Celiac Plexus Neurolysis: An interventional tool in the management of complex pain.

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Learning objectives

- Identify the morphological and functional anatomy of the celiac plexus and its visualization in multidetector CT images.
- Describe the indications, contraindications, technique and complications of celiac plexus neurolysis.
- Describe some type of approach that can be performed and their indications.
- Discuss the patient care issues that arise before, during and after celiac plexus neurolysis.

Background

Cancer pain is a major health problem which affects the patient and their family.

In cancer patients:
- 20-50% The pain appears as initial manifestation.
- 75-90% of the patients with advanced cancer have pain.
- Approximately 33% Pain is a result of treatment.
- About 70% Pain is a result of invasion of adjacent tissues.

There are several therapeutic categories for pain such as:

- Treatments specific cancer such as radiotherapy, chemotherapy, hormone therapy and surgery.
- Non-invasive procedures such as analgesics and other systemic medications, psychological techniques, physical therapy, and neurostimulation techniques.
- Invasive Techniques: Regional analgesia (local anesthesia, intraspinal narcotics). Prolonged regional analgesia (Neuolytic agents, alcoholisation tumor, analgesic cementoplasty, ablative neurosurgical techniques.

Techniques Invasive image-guided regional analgesia Neurolytic block:
Findings and procedure details

Celiac Plexus Neurolysis

Definition

Celiac plexus permanent destruction of chemical agents such as ethanol or phenol.

Location

Visceral large plexus, found in the retroperitoneum, on the anterolateral surface of the aorta and around the origin of the celiac artery. (Fig. 1)

It serves as a center of transmission of nociceptive impulses originating in the upper abdominal viscera from the stomach to the proximal transverse colon.

Anatomy

Contains visceral sympathetic fibers, parasympathetic and sensory afferent fibers of the upper abdominal organs, including the pancreas, liver, biliary tract, gallbladder, spleen, adrenal, kidney, mesentery, stomach, small intestine and thick to the proximal region of the transverse colon. (Fig. 2)

94% of celiac ganglia are at the level of D12 and L1.

The position can vary and be anywhere from the intervertebral disc D12-L1 until the middle of the L2 vertebral body.

Indications
Persistent and intractable malignant cause esophageal, gastric, pancreatic or biliary abdominal pain.

Metastatic liver cancer, retroperitoneal lymph node metastases.

There may be benefit in the management of nausea and severe vomiting in patients with pancreatic cancer.

Provides relief from abdominal pain from chronic pancreatitis.

Not indicated musculoskeletal system extension, abdominal wall or peritoneal involvement.

**Contraindications**

Coagulopathy and severe thrombocytopenia.

Abdominal aortic aneurysm, aortic mural thrombosis, eccentric origin of the celiac trunk.

Local infection, intra-abdominal or sepsis.

Intestinal obstruction.

Poor visualization of anatomical structures.

**Pre procedure:**

In the preassessment procedure must inform the patient, perform a neurological assessment and pain scale. Explain informed consent.

**Technique**

Planning and patient position:

An essential first step in CT guidance is pre planning process as the patient’s position, site entrance and path of the needle and the injection of neurolytic agent.

The position of the patient depends on choosing the most appropriate, least invasive and complicated, safer, more comfortable and less movement path. The most used position is prone position. Followed by lateral decubitus. Less common are the supine that is more comfortable but requires crossing bodies and oblique positions.

According to the blockade we want to make use antecrural mixed technique, retrocrural o mixed. *(Fig. 3)*
Neurolitic injection agent in the antecrural technique is performed in the space above the diaphragm and the aorta crura.

The retrocrural regards space behind the crura and diaphragm in this space injection produces a splanchnic nerve block.

**Neurolytic agents**

Neurolytic agents are used (Fig. 4)

Ethanol: neurolysis is achieved with a concentration of over 50%.

Phenol: More viscous less effective.

Cocktail absolute ethanol (95-100%), bupivacaine and iodinated contrast media in a ratio of (6: 3: 1)

**CT-Guided Neurolysis**

Several CT approach techniques which will be described below. (Fig. 5)

**Bilateral posterior paravertebral Antecrural Approach**

This technique is the method most frequently performed.

His steps are:

An abdominal CT scan without contrast preliminary to locate the celiac artery and celiac plexus is performed.

Puncture sites were selected.

The angle and depth of needle entry is determined.

The trajectory of the percutaneous needle is identified celiac plexus.

Injection site neurolitic determining agent.

The optimum injection site is in cutting axial CT located between the celiac trunk and AMS.

The skin at the point of entry of the needle is cleaned with an antiseptic solution and a sterile field is prepared.

After subcutaneous infiltration with local anesthetic, is advanced to the side of the vertebral bodies bevel needle tip 20-24 gauge (Chiba needle biopsy; Cook, Bloomington)
to antecrural space, taking care to avoid the rib, transverse process, vertebral body, the kidneys, and major vascular structures.

The aim is to assess that no blood flows back.

5 ml of dilute iodine contrast material in the space such antecrural 1ml iopamidol (Isovue 370) diluted in 50 ml of saline was injected.

The correct needle position is indicated by the presence of the free flow of contrast material in the space antecrural CT and no patient discomfort numbness or motor dysfunction in the lower extremities.

If the free diffusion of contrast material not seen, needles should be repositioned again and the repeated sequence.

After the free flow of contrast material is documented, approximately 40 ml (20 ml on each side) in absolute ethanol (95% -100%) is injected through the needle and antecrural space.

Neurolytic agent must diffuse along the anterolateral wall of the aorta in the retroperitoneum. This process is repeated on the contralateral side.

It is important before removing the needle, inject 2.5 ml of normal saline is injected to minimize the risk of spread of any neurolytic agent left on the needle and prevent the burning pain that occurs after the escape of neurolytic agent on route puncture. (Fig. 6, 7 and 8)

Alternative Approaches

Anterior Approach

Indication When it is not possible difficulty posterior approach by placing the patient in the prone or those with a history of ileostomy or colostomy.

Advantages: It has a lower risk of kidney or nerve damage both nerve roots and spinal cord. The needle can through the stomach, liver or pancreas before reaching the celiac plexus. It is a more patient-friendly approach.

Complications have a higher rate of these, gastric perforation may occur, chemical peritonitis, pancreatic fistula or subcapsular hematoma.

Bilateral Posterior Paravertebral Retrocrural Approach
Indication Used to splanchnic nerve neurolysis or alternatively when no invasion or loss of the anatomy of preaortic space.

Advantages: less is used neurolitic of 5-10ml (per side) being a more confined space. It is often combined with the previous approach.

**Posterior Transintervertebral Disk Approach**

Indication In cases where there is obstruction by the transverse processes or ribs. In severe degenerative disease in thoraco-lumbar region

Disk D12-L1 or L1-L2 is crossed.

Can be unilateral or bilateral with 25-30ml of neurolitic.

Advantages: This decreased the risk of injury viscera.

Complications: Trauma as discitis disc, herniated disc and spinal cord puncture.

**Posterior Transaortic Approach**

Is performed through the aorta by its posterior and anterior walls. With a needle on the left side. Although dramatic is relatively safe, important the correct location and aspiration.

Advantages: A single puncture, less damage occurs in the spinal cord.

Complications: retroperitoneal hemorrhage (hypertension coagulopathy)

**Direct infiltration of tumor**

Indication In patients with complete invasion of the retroperitoneal space in both the primary tumor and metastatic lymph nodes by. Puncture can be performed multiple for having increased resistance to injection.

**Technical adjuvants**

Care when crossing bodies are:

Liver: we must avoid the hilum, great vessels, dilated bile ducts, multiple punctures the capsule and always find the shortest route.

Stomach and small bowel loops: You can puncture.

Kidney and Pancreas aorta could be crossing.
Colon: Avoid and mainly handles filled with debris.

Hydrodissection is a technique to separate organs of the approach. It is done with a needle chiba 20-22 with 0.9% saline. It is also used in RF and drainage of abscesses.

**Post procedure care**

Rate immediate complications such as hypotension.

Income and night observation. 12 hours of rest.

Monitor vital signs. Electrolyte replacements.

Immediate neurological assessment and 24 hours.

Rating pain score and compare with the pretest.

adjust analgesics

**Complications**

Most are transient or minor such as:

Backache 96%

Orthostatic hypotension 10-52% by decreased sympathetic tone.

46% rare transient diarrhea chronic diarrhea.

Back pain radiating to shoulder diaphragmatic irritation.

Anterior abdominal pain peritoneal irritation.

Other rarer:

Neurological damage, monoplegia, bladder dysfunction or anal sphincter.

Pneumothorax, pleurisy, pericarditis, arterial damage, local hematoma, transient hematuria, abscess, damage to the intervertebral disc.

**Tips**

- The two most important factors affecting the destruction of the celiac plexus are the amount of injected neurolitic and the degree of diffusion of neurolytic agent in the antecrural space.
• The main benefit of celiac plexus neurolysis is in reducing analgesic consumption and lower incidence of adverse effects related to the medication.
• Understanding neurolysis as a componte multidisciplinary treatment strategy.
• Neurolysis performing startup stage has better pain.
• The two most common reasons for failure of the celiac plexus neurolysis are insufficient spread of neurolytic agent in the preaortic space, as a result of regional anatomic disruption of tumor infiltration, postoperative radiotherapy changes or post changes, which limits access to celiac plexus. Injection of an inadequate amount of neurolytic agent.

Images for this section:

**Fig. 1:** Morphologic anatomy of the celiac plexus. Diagram shows the relationship of the celiac plexus with the aorta and the celiac artery.
Fig. 2: Functional anatomy of the celiac plexus. Diagram shows the neural connections of the celiac plexus.
Fig. 3: Techniques for celiac plexus neurolysis. A. Antecrural. B. Retrocrural. C. Mixted.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Preference</th>
<th>Mechanism of Action</th>
<th>Viscosity</th>
<th>Pain at Injection</th>
<th>Spread</th>
<th>Nerve Destruction</th>
<th>Onset of Action</th>
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<tbody>
<tr>
<td>Ethanol</td>
<td>More common</td>
<td>Precipitation of lipoproteins and mucoproteins</td>
<td>Lower</td>
<td>Transient, may be severe</td>
<td>More</td>
<td>More intense</td>
<td>Faster</td>
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<tr>
<td>(50%-100%,</td>
<td></td>
<td>Protein coagulation and necrosis of neural</td>
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<td>40-60 mL)</td>
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<td>structures</td>
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<tr>
<td>Phenol</td>
<td>Less common</td>
<td>None, because of a local anesthetic effect</td>
<td>Higher</td>
<td>Less diffuse intense</td>
<td>Less</td>
<td>Less intense</td>
<td>Slower</td>
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<td>(3%-20%,</td>
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<td>20-25 mL)</td>
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Fig. 4: Neurolytic Agents
**Fig. 5:** CT-guided neurolysis. A. Bilateral Posterior Paravertebral Antecrural Approach. B. Anterior Approach. C. Posterior Transintervertebral Disk Approach. D. Posterior Transaortic Approach
Fig. 6: Bilateral Posterior Paravertebral Antecrural Approach. A,B,C,D. Axial multidetector CT image. Patient in prone position. Inserting needles "chiba" (Arrows) 22G to antecrural space.
Fig. 7: Bilateral Posterior Paravertebral Antecrural Approach. Checking needle position "chiba" 22G in antecrural space. A,B,C Axial multidetector CT image, left side. D Coronal multidetector CT image, bilateral.
Fig. 8: Bilateral Posterior Paravertebral Antecrural Approach. Introduction and spread of neurolitic. A,B,C,D. Axial multidetector CT image.
Conclusion

- Celiac plexus neurolysis is a safe and effective technique for the management of pain palliation, with a low complication rate.

- It should provide patients with abdominal malignancy as a key component of the multidisciplinary approach to the control of intractable abdominal pain.

- The main benefit is the reduction in analgesic consumption and lower incidence of adverse effects associated with drugs.

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References


