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Research Article

Anesthesiological Support of Thoracoscopic Operations: Vagosympathetic Blockade and High Epidural Anesthesia

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Abstract

Video-assisting thoracoscopic interventions have significant advantages over open thoracotomy procedures, including reduction of surgical pain, improvement of postoperative pulmonary function, reduction of mortality, reduction of hospital stay, but the optimal choice of anesthesia for these interventions remains relevant and not fully resolved issues of thoracic surgery.

The Purpose of the Work: Is to analyze the effectiveness of anesthesiological support for thoracoscopic operations on the lungs with a focus on unilateral vagosympathetic blockade and high epidural anesthesia.

Materials and Research Methods: 45 patients were included in the work: in group A (23 people) thoracospopic intervention was performed using high epidural anesthesia, in group B (22 people) - using unilateral paravertebral vagosympathetic blockade.

Research Results: In the case of epidural anesthesia for thoracoscopic interventions, cardiohemodynamic parameters are characterized by a tendency to hypotension and tachycardia ($p < 0.05$), compared with patients who have been used with vagosympathetic blockade

At 6 and 12 hours after the intervention, the subjective assessment of VAS pain was greater in the epidural group ($p < 0.05$). When assessing the need for additional intravenous administration of analgesics in the first 24 hours of the postoperative period, the number of patients in the epidural anesthesia group reached 35.0%, in the vagosympathetic block group - 14.0% (RR - 2.55 [0.77-8.41], OR - 3.38 [0.76-15.0], respectively).

Conclusions: Unilateral Vagosympathetic blockade according to Vishnevsky during thoracoscopic operations is not inferior in effectiveness of the analgesic effect of epidural anesthesia, while accompanied by a more stable level of cardiohemodynamics, a longer duration of analgesic effect and less need for intravenous administration of non-narcotic analgesics in the postoperative period.

Keywords: Video-assisted Thoracoscopic Surgery (VATS); Anesthesia

Entry

Video-assisted Thoracoscopic Surgery VATS has significant advantages over open thoracotomy procedures, including reduction of surgical pain, improvement of postoperative pulmonary function, reduction of mortality, reduction of hospital stay and are currently considered the most promising alternative to open interventions [5].

Despite the association of VATS with reduced surgical trauma and better postoperative results, significantly less tissue damage, this manipulation does not necessarily lead to the same reduction in the need for pain relief. Damage to the intercostal nerves, muscle damage, rib contractions or even fractures and damage to the pleural mucosa – all this is the cause of severe pain. Control of pain syndrome is one of the decisive factors in choosing a surgical intervention, since it is not only related to the effectiveness of manipulation, but also associated with the development of chronic pain, increased respiratory complications, increased length of hospital stay [6], decreased patient satisfaction. Effective pain control will increase patients' ability to rehabilitate, which can improve postoperative outcomes.

Methods of regional analgesia for thoracoscopic interventions are used from the concept of multimodal balanced anesthesia [1]. One of the main advantages is the ability to provide continued effective anesthesia throughout the surgical intervention with the transition to the postoperative period.

Thoracic epidural analgesia (TEA) remains the gold standard for perioperative and postoperative pain relief. According to the recommendations of the European Society of Regional Anaesthesia and Pain Management (ESRA), prolonged epidural analgesia (EA) is indicated for patients with severe comorbidities or during extended surgical intervention [1]. However, TEA is not currently the only choice for VATS due to the high potential risk associated with dura puncture, epidural hematoma, neuropathy and hypotension [2].

An alternative to EA may be paravertebral block (ESRA), which provides reliable afferent protection in the setting of ipsilaterality of the nociceptive flow to the posterior horns of the C7-Th11 spinal cord during thoracic surgery. Currently, paravertebral block (PVB) can be used in the presence of contraindications to epidural analgesia (coagulopathy, neurological diseases, complex thoracic spinal anatomy), as well as in patients who prefer to avoid hypotension associated with bilateral sympathetic block. The method of thoracic paravertebral block (TPVB), intercostal nerve blockade, should also be mentioned. These methods, combined with patient-controlled intravenous drug analgesia, have become the main focus of postoperative analgesia after VATS [8]. To date, various techniques and levels of depth for the Vagosympathetic block according to Vishnevsky have been proposed. Deeper infiltration in high paravertebral has been repeatedly associated with higher frequency complications, 6 by phrenic nerve block, 7 and wider craniocaudal spread, 8 but still widely performed. Posterolateral access to the deep block may be even more dangerous given its orientation towards the vertebral arteries [4]. Many questions regarding this method remain controversial.

In some studies, the authors focus on ideal concentrations of local anesthetics for shoulder and cervical plexus blockade [7]. Other authors link attention to the distribution of local anesthetic in tissues [2]. Also relevant is the involvement of the phrenic nerve at different depths of cervical plexus blockade [1].

At the same time, each method has its drawbacks. TPVB has recently been found to have a similar effect to pain control with fewer side effects than TEA [2]. Thoracoscopic intercostal nerve block is widely used in VATS because of its technical safety and simplicity [8]. But the duration of action is limited, to achieve the desired analgesic effect requires multiple injections and large doses of NSAIDs [4]. In 2016, Forero., *et al*. proposed a relatively new technique called erector spinae plane block (ESPB) [5]. In subsequent years, an increasing number of randomized controlled trials reported that ESPB could be used to provide effective treatment of analgesia after VATS [3].

Thus, the optimal choice of anesthesia method for providing thoracoscopic interventions remains relevant and not fully resolved issue of thoracic surgery.

The purpose of the work is to analyze the effectiveness of anesthesiological support for thoracoscopic operations on the lungs and mediastinal organs using Vagosympathetic blockade according to Vishnevsky and high epidural anesthesia.

Materials and Methods

The study was prospective and randomized. The inclusion criteria were: 1) the possibility of thoracoscopic intervention; 2) voluntary consent to participate in the study. The exclusion criteria are as follows: 1) severe obesity (BMI > 35 kg/m2); 3) ASA ≥ III; 4) severe respiratory failure; 5) heart failure; (6) pregnancy; 7) allergic reactions to local anesthetics; 8) dysfunction of platelets and coagulation; 9) acute infections; 10) mental illness; 11) use of opioids.

The study included 45 patients, who were divided into two groups: in group A (23 people), thoracospopic intervention was performed using high epidural anesthesia, in group B (22 people) – using unilateral vagosympathetic blockade according to Vishnevsky.

The criteria for evaluating efficacy were used: intensity of postoperative pain, consumption of analgesics in the postoperative period, chronization of pain. To assess pain, a visual-analogue scale (VAS) was used.

During surgery, all patients were regularly monitored with continuous pulse oximetry, ECG. Lung function, i.e. forced expiratory volume at 1 s (FEV1) and forced vital capacity (FVC), was assessed in a half-sitting position using a spirometer (EasyOne Spirometer, ndd Medical Technologies, Zurich, CH).

The need for analgesics was assessed taking into account the absolute (AR) and relative (RR) risks, as well as the odds ratio (OR) of the occurrence of the event, with the calculation of confidence intervals and the reliability criterion for RR and OR. Data processing was carried out using the standard software package Statistica 10.0 for Windows, calculated M - arithmetic mean and m - arithmetic mean error. Differences at $p < 0.05$ were considered probable.

All patients received written consent to participate in the study, the protocol of which was drawn up at a meeting of the commission on bioethical examination. The protocol is drawn up in accordance with the basic principles of the Helsinki Declaration on Biomedical Research.

Research Results

The gender-age distribution of patients included in the study is given in table 1.

Options	Group A n = 23	Group B n = 22	Just
Men, abs./%	11 (47,8%)	12 (54,5%)	23 (51,1%)
Women, abs./%	12 (51,2%)	10 (45,5%)	22 (48,9%)
Age, years	37,8 ± 4,8	38,4 ± 5,1	38,1 ± 4,9
BMI, kg/m^2	26,5 ± 3,8	26,8 ± 4,0	26,6 ± 4,2

Table 1: Gender-age distribution and body mass index in study groups.

The mean age of patients subjected to thoracoscopic intervention was 38.1 ± 4.9 years, body mass index - 26.6 ± 4.2 kg/m^2, with almost equal distribution of men and women (51.1 and 48.9%) and an unlikely difference in gender and age distribution in the study groups.

The duration of surgery, cardiohemodynamic data in observation groups are given in table 2.

Options	Group A	Group B	R
Duration of operation, min.	98,0 ± 15,2	90,0 ± 16,7	>0,05
SAT, mm rt. St.	103,2 ± 4,98	117,0 ± 5,12	<0,05
DAT, mmHg. Art.	52,6 ± 3,47	62,0 ± 6,11	<0,05
Heart rate, bpm.	97,0 ± 11,47	67,0 ± 12,2	<0,05
BH, movement/min.	14,7 ± 2,3	16,2 ± 1,7	<0,05

Table 2: Indicators of surgical monitoring and duration of surgery in patients subjected to thoracospopic intervention, depending on the method of anesthesiological support.

Note: p – probability of difference in indicators between observation groups.

The duration of surgery for epidural anesthesia with propofol varied from 62 to 117 minutes, on average, 98.0 ± 15.2 minutes, in the paravertebral anesthesia group with vagosympathetic blockade - from 54 to 105 minutes, on average - 90.0 ± 16.7 minutes. The difference in the duration of thoracoscopic interventions in the presented anesthesia groups was unlikely $p > 0.05$.

Cardiac hemodynamics data in the epidural anesthesia group are represented by stable indicators of systolic (SBP - 103.2 ± 4.98 mm Hg) and diastolic (DBP - 52.6 ± 3.47 mm Hg) pressure, however, with a tendency to hypotension and tachycardia (heart rate - 97.0 ± 11.47, beats/min.). In patients who used paravertebral block with vagosympathetic blockade, the parameters of systolic (SBP - 117.0 ± 5.12 mm Hg, $p < 0.05$) and diastolic (DBP - 62.0 ± 6.11 mm Hg, $p < 0.05$) pressure were within the normotensive limits, however, with a normal heart rate (heart rate - 67.0 ± 12.2, beats/min., $p < 0.05$).

By evaluating the preoperative, intraoperative and postoperative dynamics of hemodynamic parameters, the data presented in Figure 1 and 2.

As you can see, in the group of epidural anesthesia, the intraoperative decrease in systolic blood pressure was 26.2%, the increase in heart rate was 51.6%. 30 minutes after the intervention, the trend remained at 22.6% (SAP) and 43.8% (heart rate), Figure 1. In paravertebral vagosympathetic blockade, hemodynamic parameters were characterized by dynamic stability, Figure 2.

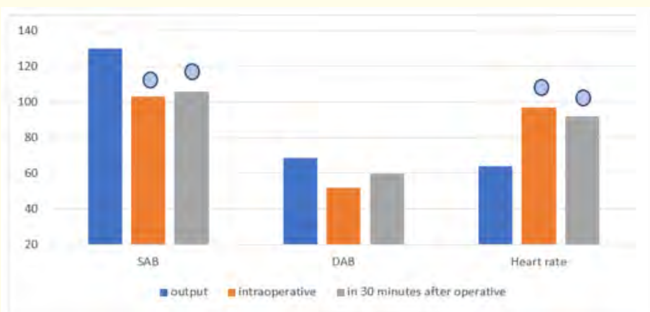

Figure 1: Hemodynamic parameters in the group of epidural anesthesia.

Note:

○ – probability of difference in indicators in the dynamics of observation.

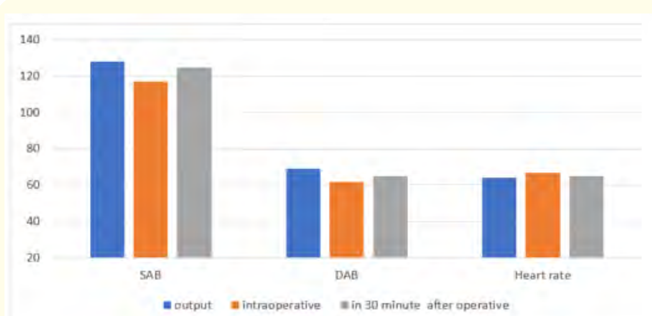

Figure 2: Hemodynamic parameters in the group of vagosympathetic blockade.

The respiratory rate, as evidenced by the data in Table 2, was within normopnea in both groups, with slightly higher rates in the vagosympathetic block group ($p < 0.05$), Table 2.

It should be emphasized that a kind of «mirror» of the effectiveness of intraoperative anesthesia are indicators of the visual analogue scale of pain intensity. The intensity of pain syndrome directly during the intervention and in the dynamics of the 1st day are shown in Table 3.

And, if directly during the intervention the intensity of pain in the anesthesiology groups did not differ probably, then 6 hours after the intervention, the subjective assessment of pain by VAS was greater in the epidural anesthesia group ($p < 0.05$). A similar pattern persisted also after 12 hours ($p < 0.05$). Perhaps this is due to the pharmacodynamics and absorption rate of the local anesthetic at different routes of its administration. However, in all cases, the intensity of pain in all patients was insignificant and less than 3 points on the visual analogue scale, Table 3.

Options	Group A	Group B	R
VAS operational	0,17 ± 0,06	0,14 ± 0,02	>0,05
VAS 6 year.	1,52 ± 0,08	0,83 ± 0,08	<0,05
VAS is 12 years old.	2,56 ± 0,09	1,72 ± 0,07	<0,05
VAS is 24 years old.	2,32 ± 0,06	2,40 ± 0,04	>0,05
VAS is 48 years old.	1,20 ± 0,07	1,48 ± 0,09	>0,05
VAS is 72 years old.	0,76 ± 0,03	0,60 ± 0,04	>0,05

Table 3: The intensity of pain directly during thoracoscopic interventions and in the dynamics of the 1st day in the groups of anesthesiological support.

Note:

p – probability of difference in indicators between observation groups.

After 24, 48 and 72 hours, the intensity of VAS pain in the observation groups probably did not differ, Table. 4.

Additionally, the need for intravenous administration of analgesics in the first 24 hours of the postoperative period in observation groups was assessed, Table 4.

Options	AR,%	RR [CI%95]	OR [CI%95]
Group A	35,0	2,55 [0,77-8,41]	3,38 [0,76-15,0]
Group C	14,0		

Table 4: The need for intravenous analgesics in the first 24 hours of the postoperative period in observation groups.

RR and OR were set at 2.55 [0.77-8.41] and 3.38 [0.76-15.0], respectively, Table 4.

The number of patients requiring intravenous administration of ketoprofen on the 1st day after the intervention in the epidural anesthesia group reached 35.0% (8 people), in the vagosympathetic blockade group – 14.0% (4 people).

Discussion

Epidural blockade is an effective method of anesthesia for thoracoscopic interventions, but is associated with side effects, the main of which is hypotension. Vagosympathetic blockade is an alternative method that provides a reliable comparable efficacy of anesthesia with fewer side effects [7]. The introduction of local anesthetic causes unilateral somatic and sympathetic blockade, which is the method of anesthetic choice for unilateral chest surgical procedures and abdominal cavity [6]. Paravertebral block is the best option in patients for whom epidural anesthesia may be contraindicated (taking anticoagulants and antiplatelet agents, the danger of an epidural hematoma), inflammatory skin lesions in the area of the intended epidural puncture, existing neurological diseases, disorders of the anatomy of the thoracic region (scoliosis, lordosis, kyphosis). These unique characteristics are associated with ipsilateral spinal nerve block and sympathetic circuit without blockage of the contralateral sympathetic circuit [1].

The efficacy of vagosympathetic block is clinically confirmed, but its limitations include dependence on the spread of local anesthetic in non-targeted spaces. In recent years, this type of blockade has been increasingly used because of its safety and accuracy in pain relief, especially in the absence of ultrasound or contraindications to epidurals.

In general, there are several studies that compare high epidural to vagosympathetic blockade, but their results are contradictory in most cases. In particular, the rate of diffusion of local anesthetic from the injection zone in the cervical space and its dependence on spontaneous respiratory movements are important, which may cause slow efficiency [8].

Conclusions

- In the case of epidural anesthesia during thoracoscopic interventions, cardiohemodynamic parameters are characterized by a tendency to hypotension (with a decrease in systolic blood pressure by 26.2%, $p < 0.05$) and tachycardia (with an intraoperative increase in heart rate by 51.6%, $p < 0.05$), compared with patients who used vagosympathetic blockade. 30 minutes after the intervention, the trend remained at 22.6% (SAP) and 43.8% (heart rate). With vagosympathetic blockade, hemodynamic parameters were characterized by dynamic stability.
- The frequency of respiratory movements when performing epidural anesthesia or vagosympathetic block was within normopnea in both groups, with higher rates in the vagosympathetic block group ($p < 0.05$).
- Directly during the intervention, the intensity of pain in the anesthesiology groups probably did not differ, but after 6 and 12 hours, the subjective assessment of pain by VAS was greater in the epidural anesthesia group ($p < 0.05$). In all cases, the intensity of pain in all patients was negligible and less than 3 points on the visual analogue scale.
- When assessing the need for additional intravenous administration of analgesics in the first 24 hours of the postoperative period, the number of patients in the epidural anesthesia group reached 35.0%, in the vagosympathetic block group – 14.0% (RR - 2.55 [0.77-8.41], OR - 3.38 [0.76-15.0], respectively).

Prospects for Further Research

Further research is needed, with careful selection of patients by age, body mass index, initial functional parameters of the cardiovascular and respiratory systems. It is important to assess the volume and type of local anesthetic for pharmacodynamic properties.

Bibliography

1. Bowness JS., *et al*. "International consensus on anatomical structures to identify on ultrasound for the performance of basic blocks in ultrasound-guided regional anesthesia". *Regional Anesthesia and Pain Medicine* 47.2 (2022): 106-112.

2. Campos JH and Peacher D. "Choosing the best method for postoperative regional analgesia after video-assisted thoracoscopic surgery". *The Journal of Cardiothoracic and Vascular Anesthesia* 34.7 (2020): 1877-1880.

3. Forero M., *et al*. "The erector spinae plane block: A novel analgesic technique in thoracic neuropathic pain". *Regional Anesthesia and Pain Medicine* 41 (2016): 621-627.

4. Hernandez-Vaquero D., *et al*. "Survival After Thoracoscopic Surgery or Open Lobectomy: Systematic Review and Meta-Analysis". *The Annals of Thoracic Surgery* 111 (2020): 302-313.

5. Hong JM., *et al*. "A prospective double-blinded randomized control trial comparing erector spinae plane block to thoracic epidural analgesia for postoperative pain in video-assisted thoracic surgery". *Saudi Medical Journal* 44.2 (2023): 155-163.

6. Jack JM., *et al*. "The role of serratus anterior plane and pectoral nerves blocks in cardiac surgery, thoracic surgery and trauma: a qualitative systematic review". *Anaesthesia* 75 (2020): 1372–1385.

7. Kingma BF., *et al*. "Paravertebral catheter versus Epidural analgesiain Minimally invasive Esophageal resectio N: a randomized controlled multicentertrial (PEPMEN trial)". *BMC Cancer* 20.1 (2020): 142.

8. Pakpirom J., *et al*. "Real-time ultrasound-guided versus anatomic landmark-based thoracicepi dural placement: aprospective, randomized, superioritytrial". *BMC Anesthesiology* 22.1 (2022): 198.