

ORIGINAL RESEARCH

Nursing Cooperation Pattern for Patients With Advanced Pancreatic Cancer and Abdominal Pain Undergoing Endoscopic Ultrasound-guided Celiac Plexus Neurolysis

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ABSTRACT

Context • Patients with pancreatic cancer (PC) at a late stage often suffer from severe abdominal pain due to the invasion of celiac plexus, and the analgesics they receive often have intolerable side effects. Endoscopic, ultrasound-guided, celiac plexus neurolysis (EUS-guided CPN) can have a good therapeutic effect.

Objective • The study intended to evaluate the ability of two nursing cooperation patterns to reduce patients' pain, decrease operation times, increase operational efficiency, and increase nurses' satisfaction, for patients with advanced PC and abdominal pain who received EUS-guided CPN.

Design • The research team designed a retrospective controlled study.

Setting • The study took place at the Shenzhen People's Hospital of the Second Clinical Medical College of Jinan University in Shenzhen, China, and at the Changhai Hospital of the Second Military Medical University in Shanghai, China.

Participants • Participants were 40 patients with advanced PC who received EUS-guided CPN at one of the two hospitals between January 2019 and January 2020.

Intervention • Twenty participants at Changhai Hospital received the traditional nursing cooperation pattern and became the control group, and 20 participants at the Shenzhen People's Hospital received the new nursing cooperation pattern and became the intervention group.

Outcome Measures • The study measured clinical data, nursing measures, diagnostic significance, and key points for the two patterns as well as compared the effects of the

new nursing cooperation method to that of traditional nursing. If the measurement data met the requirements for normality, the team used the two independent sample t-test for the intergroup comparisons. If normality wasn't satisfied, the team used medians and interquartile ranges (IQRs) for expression and the rank sum test for the intergroup comparisons. Counting data were expressed using the constituent ratio, and team used the chi-square test for comparisons between groups. $P < .05$ was considered to be statistically significant.

Results • The operations were successful, and no complications occurred. No significant difference existed in the pain scores between the control group and the intervention group ($P > .05$), while a significant difference occurred in the nurses' operation times and satisfaction. Not only were the scores for operation times for the control group (97) and the intervention group (59) significantly different, but also the nurses' satisfaction was significantly higher for the intervention group postintervention, at 83.35 ± 5.25 , than for the control group, at 62.25 ± 8.18 ($P < .001$). Such a new nursing cooperation method could assist in patient's rehabilitation and increase nurses' satisfaction.

Conclusions • The new nursing cooperation method for patients with advanced PC and abdominal pain undergoing EUS-guided CPN can reduce operation time and improve nurses' satisfaction. (*Altern Ther Health Med*. 2023;29(1):245-251).

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Patients with pancreatic cancer (PC) at a late stage often suffer from Cancerous abdominal pain due to the celiac plexus be invaded by tumor, Cancer cells invade the celiac plexus, and they often receive oral and external analgesics, such as morphine and fentanyl. However, those drugs have intolerable side effects, such as severe nausea and insomnia, and their efficacies also gradually decrease. Therefore, it's very important to develop better pain-relief methods to improve the life quality of patients.

Soweid and Azar found that endoscopic, ultrasound-guided, celiac plexus neurolysis (EUS-guided CPN) can have a good therapeutic effect.¹ The technique fundamentally blocks the signals from the celiac plexus to relieve abdominal pain. Lu F et al found that EUS-guided CPN can reduce the pain score of patients.² Lu F et al report is a systematic review and meta-analysis: success rate of CPN was 50–70%, and the analgesic effect lasted for an average of 3 and up to 6 months. a significant decrease in cancer pain level responding positively to treatment. Wyse et al found that CPN is safe and effective in patients with chronic pancreatitis, PC, and pancreatitis with diffuse abdominal pain.³

Under the guidance of a linear-array, ultrasound endoscope during EUS-guided CPN, an endoscopist needs: (1) to find the celiac plexus located at the root of the abdominal aorta and the celiac trunk's branches; (2) to determine the puncture depth and pierce the gastric wall to the celiac ganglion using a fine needle; (3) to inject bupivacaine for local anesthesia; and (4) to inject ethanol absolute to dehydrate and mortify the celiac plexus.

Preoperatively, a endoscopist needs to place an ultrasound endoscope at a reasonable position over the patient's stomach or duodenal cavity to clearly show the abdominal aorta's celiac plexus and the celiac trunk's root. The endoscopist must determine the puncture points and path using the principle that the probe should be closest to the celiac plexus while away from the blood vessels.

Intraoperatively, a nurse needs to closely monitor changes in patients' vital signs during the injection, especially blood pressure, because patients can be prone to hypotension due to the vasodilation of the abdominal organs after the sympathetic nerve blockage. Moreover, pre-operative fasting and a ban on drinking liquids can lead to a relative insufficiency in the blood supply, resulting in reduced blood volume and blood oxygenation as well as accelerated heart rate and respiratory depression.^{4,5} When the above-mentioned situations occur, the endoscopist should suspend the operation until the patient's vital signs are stable. After completion of the injection of the anesthetic, the nurse injects 10 mL of anhydrous ethanol,⁶ with various dosages from patient to patient according to the doctor's advice.

Because the celiac plexus is relatively dense, it can be difficult for nurses to inject medications, leading to longer operation times and a large reduction in nurses' comfort. If the resistance is very high, the nerve plexus' dense tissue might be increasing the resistance, leading to a better blocking effect. If no obvious resistance occurs, the needle

might penetrate the loose tissue around the body rather than the neuronal plexus. If the resistance is too high for the injection, the nurse should stop it and advise the doctor to re-select the appropriate depth of the injection.

If the nerve bundle is dense, the resistance is higher when pushing the core. Therefore, the nurse can instead use a pulse injection. The nurse needs to inform the surgeon in a timely manner if he or she feels that the nerve bundle is particularly soft, which would require an adjustment in the puncture's depth.

After the injection of ethanol absolute, the nerve plexus can appear cloudy and white because the density of ethanol absolute is higher than that of the bupivacaine. Therefore, it's more difficult to push than the bupivacaine is, and the nurse can use pulse-type pushing. After the injection of the ethanol absolute, the nurse can inject a small amount of normal saline. A slight decrease in blood pressure might occur in the few minutes after the injection, which is a manifestation of obstructive vasodilation, and the blood volume needs appropriate supplementation. The nurse needs to closely monitor patients' blood pressures, pulses, and breathing of during the whole process. After the operation, the nurse uses alcohol gauze to wrap the puncture needle to avoid splashing and the pulls it out.

Postoperatively, the nurse needs to ensure that the patients remain in bed and fast for 24 hours. During the fasting period, the nurse should give intravenous nutrition to meet the needs of the patient's body. The nurse should monitor patients using an ECG monitor for vital signs and pay close attention to changes in blood pressure, bleeding, fever, or perforations. In addition, the endoscopist might give medications to patients, such as antihemorrhagic and antibacterial agents, as the doctor prescribes.

Psychological preparation is very important for patients undergoing CPN. Insufficient preparation can lead to an unsuccessful operation. Most participants suffer from long-term pain. Because participants and their families lack an understanding of EUS-guided CPN, they are apt to become nervous, fearful, and anxious and worried about the operational risks, complications, and possible adverse outcomes. Nurses can help patients overcome their fears.

The current study intended to evaluate the ability of two nursing cooperation patterns to reduce patients' pain, decrease operation times, increase operational efficiency, and increase nurses' satisfaction, for patients with advanced PC and abdominal pain who received EUS-guided CPN.

METHODS

Participants

The research team review patient records and nurse records were used in this controlled study. The study took place at the Shenzhen People's Hospital of the Second Clinical Medical College of Jinan University in Shenzhen, China, and at the Changhai Hospital of the Second Military Medical University in Shanghai, China. Participants were patients with advanced PC who received EUS-guided CPN at

one of the two hospitals between January 2019 and January 2020. Our two hospitals have a long-term cooperative relationship and often conduct business communication. Our doctors go to their hospitals for further study. Part of the procedure is done by our doctors, and the other part is operated by their doctors. Participants were included if: (1) their doctors had confirmed that they had malignant tumors that couldn't be removed with an operation; (2) they had obvious symptoms of pain; (3) noninvasive treatments, such as painkillers, had failed; (4) they had chronic pancreatitis accompanied by persistent, intractable abdominal pain; and (5) doctors had found unexplained abdominal pain and PC or chronic pancreatitis during an endoscopic ultrasound examination.

Participants were excluded if they: (1) had an abnormal esophagus and gastric anatomy; (2) had stomach bleeding or suspected stomach bleeding or coagulopathy; (3) had serious mental illness, such as depression, anxiety, or obsessive-compulsive disorder; (4) had severe insufficient cardiac function—an NYHA cardiac function classification of \geq grade III; (5) had renal insufficiency; (6) had moderate-to-severe ventilatory dysfunction; (7) had unsatisfactory blood-glucose control; (8) had hypertension or poor blood pressure control; (9) had an abdominal infection; (10) were pregnant or lactating; (11) were allergic to pharmaceutical ingredients used in the operation, or (12) were unable to tolerate an endoscopic ultrasound examination due to other endoscopic contraindications.

Procedures

Groups. Participants at Changhai Hospital received the traditional nursing cooperation pattern and became the control group. Participants at the Shenzhen People's Hospital received the new nursing cooperation pattern and became the intervention group.

Preparatory care. Patients started restrictive diets 2 days before the operation and then had a semi-liquid diet 1 day before the operation, according to the doctor's instructions. In addition, patients needed to fast for 8-12 h before the operation and not drink water during the 4 h before the operation.

All participants received the conventional examinations prior to the EUS-guided CPN, including gastroscopy, colonoscopy, and abdominal CT or MRI. Upon patients' admission to the hospital, the patients: (1) routinely examine their hepatic and renal functions; (2) review their electrocardiograms (EKGs); (3) perform a complete blood-cell count; (4) measure their blood coagulation factors; (5) review any pathological, computerized tomography (CT) or magnetic resonance imaging (MRI) reports; (6) evaluate their severity of pain using a visual analog scale (VAS)⁷⁻⁹; and (4) record all details.

The nurses required patients to remove dentures, glasses, contact lenses, and ornament All patients' Beds had rails on both sides, and the nurses secured patients on the Beds to ensure their safety. To make participants comfortable and

safe, nurses ensured that they were kept warm and supplied a square back cushion to allow them to maintain the required posture.

Endoscopic methods. The hospitals commonly used: (1) a 25-G Cook puncture needle¹⁰ (ECHO-25, Wilson-cook, Limerick County, Munster, Ireland); (2) 0.5% bupivacaine for local anesthesia; (3) ethanol absolute for the injection; (4) 0.9% normal saline; (5) 50-mL, 10-mL, and 5-mL empty needles; (6) a disposable, aseptic extension tube (Sanxin Medtec Co., Ltd, Jiangxi, China); (7) dry gauze; (8) alcohol gauze, and (9) sterile gloves.

Preoperatively, the patients orally administered dimethyl silicone oil and 50 mL warm water: (1) Dimethyl silicone oil can change the surface tension of air bubbles in the stomach due to its small surface tension, and make the air bubbles in the stomach burst (2) to reduce the foam generation, and (3) to facilitate the endoscopist's observations during the endoscopy.

Moreover, the nurses administered a lidocaine hydrochloride gel 15 min before a patient's surgery to reduce the stimulation that the endoscope causes. In addition, the nurses performed an EKG (EDAN Instruments, Inc, Shenzhen, China) to monitor patients' vital signs and established a venous channel in patients' right arms. Participants inhaled oxygen at a rate of 4-6 L/min.

Preoperatively, the nurses placed the patient in the left lateral position with the legs bent. After fixing the patient's mouth pad and making sure that he or she was under anesthesia and had stable vital signs using the ECG, the nurses slightly raised the patient's lower jaw to tilt his or her head backward to increase the gap in the throat, which was beneficial to the endoscope's insertion. Before the endoscopist started the puncture, an nurse opened a sealed package of the puncture needles, returned the puncture needles to the outer sheath tube with hands wearing sterile gloves, and set the slip ring at the zero position. Moreover, the nurse injected the normal saline into a puncture needle to lubricate the pipeline. After the ultrasound examination, the endoscopist determined the ideal puncture spot and puncture depth.

Intraoperatively, the endoscopist used an EG-530UT2 endoscopic ultrasound and a Fuji host SU-8000, both from Fujifilm (Tokyo, Japan).

During the procedure, the nurses made sure that: (1) the endoscope was well connected to the light source, a water-sealed bottle was two-thirds full with distilled water, and a vacuum extractor was available; (2) the endoscope's control knob, gas injection, water-injection button, and suction button were operating normally; (3) the ultrasonic transducer and ultrasonic monitor were turned on, confirming that the ultrasound image would be clear; and (4) the patient's general information, such as name, age, hospital number, was put into the image-acquisition system.

Because the needles were long and thin for the EUS-guided CPN, the nurses needed to maintain the needle's placement for 10s. After confirming that no blood outflow had occurred, the nurses connected the needle to a syringe

prefilled with 5 mL of the bupivacaine and then injected 10 mL of the ethanol absolute, followed by an injection of 0.5 mL of the normal saline. Then the endoscopist carried out a unilateral injection. After a successful puncture, the nurse withdrew the needle's core and then connected the needle to a 10-mL vacuum-suction syringe.

One endoscopist kept the endoscope's position unchanged, and a nurse removed the biopsy port valve, inserted the puncture needle into the endoscopic biopsy hole, pressed the Luer lock at the front end of the handle against the entrance of the biopsy hole, rotated the puncture needle to fix it on the endoscope, and pulled the core 1-2 mm outward. The endoscopist determined the puncture depth, put the slip ring lock at the preset puncture depth, and pushed the puncture needle to the lesion while monitoring the procedure using the ultrasonic screen to provide a strong echo of the needle. The nurses gently rotated the plastic cap, wrapped the needle's core using alcohol gauze, and pulled the needle's core out of the puncture needle to avoid splashing the liquid. When it was in a round shape, the nurses placed it in a sterile place, connected it to the negative-pressure syringe, and drew it back. Because the needle was long and thin, the nurses needed to maintain the withdrawal for 10 s to make sure that no blood returned.

The nurse cooperated with the operation, and the doctor performed unilateral injection. Although medical practitioners have implemented unilateral injections in EUS-guided CPN, a large number of the short-term analgesic effects and general risks of bilateral EUS-CPN are comparable with those of unilateral EUS-CPN. Therefore, the research team used unilateral injections in EUS-guided CPN. Bilateral injection: the nurse needs to inject liquid medicine twice, while unilateral injection: the nurse only needs to inject liquid medicine once.

Equipment cleaning and sterilization after use. The nurses cleaned and disinfected the equipment after use as follows: (1) cleaned the equipment as a preliminary procedure; (2) used a multi-enzyme cleaning solution, acidic solution, and a mixture of both at different ratios to disinfect the equipment; (3) rinsed the pipeline with 75% ethanol; and (4) dried the air gun and hung it in the endoscope cabinet for future use.

Traditional nursing cooperation pattern. One endoscopist and one nurse performed the operation completely. The nurse connected the syringe containing the medications to the puncture needle directly.

Outcome measures. The study measured clinical data, nursing measures, diagnostic significance, and key points for the two nursing patterns as well as compared the effects of the intervention to that of the control. The outcome measures included a pain score measured using a visual analogue scale (VAS), operation time, and nurses' satisfaction. The research team measured pain at baseline, at 15 days after the operation, and postintervention after 30 days; measured operation time; and nurses' satisfaction postintervention.

Intervention

One endoscopist and one nurse performed the operation completely. The research team evaluated and reviewed the care points—preoperative; intraoperative, attention to the nursing and skills during the operation; and postoperative—and operational experiences.

Preoperative. The preoperative care points were: (1) that the nurse should carefully check the instruments before the surgery by paying special attention to the installation of the endoscope and making sure that the water supply and air supply were functioning normally; (2) that the nurse should provide psychological support to give patients' confidence and ensure that their moods were stable during the perioperative period. Therefore, the nurse patiently and carefully introduced information about the procedure's clinical significance, the operation's steps, and successful cases of EUS-guided CPN. The nurse also explained the postoperative precautions and care-coordination points to enhance participants' confidence, eliminate their tension and fear, and allow them to actively cooperate with medical staff to finish all examinations.

Intraoperative. The intraoperative care points were: (1) that the nurse should closely monitor patients' vital signs and cooperate well with the endoscopists during operation; (2) that the nurse should use a stepladder to raise him or her above the patient to reduce the angle between their arms and bodies, based on the mechanical principle that the smaller the angle is, the more labor is saved; (3) that the nurse should use a disposable aseptic extension tube because the extension tube has a spiral design and can be closely connected with the tail of the puncture needle to avoid splashing during the injection, allowing the nurse's level of force to not affect the penetration; (4) that the nurse should consider the use of the pulse injection method, which could not only help smoothly push the medications into the ganglion and shorten the operation time but also ensure a smooth and safe operation and reduce complications; and (5) that the nurse should effectively communicate with the doctors during the operation and report the feeling and strength of the injection process to them at the appropriate time, because that information was indispensable to performing the aseptic operation strictly.

Stepladder. The nurse stood on a stepladder (Figure 1) with a height >20 cm (Figure 1) to make sure that he or she was higher than the endoscopist. The height reduces the downward force from pushing the liquid medicine, decreasing the time of drug injection and avoiding having him or her miss the best injection spot.

Disposable aseptic extension tube. The nurse gave injections using a disposable aseptic extension tube (Figure 2), which avoids a direct connection between the needle and syringe, and used the pulse injection method to cooperate with the doctor for an injection. Traditionally, when injecting liquid medicine, a nurse would wrap the needle and syringe with gauze to prevent the liquid from splashing, which can occur from excessive pressure, but the disposable aseptic extension tube avoids the problem of liquid splashing.

The nurse would connect the puncture needle to a syringe that has the smallest minimum diameter and fill it with 0.5% bupivacaine. The nurse employed the pulse injection method, which decreases the push force. To avoid causing the patient severe pain, the nurse slowly pushed the drug from the needle into the plexus, paying attention to the patient's reaction.

Postoperative. Postoperatively, the nurse turns the patient's head to one side to remove any secretions or vomit from his or her mouth and throat. After the Steward awakening score (A maximum of two points are allocated under each of three headings making possible a total score of six for a fully re-covered patient. Consciousness: Awake: 2 points; Responding to stimuli: 1 point; Not responding: 0 point; Airway: Coughing on command or crying: 2 points; Maintaining good airway: 1 point; Airway requires maintenance: 0 point; Movement: Moving limbs purposefully: 2 points; Non-purposeful movements: 1 point; Not moving: 0 point) reaches 6 points, the nurse transfers the patients to the ward and hands them over to the ward nurses. After the patients are fully awake, they may complain of a minor headache or sore throat, and it's necessary to explain that to patients and their families.

Because of the long and repeated insertion and removal of the ultrasound endoscope, the nurse may need to treat the frictional damage of the pharynx using a cold saline to wash the patient's mouth, which can effectively relieve oral pain and pharyngeal discomfort.

The nurse should record patients' pain scores in detail. If severe abdominal pain, bloating, blood pressure drops, or unconsciousness occur, the nurse should notify the doctor for symptomatic treatment. If the EUS-guided CPN takes too long, some gas can remain in the intestinal lumen, causing abdominal distension. Usually, the medical team encourages patients to fart or burp to promote gas discharge.

Nurses' postoperative-care observations can be very important. Nurses should closely monitor patients' blood pressures, heart rates, and other vital signs to prevent postoperative complications. Moreover, it's important to make sure that the patients follow the 24-h of fasting after the operation. Nurses should decide whether a patient should be put on a normal diet on the second day based on his or her blood routine. In addition, the nurses should record patients' postoperative pain scores and assist the doctor in evaluating the postoperative analgesic effects.

Outcome Measures

Pain. In 1971, Canadian neurophysiologist Michael Zak and another researcher established the visual analogue scale (VAS). VAS score is a subjective evaluation method of patients' pain degree. 0 points are painless and 10 points are the most painful. Patients choose one of the 11 numbers according to their own pain. The scoring criteria are 0-10 points, 2-4 points for mild pain, 5-7 points for moderate pain, and 8-10 points for severe pain.

Operation time. The research defined nursing operation time as the duration from the beginning of the bupivacaine

Figure 1. The Stepladder



Figure 2. Disposable Aseptic Extension Tube Connected to the Puncture Needle. Figure 2A shows the disposable aseptic extension tube; Figure 2B shows the spiral design; Figure 2C shows the disposable aseptic extension tube connected with the puncture needle; and Figure 2D shows the disposable aseptic extension tube connected with the syringe and using the pulse injection method to inject.

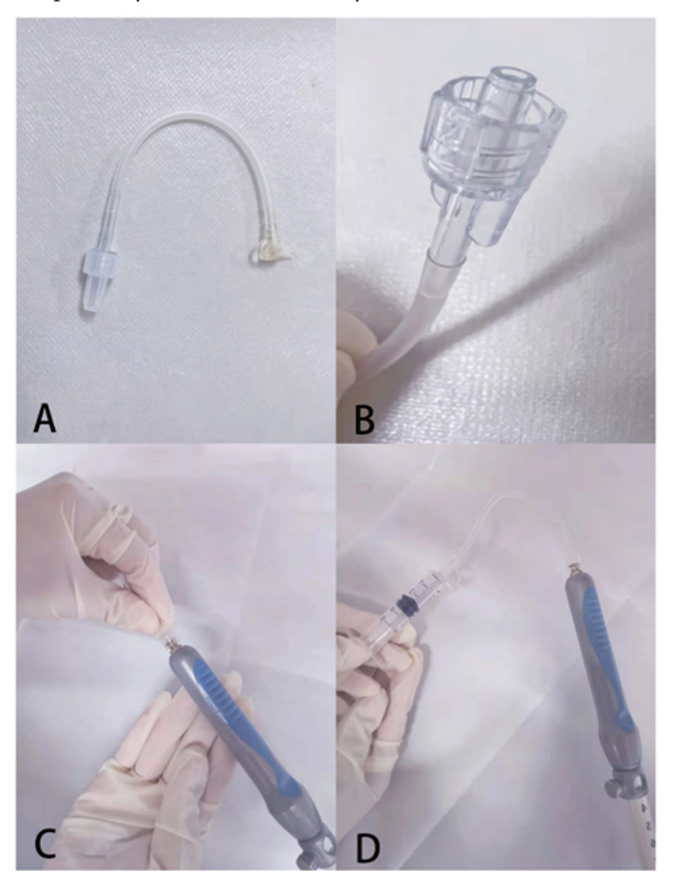


Table 1. Participants’ Characteristics at Baseline (N = 40). The study used the chi-square test for gender and the Student’s *t* test for age.

Characteristic	Control Group n = 20 n (%) Mean ± SD	Intervention Group n = 20 n (%) Mean ± SD
Gender		
Male	12 (60%)	11 (55%)
Female	8 (40%)	9 (45%)
Ages	67.5 ± 9.77	67.0 ± 8.3
Age range		
45-59	5 (25%)	3 (15%)
60-74	10 (50%)	13 (65%)
75-89	5 (25%)	4 (20%)
Average disease course	242.5 (23)	233 (43)
Concurrent issues		
Abdominal pain	20	20
Jaundice	13 (65%)	12 (60%)
Emaciation	13 (65%)	14 (70%)

Table 2. Comparison of Pain Scores for the Traditional Nursing and the New Nursing Cooperation Patterns (N = 40). The study used the Mann Whitney U test.

VAS: Pain Scores	Control Group n = 20 M (IQR)	Intervention Group n = 20 M (IQR)	U	P value
Baseline	9 (2)	9 (2)	179	.47
After 15 days	6 (2)	6 (3)	170.5	.32
Postintervention after 30 days	7.5 (2)	7 (2)	196	.82

Table 3. Comparison of Operation Time and Nurses’ Satisfaction for the Traditional Nursing and the New Nursing Cooperation Patterns. The study used the Mann Whitney U test for operation time and the Student’s *t* test for nurses’ satisfaction.

	Control Group N=20 M (IQR) Mean ± SD	Intervention Group N=20 M (IQR) Mean ± SD	t/U	P value
Operation time	247 (97)	128 (59)	11	<.001 ^a
Nurse’s satisfaction	62.25 ± 8.18	83.35 ± 5.25	-9.122	<.001 ^a

^a*P* < .001, indicating that the nursing operation time was significantly shorter and the nurses’ mean satisfaction was significantly higher for the intervention group than for the control group

injection to the end of the normal saline injection. Bupivacaine injection is to anesthetize the celiac plexus, absolute ethanol will damage the celiac plexus, and normal saline is to completely inject the residual absolute ethanol in the puncture needle into the celiac plexus. Only this process is the process of intervention, so that the time before and after the intervention can be compared.

Nurses’ satisfaction. The nurse’s satisfaction is scored from 10 aspects, including: the strength of injection during the operation, the mode of injection, the injection method, the difficulty of injection, the comfort during the injection, the length of injection, the degree of acid swelling of the nurse’s arm after the injection, the degree of tension of the nurse during the injection, the degree of satisfaction with the doctor’s cooperation, and the willingness to participate in the next CPN. 0 is the least satisfied and 10 is the most satisfied. The higher the score, the more satisfied it is.

Statistical Analysis

The research team analyzed the data using SPSS 23.0 statistical software (IBM, Chicago, Illinois, USA). If the measurement data met the requirements for normality, the team used the two independent sample *t* test for the intergroup comparisons. If normality wasn’t satisfied, the team used medians and interquartile ranges (IQRs) for expression and the rank sum test for the intergroup comparisons. Counting data were expressed using the constituent ratio, and the chi-square test for comparisons between groups. *P* < .05 was considered to be statistically significant.

RESULTS

Participants

The study included and analyzed the data of 40 participants, 20 in the intervention group and 20 in the control group. In the intervention group, 11 participants were male and 9 were female, with an average age of 67.0 ± 8.3 (Table 1). In the control group, 12 participants were male and 8 were female, with an average age of 67.5 ± 9.77. Eight patients aged 45-59 years, 23 patients aged 60-74 years, and nine patients aged 75-89 years. The average disease course was 8 months. All had abdominal pain; 26 had jaundice; and 27 were emaciated. No significant differences existed between the groups for the demographic and clinical characteristics at baseline.

Pain Scores

The pain scores for both groups were 9 (2) at baseline (Table 2). The control group’s pain after 15 days decreased to 6 (2) and postintervention was 7.5 (2), while after 15 days and 30 days the intervention group pain decreased to 6 (3) and 7 (2), respectively. No significant difference existed in pain scores between the control and intervention groups postintervention.

Operation Time and Nurses’ Satisfaction

Table 3 shows the comparisons of operation time and nurses’ satisfaction between the control group and the

intervention group. All operations were successful, and no complications occurred during the operations, such as perforation, major bleeding, or symptoms of acute alcohol poisoning, or after discharge.

The nursing operation time was significantly shorter for the intervention group, at 128 min (59)s, than that of the control group, at 247 (97)s ($P < .001$). The nurses' mean satisfaction was significantly higher for the intervention group postintervention, at 83.35 ± 5.25 , than that of the control group, at 62.25 ± 8.18 ($P < .001$).

DISCUSSION

A successful EUS-guided CPN depends not only on a skilled doctor but also particularly on the nurse's care. In performing this study, the research team hoped that nurses could better cooperate with doctors when using the new care pattern to shorten the operation times and minimize patients' pain.

In the current study, the research team enabled the nurses to assist the endoscopists to implement CPN for 40 patients and to minimize patients' pain.

The reasons why the new nursing cooperation can reduce the operation time: (1) The syringe does not directly act on the puncture needle, but is connected to the disposable aseptic extension tube, which reduces the force of the syringe and makes it easier for the nurse to push the drug into the celiac plexus; (2) Due to the role of stepladder, the height of the nurse is increased, the injection process of the nurse is more comfortable, the degree of acid swelling of the arm is reduced, and the operation time is accelerated.

The reasons for the increase of nurses' satisfaction are: (1) The injection intensity decreases, the injection mode changes, and the injection difficulty decreases; (2) The comfort degree during the injection process increases, the injection time decreases, the acid swelling degree of the nurses' arms decreases after the injection; (3) The tension of nurses during the injection eases, and the satisfaction improves as a whole.

CONCLUSIONS

The new nursing cooperation method for patients with advanced PC and abdominal pain undergoing EUS-guided CPN can reduce operation time and improve nurses' satisfaction.

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AUTHORS' DISCLOSURE STATEMENT

The authors declare that they have no conflicts of interest related to the study.

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