

Laparoscopic repair of complex ventral hernia facilitated by pre-operative chemical component relaxation using *Botulinum Toxin A*

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Learning Objectives

By the end of this journal club, participants will be able to:

1. Describe the different techniques used for hernia repair
2. Identify the patients who might benefit from the use of CCS prior to hernia repair
3. Understand the mechanism of BTA
4. Interpret pre- and post-CCS abdominal CT imaging

Module Outline

I. Case

II. Background

III. Article Overview

IV. Conclusion

Case Presentation

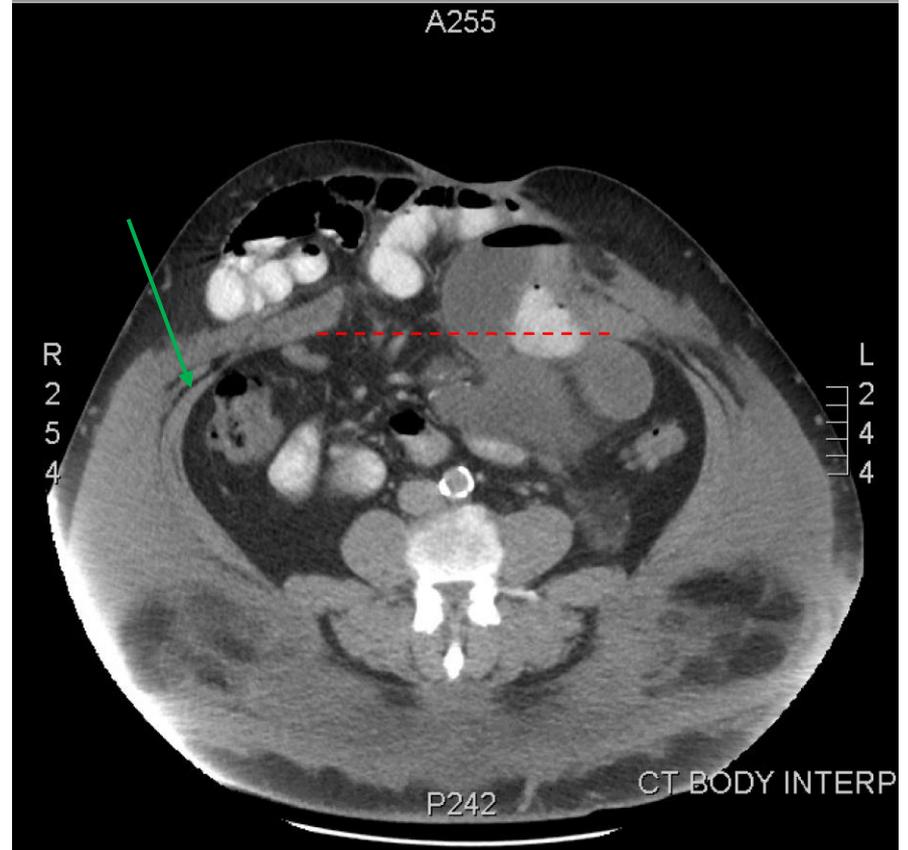
65 yo M who presents for evaluation of recurrent ventral hernia

PMHx: Multiple abdominal surgeries performed (ex lap with small bowel resection, and ventral hernia repair w/ mesh placement in 2015, and ex lap with fistula take down and hernia repair on 2018 for small bowel obstruction and enterocutaneous fistula.)

Comorbidities: BMI of 37

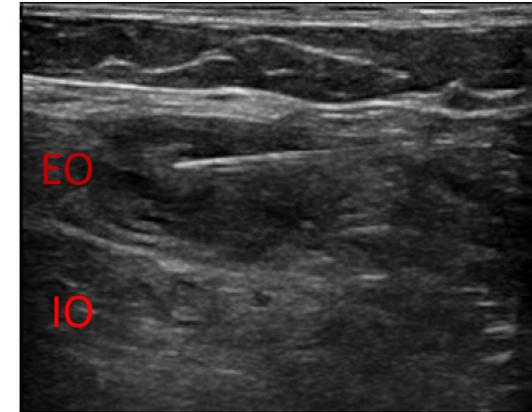
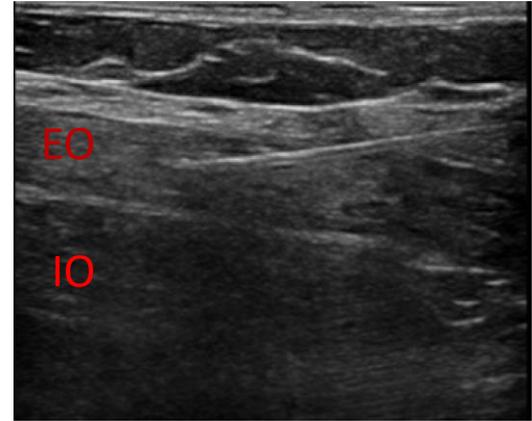
Surgical Evaluation

- Initial workup included CT abdomen/pelvis w/ contrast to evaluate hernia defect
 - 30 cm long x 17 cm ventral hernia defect w/ LOD
- Given hx of recurrent incisional hernia, patient was referred to IR for pre-operative CCS



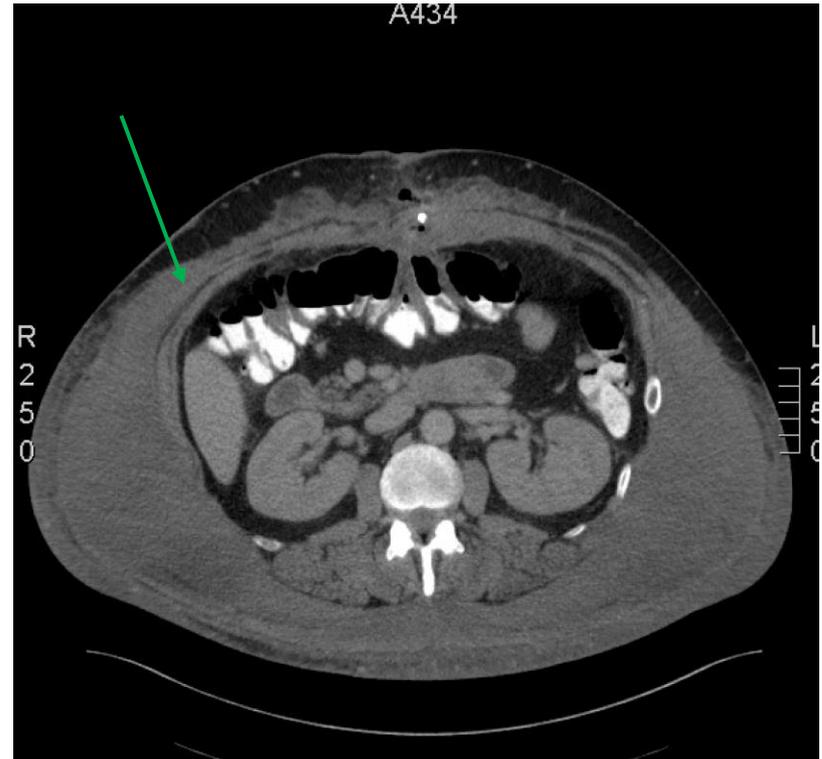
US-guided CCS

- Patient underwent pre-operative chemical component separation of the abdominal wall muscles in the IR suite



Surgical Repair of Hernia Defect

- Patient underwent open repair of ventral hernia with mesh placement 42 days after CCS
- CSS led to lateral abdominal wall muscle elongation and thinning allowing for fascial re-approximation



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Incidence of Incisional Hernia

- 20-35% of patients undergoing laparotomy may develop an incisional hernia.⁷
- Hernia recurrence occurs in up to 73% of patients with large ventral hernias and LOD
 - Recurrence risk increases with each failed hernia repair attempt as the quality of the tissue declines.⁸

Management of Incisional Ventral Hernias

Surgical repair of large ventral hernias is difficult secondary to significant muscle tension and lateral traction

- These forces reduce the volume of the peritoneal cavity and make fascial closure more difficult over time.
- Traditional repair consists:
 - Bridged repair: mesh material spans the length of the defect without the need to reapproximate the fascia.
 - Surgical component separation technique (CST): bilateral division of the external oblique muscular aponeurosis.

Despite these surgical techniques, hernia recurrence rates following surgical repair remain high

Management continued

Recently, minimally invasive techniques have been developed to facilitate fascial re-approximation in order to decrease rates of hernia recurrence.

- CCS has been proposed as an alternative treatment option to allow for primary fascial closure without tension and thus, the best chance for successful large hernia repair
 - Increases abdominal wall compliance by elongating and thinning the abdominal musculature.
 - Reduces post-operative pain and opioid use

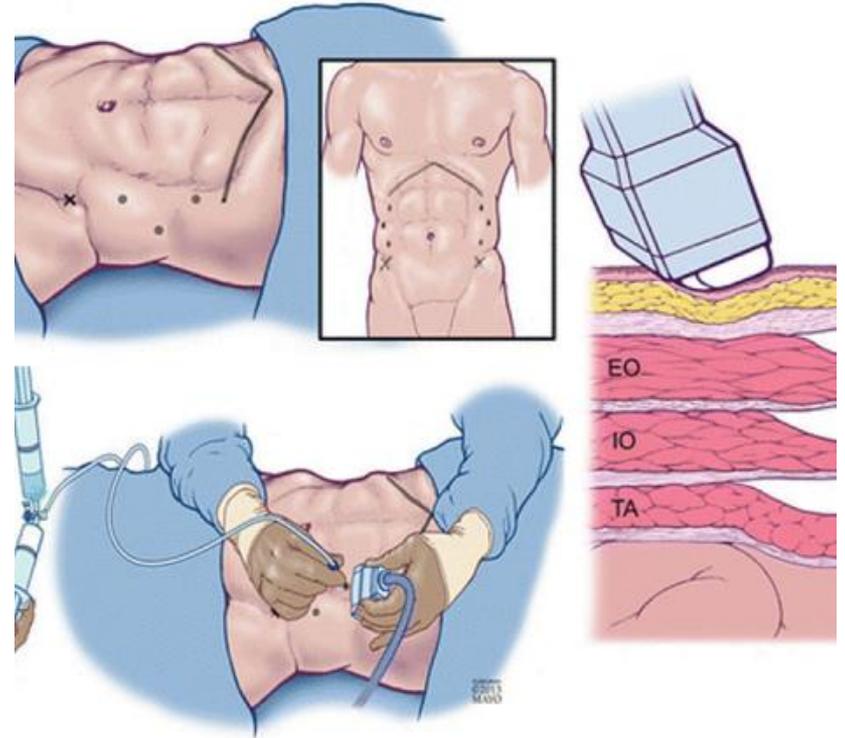
CCS Technique

Botulinum Toxin A (BTA), a neurotoxin that blocks signal transmission at the neuromuscular junction, is administered to each abdominal muscle belly (EO, IO, TA) under uninterrupted US-guidance on average 30 days prior to large hernia repair

- The paralyzing effect peaks at 2 weeks after intramuscular administration and declines gradually after 2.5 months

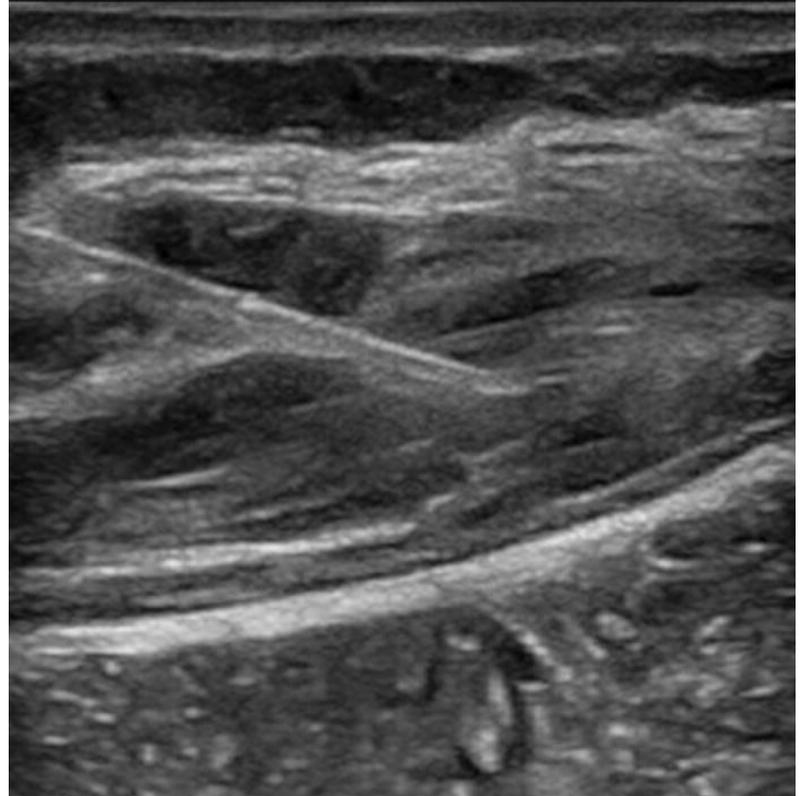
CCS Technique continued

- Mark costal margin at the level of the 9th rib and select a point anterior to the ASIS.
 - Draw a line along the anterior axillary line to connect these two anatomical locations
- Divide into 3 equidistant segments
 - Identify the EO, IO, and TA under US-guidance



CCS Technique continued

- Using a 21 g echo-tip needle, administer 8 mL of sol at each muscle belly
 - Injection is started along the TA muscle and should be repeated along more superficial muscle layers



Indications for CCS

- Loss of Domain
- Large Hernia Defects > 10 cm in length
- Giant Bilateral Inguinoscrotal Hernia
- Closure of Open Abdomen

Contraindications to BTA Administration

- Relative
 - concurrent treatment with aminoglycosides (may increase the effect),
 - penicillamine, quinine, chloroquine and hydroxychloroquine (may reduce the effect),
 - CCBs, anticoagulants (which may increase the risk of hematoma)
- Absolute
 - known hypersensitivity, neuromuscular diseases, Myasthenia Gravis, Lambert-Eaton syndrome, neuropathies, drugs affecting the muscle tone, and infections in the site of injection.
- Special Consideration
 - patients with severe chronic obstructive pulmonary disease for the possibility of botulinum toxin to affect respiratory dynamics.

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Objective

Examine the effect of pre-operative abdominal wall chemical component relaxation using Botulinum Toxin A (BTA) to induce temporary flaccid paralysis in order to facilitate laparoscopic repair of large complex ventral hernia.

Methods

Study Design

- Single-center, prospective observational study (Jan 2013- Aug 2015)
- BTA administration (300 U) to abdominal wall muscles 1-4 weeks prior to surgery
- Non-contrast serial CT examination at initial assessment, post-BTA injections in pre-operative stage, 4–8 weeks post-operative, and 6 months post-operative
- Measurements of lateral abdominal wall thickness and transverse abdominal wall length were performed by a single radiologist, using a single axial CT image at the same vertebral level on each occasion.

Methods continued

Participants

- 27 patients w/ large complex hernias
 - Minimum defect of 5 x 9 cm; Maximum defect of and the largest 24 x 27 cm
 - 12 females, 15 males w/ average age of 58 years (range 36–84 years), and a mean body mass index of 31 kg/m² (range 22–46).
 - 8 patients w/ one previous failed repair; 14 patients w/ two or more failed repairs

Statistical Analysis

- paired *t* test and descriptive statistics ($p < 0.05$).

Results

Pre-BTA mean abdominal wall length increased from 15.7 ± 3.7 cm per side to a mean length of 19.9 ± 4.0 cm per side post-BTA ($p < 0.0001$).

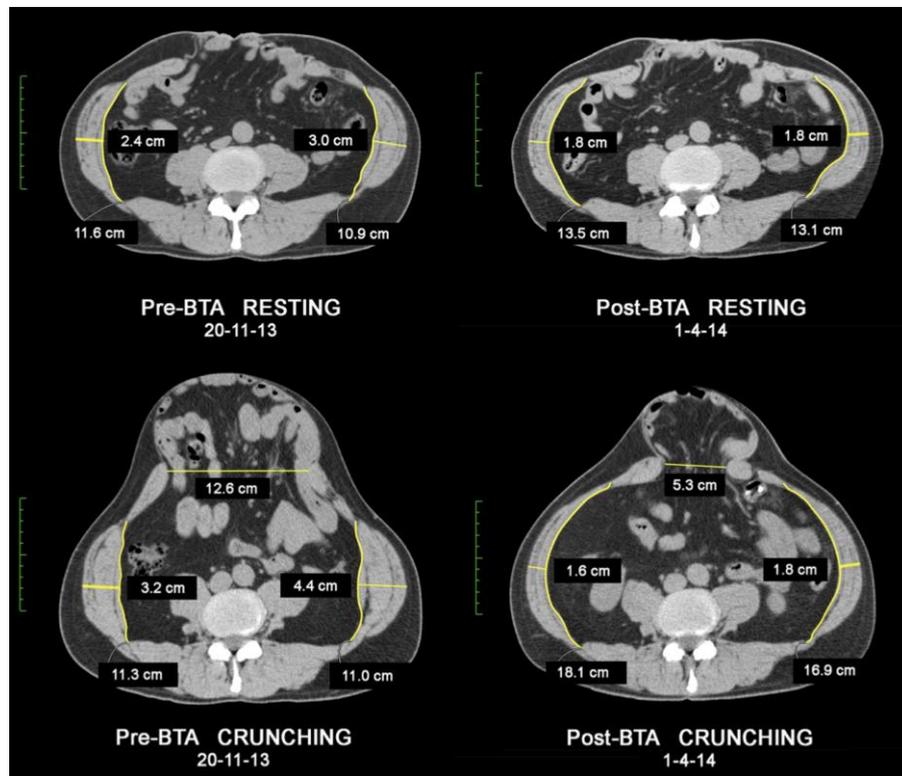
- Gain in mean transverse length of lateral abdominal muscles of 4.2 cm/side (range 0–11.7 cm/side). In patients with midline hernias ($n = 18$), when each side is added together, the mean absolute gain in lateral abdominal wall length prior to surgery was 9.8 cm (range 4.1 cm–20.2 cm) ($p < 0.0001$).
- A reduction in hernia defect size of up to 58 % was seen, as measured on CT scan

Results continued

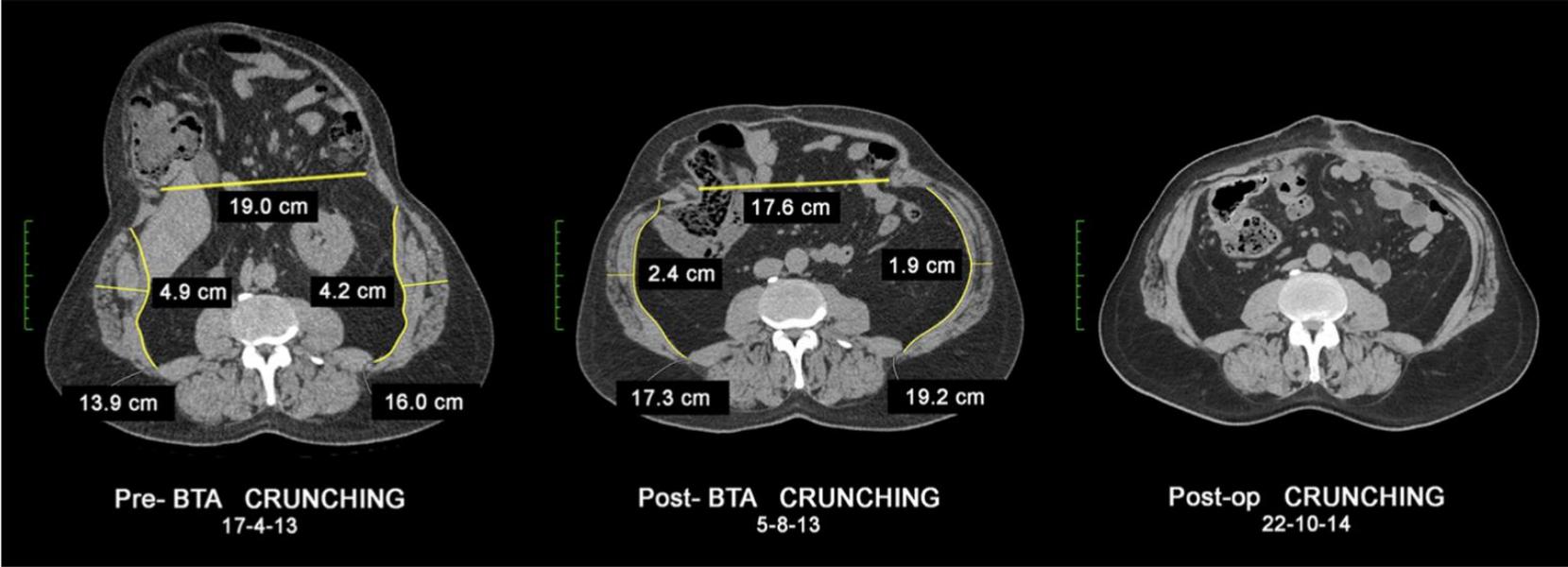
All patients had successful laparoscopic repairs of hernia defects with intra-peritoneal mesh placement

No hernia recurrences to date with mean follow-up of 16 months (range 2–33 months).

Comparison of pre-op and 2 weeks post- op coronal views and axial CT image comparison



Elongation and thinning of the lateral abdominal wall muscles



Complications

- No complications encountered from the BTA injections into the lateral abdominal muscles, and the injections were well tolerated.
- Side effects:
 - feeling of distension or bloating, and weak cough or sneeze, which were self-limiting

Study Limitations

- Observational study design is more prone to bias and confounding
- Hernia recurrence rate could only be assessed in the short-term period given limited follow-up
- All patients underwent laparoscopic hernia repair, which limits the generalizability of results to those who undergo open or robotic surgical repair of hernia defect.

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Conclusion

- Ultrasound-guided CCS is a safe and effective method for improving the success rate of surgical hernia repair.
- Changes in abdominal musculature can be observed by comparing pre- and post-BTA injection non-contrast CT scans
- US-guided BTA injections for the treatment of surgical hernia could provide a novel method for interventional radiologists to assist in the treatment of recurrent LVH defects.

Resources

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