Neurolysis of Celiac Plexus and Splanchnic Nerve under Ultrasonographic Guidance

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Celiac plexus block has been used as a strategy for the relief of visceral pain originating from terminal upper abdominal malignancy. This procedure should be performed under fluoroscopic examination for avoidance of trauma to aorta, kidney, and surrounding vessels.

Recently, computed tomography[1–3] has clarified important technical problems and anatomical relationship between aorta, celiac plexus, and splanchnic nerve, but actual confirmation of the needle-tip position has not been achieved.

The present study was undertaken to elucidate neurolysis of the celiac plexus and splanchnic nerve by use of ultrasonic guidance.

Subjects and Methods

Subjects treated in this clinical study were two women and 10 men, ranging in age from 36–77 year (58 ± 4 yrs.) who were suffering from intractable pain due to a post-operative recurrence of gastic cancer, iocomplete hepatectomy or pancreatic cancer (table 1).

The patients were placed in prone or lateral position with a pillow under the upper abdomen on a radiolucent table. An electronic liner scanner (Model SSD-280, Aloca, Japan) with a 3.5-MHz ultrasound transducer was used to take the ultrasonogram.

First, it is essential to consider the selection of the optimal route to approach the celiac plexus without impaling the surrounding blood vessels. Following infiltration of local anesthetics into dorsal region of the vertebrae, the scanner equipped with transducer and guide-needle (11 cm, 18G.) was applied to the back for the ultrasound image.

A puncture needle (20 cm, 21G. PTC needle, Hakko, Japan) was introduced according to the subcutaneously inserted guide-needle image.

Although the needle-tip can be visualized with pulsatile aortic echo image on the oscilloscope, for more discriminative image an in-situ needle oscillation or marked needle with a file is recommended.

In sonographic scanning, the acoustic shadow of a vertebra frequently diminishes the aortic image, hence the puncture needle was carefully advanced to the first lumbar vertebra's anterolateral wall in the retrocrural space (fig. 1). After removal of the scanner, 2 ml of 10% lidocaine and 8 ml of 76% urographine mixture as a test block was injected through the needle under fluoroscopy.

Results

Roentgenographic monitoring of the block procedure can be used not only for decision-making of puncture direction but also to confirm the ultimate dispersion of radiopaque

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Table 1. Patients treated with celiac plexus and splanchnic nerve neurolysis under ultrasonographic guidance

Age/Sex	Diagnosis	Patient's posture	Drug	Effectiveness
56/M	Gastric ca.*	lateral	15 ml 0.5% Bup**	+
68/M	Gastric ca.	prone	20 ml 0.5% Bup	−
71/M	Gastric ca.	prone	25 ml alcohol***	++
69/M	Gastric ca.	lateral	30 ml alcohol	++
36/F	Gastric ca.	lateral	15 ml alcohol	++
48/M	Gastric ca.	prone	20 ml alcohol	−
75/M	Gastric ca.	prone	20 ml alcohol	+
77/M	Malignant lymphoma	prone	20 ml alcohol	−
58/M	Liver metastasis	prone	30 ml alcohol	++
52/F	Gastric ca.	prone	20 ml clcohol	+
42/M	Pancreas ca.	prone	20 ml alcohol	++
48/M	Liver metastasis	prone	25 ml alcohol	++

++: Needless sedative drug.
+: Diminished dosage of sedative drug.
−: Pain persistent.

*: cancer
**: bupivacaine
***: 99.5% ethanol

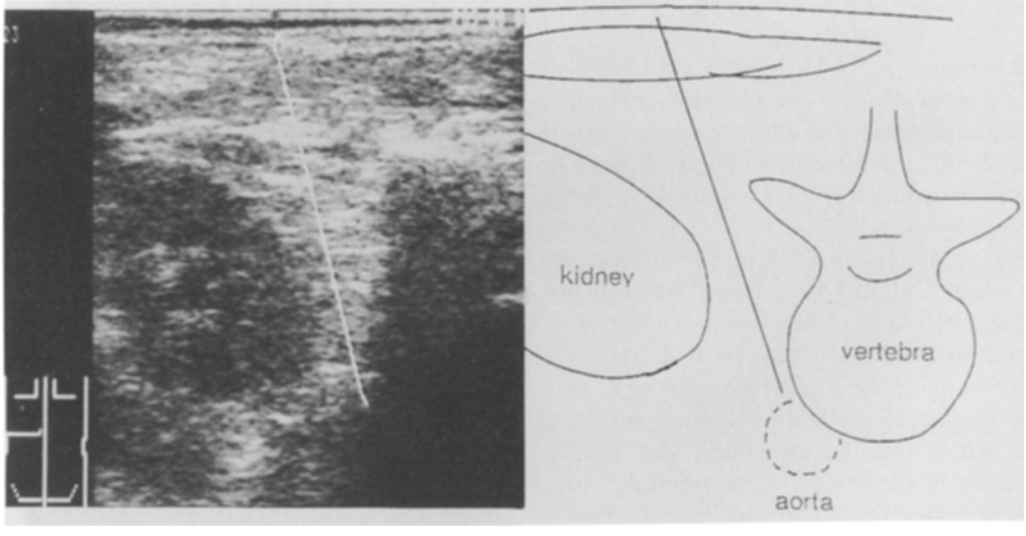

Fig. 1. Schematic diagram of puncture needle pathway and guide-line (broken line) on the ultrasonogram.

medium to a suitable compartment (fig. 2,3).

We experienced five cases of malformed dispersion of radiopaque medium (leakage from retrocrural space to psoas space) and this was corrected by placement of the needle position under fluoroscopy.

Because the radiographic finding indicated hazardous distribution of the medium to the sympathetic chain and lumbar plexus, two patients were treated with 0.5% bupivacaine solution without use of a neurolytic.

Since injection volume of 99.5% ethanol as a neurolytic is important for successful neurolysis, 22.5 ± 1.6 ml solution was employed

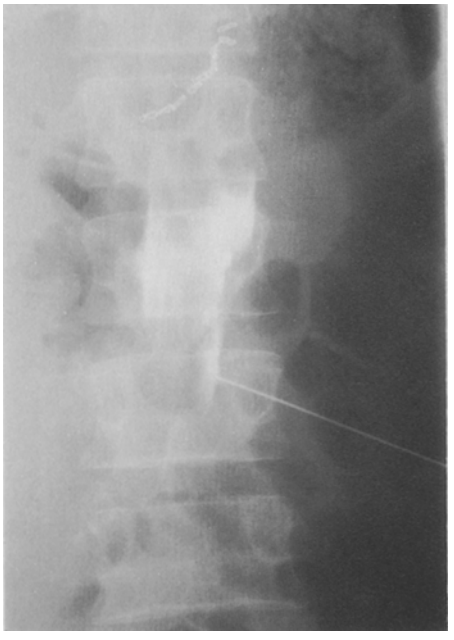

Fig. 2. Radiopaque medium image in antero-posterior scan, the contrast medium extending cephalad along the peri-aortic wall.

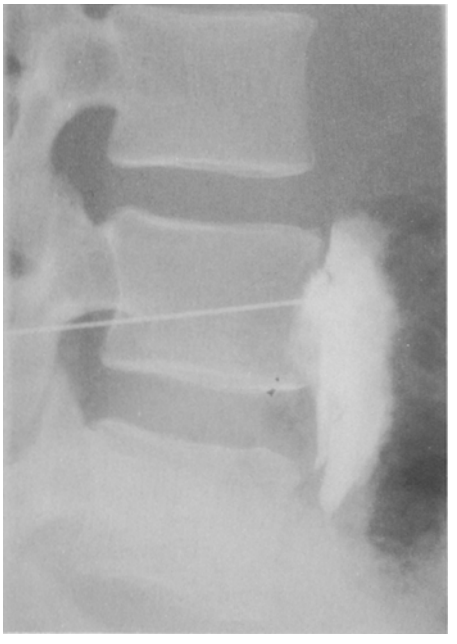

Fig. 3. Radiopaque medium image in lateral scan, the contrast medium is distributed along the vertebrae longitudinally.

in 10 patients.

As vasodilation is an inherent incidence of sympathectomy procedure, the circulatory state should be monitored for at least one hour after neurolysis for patients who suffer from malignancy.

Pain remission in 75% of the twelve patients was obtained as follows: six patients experienced disappearance of persistent pain and refused sedation; three patients received a decreased dosages of sedative drugs; and three remaining patients obtained no pain relief, which may be considered due to the inhibition of dispersion of the neurolytics – in three cases the splanchnic nerve around the soft tissue structure was altered by tumor enlargement, but complications were not observed.

Discussion

Sympathetic nerve block, especially celiac plexus neurolysis, has been advocated as the most effective therapeutic method for intractable pain, but several problems have arised in positioning and advancing the needle.

Moore[1] and Singler[2] used computed tomography to study these points. Celiac plexus, the prevertebral plexuses are formed by the union of the grater (Th_5 – Th_{10}) and lesser (Th_{12}) splanchnic nerves, and includes the celiac branch of the right vagal nerve, so that the celiac. plexus contains both sympathetic and parasympatheic nerve fibers.

The two semi-lunar ganglia in front of the twelfth thoracic and first lumbar vertebrae are placed behind the pancreas and left renal vein, anterior to the aorta and diaphragm crura.

Ganglia surround the celiac and superior mesentric arteries and are positioned between the suprarenal gland and diaphragm crura in the retroperitoneal space[4].

In the needle puncture reported in this study, we employed the radiological method as described in previously reported studies[5].

Since the celiac plexus is located anterior to the splanchnic nerves which are positioned in the retrocrural region, sympathetic block was carried out either by celiac plexus or splanchnic nerve neurolysis, depending on the condition of the patient.

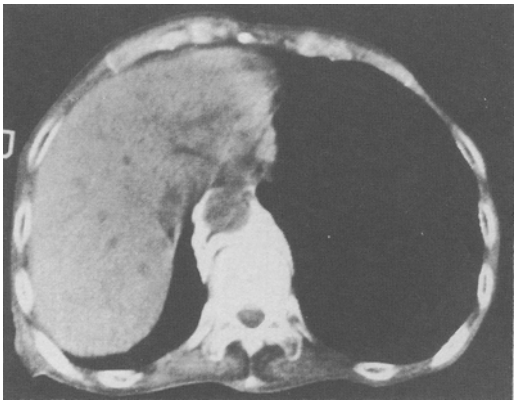

Fig. 4. Using CT scanner with contrast medium, optimum result was obtained when radiopaque solution spread to encircle the aorta.

Usually, we advanced the needle to the retrocrural space for a left side celiac plexux block as the abdomonal aorta was slightly deviated to the left of vertebral colum, making it possible to perform bilateral splanchnic nerves neurolysis by unilateral block.

As the test-block infused radiopaque medium spread into the left retrocrural space it extended to the retroaortic space as demonstrated in the CT scan picture (fig. 4).

By use of the CT scan cursor, the puncture site, angle of needle entry, and depth of needle placement were determined but the scanner had no capability to clarify the actual location of the needle in real-time, as did the ultrasonographic procedure. Sonographic description was less discriminative than the CT scan due to echogenic tissue in the dorsal region, and during this search it was found that if this PTC needle is slightly long, or too fine, it is easily deformed in the puncture process and an unclear sonographic image results from the instability of the scanner-fixing hand; correction of this problem requires scanner contact with the back of the patient securely.

Pain relief with celiac plexus or splanchnic nerve neurolysis using ultrasonographic equipment was obtained immediately in 75% of our patients, but poor result was seen in 25% of patients probably because of malformed distribution of neurolytics due to neoplasma invasion in the periaortic tissues.

In conclusion, we elucidated the technique of celiac plexus and splanchnic nerve neurolysis by liner scanner with a 3.5-MHz ultrasound transducer, applying this method to twelve patients suffering from intractable pain.

Before the permanent block with 99.5% ethanol solution, we examined the distribution of radiopaque medium (8 ml of 75% urographine and 2 ml of lidocaine mixture) with antero-posterior and lateral X-ray film.

Neurolysis of celiac plexus or splanchnic nerve using ultrasonographic guidance was determined to be safe and useful procedure to relieve visceral intractable pain.

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