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Research Progress on Postoperative Pain Management in Patients with Gastric Cancer

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Abstract

Gastric cancer is a malignant tumor disease with a relatively high incidence rate. Early-stage patients have no specific manifestations, while advancy-stage patients will be the most vulnerable to gastric cancer. Early-stage patients have no specific manifestations, while advancy-stage patients will be accompanied by severe cancer pain, a significant decline in quality of life, and the survival rate remains low after treatment. With the continuous development of nursing concepts in recent years, how to reduce the degree of cancer pain of terminally ill cancer patients, alleviate their psychological suffering, and help them face death correctly has become a new research direction. This article reviews the research progress of postoperative pain management for patients with gastric cancer in recent years, including the importance of postoperative pain management, common methods of postoperative pain management, and factors affecting postoperative pain, aiming to provide reference and guidance for further alleviating postoperative pain of gastric cancer and improving the quality of life of patients with gastric cancer in the future.

Keywords

Following Gastric Cancer Surgery, Pain Management, Analgesia, Overview

1. Introduction

The burden of disease of malignant tumors in China in 2022 showed that gastric cancer had 358,700 new cases and 260,400 deaths, ranking 5th in incidence and 3rd in deaths, respectively, among all cancer types in China [1]. Surgical resection is still the main treatment for gastric cancer. However, due to the high trauma of gastric cancer surgery, postoperative pain has been a major clinical concern. Post-

operative pain may lead to a series of negative psychological stress responses, which may trigger other pathological and physiological changes and affect the recovery process of patients [2]. Effective postoperative pain management not only significantly reduces patient suffering, but also accelerates the postoperative recovery process and reduces the incidence of complications. In recent years, with the widespread promotion of the concept of accelerated rehabilitation surgery (ERAS) and the application of various advanced analgesic techniques, postoperative pain management in gastric cancer has achieved remarkable results [3].

2. Importance of Postoperative Pain Management

Postoperative pain is the natural physiological response of the organism to tissue damage. If pain is not controlled in a timely manner, it will not only induce negative emotions in patients, but also seriously affect their sleep, reduce their quality of life and induce complications [4], which is unfavorable to patients' postoperative recovery [5]. Some studies have shown that long-term persistent pain in patients with hand trauma can greatly affect the progress of disease treatment, sleep and quality of life [6]. If the pain is not managed effectively and in a timely manner, it may turn into a regular chronic pain, which is not only detrimental to the subsequent recovery of the disease, but also affects the patient's life and work, and can lead to psychological stress [7] [8]. Moderate to severe acute postoperative pain can provoke a strong stress response, which can weaken the immune function and increase the risk of tumor recurrence and metastasis after surgery, directly affecting the patient's prognosis. In addition, pain may limit patient activity, increase the chance of deep vein thrombosis, affect respiratory function, prolong hospitalization, and increase healthcare costs.

3. Common Methods of Postoperative Pain Management

3.1. Patient-Controlled Analgesia (PCA)

3.1.1. Intravenous PCA (PCIA)

PCIA is one of the most widely used methods of postoperative analgesia. It means that through the established intravenous drug delivery system, the patient achieves analgesia by administering the drug himself using the PCIA pump. Clinically, opioids are often infused intravenously, and patients can control the dosage according to their pain level. Among them, sufentanil is the most commonly used drug for intravenous PCA after medium- to large-scale surgery [9]. A retrospective study has shown that PCIA combined with hydromorphone and sufentanil provides effective analgesia and at the same time can increase the level of immune factors, which is conducive to the rapid recovery of the patient [10]. The 2011 expert consensus on bupropion analgesia also pointed out that bupropion in combination with opioids for multimodal analgesia after medium to large-sized surgeries can reduce the adverse effects such as nausea and vomiting of opioid drugs [11]. However, PCIA has some drawbacks such as drug side effects (nausea, vomiting, constipation, etc.) and possible triggering of respiratory depression. There-

fore, when using PCIA, healthcare professionals need to closely monitor patients' responses to ensure its safety and effectiveness.

3.1.2. Epidural PCA (PCEA)

PCEA can block the transmission of pain signals more effectively and provide longer-lasting analgesia by implanting the catheter into the area of nerve distribution of the corresponding surgical incision through epidural puncture, and the drug enters the epidural space to exert its effect [12]. Studies have shown that the application of PCEA makes postoperative analgesia more conducive to patient recovery, reduces postoperative complications and the PCEA dose is small [13], the analgesic effect is good, the duration is long, and the side effects are fewer, so the overall analgesic effect is significantly better than that of PCIA [14]. Especially within 24 hours postoperatively. Liao [15] and other scholars also believe that PCEA is more effective than PCIA in the application of postoperative analgesia, because after the human body is subjected to strong stimuli such as surgery, the body's immune system will be activated due to the stress response, and the inflammatory factor is increased greatly, and the results of the comparison experiments between the two methods of analgesia show that PCEA can reduce the level of expression of inflammatory factors, thereby reducing the body's inflammatory response, thus reduce the risk of systemic organ damage. In addition, PCEA can shorten the time to first venting and promote the recovery of gastrointestinal. function. However, there are some potential risks and complications associated with PCEA (patient-controlled epidural analgesia). For example, patients may experience hypotension due to vasodilatation induced by epidural analgesia, which in turn lowers blood pressure. Epidural hematomas are also a risk that should not be overlooked, and may be caused by damage to the blood vessel during puncture or by coagulation abnormalities. Although the probability of these risks is relatively low, the medical team still needs to strictly monitor the patient's vital signs when performing PCEA to ensure the safety of the treatment.

3.2. Multimodal Analgesia

Multimodal analgesia refers to a comprehensive pain management strategy that combines analgesic drugs and/or techniques with different mechanisms of action to enhance analgesic effects and reduce the dosage of single drugs (especially opioids) and their related side effects by acting on multiple targets in the pain pathway. It reduces the use of opioid analgesics through the simultaneous application of analgesic drugs or analgesic methods with different mechanisms of action [16], and achieves safer and more effective analgesia by combining drugs with different pharmacological analgesic mechanisms and different modes of analgesia at multiple points, targeting multiple points of pain, and exerting inhibitory effects on central and peripheral neuropathic pain at the same time. For example, combining non-opioids (e.g., nonsteroidal anti-inflammatory drugs, acetaminophen, or selective COX-2 inhibitors) and opioids not only enhances analgesia, but also re-

duces the use of opioids. Zheng Mei [17] and other scholars believe that multimodal analgesia can further reduce the degree of postoperative pain in patients undergoing laparoscopic gastrointestinal cancer surgery and reduce the dose of opioid analgesics applied during postoperative analgesia, thus playing a role in promoting patients' postoperative recovery and improving the safety of postoperative analgesia. In addition, regional block techniques, such as transversus abdominis plane block (TAP block), can also play a unique role as an important component of a multimodal analgesic program [18]. With this technique, effective analgesia is obtained at the postoperative incision site. It reduces pain by blocking signaling in specific nerve pathways and helps patients to reduce discomfort during postoperative recovery. Multimodal analgesia is a comprehensive approach to pain management that incorporates a variety of analgesic tools, aiming to work synergistically through different mechanisms to achieve better analgesia and to reduce the side effects that may be caused by a single drug. The introduction of regional block techniques (e.g., TAP block) not only enhances analgesic efficiency, but also significantly improves overall patient comfort and satisfaction.

3.3. Accelerated Recovery Surgery (ERAS) Concepts

Accelerated recovery after surgery (ERAS) is a modern medical guidance concept proposed in recent years based on multidisciplinary collaboration, adjusting and optimizing surgical, interventional, and supportive measures to reduce surgical trauma and stress reactions, thus shortening patients' postoperative recovery time. Moderate to severe pain is experienced by 91.4% of patients in surgical procedures [19]. With the development of Accelerated Rehabilitation Surgery (ERAS), the concept of postoperative pain management has shifted from "pain relief" to "control of active pain and promotion of early postoperative bed mobilization" [20]. In terms of pain management, ERAS emphasizes preoperative education, multimodal analgesia, early mobility, and dietary recovery. Findings from a randomized controlled trial (RCT) revealed that a multimodal early recovery program (ERAS) based on the latest evidence-based medicine significantly improved the quality of early postoperative recovery in gastric cancer patients [21]. Specifically, this protocol effectively shortened the length of hospital stay, reduced the incidence of complications, and improved overall patient satisfaction by integrating multiple medical tools and management strategies, such as preoperative education, optimization of anesthesia, pain reduction, early feeding, and early activity. The results of this study provide strong evidence-based support for clinical practice, suggesting that multimodal ERAS programs have significant advantages in early recovery after gastric cancer surgery.

4. Factors Affecting Postoperative Pain

4.1. Patients' Own Factors

Individual differences in patients' pain thresholds and anxiety levels can signifi-

cantly affect the intensity of postoperative pain. Studies have shown that patients with higher levels of preoperative anxiety experience more intense postoperative pain and have a correspondingly higher need for analgesic medication. In addition, the patient's age, gender, and previous pain experience also have a significant impact on the effectiveness of postoperative pain management.

4.2. Surgery-Related Factors

Surgical technique (including open versus laparoscopic surgery), duration, and the extent of surgery it involves have a significant impact on the level of postoperative pain [22]. Laparoscopic surgery, with its minimally invasive and rapid recovery advantages, is associated with relatively less postoperative pain. However, in patients with advanced gastric cancer, open surgery may be more advantageous in terms of complete tumor resection and lymph node clearance. In addition, factors such as duration of surgery and amount of intraoperative bleeding may also have an impact on the level of postoperative pain.

5. Recent Research Advances in Postoperative Pain Management

5.1. Application of New Analgesic Drugs

In recent years, the development and application of some new analgesic drugs have brought new hope for postoperative pain management in gastric cancer. For example, selective cyclooxygenase-2 (COX-2) inhibitors have good analgesic effects and fewer gastrointestinal side effects. Among them, celecoxib (Celecoxib), a new nonsteroidal anti-inflammatory drug, is a highly selective COX-2 inhibitor, which has already played a role in the prevention and treatment of a variety of tumors, and its antitumor mechanism of action has become a hot spot of research in recent years [23] [24]. In addition, new opioids such as κ receptor agonists have also shown good application prospects in clinical trials. Scholars such as Chen Xiang [25] believe that the κ receptor agonist Butorphanol compounded with dexmedetomidine analgesia has positive significance in improving the pain symptoms and pain stress response of patients after laparoscopic-assisted D2 radical gastric cancer surgery.

5.2. Innovation of Nerve Block Technology

The use of nerve block techniques in the field of postoperative pain management is becoming increasingly widespread and intensive, significantly surpassing the traditional paradigm of dependence on a single opioid. These techniques reduce or eliminate pain at its source by precisely injecting or delivering local anesthetics around specific nerves or plexuses, temporarily blocking the transmission of pain signals to the central nervous system [26] [27]. In addition to the classical epidural block, which is particularly suitable for lower and middle abdominal and lower extremity surgery, providing excellent analgesia for somatic and visceral pain, but with limitations such as demanding operating technique, hypotension, urinary re-

tention, and the risk of rare, but serious, neurologic injury or epidural hematoma, numerous emerging techniques of ultrasound-guided nerve blocks are rapidly evolving due to their precision, safety, and efficacy.

5.2.1. Transversus Abdominis Plane Block (TAP Block)

The mechanism of the transversus abdominis plane block is essentially the precise injection of local anesthetic into the fascial plane between the Internal Oblique and Transversus Abdominis muscles [28] under the guidance of real-time ultrasound visualization. The thoracoabdominal nerve (T6-L1), which innervates the skin, muscles, and wall peritoneum of the anterior abdominal wall, travels within this plane. Its advantages in clinical application include: precise targeting of body wall pain, which is effective for incisional pain (Trocar holes, umbilical incisions) and anterior abdominal wall pain in abdominal surgery (especially laparoscopic surgery); relatively easy and safe to perform, with ultrasound guidance reducing the risk of accidental entry into the abdominal cavity or injury to vascularized organs; no extensive sympathetic blockade and therefore rarely causes hypotension or urinary retention; less demanding coagulation requirements than Intravertebral block; Reduced opioid requirements, effective reduction of mobility pain (coughing, turning, getting out of bed), significant reduction in postoperative opioid consumption and related side effects (nausea and vomiting, respiratory depression, intestinal paralysis); Promotes early mobility and recovery, with good pain control facilitating patients' early mobility out of bed and respiratory exercises. Conversely, disadvantages or limitations include: mainly targeting body wall pain, limited effect on visceral pain (e.g., gastrointestinal straining, anastomotic pain), and often need to be combined with other analgesic modalities (e.g., intravenous non-opioids). The duration of a single injection is limited, depending on the type and dose of local anesthetic used, and usually provides analgesia for 12 - 24 hours, making it difficult to cover the full 48 - 72 hours of the most painful postoperative period. There is individual variation in the extent of the block, which may not completely cover all incisions or have inadequate spread.

5.2.2. Continuous Peripheral Nerve Blocks (CPNB)

The mechanism of Continuous Peripheral Nerve Blocks (CPNB) is to precisely place a catheter into the target nerve sheath or near the fascial plane under ultrasound guidance, and connect an infusion pump to continuously or on-demand inject local anesthetics, so as to achieve prolonged nerve signaling block [29]. Its advantages in clinical application include: long-lasting and stable analgesia: overcoming the disadvantage of limited duration of a single block, it can provide high-quality analgesia for several days or even longer, perfectly covering the acute postoperative pain peak period; precise drug regulation: individualized analgesia can be achieved by adjusting the infusion rate (basal volume) and the patient-controlled dosage (PCA bolus) to optimize the effect and reduce the total amount of local anesthetics and the risk of toxicity. Significant reduction of opioid dependence: Provides powerful local analgesia, greatly reducing or even avoiding the use

of systemic opioids, thus minimizing their systemic side effects; Improved functional recovery: Better and longer-lasting pain control allows patients to perform functional exercises (e.g., mobility training, walking) earlier and more actively, accelerating the rehabilitation process and reducing the risk of muscle atrophy and joint stiffness; Increased patient satisfaction: sustained comfort and greater mobility significantly enhance the patient experience. Conversely, disadvantages or limitations include: more technically demanding: catheter placement and fixation requires skill and management is more complex (equipment, medication configuration, monitoring); risk of catheter-related complications: including catheter displacement, dislodgement, occlusion, localized infections, and nerve irritation/injury (rare); more resources required: infusion pump device, specialized supplies, and staff and patient education; risk of motor blockage: Continuous infusion may result in diminished motor function in the targeted innervated area, potentially affecting early activity (need to balance analgesia with motor needs). Higher cost: increased cost of equipment and consumables compared to a single block, etc.

5.2.3. Comparison of Effectiveness

TAP is more compared to epidural epidural block: TAP blocks are effective in providing analgesia for abdominal body wall incisions and are safer (especially in patients with coagulation disorders or refusal/contraindication to intralesional block). However, for open procedures requiring strong visceral analgesia or procedures involving extensive visceral manipulation, epidural blocks are often more comprehensive and effective, but they also carry a higher risk of side effects and operational management requirements. Both are often incorporated into multimodal programs to complement each other. Single block versus continuous nerve block (CPNB): CPNB is significantly superior to single block in terms of duration of analgesia, stability of quality of analgesia, and opioid-sparing effect. Studies have consistently shown that CPNB provides superior pain scores at rest and during exercise, significantly reduces remedial opioid use, accelerates functional recovery, and improves patient satisfaction. Its disadvantages lie mainly in technical complexity and administrative costs [30]. The role of emerging technologies in ultrasound-guided nerve blocks (both single and continuous) represents an important advance in regional anesthesia. They provide more flexible and safer options for potent analgesia for different types of surgery and individual patient conditions by improving precision (reducing local anesthetic dosage and complications) and expanding the range of applications (e.g., erector spinae plane block, serratus anterior plane block, lumbar quadratus block, etc., provide more options for thoracic and abdominal surgeries).

In summary, nerve block technology, especially ultrasound-guided precision block and continuous catheterization, not only dramatically reduces the total demand for and dependence on analgesic medications (especially opioids) by accurately blocking pain signaling, but also significantly improves the patient's post-

operative recovery experience by providing high-quality, long-lasting analgesia. Patients are able to perform daily activities and functional exercises earlier and more comfortably, effectively reducing the risk of pain-induced braking and its associated complications (e.g., pneumonia, deep vein thrombosis, intestinal obstruction). These advanced analgesic methods have greatly improved patients' postoperative quality of life and satisfaction, and at the same time provided clinicians with richer, more individualized, and often safer treatment choices, thus optimizing the perioperative management strategy as a whole, and improving the quality and effectiveness of healthcare services.

5.3. The Role of Psychological Intervention in Pain Management

The importance of psychological interventions in postoperative pain management is gradually being recognized. Psychological interventions such as cognitive behavioral therapy and relaxation training can effectively relieve patients' anxiety and depression and reduce postoperative pain intensity. In addition, preoperative psychoeducation can help patients better cope with postoperative pain and improve the effectiveness of pain management.

5.4. Evidence-Based Nonpharmacologic Treatment Options in Pain Management

In the field of pain management, nonpharmacological therapies play a crucial role, including acupuncture, transcutaneous electrical nerve stimulation (TENS), and relaxation therapy [31]. These methods exert their pain-relieving effects through their own unique physiological mechanisms and help to reduce dependence on medications, thereby improving the quality of life of patients. The mechanism of acupuncture mainly involves improving local blood circulation by stimulating specific acupoints to promote endorphin release. Existing evidence in the literature suggests that acupuncture has significant efficacy for chronic pain, neuropathic pain, and postoperative pain, and is particularly good at relieving pain in the lower back and pelvic region during pregnancy. The mechanism of transcutaneous electrical nerve stimulation (TENS), on the other hand, is mainly based on the activation of downstream inhibitory pathways by low-frequency currents, which prompts the release of endogenous opioids. Studies support the effectiveness of TENS in the treatment of neuropathic pain, chronic pain and postoperative pain, especially high-frequency TENS, which has been shown to be 72% effective in relieving menstrual cramps. Relaxation therapy, on the other hand, reduces patients' anxiety and depressive symptoms and enhances their psychological resilience through psychological interventions. The evidence base for this approach focuses on improving the psychological state and quality of life of patients with chronic pain, and is particularly applicable to those with psychological problems. In actual clinical practice, pharmacologic and non-pharmacologic treatments should be combined to select the most appropriate treatment plan based on the patient's specific condition and needs. Acupuncture, TENS and relaxation

therapy, as important components of non-pharmacological treatments, have been shown to be effective in relieving pain, reducing medication use and significantly improving patients' quality of life.

5.5. Patient-Reported Outcome Measures (PROMs) in Postoperative Pain Assessment

Postoperative pain has a significant impact on patient comfort and long-term health, and there are limitations in traditional methods of assessment by healthcare professionals. PROMs, which obtain information directly from the patient through standardized questionnaires, allow for a comprehensive assessment of postoperative pain in terms of its intensity, duration, and impact on functioning and quality of life, and help to optimize pain management strategies [32]. Validated PROMs tools, commonly used PROMs tools include: visual analog scale (VAS): simple and intuitive, used to assess pain intensity. Numeric Pain Rating Scale (NPRS): similar to the VAS, uses numeric scores. EQ-5D: generalized health-related quality of life assessment tool covering multiple dimensions. PROMIS: computer-based adaptive testing system that dynamically adapts the questions to assess multiple health domains. WOMAC: specific tool for patients with osteoarthritis of the knee and hip, assessing pain, stiffness, and function. PROMs can be used to assess the effectiveness of postoperative pain management interventions. By collecting data on PROMs before and after an intervention, the impact of the intervention on postoperative pain and its related health outcomes can be assessed. For example, in one study, the effects of two different pain management regimens (timed versus on-demand dosing) on postoperative pain and functional recovery in TKA patients were compared. The results showed that the timed dosing regimen demonstrated better pain control and functional recovery as assessed by PROMs on postoperative days 1 and 5. This suggests that PROMs can effectively assess the clinical effects of different pain management strategies and provide a basis for optimizing postoperative pain management.

6. Future Research Directions

Although significant progress has been made in the field of postoperative pain management in gastric cancer, there are still several issues that need to be studied in depth. Specifically, it is necessary to explore how to formulate more accurate analgesic plans based on individual patient differences, how to optimize the collaboration mechanism of multidisciplinary teams in pain management, and how to further reduce the side effects of analgesic drugs. In addition, in view of the rapid development of artificial intelligence and big data technology, its application in the field of pain management has also attracted much attention.

In this context, artificial intelligence (AI)-driven pain prediction and patient-reported outcome monitoring are increasingly becoming a research hotspot. AI technologies are able to identify patterns of postoperative pain and risk factors by analyzing a large amount of patient data, thus enabling accurate prediction of

postoperative pain [33]. For example, AI models can predict the intensity and duration of a patient's postoperative pain based on data such as the patient's preoperative health status, type of surgery, genetic information, and previous pain experience, helping healthcare professionals to formulate personalized analgesia plans in advance. At the same time, AI can also be used to monitor a patient's pain status in real time. Through wearable devices or mobile apps, AI systems can continuously collect patients' physiological data and patient-reported outcomes (PROMs) and analyze these data in real time to assess pain levels [34]. This real-time monitoring not only helps to make timely adjustments to treatment regimens, but also reduces patient complications due to increased pain. In addition, AI technology can optimize the collaboration of multidisciplinary teams in pain management. By sharing predicted outcomes and real-time monitoring data, healthcare professionals from different disciplines can better coordinate their efforts and work together to provide more comprehensive pain management support to patients. This interdisciplinary model of collaboration is critical to improving the overall outcome of postoperative pain management.

In conclusion, the application of AI in postoperative pain management for gastric cancer has a broad prospect. It can not only help healthcare professionals develop more accurate analgesic programs, but also optimize the pain management process through real-time monitoring and multidisciplinary collaboration, thus further reducing the side effects of analgesic medications and enhancing the patient's postoperative recovery experience.

7. Conclusion

Gastric cancer is a common clinical malignant tumor with the main symptom of abdominal pain, which has a high incidence rate and is characterized by a high degree of lesion and poor prognosis [35] [36]. Surgery is the main way to treat gastric cancer, but surgery is more traumatic, postoperative risks are higher, and patients also suffer from continuous severe pain after surgery, which seriously affects the prognosis [37]. In addition, patients face several problems during postoperative pain management, such as imprecision of pain assessment, monotony of analgesic methods, lack of individualized care, and insufficient knowledge of pain management among patients and their families. Therefore, postoperative pain management in gastric cancer is an important part of promoting patients' postoperative recovery [38]. In recent years, with the promotion of PCA technology, multimodal analgesic strategies, and ERAS concepts, postoperative pain management in gastric cancer has made significant progress. However, postoperative pain management still faces many challenges, and further optimization of analgesic regimens and multidisciplinary collaboration are needed to improve patients' postoperative quality of life. Future studies should focus on the development of individualized analgesic protocols and explore the application of novel analgesic techniques and psychological interventions in pain management to further improve the prognosis of gastric cancer patients.

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Conflicts of Interest

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References

[1] Zheng, R.S., Chen, R., Han, B.F., *et al.* (2024) Cancer Incidence and Mortality in China, 2022. *Chinese Journal of Oncology*, **46**, 221-231.

[2] Liu, Y. (2019) Study on Pain Status and Pain Self-Management Behavior of Patients after Radical Mastectomy for Breast Cancer. Henan University.

[3] Tian, S.F., Zheng, W. and Nan, J.R. (2023) Application Effect of Rapid Rehabilitation Surgical Concept in Operating Room Intervention for Gastric Cancer Patients. *Cancer Progress*, **21**, 1918-1921.

[4] Sun, F.C. and Huang, Y.Y. (2018) The Effect of Continuity of Care on the Management Effect of Postoperative Cancer Pain and Quality of Life of Gastric Cancer Patients. *Journal of Hunan University of Traditional Chinese Medicine*, **38**, 737.

[5] Lin, Q.H., Wen, C.C., Que, Q.M., *et al.* (2019) Study on the Effect of Perioperative Psychological Care on Postoperative Pain and Sleep Quality in Patients with Hand Trauma. *World Journal of Sleep Medicine*, **6**, 1405-1406.

[6] Faderani, R., Kanapathy, M. and Mosahebi, A. (2021) Hand Injury: Investigating the Accuracy of Referrals to a Specialist Trauma Centre. *Emergency Nurse*, **29**, 29-33. https://doi.org/10.7748/en.2021.e2065

[7] Li, R.H., Wen, Y.T., He, J., *et al.* (2022) Application of ADOPT Problem-Solving Model in Extended Care of Diabetic Foot. *Chongqing Medicine*, **51**, 898-900.

[8] Hu, L., Wang, H.F., Xu, C., *et al.* (2022) The Effect of ADOPT Model Nursing Intervention on Airway Self-Care Ability of Total Laryngectomy Patients. *Chinese Journal of Practical Nursing*, No. 29, 2254-2260.

[9] American Society of Anesthesiologists Task Force on Acute Pain Management (2012) Practice Guidelines for Acute Pain Management in the Perioperative Setting: An Updated Report by the American Society of Anesthesiologists Task Force on Acute Pain Management. *Anesthesiology*, **116**, 248-273.

[10] Liu, J., Wang, Y., Tang, Y., Luo, J., Long, Y. and Tan, S. (2020) Clinical Effect and Safety Evaluation of Hydromorphone Combined with Sufentanil in Patient-Controlled Intravenous Analgesia for Patients with Hepatocellular Cancer and Its Effect on Serum Immune Factors. *Oncology Letters*, **20**, Article No. 296. https://doi.org/10.3892/ol.2020.12159

[11] Huang, Y.G., Huang, W.Q., Li, G., *et al.* (2011) Expert Consensus on Analgesia with Butorphanol Tartrate. *Journal of Clinical Anesthesiology*, No. 10, 1028-1029.

[12] Guo, S.M., Zhang, L.Y. and Hou, T.C. (2022) Observation on the Anesthetic Effect of Dexmedetomidine Combined with Sedation Complex Anesthesia on Patients Undergoing Radical Esophageal Cancer Surgery. *Clinical Medical Engineering*, **29**, 1355-1356.

[13] Hu, S.M., Shu, H.-L., Zhang, X.-H., *et al.* (2015) Observation and Care of Analgesic

Effect of Two Self-Controlled Analgesic Methods on Patients after Open Abdominal Surgery. *Qilu Nursing Journal*, No. 9, 38-40.

[14] Liu, D.X. (2016) Observation and Nursing of Clinical Effect of PCIA and PCEA Self-Controlled Analgesia after Gastric Cancer Surgery. *China Metallurgical Industry Medical Journal*, **33**, 662-663.

[15] Liao, H.S. and Zhang, Q.H. (2017) Analgesic Effect of PCIA and PCEA after Gastric Cancer Surgery in the Elderly and the Effect on the Level of Inflammatory Factors. *Journal of Practical Cancer*, **32**, 1820-1823.

[16] Zhou, H., Jiang, Y.K., Zhang, Z.J., *et al.* (2023) Effect of Dexmedetomidine Combined with Nalbuphine in Patients Undergoing Laparoscopic Radical Gastric Cancer Surgery. *Cancer Progress*, **21**, 338-341.

[17] Zheng, M. and Li, R.X. (2023) The Effect of Multimodal Analgesic Program on Pain after Laparoscopic Gastrointestinal Surgery. *Shenzhen Journal of Integrative Medicine*, **33**, 11-14.

[18] Zhang, P.-C., Xu, G.-T. and Wang, M.-G. (2024) Study on the Analgesic Effect of Nalbuphine Combined with Transversus Abdominis Plane Block for Multimodal Analgesia in Patients after Radical Resection of Hepatocellular Carcinoma. *Chinese Journal of Clinical Pharmacology*, **40**, 2635-2639.

[19] Reddi, D. (2015) Preventing Chronic Postoperative Pain. *Anaesthesia*, **71**, 64-71. https://doi.org/10.1111/anae.13306

[20] Cai, Y.L., Liu, R. and Liu, Q.H. (2018) Application of Pain Management in Rectal Cancer Patients with Active Pain after Miles Operation. *Journal of Gannan Medical College*, **38**, 667-670.

[21] Xiao, Y.H. (2024) Observation on the Application Effect of Accelerated Rehabilitation Surgical Care in the Perioperative Period of Patients Undergoing Radical Gastric Cancer Surgery. *Heilongjiang Traditional Chinese Medicine*, **53**, 240-241.

[22] Xie, B.L., Jiang, X.X. and Wang, Y. (2025) Analysis of Pain Level and Influencing Factors in Patients after Thoracoscopic Lobectomy for Lung Cancer. *Zhejiang Trauma Surgery*, **30**, 232-234.

[23] Izzo, J.G. and Ajani, J.A. (2007) Thinking in and out of the Box When It Comes to Gastric Cancer and Cyclooxygenase-2. *Journal of Clinical Oncology*, **25**, 4865-4867. https://doi.org/10.1200/jco.2007.13.1060

[24] Grösch, S., Maier, T.J., Schiffmann, S. and Geisslinger, G. (2006) Cyclooxygenase-2 (Cox-2)-Independent Anticarcinogenic Effects of Selective COX-2 Inhibitors. *JNCI: Journal of the National Cancer Institute*, **98**, 736-747. https://doi.org/10.1093/jnci/djj206

[25] Chen, X., Li, Y., Wang, Y., *et al.* (2025) Clinical Effects of Bupropion Combined with Dexmedetomidine Analgesia in Patients after Laparoscopic-Assisted D2 Radical Surgery for Gastric Cancer. *Jilin Medical Science*, **46**, 156-158.

[26] Guo, R.X. (2023) Application of Ultrasound-Guided PECS and SAP Block in Preventing Postoperative Pain of Breast Cancer. Master's Thesis, Hebei Medical University.

[27] Luo, G. (2022) Clinical Study of Type II Thoracic Nerve Block Technique in Perioperative Analgesia for Thoracic Surgery. Master's Thesis, Bengbu Medical College.

[28] Shi, Q.C. and Liu, X.G. (2025) Effect of Ultrasound-Guided Transversus Abdominis Plane Block Combined with Thoracic Paravertebral Nerve Block and General Anesthesia in Elderly Thoracolaparoscopic Radical Esophageal Cancer Surgery. *Chinese Minkang Medicine*, **37**, 67-69+73.

[29] Xing, J. and Zhang, X.Q. (2024) Application Study of Different Continuous Nerve Block Techniques to Assist Total Hip Arthroplasty in the Elderly. *Huaihai Medicine*, **42**, 592-596.

[30] Zhang, W. (2013) Application Evaluation of Continuous Peripheral Nerve Block Compared with Single Injection Peripheral Nerve Block. Master's Thesis, Xinjiang Medical University.

[31] Zhao, Z.P., Song, Y. and Liu, T. (2025) Progress of Research on the Role of Non-Pharmacologic Treatment in Postoperative Pain Management in Orthopedics. *Research on Traditional Chinese Medicine*, **38**, 83-87.

[32] Wu, F.L. (2019) Construction of a Stage-Specific Patient-Reported Outcome Measurement System for Breast Cancer. Ph.D. Thesis, People's Liberation Army Navy Military Medical University.

[33] Wang, Z.Q. (2024) Postoperative Pain Prediction for Day Surgery Patients Based on Artificial Intelligence Model. Master's Thesis, Dalian Medical University.

[34] Zhang, N. (2025) Establishment and Validation of an AI Assessment System for Facia Expression Recognition of Adult Postoperative Pain in Postanesthesia Care Unit (PACU). Master's Thesis, Xi'an Medical College.

[35] Cholewinski, G. and Waluga, M. (2022) The Role of microRNAs in Carcinogenesis and the Utility of microRNA Determination in Diagnosis of Gastric Cancer Development. *Physiology and Pharmacology*, **73**, 562.

[36] De Re, V., Brisotto, G., Repetto, O., De Zorzi, M., Caggiari, L., Zanussi, S., *et al.* (2020) Overview of Epstein-Barr-Virus-Associated Gastric Cancer Correlated with Prognostic Classification and Development of Therapeutic Options. *International Journal of Molecular Sciences*, **21**, Article No. 9400. https://doi.org/10.3390/ijms21249400

[37] Marano, L., Carbone, L., Poto, G.E., Restaino, V., Piccioni, S.A., Verre, L., *et al.* (2023) Extended Lymphadenectomy for Gastric Cancer in the Neoadjuvant Era: Current Status, Clinical Implications and Contentious Issues. *Current Oncology*, **30**, 875-896. https://doi.org/10.3390/curroncol30010067

[38] Lu, W.M., Guo, X., Zeng, Y.Z., *et al.* (2019) Effect of Wireless Analgesic Pump System on Post-Operative Analgesic Satisfaction of Cesarean Section Patients. *Shenzhen Journal of Integrated Chinese and Western Medicine*, **29**, 84-85.