Ab-normal pain: the untold story of ACNES!

Abdominal Cutaneous Nerve Entrapment Syndrome

Dr Christine Lamontagne,

June 4th, 2021

Pediatric chronic pain education day
Conflict of Interest

• None
Objectives

1) Presentation of 3 cases of ACNES
2) Define the epidemiology of ACNES and how to diagnose it with the Carnett’s test and injection of local anesthetic
3) Explain the different non-surgical and surgical treatment options for ACNES
Question #1

- As a health care provider, have you been ever been involved with a patient suffering from anterior cutaneous nerve entrapment (ACNES)?
  - A) Yes
  - B) No
  - C) Don’t know about ACNES
Case #1

- 12 yo female with initial history of RLQ abdominal pain, fever, nausea, vomiting and diarrhea from a viral illness (April 2017).
- Pain, nausea and occasional vomiting persisted for months. Abdominal US was otherwise normal except for 3 appendicoliths seen in appendix.
- Pain and nausea persist and lead to multiple ER visits, more bloodwork, multiple abdominal U/S and abdominal CT scan which all are normal except for possible retained appendiceal stump. General Surgery consult: no surgical pathology to explain the pain. Mother is very upset.
- Referral to chronic pain clinic (April 2018)
Case #1

- Chronic abdominal pain described as sharp, stabbing, nagging, continuous and aching over RLQ. PS: 7-9/10
- Pain affecting sleep, school functioning, sports, mood, family and social functioning
- Pain increased with SLR on right side, allodynia on mild palpation over RLQ, Positive Carnett’s test
- Diagnosis of ACNES most probable
**BODY PAIN DIAGRAM:**

Using this diagram, shade the areas where you feel pain. Place an "X" on the area that hurts the most:

![Body Pain Diagram](image)

Circle the words that best describe your pain:
- sharp
- exhausting
- unbearable
- numb
- continuous
- shooting
- heavy
- stabbing
- tingling
- exhausting
- aching
- deep
- cramping
- nagging

1. Circle the one number that best describes your pain at its worst in the last week.
   - No pain
   - Worst Pain
   - 0 1 2 3 4 5 6 7 8 9 10

2. Circle the one number that best describes your pain at its least in the last week.
   - No pain
   - Worst Pain
   - 0 1 2 3 4 5 6 7 8 9 10

3. Circle the one number that best describes your average level of pain in the last week.
   - No pain
   - Worst Pain
   - 0 1 2 3 4 5 6 7 8 9 10

4. Circle the one number that tells how much pain you have right now.
   - No pain
   - Worst Pain
   - 0 1 2 3 4 5 6 7 8 9 10

The purpose of this questionnaire is to tell us about the severity of your pain and how the pain affects your day to day activities.

**FUNCTION:** Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

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<thead>
<tr>
<th>General Activity</th>
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For clinic purpose only
FUNCTIONAL INTERFERENCE SCORE 60
Case#1 (treatment)

- Initiation of 3 P approach:
  - Pharmacological: amitriptyline 10-25 mg po qhs to help with sleep and neuropathic pain
  - Physical: (OT and PT consultation) **Goals:** 1. Improved myofascial mobility with home stretches 2. Return to running (walk/run program to start), 3. Improved understanding of pacing, 4. Able to identify 2-3 physical/psychological strategies for pain self-management,
  - Psychological: Referral to community psychologist to help with stress and coping following parental separation. Social worker consultation: school liaison and school letter for accommodations
  - Ultrasound guided TAP block under GA with 20 ml of ropivacaine 0.2% and triamcinolone 50 mg near point of maximal tenderness. (July 2018)
  - Pain significantly decreased after the block which lasted about 1 month.
  - Ultrasound guided rectus sheath block under GA repeated just lateral to rectus sheath with 18 ml of bupivacaine 0.25% with epi 1:200 000 with triamcinolone 50 mg (November 2018)
FUNCTION: Circle the one number that describes how, during the past 24 hours, pain has interfered with your:

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For clinic purpose only
FUNCTIONAL INTERFERENCE SCORE: 3 /10

Reference: Adapted, Cleeland, C. S. (1991). Brief Pain Inventory (Short Form)
Case #2

- Exam: Positive Carnett’s test. Allodynia over painful area.
- Dx: probable ACNES
- Recommended combination of pharmacological, physical and psychological approach (January 2018)
Circle the words that best describe your pain: sharp, unbearable, numb, continuous, tingling, cramping, deep, burning, throbbing, exhausting, stabbing, excruciating.

1. Circle the one number that best describes your pain at its worst in the last week.  
   
   No pain  0 1 2 3 4 5 6 7 8 9 10  
   
   Worst Pain

2. Circle the one number that best describes your pain at its least in the last week.  
   
   No pain  0 1 2 3 4 5 6 7 8 9 10  
   
   Worst Pain

3. Circle the one number that best describes your average level of pain in the last week.  
   
   No pain  0 1 2 3 4 5 6 7 8 9 10  
   
   Worst Pain

. Circle the one number that tells how much pain you have right now.  
   
   No pain  0 1 2 3 4 5 6 7 8 9 10  
   
   Worst Pain

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*nors*, pain has interfered with:

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For clinic purpose only  
FUNCTIONAL INTERFERENCE SCORE \( \frac{33}{70} \)

Reference: Adapted, Cleeland, C. S. (1991). Brief Pain Inventory (Short Form)
Case #2

- July 2018: Ultrasound guided (R)rectus sheath block with ropivacaine 0.2% 20 ml and triamcinolone 60 mg: some improvement in pain for 1-2 months and improvement in functioning (school, return to soccer and basketball) agrees to amitriptyline 10 mg po qhs and pregabalin. Physiotherapy sessions for myofascial release of abdomen, core strengthening and pacing to run. Refuses psychology sessions to work on pain coping but uses mindshift app for meditation/relaxation.

- November 2018: US guided (R)rectus sheath block with trigger point injection with bupivacaine 0.25% with epi 1:200 000 18 ml + 40 mg of triamcinolone+1 ml of MgSo4 50 mg/ml: short term response.

- February 2019: Anterior and posterior cutaneous nerve release at Sick Kids by Dr Langer: no improvement in pain. August 2019: Repeat rectus sheath block with bupivacaine 0.25% with epi + 60 mg triamcinolone.

- Improvement in functioning noted. Currently discharged and studying at Carleton University.
What is ACNES?

- Abdominal wall is supplied via the anterior and lateral cutaneous branches of the anterior rami of T7 – T12. Iliohypogastric (T12-L1) and ilioinguinal(L1)
- Nerves run in a plane between the internal oblique and transversus abdominis muscles.
- Nerve Entrapment can occur where a nerve either changes its direction to enter a tunnel or pass over a fibrous or muscular band
- Most common area is lateral to the rectus muscle, other areas are ilioinguinal and iliohypogastric. Nerve Entrapment in scars can also occur
Anatomy of abdominal wall

(a)

- Tendinous intersection
- Rectus abdominis
- External oblique
- Internal oblique

(b)

- Rectus abdominis
- Anterior rectus sheath

(c)

- Skin
- External oblique
- Internal oblique
- Transversus abdominis
- Transversalis fascia
- Peritoneum
Thoracoabdominal nerves

T7-T12
Anterior cutaneous branches of T7-T12: most common site of entrapment
Risk factors:
Previous abdominal surgery, laparoscopic surgery, pregnancy, and sports activity involving rectus muscle, scar tissue, obesity.
What are the clinical features of ACNES?

- Pain usually constant or fluctuating, rarely episodic, described as neuropathic in character (stabbing, sharp, etc)
- Pain intensity sometimes related to posture (sitting, standing)
- Pain not related to meals or bowel function, no fever, no anemia, no signs of inflammation, no weight loss
- N&V: sometimes present due to pain
- Pain increases when abdominal muscles are tensed (positive Carnett’s sign)
- Discrete tender trigger points usually found at lateral margin of rectus abd. Muscle or insertion points of fascia or muscle
- Stimulation of trigger point reproduces pain and may be felt over larger area
### Synonyms of ACNES

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Overlapping expressions or synonyms used for CAWP or ACNES</th>
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<tbody>
<tr>
<td></td>
<td>Abdominal wall tenderness</td>
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<td>Abdominal wall syndrome</td>
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<td></td>
<td>Abdominal wall nerve entrapment syndrome</td>
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<td>Abdominal wall myofascial pain syndrome</td>
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<td></td>
<td>Abdominal pelvic pain syndrome</td>
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<td></td>
<td>Chronic abdominal wall syndrome</td>
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<td></td>
<td>Chronic nonvisceral abdominal pain</td>
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<td></td>
<td>Epigastric pain syndrome</td>
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<td>Ibrahim syndrome</td>
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<td>Intercostal nerve syndrome</td>
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<td>Irritation of the anterior nerves of the abdominal wall</td>
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<td>Pseudovisceral pain syndrome</td>
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<td>Rectus muscle syndrome</td>
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<td></td>
<td>Rectus abdominis nerve syndrome</td>
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<td>Rectus nerve entrapment</td>
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<td></td>
<td>Rectus syndrome</td>
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<td>Thoracic lateral cutaneous nerve entrapment</td>
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</table>
How common is chronic abdominal wall pain?

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>n</th>
<th>Prevalence of CAWP</th>
<th>Features of the overall study population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thomson, Francis (10)</td>
<td>1977</td>
<td>120</td>
<td>23 (19%)</td>
<td>Localized abdominal pain, presentation to emergency room, exclusion of intra-abdominal pathology including laparoscopy in 11 patients¹</td>
</tr>
<tr>
<td>Hall, Lee (11)</td>
<td>1988</td>
<td>ca. 160</td>
<td>15%</td>
<td>Nonspecific abdominal pain, prior exclusion of intra-abdominal disease¹¹</td>
</tr>
<tr>
<td>Gray et al. (12)</td>
<td>1988</td>
<td>67</td>
<td>19 (28%)</td>
<td>Nonspecific abdominal pain, evaluation on a surgical service, exclusion of intra-abdominal disease¹¹</td>
</tr>
<tr>
<td>Johlin, Buhac²</td>
<td>1996</td>
<td>226</td>
<td>68 (30%)</td>
<td>Gastroenterological referrals and referrals to a tertiary care center after prior diagnostic evaluation</td>
</tr>
<tr>
<td>Adibi et al. (8)</td>
<td>2012</td>
<td>998</td>
<td>30 (3%)</td>
<td>Unselected patients with chronic abdominal pain</td>
</tr>
</tbody>
</table>

¹¹ Reference numbers are not provided in the text.
How common is ACNES in children and youth?

- Cross-sectional cohort study (10 to 18 yo) in pediatric outpatient department with new-onset abdominal pain during a 2 years' time period.
- 12 of 95 adolescents with chronic abdominal pain had ACNES. Carnett sign was positive in all 12. 6 weeks after treatment (1-3 injections, n = 5; neurectomy, n = 7), pain was absent in 11 patients.
- In adolescents, ACNES present in 1/8 (12.5%) of cases of chronic abdominal pain.

Etiology of abdominal wall pain

- Hernia (Spigellian, incisional, ventral, inguinal, etc)
- ACNES (rectus, thoracic lateral, ilioinguinal, iliohypogastric)
- Endometrioma
- Abdominal wall tear (seen in athletes)
- Hematoma
- Neuroma
- Desmoid tumor
- Herpes Zoster
- Diabetic neuropathy
- Spinal nerve irritation (from thoracic spine)
- Slipping rib syndrome (luxation of 8th to 10th ribs)
- Myofascial (idiopathic)
Carnett’s test

Described by Dr. John Carnett (general surgeon) in 1926

Mayo Clin Proc. n January 2019;94(1):139-144

**Carnett’s Sign**

1. Palpate site during flexed abdomen
2. If increased pain, source is likely abdominal wall
3. If no increased pain, source is likely visceral

**FIGURE 1.** Presence of Carnett’s sign can be used to diagnose chronic abdominal wall pain. Used with permission of Mayo Foundation for Medical Education and Research. All rights reserved.
Management of ACNES

- Multidisciplinary approach involving reassurance, education, rectus muscle stretch exercises, and pacing of identified precipitating activities
- Physical approach: Application of heat or cold, use of abdominal binders, and transcutaneous electrical nerve stimulation (TENS) machine
- Pharmacological approach (can be used in combination with injections): acetaminophen, NSAIDS, pregabalin or gabapentin, amitriptyline or nortriptyline, and opioids (less commonly)
- Topical treatments: lidocaine 5%/ketamine 10% cream, capsaicin cream (0.025 – 0.075%)
Management of ACNES

1) Local anesthetic injection: blind trigger point injection or ultrasound guided rectus sheath or Transversus abdominis (TAP) blocks
2) Combined injection of local anesthetic and corticosteroids (therapeutic, may need 2-3 injections)
3) Chemical neurolysis, e.g., with phenol
4) Surgery (neurectomy or nerve decompression)
Ultrasound-guided rectus sheath nerve block: goal is injection within the neurovascular bundle/ring which carries the anterior cutaneous nerve. Both diagnostic and therapeutic
Efficacy of trigger point injection therapy

- Observational studies
  And RCTs
- Blue: immediate effect
- Red: after single injection
  (2 weeks - 6 months)
- Beige: long term after
  multiple injections (up to 7 years)

**Figure 3**

<table>
<thead>
<tr>
<th>LA</th>
<th>Greenbaum et al. (20)</th>
<th>Boelegens et al. (21)</th>
<th>Koprdova et al. *</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA + steroids</td>
<td>Shute (22)</td>
<td>Gallegos and Hobsley (23)</td>
<td>Hershfield (24)</td>
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<tr>
<td>Phenol</td>
<td>Mehta and Rangar (25)</td>
<td>McGrady and Marks (26)</td>
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Response to treatment (full relief or improvement)
Efficacy of trigger point injection therapy

• Local anesthetic/steroid injections more effective than local anesthetic alone.
• No data on which steroid is better (prednisolone Vs triamcinolone)
• Phenol injection not superior to local anesthetic/steroid injection. Done using a nerve stimulator. Some patients had chemical irritation and pain post injections (n=108, n= 76)
Efficacy of ultrasound guided nerve blocks
pediatric studies

• Case series (n=9) with **US guided trigger point injection** with 3 ml of bupivacaine 0.5% + triamcinolone 40 mg. 6 patients had >50% pain reduction after only one injection (Kanakarajan S, High K, Nagaraja R. Chronic abdominal wall pain and ultrasound-guided abdominal cutaneous nerve infiltration. A case series. *Pain Med.* 2011;12(3):382–386)

• Case series of 3 teenagers with ACNES treated with **US guided transversus abdominis plane (TAP) blocks**, injecting a local anesthetic with a corticosteroid close to the rectus abdominis muscle and close to painful trigger point. One patient had three consecutive blocks, the other had two, and the last one had only one block before pain disappeared Nizamuddin SL, Koury KM, Lau ME, Watt LD, Gulur P. Use of targeted transversus abdominis plane blocks in pediatric patients with anterior cutaneous nerve entrapment syndrome. *Pain Physician*. 2014; 17(5):E623–E627.

• Case series of 5 teenagers with ACNES treated with **rectus sheath blocks and TPI** (not ultrasound guided) with local anesthetic and triamcinolone or methylprednisolone (40-50 mg) also treated with multidisciplinary approach, all had return to function and decrease in pain after 1-3 blocks. Skinner AV, Lauder GR. Rectus sheath block: successful use in the chronic pain management of pediatric abdominal wall pain. *Paediatr Anaesth* 2007;17:1203–11
Important anatomical variation

a) Anatomy of 2/3 of individuals: thoracic nerves run between the posterior rectus sheath and rectus m. before perforating the sheath or muscle to form the anterior cutaneous branch

b) In 1/3 of individuals, the anterior cutaneous branch is formed before the rectus sheath
Other less studied approaches

- Botox injections: case series (n=15) with some success with ultrasound guided botox (40 IU) injection. Multiple injections needed (2-35).
- Radiofrequency ablation: (thermal or pulsed) Case report of successful radiofrequency ablation of DRG T11-T12 for ACNES. Observational studies of successful pulsed radiofrequency ablation for intercostal neuralgias
- Neuromodulation techniques (no studies)
Question 2

• How many patients from your practice have had diagnostic /therapeutic nerve blocks for ACNES over last year (best estimate)?
  • A) 0 or unknown
  • B) 1-3
  • C) 3-6
  • D) greater than 6
Surgical management of ACNES

- Most of the data on surgical management coming from one center in the Netherlands.
- Case series of 6 published describing complete resolution of symptoms in school aged children (9-16yo) with chronic abdominal wall pain.
- Diagnosis verified by trigger point injection with lidocaine 1% (5 ml).
- If they failed to respond to 2 therapeutic trigger point injections with lidocaine/methylprednisolone 40 mg, then anterior neurectomy was offered.
- All were pain free at 6 months and had returned to all their activities.
Before and after anterior neurectomy in 6 children

Anterior neurectomy

- Point of maximal pain identified using the Carnett test and marked with a pencil.
- Under GA, the anterior sheath of rectus abdominis muscle exposed via a 3- to 5-cm transverse skin incision.
- Branches penetrating into the subcutaneous fat through preexistent fascial holes are considered to contain nervous structures and removed. Accompanying vascular structures are ligated or coagulated.
- If additional intramuscular nerve side-branches are suspected, the anterior sheath of the rectus muscle is opened via lateral extension of these preexistent holes, and these side-branches are removed. Closure in layers with absorbable sutures.
RCT on efficacy of treatment for ACNES: injection and neurectomy

Treatment deemed as successful if pain score decreased by 50% on VAS


Question 3

How many patients from your practice have been referred for surgery (Anterior neurectomy) for ACNES over last year (best estimate)?

- A) 0 or unknown
- B) 1-3
- C) 3-6
- D) greater than 6
Failed neurectomy


- Case series (n=41) with recurrence of pain after anterior neurectomy
- Repeat surgery = posterior neurectomy and/or re-exploration of the operated site (secondary anterior neurectomy)
- Reported success rate of about 66%. A second operation for recurrent pain is more likely to succeed if patient was pain free immediately after initial surgery (93% success rate). It was only 50% in patients who had derived no benefit at all from their first operation
- About 1/3 of patients do not respond to surgery and will have to managed with multidisciplinary approach
Proposed diagnostic and therapeutic algorithm for patients with ACNES

Anterior cutaneous nerve entrapment syndrome: management challenges; Eleni Chrona
Georgia Kostopanagiotou, Dimitrios Damigos Chrysanthis Batistaki
Journal of Pain Research 2017:10 145–156

*Only in experienced centers
1) **ACNES** is common in children (12%) and adults (15-30%) but poorly recognized and often misdiagnosed. **True**

2) It is characterized by diffuse abdominal pain, usually in the middle of the rectus abdominis muscle. **False**

3) The diagnosis can be established very reliably with the aid of **Carnett’s test and confirmed with local anesthetic trigger point injection**. **True**

4) The first line of treatment is injection of local anesthetic combined with a corticosteroid. Best nerve block for ACNES is still in question. (ultrasound guided TAP (lateral border of rectus)Rectus sheath nerve block and TPI at point of maximal tenderness seems to be the most logical approach. **True**

5) If repeated injections lead to definite, but only temporary relief of pain after each injection, neurectomy of the affected nerves of the abdominal is not recommended for longer-lasting relief. **False**