Computed Tomography Versus Fluoroscopy Guidance in Antecrural Celiac Plexus Block


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Abstract

Background: Celiac plexus block has been performed by an anterior or posterior approach. The posterior approach can be either for antecrural or retrocrural space. Antecrural site refers to the injection of neurolytic agent into the space anterior to the diaphragmatic crura and aorta. The antecrural space is the most common site of neurolytic agent injection and is highly effective in achieving pain control because injection into this space directly destroys the celiac plexus where it is most concentrated, and minimizes the risk of somatic nerve roots block, which is associated with retrocrural approach. The purpose of this study is to highlight differences between two techniques as regard Time of doing each technique from its beginning to the end and any complications occurred.

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 Time of doing each technique from its beginning (needle insertion) to the end and any complications have been recorded.

Results: The parameters were comparable with significant difference between both techniques (p-value <0.05) regarding time consumed and there were no statistical significance regarding complications which occurred in both procedures.

Conclusion: We concluded CT scanning is useful to define the retroperitoneal anatomy especially when anatomic relations of the retroperitoneal organs are distorted by tumor or previous operations limiting time consumed during the procedure. However the technique does not seem important in results or complications.

Key Words: Celiac plexus block (CPB) – Antecrural approach – Visual analogue scale (VAS).

Introduction

CELIAC Plexus Block (CPB) has been used as adjunct therapy in such cases of 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 [1,2].

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 T 12-L 1 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 [1].

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 [4].

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 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 [8].

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In certain procedures where real-time imaging is necessary a combination of CT and X-ray fluoroscopy may be interesting [4]. One of the concerns with the use of CT fluoroscopy is the high radiation exposure [7]. In contrast with conventional fluoroscopy in which the patient dose is on the order of centigrays per minute of exposure, with CT fluoroscopy, patient doses may be on the order of centigrays per second. An additional concern is the scattered exposure to the hands and body of radiologists, since they may be close to the X-ray source during the manipulation of the needle [8].

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 as regard time of doing each technique from its beginning (needle insertion) to the end. Any complications have occurred.

**Patients and Methods**

After approval by the National Cancer Institute ethics committee and after obtaining informed written consent from each patient, patient 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 aching radiating to the back, age of patients from 30-70 years). Exclusion criteria were patient refusal, mentally retarded patients, uncorrectable coagulopathy (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 Paravertebral 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 unenhanced 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 prepared. 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 contrast material is used to prevent streaking artifacts, which may obscure the anatomy of the antecrural space [9].

![Computed tomographic scan demonstrating periaorti spread of contrast medium.](image)
Group two: Fluoroscopic guided Bilateral Posterior Paravertebral Antecrural Approach. Using TOSHIBA X-RAY model CXXG-012A, 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 initially 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 T12 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 3cm under continuous lateral fluoroscopic guidance until the needle tip is resting approximately 2.5 to 3cm beyond the anterior margin of the vertebral body of T12. The right-sided needle is then advanced slightly farther (i.e., 2cm past contact with the bone). Ultimately, the tips of the needles should be 2.5 to 3cm 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 [10].

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. Time of doing each technique from its beginning (needle insertion) to the end and any complications have been recorded and assessed. 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).

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>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>

Time of the block:
Group I required significantly shorter time for inducing block in comparison to Group II (p<0.001). Group I needed 47.67±7.7 minutes while group II needed 68.67±12.3 minutes (Table 2). p-value <0.05 is significant.

Table (2): Time of block in the two studied groups.

<table>
<thead>
<tr>
<th>Time of block: Mean ± SD</th>
<th>Group I (n=30)</th>
<th>Group II (n=30)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47.67±7.7*</td>
<td>68.67±12.3*</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Fig. (2): Anteroposterior fluoroscopic imaging of the needle location and contrast flow.
Complications:

The incidence of complications encountered in the studied groups is described in (Table 3).

There are only few complications related to the procedure and they are described as only transitory including temporary orthostatic hypotension, diarrhea and local pain.

<table>
<thead>
<tr>
<th>Study groups</th>
<th>Group I</th>
<th>Group II</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthostatic hypotension at 12hr:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>23</td>
<td>24</td>
<td>0.75</td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Group total</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Diarrhea:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>24</td>
<td>25</td>
<td>1.0</td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Group total</td>
<td>30</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Local pain:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>25</td>
<td>23</td>
<td>0.52</td>
</tr>
<tr>
<td>Yes</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Group total</td>
<td>30</td>
<td>30</td>
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</tbody>
</table>

Discussion

Our findings showed that less time consumed during CT guided celiac plexus block in comparison to fluoroscopy while it does not seem different in results or complications.

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 [11].

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 [12].

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 [13].

CT has emerged as the preferred modality for percutaneous celiac plexus neurolysis. Although fluoroscopy was initially popular, it has poor anatomic resolution and does not distinguish the celiac plexus from adjacent structures such as the pancreas, blood vessels, tumors, and lymph nodes. As a result, fluoroscopy-guided celiac plexus neurolysis is often associated with a higher rate of complications, such as neurologic injury resulting from imprecise tracking of the needle puncture route and indistinct display of diffusion of the neurolytic agent into the retroperitoneum [11]. Percutaneous CPB CT guided is an easy and safely performed procedure with a high success rate [14].

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 [15].

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 [16].

Neurolytic CPB is associated with both minor and major complications, minor complications are temporary and mild, and fortunately, major complications are usually rare [17].

In this study no serious complications occurred but minor complications were reported. Minor
complications of CPB include temporary orthostatic hypotension, diarrhea and local pain. Up to 23% (7 patients) had transient orthostatic hypotension in CT group while, in fluoroscopy group, 20% (6 patients) had transient orthostatic hypotension. Up to 18% of patients experience hypotension after CPB in the study of Lee [18].

Orthostatic hypotension is caused by loss of sympathetic tone and splanchnic vessels vasodilatation after CPB. It can be cured by intravenous infusion of fluids [19].

As regard diarrhea 30% (6 patients) had transient mild diarrhea in CT guided CPB. While, 25% (5 patients) fluoroscopy guided CPB had transient mild diarrhea. Up to 20% of patients experience diarrhea after CPB in the study of Lee [18].

Patients report diarrhea due to sympathetic blockade and unopposed parasympathetic efferent influence after CPB, which usually resolves within 48hr [18].

Transient local pain in group CT guided CPB, 16.7% (5 patients) had back pain. While, in fluoroscopy guided group, 23% (7 patients) had back pain. The previous minor complications which occurred had no statistical significance in both procedures.

There were no major technical complications noted in the study as paraplegia, pneumothorax, hematoma formation or kidney puncture.

References
4- JOHN R. HAGGA, VIKRAM S. DOGRA and MICHAEL FORSTING: CT and MRI of the whole body. Image-guided interventions and basic science, 8: 2411-644, 2009.
الملخص العربي

لقد أجريت هذه الدراسة على ستين مريضاً يعانون من ألام سرطان البنكرياس من عيادة الامام بديع الامام بالمعهد القومي للأورام – جامعة القاهرة.

وقد قسم المرضى عشوائياً إلى مجموعتين:

المجموعة الأولى: مجموعة الأشعة المقطعية (تتمل 20 مريض أجريت لهم سدة للضفيرة العصبية البطنية بمساعدة الأشعة المقطعة).

المجموعة الثانية: مجموعة الأشعة السينية (تتمل 20 مريض أجريت لهم سدة للضفيرة العصبية البطنية بمساعدة الأشعة السينية).

جميع مرضى الأمل خضعوا للآتي:

١. التاريخ المرضي الكامل.
٢. الفحص الأكيبنكي الدقيق.
٣. سدة للضفيرة العصبية البطنية بأحد الطرق السابق ذكرها.

٤. زمن اجراء السدة العصبية.

وعدد تسجيل البيانات وعمل الإحصائيات اللازمة تبين أن زمن اجراء السدة العصبية كان أقل لمجموعة الأشعة المقطعة مقارنة بمجموعة الأشعة السينية نتيجة الفرق في تباين الانسج بين الأشعة المقطعة والأشعة السينية، وفي من مميزات الأشعة المقطعة.

كذلك بالنسبة إلى الاعراض الجانبية فقد كانت في صورة انخفاض في ضغط الدم وحدوث أسهال والدوء الموضعي، وكل هذه الاعراض كانت في صورة بسيطة مؤقتة وسهيلة علاجها، ولم تحدث أي أعراض خطيرة مثل التهاب أو الشلل النصفي، ولا يوجد فرق إحصائي ملموس بين المجموعتين.

وقد استنتجنا أن زمن اجراء السدة للضفيرة العصبية البطنية أمام الحجاب الحاجز يرشاد الأشعة المقطعة أقل لمجموعة الأشعة المقطعة مقارنة بمجموعة الأشعة السينية، ولا يوجد أي فرق خاص لحدود الآثار الجانبية مقارنة بين المجموعتين.

كل العمل لمواجهة الغضي ويعوضه تعتبر الأشعة المقطعة من أفضل الأساليب لتوضيح طرف الابر الصحيح وتوزيع الصبغة المستخدمة وتقديم إصادا الأعضاء. علماً على ذلك فإن الأشعة المقطعة مفيدة في أظهار مناطق خلف الصفاق خاصة عندما يتم تشويعها بالأسود أو بعضيات سابقة.