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Spinal Anesthesia for Post Partum Tubal Ligation: A Comparison of Lidocaine vs. Meperidine

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Short acting neuraxial local anesthetic, lidocaine, has been a popular choice for providing surgical anesthesia for short duration surgical procedures such as post partum tubal ligation (PPTL). Meperidine is a narcotic that also has local anesthetic properties, thus provides both anesthesia and analgesia. Previous studies have shown meperidine to shorten post anesthesia care unit (PACU) stays when compared to lidocaine for neuraxial spinal anesthesia. These studies were done using variable dosing of meperidine and lidocaine based on height. This study compares lidocaine to meperidine at a standard dose of 75 mg for each in regards to the following; onset of action, side effects such as pruritis and nausea, postoperative pain control, and influences on blood pressure, heart rate, and oxygen saturation.

Methods

Healthy women scheduled for post partum tubal ligation (PPTL) that were 18 years or older and ASA class I or II were randomized to receive either preservative free meperidine 75 mg in D10W or lidocaine 75 mg in normal saline both with a final volume of 2 cc. Exclusion criteria included patient refusal, ASA class III or greater, or a history of recent drug use. Randomization was performed via computer assignment and both the anesthesiologist administering the block and the General Clinical Research Center (GCRC) representative collecting data were blinded. Only the research pharmacist who prepared the medication was aware of assignment. The anesthesiologist would then obtain the prepared medication from the anesthesia Pyxis® ensuring the number on the drug matched

the code number on the log sheets from the study notebook. A patient label was placed on the study vial to be returned to the pharmacy for tracking and unblinding at a later date.

Subjects were prehydrated with 1000 cc of lactated ringers. Anesthesia was instructed not to give any midazolam or premedications and to document if they were necessary. Once in the operating room, the patient was placed in the sitting position on the operating table with standard monitors on. Supplemental oxygen was not given unless oxygen saturation fell below 94%. A pre-spinal set of vital signs were documented and hemostats made available to assess the patient's response to painful stimuli. 2cc of study drug were then drawn up using the syringe contained in the spinal kit. Spinal anesthesia was performed in the usual manner using a 25 gauge pencil point needle drawing back only enough CSF (<0.5 cc) to confirm placement at the beginning and end of injection. The subject was then immediately placed in the supine position and the GCRC nurse began keeping track of elapsed time from when the intrathecal dose was given.

Sensory level was assessed using fluorimethane spray and surgeons were instructed not to drape until \geq T6 level has been attained. For the first 15 minutes pain was assessed by hemostat or alic clamp to the abdomen at the level of the umbilicus. In case of inadequate anesthesia, supplementation of the block was not allowed until 15 minutes had passed. Data was collected by the GCRC nurse every 5 minutes while in the operating room and every 15 minutes while in the PACU. Pain, nausea and pruritus were assessed using a visual analog scale from 0 to 10. Sedation level was based on the following 1 to 5 scale; 1 = awake, fully alert, 2 = awake, but drowsy, 3 = sleeping, easily aroused, 4 = sleeping, difficult to arouse, 5 = asleep, unresponsive. Motor block was assessed using 1 to 4 Bromage scoring; 1 = unable to flex ankle, 2 = unable to bend knee with partial motion of ankle, 3 = partial bend at the knee with full motion of the ankle, 4 = full motion at the knee and ankle. Blood pressure, heart rate, and oxygen saturation were collected via routine monitors.

Once in the PACU data collection continued as above, but at every 15 minute intervals. Specific discharge criteria from the PACU were outlined as routine criteria plus the ability to move toes, flex

ankles, or bend at the knees and a resolving sensory block with a level no higher than T10 (umbilicus) and a pain score less than 4 out of 10. Time at which the subject met discharge criteria was documented. Postoperative pain control was assessed by looking at time to first postoperative analgesic and total pain medications given in the first six hours.

Results

Twenty-nine women scheduled for PPTL were consented to participate. Of these, 15 received meperidine and 14 received lidocaine. Only one woman (meperidine group) had a failed anesthetic occurring 1 hour post spinal that subsequently required general anesthesia. She is included in the demographic and initial onset data only. Data were no longer collected once general anesthesia was induced. There were no significant differences between the two groups in regards to age, weight, height, gravidity, or parity.

Table 1. Patient demographics

	meperidine (n = 15)	lidocaine (n = 14)
Age (yrs)	29.4 (± 5.6)	28.8 (± 5.1)
Weight (Kg)	75.5 ± 17.1)	77.8 (± 10.9)
Height (cm)	159 (± 8.3)	158.2 (± 6.4)
Gravidity	4.4 ± 1.5)	3.7 (± 1.1)
Parity	3.7 (± 1.3)	3.6 (± 1.1)
Race (H/C/AI/AA)	12/3/0/0	10/2/1/1

Data are presented as mean ± SD

H = Hispanic; C = Caucasian; AI = American Indian; AA = African American

Onset and total surgery time:

The time needed to reach a sensory block of T6 was longer with meperidine (11.6 min± 4.6) compared to lidocaine (8.0 min± 2.0). This was statistically significant using the Satterthwaite T-test (p = 0.0032). Although there was a trend for longer total surgery time in the meperidine group, it was not

statistically significant. The Satterthwaite T-test ($p=0.0748$) for total surgery time was skewed due to outliers, thus a p value was taken from the Wilcoxon two sample test ($p=0.0525$).

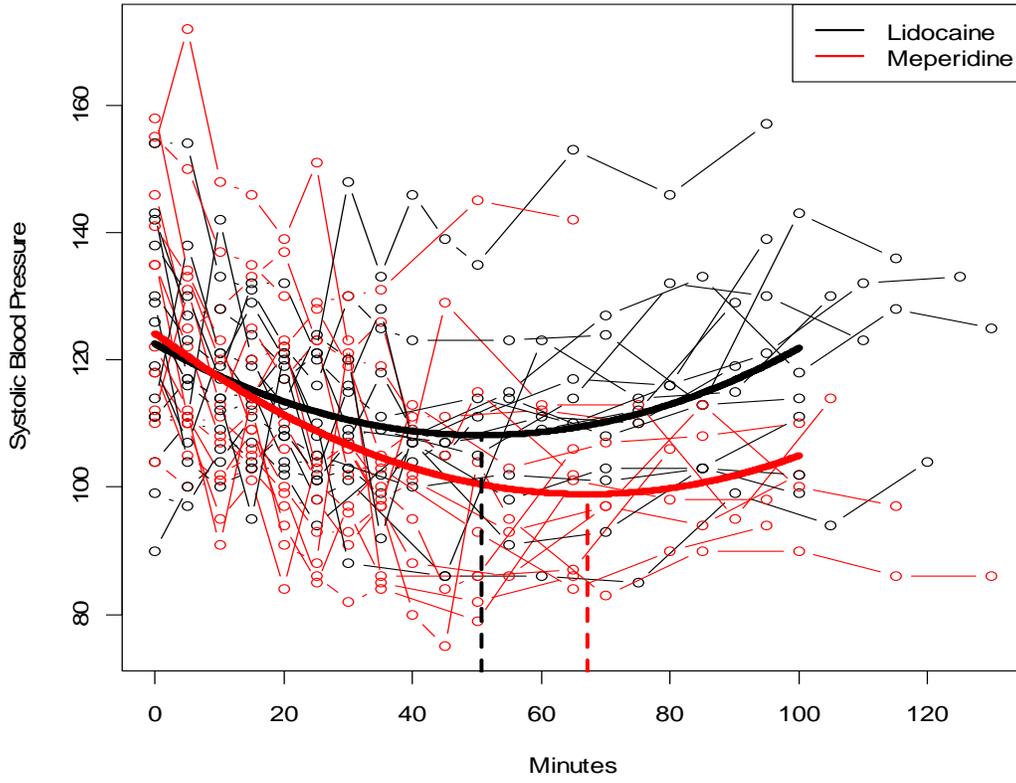
Supplementation of the block:

Three patients in the meperidine group and four in the lidocaine group required supplementation of the spinal block using a local anesthetic injected into the surgical site. This did not prove statistically significant, giving a $p=1.000$ using Fisher's exact test.

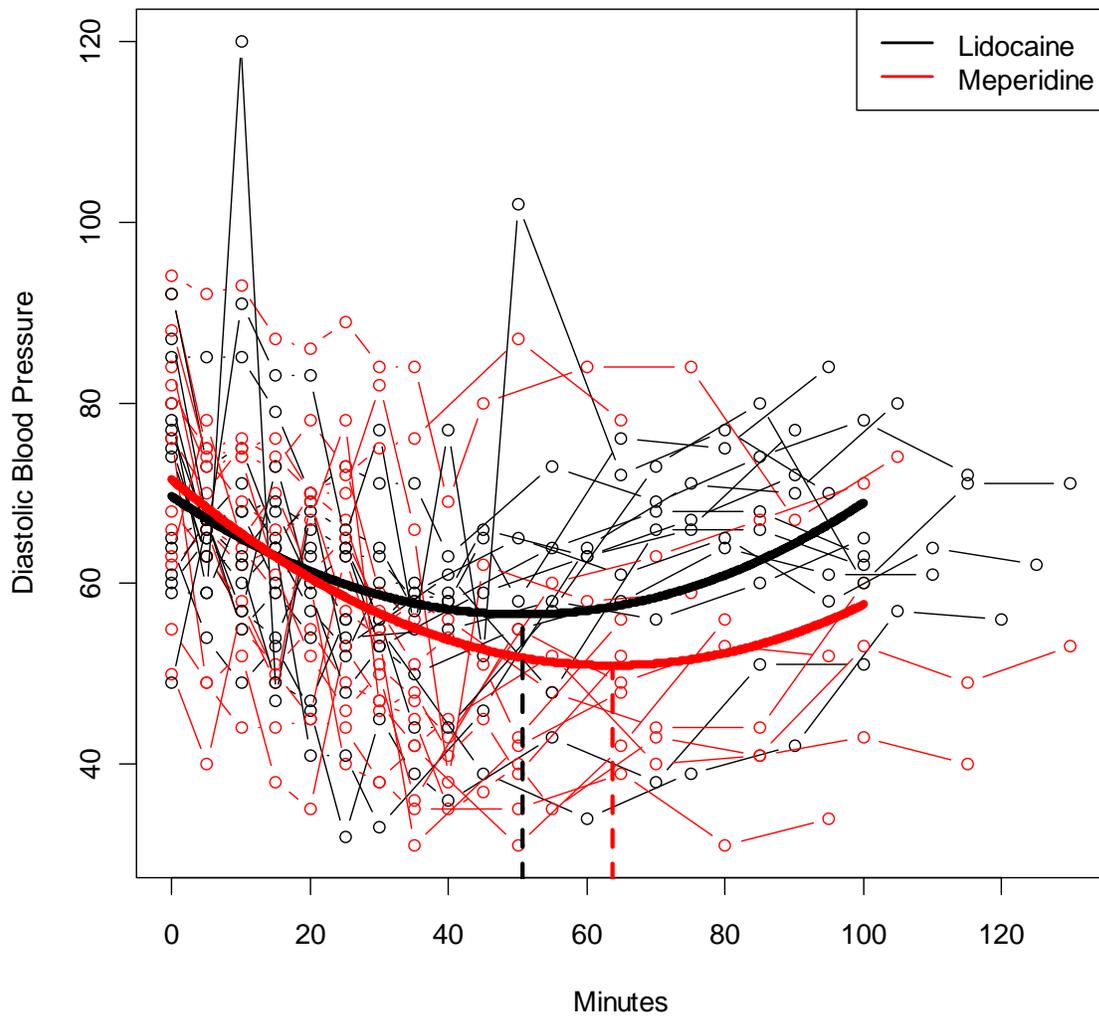
Blood pressure:

Although both groups showed a trend for decreasing blood pressure, meperidine caused a more significant drop. The plots below show a fitted average for each group with points at which the blood pressure stops decreasing (dotted line). Data were analyzed using a linear mixed effects analysis where each patient was allowed to have a unique quadratic trajectory (random effect), with fixed effect for group and with group X trajectory interactions. Fitted averages were calculated from the mixed model. The systolic pressure stopped decreasing, on average, at 51 minutes for lidocaine and at 67 minutes for meperidine. The diastolic pressure stopped decreasing, on average, at 51 minutes for lidocaine and 64 minutes for meperidine. The two groups showed no significant differences at baseline (test for equal intercepts, $p=0.7423$ for SBP, $p = 0.6308$ for DBP), statistically significant differences in the linear portion of the quadratic trajectory ($p=0.0029$ for SBP, $p= 0.0033$ for DBP), but no significant differences in the quadratic portion. This means the general shape of trajectories is the same for the two groups but offset as seen in the plots. No subjects in the lidocaine group received ephedrine or phenylephrine where 28.5% (4 patients) did so in the meperidine group. This difference was not statistically significant ($p = 0.0978$) using Fisher's exact test. Additionally there was no difference between the two groups in regards to total intravenous fluids given.

Systolic



Diastolic

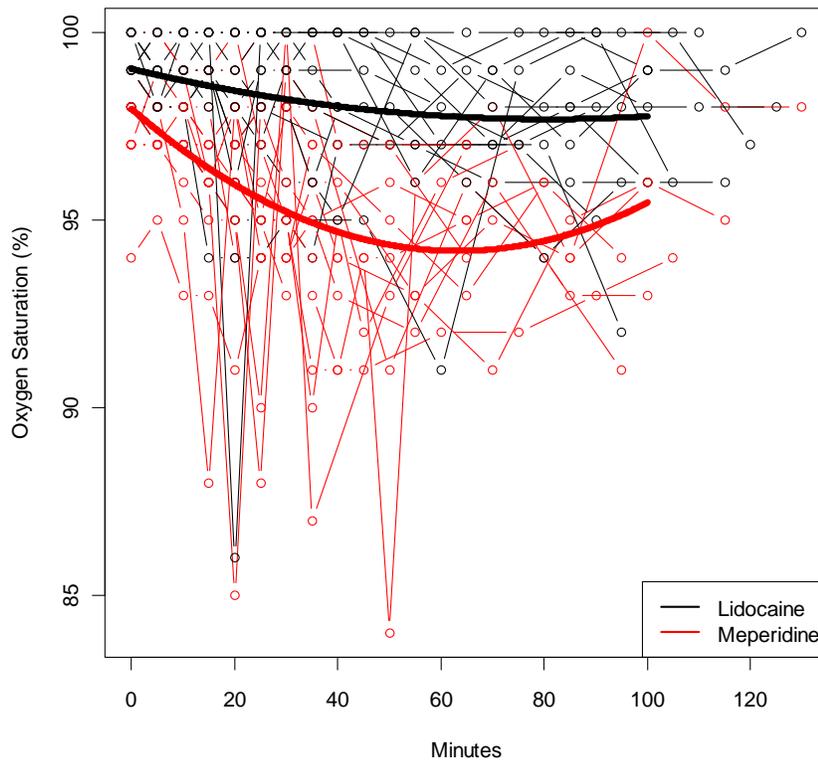


Heart rate:

There was no difference in mean heart rate between the two groups ($p = 0.919$). The lidocaine group had a mean heart rate of 74.6 ± 6.1 beats per minute and the meperidine showed a 74.9 ± 9.8 beats per minute.

Oxygen saturation:

There was no difference in oxygen saturation at baseline ($p = 0.0727$), however fitting each patient with a unique trajectory for oxygen saturation using a linear mixed-effects model did demonstrate a statistically significant difference. A linear trend ($p = 0.0491$) but no quadratic effect ($p=0.19$) was seen with lidocaine while a significant curvature relationship (quadratic term $p = 0.0016$) was seen with meperidine. There was no difference in saturation at baseline (comparison of intercepts, $p = 0.0727$). Study protocol indicated to use supplemental oxygen only if O₂ saturation fell below 94%. Five patients in the meperidine group and two in the lidocaine group received supplemental oxygen. Using Fischer's exact test this was not statistically significant, $p = 0.3845$.



Sedation:

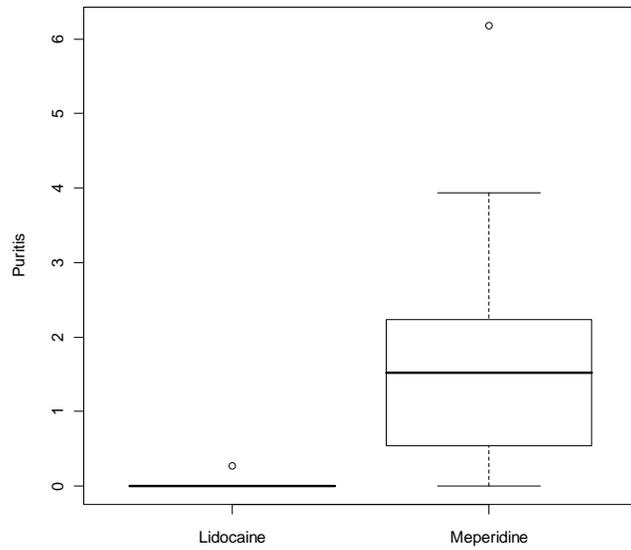
There was no difference ($p = 0.7073$) seen in regards to the subjects' level of sedation. A sedation score of 1 to 5 was used to assess this (see above in methods section).

Nausea:

Nausea was assessed using a 0 to 10 visual analog scale. There was no difference ($p = 0.797$) in the degree of nausea between the two groups.

Pruritus/ use of nalbuphine:

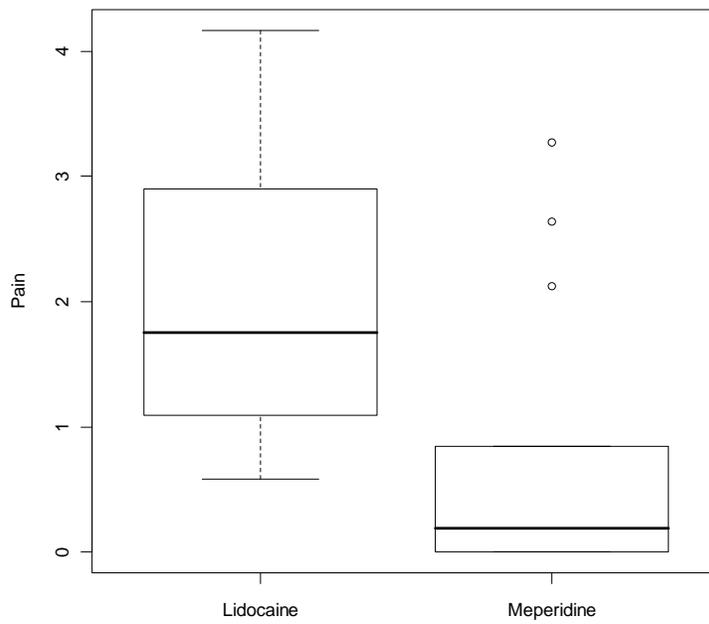
Pruritus was assessed using a 0 to 10 visual analog scale. The meperidine group reported significantly higher rates of pruritus ($p = 0.0025$), but only one patient (7.1%) in this group received nalbuphine to treat this side effect.



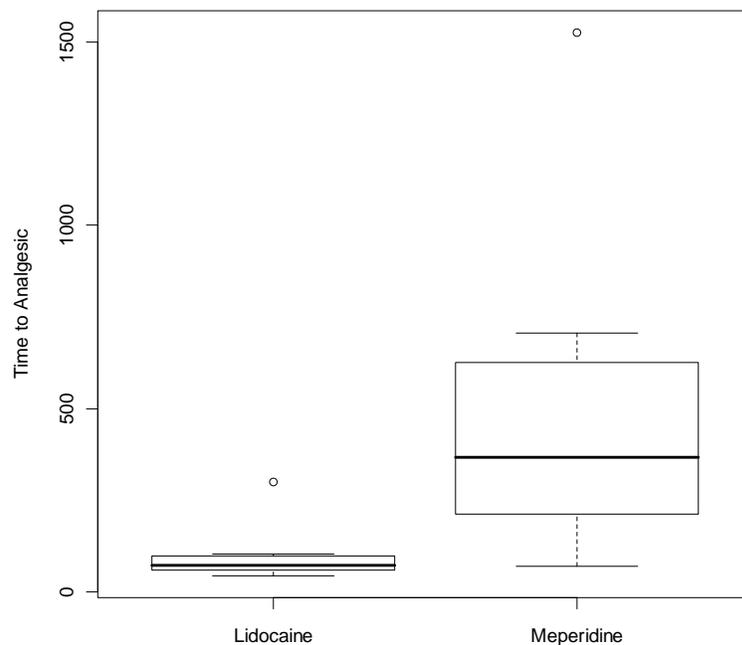
Pain:

The meperidine group reported significantly ($p = 0.0039$) less pain compared to the lidocaine group.

Pain was assessed using a 0 to 10 visual analog scale.



Additionally, patients receiving meperidine had significantly longer period of time to requesting first postoperative analgesic. Three patients in the group were in fact discharged home without ever requesting medication. Comparing patients from each group that did receive analgesics while hospitalized, the times were much longer for the meperidine group. The mean time to first postoperative analgesic was 91.5 minutes for the lidocaine group and 489.9 minutes for the meperidine group. Satterthwaite T-test proved this statistically significant, $p = 0.0083$.



Return of motor function:

Although not statistically significant ($p = 0.122$) meperidine showed a trend towards faster return of motor function. Using product limit survival estimates the mean time for return to T8 was 80 minutes after intrathecal dose for meperidine and 101 minutes for lidocaine.

PACU time:

Total PACU time was significantly less for the meperidine group compared to those who received lidocaine. The mean total time was 38.2 minutes for meperidine and 66.5 minutes for lidocaine. The Wilcoxon Two-Sample test demonstrated this to be statistically significant with a $p = 0.0054$.

	meperidine (n = 15)	lidocaine (n = 14)
Total Surgery time (min)	29.4 (± 6.3)	24.7 (± 6.9)
Time to reach T6 (min) *	11.6 (± 4.6)	8.0 (± 2.0)
Total IVF (ml)	1478.6 (± 266.5)	1378.6 (± 311.8)
Total time in PACU (min) *	38.2 (± 20.8)	66.5 (± 19.9)
Time to first post op analgesic (min) *	489.9(± 403)	91.5(± 63.2)
Mean pain score (0-10) *	0.72(± 1.1)	2.05(± 1.1)
Use of ephedrine or phenylephrine (%)	28.6	0
Use of nalbuphine for pruritus (%)	7.1	0
Mean pruritus score (0-10) *	1.8(± 1.8)	0.02(± 0.07)
Need to supplement the block (%)	21.4	28.5
Need to use supplemental oxygen (%)	35.7	14.3
Sedation (1 -5)	1.223 (± 0.281)	1.269 (± 0.348)
Nausea (0-10)	0.197 (± 0.353)	0.237 (± 0.471)

*= $p < 0.05$

Discussion/ Conclusion

At standard dosing of 75 mg each meperidine showed significant advantages over lidocaine for providing neuraxial anesthesia during PPTL. The meperidine group experienced less pain as reported on visual analog scale as well as prolonged time to first post operative analgesic. This improved analgesia, in addition to a trend towards faster motor recovery, likely contributed to significantly shorter PACU stays for meperidine. Side effects that were seen more frequently in the meperidine group included a more significant drop in blood pressure and oxygen saturation as well as increased pruritus. While the degree of hypotension was statistically significant the number of patients that received phenylephrine, ephedrine, or increased need for IV fluids was not. This demonstrates that

while meperidine caused a more graphically dramatic drop in blood pressure it was of little clinical significance thus not requiring increased interventions. This pattern was repeated with oxygen saturation and pruritus. While the meperidine group had statistically lower oxygen saturation readings they did not routinely fall below 94% thus again were not clinically significant as to warrant an increase in intervention (supplemental oxygen). Again, although more patients complained of pruritus with meperidine only one received nalbuphine to treat it. No difference was seen in regards to heart rate, sedation, nausea, or a need to supplement the spinal block. Given the advantages of improved analgesia and shorter PACU stays with easily manageable side effects we believe meperidine to be a viable alternative to lidocaine for spinal anesthesia during PPTL. This can be achieved at a standard dose of 75 mg meperidine regardless of height.

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