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Case Series

The outcome of pre-operative botulinum toxin in the treatment of large incisional hernias

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ABSTRACT

Large incisional hernias with loss of domain represents a challenge for the surgeon. Pre-operative tools such as progressive pneumoperitoneum or botulinum toxin type A have been reported as useful tools for effective and successful surgical procedure in patients with large incisional hernias. Both the mentioned procedures are complementary to hernia repair, using no-strain mesh techniques that support patients' integral management. The objective of current investigation was to assess the potential of pre-operative botulinum toxin in the treatment of large incisional hernias. Thirteen patients with large incisional hernias were investigated and examined for different parameters including diameters of the abdominal cavity and hernia sac, volume of the contents of incisional hernia and volume of the abdominal cavity which were calculated from CT scan. The current investigation was carried for a duration of two years from December 2020 and January 2022. After thorough clinical examination patients were operated for ventral incisional hernia repair. Eleven patients underwent complete repair of abdominal wall; one patient underwent mesh bridging and one patient required onlay repair. Botulinum toxin was observed to be a safe technique, which has good patient tolerance and can constitute as an effective preoperative tool in the treatment of large incisional hernia. This technique was observed to be aidful in significantly reducing the hernia content into the abdominal cavity, which in turn is an important factor in the treatment of large incisional hernia.

Keywords: Botulinum toxin, Incisional hernias, Abdominal cavity, Loss of domain hernia

INTRODUCTION

Large incisional hernias (LIHs) represent a challenge for the abdominal wall surgeon. Pre-operative tools such as progressive pneumoperitoneum (PPP) or botulinum toxin type A (BT) have been reported as useful tools for effective and successful surgical procedure in patients with large incisional hernias.[1-3] Both procedures are complementary to hernia repair, using no-strain mesh techniques that support patients integral management.[4,5] Botulinum toxin is a neuro-toxin made from bacteria after series of extensive cleaning, filtration and dilution steps.[4-7] When a highly diluted dose of botox is injected through a needle into a muscle it results in muscle relaxation or paralysis by blocking presynaptic release of the neurotransmitter (acetylcholine) at the neuromuscular junction, with reversible denervation of muscle fibers, thereby inducing partial paralysis and atrophy (Figure 1).[4-7] The effects of BT last for about three to twelve months. BT stretches the abdominal muscles and reduces the size of the hernia gap by 30-50, it also reduces the muscle tension after surgery and thereby reduces the chances of recurrence and BT also reduces pain after hernia repair surgery.[8]

Aim and objectives

The aim and objective of this study was to investigate the effectiveness of pre-operative Botulinum toxin in the treatment of large incisional hernias with loss of domain.

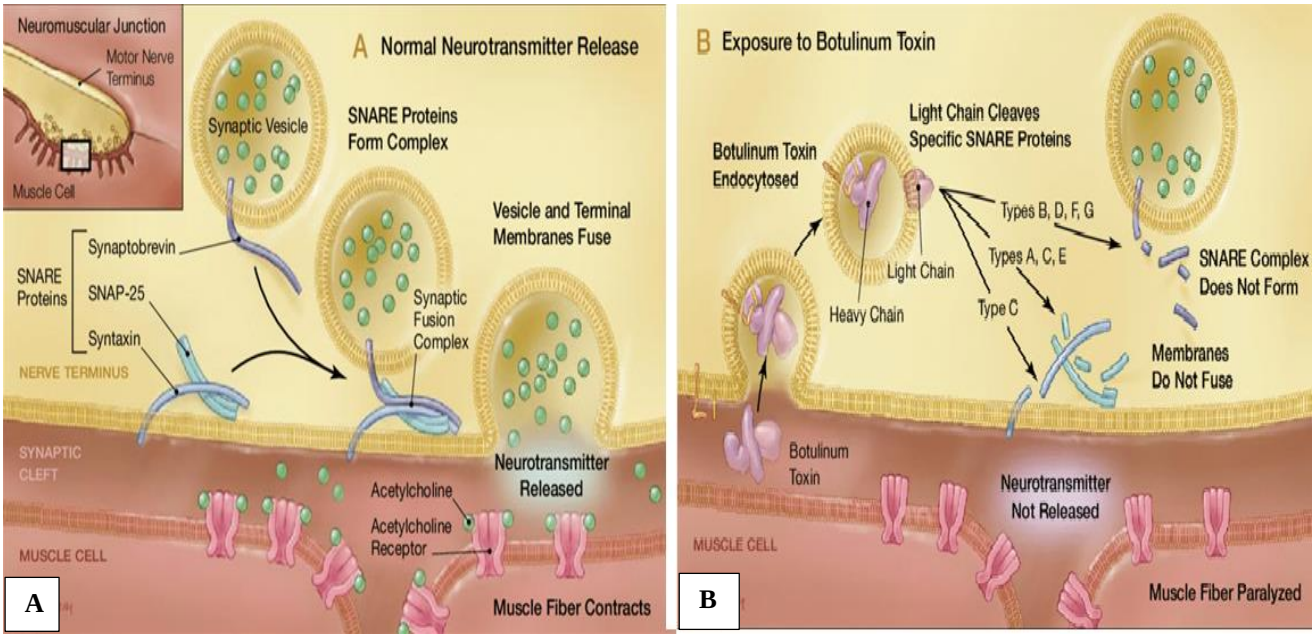

Figure 1: (A) Normal neurotransmitter release; and (B) action of botulinum toxin.[4,5]

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Current investigation was carried for a duration of two years between May 2020 and December 2021. In current investigation total thirteen patients with large incisional hernia and loss of abdominal domain were analyzed using prospectively collected data (Figure 2).

Patients with BMI>25 and Tanaka index>0.25 were included in the study. Breastfeeding females, patients with bleeding disorders, patients with BMI<25 and patients who could not afford Botox were excluded from the study. The baseline characteristics of all the study participants are depicted in (Table 1).

All the patients were administered pre-operative botulinum toxin 3 weeks prior to abdominal wall repair surgery. CT scan was used to determine diameters of the abdominal cavity and hernia sac, as well as to calculate the volume of the incisional hernia (VIH) and volume of abdominal cavity (VAC). Abdominal wall repair with posterior component separation technique was the preferred technique. The observed hernia diameters and defect size in majority of the study participants ranged from 10-15 cm and 151 to 250 cm^2 respectively as depicted in (Table 2). The CT scan reports of patients are revealed in (Figure 2).

Primary closure of the anterior fascia with posterior component separation technique was possible in 11 out of 13 patients along with placement of prolene mesh. One patient underwent inlay and onlay repair using 20×20 cm dual mesh and 30×30 cm prolene mesh respectively. One patient underwent mesh bridging with 30×30 cm prolene mesh (Figure 3). The representative images of primary closure of the anterior fascia with posterior component separation technique and mesh bridging surgical techniques are revealed in (Figure 4 and 5).

Post-surgery closure of defect with skin approximation, closure of abdominal wall with placement of drains and complete approximation of local wound are depicted in (Figure 6).

Botulinum toxin injections were administered as an outpatient procedure, three weeks before the planned operation. The location of the points for injection was guided by ultrasound to visualize the three lateral muscle layers to be infiltrated (external oblique, internal oblique, and transverse).[4,5,9-12]

A 5 ml injection of botox (50 units/5 ml) was administered at each point: 50 U of BT were infiltrated in each of the three specific points on the right side and three on the left; accounting to total BT dose of 300 U. Dose administration was done under ultrasound vision into each of the three muscle bellies of the lateral muscles.

It was observed that no complications occurred during the administration of BT. The total operative time in minutes and post-operative complications observed are depicted in (Table 3).

Table 1: Baseline characteristics of study participants.

Baseline characteristics	N
Male/female	5/8
Mean age (years)	65
Average BMI	31.4
Diabetes mellitus	4
H/O smoking	6
COPD	1

Table 2: Distribution of the patients based on hernia diameter and defect size.

Parameters	N
Hernia diameter (cm)	
10-14	3
14.1- 15	6
15.1- 20	2
20.1- 25	2
Defect size (cm^2)	
>150	1
151-200	4
201-250	7
251-300	1
>150	1

Table 3: Distribution of the patients based on operative time and post-operative complications.

Parameters	N
Operative time (minutes)	
>200-250	2
251-300	3
301-350	6
351-400	2
>401	0
Post-operative complications	
Abdominal compartment syndrome	0
Wound infection	4
Mesh infection	0
Respiratory distress	0
Chronic pain reported	3
Evidence of recurrence	0

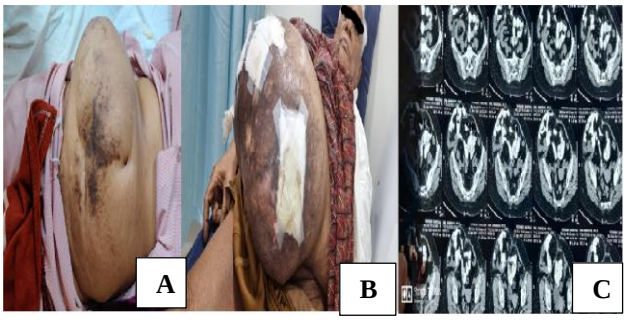

Figure 2: (A) loss of domain hernia with colour changes over abdominal wall; (B) loss of domain hernia; and (C) CT images showing herniation of bowel loops with unhampered vascularity.

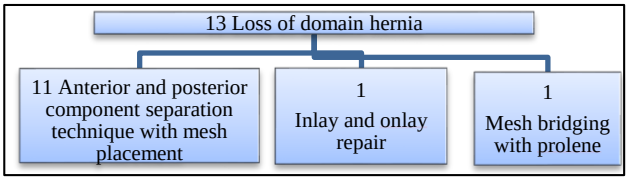

Figure 3: Procedures undertaken for abdominal wall repair.

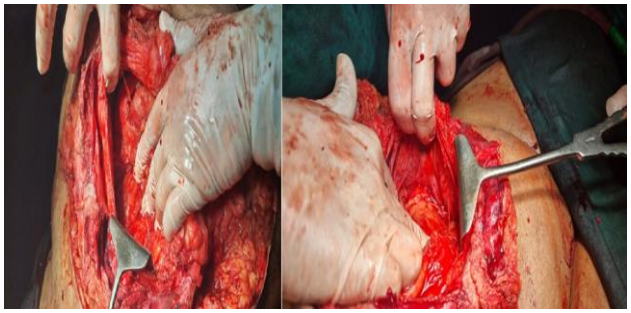

Figure 4: Posterior component separation technique.

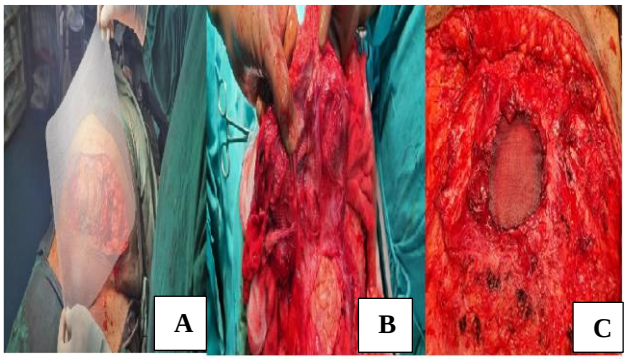

Figure 5: (A) Placement of mesh; (B) mesh adherent to abdominal wall; and (C) inlay mesh.

Figure 6: (A) Closure of defect with skin approximation; (B) closure of abdominal wall with placement of drains; and (C) complete approximation of local wound.

DISCUSSION

Baseline properties of 13 participants included in current study revealed that females outnumbered male participants, average age of the study participants was observed to be 65 years and average BMI was observed as 31.4.

Nearly 50% of study participants had smoking habit and few had prior history of diabetes mellitus or COPD.

The observed baseline parameters resembled to study report published by Ramshorst et al.[8,9] BMI and Tanaka's index of total thirteen patients with large incisional hernia and loss of abdominal domain included in current study are depicted in (Table 4).

Table 4: Distribution of the patients based on BMI and Tanaka's index.

Parameters	N
BMI classification	
Normal range (18.5-24.99)	0
Pre-obese (25-29.9)	2
Obese class I (30-34.9)	3
Obese class II (35-39.9)	5
Obese class III (>40)	3
Tanaka index	
0.25-0.30	2
0.31-0.35	4
0.36-0.40	6
0.41-0.45	1
0.46-0.50	0

Current study observations revealed that according to BMI values; majority of the LIH patients belonged to obese category (class I to class III).

Tanaka index values which were calculated based on CT abdomen and loss of domain (LOD) which is the ratio of hernia sac volume (HSV) to abdominal cavity volume (ACV), revealed that majority of included study participants exhibited Tanaka score >0.25, these observations were in accordance to the study reports published by Seretis et al.[10-15] Hernia diameter and defect size as observed in current study findings ranged from 10-15 cm and 151 to 250 cm^2 respectively which was in accordance to findings reported by Rodriguez-Acevedo et al.[16] Abdominal wall repair with posterior component separation technique was the preferred surgical technique for LIH patients.[4]

Complete fascial closure was possible in 11 patients (96.7%), and mesh bridging was needed in 2 cases. It was observed during current investigation that total operative time in all the cases ranged between 200 to 400 minutes and wound infection and chronic pain where the only post-operative complications observed in few cases.

The observations of current study were in accordance to the reports published by Tang et al.[17]

CONCLUSION

It was concluded through current study findings that posterior component separation technique, together with pre-operative botulinum toxin injections achieved an acceptable fascial closure rate. Botulinum toxin thus can provide tension free and efficient repair of abdominal wall and can also aid in reducing post-operative complications such as abdominal compartment syndrome and respiratory complications.

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