

Combined spinal-epidural anesthesia for cesarean section; needle-through-needle approach

TOSHINORI TSUTSUI¹, KUMIKO NAKAMURA², and KENJI MURANAKA³

¹Department of Anesthesiology, National Saga Hospital, 1-20-1 Hinode, Saga, Saga 849, Japan

²Department of Anesthesiology, Shimonoseki City Hospital, 1-13-1 Kouyou, Shimonoseki, Yamaguchi 750, Japan

³Department of Anesthesiology, Kokura Memorial Hospital, 1-1 Kifune, Kokura, Kitakyushu, Fukuoka 802, Japan

Abstract

Purpose. The Portex "Spinal/Epidural Set" is designed for combined spinal-epidural (CSE) anesthesia by the needle-through-needle approach. We evaluated the technical and clinical usefulness of CSE with this needle set, and also isobaric tetracaine, for cesarean section.

Methods. Thirty patients for cesarean section were included. In the left decubitus position, a 16-gauge epidural needle was introduced by the loss-of-resistance method into the lumbar intervertebral space. A 26-gauge spinal needle was threaded through the epidural needle into the subarachnoid space. Tetracaine dissolved in saline was injected. A 17-gauge catheter was advanced into the epidural space. The analgesic level was checked by the pin-prick method.

Results. The insertion in the first attempt was successful in 21 cases (70%) of the patients, and difficulty in insertion was not experienced. Inadvertent dural puncture occurred in one case, but no accidental subarachnoid catheterization was observed. Spinal anesthesia with tetracaine (11.1 ± 0.5 mg) reached the level of Th₆ on average, with a relatively wide range. Five cases (13%) were supplemented by epidural anesthesia. No postspinal headache was noted.

Conclusion. CSE technique by the needle-through-needle approach is easy to handle, and provides a speedy, reliable, and flexible analgesia as well as postoperative pain relief for patients undergoing cesarean section.

Key words: Combined spinal-epidural anesthesia, Needle-through-needle approach, Isobaric tetracaine, Cesarean section

Introduction

Combined spinal-epidural (CSE) anesthesia is a rational tactic for local anesthesia, as it starts with a spinal

block that offers an immediate action of excellent analgesia as well as muscle relaxation, and follows an epidural block that provides supplemental analgesia in the perioperative period [1–4]. Among the methods for CSE, the needle-through-needle approach in a single intervertebral space has the further advantage of identifying the subarachnoid space with a fine pencil-point spinal needle, resulting in a low incidence of postspinal headache [5]. We previously reported that this technique was useful for orthopedic lower limb surgeries which required a flexible time and anesthesia, as well as pain relief during tourniquet application or during the postsurgical period [6]. Anesthesia for lower abdominal surgery is also indicated for CSE. However, few reports are available on its clinical application to gynecological surgery. In this communication we evaluate the use of the Portex "Spinal/Epidural Set" (Portex Limited, Kent, England) for cesarean section regarding technical and clinical aspects, and also evaluate isobaric tetracaine as a local anesthetic for CSE anesthesia.

Methods

Thirty patients awaiting cesarean section were informed of spinal and epidural anesthesia, and their consent was obtained. Indications for either elective or emergency cesarean section and preoperative complications were not contraindicated for CSE anesthesia. All patients were prehydrated with 400–800 ml of acetated Ringer's solution. Premedication consisted of atropine 0.5 mg intramuscularly 30 min before entering the operating room.

With the patients in the left-decubitus position on the operating table, the lumbar 3–4 or 4–5 interspace was identified. First, an epidural needle (16-gauge, 80 mm in length), whose bevel was pointed laterally, was introduced by the midline approach into the epidural space with the aid of the loss-of-resistance method. The bevel

Address correspondence to: T. Tsutsui

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Table 1. Doses of tetracaine for cesarean section

Height	Tetracaine 20mg/dissolved in saline 5ml
Below 150cm	10mg/2.5ml
150–160cm	11mg/2.7ml
Over 160cm	12mg/3.0ml

was then turned toward the head, and a pencil-point spinal needle (26-gauge, 112mm in length) was threaded through the epidural needle into the subarachnoid space while the resistance dropped suddenly along the penetration of the dura mater. After identification of a free flowback of cerebrospinal fluid (CSF), tetracaine hydrochloride (Tetocain, Kyorin Pharm., Tokyo, Japan) dissolved in saline (Table 1) was injected over 10–15s. When the injection was completed, the spinal needle was removed and an epidural catheter (Epinido, Terumo, Tokyo, Japan) was advanced into the epidural space so that 5cm remained. Any flowback of CSF was checked through the catheter, which was filled with saline. The catheter was secured in place, and the patients was turned supine. The analgesic level was assessed by the pin-prick method every 5min after the injection of local anesthetic and just before the start of surgery, while hypotension was avoided or treated by the intermittent injection of ephedrine hydrochloride. If the sensory block did not yet reach the level to commence surgery, epidural anesthesia was supplemented with 1% lidocaine in a divided dosage.

At the end of surgery, postoperative pain relief was applied by epidural administration of morphine hydrochloride, 2–4mg per day, or buprenorphine hydrochloride, 0.2–0.4mg per day, with the aid of a drug infusion balloon catheter (DIB catheter, DIB International, Tokyo, Japan). Nonsteroidal anti-inflammatory drugs (diclofenac sodium) were also given as needed.

Technical problems during the handling of the needle and catheter were recorded. Spinal and epidural insertion were conducted slowly and identically. Apgar scores were judged by obstetric nurses. Postpartums were looked after in the ward by the special nurses who were well informed of complications about spinal and epidural anesthesia, including postspinal headache. All data concerning the postoperative complications were gathered from the documents in the ward.

Results

Indications for cesarean section and preoperative complications are listed in Table 2. Ten emergency cases were included. Technical and clinical results are shown in Table 3. Each needle was inserted with ease. In fact,

Table 2. Indications for cesarean section and coexisting complications

Indications	Complications
Repeated cesarean section	Severe anemia
Cephalopelvic disproportion	Bronchial asthma
Breech	Luxatio coxae congenita
Twin	Schizophrenia
Impended rupture	Crohn's disease
Delayed delivery	
Abnormal rotation	
Placenta previa	
Total	

Table 3. Technical and clinical results of combined spinal-epidural anesthesia

(1) Average number of attempts at successful spinal insertion	1.5 ± 0.8
Number of the cases with the first attempt at successful insertion	21 (70%)
(2) Average number of the epidural insertions	1.6 ± 1.0
(3) Difficult spinal insertion ^a	0 (0%)
Difficult epidural insertion ^a	0 (0%)
(4) Inadequate spinal anesthesia ^b	5 (17%)
Poor spinal anesthesia ^c	1 (3%)
(5) Inadvertent dural puncture	1 (3%)
Accidental subarachnoid catheterization	0 (0%)
(6) Postspinal headache	0 (0%)
Total	30

^aMore than six times of attempt or impossible insertion was denoted as difficult.

^bSpinal analgesia to Th₉₋₁₀ which was partially supplemented by epidural anesthesia was denoted as inadequate.

^cSpinal analgesia to Th₁₂ which was totally replaced by epidural anesthesia was denoted as poor.

the insertion was accomplished at the first attempt at each spinal and epidural insertion in 70% of the patients. Inadvertent dural puncture occurred in one case, whereupon the Tuohy needle was slightly withdrawn until the fresh flow of CSF ceased, after which the subarachnoid injection and epidural catheterization were completed. No case developed subarachnoid catheterization.

Spinal anesthesia with tetracaine hydrochloride 11.1 ± 0.5mg (mean ± SD) in saline reached the median level of Th₆ with a relatively wide range (Fig. 1). Ephedrine 14 ± 9mg was administered in 24 (80%) cases to treat hypotension. Six cases that showed inadequate or poor spinal anesthesia with a level of Th₁₀ or Th₁₂ received supplemental epidural anesthesia with a total dose of 1% lidocaine 9ml on average. Surgical incisions were started at about 12min after the intrathecal injection of anesthetics. None of the neonates had Apgar scores below 7 at 1 and 5min after birth. Their

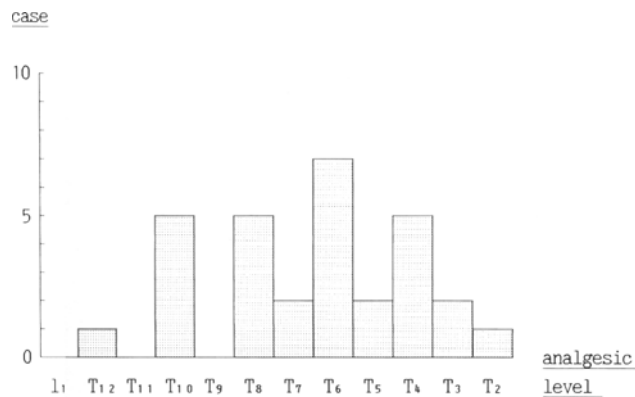


Fig. 1. Histogram of analgesic levels

neurobehavioral conditions did not seem different from those under ordinary spinal anesthesia. CSE anesthesia and obstetric surgery in all cases were carried out uneventfully within an acceptable time.

Postoperative pain relief by epidural analgesia was applied for 3 days. Diclofenac sodium 50mg was given intrarectally only once on the first postoperative day. Active movements were encouraged from the second postoperative day. Although inadvertent dural puncture occurred in one patient, no post-spinal headache was noted. However, most of the postpartums complained of back pain on the second and third postoperative days.

Discussion

Coates [1] and Muntaz et al. [2] first reported CSE anesthesia using a needle-through-needle approach in patients undergoing orthopedic surgery. After this method was approved in several institutes, Portex introduced a commercial product named the "Spinal/Epidura Set" which Carrie and O'Sullivan [3] and Rawal [4] evaluated for cesarean section thereafter.

In the preliminary reports by Carrie and colleagues [7–9], the technical usefulness of this needle was examined in 150 cases, and all the parturients had this needle successfully inserted with ease. Of them, 88% underwent the first attempt at either spinal and epidural insertion. Spinal anesthesia failed in only one case, and 28% received supplemental epidural anesthesia. The authors concluded that the CSE technique could provide a reliable spinal anesthesia and a flexible epidural analgesia for cesarean section.

The key point for successful spinal insertion is to introduce an epidural needle into the middle of the epidural space. As the vertebral protrusion of the parturient was sometimes obscure, it was speculated that the insertion might not be so easy. However, an easy iden-

tification of the epidural space with the epidural needle and a fixed penetration of the dura mater with a spinal needle were soon recognized. Consequently, 70% of our patients had the needle inserted successfully at the first attempt. Poor anesthesia ensued in 1 out of 30 cases. This technical result was related to that of geriatric participants in orthopedic surgery [6]. Moreover, the failure rate of spinal anesthesia in this series was consistent with the previously reported rate of 4% by Randall et al. [10], 3% by Patel and Swami [11], and 5% by Robert et al. [12]. On the other hand, unstable fixation of the spinal needle at the dura mater threaded through the epidural needle is claimed to diminish the effect of subarachnoid administration of local anesthetics [13]. A new fixing device is now under consideration.

In this series we experienced one case of inadvertent dural puncture. As inadvertent dural puncture is very rare, the incidence in this small population was not compared statistically. We performed a midline approach with a bevel pointing laterally to reduce backache. The Huber aperture of the epidural needle seems to be straightened for unbending the spinal needle in the epidural space [6].

As a local anesthetic for spinal anesthesia, we selected isobaric tetracaine because maneuvering of the epidural catheter would take more time than the ordinary spinal insertion, and as a result, the hyperbaric solution might cause hemianesthesia. However, hyperbaric bupivacaine is popular for CSE anesthesia in Western countries [13] because an expected analgesic level can be obtained. There are no reports on hemianesthesia when hyperbaric anesthetics are administered. On the other hand, an isobaric solution reduces the blood pressure relatively slowly [14] so that mother and baby can tolerate hypotension better than that induced by a hyperbaric solution. However, isobaric tetracaine in our regimen spread over a relatively wide range as was expected [14], and 20% of the patients received supplemental epidural anesthesia. We surmise that the dose of tetracaine in this study might be smaller than that able to induce satisfactory analgesia for cesarean section. A low dose of hyperbaric solution combined with epidural block, a balance block technique, is now proposed [15].

CSE anesthesia for cesarean section is gradually gaining popularity for various reasons. Kitamura et al. [16] mentioned the possibility of re-entering of local anesthetics from the epidural space into the CSF whenever a fine pencil-point spinal needle is used. However, Suzuki et al. [17] reported recently that a large volume of local anesthetics administered into the epidural space during CSE anesthesia would enter the CSF in a negligible amount. The six cases in this study required a mean 9 ml of supplemental 1% lidocaine for completion of anesthesia, which is similar to the dose reported by several

investigators [18,19] who administered an additional 1.5–2ml of 0.5% bupivacaine per unblocked segment. Although we believe that the local anesthetics will not immigrate into the CSF to cause high spinal anesthesia, it will be safe to inject them in divided doses when repeated attempts at successful spinal insertion are made [20].

Postspinal headache (PSH) is another reason against using spinal anesthesia for cesarean section. Recent advances in technology provide an ultrafine needle with a noncutting tip which can reduce the incidence of PSH to as low as 1.7% [21]. As this needle-through-needle approach facilitates an easy insertion of the ultrafine spinal needle, we are confident that the incidence of PSH would not be increased when the CSE method is applied to parturients. On the other hand, most of the postpartums complained of back pain [13]. We were not able to differentiate the back pain associated with spinal and epidural insertions from the so-called after-pain.

In conclusion, we reported the technical and clinical results of CSE anesthesia using the needle-through-needle approach. This method was easy to handle for parturients. Isobaric tetracaine proved to be a suitable anesthesia for cesarean section. In a few patients the unblocked segments were covered by the sequential epidural anesthesia. Postsurgical pain relief through the epidural catheter was favored by postpartums. Postspinal headache after CSE anesthesia by this method was rarely observed, even in young patients.

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