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Research Article

Chinese Expert Consensus on Celiac Plexus Block and Neurolysis for Upper Abdominal Pain (2026)

Xiaowen Wang[1, *], Huacheng Zhou[2], Wenjian Xu[3], Xiaohui Liu[1], Jiaxiang Ni[4], Guanglun Xie[5], Changsheng Ma[6], Senlin Hou[7], Zhaoxia Xue[8], Dong Yang[9], Xiaoqiu Yang[10], Tao Song[11], Tao Sun[12], Lingjie Xia[13], Ruilin He[14], Ke Ma[15], Lijuan Lu[16], Yongjin He[17], Li Wan[18], Guangzhao Liu[1]

[1]Department of Painology, The Second Hospital of Hebei Medical University, Shijiazhuang, China

[2]Department of Painology, The Fourth Affiliated Hospital of Harbin Medical University, Harbin, China

[3]Department of Radiology, Affiliated Hospital of Qingdao University, Qingdao, China

[4]Department of Painology, Xuanwu Hospital of Capital Medical University, Beijing, China

[5]Department of Pain & Rehabilitation and Palliative Medicine, Affiliated Cancer Hospital of Zhengzhou University, Zhengzhou, China

[6]Department of Human Anatomy, Hebei Medical University, Shijiazhuang, China

[7]Department of Bilio Pancreatic Endoscopic Surgery, The Second Hospital of Hebei Medical University, Shijiazhuang, China

[8]Department of Painology, The First Hospital of Shanxi Medical University, Taiyuan, China

[9]Department of Pain Medicine, Union Hospital of Huazhong Science and Technology University, Wuhan, China

[10]Department of Painology, The First Affiliated Hospital of Chongqing Medical University, Chongqing, China

[11]Department of Painology, The First Hospital of China Medical University, Shenyang, China

[12]Department of Pain Medicine, Provincial Hospital Affiliated to Shandong First Medical University, Jinan, China

[13]Department of Pain Medicine, Henan Provincial People's Hospital, Zhengzhou, China

[14]Department of Painology, The Second Affiliated Hospital of Guangxi Medical University, Nanning, China

[15]Department of Pain Medicine, Xinhua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, Shanghai, China

[16]Department of Painology, Nanjing Gulou Hospital, Nanjing, China

[17]Department of Painology, Tianjin First Central Hospital, Tianjin, China

[18]Department of Painology, The Second Affiliated Hospital of Guangzhou Medical University, Guangzhou, China

Abstract

Celiac plexus block and neurolysis (CPB/N) is an effective interventional technique for treating chronic upper abdominal pain. Currently, there are various CPB/N techniques, and there is an urgent need to develop an expert consensus to enable clinicians to correctly implement the CPB/N technique, improve efficacy, and reduce complications. A total of 20 medical experts were

[*]Correspondence: Xiaowen Wang (wangxw60@163.com)

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invited to participate in the writing of this expert consensus, including pain physicians, interventional radiologists, gastroenterologists/endoscopists, and anatomy professors. All experts are from Class A tertiary hospitals affiliated of medical universities in parts of China. Except for the anatomy professors, all experts are engaged in the clinical practice of CPB/N surgery and are familiar with indications, surgical procedures, and complication management. Chinese and English literatures related to CPB/N from January 2008 to October 2025 were retrieved to evaluate the recommendation levels. Each expert made multiple revisions to the initial draft of the expert consensus and voted on the classification levels with significant disagreements. This expert consensus reviews the anatomical characteristics of the celiac plexus, summarizes the indications and contraindications for the clinical implementation of CPB/N, describes in detail the technical methods of CPB/N via different approaches, expounds on the drugs and dosages for CPB and CPN, and depicts the clinical manifestations, management, and prevention of complications. Based on the current domestic practice of CPB/N and literature reports, the recommended grades for CPB/N are proposed. We recommend the posterior retrocrural/antecrural approach under CT guidance and EUS-guided CPB/N technique due to their high success rate and low risk. We do not recommend the approach with potential iatrogenic risks, such as transarterial puncture. The incidence of CPB/N complications is very low, and some complications are temporary. Performing CPB/N under imaging guidance can prevent the occurrence of serious complications such as nerve injury and bleeding.

Keywords

Celiac Plexus, Splanchnic Nerve, Nerve Block, Neurolysis, Alcohol, Cancer Pain, Expert Consensus

1. Introduction

Pancreatic cancer is a lethal disease, 70–80% of individuals with pancreatic cancer suffer from substantial pain. Although traditional opioid analgesics may provide pain relief, opioid-associated adverse effects can significantly diminish the quality of life in these patients. Celiac Plexus Block and Celiac Plexus Neurolysis (CPB/CPN) exists as an interventional technique aimed at directly addressing visceral pain pathways, offering a potential avenue for improved pain control in this patient population [1].

The celiac plexus (CP) transmits pain impulses from the upper abdominal organs to the central nervous system. Kappis first used percutaneous posterior approach for the implementation of celiac plexus block anesthesia in 1914. In 1957, Jones used alcohol for the first time to destroy the celiac plexus and visceral nerve to treat abdominal pain of pancreatic cancer, and obtained long-term pain relief [2]. Subsequently, numerous scholars have reported the application of CPB guided by imaging for the treatment of upper abdominal cancer pain. CPB or CPN has been widely used for abdominal pain caused by upper abdominal cancer and non cancerous diseases [2-5]. CPN is used for cancer abdominal pain patients, which can alleviate pain, reduce opioid dosage, and reduce or alleviate adverse effects [4, 6]. It is a safe analgesic technique since the complications are mild and transitory [7]. Celiac Plexus Block and Neurolysis (CPB/N) procedures represent a valuable interventional modality for managing chronic pain in patients with unresectable pancreatic cancer, particularly when conventional systemic analgesic therapy fails to provide adequate relief [1]. CPN should be the first choice for interventional treatment of abdominal pain in pancreatic cancer [8].

Although there have been reports of using CPB/N for cancer-related abdominal pain both domestically and internationally, there is currently no relevant technical guidance consensus In China. For this reason, we invited 20 experts to participate in the writing for this expert consensus. This expert consensus summarizes the basic knowledge and clinical application of CPB/N, proposes the best procedures based on literature, and provide guidance for clinical doctors to correctly implement CPB/N to improve treatment effectiveness, to reduce complications.

CPB and CPN are related procedures. CPB typically involves the temporary interruption of nerve function by the injection of local anesthetics (bupivacaine and lidocaine) serving as both a diagnostic and therapeutic intervention, by predicting the effectiveness of neurolysis and providing short-term pain relief. CPN is a procedure aimed at long-term pain relief through the chemical ablation of the nerves using neurolytic agents such as alcohol or phenol [1]. In addition, the early use of paraspinal blind puncture CPB has been abandoned by Chinese pain specialists due to inaccurate positioning and the risk of serious complications such as pneumothorax and bleeding. So this expert consensus will not describe this method. During open abdominal surgery, CPB or CPN performed under direct visualization by the surgeon is also not included in this expert consensus.

2. Methods (Consensus Development)

2.1. Composition of the Expert Group

In China, although interventional radiologists, gastroenterologists/endoscopy doctors also implement CPB/N to treat pain of pancreatic cancer, pain physicians perform most CPB/N procedures. Due to the presence of wards in the pain

department, pain physicians can focus on treating upper abdominal cancer pain, with the largest number of patients treated and the most extensive clinical experience. Therefore, we have invited 20 experts to write this expert consensus, including 17 pain specialists, 1 anatomy professors, 1 interventional radiologists and 1 gastroenterologists/endoscopists. The pain specialist provided a detailed implementation plan for CPB/N; Anatomy professors and imaging experts provide guidance on relevant content to ensure accurate and error free professional descriptions, Gastroenterologists/endoscopists writed the content of ultrasound-guided CPB/N. Selected criteria: Except for anatomy, all experts are engaged in CPB/N surgery in clinical practice, familiar with its indications and operating procedures, and proficient in handling complications. Experts who are not engaged in CPB/N surgery are not invited. The invited experts are located in the east, north, and south regions of China (Figure 1). These regions represent the developed medical areas in China. All experts are renowned experts or department heads from medical universities or affiliated tertiary hospitals in various regions.

Figure 1. *Experts Geographic Distribution Map.*

2.2. Search Strategy

The PubMed, Embase, NSTL (national science and technology library of China) and CNKI (China National Knowledge Infrastructure) databases were searched for retrieving the relevant articles. The search timeline was from January 2008 to October 2025, and only English- or Chinese-published articles were retrieved. MeSH terms included "pancreatic cancer pain", "Celiac Plexus anatomy", "Celiac Plexus Block", "Celiac Plexus Neurolysis" and "CPB/N by endoscopic ultrasound". A combination of key and subject words was employed to conduct a comprehensive search. Inclusion criteria: Design scientific and reliable clinical studies, Reviews, case analyses, and meta-analyses.

2.3. Evidence Identification

Experts screen literature based on their own clinical experience. It is recommend mainly methods that widely reported in literature, scientifically reliable research and high data credibility. For methods that are rarely reported, have high medical risks, and are rarely used domestically In China, it is recommendations by low-level or it should be made to abandon them. Based on literature reports and clinical experience, experts should propose solutions for the management and prevention of complications. The evaluation of any method should not be based solely on literature reports, but should reflect the opinions of experts themselves.

2.4. Consensus Technique

Create a Weixin chat group for all participating experts to communicate and submit revised drafts. The author divided the content of the plan into individuals and collected their initial drafts. Publish expert consensus drafts in Weixin chat groups and request experts to respond to the revised content within a certain period of time. Then, the author summarizes the manuscript and publishes it again, and experts revise the manuscript again. This expert consensus has been revised a total of 11 times. Especially regarding the significant differences in recommendation levels, all experts believe that the classification of recommendation levels should be based on clinical practice In China. Finally, the level recommendation is completed through voting.

2.5. Evidence Grading Level

The Grading of Recommendations Assessment Development and Evaluation (GRADE) working group evaluates the quality of research evidence and comprehensively determines the level of evidence based on research design and other evidence features.

Reference value grading

I: Randomized controlled trial study;

II: Randomized controlled trials or retrospective studies with large sample patients from multiple centers;

III: Retrospective study;

IV: Summary of group cases (total less than 100 cases) and expert opinions.

Evidence based medicine grading of recommended viewpoints

A: Highly recommended, with at least two Level I evidences;

B: Recommendation: 1 Level I evidence or 2 Level II evidence;

C: Recommended or not recommended, 1 level II evidence or 2 level III evidence;

D: Not recommended, Level IV evidence.

3. Results (Consensus Statements / Recommendations)

3.1. Anatomical Characteristics of the Celiac Plexus

3.1.1. Overview

The visceral nerves are divided into visceral motor, visceral sensory, and enteric nerves. The visceral motor nerves include sympathetic and parasympathetic nerves, also known as autonomic or vegetative nervous system. The visceral sensory nerves transmit visceral sensory impulses from the visceral organs to the central nervous system, perceiving pain and discomfort in the visceral organs. These visceral sensory nerves (visceral afferent fibers) usually travel with sympathetic and parasympathetic nerves. Therefore, by blocking the visceral nerves, visceral pain transmission is blocked, and at the same time, related adverse reactions such as decreased blood pressure may occur with autonomic nerve block [9].

3.1.2. Thoracic Splanchnic Nerve

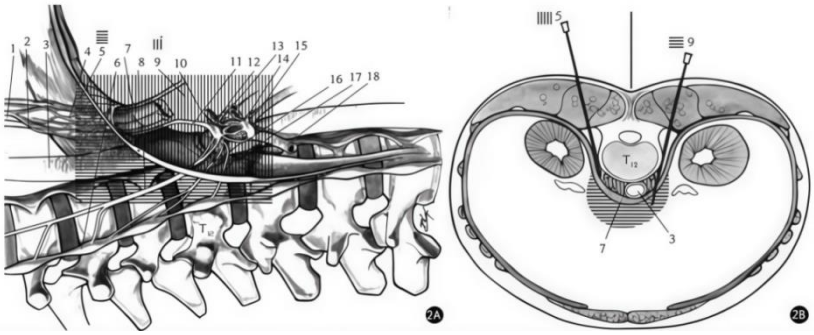

Figure 2. *CP and SN Position Map [10].*

Note: CP is the abdominal nerve plexus, SN is the visceral nerve. Figure 2A shows the sagittal anatomy of CP and SN, as well as the location of the pre-diaphragmatic and post diaphragmatic block areas. SN is located behind the diaphragmatic foot, in the narrow area surrounded by the diaphragmatic foot, vertebral body, and abdominal aorta. CP is located anterior inferior to the diaphragmatic foot and anterior lateral to the abdominal aorta. Figure 2B shows the cross-sectional anatomy and the position of the puncture needle for each blocking method, with the diaphragm as the boundary. The block in the posterior area of the diaphragmatic foot mainly blocks visceral nerves, while the block in the anterior area mainly blocks CP. In the figure, 1 represents the right vagus nerve, 2 represents the esophagus, 3 represents the aorta, 4 represents the esophageal plexus, 5 represents the posterior area of the diaphragmatic foot, 6 represents the sympathetic nerve chain, 7 represents the diaphragm, 8 represents the visceral great nerve, 9 represents the anterior area of the diaphragmatic foot, 10 represents the anterior trunk of the vagus nerve, 11 represents the posterior trunk of the vagus nerve, 12 represents the abdominal ganglion, 13 represents the aorta, 14 represents the superior mesenteric ganglion, 15 represents the superior mesenteric artery, 16 represents the visceral small nerve, 17 represents the visceral minimal nerve, and 18 represents the renal artery.

The thoracic visceral nerves, abbreviated as splanchnic nerves (SN), are composed of preganglionic fibers that pass through the T5 or T6-12 sympathetic ganglia. SN is divided into greater splanchnic nerve (GSN), lesser splanchnic nerve (LSN), and least splanchnic nerve (ISN). GSN, LSN, and ISN are connected to CP.

SN is the main origin nerve of visceral afferent nerves in CP. The nociceptive afferent fibers of the upper abdominal parenchymal organs mainly travel within the GSN. GSN passes through the root of the diaphragm at the T11 to 12 level

and connects to the celiac ganglia (Figure 2A) [10]. GSN is located in the retroperitoneal space, behind the diaphragmatic foot, within the posterior space of the diaphragmatic foot. This space is a potential, closed triangular stenosis area surrounded by the diaphragmatic foot, vertebral body, and abdominal aorta (Figure 2B) [10, 11]. Therefore, splanchnic nerve neurolysis (SNN) is rarely affected by surrounding structures [12]. Under X-ray or CT guidance, the paraspinal approach can be used to reach the splanchnic nerves. So, when CPB was performed behind the diaphragm foot by the posterior paravertebral approach, the nerves blocked is splanchnic nerves actually.

3.1.3. Celiac Plexus

CP is the largest splanchnic nerve plexus, connected to GSN, LSN, ISN, and vagus nerve. CP is the intersection of sympathetic, parasympathetic, and visceral sensory nerves, and is the main convergence point for pain transmission in the upper abdominal organs [2, 13]. CPB is an effective method for regulating pain originating from these internal organs.

CP is located in the retroperitoneal space and embedded in the adipose tissue in front of the abdominal aorta, between the aorta and the superior mesenteric artery (SMA) [2]. In front of CP are the stomach and pancreas, and behind of CP is the spine, CP located in the anterior diaphragmatic space (Figure 1). The size of the celiac ganglion ranges from 0.5 to 4.5 cm, with an average of 2.7 cm. Its position varies greatly, but it is mostly located from the T12-L1 transvertebral discto the midline of the L2 vertebral body [14]. The relationship between the CP and the aorta is more consistent than that of the vertebral body, therefore, the aorta is a reliable marker for CP localization [2, 6]. During endoscopic ultrasound examination, it is easy to locate CP using the aorta as a marker [15].

3.2. Classification of CPB/N

According to the puncture site, it can be divided into posterior approach and anterior approach. The posterior approach has the needle insertion point on the back, while the anterior approach has the needle insertion point on the abdomen. For the accuracy and safety of block therapy, We recommend to perform the procedure under imaging guidance, and blind puncture is no longer used. Currently commonly used clinical methods [16].

3.2.1. Posterior Paravertebral Approach

Posterior approach can be divided into posterior retrocrural approach and posterior antecrural approach. Posterior retrocrural approach indicated that needle tip of the posterior is placed behind the diaphragm foot (SNB); Posterior antecrural approach indicated that needle tip of the posterior is placed in front of the diaphragm foot (CPB).

3.2.2. Posterior Transintervertebral Disc Approach

The target is the same as the posterior paravertebral approach, but the puncture path passes through the intervertebral disc.

3.2.3. Posterior Transaortic Approach

The needle is inserted through the aorta and placed in front of the aorta and diaphragmatic foot.

3.2.4. Anterior Approach

The patient lies supine and the needle is inserted under the xiphoid process. According to the guidance method, it can be divided into CT guided approach, abdominal ultrasound guided approach, and endoscopic ultrasound guided approach.

3.3. Indications and Contraindications for CPB/N

3.3.1. Indications

1. Cancer pain of upper abdominal organs includes malignant lesions of gastrointestinal tract, pancreas, especially applicable to unresectable pancreatic cancer, liver cancer, bile duct cancer, metastatic liver cancer, and refractory abdominal pain related to retroperitoneal lymph node metastasis [2, 6]. 2. Non cancerous upper abdominal pain, such as long-term refractory abdominal pain caused by chronic pancreatitis [6, 10], can be treated with CPB, but CPN should be used with caution.

3.3.2. Contraindications [2]

1. Difficult to correct coagulation disorders or thrombocytopenia patients to avoid increased risk of bleeding; 2. Patients with puncture site or intra-abdominal infection and sepsis; 3. Patients with tumor metastasis in the puncture path; 4. Organic intestinal obstruction patients, as CPN can promote intestinal motility and exacerbate obstruction; 5. Patients with extreme emaciation, exhaustion, and shock are unable to withstand the blood pressure drop after blockade. 6. Patients taking disulfiram drugs (such as cephalosporins) are not suitable for ethanol nerve damage. Skin flushing, tachycardia, nausea, vomiting, and headache may occur [10]. 7. Patients with abdominal aortic aneurysm, aortic wall thrombus, or displacement of the aorta root should not use diaphragmatic foot block, as there is a risk of accidental bleeding. If necessary, it can be changed to diaphragmatic foot puncture and SNN can be performed. 8. For patients whose tumors have filled the space behind the diaphragm, the anatomical structure cannot be identified on imaging, and the puncture needle is difficult to enter the target position. In this case, the posterior approach is relatively contraindicated, and the anterior approach can be tried. (Table 1).

Table 1. Indications/contraindications for CPB/N.

		Disease or condition	Note
Indications	Cancer pain of upper abdominal	pancreatic cancer, liver cancer, bile duct cancer, metastatic liver cancer, retroperitoneal lymph node metastasis	Preferred for CPN
	Non cancerous pain of upper abdominal	chronic pancreatitis	Preferred for CPB
	Differential diagnosis	CPB can block visceral pain, but cannot block abdominal wall pain	Preferred for CPB, or combined with intercostal nerve block
contraindications	absolute contraindications	Difficult to correct coagulation disorders or thrombocytopenia	Prevent increased risk of bleeding
		puncture site or intra-abdominal infection and sepsis	Prevent the spread of infection
		tumor metastasis in the puncture path	Prevent tumor spread
		Organic intestinal obstruction	CPN can promote intestinal motility and exacerbate obstruction
		extreme emaciation, exhaustion, and shock	Unable to withstand the blood pressure drop after CPN
		taking disulfiram drugs (such as cephalosporins)	Preferred for phenol. not suitable for ethanol nerve damage [10].
	Relative contraindications	aortic aneurysm, aortic wall thrombus, or displacement of the artery root	Preferred for posterior retrocrural approach and SNN can be performed. There is a risk of accidental bleeding for Posterior antecrural approach.
		tumors have filled the space behind the diaphragm, the anatomical structure cannot be identified on imaging, and the puncture needle is difficult to enter the target position.	Preferred for anterior approach

3.4. Drug Selection for Celiac Plexus Block

Local anesthetics: 0.5% to 1.0% lidocaine or 0.25% to 0.50% bupivacaine (or ropivacaine) is usually used. A mixture of 1% lidocaine and 0.25% bupivacaine can also be used when CPB.

Neurolytic drugs : Neurolytic drugs Anhydrous Ethanol and Phenol are Commonly Used.

Currently, anhydrous ethanol is widely recommended in clinical practice. 50-95% ethanol can be used for CPN, and the higher the concentration of ethanol, the greater the damage to nerve fibers, and the better the effect of CPN [17]. Injecting ethanol can cause severe transient pain, so local anesthetics should be injected before injection ethanol or added to ethanol. Simultaneouslyiodine contrast agent add to ethanol to display drug distribution. During CPN, ethanol can be used for 20ml on each side in front of the diaphragmatic foot. During SNN, ethanol can be used for 6-10ml on each side behind the diaphragmatic foot. 10% phenol is usually used. Phenol has an immediate local anesthetic effect and does not cause temporary pain. When the dosage of phenol exceeds 8.5 grams, there may be side effects of central nervous system suppression and cardiac toxicity, while when the dosage is below 100 milligrams, it is usually safe. Phenol is not as effective as ethanol, so it is currently not commonly used [2, 18]. (Table 2).

Table 2. Common drugs for CPB/N.

Drug category	Drugs	Concentration (%)	usage	Purpose
Local anesthetics	Lidocaine	0.5% to 1.0%	A mixture of 1% lidocaine and 0.25% bupivacaine commonly used	Preventing ethanol induced pain. Signs of CPB efficacy.
	Bupivacaine or Ropivacaine	0.25% to 0.5%		
Neurolytic drugs	Anhydrous ethanol	50-95%	75% commonly used	Preferred for CPN and SNN
	phenol	10%	less commonly used	Preferred for taking disulfiram drugs (such as cephalosporins)

3.5. Common Methods for CPB/N

This article will introduce various blocking methods for CP based on different puncture paths, and the auxiliary positioning methods will be introduced in each method. The puncture paths of CPB and CPN are the same, but the difference lies in the drugs used, which will not be separately introduced here.

3.5.1. Posterior Retrocrural/Antecrural Approach

The bilateral posterior retrocrural/antecrural approach is a traditional technique that is suitable for both SNN and CPB, while the diaphragmatic foot anterior CPB is most commonly used. When the tumor spreads and causes anatomical disorder around the CP, posterior diaphragmatic SNN can be chosen, or it can be performed simultaneously with the antecrural approach to enhance the analgesic effect [18]. The majority of SSN were performed at L1 and T12. The analgesic effect of SNN is equivalent to that of CPN, biggest advantage of SNN is that independent of changes in the anatomical structure of the celiac plexus [19, 20].

(i). CT Guided Puncture (Evidence Category and Recommendation Level I - A)

Preoperative preparation: All surgical details, complications, effective and postoperative duration must be discussed with the patient and their family before surgery, and informed consent for the surgery must be obtained. Fasting for 6 hours and water deprivation for 2 hours before surgery to prevent the risk of vomiting and suffocation after using sedatives and hypnotics. To establish a venous access before surgery, 500-1000ml of fluid should be supplemented [10].

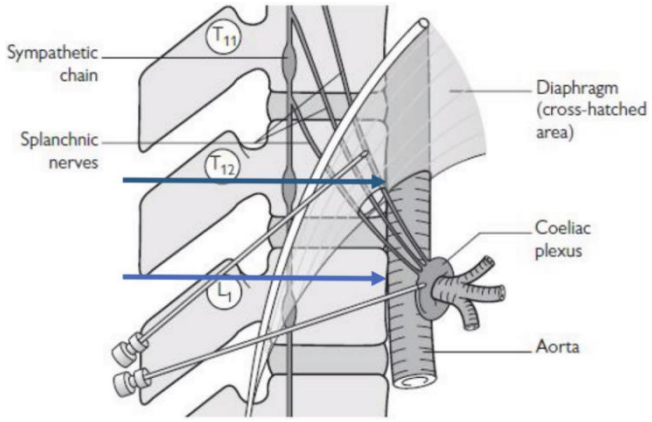

Figure 3. Diagram showing neural connections and various needle positions for celiac plexus and splanchnic block. Blue arrows show needle placement for the Procedure [21].

The patient's prone position is used for CT guided bilateral retrocrural approach. The puncture point should be at the level of T12-L1 vertebral body, 5-7 cm away from the midline. Apply sterile towels locally on the skin, infiltrate anesthesia at the puncture site and puncture path. CT scan positioning, the puncture path should be planned to avoid ribs, transverse processes, vertebral bodies, and major vascular structures. After the puncture needle passes through the skin, the needle tip tilts inward at an angle of about 45 °, upward at an angle of about 15 °, and towards the T12 vertebral body. The needle moves

forward along the lateral surface of the vertebral body. When the needle touches the lateral surface of the L1 vertebral body and there is resistance, it can be slightly retracted, the needle tip can be slightly adjusted, and then moved forward along the lateral surface of the vertebral body again. Be careful not to insert the needle too deeply, and adjust the needle angle and depth at any time under image monitoring. The puncture procedures for SNN and CPN under CT guidance are the same, with the difference being the target of injection. [Figure 3].

When the tip of the SNN needle is located behind the diaphragmatic foot, contrast agent can be injected. Once the distribution is ideal, nerve damage medication, usually 5-10 ml, can be injected. The nerve damage solution usually spreads along the anterior side of the upper lumbar and thoracic vertebrae, and only spreads within the boundary of the diaphragmatic foot space [2, 12]. The CPN needle tip enters the anterior space of the diaphragmatic foot, usually 2 cm deeper on the right side than on the left side. The ideal position for the needle tip is approximately 1-2 cm anterior to the aorta, horizontally between the diaphragmatic foot and pancreas, and between the celiac trunk and SMA [10, 18]. After the needle tip enters the target, 5 ml of contrast agent is injected, and once the distribution is ideal, 10-20 ml of nerve damaging drug is injected on each side. CT localization and injection are shown in Figures 4 and 5 (Figure 4 shows ethanol injection, and Figure 5 shows phenol injection). Before removing the needle, inject 0.5-1.0 ml of physiological saline solution through the puncture needle to prevent the leakage of destructive drugs into the puncture path [17].

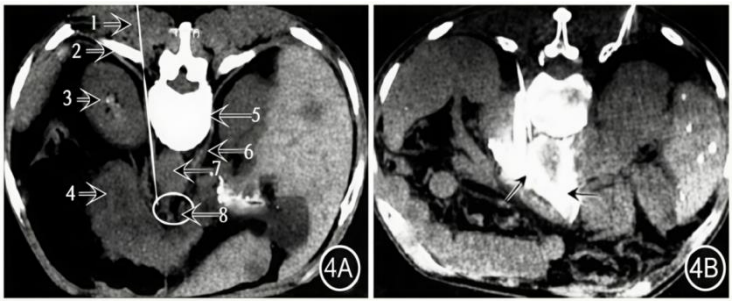

Figure 4. *CT guided CPN (T12-L1 level) [17].*

Note: CPN is a procedure for the destruction of the abdominal nerve plexus; Figure 4A is a schematic diagram of CPN, with the puncture needle reaching the anterior lateral CP area of the aorta; Figure 4B shows the diffusion of the lesion drug and contrast agent around the aorta in the CP region (indicated by the white arrows); In the figure, 1 is the puncture needle, 2 is the rib cage, 3 is the kidney, 4 is the pancreatic tumor, 5 is the vertebral body, 6 is the diaphragm, 7 is the abdominal aorta, and 8 is the area of the abdominal nerve plexus.

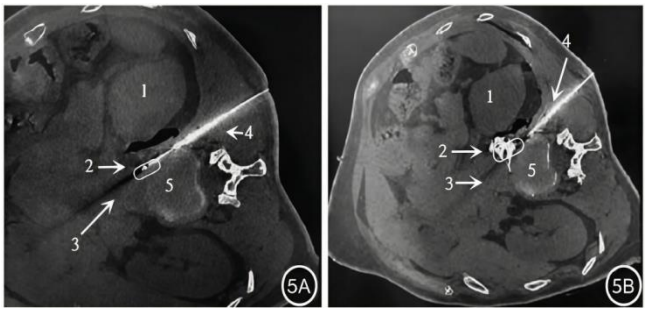

Figure 5. *CT guided SNN puncture injection process [22].*

Note: Figure 5A shows the insertion of the puncture needle into the anterior edge of the L1 vertebral body; Figure 5B shows target injection, slowly injecting 5 ml of 6% phenol solution, rinsing the puncture needle with 0.2% lidocaine solution containing a small amount of compound betamethasone, and the patient lying prone for 30 minutes to avoid diffusion of phenol solution into the intervertebral foramen; In the figure, 1 represents the kidney, 2 represents the SN region, 3 represents the abdominal aorta, 4 represents the puncture needle, and 5 represents the L1 vertebral body; SNN stands for visceral nerve destruction surgery, SN stands for visceral nerve.

Postoperative care: Observe the degree of pain relief in the patient after surgery, and send them back to the ward for observation after their blood pressure stabilizes. Stay in bed for at least 12 hours after surgery. Monitor blood pressure, heart rate, and other vital signs. Intravenous infusion as needed. Perform neurological examination immediately after surgery and within 1 day after surgery to determine the presence of neurological complications. Assess the patient's pain intensity (using a VAS scoring system of 1-10 points) and compare the results with preoperative data. Evaluate the degree of postoperative analgesic reduction and objectively assess whether pain has improved [2].

CT has become the preferred guidance technique, and all procedures of CPB can be guided by CT. The advantages of CT guidance: it can distinguish the anatomical structure of the upper abdominal organs, the range of tumor spread, and the anatomical variations of the celiac trunk; Being able to guide and monitor the location, depth, and angle of the puncture needle during the puncture process; During the injection process, the injection site and diffusion range of nerve damaging drugs can be observed to avoid accidental injection into adjacent structures or leakage into the peritoneal cavity.

(ii). X-ray Fluoroscopy Guided Puncture (Evidence Category and Recommendation Level II - B)

(a). Retrocrural approach

The position and preparation for puncture of retrocrural under the X-ray fluoroscopy guidance are similar to those under CT guidance. In the anterior posterior position of the X-ray, tilt the perspective centerline to one side at an angle of 20-30 ° at the level of the L1 vertebral body, so that the apex of the transverse process overlaps with the anterior lateral edge of the vertebral body. Tilt the perspective centerline towards the head at an angle of about 20 °, so that the lower edge of the T12 rib head is displayed on the T12 vertebral body. Then, the puncture needle enters along the coaxial direction, and the needle tip does not touch the transverse process during insertion, reaching the anterior side of the vertebral body, as shown in Figure 6 [10]. The needle insertion method on the other side is the same as before. After withdrawing no blood, contrast agent was injected, followed by 5-10 ml of nerve damage medication. X-ray fluoroscopy showed that the contrast agent spread to the front of the vertebral body and the back of the diaphragm [23].

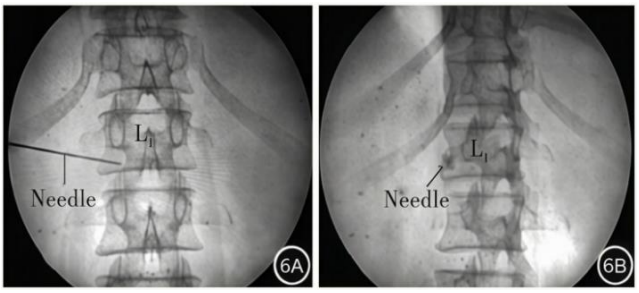

Figure 6. *Position of SNN puncture needle under X-ray fluoroscopy guidance [10].*

Note: SNN refers to visceral nerve destruction surgery; Figure 6A shows the X-ray anterior posterior view, with the needle tip reaching the lateral edge of the L1 vertebral body; Figure 6B shows the X-ray oblique position, with the perspective centerline tilted at an angle of about 20 ° towards the head, and the needle tip reaching the L1 vertebral body.

(b). Antecrural approach

The procedures of the antecrural approach is the same as the retrocrural approach, except that the needle tip passes through the diaphragmatic foot. Due to the inability to determine the relationship between the needle tip and the aorta under fluoroscopy, this method is not recommended for clinical use.

(iii). MRI Guided Puncture (Evidence Category and Recommendation Level III-B)

There are few reports on the application of CPB by MRI guided. But CPN by MRI guidance is a safe and feasible. [24-26]. In MRI guidance, there are the advantages of soft tissue visualization, real-time monitoring of needle movement, and avoiding personnel exposure to ionizing radiation. 0.4 T and 0.5 T are open low field MRI, while 1.5 T is closed high field MRI with higher image resolution.

Procedure steps The patient lies prone on the MRI examination bed, with the coil fixed at the T10 and L2 levels on the back. Obtain transverse, coronal, and sagittal SE T1W1 and FSE T2W1 images to identify key structures around CP. Transfer the collected images to the navigation system workstation for surgical path, puncture site, and target localization. After calibration, remove the examination bed from the imaging site [25].

After local anesthesia at the puncture site, an 18 GMRI compatible coaxial puncture needle was advanced to the target under real-time virtual guidance of an optical tracking system. Move the patient and examination bed back to the same position where the first set of MRI images were obtained. Repeat the fast imaging sequence (such as Flash, SPGR, etc.) to identify the position of the puncture needle again. After confirming the needle, inject 2 ml of 1% lidocaine, and after the pain subsides, inject 20 ml of ethanol. Collect images again, and if the ethanol distribution is not satisfactory, perform a second puncture on the other side of the celiac plexus [25].

3.5.2. Posterior Transvertebral Disc Approach (Evidence Category and Recommendation Level II-B)

(i). CT Guided

When the puncture needle is obstructed by the transverse process or ribs in the paravertebral path, the posterior approach through the transvertebral disc can be used. The specific procedures is similar to the "retrocrural approach". This approach directly penetrates the T12-L1 or L1-2 transvertebral disc with a puncture needle, reaching the position adjacent to the aorta at the level of the abdominal trunk (Figure 7) [1]. There is a sense of breakthrough when the needle passes through the anterior longitudinal ligament. When the needle tip reaches the anterior space of the diaphragm, contrast agents, local anesthetics, or anhydrous ethanol can be injected separately. The transvertebral disc approach can be performed unilaterally or bilaterally.

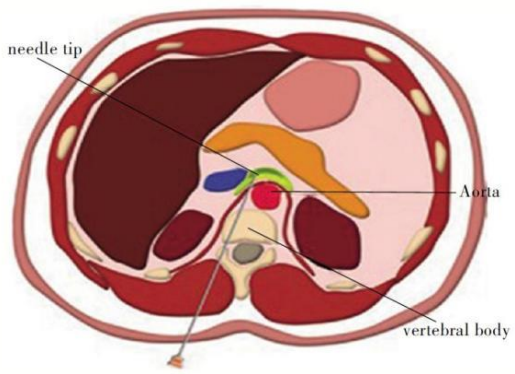

Figure 7. Diagram shows the transintervertebral disk approach for celiac plexus neurolysis, in which the needle traverses the intervertebral disk space lateral to the spinal cord [1].

(ii). X-ray Fluoroscopy Guided

The surgical procedure is similar to the bilateral retrocrural approach under X-ray, but the puncture path of this approach passes through the intervertebral disc, and the target is the midpoint of the anterior edge of the transvertebral disc (the inner 1/3 area of the bilateral pedicle line). With the application of CT and ultrasound guidance, the use of fluoroscopy guidance technology is gradually decreasing [19].

Main advantages of the transvertebral disc approach: (1) Avoid the possible nerve root damage caused by ethanol flowing into the intervertebral foramen; (2) Avoid damage to the lumbar arteries (which may cause paraplegia) and other nearby organs such as the liver, kidneys, intestines, pancreas, etc [12].

Disadvantages of the transvertebral disc approach: transvertebral disc injury carries the risk of secondary discitis, disc herniation, and spinal cord puncture injury. Patients with severe degenerative diseases of the thoracolumbar spine have difficulty in puncture, and this approach should be used with caution [2, 18].

3.5.3. Posterior Transaortic Approach (Evidence Category and Recommendation Level III-C)

The specific puncture procedure of the posterior approach through the aorta is similar to that of the retrocrural approach. We recommend to perform puncture under CT guidance. Predetermine the position of the abdominal aorta, adopt a left paraspinal approach, and insert a single needle through the posterior and anterior walls of the aorta, with the needle tip pressed against the anterior space of the aorta. After confirming the needle tip position with CT and drawing back no blood, inject 3-4 ml of contrast agent. After satisfactory diffusion, inject 25-40 ml of ethanol to complete CPN.

The main advantage of this method is that a single injection can block CP, and the possibility of spinal cord injury is very small; The main disadvantage is an increased risk of retroperitoneal bleeding, especially in patients with abdominal aortic calcification, hypertension, or coagulation disorders [2, 18]. Therefore, it is not recommended to use this approach routinely.

3.5.4. Anterior Approach

The anterior approach of CPN was first described in 1918, but its use was discontinued due to the high incidence of complications from blind puncture. The application of image-guided technology has led to the reuse of the anterior approach. Due to potential complications such as visceral organ damage, it is only used as an alternative method to the posterior approach [1]. The anterior approach is divided into CT guided, ultrasound-guided, and endoscopic CPN. In recent years, there has been a gradual increase in reports on ultrasound-guided and endoscopic CPN [27-31].

(i). CT Guided Anterior Approach (Evidence Category and Recommendation Level II-C)

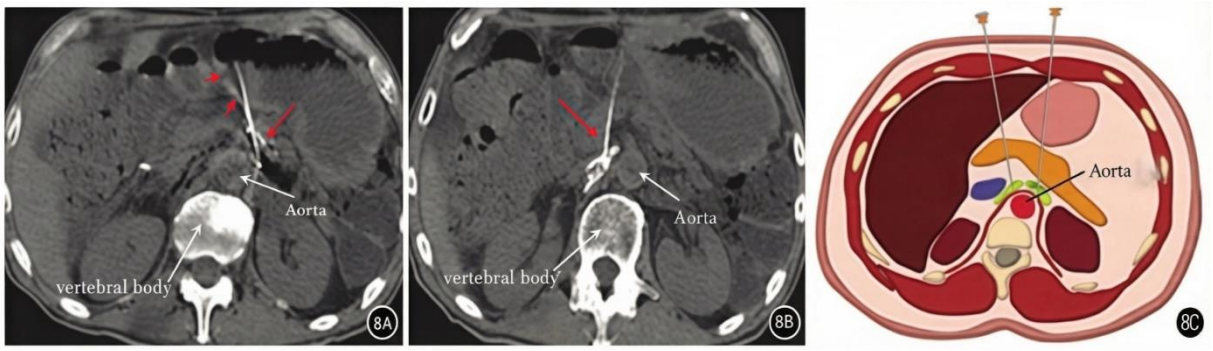

Figure 8. The anterior approach to CT-guided celiac plexus neurolysis in a 65-year-old woman with metastatic biliary cancer. 8A and 8B Axial multidetector CT images show the position of the needle tips to the right and left of the celiac axis, which is indicated by the needle tip position and the injection of contrast material (arrow). Areas of low attenuation within the areas of hyperattenuating contrast material correspond to the injection of ethanol, the neurolytic agent. In 8C, the path of the needle is seen to be through the stomach (arrowheads) and to the celiac plexus. 8C Diagram shows the technique for anterior celiac plexus block [32].

The patient is in a supine position, and a CT scan is used to determine the location of the puncture needle. The puncture needle is inserted through the anterior abdominal wall, usually directly below the xiphoid process as the puncture point. The target of the needle tip is the same as the antecrural approach, that is, the needle tip should be placed in front of the aorta and diaphragmatic foot. The puncture needle of this approach usually passes through the stomach, liver, or pancreas to reach the celiac plexus. After determining the needle tip position, inject 30-50 ml of ethanol into the anterior compartment of the diaphragm. This technique is divided into single needle and double needle methods (Figure 8), with double needle injection being superior to single needle central injection [32].

(ii). Abdominal Ultrasound Guided Anterior Approach (Evidence Category and Recommendation Level III-B)

The ultrasound guided divided into abdominal ultrasound and endoscopic ultrasound guidance. The advantages of ultrasound guidance: comfortable supine position for patients; Real time monitoring of the puncture process allows for real-time visualization of the arteries, avoiding accidental damage to large blood vessels; Without the use of contrast agents, the diffusion of drugs can be observed, and even if the tumor mass causes CP displacement, the location of CP can be identified. Due to the fact that this method can avoid neurological complications related to the posterior approach from the anterior approach to CP, but this technique highly relies on the experience of the procedure physician, and accurate identification of CP may sometimes be challenging [30]. In recent years, more and more literatures reported that ultrasound-guided CPB/N was used to treat pain in pancreatic cancer. [33-36].

Procedure steps: This method is best performed with the assistance of a professional ultrasound specialist. Use an abdominal ultrasound device with the probe placed directly below the xiphoid process to identify the abdominal aorta, branches of the abdominal trunk, and superior mesenteric artery. Choose easily accessible and clear avascular access (or long axis midline or short axis through the liver or stomach) as the puncture needle entry point. After local anesthesia of the skin, a 20 G 20 cm long puncture needle was used to reach the target between the aorta and the superior mesenteric artery above the aortic wall under direct visualization. After successful diagnostic blockade, inject 10-20 ml of 0.25% bupivacaine through a needle. After the pain is relieved, inject 20-40 ml of ethanol. Rinse the needle cavity with 2 ml of physiological saline [30].

(iii). Endoscopic Guided Anterior Approach (Evidence Category and Recommendation Level II-A)

Wiersema first described endoscopic ultrasonography (EUS-CPN) guided by gastric endoscopy in 1996. EUS-CPN uses color Doppler guidance in the gastric cavity, and the puncture path avoids blood vessels, making it more accurate and safe [29, 36]. The incidence of complications in this method is very low, with a pain relief rate of 70% [35]. Percutaneous retrocrural CPN should be considered when endoscopic ultrasound-guided CPN is not effective [37].

This approach is usually operated by gastroenterologists or endoscopists. The patient is lying on the left side and undergoing conscious sedation or general anesthesia. According to the operating procedures of endoscopy, the ultrasound endoscope is inserted into the stomach through the oral cavity, about 1-2 cm below the cardia, and the abdominal aorta is identified on the posterior wall of the lesser curvature of the stomach. The CP is located on both sides of the anterior wall of the abdominal aorta and the origin of the abdominal trunk [38]. Color Doppler is used in the target area to observe for vascular and structural variations, ensuring the safety of the puncture path [29, 36].

After determining the target, a 20G puncture needle is inserted through the gastric wall via endoscopy, with the needle tip placed at the target. After drawing back no blood, 3 ml of 0.75% bupivacaine and 10-20 ml of 98% ethanol are injected, and the same procedure is performed on the other side of the abdominal aorta [29, 36, 39, 40]. After ethanol injection, "whitening" or "blizzard sign" will immediately occur, and the display screen will show heterogeneous high echo areas similar to snowflakes. At this time, endoscopy cannot visually track the target, which is one of the disadvantages.

3.6. Evaluation of the Therapeutic Effect of CPB/N

3.6.1. The Abdominal and Back Pain Disappears or Significantly Reduces

Using CPN alone can alleviate pain in 10% to 24% of patients, and when combined with other treatments, it can alleviate pain in 80% to 90% of patients [2]. After CPN treatment, 89% of patients experienced optimal pain relief within 2 weeks, and 90% of patients experienced partial or complete pain relief within 3 months [18]. The average pain relief period is 72 days [28].

3.6.2. Blood Pressure Drops Significantly with Bilateral Blockade

Hypotension is both a sign of successful CPN and a complication of CPN. The incidence of hypotension is 60.4% to 77.0% [41]. Systolic pressure can be reduced by 20% -30% [2, 18, 42]. Individual patients can continue until 3 days after surgery [43].

3.6.3. Increased or Hyperactive Intestinal Peristalsis

Due to excessive gastrointestinal motility, patients may experience relief of bloating and temporary diarrhea, which can

alleviate constipation caused by opioid drugs and be beneficial for patients. The relief of constipation and bloating is a sign of successful abdominal nerve block.

3.7. Complications and Precautions of CPB/N

CPN is a relatively safe surgery, with less than 2% of patients experiencing serious complications during percutaneous CT guided CPN, mostly temporary and mild complications [2]. Common complications include back pain, hypotension, and diarrhea. Complications related to puncture needles are often associated with the puncture path.

3.7.1. Back Pain

Also Known as Chest and Back Burning Syndrome. This nerve damaging drug stimulates the soft tissues of the diaphragm and puncture pathway, and may also damage the sensory nerve fibers inside the CP, causing ethanol induced neuropathy. 6.9% to 10% of patients experience burning pain at the back puncture site [44]. Back pain usually radiates to the shoulders and may persist for up to 72 hours after surgery [2, 45]. Treatment: Generally, recovery can be achieved within a few days, and taking nonsteroidal anti-inflammatory drugs can alleviate back pain [12]. For particularly severe cases, steroid hormones and local anesthetics can be used for paraspinal block, and the pain will generally be relieved or disappear. Prevention: Under imaging guidance, try to minimize the number of punctures as much as possible; Do not use too much SNN dosage; Before pulling out the puncture needle, be sure to rinse the needle tube to avoid residual drugs stimulating the soft tissue of the puncture path.

3.7.2. Hypotension

Hypotension is caused by decreased sympathetic nervous system tension and vasodilation. Prevention: It can accelerate infusion and use vasopressors if necessary, both of which can quickly relieve symptoms [17]. Preoperative infusion of 500-1000ml can prevent a sharp drop in blood pressure after surgery [46].

3.7.3. Diarrhea

The incidence of diarrhea is as high as 44%, but it is mostly temporary [41]. It may be related to the relative hyperactivity of parasympathetic nervous system function and enhanced intestinal peristalsis after sympathetic nerve block, which is often self limiting. Treatment: It usually takes 2-3 days to recover, rarely exceeding 1 week [17], no special treatment is needed, and in severe cases, fluid replacement is necessary.

3.7.4. Bleeding

Bleeding can accidentally damage the adjacent abdominal aorta and inferior vena cava, especially the abdominal aorta, which can easily cause retroperitoneal bleeding. Processing: Monitor blood pressure and pulse. If there is a significant or rapid decrease in blood pressure, pale complexion, and progressive decrease in hemoglobin, bleeding can be suspected. Ultrasound can diagnose retroperitoneal bleeding. Treatment: Use emergency measures such as hemostatic drugs, blood transfusion, and pressure boosting, and perform emergency surgery to stop bleeding if necessary. Prevention: Complications of this procedure are prone to occur under blind puncture and X-ray guidance. We recommend to use CT guidance to avoid damaging blood vessels and internal organs.

3.7.5. Neurological Complication

Neurological complications include nerve root and spinal cord injuries, with the most severe cases leading to lower limb paralysis. Anterior spinal artery syndrome can also occur, due to spasm of the anterior spinal artery blood vessels, resulting in temporary lower limb weakness [47]. It is possible that ethanol diffuses into the anterior spinal artery through the T12 intercostal artery, causing Adamkiewicz artery injury and leading to spinal ischemic infarction [40]. The Adamkiewicz artery originates from the aorta, located from T7 to L4, supplying the lower two-thirds of the anterior spinal artery, which is closely related to the abdominal ganglia. Ethanol entering the spinal canal by mistake can cause severe pain in the lower back, and in severe cases, it can lead to paraplegia [2]. The distribution of destructive drugs outside the intervertebral foramen can damage the spinal nerves and cause sensory or motor dysfunction.

3.7.6. Organ Damage

Organ damage induced by visceral puncture is mostly caused by anterior approach or X-ray fluoroscopy guidance. Under CT guidance, organ damage or neurological complications are not common. Including kidney injury, transvertebral discinjury, lumbar nerve damage, peritonitis, retroperitoneal abscess, pneumothorax, bilateral diaphragmatic paralysis, and ejaculation dysfunction, the incidence rate is less than 0.15% [43, 46, 48-51]. The cause of visceral injury is due to improper positioning of the puncture site, angle and depth of needle insertion [52].

3.7.7. Drug Toxicity Reactions

Local anesthetics accidentally entering blood vessels can cause toxic reactions to local anesthetics. Excessive ethanol dosage or rapid absorption can lead to toxic reactions, manifested as drunkenness, with alcohol odor in exhaled breath, facial flushing, palpitations, and increased heart rate, but without any consciousness disorders. After 2 hours of oxygen inhalation, normal recovery can occur [53]. High doses of ethanol accidentally entering blood vessels can cause ethanol poisoning, epileptic seizures, and loss of consciousness. Improper injection or excessive absorption of phenol into blood vessels can also cause toxic reactions, manifested as inducing muscle spasms, epileptic seizures, loss of consciousness, as well as complications such as hypotension, arrhythmia, and liver and

kidney function damage.

4. Discussion

The Chinese experts consensus is based on the clinical practice of domestic medical experts and combined with domestic and foreign literature evidence. The selection of approachs should be individualized based on operator's preference, patient'sanatomy and comorbidities, and extent of disease. Specific considerations include a lower risk of damage to visceral organs and a decreased incidence of neurologic complications. In China, although interventional radiologists and gastroenterologists/endoscopists also implement CPB/N, pain physicians have the highest number of CT guided CPB/N and have extensive experience. Therefore, this expert consensus focuses more on pain physicians. Due to the popularity of CT instruments In China, CT guided CPB/N has become easier, and most doctors can proficiently master this technique after short-term training. So we recommended to choose CT guided posterior approach and endoscopic ultrasound-guided approach. Both methods are guided by imaging for puncture, with a high success rate and few complications. Consistent with the suggestions of foreign scholars [1, 18]. There are few literature retrieved on transintervertebral disc approach and transaortic approach, and there are almost no Chinese literature available. Chinese medical experts rarely perform transintervertebral disc approach and transarterial approach, and also rarely performed C-arm guided punctures. Therefore, unlike foreign countries [1, 18], this expert consensus does not advocate the implementation of transintervertebral disc approach and transaortic approach, and recommends abandoning the transarterial approach. Although there have been no reported incidents of bleeding accidents in the literature [23, 54], from a clinical perspective, this method still carries potential risks of bleeding.

In China, anhydrous ethanol is chosen as the drug for nerve neurolysis, and phenol is almost not used. The most commonly utilized mixture consists of 95 to 100% ethanol, bupivacaine, and iodinated contrast in a 6:3:1 ratio [18]. The concentration of anhydrous ethanol is generally 70-75%, and the optimal volume of the mixture is to cover the aorta with contrast agent. Excessive diffusion may cause damage to surrounding tissues. Measures to reduce complications include: puncture positioning must be performed under imaging guidance (preferably under CT or EUS guidance), and C-arm guidance has poor accuracy. Before injecting the medication, make sure there is no blood drawn back from the syringe. Before removing the puncture needle, inject physiological saline to prevent ethanol from staying in the puncture path and causing pain. The patient returned to the ward, monitored blood pressure and pulse for 48 hours, and received intravenous infusion to treat hypotension.

5. Conclusion

CPB/N are safe and effective procedures for managing chronic upper abdominal malignant pain. Absolute contraindications included that patients with refractory coagulation disorders or thrombocytopenia, patients with puncture site or intra-abdominal infection as well as sepsis and patients with organic intestinal obstruction. In clinical practice, there are various approachs for CPB/N. CT guided posterior approaches are most commonly performed. EUS guided anterior approache by endoscopists is also commonly used. CPB/N is considered a low-risk procedure. Most adverse reactions are transient. Most common complications are local back pain, hypotension, and intestinal hypermotility diarrhea. The last one can improve the side effects of opioid drugs and it is beneficial for patients. Image guidance is crucial. Accurate positioning under imaging can avoid damaging nerves and puncturing arteries, resulting in bleeding. Mastering the operation technique of CPB/N is not difficult. As long as one understands the anatomy of the celiac plexus, recognizes the anatomical structure under imaging, adjusts the needle insertion direction under imaging guidance, and is familiar with the management of complications, the implementation of CPB/N will surely be successful.

Evidence category and recommendation level Table 3.

Table 3. *Evidence category and recommendation level.*

Methods	evidence features	Recommended level	
1. CT guided posterior antecrural approach CPN for chronic upper abdominal cancerous pain	I	A	I-A
2. CT guided posterior retrocrural approach SNN for advanced upper abdominal cancerous pain	I	B	I-B
3. X-ray fluoroscopy guided posterior approach	II	B	II-B
MRI guided posterior approac	III	B	III-B
4. transintervertebral disc approach CPN	II	B	II-B
5. CT guided anterior approach	II	C	II-C

Methods	evidence features	Recommended level	
6. transaortic approach CPN	III	C	III-C
7. Abdominal ultrasound guided anterior approach	III	B	III-B
8. Endoscopic Ultrasound-Guided CPB/N	II	A	II-A

Conflicts of Interest

All authors declare no conflicts of interest.

References

[1] Chen CK and Erdek MA. Celiac plexus block and neurolysis procedure: treatment of chronic pain in pancreatic cancer. Pain Manag. 2025; 15(11): 779-781. https://doi.org/10.1080/17581869.2025.2555163

[2] Kambadakone A, Thabet A, Gervais DA, Mueller PR and Arellano RS. CT-guided celiac plexus neurolysis: a review of anatomy, indications, technique, and tips for successful treatment. Radiographics. 2011; 31(6): 1599-621. https://doi.org/10.1148/rg.316115526

[3] Burchiel KJ and Raslan AM. Contemporary concepts of pain surgery. J Neurosurg. 2019; 130(4): 1039-1049. https://doi.org/10.3171/2019.1.Jns181620

[4] Uysal A, Unal E, Karaosmanoglu AD, Arellano R, Ciftci TT, Akinci D and Akhan O. The role of interventional radiology in the treatment of patients with pancreatic cancer. Br J Radiol. 2021; 94(1118): 20200702. https://doi.org/10.1259/bjr.20200702

[5] Yalamuru B, Weisbein J, Pearson ACS and Kandil ES. Minimally-invasive pain management techniques in palliative care. Ann Palliat Med. 2022; 11(2): 947-957. https://doi.org/10.21037/apm-20-2386

[6] Aman MM, Mahmoud A, Deer T, Sayed D, Hagedorn JM, Brogan SE, Singh V, Gulati A, Strand N, Weisbein J, Goree JH, Xing F, Valimahomed A, Pak DJ, El Helou A, Ghosh P, Shah K, Patel V, Escobar A, Schmidt K, Shah J, Varshney V, Rosenberg W and Narang S. The American Society of Pain and Neuroscience (ASPN) Best Practices and Guidelines for the Interventional Management of Cancer-Associated Pain. J Pain Res. 2021; 14: 2139-2164. https://doi.org/10.2147/jpr.S315585

[7] Pacheco-Feijoó GM, Amado-Tineo JP, Plancarte-Sánchez R, Valdivia CC and López-Millán JM. Efficacy and Safety of Celiac Plexus Neurolysis in the Treatment of Chronic Pain Secondary to Oncological Pathology of the Upper Hemiabdomen: A Systematic Review and Meta-Analysis. Indian J Palliat Care. 2023; 29(4): 394-406. https://doi.org/10.25259/ijpc_203_2022

[8] Gamboa AC and Snyder RA. Surgical Palliation for Pancreatic Cancer. Surg Oncol Clin N Am. 2026; 35(1): 167-179. https://doi.org/10.1016/j.soc.2025.05.005

[9] Daniels M, Duran E, Pan V, Rentzepis P, An T, Thabet A, Hao D. Computed Tomography-Guided Celiac Plexus Block and Neurolysis: Technical Outcomes and Complications. Pain Physician. 2026 Jan; 29(1): E71-E78. PMID: 41628217.

[10] Bahn BM and Erdek MA. Celiac plexus block and neurolysis for pancreatic cancer. Curr Pain Headache Rep. 2013; 17(2): 310. https://doi.org/10.1007/s11916-012-0310-y

[11] Wada S, Arai Y, Sone M, Sugawara S and Itou C. The value of angio-CT system on splanchnic nerve neurolysis. Diagn Interv Radiol. 2021; 27(3): 408-412. https://doi.org/10.5152/dir.2021.20224

[12] Cai Z, Zhou X, Wang M, Kang J, Zhang M and Zhou H. Splanchnic nerve neurolysis via the transdiscal approach under fluoroscopic guidance: a retrospective study. Korean J Pain. 2022; 35(2): 202-208. https://doi.org/10.3344/kjp.2022.35.2.202

[13] Pereira GA, Lopes PT, Dos Santos AM, Pozzobon A, Duarte RD, Cima Ada S and Massignan Â. Celiac plexus block: an anatomical study and simulation using computed tomography. Radiol Bras. 2014; 47(5): 283-7. https://doi.org/10.1590/0100-3984.2013.1881

[14] Haviarová Z, Kuruc R and Matjčík V. Contribution to the variability in the coeliac plexus structure and formation. ANZ J Surg. 2024; 94(12): 2258-2262. https://doi.org/10.1111/ans.19234

[15] Moutinho-Ribeiro P, Costa-Moreira P, Caldeira A, Leite S, Marques S, Moreira T, Nunes N and Bispo M. Endoscopic Ultrasound-Guided Celiac Plexus Interventions. GE Port J Gastroenterol. 2020; 28(1): 32-38. https://doi.org/10.1159/000508293

[16] Vig S, Bhan S and Bhatnagar S. Celiac Plexus Block - An Old Technique with New Developments. Pain Physician. 2021; 24(5): 379-398.

[17] Xie GL, Guo DP, Liu C, et al. Comparison of the efficacy of celiac plexus neurolysis alone or combined with retroperitoneal lymph node injection in the treatment pain associated with pancreatic cancer [J]. Chinese Medical Journal, 2020, 100(5): 357-362. https://doi.org/10.3760/cma.j.issn.0376-2491.2020.05.008

[18] Cornman-Homonoff J, Holzwanger DJ, Lee KS, et al. Celiac plexus block and neurolysis in the management of chronic upper abdominal pain [J]. Semin Intervent Radiol, 2017, 34(4): 376-386. https://doi.org/10.1055/s-0037-1608861.

[19] Luo L, Cao X, Qiu M, Zhu M, Yan Y, Zhang D, Zhang X. Splanchnic nerve block via transdiscal and paraspinal approach in the treatment of pain in advanced pancreatic cancer: A randomized controlled trial. Medicine (Baltimore). 2025 Sep 19; 104(38): e44250. https://doi.org/10.1097/MD.0000000000044250

[20] Lu F, Li X, Song L, Ye L, Wang X, Wang R. Efficacy and Safety of Celiac Plexus Neurolysis Versus Splanchnic Nerve Neurolysis in the Management of Abdominal Cancer Pain: A Meta-analysis of 359 Patients. Pain Physician. 2024 Jan; 27(1): 1-10.

[21] Koyyalagunta D, Mach S, Chung M. Comparison of Different Spinal Level Approaches in Splanchnic Sympathetic Neurolysis for Intractable Upper Abdominal Cancer Pain: A Retrospective Review. Pain Physician. 2025 Jul; 28(4): E403-E410.

[22] Lu XM, Gu YP, Wu GP, et al. Application of low volume phenol in celiac plexus neurolysis for the treatment of upper abdominal cancer pain [J]. Chinese Journal of Interventional Radiology, 2021, 30(11): 1166-1169. https://doi.org/10.3969/j.issn.1008-794X.2021.11.019

[23] Shwita AH, Amr YM, Okab MI. Comparative study of the effects of the retrocrural celiac plexus block versus splanchnic nerve block, Carm guided, for upper gastrointestinal tract tumors on pain relief and the quality of life at a sixmonth follow up [J]. Korean J Pain, 2015, 28(1): 22-31. https://doi.org/10.3344/kjp.2015.28.1.22

[24] Hol PK, Kvarstein G, Viken O, et al. MRIguided celiac plexus block [J]. J Magn Reson Imaging, 2000, 12(4): 562-564. https://doi.org/10.1002/15222586(200010)12:43.0.co;2-a

[25] Jin G, Qiu X, Ding M, et al. Navigated magnetic resonance imagingguided celiac plexus neurolysis using an open magnetic resonance system for pancreatic cancer patients with upper abdominal pain [J]. J Cancer Res Ther, 2019, 15(4): 825-830. https://doi.org/10.4103/jcrt.JCRT_38_19

[26] Marker DR, U Thainual P, Ungi T, et al. 1.5 T augmented reality navigated interventional MRI: paravertebral sympathetic plexus injections [J]. Diagn Interv Radiol, 2017, 23(3): 227-232. https://doi.org/10.5152/dir.2017.16323

[27] Wang L, Lu M, Wu X, et al. Contrastenhanced ultrasoundguided celiac plexus neurolysis in patients with upper abdominal cancer pain: initial experience [J]. Eur Radiol, 2020, 30(8): 4514-4523. https://doi.org/10.1007/s00330-020-06705-z

[28] Asif AA, Walayat SK, Bechtold ML, et al. EUSguided celiac plexus neurolysis for pain in pancreatic cancer patientsa metaanalysis and systematic review [J]. J Community Hosp Intern Med Perspect, 2021, 11(4): 536-542. https://doi.org/10.1080/20009666.2021.1929049

[29] Pérez-Aguado G, de la Mata DM, Valenciano CM, et al. Endoscopic ultrasonography-guided celiac plexus neurolysis in patients with unresectable pancreatic cancer: An update. World J Gastrointest Endosc. 2021 Oct 16; 13(10): 460-472. https://doi.org/10.4253/wjge.v13.i10.460

[30] AbdelGhaffar ME, Ismail SA, Ismail RA, et al. Comparison between two volumes of 70% alcohol in single injection ultrasoundguided celiac plexus neurolysis: a randomized controlled trial [J]. Pain Physician, 2022, 25(3): 293-303.

[31] Kamata K, Kinoshita M, Kinoshita I, et al. Efficacy of EUS-guided celiac plexus neurolysis in combination with EUS-guided celiac ganglia neurolysis for pancreatic cancerassociated pain: a multicenter prospective trial [J]. Int J Clin Oncol, 2022, 27(7): 1196-1201. https://doi.org/10.1007/s10147022021606

[32] Wyse JM, Chen YI, Sahai AV. Celiac plexus neurolysis in the management of unresectable pancreatic cancer: when and how? [J]. World J Gastroenterol, 2014, 20(9): 2186-2192. https://doi.org/10.3748/wjg.v20.i9.2186

[33] Singh S, Facciorusso A, Vinayek R, et al. Endoscopic Ultrasound-Guided Treatments for Pancreatic Cancer: Understanding How Endoscopic Ultrasound Has Revolutionized Management of Pancreatic Cancer. Cancers (Basel). 2024 Dec 30; 17(1): 89. https://doi.org/10.3390/cancers17010089.

[34] Rogers HK, Shah SL. Role of Endoscopic Ultrasound in Pancreatic Cancer Diagnosis and Management. Diagnostics (Basel). 2024 May 31; 14(11): 1156. https://doi.org/10.3390/diagnostics14111156.

[35] Xuan M, Li N, Wu C. A meta-analysis on the efficacy of endoscopic ultrasonography for treatment of pancreatic cancer. Clinics (Sao Paulo). 2024 Mar 28; 79: 100348. https://doi.org/10.1016/j.clinsp.2024.100348

[36] Li M, Wang Z, Chen Y, et al. EUSCGN versus EUSCPN in pancreatic cancer: a qualitative systematic review [J]. Medicine (Baltimore), 2021, 100(41): 1-7. https://doi.org/10.1097/md.0000000000027103

[37] Motoyama Y, Sato H, Nomura Y, et al. Percutaneous retrocrural versus ultrasound-guided coeliac plexus neurolysis for refractory pancreatic cancer pain. BMJ Support Palliat Care. 2023 Oct; 13(e1): e81-e83. https://doi.org/10.1136/bmjspcare-2020-002246

[38] Xu WJ, Hao SJ, Zhong L. Research progress of celiac plexus neurolysis for analgesia of pancreatic cancer [J]. International Journal of Digestive Diseases, 2014, 34(2): 93-95. https://doi.org/10.3969/j.issn.1673-534X.2014.02.007

[39] Sachdev AH, Gress FG. Celiac Plexus Block and Neurolysis: a review [J]. Gastrointest Endosc Clin N Am, 2018, 28(4): 579-586. https://doi.org/10.1016/j.giec.2018.06.004

[40] Seicean A. Celiac plexus neurolysis in pancreatic cancer: the endoscopic ultrasound approach [J]. World J Gastroenterol, 2014, 20(1): 110-117. https://doi.org/10.3748/wjg.v20.i1.110

[41] Dong D, Zhao M, Zhang J, et al. Neurolytic splanchnic nerve block and pain relief, survival, and quality of life in unresectable pancreatic cancer: a randomized controlled trial [J]. Anesthesiology, 2021, 135(4): 686-698. https://doi.org/10.1097/aln.0000000000003936

[42] Shi R, Yang YN, Ma DX, et al. Celiac plexus neurolysis by CT localization and fluoroscopy guided for the treatment of intractable abdominal pain associated with pancreatic cancer: a case report and literature review [J]. Chinese Journal of Pain, 2020, 16(2): 136-139. https://doi.org/10.3760/cma.j.cn101658-20200219-00019

[43] Yousefshahi F, Tahmasebi M. Longlasting orthostatic hypotension and constipation after celiac plexus block: a case report [J]. Anesth Pain Med, 2018, 8(1): 1-3. https://doi.org/10.5812/aapm.63221

[44] Okita M, Otani K, Gibo N, et al. Systematic review and meta-analysis of celiac plexus neurolysis for abdominal pain associated with unresectable pancreatic cancer [J]. Pain Pract, 2022, 22(7): 652-661. https://doi.org/10.1111/papr.13143

[45] Kong P, Yuan TW, He Y, et al. The application value of percutaneous celiac plexus block by CT guided in upper abdominal cancer pain [J]. Journal of Interventional Radiology, 2020, 29: 1000-1003. https://doi.org/10.3969/j.issn.1008-794X.2020.10.009

[46] Sato T, Nishibori Y, Sekikawa M, et al. Prophylactic Perioperative Fluid Infusion Strategy During Splanchnic Nerve Neurolysis to Prevent Systemic Hypotension: A Case Series of 70 Patients With Cancer. Pain Physician. 2025 Jan; 28(1): 51-57.

[47] West T, Pogu S, Wanderman R, et al. Possible Transient Anterior Spinal Artery Syndrome After a Celiac Plexus Neurolytic Block. Cureus. 2023 Aug 19; 15(8): e43771. https://doi.org/10.7759/cureus.43771

[48] Sample J, Hammad F, Ghazaleh S, et al. A rare complication of ileus following endoscopic ultrasoundguided celiac plexus neurolysis: a case report [J]. Cureus, 2020, 12(10): 1-5. https://doi.org/10.7759/cureus.10963

[49] Zhou Y, O'Donovan B, Beqari J, et al. Retroperitoneal necrosis as a rare complication after celiac plexus block [J]. Cureus, 2021, 13(2): 1-4. https://doi.org/10.7759/cureus.13169

[50] Koker IH, Aralasmak A, Unver N, et al. Spinal cord ischemia after endoscopic ultrasound guided celiac plexus neurolysis: case report and review of the literature [J]. Scand J Gastroenterol, 2017, 52(10): 1158-1161. https://doi.org/10.1080/00365521.2017.1335771

[51] McAninch SA, Raizada MS, Kelly SM. Pulmonary embolism following celiac plexus block and neurolysis [J]. Proc (Bayl Univ Med Cent), 2016, 29(3): 329-330. https://doi.org/10.1080/08998280.2016.11929458

[52] Zhao L, Liu SW. Applied anatomy of percutaneous celiac plexus puncture [J]. Chinese Journal of Clinical Anatomy, 1998, 16(4): 331-333. https://doi.org/10.13418/j.issn.1001-165x.1998.04.021

[53] Chen W, Fei Y, Yao M, etc. The dosage-effect relationship of anhydrous ethanol celiac plexus block by CT guided for the treatment of refractory upper abdominal cancer pain [J]. Chinese Journal of Anesthesiology, 2020: 320-322. https://doi.org/10.3760/cmaj.cn131073.20191001002.00316

[54] Ahmed A, Arora D. Fluoroscopy-guided Neurolytic Splanchnic Nerve Block for Intractable Pain from Upper Abdominal Malignancies in Patients with Distorted Celiac Axis Anatomy: An Effective Alternative to Celiac Plexus Neurolysis - A Retrospective Study. Indian J Palliat Care. 2017 Jul-Sep; 23(3): 274-281. https://doi.org/10.4103/IJPC.IJPC_28_17