

# Use of inj. Botox to the abdominal wall in large incisional hernia repair: A local experience in a tertiary hospital in Singapore

## ABSTRACT

Large incisional hernias are challenging to manage even with techniques like Component Separation (CS). Although chemical component separation with botulinum toxin A (BTA) prior to surgical repair has gained popularity over the years, it still remains poorly described in Southeast Asian literature. We share our local experience using BTA as an adjunct prior to CS in the repair of a large 8 x 15 cm incisional hernia. 3 weeks before surgical repair of his hernia, 300 IU of BTA was injected over 3 sites of the lateral abdominal wall (LAW) muscles bilaterally. The patient subsequently underwent elective surgery and was discharged well on postoperative day 5. A CT scan was done at 3 months showing no recurrence and sustained lengthening of his LAW muscles. In conclusion, low dose BTA increases LAW muscle length, facilitates fascial closure without tension as well as increasing abdominal cavity volume hence promoting better physiological postoperative adaptation. Despite being a useful adjunct in the management of large incisional hernias, there is significant variation in the dosage, concentration and techniques in which BTA is administered, as well as the optimal duration for administration prior to surgery. Further studies would have to be performed to obtain a consensus as to the best practice for the use of BTA.

**Keywords:** *Botulinum toxin A, Chemical Component Separation, Large Incisional hernia, Lateral abdominal wall*

## INTRODUCTION

“Large incisional hernias are debilitating complications that are difficult to manage even with techniques such as Ramirez’ component separation (CS) and Progressive Preoperative Pneumoperitoneum (PPP) which have been described in the literature for decades” [1,2,3]. “Incisional hernias occur at previous laparotomy incision sites as they are inherent areas of weakness that are susceptible to separation in the face of intra-abdominal pressures. The European Hernia Society recommends consideration of component separation with or without posterior release for moderate-large complex hernias”[4]. CS techniques were first described by Ramirez et al to elongate LAW musculature and reduce tension for primary fascia closure. Apart from being technically challenging, CS is associated with complications such as surgical site infection, seroma, wound dehiscence and enterocutaneous fistula at the site of hernia repair[5].

Subsequently, in the 1990s, Ibarra-Hurtado et al[6] introduced chemical component separation, using BTA to paralyze and elongate the LAW musculature before surgical repair. Ibarra-Hurtado et al. demonstrated that BTA use allowed a mean of 5.25 cm reduction in fascial defect width at 4 weeks while Zielinski et al. from Mayo Clinic further reported BTA use to increase the closure rate of midline defect by 6% within 24h[7]. BTA use has also been safely described for fascial defects of 6 to 18 cm in size by several other authors[8-12], showing its benefit in complex abdominal wall reconstruction.

To our knowledge, despite the benefits of BTA, there is limited literature on its use in the management of large complex hernias in Singapore. One of the postulated reasons for this could be due to the significant variation in the dosage, concentration and anatomical landmarks in which BTA is administered, as well as the optimal duration for administration prior to surgery. As a result of this, BTA is still considered as off-label use in Singapore. As such, we would like to share our experience with BTA chemical component separation prior to surgery for a large incisional hernia.

## **CASE PRESENTATION**

The patient is a 72-year-old male who was admitted for massive diverticular bleeding from the caecum, resulting in haemorrhagic shock requiring massive blood transfusions. He

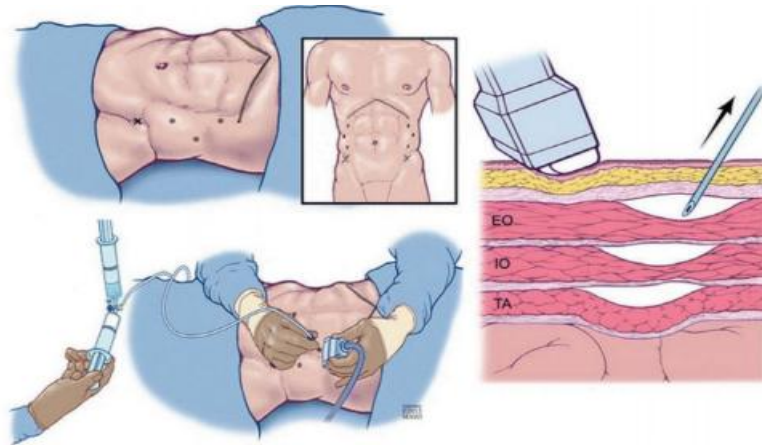
underwent angioembolization but had recurrent bleeding post embolization and became hemodynamically unstable again. He underwent emergency laparotomy, right hemicolectomy and temporary closure. He subsequently underwent a re-look laparotomy, ileocolic anastomosis and abdominal closure a day later. Post operatively, his stay was complicated by a contained anastomotic leak which was managed by percutaneous drainage and antibiotics. He also developed wound infection which was managed conservatively with wound packing. His anastomotic leak sealed eventually and he was discharged after a month. Five months after discharge, he was reviewed in clinic and found to have developed a large 8 x 15 cm incisional hernia above the level of the umbilicus. The large incisional hernia was limiting his daily activities and he was keen for surgical repair.



Figure 1: CT showing 8 cm incisional hernia defect

## TECHNIQUE

Our interventional radiologist elected to use the technique described by Zendejas Et al [13]. 3 weeks prior to definitive surgery, 300 IU of BOTOX<sup>®</sup>, mixed in 150 mL of sterile water, was equally distributed at three sites bilaterally along the anterior and mid axillary line as depicted in Fig 2 below. At each site an equal volume was injected just deep to the external oblique, internal oblique, and transversus abdominis fascia. The patient did not develop any complications after the procedure.



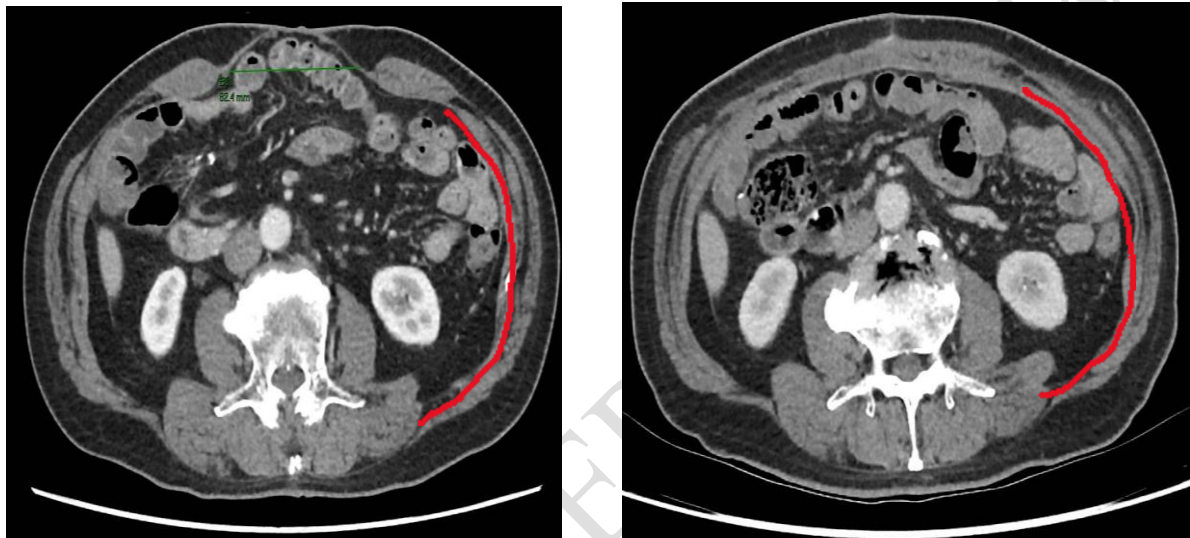
**Figure 2: Botox injection technique described by Zendejas et al[13]**

Three weeks later, the patient underwent elective laparotomy, adhesiolysis and anterior component separation. The abdomen was entered via the midline and adhesiolysis was performed. A small bowel enterotomy occurred resulting in spillage of enteric contents. This was repaired immediately with interrupted absorbable sutures. The external oblique aponeurosis was then divided lateral to the linea semilunaris from above the costal margin to the anterior superior iliac spine to complete an anterior component separation. Closure was performed with interrupted PDS 2/2 sutures as the patient had fairly minimal subcutaneous tissue and complained of discomfort from his sutures after his previous laparotomy. Furthermore, PDS sutures last 6 to 7 months which is more than sufficient time for wound healing. No mesh was used as we were able to obtain tension free primary closure of the fascia after anterior component separation and also because of enteric spillage from the enterotomy. The overlying hernia sac and excess skin were trimmed before subcutaneous closure with Vicryl 2/0 and staples to skin. Drains were inserted to the subcutaneous planes bilaterally to avoid seroma formation.

Post operatively, the patient recovered uneventfully. He did not develop any ileus, abdominal compartment syndrome or respiratory complications. By post operative day (POD) 2, he could ambulate 50 metres with minimal pain. He was placed on an abdominal binder while ambulating to help minimize pain. He was progressed to diet on POD 3. Immediate post operative pain control was initially managed with bilateral paravertebral On-Q pumps until POD 4, with only oral Oxynorm and

Paracetamol thereafter. The patient was sent home with subcutaneous drains on POD 5 to avoid seroma formation.

On review in clinic on POD 12, both lateral subcutaneous drain outputs were minimal and both were removed. The midline wound had healed well and staples were also removed. A repeat CT abdomen pelvis done at 3 months showed no early recurrence. The patient was followed up for 1 year with no recurrence on clinical examination.



**Figure 3: Pre-operative and post operative CT comparisons showing persistent lengthening of LAW musculature and successful primary fascial closure after CS.**

## DISCUSSION

The aim of pretreatment with BTA prior to surgical repair of large incisional hernias is to promote improved rates of primary fascial closure by decreasing hernia defect size and to allow for healing under tension-free circumstances [14]. BTA can also possibly avoid the need for CS, reduce recurrence, and avoid abdominal compartment syndrome post operatively.

“BTA is a protein with neurotoxin activity that is produced by *Clostridium botulinum*. It works at the neuromuscular junction by inhibiting the release of acetylcholine, thereby inducing flaccid paralysis. This muscle flaccidity results in LAW musculature lengthening by 3–4 cm on each side; and 6–8 cm in total. This suggests that a defect of 6–8 cm size would likely get the best benefit for primary

closure without component separation techniques”[15]. “The peak onset of action is approximately 2 weeks and can last up to 6 months”[16]. Commercial brands available locally in Singapore are BOTOX<sup>®</sup> and Dysport<sup>®</sup>.

Despite multiple papers being published about the use of BTA for abdominal wall reconstruction there is significant variation in the dosage used, technique of injection and duration before surgery. This is demonstrated in the paper published by Timmer et al[18] which has been summarized as appendix 1.

Dosage wise, generally, either 500 units of Dysport<sup>®</sup> or 200-300 units of BOTOX<sup>®</sup> is most commonly used. In terms of technique, Ibarra-Hurtado, Zielinski, Zandejas, Elstner and Hoffman[6,7,13,17,22], have described four different techniques but with onesimilar end result. They concluded that the administration should be at 3-5 locations bilaterally between the midclavicular to midaxillary line and should involve all 3 layers of LAW. The pattern could be a straight line or in a triangle from costal margin to superior iliac fossa. As for the optimal pretreatment duration before surgery, most papers in general advocate a duration of 2-4 weeks post injection as the peak onset of action for BTA is approximately 2 weeks. In our patient, we used 300 IU of BOTOX<sup>®</sup>, mixed in 150 mL of sterile water, which was equally distributed at three sites bilaterally along the anterior and mid axillary line. At each site an equal volume was injected just deep to the external oblique, internal oblique, and transversus abdominis fascia. The patient was operated on 3 weeks later.

Reported complications of BTA injections include weak cough or sneeze, backache and dyspnoea [19,20]. Some authors have suggested decreasing the dose of BTA used to minimize said complications while others have suggested sparing one of the layers of the LAW complex. With the currently available data, it is not possible to assess an optimal dosage and technique. More data from randomized controlled trials e.g. by D Moszkowicz et al[21] and NCT04419844 will help to provide more answers as to the best practice involving BTA for abdominal wall reconstruction. However, despite the lack of high-quality data so far, it is fair to say that BOTOX pretreatment seems safe as there has not been any major complications reported so far. Our patient similarly did not complain of any symptoms or experience any complications after the was BOTOX<sup>®</sup> administered.

## CONCLUSION

The use of BTA in the repair of large incisional hernias is safe without major procedural complications. The technical aspects and treatment regimens for BTA differ substantially. Randomized trials and prospective studies are therefore needed for comparison of outcomes in future research.

### Consent

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

### Ethical Approval:

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

## ACKNOWLEDGEMENTS

We will like to thank Dr Sulaiman and Dr Prasanna Sivanth Tirukonda for their assistance in the care of this patient.

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UNDER PEER REVIEW

## APPENDIX 1

References	Mean defect width (cm)	Type BTA, units (IE)	Volume injected (mL)	Injections (per side)	Muscles injected	Timing prior to surgery	Radiological guidance	Type repair	Mesh repair	Fascial closure	Follow-up (months)	Recurrence (%)
Blaha	8.5	Botox®, 200	30	n.r.	EO, IO, TA, RA	Intraoperative	None (direct visualization)	Open hernia repair with bilateral retrorectus release	100%	100%	n.r.	n.r.
Bueno-Lledó	16.1	Dysport®, 500	50	n.r.	EO, IO, TA	38 days	US + EMG	Open hernia repair	100%	97%	34.5	8%
Bueno-Lledó	14.9	Dysport®, 500	50	5	EO, IO, TA	34 days	US + EMG	Open hernia repair	100% <sup>a</sup> 100% <sup>b</sup>	100% <sup>a</sup> 95% <sup>b</sup>	19.6 <sup>a,b</sup>	0% <sup>a</sup> 5% <sup>b</sup>
Catalan-Garza	13.9	Botox®, 300	150	3	EO, IO, TA	6 weeks	US	Open hernia repair	n.r.	78%	24	11%
Chan	n.r.	Botox®, 200	n.r.	n.r.	EO, IO	30 days	US	Totally extracorporeal minimally invasive	100%	100%	18.3	0%
Cháves-Tostado	14.6	Botox®, 100	n.r.	5	n.r.	40 days	EMG	Open hernia repair	100%	78%	16	0%
Deerenberg	14.1	Botox®, 200 or 300	100 or 150	3	EO, IO, TA	4 weeks	US or CT	n.r.	97% <sup>a</sup> 96% <sup>b</sup>	92% <sup>a</sup> 81% <sup>b</sup>	14 <sup>a</sup> 29 <sup>b</sup>	9% <sup>a</sup> 12% <sup>b</sup>
Elstner	12.3	Botox®, 300 <sup>a</sup>	150	3	EO, IO, TA	1-4 weeks	US	Laparoscopic	100%	100%	19	0%
Elstner	11.4	Botox®, 200	100	3	EO, IO or EO, IO, TA	2-4 weeks	US	Laparoscopic	100%	100%	24	0%
Farooque	11.0	Botox®, 300	150	3	EO, IO, TA	2 weeks	US	Laparoscopic	100%	n.r.	n.r.	n.r.

References	Mean defect width (cm)	Type BTA, units (IE)	Volume injected (mL)	Injections (per side)	Muscles injected	Timing prior to surgery	Radiological guidance	Type repair	Mesh repair	Fascial closure	Follow-up (months)	Recurrence (%)
Hernández López	n.r.	Botox®, n.r.	n.r.	n.r.	n.r.	4 weeks	n.r.	Open hernia repair	100%	100%	12	n.r.
Ibarra-Hurtado	13.9	Dysport®, 500	n.r.	5	n.r.	4 weeks	EMG	Open hernia repair	n.r.	100%	9.1	0%
Ibarra-Hurtado	14.7	Dysport®, 500	5	5	EO, IO	4 weeks	US	Open hernia repair	24%	100%	49	0%
Kohler	12.2	Not specified, 400	n.r.	n.r.	EO, IO, TA	26 days	US	Open hernia repair	n.r.	n.r.	12	6%
Nielsen	12.1	Botox®, 300	60 or 150	3 or 5	EO, IO, TA	32 days	US	Open hernia repair	100%	100%	1	n.r.
Palmisano	11.2	Botox®, 200 or Xeomin®, 100	n.r.	n.r.	n.r.	4 weeks	US	Open hernia repair	100%	100%	n.r.	2.6%
Tashkandí	16.0	Dysport®, 500	180	3	EO, IO, TA	3–6 weeks	US	Open hernia repair	54%	100%	n.r.	n.r.
Yurtkap	n.r.	Botox®, 300	150	3	EO, IO, TA	45 days	US	Open hernia repair	100%	82%	19.5	14%
Zendejas	n.r.	Botox®, 300	150	3	EO, IO, TA	Range 0–19 <sup>b</sup>	US	Open hernia repair (45%) laparoscopic repair (55%)	100% <sup>a</sup> 100% <sup>b</sup>	41% <sup>a</sup> 36% <sup>b</sup>	15.6 <sup>a</sup> 18.4 <sup>b</sup>	9% <sup>a</sup> 9% <sup>b</sup>
References	Mean defect width	Type BTA, units (IE)	Volume injected (mL)	Injections (per side)	Muscles injected	Timing prior to surgery	Radiological guidance	Type repair	Mesh repair	Fascial closure	Follow-up (months)	Recurrence (%)
Blaha	8.5	Botox®, 200	30	n.r.	EO, IO, TA, RA	Intraoperative	None (direct visualization)	Open hernia repair	100%	100%	n.r.	n.r.

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Bueno-Lledó	14.9	Dysport®, 500	50	5	EO, IO, TA	34 days	US + EMG	Open hernia repair	100%a 100%b	100%a 95%b	19.6a,b	0%a 5%b
Catalan-Garza	13.9	Botox®, 300	150	3	EO, IO, TA	6 weeks	US	Open hernia repair	n.r.	78%	24	11%
Chan	n.r.	Botox®, 200	n.r.	n.r.	EO, IO	30 days	US	Totally extracorporeal minimally invasive	100%	100%	18.3	0%
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Deerenberg	14.1	Botox®, 200 or 300	100 or 150	3	EO, IO, TA	4 weeks	US or CT	n.r.	97%a 96%b	92%a 81%b	14a 29b	9%a 12%b
Elstner	12.3	Botox®, 300a	150	3	EO, IO, TA	1-4 weeks	US	Laparoscopic or laparoscopic-assisted	100%	100%	19	0%
Elstner	11.4	Botox®, 200	100	3	EO, IO or EO, IO, TA	2-4 weeks	US	Laparoscopic or laparoscopic-assisted	100%	100%	24	0%
Farooque	11.0	Botox®, 300	150	3	EO, IO, TA	2 weeks	US	Laparoscopic	100%	n.r.	n.r.	n.r.
Hernández López	n.r.	Botox®, n.r.	n.r.	n.r.	n.r.	4 weeks	n.r.	Open hernia repair	100%	100%	12	n.r.
Ibarra-Hurtado	13.9	Dysport®, 500	n.r.	5	n.r.	4 weeks	EMG	Open hernia	n.r.	100%	9.1	0%

References	Mean defect width (cm)	Type BTA, units (IE)	Volume injected (mL)	Injections (per side)	Muscles injected	Timing prior to surgery	Radiological guidance	Type repair	Mesh repair	Fascial closure	Follow-up (months)	Recurrence (%)
								repair				
Ibarra-Hurtado	14.7	Dysport®, 500	5	5	EO, IO	4 weeks	US	Open hernia repair	24%	100%	49	0%
Kohler	12.2	Not specified, 400	n.r.	n.r.	EO, IO, TA	26 days	US	Open hernia repair	n.r.	n.r.	12	6%
Nielsen	12.1	Botox®, 300	60 or 150	3 or 5	EO, IO, TA	32 days	US	Open hernia repair	100%	100%	1	n.r.
Palmisano	11.2	Botox®, 200 or Xeomin®, 100	n.r.	n.r.	n.r.	4 weeks	US	Open hernia repair	100%	100%	n.r.	2.6%
Tashkandi	16.0	Dysport®, 500	180	3	EO, IO, TA	3–6 weeks	US	Open hernia repair	54%	100%	n.r.	n.r.
Yurtkap	n.r.	Botox®, 300	150	3	EO, IO, TA	45 days	US	Open hernia repair	100%	82%	19.5	14%
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(r) retrospective, (p) prospective, RCT randomized controlled trial, VIH ventral incisional hernia, LOD loss of domain, DCL damage control laparotomy, n.r not reported, ACS anterior component separation, TAR transversus abdominis release.

<sup>a</sup>Most patients received a total dose of 300 Botox® or equivalent dose of Dysport®

<sup>b</sup>Due to logistical and patient clinical issues, nine patients (41%) had it a median of 6 days (range 1–19 days) prior to surgery, and 13 (59%) had it performed on the same day as surgery

<sup>c</sup>Nine patients (50%) underwent BTA injections within 24 h of their open abdomen procedure. Timing in the other nine patients is not mentioned