Intrathecal Morphine As Analgesia For Labor Pain

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Abstract: **In this descriptive study of intrathecal morphine sulfate used for pain control during labor, 49 parturients received morphine intrathecally, 78 were administered butorphanol tartrate (Stadol™), and 34 received no analgesia. Significant differences for the intrathecal group included: (1) decreased requirement of nitrous oxide for delivery, (2) lower number of doses of postpartum intramuscular pain medication, and (3) increased use of forceps. The intrathecal morphine group showed no prolongation of labor and no major side effects in mothers or newborns. The results suggest that the use of lower levels of intrathecal morphine sulfate (0.5 mg) is as safe and effective as the more traditional intravenous analgesia for labor. (J Am Bd Fam Pract 1988; 1:245-50.)**

The use of intrathecal and epidural narcotics for analgesia has been well established. Wang[1] and Yaksh[2] each reported a powerful and long-lasting analgesic effect with no adverse tissue reaction of the spinal cord in animals. Wang and associates further showed the efficacy of the technique in patients with intractable cancer pain.[3]

Later studies of obstetrical patients showed mixed results for both degree of pain relief and incidence of side effects.[4-6] Cousins and Mather[7] concluded from a review of the literature that intrathecal opioids seemed more effective than epidural opioids for labor pain because of marked vascular absorption when the epidural route was used. Others concluded that side effects from use of intrathecal morphine were clinically unacceptable.[8] Abboud, et al.[9] reported excellent analgesic outcomes in a study comparing two doses of morphine intrathecally (0.5 mg and 1.0 mg). Although the frequency of pruritus, nausea, vomiting, and urine retention was high in both groups, these side effects could be reversed effectively. The frequency of more serious side effects was low. Because there were no statistical or clinical differences between the two groups, the investigators concluded that there was no need for the 1.0 mg dose and recommended further studies using doses lower than 0.5 mg. They believed that the analgesic effect would remain strong and side effects further minimized. Cousins[7] also recommended further studies of the clinical effects of doses less than 1.0 mg.

The most common side effects reported were pruritis, nausea, vomiting, and urine retention, but bradycardia, hypotension, and frontal headache were noted. The dangers of delayed respiratory depression were emphasized, and most studies agreed that intrathecal morphine is contraindicated unless there is recourse to intensive care units.[10]

Here, we report results of a descriptive study of intrathecal morphine conducted in a group family practice that had no option for epidural anesthesia. We compared labor and delivery in parturients who received intrathecal analgesia for labor pain with those who received an intravenous analgesic or no analgesic.

Methods

All of the obstetric patients (n = 199) in a rural, group family practice were included in the study. The time period was from March 1982 to October 1984. Thirty-eight (19.1 percent) of these patients eventually required Cesarean sections. During the prenatal period, the patients were informed of the two types of analgesia available during labor and were allowed to choose either or none. This decision did not have to be made until labor was established and could be changed at any time if there were no medical contraindications. In the 161 vaginal deliveries, 49 patients (30.4 percent) received intrathecal morphine, 78 (49.4 percent) intravenous butorphanol tartrate (Stadol™), and

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Table 1. *Descriptive Data by Analgesia Type of Vaginal Deliveries.*

Descriptors	Intrathecal Morphine	Intravenous Stadol™	No Analgesia	Total Group
Mothers	49 (30%)	78 (48%)	34 (21%)	161
Mean age	21.5	22.6	22.5	22.2
Mean parity	0.5	1.4	1.7	1.2
Mean gestational age at delivery	39.7	39.8	39.1	39.6

34 (21.1 percent) received no analgesia during labor. In patients receiving intrathecal morphine, local infiltration of Xylocaine™ (lidocaine) was administered in the L3–4 interspace; a 25-gauge spinal needle was inserted into the spinal canal, and 0.5 mg preservative-free morphine sulfate in 2.0 mL of 10 percent dextrose solution was injected. Patients were then allowed to resume any position or state of ambulation. To decrease nausea, scopolamine (Transderm-V™) was applied behind the ear as soon as the decision was made for intrathecal morphine, and 50 mg of hydroxyzine pamoate (Vistaril™) was administered intramuscularly 30 minutes after the intrathecal injection. Diphenhydramine hydrochloride (Benadryl™) was given by mouth as needed for itching.* Naloxone (Narcan™) was kept immediately available in the event of respiratory depression, and 0.2 mg was given intravenously if the respiratory rate fell below 10/minute. Also immediately available were a laryngoscope, endotracheal tubes, and an Ambu bag. In the Stadol™ group, patients were given Stadol™ 0.5 mg to 1.0 mg every 2 hours as needed until approximately 2 hours before expected time of delivery.

Side effects, blood pressure, pulse rate, and temperature were recorded at 5-minute intervals for 60 minutes following the intrathecal injection and hourly thereafter for 12 hours or until delivery, whichever was longer. Respiratory rate was observed at 15-minute intervals for the same period of time. Hypotension was defined as systolic blood pressure less than 100 mmHg or a decrease greater than 30 mmHg systolic or 15 mmHg diastolic from the preinjection state. Bradycardia was defined as a heart rate of less than 60/minute; respiratory depression was defined as a rate of less than 10/minute. Somnolence, nausea, vomiting, dizziness, pruritis, and headache were also observed and recorded. The Stadol™ and no analgesia groups had hourly blood pressure, pulse rate, respiratory rate, and temperature recorded. All patients were allowed local infiltration, pudendal

*We now use and recommend replacing use of Transderm-V™, Vistaril™, and Benadryl™ with naloxone 0.8 mg in each 1,000 mL intravenous fluids beginning at the time of intrathecal injection and running initially at 100 mL/hour. This rate can be increased, or it can be supplemented with 0.1 mg naloxone intravenous bolus to control nausea or itching and may be continued as long as symptoms persist. This has the added benefit of decreasing the risk of respiratory depression.

Table 2. *Variables by Analgesia Type.*

Variables	Intrathecal Morphine	Intravenous Stadol™	No Analgesia
Nitrous Oxide (%)	24.5	41.5	20.6
Forceps (%)	51.0	33.3	14.7
Apgar 1 minute (mean)	8.8	8.6	8.5
Apgar 5 minutes (mean)	9.7	9.6	9.3
Doses postpartum oral pain medication (mean)	1.6	1.9	1.7
Doses postpartum intramuscular pain medication (mean)	0.1	0.3	0.7
Days in hospital (mean)	2.2	2.1	2.5
C-section (%) (secondary to failure to progress)	13.0	16.0*	

*Combined IV Stadol™ and no analgesia.

Table 3. *Results of a Multivariate Analysis of Covariance (MANCOVA) with Type of Analgesia as the Independent Variable.*

	Standarized Discriminant Function Weights*	
Dependent Variables	Function 1 (10% of Variance)	Function 2 (Additional 8% of Variance)
Nitrous Oxide†	−1.018	0.244
Forceps	0.630	−0.808
Apgar 1 minute	0.324	−0.126
Apgar 5 minutes	−0.138	−0.277
Oral pain medication postpartum	−0.076	0.466
Intramuscular pain medication postpartum	−0.134	−0.341
Length of hospital stay	0.746	0.189

*The weight for each dependent variable represents its relative contribution to the significant group differences obtained, a larger weight indicating a greater contribution.

†Wilkes-Lambda = 0.8166 $P < 0.003$.

block, or nitrous oxide for delivery as requested by the patient.

Following an examination of the distribution of study variables by crosstabulation analysis, the chi-square statistic was used to detect statistical significance. Where necessary, statistics that adjusted for sample or contingency table size were used. Because age and parity are known to be closely related to obstetric outcomes, it would have been desirable to control statistically for both of these variables. However, because age and parity are highly correlated, the decision was made to use parity as the single covariate in a multivariate analysis of covariance (MANCOVA), with type of analgesia as the independent variable and the set of outcomes as dependent variables. Discriminant analysis following significant MANCOVA was performed to detect additional information regarding the contribution of each dependent variable to the significant effect.

Results

Table 1 provides descriptive data on the 161 mothers who delivered vaginally. The intrathecal morphine mothers were typically younger nulliparas than the intravenous Stadol™ and the no analgesia mothers.

Results of the outcome variables are presented in Table 2. A larger proportion of patients in the intrathecal group had forceps applied (51 percent), but a smaller proportion of the intrathecal group (24.5 percent) received by request nitrous oxide at delivery. Apgar scores were slightly higher for the intrathecal group. The number of days in the hospital was similar for the intrathecal and intravenous groups and higher for the no analgesia group. The number of doses of both intramuscular and oral postpartum pain medication was slightly lower for the intrathecal group than for either the intravenous Stadol™ or no analgesia group.

Two significant functions emerged to represent independent underlying entities that are responsible for the significant differences between the analgesia types (Table 3). The first function ac-

Table 4. *Side Effects of Intrathecal Group.*

	n	Percent
Itching	49	100
Nausea	13	8
Urine retention	3	1.9
Headache	2	1.2
Vomiting	1	0.6
Respiratory depression	0	0
Bradycardia	0	0
Hypotension	0	0
Dizziness	0	0
Somnolence	0	0

Table 5. *Changes in Pain Level within the Grouped Intrathecal Patients and the Grouped Intravenous Patients.*

	Pain Level Change (1–10 analog scale)	Level of Significance (two-tailed t-test)
Intrathecal patients n = 10		
Pain at injection/pain after 1 hour	−3.17	$P = <0.000$
Pain at injection/pain at delivery	−0.44	$P = 0.544$
Pain at injection/minimum pain	−4.87	$P = <0.000$
Intravenous patients n = 7		
Pain at injection/pain after 1 hour	0.33	$P = 0.505$
Pain at injection/pain at delivery	1.61	$P = 0.006$
Pain at injection/minimum pain	0.10	$P = 0.856$

counted for 10 percent of the variance. The standardized weights indicate that use of nitrous oxide contributed most to this function. The fact that this was the only variable for which the univariate F test was significant ($P < 0.003$) supports the interpretation of the standardized weights. The standardized weights for the second function, which was able to explain an additional 8 percent of the variance, are also given in Table 3.

Table 4 describes the frequency of side effects of the intrathecal group. Itching was universal but controlled by Benadryl™; the average number of doses was 1.1. Eight percent of the patients became nauseated, but this was controlled with Transderm-V™ and the initial Vistaril™ injection. Vomiting occurred in one patient who required a second Vistaril™ injection. Urine retention requiring a single brief catheterization occurred in 3 patients, and one of these needed an indwelling Foley catheter for 24 hours. No instance of respiratory depression, bradycardia, hypotension, dizziness, or somnolence occurred. Spinal headache occurred in 2 patients.

Cervical dilatation at the time of intrathecal injection averaged 2.7 cm. The mean time between intrathecal injection and completion of second stage of labor was 8 hours 30 minutes for nulliparas and 7 hours 3 minutes for multiparas. This suggests no prolongation of labor from intrathecal morphine.

There were 11 patients who required Cesarean section because of failure to progress in labor. All were nulliparas (13 percent of the intrathecal group and 16 percent of the others). Twenty-seven Cesarean sections were performed on patients who did not labor and who did not receive intrathecal or intravenous narcotics.

Table 6. *Changes in Pain Level Between the Grouped Intrathecal Patients and the Grouped Intravenous Patients.*

	Mean (SD)	Level of Significance (two-tailed t-test)
Centimeters dilated at injection:		
Intrathecal group	2.60 (0.84)	$P = 0.151$
Intravenous group	3.29 (0.95)	
Pain at injection		
Intrathecal group	5.33 (2.7)	$P = 0.045$
Intravenous group	7.70 (1.77)	
Pain after 1 hour		
Intrathecal group	2.16 (1.85)	$P = <0.000$
Intravenous group	8.03 (1.30)	
Pain at delivery		
Intrathecal group	4.89 (3.26)	$P = 0.002$
Intravenous group	9.31 (0.96)	
Minimum pain		
Intrathecal group	0.46 (0.79)	$P = <0.000$
Intravenous group	7.80 (1.42)	

Discussion

Clinically, pain relief was between 30 and 45 minutes for the intrathecal group, with mean peak relief at 1.5 hours. Some relief was sustained for 24 to 36 hours. Patients experienced "tightening" with each uterine contraction but experienced little or no accompanying pain during the first stage of labor. Decreased pain was felt during the second stage of labor, yet this did not appear to interfere with the effectiveness of maternal pushing. Analgesia was such that forceps could be applied with only slight increase in discomfort. Local infiltration was required for the episiotomy.

The results of this preliminary study suggest that the intrathecal injection of morphine, 0.5 mg, can be as safe as the traditional intravenous analgesia administered for labor pain.

Benefits included a decreased pain medication requirement for both nitrous oxide at delivery and postpartum pain medication. Mean Apgar scores were higher for the intrathecal group, and no major side effects to mother and newborn were indicated. Results also indicated no prolongation of labor for the intrathecal group. No increase in the Cesarean section rate was also noted for the intrathecal group.

A statistically significant finding was the increased use of forceps with the intrathecal route. This was accounted for by the investigating physician's preference for low outlet forceps extraction in many nulliparas in the interest of shortening the second stage, the high percentage of intrathecal group nulliparas, and the analgesic effect of the morphine allowing forceps delivery. All of these results suggest that the intrathecal injection of morphine may be as safe as the traditional labor analgesia for both mothers and newborns.

Pain Relief

The safety of intrathecal morphine has been discussed, but further studies are needed to establish its effectiveness (i.e., pain relief). We did a small preliminary study on effectiveness in 17 patients using a visual analog scale[11] that proved satisfactory for the subjective measure of pain. The scale was a straight line, which defined the extreme limits of the sensation of pain as "pain as bad as it could be" and "no pain." Patients placed a mark along the line at the point that they believed most closely described the pain at that time. A plastic overlay was applied to the scale to quantify each measure.

For the 17 women who were measured for pain, 10 were administered morphine intrathecally and 7 received intravenous Stadol™. Results are shown in Tables 5 and 6. For the patients within the intrathecal group, the change in pain level at injection and pain level after 1 hour was -3.17 ($P = < 0.000$); that is, pain was perceived as approximately 3 points less after 1 hour than at injection. Conversely, the intravenous patients perceived very little change in pain level after 1 hour (0.33). The intravenous patients receiving intrathecal morphine reported a large reduction between pain perceived at injection and their minimum pain levels (-4.87, $P = < 0.000$), while change in the intravenous group levels for that period was minimal (0.10).

To explore pain levels, changes in levels between the intrathecal patients as a group and the intravenous patients as a group were measured (Table 6). Three out of four tests were statistically significant at the 0.005 level.

Admittedly too small a sample for conclusions to be drawn about the pain relief effects of the intrathecal route compared with the intravenous method effects, the results gathered from the 17 patients seem to suggest that subjective pain can be reduced to a greater extent with intrathecal analgesia.

Conclusion

We used a lower dose of morphine than that reported in many studies. The favorable results shown here may be attributable to the lowered dose. Caution in using the procedure is recommended, particularly in monitoring for late onset respiratory depression, which has been reported in studies using higher levels of morphine.[8]

In conducting research in the private setting, an unavoidable bias is self selection. For this reason, nulliparas were overrepresented in the intrathecal group and multiparas were overrepresented in the intravenous and no analgesia groups. Although this limited the depth of information retrievable from the study, self selection bias had no detrimental effect on demonstrating the safety of intrathecal morphine.

Further investigation of the safety of intrathecal morphine is indicated along with continued research that quantifies the analgesic capability of the intrathecal route for pain against other analgesics. A comparison of side effects and pain

relief with epidural anesthesia would also be informative. Perhaps effective relief from labor pain can be shown with even lower doses of morphine.

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