NEW TECHNIQUE FOR THE NEUROLYTIC CELIAC PLEXUS BLOCK: THE TRANSINTERVERTEBRAL DISC APPROACH

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NEUROLYTIC celiac plexus block is one of the effective treatments for relief of intractable intraabdominal pain due to malignancy or chronic pancreatitis. The percutaneous celiac plexus block technique was first described by Kappis in 1919 and subsequently refined by several authors to improve results and avoid complications. However, conventional techniques sometimes cannot be used in patients who have organomegaly or anatomic anomalies. Furthermore, complications such as paraplegia, pneumothorax, and liver or kidney puncture cannot be avoided with conventional techniques. The purpose of this study was to examine the safety and efficacy of the transintervertebral disc approach of celiac plexus alcohol block, which was developed in our institution, first presented in 1991 and reported in 1992. In our approach, the needle insertion point is closer to the midline compared to conventional methods, so that the chance of organ puncture is minimal, and the tips of the needles can be placed adjacent to the anterolateral or lateral wall of the aorta bilaterally. We used 25-g needles instead of 20-G needles to reduce the severity of complications should they occur secondary to needle insertion.

Case Report

Methods and Materials

After institutional approval and the patients' informed consent were obtained, we treated 58 patients with cancer (25 inoperable) who were referred to us because of intractable intraabdominal pain secondary to malignancy. It was confirmed by epidural test blocks using local anesthetics that the pain was of visceral origin. Patients in extremely poor general condition and showing abnormal values in routine coagulation studies were excluded. Retropertioneal anatomy of the patients was evaluated by computed tomography (CT) 1–2 weeks before the blocks. To place the needle tip close to the anterolateral or lateral wall of the aorta without penetrating organs or tumors, the best needle insertion site and the angle and depth of the needle were determined using preinstalled software (Toshiba, Tokyo, Japan) 1 or 2 weeks before the block (fig. 1A).

During the celiac plexus alcohol block, the patients were given lactated Ringer's solution and monitored by ECG, automated blood pressure cuff, and pulse oximetry. Usually, the blocks were performed with the patients in the prone position under CT scans. If they could not tolerate the prone position, they were placed in the lateral position, and the block was performed using fluoroscopic guidance. After the intervertebral discs ranging from T11 to L2 were observed under fluoroscopy or CT scan, local anesthesia was performed with 1% lidocaine, 5 ml at the needle insertion sites, which were 2.5–5.0 cm from midline at the intervertebral disc level of T11–T12, T12–L1, or L1–L2. Under fluoroscopic or CT guidance, two 25-G 15-cm-long needles were inserted through the predetermined insertion sites toward the intervertebral disc, in the predetermined direction. When the tip of the needle encountered the disc, the needle was advanced until the tip just penetrated it (fig. 1B, bilateral ipsilateral approach), and it was confirmed that the depth of the needle agreed with that determined before the block. Penetration was confirmed further by the loss-of-resistance technique with a syringe containing 5 ml of sterile saline.

Key words: Anesthetic techniques: celiac plexus block. Pain, intractable. upper abdominal neoplasms.

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Fig. 1. (A) The computed tomography (CT) scan at the level of L1–L2 is shown. The best insertion site and the angle and depth of the needles were determined before the celiac plexus block. Line 1 indicates the distance from the midline to the insertion point, line 2 indicates the depth of the needles, and the angle between lines 1 and 2 shows the insertion angle of the needle on the right side. (B) The CT scan shows the tips of two needles through the intervertebral disc at the level of L1–L2 (ipsilateral approach, L-L and R-R type) in the same patient as A. (C) Arrows represent the spread of contrast medium which encircles the aorta in the same patient as A. The scale indicates 5 cm.

Fig. 2. (A) The computed tomography (CT) scan shows the tips of two needles through the intervertebral disc at the level of T12–L1 (X, ipsilateral approach, L-L type; Y, contralateral approach, L-R type; *, osteophyte). We placed the needle “X” to posterior wall of the aorta because of the danger of kidney puncture in this case. The scale indicates 5 cm. (B) Arrows indicate the spread of contrast medium around the aorta in the same patient as A. The scale indicates 5 cm.
The appropriate placement of the needle tip was verified by x-ray or CT scan, and 1 ml 10% lidocaine with 4 ml of contrast medium was injected on each side after a negative aspiration test (fig. 1c). If satisfactory pain relief and adequate spread of contrast medium were confirmed, we waited for 30 min and injected 5–25 ml of 99.5% ethyl alcohol on each side through the needles after a negative aspiration test. The doses of 99.5% ethyl alcohol were determined by the spread of contrast medium and the patients’ general condition. Patients were observed closely for 1 h after the injection and returned to the ward. In cases of anatomic anomaly of the vertebra, such as osteophytes, or organomegalies, such as hepatomegaly or displaced aorta, for which bilateral ipsilateral approaches were impossible or unsafe, we used the ipsilateral approach combined with the contralateral approach, such as L1 ipsilateral plus L8 contralateral approach (fig. 2).

Pain relief was assessed by using visual analog pain scores, and the doses of opioid or nonopioid analgesics were compared before and immediately after the celiac plexus block, 1 week and 1, 3, and 6 months later.

Values are shown as the mean ± SD. Statistical analysis was performed with use of Wilcoxon’s matched pairs rank-sum test, and statistical significance was assigned as P < 0.05.

Results

The patients (35 men and 23 women) ranged in age from 35 to 80 yr (mean 58 ± 9.7 yr), and weight ranged from 32 to 75 kg (mean 49.3 kg). The primary sites of malignancy were pancreas in 32 patients, liver and bile ducts in 9, stomach in 7, colon in 7, esophagus in 2, and primary site undiagnosed in 1. Nineteen patients were receiving oral or rectal administration of morphine within 2 weeks before the celiac plexus block. The main reasons were receiving intramuscular buprenorphine hydrochloride. The mean doses of morphine and buprenorphine hydrochloride before celiac plexus block are shown in table 1.

In 35 patients, two needles were placed on each side of the aorta using the ipsilateral approach (L1-L7 type plus R-R type). Because of the anatomic anomaly of the vertebra or organomegaly, we used the contralateral approach combined with the ipsilateral approach, as L8-R type, in 25 patients. The total amount of injected 99.5% ethyl alcohol was between 15 and 45 ml (mean 31.4 ml).

Table 1 shows the visual analog pain scores by the patients and the doses of analgesics before and after the celiac plexus block. Visual analog pain scores were significantly decreased, as was use of opioid analgesics after the blocks (table 1). Some patients shifted from the need of buprenorphine or morphine to nonopont, nonopioid analgesics, such as diclofenac sodium or indomethacin. All patients obtained complete pain relief immediately after the block. One week later, three patients (5.2%) did not have satisfactory pain relief and received a second celiac plexus block, resulting in satisfactory pain relief until their death. In the remaining 55 patients, only 6 (10.9%) needed nonopioid analgesics, and another did not need any analgesics. The percentage of cases with complete pain relief with no analgesics after the initial celiac plexus block gradually decreased to 76.9% (40 of 52 patients) at 1 month, 54.5% (18 of 33 patients) at 3 months, and 44.4% (4 of 9 patients) at 6 months, respectively. Patients with poor pain scores after 1 month of the block mainly were treated with oral or rectal administration of morphine, because their pain appeared to be somatic in origin, secondary to tumor metastasis. Thirty-two patients (55.2%) did not need any analgesics after the treatment.

Discussion

Percutaneous celiac plexus block elevates upper intraabdominal visceral effects include elevation of the need for opioids, increased bowel motility, and improved bowel motility.4 Moreover, a posteroanterior approach with guidance to position needles by using CT guidance, more widely spread of solution, and better spread of solution, the conventional approach sometimes cannot be performed. Anatomical relationship of the celiac plexus is distorted by cancer growth, and the formation of new blood vessel network, making the injection of alcohol also involved in the tumor.5,6 Tumor may be demonstrated through the anterior or posterior ventral disc; thus, it can be performed after the block.

Table 1. Visual Analogue Pain Scores (VAS), and the Total Daily Doses and Requirement of Analgesics before and after the Celiac Plexus Alcohol Block Using Transintervertebral Disc Approach

<table>
<thead>
<tr>
<th></th>
<th>Before the Block</th>
<th>Immediately after the Block</th>
<th>1 Week Later</th>
<th>1 Month Later</th>
<th>3 Months Later</th>
<th>6 Months Later</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>VAS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Doses of opioid analgesics (mg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Buprenorphine hydrochloride</td>
<td>9.3 ± 0.7</td>
<td>0*</td>
<td>0.4 ± 1.3*</td>
<td>1.5 ± 3.0*</td>
<td>3.4 ± 4.2*</td>
<td>3.7 ± 4.4*</td>
</tr>
<tr>
<td>(no. of patients)</td>
<td>39</td>
<td></td>
<td>(0)</td>
<td>(2)</td>
<td>(4)</td>
<td>(0)</td>
</tr>
<tr>
<td>Morphine (no. of patients)</td>
<td>58 ± 24</td>
<td>0*</td>
<td>0*</td>
<td>0.6 ± 0*</td>
<td>0.6 ± 0.2*</td>
<td>0*</td>
</tr>
<tr>
<td>(19)</td>
<td>(0)</td>
<td></td>
<td>(4)</td>
<td>(4)</td>
<td>(4)</td>
<td>(4)</td>
</tr>
<tr>
<td>No. of patients requiring opioid analgesics (%)</td>
<td>58 (100)</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>(0)</td>
<td>(0)</td>
<td></td>
<td>(11.5)</td>
<td>(42.4)</td>
<td>(44.4)</td>
<td></td>
</tr>
<tr>
<td>No. of patients requiring nonopioid analgesics (%)</td>
<td>0 (0)</td>
<td>0</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>0</td>
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<td>(0)</td>
<td>(0)</td>
<td></td>
<td>(10.3)</td>
<td>(11.5)</td>
<td>(3.0)</td>
<td>(0)</td>
</tr>
<tr>
<td>Total no. of patients</td>
<td>58</td>
<td>58</td>
<td>58</td>
<td>52</td>
<td>33</td>
<td>9</td>
</tr>
</tbody>
</table>

Values are mean ± SD. Because the therapeutic doses of oral and rectal morphine are similar, both are calculated together in this table (two patients before the block and four patients at 6 months received rectal morphine). Buprenorphine hydrochloride is administered intramuscularly.

VAS: 0 = no pain; 10 = worst imaginable pain.

* P < 0.05 versus values before the block.

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initial celiac plexus block until their death. The duration of complete pain relief and the patients’ survival period ranged from 1 week to 16 months (mean 3.2 ± 3.6 months) and 1 week to 18 months (mean 4.1 ± 3.8 months), respectively.

There were no technical complications, such as motor or sensory disturbances, pneumothorax, or kidney and liver punctures. We found no cases of discitis, disc herniation, or degeneration of the disc. In 25 needle insertions (21.6%), aortic puncture occurred. When the needle tip encountered the aorta, we withdrew the needle in 23 cases until the blood did not flow back with an aspiration test, and the loss of resistance was obtained again before injecting the test dose. In the remaining two, we further advanced the needles until they penetrated through the anterior wall of the aorta (transintervertebral disc, plus transaortic approach), and alcohol was injected after the test block. This was done because attachment of the crura to the vertebra appeared to be slack in these two patients, and unnecessary spread of alcohol would have occurred by injecting it adjacent to the posterior wall of the aorta. There were no complications from either the puncture of the aorta or the injection of alcohol in front of the aortic wall.

Immediately after alcohol injection, hypotension (systolic pressure below 90 mmHg) occurred in 21 patients (36.2%), which was treated by intravenously administered fluids or ephedrine. Side effects due to the injection of alcohol also involve diarrhea and acetaldehyde syndrome, which is characterized by facial or whole-body flushing, palpitations, diaphoresis, hypotension, tachycardia, vomiting, and dizziness.

Forty-one patients (70.7%) experienced diarrhea or frequent bowel movement. Acetaldehyde syndrome-like reaction was observed in 13 patients (22.4%). These side effects resolved within several days without any sequela. There were no patients suffering from back pain with the injection of alcohol.

Discussion

Percutaneous celiac plexus block is used widely to alleviate upper intraabdominal cancer pain. Other beneficial effects include elimination or marked reduction of the need for opioids, increased food intake, and improved bowel motility. Moore popularized the classic percutaneous approach with fluoroscopic or palpatory guidance to position needles on each side of the aorta. By using CT guidance, more precise needle placement and better spread of solution could be obtained. However, the conventional approach for celiac plexus block sometimes cannot be performed in patients whose anatomy relates to the retroperitoneal organs is distorted by cancer growth or by a previously performed operation. Ischia et al. advocated the transaortic approach to guarantee the success of the procedure.

spreads only in the area anterior to the crura of the diaphragm. Muehle et al. and Matamala et al. described the percutaneous approach to the celiac plexus using radiographic or ultrasound guidance. This approach may involve penetration of liver, bowel, pancreas, or tumor, and its safety and efficacy have not been established. In the conventional approach, the needle may pass through the kidney when the distance from the spinous process of the vertebra to the needle insertion point is increased. The danger of kidney or liver puncture in our approach is almost negligible, because the needle insertion point in our approach is closer to the midline. In addition, we used 23-G needles rather than the 20-G needles reported for conventional techniques. Should organ puncture occur, complications probably would be minimal in our technique. Our new technique for the celiac plexus block, the transintervertebral disc approach, was developed to overcome these technical difficulties and ensure the safety and efficacy of the block. The transintervertebral disc approach for neurolytic superior hypogastric plexus block has been used and reported with good results.

The rate of initial pain relief immediately after block with the conventional method was 94% and 85%, and initial pain relief by the transaortic method was 91% and 93%, respectively. We successfully treated all patients, and achieved complete pain relief in 100% of the patients immediately after the block. This is mainly because our transintervertebral disc approach made it possible to place the tip of the needle in the area close to the anterolateral or lateral wall of the aorta, despite the abnormal retroperitoneal anatomy in some cases. For instance, figure 3a shows that the aorta was displaced toward the left side by the enlarged liver, and the needle tip cannot be placed near the right side anterolateral or lateral wall of the aorta with conventional celiac plexus approaches. Using the transintervertebral disc approach, the needle tips were successfully placed, and satisfactory spread of contrast material was obtained (figs. 5b and 3c).

Although our assessment of pain relief is slightly different from the previously reported cases, the number of patients with complete pain relief (required either opioid analgesics or nonopioid analgesics: 76.9% at 1 month and 54.3% at 3 months) surpasses that of Lieberman (complete pain relief at 6 weeks, 43%), and Negretti and Tamagno (46.5% at 1 month and 26.5% at 2 months). Even 6 months later, complete

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pain relief remained in 44.4% of our patients. The reasons why our results of followup pain relief were better than other reports may be as follows:

1. Positioning the needle tips adjacent to the anterolateral or lateral wall on each side of the aorta in our technique may have facilitated maximum spread of alcohol. The celiac plexus lies over the anterolateral wall of the aorta, bilaterally. Moore placed the tip of the needle at the points immediately posterior to the aorta on the left and in close proximity to its anterolateral wall on the right. In the transaortic approach by Ishia et al., the needle tip lay in the fatty connective tissue and in the middle of the dense network of the celiac plexus in front of the aorta. The insertion point in our method is significantly closer to the midline compared to the conventional methods, which facilitates the ideal positioning of the needle tip.

2. The concentration of injected alcohol in our method was high in contrast to the previously reported cases in which 50%–75% alcohol was used. It has been reported that adequate neurolysis could be obtained with 50% alcohol concentration. However, injected alcohol may be diluted with preinjected lidocaine and contrast medium. Thus, it is conceivable that a high concentration of alcohol may have contributed to the prolonged pain relief in our cases. In addition, the unnecessary spread of injected alcohol along the needle to the intervertebral foramen or psoas compartment is prevented by the anterior surface of the disc in our approaches.

3. The doses of buprenorphine hydrochloride and morphine were relatively small, and the duration of their administration was less than 2 weeks before the celiac plexus block. It is our strategy to treat patients with visceral cancer pain by neurolytic block even when they are receiving the first line of therapy in the World Health Organization cancer treatment guidelines at the early stage of cancer used to the long-term pain treatment.

We must consider the complications of the intervertebral disc. The discitis, degeneration of the disc, or degeneration did not initiate degeneration of a previously normal disc in a 47-year-old patient. Johnson found no evidence of degeneration in normal disc material. We did not find any discitis or degeneration of the disc. Side effects after the celiac plexus block were observed in our patients after conventional methods. The patient complained of acid reflux, diarrhea, and frequent bowel movements. The patient reacted to the injection of alcohol. The reaction may have resulted from the injection of alcohol.

In conclusion, the transaortic approach for celiac plexus block is easy and has been used in 58 patients without complications and without serious adverse reactions.

References

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Fig. 3. (A) The computed tomography (CT) scan at the T12 vertebra level shows that the enlarged liver has displaced the aorta to the left side. The conventional approach on the right side was thought to be difficult and unsafe. (B) Arrows represent the spread of contrast medium surrounding the aorta in the lateral roentgenogram by the transintervertebral disc approach in the same patient as A. (C) Lateral view of the vertebra and needle placement using transintervertebral disc approach (T12-L1) are illustrated. Arrows indicate the spread of contrast medium in the same patient as A. The scale indicates 5 cm.
pain treatment guidelines. The neurolytic block at the early stage of cancer pain may have contributed to the long-term pain relief in our study.

We must consider the complications from puncture of the intervertebral disc. The procedure may result in discitis, degeneration of the disc, or disc herniation. Flanagan and Chung reported that diagnostic discography did not initiate degenerative changes in the previously normal disc in a 10–20-yr followup study. Johnson found no evidence that diagnostic discography of a normal disc produced a herniation of nuclear material. We did not find a case of discitis, disc herniation, or degeneration of the disc by x-ray examination. Side effects after the celiac plexus block with alcohol were observed in our technique as well as in the conventional methods. These include hypotension and diarrhea or frequent bowel movement due to sympathetic nerve blockade. Acetaldehyde syndrome-like reaction may have resulted from higher incidence of aldehyde dehydrogenase L-deficiency among the Japanese populations rather than the high concentration of injected alcohol.

In conclusion, the transintervertebral disc approach for celiac plexus block is effective and was performed in 58 patients without encountering technical difficulties and without serious complications.

References