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ORIGINAL

IMPACT OF TARGET-CONTROLLED INFUSION ANESTHESIA WITH REMIFENTANIL AND PROPOFOL ON POSTOPERATIVE RECOVERY AND PHYSICAL REHABILITATION OF ATHLETE PATIENTS UNDERGOING MODIFIED RADICAL MASTECTOMY AFTER NEOADJUVANT CHEMOTHERAPY

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ABSTRACT

Background: Modified radical mastectomy remains a prevalent surgical approach for treating breast cancer, with remifentanil and propofol serving as cornerstone anesthetics due to their efficacy. Their impact on the postoperative recovery of athletes, who require rapid return to physical activities, is of particular interest. **Methods:** This study involved 100 patients who underwent modified radical mastectomy following neo adjuvant chemotherapy. They were divided into two groups: one receiving remifentanil (n=50) and the other a combination of remifentanil and propofol (n=50). Outcomes assessed included recovery times, pain levels, complication rates, and clinical indicators, with a special focus on metrics significant to athletes' physical rehabilitation. **Results:** The compound anesthesia group showed significantly shorter onset times for anesthesia, consciousness recovery, extubation, and respiratory satisfaction compared to the remifentanil-only group ($P<0.05$). Additionally, visual analog scale (VAS) scores and agitation levels were substantially lower, and complication rates were reduced (26% vs. 56%, $P<0.05$). Postoperative immune function indexes and intraoperative hemodynamic stability also favored the compound anesthesia group. Notably, recovery times for

respiratory function and directional force, crucial for athletes, were significantly shorter in the compound group (P<0.05). **Conclusion:** The combination of remifentanil and propofol for target-controlled infusion anesthesia significantly enhances postoperative recovery, reduces complication rates, and ensures greater stability in clinical indicators relevant to athletes. These findings support the preference for compound anesthesia in surgeries for athlete patients, optimizing their rehabilitation process and hastening their return to training and competition.

KEYWORDS: Neo Adjuvant Chemotherapy; Modified Radical Mastectomy; Remifentanil; Propofol; Target-Controlled Infusion Anesthesia

1. INTRODUCTION

Breast cancer remains one of the most common malignancies affecting women worldwide, and athletes are not exempt from this statistic. The modified radical mastectomy, a cornerstone treatment for this disease, presents unique challenges in the context of athlete patients whose livelihoods depend significantly on their physical capabilities. Postoperative management, particularly anesthesia, plays a pivotal role in determining how quickly and effectively these individuals can return to their training routines and competitive performances (Boere et al., 2022; Burstein et al., 2021; Desai & Aggarwal, 2021; Jagsi et al., 2022; Qiu, Zhong, Hu, & Wu, 2022; Xu, Chen, Hu, & Huang, 2021; A. Zhang, Wang, Fan, & Mao, 2021; Zhao & Rosen, 2022). Athlete patients present unique challenges that transcend the typical postoperative recovery trajectory. The demands of returning to a high level of physical fitness and the psychological readiness to compete at elite levels require that every aspect of their medical care be optimized for speed and efficiency. This includes minimizing the physical downtime associated with surgery and enhancing the recovery process to prevent long-term detriments to their performance (De Rose et al., 2022; McCart Reed, Kalinowski, Simpson, & Lakhani, 2021; Paluch-Shimon et al., 2022). Anesthesia is a critical component of this optimization. Remifentanil and propofol, widely used for their rapid onset and recovery properties, have become a focal point of research within surgical practices. However, the generic application of these anesthetics may not meet the specialized needs of athlete patients. Enhanced recovery protocols that incorporate target-controlled infusion (TCI) anesthesia offer a more refined approach, allowing for the administration of anesthesia tailored to the patient's specific physiological requirements (Cilibrasi, Papanastasopoulos, Samuels, & Giamas, 2021; Miglietta et al., 2022; Mondal, Conole, Nautiyal, & Tate, 2022; Wang, Li, Liu, & Song, 2021). TCI provides anesthesiologists with the ability to maintain more stable drug levels in the blood, thereby reducing the risk of over- or under-dosing, which can lead to extended recovery times or insufficient pain management, respectively. For athletes, whose bodies are finely tuned and highly sensitive to physical alterations, the precision of TCI could mean the

difference between a swift recovery and extended complications that might jeopardize their careers (Aitken, Correa, Samuels, Gannon, & Llaguna, 2022; Chen et al., 2022; Lopez, Padilla, García, Orozco, & Rodilla, 2021). This study specifically investigates the effectiveness of TCI anesthesia with remifentanil and propofol in accelerating recovery times and improving clinical outcomes for athlete patients undergoing modified radical mastectomy after neo adjuvant chemotherapy. It hypothesizes that a targeted compound anesthesia protocol will result in significantly better recovery outcomes—shorter hospital stays, less postoperative pain, quicker return to training, and lower incidence of complications—compared to standard anesthesia practices. The implications of this research extend beyond individual patient care to influence broader practices in surgical oncology and sports medicine (Lefrère et al., 2021; Liu, Zhou, Song, & Tang, 2021; Sessler et al., 2019; X. Zhang et al., 2019). By documenting and analyzing how tailored anesthesia protocols can benefit athlete patients, the study aims to contribute to a more nuanced understanding of postoperative care in this unique population. This knowledge could lead to advancements in personalized medicine approaches, not only improving outcomes for athlete patients but also setting new standards for postoperative care in sports-related medical practices.

2. Materials and Methodologies

2.1 Research object

A hundred patients who received modified radical mastectomy after neoadjuvant chemotherapy at XXX Hospital from January 2021 to December 2021 were retrospectively recruited. Regarding the adoption of anesthetics, the patients were assigned into remifentanil anesthesia group (n=50) (remifentanil anesthesia) and compound anesthesia group (n=50) (remifentanil combined with propofol target-controlled infusion anesthesia). All patients underwent modified radical mastectomy after neoadjuvant chemotherapy. The anesthesia effects, recovery effects, and complications of the two groups were compared.

Inclusion criteria: (1) patients' medical records were complete; (2) patients had undergone modified radical mastectomy after neoadjuvant chemotherapy; (3) patients had no anesthesia drug taboo; (4) patients had no other malignant tumors; (5) patients who voluntarily participated in this experiment and signed the informed consent form. Exclusion criteria: (1) incomplete medical records; (2) patients complicated with important organ diseases; (3) patients suffering from hereditary diseases; (4) patients suffering from immune system diseases; (5) patients with mental disorders and thus unable to communicate normally; and (6) patients not willing to participate in the study.

2.2 Methods

Patients in both groups underwent modified radical mastectomy after neoadjuvant chemotherapy. Atropine (0.5 mg, H34021900, Huayuan Pharmaceutical Group Co., Ltd., Anhui, China) was injected 10 min before anesthesia. Mechanical ventilation (VT) 8–10 mL/kg, RR 10/min, and I:E=1:2 was performed after tracheal intubation. Patients in remifentanil anesthesia group were continuously pumped with remifentanil (H20030197, Renfu Pharmaceutical Co., Ltd., Yichang, China) at 0.05–2.00 μg/ (kg min), while patients in compound anesthesia group were continuously pumped with propofol (H20030114, Guorui Pharmaceutical Co., Ltd., Sichuan, China) at 4–6 mg/(kg h). All drugs were stopped in both groups after the operation, and the recovery time from anesthesia was observed. The pain and complications of the patients were observed after the operation, and the perioperative hemodynamic indicators and immune function-related indicators of the two groups were analyzed.

2.3 Observation indicators

(1) Statistics were made on the general information of patients in two groups, mainly including the average age, average length of education, and body mass index (BMI) of patients. The BMI calculation method is shown in Equation (1). The number of pregnant and lying-in women in the two groups of subjects was counted.

$$BIM = \frac{Weight}{Height^2} \quad (1)$$

(2) A comparative analysis was performed on the anesthesia recovery of patients in different groups, including operation time, onset time of anesthesia, consciousness recovery time, extubation time, and respiratory satisfaction time. (3) A comparative analysis of the pain score and agitation score in different groups was performed, including visual analog scale (VAS) score, postoperative nausea and vomiting (PONV) score, and agitation score. (4) Comparison and analysis of surgical infusion volume and surgical bleeding volume were performed between groups. (5) Comparison and analysis of postoperative complications between groups were performed. The main postoperative complications were nausea, vomiting, dizziness, palpitation, restlessness, respiratory depression, and gastrointestinal discomfort. The calculation method of postoperative complications is shown in Equation (2), where *Number of complications* is the number of complications in patients, and *Total* is the total number of patients.

$$\text{Complication} = \frac{\text{Number of complications}}{\text{Total}} \quad (2)$$

(6) Comparison and analysis of perioperative immune function indicators in two groups of patients were carried out, mainly including CD3+, CD4+, CD8+,

and natural killer cells (NK). (7) Comparison and analysis of perioperative hemodynamic indicators in two groups of patients, including systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and oxygen saturation (SpO_2). (8) A comparative analysis was performed on the situations where patients in the two groups were converted into severe cases. The calculation method of *Severity rate* is shown in Equation (3), where *Number of severe cases* is the number of patients converted into severe cases, and *Total* is the total number of patients.

$$\text{Severity rate} = \frac{\text{Number of severe cases}}{\text{Total}} \quad (3)$$

(9) A comparative analysis was performed on postoperative recovery. The evaluation indexes mainly include respiratory recovery time and directional force recovery time.

2.4 Statistical processing

Excel 2016 was employed to record and summarize data. SPSS 20.0 was employed for data statistics and analysis. Mean standard deviation ($\bar{x}\pm s$) was how all measurement data was denoted in this work, and a *t*-test was adopted. Percentage (%) was how count data was denoted, tested by χ^2 test. $P<0.05$ indicated a significant difference.

3. Result

3.1 Contrast of general data

Table 1 illustrates the comparison of the data of patients. The years of education of patients in remifentanil anesthesia group was 12.33±2.67 years, while that in compound anesthesia group was 12.75±2.95 years. The average age of patients in remifentanil anesthesia group was 33.66±5.21 years, and that in compound anesthesia group was 33.52±5.58 years. The BMI of remifentanil anesthesia group was 21.39±3.62 kg/m_2 and that of compound anesthesia group was 21.14±3.82 kg/m^2. The years of education, mean age, and BIM differed slightly between groups ($P>0.05$), indicating comparability.

Table 1: Contrast of general data

GROUP	AGE (YEARS OLD)	YEARS OF EDUCATION (YEARS)	BIM (KG/M^2)
REMIFENTANIL ANESTHESIA GROUP	33.66±5.21	12.33±2.67	21.39±3.62
COMPOUND ANESTHESIA GROUP	33.52±5.58	12.75±2.95	21.14±3.82

3.2 Comparative analysis of recovery from anesthesia

Table 2 illustrates the comparation of anesthesia recovery. The operation time of patients in remifentanil anesthesia group was 86.77 min and that of patients in compound anesthesia group was 86.92 min. The onset time of anesthesia was 1.94 min in remifentanil anesthesia group and 1.65 min in compound anesthesia group. The consciousness recovery time of patients in remifentanil anesthesia group was 19.22 min and that of patients in compound anesthesia group was 14.94 min. The extubation time of patients in remifentanil anesthesia group was 13.74 min and that of patients in compound anesthesia group was 10.82 min. The respiratory satisfaction time of patients in remifentanil anesthesia group was 9.37 min and that of patients in compound anesthesia group was 6.28 min. No marked difference in operation time was suggested between groups (P>0.05). The onset time of anesthesia, consciousness recovery time, extubation time, and respiratory satisfaction time of patients in compound anesthesia group were obviously shorter relative to those of patients in remifentanil anesthesia group (P<0.05).

Table 2: Comparative analysis of recovery from anesthesia between groups

GROUP	OPERATION TIME	ONSET TIME OF ANESTHESIA	CONSCIOUSNESS RECOVERY TIME	EXTUBATION TIME	RESPIRATORY SATISFACTION TIME
REMIFENTANIL ANESTHESIA GROUP	86.77	1.94	19.22	13.74	9.37
COMPOUND ANESTHESIA GROUP	86.92	1.65	14.94	10.82	6.28

3.3 Comparative analysis of pain and agitation scores

Table 3 illustrates the comparative analysis of pain and agitation scores. The VAS score of the patients in remifentanil anesthesia group was 2.58 points and that of the patients in compound anesthesia group was 2.13 points. The PONV score was 0.41 for patients in remifentanil anesthesia group and 0.49 for patients in compound anesthesia group. The agitation score of patients in remifentanil anesthesia group was 0.23 points and that of patients in compound anesthesia group was 0.07 points. The VAS and agitation scores of the patients in compound anesthesia group were dramatically inferior to those of remifentanil anesthesia group, and the PONV score was greatly superior to remifentanil anesthesia group (P<0.05).

Table 3: Contrast of pain score and agitation score between groups

GROUP	VAS SCORE	PONV SCORE	RESTLESSNESS SCORE
REMIFENTANIL ANESTHESIA GROUP	2.58	0.41	0.23
COMPOUND ANESTHESIA GROUP	2.13	0.49	0.07

3.4 Comparative analysis of surgical infusion volume and surgical bleeding volume

Figure 1 is a comparative analysis of the surgical infusion volume and surgical hemorrhage volume of patients. The surgical infusion volume of patients in remifentanil anesthesia group was 963.22 mL, the surgical infusion volume of patients in compound anesthesia group was 969.38 mL, the surgical hemorrhage volume of patients in remifentanil anesthesia group was 45.28 mL, and the surgical hemorrhage volume of patients in compound anesthesia group was 46.33 mL. No great difference in the surgical infusion volume and surgical hemorrhage volume of patients was found between groups (*P*>0.05).

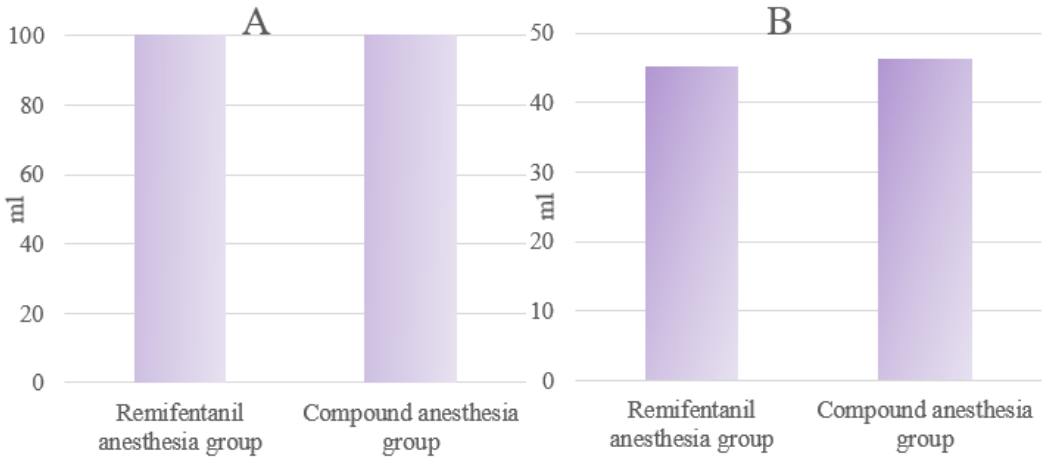


Figure 1: Contrast of surgical infusion volume and surgical blood loss between groups. (A is surgical infusion volume, B is surgical blood loss)

3.5 Comparative analysis of postoperative complications

Figure 2 is a comparative analysis of postoperative complications of patients. Among the patients in remifentanil anesthesia group, six experienced nausea, two experienced vomiting, eight experienced dizziness, four experienced palpitation, three experienced agitation, two experienced respiratory depression, and three experienced gastrointestinal discomfort. In the patients in compound anesthesia group, there were three patients who experienced nausea, zero patients who experienced vomiting, four patients who experienced dizziness, two patients who experienced palpitation, zero patients who experienced agitation, one patient who experienced respiratory

depression, and three patients who experienced gastrointestinal discomfort. The incidence of complications was 56% in remifentanil anesthesia group and 26% in compound anesthesia group. Therefore, the incidence of complications in compound anesthesia group was evidently inferior to remifentanil anesthesia group (P<0.05).

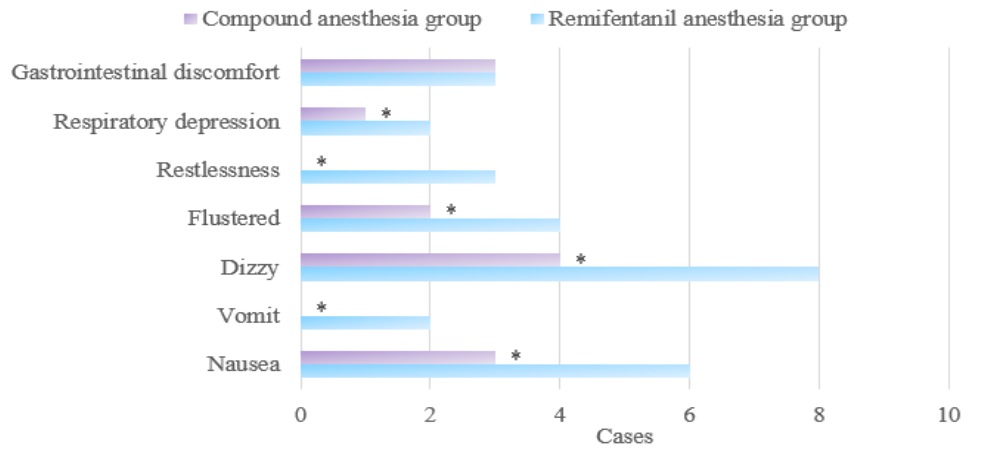


Figure 2: Comparative analysis of postoperative complications. (* P<0.05 vs. remifentanil anaesthesia group.)

3.6 Comparative analysis of perioperative immune function indexes

Figure 3 illustrates the comparative analysis of perioperative immune function indexes between groups. In remifentanil anesthesia group, the percentage of CD3+ cells were 75.28% before surgery, 56.77% 1 days after surgery, 61.33% 2 days after surgery, and 72.81% 3 days after surgery. In compound anesthesia group, the percentage of CD3+ cells were 75.62% before surgery, 62.58% 1 days after surgery, 72.47% 2 days after surgery, and 72.45% 3 days after surgery. In remifentanil anesthesia group, CD4+ was 45.37% before surgery, 26.32% 1 days after surgery, 33.26% 2 days after surgery, and 43.91% 3 days after surgery.In compound anesthesia group, CD4+ was 45.83% before surgery, 33.18% 1 days after surgery, 42.18% 2 days after surgery, and 43.18% 3 days after surgery. In remifentanil anesthesia group, CD8+ was 33.95% before surgery, 30.72% 1 day after surgery, 31.22% 2 days after surgery, and 32.18% 3 days after surgery. In compound anesthesia group, CD8+ was 33.42% before surgery, 30.02% 1 days after surgery, 31.75% 2 days after surgery, and 32.84% 3 days after surgery. The NK of remifentanil anesthesia group was 18.45% before surgery, 10.78% 1 days after surgery, 15.83% 2 days after surgery, and 17.64% 3 days after surgery. In compound anesthesia group, NK was 18.62% before surgery, 14.38% 1 days after surgery, 17.92% 2 days after surgery, and 17.82% 3 days after surgery. Hence, the indexes of immune function in both groups gradually recovered after surgery, and those in compound anesthesia group recovered faster (P<0.05).

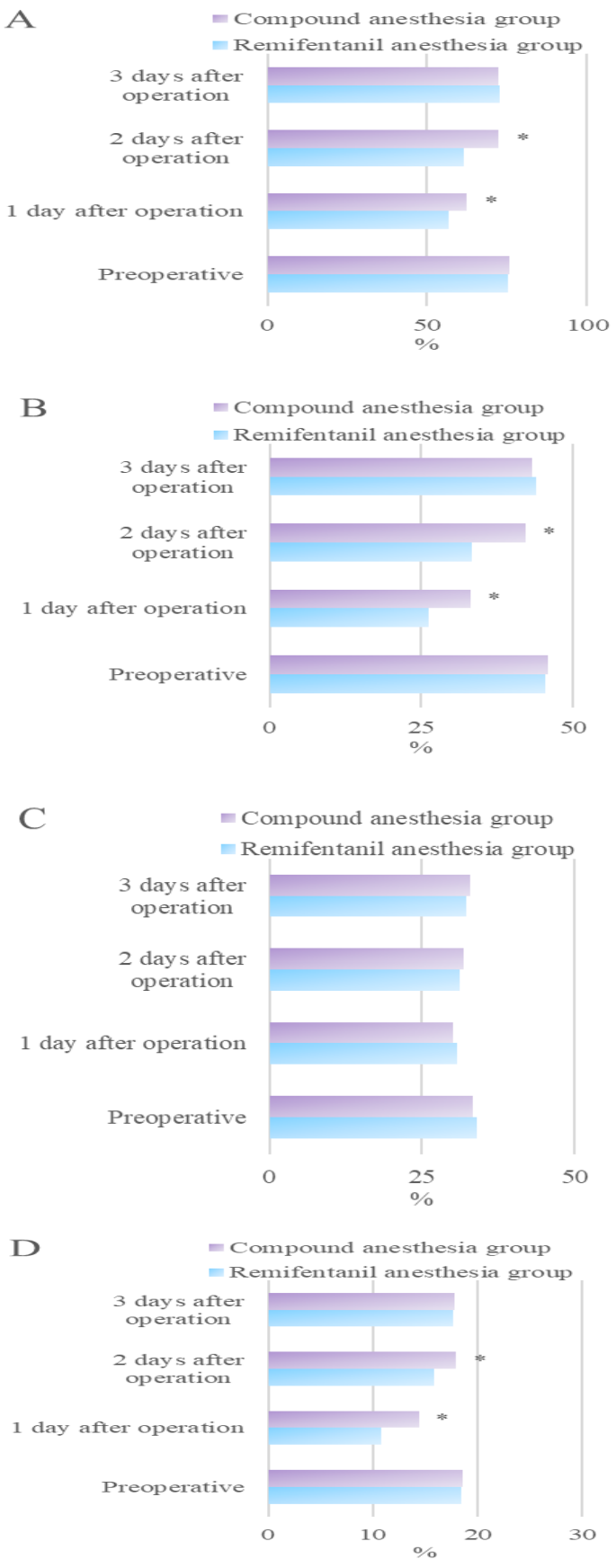
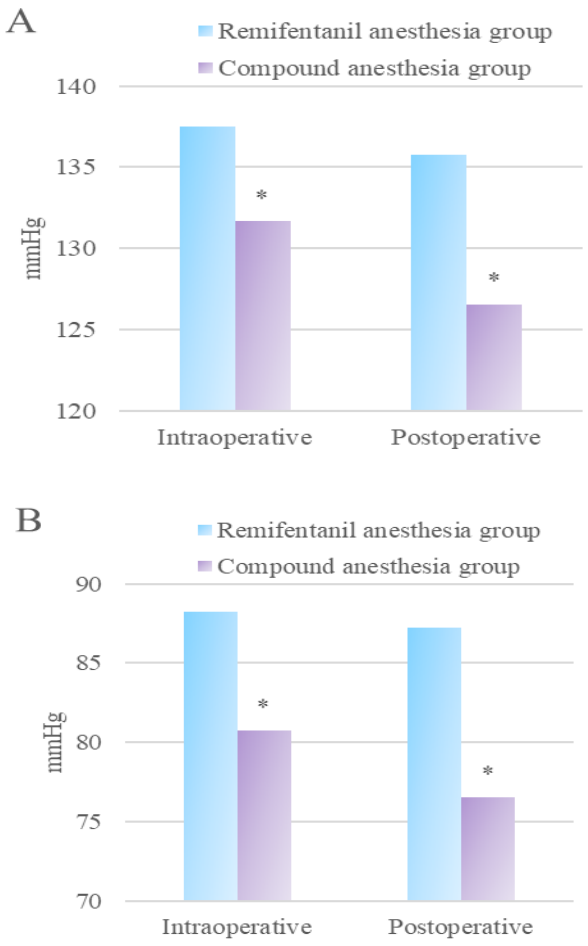


Figure 3: Contrast of perioperative immune function indexes between groups. (A is CD3+, B is CD4+, C is CD8+, D is NK, * *P*<0.05 vs. remifentanil anesthesia group.)

3.7 Comparative analysis of perioperative hemodynamic indexes

Figure 4 illustrates the comparative analysis of perioperative hemodynamic indexes between groups, where A is SBP, B is DBP, C is HR, and D is SpO_2. The intraoperative SBP of remifentanil anesthesia group was 137.48 mmHg, and the postoperative SBP was 135.79 mmHg. In compound anesthesia group, the SBP was 131.67 mmHg during the operation and 126.56 mmHg after the operation. The intraoperative DBP in remifentanil anesthesia group was 88.27 mmHg, and the DBP was 87.22 mmHg after surgery. The intraoperative DBP in compound anesthesia group was 80.77 mmHg and was 76.56 mmHg after surgery. The intraoperative HR of remifentanil anesthesia group was 92.17 times/min, and the postoperative HR was 90.37 times/min. In compound anesthesia group, the intraoperative HR was 80.56 times/min, and the postoperative HR was 77.32 times/min. In remifentanil anesthesia group, the intraoperative SpO_2 was 97.33%, and the postoperative SpO_2 was 99.82%. In compound anesthesia group, SpO_2 was 97.45% intraoperatively and 99.48% postoperatively. Therefore, the postoperative hemodynamic indexes of patients in both groups gradually recovered, the recovery of patients in compound anesthesia group was faster, and the intraoperative hemodynamic indexes of patients in compound anesthesia group were more stable (P<0.05).



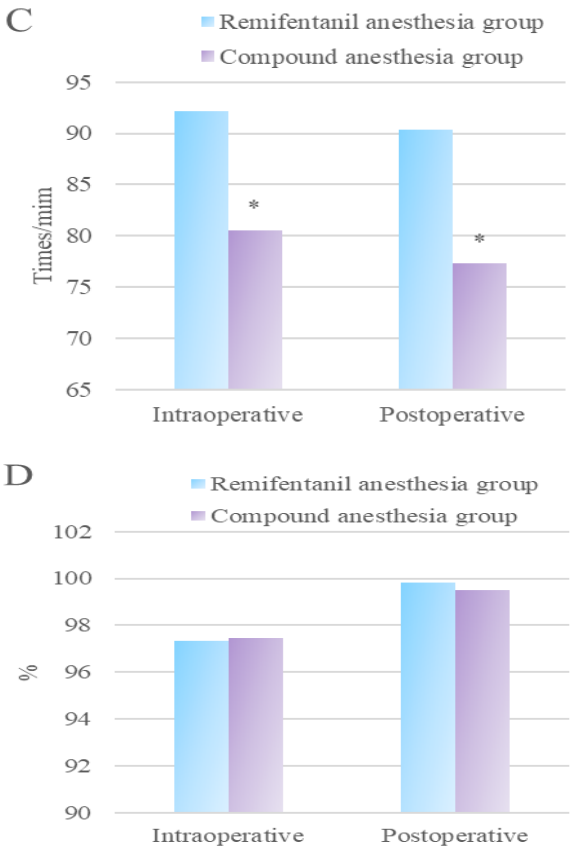


Figure 4: Contrast of perioperative hemodynamic indexes between groups. (A is SBP, B is DBP, C is HR, D is SpO_2, * *P*<0.05 vs. remifentanil anesthesia group.)

3.8 Comparative analysis of conversion to severe disease

Figure 5 illustrates the comparative analysis of the conversion of patients into severe conditions between groups. Among the patients under remifentanil anesthesia, 2 patients were converted into severe conditions, accounting for 4%; among the patients under combined anesthesia, 4 patients were converted into severe conditions, accounting for 8%. The number of patients who converted to severe disease in compound anesthesia group was substantially less versus remifentanil anesthesia group (*P*<0.05).

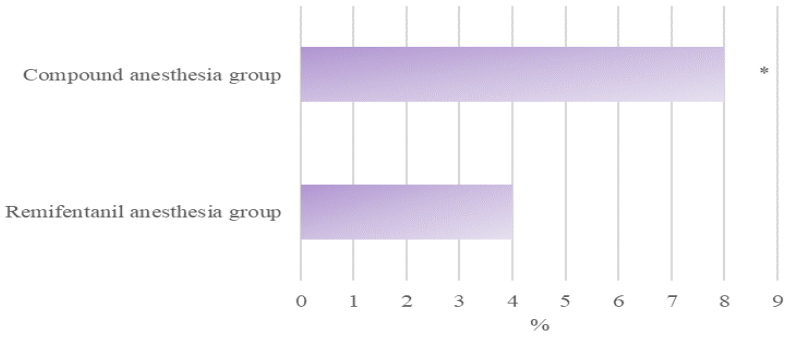


Figure. 5: Contrast of conversion to severe disease between groups. (* *P*<0.05 vs. remifentanil anaesthesia group.)

3.9 Comparative analysis of postoperative recovery

Figure 6 is a comparative analysis of postoperative respiratory recovery time of patients. The postoperative respiratory recovery time of patients in remifentanil anesthesia group was 8.72 min and that of patients in compound anesthesia group was 5.98 min. The postoperative respiratory recovery time of patients in compound anesthesia group was markedly shorter versus remifentanil anesthesia group (P<0.05). Figure 7 shows the recovery time of directional force after surgery between groups. The recovery time of postoperative directional force of patients in remifentanil anesthesia group was 21.27 min and that of patients in compound anesthesia group was 14.89 min. The recovery time of postoperative directional force in compound anesthesia group was drastically shorter versus remifentanil anesthesia group (P<0.05).

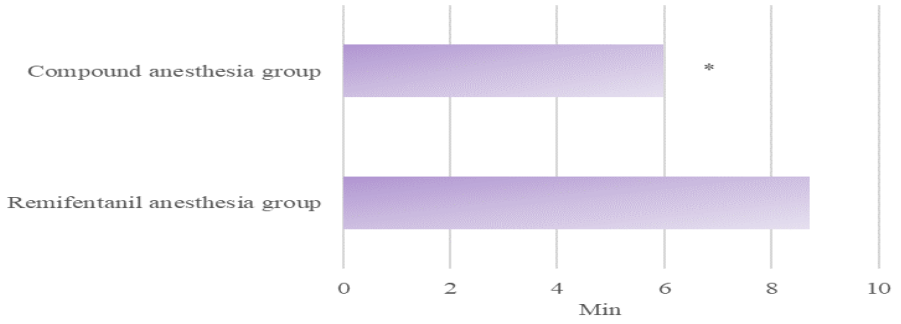


Figure.6: Contrast of postoperative respiratory recovery time between groups. (* P<0.05 vs. remifentanil anaesthesia group.)

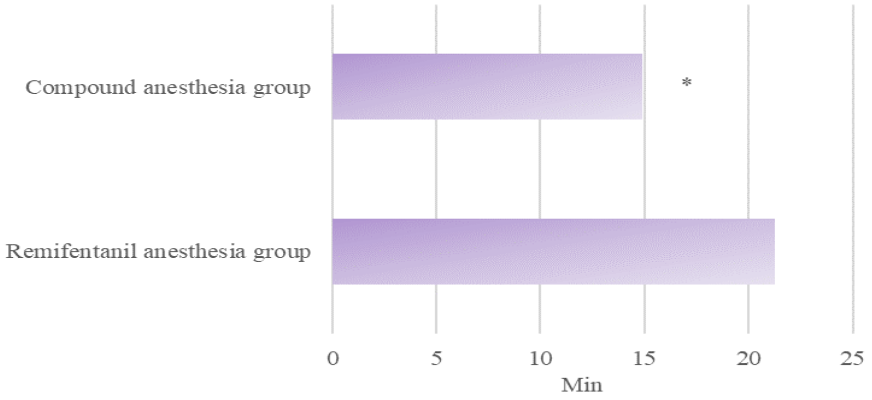


Figure.7: Comparative analysis of postoperative orientation recovery time. (* P<0.05 vs. remifentanil anaesthesia group.)

4. Discussion

The incidence of breast cancer has become increasingly high recently and has become the world's first incidence of cancer. The onset of breast cancer is gradually younger, and many young women have developed breast

cancer (Subhan & Muzibur Rahman, 2022). Breast cancer has many types, complex etiology, and various treatment options and prognoses, which require targeted treatment (Bodewes, van Asselt, Dorrius, Greuter, & de Bock, 2022). Surgical treatment is currently the most common treatment, which can better control the disease, improve the prognosis, and increase the survival rate and productive life of patients (Corradini et al., 2021). Modified radical mastectomy for breast cancer can cure the disease well, with less damage to the patients during the operation, rapid postoperative recovery, and good therapeutic effect (Bimonte et al., 2021; R. Yan, Song, Wang, Tian, & Ma, 2023). Anesthesia is an important part of surgery and is of great significance to the success of surgery. Selecting appropriate anesthesia methods and anesthetics can ensure the smooth progress of the surgery, promote the early recovery of patients after surgery, and reduce the pain of patients (Kang et al., 2020; Oh, Hong, Park, Kwon, & Kim, 2022). Remifentanil is an opioid, and it is an ideal target-controlled infusion drug for anesthesia due to its short duration of anesthesia effect, good controllability, and low probability of postoperative complications (Tian et al., 2020). Propofol is an intravenous anesthesia drug that is often adopted in intravenous anesthesia surgery. It has good analgesic and sedative effects, a low probability of postoperative agitation and high safety (Y. Zhang, Jiang, & Luo, 2022). (Y. Zhang et al., 2022) studied the analgesic effects of remifentanil combined with dexmedetomidine on patients after modified radical mastectomy and the effects on T lymphocyte subsets during the perioperative period. CD4+ and CD4+/CD8+ cell ratio under anesthesia with remifentanil combined with dexmedetomidine was superior to that under anesthesia induction and maintenance with remifentanil alone (P<0.05), yet that of CD8+ cells were relatively inferior (P<0.05). Remifentanil plus dexmedetomidine could enhance analgesia and reduce immunosuppression postoperatively for breast cancer patients who received modified radical mastectomy. (T. Yan, Zhang, Wang, Sun, & Zheng, 2018) analyzed the impact of total intravenous anesthesia based on propofol/remifentanil and inhalation anesthesia based on sevoflurane on the release of vascular endothelial growth factor (VEGF) and transforming growth factor-β (TGF-β) and recurrence rate in patients after breast cancer surgery. Compared with inhalation anesthesia based on sevoflurane, total intravenous anesthesia based on propofol/remifentanil could considerably suppress breast surgery-induced VEGF but was not beneficial to the short-term recurrence of breast cancer. Propofol is an imperative intravenous anesthetic that can suppress the activity of breast cancer cells by weakening the inhibition of immune system and facilitating tumor cell apoptosis (Fang, Zhou, Xia, Lu, & Liu, 2022). (Sun, Liu, Pei, Zhao, & Huang, 2022) explored whether propofol and its commonly used clinical preparations affected the chemotherapy effect of triple-negative breast cancer cells by regulating cell iron ptosis and found that propofol had an antiproliferative effect on triple-negative breast cancer cells and might be a potential adjuvant that partially improved the chemotherapy sensitivity of triple-negative breast cancer cells by

promoting cell iron removal. The adoption efficiency of remifentanil combined with propofol target-controlled infusion anesthesia for breast cancer patients undergoing modified radical mastectomy after neoadjuvant chemotherapy was analyzed, and the anesthesia effect, recovery, complications, immune function indexes, and hemodynamic indexes of different anesthetics were compared. The results revealed that the onset time, consciousness recovery time, extubation time, and respiratory satisfaction time of patients in compound anesthesia group were shorter versus remifentanil anesthesia group (P<0.05). The VAS and agitation scores of compound anesthesia group were relatively lower versus remifentanil anesthesia group, and the PONV score was superior to that of remifentanil anesthesia group (P<0.05). No remarkable difference was indicated in the surgical infusion volume and surgical bleeding volume between groups (P>0.05).

The incidence of complications was 56% in remifentanil anesthesia group and 26% in compound anesthesia group. The incidence of complications in compound anesthesia group was lower versus remifentanil anesthesia group (P<0.05). After surgery, the immune function indexes of the two groups gradually recovered, and the patients in compound anesthesia group recovered faster (P<0.05). Patients in the postoperative compound anesthesia group recovered faster, and the hemodynamic indicators of the patients in the intraoperative compound anesthesia group were more stable (P<0.05). Furthermore, of the patients in remifentanil anesthesia group, 4% were converted to critical illness, and among the patients in compound anesthesia group, 8% were converted to critical illness. The number of patients in compound anesthesia group who converted to critical illness was inferior to remifentanil anesthesia group (P<0.05). The postoperative respiratory recovery time and postoperative directional force recovery time of patients in compound anesthesia group were shorter versus remifentanil anesthesia group (P<0.05). The results proved that remifentanil combined with propofol target-controlled infusion anesthesia had great advantages, good anesthesia effect, short recovery time, and fewer complications and had a positive clinical application value.

5. Conclusion

The findings from this study underscore the superior benefits of combining remifentanil with propofol in a target-controlled infusion anesthesia approach for athlete patients undergoing modified radical mastectomy post-neo adjuvant chemotherapy. This anesthesia strategy not only ensures effective pain management and rapid onset of action but also significantly improves various postoperative recovery parameters crucial for athletes, including reduced recovery times for consciousness, extubation, and respiratory satisfaction. The reduced complication rates and enhanced stability of hemodynamic and immune function indexes observed in the compound

anesthesia group highlight the tailored benefits of this approach. These factors are especially critical for athletes, whose careers depend heavily on their ability to recover quickly and return to peak physical condition post-surgery. The shortened recovery times for respiratory function and directional force are particularly relevant, as they directly impact an athlete's training and competitive performance.

Additionally, the lower visual analog scale scores and agitation levels in the compound anesthesia group suggest a more comfortable recovery process, which can significantly affect an athlete's psychological readiness to resume training. The marked decrease in the incidence of complications further emphasizes the safety and efficacy of the compound anesthesia approach, making it a preferable option for surgeries in this unique patient demographic. Given these outcomes, it is recommended that medical professionals consider the compound anesthesia approach when planning surgeries for athlete patients, particularly those requiring quick postoperative recovery for a return to training and competition. Future research should focus on long-term follow-up with athlete patients to assess the sustained benefits of this anesthesia approach on their sports performance and overall quality of life.

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