Journal of Clinical Anesthesia (2014) **26**, 523–529

Journal of Clinical Anesthesia

Original Contribution

The effect of epidural lidocaine administration on sedation of propofol general anesthesia: a randomized trial☆,☆☆,★

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Received 6 September 2012; revised 10 March 2014; accepted 11 March 2014

Keywords:
Bispectral index;
Epidural block;
Epidural lidocaine;
Propofol induction dose;
Sedation

Abstract

Study Objective: To examine the influence of epidural and intravenous (IV) lidocaine, and height of the epidural sensory block, on the dose of propofol required for induction of general anesthesia.

Design: Randomized controlled study.

Setting: University hospital.

Patients: 66 adult, ASA physical status 1 and 2 patients, aged 25 to 65 years, undergoing elective abdominal surgery.

Interventions: Patients were randomized to 4 groups: the epidural saline control group (Group C; L_2-L_3 puncture, epidural and IV saline), the IV lidocaine group (Group IV; L_2-L_3 puncture, saline epidural, IV lidocaine 1 mg/kg), the lumbar epidural lidocaine group (Group EL; L_2-L_3 puncture, 1.5% lidocaine epidural, IV saline), and the thoracic epidural lidocaine group (Group ET; T_9-T_{10} puncture, 1.5%lidocaine epidural, IV saline). Two minutes after the beginning of the infusion of IV lidocaine or saline, propofol anesthesia was initiated.

Measurements: Mean arterial blood pressure (MAP), heart rate (HR), and sensory block height were monitored. The induction dose of propofol, its estimated effect-site concentration (Ce), and plasma concentration were measured at various time points. Finally, we recorded the time taken for the bispectral index (BIS) to decrease to 60, the plasma concentration of lidocaine at induction, and the occurrence of adverse events. The induction time (when BIS reached 60) also was recorded.

Main Results: The induction propofol dose, Ce, and plasma concentration of propofol when BIS equaled 60 were significantly lower in Group IV, Group EL, and Group ET than Group C. The above parameters in Group ET (T_9 - T_{10} puncture) were significantly less than in Group EL (L_2 - L_3 puncture). The induction doses of propofol and plasma concentration of propofol and lidocaine were significantly higher in Group IV than in Groups EL or ET.

☆ Supported by departmental funding only.

☆☆ The authors have no conflicts of interest to declare.

★ Clinical trial registration number: ChiCTR-RRC-11001568.

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http://dx.doi.org/10.1016/j.jclinane.2014.03.016

Conclusions: Epidural and IV lidocaine reduce the dose of propofol required to induce general anesthesia. Administration of lidocaine via the epidural route reduces anesthetic requirements more so than the IV route. Propofol requirements were further reduced in patients with higher sensory epidural block.

1. Introduction

Epidural block is a widely accepted technique for regional anesthesia and postoperative analgesia [1]. A combined epidural-general anesthesia technique is frequently used in major abdominal surgery. The technique reduces general anesthetic requirements, presumably by blocking the nociceptive input to the spinal cord and higher centers that originate from the surgical site [2]. Neuraxial anesthesia alters both processes by reducing the preterminal release of neurotransmitters and hyperpolarizing postterminal second order neurons [3,4].

Several studies have demonstrated that epidural, intramuscular, and intravenous (IV) local anesthetics may intensify the effects of general anesthesia, reduce sedative or anesthetic dose requirements, and decrease side effects such as hypotension and injection pain [5–8]. However, the influence of epidural or systemic administration of local anesthetics on general anesthetic requirements has not been studied.

A wide variety of local anesthetic doses has been used to achieve sensory block in previous studies [5,9,10]. It is unclear whether the reduced requirements noted in these studies was due to an effect of the different routes of administration of local anesthetics or increased intensity of epidural block. The systemic effects of local anesthetics or their combination are also still unknown. Therefore, we evaluated the influence of different routes of administration of a similar dose of lidocaine (IV vs epidural) at different levels of epidural block on the sedative and hypnotic effects of propofol during induction of general anesthesia.

2. Materials and Methods

2.1. Patients

This randomized, controlled study was approved by the Ethics Committee of Zhejiang University Hospital, China (First Affiliated Hospital, School of Medicine, Zhejiang; ref. no. 2011-103), and patients gave written, informed consent to participate. The study group consisted of adult, ASA physical status 1 and 2 patients, aged 25 – 65 years, 45 - 85 kg, undergoing elective abdominal surgery. Exclusion criteria were any contraindication to epidural anesthesia; history of cardiovascular, psychological or neurological diseases; alcohol abuse; and current use of sedatives, opioids, or drugs that induce or inhibit liver enzymes.

Patients were randomly assigned to 4 groups by sealed envelope assignment prepared by one researcher at the Zhejiang University. Randomization was achieved by block randomization using a random numbers table. The randomization program allows the printing of randomization envelopes on paper, over-printed with numbers to aid code concealment.

2.2. Groups

The 4 groups received the following: epidural saline (Group C, control group; L_2-L_3 puncture and epidural and IV saline); IV lidocaine (Group IV; L_2-L_3 puncture, saline epidural, and IV lidocaine 1 mg/kg); lumbar epidural lidocaine (Group EL; L_2-L_3 puncture, 1.5% lidocaine epidural, and IV saline), or thoracic epidural lidocaine (Group ET; T_9-T_{10} puncture, 1.5% lidocaine epidural, and IV saline).

2.3. Preanesthesia management

No premedication was administered. On arriving in the operating room, each patient received a peripheral IV infusion of 10 mL/kg of lactated Ringer's solution, and an arterial catheter was inserted in the left radial artery. Routine monitoring, including electrocardiogram (model M8004A; Philips Healthcare, Andover, MA, USA), heart rate (HR), and pulse oximetry (SpO_2), was established. Bispectral index values (BIS monitor model A-2000; Aspect Medical Systems, Norwood, MA, USA) and invasive measurement of mean arterial pressure (MAP) also were recorded.

2.4. Anesthetic procedure: epidural anesthesia

Before the induction of general anesthesia, an epidural catheter was inserted at the T_9-T_{10} interspace in Group ET or at the L_2-L_3 interspace in the other groups. After patients were turned supine, an epidural catheter was advanced 3 cm cephalad into the epidural space and a 5 mL test dose of 1.5% lidocaine was administered in Groups EL and ET. An additional 5 mL bolus dose was given after 5 minutes. In Groups C and IV, normal saline 5 mL was injected via the epidural catheter, and a further 5 mL was given 5 minutes later. An IV injection of lidocaine 1 mg/kg was administered to patients in Group IV; the same volume of saline was given to the other patient groups before induction of general anesthesia. Sensory blockade was evaluated using the response to pinprick 5, 10, and 15 minutes after the first