. In 5 (8.5%) patients hernia was recurrent.

In 14 (23.7%) patients an asymmetric location of the hernial defect relative to the midline and unilateral deformation of the anterior abdominal wall were observed. In these patients the introduction of BTA could not be carried out at previously planned points. During the ultrasound examination, lateral displacement of the muscles was observed in these patients, which required individual selection of BTA injection points with optimal visualization of the necessary muscle.

In all patients, the movement of the needle in the tissues during muscle puncture was carried out under the control of a 4-15 MHz linear ultrasonic sensor. When placing the tip of the needle in the thickness of the necessary muscle, before introducing BTA, the neurostimulator was turned on to check the position of the needle direct in muscles tissue. At the same time, a subjective sensation in the patient and visual signs of twitching of the punctuated muscle on the monitor of the ultrasound apparatus were checked. In 32 (54.2%) patients there was at least one episode of absence of punctuated muscle contraction with a clear visual placement of the needle tip in the thickness of this muscle. Such situation required the correction of the needle tip placement or a repeated puncture attempt. The need for correction of the placement of the needle in two puncture points occurred in 14 (23.7%) patients, in three or more puncture points – in 5 (8.5%) patients. There were no complications during or after BTA injection into the muscles of the anterior abdominal wall.

After the introduction of BTA, the average width of the hernia defect decreased by 4.5 ± 1.11 cm (min – 1.4 cm, max – 6.5 cm), which was 34.66 ± 9.01 % of the primary width of the hernia ($p<0.001$). An average length of the hernia defect after the introduction of BTA also decreased ($p=0.048$), but the changes were minimal (Table 2).

After the introduction of BTA, a significant increase in the volume of the abdominal cavity was observed. An average increase in the volume of the abdominal cavity after the administration of BTA was 364.49 ± 380.14 cm^3 (min – 33.90 cm^3, max – 1034.0 cm^3), which was 4.04 ± 4.55 % from the initial indicator ($p=0.008$). At the same time, the opposite changes in the volume of the hernia sac were observed. The volume of the hernial sac decreased an average 68.59 ± 47.94 cm^3 (min – 27.60 cm^3, max – 160.0 cm^3), which was 21.43 ± 16.57 % from the initial indicator ($p=0.005$) (Fig. 2).

The length of the abdominal wall was measured from the lateral margin of the quadratus lumborum muscle to the medial margin of the rectus muscle from the comparable axial image (section) (Fig. 3).

After the injection of BTA, a significant increase in the length of the abdominal wall and a decrease in its thickness were observed. On the right side, the average increase in the length after BTA was 1.78 ± 1.26 cm (min – 0.1 cm, max – 3.81 cm), which was 6.52 ± 4.49 % from initial length ($p=0.027$). The same tendency was on the left side – 1.84 ± 11.47 cm (min – 0.23 cm, max – 3.6 cm) after BTA, equivalent to 7.25 ± 4.50 % from initial one

(p=0.006). On the right side, the average decrease in the thickness of the abdominal wall after BTA was 0.28 ± 0.15 cm (min – 0.08 cm, max – 0.50 cm), which was 16.55 ± 8.17% from the initial indicator (p<0.001), on the left side – 0.11 ± 0.10 cm (min– 0.01 cm, max – 0.27 cm), which was 6.67±5.77 % from the initial thickness (p=0.017).

Surgery was performed 4 weeks after the administration of BTA in 47 (79.7%) patients, at 5 weeks – in 12 (20.3%) patients. 50 (84.7%) patients underwent laparoscopic hernioplasty with intraabdominal mesh introduction and fixation. 7 (11.9%) patients underwent open IPOM hernia repair: laparotomy, resection of hernia sac, intraabdominal mesh introduction and fixation by transaponeurotic separate sutures, open suturing of the aponeurosis of the rectus abdominis muscle. In all cases with intraabdominal mesh positioning the composite mesh was used, without draining of abdominal cavity. 2 (3.4%) patients with incisional hernias underwent laparotomy, adhesiolysis, hernioplasty using the sublay method, drainage of the wound according to Redon technique.

During laparoscopic hernioplasty the first trocar was installed using optical type one or by "open" technique according to Hassan's method. We consider it is necessary to use just such techniques, which allows to minimize the risk of internal organs injury in case of their fixation to the anterior abdominal wall. Suturing of hernia defect was made by applying separate subcutaneous transaponeurotic sutures (IPOM) in 27 (54%) patients and by open suturing trough small incision directly under the hernia defect (IPOM+) – in 23 (46%) patients. Tightening of applied sutures was performed extracorporeally when the intraabdominal pressure was reduced.

In all cases (n=57) with intraabdominal mesh positioning the composite meshes with anti-adhesive coating were used, while in 19 (33.4 %) cases – based on polypropylene, in 38 (66.7 %) cases – based on polyester. In 2 cases open hernia repair by sublay technique were performed, a light polypropylene mesh was used. The size of the mesh was chosen individually in all cases, depending on the size and number of defects of the anterior abdominal wall, but was not less then 20x25cm according to the mesh overlap of the margins of the hernia defect 5 cm or more.

Fixation of the mesh during open hernia repair (n=9) was performed typically with separate polypropylene non-absorbable sutures (open IPOM and open sublay surgery). During laparoscopic hernioplasty (n=50) mesh fixation was carried out in 2 stages. The first stage was fixation of the mesh to the anterior abdominal wall at 4 points using subcutaneous transaponeurotic sutures. On second stage the mesh was fixed by tacks using the "double crown" technique (absorbable tacks – in 21 (42 %) patients, non-absorbable – in 29 (58 %) patients).

The laparoscopic technique of hernioplasty did not involve drainage of wounds and the abdominal cavity. The postoperative wound was drained according to Redon technique in all 2 cases after open hernioplasty using the sublay technique and in 3 cases after open IPOM hernia repair. The drain was removed on the 3-4th postoperative day with minimal daily discharge from the drain. Operation duration was 134.20 ± 41.6 min for laparoscopic hernia repair, 181.4 ± 15.74 min for open IPOM operation and 172.50 ± 10.61 min for open sublay surgery.

Measurement of intra-abdominal pressure was performed by an indirect method immediately after the administration of BTA and at the end of the surgical intervention. Indicators of the intra-abdominal pressure level in both cases in all patients fluctuated within the normal range. All patients underwent a control ultrasound examination in 2 weeks, 1 month after surgery and 23 patients also underwent it 1 year after surgery. No recurrence of the hernia was detected during the observation period of 12 months.

DISCUSSION

Laparoscopic hernioplasty for VH can reduce the risk of postoperative complications, especially in overweight patients. However, the size of the hernia defect can be a limiting factor when choosing a laparoscopic method of hernioplasty. Large hernia defects of the anterior abdominal wall with a width of more than 10 cm may require component separation for adequate suturing of the hernia, avoiding tension and reducing the risk of compartment syndrome. The need for component separation makes it necessary to choose an open method of performing hernioplasty.

Chemical separation of the abdominal wall with the use of BTA opened new opportunities for laparoscopic hernioplasty of VH and also made it possible to avoid the use of traumatic component separation in open surgery for giant VH. Since the appearance of the first publication in 2009, according to the electronic database PubMed, more than 80 publications were published about the use of BTA in the treatment of VH, including 2 systematic reviews of the literature [16, 18] and 3 combinations of a systematic review and meta-analysis [1, 19, 20].

In a systematic review Wegdam et al. analyzed the data of 14 published studies that were conducted from 2009 to 2020 and included the results of using BTA (559 patients) and the combination of BTA with PP

(267 patients). The most frequently used dose of Botoxâ is 300 IU [16]. When evaluating the dosage of BTA, it is necessary to consider that Botoxâ and Dysportâ have different potencies, with a commonly referenced dosing ratio ranging from 1:2 to 1:3. However, this ratio may vary based on clinical application and individual patient response [21]. According to the results of the conducted studies, it was noted that the use of a total doses of BTA 100 IU or 150 IU were ineffective [16].

Only 2 studies were presented, in which the use of a total dose of BTA less than 200 IU was indicated [22, 23]. Chávez-Tostado et al. [22] reported the use of a total dose of BTA 100 IU. In this study 50% of patients (n =7) have a reduction in the diameter of the hernia defect after BTA, and only for 22% (n =3) of patients the component separation was performed to restore the integrity of the aponeurosis. At the same time, in 50% of patients, the size of the hernial defect was more than 15 cm. There were no data on the correlation between the diameter of the hernial defect and the percentage of its reduction after the introduction of BTA. It can be assumed that the low efficiency of using this dose of BTA is connected precisely with the choice of the same dose for hernia defects of different sizes (from 10 to 34.3 cm) and different deformation of the muscles of the anterior abdominal wall. In both studies [22, 23] open hernioplasty was performed and it is not indicated how the lateral length of the muscles of the abdominal wall changed.

In one publication, which was not included in the above-mentioned literature reviews, Mourad et al. presented the results of treatment of a patient with an incisional ventral hernia using preoperative administration of BTA. A total dose of 100 IU of BTA was sufficient for subsequent open hernioplasty with suturing of the hernia defect [24].

Tang et al. also used a BTA in dose of less than 200 IU, namely 100 IU and 150 IU. The administration of BTA in all 22 patients was combined with PP and the dynamics of changes in the length of the muscles of the anterior abdominal wall, the volume of the hernial sac and the abdominal cavity were analyzed. In all patients the width of the hernia defect was more than 10 cm, and in 2 (9%) patients it exceeded 15 cm. At the same time, all patients managed to perform primary laparoscopic hernioplasty with suturing of the hernia defect [25]. But it was not indicated in which case a dose of BTA 100 IU, or 150 IU was chosen. It is also impossible to evaluate the effectiveness of the use of BTA itself since its combination with PP does not make it possible to estimate the effect of each of the methods separately on the length of the muscles of the anterior abdominal wall.

According to the results of our study, we concluded that the use of only BTA injections has a significant effect on the length of the muscles of the anterior abdominal wall. But the amount of muscle lengthening is smaller compared to the results of the study when BTA administration is combined with PP. Thus, in our study, muscle length increased by 1.8 cm on each side on average, while in Tang's study et al. this indicator reached 4.1 cm, varying in the range from 1.5 to 7.2 cm on each side [25]. Rodriguez-Acevedo et al. also reports a significant increase in the length of the muscles of the abdominal wall both when BTA is administered and when BTA is combined with PP [26]. At the same time, only the introduction of BTA (200 or 300 IU) lengthens the muscles by an average of 4.2 ± 2.5 cm, while the combination of BTA with PP shows even lower values (3.7 ± 1.9 cm), although the difference is not statistically significant. Yurtkap et al. shows a more significant lengthening of the abdominal muscles when combining BTA and PP (4 cm) compared to BTA (2-3 cm), although it does not indicate the statistical significance of this difference and emphasizes the risk of developing complications when using PP [27]. Bueno-Lledó et al. reports the results of currently the largest number of observations (100 patients) of the use of BTA and PP with loss of domain hernias [28]. In his study, he does not separately analyze the effectiveness of BTA and the change in the length of the muscles of the abdominal wall but indicates the importance of evaluating the change in the diameter of the hernial defect and the change in the ratio of herniary volume to abdominal cavity volume. In all these studies a total dose of BTA, which was administrated before the operation in every case, was more than 200 IU [25-28].

Currently, there is no standardized protocol for chemical separation using BTA before VH repair. The issues of BTA dose selection, the number of injection points, the number of layers (muscles) into which BTA should be injected, methods of visualization and control of the BTA injection remain debatable. BTA is injected into both 3 [29] and 5 [14] points on each side of the abdominal wall. At the same time, the difference in the prevalence of effectiveness of one of the methods is uncertain [27]. In our study, in all cases, 3 injection points were sufficient to visualize each of the lateral muscles of the abdominal wall and perform their safe puncture. The use of double control of the injection site (ultrasound and neurostimulator) is mandatory in our case since visual control of the placement of the needle tip does not always ensure the accuracy of BTA injection directly into the muscle. This may be due to excessive development of fibrous tissue in deformed muscles of the abdominal wall due to large hernial protrusion.

We would also like to highlight that indirectly measuring intraabdominal pressure following BTA injections

is an invasive procedure, potentially leading to urinary complications. In our study, in all patients the maximum size of the hernial defect did not exceed 20 cm. And in all cases the intraabdominal pressure didn't increase above normal range. Therefore, we believe that indications for intraabdominal pressure assessment should be determined individually in case of suspicion of a high risk of developing compartment syndrome (the size of the hernial defect is more than 20 cm, the high ratio of herniary volume to abdominal cavity volume, loss of domain hernia and others).

There are also no clear indications for the use of BTA, no patient selection algorithm for the administration of BTA in the preoperative period, and the clearly defined time frame for subsequent hernioplasty (from administration on the day of surgery to 6 weeks before surgery). According to the results of a systematic review and meta-analysis of literature, van Rooijen et al. suggests using BTA in the presence of fibrotic changes in the muscles of the anterior abdominal wall or their thickening. In case of loss of domain PP should be chosen [24]. Bittner et al. notes the possibility of serious complications when using PP and better tolerability of BTA [12]. At the same time, the significance of a statistically difference in the lengthening of the muscles of the abdominal wall when comparing these methods is controversial [25, 26]. However, according to Bittner et al., the use of only BTA for large hernias does not allow to suture the hernia defect without component separation [12]. In our study, in all patients it was possible to suture the hernia defect without component separation, but in 15.3% of cases the open hernia repair was done. It should be considered that we did not include in the study patients with a defect width of more than 20 cm and loss of domain.

CONCLUSIONS

The administration of BTA injections in the muscles of the anterior abdominal wall makes it possible to perform laparoscopic IPOM hernioplasty for patients with large size VH. BTA injections in the preoperative period reduce the number of patients for open hernia surgery and allow to avoid the traumatic technique of component separation during VH repair. It is necessary to standardize the method of administering BTA, to study the effectiveness of different doses of BTA on changes in the length of the muscles of the anterior abdominal wall and to determine the indications for the use of a combination of BTA with other methods of preoperative preparation of patients with large and giant VH.

REFERENCES

1. Timmer AS, Claessen JJM, Atema JJ et al. A systematic review and meta-analysis of technical aspects and clinical outcomes of botulinum toxin prior to abdominal wall reconstruction. Hernia. 2021;25(6):1413–1425. doi:10.1007/s10029-021-02499-1. DOI
2. Cherla DV, Poulose B, Prabhu AS. Epidemiology and disparities in care: the impact of socioeconomic status, gender, and race on the presentation, management, and outcomes of patients undergoing ventral hernia repair. Surg Clin North Am. 2018;98(3):431-440. doi:10.1016/j.suc.2018.02.003. DOI
3. Raftopoulos I, Vanuno D, Khorsand J et al. Outcome of laparoscopic ventral hernia repair in correlation with obesity, type of hernia, and hernia size. J Laparoendosc Adv Surg Tech A. 2002;12(6):425-429. doi:10.1089/109264202762252695. DOI
4. Schlosser KA, Arnold MR, Otero J et al. Deciding on optimal approach for ventral hernia repair: laparoscopic or open. J Am Coll Surg. 2019;228(1):54-65. doi:10.1016/j.jamcollsurg.2018.09.004. DOI
5. Bittner R, Bingener-Casey J, Dietz U et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society [IEHS])-part 1. Surg Endosc. 2014;28(1):2-29. doi:10.1007/s00464-013-3170-6. DOI
6. Bittner R, Bingener-Casey J, Dietz U et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society [IEHS])—Part 2. Surg Endosc. 2014;28(2):353-379. doi:10.1007/s00464-013-3171-5. DOI
7. Bittner R, Bingener-Casey J, Dietz U et al. Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society [IEHS])-Part III. Surg Endosc. 2014;28(2):380-404. doi:10.1007/s00464-013-3172-4. DOI
8. Earle D, Roth JS, Saber A et al. SAGES guidelines for laparoscopic ventral hernia repair. Surg Endosc. 2016;30(8):3163-3183. doi:10.1007/s00464-016-5072-x. DOI
9. Silecchia G, Campanile FC, Sanchez L et al. Laparoscopic ventral/incisional hernia repair: updated Consensus Development Conference based guidelines [corrected] published correction appears in Surg Endosc. Surg Endosc. 2015;29(9):2485. doi:10.1007/s00464-015-4293-8. DOI
10. Liang MK, Holihan JL, Itani K et al. Ventral hernia management: expert consensus guided by systematic review. Ann Surg. 2017;265(1):80-89. doi:10.1097/SLA.0000000000001701. DOI
11. Bittner R, Bain K, Bansal VK et al. Update of Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias. (International Endohernia Society [IEHS])-Part Aю [published correction appears in Surg Endosc. Surg Endosc. 2019;33(10):3069-3139. doi:10.1007/s00464-019-06907-7. DOI

12. Bittner R, Bain K, Bansal VK et al. Update of Guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias (International Endohernia Society [IEHS]): Part B. Surg Endosc. 2019);33(11):3511-3549. doi:10.1007/s00464-019-06908-6. DOI
13. Köckerling F, Hoffmann H, Mayer F et al. What are the trends in incisional hernia repair? Real-world data over 10 years from the Herniamed registry. Hernia. 2021;25(2):255-265. doi:10.1007/s10029-020-02319-y. DOI
14. Ibarra-Hurtado TR, Nuño-Guzmán CM, Echeagaray-Herrera JE et al. Use of botulinum toxin type A before abdominal wall hernia reconstruction. World J Surg. 2009;33(12):2553–2556. doi:10.1007/s00268-009-0203-3. DOI
15. Elhage SA, Deerenberg EB, Shao JM et al. The use of botulinum toxin A in chemical component separation: a review of techniques and outcomes. Plastic and Aesthetic Research. 2020;7:16. doi:10.20517/2347-9264.2020.03. DOI
16. Wegdam JA, de Vries Reilingh TS, Bouvy ND et al. Prehabilitation of complex ventral hernia patients with Botulinum: a systematic review of the quantifiable effects of Botulinum. Hernia. 2021;25(6):1427-1442. doi:10.1007/s10029-020-02333-0. DOI
17. Muysoms FE, Miserez M, Berrevoet F et al. Classification of primary and incisional abdominal wall hernias. Hernia. 2009;13(4):407–414. doi:10.1007/s10029-009-0518-x. DOI
18. Alam NN, Narang SK, Pathak S et al. Methods of abdominal wall expansion for repair of incisional hernia: a systematic review. Hernia. 2016;20(2):191–199. doi:10.1007/s10029-016-1463-0. DOI
19. Weissler JM, Lanni MA, Tecce MG et al. Chemical component separation: a systematic review and meta-analysis of botulinum toxin for management of ventral hernia. J Plast Surg Hand Surg. 2017;51(5):366–374. doi:10.1080/2000656X.2017.1285783. DOI
20. van Rooijen MMJ, Yurtkap Y, Allaeys M et al. Fascial closure in giant ventral hernias after preoperative botulinum toxin A and progressive pneumoperitoneum: A systematic review and meta-analysis. Surgery (United States). 2021;170(3):769–776. doi:10.1016/j.surg.2021.03.027. DOI
21. Scaglione F. Conversion ratio between Botox®, Dysport®, and Xeomin® in clinical practice. Toxins (Basel). 2016;8(3):65. doi:10.3390/toxins8030065. DOI
22. Chávez-Tostado KV, Cárdenas-Lailson LE, Pérez-Trigos H. Results of preoperative application of botulinum toxin type A in treatment of giant incisional hernias. Revista Hispanoamericana deHernia. 2014;2(4):145–151. doi:10.1016/j.rehah.2014.06.001. DOI
23. Zielinski MD, Kuntz M, Zhang X et al. Botulinum toxin A-induced paralysis of the lateral abdominal wall after damage-control laparotomy: a multi-institutional, prospective, randomized, placebo-controlled pilot study. J Trauma Acute care Surg. 2016;80(2):237–242. doi:10.1097/ta.00000 00000000917. DOI
24. Mourad AP, De Robles MS, Winn RD. Low-dose pre-operative Botulinum Toxin A effectively facilitates complex ventral hernia repair: a case report and review of the literature. Medicina (Kaunas, Lithuania). 2020;57(1):14. doi:10.3390/medicina57010014. DOI
25. Tang FX, Ma N, Huang E et al. Botulinum Toxin A facilitated laparoscopic repair of complex ventral hernia. Front Surg. 2022;8:803023. doi:10.3389/fsurg.2021.803023. DOI
26. Rodriguez-Acevedo O, Elstner KE, Jacombs ASW et al. Preoperative Botulinum toxin A enabling defect closure and laparoscopic repair of complex ventral hernia. Surg Endosc. 2018;32(2):831–839. doi:10.1007/s00464-017-5750-3. DOI
27. Yurtkap Y, van Rooijen MMJ, Roels S et al. Implementing preoperative Botulinum toxin A and progressive pneumoperitoneum through the use of an algorithm in giant ventral hernia repair. Hernia. 2021;25(2):389–398. doi:10.1007/s10029-020-02226-2. DOI
28. Bueno-Lledó J, Carreño-Saenz O, Torregrosa-Gallud A et al. Preoperative botulinum toxin and progressive pneumoperitoneum in loss of domain hernias – our first 100 cases. Front Surg. 2020;7:3. doi:10.3389/fsurg.2020.00003. DOI
29. Zielinski MD, Goussous N, Schiller HJ et al. Chemical components separation with botulinum toxin A: a novel technique to improve primary fascial closure rates of the open abdomen. Hernia. 2013;17(1):101–107. doi:10.1007/s10029-012-0995-1. DOI

The work is a fragment of the planned research work of the Department of General Surgery No2 of Bogomolets National Medical University "Improvement of diagnostic methods, surgical treatment of pathologies of abdominal organs, anterior abdominal wall and metabolic syndrome" (State registration number 0123U105130).

CONFLICT OF INTEREST

The Authors declare no conflict of interest

CORRESPONDING AUTHOR

Tetiana V. Tarasiuk

Bogomolets National Medical University

13 Taras Shevchenko Boulevard, 01601 Kyiv, Ukraine

e-mail: tara-tanya@ukr.net

ORCID AND CONTRIBUTIONSHIP
Tetiana V. Tarasiuk: 0000-0001-6629-3908 A B C D F
Oleksandr Yu. Ioffe: : 0000-0002-1306-7920 A E F
Oleksandr M. Chukanov: 0000-0003-1081-9573 B
Mykola S. Kryvopustov: 0000-0003-4978-4873 B C
Oleksandr P. Stetsenko: 0000-0002-2219-653X E

A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article

RECEIVED: 09.02.2024
ACCEPTED: 23.05.2024