Biomedical Research 2017; 28 (11): 4897-4901

ISSN 0970-938X
www.biomedres.info

Effects of different anesthesia modes on the stress hormones and immune factors of radical mastectomy patients.

Zhi Zhang[1,2], Yan Zhang[3], Shu-Biao Wu[1], Tie-Li Dong[1*]

[1]Department of Anesthesiology, the Second Affiliated Hospital of Zhengzhou University, Zhengzhou, Henan, PR China

[2]Department of Anesthesiology, Huaihe Hospital of Henan University, Kaifeng, Henan, PR China

[3]Department of Pathology, Huaihe Hospital of Henan University, Kaifeng, Henan, PR China

Abstract

Objective: This study aims to examine the combined effects of laryngeal mask inhalation anesthesia and epidural anesthesia on stress hormones and immune factors of radical mastectomy patients.

Method: A total of 68 patients who underwent radical mastectomy from February 2015 to January 2017 participated in the study. They were divided into the control group (trachea cannula combined with traditional intravenous anesthesia) and observation group (laryngeal mask inhalation anesthesia combined with epidural anesthesia) according to the type of surgical anesthesia used. Peripheral venous blood cortisol and T-lymphocyte subpopulation (CD3+, CD4+, and CD8+) were tested before anesthesia administration (T1), immediately after anesthesia administration (T2), immediately after radical mastectomy (T3), and 3 days after radical mastectomy (T4). Differences in the stress hormones and immune factors of the patients were evaluated on the basis of the differences in cortisol concentrations and numerical changes in the CD3+% and CD4+/CD8+ values.

Results: The CD3+% and CD4+/CD8+ values of the two groups show no significant difference before the radical mastectomy but decrease considerably immediately after anesthesia administration. The decreases in the CD3+% and CD4+/CD8+ values of the control group are larger than those of the observation group and continue to decrease continuously after the radical mastectomy. However, the observation group still has higher CD3+% and CD4+/CD8+ values than the control group. Although the CD3+% and CD4+/CD8+ values decrease at varying extents 3 days after radical mastectomy, they remain higher than those obtained before radical mastectomy, and the observation group has higher CD3+% and CD4+/CD8+ values than the control group. The varying cortisol concentrations at different time points correspond to the T-lymphocytes. The cortisol concentrations increase considerably after the anesthesia, particularly in the control group increase continuously after radical mastectomy. The cortisol concentration of the observation group is lower than that of the control group. Although the cortisol concentrations decrease at varying extents 3 days after radical mastectomy, they remain higher than those obtained before radical mastectomy. The cortisol concentrations of the observation group are lower than those of the control group.

Conclusions: Simultaneously administering anesthesia through laryngeal mask inhalation and epidural anesthesia can significantly reduce damages to the body immunities of patients treated with radical mastectomy. This approach results in smaller stress damages compared with anesthesia administration through total intravenous endotracheal intubation and is thus beneficial to postoperative rehabilitation. Furthermore, this approach can reduce postoperative secondary infection and probable harm to patients.

Keywords: Radical mastectomy, Stress hormone, Immune factor.

Accepted on March 27, 2017

Introduction

Breast cancer is characterized by malignant lesions in breast epithelial tissues and one of the common malignant diseases affecting females [1,2]. Breast cancer patients suffer from damages from radical mastectomy and their bodies often exhibit substantial stress reaction before the operation and after anesthesia administration [3]. These effects increase the risks of postoperative complications, such as septicopyemia and infection and influence operative treatment effects and postoperative rehabilitation [4,5]. Thus considerable attention must be given to the different effects of different anesthesia modes on immunity and stress hormone of patients in clinics. In this study, the effects of simultaneously administering laryngeal mask inhalation anesthesia and epidural anesthesia and performing trachea cannula with traditional intravenous anesthesia on stress hormones and immune factors of patients treated with radical mastectomy were observed clinically during the perioperative periods.

General Information and Method

General information

The study included 68 patients who underwent radical mastectomy under general anesthesia from February 2015 to January 2017. The patients were all females and aged 27-63 years (average of 40.83 ± 12.71 years). The disease courses ranged from four months to four years, (1.64 ± 3.27 years in average). The diagnoses performed conformed to the ASA classification (level I-II) and TNM staging (stage I-II). Pathological details are shown in Figures 1 and 2. The clinical manifestations of the patients were as follows: orange peel of skin, nipple lump, hollow and polyrrhea, accompanied with axillary lymph node metastasis. The patients were divided into the control group (trachea cannula combined with traditional intravenous anesthesia) and observation group (laryngeal mask inhalation anesthesia combined with epidural anesthesia) according to the type of surgical anesthesia used. The groups had 34 patients each. No statistically significant difference was observed between the groups in terms of age, course of disease, patient condition, and educational background (P>0.05), and the groups were comparable. All the respondents or their family members provided their informed consents.

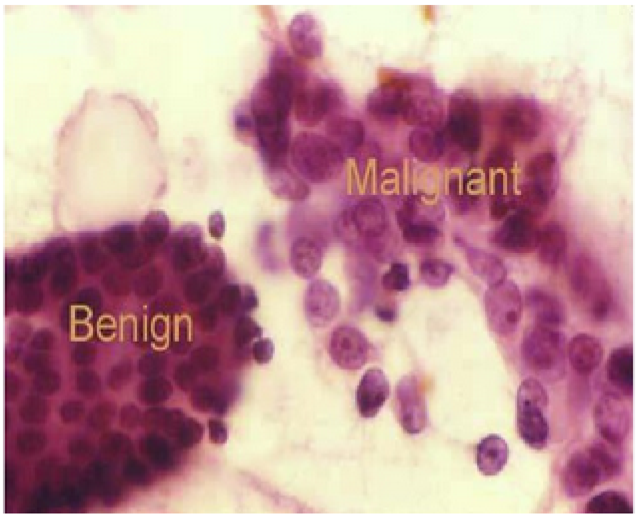

Figure 1. *Breast cancer cells under the electron microscope.*

Inclusion and exclusion criteria

The inclusion criteria in the study were as follows: the patients underwent clinical diagnosis of breast cancer and suggestion on radical mastectomy; had no of cancerous metastasis and other complications, such as cardiac failure, incomplete hepatorenal functions, dysneuria, and diabetes; signed the informed consent form; and provided complete patient data.

Meanwhile, the following were the exclusion criteria: the patients had no surgical indication and underwent conservative therapy; were suffering from fundamental emotional dysfunction, organ failure, or organ dysfunction; pregnant or lactating; had low clinical treatment compliance; and discontinued the program halfway during the research; did not sign the informed consent form; and refused to provide their medical history.

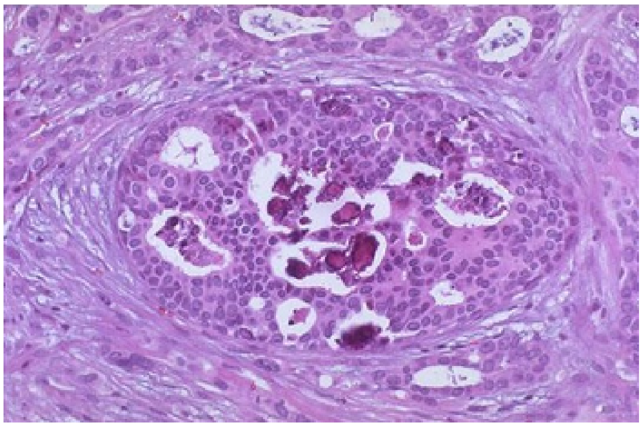

Figure 2. *Breast cancer tissue under pathological biopsy.*

Anesthesia mode

The vein channels of the patients were opened upon entry in the operating room, and their blood pressures, heart rates, blood oxygen levels, and other life indexes were routinely monitored. The index changes of respiratory functions were also monitored with breathing flow sensor. Intravenous drip with 10 mg of diazepam and 0.5 mg of atropin and anesthesia containing 0.2 mg/kg of diazepam and 4 μg/kg of fentanyl were simultaneously administered to each patient 30 min before the operation. The patients were injected intravenously with 1.5 mg/kg of succinylcholine when they were unconscious.

The patients in the control group underwent trachea cannula coupled with traditional intravenous anesthesia when their jaws were completely relaxed. This treatment includes endotracheal intubation and external connection with breathing machine to monitor and control breath. During surgery, the vein was injected with 0.3-0.4 mg/kg diprivan every 30-40 min through a micropump. Meanwhile, the patients in the observation group were treated through laryngeal mask inhalation anesthesia coupled with epidural anesthesia. The size of the laryngeal mask depended on the weight of the patient. Breathing was monitored and controlled in the same manner. The patients underwent a continuous dose of isoflurane through inhalation and received epidural bolus injection with 0.25% 6 ml bupivacaine every 1 h.

Anesthesia administration was stopped immediately at the start of suturing, and the postoperative rehabilitation was observed.

The patients left the operating room after the level of oxyhemoglobin saturation and electrolyte normalizes.

Selection of test indexes

From each patient, 4 ml of peripheral venous blood was collected before the anesthesia administration (T1), immediately after anesthesia administration (T2), immediately after radical mastectomy, and 3 days after the radical mastectomy (T4). This procedure was performed on patients with empty stomachs in the morning. The obtained blood samples were placed in anti-freezing test tubes and stored in static under room temperature for 15 min. The samples were then centrifuged at 3000 r/min for 5 min. The serum and plasma of each blood sample were separated and kept under -15°C. The blood samples were collected 3 days after the operation and analysed uniformly. Cortisol concentration was tested through high-performance liquid chromatography to detect the changes in body stress factors. T-lymphocyte subpopulations (CD3+, CD4+, and CD8+) were then tested through ELISA chemical immunization method coupled with flow cytometry to detect the immune index. The CD3+% and CD4+/CD8+ values were calculated and used to express the variations in the immunities of the patients.

Statistical method

Data analysis was performed in SPSS16.0. The measurement data were expressed as mean ± standard deviation ($\bar{x} \pm S$), and enumeration data were expressed as percentages. Group comparison was tested through χ^2 and difference with a P value of <0.05 was considered statistically significant.

Results

T-lymphocyte immunity

No significant difference is observed between the control and observation groups in terms of CD3+% before the operation. At T2, the observation group has significantly higher CD3+% than the control group, but the variation amplitude of the former is far smaller than that of the latter (P<0.001). At T3, the CD3+% of the control group is far lower than that of the observation group (P<0.001). At T4, the CD3+% values of both groups increase at varying extents but remain lower than those before the operation. Furthermore, the CD3+% of the observation group is higher than that of the control group (P<0.05).

Similarly, no significant difference is observed between the groups in terms of CD4+/CD8+ before the operation. At T2, the CD4+/CD8+ values of both groups decreases significantly (P<0.001), and the reduction in the control group is more evident than that of the observation group (P<0.001). The CD4+/CD8+ continue to decrease after the operation. However, the CD4+/CD8+ of the observation group remains higher than that of the control group (P<0.05). At T4, the CD3+% have same test result. Meanwhile, the CD4+/CD8+ values increase at varying extents but remains lower than those before the operation. Similarly, the CD4+/CD8+ of the observation group are higher than that of the control group (P<0.05, Table 1).

Table 1. *Test results of T-lymphocyte immunity at different time ($\bar{x} \pm S$).*

Test item	Groups	T1	T2	T3	T4
CD3+%	Control group	87.04 ± 11.23	64.83 ± 4.123	57.13 ± 2.743	80.14 ± 5.123
	Observation group	87.20 ± 13.28	73.56 ± 5.8113	69.03 ± 4.1213	81.47 ± 5.1823
CD4+/CD8+	Control group	1.67 ± 0.41	1.41 ± 0.173	1.24 ± 0.343	1.58 ± 0.413
	Observation group	1.70 ± 0.27	1.64 ± 0.2813	1.37 ± 0.1623	1.68 ± 0.3323

Note: ^{1}P<0.001 and ^{2}P<0.05 compared with the control group; 3P < 0.05 for the intragroup comparison at T1.

Cortisol concentration

The cortisol concentrations of both groups increase at varying extents after anesthesia administration, particularly those of the control group (P<0.001). At T3, the cortisol concentration of the control group is significantly higher than that of the observation group (P<0.005). At T4, the cortisol concentrations of both groups decrease at varying extents but remain higher than those before the operation (P<0.005). The cortisol concentration of the observation group is higher than that of the control group (P<0.001, Table 2).

Table 2. *Test results of cortisol concentration ($\bar{x} \pm S$).*

Test item	Groups	T1	T2	T3	T4
Cortisol concentration	Control group	187.23 ± 21.82	231.36 ± 7.673	302.63 ± 5.933	222.54 ± 6.173
	Observation group	193.45 ± 11.81	202.53 ± 6.8732	287.64 ± 5.8231	207.71 ± 5.1931

Note: ^{1}P<0.001 and ^{2}P<0.05 compared with the control group; ^{3}P<0.05 for intragroup comparison at T1.

Discussion

Breast cancer is characterized by malignant lesions of breast epithelial tissues and is one of the common malignant diseases among females. Radical operation for such disease must be implemented after diagnosis to prevent metastasis [6]. Otherwise, treatment failure and mistreatment can promote cancer cell proliferation and diffusion to other tissues and organs through blood circulation and lymphatic return. These effects threaten the safety and physical and psychological health of women. Patients with malignant tumors have weak immunity. Thus, damages resulting from radical operations and substantial stress reactions after anesthesia and before the operation can increase the risk of septicopyemia or infection [7,8]. These complications can greatly influence therapy and postoperative rehabilitation. Surgical treatment for breast cancer has been improving gradually in recent years. However, most current surgical technologies remain invasive and sometimes results in secondary cancer metastasis, which is caused by cancer cell diffusion to other tissues and organs through blood circulation and lymphatic return, when the tumor is not eliminated completely [9]. Among the surgical treatments for breast cancer, radical mastectomy remains the most widely applied in clinics. However, these treatment compromises the immunity of patients. Different anesthesia modes have varied effects on immunity and stress hormones. Considering the development in anesthesia technology, this paper mainly discusses whether or not epidural anesthesia and laryngeal mask inhalation technique facilitate the reduction of stress reaction and profound effects on the immunity functions of patients during the intraoperative period.

T-lymphocytes are crucial to immune response. CD3+ represents total T-cells, and CD4+ is a T-cell helper factor, which participates in the immune response. CD8+ is an immunity suppressor cell and has lethal effect on immune target cells [10]. Thus, CD4+ /CD8+ reflect disease severity and prognosis and can directly reflect the state of immunity. Cortisol is an important index for stress level monitoring and often called as the stress hormone. Our results indicated that the CD3+% and CD4+/CD8+ values of the control and observation groups are similar before the operation but reduce significantly immediately after anesthesia administration. The reduction in the CD3+% and CD4+/CD8+ values of the control group is more significant than those of the observation group. Furthermore, the CD3+% and CD4+/CD8+ values both groups continue to decrease, while the observation group remains to have higher CD3+% and CD4+/CD8+ value than the control group. Three days after the operation, the CD3+% and CD4+/CD8+ of two groups increase at varying extents but remain lower than those before the operation. The CD3+% and CD4+/CD8+ of the observation group are higher than those of the control group. The variations in the cortisol concentrations at different time points are consistent with the variations in the T-lymphocytes. The cortisol concentration increases significantly at T2, particularly that of the control group. It continues to increase at T3, wherein the observation group has higher cortisol concentration than the control group. At T4, the cortisol concentrations of both groups decrease at varying extents but remain higher than those before the operation. The observation group has higher cortisol concentration than the control group.

Conclusion

Laryngeal mask inhalation anesthesia coupled with epidural anesthesia can reduce the profound effects of radical mastectomy on patients. This treatment method is better than complete trachea cannula combined with traditional intravenous anesthesia in terms of reducing stress damages, improving postoperative rehabilitation, and lowering the risk of secondary infection and injuries. In addition, laryngeal masks facilitate ventilation during operation and can be operate easily without the risk of injuring the vocal cords and trachea. Laryngeal masks are safe for patients with cardiovascular diseases. However, laryngeal masks cannot isolate the respiratory tract and esophagus completely and thus may cause wrong aspiration of secretions in the respiratory tract. Thus, the breathing conditions of patients must be monitored closely during the operation.

References

1. Biswas G, Sarkar S, Acharya K. Free radical scavenging and anti-inflammatory activities of the extracts of Astraeus hygrometricus (Pers.) Morg. Lat Am J Pharm 2010; 29: 549-553.
2. Levy YA, Fainberg KM, Amidror T, Regev K, Auriel E. High and dysregulated secretion of epidermal growth factor from immune cells of patients with relapsing-remitting multiple sclerosis. J Neuroimmunol 2013; 257: 82-89.
3. Jiang X, Chen X, Wei Y. Free radical scavenging activity and flavonoids contents of Polygonum orientale leaf, stem and seed extracts. Lat Am J Pharm 2009; 28: 284-287.
4. Chandrakar C, Sharma M. Approach for design of early warning monitoring system for detection of the abnormal cardiac behaviour of any individual. Biomed Res India 2017; 28: 81-86.
5. Dasgupta S, Navarrete AM, Delignat S, Wootla B, Andre S. Immune response against therapeutic factor VIII in hemophilia A patients-a survey of probable risk factors. Immunol Lett 2007; (1): 23-28.
6. Formagio ASN, Santos LACD, Cardoso CAL. Free radical scavenging and anti-edematogenic activities of essential oil obtained from Trichilia silvatica DC. (Meliaceae) leaves. Lat Am J Pharm 2012; 31: 469-473.
7. Schwarz E, Beveren NJ van, Ramsey J, Leweke FM, Rothermundt M. Identification of subgroups of schizophrenia patients with changes in either immune or

growth factor and hormonal pathways. Schizophrenia Bull 2013; 40: 787-795.

8. Reipert BM, Helden PM van, Van PM, Schwarz HP, Hausl C. Mechanisms of action of immune tolerance induction against factor VIII in patients with congenital haemophilia A and factor VIII inhibitors. Brit J Haematol 2007; 136: 12-25.
9. Thilakvathi B, Shenbaga DS, Bhanu K, Malaippan M. EEG signal complexity analysis for schizophrenia during rest and mental activity. Biomed Res India 2017; 28: 1-9.
10. Camtosun A, Celik H, Altintas R, Topcu I, Tasdemir C. Does preoperative neutrophil-to-lymphocyte ratio have a value in predicting recurrence in bladder tumour after intravesical BCG treatment. Biomed Res India 2017; 28: 36-40.

*Correspondence to

Tie-Li Dong

Department of Anesthesiology

The Second Affiliated Hospital of Zhengzhou University

PR China