

Multimodal approach to pain management in thoracic surgery

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The American Cancer Society estimated that 68,820,000 men and 61,360,000 women in the United States of America would die from lung and bronchial cancer in 2022, which is equal to 21 % of all cancer deaths. Patients who undergo thoracotomy have a higher risk of postoperative complications due to the severe pain syndrome that typically develops after surgery. Even though there has been extensive research on the advantages and disadvantages of various perioperative analgesia techniques, the search for the best and safest still continues.

OBJECTIVE — to improve the results of perioperative anesthesia in patients undergoing thoracotomy by choosing the optimal method of analgesia.

MATERIALS AND METHODS. A total of 59 patients with lung cancer who underwent thoracotomy at the communal non-profit enterprise «Kyiv City Clinical Hospital No 17» from 2018 to 2020 were included in an open-label noncommercial randomized controlled clinical trial. Patients were divided into 2 groups: the multimodal analgesia (MA) group (32 patients) and the epidural analgesia (EA) group (27 patients). According to the concept of preemptive analgesia, patients in the MA group received 1000 mg of paracetamol and 50 mg of dexketoprofen intravenously 1 hour before surgery. In the postoperative period, dexketoprofen and paracetamol were administered every 8 hours in combination with epidural analgesia. During postoperative epidural analgesia, patients received 40 mg of a 2 % lidocaine solution through a catheter inserted into the epidural space (Th5—Th6) and a ropivacaine 2 mg/mL (3—14 mL/h) infusion. Patients in the EA group received only epidural analgesia in the postoperative period. After placement of an epidural catheter in the epidural space (Th5—Th6), they had an injection of 40 mg of a 2 % lidocaine solution and an epidural infusion of ropivacaine 2 mg/ml (3—14 mL/h).

RESULTS. The study groups did not demonstrate a statistically significant difference in terms of age, height, weight, a grade of anesthesiological risk (ASA), blood loss, surgery duration, and surgical volume ($p > 0.05$). The level of analgesia was assessed using the numerical rating scale (NRS) after 3, 6, 24, and 32 hours after surgery. Every research stage revealed a significant difference in the level of pain syndrome between the study groups ($p < 0.05$). Patients in the EA group experienced more severe pain syndrome than those in the MA group. Consequently, 7 patients (26%) in the EA group were anesthetized with morphine 10 mg intramuscularly compared to 3 patients (9%) in the MA group.

CONCLUSIONS. In patients undergoing thoracic surgery, a multimodal analgesic approach, which includes the use of COX-2 and COX-3 inhibitors in combination with epidural analgesia, has been shown to produce better analgesia compared to epidural anesthesia alone. The beneficial effect of multimodal analgesia was seen in a significant difference ($p < 0.05$) in the intensity of pain syndrome between the study groups in the early postoperative period after thoracotomy.

KEYWORDS

NSAIDs, enhanced recovery after surgery, multimodal analgesia, postoperative pain.

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19.3 million new cases of cancer were registered in 2020. Lung cancer is the second most common cancer worldwide. It is the most common cancer in men and the second most common cancer in women. In 2020, there were 2,206,771 new cases of lung cancer

diagnosed in both genders and at all ages worldwide. It is 11.4 % of the total 19,292,789 new cases of cancer globally.

According to the data provided by the American Cancer Society, lung cancer is by far the leading

cause of cancer death, making up 1,796,144 cases per year, or 18 % of all cancer deaths [29]. The American Cancer Society estimated that 68,820,000 men and 61,360,000 women in the United States of America would die from lung and bronchial cancer in 2022, which is equal to 21 % of all cancer deaths [4].

Oncological diseases of the upper and lower respiratory tract are the most common causes of morbidity and mortality in the structure of malignant neoplasms in Ukrainian men aged from 30 to 74 years. According to the data provided by the National Cancer Registry (bulletin No 22) for 2020, the incidence rate of malignant neoplasms of the trachea, bronchi, and lungs was 15.2 % and the mortality rate was 16.5 % [1]. The total number of registered patients with oncological diseases of the trachea, bronchi, and lungs was 32,701 per 100,000 population (23,539 per 100,000 population in men and 9,162 per 100,000 population in women) [2].

43.3 % of patients with the 4th stage of malignant neoplasms of the trachea, bronchi, and lungs were identified for the first time in Ukraine in 2021. For other stages, this indicator was as follows: 7.9 % with the 1st stage, 7.8 % with the 2nd stage, and 30 % with the 3rd stage [2].

Cigarette smoking is the number one risk factor for lung cancer. The CDC reports that people who smoke cigarettes are 15 to 30 times more likely to develop lung cancer or die from lung cancer than people who do not smoke. Even smoking a few cigarettes a day or smoking occasionally increases the risk of lung cancer [8]. The tobacco epidemic is one of the greatest public health threats that the world has ever faced. Tobacco kills more than 8 million people each year worldwide. More than 7 million of those deaths are the result of direct tobacco use, while around 1.2 million are the result of non-smokers being exposed to second-hand smoke [14]. Mostly, lung cancer requires complex treatment, which includes surgery (atypical resection, lobectomy, or pneumonectomy). The extent of surgical intervention depends on the stage, morphological characteristics, and localization of the tumor. A thoracotomy is a surgical procedure in which an incision is made between the ribs for the purpose of inserting a retractor for further visualization and removal of the tumor. Operative interventions on the lungs, such as a thoracotomy, which is one of the most painful procedures, are accompanied by severe pain syndrome in the postoperative period and can lead to an increased number of cases of chronic pain syndrome after hospital discharge [13, 16, 24].

Among the factors that may be linked to postoperative pain are intraoperative damage to the ribs caused by the insertion of a retractor, damage to the

intercostal nerves, the use of drains, rib raising, suturing technique, etc.

Due to the severe pain syndrome in the postoperative period, patients who undergo thoracotomy have an increased risk of developing postoperative complications, with pneumonia and atelectasis prevailing [7]. In most cases, these complications result from impaired sputum evacuation due to the patient's inability to adequately cough up sputum and a significant decrease in breathing volume [7, 11, 13, 17].

Complications increase the patient's recovery time and the length of hospital stay, which leads to rising costs of medical treatment and a longer period of temporary disability. Since pain is a subjective sign, doctors often underestimate its intensity for a particular patient. As a result, the chance of developing complications in the postoperative period increases. According to the US Institute of Medicine, from 30 % to 75 % of patients report severe pain despite anesthesia [9].

Modern perioperative analgesia includes multimodal analgesia, which combines the administration of two or more analgesic drugs that act on the transduction, transmission, modulation, and perception of pain impulses.

An Enhanced Recovery After Surgery (ERAS) program, or «fast-track surgery», was pioneered by H. Kehlet, a Danish colorectal surgeon, in the 1990s. It is an evidence-based multimodal approach that has been shown to limit surgical trauma burden, relieve pain, and ensure early and uneventful postoperative recovery. The ERAS program addresses perioperative care concerns, aspects of the surgical technique, and the postoperative period in patients who undergo surgical treatment [19, 31]. ERAS is based on pathophysiological principles that allow for reduced postoperative stress, pain relief, early mobilization, and the commencement of early oral nutrition [20].

There are many methods of perioperative analgesia for patients undergoing thoracic surgery, but the search for the best method of analgesia is still ongoing. The gold standard of this procedure is the placement of an epidural catheter at the level of Th5–Th6 in the epidural space with the aim of further administration of anesthetics for analgesia at the appropriate level. Analgesia is achieved by blocking the transmission of impulses along the nerve endings of the spinal cord. Nevertheless, not all studies have shown the advantage of epidural analgesia over alternative types of regional anesthesia [27].

Epidural analgesia (EA) is most often used in thoracic surgery. However, since oncological diseases of the trachea, bronchi, and lungs are among the 5 most common nosological forms of malignant

neoplasms that affect men aged 30 to 74 years in Ukraine, it is necessary to take into account possible complications that may arise during or after placing an epidural catheter [2]. The most frequent side effects of epidural analgesia are hypotension in the intraoperative and postoperative periods, dizziness, itching at the puncture site, and uneven or unilateral analgesia due to improper positioning of the epidural catheter [15].

In 1983, C. J. Woolf first proposed the concept of preemptive analgesia. In his study, he provided evidence of central sensitization, which he described as the formation of complex pain syndrome after irritation. Preemptive analgesia involves the administration of analgesic drugs before surgery in order to prevent postoperative pain [21]. In 2002, H. Kehlet and I. Dahl observed no benefit from the preoperative administration of nonsteroidal anti-inflammatory drugs compared to the postoperative one, evaluating the level of postoperative analgesia and the development of chronic pain syndrome [23].

Nonsteroidal anti-inflammatory drugs (NSAIDs), which are part of multimodal anesthesia, suppress the body's inflammatory response to a stimulus, such as surgery, by inhibiting cyclooxygenase (COX) [32]. Since the stress response to surgery may increase the risk of exacerbation of a gastric ulcer, NSAIDs should be cautiously prescribed to prevent bleeding from the gastrointestinal tract [28].

A study that involved 250 randomized patients who had recently undergone surgery showed that 80% of patients experienced acute pain after surgery, and almost 25% of patients experienced side effects after taking pain medication [5].

Even though there has been extensive research on the advantages and disadvantages of various perioperative analgesia techniques, the search for the best and safest still continues.

OBJECTIVE – to improve the results of perioperative anesthesia in patients undergoing thoracotomy by choosing the optimal method of analgesia.

Materials and methods

The study was conducted according to the ethics principles of the Helsinki Declaration, GCP (Good Clinical Practice), and the Law of Ukraine «On Medications» and was approved by the Ethics Commission of Bogomolets National Medical University. After being informed about the research, all patients signed a research participant agreement.

The scientific research work «Optimization of Perioperative Management of Patients in Cardiothoracic Surgery» served as the foundation for this study. A total of 59 patients with lung cancer who

underwent thoracotomy at the communal non-profit enterprise «Kyiv City Clinical Hospital No 17», Department of Anesthesiology and Intensive Therapy of Bogomolets National Medical University, from 2018 to 2020 were included in an open-label noncommercial randomized controlled clinical trial. Randomization was performed using an unequal randomization method. Patients were divided into 2 groups: the multimodal analgesia (MA) group and the epidural analgesia (EA) group. There were 32 patients in the MA group and 27 patients in the EA group.

According to the concept of preemptive analgesia, patients in the MA group received 1000 mg of paracetamol and 50 mg of dexketoprofen intravenously 1 hour before surgery. In the postoperative period, dexketoprofen and paracetamol were administered every 8 hours in combination with epidural analgesia. During postoperative epidural analgesia, patients received 40 mg of a 2% lidocaine solution through a catheter inserted into the epidural space (Th5–Th6) and a ropivacaine 2 mg/mL (3–14 mL/h) infusion.

Patients in the EA group received only epidural analgesia in the postoperative period. After placement of an epidural catheter in the epidural space (Th5–Th6), they had an injection of 40 mg of a 2% lidocaine solution and an epidural infusion of ropivacaine 2 mg/mL (3–14 mL/h).

The inclusion criteria were: (1) men and women 30 to 80 years old; (2) lung cancer requiring surgery; (3) a PS of 0 to 1 on the ECOG scale; (4) a signed research participant agreement; (5) absence of concomitant pathology or concomitant pathology in stable remission (ASA classes II–III); (6) a negative pregnancy test and the use of effective contraceptives during the entire study and 3 weeks after it; or inability to have children (hysterectomy or tubal ligation, a clinical diagnosis of infertility); or menopause for more than 1 year (absence of menstruation for at least 12 months). Adequate methods of contraception include surgical sterilization, the double-barrier method of contraception, local contraception, and the ability to follow all the statements of the agreement.

The exclusion criteria were: (1) refusal to participate in the research; (2) age under 30 or over 80; (3) hypersensitivity to dexketoprofen, paracetamol, ropivacaine, or lidocaine; (4) malignant neoplasms of the heart, pericardium and/or large vessels; (5) hemoglobin level < 90 g/L at the time of surgery; (6) participation in any other clinical trial; (7) gastric or duodenal ulcer with a risk of bleeding in the anamnesis; (8) kidney failure or liver failure; (9) pregnancy or lactation; (10) massive

intraoperative blood loss requiring transfusion of formed blood elements; (11) diabetes mellitus (type 1 and type 2); (12) any other subcompensated or decompensated somatic diseases, or those assessed as severe or moderate (ASA class IV).

The standard and analytical data models were created in Excel and in Statistica 10, respectively. All calculations and graphs were made in the Statistica 10 application.

Results and discussion

Since the principal goal of preemptive analgesia is rapid recovery, it is important to provide adequate pain relief and early mobilization of patients in the early postoperative period, which can be achieved through a multimodal approach [20]. The presence of side effects and complications related to the placement of an epidural catheter explains the search for alternative pain relief techniques. It is recommended to insert an epidural catheter into the thoracic spine at the level of the 5th–6th vertebra during thoracotomy. It is assumed that manipulation at a higher level increases the risk of neurological damage to the spinal cord. As an alternative to catheterization of the epidural space, the effectiveness of intravenous administration of non-steroidal anti-inflammatory drugs (NSAIDs), such as tramadol and lornoxicam, has been reported in patients after thoracotomy. The authors noted a reduction in side effects and pulmonary complications in patients who received NSAIDs intravenously [18].

Maintaining proper breathing in patients who have had respiratory surgery is crucial for ensuring adequate ventilation. Respiratory complications in the early postoperative period may be associated with depression of the respiratory center due to the action on the mureceptors of the respiratory center, increased muscle tone, decreased respiratory volume, and increased hypercapnia [3, 22, 25].

Our study shows a reduction in the need for opioid prescriptions since a decrease in blood pressure in patients after the administration of opioids is highly undesirable and pulmonary surgery requires a restrictive approach to infusion therapy [6].

A total of 59 patients participated in the study. The study groups did not demonstrate a statistically significant difference in terms of age, height, weight, a grade of anesthesiological risk (ASA), blood loss, surgery duration, and surgical volume ($p > 0,05$). Table 1 presents demographic data of the groups.

18 lobectomies, 8 pneumonectomies, 4 atypical lung resections, and 2 bilobectomies were performed in the MA group, compared to 17 lobectomies, 6 pneumonectomies, 3 atypical lung resections, and

Table 1. **Characteristics of patients by age, gender, height, weight, a grade of anesthesiological risk (ASA), blood loss, surgery duration and surgical volume**

| Index | MA group (n = 32) | EA group (n = 27) |
|--------------------------|-------------------|-------------------|
| Age, years | 57.4 ± 11.2 | 57.02 ± 10.3 |
| Male/female | 26/13 | 28/9 |
| Weight, kg | 75.5 ± 13.4 | 76.7 ± 16.7 |
| Height, cm | 170.9 ± 6.7 | 169.4 ± 7.5 |
| ASA: II/III | 27/5 | 23/4 |
| Blood loss, mL | 369.0 ± 69.3 | 358.0 ± 76.3 |
| Duration of surgery, min | 137.5 ± 91.8 | 164.0 ± 61.06 |

All $p > 0.05$.

1 bilobectomy in the EA group. Figure presents surgical volume for each group.

Blood pressure, heart rate, respiration rate, and SpO₂ were evaluated during the patients' stay in the ICU. Additionally, all patients in both groups were administered nasal or mask oxygen with a flow of 3–4 L/min for the first 12–24 hours after surgery.

The level of analgesia was assessed using the numerological rating scale (NRS), where 0 mm is the absence of pain and 100 mm is unbearable pain. Pain control assessment times were 3, 6, 24, and 32 hours after surgery.

Analgesia was considered effective if the pain level was up to 50 mm according to the NRS scale and there was no need for additional morphine analgesia. Table 2 present comparison of NRS values in particular groups after surgery.

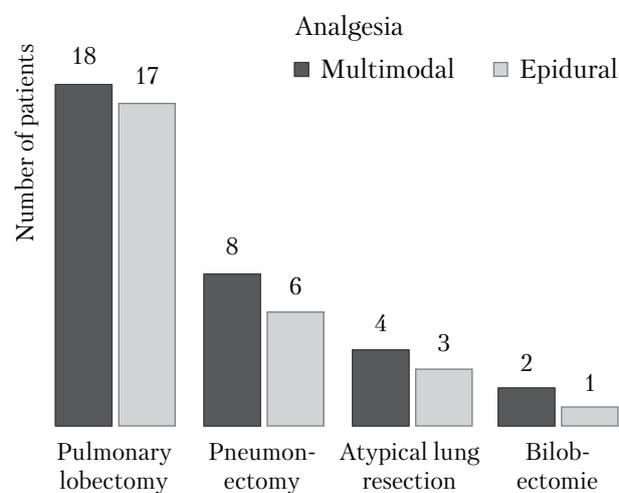


Figure. **Differentiation of operations for each group**

Table 2. Comparison of NRS values in the study groups 3, 6, 24, and 32 hours after surgery

| Index | MA group | EA group |
|--|------------|---------------|
| 3 hours after surgery | 21.4 ± 1.3 | 31.2 ± 2.1* |
| 6 hours after surgery | 25.3 ± 1.7 | 37.4 ± 1.8* |
| 24 hours after surgery | 28.1 ± 1.5 | 34.6 ± 2.3*** |
| 32 hours after surgery (during coughing) | 31.7 ± 2.1 | 41.2 ± 2.7** |
| Requirement for additional analgesia with morphine | 3 (9%) | 7 (26%) |

* p < 0.001; ** p < 0.01; *** p < 0.05.

The assessment of pain syndrome 3 hours after surgery showed that patients in the EA group experienced more intensive pain syndrome than patients in the MA group, although the indicator corresponded to mild or moderate pain. 6 hours after surgery, 4 patients (14 %) in the EA group reported severe pain that was not reduced by an increased bolus injection volume of ropivacaine into the epidural catheter. These patients were anesthetized with 1 mL of 1 % morphine intramuscularly. Only 2 patients (6 %) in the MA group reported severe pain and were also anesthetized with 1 mL of 1 % morphine intramuscularly. A day after surgery, early mobilization was used in both groups, which included sitting on the bed. Another 3 patients (11 %) from the EA group reported pronounced pain along with irritating effect of mobilization and cough. They were anesthetized with an additional dose of morphine. In the MA group, only 1 patient (3 %) reported pronounced pain. 32 hours after surgery, patients in both groups were subjectively satisfied with the level of analgesia, which was estimated to be less than 40 mm on the NRS scale during rest. Therefore, the level of analgesia was assessed during coughing. Although all patients in both groups did not report pain before being asked to cough up sputum, patients in the EA group reliably reported more severe pain during coughing.

More than one analgesic modality is used to achieve effective pain control after surgery. Systemic administration of two or more drugs that are strategically combined to block pain perception at various locations in the peripheral and central nervous systems while providing analgesia may improve pain relief and reduce opioid consumption [12].

In many other studies, multimodal analgesia provided better analgesia with more rapid postoperative recovery and a lower number of side effects.

It most likely has a positive impact on further outcomes [10, 30]. ERAS protocols, minimally invasive surgery, and intraoperative anesthetic management improve the prognosis and safety of thoracic surgery.

Admission to the ICU is especially recommended for patients with comorbidities, a reduced cardiopulmonary reserve, extensive lung resections, or those requiring support due to life-threatening organ failure. Intensive cardiorespiratory monitoring, proper management of thoracic drainage, aggressive pain control (multimodal analgesia and regional anesthesia), nausea, and multimodal rehabilitation are key elements for avoiding adverse effects during the postoperative period [26].

Conclusions

The increasing incidence of lung cancer worldwide contributes to the growing necessity of surgical treatment. After thoracotomy, patients require the safest and most effective method of analgesia. In patients undergoing thoracic surgery, a multimodal analgesic approach, which includes the use of COX-2 and COX-3 inhibitors in combination with epidural analgesia, has been shown to produce better analgesia compared to epidural anesthesia alone. The beneficial effect of multimodal analgesia was seen in a significant difference (p < 0.05) in the intensity of pain syndrome between the study groups in the early postoperative period after thoracotomy.

Preemptive analgesia in combination with epidural analgesia produces a satisfactory level of analgesia and allows for reduced use of opioids in the early postoperative period.

DECLARATION OF INTERESTS

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHORS CONTRIBUTIONS

H. Poniatovska: idea, design, materials and methods, formalization, statistics; S. Dubrov: materials and methods, design, data processing, conclusions.

REFERENCES

- Федоренко ЗП, Гулак ЛО, Михайлович ЮЙ та ін. Рак в Україні, 2020-2021. Захворюваність, смертність, показники діяльності онкологічної служби [Електронний ресурс]. Бюлетень Національного канцер-реєстру України 2021;22. http://www.ncru.inf.ua/publications/BULL_22/index.htm
- Федоренко ЗП, Сумкіна ОВ, Гулак ЛО, Горох ЄЛ та ін. Рак в Україні, 2020-2021. Захворюваність, смертність, показники діяльності онкологічної служби [Електронний ресурс]. Бюлетень Національного канцер-реєстру України 2022;23. http://www.ncru.inf.ua/publications/BULL_23/index.htm

3. Algera MH, Olofsen E, Moss L, et al. Tolerance to opioid-induced respiratory depression in chronic high-dose opioid users: a model-based comparison with opioid-naïve individuals. *Clin Pharmacol Ther.* 2021 Mar;109(3):637-45. doi: 10.1002/cpt.2027. Epub 2020 Oct 5.
4. American Cancer Society. Cancer Facts & Figures 2022. Information and Resources about for Cancer: Breast, Colon, Lung, Prostate, Skin. <https://www.cancer.org/research/cancer-facts-statistics/all-cancer-facts-figures/cancer-facts-figures-2022.html>
5. Apfelbaum J, Chen C, et al. Postoperative pain experience: results from a national survey suggest postoperative pain continues to be undermanaged. *Anesth Analg.* 2003 Aug;97(2):534-40. doi: 10.1213/01.ANE.0000068822.10113.9E
6. Baldo BA. Toxicities of opioid analgesics: respiratory depression, histamine release, hemodynamic changes, hypersensitivity, serotonin toxicity. *Arch Toxicol.* 2021 Aug;95(8):2627-42. doi: 10.1007/s00204-021-03068-2. Epub 2021 May 11.
7. Carr DB, Goudas LC. Acute pain. *Lancet.* 1999 Jun;353(9169):2051-8. doi: 10.1016/S0140-6736(99)03313-9.
8. CDC. Centers for Disease Control and Prevention. What are the risk factors for lung cancer? https://www.cdc.gov/cancer/lung/basic_info/risk_factors.htm
9. Chauvin M. Prise en charge post-opératoire. La douleur après l'intervention chirurgicale [Postoperative patient management. Pain after surgical intervention]. *Presse Med.* 1999 Jan 30;28(4):203-11. (In French)
10. Dunn LK, Durieux ME, Nemergut EC. Non-opioid analgesics: Novel approaches to perioperative analgesia for major spine surgery. *Best Pract Res Clin Anaesthesiol.* 2016;30:79-89.
11. Fiorelli A, Morgillo F, Milione R, et al. Control of post-thoracotomy pain by transcutaneous electrical nerve stimulation: effect on serum cytokine levels, visual analogue scale, pulmonary function and medication. *Eur J Cardiothorac Surg.* 2012 Apr;41(4):861-8; discussion 868. doi: 10.1093/ejcts/ezr108.
12. Gelman D, Gelman A, Urbanaitė D, Tamošiūnas R, Sadauskas S. Role of multimodal analgesia in the evolving enhanced recovery after surgery pathways. *Medicina (Kaunas).* 2018 Apr 23;54(2):20. doi: 10.3390/medicina54020020.
13. Gerner P. Postthoracotomy pain management problems. *Anesthesiol Clin.* 2008 Jun;26(2):355-67. doi: 10.1016/j.anclin.2008.01.007
14. Global Burden of Disease [database]. Washington, DC: Institute of Health Metrics; 2019. IHME, accessed 17 July 2021.
15. Horlocker TT, Vandermeulen E, Kopp SL, et al. Regional Anesthesia in the Patient Receiving Antithrombotic or Thrombolytic Therapy: American Society of Regional Anesthesia and Pain Medicine Evidence-Based Guidelines (Fourth Edition). *Reg Anesth Pain Med.* 2018 Apr;43(3):263-309. doi: 10.1097/AAP.0000000000000763.
16. Institute of Medicine (US) Committee on Advancing Pain Research, Care, and Education. *Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research.* National Academies Press; 2011. 382 p.
17. Iyer A, Yadav S. Postoperative care and complications after thoracic surgery. in: principles and practice of cardiothoracic surgery. Intech Open; 2013. <https://doi.org/10.5772/55351>
18. Jin J, Min S, Chen Q, Zhang D. Patient-controlled intravenous analgesia with tramadol and lornoxicam after thoracotomy: A comparison with patient-controlled epidural analgesia. *Medicine (Baltimore).* 2019 Feb;98(7):e14538. doi: 10.1097/MD.00000000000014538. PMID: 30762794; PMCID: PMC6408084.
19. Kehlet H, Dahl JB. The value of «multimodal» or «balanced analgesia» in postoperative pain treatment. *Anesthesia & Analgesia.* 1993 Nov;77(5):1048-56.
20. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg.* 2008 Aug;248(2):189-98. doi: 10.1097/SLA.0b013e31817f2c1a. PMID: 18650627.
21. Kissin I. Preemptive analgesia. *Anesthesiology.* 2000 Oct;93(4):1138-43. doi: 10.1097/00000542-200010000-00040.
22. Mercadante S. Opioid analgesics adverse effects: the other side of the coin. *Curr Pharm Des.* 2019;25(30):3197-202. doi: 10.2174/1381612825666190717152226.
23. Moïniche S, Kehlet H, Dahl JB. A qualitative and quantitative systematic review of preemptive analgesia for postoperative pain relief: the role of timing of analgesia. *Anesthesiology.* 2002 Mar;96(3):725-41. doi: 10.1097/00000542-200203000-00032
24. Montes A, Roca G, Sabate S, Lao JJ, Navarro A, et al; GENDOL-CAT Study Group. Genetic and Clinical Factors Associated with Chronic Postsurgical Pain after Hernia Repair, Hysterectomy, and Thoracotomy: A Two-year Multicenter Cohort Study. *Anesthesiology.* 2015 May;122(5):1123-41. doi: 10.1097/ALN.0000000000000611
25. Moran BL, Myburgh JA, Scott DA. The complications of opioid use during and post-intensive care admission: A narrative review. *Anaesth Intensive Care.* 2022 Mar;50(1-2):108-26. doi: 10.1177/0310057X211070008. Epub 2022 Feb 16.
26. Muñoz de Cabo C, Hermoso Alarza F, Cossio Rodriguez AM, Martín Delgado MC. Perioperative management in thoracic surgery. *Med Intensiva (Engl Ed).* 2020 Apr;44(3):185-191. English, Spanish. doi: 10.1016/j.medin.2019.10.012. Epub 2019 Dec 20. PMID: 31870510.
27. Rawal N. Epidural technique for postoperative pain: gold standard no more? *Reg Anesth Pain Med.* 2012;37(3):310-7. doi: 10.1097/AAP.0b013e31825735c6.
28. Sostres C, Gargallo CJ, Arroyo MT, Lanás A. Adverse effects of non-steroidal anti-inflammatory drugs (NSAIDs, aspirin and coxibs) on upper gastrointestinal tract. *Best Pract Res Clin Gastroenterol.* 2010 Apr;24(2):121-32.
29. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71:209-249. <https://doi.org/10.3322/caac.21660>
30. Tan M, Law LS, Gan TJ. Optimizing pain management to facilitate Enhanced Recovery after Surgery pathways. *Can J Anesth.* 2015;62:203-18. [CrossRef] [PubMed]
31. Upp J, Kent M, Tighe PJ. The evolution and practice of acute pain medicine. *Pain Med.* 2013 Jan;14(1):124-44. doi: 10.1111/pme.12015.
32. Vane JR. Inhibition of prostaglandin synthesis as a mechanism of action for aspirin-like drugs. *Nat New Biol.* 1971 Jun 23;231(25):232-5.

Мультиmodalний підхід до знеболювання в торакальній хірургії

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За прогнозом Американського онкологічного товариства, у 2022 р. 68820000 чоловіків і 61360000 жінок у США мали померти від раку легенів і бронхів, що становить 21 % від усіх смертей від раку. У зв'язку з виразним больовим синдромом у післяопераційний період у хворих, які перенесли операцію торакотомії, підвищується ймовірність розвитку післяопераційних ускладнень. Попри наявність великої кількості публікацій у медичних ресурсах про переваги та недоліки того чи того методу періопераційного знеболювання, триває пошук найкращого та найбезпечнішого методу.

Мета — поліпшити результати періопераційного знеболювання пацієнтів при торакотомії шляхом вибору оптимального методу.

Матеріали та методи. У відкрите некомерційне рандомізоване контрольоване клінічне дослідження було залучено 59 хворих на рак легенів, які перенесли торакотомію в Київській міській клінічній лікарні № 17 у період з 2018 до 2020 р. Пацієнтів розподілили на дві групи: групу мультиmodalної аналгезії (МА) — 32 пацієнти та групу епідуральної аналгезії (ЕА) — 27 пацієнтів. Відповідно до концепції превентивної аналгезії пацієнти групи МА отримували 1000 мг парацетамолу та 50 мг декскетопрофену внутрішньовенно за 1 год до розрізу. У післяопераційний період декскетопрофен та парацетамол вводили кожні 8 год у поєднанні з епідуральною аналгезією (40 мг 2 % розчину лідокаїну при встановленні катетера в епідуральний простір (Th5–Th6) та ропивакаїн у дозі 2 мг/мл (3–14 мл/год) у післяопераційний період). Пацієнти у групі ЕА отримували лише епідуральну аналгезію (після встановлення епідурального катетера в епідуральний простір (Th5–Th6) вводили 40 мг 2 % розчину лідокаїну, у післяопераційний період — епідурально ропивакаїн у дозі 2 мг/мл (3–14 мл/год)).

Результати. У досліджуваних групах не виявлено статистично значущої різниці ($p > 0,05$) за віком, зростом, масою тіла, ступенем анестезіологічного ризику (ASA), об'ємом крововтрати, тривалістю та обсягом оперативного втручання. Рівень аналгезії оцінювали за нумерологічною шкалою (NRS) через 3, 6, 24 і 32 год після операції. У групі ЕА виявлено статистично значущо більшу різницю за рівнем больового синдрому на кожному етапі дослідження ($p < 0,05$). Сім (26 %) пацієнтів цієї групи отримали додаткове знеболювання морфіном у дозі 10 мг внутрішньом'язово, у групі МА — 3 (9 %).

Висновки. Мультиmodalний підхід до знеболювання хворих, які перенесли торакальні операції, який передбачає використання препаратів циклооксигенази-2 і циклооксигенази-3 та епідуральної аналгезії, продемонстрував кращий рівень аналгезії порівняно з епідуральною аналгезією. Про це свідчила статистично значуща ($p < 0,05$) різниця при оцінці виразності больового синдрому в ранній період після торакотомії.

Ключові слова: НПЗП, прискорене відновлення після операції, мультиmodalна аналгезія, післяопераційний біль.

FOR CITATION

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