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Original Article

Clinical research of percutaneous bilateral splanchnic nerve lesion for pain relief in patients with pancreatic cancer under X-ray guidance

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Abstract: Objective: to observe the therapeutic effects of percutaneous bilateral splanchnic nerves block in patients with intractable pain due to pancreatic cancer. Methods: twenty-fourpatients (advanced pancreatic cancer) with intractable pain were enrolled in the research. Through approach of the edge of T11 vertebral body with double-needle technique, the researchers carried out the bilateral lesion of the greater and the lesser splanchnic nerve with absolute ethyl alcohol under X-ray guidance. Follow-up was six months. Numerical rating scale (NRS) and quality of life (QOL) were all assessed pre- and post-procedure (1 d, 1 w, 2 w, 1 m, 2 m, 3 m, 4 m, 5 m, 6 m). The daily morphine consumption was recorded. Results: NRS and daily morphine consumption decreased when compared to pre-procedure while QOL increased. These differences were found to be statistically significant ($P<0.05$). 9 patients suffered from diarrhea temporally and recoveredin one week. Conclusion: Percutaneous bilateral splanchnic nerves lesion under X-ray guidancecan treat intractable pain caused by pancreatic cancer and improve patients'life quality with minor complication.

Keywords: The greater splanchnic nerve, the lesser splanchnic nerve, pancreatic cancer, cancer pain, absolute ethyl alcohol

Introduction

The pancreatic cancer is one of the top 10 most common cancers in China [1]. Although surgical methods have developed nowadays, the pancreatic cancer still has a poor prognosis [2, 3]. Pain is the most common symptom in 80-85% patients with pancreatic cancer, which may happen in any period of the disease with different degree. Thus palliative care, pain control and how to improve living quality are as important as radical surgery. There are many methods to cure the pancreatic cancer pain, such as narcotics, epidural analgesia, intrathecal morphine pump, nerveblock. Opioid drugs and adjuvant analgesics can't get satisfied analgesia effect, and the drugs have side effects such as nausea, vomiting and pruritus which weaken the quality of life. Nerveblock is called the forth step of cancer therapy. Neurolytic celiac plexus block (NCPB) and splanchnic nerves lesion are used to cure pancreatic cancer pain. These two methods are proved to be effective in pain control. But little has been reported about splanchnic nerves lesion. The aim of our study is to explore the efficacy and safety of splanchnic nerves lesion.

Materials and methods

The plan of the trail has been examined and approved by the Ethics Committee in the hospital. Between May 2012 and May 2014 we enrolled 24 patients (19 men and 5 women) with a mean age of 58.5 (range 49-78) suffering from intractable pain due to pancreatic cancer into the search. 18 patients received radical surgery or palliative surgery. 18 patients were treated with chemotherapy. Adherence to the World Health Organization analgesic ladder consisting of medication titration, all the patients required the use of high-dose narcotics and adjuvant analgesics, but still had severe pain (Numeric Rating Scale, NRS>7). Before the

Figure 1. Oblique view. The needle at the lateral edge of the verterbral body.

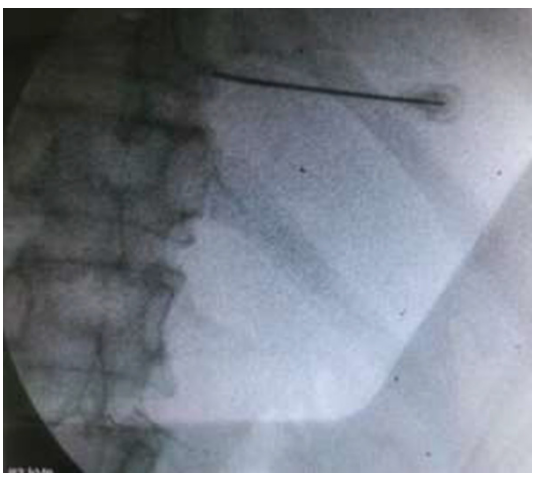

Figure 2. Posterior-anterior view. Tip of the needle in touch with the lateral border of the vertebra.

Figure 3. Lateral view. Final needle position.

nerve lesion, we evaluated the patients' systemic disease. Patients with infection, coagulation dysfunction, serious spine malformation, and poor cardiac or poor pulmonary function were excluded. Before the procedure, we illustrated the method, anticipated effects, complications and side effects which would probably happen to patients and their family. We got the informed consent from the patients and their family members. The whole procedure was carried out under X-ray guidance using aseptic technique in sterile environment. Diagnostic splanchnic nerve block was carried out first. 6 ml lidocaine was injected to each side of splanchnic nerve to estimate the effects. If the patient felt the pain relief more than 50%, the lesion of the splanchnic nerve would be taken in the next day. Before the procedure the patients were fasting for 6 hours and water deprivation for 2 hours. Narcotics were stopped on the procedure day. After the patient entered the operating room, the physician established the venous channel, kept the patient in a prone position and put a pillow under thepatient's upper abdomen to raise the lower back. Vital signs were monitored throughout the procedure, including ECG, blood pressure and oxygen saturations. Before the procedure 2 mg midazolam was injected to ease the patient into sedation. Through approach of the edge of T11 vertebral body, T11 inferior endplate was kept in a line in the posterior-anterior view. Then the costovertebral angle was made to be projected in the middle of the vertebral body bymoderating C-arm to the caudal side. Then C-arm was rotated 15° to the puncture side. The projection point of the costovertebral angle on the skin was the puncture point, which had adistance less than 4 cm from spinous process in most cases. After local anesthesia with 1% lidocaine 3-4 ml at the puncture point, the needle (20 G, 15 cm) was inserted for 3-4 cm using theoblique view (**Figure 1**). The C-arm was reset to the posterior-anterior position and the needle was checked whether it was just close to the vertebral body (**Figure 2**). The needle was advanced slowly using the lateral view under the x-ray guidance (**Figure 3**). The needle was stopped when the tip arrived at the anterior and middle third of the vertebral body. Make sure the needle did not piece into vessels. Then 6 ml 1% lidocaine was injected. If the pain relief >50% after 10 minutes, 6 ml 95% absolute ethyl alcohol was injected. The same procedure was repeated on the other side. After the procedure 40 mg parecoxib was injected to alleviate the pain of the puncture point. The patient was

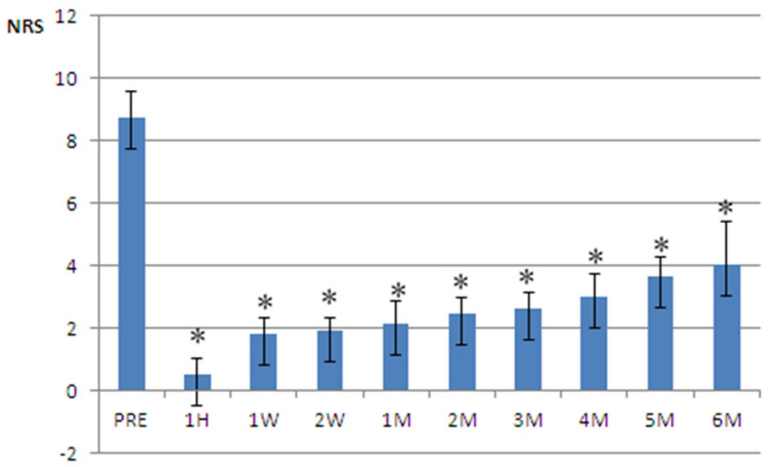

Figure 4. Mean pre- and post-procedure values of Numeric Rating Scale (NRS 0-10) during the follow-up. *: P<0.05 when compared with PRE.

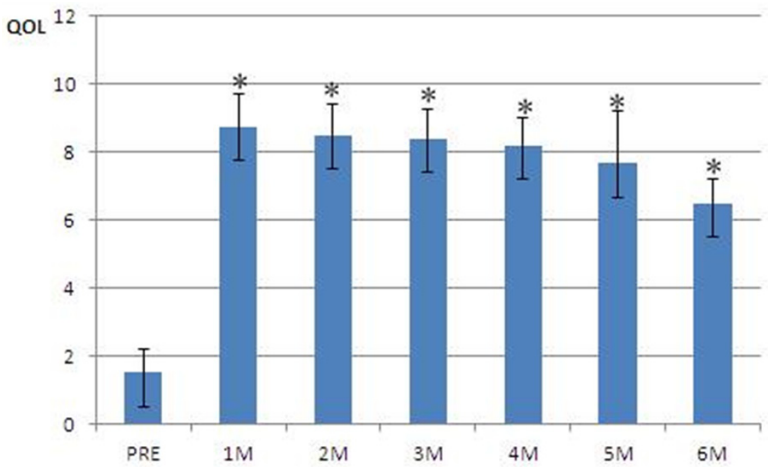

Figure 5. Mean pre- and post-procedure values of Quality Of Life (QOL 0-10) during the follow-up. *: P<0.05 when compared with PRE.

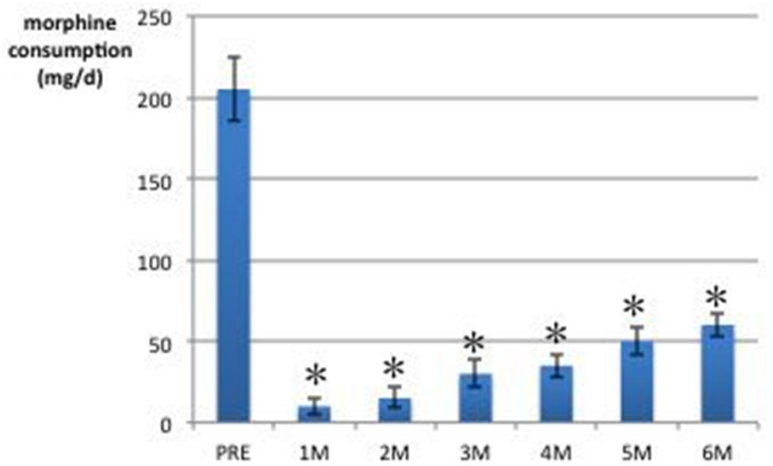

Figure 6. Mean pre- and post-procedure consumptions of morphine (mg/d) during the follow-up. *: P<0.05 when compared with PRE.

observed for 1 hour. If the patient's life signs were stable and have nouncomfortable complain, the patient was sent back to the ward. The patient was ordered to keep prone position for 2 hours and then change to supine position for 24 h. The blood pressure, respiratory rate, heart rate were monitored. The patient was treated with oxygen uptake and fluid infusion. Vasoactive drugs would be used to remedy hypotension if necessary.

The researchers observed and followed the patients' Numeric Rating Scale (NRS, 10 was the worst score with 0 being the best) and Self-reported quality of life (QOL, 10 was the best scorewhile 0 being the worst) pre- and post-procedure (1 d, 1 w, 2 w, 1 m, 2 m, 3 m, 4 m, 5 m, 6 m), recorded the daily morphine consumption during the follow-up. The complications and unwanted side effectswere recorded. The NRS and QOL were evaluated by the same physician.

Numerical data was expressed as the mean ± standard deviation. Statistical analysis was taken with the Statistical Package for Social Sciences (SPSS) 20.0; using One-factor Analysis of Variance (One-Way ANOVA). The statistical significance was set at the 95% confidence intervals.

Results and discussion

24 patients met the experiment requirements. One patient refused the procedure after diagnostic nerve block. Serious complications such as shock, intractable hypotension, arrhythmia did not occur

in any patient. Each patient suffered from burning pain in the abdomen or on the back which was diminished within 2 days after the use of NSAIDS. Eight patients affected by mildself-recovery diarrhea for 2 to 3 days. Diarrhea is graded by using NCI CTC V4.03. The grade 1 is defined as mild diarrhea, the grade 2 is defined as moderate and the grade 3-5 is defined assevere [13]. One patient suffered from moderate diarrhea which alleviated in 5 days after symptomatic treatment. Severe diarrhea did not occur. Follow up was 6 months. Most patients passed away in 5 months after the treatment. One patient died within 2 weeks. Only two patients survived more than 6 months. NRS and daily morphine consumption post-procedure decreased when compared to pre-procedure while QOL increased. These differences were found to be statistically significant ($P< 0.05$) (**Figures 4**-**6**).

The result of our research demonstrated that bilateral splanchnic nerve lesion can be used to pain management of the pancreatic cancer safely and effectively. Also, the procedure can improve the patients' life quality. The block or lesion of the sympathetic nerve plays an important part in pain relief. Although the mechanism is not clear, the block of the sympathetic nerve and parasympathetic nerve in cervical, thoracic, celiac, pelvic and sacrococcygeal region is a vital method in cancer pain therapy. The key point of the nerve block is the location of the injection target point and the spreading range of the neurolytic drugs. Adequate injection point, safe puncture tract and full immersion of the neurolytic drugs around the nerve insure the analgesiceffect.

Neurolytic Celiac plexus block (NCPB) is carried out wildly in patients suffering from pain caused by pancreatic cancer, retroperitoneal tumor, metastatic tumor and chronic abdominalpain which can't be cured using traditional treatmentsince it was first described by Kappis in 1914 [7-12]. The neurolytic drugs must be injected around the celiac trunk, superior mesenteric artery, and the abdominal aorta on the level of the T12~L1 vertebra to ensure the effect of Celiac plexus destruction. But the celiac plexus locates in a deep position. Many factors influence the drug expansion and increase puncture difficulty and risk. The factors include the retroperitoneal anatomical variations resulting from the tumor invasion, celiac plexus and neuropathic pathway sinfiltrated by ascites and tumor [4]. Although transaortic approach has high security, it still has many complications such as hypotension, diarrhea, abdominal aortic dissection and injectionpain. Also, some patients with cohesive diseases can't undergo this procedure. The pain fibers of the midsection organs run with the sympathetic nerve system [15]. The fibers travel within plexus pancreaticus, pancreatic branch and celiac plexus to the greater splanchnic nerve, the lesser splanchnic nerve and lumbar sympathetic trunk. And then the fibers enter the spinal cord. After that the pain fibers arrive at ventral posterolateral nucleus through spinothalamic tract. The intractable pain in patients with advanced upper abdominal cancer results from the direct tumor infiltration of peripheral nerve [4]. The greater splanchnic nerve is derived from the fifth to ninth thoracic ganglia perforates the crus of the diaphragm and terminates on the celiac ganglion [6]. The lesser splanchnic nerve is usually formed by the rami of the tenth and eleventh thoracic ganglia and terminates on the aorticorenal ganglion [6]. The right greater splanchnic nerve in the abdomen locates posterior of the inferior vena cava in most of thecases. The mean length of the right nerve is 41 mm (20-55 mm). The left greater splanchnic nerve locates on the left side of the abdominal aorta with mean length of 24 mm (15-30 mm) in the abdomen. In the chest the right greater splanchnic nerve locates on the right side of the azygos vein and the left greater splanchnic nerve locates on the left side of aorta. In the abdomen and chest the greater and lesser splanchnic nerve have a constant track and superficial position (subperitoneal and subpleural) that make the block of pain conduction be simple. Also, the retrocrural space is a rigid anatomic space that limits the widely spread of the drug [4, 5]. The drugs have a fully combination with the greater and lesser splanchnic nerve that pass through the space. When compared to the NCPB, SNB through approach of the thoracic paravertebral retrocrural has highly-selective target nerve, and it gets satisfactory lesion effect with a less volume drug. Some researchers have used 15-25 mlabsolute ethyl alcohol on each side of the splanchnic nerve to cure the pancreatic pain [14]. In our research we get significant effect by only 6 ml absolute ethyl alcohol on each side. When using high-

dose neurolytic drug it will expand to the head end which will damage the somatic nerve and cause severe chest pain [16-18]. As a result of less dose drug the incidence of postural hypotension and refractory diarrhea were reduced. The advanced cancer patients are usually in the condition of cachexia and have a poor tolerance to alcohol. The low-dose drug makes drunken phenomenon impossible. The puncture track is adjacent to the thoracic vertebrae and quite superficial that keeps the needle away from great vessels such as abdominal aorta and inferior vena cava [14]. The occurrence of pneumothorax and bleeding from vessel rupture is low.

Conclusion

The percutaneous bilateral lesion of the greater and lesser splanchnic nerve under X-rayguidance can be simply operated and has satisfactory effects on reducing the pancreatic cancerpain and improving life quality. It's a good choice to treat the refractory pancreatic cancer pain.

Disclosure of conflict of interest

None.

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