

## Total Spinal Block after Epidural Injection into an Interspace Adjacent to an Inadvertant Dural Perforation

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Puncture of the subarachnoid space is a common technical complication of epidural anesthesia with an incidence ranging from 0.2-3.0 per cent.<sup>1</sup> Whether the needle should be repositioned in the epidural space of the same or an adjacent interspace for injection of the local anesthetic for epidural anesthesia is controversial.<sup>2,3</sup>

In the last 2,603 Cesarean sections performed under epidural anesthesia in our institution, there have been 58 inadvertent dural punctures (2.23 per cent). In 31 of the 58 cases an injection was made through the needle at the next cephalad interspace using 75 to 85 per cent of the usual dose of local anesthetic. A test dose was used and an epidural catheter inserted in all 31 cases. Of the 31 parturients, 14 were either not in labor or were having contractions at more than 10-min intervals, and eight were having contractions every 4- to 10-min intervals. The three total spinal anesthetics occurred in a group of nine patients having contractions at intervals of less than 4 min. Taking into account the increased cephalad spread of anesthesia with increased body weight,<sup>4</sup> three additional patients in labor had a high level of anesthesia defined as a level more than 2 SD above the mean. The levels were C7, C5, and T2. By chi-square analysis there was a strong probability that the high levels of sensory anesthesia were related to the frequency of uterine contractions. ( $P < 0.01$ ). The three cases of total spinal anesthesia are described below.

### REPORTS OF THREE CASES

*Patient 1.* A 26-year-old parturient (height 163 cm, weight 60.8 kg) consented to an epidural anesthetic for a repeat Cesarean section. Strong uterine contractions were occurring every 3 min. While attempting an epidural anesthetic, a dural tap occurred at L3-4 and the needle reinserted at L2-3. Five minutes after a test dose of 0.75 per cent bupivacaine 2 ml had not produced sensory loss, a further 15 ml were injected at a rate of 1 ml every 4 seconds through the epidural needle. An epidural catheter was then inserted. A T4 level of sensory anesthesia was present at 5 min and a C3 level at 8 min. The patient

complained of dyspnea and a moment later apnea developed. The trachea was immediately intubated and ventilation was controlled for the subsequent 140 min. The arterial blood pressure fell from 120/80 to 100/60 torr immediately after endotracheal intubation and two doses of ephedrine, 10 mg, were subsequently administered. The baby was delivered 5 min after endotracheal intubation and had an Apgar score of 8 at 1 min and 9 at 5 min. The duration of the block, measured to the time of complete recovery of motor and sensory function, was 250 min.

*Patient 2.* A 34-year-old parturient (height 152 cm, weight 66.7 kg), experiencing strong uterine contractions at less than 3-min intervals, consented to an epidural anesthesia for Cesarean section. While attempting an epidural anesthetic, a dural tap occurred at L3-4 and the needle was reinserted one space cephalad. Five minutes after a test dose of 0.75 per cent bupivacaine, 3 ml, had not resulted in sensory loss, a further 14 ml were injected through the needle at a rate of 1 ml every 4 seconds. An epidural catheter was then inserted. Twenty minutes later the sensory loss was T3. A Cesarean section was then performed with the delivery of the baby with an Apgar score of 9 at 1 min and 10 at 5 min. Forty minutes after injection, a C6 level of sensory loss was recorded and approximately 2 min later she became apneic after which the trachea was intubated and ventilation controlled. The arterial blood pressure originally 130/65 fell twice to 100/50 torr. The pressure increased to above 120/65 on both occasions following the administration of 5 mg ephedrine. Spontaneous breathing returned after 160 min when a T4 level of sensory loss was recorded. The duration of the block to complete recovery of motor and sensory function was 310 min.

*Patient 3.* A 19-year-old obese parturient (height 165 cm, weight 94 kg) with preeclampsia and uterine contractions occurring at less than 3-min intervals was scheduled for Cesarean section for failure to progress in labor. Arterial blood pressure was 160/100 torr with 1 + albuminuria and slight peripheral edema. A dural puncture occurred at L3-4, the epidural needle repositioned at L2-3, and there was no sensory loss 5 min after a test dose of 3 ml 0.75 per cent bupivacaine had been administered. Thirteen ml of 0.75 per cent bupivacaine was administered at the rate of 1 ml every 4 seconds. At 15 and 25 min after the injection the sensory loss was at the T10 dermatome. A test dose of 2 per cent chloroprocaine, 2 ml, was injected through the catheter without further cephalad spread of sensory anesthesia and 5 min later a further 8 ml was administered. Within 2 min the patient became dyspneic and uncooperative. Anesthesia was rapidly induced with thiopental and succinylcholine after which the trachea was intubated. The baby was delivered 8 min later with an Apgar score of 6 at 1 min and 9 at 5 min. The arterial blood pressure which had remained at 160/110 torr fell to 120/70 torr. The administration of 5 mg ephedrine was followed by an increase in arterial blood pressure to greater than 140/90. The Cesarean section was completed 70 min after endotracheal intubation. The patient was conscious 5 min later but was unable to breathe spontaneously, had a weak grip, and a C3 level loss. The duration of the block to complete recovery of motor and sensory function was 390 min.

There was no residual neurological complication in the series. Of the 27 patients who did not receive epidural anesthesia, 14 developed

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a headache and six required an epidural blood patch. Of the 31 receiving an epidural, seven developed a headache and four required an epidural blood patch. By chi-square analysis, the frequency of headache was greater with those patients who did not receive an epidural ( $P < 0.05$ ). The lower incidence of headache in patients sustaining a dural tap and subsequently receiving epidural anesthesia compared with those subsequently receiving other forms of anesthesia agrees with the findings of Shnider and Levinson.<sup>5</sup>

### DISCUSSION

Several authors recommend that after inadvertent dural puncture the epidural needle should be withdrawn and reinserted in the same or an adjacent interspace. Of 520 cases of dural puncture recorded in over 25,000 epidural anesthetics only one case of a total spinal was reported which was attributed to failure to perform a test dose.<sup>6-12</sup> Anesthesia for both vaginal delivery and Cesarean section were included in some of these reviews. The risk of total spinal anesthesia following the use of the same or an adjacent interspace was, however, emphasized in two accounts of obstetrical anesthesia which included 2,332 Cesarean sections and 24,595 vaginal deliveries.<sup>3,13</sup> The first of these two papers gave an anecdotal account of total spinal anesthesia occurring following this procedure at other hospitals. No details are given.

The total spinal block developed 8 minutes after the initial epidural injection in the first case, 40 minutes after in the second case, and almost immediately after an augmentation dose in the third case. In two previously detailed case reports,<sup>14,15</sup> the total spinal took less than 15 minutes to develop. There is also a previous report of a total spinal following the fourth augmentation dose of a continuous epidural block for the relief of labor pain and this resulted in death.<sup>16</sup> The time between epidural injection and the total block in my second case report is however over 40 minutes, an unexpectedly long interval. An explanation might be that during the 40 minutes intermittent increases in epidural pressure due to uterine contractions gradually forced the local anesthetic into the subarachnoid space. Bupivacaine administered for epidural anesthesia will continue to anesthetize additional sensory segments for 40 minutes after injection.<sup>4</sup> When the total spinal follows immediately on the injection of local anesthetic through a catheter, the catheter tip probably is near the site of dural puncture.

The authors of three current textbooks of obstetrical anesthesia recommend inserting the epidural needle in an interspace other than the one where the dural puncture occurred without additional precautions.<sup>1,5,17</sup> Three other authors suggest that there is partial leakage of local anesthetic through the dural hole giving a confusing mixture of spinal and epidural anesthesia and advise slow administration and the use of a smaller dose.<sup>18-20</sup>

Lee and Atkinson describe a technique of leaving the epidural needle in the dural hole, using an adjacent space for the injection and then removing both needles together.<sup>21</sup>

My experience supports the view that a higher level of sensory loss often occurs following the use of the next adjacent cephalad interspace despite the reduction of the dose of local anesthetic by 15 to 25 per cent. The level obtained in all 31 parturients was equal to or higher than the mean anticipated from the patients weight.<sup>4</sup> In addition, three parturients developed a total spinal and three had sensory loss higher than 2 standard deviations above the anticipated level. The highest levels occurred in parturients having uterine contractions and the association was statistically significant with a  $P < 0.01$ .

Based on my experience described in this report, I recommend that a more cephalad interspace after dural puncture be used solely for anesthesia for vaginal delivery when small amounts of local anesthetic are used (*e.g.*, a maximum of 25 mg bupivacaine) and not for Cesarean section when a much larger dose is needed (*e.g.*, 150 mg bupivacaine). For Cesarean section, I believe a subarachnoid or general anesthesia should be instituted following dural puncture.

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Anesthesiology  
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## New Method for Fiberoptic Endotracheal Intubation of Anesthetized Patients

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Flexible fiberoptic laryngoscopy is a valuable method for endotracheal intubation of patients whose tracheas are difficult or impossible to intubate with conventional laryngoscopes.<sup>1-3</sup> This technique has generally been described in the awake state with topical anesthesia and sedation. For many patients, however, this is a stressful and unpleasant experience.

Endotracheal intubation of anesthetized patients with fiberoptic laryngoscopes introduces special problems. The pharynx collapses, leaving little or no air space to see through. The conventional laryngoscope provides its own exposure by lifting the anterior pharynx, which the fiberoptic instrument does not do. Visualization is difficult or impossible unless some other means is found to expand the pharynx. Lloyd has recommended pulling forward on the tongue with lung forceps.<sup>4</sup> This can not always be done (*e.g.*, ankylosis of temporomandibular joint), does not always expand the hypopharynx sufficiently to lift the epiglottis, is traumatic to the tongue, and always requires an assistant.

The standard surgical tongue retractor was modified (fig. 1) to provide the exposure needed for fiberoptic laryngoscopy in anesthetized patients without an assistant. A slightly smaller size was made for females. Only simple tools were required to produce this retractor.

The retractor was designed to be used by an unassisted operator as illustrated in figures 1 and 2. The last three digits of the hand are used to hold the retractor after it has been placed in the mouth, and provide gentle lifting pressure to expose the larynx. The thumb and forefinger of the same hand can easily thread the fiberoptic laryngoscope into the trachea through the mouth or nose. The retractor may also be held by an assistant if the operator prefers. Complete exposure of the larynx is obtained.

The author has used this technique (unassisted) for 200 intubations of many different kinds of patients. They include ankylosing spondylitis, ankylosis of tempero-

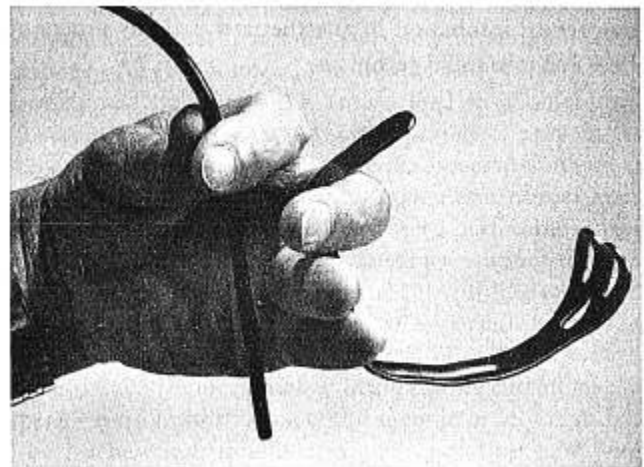


FIG. 1. Hand positioned to pass fiberoptic laryngoscope while holding retractor.

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