Advances in Precision Medicine, 2026, Volume 11, Issue 7
https://bbwpublisher.com/journal/APM
Online ISSN: 2424-9106
Print ISSN: 2424-8592

Advances in the Application of Artificial Intelligence in Operating Room Nursing

Xin Jin

Deyang People's Hospital, Deyang 618000, Sichuan, China

Abstract: With the rapid penetration of Artificial Intelligence (AI) technology in the medical field, operating room nursing, as a core aspect of perioperative medical safety, is gradually undergoing an intelligent transformation from experience-driven to data-driven. This article systematically reviews the application progress of AI technology in the three-core operating room nursing stages—preoperative, intraoperative, and postoperative—based on relevant domestic and international research from 2023 to 2026, summarizes current research results and application limitations, and looks forward to future development directions, providing a reference for promoting the clinical translation and application of AI in the field of operating room nursing.

Keywords: Artificial intelligence; Operating room nursing; Perioperative period; Application progress; Review

Online publication: July 26, 2026

1. Introduction

As the core location for surgical treatment and emergency care of critically ill patients in medical institutions, the operating room's nursing quality directly affects surgical success rates and patient prognosis and safety. In recent years, with the rapid development of AI technologies such as big data, machine learning, and deep learning, AI, with its powerful multi- source data integration capabilities and nonlinear prediction advantages, has gradually penetrated into all aspects of perioperative nursing, providing technical support for the intelligent upgrading of operating room nursing.

2. Application research of preoperative procedures

2.1. Surgical risk assessment

Accurate surgical risk assessment is the core basis for perioperative nursing decision-making, directly affecting surgical plan design and perioperative nursing resource allocation. AI technology, by integrating multi-source heterogeneous medical data such as patient electronic health records, imaging examination data, and genomic data, can build a more accurate personalized surgical risk prediction system, providing more

comprehensive data support for clinical decision-making.

Hu Xiaoyi, Wang Di, Ji Muhuo, and others have shown that in the field of thoracic anesthesia, artificial intelligence models can combine various preoperative and risk-related data of patients to accurately predict the probability of common risk events such as difficult airway during surgery, intraoperative awareness, intraoperative hypotension, and hypoxemia, and help nurses to formulate corresponding nursing plans in advance [1]. Razzaghi and others proposed a prediction model specifically for the risk of postoperative complications [2]. This study also confirmed that machine learning algorithms are indeed effective in optimizing clinical decision support and improving the quality of patient care.

2.2. Preoperative visit to the patient

In terms of the application of intelligent personalized push technology, Ma Zhangfang, Yang Xiaoxiao, Wang Ying and others used the intelligent push technology with the health education precision connection system to carry out pre-hospital preparation nursing. The results showed that this technology can effectively reduce the preoperative anxiety of patients undergoing day surgery under general anesthesia in ophthalmology and improve the patients' compliance in completing preoperative preparation [3].

3. Application research of intraoperative procedures

3.1. Monitoring and early warning of vital signs

Continuous monitoring of vital signs and timely early warning of abnormal events during surgery are the core safeguards for ensuring patient safety. AI technology, combined with smart wearable sensors and IoT devices, enables continuous collection and real-time intelligent analysis of vital sign data, effectively compensating for the shortcomings of traditional monitoring methods [4].

Song Jincheng and Li Jin proposed that artificial intelligence plays an increasingly crucial role in clinical anesthesia nursing, especially in core aspects such as monitoring patients' vital signs and monitoring the depth of anesthesia during the anesthesia stage [5]. The application advantages of this technology have been widely recognized in the industry. Fu Xiaoxiao and Wang Chun designed and developed a streaming data processing platform based on Apache Flink and complex event processing [6]. This platform combines multimodal fusion technology and a finite state machine to complete the abnormal detection of multidimensional vital signs. It can also explore the intrinsic connection between the trend of vital sign changes and serious complications such as postoperative infection, respiratory failure, pulmonary embolism, and cardiac arrest, thereby realizing early warning of serious complications.

3.2. Intraoperative hypothermia care

Unplanned intraoperative hypothermia is a common and serious complication in operating room care. Accurately identifying high-risk individuals and implementing targeted warming measures is the core strategy for managing intraoperative hypothermia. The introduction of machine learning technology provides a new tool for predicting the risk of intraoperative hypothermia, driving a shift in hypothermia care from passive response to proactive prevention.

Zhang Mengran, Li Yan, and Zhang Menghan used four algorithms, namely BP neural network, support vector machine, random forest, and logistic regression, to build a model for predicting the risk of intraoperative hypothermia in patients undergoing off-pump coronary artery bypass grafting [7]. This model

can provide evidence for clinical assessment and prevention of intraoperative hypothermia in patients undergoing this type of surgery. Xiang Haiyan, Huang Lifeng, Qian Weiming, and others used the ANN algorithm to build a prediction model for IPH in patients under general anesthesia, which included 20 predictive variables, including general patient information, surgery-related information, anesthesia recovery indicators, and perioperative body temperature [8]. This model can not only predict the risk of intraoperative hypothermia in patients, but also predict the risk of hypothermia during the high-risk period of anesthesia recovery. Its practical application scope is wider.

4. Application research in postoperative procedures

4.1. Surgical instrument management

The cleaning, disinfection, and full-process traceability of surgical instruments are crucial for ensuring the quality and safety of operating room nursing care and are also key aspects of hospital infection control. The application of AI technology is driving the transformation of surgical instrument management towards intelligence and closed-loop systems.

Liang Pengke built an intelligent sorting system for surgical instruments based on a binocular vision system [9]. The system tracks the flow path of instruments through RFID tags and automatically counts the number of instruments and identifies the types of instruments by combining visual recognition technology. This can avoid serious medical accidents such as instruments being left in the patient's body cavity. Qiu Suyun, Bao Rong, Chen Haiping and others systematically sorted out the cleaning methods and quality monitoring schemes of Da Vinci robotic surgical instruments [10]. The study found that the standardized cleaning scheme for Da Vinci robotic surgical instruments that they constructed is scientific and can improve the quality of instrument cleaning and shorten the average manual cleaning time. Tian Feng's research results showed that after applying the artificial intelligence-based ophthalmic cataract surgery instrument management system to clinical nursing, the instrument counting accuracy rate reached 97.2%, which was higher than the 89.6% of the control group, and could significantly improve the accuracy of instrument counting [11].

4.2. Postoperative pain management

Postoperative pain is a significant factor affecting patient recovery quality and patient satisfaction, and achieving individualized and precise pain management is a challenging issue in perioperative nursing. AI technology, by constructing machine learning models to predict patients' postoperative pain levels and analgesia needs, offers a new approach to precision pain management.

In the field of postoperative pain risk prediction, Liu Decheng, Wang Yimin, Chen Weixing et al. relied on real-world clinical medical data to complete the construction and verification of a model for predicting the risk of acute moderate to severe postoperative pain in patients [12]. This study screened 2434 adult patients who underwent elective anesthesia surgery and used the postoperative visual analog scale score 24 hours after surgery as the outcome indicator for model training. The model obtained showed good prediction accuracy and could assist clinicians in formulating individualized analgesia plans in advance.

In the direction of optimizing the application of machine learning algorithms, some researchers have carried out the construction and verification of the risk prediction model for postoperative neuropathic pain in patients with thoracic tumors. Among them, the research of Ma Shu, Zhang Jiashu, Li Yibing et al. used

Cox regression analysis to screen independent clinical risk factors for postoperative chronic pain syndrome [13]. The purpose of the study was to clarify the occurrence of acute pain and postoperative neuropathic pain after thoracic tumor surgery, as well as the development trajectory of neuropathic pain, so as to provide a basis for subsequent early clinical intervention and nursing.

5. Summary and outlook

AI technology has demonstrated significant application value in the three core perioperative nursing stages: preoperative, intraoperative, and postoperative. It can effectively improve the accuracy of risk prediction, optimize nursing processes, enhance management efficiency, and improve patient outcomes, driving the transformation of operating room nursing from traditional experience-based models to intelligent and precise approaches. However, the current application of AI in operating room nursing still has some limitations, affecting its ease of use. Future research needs to conduct large-scale, multi-center clinical studies to validate the clinical effectiveness of AI models, focusing on optimizing interpretable AI algorithms to improve model transparency, promoting the deep integration of AI systems with existing hospital information infrastructure, and exploring new pathways for cultivating the capabilities of operating room nurses in the context of AI. This will fully leverage the enabling role of AI technology and continuously improve the quality and safety of operating room nursing.

Disclosure statement

The author declares no conflict of interest.

References

[1] Hu X, Wang D, Ji M, et al., 2024, Application Prospects of Machine Learning in the Field of Anesthesiology. Journal of Clinical Anesthesiology, 40(6): 634–638.

[2] Razzaghi T, Safro I, Ewing J, et al., 2019, Predictive Models for Bariatric Surgery Risks with Imbalanced Medical Datasets. Annals of Operations Research, 280(1): 1–18.

[3] Ma Z, Yang X, Wang Y, et al., 2025, Application of Intelligent Push Technology in Pre-Hospital Preparation for Ophthalmic Day Surgery Patients Under General Anesthesia. Ophthalmology, 34(1): 58–62.

[4] Zhang Q, Qiu D, Zhang Z, 2021, Using Machine Learning to Predict the Effect of Preoperative Nursing on the Prevention of Surgical Pressure Ulcers. China Digital Medicine, 16(4): 45–49.

[5] Song J, Li J, 2025, Advances in the Application of Artificial Intelligence Technology in Clinical Anesthesia. China Medical Device Information, 2025(12): 30–33.

[6] Fu X, Wang C, 2026, Research on the Construction of a Medical and Health Streaming Data Processing Platform for Real-Time Clinical Early Warning. Software, 2026(1): 126–128.

[7] Zhang M, Li Y, Zhang M, et al., 2025, Construction of a Prediction Model for Intraoperative Hypothermia Risk in Off-Pump Coronary Artery Bypass Grafting Patients Based on Machine Learning Algorithm. Journal of Nursing, 32(9): 64–68.

[8] Xiang H, Huang L, Qian W, et al., 2022, Construction and Application of a Deep Learning-Based Model for Predicting Unplanned Hypothermia in Patients Under General Anesthesia During the Perioperative Period.

Chinese Journal of Emergency Medicine, 31(8): 1116–1120.

[9] Liang P, 2022, Research on Surgical Instrument Image Recognition and Sorting Based on Deep Learning, thesis, Yanshan University.

[10] Qiu S, Bao R, Chen H, et al., 2025, Development and Application of Standardized Cleaning Protocol for da Vinci Robotic Surgical Instruments. Chinese Journal of Nursing, 2025(S2): 47–53.

[11] Tian F, 2026, Design and Nursing Application Effect Analysis of Ophthalmic Operating Room Instrument Management System Based on Artificial Intelligence. Health Advice, 2026(6): 184–186.

[12] Liu D, Wang Y, Chen W, et al., 2024, Construction of a Risk Prediction Model for Postoperative Acute Moderate to Severe Pain Based on Real-World Data. Shenzhen Journal of Integrated Traditional and Western Medicine, 34(18): 1–5.

[13] Ma S, Zhang J, Li Y, et al., 2026, Predictive Model of Postoperative Chronic Pain Syndrome of Breast Cancer Based on Machine Learning Algorithm Integrating Clinical Factors and Ultrasound Imaging Features. Chinese Journal of Endocrine Surgery, 20(2): 204–211.