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Application of Visual Teaching for Trunk Nerve Block in Standardized Training of Anesthesiology Residents

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Abstract: *Trunk nerve block includes thoracic paravertebral block, erectinal spinal plane block, quadrate abdominalis block, ilio-hypoabdominalis -ilioinguinal nerve block, rectus sheath block, transverse abdominalis plane block, etc. Visual teaching can ensure that anesthetist-training physicians understand the operation key points and anatomical basis of trunk nerve block. The application of visual teaching in trunk nerve block teaching of anesthetized physicians also clarified how to carry out ultrasonic maintenance and operation, and proposed the precautions of visual teaching, and clarified the teaching results and advantages. The application of ultrasonic visualization guidance technology in trunk block teaching makes the operation more standardized and specific, which can not only improve the learning initiative of students, but also ensure the teaching quality and teaching efficiency, facilitate the unification of teaching standards, and achieve the homogenization of teaching effects.*

Keywords: *Anesthesiology; standardized training; visual teaching; trunk nerve block*

1. Introduction

During the training of hospital residents, it is necessary to ensure the independent decision-making ability and self-learning ability of residents after the training, so that they can solve medical problems in time in the future. In particular, the standardized training and guidance of anesthesiology residents and the clinical practice ability of interns are extremely important. Once the personal ability of anesthesiologists is insufficient, it will not only affect the life, health and safety of patients, but also lead to the decline of the hospital's reputation [1]. At present, with the continuous progress of medical technology in China, it is necessary to pay attention to the quality characteristics, basic ability and knowledge structure of new medical talents during the training, so as to further promote the leapfrog growth of medical students to doctors. According to statistics, most of the professional knowledge of clinicians in China is acquired in post-graduation medical education, which pays more attention to on-the-job training of medical students, so that residents can improve their clinical skills and enrich their theoretical knowledge with high learning efficiency. However, there are great challenges during the teaching period, such as the patient's own physiological variation, the patient's own anatomy, etc., often there will be invasive operation errors, seriously affecting the quality of life of patients, and easily inducing medical complaints or medical disputes. Visual teaching is the teaching of anesthesia block by means of ultrasound, image and video. Ultrasound-guided nerve block has more than 30 years of experience. In order to improve this situation, this paper reviews the application effect of visual teaching in trunk nerve block teaching of anesthetized physicians. The specific contents are as follows.

2. Basic ultrasound knowledge for resident training physicians

2.1. Basic content

Most resident anesthesiologists have little understanding of ultrasound and imaging convenience, so they need to carry out corresponding basic knowledge teaching guidance. During the implementation of ultrasonic visualization teaching, the first stage is the explanation of basic ultrasound knowledge, covering ultrasonic system knowledge, scanning mode, probe working principle, piezoelectric effect, probe structure, ultrasonic mode, ultrasonic principle and advantages, propagation speed, ultrasonic refraction and reflection, and the concept of sound wave [2]. Teachers can invite ultrasound teachers to

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give lectures in different sessions to ensure the absorption and digestion of knowledge.

2.2. Choose the right ultrasound

In the early stage, the anesthesiologist's resident training teaching mostly used the machines eliminated by the ultrasound department, followed by the purchase of portable Apple brand ultrasound, and the recent application of Sono ultrasonic machine, the number gradually improved to 10, and equipped with esophageal ultrasound. The use of ultrasound visualization teaching makes the teaching of anesthesiologists more convenient and ensures the learning initiative of anesthesiologists.

The materials and tools required by the anesthesiologist during residence training include bone and joint model, heart model, ultrasound localization nerve block map, camera, video camera, various puncture needles, and nerve stimulator. The availability of teaching equipment can improve the learning methods and approaches of trained physicians and promote the improvement of nerve block teaching quality.

3. Guide and teach physicians to perform ultrasound maintenance and operation guidance for resident physicians

3.1. Practical operation teaching of ultrasound

After the resident physician has learned the basic knowledge of ultrasound, the instructor should conduct practical teaching, including disinfection of trunk nerve block and preoperative preparation, monitoring and guidance of vital signs, timely creation of venous channels for the patient, use of analgesics and sedatives according to the actual situation of the patient, and improve the patient's puncture discomfort. In particular, attention should be paid to the common functions of ultrasound. Such as the adjustment of probe gain, the conversion of probe mode, the adjustment of neural scanning options and scanning depth [3].

3.2. Clinical training in ultrasound

First of all, according to the difference in the location of the low-frequency ultrasonic probe or high-frequency ultrasonic probe, the former is mostly used for deep structure exploration, the latter is used for superficial structure exploration. Secondly, more attention should be paid to the selection of puncture pathways, and the blocking target should be determined according to the direction of ultrasound, adjacent structures, nerves, etc. Finally, the experimental drug was injected on the nerve surface, and other drugs were injected after withdrawal without blood, paying attention to the physiological response and vital signs of patients.

3.3. Understand the maintenance and maintenance of ultrasound machines

Before the operation demonstration, apply the probe protective cover, wipe the coupling agent after completion, clean the key interface, timely collect the ultrasonic wire and power cord, and put it in a specific position. During the teaching period, the teacher should inform the anesthesian-trained physician to pay attention to the use of ultrasound, follow the procedure, criticize and educate the operation mistakes, so as to reduce the failure of the ultrasound machine and avoid damage to the parts.

4. The application of visual teaching in trunk nerve block of resident training doctors

During the teaching period, it is necessary to inform the resident physician to pay attention to the safety of the anesthesia of the patient. During the visual guided nerve block, it is necessary to do a good job of attention guidance and teaching focus analysis.

4.1. Transversus abdominis plane block, TAPB

There are 4 pairs of muscles in the anterolateral abdominal wall from shallow to deep, including rectus abdominis, transversal abdominis, internal obliquus abdominis and external obliquus abdominis. The rectus abdominis is parallel to the midline and symmetrical along the white line. The fascia space between the transverse abdominalis and the internal oblique abdominalis is the plane of the transverse

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abdominalis, and its internal shape is T. The ~L spinal nerve passes through the foramen and exits the lateral intercostal and anterior cutaneous branches. Ultrasound-guided TAPB block includes posterior approach, lateral approach, and subcostal approach.

4.1.1. External approach TAPB technique

This approach technique requires that the patient remain in a lateral or supine position, disinfect the skin in the midline of the axillary area of the patient's abdomen on one side, use a convex array probe or a linear array probe, apply a coupling agent to the probe, and wear a sterile sleeve. The probe was positioned at the midaxillary line between the superior margin of the iliac crest and the 12th rib, perpendicular to the midaxillary line, using the in-plane technique, with the same operation as before. Lateral approach is a widely used TAPB technique at this stage, but its analgesic effect on the upper abdomen is not ideal after implementation. Some studies and experiments suggest that it can be combined with the subcostal approach to form multi-image injection to expand the block range. However, for patients with low muscle mass or the elderly or children, it is necessary to pay attention to the local dosage of anesthetic drugs and reduce drug concentration as much as possible.

4.1.2. Subcostal approach TAPB technique

In this approach, the patient is required to maintain a supine position, the patient's upper limbs are naturally placed on both sides of the chest wall, the patient's abdomen is fully exposed, and the upper abdomen skin is disinfected with a linear array probe (6-18MHz), the probe is applied with coupling agent, and sterile sleeves are worn. The probe was placed below the costal margin of the patient to identify the three layers of muscle and the plane of the transverse abdominal muscle. The needle was successively passed through the subcutaneous = external abdominal oblique muscle - internal abdominal oblique muscle or rectus abdominis from the inside out. When it reached the plane of the transverse abdominal muscle, the needle was drawn back without air and blood, and a small amount of normal saline was injected to determine the position of the needle tip.

4.1.3. Rear approach TAPB technique

In this approach, the patient is instructed to maintain a lateral lying position, with the affected side facing up, and the skin should be disinfected in the middle and back axillary lines of one side of the abdomen. A convex array probe or a linear array probe can be used, coupler is applied to the probe, and sterile sleeves are worn. The probe is positioned perpendicular to the posterior axillary line between the iliac crest and the costal margin [4]. The target location was superficial to the transverse fascia of the abdomen and anterior to the quadratus lumbois. The in-plane technique is used to enter the needle from inside out to reach the target plane, and the operation after safe withdrawal is consistent with the outside approach. Compared with the lateral TAPB technique, the posterior TAPB technique has better analgesic effect in gynecological surgery, cesarean section and lower abdominal surgery, and the analgesic time is longer.

4.2. Rectus sheath block, RSB

The rectus abdominis of the patient is a long elliptical muscle, with the medial margin near the white line, and the lateral margin showing an arcuate groove on the surface of the anterior abdominal wall, forming the semilunar line. The aponeus of the internal oblique, external oblique and rectus abdominis are divided into two layers, which wrap around the anterior and posterior positions of the rectus abdominis, forming the posterior sheath and anterior sheath of the rectus abdominis, and then fuse again into the medial white line. The upper 2/3 of the posterior sheath of the rectus abdominis is intact, and the lower 1/3 is absent near the middle of the umbilicus and pubis. The T7-u intercostal nerve, the anterior cutaneous branch of the subcostal nerve, passes inwards between the rectus abdominis and the posterior sheath of the rectus abdominis after penetrating from the plane of the transverse abdominis.

The patient should remain supine with both upper limbs placed naturally on both sides of the chest wall, exposing the anterior abdominal wall of the patient, and giving the skin disinfection treatment. Select a linear array probe, apply coupling agent to the probe, and wear a sterile sleeve. The probe was placed horizontally next to the white line, and blocked at the navel, below the umbilical cord, and above the umbilical cord according to the requirements of the operation. The probe should be made perpendicular to the white line. Color Doppler mode was used to identify the movement of abdominal artery and prevent vascular puncture. Intraplane technique was used to insert the needle from the inside out and gradually pass through the subcutaneous tissue, anterior sheath of rectus abdominalis muscle, muscle and posterior sheath of rectus abdominalis muscle. In the clinical report, it was pointed out that

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the dosage of RSB was 15-20 ml per side, and the current concentration was 0.25%-0.50% ropivacaine, 15-20 ml per side.

4.3. Iliohypogastric - ilioinguinal nerve block

4.3.1. Anatomical basis of iliohypogastric - ilioinguinal nerve

The iliohypoabdominal-ilioinguinal nerve consists of T12-L1 nerve fibers that run along the lateral margin of the psoas major, in front of the quadratus psoas, behind the kidney, and then through the front of the iliac muscle, passing through the transverse abdominus and the internal obliquus into the inguinal canal. The muscular branches are distributed in the abdominal wall muscle passing through the ilioinguinal nerve. The following two cutaneous branches are distributed in the skin. The anterior cutaneous branch, also known as the inferior abdominal branch, passes between the internal abdominal oblique muscle and the transverse abdominal muscle, oblique forward and down, about 2cm inside the anterior superior iliac spine, and penetrates the internal oblique aponeurosis of the external oblique abdomen, about 3cm above the subcutaneous ring of the inguinal canal, penetrates the external oblique aponeurosis of the abdomen, and innervates the skin of the pubic region. The lateral cutaneous branch: the lateral cutaneous branch, also known as the iliac branch, Above the anterior iliac ridge, at the junction of the middle 1/3, behind the lateral cutaneous branch of the 12th thoracic nerve, passing through the internal oblique and external oblique muscles of the abdomen, descending to the superficial fascia layer, distributed in the skin of the lateral gluteal region.

4.3.2. IHN/IIN block is commonly used

The patient was instructed to maintain a supine position, and the skin of the lower abdominal groin was disinfected. A linear array probe was used, and the probe was placed inside the anterior superior iliac spine, where the navel was directly connected to the anterior superior iliac spine. The hypoechoic structure between the transverse abdominal muscle and the internal oblique abdominal muscle could be observed under ultrasound [5]. The deep circumflex iliac artery can be investigated by using color Doppler mode. Using in-plane technique to enter the needle from the inside out, there is a relatively obvious breakthrough feeling when the needle tip enters the muscle layer, and the position can be defined by the injection of a small amount of salt water.

4.4. Quadratus lumborum block, QLB

The quadrate psoas are two deep muscles located on both sides of the spine in the posterior wall of the abdominal wall, starting from the lower margin of the 12th rib and the posterior part of the transverse process of the 1-4 lumbar vertebrae, ending at the upper margin of the iliac crest, with the psoas major muscle on the medial side and the erector spine muscle on the posterior side, separated by the middle layer of the thoracolumbar fascia.

4.5. Erector spinae plane block, ESPB

The patient should remain in a lateral position with the affected body facing upward. A low frequency convex array or high frequency linear array probe should be used to locate the corresponding spinous process and thoracic block according to the target. The probe should move from the 12th rib to the head, locate the target rib, and then move the probe inward until the spinous process and transverse process are located. The median sacral ridge image can be observed by ultrasound, and the articular process or transverse process of the 5th lumbar spine can be observed by moving towards the head position. The probe was moved to the transverse process of the target, marked, and the skin was disinfected. The probe was placed in the midline position of the spine, and the long axis of the probe was parallel to the spine. The sound image of the spinous process was observed under ultrasound. The probe moved 3cm to the affected side, and the sound image of the transverse process could be seen under the ultrasound. The transverse process surface of the upper thoracic segment was the trapezius muscle, the rhomboid muscle and the erector ridge muscle from shallow to deep, respectively, while the lower thoracic segment was the serrate muscle, the latissimus dorsi muscle and the erector ridge muscle [6]. The superficial space between rhomboid muscle and erector ridge muscle or the deep space between erector ridge muscle and transverse process can be selected as the approach.

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4.6. Thoracicparavertebral block, TPVB

The patient should be kept in a lateral position with the affected side facing upwards. A low-frequency convex array probe should be used. After selecting the spinous process corresponding to the thoracic vertebra segment, the probe should be placed laterally on the lateral spinous process, and the scanning depth should be set at 3 cm. During the operation, the tip of the needle passes through the erector spine muscle and the superior ligament of the costotransverse process to the thoracic paravertebral space, and the local anesthetic can be injected without blood or air, or the local anesthetic can be injected into the inner and upper side of the pleura and the outer and lower part of the articular process.

5. Teaching effect and clinical experience

The teaching of nerve block under ultrasound guidance is a new project in the teaching development of anesthesiology resident training physicians. Under the guidance of ultrasound technology, resident physicians can observe the bone surface, muscle and nerve tissue of patients. Visualization technology can ensure the success rate of puncture, accurately puncture direction and improve puncture clarity. At the same time, the visual teaching mode actively improves the learning initiative and enthusiasm of medical students in residential training, which can be quickly applied in clinical practice after they master the operational skills, promote the increase of learning self-confidence of medical students in residential training, make them more active in exploring learning content, and get positive feedback. In addition, after the implementation of visual teaching, the comprehensive level of teaching teachers is fully improved, and ultrasound guidance operation has high requirements for anatomy. In order to ensure the teaching quality, teaching teachers need to constantly learn new knowledge, so that they can be familiar with operational skills and understand the key teaching contents when teaching medical students in resident training. Another report [7] proposed that visual teaching could actively improve the safety of patients, and the use of ultrasonic visualization technology could ensure students' understanding of puncture safety, reduce the rate of erroneous puncture, ensure the safety of teaching operations, and increase the insurance system of teaching. At the same time, during the implementation of visual teaching, attention should be paid to the principle of gradual progress. After repeated basic knowledge education and simulation training, teachers should guide medical students in residential training to watch relevant teaching videos, so that they can understand the actual operation process and actual situation, and gradually carry out clinical teaching experiments, so that they can accurately understand the block demand and block location. The nerve block experiment was completed on the model [8].

6. Conclusions

To sum up, the application of ultrasonic visual guidance technology in trunk block teaching of clinical anesthesia makes the operation more specific and standardized, can stimulate students' enthusiasm, improve teaching safety and efficiency, facilitate the unification of teaching standards, and achieve the homogenization of teaching effects.

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