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Endoscopic ultrasound celiac plexus block and neurolysis

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ABSTRACT

Over the last decade, endoscopic ultrasound-guided celiac plexus block and celiac plexus neurolysis (CPN) have been established as effective and safe interventions to palliate visceral abdominal pain resulting from chronic pancreatitis and pancreatic cancer, respectively. Endoscopic ultrasound-guided approach has advantages over the percutaneous methods because it facilitates precise injection into the region owing to its more direct access. More recently, celiac ganglion neurolysis has been promoted as a safe alternative to CPN and it may be a more efficacious technique than CPN. Although large, adequately powered randomized trials are lacking, observational studies and small randomized trials support the use of celiac plexus block and CPN in palliation of pain in patients with chronic pancreatitis or pancreatic cancer, respectively. However, these interventions' affect on quality of life and survival is unclear and further large randomized studies are needed.

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1. Introduction

Chronic abdominal pain is the cardinal symptom of chronic pancreatitis (CP) and it is also common among patients with pancreatic cancer (PC). It can be debilitating to patients, often resulting in a high rate of disability, depressive symptoms, and a reduced quality of life [1,2]. Estimated financial burden on the healthcare system attributable to management of chronic abdominal pain from CP alone exceeds 600 million dollars annually [3]. Acetaminophen, nonsteroidal anti-inflammatory drugs, and narcotics can be helpful in palliating the pain. However, patients often require a very high dose of narcotics to obtain adequate pain relief and this often leads to unwanted, opioid induced side-effects. They include dependence, constipation, narcotic bowel syndrome, and delirium in elderly patients [4-6]. Additionally, patients with CP often have a history of substance abuse or ongoing substance dependence, making opioids an undesirable option for analgesia [6]. In the context of the limited role of medical therapy, invasive interventions such as celiac plexus block (CPB), celiac plexus neurolysis (CPN), and celiac ganglion neurolysis (CGN) have been developed to offer safe and effective therapeutic options complementary to medical therapy for pain relief.

The celiac plexus is a network of nerves that is located between T12-L2, in the retroperitoneal space around the celiac trunk. It carries nociceptive signals from the pancreas to the brain [7,8]. As early as 1914, investigators hypothesized that delivery of anesthetic or ablative agents directly into the celiac plexus region via a percutaneous injection, would result in an enhanced analgesic effect while limiting systemic side effects [9]. This led to the development of several percutaneous methods including transaortic, anterior, transdiscal, and paramedian approaches under the guidance of various imaging modalities such as fluoroscopy, ultrasound, and computed tomography [10-12]. With the wide availability of endoscopic ultrasound (EUS), endosonographers began performing CPN and CPB under EUS guidance since 1996 [13]. EUS guidance minimizes the distance a needle must traverse to get to the celiac plexus and facilitates a safe injection by visualizing a path clear of surrounding organs. Thus, EUS guidance offers potential advantage over the percutaneous method, which carries risk of injury to kidneys and lungs owing to proximity of these organs to the percutaneous needle path. Although head-to-head trials are lacking, it offers a more precise injection into the celiac plexus vs the percutaneous approach and may even be superior to the percutaneous approach in alleviating pain [12,14]. The celiac plexus injection technique has been refined, and some have advocated for injection of the ablation agent directly into the celiac ganglia as EUS allows a clear visualization of the structure in up to 86% of patients in experts' hands [15]. Proponents of this technique argue that this results in an enhanced ablation of nerve tissues [15-17,18]. There are other numerous variations in the techniques of CPB, CPN, and CGN that range from injection into different sites, use of different ablative agents, use of different volume and concentration of ethanol, and addition of steroids in

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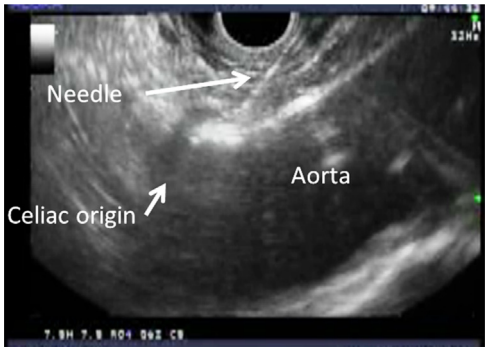

Fig. 1. Celiac plexus injection (Courtesy of Tyler K. Stevens, MD).

the injectate. This review describes different techniques of CPB, CPN, and CGN and it summarizes the efficacy data for each of the techniques.

2. Preprocedural considerations

Prior to performing a CPB or CPN, complete blood count and coagulation parameters should be obtained to ensure that the patient is not at an increased risk of bleeding. The potential need for anesthesia assisted deep sedation should be assessed. If a patient has a history of long-term narcotic use with tolerance, severe cardiopulmonary conditions, or a history of inadequate sedation with moderate sedation, anesthesia assistance may be required. Due to the frequency of postprocedural hypotension, some centers routinely administer a 1 L fluid bolus in the periprocedural period [13,18]. Periprocedural intravenous antibiotics are also administered to reduce the risk of postprocedural infection. Informed consent should be obtained, after discussing the benefits, risks, and alternatives of the procedure. Even though most adverse events are self-limited, patients should be warned that they could experience self-limited postprocedural pain, symptoms of hypotension, and diarrhea. Patients in whom CPN or CGN are planned, the possibility of exceedingly rare but serious complications such as permanent paralysis and death should be included in the informed consent process.

3. Celiac plexus block and celiac plexus neurolysis

3.1. Procedure technique

When performing a CPB or CPN, identification of celiac takeoff from the aorta is the most important first step (Figure 1.). The linear echoendoscope is advanced to just beyond the gastroesophageal junction and by torqueing clockwise or anticlockwise, a sagittal view of the aorta and the celiac trunk are easily identified (Figure 1). The celiac plexus is located around the celiac artery takeoff. Doppler signal is turned on at this stage to identify any intervening vascular structures in the path of the needle. A fine needle aspiration needle or a specially designed "Celiac Plexus Needle" can be used for injection. The celiac plexus needle differs from the standard fine needle aspiration needles in that it has multiple fenestrations to allow injectate to be delivered in various directions along the needle tip. One example is the EchoTip Ultra CPN needle (Cook Medical, Inc). There have been no studies comparing different needle types or sizes. Sizes of needles used include 19 gauge (G), 20 G, 22 G, and 25 G [12,19-21]. Most commonly, the 22 G is used and less commonly 19 G, 20 G, and 25 G for CPN and CPB. The CPN needle is 20 G in size. The needle is advanced to the area just anterior to the celiac trunk, which is where the celiac plexus is located. The injection can be performed, targeting 1 site (central injection technique) or 2 sites (bilateral injection technique) which will require injections at areas immediately right anterolateral and left anterolateral to the celiac trunk. The needle needs to be primed with saline to remove air from the channel of the needle and then it is advanced into the target location. Color Doppler signal is used to avoid the vascular structures as it is passed towards the celiac plexus. A syringe is attached and suction is applied to ensure that the needle has not punctured into or through a vessel. If the goal is to temporarily anesthetize the celiac plexus (ie, CPB for benign conditions such as CP), 10-20 cc of 0.25% bupivacaine with or without 5-10 cc of triamcinolone (40-80 mg) can be injected. The addition of triamcinolone offers a theoretical advantage of making the analgesic effect more durable but data to support its routine use is lacking [22]. If the goal is to achieve ablation of the nerve tissues for a more permanent effect (ie, for palliation of pain in PC), 10-20 cc of 0.25% bupivacaine is first injected. The goal of first injecting with bupivacaine is 2-fold. First is to help reduce the chance of postprocedural pain that can often occur with ethanol injection alone. The second is to observe for sustained postinjection hypotension before injecting the dehydrated alcohol. Injection of alcohol achieves an ablation effect by causing deep nerve tissue damage. The volume of alcohol injected is typically 5-10 cc of 50%-100%. The volume of each constituent will vary depending on the practitioners' preference. The needle is flushed with 3 cc of saline to ensure the ethanol is expelled before its withdrawal, to avoid caustic effect of the alcohol on the gastric mucosa and needle tract.

4. Celiac ganglion blocks and neurolysis

With recent improvement in EUS image quality, investigators have explored the efficacy and safety of EUS-guided injection directly into the ganglia [15,17], to potentially achieve superior analgesic efficacy. Theoretically, this would allow a more targeted delivery of the injectate into the "hub" of the nociceptive nerves (Figure 2). Because the ganglia are located on either side of the celiac takeoff, endosonographic visualization is achieved up to 86% of the time in expert hands [15,20,23]. The size of the ganglia varies, from as small as 2-3 mm, up to 20 mm [24,25]. They are typically oval, hypoechoic, and have an irregular shape. Two different injection strategies have been described, depending on the size of the ganglia visualized. For smaller ganglia (ie, $<$ 10 mm in size), it is advisable to target the center of the target ganglion. For larger ganglia, the needle is introduced to the deepest level and the injection is carried out as the needle is gradually retracted [25].

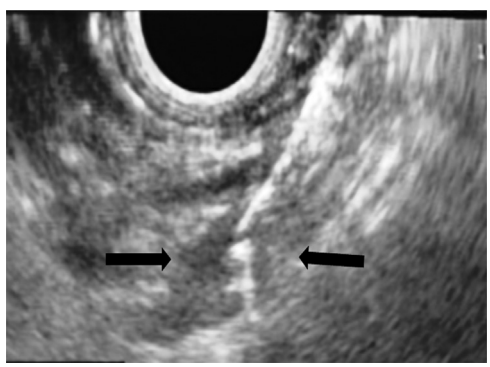

Fig. 2. Celiac ganglion injection (Courtesy of Tyler K. Stevens, MD).