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Lumbar Sympathetic Blocks Speed Early and Second Stage Induced Labor in Nulliparous Women

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Background: **Rapid cervical dilation reportedly accompanies lumbar sympathetic blockade, whereas epidural analgesia is associated with slow labor. The authors compared the effects of initial lumbar sympathetic block with those of epidural analgesia on labor speed and delivery mode in this pilot study.**

Methods: **At a hospital not practicing active labor management, full-term nulliparous patients whose labors were induced randomly received initial lumbar sympathetic block or epidural analgesia. The latter patients received 10 ml bupivacaine, 0.125%; 50 μg fentanyl; and 100 μg epinephrine epidurally and sham lumbar sympathetic blocks. Patients to have lumbar sympathetic blocks received 10 ml bupivacaine, 0.5%; 25 μg fentanyl; and 50 μg epinephrine bilaterally and epidural catheters. Subsequently, all patients received epidural analgesia.**

Results: **Cervical dilation occurred more quickly (57 *vs.* 120 min/cm cervical dilation; $P = 0.05$) during the first 2 h of analgesia in patients having lumbar sympathetic blocks (n = 17) than in patients having epidurals (n = 19). The second stage of labor was briefer in patients having lumbar sympathetic blocks than in those having epidurals (105 *vs.* 270 min; $P < 0.05$). Nine patients having lumbar sympathetic block and seven having epidurals delivered spontaneously, whereas seven patients having lumbar sympathetic block and seven having epidurals had instrument-assisted vaginal deliveries. Cesarean delivery for fetal bradycardia occurred in one patient having lumbar sympathetic block. Cesarean delivery for dystocia occurred in five patients having epidurals compared with no patient having lumbar sympathetic block (P = not significant). Visual analog pain scores differed only at 60 min after block.**

Conclusions: **Nulliparous parturients having induced labor and receiving initial lumbar sympathetic blocks had faster cervical dilation during the first 2 h of analgesia, shorter second-stage labors, and a trend toward a lower dystocia cesarean delivery rate than did patients having epidural analgesia. The effects of lumbar sympathetic block on labor need to be determined in other patient groups. These results may help define the tocodynamic effects of regional labor analgesia. (Key words: Obstetric anesthesia; patient satisfaction.)**

LABOR analgesia should speed cervical dilation. Severe labor pain is associated with high plasma epinephrine levels, epinephrine is tocolytic, and epidural labor analgesia decreases pain and plasma epinephrine levels.[1–3] Yet epidural analgesia is associated with increased duration of the first and second stages of labor.[4,5] Parturients in whom epidural analgesia is continued until delivery have longer second stages and an increased incidence of forceps delivery compared with parturients whose epidurals were discontinued at 8 cm cervical dilation.[4] A recent meta-analysis of trials randomizing patients to receive parenteral opioid or epidural analgesia found that both the first and second stages or labor were longer in patients in the epidural groups.[5]

Short labors reportedly follow temporary or permanent interruption of the lumbar sympathetic chain. Labor progresses rapidly in patients receiving lumbar sympathetic block (LSB) labor analgesia[6–10] and in pregnant patients and in dogs with bilateral surgical sympathectomies.[11–13] However, no clinical trials compare the tocodynamic effects of LSB and epidural labor analgesia.

We hypothesized that labor would progress more rapidly in parturients receiving initial labor analgesia with LSBs than in patients receiving initial epidural analgesia. We designed this randomized, single-blinded pilot study to compare the effects of LSB with those of epidural analgesia on labor speed and delivery route in nulliparous women undergoing labor induction. Our primary outcome was the rate of cervical dilation in the first 2 h after block placement; our secondary outcomes were

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the rate of cervical dilation in active first stage labor (4 to 10 cm cervical dilation), the length of the second labor stage, the rate of cesarean delivery for dystocia, block complications, and maternal satisfaction.

Materials and Methods

The Women's College Hospital Ethics Committee approved this protocol. We obtained written informed consent from nulliparous women carrying a singleton fetus in a vertex position who were undergoing labor induction with cervical prostaglandin gel, intravenous oxytocin, or both. All patients carried fetuses between 37 and 42 weeks' gestational age. Data were collected between December 1, 1997 and April 30, 1998. Exclusion criteria included (1) diabetes, (2) preeclampsia requiring magnesium or antihypertensive treatment, (3) maternal body mass index greater than 35, (4) cervical dilation of 6 cm or more, (5) maternal height less than 150 cm or more than 180 cm, and (6) a nonreassuring fetal heart rate pattern.

Obstetricians at Women's College Hospital minimize intrapartum cervical examination and instrumentation and permit slow first and second labor stages as long as there is no clinical evidence of chorioamnionitis. Internal uterine pressure catheters are used rarely. If the mother and fetus are tolerating labor well, most Women's College obstetricians allow second stage durations of 8 h before cesarean delivery is performed for failure of descent. If the cervix is fully dilated but the fetal head is high, anesthesiologists administer sufficient epidural local anesthetic to abolish the mother's urge to push (generally 10 ml 2% carbonated lidocaine). Oxytocin infusion rates are increased to lower the fetal head station before the epidural block is lightened and the mother is allowed to push. These practices are in contrast with policies in many US hospitals and with the American College of Obstetricians and Gynecologists' definition of prolonged second-stage labor (more than 3 h in nulliparous patients with epidural analgesia).[14]

Each patient was randomized, using a computer-generated randomization list, to receive initial labor analgesia with either epidural or LSB analgesia. The obstetricians were unaware of patient group assignment. The anesthesiologist caring for the patient and collecting data also prepared the study medications and thus knew the patient's group assignment.

When a patient requested analgesia, her cervix was examined, and she received 500 ml lactated Ringer's solution intravenously. Oxytocin administration was stopped before block placement and resumed, at a lower infusion rate, 30 min after epidural catheter taping. All patients sat for epidural or LSB placement.

Patients in the LSB group received 10 ml normal saline injected incrementally through the epidural needle at the L2–L3 or L3–L4 interspaces, an epidural catheter placed, and a continuous epidural infusion of normal saline. Bilateral LSBs were placed using a modification of Bonica's lateral method.[15,16] Skin wheals were placed 8 cm to the left and right of the top of the L3 spinous process. A 22-gauge, 12.7-cm (5-inch) Quincke-point spinal needle was inserted through each skin wheal at a right angle to the patient's longitudinal axis and at a 55–60° angle to the plane of the patient's back. One to two milliliters of lidocaine, 1.5%, was injected slowly as the needle was inserted about 7 cm into the back. A fluid-lubricated glass syringe was attached to the end of the needle and the anterior border of the psoas muscle was identified using an air loss-of-resistance technique. Resistance was usually lost when 9 to 12 cm of the needle had been inserted. On each side, we aspirated for blood or cerebral spinal fluid and incrementally injected 10 ml bupivacaine, 0.5%; 25 μg fentanyl, and 50 μg epinephrine. After the first 3-ml increment, we waited 2 min before questioning the patient about signs of intravenous or subarachnoid injection. Then we injected 4 ml followed by 3 ml and waited 1 min between aliquots and then questioned the patient about signs of intravenous injection.

Patients in the epidural group had skin wheals placed 8 cm to the left and right of the top of the L3 spinous process and 2 ml lidocaine, 1.5%, infiltrated 5 cm deep in the direction that would be followed for LSB placement. The lidocaine was injected incrementally using the timing described before for LSB injection. We used an air loss-of-resistance technique to identify the epidural space at the L2–L3 or L3–L4 interspace. Through the epidural needle, we injected incrementally 10 ml bupivacaine, 0.125%, with 50 μg fentanyl and 100 μg epinephrine. We inserted the epidural catheter and removed the needle. We started a continuous epidural infusion of plain bupivacaine, 0.08%.

At the first request for supplemental analgesia by patients in either group, we injected 10 ml bupivacaine, 0.125%, with 50 μg fentanyl and started a continuous infusion of bupivacaine, 0.08%, with 2 mg/ml fentanyl. We titrated the infusion and administered epidural boluses as clinically indicated until delivery.

All patients were cared for in the supine position with left lateral tilt. We recorded blood pressure and the patient's reported pain score before and 10, 20, 30, 60, and 120 min after block injection. Patients were asked to report their contraction pain using a verbal analog scale, with 0 representing no pain and 10 the worst imaginable pain. Pain scores were not recorded after the patient requested additional pain medication. Thirty minutes after block injection, we asked the patient to rate the insertion pain of the preanesthetically placed 16-gauge intravenous cannula (generally inserted by nursing staff without local anesthesia), LSB placement, and epidural placement using the same verbal analog scale. We measured the patient's sensory level to cold (ice) and motor strength before and 30, 60, and 120 min after block injection. We noted whether treatment was instituted for hypotension, tetanic uterine contractions, or nonreassuring fetal heart rate patterns in the first hour of analgesia. At 120 min, we asked the patient to rate as excellent, good, fair, or poor her satisfaction with the first 2 h of analgesia.

We assessed motor strength using a modified Bromage score: 0 = patient able to perform a straight leg raise and hold the leg up against thigh pressure exerted by the investigator's hand, 1 = patient able to perform a straight leg raise but unable to resist thigh pressure, 2 = free knee flexion, 3 = moves ankles freely, and 4 = complete lower extremity motor block. After 30 min, the patient stood and tried to step onto and off of a 9-inch-high without assistance. Patients who passed this step test were permitted to walk to the restroom as desired.

Whenever possible, the same person examined the patient's cervix before and 2 h after block injection. The examiner was unaware of the patient's group assignment. We recorded the time of first analgesic request, the results and times of cervical examinations closest to 4 and 10 cm cervical dilation, and delivery time and route (spontaneous; vacuum; low, mid, or midrotational forceps; or cesarean delivery). We calculated the rate of cervical dilation during the first 2 h of analgesia and the active first stage of labor (4–10 cm cervical dilation) in min/cm of cervical dilation. If we did not know the time the cervix was 4 cm dilated, we calculated the rate using the known cervical dilation closest to 4 cm. We recorded 1- and 5-min Apgar scores and the infant's birth weight.

Statistics

Our primary outcome was the rate of cervical dilation during the first 2 h of analgesia. To demonstrate an effect size of 1 standard deviation difference between the two groups, with an alpha error of 0.05 and a power of 0.8, 17 patients were necessary in each group.

We assessed demographic variables using descriptive statistics. We used the Mann-Whitney U test to compare cervical dilation rates and second-stage durations. We compared verbal analog scores for pain using repeated measures analysis of variance. We evaluated other outcomes using unpaired Student *t* tests, chi-square analysis, and Fisher exact test as appropriate. $P < 0.05$ was considered significant.

Table 1. Maternal and Infant Demographics

	LSB (n = 17)	Epidural (n = 19)
Age (yr)*	32 ± 5	32 ± 3
Height (cm)*	168 ± 5	165 ± 6
Weight (kg)*	79 ± 12	76 ± 12
Gestational age (wk)*	39.6 ± 1.5	39.9 ± 1.4
Indication for induction (n)		
Postdates	6	7
Ruptured membranes, no labor	9	7
Mild preeclampsia	2	5
Preblock cervical dilation (cm)*	2.4 ± 1.3	2.4 ± 1.7
Preblock effacement (%)*	79 ± 14	82 ± 18
Preblock station (cm)*	−1.5 ± 0.6	−1.0 ± 1.0
% receiving vaginal prostaglandin gels	29	42
% receiving oxytocin	94	94
Infant birthweight	3,492 ± 541	3,578 ± 472
1 min Apgar < 7 (n)	2	2
5 min Apgar < 7 (n)	1	0

* Mean ± standard deviation.

LSB = lumbar sympathetic block.

Results

Thirty-nine patients participated in this study. Three patients did not request regional labor analgesia after randomization; data from these patients are not reported because no information is available on the study's primary end point (rate of cervical dilation in the first 2 h of analgesia). Two of these patients were randomized to the LSB group and one to the epidural group; labor proceeded quickly and uneventfully in all three patients. Demographic characteristics of the remaining 36 patients, including preblock cervical examinations, infant birth weights, and 1- and 5-min Apgar scores, did not differ between the groups (table 1). The obstetrician of one patient in the epidural group learned her group assignment intrapartum. It is unlikely that this affected our results, because another obstetric team member

Table 2. Labor Characteristics

	LSB (n = 17)	Epidural (n = 19)	*P* Value
Cervical dilation 1st 2 h (min/cm)*	57 (13–155)	120 (27–240)†	0.05
Cervical dilation 1st stage (min/cm)*	32 (13–120)§	42 (9–105)‡	NS
Second labor stage (min)*	105 (36–371)	270 (18–489)¶	<0.05
Delivery (n)			
Spontaneous	9	7	
Vacuum	3	3	NS
Forceps: low	0	2	
Mid	3	2	
Mid-rotational	1	0	
Cesarean delivery (n)			
Total	1	5	
Arrest of dilation	0	2	NS
Arrest of descent	0	3	
Fetal bradycardia**	1	0	

NS = not significant.
* Median (range).
† Six patients did not dilate.
‡ Two patients did not complete the 1st stage.
§ One patient did not complete the 1st stage.
¶ Five patients did not complete the 2nd stage.
** Infant had nuchal cord × 3. Bradycardia began 90 minutes after block placement.
LSB = lumbar sympathetic block.

performed the cervical examinations and the patient delivered vaginally. The mean untreated preblock blood pressures of the six patients diagnosed with preeclampsia were systolic, 125 ± 5 mmHg and diastolic, 88 ± 4 mmHg.

The rate of cervical dilation in the first 2 h after block placement was significantly faster in the LSB than in the epidural group (table 2). Many of our patients spent their first 2 h of analgesia in latent-phase labor; 5 patients in the LSB group and 10 in the epidural group had not entered active-phase labor (*i.e.*, their cervices were < 4 cm dilated) at the end of this time (fig. 1). The speed of active first-stage labor was rapid and similar in the two groups (table 2). The second stage of labor was significantly shorter in patients in the LSB group than in epidural group (table 2). Second-stage labor lasting more than 3 h occurred in four patients in the LSB group and in eight patients in the epidural group.

Cesarean delivery occurred in five patients in the epidural group compared with one in the LSB group (28% *vs.* 6%, *P* = not significant; table 2). The cesarean delivery rate in our epidural group is comparable to the rate in all 148 nulliparous women in whom labor was induced (most of whom received epidural analgesia) at Women's College Hospital during the data collection period (30%). Five patients in the epidural group but no patient in the LSB group underwent cesarean delivery for dystocia. One patient in the LSB group underwent cesarean delivery for fetal bradycardia that began 90 min after block placement; in this case, the umbilical cord was wrapped three times around the infant's neck. The rates of instrument-

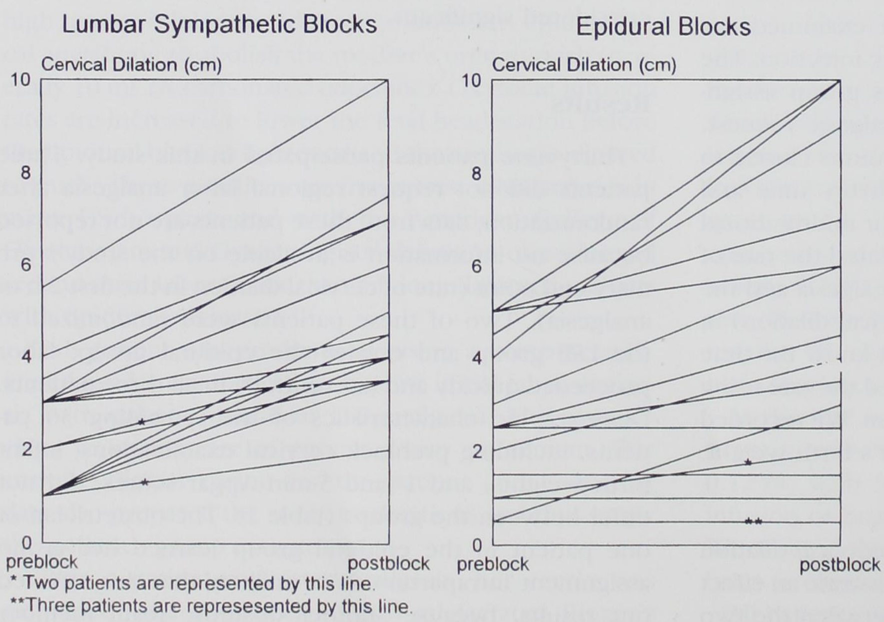

Fig. 1. For all patients studied, cervical dilation (measured in cm) immediately before (preblock) and 2 h after (postblock) placement of lumbar sympathetic blocks (*left*) or epidural blocks (*right*) for initial labor analgesia.

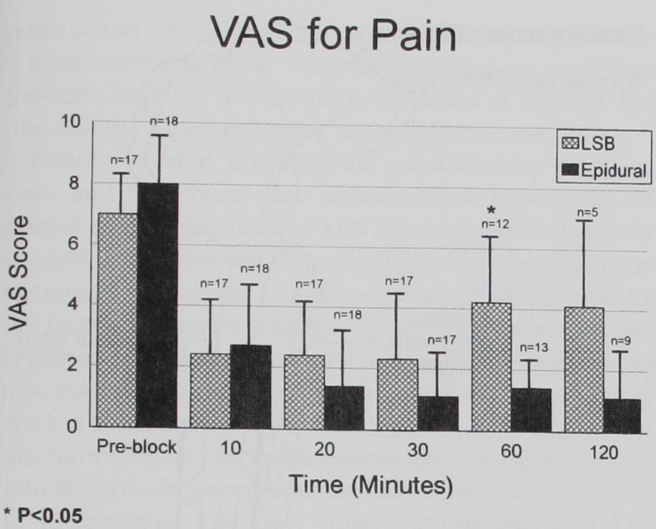

Fig. 2. Mean (±SD) pain scores over time after the initiation of lumbar sympathetic block or epidural labor analgesia.

assisted and spontaneous vaginal delivery did not differ between the groups.

All patients in both groups reported that their labor pain decreased after regional analgesia was instituted (fig. 2). Because labor pain decreased, we assumed that the blocks had been placed effectively. Pain scores between the groups differed only at the 60-min time point ($P < 0.05$). Sensory block was more extensive in patients in the epidural group than in those in the LSB group ($P < 0.001$, table 3). Vaginal pain, which should not be affected by LSB, triggered the request for epidural catheter activation in 14 of the 17 patients in the LSB group. No patient had a Bromage motor score greater than 1, and all patients walked to the restroom at least once. Patient satisfaction was comparable in the two groups.

Patients rated LSB insertion as no more painful than epidural catheter placement. We analyzed data from patients in the LSB group only, because patients in the epidural group did not have fluid injected in the vicinity of the sympathetic chain. Pain scores were intravenous cannula, 3.3 ± 2.3; LSB, 3.8 ± 2.7; and epidural catheter, 3.9 ± 2.6.

One patient in the LSB group required 5 mg intravenous ephedrine for mild hypotension, but no patient in the epidural group became hypotensive. There were no tetanic uterine contractions or nonreassuring fetal heart rate patterns during the first hour after block in any patient. We saw no clinical evidence of blood vessel or dural puncture during LSB or epidural placement. No other complications of block placement occurred.

Discussion

We found that labor proceeded more quickly during the first 2 h of analgesia after initial pain relief with LSBs than with epidural analgesia. In addition, we observed that patients in the LSB group had shorter second-stage labors than did those in the epidural group. This occurred even though all patients in the LSB group subsequently received epidural analgesia. Intravenous fluid administration, effective labor analgesia, and motor weakness have been proposed as mechanisms for epidural-associated labor prolongation. Yet all of our patients received 500 ml intravenous fluid. Pain scores differed between groups only at 60 min, and all patients were strong enough to walk to the restroom at least once.

Previous case series report rapid cervical dilation in spontaneously laboring, nulliparous patients receiving LSB labor analgesia.[6,8–10] Meguiar and Wheeler,[6] Jarvis,[9] and Reich[10] report the time from 5 to 10 cm cervical dilation as 158 ± 92 min, 191 min, and 114 min after LSB placement. In contrast, studies by Chestnut *et al.*[4,17,18] report the time from 4 to 10 cm cervical dilation as 329 ± 197 min, 381 ± 239 min, and 354 ± 236 min after epidural analgesia. To our surprise, we did not find an intergroup difference in active-phase duration. However, the active-phase dilation rate in our patients having induced labor and receiving epidural analgesia (42 min/cm) is closer to that of previous LSB (about 30 min/cm) than previous spontaneous labor epidural (about 60 min/cm) case series.

Table 3. Regional Block Assessment

	LSB (n = 17)	Epidural (n = 19)	*P* Value
Dermatomes blocked 30 min postblock (n)*	4 ± 4	13 ± 8	<0.001
Bromage score 30 min postblock (n)			
0	17	14	NS
1	0	5	
>1	0	0	
Time to reinjection (min)†	65 (30–140)	90 (20–415)‡	NS
Patient satisfaction (n)			
Excellent	8	15	
Good	7	3	NS
Fair	2	1	
Poor	0	0	

NS = not significant.

* Mean ± standard deviation.

† Median (range).

‡ Two patients did not request additional analgesia.

LSB = lumbar sympathetic block.

Endogenous plasma epinephrine levels correlate with labor duration.[1] However, our results probably are not the result of intergroup plasma epinephrine differences. Epidural analgesia decreases plasma epinephrine by 56%; it is not likely that LSBs are significantly more effective.[3] In addition, plasma epinephrine levels correlate with labor pain severity, and our patients receiving epidural analgesia were at least as comfortable as those receiving LSB at all times (fig. 2).

Peripheral resection of the uterine autonomic nerves greatly influences labor duration in both human patients and gravid dogs.[11-13] In dogs, surgical lumbar sympathectomy leads to rapid cervical dilation and delivery, whereas transection of the pelvic parasympathetic nerves delays labor onset and increases labor duration.[12,13] Ten labors in eight patients who had had superior hypogastric plexus resection averaged 5 h; in a control group, labor duration was 13 h.[11]

Uterine sympathetic efferents are believed to leave the spinal cord only between T10 and L1.[19] This may not be true. In postpartum dogs, fright inhibits uterine contractions.[20] Alpha-adrenergic blockade abolishes the tocolytic effects of fright.[20] Fright-induced tocolysis and the prevention of this tocolysis by α-adrenergic antagonists still occur after spinal cord transection at T2–T3 or T3–T4.[20] Based on this research, we theorize that norepinephrine-mediated tocolytic efferents exit the central nervous system cephalad to T3, travel through the peripheral sympathetic chain, and diminish the strength and frequency of uterine contractions (fig. 3).

If our theory is correct, autonomic imbalance may explain the association between epidural analgesia and slow labor. Low-dose lumbar epidural analgesia would not affect sympathetic efferents exiting the central nervous system cephalad to T3. However, epidural analgesia could partially block tocodynamic sacral parasympathetics.

We believe this theory may explain why our patients in the LSB group had shorter second-stage labors. However, we cannot prove that the lumbar sympathetic chain was blocked during second-stage labor because we injected the preplaced epidural catheters when patients reported perineal pain. Second-stage blockade is probable, because Meguiar and Wheeler[6] administered bupivacaine–epinephrine LSBs and reported analgesia that lasted 283 ± 103 min in 12 of 40 parturients and analgesia until delivery in 28 of 40 parturients.[6] An alternate hypothesis for our second-stage results is that LSBs decreased the incidence of fetal malposition during early labor.

We found LSBs easy to perform and no more painful than epidural catheter placement. Needle contact with

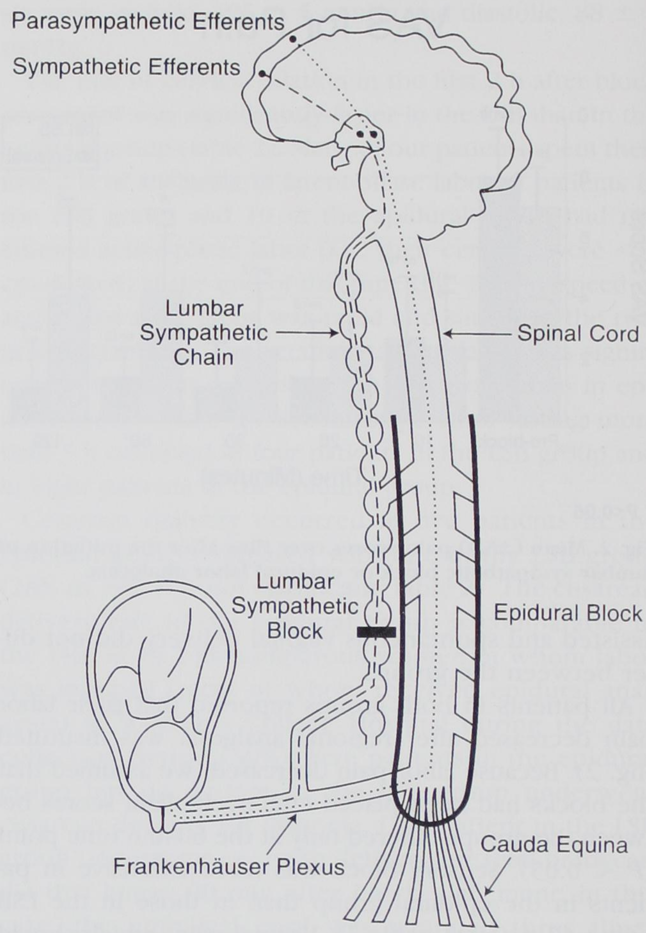

Fig. 3. Proposed pathways of tocolytic sympathetic and tocodynamic parasympathetic efferents. Nerve transection experiments in pregnant and postpartum dogs suggest that tocolytic sympathetic efferents exit the central nervous system cephalad to T3 and travel to the uterus *via* the peripheral sympathetic chain. Tocodynamic parasympathetic efferents are interrupted by cutting the pelvic parasympathetic nerves. Epidural analgesia may slow labor by partially blocking pelvic parasympathetic outflow without affecting the tocolytic sympathetic efferents.

bone and lidocaine skin wheal injection were the most painful parts of both blocks. To minimize bone contact, we used Bonica's loss-of-resistance LSB technique.[15,16] If the epidural catheter was inserted easily, patients reported more pain with LSB than epidural placement. However, if epidural placement was difficult, LSB injection was rated as the less painful procedure.

Bonica recommends that the LSB needle be inserted at the L2 or L3 level 8 cm lateral to the midline in small and 10 cm lateral in large adults.[15,16] The psoas muscle originates at T12 or L1 and grows larger as it travels caudally. At L1 or L2, one might falsely lose resistance at shallow depth in the perirenal fat pad, especially if the insertion point is too lateral. Bonica recommends placing LSBs in a cross-sectional plane including the top of a spinous process, because the aponeurotic fascia is thicker and one obtains a clearer loss of resistance in these planes.[15]

Tetanic uterine contractions, problematic hypotension, and fetal heart rate abnormalities have been reported as complications of LSB labor analgesia, but only in early case series not describing intravenous fluid management.[8,10] Meguiar and Wheeler administered 500 ml D5 lactated Ringer's solution before LSB placement and reported no side effects.[6] We saw mild hypotension in one patient, no uterine hypertonus, and no anesthesia-related abnormal fetal heart rate patterns. Our policy of discontinuing oxytocin administration during and for 30 min after block placement may have lessened the chance of hypertonus. The only other complications of LSB labor analgesia noted in the 712 patients in the English literature are one blood vessel puncture, one seizure, and one broken needle.[7,9,10]

Serious complications of LSB placement could occur, and these blocks should be placed only by skilled anesthesiologists. The lumbar sympathetic chains lie close to the aorta, the inferior vena cava, and the kidneys. The dose of bupivacaine injected on each side (50 mg) is large enough to cause seizures, cardiovascular collapse, and death if injected into a blood vessel.[21] Dural puncture during attempted LSB placement has been reported in prone nonpregnant patients.[22] The usual subarachnoid dose of bupivacaine for cesarean delivery is 12–15 mg; intrathecal injection of 50 mg bupivacaine would lead rapidly to a complete spinal.

The current investigation is a pilot study that we hope will lead to further investigation of the relations between analgesia, sympathetic blockade, and labor dynamics. Systemic β-adrenergic blockers might have similar tocodynamic effects; propranolol administration to women with dystocia reduces the cesarean delivery rate.[23] We do not know if LSBs will speed labor in institutions that practice active labor management or that avoid dense epidural block during second-stage labor. For logistic reasons, this was not a double-blinded study. Single-blinded studies tend to report larger treatment effects than do double-blinded trials.[24] Despite these limitations, our results suggest that intrapartum autonomic manipulation could have important clinical effects and highlight the need for further research.

In conclusion, we found that patients receiving LSB analgesia had more rapid cervical dilation during the first 2 h after block placement, shorter duration of the second labor stage, and a trend toward a lower dystocia cesarean delivery rate than did patients receiving epidural analgesia. The rate of cervical dilation during active first-stage labor did not differ between the groups. Lumbar sympathetic block analgesia may benefit women with protracted labor. Future studies are needed to verify these results and to determine if the proposed mechanism for the effects of LSB block on labor progress is correct.

References

1. Lederman RP, Lederman E, Work B Jr, McCann DS: Anxiety and epinephrine in multiparous women in labor: Relationship to duration of labor and fetal heart rate pattern. Am J Obstet Gynecol 1985;153:870–7

2. Zuspan FP, Cibils LA, Pose SV: Myometrial and cardiovascular responses to alterations in plasma epinephrine and norepinephrine. Am J Obstet Gynecol 1962; 84:841–51

3. Shnider SM, Abboud TK, Artal R, Henriksen EH, Stefani SJ, Levinson G: Maternal catecholamines decrease during labor after lumbar epidural anesthesia. Am J Obstet Gynecol 1983; 147:13–5

4. Chestnut DH, Vandewalker GE, Owen CL, Bates JN, Choi WW: The influence of continuous epidural bupivacaine analgesia on the second stage of labor and method of delivery in nulliparous women. Anesthesiology 1987; 66:774–80

5. Halpern SH, Leighton BL, Ohlsson A, Barrett JFR, Rice A: The effect of epidural *versus* parenteral opioid analgesia on the progress of labor: A meta-analysis. JAMA 1998; 280:2105–10

6. Meguiar RV, Wheeler AS: Lumbar sympathetic block with bupivacaine: Analgesia for labor. Anesth Analg 1978; 57:486–90

7. Shumacker HB, Manahan CP, Hellman LM: Sympathetic anesthesia in labor. Am J Obstet Gynecol 1943; 45:129

8. Hunter CA Jr: Uterine motility studies during labor: Observations on bilateral sympathetic nerve block in the normal and abnormal first stage of labor. Am J Obstet Gynecol 1963; 85:681–6

9. Jarvis SM: Paravertebral sympathetic nerve block, a method for the safe and painless conduct of labor. Am J Obstet Gynecol 1944; 47:335–42

10. Reich AM: Paravertebral lumbar sympathetic block in labor: A report on 500 deliveries by a fractional procedure producing continuous conduction anesthesia. Am J Obstet Gynecol 1951; 61:1263–76

11. Rysanek WJ, Cavanagh D: Presacral neurectomy and its effects on subsequent pregnancies. Am Surg 1958; 24:335–45

12. Shabanah EH, Toth A, Maughan GB: The role of the autonomic nervous system in uterine contractility and blood flow. I. The interaction between neurohormones and sex steroids in the intact and isolated uterus. Am J Obstet Gynecol 1964; 89:841–59

13. Shabanah EH, Toth A, Maughan GB: The role of the autonomic nervous system in uterine contractility and blood flow. II. The role of the parasympathetic neurohormone acetylcholine in uterine motility and blood flow. Am J Obstet Gynecol 1964; 89:860–80

14. American College of Obstetricians and Gynecologists: Dystocia and the augmentation of labor. Technical Bulletin 218. Washington, DC, 1995

15. Bonica JJ, Buckley FP: Regional analgesia with local anesthetics, The Management of Pain, 2nd Edition. Edited by JJ Bonica. Philadelphia, Lea & Febiger, 1990, pp 1883–966

16. Bonica JJ, McDonald JS: Other regional analgesic/anesthetic techniques, Principles and Practice of Obstetric Analgesia and Anesthesia, 2nd Edition. Edited by JJ Bonica, JS McDonald. Baltimore, MD, Williams & Wilkins, 1995, pp 497-537

17. Chestnut DH, McGrath JM, Vincent RD, Penning DH, Choi WW, Bates JN, McFarlane C: Does early administration of epidural analgesia affect obstetric outcome in nulliparous women who are in spontaneous labor? Anesthesiology 1994;80:1201-8

18. Chestnut DH, Owen CL, Bates JN, Ostman LG, Choi WW, Geiger MW: Continuous infusion epidural analgesia during labor: A randomized, double-blind comparison of 0.0625% bupivacaine/0.0002% fentanyl *versus* 0.125% bupivacaine. Anesthesiology 1988; 68:754-9

19. O'Brien M: Uterovaginal plexus, Gray's Anatomy, 38th Edition. Edited by LH Bannister, MM Berry, P Collins, M Dyson, JE Dussek, MWJ Ferguson. New York, Churchill Livingstone, 1995, p 1309

20. Shabanah EH, Toth A, Maughan GB: The role of the autonomic nervous system in uterine motility and blood flow. III. Visual, auditory, and painful stimuli and their influence on uterine motility before and after cord section and the effect of sympatholytic drugs in restoring normal activity. Am J Obstet Gynecol 1965; 92:796-813

21. Albright GA: Cardiac arrest following regional anesthesia with etidocaine or bupivacaine (Editorial). Anesthesiology 1979; 51:285-7

22. Artuso JD, Stevens RA, Lineberry PJ: Post dural puncture headache after lumbar sympathetic block: A report of two cases. Reg Anesth 1991; 16:288-91

23. Sanchez-Ramos L, Quillen MJ, Kaunitz AM: Randomized trial of oxytocin alone and with propranolol in the management of dysfunctional labor. Obstet Gynecol 1996; 88:517-20

24. Schulz KF, Chalmers I, Hayes RJ, Altman DG: Empirical evidence of bias: Dimensions of methodological quality associated with estimates of treatment effects in controlled trials. JAMA 1995; 273:408-12