Abdominal cutaneous nerve entrapment syndrome

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Key points

Abdominal cutaneous nerve entrapment syndrome is a frequently overlooked diagnosis in patients with abdominal pain.

The syndrome is often associated with a characteristic history and physical examination findings.

Significant pain relief after nerve block is considered to establish the diagnosis.

An early diagnosis may prevent the development of central sensitization and spare the patient extensive investigation, including psychiatric consultation and surgery.

The condition can potentially be treated successfully by using one of several treatment options.

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Chronic abdominal pain is a frequently presenting condition in the pain clinics. Patients have often undergone a plethora of investigations, including diagnostic surgery and psychiatric review, before referral to Pain Management Services. Ongoing pain leads to development of central sensitization, which is heightened sensitivity to pain and touch, because of the effect of persistent pain on the neuroplasticity of the central nervous system. It can result in significant anxiety, distress, and loss of work days for the patient.

Up to 30% of patients with chronic abdominal pain have pain originating in the abdominal wall[1,2] and abdominal cutaneous nerve entrapment syndrome (ACNES) is the most frequent cause of pain in these cases.[3] This diagnosis can be established from the patient's history, physical examination, and positive response to local anaesthetic injection.[4] More awareness among clinicians of the abdominal cutaneous nerve entrapment syndrome could lead to earlier diagnosis and prevent the consequences of prolonged investigation and pain.

Applied anatomy

The sensory supply to the abdominal wall is via the anterior and lateral cutaneous branches of the anterior rami of the 7th–12th thoracic nerves (Fig. 1). T7 supplies the infrasternal area and T10 the level at the umbilicus. The anterior ramus of L1 is also involved, supplying the area above the pubis as the iliohypogastric nerve (T12, L1).

These sensory nerves run in a plane between the internal oblique and transverses abdominis muscles. The thoracic nerves advance to the posterior wall of the rectus sheath and each enters a neurovascular channel in the rectus muscle to supply the skin. Each of the neurovascular channels in the rectus muscle contains a fibrous ring which should allow the anterior cutaneous nerve to pass through freely; this ring however can also become a site of nerve compression and ischaemia resulting in symptoms of ACNES.

The anterior cutaneous branches of the thoracoabdominal (T7–11) and subcostal (T12) nerves are the most susceptible to entrapment because of their passage through the neurovascular channels in the rectus muscle. Peripheral nerve entrapment occurs at points where a nerve either changes its direction to enter a tunnel or pass over a fibrous or muscular band.[5] Applegate[3] described the course of anterior cutaneous branches in his publications on ACNES. They change direction by nearly 90° while entering the rectus channel, and pass through a fibrous ring in the channel to exit via a hiatus in the overlying fibrous rectus sheath. These combined factors make them vulnerable to entrapment.

Clinical presentation

Patients with ACNES can present with acute or chronic pain. The nature of the pain can vary between individuals, but ACNES usually results in well localized, unilateral with features of neuropathic pain. Retrograde radiation of pain from an entrapment neuropathy is known as the Valleix phenomenon and has been well documented, particularly in cases of carpal and tarsal tunnel syndromes. In the setting of anterior cutaneous nerve entrapment, this retrograde radiation of pain may mimic a thoracic radiculopathy. Radiation in the upper abdomen is along the horizontal course of the thoracoabdominal nerves in this region, while in the lower abdomen, it is along the more oblique course of the lower thoracoabdominal and subcostal nerves. Radiation may occur only with movement, suggesting the entrapment occurs with muscle contraction.

A female preponderance has been noted in the literature with incidence as high as five times

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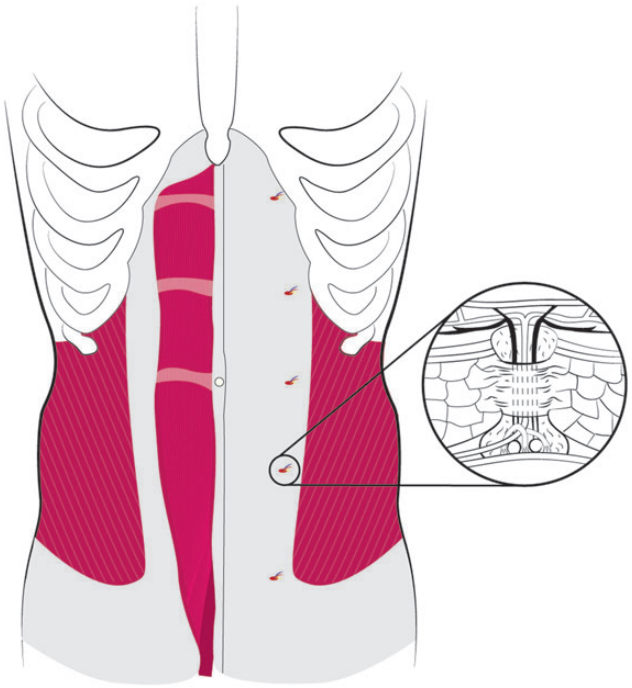

Fig 1 Diagram representing the anterior branches of thoracic nerves emerging through the rectus.

in females. Factors that potentially stretch the neurovascular bundle within the rectus muscle either from behind or pulling from the front have been noted in patients with ACNES. Previous abdominal surgery, laparoscopic surgery, pregnancy, and sports activity involving rectus muscle are some of the commonly identified factors. Cutaneous branches can also become entrapped in scar tissue; therefore, the dermatomal distribution of abdominal wall pain should be considered in relation to the site of any abdominal scars.

Diagnosis

Clinical findings

On clinical examination, patients can usually lie still without significant distress and locate the point of pain with a fingertip. Deep palpation of the abdomen does not elicit the tenderness associated with peritoneal involvement. Carnett's sign, first described by John B. Carnett in 1926, is useful in identifying the abdominal wall as the source of pain. It is positive if splinting of the abdominal muscles while pressing on the painful point increases the pain. In the supine position, the patient is asked to lift either their head and shoulders or their straight legs off the bed while the examiner presses over the tender area. Contraction of the rectus muscle constricts the neurovascular channel and worsens the compression neuropathy in patients with ACNES. Other conditions resulting in a positive Carnett's sign are abdominal hernias, abdominal wall haematomas, and rib tip syndrome. The Hover sign has also been described in cases of ACNES.[6] If the anterior openings in the rectus sheath are palpable, pressure over the nerve passage will cause pain in a patient with ACNES and this is a positive Hover sign.

Sensory disturbance such as hypaesthesia, hyperalgesia, or allodynia around the area of pain also supports a diagnosis of ACNES. Sensory abnormalities around the point of maximal tenderness have been noted in as high as 75% of these patients.[4]

Diagnostic interventions

ACNES can be diagnosed by local anaesthetic injection into the neurovascular channel in the rectus muscle. The local anaesthetic injection blocks sensory transmission, but it is hypothesized that it also reduces any compressive herniation through the fibrous channel by hydro-dissection of tissue causing nerve entrapment. A recent single-centre randomized double-blind controlled trial validated the use of local anaesthetic infiltrations against the saline injections in the diagnosis of ACNES.[4]

Landmark techniques have been used to position the needle for local anaesthetic injection. Oval-shaped depressions may be palpated on the lateral edge of the rectus muscle corresponding to the aponeurotic openings for T8, 9, 10, 11, and 12 anterior cutaneous nerves. At the depression, the needle is advanced through the skin, subcutaneous tissue, and just past the aponeurosis into the fatty plug surrounding the nerve and blood vessels emerging from the channel in the rectus. This is the point of injection. Others have used a nerve stimulator to identify the nerve.[7]

Ultrasound-guided local anaesthetic injection is increasingly recommended in the literature.[8] It allows accurate placement of the local anaesthetic, with minimal discomfort to the patient. The ultrasound probe is positioned in the anatomic transverse plane medial to the painful point. A high-frequency transducer in the range of 10–15 MHz is preferable for visualization of superficial nerves, but this high frequency may limit the depth of penetration and the full thickness of the rectus muscle must be visualized. A broad bandwidth allows the operator to select the examination frequency best matched to the patient's anatomy. A broad bandwidth 38 mm linear array transducer is ideal. The medial border of the rectus muscle and the linea alba is visualized, with the rectus appearing as a hypoechoic area enclosed in a hyperechoic fascia. Moving the ultrasound probe laterally brings the lateral border of the rectus and the linea semilunaris into view. Approximately 0.5–1 cm medial to the hyperechoic semilunaris, the nerve can be located as a hyperechoic oblique line within the rectus muscle (Fig. 2). Visualization of the nerve or the tunnel is optimized by cephalocaudad movement or tilting of the probe to allow the array of ultrasound beam to travel as much parallel to the nerve as possible. This usually coincides with the point of maximal tenderness elicited on examination and is the anterior cutaneous nerve passing through the rectus. Under aseptic conditions, the ultrasound needle is advanced in the longitudinal axis of the probe from medial aspect to reach channel and the nerve in the rectus. The needle can be gently advanced within the rectus muscle to reach the posterior rectus sheath. The needle tip should be visualized all the time to avoid penetration of peritoneum. A 22 G