Effect of propofol intravenous anesthesia on hemorheology, hemodynamics and immune function in patients with colorectal cancer after radical operation

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ABSTRACT

Objective: To investigate the effect of Propofol Intravenous Anesthesia on hemorheology, hemodynamics and immune function in patients with colorectal cancer after radical operation. Method: A total of 100 patients with colorectal cancer treated in our hospital from September 2015 to August 2017 were randomly divided into observation group and control group according to random number table. The control group was inhaled sevoflurane anesthesia, observation group propofol intravenous anesthesia. The changes of hemorheology, hemodynamics and immune function were compared between the two groups. Results: There was no significant difference in hemorheology index, hemodynamic index, T lymphocyte subsets CD45RA⁺, CD45RO⁺, CD45RA’/CD45RO’ levels between the two groups before anesthesia. Anesthesia 1.5 h after, the levels of LBV, HBV, PV, EAI and EDI in the two groups were significantly decreased, but there was no significant difference between the observation group and the control group. At 1.5 h after anesthesia induction, the HR and SBP levels of the observation group did not change significantly compared with anesthesia before, while the HR and SBP levels of the 1.5 h after anesthesia induction in the control group were significantly lower than those before anesthesia and significantly lower than the corresponding level HR level (86.43±13.25) times/min, SBP level (110.84±15.41) mmHg in the observation group. At the end of surgery, the levels of CD45RA⁺ and CD45RO⁺ in the observation group were significantly decreased, but increased at 72 h after operation. Conclusion: After operation, CD45RA⁺ and CD45RO⁺ levels in the control group were significantly decreased, and preoperatively, which can significantly improve the hemorheology and reduced hemodynamic effects, and contribute to the recovery of patients with immune function, is worth clinical promotion.

1. Introduction

Colorectal cancer is a common malignant gastrointestinal tumor, surgery can be adopted for radical treatment in the early stage[1]. Due to physiological function in patients with cancer decreased, poor tolerance with anesthesia and surgery[2]. Surgical trauma can cause nonspecific physiological stress response, anesthesia can bring effect on immune function, hemorheology and hemodynamics to the patient. Therefore, the choice of anesthetic is very important for the surgical efficacy and the prognosis of the patients[3,4]. This study is to investigate the effects of propofol intravenous anesthesia on hemorheology, hemodynamics and immune function in patients undergoing radical resection of colorectal cancer. The research is summarized as follows.

2. Data and methods

2.1 Clinical data

A total of 100 patients with colorectal cancer who underwent radical resection in our hospital from September 2015 to August 2017 were randomly divided into observation group and control...
group according to odd-even order of admission number, each group contained 50 cases. Among them, the observation group: 28 males and 22 females, aged form 35-68 years old; 37 patients of Society of Anesthesiologists grade I, 13 patients of ASA grade II. Control group: 26 males and 24 females, aged form 38-71 years old; 34 patients of ASA grade I, 13 patients of ASA grade II. There was no significant difference between in general information the two groups (P>0.05). The study was approved by the Medical Ethics Committee of our hospital; patients were informed and signed informed consent. Inclusion criteria: (1) histologically confirmed by pathological diagnosis as primary colon cancer or rectal cancer; (2) met ASA grade I-I diagnostic criteria; (3) with indicators of radical surgery; (4) without preoperative radiotherapy and chemotherapy; (5) without serious complications. Exclusion criteria: (1) accompanied by hemorheological diseases; (2) associated with diabetes; (3) associated with hypertension, coronary heart disease; (4) allergic to drugs used in this study; (5) suffering from mental, neurological diseases; (6) took anticoagulant before a week of operation.

2.2 Treatment method

After admission, patients in both groups were given intramuscular injection of 0.1 g of sodium phenobarbital, 0.3 mg of scopolamine, began to monitor heart rate, blood pressure, oxygen saturation after went into the operating room, open the venous fluid, intravenous injection fluid for supplement electrolyte, the speed set as 12-15 mL/kg h, monitoring with the monitor (model GE Dash-4000) for index testing.

Both groups were anesthetic induction with intravenous injection of midazolam 0.05 mg/kg (Approval number H10980026, Jiangsu Ehwa Pharmaceutical Group Co., Ltd.), 0.3-0.4 μg/kg sufentanil (Approval number H20054172, Yichang Renfu Pharmaceutical Co., Ltd.). The observation group was followed by intravenous infusion of 1-2 mg/kg propofol (Approval number H20123138, Jiangsu Ehwa Pharmaceutical Group Co., Ltd.). Infused intravenously with 0.6 mg/kg rocuronium bromide when patients deeply slept, and then tracheal intubation connecting with ventilator. In the control group, oxygen flow was adjusted to 1 L/min and 5% sevoflurane after inducing patients to deeply slept by 6 L/min oxygen flow and 8% sevoflurane, later intravenously infused with 0.6 mg/kg of rocuronium bromide and tracheal intubation connecting with the ventilator.

Anesthesia maintenance, the control group selected 2%-5% sevoflurane continuous inhalation, sufentanil 0.1-0.3 μg/kg min continuous pump. The observation group chose propofol 2.5 mg/kg·h and sufentanil 0.1-0.3 μg/kg min were continuously pumped. According to the specific conditions of patients during operation, adjust sufentanil and propofol or sevoflurane dosage to ensure intraoperative safety.

2.3 Test indicators and methods

Hemorheology and hemodynamics test: Venous blood was collected before anesthesia and 1.5 h after anesthesia induction respectively, hemorheology indexes were detected by Hemorheology analyzer (LBY-N6B analyzer, Beijing Precil Company) whole blood viscosity (WBV), including high shear viscosity (HBV), low shear viscosity (LBV), plasma viscosity (PV), erythrocyte aggregation index (EAI), erythrocyte deformability index (EDI). And recorded other hemodynamic parameters such as heart rate (HR), systolic blood pressure (SBP) and diastolic blood pressure (DBP).

Detection of T lymphocyte subpopulations: collected 3 mL of elbow venous blood before anesthesia, after surgery and 72 h after operation respectively, T lymphocyte subsets CD45RO+, CD45RA+, CD45RA/-CD45RO+ were detected by flow cytometry (American BD Company).

2.4 Statistical methods

The results of this study using SPSS 18.0 statistical software for analysis. In this study, the hemorheology indicators WBV (LBV, HBV), PV, EAI, EDI level, hemodynamic parameters HR, SBP, DBP level and CD45RO+, CD45RA+, CD45RA/-CD45RO+ were conformed to normal distribution, represented as mean ± SD, intragroup comparison before and after treatment and intergroup comparison after treatment adopted t test. P<0.05 indicated significant difference.

3. Results

3.1 Comparison of hemorheology indicators in two groups

There was no significant difference in hemorheological parameters between the two groups before anesthesia (P>0.05). The levels of LBV, HBV, PV, EAI and EDI in the observation group were (10.81 ± 0.34) m-pas, (4.34 ± 0.41) m-pas, (1.38 ± 0.14) m-pas and (7.73 ± 0.59) and (0.58 ± 0.19) respectively, in the control group respectively (11.77 ± 0.28) m-pas, (4.27 ± 0.55) m-pas, (1.40 ± 0.21) m-pas, (7.67 ± 0.62) and (0.59 ± 0.21). The levels of LBV, HBV, PV, EAI and EDI in the two groups were significantly decreased than those before anesthesia (P<0.05), while there was no significant difference between the two groups (P>0.05). See Table 1.

Table 1.

Comparison of hemorheology indicators in two groups (n=50).

<table>
<thead>
<tr>
<th>Group</th>
<th>Time</th>
<th>LBV (m-pas)</th>
<th>HBV (m-pas)</th>
<th>PV (m-pas)</th>
<th>EAI</th>
<th>EDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Before anesthesia</td>
<td>12.32±1.43</td>
<td>5.75±1.32</td>
<td>1.75±0.22</td>
<td>8.93±0.41</td>
<td>0.72±0.24</td>
</tr>
<tr>
<td></td>
<td>1.5 h after anesthesia</td>
<td>10.81±0.34'</td>
<td>4.34±0.41'</td>
<td>1.38±0.14'</td>
<td>7.73±0.59'</td>
<td>0.58±0.19'</td>
</tr>
<tr>
<td>Control</td>
<td>Before anesthesia</td>
<td>12.21±1.23</td>
<td>5.62±1.39</td>
<td>1.72±0.27</td>
<td>8.97±0.47</td>
<td>0.69±0.27</td>
</tr>
<tr>
<td></td>
<td>1.5 h after anesthesia</td>
<td>11.77±0.28'</td>
<td>4.27±0.55'</td>
<td>1.40±0.21'</td>
<td>7.76±0.62'</td>
<td>0.59±0.21'</td>
</tr>
</tbody>
</table>

Compared with before anesthesia, P<0.05.
Table 2.
Comparison of hemodynamic levels of two groups (n=50).

<table>
<thead>
<tr>
<th>Group</th>
<th>Time</th>
<th>HR (times/min)</th>
<th>SBP (mmHg)</th>
<th>DBP (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Before anesthesia</td>
<td>85.61±16.83</td>
<td>114.75±21.11</td>
<td>79.32±15.67</td>
</tr>
<tr>
<td></td>
<td>1.5 h after anesthesia</td>
<td>86.43±13.25</td>
<td>110.84±15.41</td>
<td>81.07±14.58</td>
</tr>
<tr>
<td>Control</td>
<td>Before anesthesia</td>
<td>87.67±15.79</td>
<td>112.62±18.39</td>
<td>80.03±16.79</td>
</tr>
<tr>
<td></td>
<td>1.5 h after anesthesia</td>
<td>74.02±12.28</td>
<td>106.34±13.81</td>
<td>78.81±15.74</td>
</tr>
</tbody>
</table>

Compared with before anesthesia, *P<0.05; compared with control group in the corresponding period, *P<0.05.

Table 3.
Comparison of T lymphocyte subsets level in two groups (n=50).

<table>
<thead>
<tr>
<th>Group</th>
<th>Time</th>
<th>CD45RA+ (%)</th>
<th>CD45RO+ (%)</th>
<th>CD45RA-/CD45RO- (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Before anesthesia</td>
<td>44.82±7.84</td>
<td>41.75±6.32</td>
<td>1.13±0.97</td>
</tr>
<tr>
<td></td>
<td>At the end of operation</td>
<td>41.07±6.58</td>
<td>35.34±7.11</td>
<td>1.21±0.82</td>
</tr>
<tr>
<td></td>
<td>72 h after operation</td>
<td>43.61±6.83</td>
<td>40.92±6.83</td>
<td>1.12±0.84</td>
</tr>
<tr>
<td>Control</td>
<td>Before anesthesia</td>
<td>43.78±6.79</td>
<td>40.87±6.39</td>
<td>1.17±0.75</td>
</tr>
<tr>
<td></td>
<td>At the end of operation</td>
<td>40.81±5.74</td>
<td>36.34±6.95</td>
<td>1.23±0.62</td>
</tr>
<tr>
<td></td>
<td>72 h after operation</td>
<td>42.94±6.39</td>
<td>25.72±6.27</td>
<td>1.85±0.87</td>
</tr>
</tbody>
</table>

Compared with before anesthesia, *P<0.05; compared with control group in the corresponding period, *P<0.05.

3.2 Comparison of hemodynamic levels of two groups

There was no significant difference in hemodynamic HR, SBP and DBP levels between the two groups before anesthesia (P>0.05). At 1.5 h after anesthesia induction, the HR and SBP levels in the observation group did not change significantly compared with before anesthesia, while the HR and SBP levels at 1.5 h after anesthesia induction in the control group were significantly decreased than those before anesthesia (P<0.05), and were significantly lower than those in the observation group (86.43 ± 13.25) times/min, SBP level (110.84 ± 15.41) mmHg (P<0.05). See Table 2.

3.3 Comparison of T lymphocyte subsets level in two groups

Before anesthesia, there was no significant difference in CD45RA+, CD45RO+, CD45RA+/CD45RO+ levels in the two groups (P>0.05). After surgery, the CD45RA+, CD45RO+ levels in the observation group were significantly decreased than those before anesthesia (P<0.05), and the CD45RA+, CD45RO+ levels rose again at 72 h after operation, moreover, there was no significant difference compared before anesthesia (P>0.05). After operation finished, the CD45RA+, CD45RO+ levels in the control group were significantly decreased than those before anesthesia (P<0.05); CD45RA+ level rose again at 72 h after operation and CD45RO+ level continued to decrease, there was no significant difference in CD45RA+ level compared with before anesthesia (P>0.05), while the level of CD45RO+ was significantly decreased (P<0.05). The CD45RO+ level in observation group at 72 h after operation was significantly higher than that in control group (P<0.05). The CD45RA+/CD45RO+ level in the observation group at the end of surgery and 72 h after operation was not significantly different from that before anesthesia (P>0.05). The CD45RA+/CD45RO+ level in the control group at 72 h after operation was significantly increased than that before anesthesia and was significantly higher than that in the observation group at 72 h after operation (P<0.05). See Table 3.

4. Discussion

Colorectal cancer is a common malignancy. The incidence of male patients is higher than that of females. The early symptoms are not obvious and are not easily detected by the patients. When the condition is found usually developed to advanced stage, therefore the optimal treatment time is often missed[6]. Early colon cancer can be basically cured by radical surgery, intraoperative anesthesia will affect the patient's blood function and immune function, in order to reduce the adverse effects of surgery and improve prognosis of patient, the choice of anesthetic is very important[7]. Sevoflurane has the advantages of good controllability, fast induction and fast recovery, it is a halogen-inhaled narcotic and has little effect on the respiratory and cardiovascular systems of patients, it also has certain muscle relaxation effect, which is good for surgery[8]. Propofol is an alkylphenolic compound, with advantage of good fat-soluble, fast recovery, fast onset, high safety, is a short-acting intravenous anesthetic, with no significant stimulation of the respiratory tract and liver and kidney function, can reduce the brain metabolic rate and intracranial pressure, so that patients remain in a good state during surgery, reducing pain sensitivity caused by traction during surgery and improve the efficiency of surgery[9-11].

Cancer patients often have abnormal blood functions, surgical trauma can make the patient's blood viscosity increased, leading to thrombosis, threatening life of patients[12]. The rheological properties of red blood cells of hemorheology parameters play a major role, of which erythrocyte deformability and aggregation is closely related to blood viscosity, blood microcirculation[13]. Under
negative surface charge and Van der Waal’s force, erythrocytes show different aggregation is higher. Therefore, the degree of erythrocyte aggregation can indicate the condition of blood viscosity, and the good deformability is the precondition of erythrocytes passing through capillaries and maintain normal perfusion of microcirculation[14-16]. Some studies have shown that[17], propofol significantly improve the various indicators of hemorheology, can reduce the incidence of thrombosis in patients with radical surgery. Hemodynamics is flow mechanistic analysis of blood in the cardiovascular system, focusing on blood pressure, blood flow resistance, blood flow, and their interactions[18,19].

The results of this study showed no significant difference in hemorheological parameters between the two groups before anesthesia ($P>0.05$). The levels of LBV, HBV, PV, EAI and EDI in the two groups at after anesthesia induction were significantly decreased than those before anesthesia ($P<0.05$), but there was no significant difference between the observation group and the control group ($P>0.05$). There was no significant difference in hemodynamic HR, SBP and DBP levels between the two groups before anesthesia ($P>0.05$). At 1.5 h after anesthesia induction, the HR and SBP levels in the observation group did not change significantly before anesthesia, while the HR and SBP levels at the 1.5 h after anesthesia induction in the control group were significantly decreased than those before anesthesia ($P<0.05$), and were significantly lower than those in the observation group ($86.43$ ± $13.25$ times/min, SBP level ($110.84$ ± $15.41$) mmHg ($P<0.05$). It is indicated that propofol intravenous anesthesia can effectively reduce the indexes of hemorheology, and have less influence on perioperative hemodynamics in patients with colorectal cancer and with higher safety. It is suggested that propofol intravenous anesthesia has a good effect in preventing thrombus and has better effect, and compared with sevoflurane, its effect on stabilize hemodynamics was better.

Due to the proliferation of cancer cells in patients with colorectal cancer will affect the normal physiological function of patients, leading to the patient’s immune function decrease, so the tolerance of surgery and anesthesia is usually poor[20]. Studies have shown[21] that anesthetics have a transient effect on immune function. Although the body may return to normal after drug withdrawal, there are still potential threats. CD45RA+ CD45RO- are important T lymphocyte subsets, which can regulate cellular immunity and humoral immunity. Among them, CD45RA+ cells are unstimulated naive T cells; CD45RO- cells are functional cells differentiated by antigen stimulation; CD45RA+/CD45RO- increase suggested worsening of the disease[22]. In this study, there was no significant difference in the levels of CD45RA+, CD45RO-, CD45RA+/CD45RO- between the two groups before anesthesia ($P>0.05$). After surgery, the CD45RA+, CD45RO- levels in the observation group were significantly decreased than those before anesthesia ($P<0.05$), and the CD45RA+, CD45RO- levels rose again at 72 h after operation, moreover, there was no significant difference compared before anesthesia ($P>0.05$). After operation finished, the CD45RA+, CD45RO- levels in the control group were significantly decreased than those before anesthesia ($P<0.05$); CD45RA- level rose again at 72 h after operation and CD45RO+ level continued to decrease, there was no significant difference in CD45RA- level compared with before anesthesia ($P>0.05$), while the level of CD45RO- was significantly decreased ($P<0.05$). The CD45RO+ level in observation group at 72 h after operation was significantly higher than that in control group ($P<0.05$). The CD45RA+/CD45RO- level in the observation group at the end of surgery and 72 h after operation was not significantly different from that before anesthesia ($P>0.05$). The CD45RA+/CD45RO- level in the control group at 72 h after operation was significantly increased than that before anesthesia ($P<0.05$). It showed that postoperative sevoflurane have inhibit effect on T lymphocyte subsets in patients and with longer duration, moreover propofol anesthesia is relatively stable, without significant effect on patient immunity. The reason may be related to propofol has less irritating effect on the body, with rapid onset and enable patients to faster recovery, causing the less stress response and inflammatory response[23].

In summary, patients undergoing radical resection of colorectal cancer with propofol intravenous anesthesia have a significant effect on the improvement of hemorheology while having less effect on hemodynamics and contributing to the recovery of immune function in patients, it is worthy of clinical promotion.

References


