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Application of ALCOCK Tube Ultrasound-guided Internal Pudendal Nerve Block in Postoperative Anal Analgesia

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Abstract

Background: While surgery is the most effective treatment for anorectal diseases, traditional anesthesia methods are increasingly regarded not suitable for the clinical needs of anorectal patients. Although pudendal nerve block can play a good analgesic role in the anal region, the traditional pudendal nerve block is performed under blind probing, which is inaccurate in positioning, has poor anesthesia effect, and causes many complications.

Objectives: At present, ultrasound-guided pudendal nerve block for analgesia has emerged in clinical practice. Therefore, the present study aimed to investigate the analgesic effect of ALCOCK tube ultrasound-guided internal pudendal nerve block in anal surgery.

Methods: A prospective study was conducted. A total of 134 patients who underwent anal surgery in Hangzhou Lin'an District First People's Hospital from May, 2021 to July, 2022 were divided into three categories according to mixed hemorrhoids, anal fistula, and anal fissure and randomly divided into control and experimental groups. The two groups were treated with corresponding surgical treatment, and the experimental group was treated with bilateral pudendal nerve block under the guidance of ALCOCK tube ultrasound at the end of the operation. The operation time, blood loss, initial postoperative pain time, and visual analogue scale, postoperative pain score at each time point, incidence of complications, and patient satisfaction were recorded and analyzed.

Results: The operation time of the experimental group was significantly longer than that of the control group, the bleeding volume of anal fistula in the experimental group was more than the control group, the first pain time of anal fistula in the experimental group was higher than that of the control group. The first pain score of anal fistula in the experimental group was lower than that of the control group. Follow-up showed that the pain scores of anal fistula and anal fissure groups were inconsistent 48 h after surgery. The total incidence of adverse reactions was lower, and the patient satisfaction was higher in the experimental group than in the control group.

Conclusion: The application of internal pudendal nerve block under the guidance of ALCOCK tube ultrasound in anal surgery has a good analgesic effect and high patient satisfaction, which is worthy of promotion.

Keywords: ALCOCK tube, Analgesia, Anus surgery, Nerve block

1. Background

Anal surgery is a common surgical procedure used for the treatment of various rectal and anal diseases. These surgeries, including anal fistula repair, rectal polyp removal, anal fissure repair, and rectal resection, aim to alleviate patient symptoms, improve quality of life, and facilitate recovery. However, postoperative pain remains a major concern faced by patients following anal surgery and significantly impacts their comfort and rehabilitation (1, 2). Postoperative pain not only causes discomfort and distress to patients but can also prolong hospital stays, increase recovery time, and have a negative impact on their quality of life. Therefore, postoperative pain management plays a crucial role in the management of anal surgery. Effective postoperative analgesic strategies can alleviate pain, promote early recovery, and reduce the occurrence of complications (3, 4). Currently, various techniques and methods for postoperative analgesia are applied in the management of anal surgery pain, including local anesthetic injections, systemic analgesic drug use, and nerve blockade. Among them, nerve blockade has been extensively studied and applied in various surgeries to provide effective postoperative pain relief (5).

Nerve blockade is a commonly used analgesic technique that involves the administration of medication along the neural pathways to block or alleviate the transmission of pain signals, thereby achieving analgesic effects. It can act locally or systemically on the nervous system, blocking the transmission of nociceptive nerves, thus reducing or eliminating the sensation of pain (6, 7). Nerve blockade can be implemented through different approaches, including surface anatomical landmarks, nerve stimulators, or techniques under ultrasound guidance. Ultrasound-guided nerve blockade has emerged as a significant advancement in nerve blockade techniques. It utilizes needle placement under ultrasound imaging guidance, providing real-time visualization of anatomical structures, thereby increasing accuracy and safety (8). In recent years, ultrasound-guided pudendal nerve blockade under ALCOCK canal has gained increasing attention as an

emerging postoperative analgesic technique. The ALCOCK canal is an important anatomical structure located in the female pelvic floor, through which the pudendal nerve responsible for supplying the perineal and perianal regions passes. By performing pudendal nerve blockade under ultrasound guidance, precise drug delivery to this area can be achieved, and localized analgesic effects can be provided (9, 10). The technique of ultrasound-guided pudendal nerve blockade under ALCOCK canal involves needle placement and medication injection under ultrasound imaging guidance to accurately block the conduction pathway of the pudendal nerve. Ultrasound guidance provides real-time anatomical localization and visualization, enabling physicians to accurately determine the position of the needle and avoid injury to surrounding tissues or blood vessels. One of the advantages of this technique is its precision and accuracy in needle placement, thereby providing better pain control. Ultrasound-guided pudendal nerve blockade under ALCOCK canal can selectively target the pain-sensitive area, reducing pain and discomfort at the surgical site. Furthermore, compared to other analgesic methods, this technique carries a lower risk of systemic drug absorption and side effects (11-13).

Although nerve blockade is a widely used analgesic method, its application in postoperative analgesia for anal surgery still faces certain challenges. In this context, ultrasound-guided pudendal nerve blockade under the ALCOCK canal has gained attention as an emerging postoperative analgesic technique. However, research on the application of this technique in postoperative analgesia for anal surgery is relatively limited. Therefore, this study aims to review and summarize existing literature to explore the application of ultrasound-guided pudendal nerve blockade under the ALCOCK canal in postoperative analgesia for anal surgery.

2. Objectives

Moreover, this study intends to investigate the effect of this technique on pain control, its impact on postoperative recovery, as well as its potential advantages and limitations. Additionally, this research intends to discuss the applicability and clinical prospects of this technique in postoperative pain management. By delving into the research and understanding of this technique, it is hoped that it can provide clinicians with more options for postoperative analgesia in anal surgery, thereby improving patients' surgical experience and recovery outcomes.

3. Methods

3.1. Study design and participants

In this prospective randomized controlled trial, random sampling methods were employed to select patients who met the experimental criteria. A group of patients requiring anal surgery was randomly selected from the medical record system of Hangzhou Lin'an District First People's Hospital or based on recommendations from physicians. They were invited to participate in the study. Considering the objectives of the experiment, heterogeneity of the sample, acceptable level of error, and available resources, statistical methods were used to estimate the minimum sample size required to achieve the desired effect size and level of significance. Power analysis or sample size calculations were performed to determine the number of the recruited participants. The sample size was determined to be approximately 100-200 cases to ensure the reliability and effectiveness of the experimental results.

Finally, 134 patients who underwent anal surgery at Hangzhou Lin'an District First People's Hospital from May 2021 to July 2022 were selected as the study participants. The study was conducted with the approval of the hospital's Ethics Committee (Hangzhou Lin'an District First People's Hospital, No. 20200215, No. HLDFP202051). All included patients provided their consent to participate in the study with the permission of their family members and signed informed consent forms. Patients were grouped based on inclusion and exclusion criteria.

Inclusion criteria were as follows: patients diagnosed with grade III or IV mixed hemorrhoids, low-level anal fistula, or simple anal fissure based on their medical history, physical signs, and anorectal examination. American Society of Anesthesiologists (ASA) class I-II. Level I: Normal and healthy patients. Level II: Patients with mild systemic diseases without substantial functional limitations. Moreover, patients aged between 15 to 75 years were included in the study.

Exclusion criteria were as follows: coagulation disorders, severe hepatic or renal dysfunction, ASA class greater than II, patients with poor compliance or mental disorders, pregnant or lactating women, history of chronic pain, long-term or current use of analgesics and other psychotropic drugs.

The eligible patients were divided into three categories based on their diagnosis of mixed hemorrhoids, anal fistula, or anal fissure. Subsequently, they were randomly allocated into the control and experimental groups using a random number table and the random number remainder method.

3.2. Surgical methods

All patients in control and experimental groups fasted and emptied their stools on the day of surgery and had an enema 3 h before surgery and skin preparation at the perineum. Both groups were treated with corresponding surgery under spinal anesthesia. The patients with mixed hemorrhoids

were treated with external stripping and internal ligation resection, the patients with anal fistula were treated with low anal fistula resection, and the patients with anal fissure were treated with anal fissure incision and internal sphincterotomy. The operation time, anesthetic response, intraoperative blood loss, and other information of the two groups were recorded in detail.

3.3. The internal pudendal nerve block guided by ALCOCK tube ultrasound

At the end of the surgery, the experimental group underwent bilateral pudendal nerve block. The patient was placed in the prone position, and the lower limbs were separated to expose the pudendal region, and use sterile cotton balls to disinfect the genitals. A low frequency 2-5MHz ultrasound probe (SonoSite, USA) with a sterile protective cover was selected and placed at the ischial tuberosity. It moved slowly cephalad along the long axis, and the ischial spine plane was found, which appeared as a straight, hyperechoic bright line. Above the ischial spine is the sacrospinous ligament, and the sacrotuberous ligament lies just above the hyperechoic line.

By observing the location of the internal pudendal nerve and ALCOCK tube, it was found that the pudendal nerve is located on the outer wall of the ischial rectal fossa, which is 3-4 cm above the ischial tuberosity. A 100mm, 21G short bevel needle was selected, and the puncture needle was connected to a nerve stimulator, and the current was modulated by about 1mA. The puncture point was 1cm from the inner side of the ultrasound probe. The in-plane needle insertion technique was used to advance in the direction of the ischial spine, and the needle tip and surrounding structures were clearly visible during the whole process. When the needle broke the sacrotuberous ligament, a small amount of normal saline was injected, and the position of the needle tip was observed according to the water separation phenomenon. When a hypoechoic fusiform image appeared in the gap formed by the sacrospinous ligament and the sacrotuberous ligament, indicating that the needle tip was at the target position and no blood was aspirated, 10mL 0.33% ropivacaine was slowly injected. If the target position was not clear under ultrasound guidance, the current stimulation of the nerve stimulator caused an automatic contraction of the adductor muscle of the ipsilateral external anal sphincter, indicating that the needle was close to the pudendal nerve and the stimulating current was gradually reduced to 0.4mA. In this study, the anal sphincter contracted, indicating that the target location was reached and medication was injected. Care needed to be taken during the injection to prevent damage to nerves or blood vessels. Pudendal nerve block was performed in the same way on the other side. The control group was not given nerve block at the end of the operation.

Both groups received usual care after surgery, and physicians needed to observe the patient's response to ensure that the procedure was successful.

3.4. Evaluation indexes

The preoperative data of patients were collected, including gender, age, diagnosis, pain tolerance, diagnosis, etc. The intraoperative data of the patients were collected, including operation time, anesthetic response, intraoperative blood loss, etc. The first occurrence time of postoperative pain, the first use time of analgesic drugs, the grade of anal pain, the total amount of analgesic drugs, the urination, the occurrence of complications and the corresponding treatment methods, and the satisfaction of patients were recorded at 4h, 8h, 12h, 24h, 48h, and 72h after operation. Postoperative complications included bleeding, wound infection, anal stenosis, skin bridge edema, anesthetic reaction, local anesthetic toxicity, nausea and vomiting, urinary retention, and fecal retention.

3.5. Evaluation tool

The visual analogue scale (VAS) method was used to score the pain (Table 1). The scale is mainly composed of a 100 mm straight line. One end of the straight line indicates complete painless, and the other end indicates extreme pain. The patient marks the position on the straight line according to the pain situation, and the score ranges from 0 to 10. The higher the score, the higher the degree of pain.

Patient satisfaction was investigated using the department's self-made questionnaire, which was mainly based on the 0-10 numerical score, with <7 as unsatisfied and>=7 as satisfied. The patient satisfaction questionnaire included 15 questions, such as "Do you remember having nightmares during the surgery?", "Did you experience pain when the doctor performed the surgery?", "Can you recall what happened during the surgery?", and "Did you feel severe pain upon awakening after the surgery?" Patients were able to choose options such as "very much, somewhat, a little, not at all" based on their own experiences. The scores for each group were recorded and organized.

Table 1. Visual analogue scale scoring standard for postoperative pain among patients

Scores	Pain levels	Symptoms
0	No pain	No obvious pains and symptoms
1-3	Mild pain	Pain was tolerable with painless facial expression. Sleep was mildly disturbed without the need for painkillers
4-6	Moderate pain	Painful facial expression appeared and sleep was disturbed so that painkillers should be applied
7-10	Severe pain	Pain was excruciating and intolerable. Patients were restless, which seriously disturbed sleep or daily life

3.6. Statistical analysis

Data analysis was performed using the analytical methods as required by the CONSORT statement. The SPSS statistical software (version 23) was used for relevant data processing. Quantitative variables were denoted by mean and standard deviation, and qualitative variables were expressed as frequency (%). The comparison between groups was carried out by independent sample *t* test. Qualitative data were analyzed by Chi square, test and repeated measures ANOVA was used to analyze the VAS pain scores of the experimental group and the control group at different time points (4h, 8h, 12h, 24h, 48h, and 72h after operation). A *P-value* < 0.05 was considered statistically significant.

4. Results

4.1. Clinical data and intraoperative data

As given in Table 2, no significant difference was observed in the mean age and gender ratio of patients in the hemorrhoids group, anal fistula group, and anal fissure group (P>0.05), which were comparable. In terms of intraoperative indicators, the operation time of hemorrhoids in the experimental group was significantly higher than the control group (P<0.05).

The operation time and blood loss of anal fistula in the experimental group were significantly higher than those of the the control group (P<0.05). The operation time of the anal fissure in the experimental group was significantly higher than the control group (P<0.05).

4.2. Evaluation on first pain

As shown in Table 3, the first pain time of hemorrhoids in the experimental group was significantly lower than the control group (P<0.05), and the first pain time of anal fistula in the experimental group was significantly higher the control group (P<0.05). In terms of anal fissure, the first pain score of the experimental group was significantly lower than that of the control group (P<0.05).

Table 2. Basic clinical data and intraoperative indicators of the patients

Indicators		Hemorrhoids group		*P value*	Anal fistula group		*P value*	Anal fissure group		*P value*
		Control group (n=24)	Experimental group(n=32)		Control group(n=20)	Experimental group(n=18)		Control group(n=19)	Experimental group(n=21)	
Gender	Male	15(62.5%)	19(59.38%)	0.072	16(80%)	15(83.33%)	0.055	6(31.58%)	7(33.33%)	0.070
	Female	9(37.5%)	13(40.62%)		4(20%)	3(16.67%)		13(68.42%)	14(66.67%)	
Age (years)		42.38±12.54	39.63±13.43	0.064	40.95±13.58	39.61±12.94	0.085	43.47±11.34	41.81±14.30	0.066
Procedure time (minutes)		41.46±10.67	50.12±12.75	0.005*	24.7±17.25	30.11±18.15	0.012*	32.63±20.92	39.52±20.29	0.042*
Intraoperative blood loss (mL)		2.58±1.32	3.16±1.42	0.007*	1.55±0.55	3.17±2.11	0.008*	2.47±1.35	2.76±1.34	0.039*

* indicates that the difference between the experimental group and the control group is statistically significant (*P*<0.05)

Table 3. Comparison of the first postoperative pain time and score of patients

Indicators	Hemorrhoids group		*P value*	Anal fistula group		*P value*	Anal fissure group		*P value*
	Control group (n=24)	Experimental group(n=32)		Control group(n=20)	Experimental group(n=18)		Control group(n=19)	Experimental group(n=21)	
First pain time (h)	13.79±13.75	7.38±2.26	0.023*	3.65±1.35	11.76±9.25	0.011*	10.67±7.75	9.9±4.99	0.072
First pain score (points)	2.00±1.22	1.72±0.94	0.055	2.00±0.00	1.22±0.97	0.034*	1.22±0.42	1.14±0.35	0.068

* indicates that the difference between the experimental group and the control group is statistically significant (*P*<0.05)

4.3. Pain scores after surgery

As presented in Figure 1A, the comparison of VAS pain scores for hemorrhoids experimental and control groups at all time periods after surgery indicated no significant differences (P>0.05). As shown in Figure 1B, VAS pain score for anal fistula experimental group 48 h after surgery was significantly higher than that of the anal fistula control group (P<0.05). As suggested in Figure 1C, VAS pain score for anal fissure experimental group 48 h after surgery was apparently lower than that of the anal fissure control group (P>0.05).

4.4. Comparison of postoperative complications

As displayed in Table 4, one patient in hemorrhoids experimental group suffered from constipation. The total incidence of adverse reactions in hemorrhoids experimental group was 3.13%. In hemorrhoids control group, five patients suffered from urinary retention with the total incidence of adverse reactions of 20.83%. It can be seen that the incidence of adverse reactions in the hemorrhoids experimental group is significantly lower than that in the control group (P<0.05). According to the relevant data in Table 3, it was found that the total incidence of adverse reactions in anal fistula and fissure experimental groups were both lower than those in anal fistula and fissure control group (P<0.05).

4.5. Comparison of postoperative patient satisfaction

As shown in Figure 2, in terms of hemorrhoids, the satisfaction score for patients in the experimental group was 8.73 ± 0.52, while it was 7.62 ± 0.46 for the control group (P=0.330). Regarding anal fistula, the satisfaction scores for the experimental group and control group were 8.41 ± 0.42 and 7.03 ± 0.58 (P=0.192), respectively. Additionally, for anal fissure, the satisfaction score for the experimental group was 9.02 ± 0.61, compared to 7.67 ± 0.59 for the control

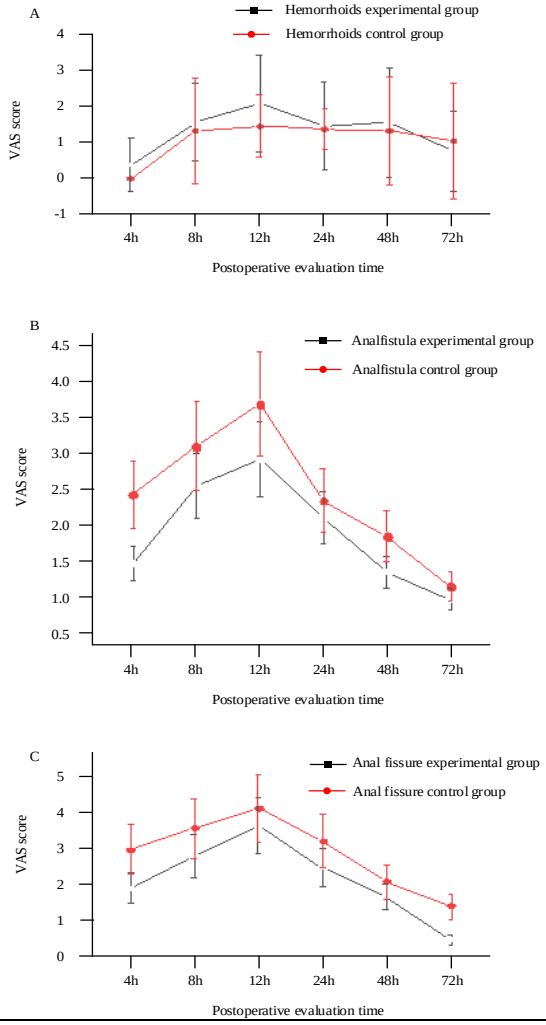

Figure 1. Visual analogue scale (VAS) pain scores during postoperative follow-up
Figure 1A shows VAS scores for patients with hemorrhoids, Figure 1B displays VAS scores for patients with anal fistula, and Figure 1C presents VAS scores for patients with anal fissure

Table 4. Statistics of postoperative complications

Indicators	Hemorrhoids group		*P* value	Anal fistula group		*P* value	Anal fissure group		*P* value
	Control group (n=24)	Experimental group(n=32)		Control group(n=20)	Experimental group(n=18)		Control group(n=19)	Experimental group(n=21)	
Urinary retention	5 (20.83%)	-	-	-	-	-	-	1 (4.76%)	-
Bleeding from the anal incision	-	-	-	1 (5%)	-		1 (5.26%)	-	-
Constipation	-	1 (3.13%)	-	2 (10%)	-	-	3 (15.79%)	-	-
Fecal retention	-	-	-	2 (10%)	1 (5.56%)	-	-	-	-
Total adverse reaction rate (%)	5 (20.83%)	1 (3.13%)	0.046*	5 (25%)	1 (5.56%)	0.037*	4 (21.05%)	1 (4.76%)	0.042*

* indicates that the difference between the experimental group and the control group is statistically significant (*P*<0.05)

group (P=0.071). Analysis of the research data indicated that patients in the experimental group had higher levels of satisfaction than those in the control group in terms of hemorrhoids, anal fistula, and anal fissure. These differences were statistically significant (P<0.05).

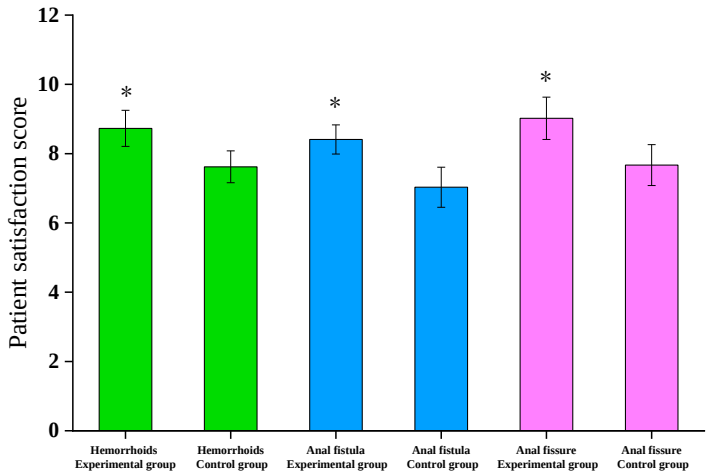

Figure 2. Investigation results of the postoperative patient satisfaction
Figures 2 shows the results of the satisfaction among patients with hemorrhoids, anal fistula, and anal fissure, respectively
*Indicating that the difference in patients' satisfaction between experimental and control groups was significant (P<0.05)

5. Discussion

Traditional local infiltration anesthesia for perianal procedures often leads to inadequate muscle relaxation and increased intraoperative and postoperative complications, significantly impacting the success of the surgery and patient recovery. Relevant studies have shown that over 80% of patients experience symptoms such as local anal pain and swelling following injection and ligation of internal hemorrhoids (15). Perianal nerve block anesthesia, based on regional anatomy theory, involves injecting anesthetic agents in the pain-insensitive zone located 7 mm below the dentate line, effectively reducing the occurrence of pain and other complications. In this work, patients undergoing perianal surgery were divided into groups based on the presence of mixed hemorrhoids, anal fistula, or anal fissure and then randomly assigned to either the control group or the experimental group. The experimental group received bilateral perianal nerve block under ultrasound guidance through the ALCOCK canal at the end of the surgery. Clinical indicators were analyzed for both groups of patients. The perianal nerve block performed under ultrasound guidance through the ALCOCK canal demonstrated good effectiveness, with noticeable postoperative analgesic effects. Many patients experienced significant pain relief and comfort after the surgery. This technique successfully alleviated postoperative pain and showed potential advantages in pain control. Additionally, through perianal nerve block, we observed fewer postoperative complications and adverse events. The ALCOCK canal ultrasound-guided nerve block exhibited improved safety during the postoperative recovery process. It will further discuss and explain these results in the following sections.

The obtained results revealed that the operation time of the experimental group using pudendal nerve block was higher than that of the control group, since this technique is an additional surgical step and takes a certain amount of time. In general, the amount of bleeding in the experimental group was higher than the control group in anal fistula surgery, and the amount of bleeding in the other two groups was not significantly increased. In terms of the first pain time, patients with hemorrhoids and anal fistula showed different situations, while patients with anal fissure showed no difference in the first pain time. In the first pain score of patients with anal fistula, the pain score of the experimental group was lower than that of the control group, which indicated that the effect of pudendal nerve block in anal fistula surgery was better than that of the traditional surgery. In addition, during the follow-up after surgery, it was found that the pain score of the experimental group was similar to that of the control group in terms of hemorrhoids at each time point, the pain score of the experimental group was higher than that of the control group in terms of anal fistula at 48 h after surgery, and the pain score of the experimental group was lower than that of the control group in terms of anal fissure at 48 h after surgery. After comparison, it was found that there was no significant difference in the postoperative pain of hemorrhoids, anal fistula, and anal fissure between the two surgical methods. The number of patients with postoperative complications

was small; however, the incidence of adverse reactions in each experiment was lower than the control group. This is similar to the results of a randomized controlled study conducted by Imbelloni et al. (2005) (16). They found that bilateral pudendal nerve block provided better pain relief after hemorrhoid surgery, reduced the need for analgesics, and the average duration of analgesia reached 23.8 ± 4.8 hours without increasing urinary retention and other local or systemic complications related to anesthetics. This is because pudendal nerve block in ALCOCK tube (pudendal tube) can block the concentric conduction of nerve fibers and reduce the excitability of vagus nerve, which can more effectively relax and soften the muscles and reduce or disappear the pain of patients.

Tepetes et al. (2010) (17) published a randomized prospective clinical trial showing that pudendal nerve block provides better analgesia than local anesthetics in hemorrhoid surgery without increasing complications. The latest double-blind randomized controlled study found that compared with patients with spinal anesthesia alone, pudendal nerve block can significantly reduce the pain of patients within 48 h after surgery without increasing postoperative complications, and can significantly shorten the hospital stay of patients (18). Jiaqing et al. (2023) (19) reported that pudendal nerve block after external stripping and internal ligation resection of mixed hemorrhoids could significantly reduce postoperative pain and the incidence of urinary retention, without increasing other complications, such as bleeding, infection, and anal stenosis. Fadel et al. (2021) (20), in a review of 339 studies, found that the use of bilateral neuroblocking agents during anorectal surgery can improve patient outcomes, especially when bupivacaine or lidocaine is used with anatomical markers or nerve stimulation techniques. These related studies have shown that the application of internal pudendal nerve block can effectively reduce the complications of anal surgery. According to the postoperative satisfaction survey of patients in this experiment, the postoperative satisfaction of patients in the experimental group with nerve block was significantly higher than that of the control group, indicating that nerve block can effectively reduce the pain of patients. However, the shortcomings of this experiment are that the sample size is not large enough and the sample source is single, which may reduce the reliability and representativeness of the experimental results. In patients with mixed hemorrhoids, anal fistula, and anal fissure, if there are differences between their surgical types, it may affect the comparability and generalization of the experiment. In addition, the evaluation indicators may also have limitations and can't fully reflect pain experience and rehabilitation of patients. In the future, more in-depth exploration in this direction is needed to provide a more effective plan for postoperative analgesia in patients undergoing perianal surgery.

6. Conclusion

Based on the findings of the present research, ALCOCK canal ultrasound-guided perianal nerve block demonstrated superior analgesic effects compared to traditional surgery in perianal procedures. Patients who undergone perianal nerve block experienced fewer adverse reactions and higher satisfaction levels. Future studies can focus on increasing the sample size and diversity, enhancing the completeness of experimental design, and further exploring the effectiveness and safety of this technique, establishing it as a reliable option for perianal surgery. In conclusion, ALCOCK canal ultrasound-guided perianal nerve block is a reliable choice for perianal surgery and holds significant value for widespread application.

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Footnotes

Conflicts of Interest: Authors state no conflict of interest.

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