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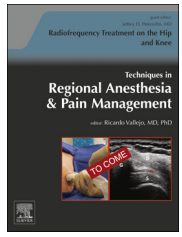

Radiofrequency ablation of splanchnic nerves for control of chronic abdominal pain

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ABSTRACT

Chronic abdominal pain is a complex physical and psychological problem that requires comprehensive treatment options tailored to the needs of patients. Splanchnic nerve blocks and radiofrequency denervation of greater and lesser splanchnic nerves may provide prolonged treatment effect that still needs to be studied in a randomized prospective fashion. Here we describe improved fluoroscopy-guided technique for the radiofrequency ablation of splanchnic nerves, details on approach, technique, and potential complications.

Introduction

The prevalence of chronic abdominal pain (CAP) is surprisingly high, 22.9 per 1000 individual-years, affecting approximately quarter of adult population at least once in their lifetime, women more frequently than men.[1-3] Although chronic pain is present in approximately 80%-90% of patients with chronic pancreatitis, postsurgical adhesions may be the cause of persistent pain in 45%-90% of patients, most frequently after cholecystectomy, herniorraphy, or adhesiolysis.[4] Chronic abdominal wall pain (CAWP), defined as pain with a fixed location of abdominal wall tenderness of <2.5 cm of diameter, must be differentiated from visceral sources of abdominal pain.[5-7] Up to 30% of patients with CAP may have CAWP, caused most frequently by the entrapment of cutaneous abdominal nerve branches (ACNES; 7). Chronic abdominal visceral pain is a complex process with presence of hyperalgesia and sometimes allodynia. After putative diagnosis and less invasive treatments, diagnostic splanchnic block followed by radiofrequency (RF) ablation should be considered.[4] Properly executed, this may provide high quality prolonged pain relief. This article focusses on initial outcomes, proper technique, possible complications, and tips on how to improve outcomes.

Establishing diagnosis

Clinical presentations of CAP are varied. Proper initial inspection of the abdomen may provide clues to the chronic pain source. For example, surgical scars associated with localized allodynia or hyperalgesia or both may lead to diagnosis of nerve damage or neuroma or both. CAWP is usually well localized with point tenderness on palpation, whereas visceral pain is usually poorly localized. Carnett test helps to determine if abdominal wall pain is present; in supine position and with the knees and hips flexed to decrease abdominal wall tension, the patient is asked to tense the abdominal muscles by lifting the head and shoulders off the bed. A positive Carnett test is increased pain on palpation as the patient contracts the abdominal muscles, but false-positives are high, especially in visceral diseases involving peritoneum.[4-7]

When attempting to understand CAP, nerve blocks may be of diagnostic, therapeutic, or even prognostic value. Not infrequently, the cause of abdominal pain may remain elusive in a small subgroup of patients despite extensive imaging, endoscopies, and other studies. In these circumstances, various nerve blocks may have both diagnostic and therapeutic values. Both sympathetic and somatic nerve

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blocks may be valuable in understanding and treating abdominal pain. Sympathetic nerve blocks are used to block the splanchnic nerves, celiac plexus, superior hypogastric nerve plexus, or ganglion *impar*. Somatic nerve blocks include paravertebral nerve block, intercostal nerve block, transversus abdominis plane block, rectus abdominis sheath block, and blocks of the ilioinguinal, iliohypogastric, and genitofemoral nerves. By differentiation of visceral pain origin from somatic pain origin, these diagnostic nerve blocks guide appropriate treatment.[4,7,8]

Differential retrograde epidural block (DREB) may be used to help differentiate visceral from nonvisceral sources of pain. Case series suggest that responses to DREB may be a useful predictor of treatment responses. The diagnostic value of DREB relies on the sensitivity of various nerve fiber types to local anesthetic neural blockade. Sympathetic nerve fibers and visceral afferent nerves have a higher C to Aδ fiber ratio (10:1) and are more sensitive to local anesthetic neural blockade than the somatic nociceptive fibers. DREB involves placement of an epidural catheter under fluoroscopy and injection of saline twice (placebo), followed by incremental injection of local anesthetic with close monitoring of vital signs and serial neurological examination. A local anesthetic (usually 2% 3-chlorprocaine or 1% lidocaine 10-30 ml) serves to differentiate between predominantly visceral, somatosensory, and central chronic pain, whereas the saline injections may help differentiate placebo effects, malingering, and sometimes psychogenic source of pain. Despite its use in case series, the absolute validity of DREB remains to be established. Accurate interpretation can be difficult for several reasons including a significant overlap between visceral and somatic nociceptive nerves, visceral pain that may coexist with somatic abdominal pain, and the role played by central sensitization as a component of abdominal pain. In addition, contributions from the vagal nerves to abdominal pain cannot be determined by DREB. Furthermore, the sensitivity and specificity of DREB is relatively low. Thus, responses to DREB combined with other clinical information are only suggestive of visceral, somatic, or central source of pain.[9,10]

Treatment

Managing pain, rather than curing disease, is often main objective. Lifestyle changes, use of membrane stabilizers and antidepressants or ketamine infusions, in various doses can be attempted. Short-acting opioids may be used for severe breakthrough pain; however, chronic opioid therapy should be avoided where possible, owing to potential risks including opioid tolerance, dependence, opioid-induced hyperalgesia, overdose, abuse, addiction, and death.[11-13]

RF ablation of splanchnic nerves

RF ablation of the splanchnic nerves is used to interrupt or modulate neural or pain conduction or transmission or all these. Historically, the splanchnic nerves, mainly the greater, lesser, and least and the celiac plexus were considered possible targets for visceral pain control. Sympathetic innervation of the abdominal organs includes preganglionic fibers of T5-T12 that merge to travel with the ventral ramus. Together with communicating rami, visceral sympathetic fibers course in the direction of the sympathetic chain and then make synaptic contacts with postganglionic neurons at the celiac, aortorenal, and superior mesenteric ganglion. Splanchnic nerves branch with the vagal preganglionic parasympathetic fibers, sensory fibers of the phrenic nerve, and postganglionic sympathetic fibers to form a large celiac plexus spread wide around the abdominal aorta. In contrast, greater, lesser, and least splanchnic nerves are localized in a relatively narrow space between the lateral border of the vertebra and pleura (Figure 1).[14]

Splanchnic and celiac plexus blocks are commonly performed for control of visceral abdominal pain percutaneously under fluoroscopic guidance.[4] Celiac plexus blocks may be performed through a transaortic, retrocrural, or transdiscal approach without clear diagnostic advantage seen with any specific technique. Classical description of celiac plexus block involves placement of the needle through the paraspinal area of the middle back (L1 vertebral body). Bilateral splanchnic block is performed at T11 to deliver local anthetic or steroid combination to the paravertebral compartment medial to the pleural cavity and near to the greater and lesser splanchnic nerves (needle tip positioned at the posterior third of T11 vertebral body).[4]

Anatomical considerations

The anterolateral horn in the spinal cord is important in innervation of abdominal contents. Preganglionic fibers, as described earlier, leave the spinal column at T5-T12 and then merge with the ventral ramus. There are also communicating rami between these fibers, which course together in the direction of the sympathetic chain. There are no synapses in the sympathetic chain, but these occur only more peripherally at the level of the ganglia; celiac, aorticorenal, and superior mesenteric. More importantly, those preganglionic fibers are grouped into the 3 splanchnic nerves (greater, lesser, and least) that course in predictable anatomical locations in the anterolateral paravertebral space. This space is limited by the lateral boarder of the vertebral body, medial pleura, and crus of the diaphragm. Owing to predictable nerve

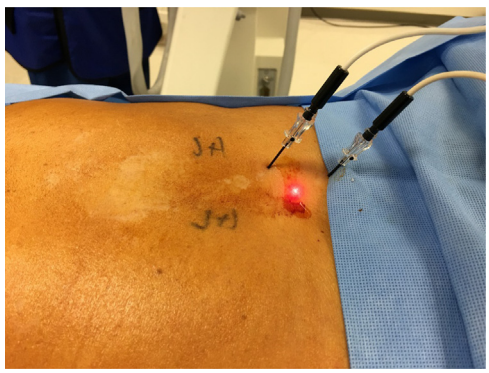

Fig. 1 – Appropriate angle of two 18 G RF needles piercing the skin at the right mid-paraspinal thoracolumbar area. Notice that only 1 side (right or left splanchnic nerves) is denervated at a single operative setting owing to the remote risk of bilateral pneumothorax. (Color version of figure is available online.)