



Spectrum of abdominal anterior cutaneous nerve entrapment syndrome (ACNES) with successful management: a case report

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Abstract

Abdominal pain is a common symptom with a spectrum of causes. Anterior cutaneous nerve entrapment syndrome (ACNES) is a commonly overlooked and underdiagnosed cause for anterior abdominal pain. Among the patients of chronic abdominal wall pain, the incidence of ACNES is 10–30% and the most common cause is nerve entrapment at the lateral border of the rectus muscle. We describe two cases covering varied location of entrapment, one at the medial border of rectus and another at lateral border explaining the need of ultrasound for successful management of both. This case report illustrates the difficulty of making this diagnosis, utility of ultrasound and a brief review of literature.

Keywords Chronic abdominal pain · Anterior cutaneous nerve entrapment syndrome · Chronic abdominal wall pain · Abdominal wall pain

Abbreviations

ACNES	Anterior cutaneous nerve entrapment syndrome
CT	Computed tomography
MRI	Magnetic resonance imaging
HD	Hydro dissection
VAS	Visual Analog Scale
GERD	Gastro esophageal reflux disease
PPF	Pre peritoneal fat
LA	Local anaesthesia

on an average from initial presentation to diagnose ACNES, leading to unnecessary consultation and testing [1, 2]. The incidence is approximately 2% of patients presenting with acute abdominal pain at the emergency department, has a predilection of females and commonly seen between 3rd and 5th decades of life but also in adolescents [3].

Written informed consent was obtained from the patients for publication of this case report and accompanying images.

Introduction

Among the plethora of pathologies that can cause chronic anterior abdominal pain, ACNES is commonly underdiagnosed and undertreated [1], commonly erroneously misinterpreted as other visceral pain [1]. It usually takes over a year

Report

Case 1

A 22-year-old patient presented with a 5-year history of severe left supraumbilical dull pain without any altered sensation. There was no history of trauma or surgery. He was not a keen sports person either. The pain was transiently relieved with oral anti-inflammatory medications during the initial period of 2 years. However, for the last 3 years he has been having intramuscular or intravenous analgesics for relief. He had consulted several specialists including general surgeons, gastroenterologists and a neurologist who could not find any possible cause for his symptoms. Ultrasound, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) of abdomen were performed all of which were unremarkable. On clinical examination he had focal pain in the left anterior abdominal wall with an area

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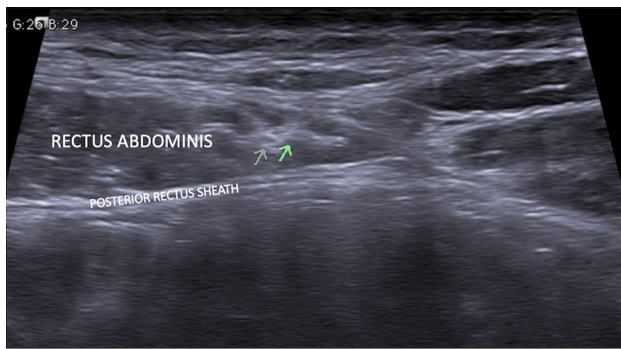


Fig. 1 Axial ultrasound image of the left abdominal wall showing the anterior cutaneous nerve (arrows)

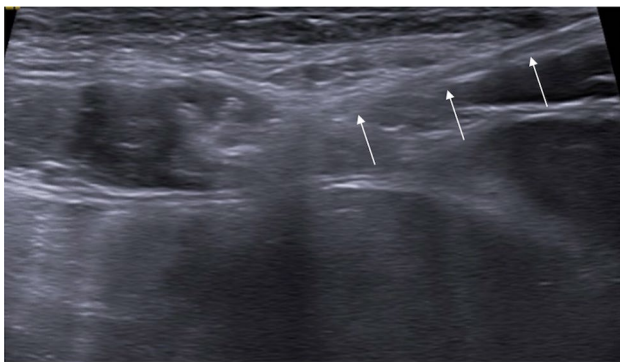


Fig. 2 Axial ultrasound images showing ultrasound guided needle (arrows) insertion around the anterior cutaneous nerve

of focal tenderness on palpation, without any altered sensation. Carnett's test (pain on active contraction of abdominal muscles) was positive. A provisional clinical diagnosis of ACNES was considered probable and the option of doing an ultrasound-guided diagnostic block for ACNES was discussed with the patient.

A diagnostic block was performed under direct ultrasound guidance with 1 ml of 2% lignocaine at the site of the anterior cutaneous nerve near lateral border of left rectus abdominis muscle belly (Fig. 1). Following this he had near complete resolution of symptoms and Carnett's test was negative just after the block. Subsequently, Hydro-Dissection (HD) using 7 ml Injection 5% dextrose, 40 mg of triamcinolone and 2 ml of lignocaine was performed in the same sitting. HD was performed using a 22G lumbar puncture needle using in plane technique with the needle trajectory from lateral to medial (Fig. 2).

Following the HD, the Visual Analog Scale (VAS) score decreased from 5 to 1 at 6 weeks. However, he had recurrence of symptoms at 3 months following an episode of heavy weight lifting. Ultrasound-guided HD was performed again with significant improvement of VAS from 7 to 1 at

6 weeks. He had a second episode of recurrence at 3 months, and he underwent ablation with 1 ml of absolute alcohol mixed with 1 ml of 2% lidocaine. He has been asymptomatic since at 14 months follow-up.

Case 2

A 34-year-old male patient presented with dull, localised pain with a sharp component at epigastric site supraumbilically, which was insidious in onset and gradually progressive since 2014. Pain aggravated post activity involving contraction of abdominal wall (VAS score-8/10) but a baseline discomfort was felt by him at all times (VAS score-4/10). The patient consulted a gastroenterologist who after initial ultrasound abdomen thought the pain generator to be jejunojejunal intussusception for which he underwent diagnostic laparoscopy, but intraoperative picture was unremarkable. This prompted the surgeon to manage it as functional pain syndrome and he was referred to a psychiatrist. Later in 2020, the patient still suffering was diagnosed with Gastro-Esophageal Reflux Disease (GERD) by manometry and upper gastrointestinal endoscopy and underwent fundoplication operation, which yet again brought no relief to his symptoms. In 2021, patient got an MRI abdomen and pelvis with normal study report. Patient presented to us in 2023 with electric-shock like pain at the epigastric region since almost 9 years, and on clinical examination, there was tenderness in epigastrium with a positive Carnett's sign which made us to think of primary possibility of ACNES. High resolution ultrasound done with a multi-Hertz linear transducer (PLT-1005BT probe, frequency range 5–14 MHz, Aplio A; Canon Medical Systems, USA) revealed the mild thickened right anterior cutaneous nerve in rectus tunnel in the preperitoneal fat, just medial to the medial margin of right rectus abdominis muscle in comparison with left side, with typical aggravation of symptoms on probe pressure- Positive sonographic Tinel's sign confirming the diagnosis of ACNES (Fig. 3). We did a diagnostic block at the site of enlarged anterior cutaneous nerve cross-section seen under ultrasound guidance with 1 ml of 1% lignocaine which resulted in immediate reduction of patient symptoms by 70–80% which confirmed our diagnosis and in the same sitting we did a therapeutic HD using total volume of 8 ml with 5% dextrose and 40 mg triamcinolone (Fig. 4).

On follow-up, the patient reported 60–70% pain relief at 6 weeks post procedure and the decision of a second sitting for HD was taken. Similar volume of 8 ml mixture using 5% dextrose, 40 mg triamcinolone with 1 ml of 1% lignocaine was injected around the right anterior cutaneous nerve at the medial border of right rectus abdominis at 6 weeks.

Follow-up with the patient revealed 100% pain relief at the site, 6 months post second sitting of HD for ACNES.

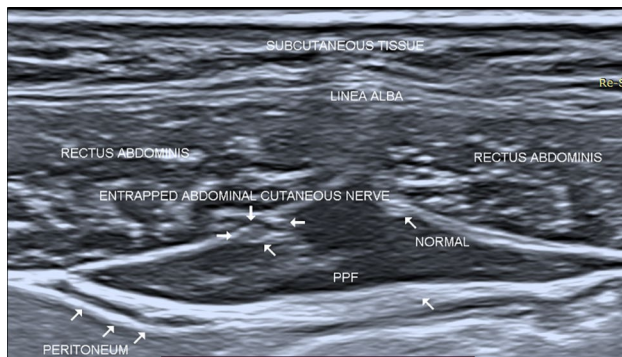


Fig. 3 Ultrasound axial image at the level of epigastrium with enlarged right anterior cutaneous nerve in comparison with the left, along the medial margin of rectus abdominis muscle in the preperitoneal fat (PPF)

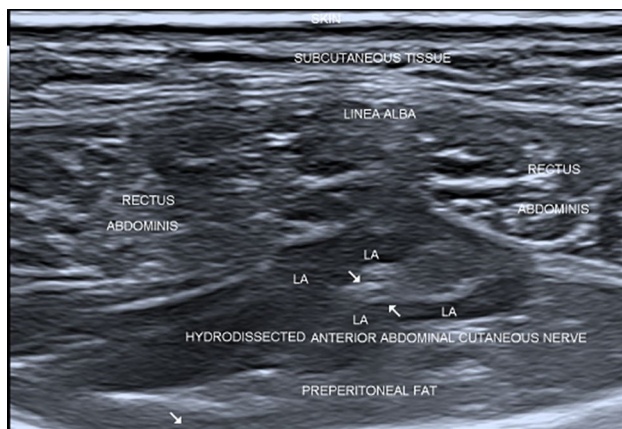


Fig. 4 Hydrodissected anterior cutaneous nerve with surrounding local anaesthesia pool (LA)

Discussion

ACNES presents a clinical challenge, as there are no available functional or imaging findings to confirm this and the diagnosis is based on clinical criteria. A recent study showed that typical findings in history and physical examination, including sensory disturbances, a positive pinch sign and a positive Carnett's sign, combined with a positive modified rectus sheath block are the typical characteristics of ACNES patients [1].

The incidence of ACNES is thought to be 10–30% of patients with chronic abdominal wall pain [4]. The sensory innervation of the anterior abdominal wall is by the lower intercostal nerves (T8–T12) which after their course in the intercostal spaces, course behind the costal margin (7–12), run between the internal oblique and transversus abdominis muscles, up to the point where they reach the rectus abdominis muscle; at this point they make a 90°

turn to enter the posterior rectus sheath, to pierce the rectus muscle and to finally reach the skin where they terminate as anterior cutaneous branches [2, 5] (Fig. 5). There are five channels on each side of the lateral border of the rectus abdominis, which can be seen as nerves coming out from the foramen with help of high-resolution linear ultrasound probe.

Thompson and Kopell postulated that entrapment of these nerves may occur at the anatomical sites where these abruptly turn to enter osseofibrous or fibrous tunnel or over a fibrous or muscular band as these are the locations of maximal mechanical irritation [6]. The most likely anatomical site of entrapment is at the point they turn to enter the rectus channels at the lateral border of the rectus muscle. The anterior cutaneous nerves transverse through a rectus channel consisting of an intramuscular fibrous ring located superficial to the posterior rectus sheath. Fat herniation through this ring, scar tissue adjacent to the nerves, stretching of the nerves and bunching of the nerves secondary to increased intra-abdominal pressure is thought to cause alteration of the normal function of these nerves resulting in ACNES [2]. However, in few cases, the entrapment can occur at the medial border of the rectus muscle as well before entering into the preperitoneal fat as depicted in our second case. Patients with history of previous surgery, obesity and pregnancy are considered to be at risk of ACNES [2, 7]

The diagnosis of ACNES is by combination of clinical history of anterior abdominal pain, altered sensation and Carnett's test (eliciting abdominal tenderness on active contraction of abdominal muscles) [8–10]. Carnett's test has high sensitivity and specificity of over 80% [11]. The

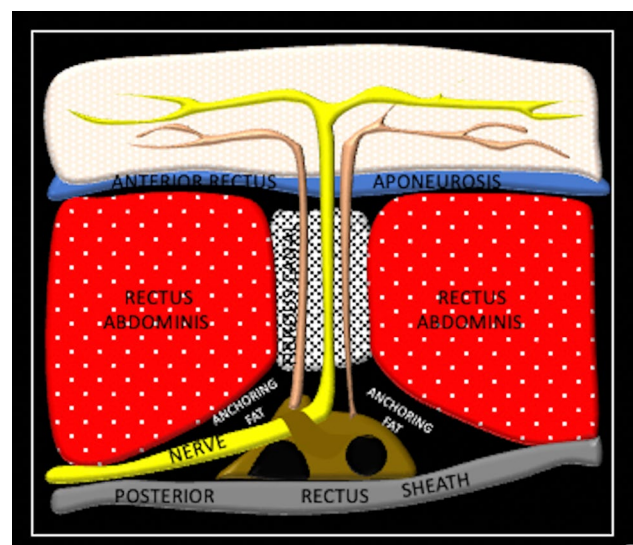


Fig. 5 Schematic diagram showing anatomy of anterior abdominal wall and anterior cutaneous nerve (illustration courtesy author Dr Rajesh Botchu)

management of ACNES includes analgesics, percutaneous injection of local anaesthetic and steroids, radiofrequency ablation, chemical neurolysis, neurectomy and peripheral nerve stimulation. A diagnostic block of local anaesthetic into the trigger points enables one to diagnose ACNES. These can be performed under ultrasound guidance.

In our cases the initial management was with ultrasound-guided diagnostic injection of local anaesthetic as the patients had already tried oral analgesics and anti-convulsants for a long duration. HD is an established technique for treating neurological pain. Mechanical benefits of HD may relate to release of nervi nervorum or vasa nervorum compression [12]. This was used with temporary relief in our patient described in first case on two occasions. However, as he had recurrence of pain, nerve ablation with absolute alcohol was performed resulting in resolution of symptoms. Nerve HD twice for the second case relieved him completely, each time volume used was 8 ml [13].

ACNES is an uncommon cause for anterior abdominal pain. Awareness of this entity and high index of suspicion with the use of ultrasound imaging is essential to pick it up early and decrease morbidity.

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Declarations

Conflict of interest No conflicts of interest. No financial disclosures.

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References

- Mol FMU, Maatman RC, De Joode LEGH, Van Eerten P, Scheltinga MR, Roumen R (2021) Characteristics of 1116 consecutive patients diagnosed with anterior cutaneous nerve entrapment syndrome (ACNES). *Ann Surg* 273(2):373–378. <https://doi.org/10.1097/SLA.0000000000003224>. (PMID: 30817351)
- Applegate WV (2002) Abdominal cutaneous nerve entrapment syndrome (ACNES): a commonly overlooked cause of abdominal pain. *Perm J* 6(3):20–27 (PMCID: PMC6220638)
- Van Assen T, Brouns JA, Scheltinga MR, Roumen RM (2015) Incidence of abdominal pain due to the anterior cutaneous nerve entrapment syndrome in an emergency department. *Scand J Trauma Resusc Emerg Med* 8(23):19. <https://doi.org/10.1186/s13049-015-0096-0>. (PMID:25887961;PMCID:PMC4327965)
- Lindsetmo RO, Stulberg J (2009) Chronic abdominal wall pain—a diagnostic challenge for the surgeon. *Am J Surg* 198:129–134
- Davies F, Gladstone RJ, Stibbe EP (1932) The anatomy of the intercostal nerves. *J Anat* 66(Pt 3):323–333 (PMID: 17104377; PMCID: PMC1248937)
- Kopell HP, Thompson WA (1976) Peripheral entrapment neuropathies. Robert E Kreiger Publishing, Malabar, pp 1–7
- Galindo BS (2022) Chronic abdominal pain due to entrapment of the anterior abdominal cutaneous nerve (ACNES): about a case. *J Fam Med Prim Care* 11(8):4834–4836. https://doi.org/10.4103/jfmpc.jfmpc_228_22. (PMID: 36352957; PMCID: PMC9638677)
- Carnett JB, Bates W (1933) The treatment of intercostal neuralgia of the abdominal wall. *Ann Surg* 98:820–829
- Tanizaki R, Takemura Y (2017) Anterior cutaneous nerve entrapment syndrome with pain present only during Carnett's sign testing: a case report. *BMC Res Notes* 10:503
- Lam K, Vasey C (2018) Diagnostic dilemma: think about anterior cutaneous nerve entrapment syndrome (ACNES) in patients with atypical abdominal pain and Crohn's disease. *Case Rep* 2018:bcr-2017
- Srinivasan R, Greenbaum DS (2002) Chronic abdominal wall pain: a frequently overlooked problem: practical approach to diagnosis and management. *Am J Gastroenterol* 97(4):824–830
- Lam KH, Hung CY, Chiang YP, Onishi K, Su DC, Clark TB, Reeves KD (2020) Ultrasound-guided nerve hydrodissection for pain management: rationale, methods, current literature, and theoretical mechanisms. *J Pain Res* 4:1957–1968
- Jacobs MLYE, van den Dungen-Roelofsen R, Heemskerk J, Scheltinga MRM, Roumen RMH (2021) Ultrasound-guided abdominal wall infiltration versus freehand technique in anterior cutaneous nerve entrapment syndrome (ACNES): randomized clinical trial. *BJS Open* 5(6):124. <https://doi.org/10.1093/bjsopen/zrab124>. (PMID: 34964825; PMCID: PMC8715735)

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