Computed Tomography Versus Fluoroscopy Guidance in Celiac Plexus Neurolysis for Treatment of Upper Abdominal Malignant Pain


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Abstract

Background: Visceral cancer pain from upper abdominal viscera (pancreas, liver, gall bladder and stomach) may be abolished by a Neurolytic Celiac Plexus Block (NCPB). The purpose of this study is to highlight differences between two techniques as regard efficacy by means of Visual Analogue Scale (VAS), percent reduction in daily morphine consumption.

Methods: 60 patients with pancreatic cancer pain for which pharmacological treatment (NSAIDs and opioids) proved either ineffective or limited by side effects were randomly allocated into two groups. Study was done over eighteen months from January 2013 to June 2014. Each patient is assessed by linear Visual Analogue Scale (VAS) and percent reduction in daily morphine consumption. All evaluation parameters were done before the block, at day (0) 2hr post block, 2 days, 2 weeks and 3 weeks post block.

Results: The parameters were comparable with no significance difference between both techniques (p-value < 0.05).

Conclusion: We concluded that an effective NCPB, regardless of the technique used, produce immediate analgesia and allowed a reduction in opioid dose.

Key Words: Celiac Plexus Block (CPB) – Abdominal cancer pain – Visual Analogue Scale (VAS).

Introduction

DESPITE advances in pain management, pain remains a common persistent symptom among persons with cancer. Estimates of pain prevalence among persons with cancer range from 14%-100% [1].

The effect of the sympathetic nervous system as a factor in a variety of painful conditions in humans has been a part of conventional medical wisdom for over 100 years. The Sympathetic Nervous System (SNS) is a part of the autonomic nervous system that controls the body’s involuntary activities. It has been implicated in Neuropathic Pain (NeP), vascular, and visceral pain.

Malignant tumors originated from pancreas, stomach and liver may cause abdominal pain which is unresponsive to large doses of narcotic analgesics and which considerably impairs the patient’s quality of life. Coeliac Plexus Block (CPB) has been used as adjunct therapy in such cases [2].

The celiac plexus, the largest of the three sympathetic plexuses is about 3cm in length and 4cm in width, typically lies anteriorly and anterolaterally to the aorta at the level between the T12-L1 intervertebral disc and L2 vertebral body [3].

Before the 1970s, celiac plexus blocks were performed blindly, in 1979; hegedus stressed the importance of using radiological guidance to locate the exact level of the celiac axis. Celiac plexus block can be performed with imaging techniques such as fluoroscopy, CT, MRI, ultrasound and endoscopic-ultrasound [4].

Pain practitioners have to rely on fluoroscopy for image-guided injection for an increasing number of analgesic procedures. Although fluoroscopy can provide multiplanar visualization of a needle or instrument it is incapable of directly visualizing soft tissue abnormalities. Fluoroscopic localization of instruments depends on indirect information obtained from displacement of contrast filled structures [5].

Computed Tomography (CT) represents at present the best imaging guidance technique in numerous interventional procedures. Owing to the high spatial resolution and the good tissue contrast, it is possible to place precisely and safely needle
Computed Tomography Versus Fluoroscopy Guidance in CPN

and trocar tips on target, and lytic agents or anti-inflammatory drugs can be delivered with high reliability. This result in significantly reduced morbidity (lower than 2.5% out of 756 interventions) and improves the effectiveness of the various interventional procedures [6].

The aim of the study:
- To evaluate two different techniques of celiac plexus block, the first is done computed tomography guided and the latter is done under fluoroscopic guidance. All selected patients for both techniques are on pharmacotherapy with inadequate pain relief.
- To highlight differences between two techniques as regard efficacy by means of Visual Analogue Scale (VAS), percent reduction in daily morphine consumption.

Patients and Methods

After approval by the National Cancer Institute ethics committee and after obtaining informed written consent from each patient. Patients were randomly allocated to two groups using closed envelope for randomization.

Group one: CT group (30 patients, scheduled for Neurolytic Celiac Plexus Block (NCPB) by computed tomography guidance.

Group two: C-arm fluoroscopy group (30 patients, scheduled for Neurolytic Celiac Plexus Block (NCPB) by C-arm fluoroscopic guidance.

The inclusion criteria were patients with upper abdominal cancer pain (cancer pancreas) dull ach- ing radiating to the back, age of patients from 30-70 years). Exclusion criteria were patient refusal, Mentally retarded patients, uncorrectable coagu- lopathy (anticoagulant therapy, and hemorrhagic disorders), local infection or neoplasm can spread when needles are inserted through infected or cancerous tissues and bowel obstruction.

Preoperatively, all patients were evaluated with respect to their systemic diseases and hematological investigations (CBC, platelet function and prothrombin time). Also, CT scan was evaluated for tumor spread, any displacement or variation of anatomical structures. Patients had 1000cc lactated ringer solution via 18G intravenous catheter prior to the procedure. The vital parameters of the patients (heart rate, noninvasive blood pressure, and oxygen saturation) were monitored during and two hour after the procedure continuously. The patients were sedated preoperatively with midazolam 1-2mg.

The celiac plexus block was done by one of the following techniques:

Group one: CT guided bilateral posterior para-vertebral antecrural approach using TOSHIBA CT model CGGT-018A, the patient is placed in the prone position with a pillow under the abdomen to flex the thoracolumbar spine. Preliminary unen- hanced abdominal CT is performed to help
A- Localize the celiac artery and celiac plexus.
B- Select the puncture site.
C- Determine the angle and depth of needle entry. 
D- Identify the percutaneous needle path to the celiac plexus, and
E- Determine the site of neurolytic agent injection.

The skin at the point of needle entry is cleaned with antiseptic solution, and a sterile field is pre- pared. After subcutaneous infiltration with 1% lidocaine, a 20-gauge, 15-cm chiba needle; is advanced alongside the vertebral bodies into the antecrural space.

The ideal needle tip position is approximately 1-2cm anterior to the aorta, between the diaphragmatic crura and the pancreas, at the level between the celiac trunk and the SMA. After the position of the needle tip is confirmed by CT, it is important to aspirate the needle to determine if blood is present. If blood return is seen, the needle must be repositioned. If no blood return is seen, 5mL of diluted iodinated contrast material is injected into the antecrural space. Diluted omnipaque con- trast material is used to prevent streaking artifacts, which may obscure the anatomy of the antecrural space [7].

Group two: Fluoroscopic guided Bilateral Posterior Paravertebral Anterocural Approach. Using TOSHIBA X-RAY model CXXG-0 1 2A, the patient is placed in the prone position with a pillow under the abdomen to flex the thoracolumbar spine. The skin was prepared with antiseptic solution. The spinous process of the L1 vertebral body is then identified with fluoroscopy. The skin, subcutaneous tissues, and musculature are infiltrated with 1.0% lidocaine at the points of needle entry. 20 gauge, 15-cm chiba needles was inserted through the previously anesthetized area. The needles are ini- tially oriented 45 degrees toward the midline and about 20 degrees cephalad and are advanced under continuous fluoroscopic guidance to ensure contact with the inferolateral portion of T 12 vertebral body. Once bony contact the depth is noted, the needles are withdrawn to the level of the subcutaneous tissue and redirected about 60 degrees from the
midline and advanced under continuous fluoroscopic guidance so as to walk off the lateral surface of the T12 vertebral body. The needles slide past the lateral surface of the vertebral body, the left-sided needle is gradually advanced approximately 3 cm under continuous lateral fluoroscopic guidance until the needle tip is resting approximately 2.5 to 3 cm beyond the anterior margin of the vertebral body of T12. The right-sided needle is then advanced slightly farther (i.e., 2 cm past contact with the bone). Ultimately, the tips of the needles should be 2.5 to 3 cm beyond the anterior border of the vertebral body and lying in the precrural space. The stylets of the needles are then removed, and the needle hubs are inspected for the presence of blood, cerebrospinal fluid, or urine. After gentle aspiration a small amount of contrast material suitable for intrathecal use is injected through each needle, and its spread is observed radiographically. On the fluoroscopic anteroposterior view, contrast should be concentrated anterior to the T12 vertebral body. For both techniques; approximately 40 mL (20 mL on each side) of 50% alcohol was injected [8].

After end of the procedure patient is transported to Post Operative Care Unit (PACU). Pulse, blood pressure and oxygen saturation of the patient are monitored for 2 hours post block. Patient is discharged from PACU to ward or home after 2 hours. Each patient is assessed by linear Visual Analogue Scale (VAS) (where 0=no pain and 10=worst pain imaginable) and percent reduction in daily morphine consumption. All evaluation parameters were done before the block, at day 0 2 hr post block, 2 days, 2 weeks and 3 weeks post block. All patients were observed during the whole period of study.

Statistical analysis:

Data was analyzed using SPSS package version 17. Numerical data were expressed as mean ± SD and median (range). Qualitative data were expressed as frequency and percentage. For quantitative data, comparison between two groups was done using student t-test. ANOVA test for repeated measures was used to compare VAS score readings upon time. Correlation between numerical values was tested using Pearson method. p-value less than 0.05 were considered significant and power for the study set at 85%.

Results

Sixty patients underwent CPB were studied in the National Cancer Institute in the period between January 2013 to June 2014. All patients completed the study. Patient characteristics were comparable in both groups and presented in (Table 1).

Visual Analogue Scale (VAS):

VAS score preblock was comparable in both groups (p=1.000). It was 8.03 ± 0.93 in Group I and 8.03 ± 0.89 in Group II as shown in (Table 2).

Reduction of daily morphine consumption:

Obvious reduction of the need for opioids was observed in the two groups. The mean value of patient analgesic consumption (mg/day) before treatment in Group I and Group II was significantly reduced after neurolysis but without significant difference between both groups (Table 3).

Table (1): Patients’ characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Group I (n=30)</th>
<th>Group II (n=30)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: Mean ± SD</td>
<td>47.5 ± 6.3</td>
<td>50 ± 5.2</td>
<td>0.065</td>
</tr>
<tr>
<td>Median (Range)</td>
<td>49 (33-59)</td>
<td>50 (39-60)</td>
<td></td>
</tr>
<tr>
<td>Sex, No. (%):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>13 (43.3%)</td>
<td>15 (50.0%)</td>
<td>0.605</td>
</tr>
<tr>
<td>Female</td>
<td>17 (56.7%)</td>
<td>15 (50.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Table (2): VAS score before, 2 hours and 2 days, 2 weeks and 3 weeks postblock in the two studied groups.

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Group I</th>
<th>Group II</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Pre-VAS</td>
<td>8.000</td>
<td>7.0</td>
<td>10.0</td>
</tr>
<tr>
<td>VAS 2hr</td>
<td>3.0</td>
<td>1.0</td>
<td>9.0</td>
</tr>
<tr>
<td>VAS day 2</td>
<td>3.0</td>
<td>1.0</td>
<td>9.0</td>
</tr>
<tr>
<td>VAS week 2</td>
<td>4.5</td>
<td>2.0</td>
<td>9.0</td>
</tr>
<tr>
<td>VAS week 3</td>
<td>5.5</td>
<td>3.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>
Table (3): Reduction of daily morphine consumption.

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Group I</th>
<th>Group II</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. deviation</td>
<td>Mean</td>
</tr>
<tr>
<td>Pre morph (mg/day)</td>
<td>87.333</td>
<td>32.8983</td>
<td>90.667</td>
</tr>
<tr>
<td>Morph 0 day (mg/day)</td>
<td>14.667</td>
<td>20.1260</td>
<td>22.333</td>
</tr>
<tr>
<td>Morph week 2 (mg/day)</td>
<td>52.667</td>
<td>23.9156</td>
<td>52.000</td>
</tr>
<tr>
<td>Morph week 3 (mg/day)</td>
<td>74.000</td>
<td>25.4070</td>
<td>77.667</td>
</tr>
</tbody>
</table>

Discussion

Our finding showed that the mean values of VAS were very low by both techniques and throughout the period of observation after the block. Also, there is reduction in daily morphine consumption.

With the introduction of US and CT guidance, fluoroscopy-guided techniques gradually fell out of favor. US has been described as a simple and cost-effective modality for use with celiac plexus block and permits real-time visualization of the aorta and visceral arteries and enables diffusion of the neurolytic agent to be viewed without the aid of contrast media. Despite these advantages, US-guided celiac plexus neurolysis requires a high degree of operator skill and experience and a favorable patient body habitus for the retroperitoneal structures to be clearly depicted [9].

Since Haaga and Colleagues first described the value of CT in guiding neurolytic celiac plexus block, CT has superseded other imaging modalities as the preferred technique, with its proved safety record. With multidetector CT guidance, needle placement into the region of the celiac plexus and the location of the needle in relation to vital anatomic structures, such as the pancreas, aorta, celiac artery, and SMA, may be directly visualized. In addition to retroperitoneal structures, CT also depicts the extent of tumor spread and other causes of abdominal pain such as duodenal obstruction, bone destruction, and muscle invasion [10].

Some authors have recommended the use of CT scanning as a method of reducing or eliminating the morbidity associated with celiac neurolysis, although the type of radiographic guidance to be adopted is still debatable [11]. Accurate placement of the needle in relation to celiac artery may be important in improving the efficacy of the block [12].

Iki et al., reported that, three-dimensional CT allowed excellent visualization of the spreading pattern of neurolytic solution in a target site, thus providing effective pain relief of pain [13].

The two main considerations that justify the use of CT are that it is able to depict anatomic variations of the celiac trunk, which is closely related to the celiac plexus in relation to vertebral column (from the bottom of T12 to the middle of L2) and regional distortion, which results from tumor spread. Accurate procedure planning is also possible at CT because the needle puncture site, the depth and angle of needle insertion, and the site of injection of the neurolytic agent may be decided before neurolysis is performed. One of the most important aspects of CT is its ability to depict the extent of spread of the neurolytic agent within the antecrural space, allowing any inadvertent injection into adjacent structures or leakage into the peritoneal cavity to be detected. The recent introduction of CT fluoroscopy has made CT-guided celiac plexus neurolysis more accurate and easier to perform [13].

However, CT imaging does not have advantages over fluoroscopy concerning the proper positioning of the needles, unless cancer infiltration has distorted tissue anatomy around the celiac plexus. Moreover, CT confirms only needle position and does not allow a continuous guidance during the procedure, expensive, requires specialized personnel, and exposes the patient to more radiation, especially when multiple images are necessary. Finally, there are suggestions that outcome for successful NCPB does not appear to vary depending on the radiological guidance used [14] and this is in agreement with our study.

Yang and Oraee reported a modified approach to transcrural celiac plexus by using patient-specific CT images as a roadmap to perform the block under fluoroscopy by drawing the needle trajectories on that film, measuring the distance from the midline to the left and right needle entry, and measuring the angle for the left and right needle insertion, thereby avoiding painful needle contact on the bone, reduce needle redirections, and decreased possibility of vital organ puncture. Therefore, they got the benefits of the two procedures.
but they used 10ml of 6% phenol, which differs from our neurolytic agent in our study [4].

The study of Rykowski and Hilgier, concluded that, unilateral transcruical celiac plexus neurolysis by fluoroscopic control has been shown to provide effective pain relief in 74% of patients with pancreatic cancer pain, which differ from our study where NCPB was done bilaterally [15].

In a meta-analysis of neurolytic, CPB for cancer pain it was concluded that the procedures carried out with fluoroscopy versus CT or ultrasound guided technique fail to show higher rates of success or lower incidence of adverse effects [7].

Brown et al., found no difference in the incidence of successful block among the different radiographic techniques of verifying needle placement [16]. Ischia et al., found that the analgesic results are independent of the techniques used in the study. Different techniques have been proposed in an attempt to improve the analgesic effects and reduce the risk of complications. However the technique does not seem important in results or complications [17].

Reduction in analgesic consumption is an indirect method to evaluate pain intensity and efficacy of associated treatments, so, the mean values of the daily analgesic consumption were significantly reduced after neurolysis in both groups. This coincide with the result of Kawamata et al., who reported that, CPB has been shown to reduce narcotic reirment and limit narcotic dose releated side effects [18].

References
الملخص العربي

قد أجريت هذه الدراسة على ستين مريضاً يعانون من ألم سرطان البنكرياس من عيادة الألام بالمعهد القومي للأورام - جامعة القاهرة.

وقد قسم المرضى عشوائياً إلى مجموعتين:

المجموعة الأولى: مجموعة الاشعة المقطعية (تضمن 30 مريض أجريت لهم سد.inflate.\textsuperscript{a} للاضطراب العصبي البطني بمساعدة الاشعة المقطعية).

المجموعة الثانية: مجموعة الاشعة السينية (تضمن 30 مريض أجريت لهم سد.inflate.\textsuperscript{a} للاضطراب العصبي البطني بمساعدة الاشعة السينية).

جميع مرضى الألم خضعوا للآتي:

- التاريخ المرضي الكامل.
- الفحص الأكليبي الدقيق.
- سدة للضفيرة العصبية البطنيه باند.\textsuperscript{a} الطرق السابق ذكرها.
- تقييم الألم (قياس الألم الأحادي المرنى).
- استهلاك المورفين اليومي.

وبعد تسجيل البيانات وعمل الاختبارات اللازمة بين المريض البصري بالألم قد قيل في المجموعتين لا يوجد فرق إحصائى ملحوظ.

بالإضافة إلى أن المعدل اليومي لاستهلاك المورفين قل بعد علاج السد.inflate.\textsuperscript{a} للاضطراب العصبي البطنيه ولا يوجد فرق إحصائى ملحوظ.

وقد استنتجنا أن السدة للضفيرة العصبية البطنيه اياً كان الأسلوب الفني المستخدم في عملها قادر على تسكين الألم وتقليص معدل جرعات المخدر المستخدم وتجنب اثاره الجانبية الضارة.