Effect of peri-operative intravenous infusion of lignocaine on haemodynamic responses to intubation, extubation and post-operative analgesia

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ABSTRACT

Objective: To study the effect of peri-operative intravenous infusion of lignocaine on haemodynamic responses to intubation, extubation and post-operative analgesia. Methods: A total of 90 patients performed with elective laparoscopic cholecystectomy under total anesthesia were randomly divided into three groups with 30 patients in each group. In Group A, patients received 6 mL normal saline as bolus over 10 min followed by 6 mL/h infusion, whereas in Group B, patients were intravenously injected with 2% lignocaine at the rate of 1 mg/kg intravenous injection, 10 min later, conducting intravenous infusion at the rate of 1 mg/kg/h until an hour after operation. In Group C, patients were intravenously injected with 2% lignocaine at a rate of 1.5 mL/kg intravenous injection, 10 min later, conducting intravenous infusion at a rate of 1.5 mL/kg/h until an hour after operation. We recorded the heart rate (HR) and mean arterial pressure (MAP) of before infusion lignocaine (T0), before induction (T1), intubation (T2), 3 min after intubation (T3), 10 min after intubation (T4), extubation (T5), 3 min after extubation (T6) and 10 min after extubation (T7). We also recorded the total injection dosage of ketorolac and pentazocine. Results: The HR and MAP of Group A on T2 and T5 were higher than T0, whereas, the HR and MAP in Groups B and C on T2 and T5 were lower than that of in Group A. The pain-free period in Groups B and C was longer than Group A. The ketorolac and pentazocine requirement in Groups B and C were lower than Group A. Conclusions: Patients were administrated with 2% lignocaine before operation at a rate of 1 mg/kg intravenous injection bolus, 10 min later at the rate of 1 mL/kg/h or 1.5 mL/kg intravenous infusion until an hour after operation. Administration of lignocaine can effectively prevent the change of haemodynamics resulting from intubation and extubation. Furthermore, it can significantly relieve the postoperative pain and reduce the usage amount of analgesic drug.

1. Introduction

Trachea intubation and subsequent extubation usually result the increases of heart rate and arterial blood pressure, arrhythmia, and the rise of intracranial pressure and intraocular pressure. Many drugs have been advised to use for controlling the adverse events of haemodynamics, including lignocaine, esmolol, alfentanil and fentanyl[1]. In tracheal intubation and extubation, sigle-bolus administration of lignocaine is very effective, which has been used for reducing the related response of haemodynamics. In addition, intravenous infusion of lignocaine in perioperative period has been used as a method to control postoperative pain[2-5]. Although laparoscopic cholecystectomy is a minimally invasive surgery, many patients still suffer moderate to severe pain after operation. Lignocaine may help to reduce pain for these patients. This study was to observe whether the intravenous injection of lignocaine in perioperative period followed by the intravenous infusion of lignocaine during operation can reduce the change of haemodynamics at tracheal intubation and extubation or not, as well as to relive postoperative pain of elective laparoscopic cholecystectomy.
2. Materials and methods

2.1. General data

This study was approved by the Medical Ethics Committee, and all patients signed the informed consent. A total of 90 patients performed with elective laparoscopic cholecystectomy under total anesthesia in Grade ASA-I-I were selected as from January 2015 to December 2015. Exclusion criteria: patients had cardiovascular and cerebrovascular diseases, hepatic renal dysfunction, coagulation disorders, and predict difficult intubation. Patient’s body weight was < 50 kg, or >100 kg. In addition, when operation method must change to open cholecystectomy from laparoscope or operation time over 120 min. All of these cases were excluded in this study.

2.2. Anaesthesia methods

The day before surgery, patients learnt the VAS under the guidance of anesthetist, and to identify “0” was “no pain” and “10” was “the worst pain”. Moreover, patients were required to report the following reactions after operation, such as dizzy, numbness around mouth, metallic taste, nausea, vomit and pruritus. Patients were randomly divided into three groups with 30 patients in each group. Ten min before anesthesia induction, patients in Group A were administrated with 6 mL normal saline by intravenous injection, 10 min later, conducting intravenous infusion with normal saline at the rate of 6 mL/h. Patients in Group B were intravenously injected with 2% lignocaine at the rate of 1 mL/kg, 10 min later, conducting intravenous infusion at the rate of 1 mL/kg/h until 1 h after operation. Patients in Group C were intravenously injected with 2% lignocaine at the rate of 1.5 mL/kg, then 10 min later, conducting intravenous infusion at the rate of 1.5 mL/kg/h until 1 h after operation. In order to prevent the potential toxicity of lignocaine, the maximum holding time of intravenous infusion is 180 min (including 1 h infusion after operation). Anesthesia inductions for all patients were 0.06 mg/kg midazolam, 2.5 mg/kg propofol, 2 μg/kg fentanyl and 0.2 mg/kg cisatracurium. After tracheal intubation, patients were supported by anesthesia machine for mechanical ventilation. Propofol, remifentanil and cisatracurium were used during the operation. After operation, neostigmine and atropine combined with antagonism were used, then conducting tracheal extubation. Later, patient was transferred to recovery room.

2.3. VAS score

VAS score were recorded every ten min in the first hour, and the later every two hours or when patients complained pain. When the patient’s VAS ≥4 for the first time, muscle was injected with 0.5 mg/kg ketorolac, later, if VAS ≥4 occurs again, then patient was conducted with intramuscular injection of ketorolac every 6 h. Though ketorolac was administrated, if patient’s VAS ≥4, then given 0.25 mg pentazocine. HR and MAP were recorded before infusion lignocaine (T0), before induction (T1), intubation(T2), 3 min after intubation (T3), 10 min after intubation (T4), extubation (T5), 3 min after extubation (T6) and 10 min after extubation (T7). Pain-free period (VAS<4) were regarded as the first time of requiring ketorolac injection from the end of operation. The total injection dosage of ketorolac and pentazocine for all patients were recorded.

2.4. Statistical analysis

Statistical software SPSS 10.0 was used for analysis. Measurement data were expressed by Mean ± SD. One-Way ANOVA was used for comparison among groups. Comparison of rate was tested by chi-square. P<0.05 was considered as statistical significance.

3. Results

3.1. Comparison of general information in three groups

The mean ages of three groups were (48.4±5.2) years, (49.3±6.3) years and (47.5±7.5) years, respectively. Heights were (171±5) cm, (170±6) cm and (172±6) cm, respectively. Body weights were (66.5±6.8) kg, (67.8 ± 10.4) kg and (69.5±11.2) kg, respectively. Time of operation was (63±12) min, (69±10) min and (65±9) min respectively. Comparison of age, height, and body weight and operation time in three groups has no obvious difference (P>0.05).

3.2 Changes of HR and MAP in patients of three groups at each time point

The HR and MAP of Group A on T2 and T5 were higher than T0 (P<0.05), whereas, the HR and MAP of Groups B and C on T2 and T5 were lower than that of in Group A (P<0.05). The comparative difference among Groups B and C has no statistical significance (P>0.05) (Table 1).

3.3. Comparison of postoperation pain and medication use in patients of three groups

Pain-free periods in Groups A, B, C were (54±12) min, (32±10) min and (33±12) min. The pain-free period in Groups B and C was longer than Group A (P<0.05). The ketorolac and pentazocine requirement in Groups B and C were lower than Group A (P<0.05). The ketorolac in three groups were (60±17) mg, (27±16) mg and (25±12) mg. The requirements of ketorolac in Groups B and C were significantly lower than Group A (P<0.05). The requirements of pentazocine in three groups were (13±8) mg, (7±6) mg and (6±4) mg. The requirements of pentazocine in Groups B and C were significantly lower than Group A (P<0.05).

Table 1

<table>
<thead>
<tr>
<th>Index</th>
<th>Groups</th>
<th>n</th>
<th>T0</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
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</thead>
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<td>81±6</td>
<td>81±5</td>
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<td>109±11</td>
<td>85±11</td>
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<tr>
<td></td>
<td>B</td>
<td>30</td>
<td>83±6</td>
<td>82±5</td>
<td>88±9</td>
<td>84±9</td>
<td>82±10</td>
<td>89±9</td>
<td>84±10</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>30</td>
<td>82±7</td>
<td>85±6</td>
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<td>85±5</td>
<td>86±9</td>
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<td>98±10</td>
<td>95±9</td>
<td>94±12</td>
<td>93±8</td>
</tr>
</tbody>
</table>

Note: compared to T0, *P<0.05; compared to Group A, #P<0.05.
4. Discussion

Although the effectiveness of lignocaine used in controlling the changes of haemodynamics of tracheal intubation/extubation and postoperative analgesia has been studied and applied individually[6]. If these effectiveness can be applied at the same time, that will be very beneficial. The purpose of this study was to determine whether the initial bolus dose of lignocaine followed by low-dose continuous intravenous infusion can significantly benefit for these two aspects or not. Our results showed that patients received 2% lignocaine before operation at the rate of 1 mL/kg or 1.5 mL/kg intravenous injection, 10 min later, conducting intravenous infusion at a rate of 1.5 mL/kg/h until an hour after operation, which can effectively prevent the hemodynamics changes caused by intubation and extubation, moreover, it can effectively relieve postoperative pain, and reduce the use of analgesic drugs.

The difference of types of surgery may results in different postoperative pain degree and hemodynamics changes. In order to prevent the deviation of pain assessment after operation, we observed patients with laparoscopic cholecystectomy. The dosage of lignocaine is fixed, and the total duration is limited to 120 min in order to prevent its toxic reaction. In different studies of the analgesic effect of lignocaine, some studies have found that patients given 1.5 mg/kg intravenous injection after intubation followed by different infusion rates from 1.5 mg/kg/h to 3 mg/kg/h until 6-24 h after operation, and plasma levels of lignocaine were 1-3.8 µg/mL[7]. Likewise, in different studies of using lidocaine to control the changes of hemodynamic, and only 1-2 mg/kg lignocaine was used for intravenous injection, which was usually administrated before the tracheal intubation or extubation[8]. We used continuous infusion of lignocaine and did not found that the rate of 1.5 mL/kg/h was better than rate of 1 mL/kg/h. In this study, HR and MAP in Groups B and C were significantly lower than Group A. This weakening effect on HR and MAP had also been reported before, and lignocaine, either use alone, or combined with dexmedetomidine[9]. These weakening effects on haemodynamics were attributed to lignocaine, which causes the expansion of small arteries, the weakness of autonomic nerve reaction, antitussive function and the depth increase of general anesthesia. In this study, we also observed HR and MAP in Groups B and C during tracheal extubation were significantly lower than Group A. Cough generated by the stimulation of extubation may increase HR and MAP. The weakening effects of lignocaine might be due to its antitussive effect, reducing the cough reaction, and resulting in the hemodynamic stability. We still found that the painless intervals and the requirements for analgesics of patients in Groups B and C in first 24 h after surgery were significantly lower than that of in Group A. Some studies supported that the intravenous infusion of lignocaine can be used for the postoperative pain relief[10,11]. We systemic reviewed the randomized controlled tests of the effect of intravenous lignocaine on the postoperative analgesia and analgesia found that intravenous injection of lignocaine during perioperative period is safe, and these patients have lower VAS, lower requirement for analgesic after operation and for anaesthetic during operation, faster recovery of intestinal function, and shorter hospital stays[8]. This analgesic effect may be due to the intravenous injection of lignocaine inhibited the excitability of dorsal horn neurons, lowering the spike potential, amplitude and conduction time of medullated nerve fiber A and unmyelinated nerve fibers C by inhibiting nerve conduction to lower neural responses of postoperative pain. We did not use lignocaine and bupivacaine to infiltrate operative incision in the study, because this operation may influence the intensity of postoperation pain so as to influence the analgesic requirement. We only analyzed the analgesic effect of lignocaine in 24 h after surgery, and found that it has significant effects. Other studies reported the analgesic effect of lignocaine from 2-48 h after surgery, but only one study reported this effect on day 2 and day 3 after surgery. This difference may be due to the different types of operations, namely, different studies have different scopes of tissue trauma.

Our study has its limitation, which mainly could not detect the plasma lignocaine concentrations. Our study only analyzed non-steroidal anti-inflammatory drugs, like the dosages of ketorolac and pentazocine after operation, and did not use opioids. In addition, we only studied the analgesic effect of intravenous lignocaine in the first 24 h after operation. Our observational indices did not include the days of hospitalization, early ambulation time and the total hospitalization costs of patients. In order to prove whether other surgical procedures can obtain similar results, further research is needed.

In conclusion, the rate of 1 or 1.5 mg/kg/h of lignocaine for intravenous injection followed by the rate of 1 or 1.5 mg/kg/h for intravenous infusion can reduce the increase of HR and MAP in the period of intubation and extubation, and it can also prolong the duration of pain-free period and reduce the analgesic requirement.

Reference