EUS-guided celiac plexus neurolysis by using highly viscous phenol-glycerol as a neurolytic agent (with video)

Hirotoshi Ishiwatari, MD, PhD,[1] Tsuyoshi Hayashi, MD, PhD,[1] Makoto Yoshida, MD, PhD,[1] Michihiro Ono, MD,[1] Tsutomu Sato, MD, PhD,[1] Koji Miyanishi, MD, PhD,[1] Yasushi Sato, MD, PhD,[1] Rishu Takimoto, MD, PhD,[1] Masayoshi Kobune, MD, PhD,[1] Hiroyuki Masuko, BPharm,[2] Atsushi Miyamoto, MP, PhD,[2] Tomoko Sonoda, DDS, PhD,[3] Junji Kato, MD, PhD[1]

Sapporo, Japan

EUS-guided celiac plexus neurolysis (EUS-CPN) is considered to be a reliable treatment for cancer-related pain. However, inadequate distribution of the neurolytic agent to the celiac plexus (CP) has been presumed to contribute to the failure of pain relief. Indeed, it has been reported that the distribution of the neurolytic agent to only the left side of the celiac artery (CA) (as assessed by CT) is a significant predictor of negative response to EUS-CPN.[1] Generally, the injected neurolytic agent in EUS-CPN is more likely to flow into the left side of the CA. Further, it often spreads extensively beyond the CP and throughout the retroperitoneal cavity.[1,2] These tendencies probably relate to the left lateral decubitus position during the procedure and the supine position after the procedure, which allow the neurolytic agent to spread extensively by gravity, preventing it from remaining near the CA. We hypothesized that a highly viscous neurolytic agent would remain around the CP and provide better pain relief.

Ethanol and phenol are the neurolytic agents commonly used in CPN. Although they permanently destroy the CP, they have low viscosities.[3] A representative highly viscous neurolytic agent is glycerol, which has been recommended for blocking the gasserian ganglion in trigeminal pain.[4] Glycerol is not suitable for CPN treatment because its destructive effect is reversible. Nonetheless, potentially it provides a clinically approved viscous substrate for phenol and ethanol delivery.[4] Accordingly, we examined the feasibility of mixing these agents with glycerol to increase their viscosities.

Ethanol is a thin liquid that is used for CPN at a concentration of >50%, which is necessary to provide reliable neurodestructive effects.[5] Hence, this mixture is not suitable for our purpose. Phenol is generally injected at a concentration of 6% to 7%.[6,7] Because phenol's pure form is a 100% crystalline solid that is highly soluble in glycerol and water, this concentration can be maintained even when mixed with >50% glycerol.[3,6,7] Therefore, we applied this mixture (phenol-glycerol) to EUS-CPN. The goal of this intervention-based case series was to investigate the feasibility of EUS-CPN by using highly viscous phenol-glycerol.

Abbreviations: CA, celiac artery; CP, celiac plexus; CPN, celiac plexus neurolysis; EUS-CPN, EUS-guided CPN.

DISCLOSURE: *All authors disclosed no financial relationships relevant to this article.*

This video can be viewed directly from the GIE website or by using the QR code and your mobile device. Download a free QR code scanner by searching "QR Scanner" in your mobile device's app store.

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Current affiliations: Department of Medical Oncology and Hematology, Sapporo Medical University, Sapporo (1), Department of Hospital Pharmacy, Sapporo Medical University, Sapporo (2), Department of Public Health, Sapporo Medical University, Sapporo (3).

Reprint requests: Hirotoshi Ishiwatari, MD, PhD, Department of Medical Oncology and Hematology, Sapporo Medical University School of Medicine, South 1, West 16, Chuo-ku, 060-8543 Sapporo, Japan.

PATIENTS AND METHODS

Study design

In this prospective case series, we monitored pain relief, the distribution of phenol-glycerol, and the safety of EUS-CPN by using a mixture of 7% phenol and 60% glycerol. After we obtained approval from the Institutional Review Board of Sapporo Medical University, the study was conducted at Sapporo Medical University Hospital. All patients provided written informed consent for the procedure and data collection.

Patient eligibility

Each patient was evaluated through a medical history, physical examination, pain assessment, blood examination, and dynamic contrast-enhanced CT before the procedure. The inclusion criteria were as follows: (1) unresectable upper abdominal cancer diagnosed on dynamic contrast-enhanced CT, (2) pathologically confirmed malignancy, (3) upper abdominal pain with a numeric rating scale score of ≥4 (11-point numeric rating scale: 0 = no pain, 10 = worst possible pain), (4) performance status of 0 to 3 on the Eastern Cooperative Oncology Group Scale, and (5) age ≥20 years. The exclusion criteria were as follows: (1) history of CPN, (2) prolongation of prothrombin time

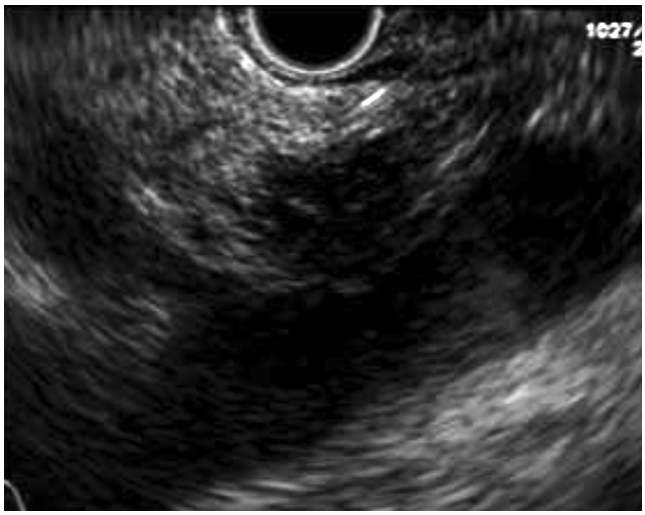

Figure 1. EUS image taken during the injection of a mixture of 7% phenol and 60% glycerol. The visibility was not impaired, and the injected neurolytic agent was clearly visualized as a hypoechoic mass on the cephalad location of the celiac artery.

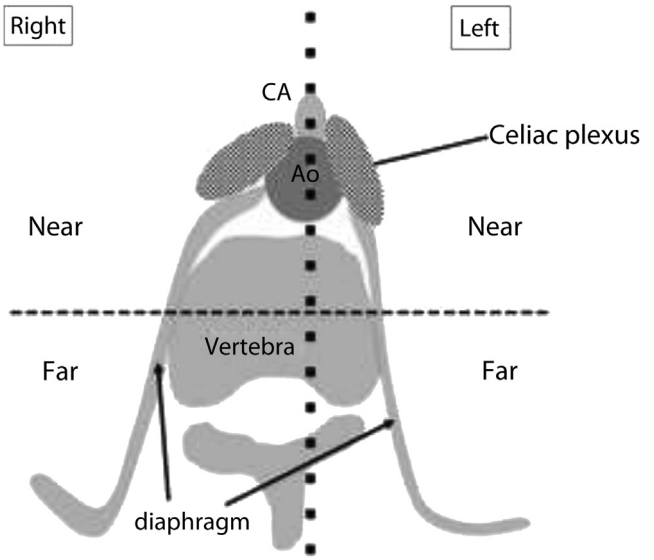

Figure 2. The distribution of neurolytic agent was evaluated by CT. The area around the celiac artery was divided by a vertical line along the base of the artery and a horizontal line along the middle of the vertebrae. The presence of contrast medium within and beyond the horizontal line was defined as "near" and "far," respectively, and the absence of contrast medium distribution was defined as "not distributed."

($\leq$50%), and (3) reduced platelet count ($\leq$50,000/mm^3) (normal range: 150,000-400,000/mm^3).

EUS-CPN

EUS-CPN was performed by two skilled endosonographers (H.I., T.H.), who had performed >50 EUS-CPNs before the study. The endosonographers used a sterile 22-gauge FNA needle (NA-200H-8022; Olympus Medical, Tokyo, Japan), with the central method, as previously described.[8,9] Twenty milliliters of solution was slowly injected from a 5-mL syringe into the area cephalad of the base of the CA. The injection was performed once, with a little withdrawing of the needle tip (Fig. 1, Video 1, available online at www.giejournal.org).

Preparation of the neurolytic agents

We planned this study by using 60% glycerol because a solution of 70% glycerol barely could pass through a 22-gauge needle on manual injection by using a 5-mL syringe. After 0.7 g of phenol was added to 6 mL of glycerol, the solutions were adjusted with distilled water to bring the total volume to 10 mL and were prepared in ampoules by the hospital pharmacist under strict sterile conditions. Just before the procedure, a total of 18 mL of neurolytic agent was mixed with 2 mL of contrast medium to assess the distribution of the neurolytic agent by CT.

Pain relief

All patients filled out questionnaires about the strongest pain they experienced daily. Responses were assessed by the physician. Pain relief was classified as complete response, partial response, and no response, which were defined as numeric rating scale scores of 0 to 1, 2 to 3, and $\geq$4, respectively, as assessed 7 days after the procedure. A positive response rate was defined as the percentage of patients who obtained partial response or complete response. Subsequently, the questionnaires were continuously assessed on daily rounds until patient discharge or, in the outpatient clinic of our hospital, at least monthly. To avoid the influence of other treatments, the base dose of analgesic was fixed until exacerbation of the daily strongest pain was $\geq$4 in the numeric rating scale. During each follow-up contact, the physician explained that patients should not increase the base dose of analgesics by themselves. Outpatients experiencing pain exacerbation consulted nurses by telephone and visited the clinic to adjust the base dose of analgesic immediately. Follow-up was continued until an increase in the base dosage of analgesic, patient death, or the end of the follow-up period. The duration of pain relief was defined as the period between EUS-CPN and an increase in pain of $\geq$4 on the numeric rating scale.

Distribution of the injected neurolytic agent

The contrast medium distribution was evaluated from axial CT images obtained immediately after EUS-CPN. The area around the CA was divided by a vertical line along the base of the CA, and the presence of contrast medium was evaluated on the right and left areas of the CA. Contrast medium distribution within and beyond the horizontal line along the middle of the vertebrae was defined

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