

Effect of B-ultrasound-guided nerve block on analgesia and sedation in patients with acute cholecystitis undergoing puncture and drainage

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To investigate the effect of B-ultrasound-guided nerve block on analgesia and sedation in patients with acute cholecystitis undergoing puncture and drainage. Methods 96 patients with acute cholecystitis who underwent puncture and drainage from May 2018 to November 2020 were randomly divided into control group and observation group by random number table method, with 48 cases in each group. The patients in the control group were anesthetized by local infiltration. The patients in the observation group were anesthetized by B-ultrasound-guided nerve block. Heart rate, blood pressure, analgesia score, sedation score, and oxidative stress level were compared between the two groups. Results At the time of puncture (T2), heart rate (HR) and mean arterial pressure (MAP) in the two groups were significantly lower than those before operation (T1) ($P<0.05$); at the end of operation (T3), HR and MAP in the control group were significantly higher than those at T1 ($P<0.05$); at T2, HR and MAP in the observation group were significantly higher than those in the control group ($P<0.05$); at T3, HR and MAP in the observation group were significantly lower than those in the control group ($P<0.05$). At T2 and T3, Ramsay sedation score in both groups was significantly lower than that at T1 ($P<0.05$), while Ramsay score in the observation group was significantly higher than that in control group ($P<0.05$); at T2 and T3, visual analog scale (VAS) pain score in both groups was significantly higher than that at T1 ($P<0.05$), while VAS score in the observation group was significantly lower than that in the control group ($P<0.05$). After operation, the levels of serum malondialdehyde (MDA) and superoxide dismutase (SOD) in the two groups were significantly higher than those before operation ($P<0.05$), and the levels of serum total antioxidant capacity (T-AOC) were significantly lower than those before operation ($P<0.05$); after operation, the levels of serum SOD and T-AOC in the observation group were significantly higher than those in the control group ($P<0.05$), and the levels of MDA in the observation group were significantly lower than those in the control group ($P>0.05$). Conclusion B-ultrasound-guided nerve block anesthesia can maintain the stable hemodynamic index of patients with acute cholecystitis undergoing puncture and drainage therapy, improve the analgesic and sedative effect and reduce the oxidative stress response of the body.

Key words: Nerve block; B-ultrasound-guided; Acute cholecystitis; Puncture and drainage; Analgesia

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Acute cholecystitis is one of the common acute abdominal diseases in clinical practice. Its onset is rapid and its disease progression is rapid. If the patient fails to receive timely treatment, it may be complicated with severe complications such as gallbladder perforation, sepsis and pancreatitis¹. At present, laparoscope-guided cholecystectomy (LC) is preferred for the treatment of patients with acute cholecy

stitis whose initial symptoms are less than 72h. However, the local inflammation of gallbladder and adhesion to surrounding tissues are more severe in the patients with acute cholecystitis whose initial symptoms are more than 72h. If LC treatment is performed, it is easy to cause injury during operation and cause multiple postoperative complications, which seriously affects the patient's prognosis². Ultrasound-guided percutaneous

transhepatic gallbladder drainage, as an acute palliative treatment, can rapidly improve the clinical symptoms of patients with acute cholecystitis, reduce mortality, and is increasingly used in the clinical treatment of patients with acute cholecystitis³. For patients receiving acute cholecystitis puncture and drainage therapy, local infiltration anesthesia was used for analgesia. However, due to differences in patients' constitution, some patients had insufficient analgesic effect, which caused strong surgical stress response and affected postoperative prognosis. Therefore, it is of great significance to actively search for an analgesic and sedation method with exact analgesic effect to promote postoperative rehabilitation of patients receiving acute cholecystitis puncture and drainage therapy. Planar nerve block of the transversus abdominis is an anesthetic method that infuses local anesthetic into the fascial plane between the obliquus internus and the transversus abdominis to block pain nerve conduction on the anterior side of the abdominal wall, thereby alleviating the pain sensation at the incision of the anterior abdominal wall⁴. In addition, with the development of ultrasound technology, more precise nerve block anesthesia technique under ultrasound guidance is more and more widely used in clinical anesthesia operation. Based on this, this study is to investigate the effect of B-ultrasound-guided nerve block on analgesia and sedation in patients with acute cholecystitis undergoing puncture and drainage, so as to provide reference basis for clinical anesthesia mode selection.

DATA AND METHODS

General data

96 patients with acute cholecystitis who underwent puncture and drainage from May 2018 to November 2020 were randomly divided into control group and observation group by random number table method, with 48 cases in each group. Control group: 20 males and 28 females, aged 35-70 years, mean age (48.62 ± 8.56) years, weight 40-75 kg, mean weight (60.53 ± 10.35) kg; observation group: 22 males and 26 females, aged

34-68 years, mean age (47.23 ± 7.45) years, weight 42-78 kg, mean weight (61.25 ± 11.22) kg. There was no significant difference but comparability in general clinical data between the two groups ($P > 0.05$). The study was reviewed and approved by the Ethics Committee of the hospital, and all the patients signed the informed consent form. Inclusion criteria: ① 30 years of age \leq Patients \leq 70 years of age; ② Patients diagnosed with acute cholecystitis according to clinical symptoms and physical signs, conforming to indications of ultrasound-guided percutaneous transhepatic cholecystectomy; ③ Patients with anesthesia classified as American Society of Anesthesiologists (ASA) grades I ~ II; ④ Patients with complete clinical data. Exclusion criteria: ① Patients with a history of allergy to narcotic drugs; ② Patients with severe cardiac, hepatic and renal insufficiency; ③ Patients with malignant wasting diseases such as tumor; ④ Patients with a history of previous major abdominal surgery.

Methods

Patients in both groups completed all preoperative examinations (including hematology, urinalysis, coagulation, liver function, renal function, blood glucose test, acid-base water and electrolyte balance, chest X-ray, ECG, etc.). After the patient entered the room, the multi-function monitor was started to routinely monitor blood pressure, ECG, pulse oxygen saturation, etc., and the upper limb venous access was opened.

The patients in the control group were placed in supine position, disinfected and draped, and given 5 ml local infiltration anesthesia with 1% lidocaine (manufacturer: Shanghai Zhaohui Pharmaceutical Co., Ltd., SFDA Approval No.: GYZZ H31021071, specification: 20 ml: 0.4 g), then puncture and drainage treatment was performed.

The anesthesia method of B-ultrasound-guided nerve block was used in the observation group. After the patient is placed in the supine position, routinely disinfected and draped, vertically place a sterile high frequency ultrasound probe (Beijing Zhongtong Hengchuang Testing Technology Co., Ltd.) at the anterior axillary line at the lower edge

of right rib arch. The probe plane is parallel to the direction of lower edge of right rib arch, and gradually move to the subxiphoid direction until it reaches or approaches the transition aponeurosis of rectus abdominis muscle. Use in-plane technique to guide short oblique nerve block puncture needle to make puncture, confirm that when the needle tip reaches above the plane of transversus abdominis muscle, puncture the fascia of transversus abdominis muscle to draw back and confirm that there is no blood, then inject the local anesthetic ropivacaine (0.5%, Guangdong Jiabo Pharmaceutical Co., Ltd.) into the left side to operate the same as the right side, the bilateral local anesthetic dose is equal, and inject 0.8 mL of local anesthetic per kilogram in total. After completion of anesthesia, puncture drainage was performed.

Observation indicators

Heart rate, blood pressure

Heart rate (HR) and mean arterial pressure (MAP) were measured and recorded before operation (T1), at the time of puncture (T2) and at the end of operation (T3) by multifunctional monitor (Drager, Germany).

Sedation score

Using Ramsay sedation scoring scale, the sedation degree of patients in the two groups was scored at T1, T2 and T3, respectively, with scores ranging from 1 to 6, with higher scores indicating better sedation effect ⁵.

Analgesia score

Pain was rated on a visual analog scale (VAS) before operation (T1), at the time of puncture (T2), and at the end of operation (T3), with scores ranging from 0 to 10, with higher scores indicating more severe pain, with 0 indicating no pain, and 10 indicating worst pain ⁶.

Oxidative stress levels

For each group, 3 ml venous blood was collected before operation and at 6h after operation, and separate

d with a serum separator at 3000 r/min for 10 min, and the supernatant was retained for examination. Serum malondialdehyde (MDA) and superoxide dismutase (SOD) levels were measured by enzyme-linked immunosorbent assay (ELISA), and serum total antioxidant capacity (T-AOC) levels were measured by microassay. All kits were purchased from Shanghai Enzyme-linked Biotechnology Co., Ltd. and operated in strict accordance with the instructions for use.

Statistical methods

SPSS 20.0 was used for statistical analysis. The count data were compared with χ^2 test. The measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm s$). t test was used for comparison. $P < 0.05$ was used as the difference with statistical significance.

RESULTS

Comparison of HR and MAP levels in the two groups

At T2, the levels of HR and MAP in the two groups were significantly lower than those at T1 ($P < 0.05$); at T3, the levels of HR and MAP in the control P were significantly HR than those at T1 ($P < 0.05$), and the levels of HR and MAP in the observation group were not significantly different from those at T1 ($P > 0.05$); at T1, the levels of HR and MAP in the two groups were not significantly different ($P > 0.05$); at T2, the levels of HR and MAP in the observation group were significantly higher than those in the control group ($P < 0.05$); at T3, the levels of HR and MAP of the observation group were significantly lower than those in the control group ($P < 0.05$), see Table 1.

Table 1. Comparison of HR and MAP between patients of the two groups						
Group	HR (beats/min)			MAP (mmHg)		
	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
Control group	73.14 \pm 10.04	62.78 \pm 9.54*	82.58 \pm 9.18*	86.23 \pm 6.41	78.71 \pm 9.66*	93.74 \pm 5.10*
Observation group	72.82 \pm 9.62	68.81 \pm 8.62*	70.12 \pm 8.32	87.44 \pm 7.32	83.16 \pm 8.51*	86.71 \pm 6.18
t value	0.159	-3.249	6.968	-0.862	-2.395	6.079
P value	0.874	0.002	0.000	0.391	0.019	0.000
Note: Compared with before operation (T ₁), * $P < 0.05$						

Comparison of postoperative analgesia and sedation scores between the two groups

At T1, there was no significant difference in Ramsay score and VAS score between the two groups ($P>0.05$). At T2 and T3, Ramsay scores in both groups were significantly lower than T1 ($P<0.05$), while Ramsay scores in the observation group were significantly higher than that in control group ($P<0.05$). At T2 and T3, VAS scores in both groups were significantly higher than those at T1 ($P<0.05$), while VAS scores in the observation group were significantly lower than that in the control group ($P<0.05$). See Tables 2 and 3.

Table 2 Comparison of sedation scores of patients in the two groups			
Group	Ramsay score		
	T ₁	T ₂	T ₃
Control group	2.32±0.23	1.74±0.32*	1.86±0.22*
Observation group	2.30±0.17	1.88±0.29*	2.11±0.24*
t value	0.485	-2.246	-5.320
P value	0.629	0.027	0.000
Note: Compared with before operation (T ₁), *P<0.05			

Table 3. Comparison of analgesic scores between the patients of the two groups			
Group	VAS score		
	T ₁	T ₂	T ₃
Control group	2.31±0.52	3.46±0.46*	2.89±0.63*
Observation group	2.21±0.68	2.76±0.51*	2.38±0.32*
t value	0.809	7.061	5.001
P value	0.420	0.000	0.000
Note: Compared with before operation (T ₁), *P<0.05			

Comparison of oxidative stress levels in the two groups

Before operation, there was no significant difference in the levels of SOD, T-AOC and MDA between the two groups ($P>0.05$); after operation, the levels of SOD and MDA in the serum of the two groups were significantly higher than those before operation ($P<0.05$), and the levels of T-AOC were significantly lower than those before operation ($P<0.05$); after operation, the levels of SOD and T-AOC in the observation group were significantly higher than those in the control group ($P<0.05$), and the

level of MDA were significantly lower than that in the control group ($P>0.05$). See Table 4.

Table 4. Comparison of serum SOD, T-AOC and MDA levels between the two groups						
Group	SOD (U/mL)		T-AOC (U/mL)		MDA (mmol/mL)	
	Before operation	After operation	Before operation	After operation	Before operation	After operation
Control group	78.38±8.32	87.14±9.13*	16.28±2.39	12.34±2.47*	2.26±0.39	4.69±0.58*
Observation group	77.52±8.49	96.23±7.69*	16.85±3.07	14.52±2.78*	2.17±0.33	3.12±0.53*
t value	0.501	-5.276	-1.015	-4.061	1.221	13.844
P value	0.617	0.000	0.313	0.000	0.225	0.000
Note: Compared with before operation (T ₁), *P<0.05						

DISCUSSION

With the change of people's living habits and dietary structure, the incidence of acute cholecystitis in China has been increasing year by year. Due to thickened gallbladder wall edema and unclear anatomy of gallbladder triangle during onset of acute cholecystitis, patients with severe acute cholecystitis or patients with symptoms of acute cholecystitis over 72 hours are at high risk for emergency cholecystectomy and are prone to complications. Therefore, initial conservative treatment for such patients is clinically recommended, including percutaneous transhepatic gallbladder puncture and drainage, application of antibiotics, and subsequent delayed surgery ⁷. Ultrasound-guided percutaneous transhepatic gallbladder drainage can be performed under local anesthesia and can be performed at the bedside. The surgical operation is relatively simple and less invasive than LC. According to the clinical study, the application of ultrasound-guided percutaneous transhepatic gallbladder drainage has created favorable conditions for elective surgery in patients with acute cholecystitis, significantly reducing mortality and complication rate and improving survival rate of patients ⁸. Percutaneous transhepatic gallbladder puncture and drainage is usually performed under local infiltration anesthesia. Due to the differences in individual constitution and sensitivity to anesthetic drugs, some patients have insufficient analgesic effect when only receiving local infiltration anesthesia, which requires

additional dosage of anesthetic drugs to cause adverse reactions, thus affecting patients' prognosis⁹. Therefore, it is of great significance to actively seek an effective analgesic and sedation method to reduce the occurrence of complications in patients with acute cholecystitis undergoing puncture and drainage and to promote the postoperative rehabilitation of patients. Transversus abdominis plane nerve block anesthesia is an important method of analgesia during and after abdominal operation, which can make the anterior abdominal wall obtain good analgesic effect. At present, clinical studies on the effect of B-ultrasound-guided nerve block on analgesia and sedation in patients with acute cholecystitis undergoing puncture and drainage are rare.

The results of this study showed that, during puncture and at the end of operation, the Ramsay score of patients in both groups was significantly lower than that before operation, and that of patients in the observation group was significantly higher than that of patients in the control group, and the VAS score of patients was significantly higher than that before operation, and the VAS score of patients in the observation group was significantly lower than that of patients in the control group. It is suggested that compared with the local infiltration anesthesia method, the anesthesia method guided by B-ultrasound for the plane nerve block of transversalis abdominis in patients with acute cholecystitis undergoing puncture and drainage has better analgesic and sedative effect. Planar nerve block of the transversus abdominis is a method of injecting local anesthetic into the fascial space between the transversus abdominis and the transversus medialis obliquus muscle in the lumbar triangle. It blocks the signal transmission of the anterior branches of the T7 and T8 nerves that innervate the epigastric muscle through the lateral rectus abdominis muscle plane, blocks the conduction of peripheral noxious stimuli up to the center, inhibits the formation of pain sensitization in the center, and avoids the production of pain sensation, thus providing sedation and analgesia effect^{10,11,16}.

Surgical operations such as surgical puncture may

cause trauma to patients, which may cause a series of comprehensive neuroendocrine and metabolic reactions, resulting in increased secretion of sympathetic pituitary adrenaline, and increased secretion of catecholamine substances in the body. Patients generally present with hemodynamic imbalance phenomena such as increased heart rate and increased blood pressure¹². The results of this study showed that HR and MAP in the control group were significantly lower than those after operation and in the observation group at the time of puncture, while HR and MAP in the control group were significantly higher than those before operation and in the observation group at the end of operation, and there was no significant difference in HR and MAP of the observation group before operation. The results showed that compared with the local infiltration anesthesia method, the anesthesia method of plane nerve block of abdominal transversus muscle guided by B-ultrasound in patients with acute cholecystitis undergoing puncture and drainage was more beneficial to maintain the haemodynamic stability of the body. This may be because plane nerve block anesthesia of the transversus abdominis effectively blocks the signal transduction of the nerve at the puncture and drainage site and effectively attenuates pain stimulation, thus helping the patient to maintain haemodynamic stability¹³.

In patients with acute cholecystitis undergoing puncture and drainage surgery, due to the stimulation of various internal and external factors, a large number of free radicals or reactive oxygen species can be generated through various mechanisms such as catecholamines self-oxidation, so that the human body is in a state of high oxidation reaction, leading to oxidative damage of tissues and organs. SOD is an antioxidant enzyme in vivo, which can catalyze the disproportionation reaction of superoxide free radicals and scavenge oxygen free radicals, and its level can reflect the ability of scavenging oxygen free radicals in the body. MDA is an intermediate metabolite of lipid peroxidation induced by oxygen free radical attacking unsaturated fatty acid in biofilm, and its level changes can indirectly reflect the level of oxygen free radical in the body and the degree of

tissue damage. T-AOC represents the sum of various antioxidants in the body and to some extent reflects the total antioxidative capacity of the body¹⁴. The results of this study showed that the levels of SOD and T-AOC in the observation group were significantly higher than those before operation and in the control group, and the levels of MDA were significantly lower than those before operation and in the control group at 6 hours after operation. Compared with the local infiltration anesthesia method, the anesthesia method guided by B-ultrasound in patients with acute cholecystitis puncture and drainage can effectively inhibit the reaction of oxidative stress. Transversus abdominis plane nerve block can reduce the degree of ischemia and hypoxia during the operation by promoting the stable hemodynamics of the body, so as to control the serum MDA level after the operation. In addition, the plane nerve block of the transversus abdominis muscle can also promote the synthesis and release of SOD by inhibiting the release of catecholamines and other substances, thus scavenging the oxygen free radicals, alleviating the oxidative stress reaction and maintaining the constant level of T-AOC¹⁵.

In conclusion, B-ultrasound-guided nerve block anesthesia can maintain stable hemodynamic indicators, improve analgesic and sedative effects and reduce the oxidative stress response in patients with acute cholecystitis undergoing puncture and drainage therapy.

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