



Original Contribution

Effects of epinephrine in the epidural space on the incidence of blood vessel injury by epidural catheter insertion for cesarean section: a prospective, randomized, double-blind study^{☆,☆☆}



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Abstract

Study objective: To evaluate the effects of epinephrine (1:200,000) in the epidural space on the incidence of blood vessel injury by epidural catheter insertion for cesarean section.

Design: Prospective observational study.

Setting: University-affiliated teaching hospital.

Patients: Four hundred laboring women with singleton cephalic presentations at term who underwent cesarean section and requested continuous epidural analgesia.

Interventions: Preadministration of 5 mL of isotonic sodium chloride solution containing epinephrine (1:200,000) or 5 mL of isotonic sodium chloride solution through an epidural needle before catheter insertion.

Measurements: Cases with bloody fluid in the epidural needle or catheter during catheter insertion, aspiration of frank blood from the epidural catheter, and blood noted in the caudal end of the epidural catheter upon removal were recorded.

Main results: Eight parturients were excluded from the analysis for technical reasons. There were no significant differences between patients in the 2 groups with respect to cases with bloody fluid in the epidural needle during catheter insertion (7.6% vs 9.8%, $P = .44$), the epidural catheter during catheter placement (6.0% vs 6.7%, $P = .80$), aspiration of frank blood in the epidural catheter (1.0% vs 1.0%, $P = .98$), and blood noted in the caudal end of the epidural catheter upon removal (27.3% vs 30.4%; $P > .49$).

Conclusion: Twenty-five micrograms of epinephrine (1:200,000) in the epidural space does not reduce the incidence of blood vessel injury induced by insertion of an epidural catheter.

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1. Introduction

There are extensive vascular plexuses in the epidural space which may be punctured during epidural puncture [1–4], especially in parturients. Occasionally, blood vessel injuries occur during epidural catheter insertion [5–7]. The incidence of injuries involving the epidural venous plexus on intravascular (IV) epidural catheter insertion was between 1.3% and 15.7% for obstetric patients; the incidence was higher when the puncture is performed with the patients in the sitting position [2]. Furthermore, inadvertent epidural venous injuries may lead to local anesthetic-induced cardio- or neurotoxicity, a poor anesthetic effect, and even the occurrence of epidural hematomas [8–10]. Therefore, it is important to make an effort to prevent blood vessel injuries during obstetric epidural anesthesia. As a result, it has been theorized that epinephrine (5 µg/mL) in the epidural space may vasoconstrict the epidural veins and possibly reduce the incidence of injuring the epidural vascular plexus before insertion of the catheter. We hypothesized that predistension of the epidural space with epinephrine (5 µg/mL) would decrease the incidence of epidural vein injuries.

2. Materials and methods

2.1. Ethics statement

The protocol was reviewed according to the Declaration of Helsinki and approved by the Human Ethics Committee of Nanjing Medical University on January 24, 2010. All study participants gave written informed consent.

Between February 2010 and December 2011, after obtaining the approval from the institutional research ethics committee and informed consent, 400 parturients, American Society of Anesthesiologists physical status class I or II, with singleton cephalic presentations at full term who presented for cesarean delivery conducted during epidural anesthesia were enrolled in the current study. All women received routine prenatal care, and epidural catheter placements were performed after confirming the normal platelet counts and coagulation assays. The exclusion criteria included bleeding history or bleeding tendency; pregnancy-induced hypertension; heart, lung, liver, and kidney diseases; preeclampsia; obesity (body mass index > 35 kg/m²); history of alcohol or drug abuse, or heavy smoking; and coagulopathies.

Parturients were randomly assigned into 2 groups (groups E and N) using a computer-generated randomization list and a sealed envelope technique. After receiving 10 mL/kg of Ringer's lactate solution intravenously, all of the parturients underwent a lumbar epidural puncture with an 18G Tuohy needle (SuJia Medical Device Co, ZheJiang, China) at the L2-L3 intervertebral disk space using a midline approach with the patients in the left lateral decubitus position.

After identification of the epidural space by loss of resistance with 1 mL of isotonic sodium chloride solution and a negative aspiration test for blood or cerebrospinal fluid, 5 mL of isotonic sodium chloride solution containing epinephrine (1:200,000) or 5 mL of isotonic sodium chloride solution was injected into the epidural space of patients in groups E and N, respectively, through the epidural needle (injection speed = 1 mL/s) while the syringe plunger was held closed for 20 seconds to ensure that the solution spread sufficiently [5]. The isotonic sodium chloride solution or the solution containing epinephrine (1:200,000) was prepared by an independent investigator who was not involved in the study. One minute thereafter [4], a polyamide multiorifice epidural catheter (20 gauge × 90 cm; SuJia Medical Device Co, ZheJiang, China) with 3 lateral ports at 0.5, 1.0, and 1.5 cm from a closed distal tip was tressed 3 cm into the epidural space through the cranially directed tip of the epidural needle. All of the parturients were placed in the left-tilted supine position until delivery after the catheter was fixed to the skin.

As an intrathecal test dose, 3 mL of 1.5% lidocaine was injected. Five minutes later, if no signs of subarachnoid injection were noticed, 5 mL of 0.75% ropivacaine was injected epidurally, and another 5 mL was injected 5 minutes later, if necessary; additional anesthetic was given to produce adequate anesthesia, which was confirmed by the lack of a bilateral response to pinprick at the T8 vertebral level. The injection speed for the local anesthetic solution was 0.5 mL/s. Patients were maintained hemodynamically stable by intravenous fluid expansion and vasoactive drugs. All the injectates (with or without epinephrine) were kept at room temperature (23°C ± 1°C).

The observation of the injuries to the epidural vascular plexus was performed by an independent anesthesiologist and consisted of bloody fluid in the epidural needle or catheter during catheter insertion, aspiration of frank blood from the epidural catheter, or blood noted in the caudal end of the epidural catheter upon removal. A 2-mL syringe was aspirated with the plunger withdrawn to 0.5 mL for 20 seconds to provide a negative pressure test following successful epidural catheter placement for 3 cm. Intravascular placement was considered if the frank blood was detected by aspiration. If IV placement occurred, the catheter was withdrawn 1 cm and another 1 cm if IV persisted. If this maneuver did not lead to withdrawal from the vein, the catheter was removed and general anesthesia was given.

All of the participants underwent continuous epidural anesthesia for the first time in the present study. General anesthesia would be performed in case of either difficulties during the puncturing procedure or epidural failures because of a nonfunctional epidural catheter. All procedures were performed by the same experienced anesthesiologist who has engaged in obstetric anesthesia for more than 10 years.

2.2. Statistical analysis

Based on previous studies [5], to detect a reduction in the incidence of IV catheter insertion from 10% to 3%, 140

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