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A Comparison of Traditional Epidural and Low-Dose Epidural Techniques

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A Comparison of Traditional Epidural and Low-Dose Epidural Techniques

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Outline

I. Introduction
   A. General Statistics
   B. Types of Epidurals
      1. Traditional
      2. Patient-Controlled
      2. Combined
      3. Mobile

II. Tradition Epidurals
   A. Relationship to Oxytocin and Fetal Position
   B. Compared to
      1. No Epidurals
      2. Patient-Controlled Epidurals
      3. Combined Epidurals
      4. Combined and Mobile Epidurals

III. Combined Epidurals
   A. Nulliparous vs. Parous
   B. Levobupivacaine vs. Ropivacaine
   C. Saline vs. No Saline
   D. Ephedrine vs Saline
   E. Compared to No Combined
   F. Combine Compared to Mobile

IV. Mobile Epidural

V. Conclusion

Abstract

The purpose of this thesis was to compare traditional epidural analgesia to other low-dose epidural analgesic techniques e.g. combined spinal-epidural analgesia and mobile epidural analgesia. The risk and side-effects of each type of epidural had on both mother and the newborn was researched and discussed. This was a comprehensive analysis of several studies dating from 1989 to 2016. It was found that traditional epidural analgesia increased the risk for cesarean deliveries, vaginal assisted deliveries, longer duration of labor, postpartum hemorrhage, breastfeeding cessation, higher temperature, lower maternal satisfaction and failed catheters. No effect on the newborn was found. Combined spinal was associated a with significantly decreased risk for cesarean deliveries, vaginal assisted deliveries motor leg weakness, and catheter failure; along with mild side-effects; pruritus, nausea, drowsiness, and some motor weakness. No effect on the newborn was found. Mobile epidural was associated with less fecal incontinence, and an increased need for oxytocin. Women can get an epidural without the risks of long-term side-effects on her nor the newborn. I would recommend combined spinal epidural analgesia due to its effectiveness, low associated risk and high maternal satisfaction.

I. Introduction

Parturition (i.e. childbirth) is one of the most beautiful, yet painful experiences that a woman may go through in her life. The epidural, the first method to reduce the pain of childbirth, was introduced in 1938. It was a godsend to may pregnant women. The number of epidurals used for pain associated with labor grew by 60% from 1938 to the 1970s. As the popularity of epidural increased, there was also an increase number of cesarean births. It was suspected that there was a correlation between cesarean births and the increased popularity of Epidural analgesia form the 1970s to 2010.[16]

Researchers then began to think that there may be other negative effects on the mother and the newborn that are associated with epidurals. For example, some believed that epidurals could increase the risk of cesarean births[34], vaginal assisted deliveries, and longer duration of labor[11]. Some believed that epidural may also have negative effects on the newborns body such as its birth weight, height and APGAR score (Appearance, Pulse, Grimace, Activity and Respiration). They can also affect breastfeeding success and overall health of the newborn.[15]

In contrast, the pain associated with natural childbirth (i.e. no epidurals) can cause more difficult labor and can lead to vaginal assisted deliveries due to dystocia (i.e. difficult childbirth).[34] There is also an increased amount of cortisol levels in women who are in an intense amount of pain during childbirth. Cortisol is released due to the stress response and can lead to an increase in heartrate, blood pressure and respiration. All of which can affect the baby in the womb.

There are four main types of epidurals: traditional, spinal, combined-spinal and mobile. Traditional epidural involves the use of a catheter that is inserted through a needle like tube just above the dura matter of the spinal cord (Figure-1). Once inserted it will then deliver an either constant dose of analgesic or be patient-controlled. When using a patient-controlled epidural, the mother has a device in which she is able to deliver small amounts of an analgesic on top of the routine set doses of an analgesic. Once she administers a dose she will be locked out for a specific amount of time before another dose is allowed. A spinal epidural involves a single injection of an analgesic into the spinal fluid. It will normally last about 90-120 minutes. This thesis will not cover studies done with spinal epidurals because they are almost always used for cesarean deliveries; but it is important to know that they are used and why they are used.

A combined-spinal epidural uses a combination of a traditional and spinal epidural (Figure 2). A tube-like needle is inserted in-between the vertebra and in to the spinal column. An initial injection of an analgesic is injected into the spinal fluid. A catheter is then inserted through the needle just above the dura matter. Either a constant or an intermittent dose of an analgesic is administered throughout the course of labor. Combined spinal epidural analgesia is growing in its popularity due to its effectiveness. It is most commonly used for women who have high risk pregnancies. The hope is that it will reduce the total duration of labor and reduce the chance for risk involved with traditional epidural analgesia. The initial injection of analgesic will have a faster onset of pain relief which will help the mother control her pain more quickly and more effectively. The blouse of

analgesic that are given throughout labor will help to maintain pelvic floor mobility and help the mother feel her contractions.

The last type of epidural is a mobile epidural. It is a catheter that is inserted the same way that a traditional epidural is inserted but instead of a high dose of an analgesic only a low dose in administered at either a constant or intermittent rate. The theory behind mobile epidural analgesia is that when using a traditional epidural, woman cannot feel their contractions. This will lead to ineffective pushing during the contractions which will greatly reduce the success of each contraction. This will lengthen the total duration of labor and put the women at risk for dystocia which can lead to other problems. In mobile epidural, the woman will be able to feel more of her contraction and still retain pelvic floor mobility. She will have more success with each contraction and hopefully have a shorter total duration of labor. This will hopefully reduce some risk involved with traditional epidural analgesia.

Figure 1

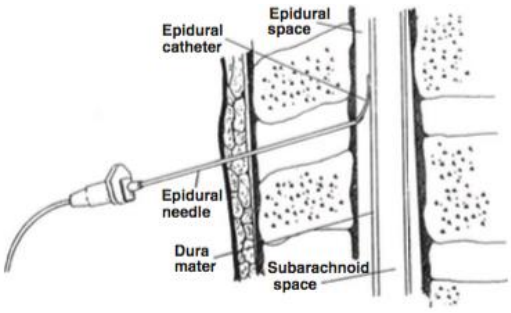
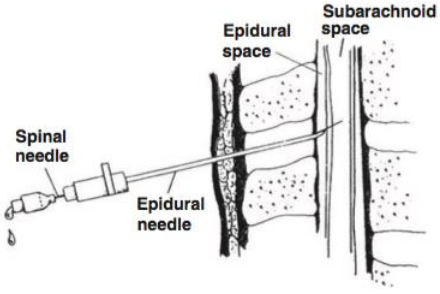


Figure 2



This thesis will address three of the main types of epidurals (i.e. traditional epidural, combined-spinal epidural and mobile epidural.) It will also compare the types of epidural to each other as well as no epidural at all. Finally, it will

address how epidurals effect the wellbeing of the newborn and the effects on breastfeeding. I will also conclude which type of epidural seems to have the least amount of side effects with the best results. Statistically significant differences were set at a p-value of <0.05.

II. Traditional Epidurals

Epidurals were first introduced in 1938; it is one of the most common forms of analgesia for pain associated with childbirth.[16] It is mostly an effective method to control labor pain. An epidural is performed by inserting a catheter into the spinal column just outside the dura matter of the spinal cord. Once in place, an analgesic (e.g. ropivacaine and/or fentanyl) is administered either at a constant rate, in blouses or through patient administered doses. Once the epidural catheter is in place the woman is no longer allowed to get up or walk around in order to prevent catheter migration. The traditional epidural (also known as neuraxial analgesia) is currently the most common epidural. [1] Tradition epidurals have been associated with longer labors, more frequent vaginal assisted deliveries, and caesarean deliveries. Studies have also shown a correlation between traditional epidural analgesia and abnormal positions (i.e. malposition) of the fetus. Malposition can cause more complications in childbirth an increased risk for assisted delivery and a longer duration of labor due to a weakening of the pelvic floor muscle and the mother not being able to feel her contractions. Traditional epidural analgesia has not been known to affect the wellbeing of mother or child.

A. Oxytocin and Fetal Position

A study found in the Journal of Evolution of Medical and Dental Sciences did not find an association with difference types of analgesics that are used in traditional epidural analgesia. Both ropivacaine and bupivacaine are commonly used analgesics that do not appear to pose any risk during labor. When epidurals are administered it is common practice to put the mother on a low-dose oxytocin drip. This is done to help progress labor. There was research done that showed that a low-dose oxytocin drip increased the risk for cesarean delivery. They found that a high-dose of oxytocin did not increase the risk for cesarean delivery. When using traditional epidural analgesia, it may help to use a high-dose of oxytocin in order to prevent operative deliveries, due to oxytocin inducing more successful contractions. (A comparison of not oxytocin vs. low dose oxytocin was vs. high dose oxytocin was not preformed.) This study used patient-controlled epidural analgesia. During patient-controlled epidural analgesia the mother has the ability to administer small doses of analgesia during labor. Once one dose is administered the mother would then be locked out for a certain amount of time before another dose would be allowed. The patient-controlled dose was used on top of the normal-timed doses. Most women preferred patient-controlled epidural analgesia to continuous epidural analgesia. Some, even found that patient-controlled epidural analgesia reduces pain more than continuous epidural analgesia.[32]

They also compared the efficacy and safety of traditional (n=40) to patient-controlled (n=40) epidurals. The following variable were measured: VAS (Visual

analog scale) scores for pain and satisfaction, sensory and motor block, the need for analgesic supplements, and APGAR scores. There was no significant difference in pain relief between the groups. There was a significant decreased risk for motor weakness in those who were in the PCEA (Patient-controlled epidural analgesia) group when compared to the CIEA (Continuous-infusion epidural analgesia). Neonatal wellbeing, as measured by APGAR scores at 0 and five minutes after delivery were not significantly different between the groups. This study found that women preferred patient-controlled epidural significantly more than continuous epidural. In conclusion, patient-controlled epidural analgesia was as effective as traditional epidural analgesia, had no negative effect on fetal wellbeing, while requiring less analgesic supplements. I can conclude that patient-controlled epidural analgesia has a greater success than continuous epidural analgesia.[32]

A meta-analysis in the Journal of Obstetrics and Gynecology initially examined 19 trials throughout North America that compared epidural analgesia and opioid analgesia. [19] Epidural analgesia typically use a high dose of oxytocin along with the analgesic while opioid analgesia uses a lower dose of oxytocin along with the analgesic. The trials were obtained from the Cochrane and Medline databases. Because there was missing data in 11 trials, only 8 were used for statistical analysis. Of the 8 that were used, 7 of the trials used a high-dose oxytocin and found that there was no statistical evidence that epidural analgesia increased the risk of cesarean delivery. In contrast, the remaining trial found that there was an increased risk of Cesarean delivery when using low-dose

oxytocin. The researchers concluded that when high-dose oxytocin is used during labor there is not an increased risk for cesarean delivery. However, when low-dose oxytocin is used during labor there is an increased risk for cesarean delivery. This study stands out when compared to other studies that are in this thesis. Most of which showed a strong relationship between traditional epidural analgesia and cesarean deliveries.

In a double-blind study, Carseldine et al. compared the effects of occiput-anterior and occiput-posterior positions on labor in 160 women. Ultrasound technology was used to determine the location and position of the fetus in the birth canal. Once the positions were determined the women were divided into two groups: occiput-posterior group (n=19) and the occiput anterior group (n=141). The duration of second stage labor was significantly longer in the occiput-posterior group (about 3 hours) than the occiput-anterior group (about 2 hours). Also, operative delivery was significantly higher in the occiput-posterior group (68%) than the occiput-anterior group (27%). It was concluded that the occiput-posterior position increases the duration of labor, as well as the risk for operative delivery. This is important to note because some studies will find that traditional epidural can increase the risk for malposition.[4]

Ray et al. examined if the position of the fetal head at the time of epidural placement is associated with malposition in 398 women.[27] Other factors associated with malposition such as nulliparity, macrosomia (i.e. larger than normal), induction of labor, and cervical dilation was examined. Of those who had an epidural 200 had a malposition at 5 cm of dilation (Table 1). The only factor

associated with malposition was a high position of the fetal head at the time of epidural placement; 26.5% of the malposition group was in the high position compared to 13.6% in the anterior position group.[27]

Table 1

	Malposition at 5 cm *N* = 200, *n* (%)	Anterior position at 5 cm *N* = 198, n (%)	*p*
"High" station at EA (*n* = 80)	53 (26.5)	27 (13.6)	0.001
Nulliparity (*n* = 235)	126 (63.0)	109 (55.0)	0.11
Macrosomia (*n* = 38)	17 (8.5)	21 (10.6)	0.47
Induction (*n* = 85)	40 (20.0)	45 (22.7)	0.51
Dilatation < 3 cm at EA (*n* = 71)	37 (18.5)	34 (17.2)	0.93

EA, epidural analgesia.

B. Comparisons of Traditional Epidurals

1. Traditional vs. No Epidurals

A study was done on a cohort of nine Danish labor wards which included 2,721 women who were full term nulliparous (i.e. had never given birth) women who had a spontaneous delivery and a singleton pregnancy with correct presentation. [11] The women had epidurals (n=588) were compared to the women who did not have epidurals (n=2133). The results are summarized in Table 2.

Table 2

Outcome	*No epidural (n = 2,133) No. (%)*	*Epidural (n = 588) No. (%)*	p[a]
Emergency cesarean section	93 (4.4)	144 (24.5)	< 0.001
Vacuum extraction	271 (12.7)	135 (23.0)	< 0.001
Spontaneous delivery	1769 (83.0)	309 (52.6)	< 0.001
Apgar score ≤ 7	20 (0.9)	11 (1.9)	0.08
Postpartum hemorrhage[b]	278 (13.5)	111 (19.8)	< 0.001

As compared to the women who did not have an epidural, the epidural group had significantly ($p < 0.001$) more emergency caesarean sections (24.5% vs. 4.4%), more vacuum extractions (23% vs. 12.7%), less spontaneous (i.e. not induced labor) deliveries (52.6% vs. 83%), and more postpartum hemorrhage (19.8% vs. 13.5%). The negative effects of the epidurals were observed in both high-risk and low-risk patients. In contrast, the Apgar scores of the two groups were not significantly different. The results of this study show that traditional epidurals have negative effects on nulliparous women, but not their newborns. [11]

In another study, Throp et al. examined the effects of epidurals on cesarean deliveries due to dystocia, a difficult labor due to an abnormal position of the fetus.[33] The study included 711 nulliparous, full-term women who had cephalic presentations and were not induced; 264 women had epidurals. There was a significant increase of cesarean deliveries in the epidural group; 10.3% of the women in the epidural group compared to 3% in the non-epidural groups had cesarean deliveries had cesarean deliveries. The duration of labor was also longer in the epidural group (8.6 ± 3.1) compared to the experimental group (4.7 ± 2.8). The researchers concluded that the epidural increases the risk of cesarean delivery and a longer duration of labor due to dystocia in nulliparous women.

Furthermore, a meta-analysis was conducted by Tyrell et al. It was a systematic review of 27 randomized controlled trials that compared epidural analgesia to no analgesia.[34] The main focus was to see if epidural analgesia increased the risk of cesarean deliveries. The analysis included 210,708 women who did not have any major complications during labor with singleton pregnancies. Out of the 210,708 women, 66,317 received an epidural. About 31% of these women had cesarean deliveries due to failure to progress during labor, and about 9.8% of the control group had cesarean deliveries. The risk ratio for the experimental group was 2.5. The researchers concluded that epidurals increase the risk of cesarean deliveries in women who had no previous complications during their first delivery.[34]

Becker et al. looked at the effects of traditional epidural analgesia on the ST analysis of fetal electrocardiograms.[3] The ST analysis is a recent method used to assess the health of the fetal heart. This study contained high-risk singleton pregnancies who presented in the cephalic position (n=144); 72 received epidural analgesia and 72 received no analgesia. The ST analyses at one and two hours after the epidural was administered were compared to the ST baselines. There were no significant differences in the ST analyses between those who received epidural analgesia compared to the control group. This study shows that traditional epidurals do not affect the ST analysis of fetal electrocardiograms.[3]

Because previous studies regarding the association between epidurals and breastfeeding were inconclusive, and had methodological flaws, Dozier at al.

aimed to assess the effects of epidural analgesia on breastfeeding with improved methods.[9] Data was gathered from two cohort studies with a total of 772 women who had vaginal delivers. They adjusted the results for standard demographics and other factors and found that if a woman received an epidural they are 1.26% more likely to stop breastfeeding the first month with a p-value of <0.01. They also found that if a woman received an epidural they were more likely to receive oxytocin with a p-value of <0.01. Oxytocin helps to induce contracts and progress labor. They found a relationship between breastfeeding cessation and epidural analgesia but there was too many confounding variables to be significant.[9]

Gizzo et al. assessed the effects that epidurals on the duration of labor, newborn well-being and early breastfeeding.[15] The study used nulliparous women who were separated into either epidural group and no-epidural group. The well-being of the baby was determined by birth weight and length, APGAR score, and time between birth and exposure to the breast. There were no significant differences between the groups regarding well-being; the birth weights and lengths, Apgar scores, and type of deliveries were similar. However, the duration of labor was significantly longer in the epidural group (363 ±62 min) than the no epidural group (292 ±65 min). The was a significant difference in length of the first breastfeeding session, the mean duration <30 minutes, Group A 62.2%, Group B 29.3%. In conclusion, the epidural analgesia significantly increased the duration of labor and the length of the first breastfeeding session, but it had no effect on neonatal outcome. [15]

Because hearing loss has occurred in some people following epidural analgesia not associated with labor, a study by Kraus et al. aimed to evaluate the effect of epidural analgesia on the hearing system of women after normal labor.[20] Twenty women were divided into two groups: 12 epidural and 8 no analgesia. Both groups received a distortion product otoacoustic emissions (DPOAES) test and an auditory at brainstem response (ABR) test at admission, 15 minutes, 1 hour, and 3 hours after labor. An auditory brainstem response (ABR) test was also administered to both groups at admission, during labor, and after labor.

Table 3: DPOAES

Frequencies (Hz)	*On admission*	*15 minutes after labor*	*1 hour after labor*	*3 hours after labor*
8000 epidural	9.0 (5.4)	8.5 (5.2)	9.6 (4.7)	10.2 (5.6)*
8000 no epidural	5.8 (4.6)	5.6 (4.6)	6.5 (3.9)	7.6 (4.7)*
6000 epidural	9.5 (7.3)	10.3 (7.1)*	11.9 (5.9)*	11.0 (6.7)*
6000 no epidural	7.2 (6.3)	8.6 (7.2)*	11.1 (6.8)*	9.9 (7.1)*
4000 epidural	10.9 (6.9)	11.7 (6.4)	12.5 (6.4)	11.9 (7.1)
4000 no epidural	9.1 (5.4)	10.4 (5.3)*	11.7 (4.9)*	11.8 (4.9)*
3000 epidural	12.6 (6.3)	11.4 (5.8)*	11.5 (6.1)	11.8 (5.2)
3000 no epidural	9.1 (8.6)	9.7 (7.6)	9.1 (8.3)	8.6 (8.0)
2000 epidural	13.7 (5.4)	12.2 (4.9)	12.8 (4.7)	12.5 (4.7)
2000 no epidural	8.9 (9.1)	8.5 (8.3)	8.1 (8.2)	9.2 (8.0)
1000 epidural	12.6 (4.3)	6.9 (4.2)*	8.1 (3.8)*	12.2 (3.9)
1000 no epidural	8.2 (6.6)	8.1 (6.9)	7.8 (6.6)	8.3 (6.3)
750 epidural	11.8 (5.7)	4.1 (3.8)*	4.3 (3.1)*	10.9 (4.6)*
750 no epidural	5.9 (8.3)	7.1 (7.8)	6.7 (8.1)	6.6 (7.8)
500 epidural	9.7 (8.1)	1.1 (4.5)*	2.0 (4.6)*	7.3 (6.3)*
500 no epidural	3.9 (6.5)	4.4 (6.8)	4.9 (6.8)	4.6 (6.2)

*Comparison between mean of DPOAE scores on baseline and three time points after delivery were tested by the Friedman test, $\alpha < 0.05$.

Table 4: ABR

	Epidural (n = 12) ABR (ms)	*No epidural (n = 8) ABR (ms)*
Wave 1		
Before labor	1.5 (0.1)	1.4 (0.1)
During labor	1.5 (0.1)	1.4 (0.1)
3 hours after labor	1.5 (0.1)	1.4 (0.1)
Wave 3		
Before labor	3.6 (0.2)	5.5 (0.2)
During labor	3.6 (0.1)	5.5 (0.2)
3 hours after labor	3.6 (0.1)	5.5 (0.2)
Wave 5		
Before labor	5.6 (0.2)	3.5 (0.2)
During labor	5.6 (0.1)	3.5 (0.2)
3 hours after labor	5.6 (0.1)	3.5 (0.2)

There were no significant differences in the DPAOES (Table 3) and ABR (Table 4) between the groups. In conclusion, epidural analgesia does not significantly affect hearing in women.[20]

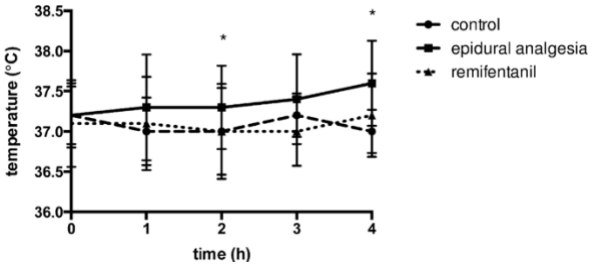
Biased on these studies it can be concluded that epidural analgesia does not affect the wellbeing of a new born, breastfeeding, or the health of the mother.[3, 9, 11, 15, 20, 33, 34]

2. Traditional vs. Patient-Controlled Epidurals

In a randomized, controlled study, Douma et al. compared the effects of traditional epidural analgesia and remifentanil patient-controlled epidural analgesia on maternal temperature.[8] Also, secondary outcomes such as maternal oxygen saturation, pain, and sedation, as well as APGAR scores were measured. One-hundred and forty women were divided into three groups: 49 traditional, 49 patient-controlled, and 42 no epidural.

A higher temperature developed in the patient-controlled group than the traditional and control groups two and four hours into labor (Figure 3).

Figure 3



This difference was maintained when other confounding variables were ruled out (Table 5). Also, the duration of the first stage of labor was longer in the traditional and patient-controlled groups than the control group (Table 5).

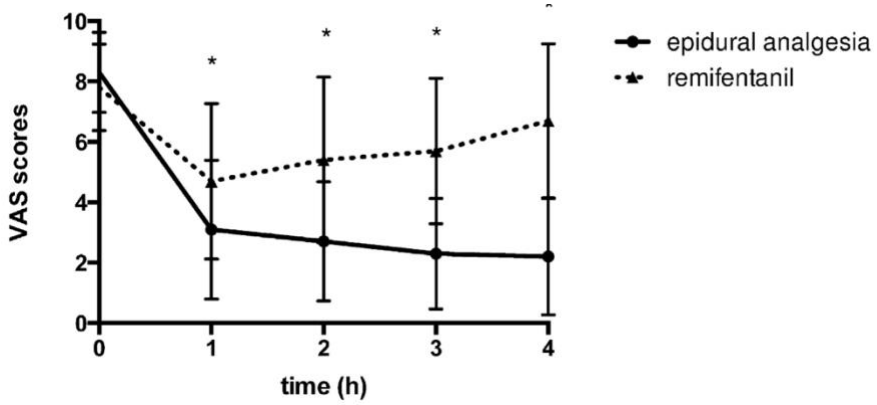
Table 5

	Odds ratio	95% CI	*P* value
Type of analgesia			0.02
Epidural analgesia*	7.44	0.80, 68.8	0.08
Remifentanil*	0.93	0.07, 12.5	0.96
Duration of first stage of labour	1.01	1.00, 1.01	0.01

*Compared to control.

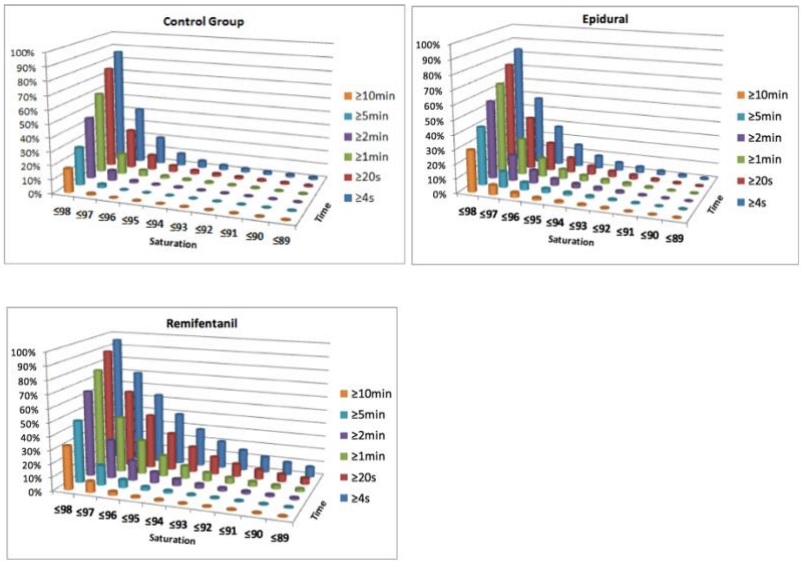
As expected, pain was lower in the traditional and patient-controlled compared to the control group. As labor progressed pain decreased more in the patient-controlled group than the traditional group (Figure 4).

Figure 4



There were more incidences of lower maternal oxygen saturation in the traditional and patient-controlled groups than the control group (Figure 4). Also, there were more incidences of lower maternal oxygen saturation patient-controlled group than the traditional group (Figure 5).

Figure 5



Fetal outcome, as measured by APGAR score was not significantly different between the groups (Table 6).[8]

Table 6

	Control (n=42)	Epidural (n=49)	Remifentanil (n=49)	P value C vs EA vs. RPCA
Apgar score				
1 min	8.7 ± 0.77	8.3 ± 1.48	8.6 ± 1.12	0.71
5 min	9.7 ± 0.64	9.5 ± 0.66	9.5 ± 1.18	0.33
<7 at 5 min	0	0	2 (4%)	0.128

In conclusion, the traditional epidural is associated with higher maternal fever, while the patient-controlled epidural is associated with more frequent events of hypoxemia (i.e. lower level of oxygen in the blood.) Neither treatments affected fetal outcome.

3. Traditional vs. Combined Epidurals

This study, by Collis et al. aimed to compare combined spinal-epidural to standard (traditional) epidural.[5] They looked at overall satisfaction of mothers,

and possible side effects of combined spinal-epidural. The preformed a randomized observational study of 197 women in labor; the women were randomly split into two groups. The combined spinal-epidural group contained 98 women who received bupivacaine and fentanyl. The traditional epidural group contained 99 women who received bupivacaine. Women who received combined-spinal epidural analgesia had a higher satisfaction rating when compared to traditional epidural. The combined spinal-epidural analgesia group had significantly fewer incidences of motor leg weakness (n=12) when compared to standard epidural (n=32). For those who had motor weakness in the combined spinal-epidural group, the motor weakness resolved within one hour. For those who had motor weakness in the traditional epidural group, the motor weakness in some of the women increased with labor and did not resolve. There were no significant differences in side effects between the two groups expect for mild pruritus (i.e. itchy skin) that occurred in combined spinal-epidural group. Combined spinal-epidural had a higher satisfaction rating, faster onset, less motor block and more self-control when compared to standard epidural. The only significant side effect in combined spinal-epidurals, mild pruritus, was easily treated.[5]

A study by Groden et al. aimed to compare combined spinal-epidural analgesia with epidural analgesia during labor focusing on catheter failure rates and time course with analgesia.[17] Data was collected from October 2012 through September 2014 through a Quality Assurance program. A catheter failure was defined as a catheter that needed to be replaced after it had been properly

placed and adjusted. There were 5487 participants who received analgesia; 3980 received combined spinal epidural and 1597 received epidural analgesia. Catheter failure occurred in 85 (2.1%) of those who received combined spinal-epidural analgesia and 59 (3.9%) of those who received epidural analgesia. The average time before replacement of the catheters was needed in the combined spinal-epidural (n=80) was 512±422 min and in epidural analgesia (n=57) was 354±300 min with a p-value of 0.02. The median time until replacement was needed in combined spinal-epidural analgesia was 398 [IQR 131-578] min and in the epidural group 281[IQR 186-767] min with a p-value of <0.0001. The researchers concluded that combined spinal-epidural analgesia was less likely to fail when compared to epidural analgesia and the was a longer duration of time before the failed catheter was detected and in need of replacement. This goes to further prove that combined spinal-epidural analgesia works better and has fewer side effects when compared to epidural analgesia.[17]

A study by McKenzie et al. compared the efficacy of programmed intermittent epidural blouses (PIEB) + patient-controlled epidural analgesia (PCEA) to continuous epidural infusion (CEI) + PCEA in 609 women. The CEI was pre-set on 12ml/h (PCEA 12 mL bolus, lockout 15 min).[24] Those who received a continuous epidural infusion had a higher VBS pain score after epidural and before delivery (VBS=2) when compared to programmed intermittent epidural blouses (VBS=0) with a p-value of 0.03. There was also an increased risk of documentation of a unilateral block in continuous epidural infusion (5.4%) when compared to programmed intermittent epidural blouses

(1.8%) with a p-value of 0.02. Programmed intermittent epidural blouses when compared to continuous epidural infusion decrease the risk for rescue boluses. Programmed intermittent epidural blouses are preferred to help with the maintenance of labor when compared to continuous epidural infusion. There was no significant difference in mode of delivery, parity, labor type (i.e. spontaneous induction and oxytocin augmentation), hypotension, and number of clinician boluses.[24]

4. Traditional vs. Combined vs. Mobile Epidurals

This study by The Lancet et al. aimed to compare tradition epidural to low-dose combined spinal epidural and low-dose infusion (mobile) techniques.[10] The randomly assigned 1054 women who were nulliparous and requested epidural analgesia into three groups; traditional epidural (n=353), low-dose combined spinal-epidural analgesia (n=351) and low-dose infusion epidural (n=350). They looked at mode of delivery, progression of labor, efficacy of analgesia and effect on the newborns. They found that those who received a traditional epidural were less likely to have a spontaneous vaginal delivery (n=124, 35.1%) when compared to low-dose combined spinal-epidural analgesia (n=150, 42.7%) and low-dose infusion epidural (n=150, 42.9%) with a p-value of 0.04. The researchers believed this was cause by a significant increase risk for instrumental vaginal deliveries (Table 7).[10]

Table 7

Delivery	Traditional epidural (n=353)	Combined spinal epidural (n=351)	Low-dose infusion epidural (n=350)
Normal vaginal	124 (35%)	150 (43%)	150 (43%)
Instrumental vaginal	131 (37%)	102 (29%)	98 (28%)
Caesarean section	98 (28%)	99 (28%)	102 (29%)

*p=0·04, 1DF for normal vs other deliveries.

There was an increased number of APGAR scores at 1 min <7 in low-dose infusion epidural (n=64, 18%) when compared to traditional epidural (n=38, 11%) with a p-value of 0.01. The was a higher number of patients who needed high-level resuscitation in those who received low-dose infusion epidural (n=16, 5%) when compared to epidural analgesia (n=5, 1%) with a p-value of 0.02. Low-dose epidural significantly increases the number of normal vaginal deliveries when compared to traditional techniques. There were some mild adverse effects on the newborn such as increased risk for a poor APGAR score, less than 7 and an increased risk for high-level resuscitation with the low-dose infusion group. Researchers believe this is due to the fentanyl that is in the analgesic. They suggest that more research should be done on the effects of low-dose analgesia on newborns and that traditional epidural analgesia should not be used frequently.[10]

Wilson and MacArthur aimed to compare traditional epidurals to combined spinal-epidurals and mobile epidurals.[35] There were 1054 were primparous women and were randomly divided in to three groups: traditional (n=353), combined (n=351) and mobile (n=350). They found that significantly more women maintained normal leg power in both mobile groups. They also found that

combined-spinal epidural significantly maintained better leg power when compared to the low-dose infusion group. (No p-values were given.) There was no significant difference between the groups in level of ambulation and mode of delivery. There were not significant sides effects on the newborn.

Combined spinal epidural analgesia does not appear to increase the risk for operative delivers nor a long total duration of labor. However, there are some mild side effects which include pruritus, lightheadedness, and dizziness.

This study by Ishmail et al. aimed to compare traditional epidurals to, patient-controlled epidurals, and combined epidurals using a randomized interventional study.[18] This study included 1,140 healthy nulliparous women who requested epidural analgesia between September 2009 and August 2011 in the TAIBA Hospital in Kuwait. The women were randomly placed in to one of the three following groups: traditional (n=380), patient-controlled (n=380) and combined (n=380). They mainly looked at the rate of cesarean deliveries. In all three groups, the wellbeing of the child was not affected. The duration of labor was significantly shorter in those who had a combined spinal-epidural with a p-value of <0.01. Also, the average VAS pain scores were also significantly lower in those who had a combined spinal-epidural. The overall satisfaction score with analgesia was significantly higher in those whom had a combined spinal-epidural. There were no significant differences between the three types of analgesia in mode of delivery. Overall, combined spinal-epidural had the better outcomes because it shortens the length of labor, better VAS pain scores and has a higher satisfaction rating.[18]

This study by Wilson and Moore et al. aimed to compare the long-term effects of traditional epidurals (n=262) to, combined epidurals (n=266) and mobile epidurals (n=262).[36] In the past, the long-term effects have been backaches and headaches. They found that when compared to high-dose epidural, a combined spinal epidural is less likely to cause postpartum headaches with a p-value of <0.21. There were no other significant differences between traditional and combined epidurals. They also found that low-dose infusion, when compared to traditional was less likely to cause fecal incontinence and stress incontinence. There was no significant difference in the about of backaches between the three groups. This study showed that there was little to no risk of long term side-effects in traditional, mobile and combined epidurals.[36]

III. Combined Epidurals

A. Nulliparous vs. Parous

This study by Rukewe et al. aimed to compare nulliparous women to parous women who received combined epidurals.[29] The researchers looked 30 women; 21 were nulliparous and 9 were parous. They wanted to show that it was safe for both first time mothers and mothers who have been pregnant before. There were no significant results in labor characteristics, e.g. duration of labor, maternal satisfaction, cervical dilation, onset time, duration of labor etc. There was not a significant difference in neonatal outcome and any complications except for APGAR score at 1 min, Nulliparous women had a score of 7.7±1.5 while the parous women's child had an APGAR score of 8.9±0.3. They did observe vomiting and shivering in both groups. The researchers concluded that

combined spinal-epidural is a safe technique for both nulliparous and parous women.[29]

B. Levobupivacaine vs. Ropivacaine

Attri et al. preformed a double-blind study aimed to compare levobupivacaine and ropivacaine with fentanyl using combined epidurals.[2] The looked for sensory block and risk for both mother and child. The researchers divided the participants (n=60) in to two groups; Group A (n=30) and Group B (n=30). Group A received 3 mg intrathecal levobupivacaine with 25 ug fentanyl, epidural top-ups were given PRN and included 14mL levobupivacaine 0.125% with 30 ug fentanyl. Group B received 4mb intrathecal ropivacaine with 25 ug fentanyl and were given epidural top-ups PRN that contained 14 mL ropivacaine 0.2% with 30ug fentanyl. They looked for sensory and motor block, hemodynamics maternal and fetal outcome, side effects and any complications. The found that Group A (4.72 ±0.54 min) had a faster onset than Group B (5.58±0.49). The total duration of the use of analgesia was longer in Group A (117.00±11.86 min) when compared to Group B (90.17±8.85 min). There were complications and side effects in both groups with no significant difference. Those who received levobupivacaine with fentanyl causes an early onset and a longer duration of analgesia with compares to ropivacaine with fentanyl during labor analgesia.[2]

C. Saline vs. No Saline

Gadalla et al. in this study wanted to find out if injecting 10 mL of saline before placing the epidural catheter could decrease the number of intravenous

epidural catheter placement during the use of a combined spinal-epidural (CSE) labor analgesia.[13] The study included 100 women who requested combined spinal-epidural with either 20 ug fentanyl or 10 ug sufentaiyl into two groups. Dry group (n=50) were those who did not receive saline before catheter placement; the saline group (n=50) received a 10 milliliters saline injection before the catheter placement. They determined the presence of an incorrect catheter placement if: blood aspirated, the mother became tachycardia, if intracardiac air was heard after injection of air 1.5mL. The dry group had an intravenous epidural catheter placement in 10 out of the 50 mothers and the saline group had only one incidence of intravenous epidural catheter placement. This was comparable. The researchers concluded that a 10 milliliters injection of saline before catheter placement reduces the risk for accidental venous catheter placement.[13]

D. Ephedrine vs Saline

Gambling et al. tried to determine if ephedrine 10mg given parochially during combined spinal-epidural can prevent EPFB when compared to a saline group.[14] EPFB was defined as bradycardia <90 beats per minute that lasted longer than 2 minutes and occurred from the administration of the combined spinal-epidural until 30 minutes after administration of combined spinal epidural. The mothers were divided into two groups; ephedrine (EPH) n=299 and normal saline placebo (NS) n=297. EPFB occurred in 8(2.7%) of the ephedrine group and 14(4.7%) in the placebo group with a p-value of 0.184. There were not significant differences between the two groups in; urgent cesarean delivery, uterine hypertonus, uterine tachysystole, and abnormal FHR patterns. The

researchers concluded that giving prophylactic intravenous ephedrine when given at the time of combined spinal epidural, does not effectively prevent EPFB that is associated with combined spinal epidural.[14]

E. Compared to No Combined

The researchers in this study, Xing et al., aimed to see if a combined spinal-epidural analgesia affected the function of pelvic floor muscle.[37] A sample of 285 women were divided into a CSEA group (n=143) and control group (n=143). The researchers tested muscle strength using a scale from 0-5 comparing Type I and Type II muscle fibers. They also looked at the degree of muscle fatigue using a scale for 0- (-3) comparing type I and Type II muscle fibers. The two groups did not have a significant difference in the function of their pelvic floor muscle. However, combined spinal epidural had significant shorter duration of 1 stage labor (6.22 hours), 2 stage labor (26.12 minutes) and total length of labor (7.25 hours) when compared to the control group, 1 stage labor (8.63 hours), 2 stage labor with (51.76 minutes), and total length of labor 99.52 hours); with p-values less the 0.05 (Table 8).[37]

Table 8

Labor stage	CSEA group	Control group	*P* value
First stage, h	6.22 (3.17–9.27)	8.63 (5.37–11.89)	<0.001*
Second stage, min	46.19 (28.7–63.68)	51.76 (32.35–71.17)	0.011*
Total labor duration, h	7.25 (4.63–9.87)	9.52 (6.49–12.55)	<0.001*

CSEA, combined spinal-epidural analgesia; h, hour; min, minutes.
* Mann-Whitney U test.

Combined spinal epidural does will not affect the risk for having postpartum pelvic muscle disorder. However, it does have a significant shorter

duration of 1st stage labor, 2nd stage labor and total length of labor. There were no significant side effects on the mother and child that were reported.[37]

F. Combine Compared to Mobile

The researchers, Pascual-Ramirez et al., in this study aimed to compare combined to mobile epidurals analgesia, and see their effects on the duration of labor.[26] 144 women participated and were randomly assigned to either the combined spinal-epidural group (n=72) or the low-dose epidural group (n=72). The combined spinal-epidural contained 2.5 mg of bupivacaine, 25 ug of fentanyl and 200 ug of morphine. They found that there was no significant difference in the duration of labor between combined spinal-epidural and low-dose epidural (Table 9).

Table 9

Table 2
Primary outcomes: time in minutes since the neuraxial block was started.

	LEA (n = 72)		CSEA (n = 72)		*P* value
	n	Mean ± SD	n	Mean ± SD	
Total population analysis					
Stage I period	63	204 ± 109	58	212 ± 133	0.85
Stage II period	62	42 ± 32	57	43 ± 34	0.60
Total labor duration	62	246 ± 112	57	255 ± 144	0.77
Nulliparous subgroup analysis					
Stage I period	34	237 ± 109	30	239 ± 142	0.94
Stage II period	33	48 ± 32	29	51 ± 34	0.76
Total labor duration	33	282 ± 113	29	185 ± 145	0.91

Abbreviations: LEA, local anesthetic epidural; CSEA, combined spinal–epidural analgesia.

Women in the combined spinal-epidural group had increased instances of pruritus during labor and after labor, lightheadedness postpartum, nausea postpartum, and drowsiness postpartum, when compared to low-dose epidural. However, the combined spinal group had a reduced need for levobupivacaine

and had lower sensory blockade. The researchers concluded that combined spinal-epidural did not shorten the duration of labor when compared to low-dose epidural, however, then did have a reduced levobupivacaine need and motor weakness.[26]

IV. Mobile Epidurals

A. Mobile vs. No epidural

Maroni et al. looked to compare mobile epidural vs. no epidural. They assessed the progression of fetal head down the birth canal.[23] They did this using a three-dimensional ultrasound during the second stage of labor in both women who had an epidural (n=41) and the non-epidural group (n=30). They took scans of the baby every 20 minutes during active labor to obtain sonographic volume data using the transperineal approach. They did not find a significant difference in the decent of fetal head during between mobile epidural and non-epidural. There was and increased amount of oxytocin use in the mobile epidural group (n=34) when compared to the non-epidural group (n=120) with a p-value of <0.001. The researchers suggested that the increase use of oxytocin in the mobile group could have affected the duration of labor. They concluded that mobile epidural does not have any effect on the progression of the fetal head in the birth canal.[23]

V. Conclusion

This thesis has explained the risk of three main types of epidurals: Traditional, Combined-Spinal and Mobile. Some may ask the question “should I have an epidural?”. From what I have learned it can say that yes you “can” have

an epidural. All three types of epidurals effectively reduced pain associated with childbirth. Some studies showed that there is an association with a shorter labor when comparing epidurals to no epidural. If a woman chooses not to have an epidural she will experience an extreme amount of pain. This pain can slowly weaken the mother and cause tiredness. By the time it comes for the woman to push she is already tired from pain and does not have the energy to effetely push the baby out; she may not have the energy to push through the contractions. This will lengthen her labor.

Traditional epidurals are the most common route for relief from the pain of childbirth. They effetely eliminate pain so much that some can even sleep through their contractions. However, this can cause a problem; sometimes when women cannot feel their contractions they do not know when to push and do not push effectively. I have heard that when a woman can feel her contractions the body will literally force her to push at the correct times. This is not so with a traditional epidural; because of this, most women who have a traditional epidural have a longer labor when compared to other epidural techniques. Significantly longer labor was found in 4 studies (Table 10). In the studies that I found, 4 of those found that traditional epidurals significantly increase the risk for cesarean delivery when compared to no-epidural or other epidural techniques (Table 10). Two of the studies found that those who had traditional epidurals were significantly more likely to have a vaginal assisted delivery. They also put a great risk for malposition during labor which can create complications. This was found significant in 2 studies. I also saw in some studies that there is an increased risk

for postpartum hemorrhage, breastfeeding cessation, higher temperature, lower maternal satisfaction and failed catheters. In all of the studies that I found there were no risks associated with the newborn. Traditional epidurals do not have an effect on new born wellbeing.

Low-dose techniques are starting to emerge and become more popular. The ones that I focused on in my research were combined spinal epidural and mobile epidural. Combined spinal is the more common of the two. The idea behind the low-dose techniques is that if the mother can still fell some of her contractions, she will be able to push through them. Unlike in traditional, the mother will have more effective pushes during contractions which will help with the overall success of labor. Low-dose techniques take the benefits of no epidural and traditional epidural with fewer risk. Combined spinal epidural has a significantly decreased risk for cesarean deliveries, vaginal assisted deliveries motor leg weakness, and catheter failure. Combined spinal dose have on significant side effect, pruritus which is itchy skin. It can easily be treated. It may also cause nausea, drowsiness, and some motor weakness. All studies showed higher maternal satisfaction and shorter labor when using combined spinal epidural. There is no risk associated with the wellbeing of the newborn.

Based on my research, I would recommend a low-dose epidural technique; specifically combined-spinal epidural analgesia. Its association with a shorter labor with a high maternal satisfaction along with fewer Side effects makes it the best choice. It is most commonly recommended to women who have high risk pregnancies but is not as common as traditional epidurals. This may be

caused by some insurance companies not covering combined spinal epidurals (it's basically two epidurals in one which leads me to believe that it will be more expensive). I hope that it will become more available to women with time.

Table 10		
Title	Influence on Mother	Influence on Baby
Traditional Epidural PCE Oxytocin (Sumaiah, 2016))	Less Pain Motor leg weakness (traditional)	No effect
Traditional Epidural Low-dose Oxytocin (Kotaska, 2011)	Cesarean delivery	n/a
Traditional Epidural Malposition (Carseldine, 2013)	Longer labor Malposition	n/a
Traditional Epidural (Ray, 2005)	Malposition risk	n/a
Traditional Epidural (Eriksen 2011)	Cesarean delivery vacuum extractions Induced labor Postpartum hemorrhage	No effect
Traditional Epidural (Throp, 1989)	Cesarean delivery Longer labor	n/a
Traditional Epidural (Tyrell,)	Cesarean delivery	n/a
Traditional Epidural (Becker,)	No effect	No effect on HR
Traditional Epidural (Dozier, 20)	Breastfeeding Cessation	n/a
Traditional Epidural (Gizzo, 20)	Longer labor Longer breastfeeding session	n/a
Traditional Epidural (Karus)	No effect on hearing	n/a
Traditional vs PCE (Douna)	Higher temperature (Traditional) Hypoxemia (PCE)	n/a
Traditional vs Combined (Collis)	Motor leg weakness (traditional) Pruritus (CSE)	n/a
Traditional vs Combined (Groden)	Failed Catheter (Traditioanl)	n/a
Traditional vs Combined (Mckenzie)	No effect	n/a
Traditional vs Combined vs Mobile (Lancet)	Assisted delivery risk (traditional)	Poor APGAR score (mobile)
Traditional vs Combined vs Mobile (Wilson and MacArthur)	Lower leg weakness (traditional)	No effect
Traditional vs Combined vs Mobile (Ishmail)	Shorter labor (CSE) Lower VS pain score (CSE) High satisfaction (CSE)	No effect
Traditional vs Combined vs Mobile (Wilson and Moore)	Less fecal incontinence (Mobile)	No effect
Combined (Rukewe)	Vomiting and shivering in both groups	No effect
Combined (Attri)	Faster onset and longer labor (levobupivacaine)	n/a
Combined (Gadalla)	Need for intravenous epidural catheter (no saline)	n/a
Combined (Gambiling)	No effect	No effect
Combined (Xing)	Shorter labor (CSE)	n/a
Combined vs Mobile (Pascual-Ramirez)	Pruritus, nauseam and drowsiness; reduce need for levobupivacaine and motor weakness (CSE)	n/a
Mobile (Maroni)	Increased need for oxytocin (Mobile)	n/a

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